Alaska Outer Continental Shelf

OCS EIS/EA
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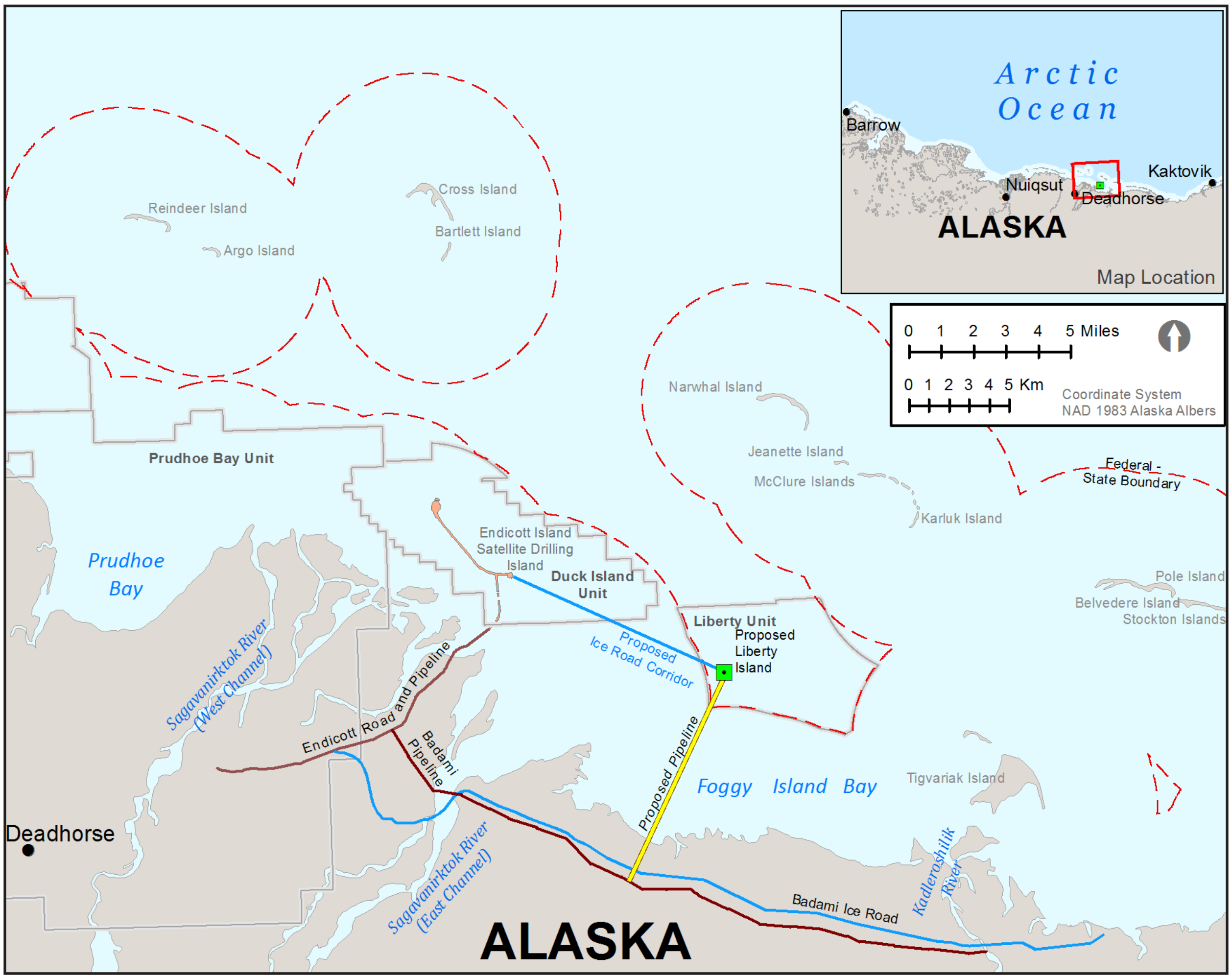
Liberty Development Project

Development and Production Plan
In the Beaufort Sea, Alaska

Draft Environmental Impact Statement

Volume 2. Chapter 7 and Appendices A through G



U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region

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Prepared by
Bureau of Ocean Energy Management
Alaska OCS Region

Cooperating Agencies
U.S. Department of Commerce,
National Oceanographic and Atmospheric Administration,
National Marine Fisheries Service

Environmental Protection Agency

U.S. Department of Defense
U.S. Army Corps of Engineers

Inupiat Community of the Arctic Slope

North Slope Borough

U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region

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Chapter 7

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APPENDIX A

Accidental Oil Spills and Gas Releases

Information, Models, and Estimates

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Appendix A. Accidental Oil Spills and Gas Releases

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A.2-OSRA Conditional and Combined Probability Tables

Tables A.2-1 through A.2-9 represent conditional probabilities (expressed as percent chance and in terms of annual, summer, and winter, respectively) that a large oil spill starting at one of either the proposed LDPI or the Liberty pipeline will contact certain defined areas within 1, 3, 10, 30, 90, and 360 days.

Tables A.2-10 and A.2-11 represent combined probabilities (expressed as percent chance), over the assumed life of the Proposed Action, and Alternatives of one or more spills ≥1,000 Bbl, and the estimated number of spills (mean), occurring and contacting a certain 1, 3, 10, 30, 90, and 360 days.

A-1. Accidental Large Oil Spills

A-1.1. Large Spill Size, Source, and Oil-Type Assumptions

Table A-1 shows the general size categories, source of a large spill(s), type of oil, size of spill(s) in bbl, and the total volume BOEM assumes in the analysis of oil-spill effects in Sections 4.2 through 4.4 and 4.7 of this DEIS for the Liberty Development and Production Plan.

A-1.2. OCS Large Oil-Spill Sizes

Large OCS spills have a minimum size, or threshold value, of 1,000 bbl, but the spill size could be larger. Table A.1-1 shows the assumed large spill sizes used in the effects analysis of a large spill for the proposed action.

The large OCS spill-size assumptions BOEM uses for a spill from the island and an offshore pipeline leak are based on reported spills in the Gulf of Mexico and Pacific OCS because no large spills (≥1,000 bbl) have occurred on the Alaska or Atlantic OCS from oil and gas activities. BOEM uses the median OCS spill size as the likely large spill size (Anderson, Mayes, and LaBelle, 2012) because it is the most probable size for that spill-size category. The Gulf of Mexico and Pacific OCS data show that a large spill most likely would be from a pipeline or a platform. The median size of a crude oil spill ≥1,000 bbl from a pipeline on the OCS from 1996-2010 is 1,720 bbl, and the average is 2,771 bbl (Anderson, Mayes, and LaBelle, 2012). The median spill size for a platform on the OCS over the entire record from 1964-2010, is 5,066 bbl, and the average is 395,500 bbl (Anderson, Mayes, and LaBelle, 2012). Outliers such as the Deepwater Horizon (DWH) spill volume skew the average and the average is not a useful statistical measure. For purposes of this analysis, BOEM uses the median spill sizes for OCS pipelines and platforms, rounded to the nearest hundred shown below, as the likely large spill sizes for an offshore pipeline leak and island spill in the proposed action. The large OCS offshore pipeline spill size due to a rupture is based on the operator’s estimate of a worst-case discharge from its pipeline, 3,979 bbl (Hilcorp, 2017), and rounded to the nearest hundred yielding 5,000 bbl.

Table A-1. Large OCS Spill-Size Assumptions in barrels.

OCS Offshore Pipeline Leak	OCS Offshore Pipeline Rupture	OCS Island Spill
1,700	5,000	5,100

A-1.3. Onshore Large Oil Pipeline Spill Size

The U.S. Department of Transportation (USDOT), Office of Pipeline Safety Research and Special Programs Administration keeps information about distribution and transmission accident and incident data online (USDOT, 2015 a, b, c). The Hazardous Liquid Accident Data (2004-2013) was analyzed to estimate crude-oil spills ≥1,000 bbl for onshore pipelines. The Pipeline and Hazardous Materials Safety Administration (PHMSA) hazardous liquid incident database covering a fixed period of time was filtered by commodity type and spill volume to obtain a subset of data specific to crude oil pipeline systems. Summary statistics were generated for the 74 crude oil spills ≥1,000 bbl identified. The median crude oil-spill size is 2,540 bbl and the average is 5,325 bbl. For purposes of analysis, BOEM uses the median spill size as the likely spill size for the analysis of a large onshore pipeline spill from the Proposed Action. The median spill size is rounded to the nearest hundred, resulting in an estimate of 2,500 bbl.

A-1.4. Source and Type of Large Oil Spills

The source is considered the place from which a large oil spill could originate. For the Proposed Action, the sources of large spills are divided into the island, offshore pipeline, and onshore pipeline. Island sources include spills from wells or from equipment located on the island such as diesel fuel tanks. Large offshore pipeline spills include spills from the offshore pipeline to the shore. Large onshore pipeline spills include spills from shore to Pump Station 1.

The types of oil spilled from island spills are assumed to be crude oil or diesel oil. Large onshore and offshore pipeline spills are assumed to be crude oil.

The type of crude oil used in this analysis is Liberty crude oil. Hilcorp provided average reservoir fluid property data from a flow test taken at the Liberty #1 well (Hilcorp 2015 DPP Section 4.2.2). The API (American Petroleum Institute) gravity is a measure of how heavy or light the oil is compared to water. The average API gravity of Liberty crude oil is 24° to 27° API (Hilcorp 2015 DPP Section 4.2.2). SL Ross Environmental Research Ltd. performed simulated weathering experiments and physical property analyses of Liberty crude oil (SL Ross 1998). SL Ross 1998 contains the laboratory data used in the weathering calculations detailed in Tables A.1-2 through A.1-5. SL Ross Environmental Research Ltd. also conducted an assessment of the behavior of Liberty crude oil if released into the environment from a spill (SL Ross, 2000).

The type of diesel oil used in this analysis is ultra low sulfur diesel (ULSD) as Hilcorp states that it will be using ULSD during operations (Hilcorp 2015 DPP Table 8-2). A comparable ULSD from Norway's Esso Slagen Refinery is used in BOEM's oil weathering analysis (SEA Consulting Group and SINTEF 2015). The ULSD sample taken from the Esso Slagen Refinery and analyzed by SEA and SINTEF has an API gravity of 38° and has EN 590 specification (SEA Consulting Group and SINTEF 2015). It was chosen to be representative for the diesel oil weathering simulations used in this analysis shown in Tables A.1-6 though A.1-8. Further, a product specification sheet by Petro Star Inc., an Alaska refinery and fuel marketing company, has information on Arctic Grade ULSD (Petrostar, 2016).

A-1.5. Historical Loss of Well-Control Incidents on the OCS and North Sea

USDOI, BOEMRE (2011; Appendix B; Table B-1), USDOI, BOEM, (2012a; Figure 4.3.3-1.), Bureau of Land Management (USDOI, BLM) (2012; Appendix G), IAOGP (2010), Bercha Group Inc. (2014a) and Ji, Johnson, and Wikel (2014) detail the loss of well control (LOWC) incidents on the OCS and/or North Sea, and discuss the analysis of their frequencies. The loss of well control occurrence frequencies, per well, are on the order of 10^{-3} to 10^{-6}. The occurrence frequencies depend upon the operation or activity, whether the LOWC was a blowout or well release, and whether there was oil spilled.

In general, historical data show that LOWC events escalating into blowouts and resulting in oil spills are infrequent and that those resulting in large accidental oil spills are even rarer events (Anderson, Mayes, and LaBelle, 2012; Bercha, 2014a, Izon et al. 2007, Ji, Johnson, and Wikel, 2014; Robertson et al., 2013; USDOI, BOEMRE, 2011; USDOI, BOEM, 2016). From 1964 to 2010 there were 283 well control incidents, 61 of which resulted in crude or condensate spills (USDOI, BOEM, 2012a; Table 4.3.3 1). From 1971 to 2010, fewer than 50 well control incidents occurred. Excluding the volume from the DWH spill, the total spilled volume was less than 2,000 bbl of crude or condensate. The largest of the 1971-2010 spills—other than the DWH event—being 350 bbl. The DWH event was the only VLOS to occur between 1971 and 2010 (USDOI, BOEM, 2012a). During that same time period, more than 41,800 wells were drilled on the OCS and almost 16 Bbbl of oil were produced.

From 1971-2010 Industry drilled 223 exploration wells in the Pacific OCS, 46 in the Atlantic OCS, 15,138 in the Gulf of Mexico OCS, and 84 in the Alaska OCS, for a total of 15,491 exploration wells. During this period, there were 77 well control incidents associated with exploration drilling. Of those 77 well control incidents, 14 (18%) resulted in oil spills ranging from 0.5 bbl to 200 bbl, for a total 354 bbl, excluding the estimated volume from the DWH spill. These statistics show that, while approximately 15,000 exploration wells were drilled, there were a total of 15 loss-of-well-control events that resulted in a spill of any size: 14 were small spills and one was a large spill (≥1,000 bbl) that resulted in a blowout. That one large/very large spill was the DWH.

From 1980 – 2011, Industry drilled 745 development wells in the Pacific OCS, 19,275 in the Gulf of Mexico OCS, and 9,174 in the North Sea. There were a total of 61 LOWC events during the drilling of the 29,194 development wells. From 1980 – 2011, Industry operated 7,674 producing wells in the Pacific OCS, 197,721 in the Gulf of Mexico OCS, and 59,137 in the North Sea. There were a total of 111 LOWC events during production and well intervention activities from the 264,532 wells (Bercha 2014).

The risk of an unlikely or rare event, such as a loss of well control incident, is determined using the best available historical data. The 2012-2017 Five-Year Program Final PEIS (USDOI, BOEM, 2012a) provides a detailed discussion of the OCS well control incidents and risk factors that could contribute to a long duration LOWC event. Risk factors include geologic formation and hazards; water depth and hazards, geographic location (including water depth); well design and integrity; loss of well control prevention and intervention; scale and expansion; human error; containment capability; response capability; oil types and weathering/fate; and specific regional geographic considerations, including oceanography and meteorology.

Quantifying the frequency of VLOSs from a loss of well control event is challenging as relatively few large oil spills that can serve as benchmarks have occurred on the OCS (Scarlett et al., 2011). Based on an analysis of this historic data from both the 1971-2010 (the modern regulatory era) and the 1964-1971 time frames, the frequency of a loss of well control occurring and resulting in a VLOS of different volumes was determined (USDOI, BOEM, 2016, Figure 3.3-1). This analysis, which is set forth in the 2017-2022 Five-Year Program Draft PEIS, was used to calculate the frequency (per well) of a spill exceeding 4,610,000 bbl, which is the VLOS volume assumed in this DEIS.

A-2. Behavior and Fate of Crude Oils

There are scientific laboratory data and field information from accidental and research oil spills about the behavior and fate of crude oils. BOEM discusses the background information on the fate and behavior of oil in Arctic environments and its behavior and persistence properties along various types of shorelines. BOEM also makes several estimates about environmental parameters to perform modeling simulations of oil weathering that are specific to the large spills BOEM estimates for analysis purposes.

A-2.1. Generalized Processes Affecting the Fate and Behavior of Oil

Several processes alter the chemical and physical characteristics and toxicity of spilled oil. Collectively, these processes are referred to as weathering or aging of the oil. The major oil weathering processes are spreading, evaporation, dispersion, dissolution, emulsification, microbial degradation, photochemical oxidation, and sedimentation to the seafloor or stranding on the shoreline (Payne et al., 1987; Boehm, 1987; Lehr, 2001).

Along with the physical oceanography and meteorology, weathering processes determine the oil's fate in the environment. Potter et al. (2012), Dickins (2011), and Lee et al. (2011) reviewed the state of fate and behavior of oil in ice and documented the relevant studies; some of which were detailed in the USDOI, MMS (2007) Lease Sale 193 FEIS, Appendix A, 2.1. Collectively, 40 years of research underpin the available science on fate and behavior of oil in open water and ice.

A-2.1.1. Shoreline Type, Oil Behavior, and Persistence

A new shorezone analysis was completed in 2014 and BOEM compiled the new Environmental Sensitivity Information (ESI) for each of the land segments along the northern coast of Alaska (Harper and Morris, 2014). For each land segment, the percentage of each ESI type by length is shown in Table A.1-9. In general, the higher the ESI number, the longer the oil is estimated to persist in that type of substrate.

A-2.2. Oil Spill Persistence

How long an oil spill persists on water or on the shoreline can vary widely, depending on the size of the oil spill and the environmental conditions at the time of the spill, and the substrate of the shoreline.

A-2.3. Assumptions about Oil-Spill Weathering

To run the oil weathering model (OWM) using a consistent framework, several assumptions are made regarding the type of oil, the size of the spill, the environmental conditions, and the location of the spill. The following assumptions are used to estimate weathering of a large oil spill:

- The weathering of crude oil is based on laboratory weathering data of a Liberty crude oil sample (SL Ross, 1998)
- The weathering of diesel oil is based on laboratory weathering data of an ULSD sample from a Norweigen Refinery (SEA and Sintef, 2015) that serves as a correlative for Arctic Grade ULSD
- The size of the large diesel fuel spill from the island is 5,100 bbl; See Section A-1.1
- The sizes of the small diesel fuel spills modeled are 3 bbl and 200 bbl.
- The sizes of the large crude oil spills are 1,700 bbl (pipeline leak), 5,000 bbl (pipeline rupture), and 5,100 (island spill); See Section A-1.1 Large Spill Size, Source, and Oil-Type
- There is no reduction in the size of spill due to cleanup; instead cleanup is considered separately as either mitigation or disturbance
- The wind, wave, water temperature, and ice conditions are as described
- The spill is a surface spill or a spill from the buried pipeline that reaches the water surface quickly
- Meltout spills occur into 50% ice cover
- The properties predicted by the OWM are those of the thickest part of the slick
- The spill occurs as an instantaneous spill over a short period of time
- The oil spill persists for up to 30 days in open water or in ice
- The fate and behavior are as modeled (Table A.1-2 through A.1-8)

Uncertainties exist, such as:

- The actual size of an oil spill or spills, should they occur
- The location of the spill
- Wind, current, wave, and ice conditions at the time of a possible oil spill
- The crude or diesel properties at the time of a possible spill

A-2.4. Modeling Simulations of Oil Weathering

To judge the effect of a large oil spill, BOEM estimates information regarding how much oil evaporates, how much oil is dispersed, and how much oil remains after a certain time period. BOEM derives the weathering estimates of Liberty crude oil and diesel fuel from modeling results using the SINTEF Oil Weathering Model (OWM) Version 4.0 (Reed et al., 2015) for up to 30 days.

BOEM simulates two general scenarios: one in which the oil spills into open water and one in which the oil freezes into the ice and melts out into 50% ice cover. BOEM assumes that open water conditions can exist within the proposed action area between July and October (See 2017 Liberty DEIS Section 3.1.2.4). BOEM assumes that meltout can occur from June through July (See 2017 Liberty DEIS Section 3.1.2.1). BOEM models both the open water and meltout spills as instantaneous. Although different amounts of oil could melt out at different times, BOEM took the conservative approach, which was to assume all the oil was released at the same time.

A-3. Estimates of Where a Large Offshore Oil Spill May Go

BOEM studies how and where large offshore spills move by using an oil-spill trajectory model with the capability of assessing the probability of oil-spill contact to resource areas, known as the Oil-Spill Risk Analysis (OSRA) model (Smith et al., 1982; Ji, Johnson, and Li, 2011). The “Large” oil spill means spills with a threshold size of ≥ 1,000 bbl. This model analyzes the likely paths of over tens of thousands of simulated oil spill trajectories in relation to biological, physical, and sociocultural resources. The trajectory is driven by the wind, sea ice, and current data from a coupled ocean-ice model. The locations of resource areas, including sociocultural resource areas, barrier islands, and the coast within the model study area, are used by OSRA to tabulate the percent chance of oil-spill contact to these areas. A full report is found within Li, Crowley and Johnson (In Preparation).

A-3.1. Inputs to the Oil-Spill-Trajectory Model

There are several inputs necessary to run the oil-spill-trajectory model and to assess the probability of oil-spill contact to environmental resource areas, boundary segments, land segments, and grouped land segments including the following:

- Study area
- Arctic seasons
- Location of the coastline
- Location of environmental resource areas
- Location of land segments and grouped land segments
- Location of boundary segments
- Location of facility
- Location of pipelines and transportation assumptions
- Current and ice information from a general circulation model
- Wind information

A-3.1.1. Study Area and Boundary Segments

Map A-1 (Maps are found in section A.1, Tables and Maps) shows the study area used in the oil-spill-trajectory analysis. It extends from 174 º E to 130º W and 66 º N to 75º N. The OSRA model has a resolution of 0.6 km by 0.6 km and a total of 6 million grid cells in the study area. The study area is formed by 40 offshore boundary segments and the Beaufort (United States and Canada) and Chukchi seas (United States and Russia) coastline. The boundary segments are vulnerable to spills in both

Arctic summer and winter. The study area is chosen to be large enough to allow most trajectories of hypothetical oil spills to develop without contacting the boundary segments through as long as 360 days.

A-3.1.2. Trajectory Analysis Periods

The OSRA model launches a hypothetical oil-spill trajectory from a hypothetical location called a launch point (described in detail in Section 3.1.5) starting on day 1 in 1986, and it continuously launches the trajectory every other day for a total of 18 years (1986-2004). Therefore, a total of 3,240 trajectories are launched over this time period. The trajectories are driven by the three-hourly wind, current and ice data from a coupled ocean-ice model with 20 years (1985-2005) of simulation (described in detail in section 3.1.6; Curchitser et al., 2013), and are computed on an hourly basis. Note that data from 1985 are not used in the trajectory analysis because they do not start on January 1st.

BOEM defines three time periods for the trajectory analysis of large oil spills. These periods are the months when trajectories are started and the chance of contact is tabulated. BOEM calls these three periods annual, summer, and winter. Shown below are the three time periods that trajectories were started and the months that make them up.

Project Area	Annual	Summer	Winter
Proposed Action Area	January-December	July 1-September 30	October 1-June 30

The annual period is from January 1 to December 31. The summer period is from July 1 through September 30 and generally represents open water or Arctic summer. The winter period is from October 1 through June 30 and represents ice cover or Arctic winter. The choice of this seasonal division was based on meteorological, climatological, and biological cycles and consultation with Alaska OCS Region analysts.

A-3.1.3. Locations of Environmental Resource Areas

Environmental resource areas (ERAs) represent spatial and temporal areas of social, economic, or biological resources or resource areas. BOEM, Alaska OCS Region analysts designate these ERAs. The analysts work with specialists in other federal and state agencies, academia and various stakeholders who provide information about these resources. The analysts also designate in which months these ERAs are vulnerable to spills, meaning the time period those resources occupy or use that spatial location. For example, birds migrate and may be there only from May to October.

There are 124 ERAs. Maps A-2a, A-2b, A-2c, A-2d, A-2e, A-2f and A-2g show the location of the 124 ERAs. These resource areas represent concentrations of wildlife, habitat, subsistence-hunting areas, and subsurface habitats within the OSRA study area. The names or abbreviations of the ERAs and the general resource they represent are shown in Table A.1-1. Information regarding the general and specific ERAs for lower trophic resources, fish, birds, marine mammals, whales, and subsistence resources is found in Tables A.1-3, 4, 5, 6, 7, and 8, respectively. Terrestrial mammals are not represented by ERAs but are represented by Grouped Land Segments (GLSs) shown in Table A.1-17 and discussed below. BOEM also includes Land as an additional environmental resource area (ERA). Land is the entire study area coastline and is made up of all the individual land segments (LSs) 1 through 146, which are described below.

A-3.1.4. Location of Land Segments and Grouped Land Segments

The coastline was further analyzed by dividing the Chukchi (United States and Russia) and Beaufort (United States and Canada) seas coastline into 146 LSs. Some LSs were added together to form larger geographic areas and were called GLSs.

The LS identification numbers (IDs) and the geographic place names within the LS are shown in Table A.1-11. Maps A-3a, A-3b, and A-3c show the location of these 146 LSs. Land segments are vulnerable to spills in both Arctic summer and winter. The GLSs, their names, and the individual LSs that make them up are shown in Table A.1-12. Maps A-4a, A-4b, and A-4c show the location of these 53 GLSs. Grouped land segments are vulnerable to spills based on the time periods shown in Table A.1-19.

A-3.1.5. Location of Proposed Hypothetical Launch Areas

Map A-5 shows the locations of the hypothetical island launch area (LA) and the hypothetical offshore pipeline LA where a large oil spill could originate from if it were to occur. BOEM used operator submitted GIS information for the pipeline route and island to estimate launch points from the launch areas. The Liberty Island LA, herein referred to as “LI”, consists of 4 launch points representing the approximated midpoints of the four sides of the island. The pipeline LA, herein referred to as “PL”, consists of 6 equally spaced launch points along the offshore pipeline route from the island to the shore. Map A-6 shows a zoomed in view of Map A-5 along with the launch points that make up the launch areas LI and PL.

A total of 3240 trajectories were simulated from each of 10 launch points over the 18 years of wind, current and ice data, for a total of 32400 trajectories. The results of the trajectory simulations from the 4 island launch points were averaged and are labeled as LI in the conditional and combined probability tables (See Tables A.2.1-56). The results of the trajectory simulations from the 6 pipeline launch points were averaged and are labeled as PL in the conditional and combined probability tables (See Tables A.2.1-56).

A-3.1.6. Ocean Current and Ice Information from a General Circulation Model

BOEM uses the results from a new coupled ice-ocean general circulation model to simulate oil-spill trajectories. The wind-driven and density-induced ocean-flow fields and the ice-motion fields are simulated using a three-dimensional, coupled, ice-ocean hydrodynamic model (Curchitser et al., 2013). The model is based on the Regional Ocean Modeling System (ROMS) (Shcheptkin and McWilliams, 2005). The ROMS has been coupled to a sea ice model (Budgell, 2005), which consists of elastic-viscous-plastic rheology (Hunke and Dukowics, 1997; Hunke, 2001) and the Mellor and Kantha (1989) thermodynamics. This model simulates flow properties and sea-ice evolution for the Arctic with enhanced resolution (5km) in the Chukchi and Beaufort seas during the years 1985-2005. The sea ice model was adapted to represent landfast ice, which occurs on the Chukchi Sea coast. The coupled ocean-ice model uses six-hourly CORE2 forcing files (Large and Yeager, 2009), including winds, air temperature, air pressure and humidity, plus daily solar radiation to compute the momentum, heat and salt fluxes. Comparison of model results with observation shows significant skill in the model capability to reproduce observed circulation and sea ice patterns in the Beaufort and Chukchi seas (Curchitser et al., 2013).

A-3.1.7. Wind Information

BOEM uses the reanalysis (1986-2004) wind fields provided by Curchitser et al. (2013). The wind data are from CORE2 (Large and Yeager, 2009) and was interpolated to the coupled ocean model grid at three-hourly intervals.

A-3.1.8. Large Oil-Spill-Release Scenario

For purposes of this trajectory simulation, all spills occur instantaneously. For each trajectory simulation, the start time for the first trajectory was the first day of the season (winter or summer) of the first year of wind data (1986) at 6 a.m. Greenwich Mean Time (GMT). The summer season consists of July 1-September 30, and the winter season is October 1-June 30. Each subsequent trajectory was started every 2 days at 6 a.m. GMT.

A-3.2. Oil-Spill-Trajectory Model Assumptions

The oil-spill-trajectory model assumptions are as follows:

- Large oil spills occur at the gravel island or along the pipeline route
- Produced oil is transported through the pipeline
- A large oil spill reaches the water surface
- Large oil spills persist long enough for trajectory modeling for up to 360 days if they are encapsulated in ice and melt out
- A large oil spill encapsulated in the landfast ice does not move until the ice moves or it melts out
- Large oil spills occur and move without consideration of weathering. The oil spills are simulated each as a point with no mass or volume. The weathering of the oil is estimated separately in the stand-alone SINTEF OWM model
- Large oil spills occur and move without any cleanup. The model does not simulate cleanup scenarios. The oil-spill trajectories move assuming booms and skimmers are not used and no other response action is taken. Large oil spills stop when they contact the mainland coastline, but not the offshore barrier islands in Stefansson Sound

Uncertainties exist, such as:

- The actual size of the large oil spill or spills, should they occur
- Whether the large spill reaches the water
- Whether the large spill is instantaneous or a long-term leak
- The wind, current, and ice conditions at the time of a possible large oil spill
- How effective response or cleanup is
- The characteristics of crude or diesel oil at the time of the large spill
- How Liberty crude or ultra low-sulfur diesel oil will spread
- Whether or not development and production occurs

A-3.3. Oil-Spill-Trajectory Simulation

The trajectory-simulation portion of the OSRA model consists of many hypothetical oil-spill trajectories that collectively represent the mean surface transport and the variability of the surface transport as a function of time and space. The trajectories represent the Lagrangian motion that a particle on the surface might take under given wind, ice, and ocean-current conditions. Thousands of trajectories are simulated to give a statistical representation, over time and space, of possible transport under the range of wind, ice, and ocean-current conditions that exist in the OSRA study area.

Trajectories are constructed to produce an oil-transport vector. For cases where the ice concentration is below 80%, each trajectory is constructed using vector addition of the ocean current field and 3.5% of the instantaneous wind field—a method based on work done by Huang and Monastero (1982), Smith et al. (1982), and Stolzenbach et al. (1977). For cases where the ice concentration is 80% or greater, the model ice velocity is used to transport the oil. Equations 1 and 2 show the components of motion that are simulated and used to describe the oil transport for each trajectory:

1. $U_{oil} = U_{current} + 0.035\ U_{wind}$ or
2. $U_{oil} = U_{ice}$

Where:

U_{oil} = oil drift vector

$U_{current}$ = current vector (when ice concentration is <80%)

U_{wind} = wind speed at 10 m above the sea surface

U_{ice} = ice vector (when ice concentration is ≥ 80%)

The wind-drift factor was estimated to be 0.035, with a variable drift angle ranging from 0º-25º clockwise. The drift angle was computed as a function of wind speed according to the formula in Samuels, Huang, and Amstutz (1982). The drift angle is inversely related to wind speed.

The trajectories age while they are in the water and/or on the ice. For each day that the hypothetical spill is in the water, the spill ages—up to a total of 360 days. While the spill is in the ice (≥ 80% concentration), the aging process is suspended. The maximum time allowed for the transport of oil in the ice is 360 days, after which the trajectory is terminated. After coming out of the ice, that is melting into open water, the trajectory ages to a maximum of 30 days.

A-3.4. Results of the Oil-Spill-Trajectory Model

A-3.4.1. Conditional Probabilities: Definition and Application

The chance that a large oil spill will contact a specific ERA, LS, GLS, or BS within a given time of travel from a certain location (LI or PL) is termed a conditional probability. The condition is that BOEM assumes a large spill occurs. Conditional probabilities assume a large spill has occurred and the transport of the spilled oil depends only on the winds, ice, and ocean currents in the study area. Conditional probabilities are reported for three seasons (annual, summer, and winter) and six time periods (1, 3, 10, 30, 90, and 360 days). Conditional probabilities are expressed as a percent chance. This means that the probability (a fractional number between 0 and 1) is multiplied by 100 and expressed as a percentage.

For the Proposed Action, annual, summer, and winter periods are shown in Section 3.1.2. Contact, tabulated from a trajectory that began before the end of summer season, is considered a summer contact. BOEM also estimates the conditional probability of contact from spills that start in winter, freeze into the sea ice, and melt out in spring or summer. Winter contacts are from spills that begin in winter. Therefore, if any contact to an ERA, LS, GLS or BS is made by a trajectory that began by the end of winter, it is considered a winter contact. BOEM also estimates annual conditional probabilities of contact within 1, 3, 10, 30, 90, and 360 days. Annual contact is for a trajectory that began in any month throughout the entire year.

A-3.4.1.1. Conditional Probabilities: Results

The chance of a large spill contacting a specific ERA, LS, GLS, or BS or any of the areas being assessed (assuming a spill has occurred) is called a conditional probability. It is conditioned on the assumption that a large spill has occurred. The conditional probability results for the oil-spill-trajectory model are summarized generally below and are listed in Tables A.2-1 through A.2-54 for the Project. The Maps referenced in this discussion are as follows:

- Boundary Segments (BSs) are shown in Map A-1,
- Environmental Resource Areas (ERAs) are shown in Maps A-2a through A-2g
- Land Segments (LSs) are shown in Maps A-3a through A-3c
- Grouped Land Segments (GLSs) are shown in Maps A-4a through 4c

For specific analysis of conditional probabilities in regard to specific resources, please see Chapter 4. The following section provides comparisons for an overall generalized view. Probabilities in the following discussions, unless otherwise noted, are conditional probabilities estimated by the OSRA model (expressed as percent chance) of a spill ≥1,000 bbl in size contacting ERAs, GLS, and LSs within the days and seasons as specified below.

Comparisons between Spill Location and Season

General Contacts through Time

1 Day; 3 Days; 10 Days; 30 Days; 90 Days; 360 Days

A-4. Oil-Spill-Risk Analysis

A measure of oil-spill risk is determined by looking at the potential for one or more large spills occurring as a result of development or production from the Proposed Action and then of a large spill contacting a shoreline segment, resource, or resource area of concern (called an environmental resource area (ERA)). If spilled crude oil contacts any portion of a shoreline segment or ERA, it is simply called a contact. The oil spill risk analysis helps determine the relative risk of occurrence and contact of one or more large spills in and adjacent to the Project Area.

Combined probabilities are the chance of one or more large spills occurring and of those spills contacting over the life of the project. They are estimated using the conditional probabilities, the large oil-spill rates, the resource estimates, and the assumed transportation scenarios. These are combined through matrix multiplication to estimate the mean number of one or more large spills from operations in and adjacent to the Project Area occurring and of any of these spills making a contact.

A-4.1. Chance of One or More Large Spills Occurring

The chance of one or more large spills occurring is derived from two components: (1) the large spill rate and (2) the resource-volume estimate. The spill rate is multiplied by the resource volume to estimate the mean number of spills. Oil spills are treated statistically as a Poisson process, meaning that they occur independently of one another. If BOEM constructed a histogram of the chance of exactly 0 spills occurring during some period, the chance of exactly 1 spill, or exactly 2 spills, and so on, the histogram would have a shape known as a Poisson distribution. An important and interesting feature of this distribution is that it is entirely described by a single parameter, the mean number of large spills. Given the mean number of large spills, you can calculate the entire histogram and estimate the chance of one or more large spills occurring.

A-4.1.1. Large Spill Rates

BOEM derives the large oil-spill rates for the Arctic OCS from a fault-tree modeling study conducted by Bercha Group Inc. (Bercha Group Inc., 2016). Using fault trees, oil-spill data from the Gulf of Mexico and Pacific OCS (Bercha Group Inc., 2013) were modified and incremented to represent expected Arctic performance and included both Arctic and non-Arctic variability.

Fault-tree analysis is a method for estimating the spill rate resulting from the interactions of other events. Fault trees are logical structures that describe the causal relationship between the basic system components and events resulting in system failure. Two general fault trees are constructed, one for large pipeline spills and one for large platform/well (Island) spills. In the Bercha Group Inc. (2006, 2008) studies, fault trees were used to transform historical spill statistics for non-Arctic regions to predictive spill-occurrence estimates for the Beaufort and Chukchi seas' sale areas. The Bercha Group, Inc. (2008) fault-tree analysis focused on Arctic effects as well as the variance in non-Arctic effects, such as spill size and spill frequency. Arctic effects were treated as a modification of existing spill causes as well as unique spill causes. Modification of existing spill causes included those that also occur in other OCS regions but at a different frequency, such as trawling accidents. Unique spill causes for pipeline spills included events that occur only in the Arctic, such as ice gouging, strudel scour, upheaval buckling, thaw settlement, and other causes. For platforms, unique spill causes included ice force, low temperature, and other causes. The measures of uncertainty calculated were expanded beyond Arctic effects in each fault-tree event to include the non-Arctic variability in spill size, spill frequency, and facility parameters, including wells drilled, number of platforms, number of subsea wells and subsea pipeline length. The inclusion of these types of variability—Arctic effects, non-Arctic data, and facility parameters—is intended to provide a realistic estimate of spill-occurrence indicators on the Arctic OCS and their resultant variability.

The Bercha Group Inc. (2016) fault tree analysis includes updated spill information from the Gulf of Mexico and the Pacific OCS (Bercha Group Inc., 2013). It also included refined information about LOWC frequencies used in the fault tree by incorporating information from a recently completed LOWC study (Bercha Group Inc., 2014a). The LOWC study updated offshore LOWC frequency information through 2011 for both the Gulf of Mexico (GOM) and the Pacific (PAC) OCS and the North Sea using information from both the SINTEF worldwide database and the U.S. GOM and PAC OCS. Previous fault tree studies (2006, 2008) used all LOWC events and their resultant frequencies regardless of whether or not they spilled crude or condensate oil. To this extent, previous fault tree results were conservative. In addition, platform spills, which occurred from a LOWC event, were previously double counted as both a platform/well spill and a LOWC event.

Recent studies (Bercha Group Inc., 2014a; Ji, Johnson, and Wikel, 2014; USDOI, BOEM, 2016) have continued to refine data and information about LOWC. Until recently, a consolidated dataset of multiple variables was not readily available to analyze the volumes of oil associated with LOWC with other applicable variables. Of the approximately 192 Gulf of Mexico LOWC events from 1980-2011, nine escalated into blowouts and spilled crude or condensate ≥ 50 bbl (Bercha Group Inc., 2014a) all of which were small spills except the DWH. The new information reveals that compared to the total number of LOWC events, there are few crude and condensate spills as a result or a LOWC escalating into a blowout.

A-4.1.1.1. Results for OCS Large Spill Rates

For purposes of fault-tree analysis, BOEM uses the the reserve estimates provided by the operator that supplement Figure 4-10 in the 2015 Hilcorp DPP; it is assumed that 0.11779 Bbbl is produced and transported. The annual rates were weighted either by the annual production divided by the total production or the year divided by the total years, and the prorated rates were summed to determine the large spill rates over the life of the development and production of the Proposed Action. For the Proposed Action, the life of development and crude oil production is ~25 ½ years. This is inclusive of an oil production period of ~22 years. Bercha Group Inc. (2016) calculated the mean spill rate for Island/Wells, Pipelines, and the total, as well as the 95% confidence intervals on the total large spill rate per Bbbl as shown in Table A-2.

Table A-2. Mean Spill Rate by Type per Billion Barrels Produced.

Type	Mean
Island/Wells	0.037 spills per Bbbl produced
Pipelines	0.020 spills per Bbbl produced
Total	0.058 spills per Bbbl produced
95% Confidence Interval	0.021 -0.105 spills per Bbbl produced

A-4.1.2. Results for the Chance of One or More Large Spills Occurring

BOEM's estimate of the likelihood of one or more large spills occurring assumes that there is a 100% chance that the development will occur and 0.11779 Bbbl of crude oil will be produced. The volume is based on estimates provided by the operator and verified by BOEM.

Additionally, the chance of one or more large spills occurring as a result of operations in and adjacent to the proposed development is estimated over the life of the development. For the proposed development, crude oil production is assumed to occur over a period of ~22 years. In the estimates of one or more large spills occurring, the annual chances for a large spill occurring from both pipeline and gravel island/wells over the entire estimated life of the development are added together to get the final result.

The large spill rates used in this section are all based on the mean number of large spills per Bbbl of hydrocarbon produced. Using the above mean spill rates for large spills, Table A-2 shows the estimated mean number of large oil spills for the Proposed Action. BOEM estimates 0.002356 pipeline spills and 0.004359 gravel island (including wells) spills would occur, for a total (over the life of the Project) of 0.0067145 spills. These are rounded to 0.0024 pipeline spills, 0.0044 gravel island spills and 0.0067 total spills.

BOEM uses the above mean spill number to determine the Poisson distribution. Figure A-1 shows the chance of no large spills occurring is 99.33%, and the chance of one or more large spills occurring is 0.67%.

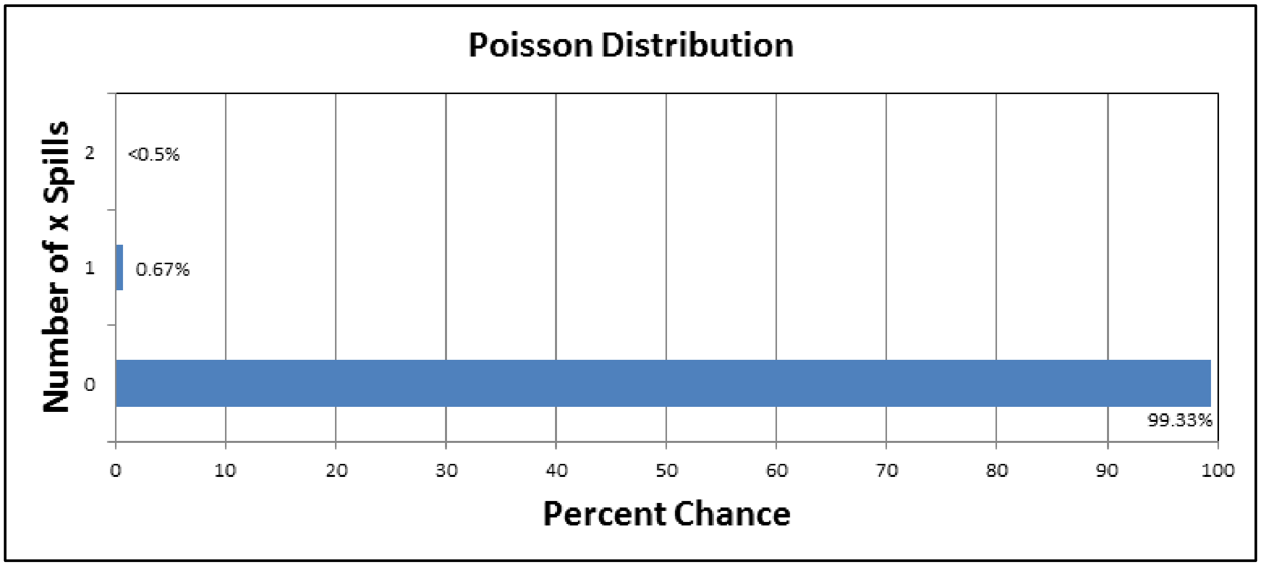


Figure A-1. Proposed Action Poisson Distribution over the Project Life.

A large spill is a statistically unlikely event. Based on the Oil-Spill Risk Analysis (OSRA) data summarized in this appendix, the mean spill number of large spills, over the entire life of the Proposed Action, is much less than one (0.0067 (about seven one thousandths of a large spill)) and the most likely number is zero. There is a 99.33% chance of no large spills occurring and a 0.67% chance of one or more large spills occurring over the life of the Proposed Action. The statistical distribution of large spills shows that it is much more likely that no large spills occur than one or more over the life of the Proposed Action. However, because large spills are an important concern, and no one can estimate the future perfectly, BOEM assumes a large spill occurs and conducts a large oil spill analysis for the development and production activities. This conservative analysis addresses whether such spills could cause serious environmental harm and informs the decision maker of potential impacts should an unlikely large spill occur. Assuming a number of large spills that is higher than the most likely number of spills helps to ensure that this Draft EIS does not underestimate potential environmental effects.

A-4.2. Chance of a Large Spill Contacting: Conditional Probabilities

The chance of a large spill from operations during the Proposed Action contacting shoreline sections or ERAs is taken from the oil-spill-trajectory model results, called conditional probabilities. These are summarized in Section 4.1.2.2 of the DEIS and are listed in Tables A.2-1 through A.2-54.

A-4.3. Results of the Oil-Spill-Risk Analysis: Combined Probabilities

Tables A.2-10 through A.2-11 show the annual combined probabilities for the Development and Production Plan. The combined probabilities reflect the chance of one or more large spills occurring and contacting resources over the Scenario life.

For the most part, the chance of one or more large spills from operations in or adjacent to the Project Area occurring and contacting grouped land segments or environmental resource areas is 1% within 30 days, or 1% within 360 days. The environmental resource areas that had a 1% chance of contact are the Boulder Patch Area and the Shaviovik River. The grouped land segment that has a 1% of contact is the U.S. Beaufort Sea Coast.

A-5. Accidental Small Oil Spills

Small spills are spills that are <1,000 bbl. Table A-3 shows the small spills BOEM analyzes for the effects of the Proposed Action in Chapter 4. BOEM considers two oil types for small spills: crude and refined oil.
Small spills, although accidental, have occurred with generally routine frequency and are considered likely to occur from development, production or decommissioning activities The majority of small spills would be contained on the gravel island or landfast ice (during winter), and refined spills that reach the open water would evaporate and disperse within hours to a few days. Further, those spills reaching the water may be contained by booms or absorbent pads. BOEM estimates small spills are likely to occur over the life of the exploration and development activities.

A-5.1. Small Spill Assumptions Summary

In order to estimate the number and volume of small crude and refined spills that could occur as a result of the Liberty project, BOEM applies results from *Oil Spill Occurrence Rates for Alaska North Slope Crude and Refined Oil Spills* published by Nuka Research and Planning Group, LLC in October 2013 (Robertson et al., 2013). Nuka's analysis of onshore ANS (Alaska North Slope) crude and refined spills greater than 1 barrel and less than 1,000 bbl is performed collectively for all facilities, pipelines, and flowlines (Robertson et al., 2013).

Nuka used data for the years 1980-2010 from three oil fields (Kuparuk River, Milne Point, and Prudhoe Bay) on the Alaska North Slope to develop regression models for estimating oil spill occurrence. The model used for this analysis is a mixed effects regression that estimates the total number of spills (both refined and crude) based on a given field's oil production volume and pipeline length (Robertson et al., 2013). The model developed by Nuka to estimate total yearly spills from a hypothetical field is provided by Equation 3 (Robertson et al., 2013).

$$\mathrm{N_{tot}} = 2.778 + \ 0.054 * (\mathrm{ProdOil}) + 0.026 * (\mathrm{TotLength})$$

Where:
$\mathrm{N_{tot}}$ = total spills per year
$\mathrm{ProdOil}$ = production of oil per year (millions of bbls)
$\mathrm{TotLength}$ = pipeline length in service (ten − thousands of linear ft)

Diagnostic tests performed by Nuka indicate that the model has a reasonably strong predictive value for annual number of spills. The 95% confidence intervals were: Intercept (-0.0003, 5.5570); ProdOil (0.0438, 0.0650); Tot Length (0.0002, 0.0496) (Robertson et al., 2013).

Using yearly production and pipeline length estimates provided by Hilcorp together with Equation 3, BOEM estimates a total of 70 small crude and refined oil spills (<1,000 bbl) during the life of the field. Applying the 95% confidence interval provides a range of 5 to 134 spills over the life of the field.

Nuka also totaled the number of small spills in three volume categories for the entire ANS spill database, which includes spills from Badami, Colville River (Alpine), Endicott, Kuparuk River, Milne Point, Nikaitchuq, North Star, Oooguruk, Prudhoe Bay, and spills from unknown ANS fields. These totals, together with the percentage of small spills in each category, are shown in Table A-3.

Table A-3. Breakdown of ANS Spills in the database by Spill Size Class.

Spills in Class	Class D 1 < Volume ≤ 10	Class C 10 < Volume ≤ 200	Class B 200 < Volume ≤ 1000
Number	1,300	250	25
Percentage	82.54 %	15.87 %	1.59 %

Note: Nuka table 3.2.
Source: Robertson et al., 2013

BOEM uses these percentages to prorate the estimated number of total small spills at Liberty. The total number of spills, 70, is multiplied by the percentage of spills in each class shown in Table A-3. Results of this proration are shown in Table A-4.

Table A-4. Estimated Small Spills at Liberty by Size Class.

Spill Class	Class D 1< Volume ≤10	Class C 10< Volume ≤200	Class B 200< Volume ≤1000	Total Spills
Number of Spills	58	11	1	70

Nuka also provides the number of crude and refined spills (679 and 898, respectively) that have occurred on the entire ANS. BOEM divides ANS crude and refined spill numbers by the total ANS spills in the database (1,577) to yield 43.06% crude spills and 56.94% refined spills occurring in the ANS. BOEM then prorates the total number of small spills estimated to occur at Liberty by the percentages of crude and refined spills. Out of the 70 small spills BOEM estimates to occur as a result of the Proposed Action, 30 are crude oil spills, and 40 are refined oil spills.

To estimate the total volume of oil spilled from small spills: BOEM first multiplies the median small spill volume of refined oil spills on the ANS, 2.39 bbl, by the estimated number of refined spills at Liberty, 40, to yield ~96 bbl and multiplies the median small spill volume for crude oil spills on the ANS, 3.33 bbl, by the number of crude oil spills estimated to occur at Liberty, 30, to yield ~100 bbl. BOEM adds the small refined spill volume, 96 bbl, to the small crude spill volume, 100 bbl, to yield 196 bbl that are spilled as a result of the proposed action (Robertson et. al; BOEM, 2016).

To estimate the number of small spills per year for the entire life of the field, BOEM divides the estimated number of small spills, 70, by the estimated summation of the number of years of development (~2 years), production life (~22 years), and decommissioning (1.5 years) to yield ~3 bbl per year. To estimate the number of small spills per year for solely the production period, BOEM divides the number of small spills, 70, by the estimated number of years of production (22 years) which yields ~3 spills per year.

As discussed by Robertson et al. (2013) and in Section A-5.1, spills that occurred from 1980-2010 from Kuparuk River, Milne Point, and Prudhoe Bay were used to develop Nuka's model (Equation 3). During the years 1980-2010, development in addition to production continued to occur at Kuparuk River, Milne Point, and Prudhoe Bay. For example, from the years 2005 to 2009, 8, 5, and 13 new development wells were drilled at Kuparuk River Unit (AOGC Kuparuk Info 2016), Milne Point (AOGC Milne Point Info 2016), Prudhoe Bay (AOGC Prudhoe Bay Info 2016), respectively. The plugging and abandoning of wells has also occurred in Prudhoe Bay (Oil and Gas Journal, 2000). While the Prudhoe Bay field is not being decommissioned, the plugging and abandoning of wells is an activity that is part of a field's general decommissioning process (see 30 CFR 250.1703). BOEM assumes that the estimated small spill number of 70 spills derived from Nuka's model represents spills that occur during the development, production, and decommissioning activities of the Proposed Action. Further, BOEM includes the 95% confidence interval to provide a range for the small spill number that accounts for the uncertainty in the model variables.

A.1. Supporting Tables and Maps

Table A.1-1. Large (≥1,000 bbl) and Small (<1,000 bbl) Oil Spill Descriptions for Analysis[1,2].

Phase	Size	Source	Type of Oil	Estimated Number	Estimated Size (in bbl)
Development or Production	Large	OCS Island	Crude or Diesel	None[3]	5100 bbl[3,4]
Development or Production	Large	Offshore Pipeline	Crude	None[3]	1,700 bbl (leak) or 4000 bbl (rupture)[3,4]
Development or Production	Large	Onshore Pipeline	Crude	None[3]	2,500 bbl spill[3,4]
Any phase	Small	Island, Roads, Onshore, Offshore	Total	~70 spills	<1,000 bbl
Development and Production	Small	Operational Spills All Sources	Crude	~30 spills	<1,000 bbl
Any	Small	Operational Spills All Sources	Refined	~40 spills	<1,000 bbl

Notes: 1. Large and small oil spill sizes are described in terms of: source of spill, phase of proposed action it could occur in, type of oil, and number and size of spill type.
2. The receiving environment for small or large spills can be: open water, on top of or under sea ice, broken ice, shoreline, tundra, snow, or the spills could be contained on the LDPI. Additionally, small spills could occur on ice or traditional roads both onshore and offshore throughout the Proposed Action Area.
3. No large spills are estimated to occur; one large spill from any of the large spill sources (island, offshore pipeline, or onshore pipeline) is assumed to occur for purposes of analysis;
4. The estimated size of a large spill that is assumed to occur for purposes of analysis.

Sources: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-2. Fate and Behavior of a 5100 bbl Diesel Oil spill from the Proposed LDPI.

Days Elapsed	Summer Spill[1]				Meltout Spill[2]			
Time After Spill (days)	1	3	10	30	1	3	10	30
Oil Remaining (%)	53	4.4	0	na	84.9	61.6	20.4	0
Oil Dispersed (%)	28.1	65.2	68.5	na	1.2	6.3	28.6	41.5
Oil Evaporated (%)	18.9	30.4	31.5	na	13.9	32.1	51	58.5

Source: USDOI, BOEM, ALASKA OCS Region (2016)
Note: The description following Table A.1-8 applies.

Table A.1-3. Fate and Behavior of a 5100 bbl Crude Oil Spill from the Proposed LDPI.

Oil Status	Summer Spill[1]				Meltout Spill[2]			
Time After Spill (days)	1	3	10	30	1	3	10	30
Oil Remaining (%)	86.3	76.3	55.6	26.7	90.3	87.7	84.5	80.2
Oil Dispersed (%)	3.2	10.7	29.2	56.1	0.1	0.4	1.2	3.3
Oil Evaporated (%)	10.5	13	15.2	17.2	9.6	11.9	14.3	16.5
Discontinuous Area(km^2) 3	8.43	34.99	166.43	690.71	10.07	41.81	198.90	825.44
Oiled Coastline(km)4	80.16				75.31			

Source: USDOI, BOEM, ALASKA OCS Region (2016)
Note: The description following Table A.1-8 applies.

Table A.1-4. Fate and Behavior of a 5,000 bbl Crude Oil Rupture from the Pipeline.

Oil Status	Summer Spill[1]				Meltout Spill[2]			
Time After Spill (days)	1	3	10	30	1	3	10	30
Oil Remaining (%)	86.3	76.2	55.6	26.7	90.3	87.7	84.5	80.2
Oil Dispersed (%)	3.2	10.8	29.2	56.1	0.1	0.4	1.2	3.3
Oil Evaporated (%)	10.5	13	15.2	17.2	9.6	11.9	14.3	16.5
Discontinuous Area (km^2) 3	8.35	34.63	164.76	683.77	9.97	41.39	196.90	817.15

Oil Status	Summer Spill[1]	Meltout Spill[2]
Oiled Coastline (km)4	79.41	74.61

Source: USDOI, BOEM, ALASKA OCS Region (2016)
Note: The description following Table A.1-8 applies.

Table A.1-5. Fate and Behavior of a 1700 bbl Crude Oil leak from the pipeline.

Oil Status	Summer Spill[1]				Meltout Spill[2]			
Time After Spill (days)	1	3	10	30	1	3	10	30
Oil Remaining (%)	85	75.5	55.2	26.4	90	87.6	84.4	80.2
Oil Dispersed (%)	4	11.4	29.6	56.3	0.1	0.4	1.3	3.3
Oil Evaporated (%)	11	13.1	15.2	17.3	9.9	12	14.3	16.5
Discontinuous Area(km^2) 3	4.82	19.98	95.06	394.51	5.75	23.88	113.6	471.47
Oiled Coastline(km) 4	47.74				44.85			

Source: USDOI, BOEM, ALASKA OCS Region (2016)
Note: The description following Table A.1-8 applies.

Table A.1-6. Fate and Behavior of a 200 bbl Diesel Oil Spill during Summer.

Oil Status	Summer Spill[1]					
Time After Spill (Hours)	1	6	12	24	48	72
Oil Remaining (%)	95.9	77.7	51.8	16.6	0.5	0
Oil Dispersed (%)	0.8	11.7	29	55.6	68.1	68.5
Oil Evaporated (%)	3.3	10.6	19.2	27.8	31.4	31.5

Source: USDOI, BOEM, ALASKA OCS Region (2016)
Note: The description following Table A.1-8 applies.

Table A.1-7. Fate and Behavior of a 200 bbl Diesel Oil Spill during Meltout.

Oil Status	Meltout Spill[2]			
Time After Spill (days)	1	3	10	30
Oil Remaining (%)	71.2	39.1	1.3	0
Oil Dispersed (%)	3.6	16.8	40.8	41.5
Oil Evaporated (%)	25.2	44.1	57.9	58.5

Source: USDOI, BOEM, ALASKA OCS Region (2016)
Note: The description following Table A.1-8 applies.

Table A.1-8. Fate and Behavior of a 3 bbl Diesel Oil Spill during Summer.

Oil Status	Summer Spill[1]					
Time After Spill (Hours)	1	6	12	24	48	72
Oil Remaining (%)	91.1	39.3	6.6	0	NA	NA
Oil Dispersed (%)	3.4	38.3	63.7	68.6	NA	NA
Oil Evaporated (%)	5.5	22.4	29.7	31.4	NA	NA

Notes: Calculated with the SINTEF oil-weathering model Version 4.0 of Reed et al. (2005) and assuming a Liberty Crude Oil (SL ROSS 1998) or Ultra Low Sulfur Diesel (SEA and SINTEF 2015).
[1] Summer or Open Water (July to October), Wind Speed 6.0 m/s, surface water temperature 5.0°C
[2] Meltout (June to July), Spill is assumed to melt out into 50% ice cover with surface water temperature of 2.0°C and wind Speed of 5.0 m/s.
[3] Equation 6 of Table 2 in Ford (1985) is used to estimate the discontinuous area of a continuing spill or the area swept by an instantaneous spill of a given volume.
[4] Oiled coastline is calculated from Equation 17 of Table 4 in Ford (1985) and is the result of stepwise multiple regressions for length of historical coastline affected
NA = not applicable
Summer surface water temperature is based on CTD Casts collected by cruises/surveys during July, August, and September between 1985-2006 (Arctic Nearshore Impact Monitoring in Development Area (ANIMIDA) (Boehm, 2001) and Endicott Environmental Monitoring Program). The Endicott Environmental Monitoring Program water temperatures were recorded using CTD instruments from 1985-1987 across a series of transect lines during open-water season (Envirosphere 1987, 1990, and 1992). Summer wind speeds are based on average wind speeds measured at Endicott during July, August, September, and October from the years 2001-2006.
Meltout surface water temperature is based on NASA JPL's ROM (Regional Ocean Modeling System) (NASA 2016) and NOAA's Biweekly Sea Ice Analysis (National Ice Center 2016) for the years 2011 to 2015. Wind speeds during meltout are based on average wind speeds measured at Endicott during June and July from the years 2001-2006.

Table A.1-9. Land Segment (LS) ID and the Percent Type of Environmental Sensitivity Index Shoreline Closest to the Ocean for United States, Alaska Shoreline.

LS ID	Geographic Place Names	1A	1B	1C	3A	3B	3C	4	5	6A	6B	6C	7	8A	8B	8C	8E	9A	9B	10A	10B	10E	U
40	Lopp Lagoon, Mint River	-	-	-	21	-	3	1	23	-	-	-	6	-	-	-	21	7	1	2	-	15	-
41	Ikpek, Ikpek Lagoon	-	-	-	16	-	6	-	-	-	-	-	12	-	-	-	21	7	2	16	-	19	2
42	Arctic Lagoon, Nuluk River	-	-	-	1	-	3	1	7	-	-	-	1	-	-	-	30	6	14	2	-	34	1
43	Sarichef Island	-	-	-	-	-	13	4	1	-	-	-	12	-	-	-	27	7	1	4	-	32	-
44	Cape Lowenstern, Shishmaref	-	-	-	6	-	8	-	-	-	-	1	7	-	-	-	32	6	4	6	-	31	-
45	LS45	-	-	-	17	-	-	-	-	-	-	-	1	-	-	-	25	7	9	-	-	40	2
46	Kalik & Singeakpuk River	-	-	-	13	-	2	-	-	-	-	-	4	-	-	-	38	7	12	-	-	24	-
47	Kitluk River	-	-	-	13	-	1	-	-	-	-	-	32	-	-	-	20	2	24	-	-	-	7
48	Cape Espenberg	-	-	-	13	-	1	-	10	-	-	-	2	-	-	-	7	8	-	25	-	20	14
49	Pish River	-	-	-	19	-	-	-	15	-	-	-	-	-	-	-	14	5	3	20	-	24	-
50	Goodhope Bay & River	1	-	3	4	-	-	4	22	4	12	-	-	-	-	-	12	-	-	4	-	35	-
51	Deering	1	-	11	15	-	-	-	23	6	4	-	-	-	-	-	12	2	1	24	-	-	1
52	Willow Bay	2	5	4	9	-	-	-	35	1	1	-	-	-	1	-	1	-	-	32	-	7	-
53	Kiwalik	-	-	-	3	-	-	-	18	-	-	-	-	2	1	-	-	3	-	13	-	43	15
54	Baldwin Peninsula	-	-	-	15	-	8	-	68	-	-	-	-	1	-	-	2	-	-	-	-	6	-
55	Cape Blossom, Pipe Spit	-	-	-	1	-	6	-	78	1	1	-	-	-	-	-	4	-	-	7	-	1	-
56	Kotzebue, Noatak River	-	1	-	-	-	3	-	13	-	-	1	-	-	-	-	8	9	1	5	-	23	38
57	Aukulak Lagoon	-	-	-	4	-	2	-	18	-	-	-	-	-	-	-	19	7	3	5	-	28	14
58	Cape Krusenstern	-	-	-	-	-	1	-	32	-	1	-	-	-	-	-	17	-	1	22	-	26	-
59	Imik, Ipiavik & Kotlik Lagoon	-	-	-	1	-	-	-	48	4	-	-	-	-	-	-	6	4	-	35	-	2	-
60	Kivalina, Kivalina & Wulik River	-	-	-	-	-	2	1	46	3	-	1	-	-	-	1	19	5	7	9	-	6	-
61	Cape Seppings	-	-	-	-	-	-	-	54	-	-	-	-	-	-	-	9	-	11	6	-	19	-
62	Atosik Lagoon	-	-	-	-	-	-	-	76	-	-	-	-	-	-	-	1	-	17	5	-	1	-
63	Asikpak Lag., Cape Seppings	-	-	1	5	-	1	1	46	11	-	-	19	-	-	-	10	3	1	1	-	-	-
64	Kukpuk River, Point Hope	1	-	2	8	-	1	2	42	4	-	-	12	-	-	-	16	4	6	-	-	1	-
65	Buckland, Cape Lisburne	13	-	2	-	-	-	-	71	10	3	-	-	-	-	-	-	-	-	1	-	-	-
66	Ayugatak Lagoon	54	-	-	-	-	-	-	32	1	-	-	-	-	-	-	-	-	-	12	-	-	-
67	Cape Sabine, Pitmegea River	38	-	3	-	-	15	-	22	1	-	-	-	-	-	-	-	-	-	19	-	-	-
68	Agiak Lagoon, Punuk Lagoon	-	-	-	-	-	11	-	76	11	-	-	-	-	-	-	-	-	-	1	-	-	-
69	Cape Beaufort, Omalik Lagoon	-	-	-	-	-	-	-	44	47	-	-	-	-	-	-	-	-	-	2	-	6	-

LS ID	Geographic Place Names	1 A	1 B	1 C	3 A	3 B	3 C	4	5	6 A	6 B	6 C	7	8 A	8 B	8 C	8 E	9 A	9 B	10 A	10 B	10 E	U
70	Kuchaurak and Kuchiak Creek	-	-	-	-	-	-	-	20	-	-	-	20	-	-	-	14	1	21	2	-	19	2
71	Kukpowruk River, Sitkok Point	-	-	-	4	-	9	-	35	-	-	-	21	-	-	-	5	19	4	-	-	2	1
72	Point Lay, Siksrikpak Point	-	-	-	4	-	2	-	49	-	-	-	8	-	-	-	12	15	-	5	-	3	-
73	Tungaich Point, Tungak Creek	-	-	-	-	-	8	-	52	-	-	-	-	-	-	1	4	15	5	10	-	4	-
74	Kasegaluk Lagoon, Solivik Isl.	-	-	-	15	-	-	-	28	1	-	-	1	-	-	-	5	41	2	5	-	-	1
75	Akeonik, Icy Cape	-	-	-	13	-	4	1	34	-	-	-	2	-	-	-	14	14	11	5	1	1	-
76	Avak Inlet, Tunalik River	-	-	-	2	-	8	3	40	-	-	-	1	-	-	-	13	11	8	1	-	13	-
77	Nivat Point, Nokotlek Point	-	-	-	13	-	3	6	42	-	-	-	9	-	-	-	12	9	4	-	-	1	-
78	Point Collie, Sigeakruk Point	-	-	-	15	-	5	-	38	-	-	-	19	-	-	-	-	4	7	-	-	5	8
79	Point Belcher, Wainwright	-	-	-	22	-	1	-	33	2	1	-	32	-	-	-	2	-	-	1	-	5	-
80	Eluksingiak Point, Kugrua Bay	-	-	-	13	-	35	-	10	-	-	-	12	-	-	-	14	9	-	1	-	5	1
81	Peard Bay, Point Franklin	-	-	-	3	-	21	-	37	1	-	-	25	-	-	-	3	9	-	-	-	-	-
82	Skull Cliff	-	-	-	-	-	76	2	12	9	-	-	1	-	-	-	-	-	1	-	-	-	-
83	Nulavik, Loran Radio Station	-	-	-	-	-	73	-	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-
84	Will Rogers & Wiley Post Mem.	-	-	-	1	-	8	-	82	-	-	-	-	-	-	-	-	-	8	-	-	-	-
85	Barrow, Browerville, Elson Lag.	-	-	-	11	-	14	-	37	-	-	-	1	-	-	-	17	2	2	3	-	7	7
86	Dease Inlet, Plover Islands	-	-	-	30	3	5	-	3	-	-	-	2	-	-	-	19	15	3	11	-	9	-
87	Igalik & Kulgurak Island	-	-	-	17	-	4	-	3	-	-	-	-	-	-	-	25	7	-	9	-	34	1
88	Cape Simpson, Piasuk River	-	-	-	6	-	5	6	-	-	-	-	-	-	-	-	14	-	-	-	-	25	44
89	Ikpikpuk River Point Poleakoon	-	-	-	2	-	4	-	-	-	-	-	-	-	-	-	4	57	-	-	-	13	20
90	Drew & McLeod Point, Kolovik	-	-	-	5	-	19	7	-	-	-	-	-	-	-	-	14	16	-	11	-	27	-
91	Lonely, Pitt Pt., Pogik Bay, Smith R	-	-	-	-	-	4	9	7	-	-	-	-	-	-	-	12	5	-	6	-	38	18
92	Cape Halkett, Garry Creek	-	-	-	1	-	20	3	-	-	-	-	-	-	-	-	26	2	-	-	-	31	18
93	Atigaru Pt, Eskimo Isl., Kogru R.	-	-	-	9	-	30	2	1	-	-	-	-	-	-	-	20	1	3	1	-	34	-
94	Tingmeachsiovik River	-	-	-	7	-	20	-	6	-	-	-	-	-	-	-	8	-	-	-	-	59	1
95	Fish Creek, Nechelik Channel	-	-	-	0	-	0	-	-	-	-	-	-	-	-	-	5	42	-	1	-	33	19
96	Tolaktovut Point, Colville River	-	-	-	1	1	0	-	-	-	-	-	-	-	-	-	8	27	-	6	-	10	46
97	Kupigruak Channel, Colville River	-	-	-	6	-	1	-	-	-	-	-	-	-	-	-	10	32	-		-	1	51
98	Kalubik Creek	-	-	-	6	-	16	13	2	-	-	-	-	-	-	-	5	19	-	15	-	25	1
99	Oliktok Point, Ugnuravik River	-	-	-	2	-		10	18	7	-	-	-	-	-	-	17	-	-	2	-	42	1
100	Milne Point, Simpson Lagoon	-	-	-	7	-	1	23	20	-	-	-	-	-	-	-	29	2	3	2	-	11	2
101	Beechy & Back Pt., Sakonowyak R.	-	-	-	6	-	3	52	17	1	-	-	-	-	-	-	3		6	5	-	5	2
102	Kuparuk River, Point Storkersen	-	-	-	1	-		-	28	-	-	-	-	-	-	-	6	30	3	1	-	13	18
103	Point McIntyre, West Dock, Putuligayuk R.	-	-	-	2	-	2	-	49	-	-	-	-	4	1	-	8	7	4	2	-	21	-
104	Prudhoe Bay, Heald Pt.	-	-	-	5	-	7	1	3	-	-	-	-	-	1	-	5	65	-	-	-	6	6
105	Point Brower, Sagavanirktok R., Duck I.	-	-	-	2	-	5	0	1	-	-	-	-	-	-	-	15	51	-	15	-	8	4
106	Foggy Island Bay, Kadleroshilik R.	-	-	-	4	-	2	8	9	-	-	-	-	-	-	-	5	37	-	8	-	21	8
107	Tigvariak Island, Shaviovik R.	-	-	-	7	-	6	0	20	3	-	-	-	-	-	-	10	27	-	3	-	23	0
108	Mikkelsen Bay, Badami Airport	-	-	-	3	-	3	4	39		-	-	-	-	-	-	4	6	-	5	-	29	7
109	Bullen, Gordon & Reliance Points	-	-	-	11	-	5	2	48		-	-	-	-	-	-	-	-	-	18	-	17	-
110	Pt. Hopson & Sweeney, Thomson	-	-	-	3	-	0	3	52	6	-	-	-	-	-	-	9		-	3	-	23	-
111	Staines R., Lion Bay	-	-	-	1	-	6	18	24	-	-	-	6	-	-	-	19	9	-	4	-	13	-
112	Brownlow Point, West Canning River	-	-	-	16	-	8	6	15	-	-	-	-	-	-	-	4	28	-	-	-	8	15
113	Canning & Tamayariak River	-	-	-	24	-	3	-	0	-	-	-	-	-	-	-	6	56	-	-	-	8	1
114	Konganevik Point	-	-	-	30	-	16	-	11	-	-	-	3	-	-	-	15	6	9	-	-	8	-
115	Collinson Point, Simpson Cove	-	-	-	3	-	8	-	39	-	-	-	2	-	-	-	1	21	-	-	-	27	-
116	Marsh and Carter Creek	-	-	-	-	-		-	63	-	-	-	5	-	-	-	-	-	-	1	-	31	-
117	Anderson Point, Sadlerochit River	-	-	-	23	-	3	-	14	-	-	-	26	-	-	-	1	17	5	1	-	10	-
118	Nataroarok Ck., Hulahula and Okpilak R.	-	-	-	15	-		-	3	-	-	-	-	-	-	-	3	74	-	-	-	5	-
119	Arey Island, Barter Island,	-	-	-	6	-	8	2	29	-	-	-	-	-	-	-	18	4	1	-	-	28	2
120	Kaktovik, Jago Lagoon, Bernard Spit	-	-	-	-	-	15	4	60	-	-	1	-	-	2	-	5	9	2	-	-	2	-
121	Jago Spit & R., Tapkaurak Spit & Lagoon	-	-	-	-	-	6	2	34	-	-	-	1	-	-	-	9	24	0	-	-	5	19
122	Griffin Point, Oruktalik Lagoon	-	-	-	-	-	20	2	43	-	-	-	-	-	-	-	13	2	2	1	-	16	-

LS ID	Geographic Place Names	1 A	1 B	1 C	3 A	3 B	3 C	4	5	6 A	6 B	6 C	7	8 A	8 B	8 C	8 E	9 A	9 B	10 A	10 B	10 E	U
123	Angun Point, Beaufort Lagoon	-	-	-	-	-	18	30	23	-	-	-	-	-	-	-	14	4	1	-	-	7	3
124	Icy Reef, Kongakut River, Siku Lagoon	-	-	-	-	-		3	26	-	-	-	-	-	-	-	2	28	1	-	-	38	3
125	Demarcation Bay & Point	-	-	-	1	-	15	3	54	-	-	-	-	-	-	-	6	7	3	-	-	5	5

Source: USDOI, BOEM (2016) from Harper and Morris (2014)
Key:

ID = identification (number). Number Description	
1A Exposed rocky shores; exposed rocky banks	**7** Exposed tidal flats
1B Exposed, solid man-made structures	**8A** Sheltered scarps in bedrock, mud, or clay; Sheltered rocky shores (impermeable) *
1C Exposed rocky cliffs with boulder talus base	**8B** Sheltered, solid man-made structures; Sheltered rocky shores (permeable) *
3A Fine- to medium-grained sand beaches	**8C** Sheltered rip rap
3B Scarps and steep slopes in sand	**8D** Sheltered rocky rubble shores
3C Tundra cliffs	**8E** Peat shorelines
4 Coarse-grained sand beaches	**9A** Sheltered tidal flats
5 Mixed sand and gravel beaches	**9B** Vegetated low banks
6A Gravel beaches; Gravel beaches (granules and pebbles) *	**10A** Salt- and brackish-water marshes
6B Gravel beaches (cobbles and boulders) *	**10B** Freshwater marshes
6C Rip rap (man-made) *	**10E** Inundated low-lying tundra
	U Unknown

Table A.1-10. Identification Number (ID) and Name of Environmental Resource Areas, Represented in the Oil-Spill-Trajectory Model and Their Location on Environmental Resource Area Maps and Tables.

ID	Name	General Resource	Map A-
1	Kasegaluk Lagoon Area	Birds, Barrier Island, Marine Mammals	A-2d
2	Point Barrow, Plover Islands	Birds, Barrier Island	A-2c
3	SUA: Enurmino-Neshkan/Russia	Subsistence	A-2g
4	SUA:Inchoun-Uelen/Russia	Subsistence	A-2f
5	Beaufort Sea Shelf Edge IBA	Birds	A-2d
6	Hanna Shoal	Lower Trophics, Seals	A-2g
7	Krill Trap	Lower Trophics	A-2c
8	Maguire and Flaxman Islands	Birds, Barrier Island	A-2a-2
9	Stockton and McClure Islands	Birds, Barrier Island	A-2a-1
10	Ledyard Bay SPEI Critical Habitat Unit	Birds	A-2f
11	Wrangel Island 12 nmi & Offshore	Marine Mammals	A-2g
12	SUA: Nuiqsut - Colville River Delta	Subsistence	A-2c
13	SUA: Kivalina-Noatak	Subsistence, Whales	A-2g
14	Cape Thompson Seabird Colony Area	Birds	A-2g
15	Cape Lisburne Seabird Colony Area	Birds, Marine Mammals	A-2f
16	Barrow Canyon	Lower Trophics	A-2c
17	Angun and Beaufort Lagoons	Birds, Barrier Island	A-2a-1
18	Murre Rearing and Molting Area	Birds	A-2g
19	Chukchi Spring Lead System	Birds	A-2d
20	East Chukchi Offshore	Whales	A-2f
21	AK BFT Bowhead FM 1	Whales	A-2b
22	AK BFT Bowhead FM 2	Whales, Marine Mammals	A-2b
23	Polar Bear Offshore	Marine Mammals	A-2g
24	AK BFT Bowhead FM 3	Whales	A-2b
25	AK BFT Bowhead FM 4	Whales, Fish	A-2b
26	AK BFT Bowhead FM 5	Whales	A-2b
27	AK BFT Bowhead FM 6	Whales	A-2b
28	AK BFT Bowhead FM 7	Whales, Marine Mammals	A-2b
29	AK BFT Bowhead FM 8	Whales, Marine Mammals	A-2b
30	Beaufort Spring Lead 1	Whales	A-2c
31	Beaufort Spring Lead 2	Whales, Marine Mammals, Fish	A-2c
32	Beaufort Spring Lead 3	Whales	A-2c

ID	Name	General Resource	Map A-
33	Beaufort Spring Lead 4	Whales	A-2c
34	Beaufort Spring Lead 5	Whales	A-2c
35	Beaufort Spring Lead 6	Whales	A-2c
36	Beaufort Spring Lead 7	Whales	A-2c
37	Beaufort Spring Lead 8	Whales, Fish	A-2c
38	SUA: Pt. Hope-Cape Lisburne	Subsistence, Marine Mammals, Fish	A-2d
39	SUA: Pt. Lay-Kasegaluk Lagoon	Subsistence, Marin Mammals, Fish	A-2e
40	SUA: Icy Cape-Wainwright	Subsistence, Fish	A-2g
41	SUA: Barrow-Chukchi	Subsistence, Fish	A-2e
42	SUA: Barrow-East Arch	Subsistence, Fish	A-2d
43	SUA: Nuiqsut-Cross Island	Subsistence, Fish	A-2c
44	SUA: Kaktovik	Subsistence, Fish	A-2c
45	Beaufort Spring Lead 9	Whales	A-2c
46	Wrangel Island 12 nmi Buffer 2	Marine Mammals	A-2g
47	Hanna Shoal Walrus Use Area	Marine Mammals, Fish	A-2e
48	Chukchi Lead System 4	Marine Mammals	A-2e
49	Chukchi Spring Lead 1	Whales, Fish	A-2g
50	Pt Lay Walrus Offshore	Marine Mammals	A-2d
51	Pt Lay Walrus Nearshore	Marine Mammals, Fish	A-2g
52	Russian Coast Walrus Offshore	Marine Mammals	A-2f
53	Chukchi Spring Lead 2	Whales, Fish	A-2d
54	Chukchi Spring Lead 3	Whales, Fish	A-2d
55	Point Barrow, Plover Islands	Marine Mammals, Barrier Islands, Fish	A-2b
56	Hanna Shoal Area	Whales, Fish	A-2g
57	Skull Cliffs	Lower Trophics, Fish	A-2b
58	Russian Coast Walrus Nearshore	Marine Mammals, Fish	A-2f
59	Ostrov Kolyuchin	Marine Mammals, Fish	A-2f
60	SUA: King Point.-Shallow Bay (Canada)	Subsistence, Whales, Fish	A-2b
61	Point Lay-Barrow BH GW SFF	Whales	A-2f
62	Herald Shoal Polynya 2	Marine Mammals	A-2g
63	North Chukchi	Whales	A-2g
64	Peard Bay Area	Birds, Marine Mammals, Fish	A-2d
65	Smith Bay	Birds, Marine Mammals, Whales	A-2c
66	Herald Island	Marine Mammals	A-2g
67	Herschel Island (Canada)	Birds, Fish,	A-2c
68	Harrison Bay	Birds, Marine Mammals	A-2a-1
69	Harrison Bay/Colville Delta	Birds, Marine Mammals	A-2a-2
70	North Central Chukchi	Whales, Fish	A-2g
71	Simpson Lagoon, Thetis and Jones Island	Birds, Fish	A-2c
72	Gwyder Bay, West Dock, Cottle and Return Islands	Birds, Fish	A-2a-2
73	Prudhoe Bay	Birds	A-2a-1
74	Herschel Island (Canada)	Polar Bear, Fish	A-2c
75	Boulder Patch Area	Lower Trophics, Marine Mammals	A-2a-2
76	Kendall Island Bird Sanctuary (Canada)	Birds	A-2c
77	Sagavanirktok River Delta/Foggy Island Bay	Birds	A-2a-2
78	Mikkelsen Bay	Birds	A-2a-2
79	Demarcation Bay Offshore	Birds	A-2c
80	Beaufort Outer Shelf 1	Lower Trophics, Fish	A-2c
81	Simpson Cove	Birds	A-2a-1
82	North Chukotka Nearshore 2	Whales	A-2g
83	North Chukotka Nearshore 3	Whales	A-2g
84	Canning River Delta	Fish	A-2a-2
85	Sagavanirktok River Delta	Fish, Marine Mammals	A-2e
86	Harrison Bay	Fish	A-2a-1
87	Colville River Delta	Fish	A-2e
88	Simpson Lagoon	Fish	A-2a-1
89	Mackenzie River Delta	Fish	A-b

ID	Name	General Resource	Map A-
90	SUA: Gary and Kendall Islands (Canada)	Subsistence	A-2b
91	Bowhead Whale Summer (Canada)	Whales	A-2c
92	Thetis, Jones, Cottle & Return Islands	Marine Mammals, Barrier Islands	A-2a-1
93	Cross and No Name Islands	Marine Mammals, Barrier Islands, Fish	A-2a-2
94	Maguire Flaxman & Barrier Islands	Marine Mammals, Barrier Islands	A-2a-1
95	Arey and Barter Islands and Bernard Spit	Marine Mammals, Barrier Islands, Fish	A-2a-2
96	Midway, Cross and Bartlett Islands	Birds, Fish	A-2a-1
97	SUA: Tigvariak Island	Subsistence, Fish	A-2a-1
98	Anderson Point Barrier Islands	Birds, Barrier Island, Fish	A-2a-1
99	Arey and Barter Islands, Bernard Spit	Birds, Barrier Island, Fish	A-2a-1
100	Jago and Tapkaurak Spits	Birds, Barrier Island, Fish	A-2a-1
101	Beaufort Outer Shelf 2	Lower Trophics, Fish	A-2c
102	Opilio Crab EFH	Opilio Crab Habitat (EFH) , Fish	A-2f
103	Saffron Cod EFH	Saffron Cod Habitat (EFH) , Fish	A-2e
104	Ledyard Bay-Icy Cape IBA	Birds, Fish	A-2e
105	Fish Creek	Fish	A-2a-1
106	Shaviovik River	Fish	A-2c
107	Point Hope Offshore	Whales, Fish	A-2f
108	Barrow Feeding Aggregation	Whales, Fish	A-2f
109	AK BFT Shelf Edge	Whales, Fish	A-2c
110	AK BFT Outer Shelf&Slope 1	Whales, Fish	A-2b
111	AK BFT Outer Shelf&Slope 2	Whales, Fish	A-2b
112	AK BFT Outer Shelf&Slope 3	Whales, Fish	A-2b
113	AK BFT Outer Shelf&Slope 4	Whales, Fish	A-2b
114	AK BFT Outer Shelf&Slope 5	Whales	A-2b
115	AK BFT Outer Shelf&Slope 6	Whales, Fish	A-2b
116	AK BFT Outer Shelf&Slope 7	Whales, Fish	A-2b
117	AK BFT Outer Shelf&Slope 8	Whales	A-2b
118	AK BFT Outer Shelf&Slope 9	Whales, Fish	A-2b
119	AK BFT Outer Shelf&Slope 10	Whales, Fish	A-2b
120	Chukchi Gray Whale Fall (Russia)	Whales	A-2e
121	Cape Lisburne - Pt Hope	Whales, Fish	A-2e
122	Bowhead Fall (Canada)	Whales, Fish	A-2c
123	Offshore Herald Island/Hope Sea Valley	Whales, Fish	A-2g
124	Chukchi Sea Nearshore IBA	Birds, Fish	A-2f

Table A.1-11. Environmental Resource Areas Used in the Analysis of Large or Very Large Oil Spill Effects on Lower Trophic Level Organisms in Sections 4.3 and 4.7.

ERA ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
6	Hanna Shoal	A-2g	January-December	Lower Trophic Level Organisms	Invertebrates	Dunton, Grebmeier and Trefry, 2014; Grebemier, 2012; Moore and Grebmeier, 2013.
7	Krill Trap	A-2c	May-October	Lower Trophic Level Organisms	Invertebrates	Ashijan et al., 2010 (Figures 8 and 14, pp.187–189); Okkonen et al., 2011.
16	Barrow Canyon	A-2c	January-December	Lower Trophic Level Organisms	Invertebrates	Moore and Grebmeier, 2013.
57	Skull Cliffs	A-2b	January-December	Lower Trophic Level Organisms	Kelp/Invertebrates	Phillips et al., 1984. (pp. 13-14 and 16-19).
75	Boulder Patch Area	A-2a-2	January-December	Lower Trophic Level Organisms	Kelp/Invertebrates	Dunton and Schonberg, 2000 (p. 383, Fig 4. pp.388-392, Table 5. p. 393, Figure 6); Dunton et.al., 2009 (p. 17, Figure 1.3. p. 27, Table 2.1).
80	Beaufort Outer Shelf 1	A-2c	January-December	Lower Trophic Level Organisms	Invertebrates	Norcross, 2013 (Ongoing and unpublished Canada/USA Transboundary survey quarterly/annual reports); Norcross and Edenfield, 2013 (Ongoing and unpublished Canada/USA Transboundary survey quarterly/annual reports).
101	Beaufort Outer Shelf 2	A-2c	January-December	Lower Trophic Level Organisms	Invertebrates	Norcross, 2013 ; Norcross and Edenfield, 2013.

Source: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-12. Environmental Resource Areas and Land Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Fish in Sections 4.3 and 4.7.

ERA GLS or LS ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
ERAs Marine Waters						
84	Canning River Delta	A-2a-2	January - December	Anadromous and Marine Nearshore Fish	Pp, DVpr, CHp, Wp, Arctic cod, capelin, Arctic cisco, stickleback, sculpin spp.	Jarvela and Thorsteinson, 1998; Johnson and Litchfield, 2015.
85	Sagavanirktok River Delta	A-2e	January - December	Anadromous and Marine Nearshore Fish	CHp, Pp, DVpr, Wp Arctic char, Arctic cod, capelin, Arctic cisco, stickleback, sculpin spp.	Craig, 1984; Jarvela and Thorsteinson, 1998; Johnson and Litchfield, 2015.
86	Harrison Bay	A-2a-1	January - December	Marine Fish – nearshore	Arctic cod, Capelin, OM, Saffron cod, Fourhorn sculpin, Wp	Craig, 1984; Jarvela and Thorsteinson, 1998; Johnson and Litchfield, 2015.
87	Colville River Delta	A-2a-1	January - December	Anadromous and Marine Nearshore Fish	CHp, Pp, DVp, Wp, Arctic cod, Capelin, OM, Saffron cod, Fourhorn sculpin, Arctic cisco, Arctic char	Craig, 1984; Jarvela and Thorsteinson, 1998; Johnson and Litchfield, 2015; MBC Applied Environmental Sciences, 2004.
88	Simpson Lagoon	A-2a-1	January- December	Marine Fish – nearshore	Arctic cod, Capelin, OM, Saffron cod, Fourhorn sculpin, Wp, Arctic char	Craig, 1984; Jarvela and Thorsteinson, 1998; Johnson and Litchfield, 2015.
89	Mackenzie River Delta	A-2b	January - December	Anadromous and Marine Nearshore Fish	CHp, OMp, Wp, Sheefish, Saffron cod, Arctic cod, Arctic char, Arctic Cisco, Pacific herring, prickleback spp., sculpin spp.	Craig, 1984; MBC Applied Environmental Sciences, 2004; Sawatzky et.al, 2007; Wong et al., 2013.
102	Opilio Crab EFH	A-2f	January-December	Opilio Crab Habitat (EFH)	Opilio Crab	NMFS, 2009.
103	Saffron Cod EFH	A-2e	January-December	Saffron Cod Habitat (EFH)	Saffron Cod	NMFS, 2009.
105	Fish Creek	A-2e	January-December	Anadromous Fish	CHp, Kp, Pp,DVp, HWp, Wp	Johnson and Litchfield, 2015.
106	Shaviovik River	A-2c	January-December	Anadromous and Marine Nearshore Fish	Ps, DVp, Arctic char, Arctic cod, capelin, Arctic cisco, stickleback, sculpin spp.	Craig and Poulin, 1975; Jarvela and Thorsteinson, 1998; Johnson and Litchfield, 2015.
GLSs Marine Waters						
153	Noatak River	A-4c	January-December	Anadromous and Marine Nearshore Fish	CHs,Kp,Pp,COp,Sp,DVp, Wp, SF	Johnson and Litchfield, 2015.
154	Cape Krusenstern	A-4a	January-December	Anadromous and Marine Nearshore Fish	CHp.Sp,Pp,COp,Sp,DVp,Wp	Johnson and Litchfield, 2015.
155	Wulik and Kivalina Rivers	A-4a	January-December	Anadromous and Marine Nearshore Fish	CHs,COp,Ks,Pp,Ss,DVs,Wp	Johnson and Litchfield, 2015.
166	KuK River	A-4b	January-December	Anadromous and Marine Nearshore Fish	CHp,Pp,BWp,LCp, OMp	Johnson and Litchfield, 2015.

ERA GLS or LS ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
181	Arctic National Wildlife Refuge	A.-4c	January-December	Anadromous and Marine Nearshore Fish	CHp,Pp,DVr,Wp,Kp,COp,OMp, Arctic char, least cisco, herring, capelin, Arctic cod, saffron cod, sculpin species, eelpout species, Arctic flounder, starry flounder, sand lance	Johnson and Litchfield, 2015; U.S. Fish and Wildlife Service, 2013.
LSs Russia						
25	Amguema River	A-3a	May - October	Anadromous Fish	CHs, Ps, ALp, DVs, ACs, Kp, Sp, COp, Ws, OMp	Andreev, 2001.
31	Kolyuchinskaya Bay	A-3a	May - October	Anadromous Fish	Ps, Ks, DVs, ACs, Wp, OMp	Andreev, 2001.
37	Chegitun River	A-3a	May - October	Anadromous Fish	Bering Cisco, ACs, DVs, Ps, Ks, CHs, Ss, OMp	Andreev, 2001.
38	Inchoun Lagoon	A-3a	May - October	Anadromous Fish	CHp, Pp, Kp, COp, Sp, Bering Cisco, Least Cisco	Andreev, 2001.
39	Uelen Lagoon	A-3a	May - October	Anadromous Fish	CHp, Pp, Kp, COp, Sp, Bering Cisco, Least Cisco	Andreev, 2001.
LSs United States						
40	Mint River	A-3b	May - October	Anadromous Fish	CHs, Ps, Sp, DVpr	Johnson and Litchfield, 2015.
41	Pinguk River	A-3b	May - October	Anadromous Fish	CHs, Pp, DVp, Wp	Johnson and Litchfield, 2015.
42	Upkuarok Creek, Nuluk River, Kugrupaga River, Trout Creek	A-3b	May - October	Anadromous Fish	DVpr, CHs, Ps, DVp, Wp, DVp, DVpr, Wp	Johnson and Litchfield, 2015.
43	Shishmaref Airport	A-3b	May - October	Anadromous Fish	DVp	Johnson and Litchfield, 2015.
44	Shishmaref Inlet, Arctic River, Sanaguich River, Serpentine River	A-3b	May - October	Anadromous Fish	DVp, SFp, Wp, CHp	Johnson and Litchfield, 2015.
47	Kitluk River	A-3b	May - October	Anadromous Fish	Pp	Johnson and Litchfield, 2015.
49	Kougachuk Creek	A-3b	May - October	Anadromous Fish	Pp	Johnson and Litchfield, 2015.
51	Inmachuk River, Kugruk River	A-3b	May - October	Anadromous Fish	CHs, Ps, DVp, CHp, Pp, DVp	Johnson and Litchfield, 2015.
53	Kiwalik River, Buckland River	A-3b	May - October	Anadromous Fish	CHp, Pp, DVp, CHp, COp, Kp, Pp, DVp, Wp	Johnson and Litchfield, 2015.
54	Baldwin Penn Kobuk River, & Channels	A-3b	May - October	Anadromous Fish	DVp, DVs, CHp, Kp, Pp, DVs, SFp, Wp	Johnson and Litchfield, 2015.
55	Hotham Inlet Ogriveg River	A-3b	May - October	Anadromous Fish	CHp, Pp, DVs, Wp CHp, Pp, DVp	Johnson and Litchfield, 2015.
56	Noatak River	A-3b	May - October	Anadromous Fish	CHp, COp, Kp, Pp, Sp, DVp, SFp, Wpr	Johnson and Litchfield, 2015.
57	Aukulak Lagoon	A-3b	May - October	Anadromous Fish	Wp	Johnson and Litchfield, 2015.
58	Tasaychek Lagoon	A-3b	May - October	Anadromous Fish	Pp	Johnson and Litchfield, 2015.
59	Kiligmak Inlet Jade Creek, Rabbit Creek, Imik Lagoon New Heart Creek, Omikviorok River	A-3b	May - October	Anadromous Fish	DVp, Wp DVp CHp, Sp, DVp Wp DVr DVp, Wp	Johnson and Litchfield, 2015.
60	Imikruk Lagoon Wulik River, Kivalina River	A-3b	May - October	Anadromous Fish	Wp, CHp, COp, Kp, Pp, Sp, DVs, Wp CHp, CHs, Pp, DVp	Johnson and Litchfield, 2015.
64	Sulupoaktak Chnl	A-3b	May - October	Anadromous Fish	Pp, DVp	Johnson and Litchfield, 2015.
67	Pitmegea River	A-3b	May - October	Anadromous Fish	CHp, Pp, DVp	Johnson and Litchfield, 2015.
70	Kuchiak Creek	A-3b	May - October	Anadromous Fish	CHs, COs	Johnson and Litchfield, 2015.
71	Kukpowruk River	A-3b	May - October	Anadromous Fish	CHp, Pp, DVp	Johnson and Litchfield, 2015.
72	Pt Lay, Kokolik River	A-3b	June - October	Anadromous Fish	CHp, Pp, DVp	Johnson and Litchfield, 2015.
74	Utukok River	A-3b	June - October	Anadromous Fish	CHp, Pp, DVp	Johnson and Litchfield, 2015.
80	Kugrua River	A-3b	June - October	Anadromous Fish	CHs,Ps	Johnson and Litchfield, 2015.
87	Inaru River, Meade River, Topagoruk River, Chipp River	A-3c	June - October	Anadromous Fish	Wsr CHs,Wp Wsr Ps,Wsr	Johnson and Litchfield, 2015.
89	Ikpikpuk River	A-3c	June - October	Anadromous Fish	Psr,Wsr	Johnson and Litchfield, 2015.
91	Smith River	A-3c	June - October	Anadromous Fish	DVp,Wp	Johnson and Litchfield, 2015.
93	Kalikpik River	A-3c	June - October	Anadromous Fish	Wp	Johnson and Litchfield, 2015.
95	Fish Creek, Nechelik Channel	A-3c	June - October	Anadromous Fish	CHp,Kp,Pp,DVp,Wp Wp	Johnson and Litchfield, 2015
96	Colville River & Delta	A-3c	June - October	Anadromous Fish	CHp,Pp,DVp,Wp	Johnson and Litchfield, 2015.

ERA GLS or LS ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
97	Colville River & Delta	A-3c	June - October	Anadromous Fish	CHp,Pp,DVp,Wp	Johnson and Litchfield, 2015.
98	Kalubik River	A-3c	June - October	Anadromous Fish	DVp,Wp Wr	Johnson and Litchfield, 2015.
99	Ugnuravik River	A-3c	June - October	Anadromous Fish		Johnson and Litchfield, 2015.
100	Oogrukpuk River,	A-3c	June - October	Anadromous Fish	Wpr Wr	Johnson and Litchfield, 2015.
101	Sakonowyak River	A-3c	June - October	Anadromous Fish	Wpr Wr	Johnson and Litchfield, 2015.
102	Kuparuk River, Fawn Creek, Unnamed 10435	A-3c	June - October	Anadromous Fish	Wr, Wp	Johnson and Litchfield, 2015.
103	Putuligayuk River	A-3c	June - October	Anadromous Fish	DVr,DVp,Wp,OMp,Wr	Johnson and Litchfield, 2015.
104	West Channel Sagavanirktok River	A-3c	June - October	Anadromous Fish		Johnson and Litchfield, 2015.
105	Sagavanirktok River, E. Sagavanirktok Creek	A-3c	June - October	Anadromous Fish	ACp,Chp,Pp,DVr,Wp DVr	Johnson and Litchfield, 2015.
106	E. Sagavanirktok Creek, Kadleroshilik River	A-3c	June - October	Anadromous Fish		Johnson and Litchfield, 2015.
107	Kavik River, Shaviovik River, 10300 (AWC#)	A-3c	June - October	Anadromous Fish	DVr, DVp, Ps	Johnson and Litchfield, 2015.
108	E Badami Creek, 10300 (AWC#)	A-3c	June - October	Anadromous Fish	DVr	Johnson and Litchfield, 2015.
109	10280 (AWC#)	A-3c	June - October	Anadromous Fish	DVr	Johnson and Litchfield, 2015.
110	10246 (AWC#)	A-3c	June - October	Anadromous Fish	DVr	Johnson and Litchfield, 2015.
111	10238 (AWC#) 10234 (AWC#) Staines River	A-3c	June - October	Anadromous Fish	DVr DVr DVr Pp,DVp,Wp	Johnson and Litchfield, 2015.
112	W. Canning River, Canning River	A-3c	June - October	Anadromous Fish	Pp,DVp,Wp CHp,Pp,DVp,Wp DVr	Johnson and Litchfield, 2015.
113	Canning River, Tamayariak River	A-3c	June - October	Anadromous Fish	DVs,DVp,Pp,Wp,CHp,DVr	Johnson and Litchfield, 2015.
115	Katakturik River, 10193 (AWC#)	A-3c	June - October	Anadromous Fish	DVp DVr	Johnson and Litchfield, 2015.
116	Marsh Creek, Carter Creek	A-3c	June - October	Anadromous Fish	DVr DVr	Johnson and Litchfield, 2015.
118	Nataroarok Creek, Hulahula River, Okpilak River	A-3c	June - October	Anadromous Fish	DVr DVp DVp DVr	Johnson and Litchfield, 2015.
119	10173 (AWC#)	A-3c	June - October	Anadromous Fish	DVr	Johnson and Litchfield, 2015.
121	Jago River	A-3c	June - October	Anadromous Fish	DVp	Johnson and Litchfield, 2015.
122	Kimikpaurauk River	A-3c	June - October	Anadromous Fish	DVr	Johnson and Litchfield, 2015.
123	Siksik River, Sikrelurak River, Angun River, 10150-2004 (AWC#) Kogotpak 10140-2006 (AWC#)	A-3c	June - October	Anadromous Fish	DVr DVr DVr DVr DVp DVr	Johnson and Litchfield, 2015.
124	Aichilik River, Egaksrak River, Kongakut River	A-3c	June – October	Anadromous Fish	DVp DVp DVp	Johnson and Litchfield, 2015.
LSs Canada						
126	Fish River	A-3c	June - October	Anadromous Fish	ACp, Wp	Craig, 1984; Kendel et al., 1974.
127	Malcolm River	A-3c	June - October	Anadromous Fish	ACp, OMp	Craig, 1984.
128	Firth River	A-3c	June - October	Anadromous Fish	ACp,OMp	Craig, 1984.
130	Spring River	A-3c	June - October	Anadromous Fish	ACp, Wp, SFp, OMp, sculpin spp.	Craig, 1984; Majewski et al, 2013.
131	Babbage River	A-3c	June - October	Anadromous Fish	ACp, Wp	Craig, 1984.
133	Blow River	A-3c	June - October	Anadromous Fish	ACp, Wp, SFp	Craig, 1984.
136-140	Mackenzie River	A-3c	June - October	Anadromous Fish	ACp, Wp, CHp, OMp, SFp	Craig, 1984.
141-146	Kugmallit Bay Tuktoyaktuk Peninsula	A-3c	June - October	Anadromous and Marine Nearshore Fish	AC, DV, OM, Arctic cisco, Least Cisco, Whitefish spp., Arctic cod, Saffron cod, Pacific herring, Arctic flounder, Starry flounder, Sculpin spp.	Niemi, et al., 2012

Key:	AC=Arctic Char	DV=Dolly Varden	W=Whitefish (undifferentiated)	AL=Arctic lamprey	P=Pink salmon	s=spawning	K=Chinook salmon
OM=Rainbow smelt	p=present	CH=Chum salmon	S=Sockeye salmon	r=rearing	CO=Coho salmon	SF=Sheefish	

Source: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-13. Environmental Resource Areas and Grouped Land Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Birds in Sections 4.3 and 4.7.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
ERA						
1	Kasegaluk Lagoon Area	A-2d	May-October	Birds, Barrier Island, Seals, Whales	Birds: BLBR, LTDU, eiders (STEI, COEI), loons (all 3 species)	Dau and Bollinger, 2009, 2012; Johnson, 1993; Johnson, Wiggins, and Wainwright, 1993; Laing and Platte, 1994; Lehnhausen and Quinlan, 1981; Morgan, Day, and Gall, 2012; Seabird Information Network, 2015.
2	Point Barrow, Plover Islands	A-2c	May-October	Birds, Barrier Island	Birds: SPEI, LTDU, BLBR, BLGU	Dau and Bollinger, 2009; Fischer and Larned, 2004; Ritchie et al, 2013; Seabird Information Network, 2015; Troy, 2003.
5	Beaufort Sea Shelf Edge IBA	A-2d	May-October	Birds		Audubon, 2015.
8	Maguire and Flaxman Islands	A-2a-2	May-October	Birds, Barrier Island	Birds: nesting COEI, molting LTDU, PALO	Dau and Bollinger, 2009, 2012, Fischer and Larned, 2004; Flint et al., 2004; Johnson, 2000; Johnson et al., 2005; Noel et al., 2005; Seabird Information Network, 2015.
9	Stockton and McClure Islands	A-2a-1	May-October	Birds, barrier island	Birds: nesting COEI, molting LTDU, staging SPEI	Dau and Bollinger, 2009, 2012; Fischer and Larned, 2004; Flint et al., 2004; Johnson, 2000, (Table 2); Johnson et al., 2005; Noel et al., 2005; Seabird Information Network, 2015; Troy, 2003.
10	Ledyard Bay SPEI Critical Habitat Unit	A-2f	July-November	Birds	Birds: seabirds, molting/staging SPEI, staging YBLO	66 FR 9146-9185; Laing and Platte, 1994; Morgan, Day, and Gall, 2012; Petersen, Larned, and Douglas, 1999; Piatt and Springer, 2003.
14	Cape Thompson Seabird Colony Area	A-2g	May-October	Birds	Birds: seabirds, gulls, shorebirds, waterfowl, staging YBLO	Morgan, Day, and Gall, 2012; Piatt et al., 1991; Piatt and Springer, 2003; Seabird Information Network, 2015; Springer et al., 1984; Stephenson and Irons, 2003.
15	Cape Lisburne Seabird Colony Area	A-2f	May-October	Birds, Marine Mammals	Birds: seabird breeding colony, staging YBLO	Dragoo and Balland, 2014; Morgan, Day, and Gall, 2012; Oppel, Dickson and Powell, 2009; Piatt et al., 1991; Piatt and Springer, 2003; Roseneau et al., 2000; Seabird Information Network, 2015; Springer et al., 1984; Stephenson and Irons, 2003.
17	Angun and Beaufort Lagoons	A-2a-1	May-October	Birds, Barrier Island	Birds: molting LTDU, scoters, staging shorebirds	Dau and Bollinger,2009, 2012; Johnson and Herter, 1989.
18	Murre Rearing and Molting Area	A-2g	May-October	Birds	Birds: murre foraging, rearing, and molting area	Piatt and Springer, 2003; Springer et al., 1984.
19	Chukchi Sea Spring Lead System	A-2d	April-June	Birds, Whales	Birds: seabird foraging area; spring migration area for LTDU, eiders (KIEI, COEI), loons	Connors, Myers, and Pitelka, 1979; Oppel, Dickson, and Powell, 2009; Piatt et al., 1991; Piatt and Springer, 2003; Sexson, Pearce, and Petersen, 2014.
64	Peard Bay Area	A-2d	May-October	Birds, Marine Mammals	Birds: eiders (all 4 species), loons (all 3 species)	Fischer and Larned, 2004; Gill, Handel, and Connors, 1985; Laing and Platte, 1994.
65	Smith Bay	A-2c	May-October	Birds, Marine Mammals, Whales	Birds: eiders (SPEI, KIEI), YBLO	Dau and Bollinger, 2009, 2012; Earnst et al., 2005; Powell et al., 2005; Ritchie, Burgess, and Suydam, 2000; Ritchie et al., 2004; Troy, 2003.
67	Herschel Island (Canada)	A-2c	May-October	Birds	Birds: LTDU, BLBR, scoters, eiders, loons, shorebirds	Johnson and Richardson, 1982; Richardson and Johnson, 1981.
68	Harrison Bay	A-2a-1	May-October	Birds, Marine Mammals	Birds: eiders (KIEI, COEI), scoters (BLSC, SUSC), geese (BLBR, CANG, GWFG), loons, shorebirds	Connors, Connors, and Smith, 1984; Dau and Bollinger, 2009, 2012,; Fischer and Larned, 2004.
69	Harrison Bay/Colville Delta	A-2a-2	May-October	Birds, Marine Mammals	Birds: geese (BLBR), eiders (KIEI, COEI), LTDU, scoters (BLSC, SUSC), loons (all 3 species)	Bergman et al., 1977; Dau and Bollinger, 2009, 2012; Fischer and Larned, 2004; Johnson and Herter, 1989.
71	Simpson Lagoon, Thetis and Jones Islands	A-2c	May-October	Birds	Birds: geese (BLBR, LSGO, GWFG), eiders (COEI, KIEI), LTDU, scoters (SUSC, WWSC), shorebirds, loons (all 3 species)	Dau and Bollinger, 2009, 2012; Connors, Connors, and Smith, 1984; Divoky, 1984; Johnson, 2000; Johnson, Herter, and Bradstreet, 1987; Johnson and Herter, 1989; Noel and Johnson, 1997; Richardson and Johnson, 1981; Stickney and Ritchie, 1996; Truett, Miller, and Kertell, 1997.
72	Gwyder Bay, West Dock, Cottle and Return Islands	A-2a-2	May-October	Birds	Birds: geese (BLBR, LSGO, GWFG), eiders (COEI, KIEI), LTDU, scoters (SUSC, WWSC), shorebirds, loons (all 3 species)	Dau and Bollinger, 2009, 2012; Fischer and Larned, 2004; Johnson, 2000; Noel et al., 2005; Noel and Johnson, 1997; Powell et al., 2005; Truett, Miller, and Kertell, 1997; Stickney and Ritchie, 1996; Troy, 2003.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
73	Prudhoe Bay	A-2a-1	May-October	Birds	Birds: geese (BLBR, LSGO, GWFG), eiders (COEI, KIEI), LTDU, scoters (SUSC, WWSC), shorebirds, loons (all 3 species)	Dau and Bollinger, 2009, 2012; Fischer and Larned, 2004; Johnson and Richardson, 1982; Noel and Johnson, 1997; Noel et al., 2005; Powell et al., 2005; Richardson and Johnson, 1981; Stickney and Ritchie, 1996; Troy, 2003; Truett, Miller, and Kertell, 1997.
76	Kendall Island Bird Sanctuary (Canada)	A-2c	May-October	Birds	Birds: eiders (KIEI, COEI), LTDU, scoters (all 3 species), loons (all 3 species)	Alexander, Dickson, and Westover, 1997; Dickson et al., 1997; Divoky, 1984; Johnson and Richardson, 1982; Richardson and Johnson, 1981.
77	Sagavanirktok River Delta/Foggy Island Bay	A-2a-2	May-October	Birds	Birds: eiders (SPEI, COE)I, LTDU, scoters (all 3 species), loons (all 3 species)	Dau and Bollinger, 2009, 2012; Divoky, 1984; Fischer and Larned, 2004; Johnson, 2000; Johnson, Wiggins, and Wainwright, 1993; Sexson, Pearce, and Petersen, 2014; Troy, 2003.
78	Mikkelsen Bay	A-2a-2	May-October	Birds	Birds: eiders (KIEI, COEI), LTDU, scoters, loons (PALO, RTLO)	Dau and Bollinger, 2009, 2012; Divoky, 1984; Fischer and Larned, 2004; Flint et al., 2004; Johnson, 2000; Noel et al., 2005.
79	Demarcation Bay Offshore	A-2c	May-October	Birds	Birds: eiders (KIEI, COEI), LTDU, scoters (SUSC, WWSC), loons, molting LTDU, staging shorebirds	Dau and Bollinger, 2009, 2012; Fischer and Larned, 2004; Johnson and Richardson, 1982; Johnson and Herter, 1989; Richardson and Johnson, 1981.
81	Simpson Cove	A-2a-1	May-October	Birds	Birds: COEI, LTDU, PALO, scoters (SUSC, WWSC)	Dau and Bollinger, 2009, 2012; Fischer and Larned, 2004; Johnson and Herter, 1989.
96	Midway, Cross and Bartlett Islands	A-2a-1	May-October	Birds, Barrier Islands	Birds: eiders (SPEI,COEI), LTDU, scoters (all 3 species), loons (all 3 species)	Dau and Bollinger, 2009, 2012; Divoky, 1984; Fischer and Larned, 2004; Johnson, 2000; Troy, 2003, (Figure 3).
98	Anderson Point Barrier Islands	A-2a-1	May-October	Birds, Barrier Islands	Birds: eiders (SPEI,COEI), LTDU, scoters (all 3 species), loons (all 3 species)	Same as ERA96
99	Arey and Barter Islands, Bernard Spit	A-2a-1	May-October	Birds, Barrier Islands	Birds: eiders (SPEI,COEI), LTDU, scoters (all 3 species), loons (all 3 species)	Same as ERA96
100	Jago and Tapkaurak Spits	A-2a-1	May-October	Birds, Barrier Islands	Birds: eiders (SPEI,COEI), LTDU, scoters (all 3 species), loons (all 3 species)	Same as ERA96
104	Ledyard Bay-Icy Cape IBA	A-2e	May-October	Birds		Audubon, 2015
124	Chukchi Sea Nearshore IBA	A-2f	May-October	Birds		Audubon, 2015
GLS						
161	Kasegaluk Lagoon Area IBA	A-4b	May-October	Birds		Audubon, 2015
170	Teshekpuk Lake Special Area (NPR-) IBA	A-4c	May-October	Birds		Audubon, 2015
171	Colville River Delta IBA	A-4a	May-October	Birds		Audubon, 2015, Brown et al., 2007.
182	Northeast Arctic Coastal Plain IBA	A-4c	May-October	Birds		Audubon, 2015
193	Kendall Island Bird Sanctuary (Canada)	A-4b	May-October	Birds		

Notes: Yellow-billed Loon (YBLO), Red-throated Loon (RTLO), Pacific Loon (PALO), COEI (Common Eider), KIEI (King Eider), SPEI (Spectacled Eider), STEI (Steller's Eider), LTDU (Long-tailed Duck), Black Scoter (BLSC), Surf Scoter (SUSC), White-winged Scoter (WWSC), Black Brant (BLBR), Greater White-fronted Goose (GWFG), Canada Goose (CANG), Lesser Snow Goose (LSGO): http://www.birdpop.org/DownloadDocuments/Alpha_codes_eng.pdf

Source: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-14. Environmental Resource Areas and Boundary Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Whales in Sections 4.3 and 4.7.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference[1]
ERA						
1	Kasegaluk Lagoon Area	A-2d	May-October	Birds, Barrier Island, Seals, Whales	Beluga Whales	Frost and Lowry, 1990; Frost, Lowry, and Carroll, 1993; Suydam et al., 2001; Suydam, Lowry, and Frost, 2005; Citta et al., 2013.
13	SUA: Kivalina-Noatak	A-2g	January-December	Subsistence, Whales	Beluga Whales	Suydam et al., 2001; Suydam, Lowry, and Frost, 2005.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference[1]
20	East Chukchi Offshore	A-2f	September-October	Whales	Bowhead Whales, Beluga Whales-fall migration, feeding	Clarke et al., 2013, 2014; Fraker, Sergeant, and Hoek, 1978; Harwood and Smith, 2002; Hauser et al., 2014; Ljungblad et al., 1988; Martell, Dickinson, and Casselman, 1984; Melnikov and Bobkov. 1993; Monnett and Treacy, 2005; Quakenbush and Citta, 2013; Quakenbush, Small and Citta. 2013; Treacy, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 2000, 2001, 2002.
21	AK BFT Bowhead FM 1	A-2b	September-October	Whales	Bowhead Whales, Beluga Whales-fall migration	Clarke et al., 2013, 2014; Hauser et al., 2014; Ljungblad et al., 1988; Monnett and Treacy, 2005; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013; Shelden and Mocklin, 2013; Treacy, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 2000, 2001, 2002.
22	AK BFT Bowhead FM 2	A-2b	September-October	Whales	Bowhead Whales-fall migration	Clarke et al., 2013, 2014; Ljungblad et al., 1988; Monnett and Treacy, 2005; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013; Shelden and Mocklin, 2013; Treacy, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 2000, 2001, 2002.
24	AK BFT Bowhead FM 3	A-2b	September-October	Whales	Bowhead Whales-fall migration	Same as ERA22.
25	AK BFT Bowhead FM 4	A-2b	September-October	Whales	Bowhead Whales-fall migration	Same as ERA22.
26	AK BFT Bowhead FM 5	A-2b	September-October	Whales	Bowhead Whales-fall migration	Same as ERA22.
27	AK BFT Bowhead FM 6	A-2b	September-October	Whales	Bowhead Whales-fall migration	Same as ERA22.
28	AK BFT Bowhead FM 7	A-2b	September-October	Whales	Bowhead Whales-fall migration	Same as ERA22.
29	AK BFT Bowhead FM 8	A-2b	September-October	Whales	Bowhead Whales-fall migration	Same as ERA22.
30	Beaufort Spring Lead 1	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Clarke et al., 2013; Ljungblad et al., 1988; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013; Shelden and Mocklin, 2013.
31	Beaufort Spring Lead 2	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
32	Beaufort Spring Lead 3	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
33	Beaufort Spring Lead 4	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales; spring migration	Same as ERA30.
34	Beaufort Spring Lead 5	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
35	Beaufort Spring Lead 6	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
36	Beaufort Spring Lead 7	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
37	Beaufort Spring Lead 8	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
45	Beaufort Spring Lead 9	A-2c	April-June	Whales	Bowhead Whales, Beluga Whales- spring migration	Same as ERA30.
49	Chukchi Spring Lead 1	A-2g	April-June	Whales	Bowhead Whales, Gray Whales, Beluga Whales – spring migration- spring leads-Chukchi	Bogoslovskaya, Votrogov, and Krupnik, 1982; Clarke et al., 2013; Doroshenko, and Kolesnikov, 1984; George et al., 2012; Heide, 1979; Ljungblad et al., 1986, 1988; Miller, Rugh, and Johnson,1986; Melnikov, Zelensky, and Ainana,1997; Melnikov et al., 2004; Melnikov and Zeh, 2007; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013; Stringer and Groves, 1991.
53	Chukchi Spring Lead 2	A-2d	April-June	Whales	Bowhead Whales, Gray Whales, Beluga Whales – spring migration- spring leads-Chukchi	Same as ERA49.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference[1]
54	Chukchi Spring Lead 3	A-2d	April-June	Whales	Bowhead Whales, Gray Whales, Beluga Whales – spring migration- spring leads-Chukchi	Same as ERA49.
56	Hanna Shoal Area	A-2g	August-October	Whales	Bowhead Whales, historically Gray Whales (Hanna Shoal)	Clarke et al., 2013; Ljungblad et al., 1986; Moore, DeMaster and Dayton. 2000; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013.
60	King Point-Shallow Bay (Canada)	A-2b	April-Sept	Whales, Subsistence	Beluga Whales	Fraker, Sergeant, and Hoek, 1978; Harwood and Smith, 2002; Harwood et al., 1996, 2010; Martell, Dickinson, and Casselman, 1984.
61	Pont Lay–Barrow BH GW SFF	A-2f	July-October	Whales	Bowhead Whales, Gray Whales; summer-fall feeding, Gray and Bowhead Whale cow/calf aggregations and bowhead fall migration	Bogoslovskaya, Votrogov, and Krupnik, 1982; Clarke et al., 2013, 2014; George et al., 2012; Ljungblad et al., 1988; Melnikov and Bobkov, 1993; Melnikov, Zelensky, and Ainana, 1997; Miller, Rugh, and Johnson, 1986; Moore and DeMaster, 1997; Moore et al., 1995; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013; Shelden and Mocklin, 2013.
63	North Chukchi	A-2g	October-December	Whales	Bowhead Whales	Martell, Dickinson, and Casselman, 1984; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013.
65	Smith Bay	A-2c	May-October	Whales, Birds, Marine Mammals	Bowhead Whales	Clarke et al., 2015a,b.
70	North Central Chukchi	A-2g	October-December	Whales	Bowhead Whales	Ainana, Zelenski, and Bychkov, 2001; Bogoslovskaya, Votrogov, and Krupnik, 1982; Melnikov, 2000; Melnikov and Bobkov, 1993; Melnikov, Zelensky, and Ainana, 1997; Miller, Rugh, and Johnson, 1986; Mizroch, Rice, and Breiwick, 1984; Mizroch et al., 2009; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013.
82	North Chukotka Nearshore 2	A-2g	July-October	Whales	Bowhead Whales, Gray Whales; summer-fall feeding and bowhead fall migration	Bogoslovskaya, Votrogov, and Krupnik, 1982; George et al., 2012; Heide-Jorgensen et al., 2012; Ljungblad et al., 1988; Melnikov and Bobkov, 1993; Melnikov, Zelensky, and Ainana, 1997; Miller, Rugh, and Johnson, 1986; Moore and DeMaster, 1997; Moore et al., 1995; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013.
83	North Chukotka Nearshore 3	A-2g	July-December	Whales	Bowhead Whales, Gray Whales; summer-fall feeding and bowhead fall migration	Same as ERA82.
91	Bowhead Whale Summer (Canada)	A-2c	July-October	Whales	Bowhead Whale-summer concentration	Braham, Fraker, and Krogman. 1980; Fraker, Sergeant, and Hoek, 1978; Harwood and Smith, 2002; Harwood, Auld and Moore, 2010; Martell, Dickinson, and Casselman, 1984; Quakenbush and Citta, 2013; Quakenbush, Small and Citta. 2013;
107	Point Hope Offshore	A-2f	June-September	Whales	Gray Whales, Fin Whales, Humpback Whales summer fall aggregation	Clarke et al., 2013 (Maps 6, 13); Friday et al., 2014; George et al., 2012; Miller, Johnson, and Doroshenko, 1985.
108	Barrow Feeding Aggregation	A-2f	September-October	Whales	Bowhead Whales, Gray Whales-feeding aggregation- fall	Clarke et al., 2012, 2013; Ljungblad et al., 1988; Monnett and Treacy, 2005; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013; Shelden and Mocklin, 2013.
109	AK BFT Shelf Edge	A-2c	July, August	Whales	Bowhead Whales-cow/calf and feeding aggregation	Christman et al., 2013; Clarke et al., 2012, 2013.
110	AK BFT Outer Shelf & Slope 1	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Clarke et al., 2013, 2014; Richard, Martin and Orr, 1998, 2001.
111	AK BFT Outer Shelf & Slope 2	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
112	AK BFT Outer Shelf & Slope 3	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
113	AK BFT Outer Shelf & Slope 4	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA10.
114	AK BFT Outer Shelf & Slope 5	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
115	AK BFT Outer Shelf & Slope 6	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
116	AK BFT Outer Shelf & Slope 7	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
117	AK BFT Outer Shelf & Slope 8	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference[1]
118	AK BFT Outer Shelf & Slope 9	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
119	AK BFT Outer Shelf & Slope 10	A-2b	July-October	Whales	Beluga Whales –summer- fall feeding concentration and movement corridor	Same as ERA110.
120	Chukchi Gray Whale Fall (Russia)	A-2e	September-October	Whales	Gray Whales-fall feeding aggregation	Bogoslovskaya, Votrogov, and Krupnik, 1982; Doroshenko and Kolesnikov, 1983; George et al., 2012; Miller, Johnson, and Doroshenko, 1985.
121	Cape Lisburne–Pt Hope	A-2e	June-September	Whales	Gray Whale-cow/calf aggregation	Ljungblad et al., 1988.
122	Bowhead Fall (Canada)	A-2c	October-December	Whales	Bowhead Whale- fall migration & feeding	Fraker, Sergeant, and Hoek, 1978; Harwood and Smith, 2002; Martell, Dickinson, and Casselman, 1984; Quakenbush and Citta, 2013; Quakenbush, Small and Citta. 2013;
123	Offshore Herald Island/Hope Sea Valley	A-2g	October - December	Whales	Bowhead Whales	Bogoslovskaya, Votrogov, and Krupnik,1982; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013.
BSs						
2	RusCh C Dezhnev	A-1	May-October	Whales	Gray Whales, Beluga Whales, Humpback Whales, Bowhead Whales	Clarke et al., 2013 (Maps 6, 13); George et al., 2012; Miller, Johnson, and Doroshenko, 1985.
39-40	Amundsen Gulf BH Spring	A-1	May-July	Whales	Bowhead Whale-spring aggregation	Braham, Fraker, and Krogman, 1980; Fraker, Sergeant, and Hoek, 1978; Harwood and Smith, 2002; Martell, Dickinson, and Casselman, 1984; Quakenbush and Citta, 2013; Quakenbush, Small, and Citta, 2013.

Source: USDOI, BOEM, Alaska OCS Region (2016).

Notes: [1.] Clarke et al. (2015a, b) and Kuletz et al.(2015) were used to help define and refine all cetacean ERAs and BSs in U.S. waters; Cita et al. (2015) was used to help define and refine all bowhead ERAs and BSs; Hauser et al. (2014) were used to help define and refine all beluga ERAs and BSs

Table A.1-15. Environmental Resource Areas, Grouped Land Segments and Land Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Marine Mammals (Polar Bears and Walrus) in Sections 4.3 and 4.7.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
ERAs						
11	Wrangel Island 12 nmi & Offshore	A-2g	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April), Walrus (July-November)	Belikov, 1993; Belikov, Boltunov, and Gorbunov, 1996; Boltunov,Nikiforov, and Semenova, 2012; Durner et al., 2006; Fay, 1982; Fay et al., 1984; Federal State Budget Institution, 2014; Fedoseev, 1981; Gilbert et al., 1992; Kochnev, 2004; Kochnev, 2006; Ovsyanikov, 2012, 2013; Solovyev et al., 2012; Stishov, 1991; Upenski and Kistchinski, 1972; Wilson et al., 2014.
15	Cape Lisburne Seabird Colony Area	A-2f	May-October	Marine Mammals	Walrus	Alaska Clean Seas (ACS), 2015; Christman, 2013; Fay, 1982; Huntington and Quakenbush, 2013; Robards, 2013.
23	Polar Bear Offshore	A-2g	November-June	Marine Mammals	Polar Bears	Durner et al., 2006; USFWS, 2013a; Wilson et al., 2014.
47	Hanna Shoal Walrus Use Area	A-2e	May-October	Marine Mammals	Walrus	Jay, Fischbach, and Kochnev, 2012, Figures 4 & 5, pp. 8-9; Kuletz et al., 2015.
50	Pt Lay Walrus Offshore	A-2d	May-October	Marine Mammals	Walrus	Fay et al., 1984; Jay, Fischbach, and Kochnev, 2012, Figures 4 & 5, pp. 8-9; Kuletz et al., 2015.
51	Pt Lay Walrus Nearshore	A-2g	May-October	Marine Mammals	Walrus	ACS, 2015; Huntington, Nelson, and Quakenbush, 2012; Jay, Fischbach, and Kochnev, 2012, Figures 4 & 5, pp. 8-9; Kuletz et al., 2015.
52	Russian Coast Walrus Offshore	A-2f	May-November	Marine Mammals	Walrus	Jay, Fischbach, and Kochnev, 2012, Figures 4 & 5, pp. 8-9.
55	Point Barrow, Plover Islands	A-2b	January-December	Marine Mammals	Polar Bears	ACS, 2015; Kalxdorff et al., 2002.
58	Russian Coast Walrus Nearshore	A-2f	May-November	Marine Mammals	Walrus	Fay et al., 1984; Jay, Fischbach, and Kochnev, 2012, Figures 4 & 5, pp. 8-9.
59	Ostrov Kolyuchin	A-2f	July -November	Marine Mammals	Polar Bears, Walrus	Belikov, Boltunov, and Gorbunov, 1996; Boltunov, Nikiforov, and Semenova, 2012; Fay, 1982; Fay et al., 1984; Gilbert et al., 1992; Kavry, Boltunov, and Nikiforov, 2008; Kochnev, 2006, 2013a, 2013b; Kochnev and Kozlov, 2012; Kochnev et al., 2003; Pereverez and Kochnev, 2012.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
66	Herald Island	A-2g	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April), Walrus (July-November)	Amstrup and Gardner, 1994; Belikov, 1993; Belikov, Boltunov, and Gorbunov, 1996; Durner et al., 2006; Fay, 1982; Federal State Budget Institution, 2014; Fedoseev, 1981; Gilbert et al., 1992; Ovsyanikov, 1998; Ovsyanikov and Menyushina, 2012; Rode et al., 2015; Stishov, 1991.
74	Hershel Island	A-2c	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April)	Durner et al., 2004; Stirling and Andriashek, 1992.
92	Thetis, Jones, Cottle & Return Isl.	A-2a-1	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April)	ACS, 2015; Durner, Amstrup, and Fischbach, 2003; Durner et al., 2004; Kalxdorff et al., 2002.
93	Cross and No Name Islands	A-2a-2	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April)	ACS, 2015; Durner et al., 2004; Kalxdorff et al., 2002; Miller, Schliebe, and Proffitt, 2006.
94	Maguire, Flaxman & Barrier Isl.	A-2a-1	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April)	ACS, 2015; Amstrup and Gardner, 1994; Durner, 2005; Durner, Amstrup, and Fischbach, 2003; Durner et al., 2004; Kalxdorff et al., 2002.
95	Arey & Barter Islands,and Bernard Spit	A-2a-2	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April)	ACS, 2015; Amstrup and Gardner, 1994; Durner et al., 2004; Kalxdorff et al., 2002; Miller, Schliebe, and Proffitt, 2006.
LSs						
22	Mys Shmidta (Cape Schmidt), Cape Kozhevnikov, Ryrkaipii	A-2a	January-December	Marine Mammal	Walrus (July-November)	Belikov, Boltunov, and Gorbunov, 1996; Boltunov, Nikiforov, and Semenova, 2012; Gilbert et al., 1992; Kavry, Boltunov, and Nikiforov, 2008; Kochnev, 2013a, 2013b; Robards, 2013.
28	Ostrov Karkarpko, Mys Vankarem (Cape Vankarem)	A-2a	January-December	Marine Mammals	Walrus (July-November)	Belikov, Boltunov, and Gorbunov, 1996; Boltunov, Nikiforov, and Semenova, 2012; Fay, 1982; Kavry, Boltunov, and Nikiforov, 2008; Kochnev, 2004, 2013a, 2013b; Kryukova and Kochnev, 2012.
29	Mys Onmyn (Cape Onmyn)	A-2a	January-December	Marine Mammals	Walrus (July-November)	Boltunov, Nikiforov, and Semenova, 2012; Fay, 1982; Kochnev, 2004; Kryukova and Kochnev, 2012.
31	Kosa Belyaka (Belyaka Spit)	A-2A	January-December	Marine Mammals	Walrus (July-November)	Robards, 2013
38	Mys Unikin (Cape Unikyn)	A-2a	January-December	Marine Mammals	Walrus (July-November)	Boltunov, Nikiforov, and Semenova, 2012; Fay, 1982; Fay et al., 1984; Kochnev, 2004, 2013a.
39	Mys Dezhnev, Mys Peek (Cape Dehznev, Cape Peek)	A-2a	January-December	Marine Mammals	Walrus (July-November)	Boltunov, Nikiforov, and Semenova, 2012; Fay, 1982; Fay et al., 1984; Fedoseev, 1981; Kochnev, 2004, 2013a.
65	Buckland, Cape Dyer, Cape Lewis, Cape Lisburne	A-2c	January-December	Marine Mammals	Polar Bear denning (October-April)	ACS, 2015; Voorhees and Sparks, 2012.
75	Icy Cape		January-December	Marine Mammals	Walrus (July – November)	Christman, 2013; Fischbach, Monson, and Jay, 2009; Huntington, Nelson, and Quakenbush, 2012; Robards, 2013.
85	Barrow, Browerville, Elson Lagoon	A-2b	January-December	Marine Mammals	Polar Bears (August-November)	ACS, 2015; Durner et al., 2006; Kalxdorff et al., 2002.
GLSs						
147	Bukhta Somnitel'naya (Somnitel'naya Spit), Davidova Spit	A-4c	January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April), Walrus (July-November)	Belikov, 1993; Belikov, Boltunov, and Gorbunov, 1996; Boltunov, Nikiforov, Semenova, 2012; Durner et al., 2006; Fay, 1982; Gilbert et al., 1992; Kochnev, 2004; Kochnev, 2006, 2013b; Ovsyanikov, 2003, 2012, 2013; Ovsyanikov, Menyushina, and Bezrukov, 2008; Rode et al., 2015; Solovyev et al., 2012.
149	Ostrov Idlidlya (Ididlya Island)	A-4c	July-November	Marine Mammals	Walrus	Boltunov, Nikiforov, and Semenova, 2012; Fay, 1982; Fedoseev, 1981; Gilbert et al., 1992; Kochnev, 2004.
150	Mys Serditse Kamen (Cape Serdtse-Kamen)	A-4c	July-November	Marine Mammals	Walrus	Belikov, Boltunov, and Gorbunov, 1996; Boltunov, Nikiforov, and Semenova, 2012; Chakilev, Dondua, and Kochnev, 2012;Fay, 1982; Fay et al., 1984; Fedoseev, 1981; Gilbert et al., 1992; Kochnev, 2004, 2013a.
151	Chukotka Coast Haulout	A-4c	July-November	Marine Mammals	Walrus	Belikov, Boltunov, and Gorbunov, 1996; Boltunov, Nikiforov, and Semenova, 2012; Fay et al., 1984; Fedoseev, 1981; Gilbert et al., 1992; Jay, Fischbach, and Kochnev, 2012, Figures 4 & 5, pp. 8-9; Kochnev, 2013a.
159	Cape Lisburne	A-4b	January-December	Marine Mammals	Polar Bear denning (October-April), Walrus (August-November)	ACS, 2015; Christman, 2013; Fay, 1982; Fay et al., 1984; Huntington and Quakenbush, 2013; Robards, 2013.
162	Point Lay Haulout	A-4a	July-November	Marine Mammals	Walrus	Christman, 2013; Fischbach, Monson, and Jay, 2009; Huntington, Nelson, and Quakenbush, 2012; Robards, 2013.
172	Colville River Delta	A-4a	October-April	Marine Mammals	Polar Bears denning	ACS, 2015; Blank, 2013.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
176	98 -129 Summer	A-4a	June-August	Marine Mammals	Polar Bears	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59), Durner et al., 2004.
178	104-129 Fall	A-4b	September-November	Marine Mammals	Polar Bears	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59) Durner et al., 2004.
179	Foggy Island Bay		January-December	Marine Mammals	Polar Bears, Polar Bear denning (October-April)	Durner, 2005; Hilcorp Alaska, LLC, 2015, Figure 3.12.1-1; Schliebe et al., 2008; Streever and Bishop, 2014.
180	110-124 Winter	A-4b	October-April	Marine Mammals	Polar Bear denning	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59); Durner, 2005; Durner, Amstrup, and Ambrosius, 2005; Durner, Amstrup, and Fischbach, 2003.
187	126-133 Spring	A-4b	March - May	Marine Mammals	Polar Bears	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59); Durner et al., 2004; Pilford, 2014.
188	126-135 Winter	A-4a	December-February	Marine Mammals	Polar Bears	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59); Durner et al., 2004.
191	136-146 Spring	A-4a	March - May	Marine Mammals	Polar Bears	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59); Durner et al., 2004; Pilford, 2014.
192	136-146 Winter	A-4a	December-February	Marine Mammals	Polar Bears	Amstrup and Gardner, 1994; Derocher et al, 2013, (Figure 13, p. 59); Durner et al., 2004.
195	Russia Chukchi Coast Marine Mammals	A-4c	July-November	Marine Mammals	Polar Bears, Walrus	Belikov, Boltunov, and Gorbunov, 1996; Boltunov,Nikiforov, and Semenova, 2012; Durner et al., 2006; Fay et al., 1984; Fedoseev, 1981; Gilbert et al., 1992; Kochnev, 2006, 2013b; Ovsyanikov, 2013; Stishov, 1991.

Source: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-16. Environmental Resource Areas, Grouped Land Segments and Land Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Marine Mammals (Ice Seals) in Sections 4.3 and 4.4.

ERA ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
1	Kasegaluk Lagoon Area	A-2d	May-October	Birds, Barrier Island,Seals, Whales	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.
46	Wrangel Island 12 nmi Buffer 2	A-2g	December-May	Marine Mammals	Bearded Seals Ringed Seals	Cameron et al., 2010; Kelly et al., 2010.
48	Chukchi Lead System 4	A-2e	December-May	Marine Mammals	Bearded Seals Ringed Seals	Cameron et al., 2010; Kelly et al., 2010.
62	Herald Shoal Polynya 2	A-2g	December-May	Marine Mammals	Ringed Seals Bearded Seals	Cameron et al., 2010; Kelly et al., 2010.
64	Peard Bay Area/Franklin Spit Area	A-2d	May-October	Marine Mammals	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.
65	Smith Bay: Spotted Seal Haulout	A-2d	May-October	Marine Mammals	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.
68	Harrison Bay	A-2a-1	May-October	Marine Mammals	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.
69	Harrison Bay/Colville Delta	A-2a-2	May-October	Marine Mammals	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.
GLS ID						
148	Kolyuchin Bay	A-4c	June-November	Marine Mammals	Spotted Seals Ringed Seals	Boveng et al., 2009; Heptner et al., 1996; Kelly et al., 2010.
169	Smith Bay Spotted Seal Haulout	A-4b	May-October	Marine Mammals	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.
173	Harrison Bay Spotted Seal Haulout	A-4b	June-September	Marine Mammals	Spotted Seals	ADF&G, 2001; Boveng et al., 2009.

Source: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-17. Grouped Land Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Terrestrial Mammals in Sections 4.3 and 4.4.

GLS ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
156	WAH Insect Relief	A-4c	July-August	Terrestrial Mammals	Caribou	ADF&G, 2001; Person et al., 2007.
160	Ledyard Brown Bears	A-4b	June-October	Terrestrial Mammals	Brown Bears	ADF&G, 1986; ADF&G, 2001.
163	Kasegaluk Brown Bears	A-4b	June-October	Terrestrial Mammals	Brown Bears	ADF&G, 1986; ADF&G, 2001.
167	TCH Insect Relief/Calving	A-4b	May-August	Terrestrial Mammals	Caribou	ADF&G, 1986; ADF&G, 2001; Carroll et al., 2011; Person et al., 2007.
174	CAH Insect Relief/Calving	A-4b	May-August	Terrestrial Mammals	Caribou	ADF&G, 1986; ADF&G, 2001; Arthur and Del Vecchio, 2009; Cameron et al., 2002; 2005; Lawhead and Prichard, 2007; Wolfe, 2000.
177	Beaufort Muskox	A-4b	November-May	Terrestrial Mammals	Muskox	ADF&G, 2001; Environment Yukon, 2009; Lawhead and Prichard, 2007; Reynolds, Wilson, and Klein, 2002.
183	PCH Insect Relief	A-4b	July-August	Terrestrial Mammals	Caribou	ADF&G, 2001; Environment Yukon, 2009; Nixon and Russell, 1990.
184	PCH Calving	A-4a	May-June	Terrestrial Mammals	Caribou	ADF&G, 2001; Environment Yukon, 2009; Fancy et al., 1989; Griffith et al., 2002.
185	Yukon Muskox Wintering	A-4a	November-April	Terrestrial Mammals	Muskox	Environment Yukon, 2009.
189	Yukon Moose	A-4b	January-December	Terrestrial Mammals	Caribou	Environment Yukon, 2009.
194	Tuktoyaktuk & Cape Bathurst Caribou Insect Relief	A-4c	July-August	Terrestrial Mammals	Caribou	Gunn, Russell, and Eamer, 2011; Nagy et al., 2005.

Source: USDOI, BOEM, Alaska OCS Region (2016).
Notes: CAH–Central Arctic Herd; PCH–Porcupine Caribou Herd; TCH–Teshekpuk Caribou Herd; WAH–Western Arctic Herd.

Table A.1-18. Environmental Resource Areas and Grouped Land Segments Used in the Analysis of Large or Very Large Oil Spill Effects on Subsistence Resources in Sections 4.4 and 4.7.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
ERA						
3	SUA: Enurmino-Neshkan/Russia	A-2g	January-December	Subsistence	Bowhead Whales, Grey Whales, Walrus, Polar Bears, Ocean Fish, Birds	Ainana, Zelensky, and Bychkov, 2001; Melnikov and Bobkov, 1993; Kochnev et al., 2003; Zdor, Zdor, and Ainana, 2010.
4	SUA:Inchoun-Uelen/ Russia	A-2f	January-December	Subsistence	Bowhead Whales, Grey Whales, Walrus, Beluga, Polar Bears, Ocean Fish, Birds	Ainana, Zelensky, and Bychkov, 2001; Huntington and Mymrin, 1996; Kochnev et al., 2003; Melnikov and Bobkov, 1993; Mymrin et al., 1999; Zdor, Zdor, and Ainana, 2010.
12	SUA: Nuiqsut-Colville River Delta	A-2c	April-October	Subsistence	Whales, Seals, Waterfowl, Ocean Fish, Moose, Caribou	Galganaitis, 2009; 2014a, 2014b; S.R. Braund and Assocs., 2010; USDOI, BLM and MMS, 2003; USDOI, MMS, 1984.
13	SUA:Kivalina-Noatak	A-2g	January-December	Subsistence, Whales	Walrus, Seals, Bowhead Whales, Beluga Whales, Polar Bears, Ocean Fish, King Crabs	Burch, 1985; Magdanz et al., 2010.
38	SUA: Point. Hope-Cape Lisburne	A-2d	January-December	Subsistence	Beluga Whales, Bowhead Whales, Walrus, Seals	Braund and Burnham, 1984; Frost and Suydam, 2010.
39	SUA: Point. Lay-Kasegaluk Lagoon	A-2e	January-December	Subsistence	Ocean Fish, Seals, Waterfowl, Beluga Whales	Braund and Burnham, 1984; Frost and Suydam, 2010; Galginaitis and Impact Assessment, 1989; Huntington and Mymrin, 1996; S.R. Braund and Assocs, 2013, 2014; USDOI, BLM and MMS, 2003.
40	SUA: Icy Cape-Wainwright	A-2g	January-December	Subsistence	Bowhead Whales, Beluga Whales	Braund and Burnham, 1984; Frost and Suydam, 2010; Kassam and Wainwright Traditional Council, 2001; USDOI, BLM and USDOI, MMS, 2003; S.R. Braund and Assocs. and University of Alaska Anchorage, ISER, 1993a; S.R. Braund and Assocs, 2013.
41	SUA: Barrow-Chukchi	A-2e	April-May	Subsistence	Bowhead Whales, Beluga Whales, Walrus, Waterfowl, Seals, Ocean Fish	Braund and Burnham, 1984; Frost and Suydam, 2010; Pedersen, 1979; S.R. Braund and Assocs., 2010; S.R. Braund and Assocs. and University of Alaska Anchorage, ISER, 1993b; USDOI, BLM and USDOI, MMS, 2003.
42	SUA: Barrow-East Arch	A-2d	August-October	Subsistence	Bowhead Whales, Beluga Whales, Walrus, Waterfowl, Seals, Ocean Fish	Braund and Burnham, 1984; Frost and Suydam, 2010; Pedersen, 1979; S.R. Braund and Assocs, 2010; S.R. Braund and Assocs. and University of Alaska Anchorage, ISER, 1993b; USDOI, BLM and USDOI, MMS, 2003.
43	SUA: Nuiqsut-Cross Island	A-2c	August-October	Subsistence	Bowhead Whales, Seals, Waterfowl, Ocean Fish	Galganitis, 2009; Galganitis, 2014a; 2014b; Impact Assessment, 1990a; S.R Braund and Assocs., 2010.
44	SUA: Kaktovik	A-2c	August-October	Subsistence	Bowhead Whales, Seals, Walrus, Beluga Whales, Waterfowl, Ocean Fish	Frost and Suydam, 2010; Impact Assessment, 1990b; North Slope Borough, 2001; S.R. Braund and Assocs, 2010.

ID	Name	Map	Vulnerable	General Resource	Specific Resource	Reference
60	SUA: King Pt.-Shallow Bay (Canada)	A-2b	April-September	Subsistence, Whales	Polar Bears, Seals, Fish, Bowhead Whales, Beluga Whales	Fisheries and Oceans Canada 2002, 2009; Environment Canada, 2000; Harwood et al., 2002, 2014.
90	SUA: Garry and Kendall Islands/ Canada	A-2b	July-August	Subsistence	Beluga Whales	Fisheries and Oeceans Canada 2002, 2009; Environment Canada, 2000: Harwood et al., 2002, 2014.
97	SUA: Tigvariak Island	A-2a-1	May-October	Subsistence	Traditional Whaling Area	Pedersen, 1979; S.R. Braund and Assocs., 2010.
GLS						
157	SUA: Point Lay, Point Hope	A-4a	June-September	Subsistence	Caribou	S.R. Braund and Assocs., 2014; Wolfe, 2013.
168	SUA: Barrow, Nuiqsut	A-4b	July-August	Subsistence	Caribou	S.R. Braund and Assocs., 2010.
175	SUA: Kaktovik, Nuiqsut	A-4b	July-August	Subsistence	Caribou	S.R. Braund and Assocs., 2010.
183	PCH Insect Relief/SUA: Kaktovik	A-4b	July-August	Subsistence	Caribou	Galginatis, 2014b; Jacobson and Wentworth, 1982: S.R. Braund and Assocs., 2010.

USDOI, BOEM, Alaska OCS Region (2016). Notes: SUA=Subsistence Use Area.

Table A.1-19. Land Segment ID and the Geographic Place Names within the Land Segment.

ID	Geographic Place Names	ID	Geographic Place Names
1	Mys Blossom, Mys Fomy, Khishchnikov, Neozhidannaya, Laguna Vaygan	46	Cowpack Inlet, Cowpack River, Kalik River, Kividlo, Singeak, Singeakpuk River, White Fish Lake
2	Mys Gil'der, Ushakovskiy, Mys Zapadnyy	47	Kitluk River, Northwest Corner Light, West Fork Espenberg River
3	Mys Florens, Gusinaya	48	Cape Espenberg, Espenberg, Espenberg River
4	Mys Ushakova, Laguna Drem-Khed	49	Kungealoruk Creek, Kougachuk Creek, Pish River
5	Mys Evans, Neizvestnaya, Bukhta Pestsonaya	50	Clifford Point, Cripple River, Goodhope Bay, Goodhope River, Rex Point, Sullivan Bluffs
6	Ostrov Mushtakova	51	Cape Deceit, Deering, Kugruk Lagoon, Kugruk River, Sullivan Lake, Toawlevic Point
7	Kosa Bruch	52	Motherwood Point, Ninemile Point, Willow Bay
8	Klark, Mys Litke, Mys Pillar, Skeletov, Mys Uering	53	Kiwalik, Kiwalik Lagoon, Middle Channel Kiwalk River, Minnehaha Creek, Mud Channel Creek, Mud Creek
9	Nasha, Mys Proletarskiy, Bukhta Rodzhers	54	Baldwin Peninsula, Lewis Rich Channel
10	Reka Berri, Bukhta Davidova, , Khishchnika, Reka Khishchniki	55	Cape Blossom, Pipe Spit
11	Bukhta Somnitel'naya	56	Kinuk Island, Kotzebue, Noatak River
12	Zaliv Krasika, Mamontovaya, Bukhta Predatel'skaya	57	Aukulak Lagoon, Igisukruk Mountain, Noak, Mount, Sheshalik, Sheshalik Spit
13	Mys Kanayen, Mys Kekurnyy, Mys Shalaurova, Veyeman	58	Cape Krusenstern, Eigaloruk, Evelukpalik River, Kasik Lagoon, Krusenstern Lagoon,
14	Innukay, Laguna Innukay, Umkuveyem, Mys Veuman	59	Imik Lagoon, Ipiavik Lagoon, Kotlik Lagoon, Omikviorok River
15	Laguna Adtaynung, Mys Billingsa, Ettam, Gytkhelen, Laguna Uvargina	60	Imikruk Lagoon, Imnakuk Bluff, Kivalina, Kivalina Lagoon, Singigrak Spit, Kivalina River, Wulik River
16	Mys Emmatagen, Mys Enmytagyn, Uvargin	61	Asikpak Lagoon,Cape Seppings,Kavrorak Lagoon,Pusaluk Lagoon,Seppings Lagoon
17	Enmaat'khyr, Kenmankautir, Mys Olennyy, Mys Yakan, Yakanvaam, Yakan	62	Atosik Lagoon,Chariot,Ikaknak Pond,Kisimilok Mountain,Kuropak Creek,Mad Hill
18	Mys Enmykay, Laguna Olennaya, Pil'khikay, Ren, Rovaam, Laguna Rypil'khin	63	Akoviknak Lagoon, Cape Thompson, Crowbill Point, Igilerak Hill, Kemegrak Lagoon
19	Laguna Kuepil'khin, Leningradskiy	64	Aiautak Lagoon, Ipiutak Lagoon, Kowtuk Point, Kukpuk River, Pingu Bluff, Point Hope, Sinigrok Point, Sinuk
20	Polyarnyy, Kuekvun', Notakatryn, Pil'gyn, Tynupytku	65	Buckland, Cape Dyer, Cape Lewis, Cape Lisburne
21	Laguna Kinmanyakicha, Laguna Pil'khikay, Amen, Pil'khikay, Bukhta Severnaya, Val'korkey	66	Ayugatak Lagoon
22	Ekiatan', Laguna Ekiatan, Kelyun'ya, Mys Shmidta, Rypkarpyy	67	Cape Sabine, Pitmegea River
23	Emuem, Kemuem, Koyvel'khveyergin, Laguna Tengergin, Tenkergin	68	Agiak Lagoon, Punuk Lagoon
24	No place names	69	Cape Beaufort, Omalik Lagoon
25	Laguna Amguema, Ostrov Leny, Yulinu	70	Kuchaurak Creek, Kuchiak Creek
26	Ekugvaam, Reka Ekugvam, Kepin, Pil'khin	71	Kukpowruk River, Naokok, Naokok Pass, Sitkok Point
27	Laguna Nut, Rigol'	72	Epizetka River, Kokolik River, Point Lay, Siksrikpak Point
28	Kamynga, Ostrov Kardkarpko, Kovlyuneskin, Mys Vankarem, Vankarema, Laguna Vankarem	73	Akunik Pass, Tungaich Point, Tungak Creek
29	Akanatkhyrgyn, Nutpel’men, Mys Onman, Vel'may	74	Kasegaluk Lagoon, , Solivik Island, Utukok River
30	Laguna Kunergin, Nutepynmyn, Pyngopil'khin, Laguna Pyngopil'khin	75	Akeonik, Icy Cape, Icy Cape Pass
31	Alyatki, Zaliv Tasytkhin, Kolyuchin Bay	76	Akoliakatat Pass, Avak Inlet, Tunalik River
32	Mys Dzhenretlen, Eynenekvyk, Lit'khekay-Polar Station	77	Mitliktavik, Nivat Point, Nokotlek Point, Ongorakvik River
33	Neskan, Laguna Neskan, Mys Neskan	78	Kilmantavi, Kuk River, Point Collie, Sigeakruk Point,
34	Emelin, Ostrov Idlidlya, I, Memino, Tepken,	79	Point Belcher, Wainwright, Wainwright Inlet
35	Enurmino, Mys Keylu, Netakeniskhvin, Mys Neten,	80	Eluksingiak Point, Igklo River, Kugrua Bay
36	Mys Chechan, Mys Ikigur, Keniskhvik, Mys Serditse Kamen	81	Peard Bay, Point Franklin, Seahorse Islands, Tachinisok Inlet
37	Chegitun, Utkan, Mys Volnistyy	82	Skull Cliff
38	Enmytagyn, Inchoun, Inchoun, Laguna Inchoun, Mitkulino, Uellen, Mys Unikyn	83	Nulavik, Loran Radio Station
39	Cape Dezhnev, Mys Inchoun, Naukan, Mys Peek, Uelen, Laguna Uelen, Mys Uelen	84	Walakpa River, Will Rogers and Wiley Post Memorial
40	Ah-Gude-Le-Rock, Dry Creek, Lopp Lagoon, Mint River	85	Barrow, Browerville, Elson Lagoon
41	Ikpek, Ikpek Lagoon, Pinguk River, Yankee River	86	Dease Inlet, Plover Islands, Sanigaruak Island
42	Arctic Lagoon, Kugrupaga Inlet, Nuluk River	87	Igalik Island, Kulgurak Island, Kurgorak Bay, Tangent Point
43	Sarichef Island, Shishmaref Airport	88	Cape Simpson, Piasuk River, Sinclair River, Tulimanik Island
44	Cape Lowenstern, Egg Island, Shishmaref, Shishmaref Inlet	89	Ikpikpuk River, Point Poleakoon, Smith Bay
45	No place names	90	Drew Point, Kolovik, McLeod Point,
91	Lonely AFS Airport, Pitt Point, Pogik Bay, Smith River	119	Arey & Barter Island
92	Cape Halkett, Esook Trading Post, Garry Creek	120	Kaktovik, Jago Lagoon, Bernard Spit

ID	Geographic Place Names	ID	Geographic Place Names
93	Atigaru Point, Eskimo Islands, Harrison Bay, Kalikpik River, Saktuina Point	121	Jago Spit & River, Tapkaurak Spit & Lagoon
94	Tingmeachsiovik River	122	Griffin Point, Oruktalik Lagoon
95	Fish Creek, Nechelik Channel, Colville River Delta	123	Angun Point, Beaufort Lagoon
96	Tolaktovut Point, Colville River	124	Icy Reef, Kongakut River, Siku Lagoon
97	Kupigruak Channel, Colville River	125	Demarcation Bay & Point
98	Kalubik Creek	126	Clarence Lagoon, Backhouse River
99	Oliktok Point, Ugnuravik River	127	Komakuk Beach, Fish Creek
100	Milne Point, Simpson Lagoon	128	Nunaluk Spit, Firth River
101	Beechy & Back Pt., Sakonowyak R.	129	Herschel Island
102	Kuparuk River, Point Storkersen	130	Ptarmagin Bay
103	Point McIntyre, West Dock, Putuligayuk R.	131	Stokes and Kay Pt., Phillips Bay
104	Prudhoe Bay, Heald Pt.	132	Sabine Point
105	Point Brower, Sagavanirktok R., Duck I.	133	Shingle Point, Escape Reef
106	Foggy Island Bay, Kadleroshilik R.	134	Tent Island & Shoalwater Bay
107	Tigvariak Island, Shaviovik R.	135	Shallow Bay, West Channel
108	Mikkelsen Bay, Badami Airport	136	Tiktalik Channel
109	Bullen, Gordon & Reliance Points	137	Outer Shallow Bay, Olivier Islands
110	Pt. Hopson & Sweeney, Thomson	138	Middle Channel, Gary Island
111	Staines R., Lion Bay	139	Kendall Island
112	Brownlow Point, West Canning River	140	North Point, Pullen Island
113	Canning & Tamayariak River	141	Hendrickson Island, Kugmallit Bay
114	Collinson Point, Konganevik Point	142	Tuktoyaktuk, Tuktoyaktuk Harbour
115	Collinson Point, Konganevik Point	143	Warren Point
116	Marsh and Carter Creek	144	Hutchison Bay
117	Anderson Point, Sadlerochit River	145	McKinley Bay, Atkinson Point
118	Sabine Point	146	Kidney Lake, Nuvorak Point

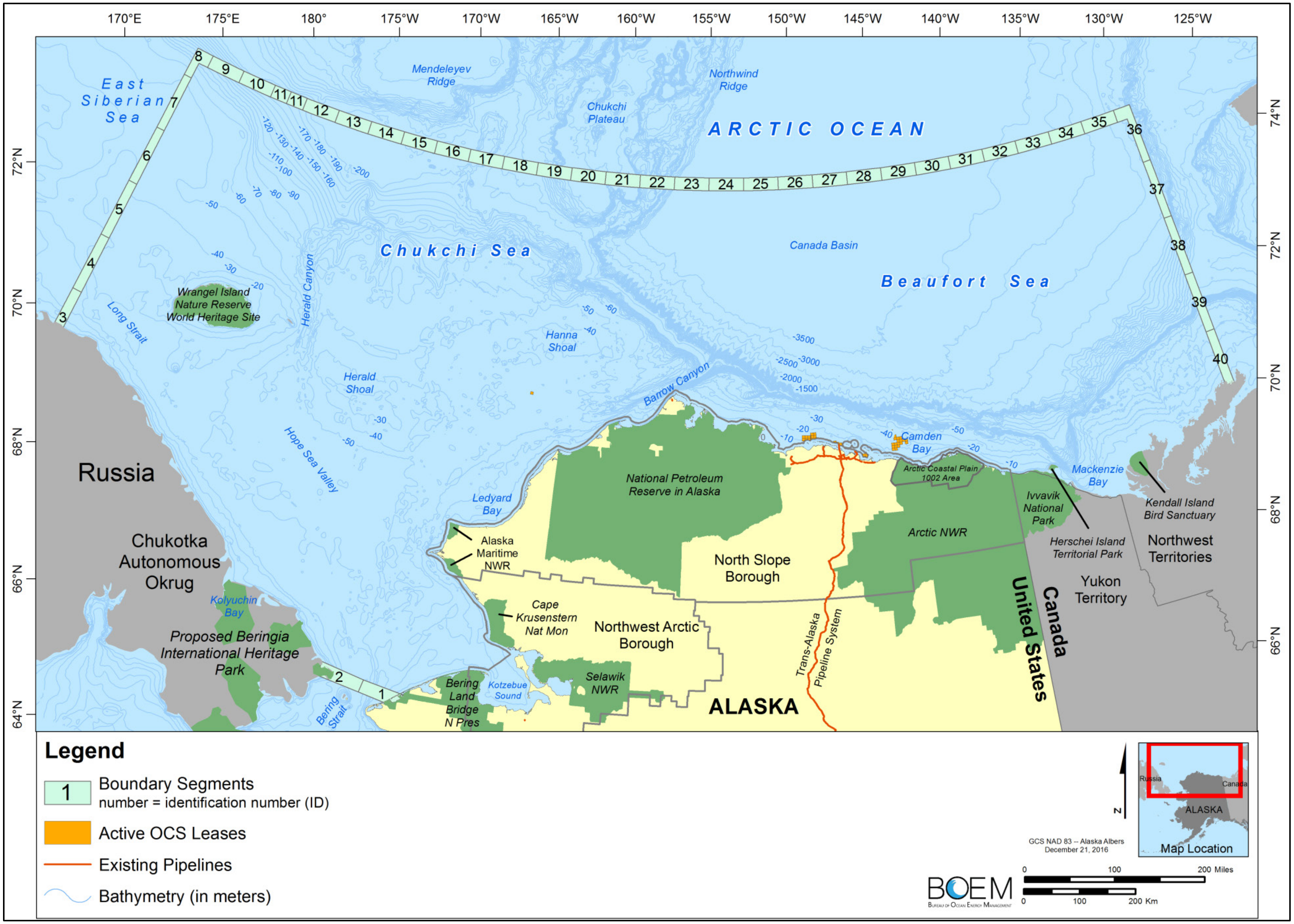
Key: ID = identification (number).
Source: USDOI, BOEM, Alaska OCS Region (2016).

Table A.1-20. Grouped Land Segment ID, Geographic Names, Land Segments ID's which make up the Grouped Land Segment and Vulnerability.

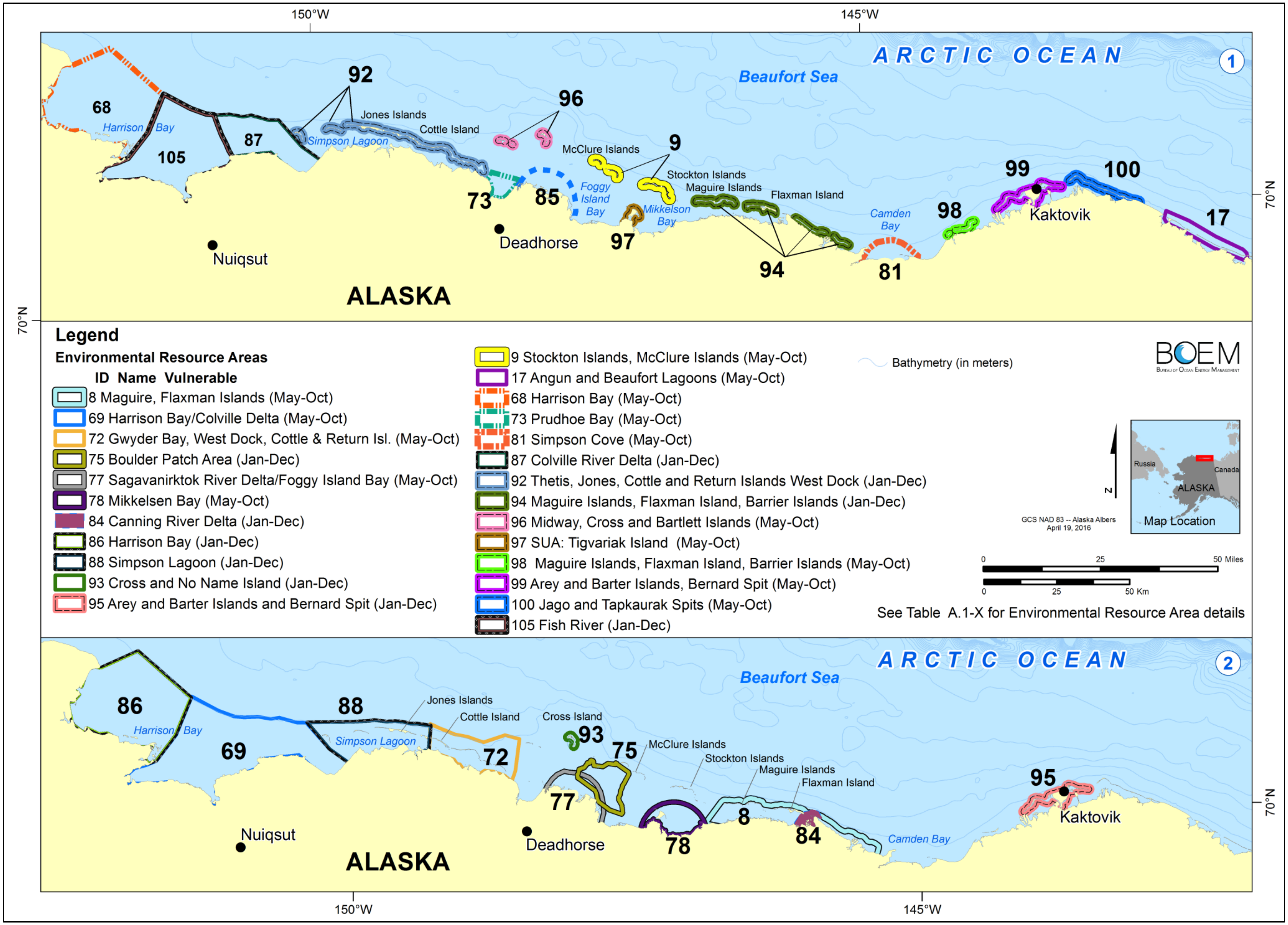
GLS ID	Grouped Land Segment Name	Land Segment ID's	Vunerable	MAP
147	Bukhta Somnitel'naya (Somnitel'naya Spit), Davidova Spit	10-11	January-December	A-4c
148	Kolyuchin Bay	30-31, 33-34	June-November	A-4c
149	Ostrov Idlidlya (Ididlya Island)	33-34	July-November	A-4c
150	Mys Serditse Kamen (Cape Serdtse-Kamen)	35-36	July-November	A-4c
151	Chukotka Coast Haulout	35-39	July-November	A-4c
152	Bering Land Bridge National Preserve	41-42, 45-50	January-December	A-4c
153	Noatak River	54-57	January-December	A-4c
154	Cape Krusenstern National Monument	57-59	January-December	A-4a
155	Wulik and Kivilina Rivers	60-61	January-December	A-4a
156	WAH Insect Relief	61-71	July - August	A-4c
157	SUA: Point Lay-Point Hope	61-71	June-September	A-4a
158	Alaska Maritime National Wildlife Refuge	62-63, 65	January-December	A-4a
159	Cape Lisburne	65-66, 67	January-December	A-4b
160	Ledyard Brown Bears	65-70	June-October	A-4b
161	Kadegaluk Lagoon Area IBA	70-78	May-October	A-4b
162	Point Lay Haulout	71-74	July-November	A-4a
163	Kasegaluk Brown Bears	73-77	June-October	A-4b
164	National Petroleum Reserve Alaska	76-77, 80-83, 86-93	January-December	A-4c
165	Kasegaluk Lagoon Special Area (NPR-A)	76-77	January-December	A-4c
166	Kuk River	78-79	January-December	A-4b
167	TCH Insect Relief/Calving	85-96	May-August	A-4b
168	SUA: Barrow-Nuiqsut	85-96	July-August	A-4b
169	Smith Bay Spotted Seal Haulout	88-89	May-October	A-4b
170	Teshekpuk Lake Special Area (NPR-A)/IBA	86-93	May-October	A-4c
171	Colville River Delta IBA	93-98	May-October	A-4a
172	Colville River Delta	94-97	October-April	A-4a
173	Harrison Bay Spotted Seal Haulout	96-99	June–September	A-4b
174	CAH Insect Relief/ Calving	98-113	May-August	A-4b
175	SUA: Kaktovik-Nuiqsut	98-113	July-August	A-4b
176	98-129 Summer	98-129	June-August	A-4a
177	Beaufort Muskox Habitat	100-103	November-May	A-4b
178	104-129 Fall	104-129	September-November	A-4b
179	Foggy Island Bay	105-107	January-December	A-4a
180	110-124 Winter	110-124	October-April	A-4a
181	Arctic National Wildlife Refuge	112-125	January-December	A-4b
182	Northeast Arctic Coastal Plain IBA	112-125	May-October	A-4b
183	PCH Insect Relief/SUA Kaktovik	112-125	July-August	A-4b
184	PCH Calving	118-123, 126-131	May-June	A-4a
185	Yukon Musk Ox Wintering	125-129	November-April	A-4b
186	Ivvavik National Park (Canada)	126-131	January-December	A-4b
187	126-133 Spring	126-133	March-May	A-4b
188	126-135 Winter	126-135	December-February	A-4b
189	Yukon Moose	130-132	January-December	A-4b
190	Tarium Nirutait Marine Protected Area	122-136,,138, 141	January-December	A-4b
191	136-146 Spring	136-146	March-May	A-4a
192	136-146 Winter	136-146	December-February	A-4a
193	Kendall Island Bird Sanctuary (Canada)	138-139	May-October	A-4b
194	Tuktoyaktuk/Cape Bathurst Caribou Insect Relief	140-146	July-August	A-4a
195	Russia Chukchi Coast Marine Mammals	1-39	July-November	A-4c
196	Russia Chukchi Coast	1-39	January-December	A-4c
197	United States Chukchi Coast	40-84	January-December	A-4c
198	United States Beaufort Coast	85-125	January-December	A-4a
199	Canada Beaufort Coast	126-146	January-December	A-4a

Source: USDOI, BOEM, Alaska OCS Region (2016).
Notes: CAH– Central Arctic Herd; IBS-Important Bird Area; NPR-A-National Petroleum Reserve-Alaska; PCH–Porcupine Caribou Herd; SUA-Subsistence Use Area;TCH–Teshekpuk Caribou Herd; WAH–Western Arctic Herd

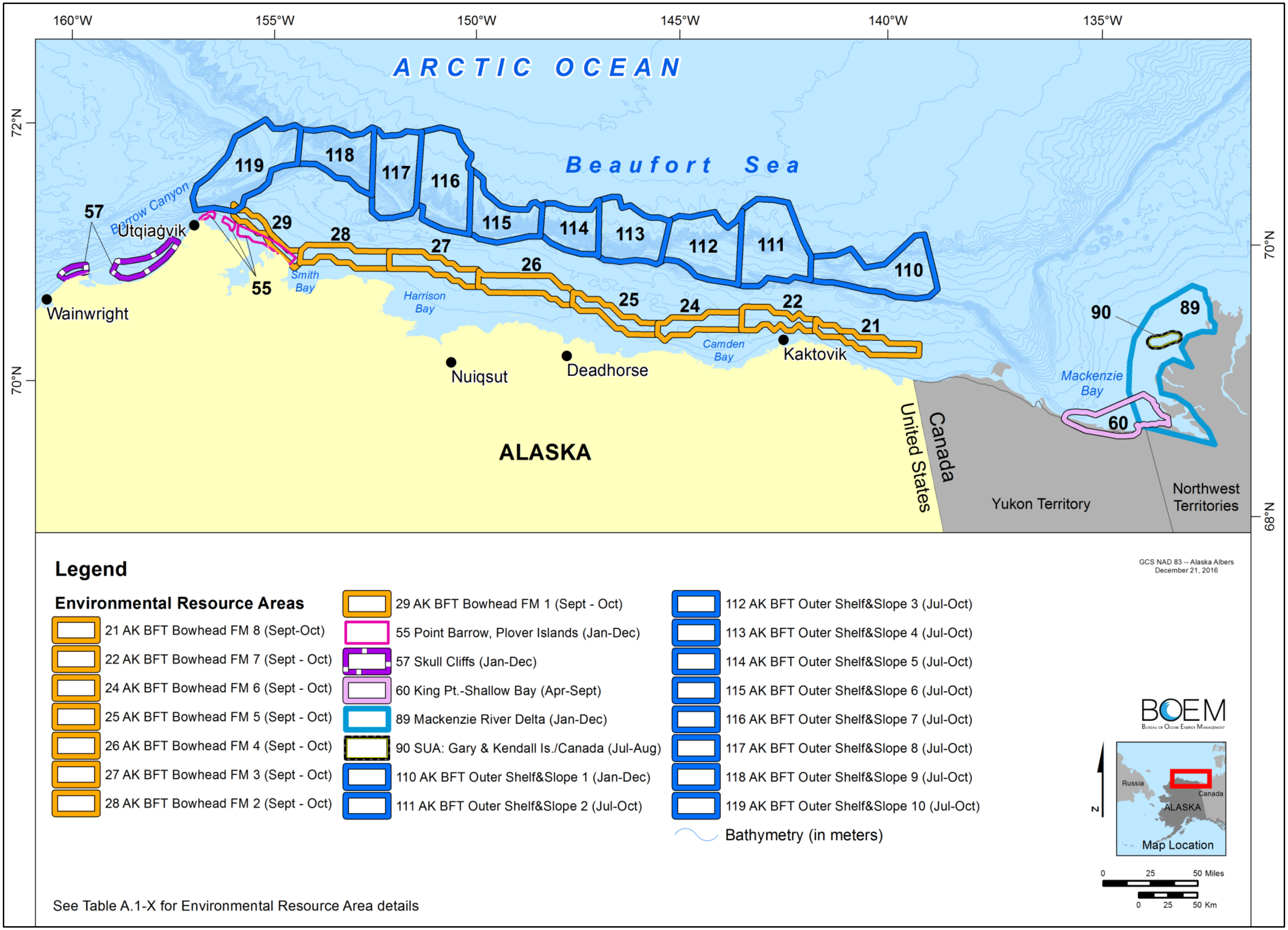
Maps



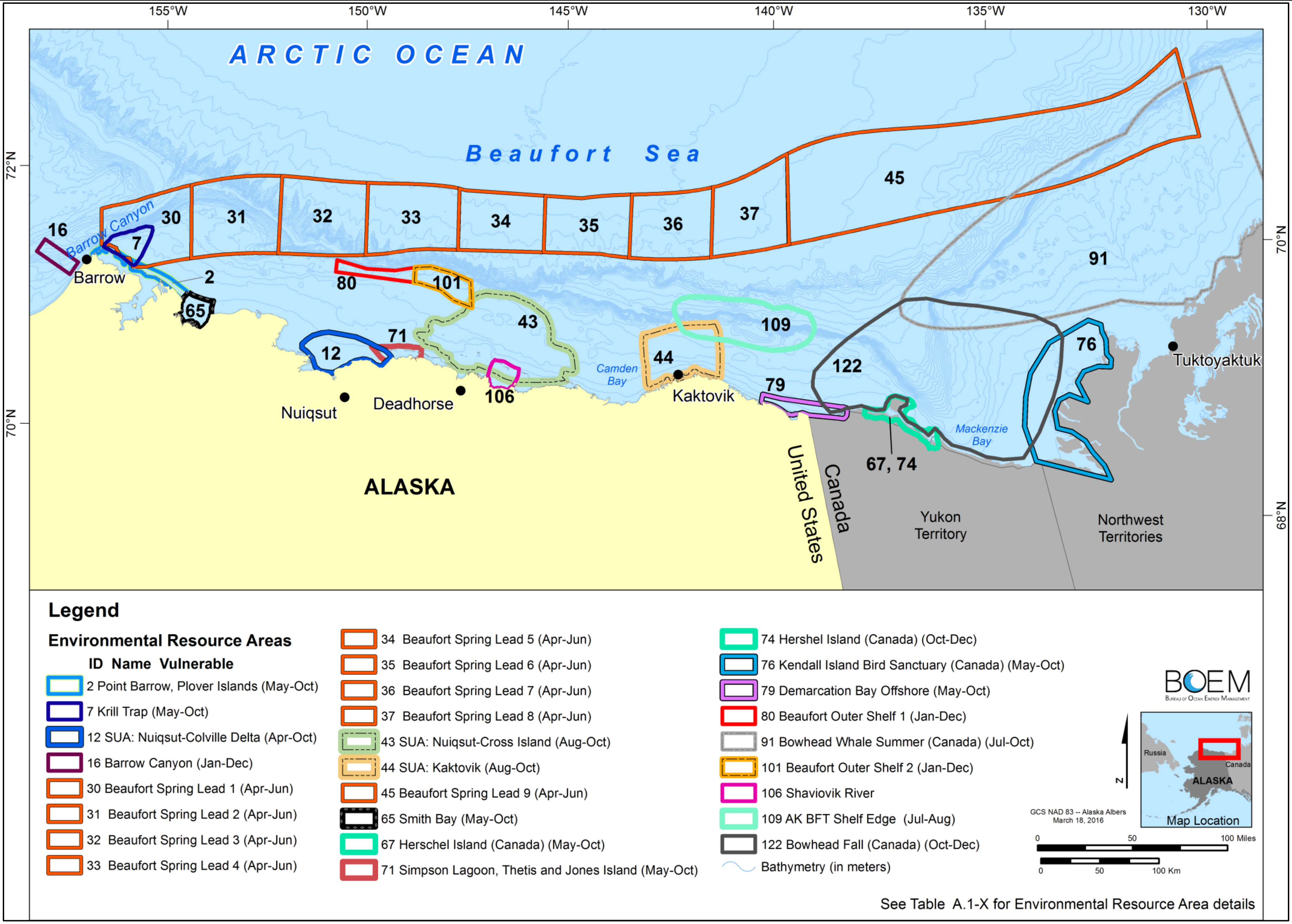
Map A-1. Study Area Used in the Oil-Spill Trajectory Analysis.



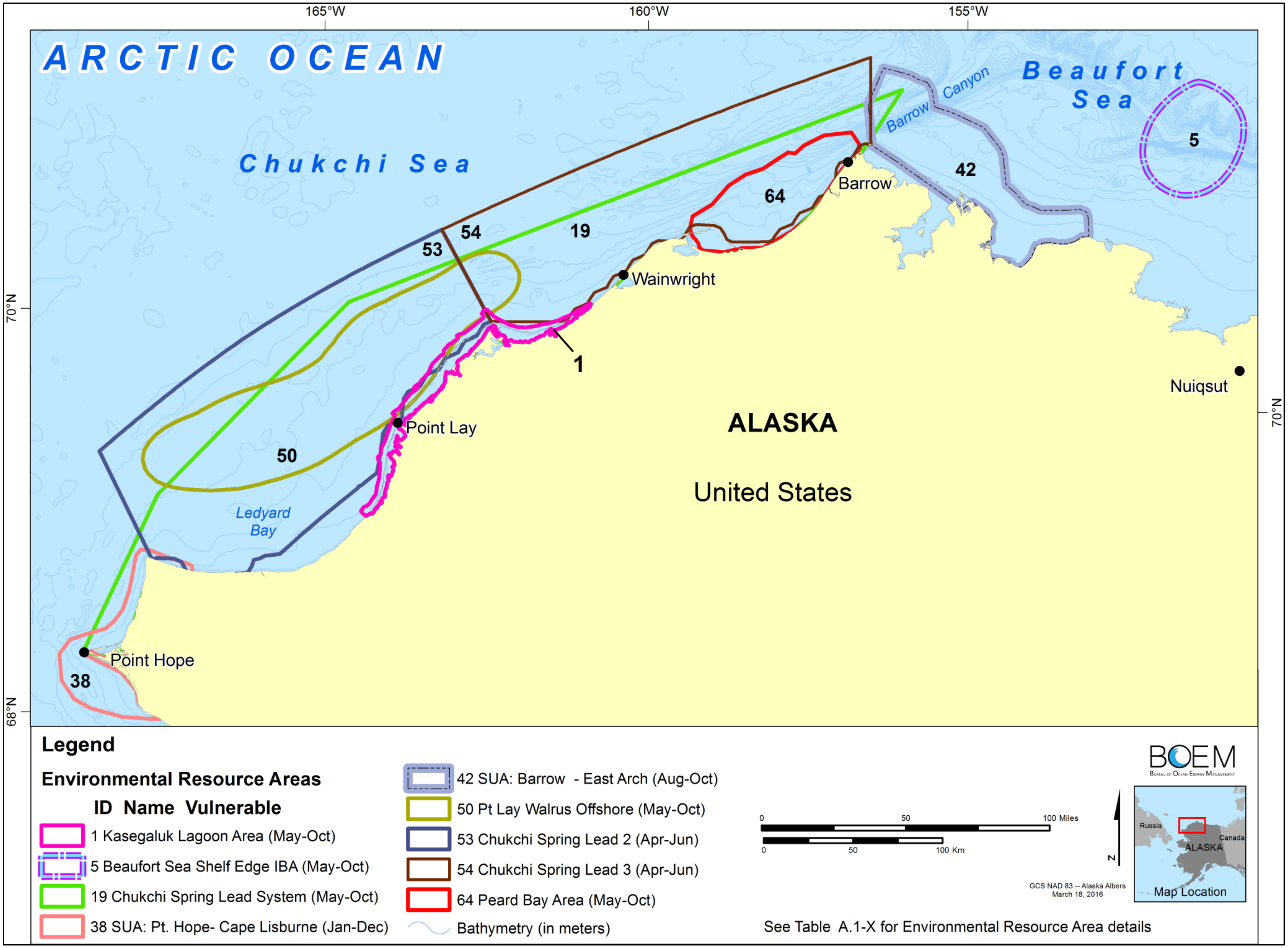
Map A-2a. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.



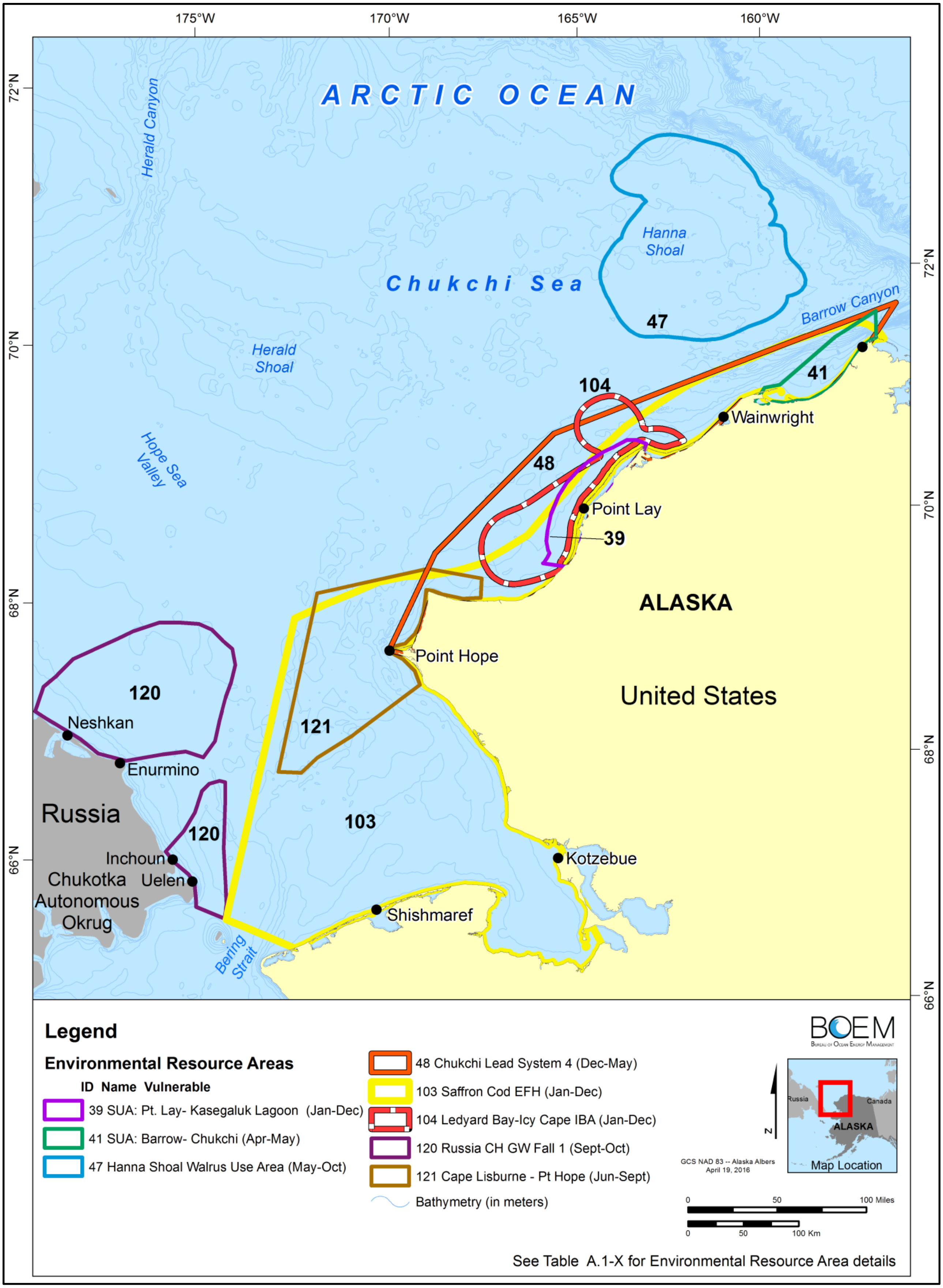
Map A-2b. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.



Map A-2c. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.

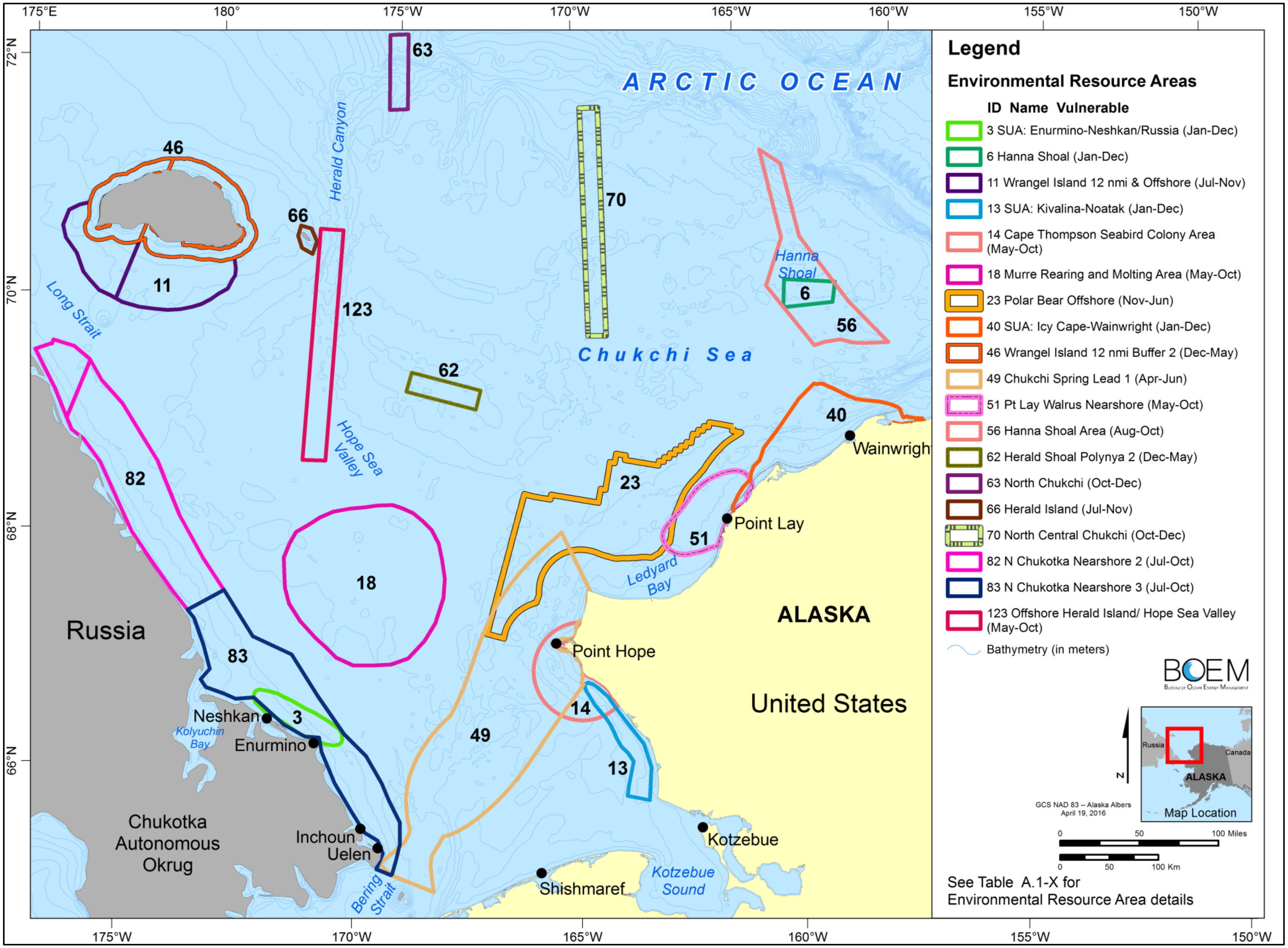


Map A-2d. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.



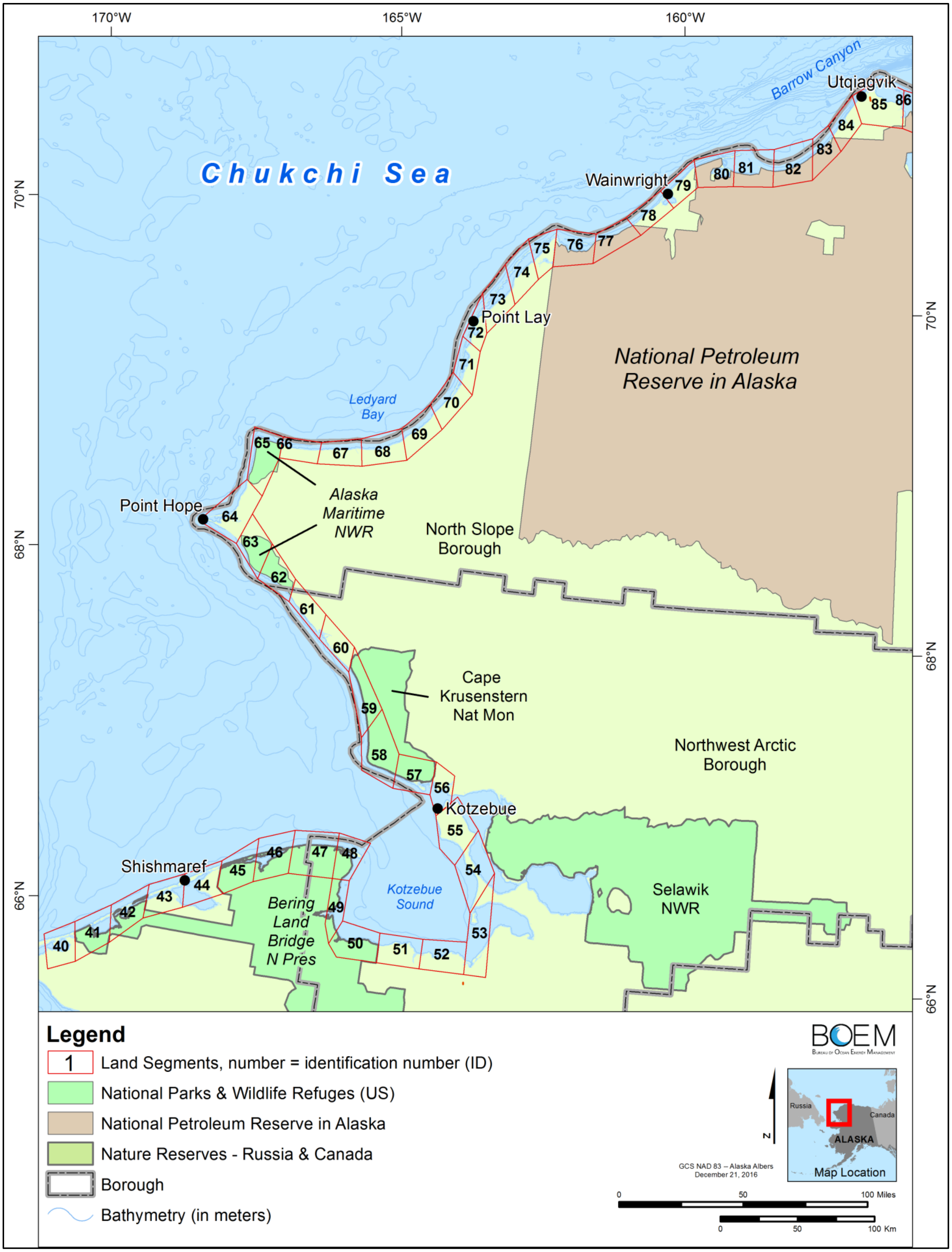
Map A-2e. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.

Map A-2f. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.

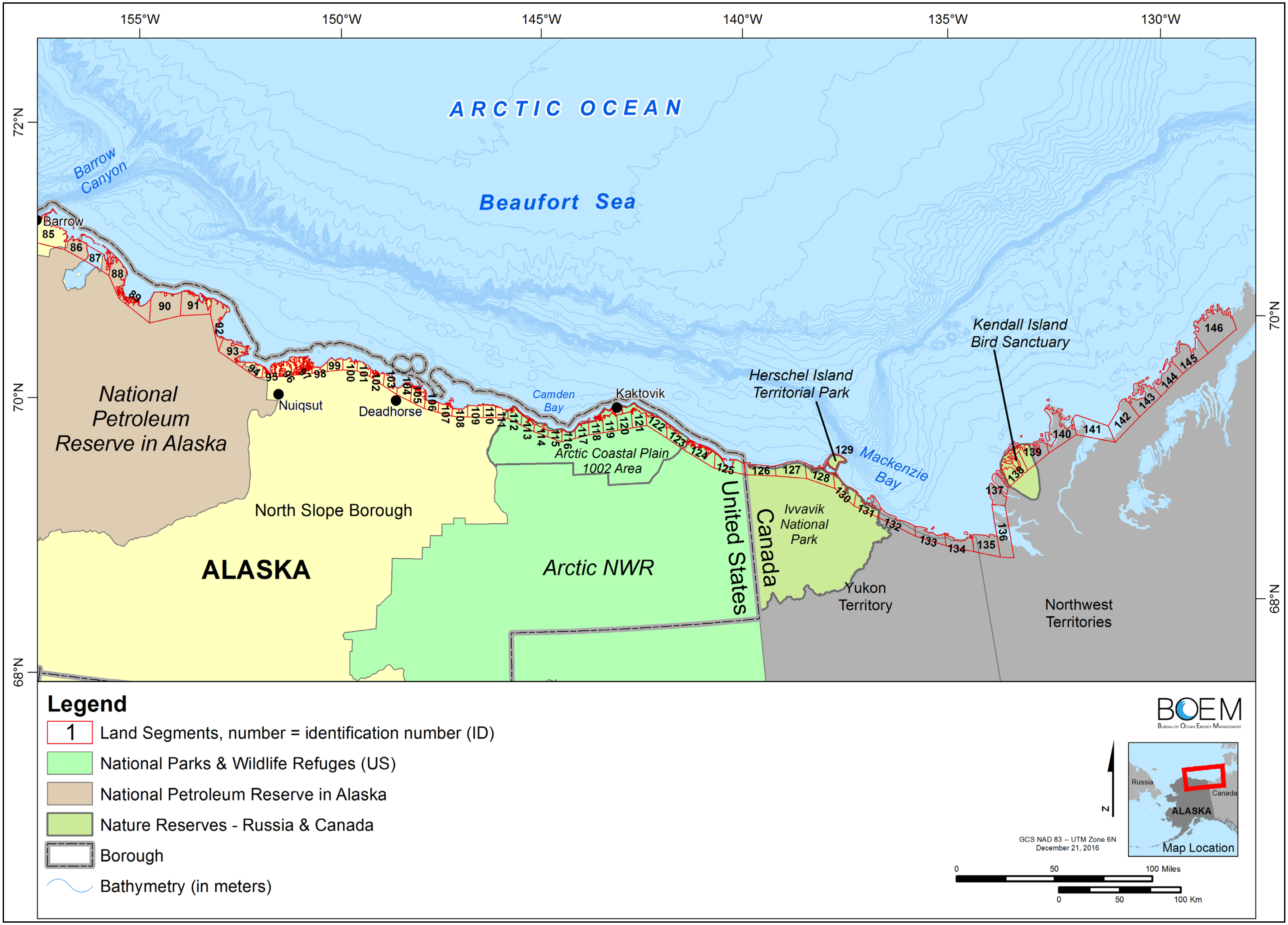


Map A-2g. Environmental Resource Areas Used in the Oil-Spill Trajectory Analysis.

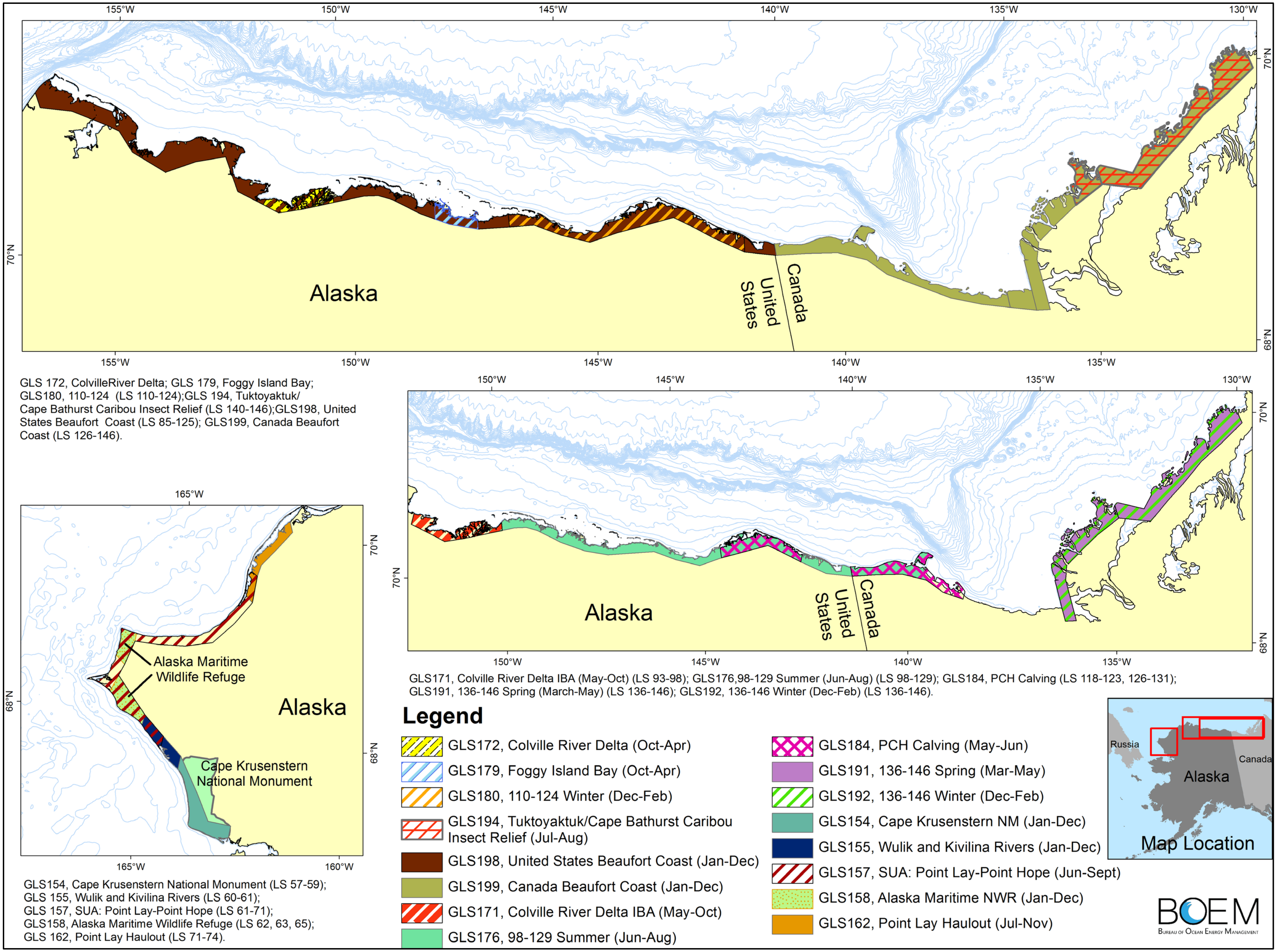
Map A-3a. Land Segments Used in the Oil-Spill Trajectory Analysis.



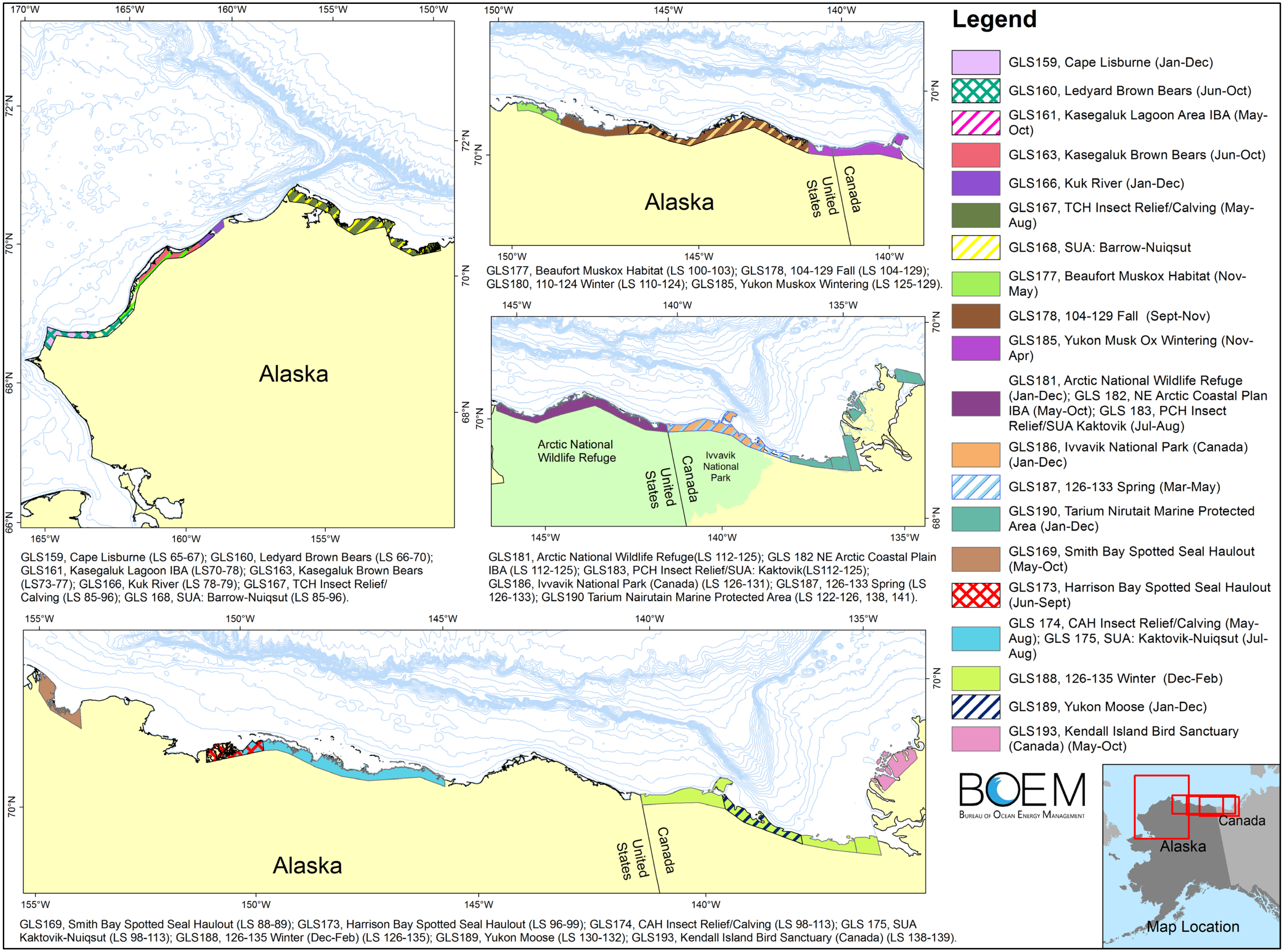
Map A-3b. Land Segments Used in the Oil-Spill Trajectory Analysis.



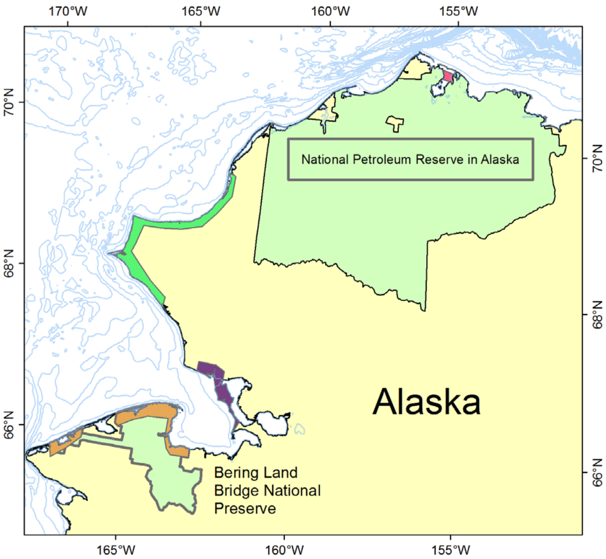
Map A-3c. Land Segments Used in the Oil-Spill Trajectory Analysis.



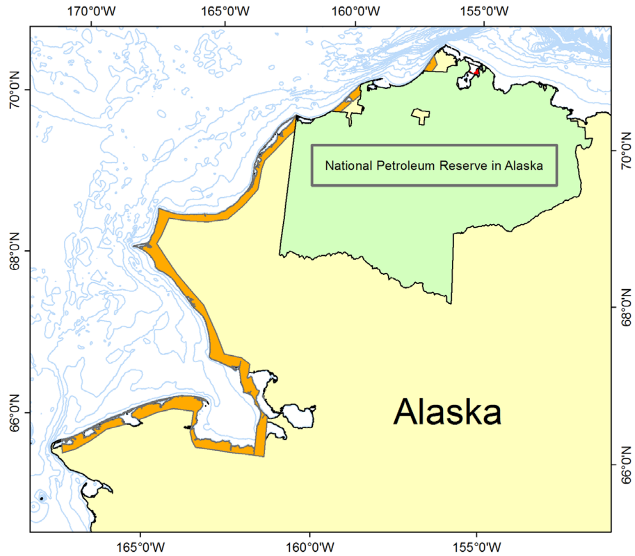
Map A-4a. Grouped Land Segments Used in the Oil-Spill Trajectory Analysis.



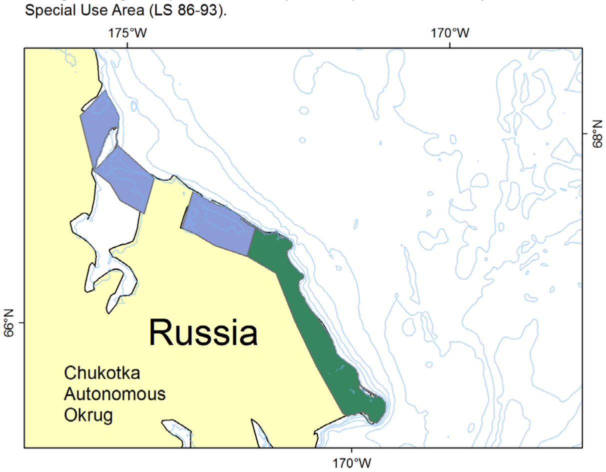
Map A-4b. Grouped Land Segments Used in the Oil-Spill Trajectory Analysis.



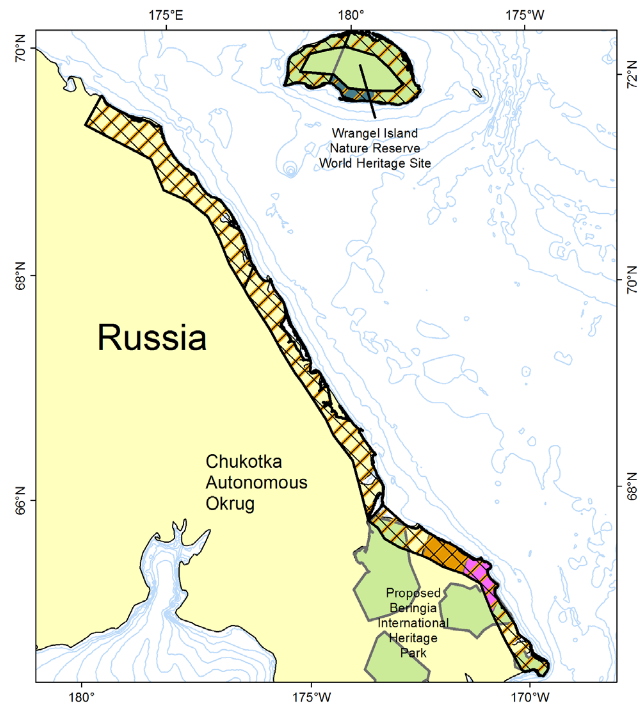
GLS152, Bering Land Bridge National Preserve (LS 41-42, 45-50); GLS 153, Noatak River (LS41-42, 45-50); GLS156, WAH Insect Relief (LS 61-71); GLS165, Kasegaluk Lagoon Special Use Area (LS 76-77); GLS170, Teshekpuk Lake Special Use Area (LS 86-93).



GLS164, National Petroleum Reserve Alaska (LS 76-77, 80-83, 86-93); GLS197, United States Chukchi Coast (LS 40-84).



GLS148, Kolyuchin Bay (Jun-Nov); GLS151, Chukotka Coast Haulout (Jul-Nov).

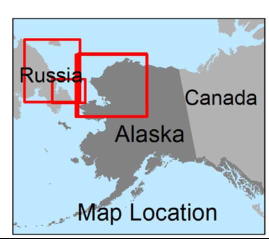


GLS147, Bukhta Somnitel'naya (LS 10-11); GLS149, Ostrov Idlidlya (LS 33-34); GLS150, Mys Serditse Kamen (LS 35-36); GLS195, Russia Chukchi Coast Marine Mammals (LS 1-39); GLS196, Russia Chukchi Coast (LS 1-39).

Legend

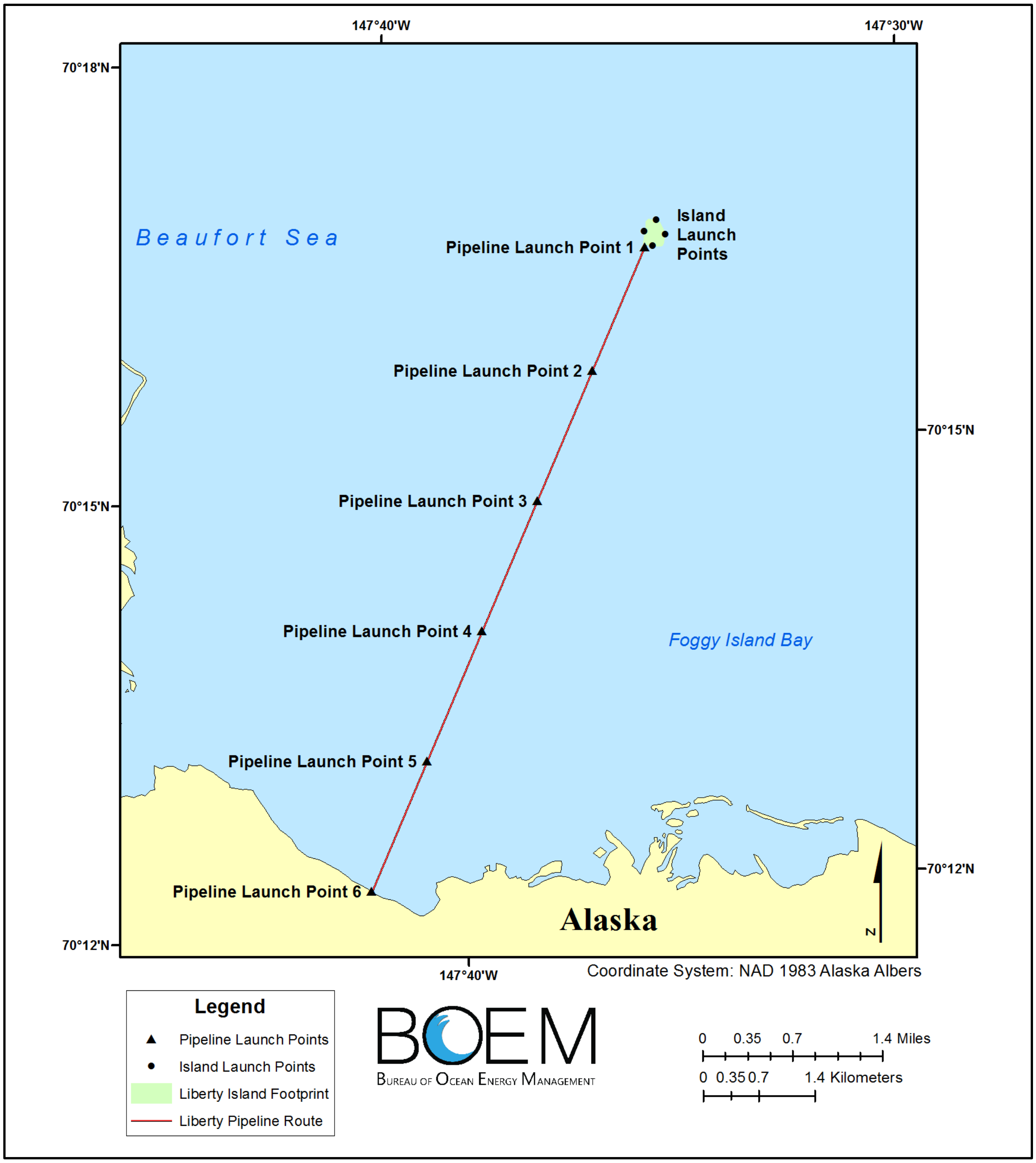
- GLS152, Bering Land Bridge National Preserve (Jan-Dec)
- GLS153, Noatak River (Jan-Dec)
- GLS156, WAH Insect Relief (Jul-Aug)
- GLS165, Kasegaluk Lagoon Special Area (NPR-A) (Jan-Dec)
- GLS170, Teshekpuk Lake Special Area (NPR-A)/IBA (May-
- GLS164, National Petroleum Reserve Alaska (Jan-Dec)
- GLS197, United States Chukchi Coast (Jan-Dec)
- GLS148, Kolyuchin Bay (Jun-Nov)
- GLS151, Chukotka Coast Haulout (Jul-Nov)
- GLS147, Bukhta Somnitel'naya (Somnitel'naya Spit) Davidova Spit (Jan-Dec)
- GLS149, Ostrov Idlidlya (Ididlya Island) (Jul-Nov)
- GLS150, Mys Serditse Kamen (Cape Serdtse-Kamen) (Jul-Nov)
- GLS195, Russia Chukchi Coast Marine Mammals (Jul-Nov)
- GLS196, Russia Chukchi Coast (Jan-Dec)

BOEM
Bureau of Ocean Energy Management



Map A-4c. Grouped Land Segments Used in the Oil-Spill Trajectory Analysis.

Map A-5. Launch Areas Used in the Oil-Spill Trajectory Analysis.



Map A-6. Launch Points Used in the Oil-Spill Trajectory Analysis. (Zoomed in from Map A-5)

A.2. OSRA Conditional and Combined Probability Tables

Tables A.2-1 through A.2-9 represent conditional probabilities (expressed as percent chance) that a large oil spill starting at a particular location Liberty Island (LI) or pipeline (PL) will contact a certain location (environmental resource area, land segment, boundary segment, or grouped land segment). The tables are further organized as annual or seasonal (winter, summer). Tables A.2-1 through A.2-3 represent annual conditional probabilities while Table's A.2-4 through A.2-9 represent seasonal conditional probabilities. Tables A.2-10 through A.2-11 represent combined probabilities (expressed as percent chance) of one or more large spills, and the estimated number of spills (mean), occurring and contacting a resource over the assumed life of the project.

If the chance of contacting a given resource area is >99.5%, it is shown with a double asterisk (**). If the chance of a large spill contacting a resource area is <0.5%, it is shown with a dash (-). Resource areas with a <0.5% chance of contact from the LI and PL are not shown.

Table A.2-1 represents the annual conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain environmental resource area (ERA) within 1, 3, 10, 30, 90, or 360 days:

Table A.2-1. Annual Environmental Resource Area.

ID	Environmental Resource Name	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
0	Land	22	51	52	72	72	84	84	90	88	93	88	93
2	Point Barrow Plover Islands	-	-	-	-	-	-	-	-	1	-	1	-
5	Beaufort Sea Shelf Edge IBA	-	-	-	-	-	-	1	1	2	1	2	1
7	Krill Trap	-	-	-	-	-	-	-	-	1	-	1	-
8	Maguire and Flaxman Islands	-	-	1	-	2	1	2	1	2	1	2	1
9	Stockton and McClure Islands	-	-	3	2	6	4	6	4	6	4	6	4
12	SUA: Nuiqsut 0 Colville River Delta	-	-	-	-	1	-	2	1	3	1	3	1
24	AK BFT Bowhead FM 3	-	-	-	-	-	-	1	1	1	1	1	1
25	AK BFT Bowhead FM 4	-	-	-	-	2	1	2	1	2	1	2	1
26	AK BFT Bowhead FM 5	-	-	-	-	1	1	2	1	2	1	2	1
27	AK BFT Bowhead FM 6	-	-	-	-	-	-	1	1	1	1	1	1
28	AK BFT Bowhead FM 7	-	-	-	-	-	-	1	-	1	1	1	1
30	Beaufort Spring Lead 1	-	-	-	-	-	-	-	-	1	-	1	-
31	Beaufort Spring Lead 2	-	-	-	-	-	-	-	-	1	-	1	-
32	Beaufort Spring Lead 3	-	-	-	-	-	-	-	-	1	-	1	-
42	SUA: Barrow-East Arch	-	-	-	-	-	-	1	-	1	1	1	1
43	SUA: Nuiqsut-Cross Island	4	1	8	4	10	5	10	5	11	5	11	5
55	Point Barrow -Plover Islands	-	-	-	-	-	-	1	-	2	1	2	1
61	Point Lay-Barrow BH GW SFF	-	-	-	-	-	-	-	-	1	-	1	-
65	Smith Bay	-	-	-	-	-	-	-	-	1	-	1	-
68	Harrison Bay	-	-	-	-	1	-	2	1	3	1	3	1
69	Harrison Bay/Colville Delta	-	-	-	-	-	-	1	1	2	1	2	1
71	Simpson Lagoon Thetis and Jones Island	-	-	-	-	2	1	3	1	3	2	3	2
72	Gwyder Bay West Dock Cottle and Return Islands	-	-	3	1	6	2	7	3	7	3	7	3
73	Prudhoe Bay	-	-	1	-	2	1	2	1	2	1	2	1
75	Boulder Patch Area	**	55	**	57	**	57	**	57	**	57	**	57
77	Sagavanirktok River Delta/Foggy Island Bay	20	20	28	26	32	28	33	28	33	28	33	28
78	Mikkelsen Bay	1	1	5	4	6	4	6	5	6	5	6	5
80	Beaufort Outer Shelf 1	-	-	-	-	-	-	3	2	4	3	4	3

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

ID	Environmental Resource Name	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
84	Canning River Delta	-	-	-	-	1	1	1	1	1	1	1	1
85	Sagavanirktok River Delta	38	39	55	49	61	54	62	54	63	54	63	54
86	Harrison Bay	-	-	-	-	1	-	3	1	4	2	4	2
87	Colville River Delta	-	-	-	-	1	-	1	1	2	1	2	1
88	Simpson Lagoon	-	-	-	-	3	1	5	2	6	3	6	3
92	Thetis, Jones, Cottle & Return Islands	-	-	2	1	7	3	10	4	10	4	10	4
93	Cross and No Name Island	-	-	1	-	3	2	4	2	4	2	4	2
94	Maguire Flaxman & Barrier Islands	-	-	1	-	2	1	3	2	3	2	3	2
96	Midway Cross and Bartlett Islands	-	-	1	-	3	1	4	2	4	2	4	2
97	SUA: Tigvariak Island	1	1	5	5	7	6	8	6	8	6	8	6
101	Beaufort Outer Shelf 2	-	-	-	-	1	-	3	2	6	3	6	3
103	Saffron Cod EFH	-	-	-	-	-	-	-	-	1	-	1	-
105	Fish Creek	-	-	-	-	-	-	2	1	3	1	3	1
106	Shaviovik River	**	**	**	**	**	**	**	**	**	**	**	**
108	Barrow Feeding Aggregation	-	-	-	-	-	-	1	-	1	1	1	1
111	AK BFT Outer Shelf & Slope 2	-	-	-	-	-	-	-	-	1	-	1	-
112	AK BFT Outer Shelf & Slope 3	-	-	-	-	-	-	1	1	1	1	1	1
113	AK BFT Outer Shelf & Slope 4	-	-	-	-	-	-	1	1	2	1	2	1
114	AK BFT Outer Shelf & Slope 5	-	-	-	-	-	-	1	1	2	1	2	1
115	AK BFT Outer Shelf & Slope 6	-	-	-	-	-	-	1	1	2	1	2	1
116	AK BFT Outer Shelf & Slope 7	-	-	-	-	-	-	-	-	1	1	1	1
117	AK BFT Outer Shelf & Slope 8	-	-	-	-	-	-	-	-	1	1	1	1
118	AK BFT Outer Shelf & Slope 9	-	-	-	-	-	-	-	-	1	-	1	-
119	AK BFT Outer Shelf & Slope 10	-	-	-	-	-	-	-	-	1	-	1	-
124	Chukchi Sea Nearshore IBA	-	-	-	-	-	-	-	-	1	-	1	-

Table A.2-2 represents the annual conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain land segment (LS) within 1, 3, 10, 30, 90, or 360 days:

Table A.2-2. Annual Land Segment.

ID	Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
85	Barrow, Browerville, Elson Lag.	-	-	-	-	-	-	-	-	1	-	1	-
88	Cape Simpson, Piasuk River	-	-	-	-	-	-	-	-	1	1	1	1
92	Cape Halkett, Garry Creek	-	-	-	-	-	-	2	1	3	1	3	1
93	Atigaru Pt., Eskimo Isl., Kogru R.	-	-	-	-	-	-	1	-	1	1	1	1
100	Milne Point, Simpson Lagoon	-	-	-	-	-	-	1	-	1	-	1	-
101	Beechy & Back Pt., Sakonowyak R.	-	-	-	-	1	-	2	1	2	1	2	1
102	Kuparuk River, Point Storkersen	-	-	-	-	1	-	2	1	2	1	2	1
103	Point McIntyre, West Dock, Putuligayuk R.	-	-	-	-	2	1	3	1	3	1	3	1
104	Prudhoe Bay, Heald Pt.	1	-	3	1	4	2	5	2	5	2	5	2
105	Point Brower, Sagavanirktok R., Duck I.	14	13	24	19	28	21	29	21	29	22	29	22
106	Foggy Island Bay, Kadleroshilik R.	6	37	17	47	21	50	21	50	21	50	21	50
107	Tigvariak Island, Shaviovik R.	1	1	5	4	7	5	7	6	7	6	7	6
108	Mikkelsen Bay, Badami Airport	-	-	1	1	3	2	3	2	3	2	3	2
109	Bullen, Gordon & Reliance Points	-	-	1	-	2	1	3	1	3	1	3	1
110	Pt. Hopson & Sweeney, Thomson	-	-	-	-	1	-	1	1	1	1	1	1
111	Staines R., Lion Bay	-	-	-	-	-	-	-	-	1	-	1	-
112	Brownlow Point, West Canning River	-	-	-	-	-	-	-	-	1	-	1	-

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A.2-3 represents the annual conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain group of land segments (GLS) within 1, 3, 10, 30, 90, or 360 days:

Table A.2-3. Annual Grouped Land Segment.

ID	Grouped Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
164	National Petroleum Reserve Alaska	-	-	-	-	-	-	4	2	7	3	7	3
167	TCH Insect Relief/Calving	-	-	-	-	-	-	2	1	3	2	3	2
168	SUA: Barrow-Nuiqsut	-	-	-	-	-	-	1	1	2	1	2	1
169	Smith Bay Spotted Seal Haulout	-	-	-	-	-	-	-	-	1	-	1	-
170	Teshekpuk Lake Special Area (NPR-A)/IBA	-	-	-	-	-	-	2	1	4	2	4	2
171	Colville River Delta IBA	-	-	-	-	-	-	1	1	2	1	2	1
174	CAH Insect Relief/ Calving	7	16	17	24	25	28	27	30	27	30	27	30
175	SUA: Kaktovik-Nuiqsut	4	8	8	12	12	14	13	14	13	14	13	14
176	98-129 Summer	6	14	14	20	21	24	23	25	24	25	24	25
177	Beaufort Muskox Habitat	-	-	-	-	3	1	4	2	4	2	4	2
178	104-129 Fall	6	15	13	20	17	23	18	23	18	23	18	23
179	Foggy Island Bay	22	51	46	70	56	76	57	77	57	77	57	77
180	110-124 Winter	-	-	-	-	1	1	2	1	2	2	2	2
181	Arctic National Wildlife Refuge	-	-	-	-	1	1	2	1	2	2	2	2
182	Northeast Arctic Coastal Plain IBA	-	-	-	-	-	-	1	1	1	1	1	1
198	United States Beaufort Coast	22	51	52	72	72	84	84	90	88	93	88	93

Table A.2-4 represents the annual conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain Environmental Resource Area (ERA) within 1, 3, 10, 30, 90, or 360 days:

Table A.2-4. Summer Environmental Resource Area.

ID	Environmental Resource Area Name	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
0	Land	25	53	54	74	74	85	85	91	88	93	88	93
2	Point Barrow Plover Islands	-	-	-	-	-	-	1	-	2	1	2	1
5	Beaufort Sea Shelf Edge IBA	-	-	-	-	-	-	3	2	4	2	4	2
7	Krill Trap	-	-	-	-	-	-	-	-	1	1	1	1
8	Maguire and Flaxman Islands	-	-	2	1	3	2	4	2	4	2	4	2
9	Stockton and McClure Islands	-	-	6	3	9	6	10	6	10	6	10	6
12	SUA: Nuiqsut - Colville River Delta	-	-	-	-	2	1	6	3	6	3	6	3
20	East Chukchi Offshore	-	-	-	-	-	-	-	-	1	-	1	-
22	AK BFT Bowhead FM 2	-	-	-	-	-	-	1	-	1	1	1	1
24	AK BFT Bowhead FM 3	-	-	-	-	1	-	2	2	2	2	2	2
25	AK BFT Bowhead FM 4	-	-	1	-	4	2	5	3	5	3	5	3
26	AK BFT Bowhead FM 5	-	-	-	-	3	1	5	3	6	3	6	3
27	AK BFT Bowhead FM 6	-	-	-	-	1	-	3	2	4	2	4	2
28	AK BFT Bowhead FM 7	-	-	-	-	-	-	2	1	3	1	3	1
29	AK BFT Bowhead FM 8	-	-	-	-	-	-	-	-	1	1	1	1
42	SUA: Barrow East Arch	-	-	-	-	-	-	2	1	4	2	4	2
43	SUA: Nuiqsut Cross Island	10	3	21	10	25	13	26	13	26	14	26	14
44	SUA: Kaktovik	-	-	-	-	-	-	1	-	1	1	1	1
55	Point Barrow -Plover Islands	-	-	-	-	-	-	1	-	2	1	2	1
61	Point Lay-Barrow BH GW SFF	-	-	-	-	-	-	-	-	2	1	2	1
65	Smith Bay	-	-	-	-	-	-	1	1	1	1	1	1
68	Harrison Bay	-	-	-	-	1	-	5	3	6	3	6	3

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

ID	Environmental Resource Area Name	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
69	Harrison Bay/Colville Delta	-	-	-	-	1	-	4	2	5	3	5	3
71	Simpson Lagoon Thetis and Jones Island	-	-	-	-	3	1	6	3	6	4	6	4
72	Gwyder Bay West Dock Cottle and Return Islands	-	-	5	1	12	5	14	6	14	6	14	6
73	Prudhoe Bay	-	-	1	-	4	2	5	2	5	2	5	2
75	Boulder Patch Area	**	54	**	56	**	56	**	56	**	56	**	56
77	Sagavanirktok River Delta/Foggy Island Bay	42	43	60	55	67	59	68	59	68	59	68	59
78	Mikkelsen Bay	2	2	8	6	10	8	10	8	10	8	10	8
80	Beaufort Outer Shelf 1	-	-	-	-	-	-	2	1	3	2	3	2
84	Canning River Delta	-	-	-	-	1	-	1	-	1	-	1	-
85	Sagavanirktok River Delta	42	43	60	55	67	59	68	59	68	59	68	59
86	Harrison Bay	-	-	-	-	1	-	5	3	6	3	6	3
87	Colville River Delta	-	-	-	-	1	-	2	1	3	2	3	2
88	Simpson Lagoon	-	-	-	-	3	1	6	3	6	4	6	4
92	Thetis, Jones, Cottle & Return Islands	-	-	2	1	8	3	10	4	11	5	11	5
93	Cross and No Name Island	-	-	1	-	3	2	4	2	4	2	4	2
94	Maguire Flaxman & Barrier Islands	-	-	-	-	2	1	2	1	2	1	2	1
96	Midway Cross and Bartlett Islands	-	-	3	1	7	3	8	4	8	4	8	4
97	SUA: Tigvariak Island	1	1	4	4	6	5	6	5	6	5	6	5
101	Beaufort Outer Shelf 2	-	-	-	-	1	-	4	3	6	4	6	4
103	Saffron Cod EFH	-	-	-	-	-	-	-	-	1	-	1	-
105	Fish Creek	-	-	-	-	-	-	3	2	4	2	4	2
106	Shaviovik River	**	**	**	**	**	**	**	**	**	**	**	**
108	Barrow Feeding Aggregation	-	-	-	-	-	-	1	-	4	2	4	2
110	AK BFT Outer Shelf & Slope 1	-	-	-	-	-	-	-	-	1	-	1	-
111	AK BFT Outer Shelf & Slope 2	-	-	-	-	-	-	1	1	1	1	1	1
112	AK BFT Outer Shelf & Slope 3	-	-	-	-	-	-	2	1	2	2	2	2
113	AK BFT Outer Shelf & Slope 4	-	-	-	-	-	-	4	2	4	3	4	3
114	AK BFT Outer Shelf & Slope 5	-	-	-	-	1	-	4	2	4	3	4	3
115	AK BFT Outer Shelf & Slope 6	-	-	-	-	-	-	2	1	3	2	3	2
116	AK BFT Outer Shelf & Slope 7	-	-	-	-	-	-	1	1	2	1	2	1
117	AK BFT Outer Shelf & Slope 8	-	-	-	-	-	-	1	1	2	2	2	2
118	AK BFT Outer Shelf & Slope 9	-	-	-	-	-	-	1	-	2	1	2	1
119	AK BFT Outer Shelf & Slope 10	-	-	-	-	-	-	1	-	2	1	2	1
124	Chukchi Sea Nearshore IBA	-	-	-	-	-	-	-	-	2	1	2	1

Table A.2-5 represents the summer conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain Land Segment within 1, 3, 10, 30, 90, or 360 days:

Table A.2-5. Summer Land Segment.

ID	Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
85	Barrow, Browerville, Elson Lag.	-	-	-	-	-	-	-	-	1	-	1	-
88	Cape Simpson, Piasuk River	-	-	-	-	-	-	1	1	2	1	2	1
91	Lonely, Pitt Pt., Pogik Bay, Smith R	-	-	-	-	-	-	-	-	1	-	1	-
92	Cape Halkett, Garry Creek	-	-	-	-	-	-	2	1	3	2	3	2
93	Atigaru Pt., Eskimo Isl., Kogru R.	-	-	-	-	-	-	2	1	3	2	3	2
97	Kupigruak Channel, Colville River	-	-	-	-	-	-	1	-	1	1	1	1
99	Oliktok Point, Ugnuravik River	-	-	-	-	-	-	1	-	1	-	1	-
100	Milne Point, Simpson Lagoon	-	-	-	-	1	-	1	-	1	1	1	1

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

ID	Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
101	Beechy & Back Pt., Sakonowyak R.	-	-	-	-	1	-	2	1	2	1	2	1
102	Kuparuk River, Point Storkersen	-	-	-	-	1	-	2	1	2	1	2	1
103	Point McIntyre, West Dock, Putuligayuk R.	-	-	1	-	3	1	3	1	3	1	3	1
104	Prudhoe Bay, Heald Pt.	1	-	3	1	5	2	5	2	5	2	5	2
105	Point Brower, Sagavanirktok R., Duck I.	17	15	27	21	32	24	33	24	33	24	33	24
106	Foggy Island Bay, Kadleroshilik R.	6	37	17	48	20	49	20	49	20	49	20	49
107	Tigvariak Island, Shaviovik R.	1	1	4	3	5	4	5	4	5	4	5	4
108	Mikkelsen Bay, Badami Airport	-	-	1	1	2	1	2	1	2	1	2	1
109	Bullen, Gordon & Reliance Points	-	-	1	-	1	1	1	1	1	1	1	1
110	Pt. Hopson & Sweeney, Thomson	-	-	-	-	1	-	1	1	1	1	1	1
112	Brownlow Point, West Canning River	-	-	-	-	1	-	1	-	1	-	1	-

Table A.2-6 represents the summer conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain Grouped Land Segment within 1, 3, 10, 30, 90, or 360 days:

Table A.2-6. Summer Grouped Land Segment.

ID	Grouped Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
164	National Petroleum Reserve Alaska	-	-	-	-	-	-	6	3	9	5	9	5
167	TCH Insect Relief/Calving	-	-	-	-	-	-	4	2	5	3	5	3
168	SUA: Barrow-Nuiqsut	-	-	-	-	-	-	4	2	5	3	5	3
169	Smith Bay Spotted Seal Haulout	-	-	-	-	-	-	1	1	2	1	2	1
170	Teshekpuk Lake Special Area (NPR-A)/IBA	-	-	-	-	-	-	6	3	8	5	8	5
171	Colville River Delta IBA	-	-	-	-	-	-	3	2	4	3	4	3
173	Harrison Bay Spotted Seal Haulout	-	-	-	-	-	-	1	1	1	1	1	1
174	CAH Insect Relief/ Calving	12	27	28	40	40	46	42	47	42	47	42	47
175	SUA: Kaktovik-Nuiqsut	12	27	28	40	40	46	42	47	42	47	42	47
176	98-129 Summer	12	27	28	40	40	46	43	48	43	48	43	48
178	104-129 Fall	12	26	25	34	30	37	30	37	30	37	30	37
179	Foggy Island Bay	24	53	48	72	57	77	58	78	58	78	58	78
181	Arctic National Wildlife Refuge	-	-	-	-	1	-	1	-	1	-	1	-
182	Northeast Arctic Coastal Plain IBA	-	-	-	-	1	-	1	-	1	-	1	-
183	PCH Insect Relief/SUA Kaktovik	-	-	-	-	-	-	1	-	1	-	1	-
198	United States Beaufort Coast	25	53	54	74	74	85	85	91	88	93	88	93

Table A.2-7 represents the winter conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain Environmental Resource Area (ERA) within 1, 3, 10, 30, 90, or 360 days

Table A.2-7. Winter Environmental Resource Area.

ID	Environmental Resource Area	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
0	Land	22	51	51	72	72	84	84	90	88	93	88	93
2	Point Barrow Plover Islands	-	-	-	-	-	-	-	-	1	-	1	-
5	Beaufort Sea Shelf Edge IBA	-	-	-	-	-	-	-	-	1	1	1	1
8	Maguire and Flaxman Islands	-	-	-	-	2	1	2	1	2	1	2	1
9	Stockton and McClure Islands	-	-	3	1	4	3	5	3	5	3	5	3
12	SUA: Nuiqsut - Colville River Delta	-	-	-	-	1	-	1	-	2	1	2	1
25	AK BFT Bowhead FM 4	-	-	-	-	1	1	1	1	1	1	1	1

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

ID	Environmental Resource Area	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
26	AK BFT Bowhead FM 5	-	-	-	-	1	-	1	1	1	1	1	1
27	AK BFT Bowhead FM 6	-	-	-	-	-	-	1	-	1	-	1	-
28	AK BFT Bowhead FM 7	-	-	-	-	-	-	1	-	1	-	1	-
30	Beaufort Spring Lead 1	-	-	-	-	-	-	-	-	1	-	1	-
31	Beaufort Spring Lead 2	-	-	-	-	-	-	1	-	1	1	1	1
32	Beaufort Spring Lead 3	-	-	-	-	-	-	1	-	1	-	1	-
34	Beaufort Spring Lead 5	-	-	-	-	-	-	-	-	1	-	1	-
35	Beaufort Spring Lead 6	-	-	-	-	-	-	-	-	1	-	1	-
42	SUA: Barrow-East Arch	-	-	-	-	-	-	-	-	1	-	1	-
43	SUA: Nuiqsut-Cross Island	2	1	4	2	5	2	5	2	5	3	5	3
48	Chukchi Lead System 4	-	-	-	-	-	-	1	-	1	-	1	-
55	Point Barrow -Plover Islands	-	-	-	-	-	-	1	-	1	1	1	1
65	Smith Bay	-	-	-	-	-	-	-	-	1	-	1	-
68	Harrison Bay	-	-	-	-	-	-	1	-	2	1	2	1
69	Harrison Bay/Colville Delta	-	-	-	-	-	-	1	-	1	1	1	1
71	Simpson Lagoon Thetis and Jones Island	-	-	-	-	1	-	2	1	2	1	2	1
72	Gwyder Bay West Dock Cottle and Return Islands	-	-	2	-	4	1	5	2	5	2	5	2
73	Prudhoe Bay	-	-	-	-	1	-	1	1	1	1	1	1
75	Boulder Patch Area	**	55	**	57	**	58	**	58	**	58	**	58
77	Sagavanirktok River Delta/Foggy Island Bay	13	12	18	16	21	17	21	18	21	18	21	18
78	Mikkelsen Bay	1	1	3	3	4	3	4	3	4	3	4	3
80	Beaufort Outer Shelf 1	-	-	-	-	1	-	3	2	5	3	5	3
84	Canning River Delta	-	-	-	-	1	1	1	1	1	1	1	1
85	Sagavanirktok River Delta	37	38	53	47	59	52	61	53	61	53	61	53
86	Harrison Bay	-	-	-	-	1	-	3	1	4	2	4	2
87	Colville River Delta	-	-	-	-	1	-	1	1	2	1	2	1
88	Simpson Lagoon	-	-	-	-	4	1	5	2	6	2	6	2
92	Thetis, Jones, Cottle & Return Islands	-	-	2	1	7	2	10	4	10	4	10	4
93	Cross and No Name Island	-	-	1	-	3	2	4	2	4	2	4	2
94	Maguire Flaxman & Barrier Islands	-	-	1	-	2	2	3	2	4	2	4	2
95	Arey and Barter Islands and Bernard Spit	-	-	-	-	-	-	1	1	1	1	1	1
96	Midway Cross and Bartlett Islands	-	-	1	-	2	1	2	1	2	1	2	1
97	SUA: Tigvariak Island	2	1	6	5	8	6	9	7	9	7	9	7
101	Beaufort Outer Shelf 2	-	-	-	-	1	-	3	2	5	3	5	3
103	Saffron Cod EFH	-	-	-	-	-	-	-	-	1	-	1	-
105	Fish Creek	-	-	-	-	-	-	1	1	2	1	2	1
106	Shaviovik River	**	**	**	**	**	**	**	**	**	**	**	**
112	AK BFT Outer Shelf & Slope 3	-	-	-	-	-	-	-	-	1	1	1	1
113	AK BFT Outer Shelf & Slope 4	-	-	-	-	-	-	-	-	1	1	1	1
114	AK BFT Outer Shelf & Slope 5	-	-	-	-	-	-	1	-	1	1	1	1
115	AK BFT Outer Shelf & Slope 6	-	-	-	-	-	-	-	-	1	1	1	1
116	AK BFT Outer Shelf & Slope 7	-	-	-	-	-	-	-	-	1	1	1	1

Table A.2-8 represents the winter conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain Land Segment within 1, 3, 10, 30, 90, or 360 days:

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

Table A.2-8. Winter Land Segment.

ID	Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
88	Cape Simpson, Piasuk River	-	-	-	-	-	-	-	-	1	-	1	-
92	Cape Halkett, Garry Creek	-	-	-	-	-	-	2	1	3	1	3	1
93	Atigaru Pt., Eskimo Isl., Kogru R.	-	-	-	-	-	-	-	-	1	-	1	-
100	Milne Point, Simpson Lagoon	-	-	-	-	-	-	1	-	1	-	1	-
101	Beechy & Back Pt., Sakonowyak R.	-	-	-	-	2	1	2	1	2	1	2	1
102	Kuparuk River, Point Storkersen	-	-	-	-	1	-	2	1	2	1	2	1
103	Point McIntyre, West Dock, Putuligayuk R.	-	-	-	-	2	1	3	1	3	1	3	1
104	Prudhoe Bay, Heald Pt.	1	-	2	1	4	1	4	2	4	2	4	2
105	Point Brower, Sagavanirktok R., Duck I.	14	13	23	18	27	20	28	21	28	21	28	21
106	Foggy Island Bay, Kadleroshilik R.	6	36	17	47	21	50	22	50	22	50	22	50
107	Tigvariak Island, Shaviovik R.	1	1	5	4	7	6	8	6	8	6	8	6
108	Mikkelsen Bay, Badami Airport	-	-	2	1	3	2	4	2	4	2	4	2
109	Bullen, Gordon & Reliance Points	-	-	1	-	2	1	3	2	3	2	3	2
110	Pt. Hopson & Sweeney, Thomson	-	-	-	-	1	-	1	1	1	1	1	1
111	Staines R., Lion Bay	-	-	-	-	-	-	-	-	1	1	1	1
112	Brownlow Point, West Canning River	-	-	-	-	-	-	-	-	1	-	1	-

Table A.2-9 represents the winter conditional probabilities (expressed as percent chance) that a large oil spill starting at the proposed LDPI or pipeline will contact a certain Grouped Land Segment within 1, 3, 10, 30, 90, or 360 days:

Table A.2-9. Winter Grouped Land Segment.

ID	Grouped Land Segment	1 day LI	1 day PL	3 days LI	3 days PL	10 days LI	10 days PL	30 days LI	30 days PL	90 days LI	90 days PL	360 days LI	360 days PL
164	National Petroleum Reserve Alaska	-	-	-	-	-	-	3	1	6	3	6	3
167	TCH Insect Relief/Calving	-	-	-	-	-	-	1	-	2	1	2	1
168	SUA: Barrow-Nuiqsut	-	-	-	-	-	-	-	-	1	-	1	-
170	Teshekpuk Lake Special Area (NPR-A)/IBA	-	-	-	-	-	-	1	-	2	1	2	1
171	Colville River Delta IBA	-	-	-	-	-	-	-	-	1	-	1	-
174	CAH Insect Relief/ Calving	6	13	14	19	20	22	22	24	22	24	22	24
175	SUA: Kaktovik0Nuiqsut	1	2	2	3	3	3	3	3	3	3	3	3
176	98-129 Summer	4	9	10	13	14	16	16	17	17	18	17	18
177	Beaufort Muskox Habitat	-	-	1	-	4	1	5	2	5	2	5	2
178	104-129 Fall	4	11	9	16	13	18	14	18	14	19	14	19
179	Foggy Island Bay	21	51	46	69	55	76	57	77	57	77	57	77
180	110-124 Winter	-	-	-	-	1	1	2	2	3	2	3	2
181	Arctic National Wildlife Refuge	-	-	-	-	1	1	2	2	2	2	2	2
182	Northeast Arctic Coastal Plain IBA	-	-	-	-	-	-	1	1	1	1	1	1
190	Tarium Nirutait Marine Protected Area	-	-	-	-	-	-	-	-	1	-	1	-
198	United States Beaufort Coast	22	51	51	72	72	84	84	90	88	92	88	92
199	Canada Beaufort Coast	-	-	-	-	-	-	-	-	1	-	1	-

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

Tables A.2-10 through A.2-11 represent combined probabilities (expressed as percent chance), over the assumed life of the Proposed Action of one or more spills ≥1,000 bbl, and the estimated number of spills (mean), occurring and contacting a certain Environmental Resource Area or Grouped Land Segment. All individual land segments had less than a 0.5% chance of contact and are not shown.

Table A.2-10. Environmental Resource Area.

ERA ID	Environmental Resource Area Name	1 day		3 days		10 days		30 days		90 days		360 days	
		%	mean	%	mean	%	mean	%	mean	%	mean	%	mean
0	Land	-	-	-	-	1	0.01	1	0.01	1	0.01	1	0.01
75	Boulder Patch Area	1	0.01	1	0.01	1	0.01	1	0.01	1	0.01	1	0.01
106	Shaviovik River	1	0.01	1	0.01	1	0.01	1	0.01	1	0.01	1	0.01

Table A.2-11. Grouped Land Segment.

GLS ID	Grouped Land Segment Name	1 day		3 days		10 days		30 days		90 days		360 days	
		%	mean	%	mean	%	mean	%	mean	%	mean	%	mean
198	United States Beaufort Coast	-	-	-	-	1	0.01	1	0.01	1	0.01	1	0.01

Note: For all tables in Section A.2, OSRA Conditional and Combined Probability Tables: ** = Greater than 99.5 percent;
- = less than 0.5 percent; LI = Liberty [Development and Production] Island, PL = Pipeline. Rows with all values less than 0.5 percent are not shown.

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Appendix B

Air Quality

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Appendix B. Air Quality

B-1. Introduction

This appendix provides tabular data to support the findings in Section 4.2.2, a more detailed description of volatile organic compounds (VOC) dispersion modeling, and a detailed explanation of rate of change in pollution concentrations by distance in relation to the two proposed LDPI alternatives at substantially differing distances from shore.

Table B-3.1-1. Description of Air Quality Impact Criteria.

Impact Category	Magnitude	Definition
Intensity	High	Causing modeled pollutant concentrations of greater than or equal to the NAAQS/AAAQS
Intensity	Medium	Causing modeled pollutant concentrations of >50% but <100% of the NAAQS/AAAQS
Intensity	Low	Causing modeled pollutant concentrations of <50% of the NAAQS/AAAQS
Duration	Long Term	Impacts to air quality that extend beyond the life of the project
Duration	Interim	Impacts last longer that 24 montsh through the life of the project
Duration	Temporary	Temporary
Potential to Occur	Probable	Unavoidable
Potential to Occur	Possible	Potential to occur
Potential to Occur	Unlikely	May occur, but unlikel to occur
Geographic Extent	Statewide	Project area and beyond
Geographic Extent	Local	Within the project areas modeled domain
Geographic Extent	Limited	Within project facillity

B-2. Background Concentrations

In 2010, as a part of Shell's Beaufort Sea OCS Prevention of Significant Deterioration (PSD) permit, support documentation, Statement of Basis, Sec. 5.6 (EPA, 2010c), the EPA reviewed the quarterly reports from the Badami, CCP and SDI monitors and analyzed the data from the collection period November 8, 2008 through October 31, 2009 for consistency with the monitoring plan and 40 CFR § 52.21. EPA concluded that the data collected from March 6, 2009 until October 31, 2009 was appropriate for use as representative background air quality levels for the Beaufort Sea (EPA, 2010c, Table 4,). Due to the lack of long-term data ambient air monitoring stations in the region surrounding the Beaufort Sea, EPA used alternative means to determine suitable background concentrations given the limited measurement period. The following is an excerpt from the aforementioned Statement of Basis (EPA, 2010c) detailing their method:

> For the annual NO_2 and SO_2 standards, the background value is the highest calendar year average from the relevant monitoring site. For the 24-hour PM_{10}, 3-hour and 24-hour SO_2, and 1-hour and 8-hour CO standards, Region 10 is using the highest value for either of the possible 5-month drill seasons at the appropriate monitoring sites.
>
> For the 24-hour $PM_{2.5}$ standard, Region 10 calculated the 98thpercentiles for each available 5-month drill season and averaged those values over the available drill seasons at each monitoring site… For the annual $PM_{2.5}$ standard, Region 10 calculated the annual average for each calendar year of data available for the four $PM_{2.5}$ monitoring sites and averaged them over available years.
>
> Note that the Wainwright Permanent and Point Lay $PM_{2.5}$ sites were potentially impacted by wildfires on 6 days during the 2010 drilling season. Region 10 has not excluded any of those potentially impacted days from the determination of $PM_{2.5}$ background values and has included them in the 98th percentile calculations, although

it is possible they could be excluded consideration with appropriate documentation. Excluding these wildfire days from consideration would result in a background concentration of 5 micrograms per cubic meter (µg/m^3).

For the 1-hour SO_2 standard, Region 10 selected the highest 1-hour value from any available 5-month drilling season… Region 10 has not calculated a single 1-hour NO_2 background value for the modeling of maximum offshore impacts…

BOEM also considered the methods and procedures used by Hilcorp to develop additional background concentrations (2015 Liberty EIA, Attachment 1, Air Quality Impact Analysis, Table 3-4). Background concentrations are used in conjunction with the computer-simulated predicted impacts to determine if emissions from the Proposed Action would cause or contribute to violations of the national ambient air quality standards (NAAQS).

B-3. NAAQS Impact Tables

B-3.1. Alternative 1: Proposed Action

Table B-3.1-1. Pollutant Impacts during Proposed LDPI Construction.

Pollutant	Averaging Period	Max Project Only Concentration[1] (µg/m^3)	EPA Approved Background Concentrations (µg/m^3)	Design Concentrations[2] (µg/m^3)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	73.2	81	154.2	82.02%
NO_2	Annual	4.4	1	5.4	5.40%
CO	1-Hour	564.3	1742	2306.3	5.77%
CO	8-Hour	162.3	1094	1256.3	12.56%
SO_2	1-Hour	1	13	14	7.14%
SO_2	3-Hour	1.2	11	12.2	0.94%
SO_2	24-Hour	0.3	4	4.3	1.18%
SO_2	Annual	0.02	2	2.02	2.53%
PM_{10}	24-Hour	11.2	53	64.2	42.80%
PM_{10}	Annual	0.7	NA	NA	NA
$PM_{2.5}$	24-Hour	5.9	6	11.9	34.00%
$PM_{2.5}$	Annual	0.7	3	3.7	24.67%

Notes: Maximum Modeled Pollutant Impacts during Proposed LDPI Construction.
[1]Modeled impact from only Liberty DPP activities without addition of the ambient background level.
[2]Modeled impact from Liberty DPP activities added to the ambient background level.

Table B-3.1-2. Pollutant Impacts for Pipeline Construction and Facility Installation.

Pollutant	Averaging Period	Max Project Only Concentration[1] (µg/m^3)	EPA Approved Background Concentrations (µg/m^3)	Design Concentrations[2] (µg/m^3)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	60.7	81	141.7	75.37%
NO_2	Annual	4.8	1	5.8	5.80%
CO	1-Hour	257.8	1742	1999.8	5.00%
CO	8-Hour	106.7	1094	1200.7	12.01%
SO_2	1-Hour	0.7	13	13.7	6.99%
SO_2	3-Hour	0.5	11	11.5	0.88%
SO_2	24-Hour	0.2	4	4.2	1.15%
SO_2	Annual	0.02	2	2.02	2.53%
PM_{10}	24-Hour	6.1	53	59.1	39.40%
PM_{10}	Annual	0.6	NA	NA	NA
$PM_{2.5}$	24-Hour	3.9	6	9.9	28.29%

Pollutant	Averaging Period	Max Project Only Concentration[1] (µg/m^3)	EPA Approved Background Concentrations (µg/m^3)	Design Concentrations[2] (µg/m^3)	Ratio of Design Concentrations to NAAQS
$PM_{2.5}$	Annual	0.6	3	3.6	24.00%

Notes: Maximum Modeled Pollutant Impacts for Pipeline Construction and Facility Installation.
[1]Modeled impact from only Liberty DPP activities without addition of the ambient background level.
[2]Modeled impact from Liberty DPP activities added to the ambient background level.

Table B-3.1-3. Pollutant Impacts during Facility Installation.

Pollutant	Averaging Period	Max Project Only Concentration[1] (µg/m^3)	EPA Approved Background Concentrations (µg/m^3)	Design Concentrations[2] (µg/m^3)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	81.6	81	162.6	86.49%
NO_2	Annual	7.7	1	8.7	8.70%
CO	1-Hour	902.8	1742	2644.8	6.61%
CO	8-Hour	434.3	1094	1528.3	15.28%
SO_2	1-Hour	31.7	13	44.7	22.81%
SO_2	3-Hour	33.4	11	44.4	3.42%
SO_2	24-Hour	16	4	20	5.48%
SO_2	Annual	0.4	2	2.4	3.00%
PM_{10}	24-Hour	9.2	53	62.2	41.47%
PM_{10}	Annual	1.1	NA	NA	NA
$PM_{2.5}$	24-Hour	6.5	6	12.5	35.71%
$PM_{2.5}$	Annual	1	3	4	26.67%

Notes: Maximum Modeled Pollutant Impacts during Facility Installation.
[1]Modeled impact from only Liberty DPP activities without addition of the ambient background level.
[2]Modeled impact from Liberty DPP activities added to the ambient background level.

Table B-3.1-4. Pollutant Impacts - Drilling, Development, Production Operations.

Pollutant	Averaging Period	Max Project Only Concentration[1] (µg/m^3)	EPA Approved Background Concentrations (µg/m^3)	Design Concentrations[2] (µg/m^3)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	83.5	81	164.5	87.50%
NO_2	Annual	6.9	1	7.9	7.90%
CO	1-Hour	1,229.00	1742	2971	7.43%
CO	8-Hour	571.2	1094	1665.2	16.65%
SO_2	1-Hour	44.6	13	57.6	29.39%
SO_2	3-Hour	49.8	11	60.8	4.68%
SO_2	24-Hour	19.1	4	23.1	6.33%
SO_2	Annual	1.54	2	3.54	4.43%
PM_{10}	24-Hour	9.6	53	62.6	41.73%
PM_{10}	Annual	0.9	NA	NA	NA
$PM_{2.5}$	24-Hour	5.8	6	11.8	33.71%
$PM_{2.5}$	Annual	0.9	3	3.9	26.00%

Notes: Maximum Modeled Pollutant Impacts - Drilling, Development, Production Operations.
[1]Modeled impact from only Liberty DPP activities without addition of the ambient background level.
[2]Modeled impact from Liberty DPP activities added to the ambient background level.

B-3.2. Alternative 3a: Relocate LDPI Approximately One Mile to the East

Table B-3.2-1. Estimated Pollutant Impacts during LDPI Construction-Alternative 3A.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 3A ($\mu g/m^3$)	Alternative 3a Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	154.2	10.3	164.5	87.5%
NO_2	Annual	5.4	0.4	5.8	5.8%
CO	1-Hour	2306.3	153.8	2460.1	6.2%
CO	8-Hour	1256.3	83.8	1340.1	13.4%
SO_2	1-Hour	14.0	0.9	14.9	7.6%
SO_2	3-Hour	12.2	0.8	13.0	1.0%
SO_2	24-Hour	4.3	0.3	4.6	1.3%
SO_2	Annual	2.0	0.1	2.2	2.7%
PM_{10}	24-Hour	64.2	4.3	68.5	45.7%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	11.9	0.8	12.7	36.3%
$PM_{2.5}$	Annual	3.7	0.2	3.9	26.3%

Table B-3.2-2. Estimated Pollutant Impacts during Pipeline Construction Alternative 3A.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 3A ($\mu g/m^3$)	Alternative 3A Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	141.7	11.3	153.0	81.40%
NO_2	Annual	5.8	0.5	6.3	6.26%
CO	1-Hour	1999.8	160.0	2159.8	5.40%
CO	8-Hour	1200.7	96.1	1296.8	12.97%
SO_2	1-Hour	13.7	1.1	14.8	7.55%
SO_2	3-Hour	11.5	0.9	12.4	0.96%
SO_2	24-Hour	4.2	0.3	4.5	1.24%
SO_2	Annual	2.0	0.2	2.2	2.73%
PM_{10}	24-Hour	59.1	4.7	63.8	42.55%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	9.9	0.8	10.7	30.55%
$PM_{2.5}$	Annual	3.6	0.3	3.9	25.92%

Table B-3.2-3. Estimated Pollutant Impacts during Drilling and Development Alternative 3A.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 3A ($\mu g/m^3$)	Alternative 3A Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	164.5	80.1	244.6	130.13%
NO_2	Annual	7.9	3.8	11.7	11.75%
CO	1-Hour	2971.0	1447.4	4418.4	11.05%
CO	8-Hour	1665.2	811.3	2476.5	24.76%
SO_2	1-Hour	57.6	28.1	85.7	43.70%
SO_2	3-Hour	60.8	29.6	90.4	6.96%
SO_2	24-Hour	23.1	11.3	34.4	9.41%
SO_2	Annual	3.5	1.7	5.3	6.58%
PM_{10}	24-Hour	62.6	30.5	93.1	62.06%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	11.8	5.7	17.5	50.14%
$PM_{2.5}$	Annual	3.9	1.9	5.8	38.67%

B-3.3. Alternative 3b: Relocate LDPI Approximately 1.5 Miles to the Southwest

Table B-3.3-1. Estimated Pollutant Impacts during LDPI Construction Alternative 3B.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Influence of Plan Change ($\mu g/m^3$)	Increase due to Distance from shore ($\mu g/m^3$)	Design Concentrations. ($\mu g/m^3$)	Ratio Design Concentrations to NAAQS
NO_2	1-Hour	154.2	-6.2	85.9	240.1	127.69%
NO_2	Annual	5.4	-0.2	3.0	8.4	8.41%
CO	1-Hour	2306.3	-92.3	1284.1	3590.4	8.98%
CO	8-Hour	1256.3	-50.3	699.5	1955.8	19.56%
SO_2	1-Hour	14.0	-0.6	7.8	21.8	11.12%
SO_2	3-Hour	12.2	-0.5	6.8	19.0	1.46%
SO_2	24-Hour	4.3	-0.2	2.4	6.7	1.83%
SO_2	Annual	2.0	-0.1	1.1	3.1	3.93%
PM_{10}	24-Hour	64.2	-2.6	35.7	99.9	66.63%
PM_{10}	Annual	NA	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	11.9	-0.5	6.6	18.5	52.93%
$PM_{2.5}$	Annual	3.7	-0.1	2.1	5.8	38.40%

Table B-3.3-2. Estimated Pollutant Impacts during Pipeline Construction Alternative 3B.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Influence of Plan Change ($\mu g/m^3$)	Increase due to Distance from shore ($\mu g/m^3$)	Alternative 3B Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	141.7	-28.3	65.7	207.4	110.35%
NO_2	Annual	5.8	-1.2	2.7	8.5	8.49%
CO	1-Hour	1999.8	-400.0	927.9	2927.7	7.32%
CO	8-Hour	1200.7	-240.1	557.1	1757.8	17.58%
SO_2	1-Hour	13.7	-2.7	6.4	20.1	10.23%
SO_2	3-Hour	11.5	-2.3	5.3	16.8	1.30%
SO_2	24-Hour	4.2	-0.8	1.9	6.1	1.68%
SO_2	Annual	2.0	-0.4	0.9	3.0	3.70%
PM_{10}	24-Hour	59.1	-11.8	27.4	86.5	57.68%
PM_{10}	Annual	NA	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	9.9	-2.0	4.6	14.5	41.41%
$PM_{2.5}$	Annual	3.6	-0.7	1.7	5.3	35.14%

Table B-3.3-3. Estimated Pollutant Impacts during Drilling and Development Alternative 3B.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Influence of Plan Change ($\mu g/m^3$)	Increase due to Distance from shore ($\mu g/m^3$)	Alternative 3B Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	164.5	401.6	328.4	492.9	262.16%
NO_2	Annual	7.9	19.3	15.8	23.7	23.67%
CO	1-Hour	2971.0	7253.7	5930.3	8901.3	22.25%
CO	8-Hour	1665.2	4065.6	3323.8	4989.0	49.89%
SO_2	1-Hour	57.6	140.6	115.0	172.6	88.05%
SO_2	3-Hour	60.8	148.4	121.4	182.2	14.01%
SO_2	24-Hour	23.1	56.4	46.1	69.2	18.96%
SO_2	Annual	3.5	8.6	7.1	10.6	13.26%
PM_{10}	24-Hour	62.6	152.8	125.0	187.6	125.04%

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Influence of Plan Change ($\mu g/m^3$)	Increase due to Distance from shore ($\mu g/m^3$)	Alternative 3B Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
PM_{10}	Annual	NA	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	11.8	28.8	23.6	35.4	101.01%
$PM_{2.5}$	Annual	3.9	9.5	7.8	11.7	77.90%

B-3.4. ALTERNATIVE 4A: RELOCATE OIL AND GAS PROCESSING TO ENDICOTT

Table B-3.4-1. Estimated Pollutant Impacts during LDPI Construction Alternative 4A.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 4A ($\mu g/m^3$)	Alternative 4A Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	154.2	-20.5	133.7	71.11%
NO_2	Annual	5.4	-0.7	4.7	4.68%
CO	1-Hour	2306.3	-306.7	1999.6	5.00%
CO	8-Hour	1256.3	-167.1	1089.2	10.89%
SO_2	1-Hour	14.0	-1.9	12.1	6.19%
SO_2	3-Hour	12.2	-1.6	10.6	0.81%
SO_2	24-Hour	4.3	-0.6	3.7	1.02%
SO_2	Annual	2.0	-0.3	1.8	2.19%
PM_{10}	24-Hour	64.2	-8.5	55.7	37.11%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	11.9	-1.6	10.3	29.48%
$PM_{2.5}$	Annual	3.7	-0.5	3.2	21.39%

Table B-3.4-2. Estimated Pollutant Impacts during Pipeline Construction Alternative 4A.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 4A ($\mu g/m^3$)	Alternative 4A Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	141.7	39.7	181.4	96.48%
NO_2	Annual	5.8	1.6	7.4	7.42%
CO	1-Hour	1999.8	559.9	2559.7	6.40%
CO	8-Hour	1200.7	336.2	1536.9	15.37%
SO_2	1-Hour	13.7	3.8	17.5	8.95%
SO_2	3-Hour	11.5	3.2	14.7	1.13%
SO_2	24-Hour	4.2	1.2	5.4	1.47%
SO_2	Annual	2.0	0.6	2.6	3.23%
PM_{10}	24-Hour	59.1	16.5	75.6	50.43%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	9.9	2.8	12.7	36.21%
$PM_{2.5}$	Annual	3.6	1.0	4.6	30.72%

B-3.5. Alternative 4b: Relocate Oil and Gas Processing to a New Onshore Facility

Table B-3.5-1. Estimated Pollutant Impacts during LDPI Construction Alternative 4B.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 4B ($\mu g/m^3$)	Alternative 4B Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	154.2	-8.2	146.0	77.67%
NO_2	Annual	5.4	-0.3	5.1	5.11%
CO	1-Hour	2306.3	-122.2	2184.1	5.46%
CO	8-Hour	1256.3	-66.6	1189.7	11.90%
SO_2	1-Hour	14.0	-0.7	13.3	6.76%
SO_2	3-Hour	12.2	-0.6	11.6	0.89%
SO_2	24-Hour	4.3	-0.2	4.1	1.12%
SO_2	Annual	2.0	-0.1	1.9	2.39%
PM_{10}	24-Hour	64.2	-3.4	60.8	40.53%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	11.9	-0.6	11.3	32.20%
$PM_{2.5}$	Annual	3.7	-0.2	3.5	23.36%

Table B-3.5-2. Estimated Pollutant Impacts during Pipeline Construction Alternative 4B.

Pollutant	Averaging Period	Proposed Action Concentrations ($\mu g/m^3$)	Change due to Alternative 4B ($\mu g/m^3$)	Alternative 4B Design Concentrations ($\mu g/m^3$)	Ratio of Design Concentrations to NAAQS
NO_2	1-Hour	141.7	11.8	153.5	81.63%
NO_2	Annual	5.8	0.5	6.3	6.28%
CO	1-Hour	1999.8	166.0	2165.8	5.41%
CO	8-Hour	1200.7	99.7	1300.4	13.00%
SO_2	1-Hour	13.7	1.1	14.8	7.57%
SO_2	3-Hour	11.5	1.0	12.5	0.96%
SO_2	24-Hour	4.2	0.3	4.5	1.25%
SO_2	Annual	2.0	0.2	2.2	2.73%
PM_{10}	24-Hour	59.1	4.9	64.0	42.67%
PM_{10}	Annual	NA	NA	NA	NA
$PM_{2.5}$	24-Hour	9.9	0.8	10.7	30.63%
$PM_{2.5}$	Annual	3.6	0.3	3.9	25.99%

B-4. VOC Analysis

Estimating emissions of VOC from evaporation of hydrocarbons (HCs) contained in an oil spill is complex because the HCs in oil are numerous, varied, and abundant. In addition, the oil contains many elements other than HCs, including impurities that vary from source to source, and can also vary over time. As such, a pound of oil will not evaporate to create a pound of VOC because of the other compounds and impurities in the oil. Rather, the weight of the evaporated VOC is likely to be some value less than a pound.

The oil spill contains lighter “fractions” of HCs, similar to gasoline, and heavier fractions similar to tars and wax-like hydrocarbons. Alaska North Slope Oil (ANSO) is a medium grade crude oil, and according to the NOAA Office of Response and Restoration:

> ANS[O] crude blends tend to emulsify quickly, forming a stable emulsion (or mousse). The rate of emulsification, while difficult to model, is known to be accelerated by wind mixing, and is thought to be related to the blend’s wax content…
>
> From 15-20% of this product evaporates in the first 24 hours of a spill, depending on the wind and sea conditions, and very little oil is dispersed into the water column. The weathered oil then starts to form a stable mousse with up to 75% water content (thereby increasing the slick volume four-fold), and it undergoes dramatic changes in its physical characteristics.
>
> The viscosity of the oil-in-water mixture increases rapidly and the color usually turns from a dark brown/black to lighter browns and rust colors. As the water content of the emulsion increases, weathering processes (e.g., dissolution and evaporation) slow down. (NOAA, 2015).

With increased time, the oil degrades to a “sticky mousse” consistency, creating a non-homogenous material with a “crust of slightly more weathered mousse surrounding a less-weathered core” (NOAA, 2015). This weathering causes the evaporation rate to steadily decrease.

Air quality impacts from an oil spill are measured by the volume of VOC that may be released into the lower atmosphere due to evaporation of the oil, relative to the reaction of these VOC with other elements in the atmosphere to form ozone.

Estimations for the rate of evaporation for the summer and meltout spill scenarios were produced using the weathering model described in Appendix A. The evaporation rates for each of the scenarios from day 1- 30 are summarized in Tables tables A.1-2 through A.1-8. In keeping with the conservative nature of this NEPA anlysis, the 30 day (or maximum) evaporation rates are used to estimate the potential VOC emissions for each spill scenario.

The analysis of a large oil spill, and the impact to air quality, assumes a single spill of one of five types during summer or meltout seasons:

1. A spill of up to 5,100 bbl of crude oil from the proposed LDPI;
2. A spill of up to 5,100 barrels of diesel from the proposed LDPI;
3. An offshore pipeline rupture of up to 4,000 barrels of crude oil;
4. An offshore pipeline leak of up to 1,700 barrels of crude oil; or
5. An onshore pipeline spill of up to 2,500 barrels of crude oil.

The analysis of a small oil spill, and the impact to air quality, assumes a single spill of one of two types:

1. A spill of up to 200 bbl of diesel from operational spills during summer and meltout;
2. A spill of up to 5 barrels of diesel from operational spills during the summer;

BOEM has utilized a crude API gravity of 24-27; a density of crude at 901.4 kg/m^3; and a density of diesel fuel at 885 kg/m^{3}for this analysis. The results of the analysis are given in Table B-3.4-1.

Table B-3.4-1. VOCs Released During Various Spill Scenarios.

Type	Barrels Spilled	Max Summer Oil Evaporated[3]	VOCs Released in Summer Spill (short tons)[4]	Max Meltout Oil Evaporated[3]	VOCs Released in Meltout Spill (short tons)[4]
Crude[1]	5,100	17%	138.6	17%	132.9
Diesel[1]	5,100	32%	249.2	59%	462.7
Crude[1]	4,000	17%	108.7	17%	104.3
Crude[1]	1,700	17%	46.5	17%	44.3
Crude[1]	2,500	40%	158.0	40%	158.0
Diesel[2]	200	32%	9.8	59%	18.1
Diesel[2]	5	31%	0.2	NA[5]	NA[5]

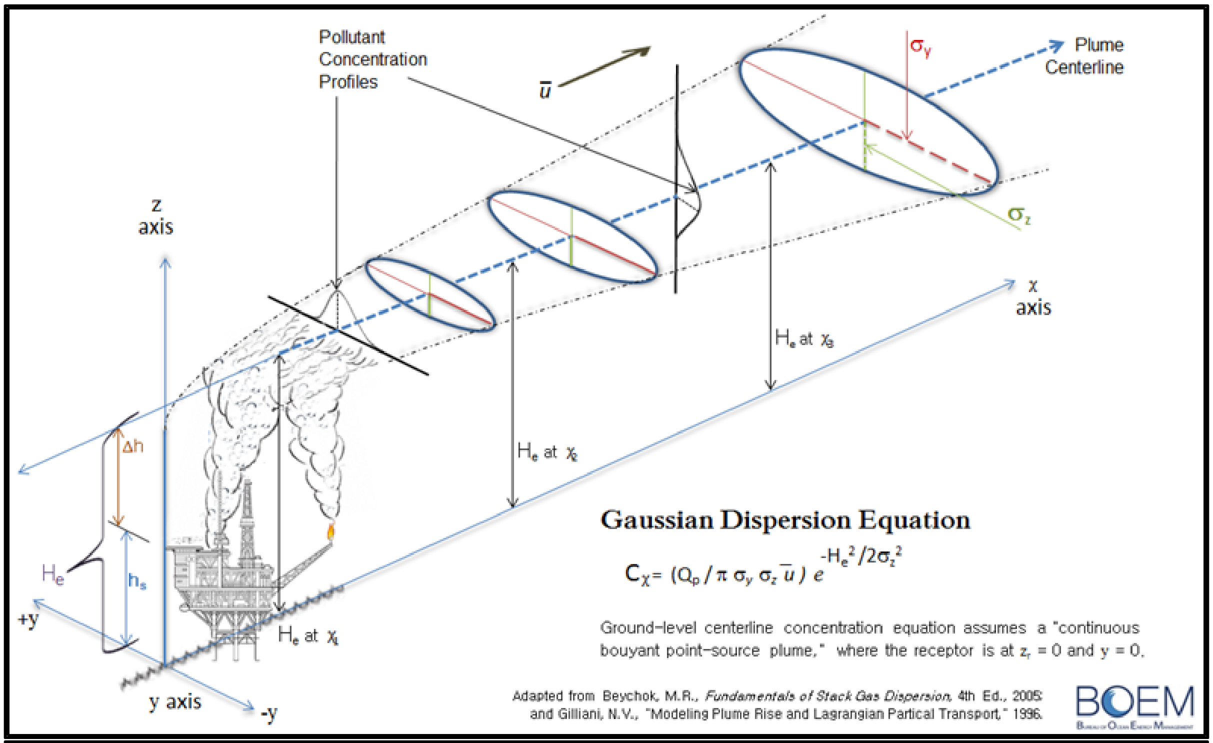
Notes: [1]Large spill scenario
[2]Small spill scenario
[3]Evaporation rates provided from weathering model in Appendix A tables A.1-2 through A.1-8
[4]Assuming all the barrels available for evaporation is evaporated as VOC.
[5]Not Analyzed

B-5. Change in Concentration via Dispersion Calculations

The purpose of these calculations is to gauge what the potential change in air quality impacts would be due to the LDPI Island relocation. The premise of this discussion is that moving the LDPI 1.5 miles closer to the shoreline will decrease the distance in which the pollutants could disperse with the ambient air and the resulting pollutant concentrations would be higher than the proposed action concentrations.

The modeling used in the proposed action analysis included the use of a Gaussian steady-state computer models. The Gaussian Dispersion Equation (GDE) (Eq (1)) predicts the greatest ground-level concentration at a location downwind assuming a continuous buoyant plume, straight-line winds from the direction of the source to the relevant receptor, which is the nearest onshore area, and expresses the solution in micrograms per cubic meter (μg/m^3). Straight-line winds assume the emissions are constrained within the plume, and are not affected by any other source of mechanical action in any other direction except in the direction of the intended ground-level receptor. The simulation allows the whole of the emission to be transported within the plume from the source to the relevant receptor site allowing the concentration at the plume centerline, which is where the greatest concentration occurs at any given downwind location, to intersect the ground and the relevant onshore receptor. Thus, there would be no other location where the concentration of pollutants would be greater. The GDE mathematical model is given in Equation (1) and is visualized in Figure B-5-1 along with a legend that explains the variables.

$$\mathrm{C}_\chi = \left({Q_\mathrm{p}}/{\pi\ \sigma_\mathrm{y} \sigma_\mathrm{z} \bar{\mathrm{u}}} \right) e^{-\mathrm{H_e}^2 / 2\sigma_\mathrm{z}^2} \qquad \text{Eq (1)}$$



Legend for the "Gaussian Dispersion Equation" Notations

C_χ	=	Maximum pollutant concentration at a point, χ, in micrograms per cubic meter (μg/m^3)
Q_p	=	Emission rate of a pollutant, p, in grams per second (g/s)
π	=	Pi, a value of 3.14, where Pi is unitless
e	=	Natural exponential function, unitless, where, $e^1 = 2.718$, $e^0 = 1$, and $\ln x = 1/e^x$
h_s	=	Actual stack height, expressed in meters (m)
Δh	=	Extent of plume rise above the stack at release due to heat bouyancy, where without bouyancy, Δh=0, expressed in m
H_e	=	Effective stack height at a point, χ, where, $h_s + \Delta h = H_e$ at χ=0, and where (H_e at χ_1) > (H_e at χ_2) > (H_e at χ_3),expressed in m
$\bar{u}$	=	Mean surface wind speed in the direction of the χ–axis, averaged over a 10–minute period, recorded at a height 10 meters above the observation surface in miles per hour, and converted to meters per second (m/s)
σ_z	=	Vertical dispersion coefficient after Pasquill (distance of plume's vertical spread below the centerline), expressed in m
σ_y	=	Horizontal dispersion coefficient after Pasquill (distance of plume's horizontal spread outward from the centerline), expressed in m
y	=	Distance from the receptor to the plume centerline in the crosswind, or y–dimension, expressed in m
z_r	=	Distance from the receptor to the plume centerline in the vertical, or z–dimension, expressed in m

Figure B-3.5-1. Gaussian Dispersion Equation. *Diagram and legend of the equation, where the equation assumes Δh is zero and the wind direction is in the direction from the source, in a straight line, to the nearest shore; results in the maximum onshore pollutant concentration (Gilliani, 1996; Arya, 1999; Beychok, 2005; and Vallero, 2008).*

For this analysis BOEM calculated the maximum pollution concentrations (C_χ) of emissions rates (Q_p) varying from 5- 150 Tons/yr at the distances (χ) 5.6 and 4.1 miles (proposed LDPI and Alternative 3B LDPI distances from land). The values of the wind, stack height, stability (D) were held as a control. The control values of wind and stack height were the average of the winds (6.2 m/s) and stack heights (13.3 m) in the Proposed Action modeling effort. The percent difference in polluntant concentrations of the resulting calclulations were compared between the two distances at ranging emission rates to determine if there is any influence on the percent difference on emission rates. The outcome from these calculations and the resulting percent differences are tabulated below. They indicate the increase in concentrations at the shoreline when comparing emissions from the alternative 3B LDPI at 4.1 miles as opposed to the proposed LDPI at 5.6 miles. The resulting analysis shows that the percent increase on concentration is independent of the emission rate. This allows BOEM to assume with confidence that moving the LDPI 1.5 miles closer to the shoreline could lead to up to a 58% increase in maximum pollutant impact concentrations at the shoreline.

Table B-3.5-1. Emissions Concentrations at Shoreline by Annual Rate and Distance.

Annual Emissions[1]	5	10	15	20	30	50	70	90	110	120	150
5.6 mi Concentration[2]	0.12	0.24	0.36	0.48	0.73	1.21	1.69	2.18	2.66	2.9	3.63
4.1 mi Concentration[2]	0.19	0.38	0.57	0.76	1.15	1.91	2.67	3.44	4.2	4.58	5.73
Percent Change	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%	58%

Notes: [1]Annual Emissions in tons per year.
[2]Concentrations are shown in micrograms per cubic meter (μg/m^3).

B-6. Additional information on MAI/PSD Increments

* When would increment analysis be required?

The PSD increment is the amount of air pollution degradation an area is allowed to experience over a baseline concentration, as specified under the Clean Air Act. Significant deterioration occurs when air pollutant concentrations exceed the applicable PSD increment. Although all increases in emissions from domestic, non-temporary sources of air pollution can contribute to consumption of the increment, evaluation of increment consumption generally occurs during evaluation of new or modified major sources of air pollution. PSD increment consumption analysis is required for permitting of new major sources or major modifications of existing sources. Since the Proposed Action is under BOEM jurisdiction and will not be a major source, PSD increment consumption analysis will not be required under ADEC's air permitting program (baseline dates and PSD increments promulgated in 18 AAC 50.020). However, actual emissions from the project will consume some portion of the PSD increment for pollutants whose baseline dates have been triggered (NO2, SO2, and PM10 for the Northern Alaska Intrastate air quality control region). The consumption of increment by the Proposed Action would be assessed in the case a new major source or major modification of an existing source occurred in the vicinity of the Liberty project. In this case, the actual emissions associated with the Proposed Action would be considered in an increment consumption analysis.

* What does the MAI compare to the actual PSD increment?

The MAI applied in the analysis acts as a conservative estimate of the maximum PSD increment consumption that could occur if the project was constructed and actually emitted at the projected emission rates. A true increment analysis would require an account of both creditable emission increases and decreases for each triggered pollutant after the baseline date. Exceedance of the MAI by the Proposed Action does not necessarily mean the project would violate the PSD increment or would result in a significant impact to air quality. Instead, the MAI analysis provides a cursory look at the possible magnitude of increment consumption attributable to the source. A formal increment consumption analysis is a modeling exercise that is conducted as part of major source PSD permitting.

* What and when do sources consume increment?

Only certain emissions apply to increment consumption. First, temporary emissions from a source do not contribute to increment consumption. Increment consumption is also only determined by an air quality modeling analysis. Increment consumption is considered on a spatial and temporal basis, not determined across an entire air quality control region as a whole. For example, if 80% of the increment is consumed at a receptor for a given major source project, which does not mean 80% of the increment is consumed for any new project in the air quality control region. And two sources can both consume 80% of the increment at the same location as long as it occurs on different days. The increment consumption is always considered on a per model receptor basis.

* What does increment consumption mean for future development?

Increment consumption by the Proposed Action could possibly be a factor in future development of major sources near the Liberty project. In the case a nearby new major source or major modification of an existing source was proposed, emissions from the Proposed Actionwould be considered in the air quality analysis of increment consumption. In the case Liberty emissions and emissions from the other major project resulted in consumption of increment at a receptor, the combined consumption from the two sources would not be allowed to exceed the PSD increment.

Appendix C

Mitigation

Appendix C. Mitigation Measures

Table of Contents

Introduction

The Council on Environmental Quality states that mitigation can include avoiding, minimizing, rectifying, reducing over time, or compensating for the impacts of an action (40 C.F.R. 1508.20). In analyzing potential impacts from the Proposed Action and other Action Alternatives, BOEM assumed implementation of, and compliance with, the mitigation measures described in sections C-1 through C-3. These include:

- Lease Stipulations.
- Design features and best management practices (BMPs) committed to by the operator.
- Other BMP's or requirements of Cooperating Agencies.

Where appropriate, BOEM analysts also identified additional mitigation measures which, if implemented, may further reduce potential impacts to various environmental resources. These additional mitigation measures are described in chapter 4 under the resource category to which they apply, as well as section C-4.

C-1. Lease Stipulations

The effects analysis assumes that Hilcorp will comply with all of the lease stipulations summarized below. Full text of the lease stipulations from the relevant lease sales is found in Appendix F.

These lease stipulations use terms that refer to the structure and titles of the former MMS, and are modified as follows:

- Minerals Management Service (MMS) is now the Bureau of Ocean Energy Management (BOEM) and/or the Bureau of Safety and Environmental Enforcement (BSEE).
- The term "Regional Supervisor, Field Operations (RS/FO)" refers to the Regional Supervisor, Leasing and Plans (RS/LP) at BOEM.

Protection of Archaeological Resources (Stipulation No. 1 of Lease Sales 124 and 144)

Stipulation Summary: If the Regional Supervisor, Field Operations (RS/FO), believes an archaeological resource may exist in the lease area, the lessee shall prepare a report to determine the potential existence of any archaeological resource that may be affected by operations prior to commencing operations. The report will be prepared by an archaeologist and geophysicist, and will be based on an assessment of data from remote-sensing surveys and other pertinent archaeological and environmental information. This report will be submitted to the RS/FO.

If evidence suggests that an archaeological resource may be present, the lessee shall locate operations so as to not adversely affect the area where the archaeological resource is located; establish that an archaeological resource does not exist or will not be adversely affected by operations; or, if an archaeological resource is likely to be present and be adversely affected by operations, take no action that may adversely affect the archaeological resource until the RS/FO has told the lessee how to protect it.

If the lessee discovers an archaeological resource while conducting operations in the lease area, the lessee will report the discovery to the RS/FO. The lessee shall make every reasonable effort to preserve the archaeological resource until the RS/FO has told the lessee how to protect it.

Protection of Biological Resources (Stipulation No. 2 of Lease Sale 124 and Stipulation No. 1 of Lease Sales 144 and 202)

Stipulation Summary: The RS/FO may require the lessee to conduct biological surveys needed to determine the extent and composition of biological populations and habitats requiring additional protection. As a result of these surveys, the RS/FO may require the lessee to relocate the site of operations, establish that operations will not have adverse effects or ensure that special biological resources do not exist, operate during times that do not adversely affect the biological resource, or modify the operation. In addition, the lessee is required to report any area of biological significance discovered during the conduct of any operations on the lease, and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO provides direction with respect to resource protection.

Orientation Program (Stipulation No. 3 of Lease Sale 124 and Stipulation No. 2 of Lease Sales 144 and 202)

Stipulation Summary: The lessee must develop a proposed orientation program for all personnel involved in the Liberty Development. The program must address environmental, social, and cultural concerns that relate to the area, including the importance of not disturbing archaeological and biological resources and habitats. The program shall be designed to increase the sensitivity and understanding of the personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program also shall include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation. The program shall be attended at least once a year by all personnel involved in on-site exploration or development and production activities. The lessee shall maintain an on-site record of all personnel who attend the program for as long as the site is active, or for a period not to exceed 5 years.

Transportation of Hydrocarbons (Stipulation No. 4 of Lease Sale 124 and Stipulation No. 3 of Lease Sales 144 and 202)

Stipulation Summary: Pipelines are required for transportation of hydrocarbons if the pipeline right-of-way can be obtained, if laying the pipeline is technologically feasible and environmentally preferable, and if pipelines can be laid without social safety net loss. No crude oil production will be transported by surface vessel from the offshore production site except in cases of emergency.

Industry Site-Specific Bowhead Whale-Monitoring Program (Stipulation No. 5 of Lease Sale 124 and Stipulation No. 4 of Lease Sales 144 and 202)

Stipulation Summary: Lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead migration will be required to conduct a site-specific monitoring program approved by the RS/FO.

Mechanisms to Protect Subsistence Whaling and Other Marine Mammal Subsistence-Harvesting Activities (Stipulation No. 6 of Lease Sale 124 and Stipulation No. 5 of Lease Sales 144 and 202)

Stipulation Summary: The lessee must conduct operations in a manner that prevents unreasonable conflicts between industry activities and subsistence activities. Prior to submitting a DPP, the lessee shall consult with the potentially affected communities, the NSB, and the AEWC to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigation measures that could be implemented to prevent unreasonable conflicts. The lessee shall make every reasonable effort to assure that development and production activities are compatible with whaling and other subsistence hunting activities, and will not result in unreasonable interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and any unresolved conflicts shall be included in the DPP. The lessee shall show in the DPP how mobilization of the drilling unit and crew, and supply boat routes will be scheduled and located to minimize conflict with subsistence activities. Those involved in the consultation shall be identified in the plan. The lessee shall notify the RS/FO of all concerns expressed by subsistence hunters during the operations and of steps taken to address such concerns.

Oil Spill Response Preparedness (Stipulation No. 7 of Lease Sale 124)

Stipulation Summary: Lessees will submit OSRPs in accordance with 30 CFR 254. The OSRP must address all aspects of oil spill response readiness, including an analysis of potential spills and spill response strategies; type, location, and availability of appropriate oil spill equipment; response times and equipment capability for the proposed activities; and response drills and training requirements. The lessee will conduct drills as necessary to demonstrate readiness and response capabilities. For production operations, drills will be conducted at least semiannually.

Compliance: Oil spill response is discussed in Section 14 of the Liberty DPP. In addition, an OSRP has been developed for the Liberty Development and will be submitted to BSEE concurrent with DPP submittal.

An agreement between the United States of America and the State of Alaska (Stipulation No. 8 of Lease Sale 124 and Stipulation No. 6 of Lease Sale 144)

Stipulation Summary: This stipulation is advisory regarding the terms of an agreement between the United States of America and the State of Alaska and applies to blocks or portions of blocks referred to in the notice as disputed.

An agreement regarding unitization (Stipulation No. 9 of Lease Sale 124 and Stipulation No. 7 of Lease Sale 144)

Stipulation Summary: This stipulation is an advisory regarding the terms of an agreement between the United States of America and the State of Alaska and applies to blocks or portions of blocks referred to in the notice as disputed.

Prebooming requirements of fuel transfers (Stipulation No. 6 of Lease Sale 202)

Stipulation Summary: Fuel transfers of 100 barrels or more occurring 3 weeks prior to or during bowhead whale migration will require pre-booming of the fuel barge.

Lighting of structures to minimize effects to Steller’s and spectacled eiders (Stipulation No. 7 of Lease Sale 202)

Stipulation Summary: Lessees are required to implement lighting requirements that minimize the likelihood that spectacled or Steller’s eiders will strike structures. Modification of lighting protocols will be undertaken if new information on bird avoidance measures becomes available. Lessees must also include a plan for recording and reporting bird strikes.

C-2. Design Features and Best Management Practices Committed to by the Operator

HAK has included the following design features and BMPs in an effort to avoid, minimize, and/or mitigate potential effects the Proposed Action may have on the physical, biological, and human environment. The impact analyses in this EIS assume the following measures will be implemented:

- Use of directional drilling enables all proposed wells to be drilled from one island (drill pad).

- The southern pipeline route was selected to avoid or minimize risks of strudel scour.
- Processing on the LDPI takes advantage of newer air emission sources rather than using existing processing facilities.
- The selected pipeline route avoids areas of mapped high density (≥ 25%) Boulder Patch.
- The pipeline design minimizes the depth and size of the trench required.
- Single phase, pipe-in-pipe design improves detection and containment of leaks.
- The size and layout of the LDPI minimizes gravel requirements and seabed footprint, while still accommodating worker safety and spill prevention and response.
- The LDPI has a mat slope armor protection system that extends from the island bench to the sea floor and a sheetpile wall to minimize the seabed footprint, overall gravel requirements, and long-term maintenance.
- Process modules on the LDPI are a “fit-for-purpose” design, which will match equipment sizing and emissions sources to the reservoir and production needs of the Liberty reservoir.
- Drilling muds will not be discharged, but stored on site and disposed via injection when the disposal well is operational. Wastewater from LDPI sewage treatment and potable water plants will also be discharged to the waste disposal well when the well is operational. Temporary and contingency discharge of wastewater under NPDES will be required when the waste disposal well is not available. The waste disposal well will be the first well drilled and completed to facilitate waste water injection instead of discharge.
- Project gravel needs and the construction schedule were designed to minimize gravel pit size and operation time.
- Heated facilities will be elevated above the gravel on pilings, have insulated floors, or have both in order to minimize building heat transmission to the permafrost.
- Thermo-siphons will be installed where needed to prevent thaw subsidence.

Water Quality

- HAK will comply with NPDES permit stipulations for temporary domestic wastewater discharges until the waste disposal well is in operation and when backhaul of wastewater is infeasible (and also as a contingency if the disposal well is unavailable). Such NPDES permits specify treatment requirements, effluent limitations, monitoring, and compliance with a BMP Plan.
- HAK will use dedicated temporary storage systems and waste minimization to prevent waste from coming in contact with snow or rainwater.
- HAK will use drip pads beneath fuel transfers and engines to prevent drips or spills from contacting water or wetlands.
- HAK will employ the use of a membrane bio reactor (MBR) to reduce the concentration of pollutants in the wastewater effluent.

Fish

- Construction will occur in winter when fewer fish species are present and when water currents are low, which will reduce TSS distribution.
- The LDPI and pipeline were located to avoid impacts to habitat and to minimize alteration of ocean currents.
- The LDPI was designed to minimize the island’s footprint and loss of bottom habitat.
- Seawater intake structures were designed to prevent fish entrainment.

- Island armoring will serve to reduce erosion and the spread of silt or gravel over fish habitat.

Birds

- HAK will develop a lighting plan to minimize the potential for bird strikes.
- Towers and other structures on the LDPI will be designed to reduce nesting by predatory birds.
- HAK will employ strict food waste control (e.g., animal-proof dumpsters) to avoid attracting predators.
- Marine traffic procedures will be implemented to avoid encountering concentrations of molting waterfowl.
- Seasonal air traffic controls (e.g., routing and minimum altitudes) over specific nesting and brooding areas (e.g., Sagavanirktok River Delta, Howe Island) will be implemented.
- Bird use and wetlands mapping in the vicinity of the onshore gravel mine site and gravel pads was considered in order to avoid high quality habitat, particularly for spectacled eiders and snow geese.

Marine Mammals

- The project is located inshore of the barrier islands and inshore of the main fall migration path of the bowhead.
- Construction will take place in winter so that noise from the pipeline installation and gravel placement for the island will not impact bowhead whales or subsistence hunting.
- Impact pile driving at LDPI that place sounds in the water above 120 decibels (dB) will not be conducted during the bowhead whale migration in the project area – late August through September.
- Barging and other support marine traffic to LDPI will utilize routes in relatively shallow water inshore of the barrier islands and will avoid the main migration path of the bowhead.
- Operational procedures that minimize the risk of contact and noise generation will be in place for project support vessels in transit during bowhead migration.
- HAK will implement a polar bear interaction plan, which includes commitments to survey potential denning habitat for maternal dens (e.g., forward-looking infrared [FLIR], or similar technology for aerial surveillance) along ice road routes to avoid active denning areas. Protection, agency reporting, and a stop work order will occur in the event of the discovery of previously unidentified polar bear dens, unless alternative action is approved by the USFWS.
- The steel sheetpile wall protecting the LDPI work surface will deter polar bear access to the island work surface.
- Procedures will be in place for approved marine mammal monitors and those licensed to haze and conduct other intentional takes to defend workers.
- Food handling and waste management procedures to avoid creating attractants will be in place, such as secure storage of food and proper disposal of chemicals and wastes.
- Training will be provided and procedures established to assure safety of worker and animals when working where marine mammals may occur.
- Activities will be set back from active polar bear dens by 1 mile or as otherwise approved by the USFWS.
- The subsea pipeline route was selected in part to provide separation from a historical polar bear denning site at Point Brower.

- Ice road management (e.g., traffic controls, re-routings, etc.) will control access in areas where marine mammals may be encountered.

Terrestrial Mammals

- Winter construction will be used to avoid conflict with summer migrants that comprise the majority of animals that utilize the North Slope.
- Strict anti-hunting, anti-harassment, and anti-feeding policies will be implemented to minimize impacts to terrestrial wildlife. Summer access will be restricted as well.
- BMPs developed for the North Slope and the State of Alaska will be followed to provide long-term habitat restoration of the mine site.
- The onshore pipeline will be elevated by approximately 7 feet to reduce impediments to terrestrial mammals.

Vegetation and Wetlands

- Wetland mapping was conducted in the vicinity of alternative mine sites and gravel pad sites to identify and avoid higher value wetland types to the extent feasible.
- Ice Roads:
  a. Preconstruction surveys and designing ice roads to avoid tussock tundra areas, steep streambanks, and deep freshwater holes would reduce potential impacts to wetlands. Also, locating ice roads in the wettest wetland areas reduces wetland impacts.
  b. Establishing speed and weight limits, providing staff training, and installing delineators along both sides of ice roads would reduce tundra damage.
  c. Ice roads and pads will be slotted at stream crossings to facilitate drainage during breakup.
- Tundra Travel:
  a. If summer tundra travel is necessary, tundra-safe low-pressure vehicles will be used. Traffic would be limited as much as possible, avoiding tight turns, using different tracks with each pass, avoiding vegetation communities most sensitive to damage from tundra travel (e.g., tussock tundra), and following the shortest path from origination to destination.
  b. Operations will be restricted to drier areas.
  c. Crossing deep water or vegetation with more than 2-3 inches of water, and crossing ponds, lakes, and wetlands bordering ponds and lakes will be avoided.
  d. Vehicle operators will be familiar with tundra vegetation types to ensure compliance with these stipulations:
     i. Incidents of damage to the vegetation mat and follow-up corrective actions that have occurred must be reported to the Alaska Department of Natural Resources, Division of Mining, Land, and Water within 72 hours of occurrence.
     ii. Vehicles will be tested to determine their ability to operate on the tundra without causing extensive damage.
     iii. Vehicles cannot carry more payload than was carried during the certification test.
     iv. Movement of equipment through willow stands must be avoided where possible.
  e. Where disturbance to the organic mat is unavoidable, the disrupted area must be stabilized the disrupted area in order to avoid disturbance to the permafrost layer.
- Gravel Mine:

a. Discharge of mine dewatering water and hydrostatic test water will be directed towards a natural drainage gradient to minimize warming of the near-surface soils and ponding of surface water. Discharge flow rate will be controlled to avoid erosion of tundra or tundra.
b. BMPs developed for the North Slope and the State of Alaska will be followed to provide long-term habitat restoration of the mine site.

- Gravel Pad Construction and Maintenance:
  a. Gravel pads will be watered, as necessary, to control dust generation.
  b. Workers will be required to stay on gravel surfaces unless their job duties require them to be on the tundra.
  c. Slopes of gravel pads will be maintained to prevent sloughing.
  d. Grading of roads shall not push material into adjacent wetlands.

Subsistence

- Criteria for island siting and design was discussed with the Nuiqsut Whaling Captains' Association. Also discussed will be marine traffic to support the Proposed Action (e.g., routes, frequency, schedule).
- HAK has agreed to enter into a Conflict Avoidance Agreement with the Alaska Eskimo Whaling Commission and the Nuiqsut Whaling Captains' Association to mitigate impacts to subsistence whaling.
- Local subsistence representatives will be employed during appropriate project phases.
- Personnel skilled at protected species identification on support vessels will be employed, when warranted, to prevent vessel-marine mammal interaction during the open-water season.
- Preferred marine routes will be established for transport of facilities and supplies to LDPI.
- Minimum aircraft altitudes and routes for helicopters and other support aircraft will be established to avoid disturbing bowhead whales and other subsistence resources, consistent with safety requirements and weather considerations.
- HAK and contract personnel will be trained on the importance of subsistence and measures to avoid conflicts.

C-3. Requirements of Cooperating Agencies, including State Agencies

In addition to the design features and BMPs committed to by the operator, there are other federal, state, and local laws and policies that are applicable to the Liberty Project. This section describes the typical/standard measures that BOEM analysts assumed would be applied to the project. BOEMs analyses of effects in chapter 4 assume these typical/standard measures will be applied, in addition to lease stipulations (section C-1) and design features and BMPs committed to by the operator (section C-2).

U.S. Army Corps of Engineers (USACE)

Chapter 1 describes the regulatory authorities of the USACE. Briefly, Section 404 of the CWA requires a Corps permit be obtained for the discharge of fill material into waters of the United States, including wetlands. Section 10 of the RHA requires that a Corps authorization be obtained prior to placing any structure within, filling, or excavating in navigable waters of the U.S. In addition to any project specific conditions the Corps may apply, the following are standard conditions that apply to all individual CWA Section 404 and/or RHA Section 10 authorizations:

1. Time limits are placed on the permit. If more time is needed to complete the authorized activity, permittees must apply for a time extension.
2. The permittee must maintain the authorized activity in conformance with the terms and conditions of the permit, even if the permitted activity is abandoned. If a permittee wishes to cease maintaining the authorized activity or desires to abandon it without transferring the permit to another entity, the permittee must obtain a modification of the permit, which may require restoration of the area.
3. If the permittee discovers any previously unknown historic or archeological remains while accomplishing the activity authorized by the permit, the permittee must immediately notify the USACE. Agency coordination is necessary to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.
4. If the permittee sells the property associated with this permit, the permittee must obtain the signature of the new owner and forward a copy of the permit to the Corps to validate the transfer of the authorization
5. If a conditioned water quality certification has been issued, the permittee must comply with the conditions specified by that permit.

EPA

Chapter 1 describes the regulatory authorities of the EPA. Briefly, section 402 of the CWA establishes the NPDES permit program to regulate discharges into waters of the U.S. While the EPA has transferred NPDES authority to ADEC under the APDES Program for activities within Alaska, they retain authority over NPDES permitting associated with offshore oil and gas facilities. The EPA also has authority over the storage and management of petroleum products under Section 311, requiring that the applicant develop and submit a Spill Prevention and Control Plan. For this project, the EPA does not have any standard conditions or BMPs that would be applicable.

NMFS

As described in chapter 1, NMFS has regulatory responsibilities under the MMPA, ESA, and the MSFCMA, among other authorities. Consultations under both the ESA and the MSFCMA generally result in project-specific requirements that would be included as conditions of BOEM’s approval. However, if warranted, the applicant may receive an authorization for incidental take under the MMPA. Such authorizations may contain project-specific conditions in addition the standard conditions described below that apply to all MMPA authorizations. The USFWS has similar authority under the MMPA and ESA, and the typical/standard mitigation measures required by NMFS and USFWS to avoid/minimize potential impacts to marine mammals are combined and summarized below.

USFWS

As described in chapter 1, the USFWS has regulatory responsibilities under the MMPA, ESA, and the MBTA, among others. Consultations under the ESA generally result in project-specific requirements that would be applied as conditions of BOEM’s approval. Similar to NMFS, the applicant may receive an authorization for incidental take under the MMPA. Such authorizations may contain project-specific conditions, if warranted, as well as the standard conditions described below. In addition, in order to comply with the MBTA, there are standard BMPs that are applicable as well.

The analyses of impacts to biological resources in this DEIS is based on the assumption that the following typical/standard mitigations required by NMFS and USFWS will be implemented.

Typical/Standard Mitigation Measures Required by NMFS and USFWS to Avoid/Minimize Potential Impacts to Marine Mammals

General Offshore Development and Production Activities

1. The operator will conduct acoustic measurements to document sound levels, characteristics, and transmissions of airborne sounds with expected source levels of ≥90 dB in air.
2. The operator will conduct acoustic monitoring of sounds produced by project-related activities and acoustic monitoring of the bowhead migration beyond the project area.
3. Unmitigable impact pile-driving at LDPI that places sounds in the water above 120 dB re 1 μPa (rms) will not be conducted during the bowhead whale migration in the project area (late August through September).
4. The operator will comply with NOAA's Marine Mammal Oil Spill Response Guidelines, as described in Appendix G.
5. The operator is responsible for ensuring there are no unmitigable adverse impacts on subsistence use of marine mammals. A variety of mechanisms may be used by NMFS or USFWS to ensure that the required communication with Alaska Native peoples occurs.

Ice-Covered Season

1. To reduce impacts to ringed seals, winter construction activities such as ice roads must begin as soon as possible once weather and ice conditions permit such activity.
2. Any on-ice construction activities initiated after March 1 in waters deeper than 3m must be surveyed, using trained dogs or a comparable method, in order to identify ringed seal structures.
3. After March 1 of each year, activities should avoid, to the greatest extent practicable, disturbance of any located seal structure. All activity should be at least 150m from any identified ice seal structure. If ice-road construction occurs after March 1, the operator must conduct a follow-up assessment in May to determine the fate of all seal structures located during monitoring near physically disturbed areas.
4. Operators must observe a 1-mi (1.6 km) operational exclusion zone around all known polar bear dens during the denning season (November–April, or until the female and cubs leave the areas). Should previously unknown occupied dens be discovered within 1 mi of activities, work in the immediate area must cease and the USFWS contacted for guidance. USFWS will evaluate these instances on a case-by-case basis to determine the appropriate action.

General Vessel Traffic

1. Operational and support vessels will be staffed with dedicated Protected Species Observers (PSOs) to alert crew of the presence of marine mammals and to initiate adaptive mitigation responses.
2. When weather conditions require, such as when visibility drops, support vessels must reduce speed and change direction, as necessary (and as operationally practicable), to avoid the likelihood of injury to marine mammals.
3. The transit of operational and support vessels through the region is not authorized prior to July 1. This operating condition is intended to allow marine mammals the opportunity to disperse from the confines of the spring lead system and minimize interactions with subsistence hunters. Exemption waivers to this operating condition may be issued by NMFS and USFWS on a case-by-case basis, based upon a review of seasonal ice conditions and available information on marine mammal distributions in the area of interest.
4. The transit route for the vessels will avoid known fragile ecosystems.

5. Vessels may not be operated in such a way as to separate members of a group of marine mammals from other members of the group.

Vessels In Vicinity Of Whales

1. Vessels should avoid groups of ≥5 whales.
2. Vessels will avoid multiple changes in direction and speed when within 300 yards (274 m) of whales and also operate the vessel(s) to avoid causing a whale to make multiple changes in direction.
3. All non-essential boat and barge traffic will be scheduled to avoid periods when bowhead whales are migrating through the area to where they may be affected by sound from the project.
4. If the vessel approaches within 1.6 km (1 mi) of observed whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the whales by taking one or more of the following actions, as appropriate:
    a. Reducing vessel speed to less than 5 knots within 300 yards (900 ft or 274 m) of the whale(s).
    b. Steering around the whale(s) if possible.
    c. Operating the vessel(s) to avoid causing a whale to make multiple changes in direction.
    d. Checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.
    e. Reducing vessel speed to 9 knots or less when weather conditions reduce visibility to avoid the likelihood of injury to whales.
5. Special consideration of North Pacific Right Whales and their critical habitat.
    a. Vessels will avoid transit within North Pacific right whale critical habitat. If transit within North Pacific right whale critical habitat cannot be avoided, vessel operators must exercise caution and reduce speed to 10 kt while within North Pacific right whale critical habitat.
    b. Vessels transiting through North Pacific right whale critical habitat must have PSOs actively engaged in sighting marine mammals. Vessels will maneuver to keep 875 yards (800 meters) away from any observed North Pacific right whale while within their designated critical habitat, and avoid approaching whales head-on consistent with vessel safety.
6. Vessels should take reasonable steps to alert other vessels in the vicinity of whale(s), and report any dead or injured listed whale or pinniped.

Vessels In Vicinity Of Pacific Walruses And Polar Bears

1. Vessels should take all reasonable precautions (i.e., reduce speed, change course heading) to maintain a minimum operational exclusion zone of 0.5 mi (0.8 km) around groups of feeding walruses.
2. Except in an emergency, vessels will not approach within 0.5 mi (0.8 km) of observed polar bears, within 0.5 mi (0.8 km) of walrus observed on ice, or within 1 mi (1.6 km) of walrus observed on land.

Aircraft Traffic in vicinity of whales or seals

1. Aircraft should not fly below 1,500 ft (457 m) within 100 ft (305 m) of whales or seals, except during emergencies and take-offs/landings.

2. Helicopter flights should be limited to prescribed transit corridors. Helicopters shall not hover or circle above or within 0.3 mi (0.5 km) of groups of whales.
3. If ice over-flights or similar repeated aerial surveys are conducted, a PSO shall be stationed aboard all flights and will document all marine mammal sightings.
4. Air traffic will be scheduled to avoid periods when bowhead whales are migrating through the area where they may be affected by noise.
5. Aircraft traffic will avoid flying over polynyas and along adjacent ice margins as much as possible to minimize potential disturbance to whales.
6. Air traffic will maintain a 1-mi radius when flying over areas where groups of ≥5 seals appear to be concentrated.
7. Aircraft will not land on ice within 1,400 m of hauled out pinnipeds.

Aircraft Traffic In Vicinity of Walruses And Polar Bears

1. Helicopters will not operate at an altitude lower than 3,000 ft (914 m) within 1 mi (1.6 km) of walrus groups observed on land, and fixed-wing aircraft will not, except in an emergency, operate at an altitude lower than 1,500 ft (457 m) within 0.5 mi (805 m) of walrus groups observed on ice, or within 1 mi (1.6 km) of walrus groups observed on land. Helicopters may not hover or circle above such areas or within 0.5 mi (805 m) of such areas (USFWS, 2011).
2. Aircraft should not fly below 1,500 ft (457 m) within 0.5 mi (805 m) of walruses or polar bears observed on ice or land, except during emergencies and take-offs/landings..
3. When weather conditions do not allow a 1,500 ft (457 m) flying altitude, aircraft may be operated below 1,500 ft (457 m); however, when aircraft are operated at altitudes below 1,500 ft (457 m), the operator must avoid areas of known walrus and polar bear concentrations and should take precautions to avoid flying directly over or within 0.5 mi (805 m) of these areas.

Onshore Development and Production Activities

1. All personnel and activities will comply with HAK’s Polar Bear and Pacific Walrus Interaction Plan that details bear avoidance and encounter procedures and training; bear guard training; safety and communication procedures; HAK’s Waste Management Plan, and NMFS and USFWS reporting requirements.
2. Holders of an LOA may be required to hire and train polar bear monitors to alert crew of the presence of polar bears and initiate adaptive mitigation response.
3. Operators seeking to carry out onshore activities in known or suspected polar bear denning habitat during the denning season (November to April) must make efforts to locate occupied polar bear dens within and near proposed areas of operation. All observed or suspected polar bear dens must be reported to the USFWS prior to the initiation of activities.

Exclusion Zones / Monitoring

1. The operator will establish and monitor, during all daylight hours, a 180 dB re 1 μPa (rms) exclusion zone for all cetaceans (whales, dolphins, and porpoises), and a 190 dB re 1 μPa (rms) exclusion zone for all pinnipeds.
2. The exclusion zones will be monitored continuously for 30-min prior to initiating any activity with the potential to produce SPLs greater than 160 dB re 1 μPa (rms). The entire exclusion zones must be visible for the entirety of the 30-min period. The exclusion zone will also be monitored for 30 min after the activity has ended.

Typical/Standard Mitigation Measures Required by USFWS to Avoid/Minimize Potential Impacts to Birds

Vegetation clearing and land disturbance activities that could harm active nests, eggs, and nestlings (e.g., for the gravel material sites, fill pads, or any other purpose) shall not occur between June 1 and July 31.

State of Alaska

The State of Alaska has regulatory, statutory, and permitting authority over waters and lands on the North Slope, (including submerged lands of the Beaufort Sea), other than those that are part of native allotments. The SOA will have permitting authority over several actions associated with the Liberty Development that will occur subsequent to BOEM's approval of Proposed Action or one of the Alternatives analyzed in this DEIS. These actions include the construction of onshore ice roads and ice pads, and gravel use. The SOA will coordinate the approval of these actions across its agencies and determine whether to approve or deny permits and leases for use of State land. The SOA does not have any standard conditions or BMPs that would be applicable, however as part of the SOA's approval process, they will apply additional mitigation measures for the protection of wildlife, air and water quality, and subsistence practices.

C-4. Additional Mitigation Measures Proposed in the Liberty DPP DEIS

BOEM analysts identified additional mitigation measures which, if implemented, may further reduce potential impacts. These additional mitigation measures are described below as well as in relevant chapters to which they apply, i.e. chapters 2 and/or 4.

Seasonal Drilling Restriction

During scoping, BOEM received several comments which proposed seasonal restrictions on drilling into hydrocarbon zones as a means to reduce the likelihood of a large or very large oil spill contacting the Beaufort Sea and adjacent coastal areas during broken ice or open weather conditions. These comments suggested that oil spilled during solid ice conditions (as opposed to broken ice or open water conditions) would be easier to clean up, and thus less likely to affect subsistence activities, resources used for subsistence, and/or other marine mammals and threatened and endangered species. Commenter recommendations varied in terms of length and timing of proposed drilling restrictions, but cumulatively, they suggesting limiting drilling into hydrocarbon zones to periods when 1) solid ice conditions surround the LDPI, and 2) there remained sufficient time to drill a relief well prior to spring break-up.

Based on these comments, and an independent review of factors relevant to development drilling and oil spill response techniques, BOEM developed for analysis in the Liberty DEIS a proposed mitigation measure that, if implemented, would restrict certain drilling activities on a seasonal basis. This proposed mitigation measure:

- Confines reservoir drilling to those times when both (1) at least 18” of ice exists in all areas within 500’ of the LDPI, and (2) such ice has not been appreciably weakened by spring overflooding. The period of time during which reservoir drilling would be allowed typically starts approximately October 21st and ends approximately June 10th);
- Defines “reservoir drilling” as any drilling (whether for development, workovers, or completion) targeting the Kekituk Zone 2 formation which occurs either beyond the last casing interval above the reservoir or within 500 ft of the reservoir; and
- Allows for non-reservoir drilling and all other operations year-round (subject to the temporary annual suspension proposed in HAK’s DPP to avoid interference with subsistence hunting).

The practical effects of imposing such a restriction would be a change in the order in which HAK drills its wells and a potential delay (approximately 3-5 months) in completing the proposed drilling program. Waste disposal wells, as well as the top hole portions of development wells, could still be drilled year-round (subject to self-imposed limitations in HAK’s DPP).

Climate Change

The Proposed Action and the action alternatives would produce GHG emissions that would contribute to climate change. These impacts could be mitigated by strategies that would reduce GHG emissions. A theoretical mechanism for reducing GHG emissions would be the use of Carbon Capture Storage/Sequestration devices. However, these devices are currently in their early stages of development and are both cumbersome and expensive. BOEM evaluated a simpler, more cost effective approach to reduce GHG emissions in the form of carbon offsets via reforestation.

The basis of this offset is that the average mature tree can sequester (consume and retain) up to 48 pounds of CO_2 per year through its 40 year lifetime. When reforesting, an average acre can hold up to 1,500 new trees. In its 2017 budget justification, the U.S. Forest Service (USFS) stated that over a million acres of National Forest System lands could benefit from reforestation (USFS, 2016). In the preceding year, the Forest Service reforested over 190,000 acres of public land and has a goal of reforesting 180,000 in the upcoming year. These efforts are accomplished with the help of non-profit partners such as the National Forest Foundation (NFF) and civic groups who contribute to the agency's capacity for reforestation through partnerships and matching fund agreements. Through these partnerships, the NFF and the Forest Service have been able to reforest areas of public land at 1:1 ratio of dollar to tree.

BOEM proposes and analyzes two levels of mitigation: 1) a partial project carbon offset, and 2) a total project carbon offset.

Partial Project Carbon Offset[1]

BOEM proposes that the lessee directly or indirectly (via NFF or USFS) assist in the reforestation of 4,600 acres of public lands. This proposed offset assumes the average acre of reforested land can hold 1,500 new trees, and that each tree at maturity can sequester 48 lbs of CO_2. The addition of 4,600 acres of mature reforested land will lead to an estimated 165,000 tons of annual carbon (CO_2) sequestration which would offset 32% of the annual GHG emissions that the Proposed Action would emit.

Total Project Carbon Offset

Under this proposal, the Proposed Action's impact on GHG emissions would be reduced to zero. BOEM proposes that the Lessee directly or indirectly (via NFF or USFS) assist in the reforestation of 9,000 acres of public lands. This proposed offset again assumes the average acre of reforested land can hold 1,500 new trees, and that each tree at maturity can sequester 48 lbs of CO_2. During the lifespans of the Proposed Action and that of trees at 25 and 40 years, respectively, it would only require 9,000 acres of mature forest to reduce the carbon emissions of the Proposed Action to zero in its lifetime

Birds

Traffic Disturbance

1. Seasonal air traffic and vessel controls (e.g., routing and minimum altitudes) would be implemented in the vicinity of shorebird and waterfowl staging (including at the Sagavanirktok and Kadleroshilik River Deltas to minimize disturbance.
2. Vessels would adhere to reduced speeds while transiting waterways that have sensitive shoreline resources (e.g., common eider, black guillemot, Arctic tern or other seabird or shorebird nesting sites).
3. Vehicle speed limits would be reduced to 30 mph on the Endicott road system, except 15 mph on the north end of Endicott Road through saltmarsh and mudflat habitat during brood-rearing season, and all Proposed Action related roads between July 1–August 15 to minimize collisions and other impacts to waterfowl and shorebird broods.
4. Personnel would be trained to watch for and stop for adult birds with broods attempting to cross roads.
5. All avian mortalities and collisions (including vehicle collisions) and their circumstances would be reported to BOEM and USFWS. These data would help verify the assumption that collision mortality is low and negative effects are small.

[1] A partial project carbon offset is inspired by the goal outlined in the Clean Power Plan wherein the United States has set the goal is to reduce GHG emissions by 32% (80 *FR* 64661, October 23, 2015).

Habitat Loss and Alteration

1. Currently, abandonment and rehabilitation of the gravel mine site would be described in a Mining and Rehabilitation Plan submitted to ADNR and USACE for approval. Solicitation of input from the USFWS would ensure that reclamation efforts would include items such appropriate bank slopes and revegetation parameters that would result in better and more diverse avian habitat.
2. Lethal take or disturbance to nesting birds during the spring and summer nesting period would be potentially additionally minimized or avoided by early staging of equipment on site and the employment of passive hazing techniques to deter birds from nesting in areas planned for construction or gravel extraction.

Collision

Collision impacts to flying birds, including those caused by light attraction, could be further mitigated by the use of monitoring and adaptive management strategies as described below. The hazards of light attraction for birds, particularly during migration, have been well-documented and basic monitoring and mitigation protocols are currently commonly recognized as appropriate strategies for tracking and reducing collision mortalities at artificial structures, including oil and gas platforms. One potential component of a mitigation strategy is monitoring in the form of comprehensive tracking, following pre-determined and scientifically approved protocols of attractions, collisions, and ultimate fate of grounded birds to obtain improved and more comprehensive assessments of the impacts associated with platform and associated vessel attraction (Wiese, et. al., 2001; Hatch Associates Limited and Griffiths Muecke Associates, 2000; Baillie, et. al., 2005; Ellis, et. al., 2013). Monitoring also can result in site or condition-specific data that can allow for adaptive management in lighting operations and other potential mitigation strategies.

Additional mitigation practices that have been recommended in recent peer-reviewed literature and will also assist with lowering impact levels are as follows:

1. The lighting plan should include details on design, installation, and day-to-day operation of lighting on the LDPI and large vessels (e.g., assist tug and similar length or larger which may be offshore over-night or longer). Plan will be developed in cooperation with the USCG, BOEM, USFWS, and FAA, and will include a contractor/staff education component to increase efficacy of Lighting Plan operations and ensure minimization of potential for bird strikes.
2. The LDPI should be designed such that all exterior lights are reduced and down-shielded (as safety and Action Plan operations allow). The U.S. Fish and Wildlife Service has recently published recommended guidelines for reducing bird collisions with buildings and building glass, and the FAA has, and while these are not specific to oil and gas facilities, the lighting design and operations recommendations (e.g., avoid unnecessary lighting; install motion sensors on all lights; ensure exterior lighting is "fully shielded" so that light is prevented from being directed outward, except as necessary for safety, and skyward; minimize light operation during bird migration periods; etc.) have general applicability (USFWS, 2016). Black-out curtains should be used to reduce attraction to interior lights.
3. The proposed LDPI exterior lighting should use shorter wavelength lights. Recent research suggests that birds are less attracted to shorter wavelength light and that installing green and blue artificial lights at structures as an additional mitigation strategy will decrease the number of mortalities among nocturnally migrating birds (Marquenie et al., 2014; Poot et al., 2008). in the North Sea studies indicated that different colored lights cause different responses. White lights caused attraction and red caused disorientation, while green and blue caused a weak response. White lights were replaced with lights that appeared green,

and this resulted in 2 to 10 times fewer birds circling the offshore platforms. (Verheijen, 1985; Montevecchi, 2006; Gauthreaux and Belser, 2006).

4. A strobe-based light-repellant system, similar to Northstar, should be designed and implemented. Such a system apparently has had some success in minimizing collisions of some species (Day et al., 2005; Greer et al., 2010).
5. The attractiveness of the LDPI to migrating birds would be generally reduced by painting buildings light tan, rather than white or very dark colors (Day et al., 2015).
6. When not in, crane boom should be lowered and, whenever possible, removed (Day, Prichard, and Rose, 2005). Unused cranes or other large heavy equipment should not be stored on-site.
7. A Gas Flare Plan should be developed and implemented. The potential impacts of gas flares will be reduced by employing the following measures:
8. The height of the end of the flaring boom should be higher than the mean flight altitude of low-flying at-risk species, such as has been suggested to be beneficial in the case of the flaring boom at Northstar Island (Day et. al, 2015), The gas flare boom(s) will be at least 66 m (215 ft) high.
9. Operations planning and education should be conducted to minimize unnecessary gas flaring during low visibility nights in the height of spring and fall passerine migration season (April 20–May 30 and July 20–September 20).
10. The onshore portion of the pipeline should be removed after the Proposed Action is complete.
11. A Monitoring Plan should be developed and implemented that, at minimum, provides for daily (or first light) surveys of the LDPI for the presence of birds, alive or dead. Basic monitoring and mitigation protocols are commonly recognized as appropriate strategies for tracking and reducing collision mortalities at artificial structures, including oil and gas platforms. One potential component of a mitigation strategy is monitoring in the form of comprehensive tracking, following pre-determined and scientifically approved protocols, of attractions, collisions, and ultimate fate of grounded birds, to obtain improved and more comprehensive assessments of the impacts associated with platform and associated vessel attraction (Wiese, et al., 2001; Hatch Associates Limited and Griffiths Muecke Associates, 2000; Baillie et. al., 2005; Ellis et al., 2013). Monitoring also can result in site or condition-specific data that can allow for adaptive management in lighting operations and other potential mitigation strategies. Records shall be kept according to protocols developed in cooperation with BOEM and the USFWS, and reports will be annually submitted to BOEM and USFWS. The Monitoring Plan would include an Adaptive Management component, and complement the Gas Flare and Lighting Plans.

Increased Predation

1. Work with BOEM and USFWS staff to develop a Wildlife Interaction Plan that at minimum includes the following:
   - Contractor/employee education on: problems associated with feeding wildlife and prohibitions against feeding or encouraging wildlife; reporting all wildlife encounters; and training on waste management and use of animal-proof dumpsters;
   - Monitoring for detection of nest building by predatory birds on towers or other structures, and fox denning on or near any of the Proposed Action facilities;
   - Discouragement of nest building and denning activities;

- o A procedure for reporting all evidence of predator attractions to the facilities, including nesting or denning; anthropogenic feeding, food caching, or stealing; persistent perching; etc., for the purpose of adaptive management;
- o Removal of (i.e., to include egg treatment or other methods as appropriate for prevention of successful nesting and re-nesting) any found nests or dens as appropriate under all applicable legal requirements including State and Federal laws and permits; and
- o All potential necessary permits for nest and den removal or other wildlife interactions, as discussed/approved/permitted in advance as necessary with appropriate State of Alaska and federal regulators prior to initiating construction.

Marine Mammals

1. Use hovercraft in lieu of boats, when/if possible. Hovercrafts would serve to reduce the in-water sound footprint.
2. Use fixed-wing aircraft in lieu of helicopters, when feasible, to reduce the potential for disturbance to marine mammals from aircraft traffic.

Terrestrial Mammals

1. In general, aircraft should maintain a minimum altitude of 1,000 AGL, and avoid flights over calving grounds between 1 May and 15 June. However, aircraft near muskox calving areas or groups should maintain a minimum altitude of 1,500 ft, and helicopter should be prohibited near musk ox. This would reduce the potential for flight responses, injuries, and separations of parturient muskoxen from their calves.
2. To maximize efficacy without overregulation, calving period-specific mitigation measures in established oil fields might be terminated or extended, based on the timing of spring snowmelt (Haskell et al., 2006).
3. Restrict use of vehicles to the area immediately around work areas and camps, and avoid muskox by 600 m (0.37 mi).
4. Survey the onshore segment of the ice road route to avoid bear dens, limit travel speed of vehicles/equipment to 25 mph, and establish grizzly bear-human avoidance protocols to ensure bears aren't attracted to work areas or people.
5. Follow speed limits of 25 mph and develop avoidance protocols for drivers and workers on the ice roads would reduce potential impacts associated with disturbance and strikes.

Subsistence

1. Potential adverse effects to Cross Island subsistence whalers from routine construction, development, production, and decommissioning could be reduced if the cessation periods for both drilling and marine vessel traffic during the fall bowhead whale migration were moved to August 1 (Kuukpik, 2015). Drilling activities and vessel traffic would be allowed to resume after the Nuiqsut bowhead whale quota of four whales is met or after the whalers officially end their whaling activities for the season.
   - o If LDPI slope protection work is completed by July 25, there would most likely be little or no impacts to Nuiqsut's 2018 whaling season. If summer construction activities for LDPI slope protection and associated vessel support traffic cease on August 25 and not continue through the end of August into September, impacts from summer construction on Nuiqsut's subsistence whaling would most likely be reduced.
   - o Communication centers could be established and subsistence advisors or representatives could be hired to reduce potential conflicts between whaling crews' scouting efforts and support vessels and aircraft traffic during August through September.

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Appendix D

Baseline Human Health Summary

BASELINE HUMAN HEALTH SUMMARY

DRAFT

LIBERTY PROJECT

MAY, 2017

Prepared by:

Alaska Department of Health and Social Services

Environmental Public Health Program

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DRAFT LIBERTY BASELINE HUMAN HEALTH SUMMARY

Introduction

This baseline human health summary presents an overview of the current health status of the communities within the North Slope Borough (NSB). This baseline health summary included Anaktuvuk Pass, Atqasuk, Kaktovik, Nuiqsut, Point Hope, Point Lay, Utqiaġvik [formerly known as Barrow], and Wainwright. This baseline health summary refers to these communities as potentially affected communities (PACs) in accordance with the HIA Toolkit (ADHSS, 2015). The summary focused on Nuiqsut because it is the closest PAC to the proposed Liberty Project.

Baseline health conditions form a fundamental context for the overall health impact assessment (HIA) process. The baseline health summary creates a point of reference for the health status of a community prior to development of a proposed project and also describes an overall health profile for an area. The baseline health summary will inform decision-makers about health vulnerabilities and strengths of PACs. This information, used in conjunction with their knowledge of the features of a project, will help them better understand the potential health implications of the project and better inform deliberations.

For Alaska, baseline health information can be found in public health surveillance systems maintained by the State of Alaska, the Alaska Native Tribal Health Consortium (ANTHC), and occasionally local borough and tribal entities. This document focuses on a review of existing public health surveillance data. The Liberty Baseline Human Health Summary presents personal health information (PHI) according to the requirements of the Health Insurance Portability and Privacy Act of 1996 (HIPPA). The State of Alaska's approach to PHI is detailed in the HIA Toolkit (ADHSS, 2015).

Alaska public health agencies routinely report public health surveillance data at the statewide or regional level. These agencies do not typically report village or community-level data to avoid privacy violations (e.g., stigmatization) and problems with statistical analysis when case numbers are small. In general, the State of Alaska does not release disaggregated results for small numbers (e.g., <6). As a result, the majority of the data presented in this baseline health summary represents the entire NSB, rather than community-level data.

Baseline community health data are organized and presented by specific Health Effect Categories (HECs). The report focuses on health data that, based on experience with similar types of projects, are likely to be most relevant to the proposed Liberty Project.

HEC1: Social Determinants of Health

The World Health Organization (WHO) defines the social determinants of health as, "the circumstances in which people are born, grow up, live, work, and age, and the systems put in place to deal with illness" and asserts that "the social determinants of health are mostly responsible for health inequities—the unfair and avoidable differences in health status seen within and between countries" (WHO, 2008).

Both health outcome data and health determinant data are used to establish baseline health status according to the social determinants of health. An outcome is a health event that has actually occurred, while a determinant is a setting or context that strongly influences health status.

Life expectancy, maternal and child health, intimate partner violence and sexual violence, oral health, suicide rates, and substance dependence are health outcomes used as general indicators of physical and social wellness. Family structure, economic status, educational attainment, family stability, and cultural continuity are health determinants that are associated with positive and negative health outcomes. For the purpose of the baseline health summary, regional information about the aforementioned criteria is compared to information for all Alaska Native peoples (AN), Alaskans statewide, and to the U.S. population, where possible.

Demographics

Population

The PACs described in this baseline summary are communities whose residents may be affected by the proposed Liberty Project. This includes the eight villages of the NSB (Anaktuvuk Pass, Atqasuk, Utqiaġvik, Kaktovik, Nuiqsut, Point Hope, Point Lay and Wainwright). Additional data will be provided, where possible, for the community of Nuiqsut, due to its proximity to the proposed project.

The population of the villages in the PACs is described in Table 1. The majority of villages are small, with populations fewer than 500 residents. The majority of residents in all communities (roughly 90%, except in Utqiaġvik) are American Indian/AN. The population is young (median age: 24-31 years old; Table 1).

Table 1. Population demographics in PACs

Village	Population size	American Indian/Alaska Native[a]	Median age (years)	Proportion of residents ≥ 65 years of age	Proportion of residents < 18 years of age
Anaktuvuk Pass	324	92%	27	4%	33%
Atqasuk	233	93%	24	6%	39%
Kaktovik	239	90%	31	8%	30%
Nuiqsut	402	90%	25	6%	28%
Point Hope	674	93%	25	6%	35%
Point Lay	189	89%	25	4%	31%
Utqiaġvik	4,212	69%	28	5%	33%
Wainwright	556	92%	28	5%	34%

Source: U.S. Census, 2014
[a]Race reported alone or in combination with one or more other races

Income

The U.S. Census Bureau collects data on median household income via the American Communities Survey (ACS). Income includes all monetary sources of income including wages, the Permanent Fund Dividend, corporation dividends, and public assistance (ADCRA, 2016). Income does not include any dollar equivalent of subsistence resources (resources from the harvesting and processing of wild foods and raw materials). For 2014, the estimated median household income in the NSB was $74,609; for Alaska it was $71,829. Median household income in the PACs ranged from $49,375 (Anaktuvuk Pass) to $85,883 (Nuiqsut; Table 2). In the majority of NSB households, permanent fund dividends account for 7-17% of the household's total income. The three most important sources of income for Iñupiat households in the NSB are wage work (57%), corporation dividend income (20%) and permanent fund dividends from the state (NSB Census, 2015)

According to the 2010-2014 ACS estimates, the per capita income in the NSB ($50,267) was one and a half times higher than in the State of Alaska ($33,129). Each PAC had a per capita income lower than the state average, with Utqiaġvik having the highest at $27,696 (U.S. Census ACS, 2014; Table 2).

Employment

Employment is another key demographic factor that influences health. Unemployment includes anyone who has made an active attempt to find work in the four-week period up to and including the week that includes the 12th of the referenced month. Due to the scarcity of employment opportunities in rural Alaska, many individuals do not meet the official definition of unemployed because they are not conducting active job searches. In October of 2016 (the most recently available data), the unemployment rate for the entire NSB was 6.7%, which was similar to the statewide unemployment rate of 6.3%, but higher than the nation-wide rate of 4.7% (ADLWD, 2016). According to the 2015 NSB Census, the unemployment rate for the NSB was 27.7%; this rate was determined through interviews and census respondents, rather than from unemployment insurance claims and accounts for the lack of employment opportunities and seasonal unemployment in the NSB. Communities outside of Utqiaġvik bear the largest burden of unemployment in the NSB (NSB Census, 2015).

Percent living below poverty level

Poverty is a powerful determinant of human health (Braveman et al., 2011). The U.S. Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty nationwide (U.S. Census, 2016). However, the U.S. Census defines poverty in a way that does not take into account the higher cost of living in Alaska. The U.S. Department of Health and Human Services adjusts poverty guidelines for entitlement programs such as Women, Infants and Children, and Temporary Assistance for Needy Families for local factors. For the 48-contiguous U.S. states, the 2016 poverty level for a 1-person household was $11,880 and for a 4-person household it was $24,300. Comparatively, the 2016 poverty level in Alaska for a 1-person household was $14,840 and for a 4-person household was $30,380 (ASPE, 2016). However, the poverty measure may still not accurately predict the well-being of a family in rural Alaska, due to the contributions from subsistence and sharing resources within the community (Goldsmith, 2007; Kofinas et al., 2016).

In 2014, the percent of residents living below the federal poverty level in the NSB was very similar to the percentage for all of Alaska (10.2% for NSB, 10.1% for Alaska; Table 2). The variation between villages is high, ranging from 3% in Nuiqsut to over 21% in Atqasuk. All villages, except Nuiqsut, had a higher percentage of residents living below the poverty line than the State of Alaska as a whole (U.S. Census ACS, 2014).

Table 2. Economic indicators

Location	Per Capita Income ($)	Median Household Income ($)	% of People Living Below the Poverty Limit
State of Alaska	33,129	71,859	10.1%
North Slope Borough	50,267	74,609	10.2%
Anaktuvuk Pass	19,122	49,375	18.9%
Atqasuk	19,968	51,500	21.5%
Kaktovik	20,782	58,125	14.8%
Nuiqsut	26,861	85,833	3.0%
Point Hope	19,497	67,500	11.9%
Point Lay	18,819	60,000	16.7%
Utqiaġvik	27,696	82,976	12.3%
Wainwright	20,551	64,861	19.3%

Source: U.S. Census ACS, 2014

Educational attainment

The highest level of household educational attainment is positively associated with improved overall family health status (Muennig, 2006). High school graduates have been found to live an average of 6 to 9 years longer than high school dropouts (Wong et al., 2002). Adults with low educational attainment are more likely to die from cardiovascular disease, cancer, and lung disease (Muennig, 2005). Multiple mechanisms have been proposed to account for this trend. Education positively impacts lifestyle choices and health-related decisions, and better-educated people are also less likely to be employed in dangerous jobs (Muennig, 2006).

Compared to the State of Alaska, the NSB has a slightly lower percentage of adults with a high school diploma and with a bachelor's degree or higher (Table 3). The percentage of adults who are high school graduates varies considerably among the communities, from a low of 69.7% in Atqasuk to a high of 82.7% in Utqiaġvik (U.S. Census ACS, 2014).

Table 3. Educational attainment

Location	Percent high school graduate or higher
Alaska	91.8%
North Slope Borough	87.1%
Anaktuvuk Pass	75.4%
Atqasuk	69.7%
Utqiaġvik	82.7%
Kaktovik	70.4%
Nuiqsut	70.4%
Point Hope	81.5%
Point Lay	80.0%
Wainwright	75.2%

Source: U.S. Census ACS, 2014

General Health

Self-rated health is one of the most consistent predictors of illness, premature death, health care utilization, and hospitalization. In 2010, more than three-quarters (79%) of Nuiqsut heads of household reported their health to be at least good, and 21% reported fair to poor health, which is generally consistent with the other NSB villages. The percentage of adults reporting to have very good to excellent health was lower in Nuiqsut (39%) than it was statewide (56%; BLM, 2013). Comparatively, in 2015, 95% of Nuiqsut heads of household reported their health to be at least good. With the exception of Anaktuvuk Pass, the percentage of household heads reporting poor to fair health in all NSB communities decreased (NSB Census, 2015).

Maternal and Child Health

Infant mortality

Infant mortality is an important indicator for population health and is influenced by living conditions, food security, domestic conflict, socio-economic well-being, and access to health services. Infant mortality can be separated into neonatal deaths, which occur during the first 28 days of life, and post-neonatal deaths, which occur from the 28th day to 1 year of life. Whereas neonatal deaths are associated with the quality of prenatal and perinatal health care, post-neonatal deaths are more closely associated with socio-economic conditions (AMAP, 2009).

The infant mortality rate in the NSB (11.6 per 1,000 live births) was 2 times higher than the rate for the State of Alaska (5.7 per 1,000 live births) from 2011-2015. In 2014, the infant mortality rate for the U.S. was 5.8 deaths per 1,000 live births. These data suggest that the post-natal experience, which is affected by socio-economic conditions, is of concern in the NSB compared to Alaska overall and the U.S., though it is important to note that infant mortality rates in the NSB have been declining in recent decades (NSB, 2012).

Low birth weight

Low birth weight is defined by the WHO as a weight at birth of less than 2,500 grams (5.5 lbs) and most often results from poor delivery of nutrients and oxygen to the fetus, which is directly related to the health of the mother (WHO, 2005). Low birth weight is associated with an increased risk of lifelong disability and a 20-fold increased risk of premature death (NCHS, 2011). Low birth weight is therefore an indicator of health in maternal and infant populations.

In 2015, the percent of low birthweight infants (all races) in the NSB was 6.4%, compared to 5.7% low birthweight infants statewide. The percent of low birthweight infants in the NSB has remained relatively stable and comparable to Alaska rates since 1995 (NSB, 2014).

Substance use during pregnancy

Substance use during pregnancy refers to the consumption of alcohol, tobacco, and/or drugs while pregnant. Substance use is a risk for both the mother and the fetus and can lead to premature detachment of the placenta, sudden infant death syndrome, and developmental problems in childhood (WHO, 2005). Alcohol use during pregnancy puts infants at risk for fetal alcohol spectrum disorders (FASD), the leading preventable cause of birth defects and developmental disabilities nationwide (CDC, 2011).

In the NSB during 2012, the percentage of infants born to all mothers who reported drinking alcohol (0.6%) during pregnancy was much less than that reported for Alaska mothers statewide (2.6%; ABVS, 2015). The NSB Baseline Community Health Analysis (NSB, 2012) reported that the prevalence of FASD in the NSB was >3 times the state average and 16 times the rate in non-Natives statewide, but was similar to the rate for AN statewide. Variation in screening practices, diagnosis, and reporting may account for some of the regional differences (NSB, 2012).

Smoking during pregnancy is the single most important contributor to low birth weight (CDC, 2004). In the NSB in 2015, 47.8% of infants were born to mothers who reported smoking during pregnancy. This was almost 3 times higher than the statewide rate of 18.5% (ABVS, 2016).

Mental Health

Mental health is a “state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community (WHO, 2014)”. Mental health, or behavioral health, is increasingly considered a critical component of overall health and is linked to physical health and well-being for people at all ages. Mental health can be affected by factors such as employment, working conditions, income, living environment, housing quality, food security, physical health, and cultural support (NSB, 2014).

Assessing mental health at the population level is often challenging, in part because diagnosis can be low (e.g., people may not seek medical care for depression). Also, Iñupiat cultural traditions sometimes prevent the open recognition and discussion of emotional suffering (NSB, 2012). These factors can result in under reporting and diagnosis of mental health issues. Often, researchers must rely on self-reported data to gain a clearer picture of mental health in a community.

Mentally unhealthy days

The Behavioral Risk Factor Surveillance System (BRFSS) asked participants ‘thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?’. From 2011-2013, NSB residents (all races) reported 3.3

mentally unhealthy days per month, compared to 3.1 mentally unhealthy days reported statewide. NSB residents reported fewer mentally unhealthy days than AN statewide (4.0 days) and all Alaskans (3.2 days). The average number of mentally unhealthy days in the NSB has more than doubled from a low of 1.5 days in 1995-1997 (BRFSS, 2016). Additionally, from 2008-2010, residents in the NSB less commonly reported always or usually receiving the social and emotional support they needed (53%) than AN statewide (66.8%) or all Alaskans (80.0%; NSB, 2012).

Suicide

Suicide is an important health outcome that can indicate mental health illness in a population and has devastating effects on families and communities. Age-adjusted suicide mortality rates are consistently higher in the NSB compared to the State of Alaska (NSB, 2014). Suicide was the fifth leading cause of death in the NSB and the sixth leading cause of death in the State of Alaska from 2013-2015. The age-adjusted suicide rate in the NSB from 2013-2015 (30.1per 100,000 U.S. year 2000 standard population) was similar to the age-adjusted rate for the State of Alaska (24.2 per 100,000 U.S. year 2000 standard population), though it is important to note that the NSB rate was based on fewer than 20 occurrences and may therefore be statistically unreliable and should be interpreted with caution. Suicide has remained a leading cause of death in the NSB for over 2 decades, ranked as either the fourth or fifth leading cause of death since 1992 (ABVS, 2015).

Substance Dependence

Substance abuse is an indication of poor mental health, can cause additional health problems, and strongly influences many related health outcomes, such as accidents and injuries, suicide, and mental health. Substance abuse includes illicit use of drugs (such as marijuana and heroin), alcohol addiction, and binge drinking. Current substance use is defined as having used (e.g., alcohol, marijuana, or cocaine) in the past 30 days.

According to the NSB 2010 Census, 33% to 57% of household heads reported that they felt a household member had been hurt often by the effects of drugs or alcohol in the previous year. This illustrates the wide-ranging effects of alcohol and drug abuse on the individual, household, and community levels (NSB, 2012).

Alcohol

Alcohol abuse is linked to chronic disease, risky and violent behavior, injuries, suicide, homicide, disintegration of family structure and well-being, and adverse home environments for children. In particular, interpersonal violence and injury are associated with “binge,” or episodic, heavy drinking (WHO, 2006; IAP, 2013). Binge drinking is defined as a pattern of drinking that brings a person’s blood alcohol concentration to 0.08 grams percent or above. Typically, this happens when men consume 5 or more drinks, and when women consume 4 or more drinks, in about 2 hours (CDC, 2015).

In the NSB, 34% of all injury hospitalizations, and 63% of assault injuries among AN were recorded as alcohol-related (NSB, 2012). According to BLM 2013, “alcohol is involved in an estimated 40% of snow machine-related injury hospitalizations, 70% of assault injuries, 57% of suicide attempts, and 45% of motor vehicle-related injury hospitalizations” (BLM, 2013).

According to data from the Alaska BRFSS, from 2011-2013, the self-reported prevalence of current alcohol use was lower in the NSB (37.4%) than among AN statewide (43.4%) and among all Alaskans (56.6%). For that time period, the NSB had one of the lowest self-reported prevalences of current alcohol use when compared to other regions in the state. Also for the same time period, the self-reported prevalence of binge drinking in the NSB (20.1%) was similar to the binge drinking prevalence for all AN statewide (20.3%) and for all Alaskans (18.6%; BRFSS, 2016).

Marijuana

In 2015, current marijuana use among high school students was higher in the Northwest region (35.7%; includes NSB, Northwest Arctic Borough, and the Nome Census Area) than high school students statewide (26.1% AN statewide, 19.0% all Alaskans statewide; BRFSS, 2016).

Tobacco

Tobacco use and exposure to second-hand smoke have been associated with many different health conditions, including lung cancer and heart disease (CDC, 2016). Rates of tobacco use in NSB are very high compared to most other areas of Alaska, with almost half of adults engaged in regular smoking. From 2011-2103, the NSB had the third-highest prevalence of current tobacco users (includes current smokeless tobacco users). The prevalence of current tobacco users in the NSB from 2011-2012 was 53% (BRFSS, 2016). The 2015 NSB census also found that 53% of the Iñupiat population reported smoking as least some days each week (NSB Census, 2015). Comparatively, 46.5% of AN statewide and 26.1% of all Alaskans reported current tobacco use (BRFSS, 2016). Adolescents in the Northwest region also had a high prevalence of current smokers. In 2015, 24.1% of high school students in the Northwest region reported smoking a cigarette in the past 30 days. Comparatively, 19.7% of AN HS students statewide and 11.1% of all high students statewide reported current cigarette-smoking status (BRFSS, 2016).

Cultural Continuity

Cultural continuity has been linked to numerous positive health outcomes, including reduced rates of suicide (Chandler, 1998; Chandler, 2004). Speaking a native language and participating in subsistence activities have been highlighted by circumpolar communities as important signifiers of community health and cultural continuity (Stevenson, 2009). Subsistence participation can include use of subsistence resources, harvest activities, sharing, and receiving subsistence resources.

In 2014, 34% of NSB residents spoke a language other than English at home (most commonly Iñupiaq; range: 36-58%). For that same year, 58% of Nuiqsut residents reported speaking a language other than English at home (U.S. Census ACS, 2014).

Participation in subsistence preserves cultural continuity and ensures cultural survival. Participation in subsistence activities is high throughout the region; in 2015, nearly 99% of household in all NSB communities participated in subsistence activities and at least 95% of NSB Iñupiat households reported consuming subsistence foods (NSB Census, 2015).

Summary

Areas of Vulnerability

- The per capita income of residents in the PACs is lower than the per capita income of the state.
- All villages, except Nuiqsut, had a higher percentage of residents living below the poverty line than the State of Alaska as a whole.
- Infant mortality rate is higher in the NSB. Even though infant mortality is steadily decreasing in the state, prenatal care remains a critical topic in the NSB.
- A greater percentage of women in the NSB reported smoking during pregnancy than in the state.
- Prevalence of smoking is higher in the NSB than most regions in the state.

Areas of Resilience/Success

- Self-reported prevalence of heavy drinking and binge drinking in the NSB is lower than most regions in the state.

All NSB communities exhibit a high level of participation in subsistence harvests and other subsistence activities (such as sharing and receiving subsistence resources).

HEC 2: Accidents and Injuries

Accidents and Injuries are an important cause of morbidity and mortality in Alaska. The term unintentional injury refers to causes of injury or death other than suicide and homicide. Fatal injury information is drawn from death certificates and the Alaska Violent Death Reporting System (VDRS), while non-fatal injuries are typically obtained from the Alaska Trauma Registry (ATR).

Fatal Injuries

Fatal unintentional injuries

From 2013-2015, unintentional injuries were the third leading cause of death among all residents of the NSB and among Alaska residents statewide. Motor vehicle accidents were the leading cause of unintentional injury death in the NSB (6 deaths), followed by poisoning (5 deaths), which is typically caused by alcohol ingestion, though an age-adjusted rate was not reported due to the small number of cases. Poisoning was the leading cause of unintentional injury death statewide, followed by motor vehicle accidents (Table 4; ABVS, 2016).

Table 4. Unintentional Injury Deaths by Cause, North Slope Borough and State of Alaska, 2013-2015

	North Slope Borough		State of Alaska	
Cause of Death	**Number of Deaths**	**Age-adjusted Rate[a]**	**Number of Deaths**	**Age-adjusted Rate[a]**
Unintentional Injuries	**15**	**68.2***	**1117**	**54.7**
Transport accidents				
Motor vehicle accidents	6	22.4*	228	10.2
Snow machine[b]	2	**	23	0.9
ATV[c]	1	**	40	1.7
Nontransport accidents				
Falls	0	**	113	7.2
Poisoning	5	**	398	18.1

Source: ABVS, 2016

[a] Age-adjusted rates are per 100,000 U.S. year 2000 standard population

[b] Deaths to an operator or passenger related to the use of a snow machine

[c] Deaths to an operator or passenger related to the use of an ATV

[*] Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution

**Rates based on fewer than 6 occurrences are not reported

Fatal intentional injuries (suicide)

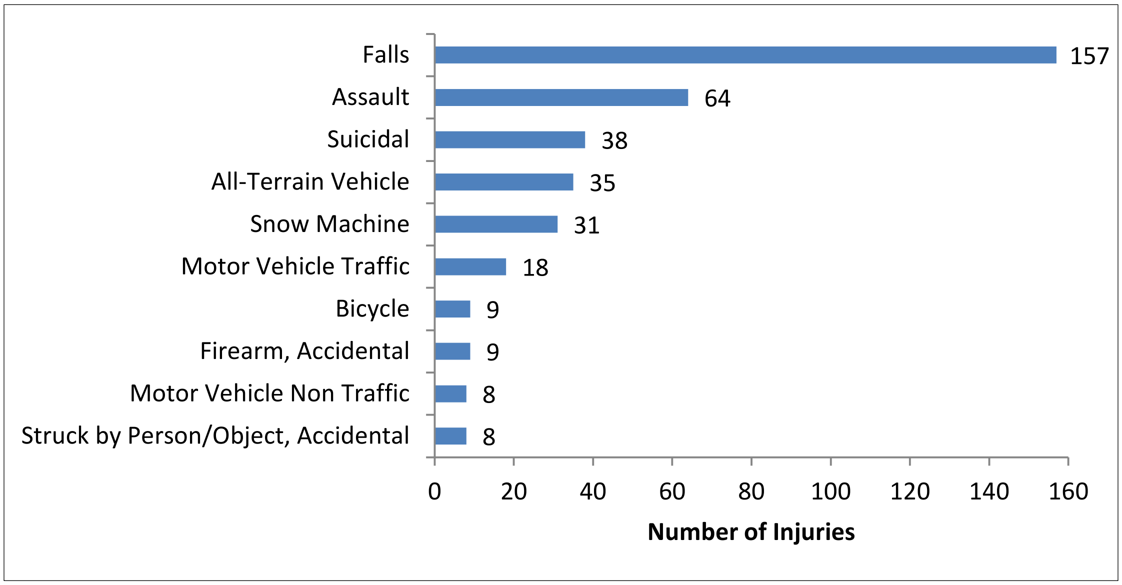
Suicide was the fifth leading cause of death in the NSB from 2013-2015 (ABVS, 2016). Suicide has remained a leading cause of death in the NSB for over 2 decades. More than two-thirds of suicides occurring in the NSB since 2000 have involved firearms (NSB, 2012).

Non-fatal injuries

According to the NSB Baseline Community Health Analysis Report, from 1999-2008, there were 736 non-fatal injury hospitalizations among NSB residents. The leading causes of injury hospitalization for this time period were falls, suicide attempts, assault, and snow machine-related injuries. With the exception of motor vehicle traffic-related injuries, injury hospitalization rates in the NSB were higher than the statewide rates. In particular, the NSB rate of snow machine-related injury hospitalizations was four times higher than the statewide rate for all Alaskans and twice as high as the rate for AN statewide (NSB, 2012).

The Alaska Trauma Registry (ATR) records non-fatal injuries that are serious enough to require admission to a health care facility. According to the ATR data, from 2009-2015, the most common cause of non-fatal injury requiring hospitalization in the NSB was falls (35% of all non-fatal injuries), followed by assault (14%), and attempted suicide (8%). These three causes of injury alone accounted for 57% of all non-fatal injuries from 2009-2015 (Figure 1). Males accounted for 57% of all injuries in this time period (ATR, 2016).

Figure 1. Leading causes of North Slope Borough non-fatal injury hospitalizations, 2009-2015



Source: ATR, 2016

* Starting 1/1/2013: Adults (18 years and older) were no longer included in the ATR due to intentional, self-inflicted, suicidal overdoses

Summary

Areas of Vulnerability

- Accidents and injuries were the third leading cause of death in the NSB from 2013-2015. The most common causes of unintentional injury deaths among all NSB residents were motor vehicle accidents (the majority of which are snow machine accidents) and poisoning (typically caused by alcohol ingestion).
- Falls, assaults, and suicide attempts were the most common causes of non-fatal injury hospitalization in the NSB from 2009-2015.

HEC 3: Exposure to Potentially Hazardous Materials

When reviewing data on exposure to potentially hazardous materials, it is important to consider health outcomes, such as the prevalence of illnesses that result from exposures to hazardous materials (including asthma and cancer), and health determinants, such as soil, water, and air quality (when data are available).

Air Quality—Expanded Discussion

Air pollution has been shown to increase the risk of a number of respiratory and cardiac conditions. Air pollution is also associated with increased daily mortality rates (Dockery et al., 1993). The elderly, children, and those with underlying health problems are particularly vulnerable to the effects of air pollution (CDC, 2016b).

According to the U.S. Environmental Protection Agency (USEPA), “tribes in Alaska face unique challenges to protecting air quality and reducing health risks in their communities:

- Most Tribes do not have a reservation or defined lands where they can assert jurisdiction to address air quality issues.
- Frozen ground prevents burying waste in landfills, and many communities resort to burning trash that creates air pollution.
- Electricity primarily comes from diesel generators that produce particulate and other air pollutants.
- The cold climate means people spend significant time indoors in homes and buildings where indoor air pollution can accumulate.
- Many homes have older wood stoves that can be inefficient and create air pollution.
- Dust from unpaved roads may contain pollutants that can be inhaled or deposited on subsistence food sources.” (USEPA, 2016)

Air quality concerns in rural Alaska villages include diesel emissions, indoor air quality, road dust, solid waste burning, and wood smoke. Residents in the NSB have also expressed concern about air pollution generated by nearby oil and gas extraction activities.

In response to concerns about air pollution generated from oil and gas extraction activities, the Alaska Native Tribal Health Consortium (ANTHC) partnered with the Native Village of Nuiqsut to conduct an independent assessment of the air quality in Nuiqsut. The study included a review of 2008-2010 air monitoring data from the ConocoPhillips Alaska, Inc. (CPAI) air monitoring station. This station is located on the northern edge of Nuiqsut, 6 miles east of the Alpine Central Processing Facility (which processes oil and natural gas from the surrounding production pads), and collects data on the following pollutants: carbon monoxide (CO), nitrogen oxides (NO_X), ozone (O_3), sulfur dioxide (SO_2), particulate matter ≤10 µm (PM_{10}), and particulate matter ≤2.5 µm ($PM_{2.5}$). Data from the air monitoring station showed pollutant concentrations generally well below the national ambient air quality standards (NAAQS). PM_{10} exceeded the 24-hour average NAAQS twice from 2008-2010 and both instances were believed to be caused by dust from natural sources. $PM_{2.5}$ exceeded the 24-hour NAAQS once from 2008-2010 and may have been due to a large forest fire plume. CO, NO_X, O_3, and SO_2 all remained below the NAAQS from 2008-2010 (ANTHC, 2011).

Researchers also collected air and water samples to assess for volatile organic compounds (VOCs). Of the 45 samples collected, 28 contained VOCs, though none of the VOC concentrations exceeded the air quality standards and screening levels set by multiple federal agencies (U.S. Environmental Protection Agency, Agency for Toxic Substances and Disease Registry, National Institute for Occupational Safety and Health, and Occupational Safety and Health Administration). VOCs specifically associated with crude oil development were either not detected or were found at very low concentrations (below all standards and screening levels) for all of the collected samples. None of the water samples had VOC concentrations that exceeded the ADEC water quality standards (ANTHC, 2011).

The most frequently identified source of air pollution during key informant interviews in Nuiqsut was oil and gas development (ANTHC, 2011). The available air monitoring data do not support this observation, as measured air pollutant concentrations are consistently low. It will be crucial to continue to monitor air quality in Nuiqsut over time.

In 2013, ADEC reviewed pollutant data from the CPAI Nuiqsut monitoring station. ADEC found that all pollutants measured by the CPAI monitor were below the Alaska Ambient Air Quality Standards (AAAQS), which were developed to protect public health in Alaska (ADEC, 2015).

Additionally, ADHSS investigated air pollution and respiratory illness in Nuiqsut in response to community concerns in 2003 and 2012. In both investigations, health data were collected from inpatient and outpatient visits for respiratory illness. The 2003 ADHSS study found no significant differences for respiratory visits in Nuiqsut compared to a similarly sized North Slope village for the years 1998-2002, except for the 10-19 years old age group. Because only one age group had a statistically higher rate of respiratory visits than the control village, it is unlikely that an air pollution source is the cause. If air pollution or another type of environmental contaminant were associated with clinic visits for respiratory conditions, most age groups would likely be impacted similarly. The study concluded that the increase in respiratory visits in Nuiqsut for 10-19 year olds was likely due to a few individuals with numerous clinic visits to address asthma-related problems (ADHSS SOE 2003). In the 2012 ADHSS study, which was conducted after the Repsol blowout event, air pollution data were collected from the CPAI monitoring station, as well as clinic visit data. The study concluded that there was a large number of visits to the Nuiqsut clinic related to respiratory conditions, but air pollution was not associated with respiratory illness in this investigation; instead, the increase in clinic visits was likely due to increased influenza and respiratory syncytial virus (RSV) activity, which was reported throughout the state during the same time period (ADHSS SOE, 2003; ADHSS SOE, 2012).

Water Quality

Overall, available water quality data for Nuiqsut indicate that, with few exceptions, water quality standards for human consumption are being met (BLM, 2014). See HEC 6: Water and Sanitation for a related discussion on water and sanitation in the NSB.

Summary

Areas of Vulnerability

- Residents of Nuiqsut have expressed concerns that the air quality in the community is poor, and have indicated that this is causing high rates of respiratory diseases; the available air monitoring data do not support this observation, as measured air pollutant concentrations are consistently low. It will be crucial to continue to monitor air quality in Nuiqsut over time.

Areas of Resilience/Success

- Available air quality monitoring data indicate that pollutants are at levels that are not expected to cause adverse health outcomes.
- Results indicate little evidence of significant air- or water-quality problems associated with oil and gas development.

HEC 4: Food, Nutrition, and Subsistence

The Alaska Federation of Natives (AFN) describes subsistence as “the hunting, fishing, and gathering activities, which traditionally constituted the economic base of life for Alaska's Native peoples and which continue to flourish in many areas of the state today” (AFN, 1993).

Subsistence is part of a rural economic system, called a “mixed, subsistence-market” economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods. Fishing and hunting for subsistence resources provides a reliable economic base for many rural regions. Subsistence is focused toward meeting the needs of families and small communities. Participants in this mixed economy in rural Alaska often augment their subsistence production by cash employment. Cash (from commercial fishing, trapping, or wages from public sector employment, construction, firefighting, oil and gas industry, or other services) provides the means to purchase the equipment, supplies, and fuel used in subsistence activities. The combination of traditional and commercial-wage activities provides the economic basis for the way of life valued in rural communities (Wolfe and Walker, 1987).

Subsistence fishing and hunting are important sources of employment and nutrition in almost all rural communities. Traditional fishing, hunting, and gathering are critical sources of nutrition for many residents in areas of Alaska where food prices are high. While some people earn income from employment, these and other residents rely on subsistence to supplement their diets throughout the year. Furthermore, traditional and cultural activities support a healthy diet, cultural continuity, and contribute to residents’ overall well-being (Ballew et al., 2004; Kofinas et al., 2016).

Food Security

Food security is defined by the Food and Agricultural Organization of the United Nations as “a situation that exists when all people at all times have physical, social, and economic access to sufficient, safe, nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2002). Food security is based on the availability, access (both physical and economical; also includes access via sharing networks), and use of food, and is related to health through malnutrition. Food insecurity, the inability to access enough food at all times to meet basic needs, is tied to poor health status among children, including: more frequent colds, ear infections, and other health problems; aggression, hyperactivity, and anxiety; increased need for mental health services; impaired cognitive functioning, lower test scores, and poorer overall school achievement (NSB, 2012; ADHSS, 2008). Food insecurity is associated with malnutrition and is also associated with increased obesity and diabetes because those who do not always have enough food often consume high-calorie foods with low nutrient value (ADHSS, 2008).

NSB households, particularly Iñupiat households, reported high levels of food insecurity in the NSB 2015 Census. In the NSB, 37% of household heads reported that there were times last year when they found it difficult to get the food needed to make healthy meals and 25% of household heads reported that there were times in the previous year when household members did not have enough to eat. Food insecurity varied greatly between communities and ranged 9-54% of households (NSB Census, 2015; Table 5).

Statewide and national food insecurity data are not easily comparable with NSB data because the state and national surveys do not ask about subsistence food security or take into account the lack of availability of many foods in remote communities. For reference, in 2010, 10.8% of Alaska households surveyed were found to have some degree of food insecurity, and 4.4% were found to have “very low food security,” with disrupted eating patterns or reduced food intake (USDA, 2010). Although the NSB 2015 census data are not directly comparable with statewide estimates, the results suggest that food insecurity is a serious problem across the NSB and, like other rural areas, exists at levels higher than statewide estimates.

Table 5. Percentage of food insecure households in the NSB, 2015

Community	% of Food Insecure Households
North Slope Borough	24
Anaktuvuk Pass	54
Atqasuk	31
Kaktovik	10
Nuiqsut	9
Point Hope	25
Point Lay	9
Utqiaġvik	25
Wainwright	24

Source: NSB Census, 2015

The Alaska Department of Fish and Game (ADF&G) conducted a harvest study in Nuiqsut during 2015. In the study, which has several questions focused on food security, 12% of Nuiqsut households worried about having enough food at one or more times during 2014. Approximately 26% of households reported that they lacked the resources (i.e., time, money, and equipment) to obtain either subsistence or store-bought foods (ADFG, 2016). In this study, Nuiqsut had a slightly higher percentage of food secure households (90%) and slightly lower very food insecure households (2%), compared to 2014 estimates for the entire state (88% food secure, 4% very food insecure; ADF&G, 2016).

Subsistence Resources

Participation in subsistence

Data from the NSB 2015 Census indicate that there is a high level of participation in subsistence activities in NSB households (nearly 99% in all NSB communities). In 2015, 95% or more of NSB Iñupiat households reported consuming subsistence foods. The 2010 NSB Census found that participation was high among both men and women (Table 6). Subsistence foods also make up a significant portion of food consumed in NSB communities.

Table 6. NSB Iñupiat household head's participation in subsistence activities

	Men	Women
Participation in spring whaling	44%	27%
Participate in fall whaling	31%	23%
Hunt sea mammals	55%	17%
Hunt land mammals	69%	30%
Fish	70%	49%
Hunt birds	61%	22%
Gather bird eggs	14%	7%
Pick berries and plants	44%	45%
Share, cook, and process wild foods	79%	82%
Sew skins and clothes	10%	42%
Make sleds and boats	38%	6%
Trap fur bearers	9%	1%

Source: NSB, 2012; NSB Census, 2010

The annual wild food harvest in 2014 for Nuiqsut was approximately 371,992 pounds in useable weight for the entire community, an average of 3,444 pounds per household and 896 pounds per person (ADF&G, 2016). In terms of usable weight, marine mammals provided 46 percent of the harvest while large land animals (29 percent of harvest), non-salmon fish (23 percent of harvest), salmon (1% of harvest), birds and eggs (1 percent of harvest), and berries and edible plants (<1 percent of harvest) contributed the rest. Table 7 shows the resources most commonly used by Nuiqsut households in 2014. Marine mammals and non-salmon fish were particularly important resources for Nuiqsut. In terms of edible weight, marine mammals (bowhead whale; bearded, ringed, and spotted seals) accounted for 46% of the total wild foods harvested. Non-salmon fish (primarily Arctic cisco, broad whitefish, least cisco, Arctic grayling, and burbot) accounted for nearly one quarter of the 2014 Nuiqsut subsistence harvest (ADF&G, 2016).

Table 7. Subsistence resources most commonly used by Nuiqsut households, 2014

Resource	Percentage of households using resource
Bowhead whale	93%
Caribou	90%
Arctic cisco	83%
White-fronted goose	74%
Broad whitefish	72%
Bearded seal	67%
Cloudberry	62%
Ringed seal	52%
Moose	43%
Blueberry	40%

Source: ADFG, 2016

NSB communities also have strong sharing networks for subsistence resources. Typically, about 30% of rural households in Alaska harvest about 70% of subsistence resources used in a community (Wolfe, 2004). A 2015 study found that in two North Slope communities, Kaktovik and Wainwright, only 25% of subsistence resources in a household were from the households' own harvesting efforts, which indicates substantial sharing of subsistence resources. Strong sharing networks within and between communities are crucial for social, cultural, health, and economic well-being. Strong sharing networks can also encourage community members, such as young adults, to take pride in harvest subsistence resources and participate in the cooperative traditions within their community; this is important for maintaining cultural continuity in a community.

Summary

Areas of Vulnerability

- NSB households, particularly Anaktuvuk Pass, reported high levels of food insecurity. More than one in three NSB household heads reported difficulty getting the food needed to eat healthy meals, and approximately 24% of household heads reported that at times in the previous year, household members did not have enough to eat.

Areas of Resilience/Success

- There is a high level of participation in subsistence activities and sharing subsistence resources among NSB households. Subsistence foods also make up a substantial portion of food consumed in NSB communities. These determinants are crucial to an individual's health and well-being, as well as ensuring cultural continuity within a community.

HEC 5: Infectious Diseases

Reportable communicable (infectious) diseases include infectious and parasitic diseases, such as tuberculosis, viral hepatitis, sexually transmitted infectious (STIs), influenza, and pneumonia.

With the exception of STIs, the number of cases of reportable infectious diseases in the NSB is very low. Because of the small number of cases of reportable infectious diseases each year, reliable prevalence rates for the NSB cannot be calculated for most individual reportable diseases. Trends in reportable infectious diseases in the NSB are generally comparable to those occurring statewide (NSB, 2012).

Reportable communicable diseases were not among the leading causes of death in the NSB. Pneumonia (2 deaths) and septicemia (1 death) were the only causes of death due to infectious diseases, accounting for less than 2% of all deaths from 2011-2013 (ABVS, 2015). No influenza deaths were reported during the same time period.

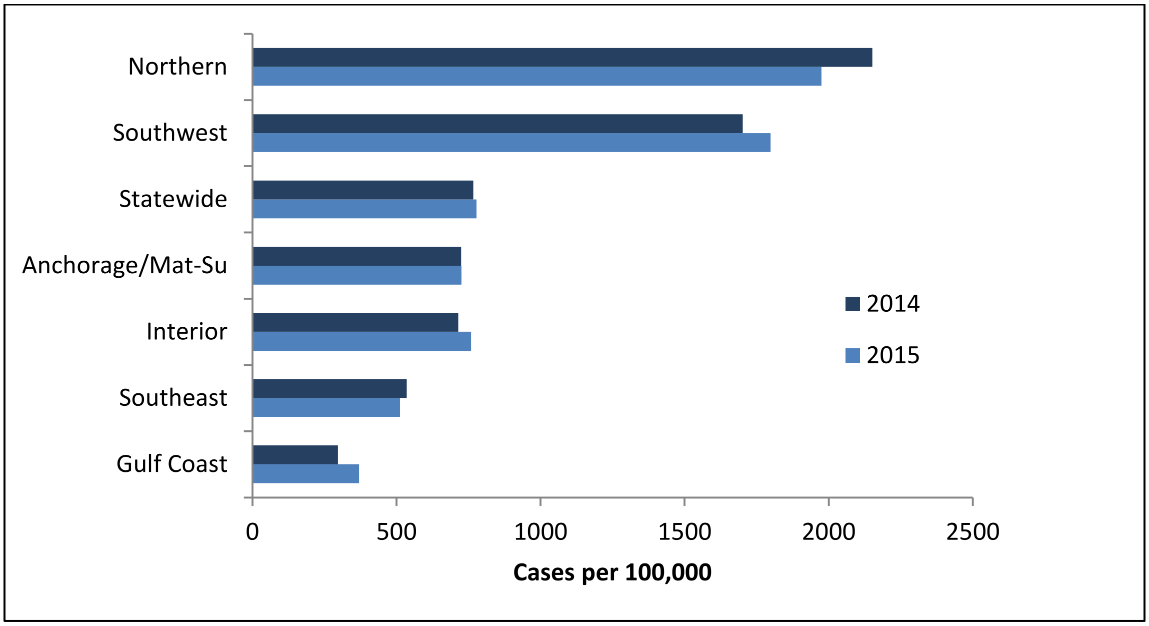
Sexually Transmitted Infections

Chlamydia rates

Chlamydia is a common STI and is caused by the bacterium *Chlamydia trachomatis* (CT). CT can cause pelvic inflammatory disease (PID), ectopic pregnancy, infertility, and preterm labor. Infants born to infected women are at risk for neonatal conjunctivitis and pneumonia. Untreated CT infections in men can cause epididymitis, Reiter syndrome, and infertility.

Alaska ranked first for CT rates nationwide from 2010-2014; rates disproportionately affect northern regions and AN. In 2015, the age-adjusted CT infection rate for the Northern Region (2,151 cases per 100,000 population; includes NSB, Northwest Arctic Borough, and Nome Census Area) was nearly three times higher than the rate statewide (766 cases per 100,000 population) and higher than any other region in Alaska (Figure 2; ADHSS, 2016b).

Figure 2. Chlamydia infection rates, by Region – Alaska 2014 and 2015

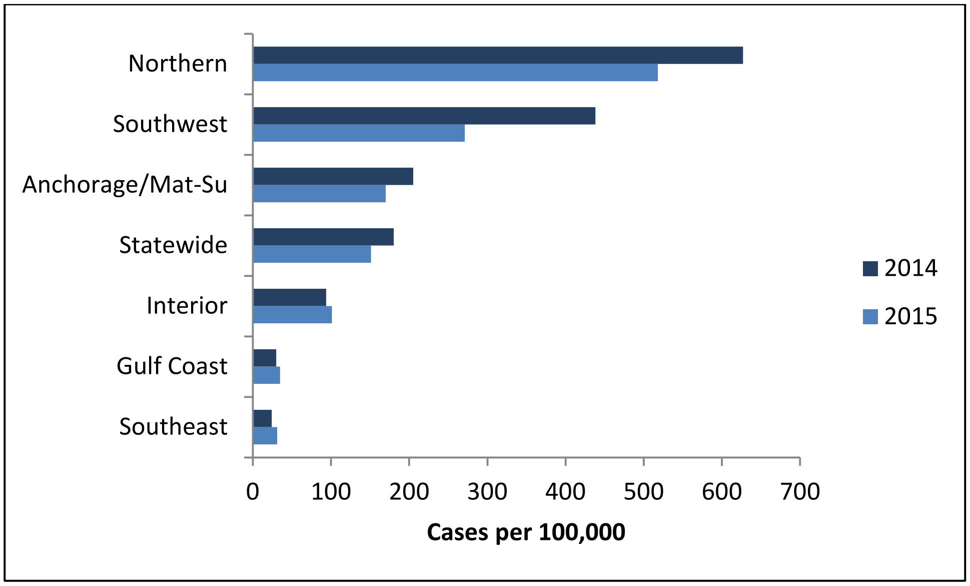


Source: ADHSS, 2016c

Gonorrhea rates

Gonorrhea is an STI caused by the bacterium *Neisseria gonorrhea*. Alaska had the third highest gonococcal infection rate in the nation in 2014 (ADHSS 2016a). The rate of gonorrhea in 2015 was 518 cases per 100,000 population for all races in the Northern Region, which was nearly 3.5 times the rate for Alaska statewide (151 cases per 100,000 population; Figure 3, ADHSS, 2016c).

Figure 3. Gonorrhea infection rates, by Region – Alaska 2014 and 2015



Source: ADHSS 2016c

Summary

Areas of Vulnerability

- The Northern region, which includes NSB communities, is disproportionately affected by chlamydia and gonorrhea.

Areas of Resilience/Success

- The number of cases of reportable, non-STI, infectious diseases in the NSB is very low.

HEC 6: Water and Sanitation

A high proportion of rural Alaska households (approximately 20%) are without basic sanitation facilities and adequate in-home water sources. Relying primarily on community-based water points can lead to inadequate amounts of water collected and increases the likelihood for disease transmission.

The lack of clean running water and proper sewage disposal is a leading cause of preventable diseases in rural Alaskan villages and is directly linked to infectious disease morbidity and mortality. Respiratory, gastrointestinal, and skin diseases are common in areas without safe or easily accessible water supplies.

In a study conducted in 6 regions in Alaska, regions with a lower proportion of in-home water service had 2.5 times the hospitalization rate of pneumonia and influenza and 2 times the rate of skin or soft tissue infection, and over 3 times the rate of respiratory syncytial virus among those younger than 5 years, when compared to higher-service regions (Hennessy et al., 2008).

Water and Sewer Service Rates

In 2015, 92% of NSB households had access to running water (NSB Census, 2015). This indicates that the majority of households drink treated water rather than unfiltered surface water, which typically results in better water quality. This compares to almost 78% of households with modern water and sewer service for rural communities within the State of Alaska.

According to the U.S. Census Bureau, 2010-2014 American Community Survey 5-Year Estimates, the proportion of households that lacked complete plumbing facilities were as follows: 10.6% in NSB, 6.9% in Utqiaġvik, 5.3% in Kaktovik, and 2.0% in Nuiqsut (U.S. Census ACS, 2014).

According to the NSB, 90% of Nuiqsut households had sewage facilities and the remaining 10% used holding tanks. Similarly, 94% of drinking water was piped to Nuiqsut households and 6% was trucked (NSB, 2015).

Nuiqsut's water and sewer system is run with a vacuum pump, creating constant flow and reducing vulnerabilities to freezing pipes. Water operators in 2014 reported few issues with frozen lines. Community water is acquired during an approximate 40-day water making season from July to August, and the water source is a tundra lake located one mile south of town (Brubaker et al., 2014). While water operators noted few issues with freezing pipes, some water and sanitation infrastructure has been impacted by changing permafrost conditions; in 2014, operators reported small-scale permafrost erosion near an outflow pipe from the water tanks. Annual erosion also threatens the sewage outflow line (Brubaker et al., 2014).

Summary

Areas of Vulnerability

- Water and sanitation infrastructure is vulnerable to changing permafrost conditions.

Areas of Resilience/Success

- More than 94% of NSB household have modern water and sewer service.

HEC 7: Non-communicable and Chronic Diseases

Diabetes

Diabetes mellitus is a metabolic disease characterized by high blood sugar levels, which result from defects in insulin secretion, insulin resistance, or both. There are two types of diabetes, Type 1 and Type 2. Type 2 is the most common type of diabetes, is associated with obesity, and is considered a preventable illness. Uncontrolled diabetes can result in serious medical consequences.

From 2011-2013, there were 3 deaths attributed to diabetes in the NSB. Due to the small numbers, an associated rate was not reported. For the same time period, there were 324 deaths related to diabetes mellitus in Alaska (age-adjusted rate of 19.4 per 100,000 U.S. year 2000 population; ABVS, 2015).

The self-reported prevalence of adult diabetes among NSB residents from 2011-2013 was 6.5%, which was similar to the prevalence for AN statewide (7.7%) and all of Alaska (7.2%). Comparatively, the prevalence of prediabetes in adults was higher in the NSB than any other region from 2011-2013. The prevalence of prediabetes in the NSB was 13.3% compared to 10.0% for AN statewide and 8.0% for all of Alaska (BRFSS, 2016).

Overweight and Obesity

Obesity and overweight are terms that define an accumulation of fat that is greater than what is considered healthy. Body mass index (BMI) is a common indicator of obesity and overweight status. Overweight refers to persons who have a current BMI assessment with a BMI of 25 to 29.9 and obese refers to persons who have a current BMI assessment of 30 or greater. Being overweight or obese increases the risk of diabetes, diseases of the heart (mainly stroke and heart disease), cancer, and premature death (WHO, 2016).

The prevalence of adult overweight or obesity among NSB residents from 2011-2013 was 75.8%, which was higher than the prevalence for AN statewide (67.0%) and for all of Alaska (65.0%). NSB had the fifth-highest prevalence of overweight and obesity of all boroughs and census areas in Alaska (BRFSS, 2016). Among NSB communities, the percent of overweight residents ranged from 17%-36% and the percent of obese residents ranged from 23%-48% (Table 8; NSB, 2012).

Table 8. Overweight and obesity among NSB households, 2012

	Overweight	Obese
Anaktuvuk Pass	32%	23%
Atqasuk	26%	38%
Kaktovik	34%	32%
Nuiqsut	28%	33%
Point Hope	29%	48%
Point Lay	17%	46%
Utqiaġvik	34%	40%
Wainwright	36%	41%
North Slope Borough	33%	39%
Alaska	37%	28%

Source: NSB, 2012

Cancer

The prevalence of self-reported cancer in the NSB was lower than the prevalence statewide from 2011-2013. For this time period, the prevalence of cancer in the NSB was 3.6% compared to 6.7% for AN statewide and 8.0% for all of Alaska (BRFSS, 2016). The NSB had the second lowest self-reported cancer prevalence of Alaska boroughs and census areas.

During 2013-2015, cancer was the leading cause of death among NSB residents and among Alaskans statewide. Table 9 presents data from the Alaska Bureau of Vital Statistics that shows the age-adjusted rates for cancer deaths in the NSB are higher than those in the state as a whole. Lung cancer was the leading cause of death due to cancer (50.8 deaths per 100,000 persons, though this rate is based on small numbers and should be interpreted with caution; ABVS, 2016).

Table 9. Cancer Deaths by Type, North Slope Borough and the State of Alaska, 2013-2016

Cause of Death	North Slope Borough		State of Alaska	
	Number of Deaths	Age-Adjusted Rate[1]	Number of Deaths	Age-Adjusted Rates[1]
Malignant Neoplasms	**44**	**327.8**	**2942**	**159.5**
Lip, Oral Cavity, and Pharynx	0	0	41	1.9
Esophagus	1	**	94	5.0
Stomach	7	23.7*	89	4.6
Colon, Rectum, and Anus	9	30.4*	273	15.0
Liver and Intrahepatic Bile Ducts	2	**	143	6.5
Pancreas	1	**	195	10.3
Larynx	0	0	12	0.6*
Trachea, Bronchus, and Lung	15	50.8*	765	41.4
Skin	0	0	49	2.8
Breast [2]	2	**	195	19.6
Cervical[2]	15	**	19	1.6
Uterine[2]	0	0	36	3.6
Ovarian[2]	15	**	58	5.7
Prostate[2]	1	**	126	17.8
Kidney and Renal Pelvis	0	0	79	4.5
Bladder	0	0	54	3.3
Brain	0	0	74	3.5
Lymphoid & Hematopoietic	2	**	236	13.5
Hodgkin's Disease	0	0	2	**
Non-Hodgkin's Lymphoma	0	0	86	4.9
Leukemia	2	**	91	5.3
Multiple Myeloma	0	0	56	3.0
All Other Lymphoid & hematopoietic	0	0	1	**
All Other and Unspecified Cancers	3	**	404	22.5

Source: ABVS, 2016

[1]Age-Adjusted rates are per 100,000 U.S. year 2000 standard population

[2] Breast, cervical, uterine and ovarian cancer rates are for females only and prostate cancer rates are for males only

* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution

**Rates based on fewer than 6 occurrences are not reported

Cardiovascular and cerebrovascular disease mortality

The prevalence of self-reported diseases of the circulatory system (heart attack, angina, or stroke) in the NSB has consistently been lower than the prevalence statewide. In 2011-2013, the prevalence of cardiovascular disease was 4.2% compared to 5.8% for all of Alaska (BRFSS, 2016). When circulatory diseases were further categorized as heart attack, stroke, cardiovascular disease, or coronary disease, the prevalence was still lower in the NSB compared to statewide (BRFSS, 2016).

The mortality rate of major cardiovascular diseases from 2011-2013 was slightly lower in the NSB than all of Alaska (Table 10; ABVS, 2015).

Table 10. Major Cardiovascular Disease Deaths, North Slope Borough and the State of Alaska, 2011 - 2013

Cause of Death	North Slope Borough		State of Alaska	
	Number of Deaths	Age-Adjusted Rate[1]	Number of Deaths	Age-Adjusted Rate[1]
Major Cardiovascular Diseases	20	165.8	2866	189.9
Heart disease	14	84.7*	2146	137.7
Ischemic heart disease	7	24.8*	1225	74.3
Acute myocardial infarction	0	0.0	246	15.7
Atherosclerotic cardiovascular disease	5	**	450	22.8
All other ischemic heart disease	2	**	529	35.9
All other heart disease	7	60.0*	921	63.4
Cerebrovascular disease	5	**	544	40.4
All other cardiovascular diseases	1	**	176	11.8

Source: ABVS, 2015
[1] Age-adjusted rates are per 100,000 U.S. year 2000 standard population
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution
**Rates based on fewer than 6 occurrences are not reported

Chronic respiratory disease rates

Historically, chronic respiratory diseases have been a major cause of morbidity and mortality in rural Alaska, and respiratory problems remain a frequently cited health concern in NSB communities. The NSB 2010 Census asked household heads whether they or other household members had, in the last 12 months, experienced any breathing problems such as asthma, emphysema, or a cough that does not go away. Thirteen percent of household heads and 8% of all adults in the NSB reported or were reported to have experienced any of these problems. The estimated prevalence of these respiratory problems did not vary significantly by ethnic group, gender, or community of residence. Of children aged 0–17 years, 5% were reported by the household head to have had breathing problems such as asthma, emphysema, or a chronic cough in the past 12 months. There was not a statistically significant difference in the relationship between village of residence and the prevalence of breathing problems among children (NSB, 2012).

Chronic lower respiratory disease mortality

Chronic lower respiratory disease (such as asthma or emphysema) is one of the most frequently stated concerns in the NSB. In the NSB, chronic lower respiratory disease has been the fourth or fifth leading cause of death for most years since at least 1992, which is comparable to the state of Alaska in recent years. From 2013-2015, the age-adjusted chronic lower respiratory disease mortality rate was higher in the NSB compared to the rate statewide (Table 11). However, the NSB mortality rates were based on fewer than 20 deaths, and should therefore be interpreted with caution as the rate may be statistically unreliable (ABVS, 2016).

Table 11. Chronic lower respiratory disease rates, NSB, 2013-2016

Detailed Cause of Death	NSB Deaths	Crude Rate[1]	Age-Adjusted Rate[2]	Alaska Deaths	Alaska Crude Rate[1]	Alaska Age-Adjusted Rate[2]
Chronic lower respiratory disease	11	37.2*	129.0*	593	26.8	37.2

Source: ABVS, 2016
[1] Crude rates are per 100,000 population
[2] Age-adjusted rates are per 100,000 U.S. year 2000 standard population
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution

Asthma

Asthma is a disease that affects the lungs and can cause repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing (CDC, 2016a). There are multiple environmental factors known to trigger or exacerbate asthma symptoms, including tobacco smoke, exhaust from heating sources and vehicles, and poor air quality (both outdoor and indoor air). Indoor air pollution is a particular concern in rural Alaska, primarily due to tightly sealed houses with inadequate ventilation and prolonged time spent indoors (NSB, 2012).

The prevalence of self-reported asthma ('Have you ever been told by a doctor, nurse, or other health professional that you have asthma?') has consistently been lower in the NSB than the prevalence statewide. In 2011-2013, the prevalence of asthma was 9.7% compared to 14.4% of for all of Alaska (BRFSS, 2016).

In response to community concerns about asthma and pollution from nearby oil and gas development activities, ADHSS investigated air pollution and respiratory illness in Nuiqsut in 2003. The 2003 ADHSS study found no significant differences for respiratory visits and asthma in Nuiqsut compared to a similarly sized North Slope village for the years 1998-2002, except for the 10-19 years old age group. Because only one age group had a statistically higher rate of respiratory visits than the control village, it is unlikely that an air pollution source is the cause. If air pollution or another type of environmental contaminant were associated with clinic visits for respiratory conditions, most age groups would likely also see increased rates of respiratory visits. The study concluded that the increase in respiratory visits in Nuiqsut for 10-19 year olds was likely due to a few individuals with numerous clinic visits to address asthma-related problems. (ADHSS SOE, 2003).

COPD

Chronic obstructive pulmonary disease (COPD) is a disease that includes emphysema and chronic bronchitis. It is the most common form of chronic lower respiratory disease in adults. Cigarette smoking is the most common risk factor for COPD, but environmental and genetic factors can also contribute to the development of COPD.

In Alaska, COPD mortality rates have historically been higher among AN than Caucasians. COPD mortality rates have also increased among AN and have remained stable among whites in Alaska. The prevalence of self-reported COPD in the NSB was lower than the prevalence statewide from 2011-2013. For this time period, the prevalence of COPD in the NSB was 4.0% compared to 7.8% for AN statewide and 5.1% for all of Alaska (BRFSS, 2016).

HEC 8: Health Services Infrastructure and Capacity

The NSB and the Arctic Slope Native Association are jointly responsible for delivering health services to NSB residents (NSB, 2012). With the exception of Utqiaġvik, all NSB communities maintain a clinic that is staffed by medical personnel via the Community Health Aide Program (CHAP). These clinics do not have a physician or physician's assistant in residence. The Samuel Simmonds Memorial Hospital (SSMH) is located in Utqiaġvik and is a 14-bed hospital with an outpatient unit that consists of a 6-room clinic and a 2-bed emergency room (Arctic Slope Native Association, 2010). Utqiaġvik is the tertiary care center for the NSB villages; cases are referred to Fairbanks or Anchorage if they cannot be admitted by SSMH. Utqiaġvik also has a community mental health center, a dental clinic, and is the location of the NSB Department of Health and Social Services (NSB, 2012).

Access to services is limited by the remote location of the villages, cost of travel, and severity of the climate (NSB, 2010). Many of the communities in the NSB suffer from chronic health care workforce shortages and turnover (NSB, 2012). The U.S. Health Resources and Services Administration characterizes the NSB as a medically underserved and health professional shortage area (NSB, 2012). In 2016, there were only 0.4 licensed physicians per 1,000 population in the NSB, compared to 2.6 licensed physicians per 1,000 population statewide (ADPH, 2016).

Summary

Areas of Vulnerability

- Access to adequate health services can be limited by cost, difficulty of travel (i.e., weather, logistics), and the capacity of clinics.

Areas of Resilience/Success

- Comprehensive health services are available in Utqiaġvik for residents throughout the NSB service area.

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Appendix E

Wetlands Delineation Report

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Liberty Development Wetland Delineation Report Foggy Island Bay, Alaska

August 2015

Prepared for

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ABBREVIATIONS

AES	ASRC Energy Services Alaska, Inc.
ANSRAM	Arctic North Slope Rapid Assessment Method
ARNI	Aquatic Resource of National Importance
ASA	Aquatic Site Assessment
CWA	Clean Water Act
E1UB	Estuarine Subtidal Unconsolidated Bottom
EPA	Environmental Protection Agency
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
ft	feet
GIS	Geographic Information Services
GPS	Global Positioning System
HGM	Hydrogeomorphic
Hilcorp	Hilcorp Alaska, LLC
L1UBH	Lacustrine Limnetic Unconsolidated Bottom Permanently Flooded
M1UB	Marine Subtidal Unconsolidated Bottom
M2US	Marine Intertidal Unconsolidated Shore
N/A	not applicable
NWI	National Wetland Inventory
OBL	Obligate
OFS	Overall Functional Score
ORM	Operations and Maintenance Business Information Link Regulatory Module
PEM1B/C	Palustrine Emergent Persistent Saturated/ Seasonally Flooded
PEM1C	Palustrine Emergent Persistent Seasonally Flooded
PEM1H	Palustrine Emergent Persistent Permanently Flooded
PUBH	Palustrine Unconsolidated Bottom Permanently Flooded
R2UB	Riverine Lower Perennial Unconsolidated Bottom
TNW	Traditional Navigable Water
UPL	Upland
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VSM	vertical support members
WOUS	Wetlands and Waters of the United States

1.0 Executive Summary

The purpose of this Wetlands and Waters of the United States (WOUS) Delineation Report is to support Hilcorp Alaska, LLC's (Hilcorp's) Liberty Development, east of Deadhorse, Alaska. This information was collected to determine the location and extent of wetlands and other WOUS in the project area which are potentially subject to the jurisdiction of the United States Army Corps of Engineers (USACE) under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act (CWA).

Hilcorp proposes to construct a self-contained offshore drilling and production facility located in the Beaufort Sea Outer Continental Shelf. A 12-inch sales oil pipeline inside a 16-inch outer pipe will transport crude oil from the facility to the Badami Sales Oil Pipeline. The offshore portion of the pipeline will be trenched. The overland portion of the pipeline will be trenched for 350 feet (ft) from the shoreline, and then elevated approximately 7 ft high on vertical support members (VSMs) for most of the remaining distance to the Badami tie-in. The onshore pipeline will go underneath a newly constructed gravel pad (approximately 50 ft x 35 ft) where it intersects with the Badami ice road. A second gravel pad (approximately 170 ft x 155 ft) will be constructed at the pipeline tie-in point with the Badami Pipeline. Hilcorp also proposes to mine gravel from a selected nearby site.

ASRC Energy Services Alaska, Inc., (AES) performed this wetlands and other WOUS delineation in accordance with the USACE Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Alaska Region (Version 2.0) (USACE 2007). AES's fieldwork and mapping efforts found the study area consists of wetlands and other WOUS, with no delineated uplands.

AES performed an Aquatic Site Assessment (ASA) based on the wetland functions and values described by the Arctic Slope Regional Corporation's Wetland Mitigation Bank's "Arctic North Slope Rapid Assessment Method" (ANSRAM). This method includes traditional evaluation of functions and values with specific elements of North Slope interest (e.g. subsistence, *Arctophila fulva*, disturbance impacts, and endangered species). The ASA found that there is a mix of Category I and II wetlands and other WOUS. The wetlands are mostly natural with no human disturbance; but are not rare for the region.

AES performed a review of Jurisdictional Determination for the wetlands under the latest regulatory guidance. The entire project area is found to be one large wetland/WOUS complex which is adjacent and neighboring to the Beaufort Sea, a territorial sea considered to be a Traditional Navigable Water (TNW).

2.0 Introduction

AES has been retained by Hilcorp to conduct wetlands delineation and ASA studies necessary for the CWA permitting. AES conducted a wetlands field survey and ASA for the onshore portion of the project July 22 – 23 and 29 – 30, 2015. The project area encompasses a larger study area than the proposed footprint to facilitate wetland avoidance and minimization evaluation during permitting.

Initially, potential wetlands were pre-mapped using aerial photography and past field experience. Field data was collected to confirm aerial signatures and alterations to the preliminary classifications were made. The focus of the 2015 effort was to determine potential jurisdictional wetlands and other WOUS within the study area.

Hilcorp proposes to construct a self-contained offshore drilling and production facility located in the Beaufort Sea Outer Continental Shelf. A 12-inch sales oil pipeline inside a 16-inch outer pipe will transport crude oil from the facility to the onshore Badami Sales Oil Pipeline. The offshore portion of the pipeline will be trenched. The overland portion of the pipeline will be trenched for 350 ft from the shoreline, and then elevated approximately 7 ft high on VSMs for most of the remaining distance to the Badami tie-in. The onshore pipeline will go underneath a newly constructed gravel pad (approximately 50 ft x 35 ft) where it intersects with the Badami ice road. A second gravel pad (approximately 170 ft x 155 ft) will be constructed at the pipeline tie-in point with the Badami Pipeline. Hilcorp also proposes to mine gravel from a selected nearby site.

3.0 Methods

Wetland field determinations were made using the USACE Wetlands Delineation Manual (Environmental Laboratory 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Alaska Region (Version 2.0) (USACE 2007).

3.1 Literature Review and Desktop Analysis

Prior to the field investigation, existing public information was reviewed to gain specific background knowledge and to identify the potential for wetlands to occur in the study corridor. Documents evaluated as part of the review include, but were not limited to the following:

- U.S. Fish and Wildlife Service (USFWS) (2015) National Wetland Inventory (NWI) maps, digital datasets, and hardcopy maps
- U.S. Geological Survey (USGS) Digital Raster Graphics (i.e., topographic maps)
- Exploratory Soil Survey of Alaska (Rieger et al. 1979)
- Wetland plant lists, including: National List of Vascular Plant Species that Occur in Wetlands, Region A (Reed 1988), the 1997 USFWS update (Reed 1997), and The National Wetland Plant List (Lichvar 2015)
- Wetland Delineation Protocols, including: USACE Wetlands Delineation Manual, Technical Report Y-87-1 (Environmental Laboratory 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Alaska Region (USACE 2007)
- Existing Geographic Information Services (GIS) layers, including: water bodies, contours, and roads
- Existing Land Status GIS layers, including: State of Alaska, Bureau of Land Management, and Native Allotments.

3.2 Pre-mapping

Scientists pre-mapped the study area based on interpretation of aerial photos. This effort was completed by digitizing wetland boundaries in a GIS geodatabase. Wetland types and boundaries were determined based on the following set of parameters:

- Vegetation patterns: Communities of vegetation display habitat breaks; with wetland communities adapted to saturated conditions generally having low plant height.
- Visual evidence of saturated soils: Surface water is identified directly and darkened areas in the photography strongly indicate saturated conditions. The proximity to open water, streams, and marshes was also used as an indicator.
- Topography: Evidence of depressions, toes of slopes, and relatively flat areas indicate areas of potentially poor drainage of soils.

Determinations of upland areas will be made by scientists when the aerial photography lack evidence of soil saturation, or topographic conditions indicate areas of well-drained soils.

Once pre-mapping of the corridor was completed, AES placed wetland determination points in areas to confirm and modify pre-mapping. Wetland determination points were uploaded to a Global Positioning System (GPS) device for field data collection.

3.3 Field Confirmation Survey

A field study was conducted to confirm and modify the wetland mapping. At each wetland point a detailed assessment of the wetland parameters was conducted and recorded on USACE Wetland Determination Data Forms specific to the Alaska Region. For wetlands, this includes filling out all relevant entries on the Wetland Determination Data Form and the Wetlands Functional Assessment Data Sheet. Soil pits were dug at each wetland determination data point to facilitate soil data collection. AES also documented other WOUS such as streams and deepwater habitats that do not meet the definition of a wetland. Observation points were completed where vegetation, hydrology, and general site characteristics are similar to places where a full point was completed. In large study areas, observation points allow field personnel to use their best professional judgment to extrapolate data from Full Points into other similar areas.

Field determination of wetlands were based on the three-parameter approach using vegetative, hydric soils, and hydrological characteristics, as described in the USACE Wetlands Delineation Manual (Environmental Laboratory 1987) and Alaska Regional Supplement (USACE 2007). Unless a data point is located in an area considered to be atypical, a problem area, or a deep-water or stream habitat, all three field indicators (hydrophytic vegetation, hydric soils, and wetland hydrology) must be present to be defined as a wetland using current approved methodology.

3.3.1 Vegetation

Hydrophytic vegetation includes macrophytic plants adapted to habitats where frequency and duration of inundation or soil saturation exerts strong selective pressures on plant species presence/absence. At each data collection point, plant species were identified using the following reference materials:

- Alaska Trees and Shrubs (Viereck and Little 2007)
- Wetland Sedges of Alaska (Tande and Lipkin 2003)
- Field Guide to Alaskan Wildflowers (Pratt 1989)
- Toolik Field Station Herbarium (Institute of Arctic Biology 2015)

Percent cover of vegetation was estimated within a designated radius of the sample point. A plant indicator status, as designated by the USFWS, was assigned to each plant species from the following categories: Obligate Wetland (OBL), Facultative Wetland (FACW), Facultative (FAC), Facultative Upland (FACU), and Obligate Upland (UPL). The vegetation community was evaluated using the Dominance Test Indicator and the Prevalence Index Indicator method (USACE 2007). The Dominance Test Indicator is more appropriate for plant communities dominated by only a few individuals. The prevalence test is more comprehensive; it accounts for all species present in the plot. Vegetation was considered hydrophytic if either test is satisfied, unless a disturbed or problematic wetland situation exists.

3.3.2 Soils

Hydric soils are generally saturated, flooded, or ponded long enough during the growing season to become anaerobic in the upper soil horizon. Soils were sampled and evaluated for hydric soil indicators at all full points. Primary hydric soil indicators in Alaska include histosols, histic epipedons, hydrogen sulfide, thick dark surface, Alaska gleyed, Alaska Redox, and Alaska gleyed pores (USACE 2007). At wetland determination data points soil pits were excavated using a shovel or soil auger to a depth sufficient to document the presence or absence of hydric soil field indicators. Soil matrix color and redoximorphic features were identified according to Munsell Soil Color Charts (2009). Soil pits are generally excavated to a minimum of 20 inches below ground surface. However, soil pits may be analyzed to a shallower depth if a restrictive or confining layer is encountered, or deeper than 20 inches if it is required to confirm the presence of a field indicator. The soil profile was described on the USACE data sheet.

3.3.3 Hydrology

Wetland hydrology indicators show that water accumulates at or near the surface for extended periods during the growing season. Direct observations of wetland hydrology are often limited during some portions of the growing season, but typical primary indicators include: surface water, high water table or saturation, water marks, sediment deposits, or drift deposits. These are particularly difficult during 2015, which was a low precipitation year for the area. Typical secondary indicators can include: drainage patterns, oxidized or reduced root channels, stunted or stressed plant cover, water-stained leaves or sediment deposits, and presence of reduced iron. Field indicators of hydrology are satisfied if one primary or two secondary field indicators are observed. Certain indicators present throughout the year can be used to confirm the occurrence of saturation or inundation for periods of time, which satisfy USACE wetland delineation criteria (Environmental Laboratory 1987; USACE 2007).

3.4 Wetland Aquatic Site Assessment (a.k.a. Functions and Values)

Wetland ‘aquatic site assessments’ and ‘functions and values assessments’ are different terms for the same regulatory requirements. Our assessment methodology focuses on providing a rapid Level 1 quantitative assessment over the wetland functions and values described by the ANSRAM method (below). Conceptually the wetland is broken into parts, and evaluated on a series of questions about wetland functions and values. These responses determine the relative value of the wetland. Wetlands determined to be ‘exceptional habitat’ are automatically rated at the highest value. Finally, if necessary, a disturbance shadow is incorporated (similar to the Anchorage Credit and Debit method) to account for impact zones around non-pristine wetlands.

To use this methodology, each wetland parcel is mapped into general Cowardin units following the NWI system and assigned separate hydrogeomorphic (HGM) classifications (Magee 1998). These HGM classes (Riverine, Depressional, Lacustrine Fringe, Tidal Fringe, Slope, and Flat) break wetlands into their broad functional differences. This component of the assessment is important because not all HGM classes perform a particular function to the same level as another HGM class. Grouping wetlands by HGM allows for a consistent approach. It is important to understand that while each wetland was grouped by HGM, they still maintained their Cowardin class (e.g. Flat PSS1C or Depressional PUBH).

Each wetland provides a combination of the following 10 functions and values depending on its specific role in the ecosystem (as described in the ANSRAM):

- Flood flow alteration
- Sediment removal
- Nutrient and toxicant removal
- Erosion control and shoreline stabilization
- Production of organic matter and its export
- General habitat suitability
- General fish habitat
- Native plant richness

- Educational or scientific value
- Uniqueness and heritage

A rapid qualitative assessment is conducted over the 10 standard wetland functions and values to evaluate the level of service the wetland provides to the ecosystem. These yes/no/not-applicable questions evaluate the wetland on basic observable characteristics which are displayed by typical wetlands with high service levels for the particular function or value.

Depending on the individual wetland and/or the HGM classification, some evaluation questions may be determined to be 'Not Applicable' (on a case by case basis). For example, large rivers rarely have >50 percent aerial cover of herbaceous plant coverage. It is important while evaluating a wetland to remember the difference between a wetland poorly providing a function (rating of 'no') and a wetland not naturally providing a function (rating of 'N/A', not applicable). A 'no' rating is an indication of dysfunction.

Once the rapid qualitative assessment is complete, an individual score is calculated for each of the 10 functions. Each functions' evaluation questions are averaged to generate an individual function or value score (Yes = 1, No = 0, N/A = not included in the average). Then all of the wetland functions and value individual scores are averaged over the individual wetland to generate the preliminary Overall Functional Score (OFS). This preliminary OFS combines the 10 standard wetland functions and values. Again, functions and values evaluated as not applicable are not included in the average.

Exceptionally important habitat (Section 3.4.1) or local disturbance category (Section 3.4.2) is also incorporated into the rapid assessment by adjusting the preliminary OFS to generate a final OFS (Section 3.4.3). This ensures accurate representation for these difficult to quantify wetland impacts.

3.4.1 Exceptional Habitat Designation

The analysis can designate wetlands as 'exceptional habitat' (and an automatic full rating) for a variety of reasons. If any agency considers the wetland to be an Aquatic Resource of National Importance (ARNI), the rating is automatically fulfilled. The habitat can also be exceptional if the area is considered irreplaceable or has unique features not found anywhere else on the North Slope. This exceptional designation allows project managers to incorporate these rare habitat designations into the evaluation.

3.4.2 Disturbance Category

The evaluation of existing disturbance impacts near a wetland was based off of the methodology of the Anchorage Debit Credit Method (Dean 2011). First, disturbances are mapped on the project. Then disturbance categories are evaluated from Table 3.4-1, and translated into buffers around the disturbance and the Impact Factor (Table 3.4-2). The preliminary OFS is then adjusted for local disturbance/development (preliminary OFS * Impact Factor = final OFS). These methods incrementally decrease the value of a wetland due to different types of disturbances and their proximity to the wetland.

Table 3.4-1 Disturbance Categories

Type of Activity		Activity Detail	Disturbance Category
None	No activity	N/A	0
Commercial	Motel, office building, restaurant, storage facility, store	N/A	3
Industrial	Heavy equipment parking, repair, storage	N/A	3
	Manufacturing	N/A	
	Material extraction, processing, storage, treatment, disposal	N/A	
	Office building	N/A	
Transportation & Shipping	Automobile	Driveway, non-residential	3
		Parking lot	
		Road, including associated trails	
	Aviation facility	Airport	
	Culverted crossing	Diameter ≥ bankfull width	2
		Diameter < bankfull width	3
	Port facility	Dock	
	Railroad	Loading/unloading, office, storage	
		Track (away from rail facilities)	2
Utilities	Office building	N/A	3
	Substation	N/A	2
	Utility line	≤ 10 feet wide surface disturbance and winter construction (only if new)	1
		> 10 feet wide surface disturbance or non-winter construction (only if new)	2

Notes:
Extend a 300-feet buffer from edge of existing impact zone to see if there is contact with wetland area. Evaluate disturbance impacted polygon separately.
If there is more than one disturbance activity for a polygon (i.e., if there are multiple activities), use the activity with the highest disturbance category score present, the total is not cumulative.

Table 3.4-2 Disturbance Category and Impact Factor

Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9

3.4.3 Final OFS

The final OFS provides a simple quartile category (I/II/III/IV) with a point estimate ranging from 0 – 1.00 to provide a repeatable quantitative evaluation for all of the functions and values the wetland provides to the ecosystem (Table 3.4-3).

Table 3.4-3 Final Overall Functional Score (OFS) Scale and Category

OFS	Category	
0.76 - 1.00	I	Highest Value
0.51 - 0.75	II	
0.26 - 0.50	III	
0 - 0.25	IV	Lowest Value

3.5 Post-Field Mapping

Field data was collected using GPS units and hard copy field maps. These locations and wetland data were electronically transferred to the existing geodatabase. The field data was used to update existing wetland mapping with new information (including functional assessment data). These updated data were incorporated into the geodatabase containing all project wetlands data. The wetlands mapping was then used to calculate approximate acreage of wetlands located in the project area.

3.6 Jurisdictional Determination

The USACE regulates wetlands and other WOUS that are under their jurisdiction. The Environmental Protection Agency (EPA) guidance outlines that the USACE has jurisdiction in eight specific cases (CFR 2015):

> “The first three types of jurisdictional waters, traditional navigable waters, interstate waters, and the territorial seas, are jurisdictional by rule in all cases.
>
> The fourth type of water, impoundments of jurisdictional waters, is also jurisdictional by rule in all cases.
>
> The next two types of waters, ‘‘tributaries’’ and ‘‘adjacent’’ waters, are jurisdictional by rule, as defined, because the science confirms that they have a significant nexus to traditional navigable waters, interstate waters, or territorial seas. For waters that are jurisdictional by rule, no additional analysis is required.
>
> The final two types of jurisdictional waters are those waters found after a case-specific analysis to have a significant nexus to traditional navigable waters, interstate waters, or the territorial seas, either alone or in combination with similarly situated waters in the region.”

While in the field, wetland scientists observed jurisdictional relationships, and provided jurisdiction opinions (see Section 4) under agency guidance, which defines (CFR 2015):

- “Adjacent” as: bordering, contiguous, or neighboring, including waters separated from other “waters of the United States” by constructed dikes or barriers, natural river berms, beach dunes and the like.
- “Neighboring” as: (1) Waters located in whole or in part within 100 feet of the ordinary high water mark of a traditional navigable water, tributary, etc. (2) Waters located in the 100-year floodplain and that are within 1,500 feet of the ordinary high water mark of a traditional navigable water, tributary, etc. (“floodplain waters”). (3) Waters located within 1,500 feet of the high tide line of a traditional navigable water or the territorial seas

AES created the Operations and Maintenance Business Information Line Regulatory Module (ORM) spreadsheet for the USACE. AES listed a new line for each polygon delineated in the study. The “Waters_Name” is a concatenation of (Cowardin Code) with (FoggyIslandBay) with (GIS FID Number). If a different ORM input strategy is desired, we can work with the USACE to deliver the needed information.

4.0 Results

Field investigations were conducted on July 22 – 23 and 29 – 30, 2015 at multiple field points. Data was only collected on the second field trip, as fog was too dense to fly on the first field trip. These dates align with the recommended field sampling conditions for the area to observe maximum hydrology (USACE 2007). Field conditions were drier than normal, as yearly precipitation was below usual averages (Table 4.0-1). This dry year was an important consideration while observing wetland soil and hydrology indicators.

Table 4.0-1 Average Total Precipitation (in) for Deadhorse, Alaska (WRCC 2015)

	January	February	March	April	May	June	July
1986-1999	0.2”	0.17”	0.14”	0.08”	0.09”	0.39”	0.68”
2015	0	0	0	0	0.07”	0.27”	0.05”

4.1 Wetlands

Foggy weather limited field efforts, but data was collected at 13 sample points. These points were spaced throughout the project area and are documented in Appendix A and field mapping in Appendix B. Table 4.1-1 is a summary of the wetland determinations made at each of these sites and acreages found over the project. Waters of the United States, including streams, lakes, and ponds were mapped using aerial photography and information gathered from the sites.

Table 4.1-1 Wetlands and Waters of the United States Sample Points

Type	Full Points	Observation Points	Onshore/Nearshore Section 10/404 Acres	Offshore Section 10 Acres
Wetlands				
Emergent:				
PEM1B/C	1, 2, 4, 6, 7, 8, 10	-	1,044.14	
PEM1C	3, 5	-	356.76	
PEM1H	9	-	172.25	
PUBH	Aerial/Satellite observations	-	82.25	
Other Waters of the United States				
Lower Perennial River:R2UB	-	4B	7.73	
Lake: L1UBH	-	5B	179.93	
Marine: M1UB, M2US	-	3B	1,080.81	225.19
Estuarine: E1UB	Aerial/Satellite observations	-	23.95	

PEM1B/C: Palustrine Emergent Persistent Saturated/Seasonally Flooded
PEM1C: Palustrine Emergent Persistent Seasonally Flooded
PEM1H: Palustrine Emergent Persistent Permanently Flooded
PUBH: Palustrine Unconsolidated Bottom Permanently Flooded
R2UB: Riverine Lower Perennial Unconsolidated Bottom
L1UBH: Lacustrine Limnetic Unconsolidated Bottom Permanently Flooded
M1UB: Marine Subtidal Unconsolidated Bottom
M2US: Marine Intertidal Unconsolidated Shore
E1UB: Estuarine Subtidal Unconsolidated Bottom

4.1.1 Emergent Wetlands (PEM1B/C, PEM1C, PEM1H)

Emergent wetlands are dominated by herbaceous angiosperms, and are the primary vegetated ecosystem in the project area. Different types of emergent wetlands were observed due to the interaction of permafrost and variances in hydrologic regime on the landscape.

Wetlands with saturated hydrological regimes (PEM1B/C) are characterized by having soils periodically saturated with water during the growing season. These had the greatest variety in characteristics over the study area. Almost all of these had patterned ground formed from ice wedges being thrust to the surface, creating small rises and depressions throughout the area. We examined the rises and depressions for the possibility of wetland/upland mosaics, but found that the highest, driest rises still had wetland vegetation and soil characteristics. Saturation and/or high water tables were found in the depressions of the patterned ground. These PEM1B/C areas had a variety of vegetation, including very low shrubs such as *Salix* and *Arctous*, and herbs like *Eriophorum* and *Carex*. Soil profiles tended to have shallow permafrost, with organics observed. Hydrology is expected to perch on top of the shallow permafrost during spring snowmelt, flooding, and/or precipitation events to create anoxic conditions during the growing season.

Wetlands with seasonally flooded hydrological regimes (PEM1C) are characterized by having soils seasonally inundated with water during the growing season. These areas had greater high centered polygon topographic relief. We examined the high parts of these polygons for the possibility of upland/wetland mosaics; but found no evidence to support that type of problematic wetland. The depressions indicated evidence of seasonal flooding. PEM1C wetlands had a large number of very small shrubs present including small *Salix* and *Dryas*, along with large amounts of *Carex*. Soil profiles consisted of histic epipedons, with ~8 inches of saturated fibric organic and deeper layers of darker mineral soils. These are due to the colder arctic temperatures and the anaerobic conditions due to the seasonal flooding.

Wetlands with permanently flooded hydrological regimes (PEM1H) are characterized by having soils frequently inundated with water during the growing season. These were low centered polygonal tundra, with large polygons and shallow water tables. These areas have relatively deep permafrost (15 inches) and thick layers of fibric organic material developed from the longer anaerobic conditions caused by permanent flooding. Few shrubs were present and vegetation consisted of *Carex* and *Eriophorum*.

4.1.2 Ponds (PUBH)

Ponds are a special type of wetlands in depressional areas with unconsolidated bottoms and permanently flooded hydrological regimes. When compared to lakes; ponds are shallower, so that air (rather than water) is the principal medium where plants grow in (Cowardin 1979). On the North Slope, ponds are often less than 20 acres large. There are a great number of ponds in the project area. These have a variety of wetland dependent plants supporting waterfowl and other types of wildlife. Observation of ponds are considered evidence enough of wetland presence, and we do not dig soil pits in them. Typically, in winter free water can be present in ponds on the North Slope deeper than 5 ft.

4.1.3 Rivers (R2UB)

Riverine systems are present in the study area, with bed and bank features and ordinary high water lines. These river systems convey waters through the flat topography to the Beaufort Sea. These are low gradient systems, and water velocity is slow. Water may flow throughout the year; but given the harsh conditions of the Arctic, some flow may be seasonal. The substrate was observed to be sand and mud.

No signs of fish were observed, and the Alaska Department of Fish and Game does not list Anadromous Fish Streams in the study area.

4.1.4 Lakes (L1UBH)

Lakes are permanently flooded lands where water (rather than air [in the case of ponds]) is the primary medium plants grow in (Cowardin 1979). Lakes have complicated characteristics on the North Slope, often with very shallow banks, large littoral zones, and polygonal bathymetry due to the underlying permafrost. Some lakes freeze solid during the winter, while others are deep enough to have free water at depths greater than 5 feet. On the North Slope, lakes are often greater than 20 acres. The large littoral zones of lakes were found to often support dense habitats of aquatic vegetation. Aerial observation of lakes was considered evidence to support delineation, and we do not dig soil pits to support their documentation.

4.1.5 Marine (M1UB, M2US)

The northern area of the project is the Beaufort Sea. This saltwater TNW is the dominate habitat for the project. It is fairly shallow, cold, and abuts the shoreline with small (3-5 foot) bluffs where permafrost is eroding into the ocean. Cold arctic winds circulate, keeping vegetation small and stunted, and the majority of the year the ocean is covered in sea ice. The Beaufort Sea was observed to be bordering, contiguous, or neighboring the entire wetland complex that is the project area.

4.1.6 Estuary (E1UB)

On the far western edge of the project area is a small estuary system which appears to hold brackish water, and be the floodplain for some riverine systems. These areas are important transition zones between salt and freshwater environments, and provide a location for turbidity to fall out prior to entering the ocean. These locations can also provide some fish species overwintering habitat. As freshwater areas freeze shut, estuaries can be refuges for typically salt water species.

4.2 *Arctophila fulva*

Arctophila fulva is an herbaceous plant which is of particular interest to conservation agencies due to its importance to waterfowl habitat. This plant has been identified to be important for many species including Endangered Species Act Steller's eiders; which seasonally inhabit the North Slope. Studies near Barrow have found that most (80 percent) Steller's eider broods are in *Arctophila fulva* habitat (Quakenbush et al. 2004).

While conducting our wetland survey we observed and noted the presence/absence of *Arctophila fulva* in the study area (Appendix B). In the study area *Arctophila fulva* is found at the edges between L1UBH-PEM1B/C and R2UB-PEM1B/C wetland areas. It is also found in the non-polygonal M2US-PEM1B/C wetland areas near the northwest of the project area. These are where wetlands border bodies of water that have seasonal periods of surface water. In these locations, *Arctophila fulva* is dense and ubiquitous where it has not been heavily grazed. Many flocks of waterfowl and geese were observed in the *Arctophila fulva* areas.

Arctophila fulva was not found in central region of the study area, where proposed development is planned. These non-*fulva* areas are along the L1UBH-PEM1B/C or L1UBH-PEM1H border areas. These habitats have better banks; without the gently increasing gradient in water depth that *Arctophila fulva* appears to prefer.

The *Arctophila fulva* areas are present on the western half of the study area, with a small presence around the unnamed river on the far eastern edge (Appendix B, Figure 2-23). We hypothesize that this species occupies a specific ecological niche. Areas must not be too dry or too wet for growth. A gradient in water depth appears to be important. Waterfowl and geese were observed only in the *Arctophila fulva* areas, which align with Ducks Unlimited research (Ducks Unlimited Inc 1998).

4.3 Aquatic Site Assessment

The ASA (Table 4.3-1, Appendix C) found that most of the wetlands were pristine and high functioning; but not: rare, unique, being used for science, or under threat from upstream sediments or toxins. All other WOUS (marine, estuaries, lakes, and rivers) in Alaska are automatically rated as Category I.

One disturbance was delineated, the Badami Pipeline, which borders the study area on the southern boundary. No disturbance was observed to wetlands in the area. Wetlands were evaluated with the disturbance buffer; but it was found that they rated the same category as without the disturbance buffer. For simplicity, we propose not to include disturbance buffers on this project.

The wetlands rated highly due to erosion control, flood flow alteration, general habitat, and native plants. All of the categories reflect that the habitats had high densities of vegetation, which was well rooted, pristine, and native. These provide great wildlife habitat, especially for waterfowl and caribou.

Some wetlands were not found to have all the characteristics needed for North Slope Category I classifications. Primarily, these wetlands are not rare for the North Slope, and similar habitats are found over millions of acres in the same Alaskan North Slope wetland complex. The wetland functions provided by these wetlands are not unique, and do not comprise a significant portion of the wetland services provided by the entire North Slope. These wetlands also do not have toxin or sediment threats observed; which are key to being high valued for those two functions. Finally, while mostly pristine, these wetlands have little evidence of being used for science or education. Science or education efforts tend to take place closer to logistic centers; as travel to the study area is difficult and expensive.

Wetlands in the project area are evaluated as Category I or II (Table 4.3-1 and Table 4.3-2). We also mapped the areas of Marine Boulder Patches and *Arctophila fulva* as Category I+, to illustrate their location (Appendix B). According to previous USACE guidance, sample ratios for compensatory mitigation may be (USACE 2015):

- Category I or II:
    - 3:1 for Preservation and
    - 2:1 for Restoration/Enhancement
- Category II or III:
    - 2:1 for Preservation and
    - 1:1 for Restoration/Enhancement

Table 4.3-1 Aquatic Site Assessment: Sample Points

Sample Point	HGM	Cowardin	Flood Flow Alteration	Sediment Removal	Nutrient and Toxicant Removal	Erosion Control and Shoreline Stabilization	Production of Organic Matter and its Export	General Habitat Suitability	General Fish Habitat	Native Plant Richness	Educational or Scientific Value	Uniqueness and Heritage	Final Overall Functional Score	Category
1	Flats	PEM1B/C	0.67	0.60	0.67	1.00	0.75	0.60	N/A	1.00	1.00	0.43	0.746	II
2	Flats	PEM1B/C	0.67	0.60	0.67	1.00	0.75	0.80	N/A	1.00	1.00	0.71	0.800	I
3	Flats	PEM1C	0.80	0.40	0.67	1.00	0.80	1.00	N/A	1.00	1.00	0.71	0.820	I
4	Flats	PEM1B/C	0.43	0.60	0.67	0.33	0.80	0.80	N/A	1.00	1.00	0.71	0.705	II
5	Flats	PEM1C	0.71	0.60	0.67	1.00	0.60	1.00	N/A	1.00	1.00	0.43	0.779	I
6	Flats	PEM1B/C	0.80	0.40	0.67	1.00	0.60	1.00	N/A	1.00	1.00	0.57	0.782	I
7	Flats	PEM1B/C	0.67	0.40	0.33	1.00	0.60	1.00	N/A	1.00	1.00	0.71	0.746	II
8	Flats	PEM1B/C	0.67	0.40	0.67	1.00	0.80	1.00	N/A	1.00	1.00	0.57	0.789	I
9	Flats	PEM1H	0.71	0.60	0.67	1.00	1.00	1.00	N/A	1.00	1.00	0.57	0.839	I
10	Flats	PEM1B/C	0.50	0.20	0.33	1.00	0.40	1.00	N/A	1.00	1.00	0.29	0.635	II

Table 4.3-2 Aquatic Site Assessment: Total Study Area

Type		Acres	Functional Category	Sample Point
Wetlands				
	PEM1B/C	619.89	I	2, 6, 8
		424.25	II	1, 4, 7, 10
	PEM1C	356.76	I	3, 5
	PEM1H	172.25	I	9
	PUBH	82.25	I	-
Waters of the United States				
Lower Perennial River:	R2UB	7.73	I	-
Lake:	L1UBH	179.93	I	-
Marine:	M1UB, M2US	1,306.00	I	-
Estuarine:	E1UB	23.95	I	-

4.4 Jurisdictional Determination

The presence of wetlands and other WOUS were analyzed under the USACE/EPA CWA Guidance described in the methods.

The TNW relevant to this study is the Beaufort Sea, which is the northern border of the study area. All wetlands were observed to be adjacent to the Beaufort Sea. All other WOUS were observed to be tributaries to the Beaufort Sea. All other WOUS had bed and bank features and indicators of ordinary high water marks.

The entire project area is found to be one large wetland/WOUS complex which is adjacent and neighboring to the Beaufort Sea, a territorial sea considered to be a TNW.

Due to these findings, our study finds that all wetlands and other WOUS in the study area are jurisdictional and that the USACE will assert jurisdiction under Section 10 of the Rivers and Harbors Act and Section 404 of the CWA. The ORM input datasheet is included as Appendix D.

5.0 Discussion

This report is the result of fieldwork and analysis conducted to support Hilcorp's Liberty Development. The report describes the results of field data collected in the summer of 2015, aerial photography, and many years of experience delineating wetlands and associated habitats on the North Slope. We provide our analysis and results for the wetland delineation, ASA, and jurisdictional status following the latest USACE and EPA guidance. We conducted more detailed analysis for a species of particular conservation concern (*Arctophila fulva*) and describe where the species is located in the project area. At this time proposed development is expected to avoid areas of *Arctophila fulva.* We conclude that there is a mix of Category I and II wetlands and other WOUS in the project area; which are mostly natural with no human disturbance, but are not rare for the region. The USACE appears to have jurisdiction due to all of the wetlands and other WOUS being adjacent and neighboring to the WOUS complex flowing into the Beaufort Sea.

The study area is subject to the jurisdiction of the USACE under Section 10 of the Rivers and Harbors Act and Section 404 of the CWA. The offshore marine waters (>3 nautical miles) are subject to Section 10 of the CWA. The nearshore marine waters (<3 nautical miles) are subject to Section 10 and Section 404 of the CWA. The onshore wetlands and other WOUS are subject to the Section 404 of the CWA.

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Appendix A
Data Points

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WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	1
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)	Flat		
Local relief (concave, convex, none)	Beach	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.21357	Long	147.7293
Datum	N/A				
Soil Map Unit Name	N/A	NWI Classification	PEM1B/C		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	x	
Hydric Soil Present?	x	
Wetland Hydrology Present?	x	
Is the Sampled Area within a Wetland?	x	

Remarks: 835-838 Near beach with primary vegetation

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover	0	20% of total cover	0
1					
2					
3					
4					
5					
6					
		Total Cover	0		
Herb Stratum		50% of total cover	0	20% of total cover	0
1	arcful	Arctophila fulva	80	YES	OBL
2	erivag	Eriophorum vaginatum	15	NO	FACW
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	95		
		50% of total cover	47.5	20% of total cover	19

Plot size (radius, or length x width) 100ft radius % Bare Ground 20

% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0

Remarks: Unknown carex with no seed heads (50%)

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	1	(A)
Total Number of Dominant Species Across All Strata:	1	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:	
OBL species	80	x 1 =	80	
FACW species	15	x 2 =	30	
FAC species	0	x 3 =	0	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	110	(B)
Prevalence Index = B/A =			1.16	

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

Y Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes x No ___

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-17								Fibric Organic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- X Histosol or Histel (A1)
- Histic Epipedon (A2)
- Hydrogen Sulfide (A4)
- Thick Dark Surface (A12)
- Alaska Gleyed (A13)
- Alaska Redox (A14)
- Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- Alaska Color Change (TA4) [4]
- Alaska Alpine Swales (TA5)
- Alaska Redox With 2.5Y Hue
- Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- Other (Explain in Remarks)

[3]One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 17

Hydric Soil Present? Yes x **No**

Remarks: Saturation inferred from the location, permafrost and all the hydrology indicators. This is a dry summer.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- x Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- x Water Marks (B1)
- x Sediment Deposits (B2)
- x Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- x Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-stained Leaves (B9)
- x Drainage Patterns (B10)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Salt Deposits (C5)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- x Shallow Aquitard (D3)
- x Microtopographic Relief (D4)
- x FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x		0
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	1
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	835-838 Near beach with primary vegetation		

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WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	2
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)	Hummocks		
Local relief (concave, convex, none)	High and low microtopo	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.2064	Long	147.71385
Datum	N/A				
Soil Map Unit Name	N/A	NWI Classification	PEM1B/C		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes x No ___**

Remarks: 839-842. Hummocks near beach. Not a upland/wetland matrix due to wetland plants and soils being everywhere (Alaska Supplement Definition)

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum	Code	Species	Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover: 0		20% of total cover:	0
1	dryint	Dryas integrifolia	30	YES	FACU
2	arcrub	Arctous ruber	10	YES	FAC
3	salova	Salix ovalifolia	10	YES	FAC
4					
5					
6					
		Total Cover	50		
Herb Stratum		50% of total cover: 25		20% of total cover:	10
1	equsci	Equisetum scirpoides	10	YES	FACU
2	arcarc	Arctanthemum arcticum	5	YES	FACW
3	erivag	Eriophorum vaginatum	5	YES	FACW
4					
5					
6					
7					
8					
9					
10					
		Total Cover	20		
		50% of total cover: 10		20% of total cover:	4

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	20	x 3 =	60
FACU species	40	x 4 =	160
UPL species	0	x 5 =	0
Column Totals:	70 (A)		240 (B)

Prevalence Index = B/A = 3.43

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

No Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** x **No** ___

Plot size (radius, or length x width): 100ft raadius | % Bare Ground: 20

% Cover of Wetland Bryophytes: 0 | Total Cover of Bryophytes: 0

Remarks: unknown carex with no seed heads (100%)

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-8								Fibric Organic
8-17	10YR3/2							Loamy sand

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol or Histel (A1)
- [x] Histic Epipedon (A2)
- [ ] Hydrogen Sulfide (A4)
- [ ] Thick Dark Surface (A12)
- [ ] Alaska Gleyed (A13)
- [ ] Alaska Redox (A14)
- [ ] Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- [ ] Alaska Color Change (TA4) [4]
- [ ] Alaska Alpine Swales (TA5)
- [ ] Alaska Redox With 2.5Y Hue
- [ ] Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- [ ] Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 17

Hydric Soil Present? Yes x No

Remarks

Histic epipedon due to dark soil under fibric organic. Saturation inferred from shallow aquitard, dry summer, and microtopo relief. This hole was dug on the highest, dryest site that could be found in the area. Thin layers are expected in cold climates.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [x] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water-stained Leaves (B9)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Salt Deposits (C5)
- [x] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [x] Shallow Aquitard (D3)
- [x] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x		0
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes x No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks

Dry year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat on the low sides of the polygons.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	2
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	839-842. Hummocks near beach. Not a upland/wetland matrix due to wetland plants and soils being everywhere (Alaska Supplement Definition)		

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	3
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)	Frost Heaves		
Local relief (concave, convex, none)	Highs and Lows	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.20286	Long	147.69737
Datum	N/A				
Soil Map Unit Name	N/A	NWI Classification	PEM1C		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes** x **No** ___

Remarks: 843-846 Wetland frost heaves with low points between. Both highs and lows are wetlands. Point taken on highest, dryest point we could find.

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum	50% of total cover	0	20% of total cover	0	
1	arcrub	Arctous ruber	40	YES	FAC
2	salova	Salix ovalifolia	25	YES	FAC
3	dryint	Dryas integrifolia	10	NO	FACU
4	drydru	Dryas drummondii	2	NO	FACU
5					
6					
		Total Cover	77		
Herb Stratum	50% of total cover	38.5	20% of total cover	15.4	
1	erivag	Eriophorum vaginatum	3	YES	FACW
2					
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	3		
	50% of total cover	1.5	20% of total cover	0.6	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	3	x 2 =	6
FAC species	65	x 3 =	195
FACU species	12	x 4 =	48
UPL species	0	x 5 =	0
Column Totals:	80 (A)		249 (B)

Prevalence Index = B/A = 3.11

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

No Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Plot size (radius, or length x width) 100ft radius % Bare Ground 10

% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0

Hydrophytic Vegetation Present? **Yes** x **No** ___

Remarks: Unknown Carex with no seed head (80%)

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
0-9								Fibric Organic
9-15	10YR3/2							Sandy Loam

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol or Histel (A1)
- [x] Histic Epipedon (A2)
- [ ] Hydrogen Sulfide (A4)
- [ ] Thick Dark Surface (A12)
- [ ] Alaska Gleyed (A13)
- [ ] Alaska Redox (A14)
- [ ] Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- [ ] Alaska Color Change (TA4) [4]
- [ ] Alaska Alpine Swales (TA5)
- [ ] Alaska Redox With 2.5Y Hue
- [ ] Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- [ ] Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 15

Hydric Soil Present? Yes: x No:

Remarks: Histic epipedon due to top layer of organics and dark sandy loam under. This is a dry year, and we would expect to see saturation at some point during the growing season, expecially during the spring. Permafrost would perch snowmelt. Point taken at highest point we could find. Thin layers are expected from cold climates.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [x] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water-stained Leaves (B9)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Salt Deposits (C5)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [x] Shallow Aquitard (D3)
- [x] Microtopographic Relief (D4)
- [x] FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x		0
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes: x No:

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry year and we surveyed during a hot and dry month. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat at the low points.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	3
Investigator(s):	Ryan Cooper, Kiel Kenning		

Remarks

843-846 Wetland frost heaves with low points between. Both highs and lows are wetlands. Point taken on highest, dryest point we could find.

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WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	3B
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	70.20306 147.69678 Eroded Shoreline Photos:847-848 Wet due to permafrost and microtopographic relief		

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WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	4
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)			terrace
Local relief (concave, convex, none)	Flat area above river	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.20931	Long	147.73663
Datum	N/A				
Soil Map Unit Name	N/A			NWI Classification	PEM1B/C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes** x **No** ___

Remarks: 849-852 River terrace next to stream

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover: 0		20% of total cover: 0	
1	salova	Salix ovalifolia	5	YES	FAC
2					
3					
4					
5					
6					
		Total Cover	5		
Herb Stratum		50% of total cover: 2.5		20% of total cover: 1	
1	arcful	Arctophila fulva	40	YES	OBL
2	erivag	Eriophorum vaginatum	10	YES	FACW
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	50		
		50% of total cover: 25		20% of total cover: 10	

Plot size (radius, or length x width) 100ft radius % Bare Ground 80

% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0

Remarks: Minuartia arctica (60%) is NI

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	3	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	100%	(A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:	
OBL species	40	x 1 =	40	
FACW species	10	x 2 =	20	
FAC species	5	x 3 =	15	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	55	(A)	75	(B)
Prevalence Index = B/A =			1.36	

Hydrophytic Vegetation Indicators:

- Y Dominance Test is >50%
- Y Prevalence Index is ≤3.0
- ___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** x **No** ___

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
0-8								Fibric Organic
8-20	10YR5/2							Sand

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

	Histosol or Histel (A1)
x	Histic Epipedon (A2)
	Hydrogen Sulfide (A4)
	Thick Dark Surface (A12)
	Alaska Gleyed (A13)
	Alaska Redox (A14)
	Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

	Alaska Color Change (TA4) [4]
	Alaska Alpine Swales (TA5)
	Alaska Redox With 2.5Y Hue
	Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
	Other (Explain in Remarks)

[3]One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: none

Depth (inches):

Hydric Soil Present? Yes x **No**

Remarks

Histic epipedon due to organics and dark soils under the top layer. Saturation is inferred from seasonal spring flooding and microtopo relief. Surface soil cracks are also apparent. Sand is possible due to historic streambed wandering.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

x	Surface Water (A1)		Inundation Visible on Aerial Imagery (B7)
x	High Water Table (A2)		Sparsely Vegetated Concave Surface (B8)
x	Saturation (A3)		Marl Deposits (B15)
	Water Marks (B1)		Hydrogen Sulfide Odor (C1)
	Sediment Deposits (B2)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Other (Explain in Remarks)
	Algal Mat or Crust (B4)		
	Iron Deposits (B5)		
x	Surface Soil Cracks (B6)		

Secondary Indicators (2 or more required)

	Water-stained Leaves (B9)
	Drainage Patterns (B10)
	Oxidized Rhizospheres along Living Roots (C3)
	Presence of Reduced Iron (C4)
	Salt Deposits (C5)
	Stunted or Stressed Plants (D1)
	Geomorphic Position (D2)
	Shallow Aquitard (D3)
x	Microtopographic Relief (D4)
x	FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x	x	0
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks

Dry year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	4
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	849-852 River terrace next to stream		

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	4B
Investigator(s):	Ryan Cooper, Kiel Kenning		

Remarks: Lat 70.20919 Long 147.73621 Stream Observation Point, Sand/ Organic bottom, seasonal, 2 feet deep, 10-30 ft wide. Lots of goose sign. Photos 853-854

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	5
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)	Flat		
Local relief (concave, convex, none)	Flat leading into pond	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.19759	Long	147.74272
Datum	N/A				
Soil Map Unit Name	N/A	NWI Classification	PEM1C		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes** x **No** ___

Remarks: 855-858. Point taken next to pond. Lots of waterfowl in the area.

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover	0	20% of total cover	0
1	salova	Salix ovalifolia	10	YES	FAC
2	drydru	Dryas drummondii	3	YES	FACU
3					
4					
5					
6					
		Total Cover	13		
Herb Stratum		50% of total cover	6.5	20% of total cover	2.6
1	carful	Carex fuliginosa	100	YES	FAC
2	erivag	Eriophorum vaginatum	20	NO	FACW
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	120		
		50% of total cover	60	20% of total cover	24

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	67%	(A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:	
OBL species	0	x 1 =	0	
FACW species	20	x 2 =	40	
FAC species	110	x 3 =	330	
FACU species	3	x 4 =	12	
UPL species	0	x 5 =	0	
Column Totals:	133	(A)	382	(B)
Prevalence Index = B/A =			2.87	

Hydrophytic Vegetation Indicators:

- Y Dominance Test is >50%
- Y Prevalence Index is ≤3.0
- ___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Plot size (radius, or length x width)	100ft radius	% Bare Ground	0
% Cover of Wetland Bryophytes	0	Total Cover of Bryophytes	0

Hydrophytic Vegetation Present? **Yes** x **No** ___

Remarks: Carex id difficult; so went with most conservative species.

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
0-7								Fibric Organic
7-20	10YR4/1							Sand

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [ ] Histosol or Histel (A1)
- [x] Histic Epipedon (A2)
- [ ] Hydrogen Sulfide (A4)
- [ ] Thick Dark Surface (A12)
- [ ] Alaska Gleyed (A13)
- [ ] Alaska Redox (A14)
- [ ] Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- [ ] Alaska Color Change (TA4) [4]
- [ ] Alaska Alpine Swales (TA5)
- [ ] Alaska Redox With 2.5Y Hue
- [ ] Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- [ ] Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: None

Depth (inches):

Hydric Soil Present? Yes x **No**

Remarks

Histic epipedon due to saturated fibric organic and dark lower soil. Saturation was present even in this dry year and dry season. Slightly thinner soil layers are too be expected from cold region.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [ ] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [x] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water-stained Leaves (B9)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Salt Deposits (C5)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		4
Saturation Present? (includes capillary fringe)	x		8

Wetland Hydrology Present? Yes x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks

Dry Year

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	5
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	855-858. Point taken next to pond. Lots of waterfowl in the area.		

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	5B
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	Arctophila fulva in lake/pond. Lots of waterfowl. Photos 859-861		

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	6
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)			Hummocks
Local relief (concave, convex, none)	highs and low hummocks	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.194	Long	147.711
Datum	N/A				
Soil Map Unit Name	N/A			NWI Classification	PEM1B/C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes x No ___**

Remarks: No Arctophila fulva. Patterned tundra. 862-865

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover	0	20% of total cover	0
1	arcrub	Arctous ruber	40	YES	FAC
2	vacvit	Vaccinium vitis-idaea	20	YES	FAC
3	dryint	Dryas integrifolia	20	YES	FACU
4	salova	Salix ovalifolia	5	NO	FAC
5	castet	Cassiope tetragona	5	NO	FACU
6					
		Total Cover	90		
Herb Stratum		50% of total cover	45	20% of total cover	18
1	erivag	Eriophorum vaginatum	20	YES	FACW
2					
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	20		
		50% of total cover	10	20% of total cover	4

Plot size (radius, or length x width) 100ft radius % Bare Ground 0

% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	20	x 2 =	40
FAC species	65	x 3 =	195
FACU species	25	x 4 =	100
UPL species	0	x 5 =	0
Column Totals:	110 (A)		335 (B)
Prevalence Index = B/A =			3.05

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

No Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** x **No** ___

Remarks: Unknown Carex with no seed head (90%)

SOIL

Sampling Point: 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
0-12								Fibric Organic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [x] Histosol or Histel (A1)
- [ ] Histic Epipedon (A2)
- [ ] Hydrogen Sulfide (A4)
- [ ] Thick Dark Surface (A12)
- [ ] Alaska Gleyed (A13)
- [ ] Alaska Redox (A14)
- [ ] Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- [ ] Alaska Color Change (TA4) [4]
- [ ] Alaska Alpine Swales (TA5)
- [ ] Alaska Redox With 2.5Y Hue
- [ ] Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- [ ] Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 12

Hydric Soil Present? Yes x No

Remarks: Saturation assumed from shallow aquitard; especially in the spring from snow melt. This is the dry month and dry year; so it was not observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [x] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water-stained Leaves (B9)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Salt Deposits (C5)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [x] Shallow Aquitard (D3)
- [x] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

	Yes	No		
Surface Water Present?	x		Depth (inches)	0
Water Table Present?	x		Depth (inches)	0
Saturation Present? (includes capillary fringe)	x		Depth (inches)	0

Wetland Hydrology Present? Yes x No

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry Year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	6
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	No Arctophila fulva. Patterned tundra. 862-865		

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	7
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)			Frost Heaves
Local relief (concave, convex, none)	None	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.19154	Long	147.69366
Datum	N/A				
Soil Map Unit Name	N/A			NWI Classification	PEM1B/C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? **Yes** x **No** ___

Remarks: 866-869 Large Frost heaves. No Arcful to be seen

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover: 0		20% of total cover: 0	
1	castet	Cassiope tetragona	70	YES	FACU
2	rubcha	Rubus chamaemorus	60	YES	FACW
3	salova	Salix ovalifolia	10	NO	FAC
4	vacvit	Vaccinium vitis-idaea	3	NO	FAC
5					
6					
		Total Cover	143		
Herb Stratum		50% of total cover: 71.5		20% of total cover: 28.6	
1	erivag	Eriophorum vaginatum	3	YES	FACW
2					
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	3		
		50% of total cover: 1.5		20% of total cover: 0.6	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 67% (A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	63	x 2 =	126
FAC species	13	x 3 =	39
FACU species	70	x 4 =	280
UPL species	0	x 5 =	0
Column Totals:	146 (A)		445 (B)

Prevalence Index = B/A = 3.05

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

No Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** x **No** ___

Plot size (radius, or length x width): 100ft radius % Bare Ground: 0

% Cover of Wetland Bryophytes: 0 Total Cover of Bryophytes: 10

Remarks: Unidentified Carex (no seed heads) in low points (80%) shrubs growing on mounds. Polygonum bistorta (1%) is NI.

SOIL

Sampling Point: 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
0-9								Fibric Organic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- x Histosol or Histel (A1)
- Histic Epipedon (A2)
- Hydrogen Sulfide (A4)
- Thick Dark Surface (A12)
- Alaska Gleyed (A13)
- Alaska Redox (A14)
- Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- Alaska Color Change (TA4) [4]
- Alaska Alpine Swales (TA5)
- Alaska Redox With 2.5Y Hue
- Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 9

Hydric Soil Present? Yes x **No**

Remarks: Thick orgs; with permafrost underlying. Assumed saturation, especially after snowmelt and with the shallow aquitard.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- x Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- x Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-stained Leaves (B9)
- Drainage Patterns (B10)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Salt Deposits (C5)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- x Shallow Aquitard (D3)
- x Microtopographic Relief (D4)
- x FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x		0
Saturation Present? (includes capillary fringe)	x		0

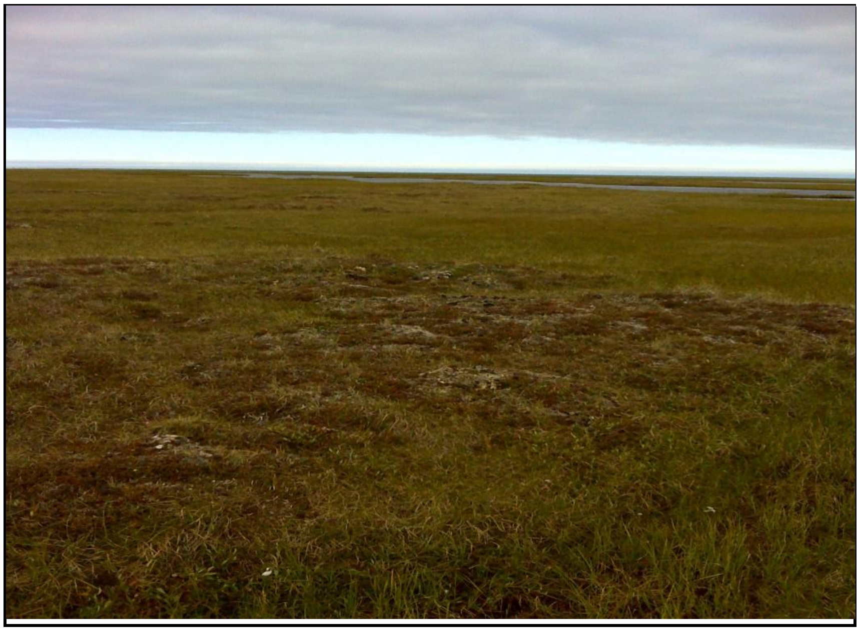
Wetland Hydrology Present? Yes x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry Year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	7
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	866-869 Large Frost heaves. No Arcful to be seen		



WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	8
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)	Hummocks		
Local relief (concave, convex, none)	polygonal	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.18968	Long	147.68599
Datum	N/A				
Soil Map Unit Name	N/A	NWI Classification	PEM1B/C		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? Yes x No ___

Remarks: Arctophila fulva in stream next to point (10 feet wide perenial) 870-873

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum	50% of total cover	0	20% of total cover	0	
1	salova	Salix ovalifolia	30	YES	FAC
2	vacvit	Vaccinium vitis-idaea	10	YES	FAC
3	arcrub	Arctous ruber	5	NO	FAC
4	dryint	Dryas integrifolia	5	NO	FACU
5					
6					
		Total Cover	50		
Herb Stratum	50% of total cover	25	20% of total cover	10	
1	erivag	Eriophorum vaginatum	3	YES	FACW
2	arcarc	Arctanthemum arcticum	3	YES	FACW
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	6		
	50% of total cover	3	20% of total cover	1.2	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:	
OBL species	0	x 1 =	0	
FACW species	6	x 2 =	12	
FAC species	45	x 3 =	135	
FACU species	5	x 4 =	20	
UPL species	0	x 5 =	0	
Column Totals:	56	(A)	167	(B)

Prevalence Index = B/A = 2.98

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

Y Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Plot size (radius, or length x width) 100ft radius % Bare Ground 0

% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0

Hydrophytic Vegetation Present? Yes x No ___

Remarks: Unknown blue/black grass (10%). Unknown carex (no seed head) (70%). Polygonum bistorta (3%) is NI.

SOIL

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type [1]	Loc [2]	Texture	Remarks
0-10								Fibric Organic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- x Histosol or Histel (A1)
- Histic Epipedon (A2)
- Hydrogen Sulfide (A4)
- Thick Dark Surface (A12)
- Alaska Gleyed (A13)
- Alaska Redox (A14)
- Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- Alaska Color Change (TA4) [4]
- Alaska Alpine Swales (TA5)
- Alaska Redox With 2.5Y Hue
- Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- Other (Explain in Remarks)

[3]One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 10

Hydric Soil Present? Yes x **No**

Remarks

Thick organics with permafrost. Assume saturation, especially after snowmelt with the permafrost. This has been a dry year and dry season.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- x Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Surface Soil Cracks (B6)
- x Inundation Visible on Aerial Imagery (B7)
- Sparsely Vegetated Concave Surface (B8)
- Marl Deposits (B15)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- Water-stained Leaves (B9)
- Drainage Patterns (B10)
- Oxidized Rhizospheres along Living Roots (C3)
- Presence of Reduced Iron (C4)
- Salt Deposits (C5)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- x Shallow Aquitard (D3)
- x Microtopographic Relief (D4)
- x FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x		0
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks

Dry Year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	8
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	Arctophila fulva in stream next to point (10 feet wide perenial) 870-873		

WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Borough/City:	North Slope Borough	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp			Sampling Point:	9
Investigator(s):	Ryan Cooper, Kiel Kenning	Landform (hillside, terrace, hummocks, etc.)	Low centered tundra		
Local relief (concave, convex, none)	low centered tundra	Slope (%)	0		
Subregion:	Arctic Coastal Plain	Lat	70.18924	Long	147.71594
Datum	N/A				
Soil Map Unit Name	N/A	NWI Classification	PEM1H		

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? Yes x No ___

Remarks: Low centered tundra, Very wet

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover	0	20% of total cover	0
1	salova	Salix ovalifolia	3	YES	FAC
2					
3					
4					
5					
6					
		Total Cover	3		
Herb Stratum		50% of total cover	1.5	20% of total cover	0.6
1	carful	Carex fuliginosa	100	YES	FAC
2	erivag	Eriophorum vaginatum	5	NO	FACW
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	105		
		50% of total cover	52.5	20% of total cover	21

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	103	x 3 =	309
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	108 (A)		319 (B)

Prevalence Index = B/A = 2.95

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

Y Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Plot size (radius, or length x width) 100ft radius % Bare Ground 0

% Cover of Wetland Bryophytes 0 Total Cover of Bryophytes 0

Hydrophytic Vegetation Present? Yes x No ___

Remarks: Carex id difficult; so went with most conservative species.

SOIL

Sampling Point: 9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
0-15								Fibric Organic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [x] Histosol or Histel (A1)
- [ ] Histic Epipedon (A2)
- [ ] Hydrogen Sulfide (A4)
- [ ] Thick Dark Surface (A12)
- [ ] Alaska Gleyed (A13)
- [ ] Alaska Redox (A14)
- [ ] Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- [ ] Alaska Color Change (TA4) [4]
- [ ] Alaska Alpine Swales (TA5)
- [ ] Alaska Redox With 2.5Y Hue
- [ ] Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- [ ] Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: permafrost

Depth (inches): 15

Hydric Soil Present? Yes x **No**

Remarks: Thick organics, with permafrost. Saturation comes up high, even during this dry month.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [ ] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water-stained Leaves (B9)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Salt Deposits (C5)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [x] Shallow Aquitard (D3)
- [x] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?		x	
Water Table Present?	x		9
Saturation Present? (includes capillary fringe)	x		3

Wetland Hydrology Present? Yes x **No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry year

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	9
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	Low centered tundra, Very wet		

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WETLAND DETERMINATION DATA FORM – Alaska Region

Project/Site: Hilcorp Liberty | Borough/City: North Slope Borough | Sampling Date: 7/29/2015

Applicant/Owner: Hilcorp | Sampling Point: 10

Investigator(s): Ryan Cooper, Kiel Kenning | Landform (hillside, terrace, hummocks, etc.) Terrace

Local relief (concave, convex, none) Convex | Slope (%) 0

Subregion: Arctic Coastal Plain | Lat 70.18433 | Long 147.72433 | Datum N/A

Soil Map Unit Name N/A | NWI Classification PEM1B/C

Are climatic / hydrologic conditions on the site typical for this time of year? Yes x No ___ (If no, explain in Remarks.)

Are Vegetation ___ Soil ___ or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes x No ___

Are Vegetation ___ Soil ___ or Hydrology ___ significantly problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes x	No ___
Hydric Soil Present?	Yes x	No ___
Wetland Hydrology Present?	Yes x	No ___

Is the Sampled Area within a Wetland? Yes x No ___

Remarks: 874-877 Terrace, Frost heaves running NE/SE near Badami pipeline

VEGETATION – Use 3/3 abbreviations. List subregion (above) for indicator status. List plants Highest to Lowest % cover.

Tree Stratum			Absolute % Cover	Dominant Species?	Indicator Status?
1					
2					
3					
4					
		Total Cover	0		
Sapling/Shrub Stratum		50% of total cover: 0		20% of total cover	0
1	arcrub	Arctous ruber	30	YES	FAC
2	dryint	Dryas integrifolia	20	YES	FACU
3	vacvit	Vaccinium vitis-idaea	15	YES	FAC
4	salova	Salix ovalifolia	10	NO	FAC
5					
6					
		Total Cover	75		
Herb Stratum		50% of total cover: 37.5		20% of total cover	15
1	erivag	Eriophorum vaginatum	5	YES	FACW
2					
3					
4					
5					
6					
7					
8					
9					
10					
		Total Cover	5		
		50% of total cover: 2.5		20% of total cover	1

Plot size (radius, or length x width) 100ft radius | % Bare Ground 0

% Cover of Wetland Bryophytes 0 | Total Cover of Bryophytes 0

Remarks: Unknown grass with no seed heads (80%). erivag on tops of hummocks

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet

Total % Cover of:			Multiply by:
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	55	x 3 =	165
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	80 (A)		255 (B)

Prevalence Index = B/A = 3.19

Hydrophytic Vegetation Indicators:

Y Dominance Test is >50%

No Prevalence Index is ≤3.0

___ Morphological Adaptations [1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation (Explain)

[1] Indicators of hydric soil and wetland hydrology must be present unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes x No ___

SOIL

Sampling Point: 10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type [1]	Loc [2]	Texture	Remarks
0-12								Fibric Organic

[1] Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2] Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- [x] Histosol or Histel (A1)
- [ ] Histic Epipedon (A2)
- [ ] Hydrogen Sulfide (A4)
- [ ] Thick Dark Surface (A12)
- [ ] Alaska Gleyed (A13)
- [ ] Alaska Redox (A14)
- [ ] Alaska Gleyed Pores (A15)

Indicators for Problematic Hydric Soils: [3]

- [ ] Alaska Color Change (TA4) [4]
- [ ] Alaska Alpine Swales (TA5)
- [ ] Alaska Redox With 2.5Y Hue
- [ ] Alaska Gleyed Without Hue 5Y or Redder Underlying Layer
- [ ] Other (Explain in Remarks)

[3] One indicator of hydrophytic vegetation, one primary indicator of wetland hydrology, and an appropriate landscape position must be present unless disturbed or problematic.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):

Types: Permafrost

Depth (inches): 12

Hydric Soil Present? Yes: x No:

Remarks: Thick layer of organics with permafrost. Expect to have saturation, especially during snowmelt with the permafrost. Point taken in a dry month during a dry year.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- [x] Surface Water (A1)
- [x] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [ ] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [ ] Iron Deposits (B5)
- [ ] Surface Soil Cracks (B6)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Marl Deposits (B15)
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Dry-Season Water Table (C2)
- [ ] Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- [ ] Water-stained Leaves (B9)
- [ ] Drainage Patterns (B10)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Salt Deposits (C5)
- [ ] Stunted or Stressed Plants (D1)
- [ ] Geomorphic Position (D2)
- [x] Shallow Aquitard (D3)
- [x] Microtopographic Relief (D4)
- [ ] FAC-Neutral Test (D5)

	Yes	No	Depth (inches)
Surface Water Present?	x		0
Water Table Present?	x		0
Saturation Present? (includes capillary fringe)	x		0

Wetland Hydrology Present? Yes: x No:

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: Dry Year. Saturation was not observed in the pit; but surface water was observed near the pit in the same habitat.

WETLAND DETERMINATION PHOTO FORM – Alaska Region

Project/Site:	Hilcorp Liberty	Sampling Date:	7/29/2015
Applicant/Owner:	Hilcorp	Sampling Point:	10
Investigator(s):	Ryan Cooper, Kiel Kenning		
Remarks	874-877 Terrace, Frost heaves running NE/SE near Badami pipeline		

Appendix B
Maps

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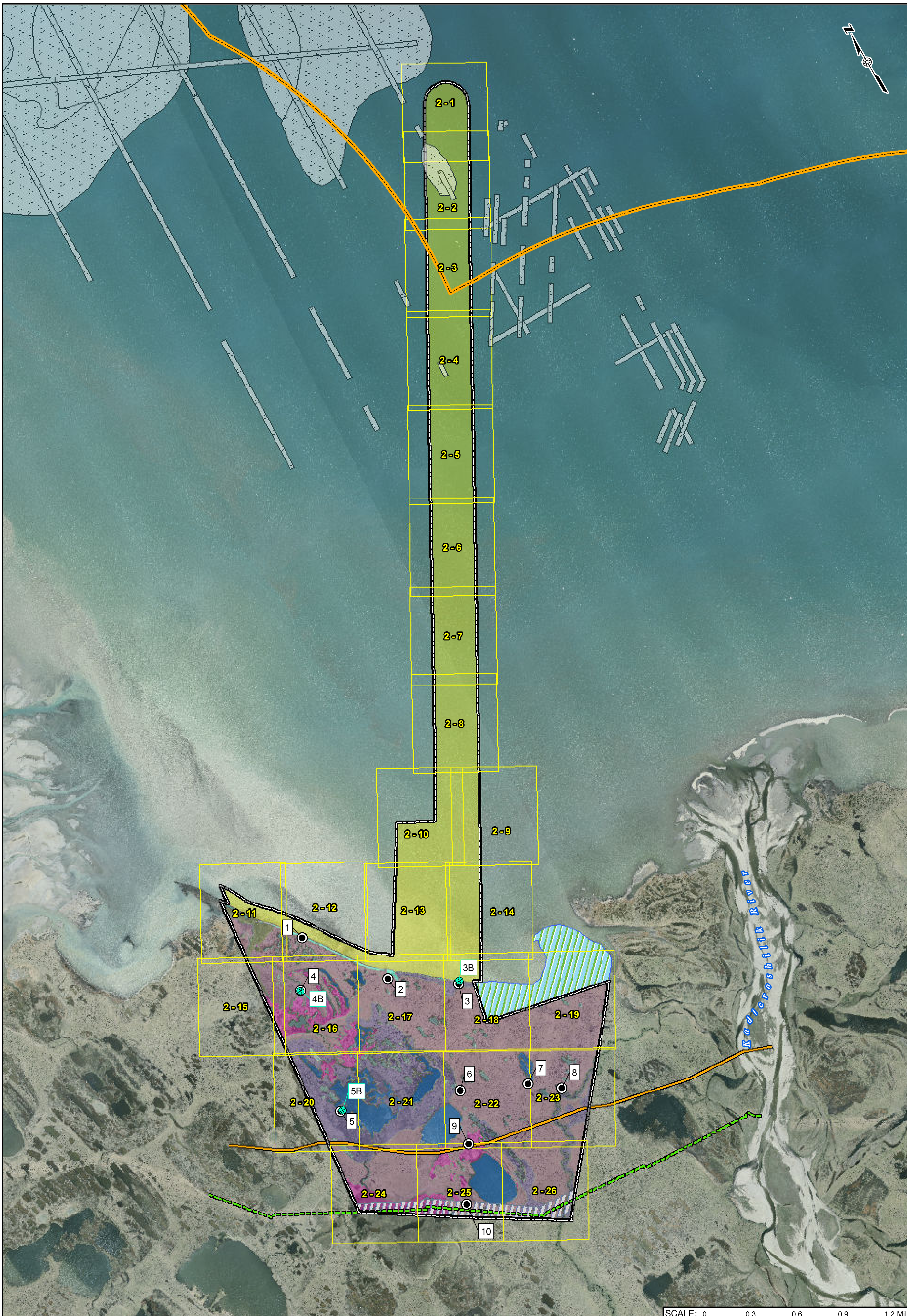

- 2015 Wetland Photo Point
- 2015 Wetland Sample Point
- Outer Continental Shelf (3 Nautical Mile buffer)
- Badami Pipeline
- Badami Seasonal Ice Road
- Study Area
- Boulder Patch
- Disturbed Shadow Effect 300 ft Buffer
- Private Land (Native Allotment)

Cowardin

- E1UB
- L1UBH
- M1UB
- M2US
- PEM1B/C
- PEM1C
- PEM1H
- PUBH
- R2UB

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Wetland Delineation Overview

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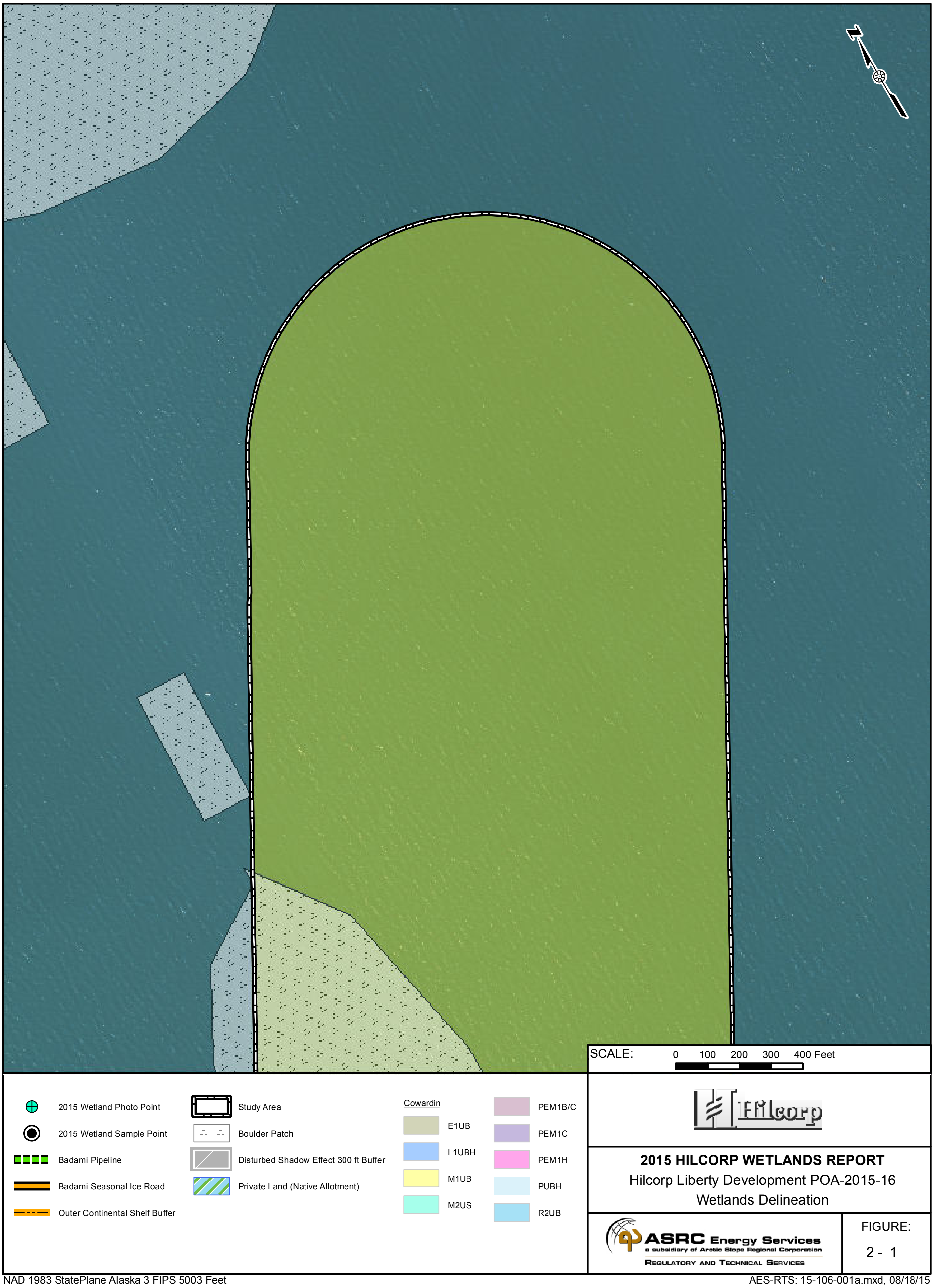
FIGURE: 1

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-003a.mxd, 08/18/15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0 100 200 300 400 Feet
2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
Private Land (Native Allotment)
Cowardin
E1UB
L1UBH
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PEM1B/C
PEM1C
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R2UB
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Wetlands Delineation
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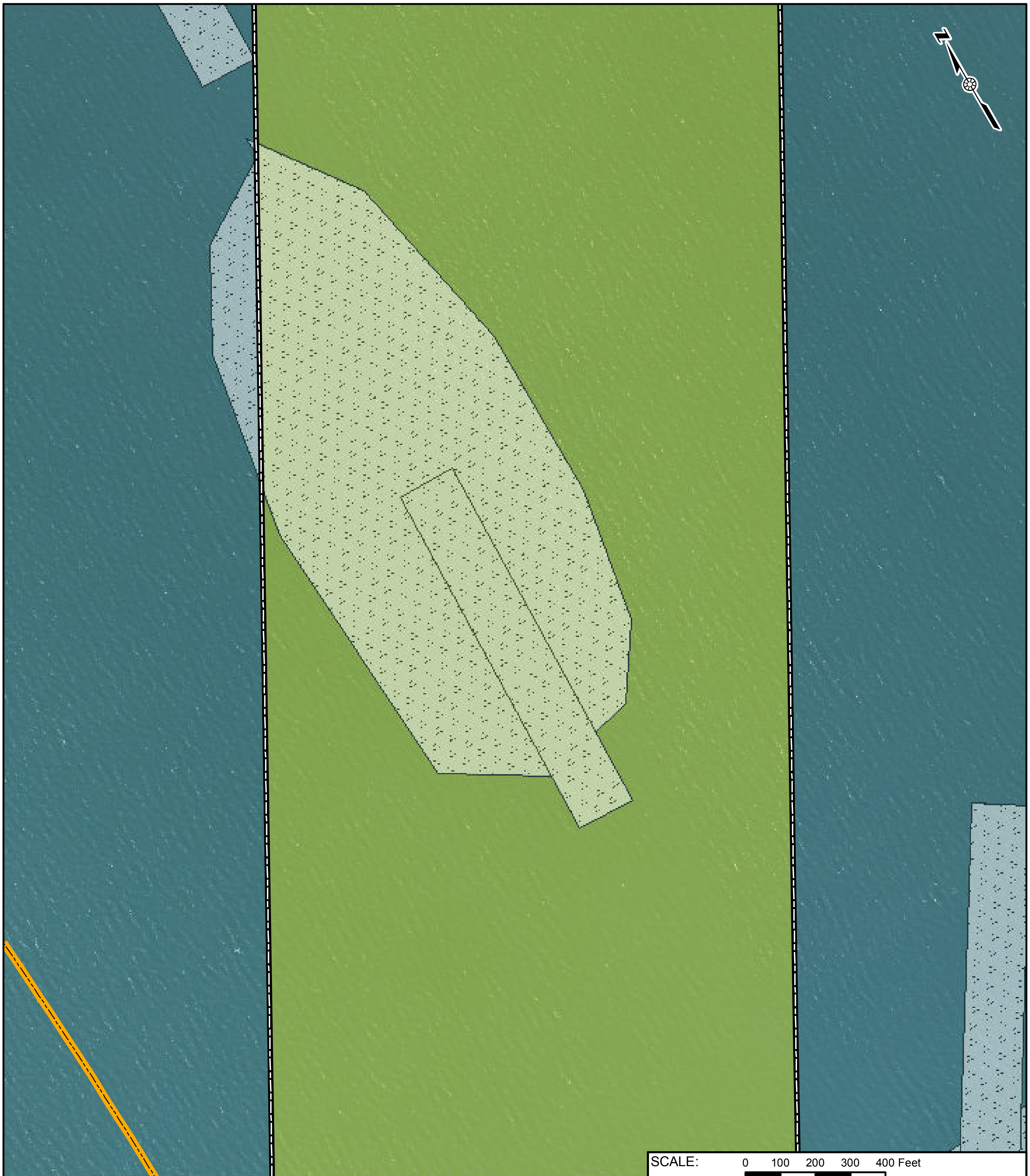
FIGURE:
2 - 1
NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15



SCALE: 0 100 200 300 400 Feet

	2015 Wetland Photo Point		Study Area	Cowardin			PEM1B/C
	2015 Wetland Sample Point		Boulder Patch		E1UB		PEM1C
	Badami Pipeline		Disturbed Shadow Effect 300 ft Buffer		L1UBH		PEM1H
	Badami Seasonal Ice Road		Private Land (Native Allotment)		M1UB		PUBH
	Outer Continental Shelf Buffer				M2US		R2UB

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Wetlands Delineation

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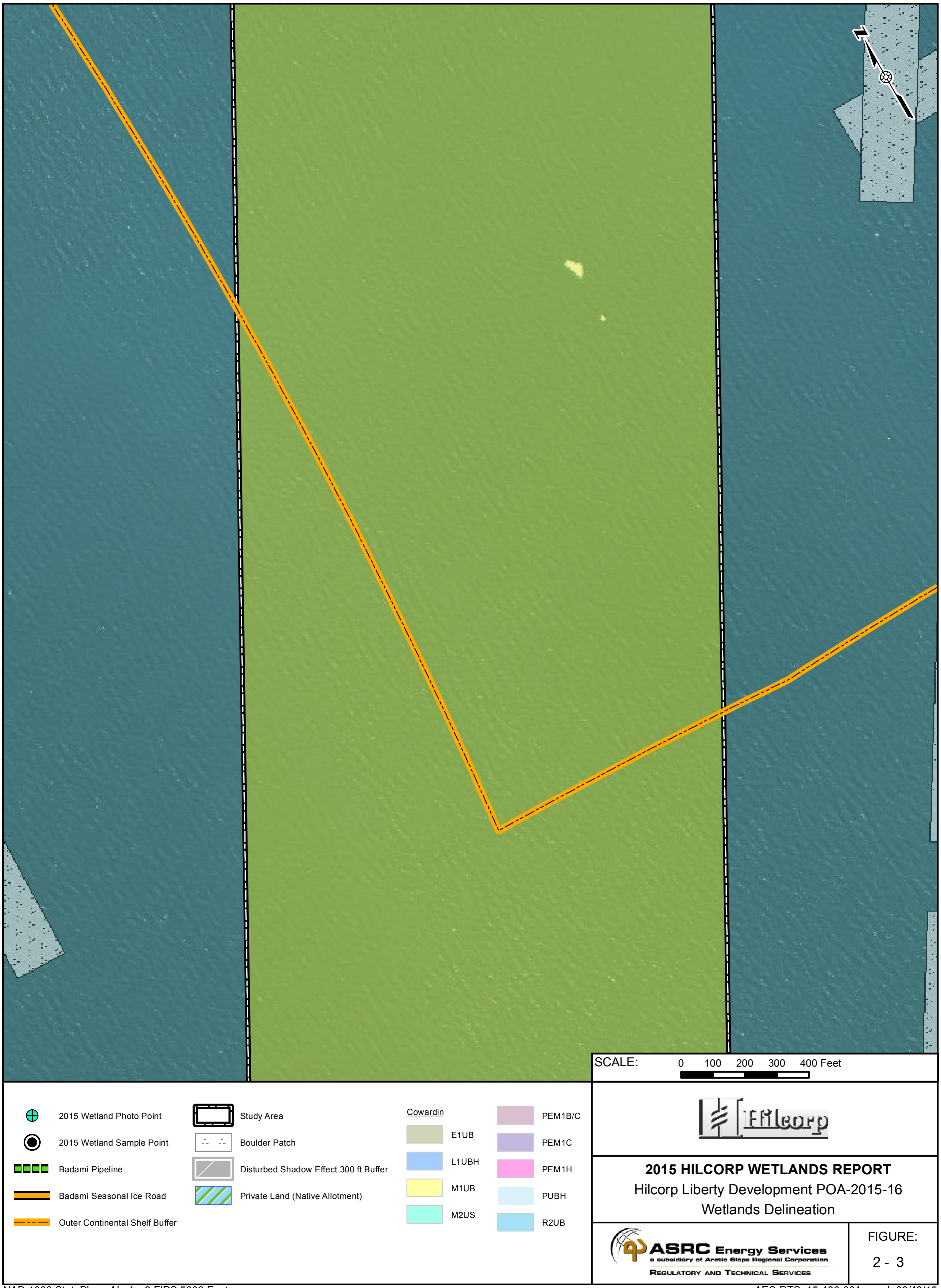
FIGURE: 2 - 2

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15



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Wetlands Delineation

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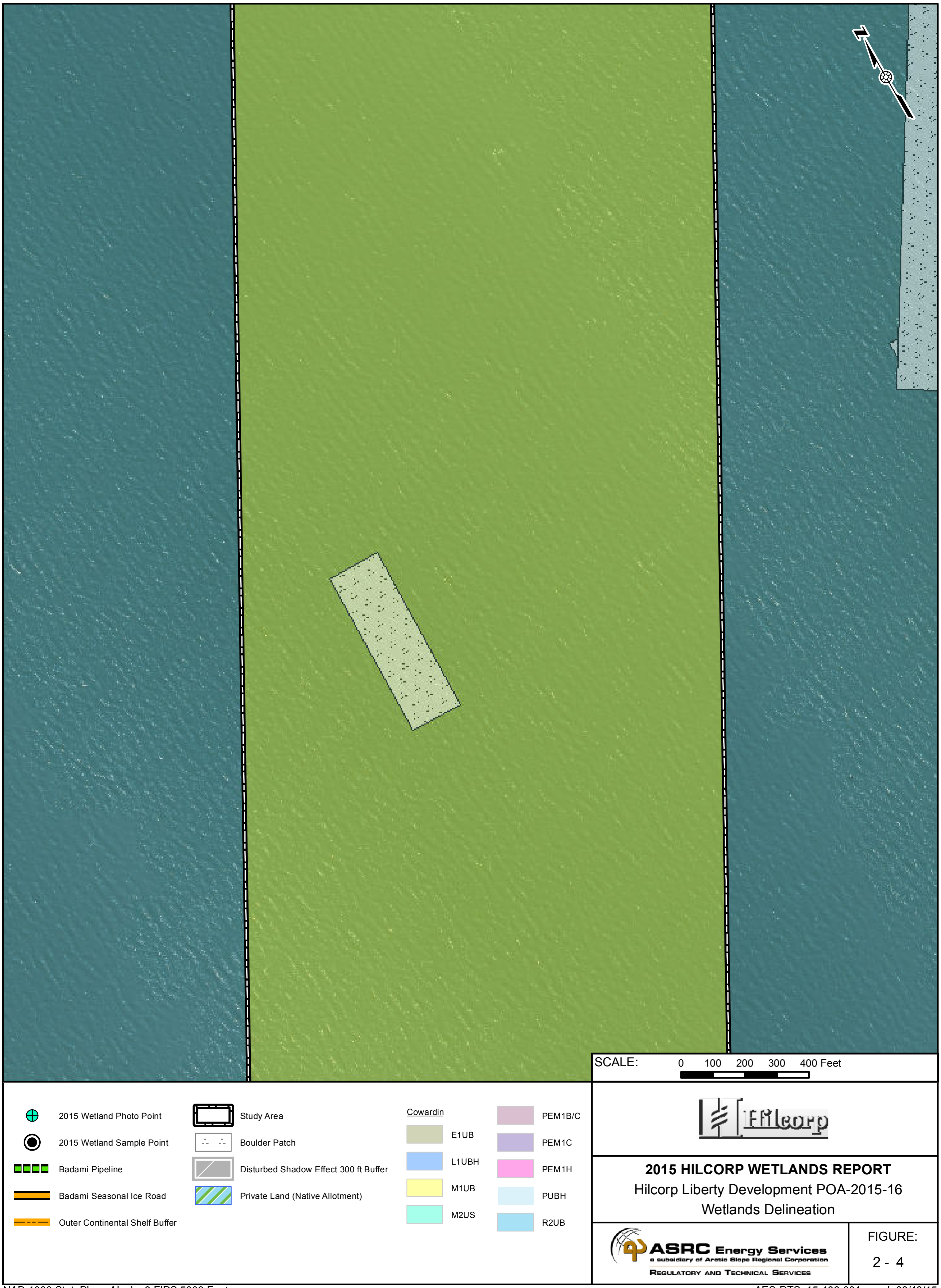
FIGURE: 2 - 3

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15



NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

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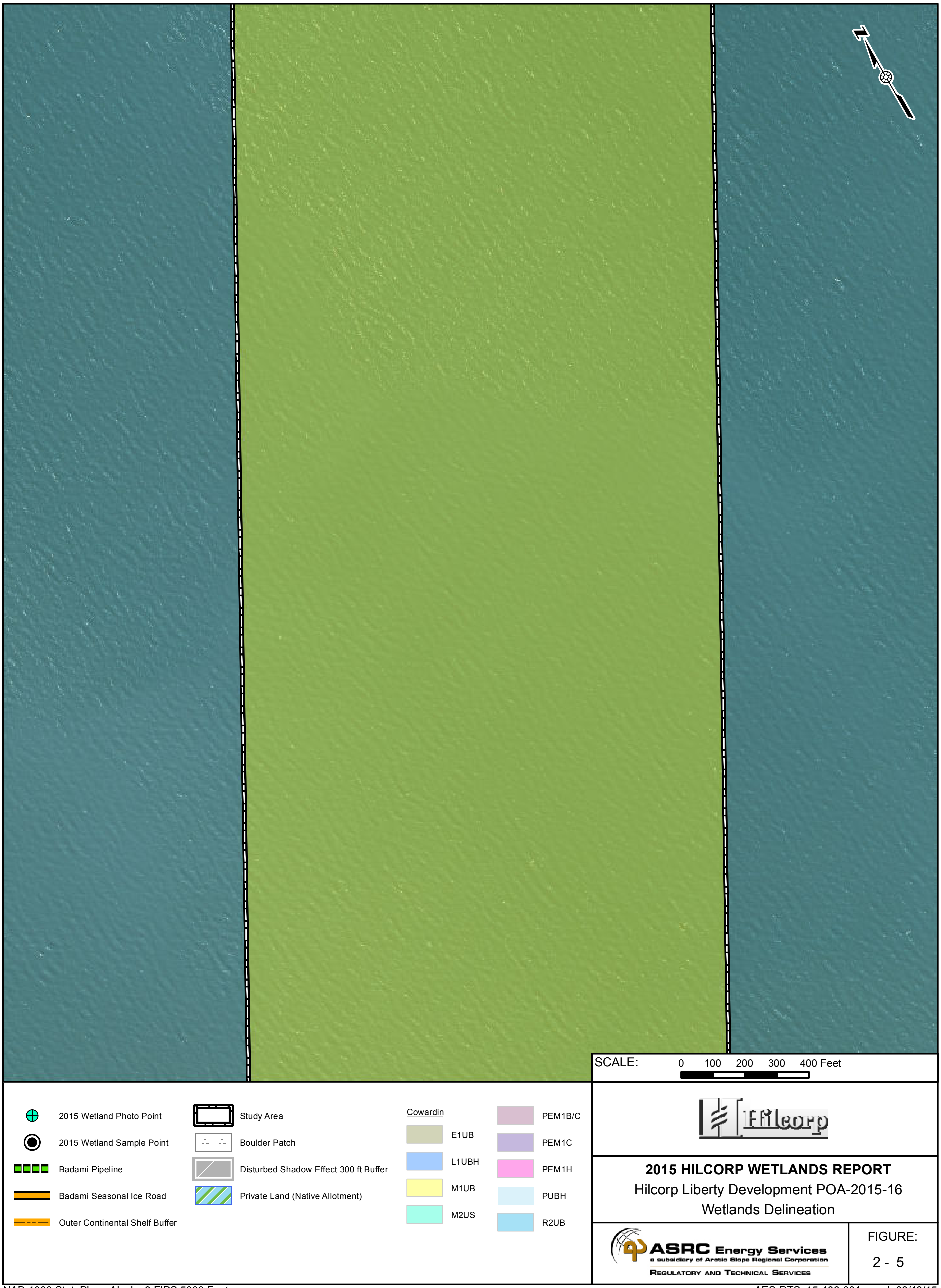

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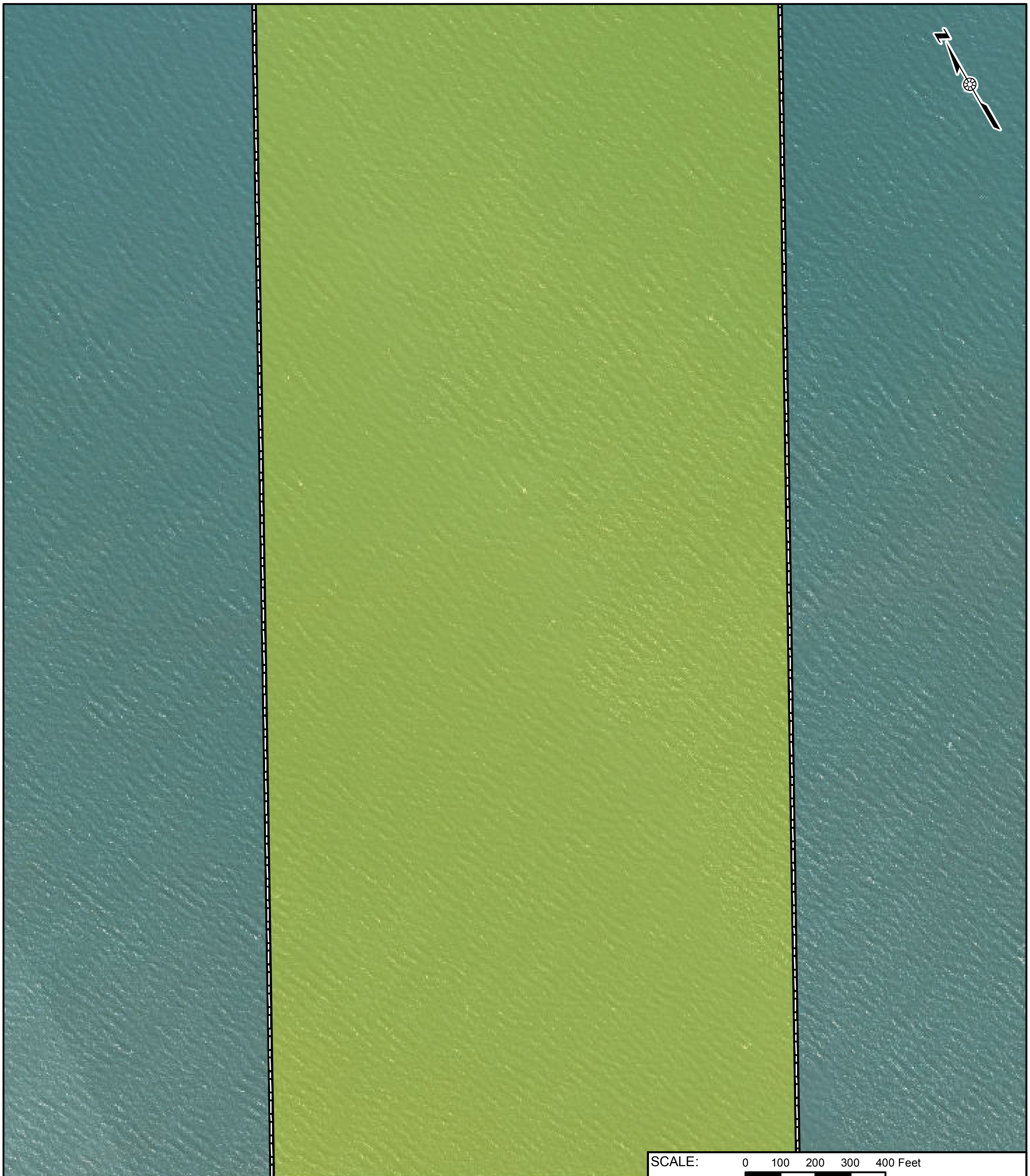

2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
Private Land (Native Allotment)

Cowardin

E1UB
L1UBH
M1UB
M2US
PEM1B/C
PEM1C
PEM1H
PUBH
R2UB

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FIGURE:
2 - 6

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15

SCALE: 0 100 200 300 400 Feet

2015 Wetland Photo Point

2015 Wetland Sample Point

Badami Pipeline

Badami Seasonal Ice Road

Outer Continental Shelf Buffer

Study Area

Boulder Patch

Disturbed Shadow Effect 300 ft Buffer

Private Land (Native Allotment)

Cowardin

E1UB

L1UBH

M1UB

M2US

PEM1B/C

PEM1C

PEM1H

PUBH

R2UB

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FIGURE:

2 - 7

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15

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FIGURE: 2 - 8

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15

SCALE: 0 100 200 300 400 Feet

2015 Wetland Photo Point	Study Area
2015 Wetland Sample Point	Boulder Patch
Badami Pipeline	Disturbed Shadow Effect 300 ft Buffer
Badami Seasonal Ice Road	Private Land (Native Allotment)
Outer Continental Shelf Buffer	

Cowardin

E1UB	PEM1B/C
L1UBH	PEM1C
M1UB	PEM1H
M2US	PUBH
	R2UB

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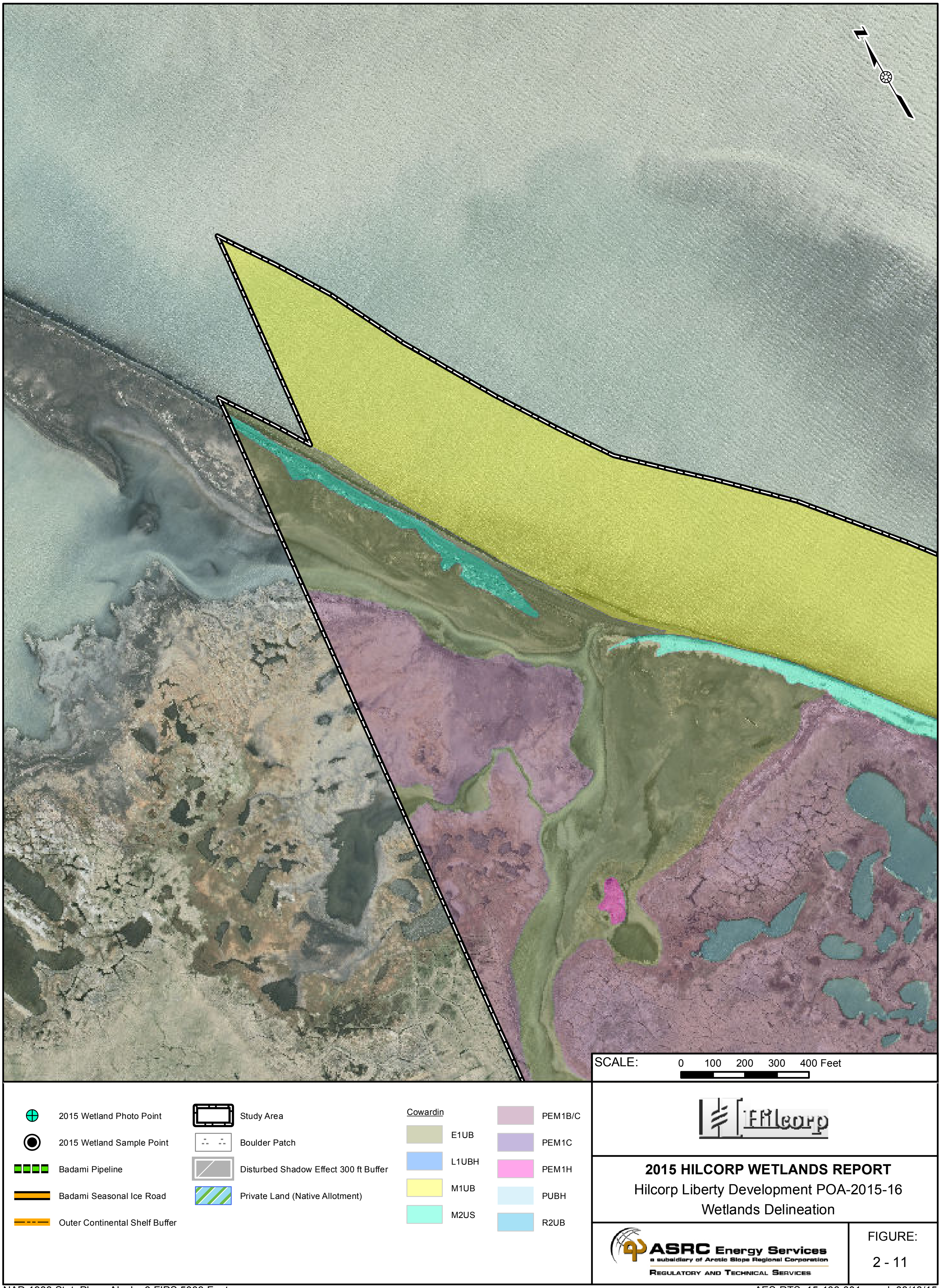
FIGURE: 2 - 9

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15



NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

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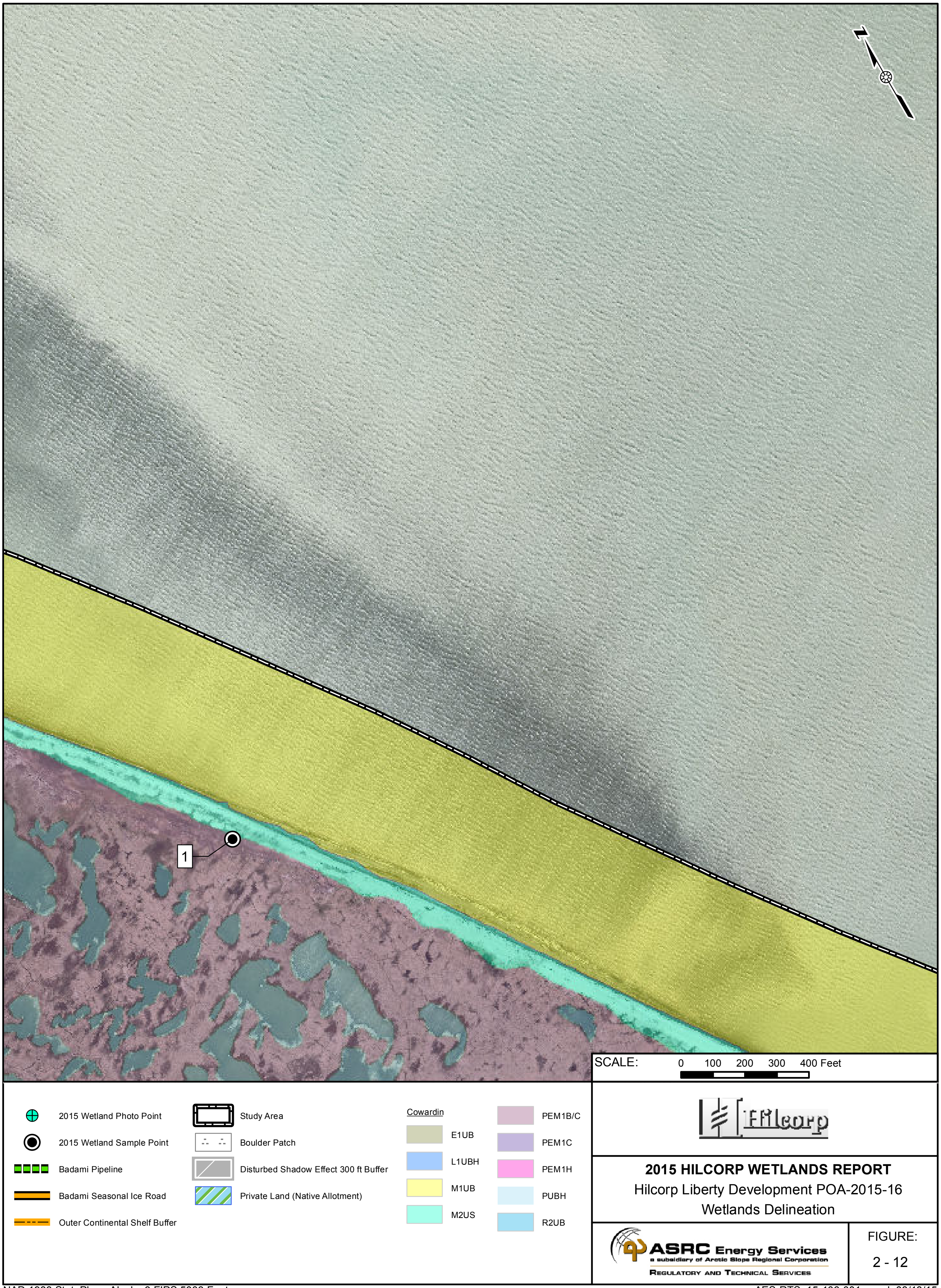

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Wetlands Delineation

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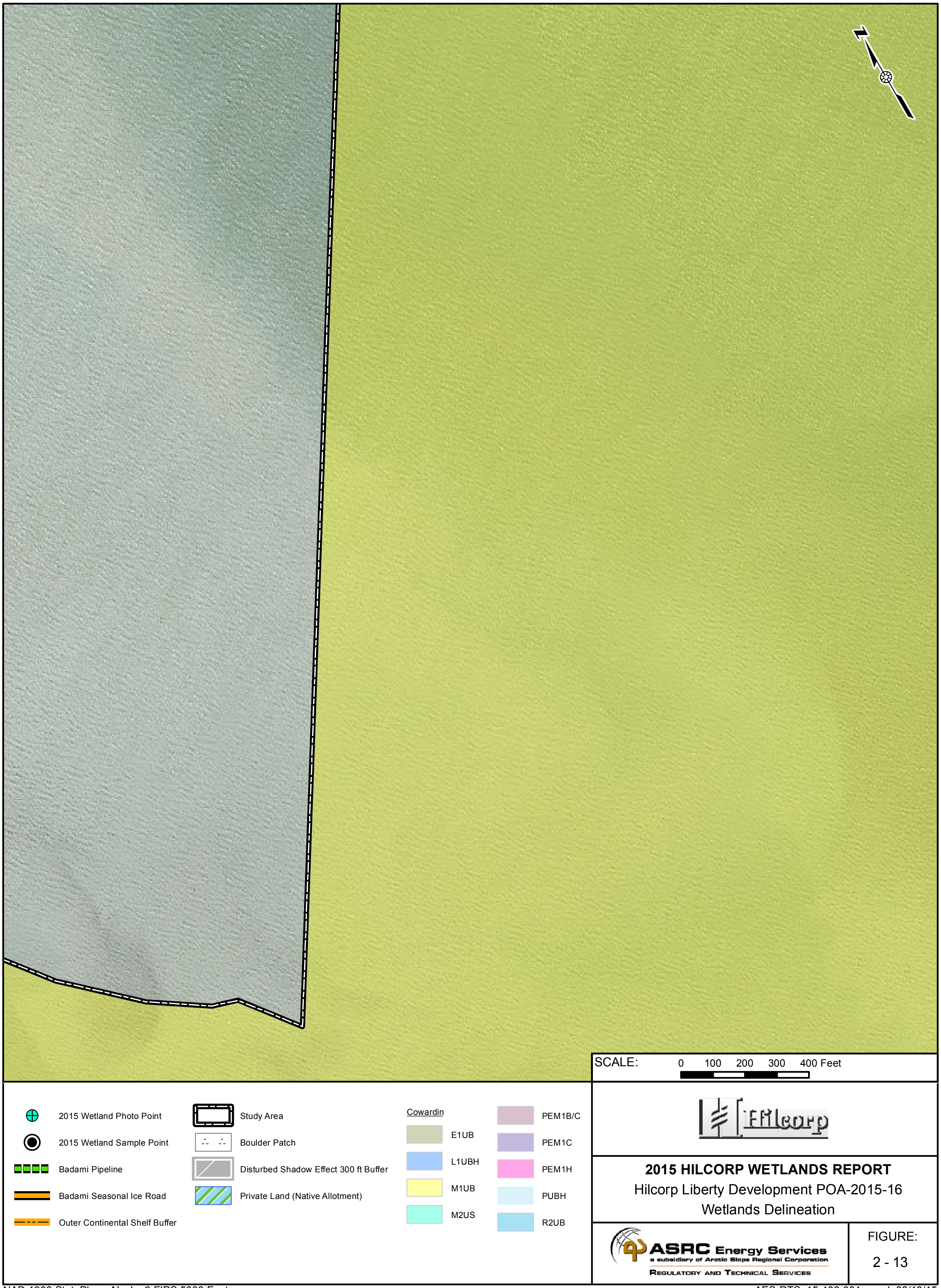
FIGURE:
2 - 12

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15



NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

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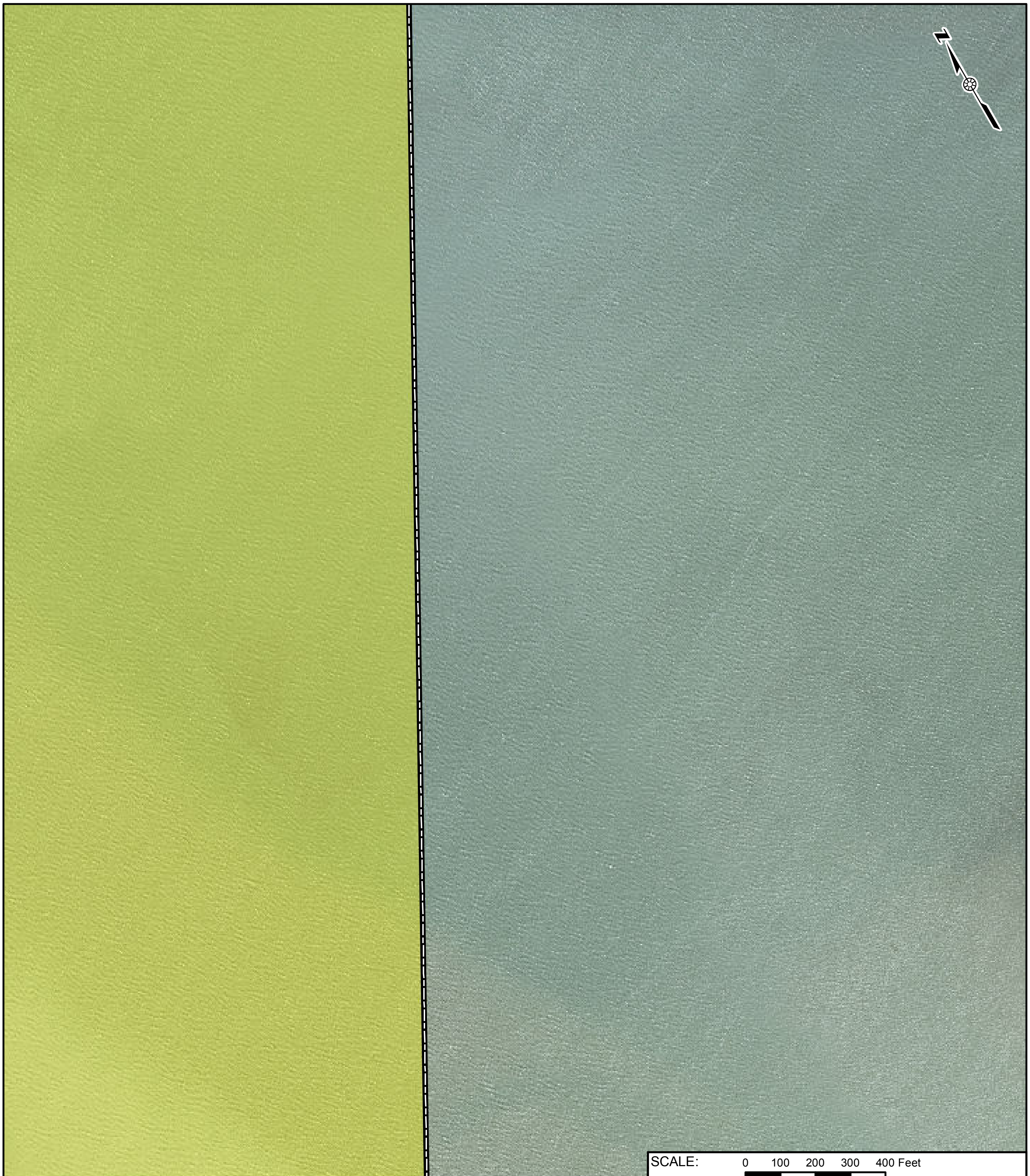

2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
Private Land (Native Allotment)

Cowardin

E1UB
L1UBH
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M2US
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PEM1C
PEM1H
PUBH
R2UB

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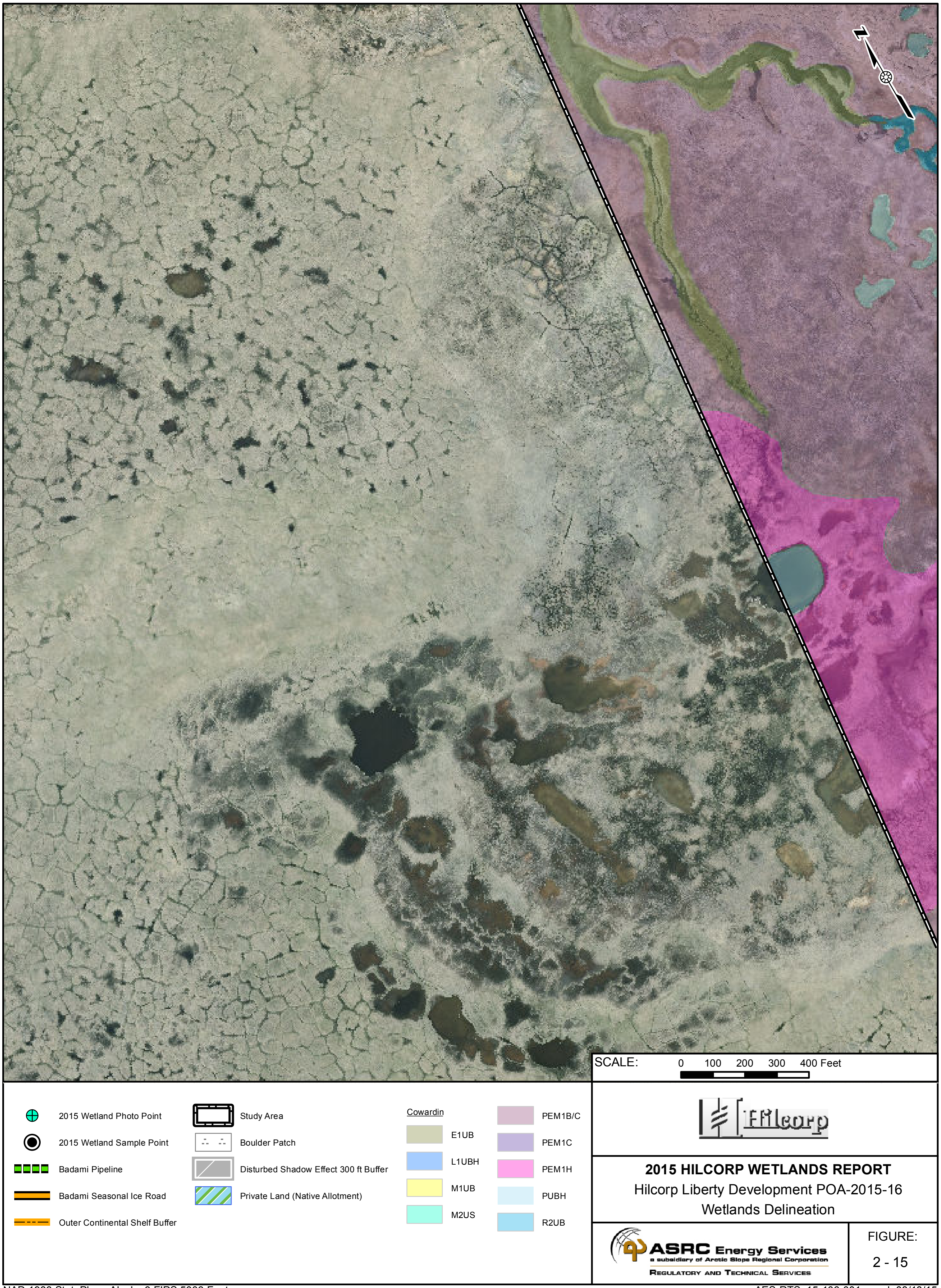
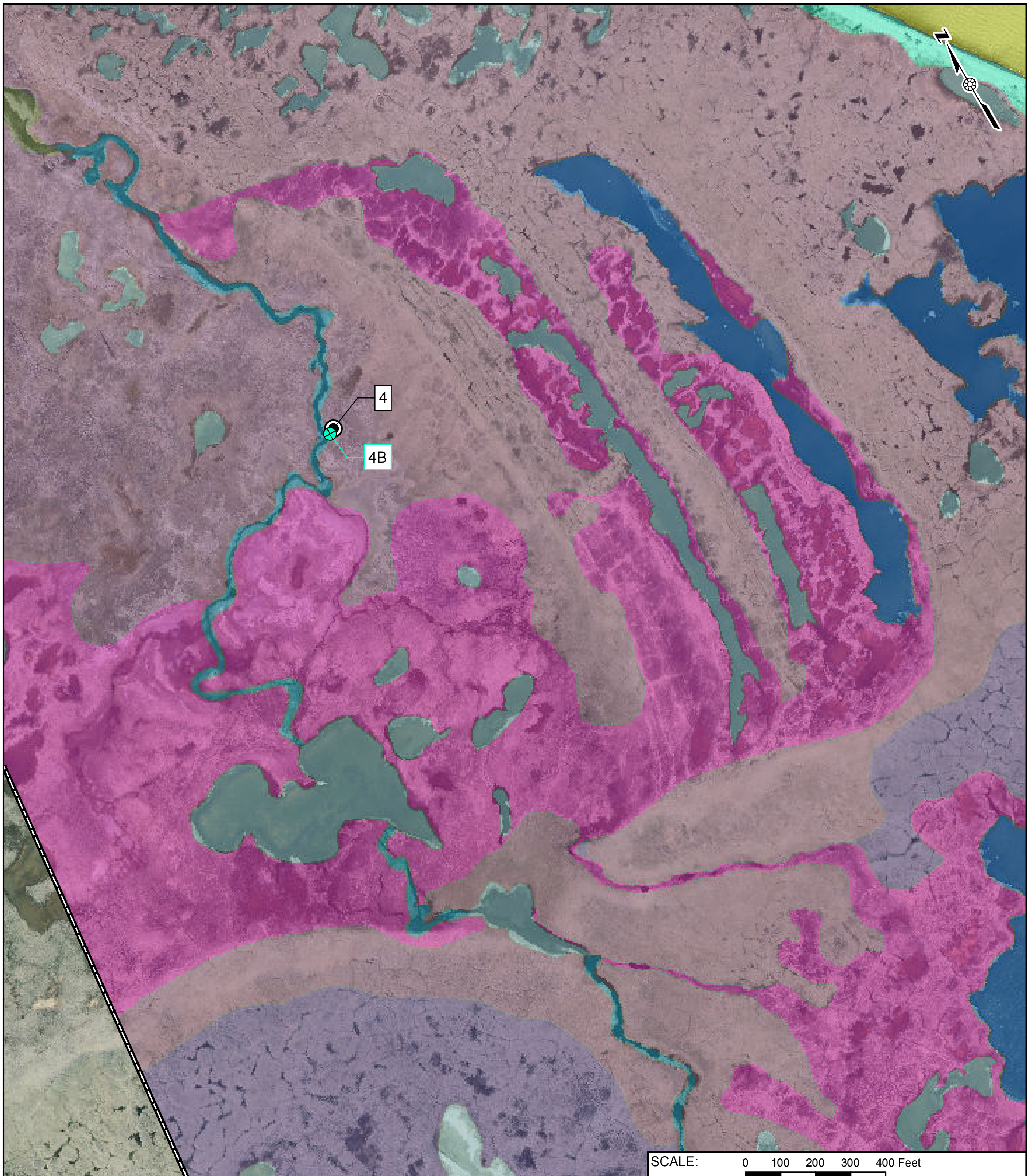
FIGURE:
2 - 14

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15



NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15



SCALE: 0 100 200 300 400 Feet

2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer

Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
Private Land (Native Allotment)

Cowardin
E1UB
L1UBH
M1UB
M2US
PEM1B/C
PEM1C
PEM1H
PUBH
R2UB

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FIGURE:
2 - 16

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15

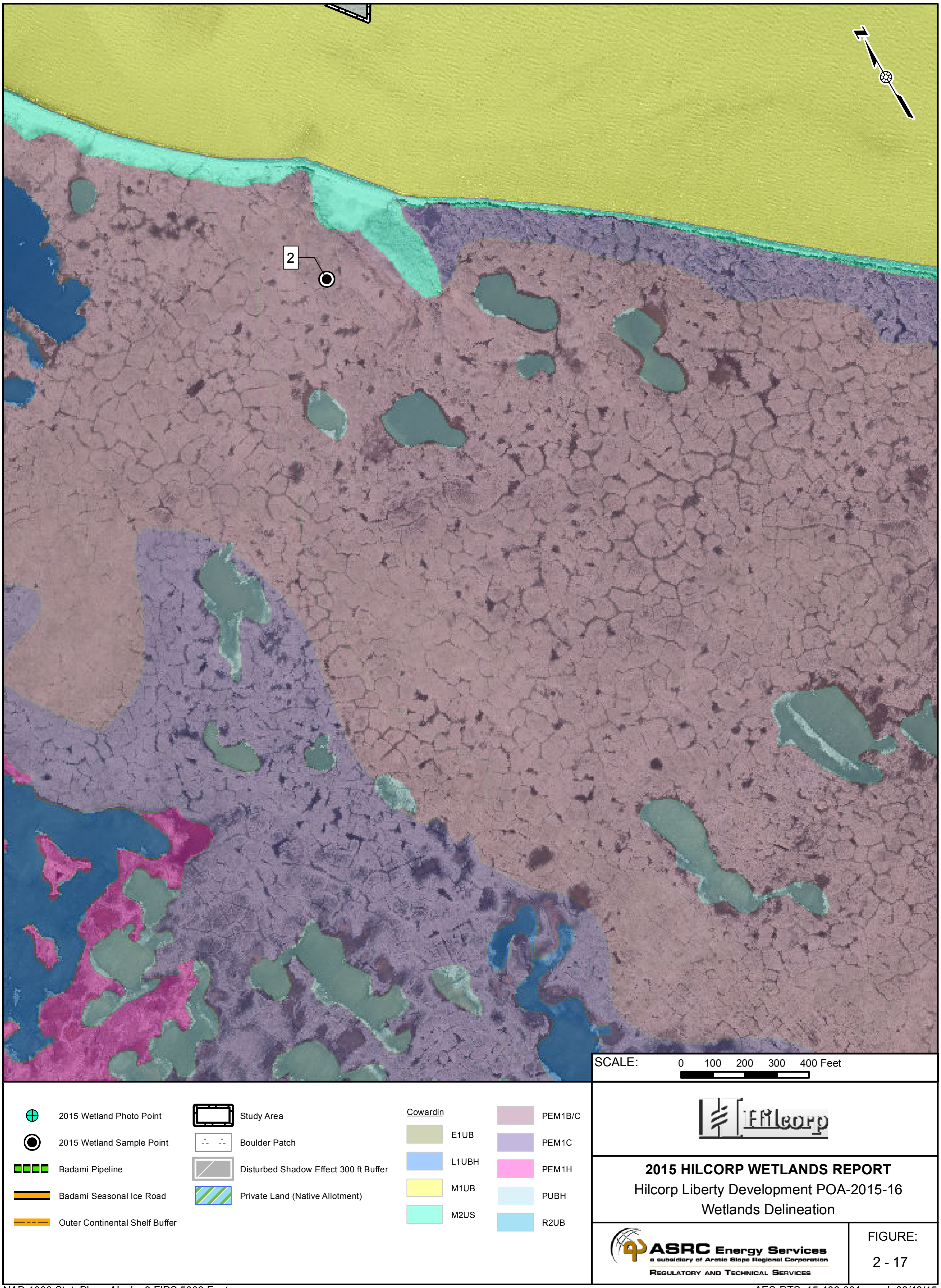

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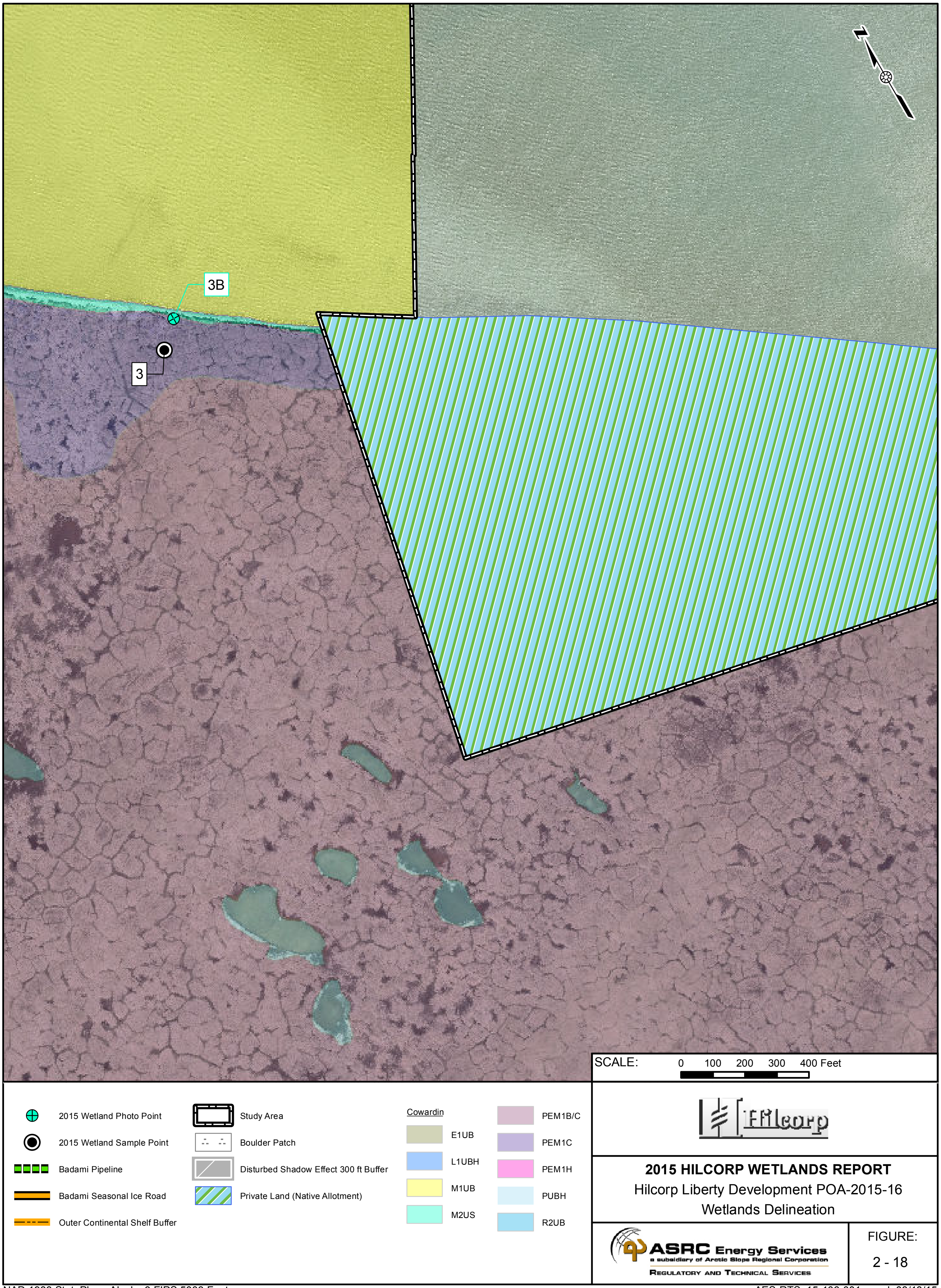
FIGURE: 2 - 17

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15


3B
3
SCALE:
0 100 200 300 400 Feet
2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
Private Land (Native Allotment)
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L1UBH
M1UB
M2US
PEM1B/C
PEM1C
PEM1H
PUBH
R2UB
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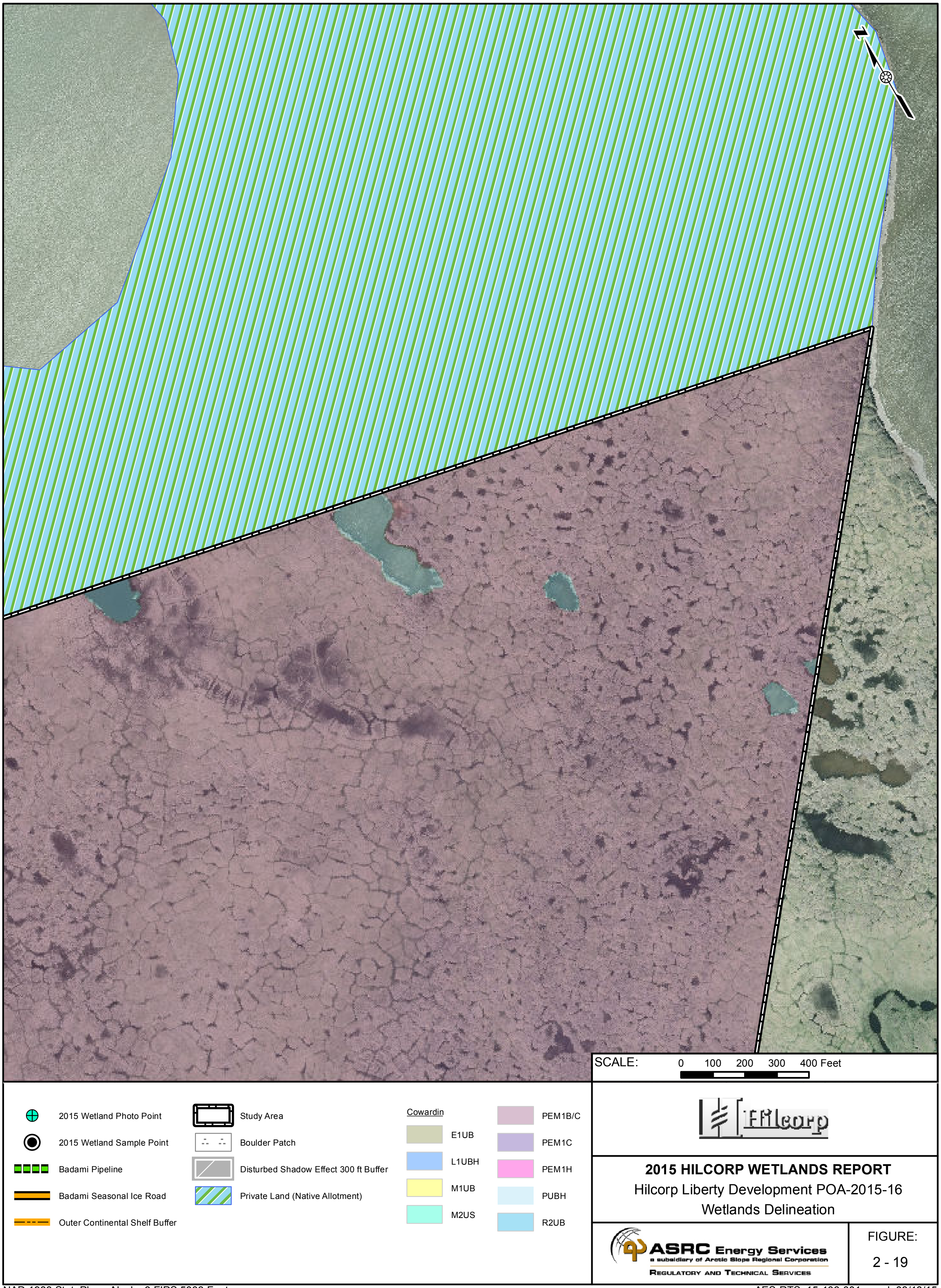
FIGURE:
2 - 18
NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15


SCALE:
0 100 200 300 400 Feet
2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
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E1UB
L1UBH
M1UB
M2US
PEM1B/C
PEM1C
PEM1H
PUBH
R2UB
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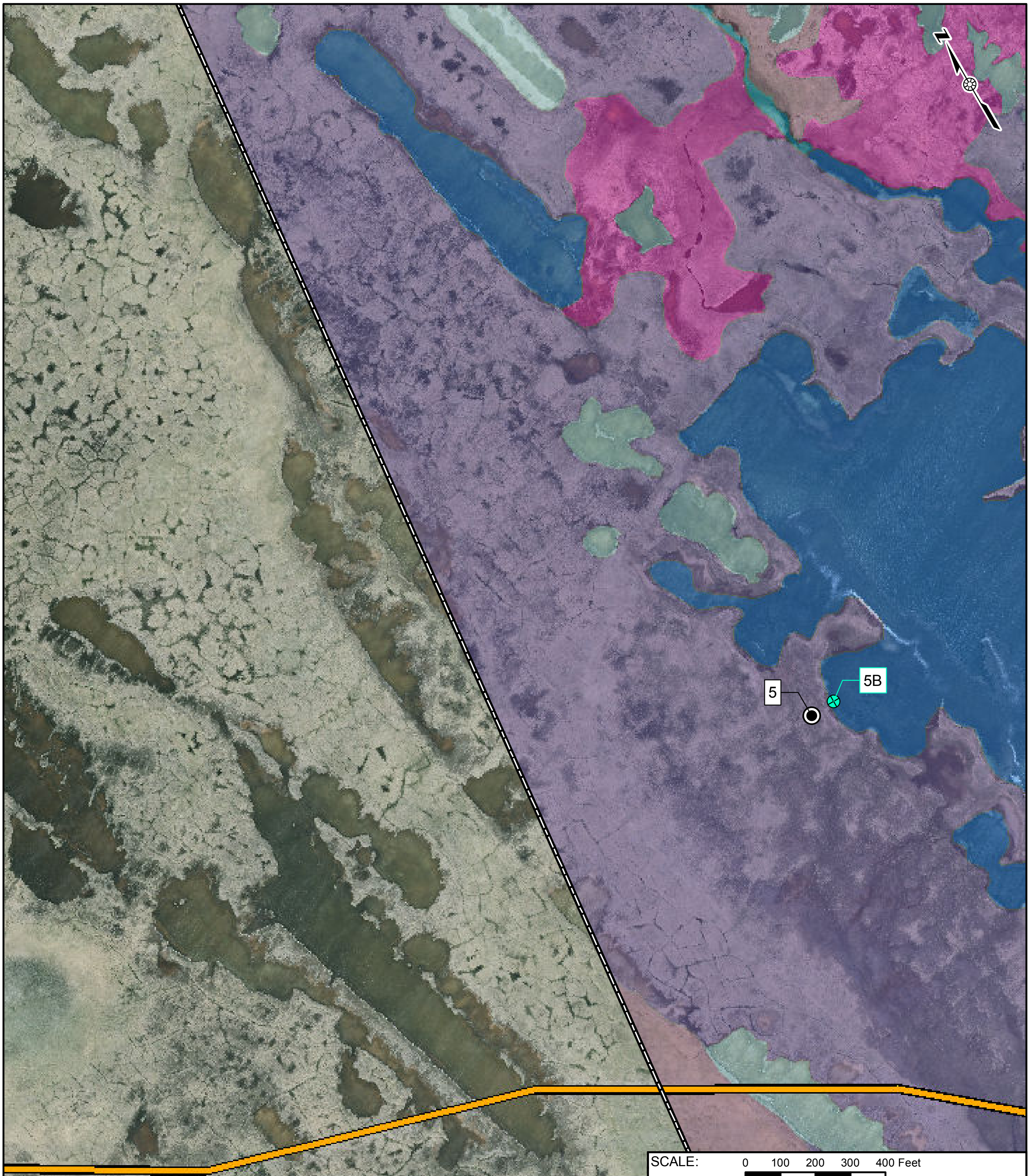
FIGURE:
2 - 19
NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15



	2015 Wetland Photo Point		Study Area	Cowardin			
	2015 Wetland Sample Point		Boulder Patch		E1UB		PEM1B/C
	Badami Pipeline		Disturbed Shadow Effect 300 ft Buffer		L1UBH		PEM1C
	Badami Seasonal Ice Road		Private Land (Native Allotment)		M1UB		PEM1H
	Outer Continental Shelf Buffer				M2US		PUBH
							R2UB

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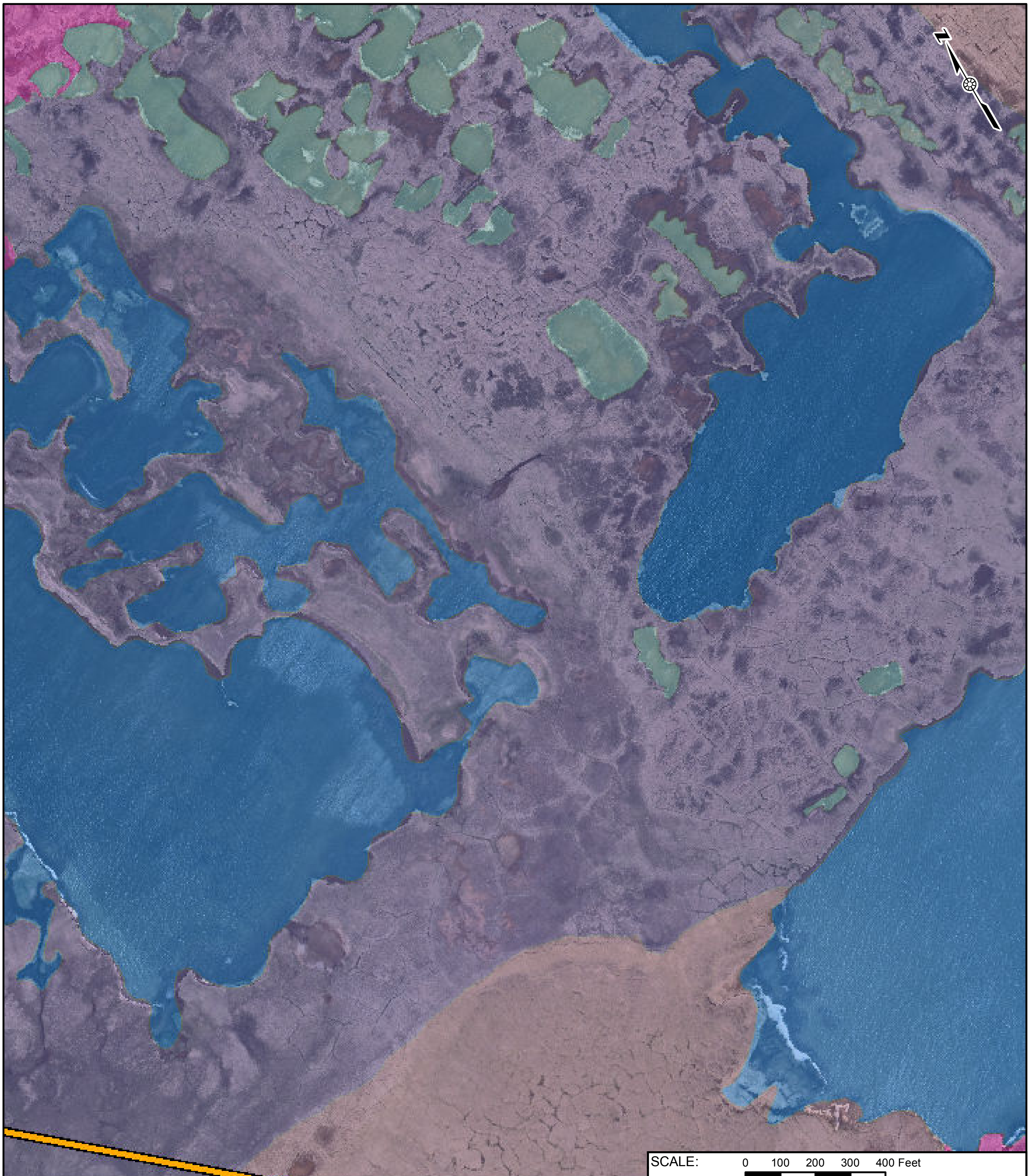
FIGURE:
2 - 20

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15



SCALE: 0 100 200 300 400 Feet

2015 Wetland Photo Point

2015 Wetland Sample Point

Badami Pipeline

Badami Seasonal Ice Road

Outer Continental Shelf Buffer

Study Area

Boulder Patch

Disturbed Shadow Effect 300 ft Buffer

Private Land (Native Allotment)

Cowardin

E1UB

L1UBH

M1UB

M2US

PEM1B/C

PEM1C

PEM1H

PUBH

R2UB

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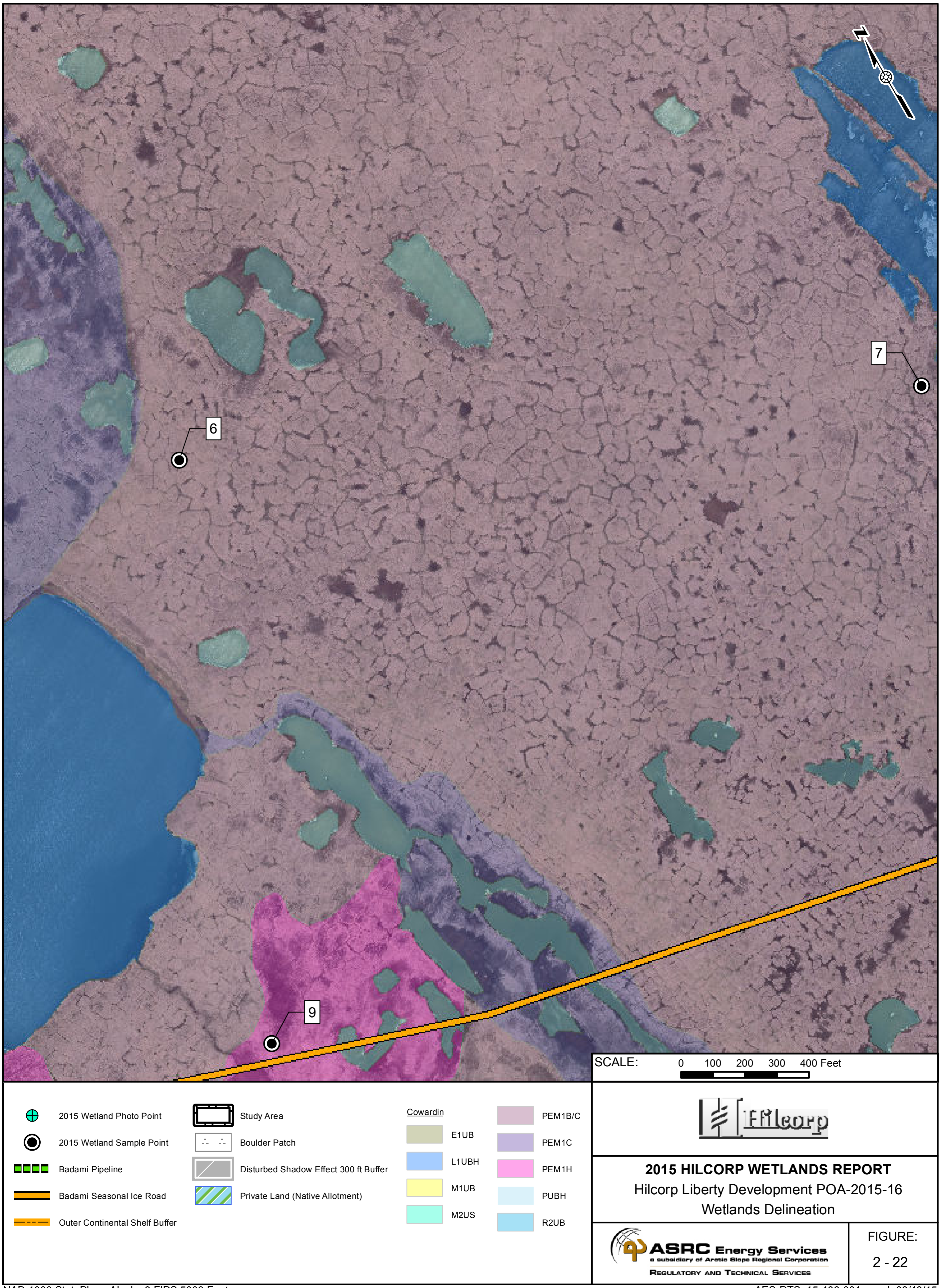
FIGURE:

2 - 21

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15



NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15

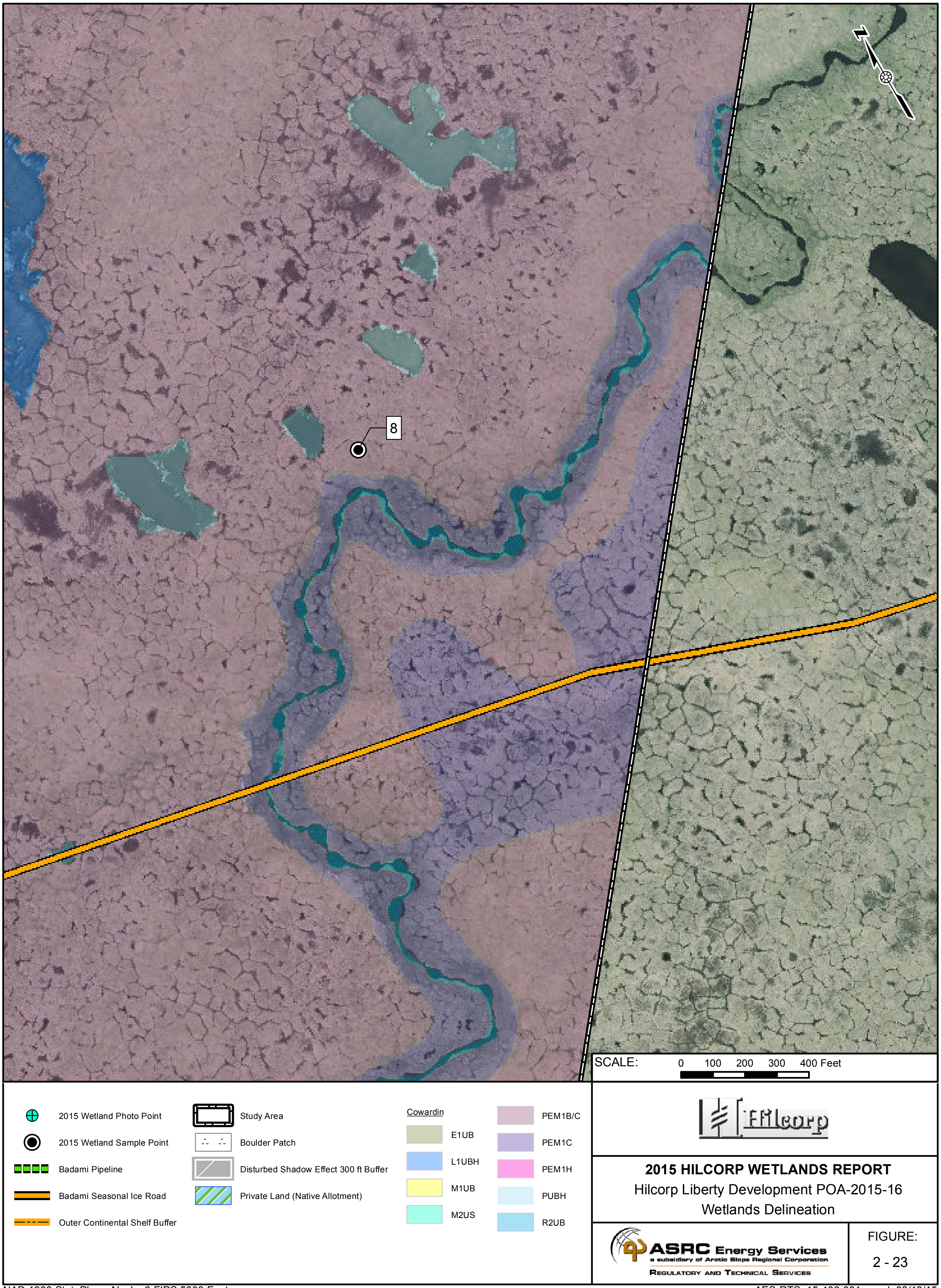


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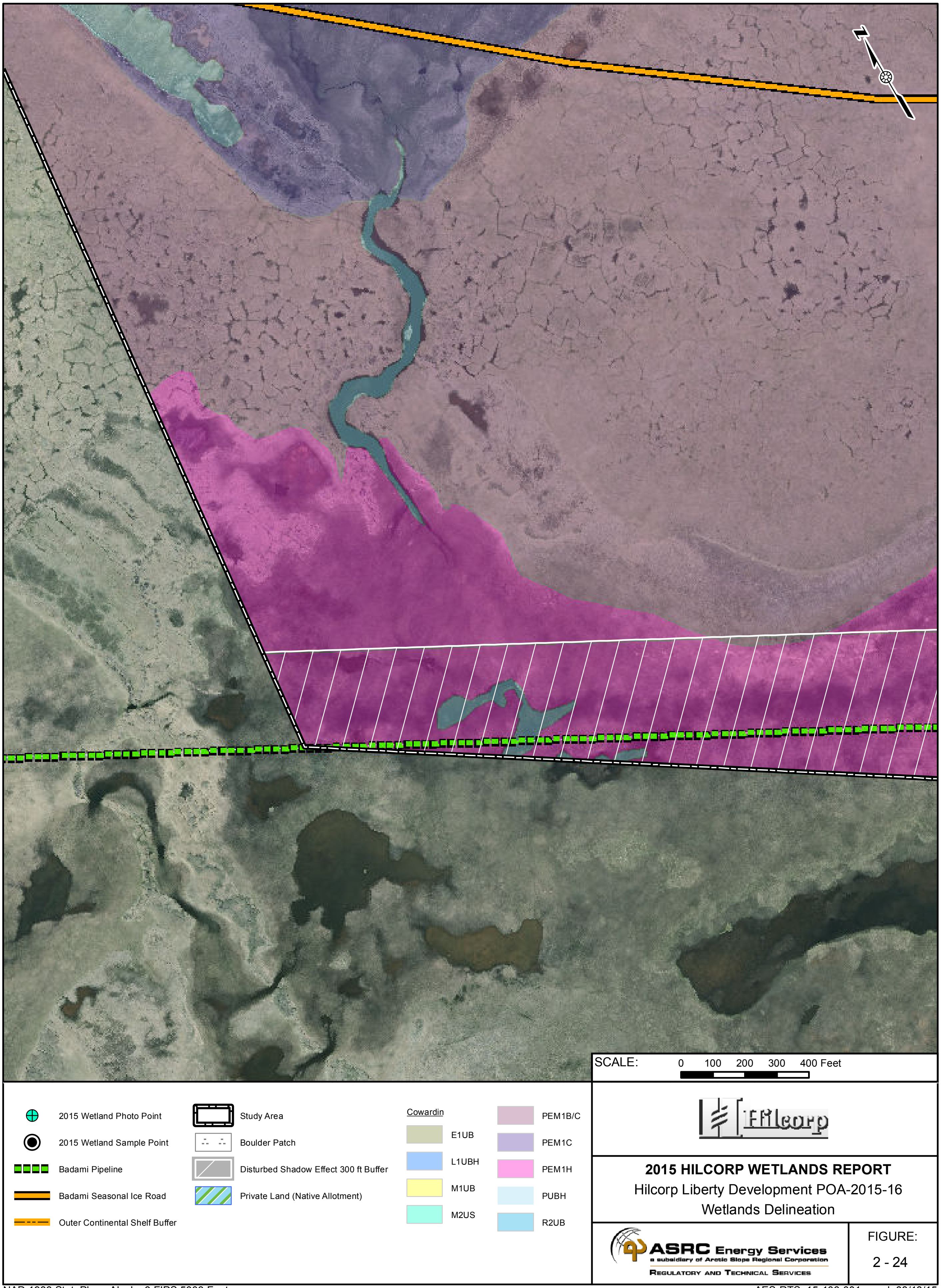
FIGURE: 2 - 23

NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet

AES-RTS: 15-106-001a.mxd, 08/18/15


SCALE:
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2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
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Hilcorp
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Wetlands Delineation
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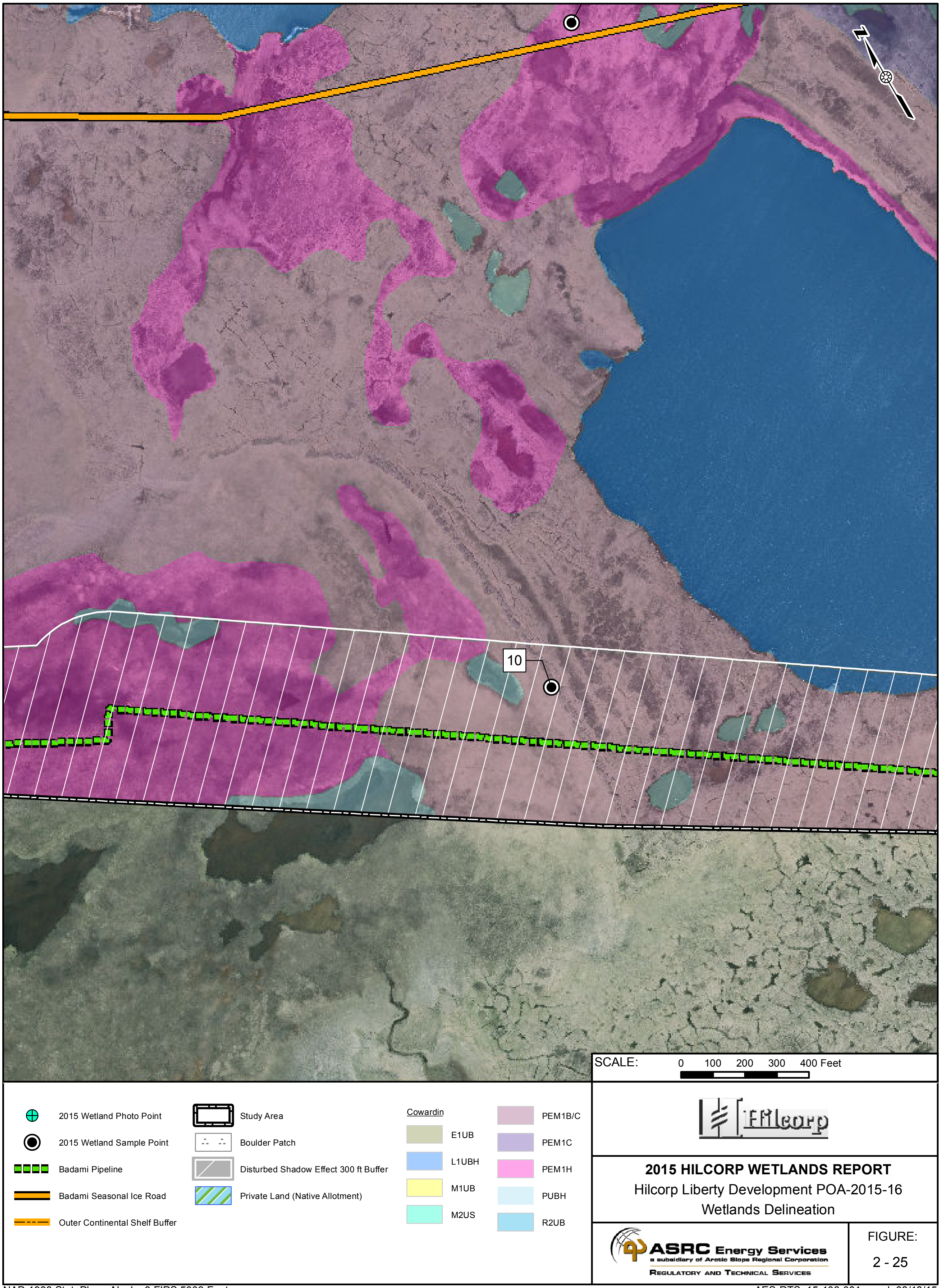
FIGURE:
2 - 24
NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15


10
SCALE:
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2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
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Cowardin
E1UB
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Hilcorp
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Wetlands Delineation
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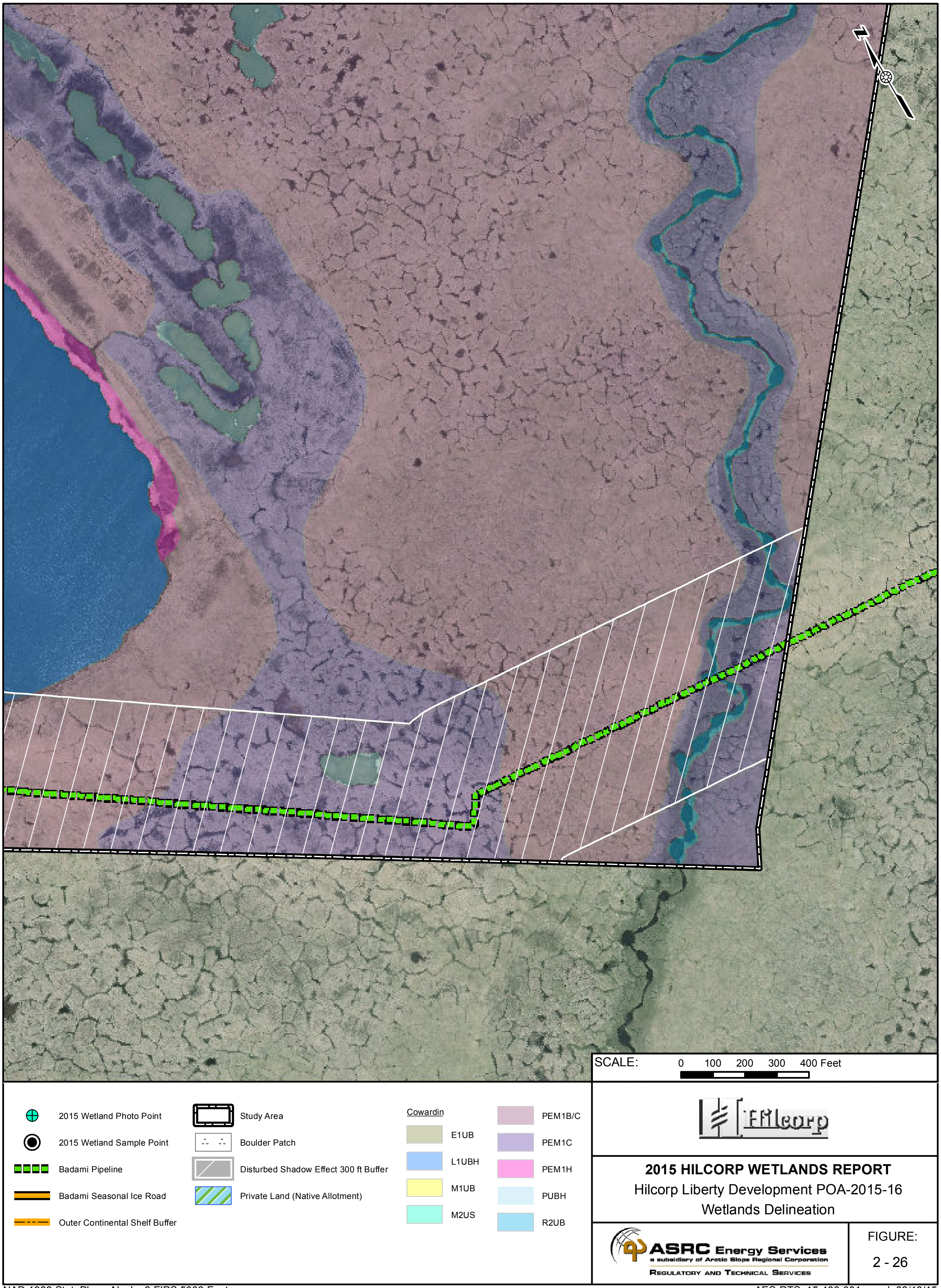
FIGURE:
2 - 25
NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15


SCALE: 0 100 200 300 400 Feet
2015 Wetland Photo Point
2015 Wetland Sample Point
Badami Pipeline
Badami Seasonal Ice Road
Outer Continental Shelf Buffer
Study Area
Boulder Patch
Disturbed Shadow Effect 300 ft Buffer
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Wetlands Delineation
ASRC Energy Services
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FIGURE:
2 - 26
NAD 1983 StatePlane Alaska 3 FIPS 5003 Feet
AES-RTS: 15-106-001a.mxd, 08/18/15

Appendix C
Aquatic Site Assessment

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Aquatic Site Assessment Summary														
Unique ID	HGM	Cowardin	Flood Flow Alteration	Sediment Removal	Nutrient and Toxicant Removal	Erosion Control and Shoreline Stabilization	Production of Organic Matter and its Export	General Habitat Suitability	General Fish Habitat	Native Plant Richness	Educational or Scientific Value	Uniqueness and Heritage	Final Overall Functional Score	Category
1	Flats	PEM1B/C	0.67	0.60	0.67	1.00	0.75	0.60	N/A	1.00	1.00	0.43	0.746	II
2	Flats	PEM1B/C	0.67	0.60	0.67	1.00	0.75	0.80	N/A	1.00	1.00	0.71	0.800	I
3	Flats	PEM1C	0.80	0.40	0.67	1.00	0.80	1.00	N/A	1.00	1.00	0.71	0.820	I
4	Flats	PEM1B/C	0.43	0.60	0.67	0.33	0.80	0.80	N/A	1.00	1.00	0.71	0.705	II
5	Flats	PEM1C	0.71	0.60	0.67	1.00	0.60	1.00	N/A	1.00	1.00	0.43	0.779	I
6	Flats	PEM1B/C	0.80	0.40	0.67	1.00	0.60	1.00	N/A	1.00	1.00	0.57	0.782	I
7	Flats	PEM1B/C	0.67	0.40	0.33	1.00	0.60	1.00	N/A	1.00	1.00	0.71	0.746	II
8	Flats	PEM1B/C	0.67	0.40	0.67	1.00	0.80	1.00	N/A	1.00	1.00	0.57	0.789	I
9	Flats	PEM1H	0.71	0.60	0.67	1.00	1.00	1.00	N/A	1.00	1.00	0.57	0.839	I
10	Flats	PEM1B/C	0.50	0.20	0.33	1.00	0.40	1.00	N/A	1.00	1.00	0.29	0.635	II

Wetland Functions and Values Evaluation Questions Unique ID:	1
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N/A
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	N
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	Y
5. Sediment deposits are present in wetland (observation or noted in application materials)	Y
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	N/A
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	N/A
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	Y
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	N
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	N
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	N/A
3. Wetland has two or more strata of vegetation	N/A
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	N
6. Is the area a known subsistence/recreation/living area	N
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Functional Sheet 2 of 31

Wetland Functions and Values Results	
Unique ID:	1
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	N/A	
5	1	
6	1	
7	1	
	Total	0.667
Sediment Removal		
1	0	
2	0	
3	1	
4	1	
5	1	
	Total	0.600
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	N/A	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	N/A	
3	0	
4	1	
5	1	
	Total	0.750
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	0	
5	1	
6	0	
	Total	0.600
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	N/A	
3	N/A	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	0	
6	0	
7	1	
	Total	0.429

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

Wetland Functions and Values Results (cont.)				
Unique ID	1			
Exceptional Habitat Designation			0	
	Weighted Score			
Flood Flow Alteration	0.667			
Sediment Removal	0.600			
Nutrient and Toxicant Removal	0.667			
Erosion Control and Shoreline Stabilization	1.000			
Production of Organic Matter and its Export	0.750			
General Habitat Suitability	0.600			
General Fish Habitat	N/A			
Native Plant Richness	1.000			
Educational or Scientific Value	1.000			
Uniqueness and Heritage	0.429			
	Total	6.712		
Standardization				
Total # of functions assessed		9		
Standardized Total		0.746		
Total (Including Disturbance and Exceptional Habitat)			0.746	
Overall Functional Score (Category)	0.76 - 1.00	I	Highest	II
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:

1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
   For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
   Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
   Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
   For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
   Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	2
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N/A
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	N
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	Y
5. Sediment deposits are present in wetland (observation or noted in application materials)	Y
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	N/A
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	N/A
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	N
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	Y
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Wetland Functions and Values Results	
Unique ID:	2
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	N/A	
5	1	
6	1	
7	1	
	Total	0.667
Sediment Removal		
1	0	
2	0	
3	1	
4	1	
5	1	
	Total	0.600
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	N/A	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	N/A	
	Total	0.750
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	0	
	Total	0.800
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	1	
6	1	
7	1	
	Total	0.714

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

Wetland Functions and Values Results (cont.)			
Unique ID	**2**		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.667		
Sediment Removal	0.600		
Nutrient and Toxicant Removal	0.667		
Erosion Control and Shoreline Stabilization	1.000		
Production of Organic Matter and its Export	0.750		
General Habitat Suitability	0.800		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.714		
	Total	7.198	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.800	
Total (Including Disturbance and Exceptional Habitat)			0.800

Overall Functional Score (Category)			
0.76 - 1.00	I	Highest	I
0.51 - 0.75	II		
0.26 - 0.50	III		
0 - 0.25	IV	Lowest	

Notes:
1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	3
HGM Class:	Flats
Cowardin Class:	PEM1C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N/A
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N/A
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	N
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	Y
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	Y
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	Y
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Functional Sheet 8 of 31

Wetland Functions and Values Results	
Unique ID:	3
HGM Class:	Flats
Cowardin Class:	PEM1C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	N/A	
4	N/A	
5	1	
6	1	
7	1	
	Total	0.800
Sediment Removal		
1	0	
2	0	
3	1	
4	1	
5	0	
	Total	0.400
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	1	
	Total	0.800
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	1	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	1	
6	1	
7	1	
	Total	0.714

Disturbance Activities		
Disturbance Category		0

Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9

Disturbance Impact Factor	1

Wetland Functions and Values Results (cont.)			
Unique ID	**3**		
Exceptional Habitat Designation			0

	Weighted Score	
Flood Flow Alteration	0.800	
Sediment Removal	0.400	
Nutrient and Toxicant Removal	0.667	
Erosion Control and Shoreline Stabilization	1.000	
Production of Organic Matter and its Export	0.800	
General Habitat Suitability	1.000	
General Fish Habitat	N/A	
Native Plant Richness	1.000	
Educational or Scientific Value	1.000	
Uniqueness and Heritage	0.714	
	Total	7.381
Standardization		
Total # of functions assessed		9
Standardized Total		0.820

Total (Including Disturbance and Exceptional Habitat)	0.820

Overall Functional Score (Category)

0.76 - 1.00	I	Highest	I
0.51 - 0.75	II		
0.26 - 0.50	III		
0 - 0.25	IV	Lowest	

Notes:
1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	4
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	N
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	Y
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	Y
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	N
2. An herbaceous layer is part of this dense vegetation	N
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	Y
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	N
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	Y
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Wetland Functions and Values Results		
Unique ID:	4	
HGM Class:	Flats	
Cowardin Class:	PEM1B/C	
Size (acres):	-	

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	0	
5	0	
6	1	
7	1	
	Total	0.429
Sediment Removal		
1	0	
2	1	
3	1	
4	1	
5	0	
	Total	0.600
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	0	
2	0	
3	1	
	Total	0.333
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	1	
	Total	0.800
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	0	
5	1	
6	1	
	Total	0.800
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	1	
6	1	
7	1	
	Total	0.714

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

Wetland Functions and Values Results (cont.)			
Unique ID	**4**		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.429		
Sediment Removal	0.600		
Nutrient and Toxicant Removal	0.667		
Erosion Control and Shoreline Stabilization	0.333		
Production of Organic Matter and its Export	0.800		
General Habitat Suitability	0.800		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.714		
	Total	6.343	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.705	
Total (Including Disturbance and Exceptional Habitat)			0.705

Overall Functional Score (Category)				
0.76 - 1.00	I	Highest	II
0.51 - 0.75	II		
0.26 - 0.50	III		
0 - 0.25	IV	Lowest	

Notes:

1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
   For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
   Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
   Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
   For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
   Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	5
HGM Class:	Flats
Cowardin Class:	PEM1C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	Y
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	Y
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	Y
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	N
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	N
6. Is the area a known subsistence/recreation/living area	N
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Wetland Functions and Values Results

Unique ID:	5
HGM Class:	Flats
Cowardin Class:	PEM1C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	1	
5	1	
6	1	
7	1	
	Total	0.714
Sediment Removal		
1	0	
2	1	
3	1	
4	1	
5	0	
	Total	0.600
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	0	
	Total	0.600
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	1	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	0	
6	0	
7	1	
	Total	0.429

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

Wetland Functions and Values Results (cont.)			
Unique ID	5		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.714		
Sediment Removal	0.600		
Nutrient and Toxicant Removal	0.667		
Erosion Control and Shoreline Stabilization	1.000		
Production of Organic Matter and its Export	0.600		
General Habitat Suitability	1.000		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.429		
	Total	7.010	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.779	
Total (Including Disturbance and Exceptional Habitat)			0.779

Overall Functional Score (Category)				
	0.76 - 1.00	I	Highest	I
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:
1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	6
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N/A
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N/A
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	Y
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	N
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	N
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	N
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Functional Sheet 17 of 31

Wetland Functions and Values Results	
Unique ID:	6
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	N/A	
4	N/A	
5	1	
6	1	
7	1	
	Total	0.800
Sediment Removal		
1	0	
2	1	
3	1	
4	0	
5	0	
	Total	0.400
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	0	
	Total	0.600
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	1	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	0	
6	1	
7	1	
	Total	0.571

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

Functional Sheet 18 of 31

Wetland Functions and Values Results (cont.)			
Unique ID	**6**		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.800		
Sediment Removal	0.400		
Nutrient and Toxicant Removal	0.667		
Erosion Control and Shoreline Stabilization	1.000		
Production of Organic Matter and its Export	0.600		
General Habitat Suitability	1.000		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.571		
	Total	7.038	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.782	
Total (Including Disturbance and Exceptional Habitat)			0.782

Overall Functional Score (Category)				
	0.76 - 1.00	I	Highest	I
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:
1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	7
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N/A
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	Y
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	N
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	N
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	N
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	Y
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

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Wetland Functions and Values Results	
Unique ID:	7
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	N/A	
5	1	
6	1	
7	1	
	Total	0.667
Sediment Removal		
1	0	
2	1	
3	1	
4	0	
5	0	
	Total	0.400
Nutrient and Toxicant Removal		
1	0	
2	0	
3	1	
	Total	0.333
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	0	
	Total	0.600
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	1	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	1	
6	1	
7	1	
	Total	0.714

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

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Wetland Functions and Values Results (cont.)			
Unique ID	7		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.667		
Sediment Removal	0.400		
Nutrient and Toxicant Removal	0.333		
Erosion Control and Shoreline Stabilization	1.000		
Production of Organic Matter and its Export	0.600		
General Habitat Suitability	1.000		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.714		
	Total	6.714	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.746	
Total (Including Disturbance and Exceptional Habitat)			0.746

Overall Functional Score (Category)				
	0.76 - 1.00	I	Highest	II
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:
1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	8
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N/A
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	Y
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	N
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	Y
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	N
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

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Wetland Functions and Values Results

Unique ID:	8
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	N/A	
5	1	
6	1	
7	1	
	Total	0.667
Sediment Removal		
1	0	
2	1	
3	1	
4	0	
5	0	
	Total	0.400
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	1	
5	1	
	Total	0.800
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	1	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	0	
6	1	
7	1	
	Total	0.571

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

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Wetland Functions and Values Results (cont.)				
Unique ID	**8**			
Exceptional Habitat Designation			0	
	Weighted Score			
Flood Flow Alteration	0.667			
Sediment Removal	0.400			
Nutrient and Toxicant Removal	0.667			
Erosion Control and Shoreline Stabilization	1.000			
Production of Organic Matter and its Export	0.800			
General Habitat Suitability	1.000			
General Fish Habitat	N/A			
Native Plant Richness	1.000			
Educational or Scientific Value	1.000			
Uniqueness and Heritage	0.571			
	Total	7.105		
Standardization				
Total # of functions assessed		9		
Standardized Total		0.789		
Total (Including Disturbance and Exceptional Habitat)			0.789	
Overall Functional Score (Category)	0.76 - 1.00	I	Highest	I
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:

1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
   For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
   Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
   Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
   For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
   Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions Unique ID:	9
HGM Class:	Flats
Cowardin Class:	PEM1H
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	N
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	Y
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	Y
7. Floodwaters come as sheet flow rather than channel flow	Y
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	Y
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	Y
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	Y
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	Y
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	Y
5. Wetland has outlet from which organic matter is flushed	Y
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	N/A
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	N/A
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	N/A
3. Wetland has two or more strata of vegetation	N/A
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	N
6. Is the area a known subsistence/recreation/living area	Y
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	Y

Wetland Functions and Values Results	
Unique ID:	9
HGM Class:	Flats
Cowardin Class:	PEM1H
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	0	
4	1	
5	1	
6	1	
7	1	
	Total	0.714
Sediment Removal		
1	0	
2	1	
3	1	
4	1	
5	0	
	Total	0.600
Nutrient and Toxicant Removal		
1	0	
2	1	
3	1	
	Total	0.667
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	1	
4	1	
5	1	
	Total	1.000
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	N/A	
5	1	
6	N/A	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	N/A	
3	N/A	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	0	
6	1	
7	1	
	Total	0.571

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

Wetland Functions and Values Results (cont.)			
Unique ID	9		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.714		
Sediment Removal	0.600		
Nutrient and Toxicant Removal	0.667		
Erosion Control and Shoreline Stabilization	1.000		
Production of Organic Matter and its Export	1.000		
General Habitat Suitability	1.000		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.571		
	Total	7.552	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.839	
Total (Including Disturbance and Exceptional Habitat)			0.839

Overall Functional Score (Category)	Range	Category		Result
	0.76 - 1.00	I	Highest	I
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:

1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
   For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
   Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
   Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
   For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
   Apply the correct impact factor to the disturbance category.

Wetland Functions and Values Evaluation Questions	
Unique ID:	10
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-
Disturbance Category:	0
A. Exceptional Habitat Designation	**Y or N**
1. Is wetland located within an area considered to be irreplaceable, or does it have unique habitat not found anywhere else on the North Slope (i.e., Teshukpuk Lake Surface Protection Area, Colville River Delta, Beaufort Sea Coastal Marsh)	N
2. Is wetland located within an area considered by any regulatory agency to be an Aquatic Resource of National Importance (ARNI)	N
B. Flood Flow Alteration	**Y or N or N/A**
1. Wetland occurs in the upper portion of its watershed	N
2. Wetland is relatively flat area and is capable of retaining higher volumes of water during storm events than under normal rainfall conditions	Y
3. Wetland is a closed system	Y
4. If flow through, wetland has constricted outlet with signs of fluctuating water levels, algal mats, and/or lodged debris	N
5. Wetland contains a dense herbaceous layer (>70% cover) or woody vegetation	Y
6. Wetland receives floodwater from an adjacent water course at least once every 10 years	N
7. Floodwaters come as sheet flow rather than channel flow	N/A
C. Sediment Removal: If moving waters consider only statements 1 and 2	**Y or N or N/A**
1. Sources of excess sediment are present up gradient of the wetland	N
2. Is wetland influenced by slow-moving water and/or a deepwater habitat	N
3. Is herbaceous vegetation present (>50% cover)	Y
4. Interspersion of vegetation and surface water is moderate in wetland presently or during flooding at least once ever 10 years	N
5. Sediment deposits are present in wetland (observation or noted in application materials)	N
D. Nutrient and Toxicant Removal	**Y or N or N/A**
1. Sources of excess nutrients (fertilizers) and toxicants (pesticides and heavy metals) are present up gradient and able to influence the wetland	N
2. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season by visual observation, or indicated by other hydrological data source	N
3. Wetland has at least 30% aerial cover of live vegetation	Y
E. Erosion Control and Shoreline Stabilization	**Y or N or N/A**
1. Wetland has dense, energy absorbing vegetation (>70%) bordering the water course and no evidence of erosion	Y
2. An herbaceous layer is part of this dense vegetation	Y
3. Shrubs able to withstand erosive flood events	Y
F. Production of Organic Matter and its Export	**Y or N or N/A**
1. Wetland has at least 30% aerial cover of herbaceous vegetation	Y
2. Woody plants in wetland are mostly deciduous	Y
3. Interspersion of vegetation and surface water is high in wetland	N
4. Wetland is inundated or has indicators that flooding is a seasonal event during the growing season	N
5. Wetland has outlet from which organic matter is flushed	N
G. General Habitat Suitability	**Y or N or N/A**
1. Is wetland located greater than 300-feet from existing development	Y
2. Undeveloped upland buffers abutting wetland	N/A
3. Wetland part of a larger wetland complex, not fragmented	Y
4. Diversity of plant species is apparent (> or = 5 species with at least 10% cover each)	Y
5. Evidence of wildlife use	Y
6. Wetland has a moderate degree of cowardin class interspersion	Y
H. General Fish Habitat	**Y or N or N/A**
1. Wetland has perennial or intermittent surface-water connection to a fish-bearing water body	N/A
2. Does wetland provide overwintering habitat for fish	N/A
3. Documented presence of fish	N/A
4. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter	N/A
5. Spawning areas are present (aquatic vegetation and/or gravel beds)	N/A
6. Juvenile rest areas	N/A
I. Native Plant Richness	**Y or N or N/A**
1. Dominant and codominant plants are native	Y
2. Wetland contains two or more Cowardin Classes	Y
3. Wetland has two or more strata of vegetation	Y
J. Educational or Scientific Value	**Y or N or N/A**
1. Site has scientific or educational use	N/A
2. Wetland is in public ownership	Y
3. Accessible trails available	N/A
4. Is the area a known recreation area	N/A
5. Subsistence (berry picking, fishing, hunting)	N/A
K. Uniqueness and Heritage	**Y or N or N/A**
1. Wetland contains documented occurrence of a state or federally listed threatened or endangered species	Y
2. Wetland contains documented critical habitat, high quality ecosystems, or priority species respectively designated by the U.S. Fish and Wildlife Service	Y
3. Wetland has biological, geological, or other features that are determined rare	N
4. Wetland has been determined significant because it provides functions scarce for the area	N
5. Are there known or reported cultural resources in the area	N
6. Is the area a known subsistence/recreation/living area	N
7. Wetland complex contains one or more of the following habitats: a) Tall shrub habitat (>.5ft in height) dominated by Salix spp. b) Aquatic herb habitat dominated by Arctophila fulva. c) Semi-permanently flooded to permanently flooded vegetated portions of drained lake basins d) Anadromous fish overwintering habitat e) Patterned wet sedge meadow and low center polygons f) High center polygon complex g) Riverine coastal mudflats h) Non-patterned wet meadow adjacent to streams and river bluffs.	N

Wetland Functions and Values Results	
Unique ID:	10
HGM Class:	Flats
Cowardin Class:	PEM1B/C
Size (acres):	-

	Raw Score	Weighted Score
Flood Flow Alteration		
1	0	
2	1	
3	1	
4	0	
5	1	
6	0	
7	N/A	
	Total	0.500
Sediment Removal		
1	0	
2	0	
3	1	
4	0	
5	0	
	Total	0.200
Nutrient and Toxicant Removal		
1	0	
2	0	
3	1	
	Total	0.333
Erosion Control and Shoreline Stabilization		
1	1	
2	1	
3	1	
	Total	1.000
Production of Organic Matter and its Export		
1	1	
2	1	
3	0	
4	0	
5	0	
	Total	0.400
General Habitat Suitability		
1	1	
2	N/A	
3	1	
4	1	
5	1	
6	1	
	Total	1.000
General Fish Habitat		
1	N/A	
2	N/A	
3	N/A	
4	N/A	
5	N/A	
6	N/A	
	Total	N/A
Native Plant Richness		
1	1	
2	1	
3	1	
	Total	1.000
Educational or Scientific Value		
1	N/A	
2	1	
3	N/A	
4	N/A	
5	N/A	
	Total	1.000
Uniqueness and Heritage		
1	1	
2	1	
3	0	
4	0	
5	0	
6	0	
7	0	
	Total	0.286

Disturbance Activities		
Disturbance Category		0
Disturbance Category		Impact Factor
0	=	1
1	=	0.99
2	=	0.95
3	=	0.9
Disturbance Impact Factor		1

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Wetland Functions and Values Results (cont.)			
Unique ID	**10**		
Exceptional Habitat Designation			0
	Weighted Score		
Flood Flow Alteration	0.500		
Sediment Removal	0.200		
Nutrient and Toxicant Removal	0.333		
Erosion Control and Shoreline Stabilization	1.000		
Production of Organic Matter and its Export	0.400		
General Habitat Suitability	1.000		
General Fish Habitat	N/A		
Native Plant Richness	1.000		
Educational or Scientific Value	1.000		
Uniqueness and Heritage	0.286		
	Total	5.719	
Standardization			
Total # of functions assessed		9	
Standardized Total		0.635	
Total (Including Disturbance and Exceptional Habitat)			0.635

Overall Functional Score (Category)				
	0.76 - 1.00	I	Highest	II
	0.51 - 0.75	II		
	0.26 - 0.50	III		
	0 - 0.25	IV	Lowest	

Notes:
1) Scores for each category component, 0 = no and 1 = yes.
2) Not all functional categories will be applicable to each wetland functional assessment.
For example, General Fish Habitat is only applicable to wetlands that are fish-bearing waters.
Functional categories that are not applicable will be treated as NA (not applicable), which means there is no score for that component. No score is not the same as 0, which would erroneously reduce the total score.
Accordingly, the maximum total score will be reduced by 1 point for each functional category that is not applicable.
For example, if General Fish Habitat does not apply, then the Total # of functions assessed is 9.
3) NA = an item that is currently not applicable, but could be applicable at a future time if more data are available.
4) See impacted area assessment worksheet for determination of disturbance activities.
Apply the correct impact factor to the disturbance category.

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Appendix D
ORM Spreadsheet

Waters_Name	Cowadin	HGM_Code	Measur	Amount	Units	Waters_Types	Latitude	Longitude	Local_Waterway	NIF Justification	Route to Section 10 Navigable Water or to TNW
E1UBFoggyIslandBay79	E1UB	ESTUARINEF	Area	23.955468	Acre	TNW	70.216044	-147.741138	FoggyIslandBay	Subsistance use area for motored boats	Flows into the Arctic Ocean
L1UBHFoggyIslandBay1	L1UBH	DEPRESS	Area	43.778496	Acre	RPW	70.18517	-147.715024	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay26	L1UBH	DEPRESS	Area	31.862461	Acre	RPW	70.191907	-147.720023	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay27	L1UBH	DEPRESS	Area	17.672715	Acre	RPW	70.196863	-147.717888	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay28	L1UBH	DEPRESS	Area	52.560254	Acre	RPW	70.197336	-147.736193	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay29	L1UBH	DEPRESS	Area	7.031947	Acre	RPW	70.197139	-147.730328	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay60	L1UBH	DEPRESS	Area	3.802657	Acre	RPW	70.202592	-147.743853	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay66	L1UBH	DEPRESS	Area	6.185933	Acre	RPW	70.20295	-147.727692	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay73	L1UBH	DEPRESS	Area	5.655029	Acre	RPW	70.207759	-147.72155	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay74	L1UBH	DEPRESS	Area	4.039176	Acre	RPW	70.208244	-147.727531	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay95	L1UBH	DEPRESS	Area	0.654375	Acre	RPW	70.183114	-147.717271	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
L1UBHFoggyIslandBay225	L1UBH	DEPRESS	Area	6.687412	Acre	RPW	70.193103	-147.691672	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
M1UBFoggyIslandBay104	M1UB	DEPRESS	Area	197.215405	Acre	TNW	70.269069	-147.594238	FoggyIslandBay	Subsistance use area for motored boats	N/A
M1UBFoggyIslandBay105	M1UB	DEPRESS	Area	27.97707	Acre	TNW	70.270502	-147.595075	FoggyIslandBay	Subsistance use area for motored boats	N/A
M1UBFoggyIslandBay106	M1UB	DEPRESS	Area	2.111235	Acre	TNW	70.25423	-147.620314	FoggyIslandBay	Subsistance use area for motored boats	N/A
M1UBFoggyIslandBay174	M1UB	DEPRESS	Area	1066.03868	Acre	TNW	70.22777	-147.663798	FoggyIslandBay	Subsistance use area for motored boats	N/A
M2USFoggyIslandBay158	M2US	DEPRESS	Area	1.288656	Acre	TNW	70.218804	-147.741788	FoggyIslandBay	Subsistance use area for motored boats	N/A
M2USFoggyIslandBay159	M2US	DEPRESS	Area	9.611465	Acre	TNW	70.210876	-147.722625	FoggyIslandBay	Subsistance use area for motored boats	N/A
M2USFoggyIslandBay229	M2US	DEPRESS	Area	1.759145	Acre	TNW	70.204531	-147.702326	FoggyIslandBay	Subsistance use area for motored boats	N/A
PEM1B/CFoggyIslandBay85	PEM1B/(	ORGSOILFLT	Area	36.629929	Acre	TNWW	70.211513	-147.741986	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay96	PEM1B/(	ORGSOILFLT	Area	0.780595	Acre	TNWW	70.185356	-147.728247	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay100	PEM1B/(	ORGSOILFLT	Area	8.921422	Acre	TNWW	70.180198	-147.702786	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay102	PEM1B/(	ORGSOILFLT	Area	0.138414	Acre	TNWW	70.187494	-147.739948	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay103	PEM1B/(	ORGSOILFLT	Area	0.032569	Acre	TNWW	70.180787	-147.696105	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay107	PEM1B/(	ORGSOILFLT	Area	15.185062	Acre	TNWW	70.18404	-147.690347	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay108	PEM1B/(	ORGSOILFLT	Area	10.210037	Acre	TNWW	70.187919	-147.685821	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay114	PEM1B/(	ORGSOILFLT	Area	24.130613	Acre	TNWW	70.183132	-147.720838	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay124	PEM1B/(	ORGSOILFLT	Area	6.811746	Acre	TNWW	70.205129	-147.741311	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay126	PEM1B/(	ORGSOILFLT	Area	5.183197	Acre	TNWW	70.203216	-147.735861	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay127	PEM1B/(	ORGSOILFLT	Area	6.415071	Acre	TNWW	70.204747	-147.735036	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay160	PEM1B/(	ORGSOILFLT	Area	14.42963	Acre	TNWW	70.20898	-147.734514	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay162	PEM1B/(	ORGSOILFLT	Area	20.296625	Acre	TNWW	70.192955	-147.747831	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay165	PEM1B/(	ORGSOILFLT	Area	14.958727	Acre	TNWW	70.185141	-147.71018	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay166	PEM1B/(	ORGSOILFLT	Area	147.709233	Acre	TNWW	70.189537	-147.730798	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay168	PEM1B/(	ORGSOILFLT	Area	610.25867	Acre	TNWW	70.194213	-147.695584	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay171	PEM1B/(	ORGSOILFLT	Area	0.551272	Acre	TNWW	70.179195	-147.703834	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay176	PEM1B/(	ORGSOILFLT	Area	7.454627	Acre	TNWW	70.217214	-147.742739	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay226	PEM1B/(	ORGSOILFLT	Area	0.159099	Acre	TNWW	70.193158	-147.69123	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1B/CFoggyIslandBay228	PEM1B/(	ORGSOILFLT	Area	113.887905	Acre	TNWW	70.20963	-147.728097	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay52	PEM1C	ORGSOILFLT	Area	25.543421	Acre	TNWW	70.186505	-147.68708	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay59	PEM1C	ORGSOILFLT	Area	27.060657	Acre	TNWW	70.185774	-147.707683	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay81	PEM1C	ORGSOILFLT	Area	9.697482	Acre	TNWW	70.186537	-147.689379	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay82	PEM1C	ORGSOILFLT	Area	0.153766	Acre	TNWW	70.190508	-147.67416	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay83	PEM1C	ORGSOILFLT	Area	0.409467	Acre	TNWW	70.190598	-147.674473	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay97	PEM1C	ORGSOILFLT	Area	2.410952	Acre	TNWW	70.179891	-147.69895	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay101	PEM1C	ORGSOILFLT	Area	1.43035	Acre	TNWW	70.180144	-147.699517	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay125	PEM1C	ORGSOILFLT	Area	0.03076	Acre	TNWW	70.20551	-147.736165	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay164	PEM1C	ORGSOILFLT	Area	12.631205	Acre	TNWW	70.203774	-147.70143	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay167	PEM1C	ORGSOILFLT	Area	264.650817	Acre	TNWW	70.198325	-147.731677	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay170	PEM1C	ORGSOILFLT	Area	1.407881	Acre	TNWW	70.17893	-147.70109	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay172	PEM1C	ORGSOILFLT	Area	0.344166	Acre	TNWW	70.179083	-147.702693	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1CFoggyIslandBay204	PEM1C	ORGSOILFLT	Area	10.990258	Acre	TNWW	70.180791	-147.70949	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay40	PEM1H	ORGSOILFLT	Area	17.344912	Acre	TNWW	70.188381	-147.714652	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay64	PEM1H	ORGSOILFLT	Area	0.34714	Acre	TNWW	70.203108	-147.726799	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay65	PEM1H	ORGSOILFLT	Area	0.155264	Acre	TNWW	70.202539	-147.728152	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay91	PEM1H	ORGSOILFLT	Area	5.075193	Acre	TNWW	70.186713	-147.732627	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay92	PEM1H	ORGSOILFLT	Area	14.763388	Acre	TNWW	70.189816	-147.74775	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay98	PEM1H	ORGSOILFLT	Area	0.016626	Acre	TNWW	70.186339	-147.731675	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay99	PEM1H	ORGSOILFLT	Area	30.812866	Acre	TNWW	70.186664	-147.738577	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay109	PEM1H	ORGSOILFLT	Area	2.102199	Acre	TNWW	70.185746	-147.726102	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay110	PEM1H	ORGSOILFLT	Area	14.048162	Acre	TNWW	70.188507	-147.724239	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay115	PEM1H	ORGSOILFLT	Area	6.428164	Acre	TNWW	70.201621	-147.740117	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay152	PEM1H	ORGSOILFLT	Area	0.367619	Acre	TNWW	70.208831	-147.727128	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay153	PEM1H	ORGSOILFLT	Area	0.195977	Acre	TNWW	70.215075	-147.741514	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay161	PEM1H	ORGSOILFLT	Area	19.946857	Acre	TNWW	70.207705	-147.744292	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PEM1HFoggyIslandBay163	PEM1H	ORGSOILFLT	Area	60.642878	Acre	TNWW	70.205627	-147.732754	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay2	PUBH	DEPRESS	Area	3.416352	Acre	TNWW	70.18979	-147.709781	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay3	PUBH	DEPRESS	Area	0.234738	Acre	TNWW	70.190668	-147.712302	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay4	PUBH	DEPRESS	Area	0.332242	Acre	TNWW	70.192407	-147.712269	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay5	PUBH	DEPRESS	Area	1.072029	Acre	TNWW	70.194845	-147.708313	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay6	PUBH	DEPRESS	Area	0.844686	Acre	TNWW	70.194742	-147.706702	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay7	PUBH	DEPRESS	Area	0.316255	Acre	TNWW	70.188775	-147.711794	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay8	PUBH	DEPRESS	Area	0.09234	Acre	TNWW	70.189262	-147.71265	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay9	PUBH	DEPRESS	Area	1.079845	Acre	TNWW	70.186194	-147.706431	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay10	PUBH	DEPRESS	Area	0.380767	Acre	TNWW	70.185008	-147.705939	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay11	PUBH	DEPRESS	Area	0.617417	Acre	TNWW	70.18417	-147.707569	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay12	PUBH	DEPRESS	Area	0.254265	Acre	TNWW	70.184552	-147.706062	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay13	PUBH	DEPRESS	Area	0.383009	Acre	TNWW	70.188867	-147.713761	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay14	PUBH	DEPRESS	Area	0.508551	Acre	TNWW	70.189275	-147.711099	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean

PUBHFoggyIslandBay15	PUBH	DEPRESS	Area	0.242348	Acre	TNWW	70.188313	-147.709314	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay16	PUBH	DEPRESS	Area	0.623918	Acre	TNWW	70.186769	-147.702216	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay17	PUBH	DEPRESS	Area	0.24145	Acre	TNWW	70.189775	-147.702409	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay18	PUBH	DEPRESS	Area	0.403543	Acre	TNWW	70.188973	-147.699777	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay19	PUBH	DEPRESS	Area	0.47243	Acre	TNWW	70.186367	-147.732198	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay20	PUBH	DEPRESS	Area	0.699951	Acre	TNWW	70.187983	-147.746634	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay21	PUBH	DEPRESS	Area	0.134987	Acre	TNWW	70.188264	-147.719241	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay22	PUBH	DEPRESS	Area	0.142177	Acre	TNWW	70.187256	-147.744856	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay23	PUBH	DEPRESS	Area	1.329177	Acre	TNWW	70.191263	-147.744897	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay24	PUBH	DEPRESS	Area	0.375018	Acre	TNWW	70.187525	-147.720526	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay25	PUBH	DEPRESS	Area	0.222146	Acre	TNWW	70.188172	-147.720798	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay30	PUBH	DEPRESS	Area	0.163719	Acre	TNWW	70.204929	-147.710284	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay31	PUBH	DEPRESS	Area	1.414283	Acre	TNWW	70.20045	-147.712172	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay32	PUBH	DEPRESS	Area	1.588116	Acre	TNWW	70.200964	-147.708119	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay33	PUBH	DEPRESS	Area	0.521439	Acre	TNWW	70.200499	-147.705814	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay34	PUBH	DEPRESS	Area	1.155571	Acre	TNWW	70.197249	-147.722093	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay35	PUBH	DEPRESS	Area	1.103831	Acre	TNWW	70.19922	-147.719995	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay36	PUBH	DEPRESS	Area	1.913752	Acre	TNWW	70.199707	-147.725576	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay37	PUBH	DEPRESS	Area	1.662552	Acre	TNWW	70.201081	-147.722106	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay38	PUBH	DEPRESS	Area	1.277252	Acre	TNWW	70.19422	-147.703201	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay39	PUBH	DEPRESS	Area	0.317851	Acre	TNWW	70.197356	-147.708424	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay41	PUBH	DEPRESS	Area	0.969526	Acre	TNWW	70.19811	-147.701855	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay42	PUBH	DEPRESS	Area	0.260326	Acre	TNWW	70.198303	-147.699691	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay43	PUBH	DEPRESS	Area	0.401345	Acre	TNWW	70.197207	-147.701568	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay44	PUBH	DEPRESS	Area	0.582535	Acre	TNWW	70.197706	-147.697672	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay45	PUBH	DEPRESS	Area	1.390727	Acre	TNWW	70.184331	-147.729975	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay46	PUBH	DEPRESS	Area	0.333304	Acre	TNWW	70.184636	-147.725455	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay47	PUBH	DEPRESS	Area	0.451177	Acre	TNWW	70.184615	-147.707301	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay48	PUBH	DEPRESS	Area	0.30793	Acre	TNWW	70.190043	-147.686938	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay49	PUBH	DEPRESS	Area	1.383144	Acre	TNWW	70.190184	-147.690862	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay50	PUBH	DEPRESS	Area	0.250664	Acre	TNWW	70.194568	-147.695888	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay51	PUBH	DEPRESS	Area	0.085056	Acre	TNWW	70.187858	-147.697328	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay54	PUBH	DEPRESS	Area	0.347116	Acre	TNWW	70.197517	-147.680502	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay55	PUBH	DEPRESS	Area	0.628139	Acre	TNWW	70.205468	-147.709982	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay56	PUBH	DEPRESS	Area	0.65687	Acre	TNWW	70.204953	-147.713495	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay57	PUBH	DEPRESS	Area	0.637389	Acre	TNWW	70.20457	-147.707548	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay58	PUBH	DEPRESS	Area	1.971785	Acre	TNWW	70.200113	-147.722855	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay61	PUBH	DEPRESS	Area	1.425047	Acre	TNWW	70.202183	-147.726192	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay62	PUBH	DEPRESS	Area	1.605711	Acre	TNWW	70.200637	-147.728014	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay63	PUBH	DEPRESS	Area	0.775808	Acre	TNWW	70.201343	-147.725912	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay68	PUBH	DEPRESS	Area	3.470674	Acre	TNWW	70.206857	-147.741167	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay69	PUBH	DEPRESS	Area	1.852073	Acre	TNWW	70.19175	-147.680688	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay70	PUBH	DEPRESS	Area	1.01225	Acre	TNWW	70.196842	-147.673875	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay72	PUBH	DEPRESS	Area	0.688484	Acre	TNWW	70.205255	-147.738217	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay75	PUBH	DEPRESS	Area	0.320217	Acre	TNWW	70.211293	-147.726848	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay76	PUBH	DEPRESS	Area	1.519736	Acre	TNWW	70.211769	-147.728888	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay77	PUBH	DEPRESS	Area	1.431562	Acre	TNWW	70.212108	-147.731014	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay78	PUBH	DEPRESS	Area	1.284307	Acre	TNWW	70.214412	-147.734375	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay80	PUBH	DEPRESS	Area	0.591765	Acre	TNWW	70.209138	-147.746253	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay87	PUBH	DEPRESS	Area	0.169956	Acre	TNWW	70.209773	-147.739194	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay88	PUBH	DEPRESS	Area	1.547279	Acre	TNWW	70.203466	-147.741622	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay89	PUBH	DEPRESS	Area	0.467856	Acre	TNWW	70.202585	-147.735662	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay90	PUBH	DEPRESS	Area	1.524207	Acre	TNWW	70.197458	-147.71268	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay93	PUBH	DEPRESS	Area	0.007281	Acre	TNWW	70.186256	-147.731144	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay94	PUBH	DEPRESS	Area	0.130747	Acre	TNWW	70.186672	-147.732972	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay111	PUBH	DEPRESS	Area	0.295542	Acre	TNWW	70.183086	-147.722918	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay112	PUBH	DEPRESS	Area	0.141839	Acre	TNWW	70.183291	-147.720767	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay113	PUBH	DEPRESS	Area	0.13402	Acre	TNWW	70.183205	-147.719864	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay116	PUBH	DEPRESS	Area	0.218956	Acre	TNWW	70.197362	-147.720076	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay117	PUBH	DEPRESS	Area	0.433141	Acre	TNWW	70.197528	-147.719058	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay118	PUBH	DEPRESS	Area	0.314075	Acre	TNWW	70.199092	-147.722405	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay119	PUBH	DEPRESS	Area	0.331423	Acre	TNWW	70.200563	-147.719437	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay120	PUBH	DEPRESS	Area	0.22566	Acre	TNWW	70.202275	-147.71849	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay121	PUBH	DEPRESS	Area	0.172325	Acre	TNWW	70.202864	-147.719682	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay122	PUBH	DEPRESS	Area	0.305978	Acre	TNWW	70.203248	-147.721618	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay123	PUBH	DEPRESS	Area	1.017211	Acre	TNWW	70.20437	-147.719822	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay128	PUBH	DEPRESS	Area	0.535808	Acre	TNWW	70.206809	-147.728977	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay129	PUBH	DEPRESS	Area	0.15367	Acre	TNWW	70.208123	-147.728867	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay130	PUBH	DEPRESS	Area	0.093494	Acre	TNWW	70.208367	-147.729087	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay131	PUBH	DEPRESS	Area	0.149166	Acre	TNWW	70.209732	-147.731541	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay132	PUBH	DEPRESS	Area	0.442565	Acre	TNWW	70.210728	-147.732199	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay133	PUBH	DEPRESS	Area	0.084102	Acre	TNWW	70.206519	-147.724986	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay134	PUBH	DEPRESS	Area	0.219478	Acre	TNWW	70.20666	-147.723829	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay135	PUBH	DEPRESS	Area	0.211296	Acre	TNWW	70.208697	-147.723691	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay136	PUBH	DEPRESS	Area	0.328983	Acre	TNWW	70.209219	-147.719913	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay137	PUBH	DEPRESS	Area	0.258191	Acre	TNWW	70.2118	-147.733271	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay138	PUBH	DEPRESS	Area	0.133295	Acre	TNWW	70.212301	-147.734033	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay139	PUBH	DEPRESS	Area	0.116038	Acre	TNWW	70.212911	-147.730434	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay140	PUBH	DEPRESS	Area	0.263443	Acre	TNWW	70.212918	-147.731593	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay141	PUBH	DEPRESS	Area	0.248052	Acre	TNWW	70.212803	-147.732954	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean

PUBHFoggyIslandBay142	PUBH	DEPRESS	Area	0.724207	Acre	TNWW	70.213189	-147.736672	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay143	PUBH	DEPRESS	Area	0.095706	Acre	TNWW	70.213559	-147.731335	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay144	PUBH	DEPRESS	Area	0.168606	Acre	TNWW	70.213797	-147.737059	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay145	PUBH	DEPRESS	Area	0.273561	Acre	TNWW	70.214165	-147.735787	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay146	PUBH	DEPRESS	Area	0.58524	Acre	TNWW	70.214301	-147.738882	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay147	PUBH	DEPRESS	Area	0.094687	Acre	TNWW	70.206068	-147.73737	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay148	PUBH	DEPRESS	Area	0.348259	Acre	TNWW	70.20675	-147.736286	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay149	PUBH	DEPRESS	Area	0.315649	Acre	TNWW	70.206922	-147.738397	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay150	PUBH	DEPRESS	Area	0.071502	Acre	TNWW	70.207804	-147.735501	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay151	PUBH	DEPRESS	Area	1.731356	Acre	TNWW	70.207679	-147.731023	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay154	PUBH	DEPRESS	Area	0.517429	Acre	TNWW	70.189419	-147.704115	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay155	PUBH	DEPRESS	Area	0.147786	Acre	TNWW	70.197795	-147.693369	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay156	PUBH	DEPRESS	Area	0.194634	Acre	TNWW	70.198952	-147.697786	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay157	PUBH	DEPRESS	Area	0.32256	Acre	TNWW	70.205393	-147.715458	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay175	PUBH	DEPRESS	Area	0.60562	Acre	TNWW	70.213694	-147.733206	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay177	PUBH	DEPRESS	Area	0.072872	Acre	TNWW	70.214486	-147.736067	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay178	PUBH	DEPRESS	Area	0.126545	Acre	TNWW	70.212744	-147.729337	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay179	PUBH	DEPRESS	Area	0.209943	Acre	TNWW	70.195766	-147.670515	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay180	PUBH	DEPRESS	Area	0.042825	Acre	TNWW	70.194187	-147.665841	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay181	PUBH	DEPRESS	Area	0.166149	Acre	TNWW	70.194071	-147.666976	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay182	PUBH	DEPRESS	Area	0.204339	Acre	TNWW	70.190831	-147.682333	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay183	PUBH	DEPRESS	Area	0.422331	Acre	TNWW	70.190298	-147.683938	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay184	PUBH	DEPRESS	Area	0.18601	Acre	TNWW	70.211469	-147.740095	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay185	PUBH	DEPRESS	Area	0.040119	Acre	TNWW	70.210681	-147.73965	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay186	PUBH	DEPRESS	Area	0.151977	Acre	TNWW	70.211034	-147.739335	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay187	PUBH	DEPRESS	Area	0.143112	Acre	TNWW	70.210974	-147.741159	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay188	PUBH	DEPRESS	Area	0.129643	Acre	TNWW	70.207459	-147.738031	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay189	PUBH	DEPRESS	Area	0.881982	Acre	TNWW	70.202281	-147.732012	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay190	PUBH	DEPRESS	Area	0.498097	Acre	TNWW	70.20115	-147.729123	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay191	PUBH	DEPRESS	Area	0.467496	Acre	TNWW	70.201323	-147.731829	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay192	PUBH	DEPRESS	Area	0.158329	Acre	TNWW	70.20113	-147.730233	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay193	PUBH	DEPRESS	Area	0.115203	Acre	TNWW	70.200754	-147.73171	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay194	PUBH	DEPRESS	Area	0.299845	Acre	TNWW	70.204377	-147.746377	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay195	PUBH	DEPRESS	Area	0.344213	Acre	TNWW	70.201605	-147.740734	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay196	PUBH	DEPRESS	Area	0.929333	Acre	TNWW	70.199246	-147.742676	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay197	PUBH	DEPRESS	Area	0.843655	Acre	TNWW	70.200256	-147.743733	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay198	PUBH	DEPRESS	Area	0.163321	Acre	TNWW	70.199579	-147.74507	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay199	PUBH	DEPRESS	Area	0.284824	Acre	TNWW	70.194897	-147.724322	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay200	PUBH	DEPRESS	Area	0.183998	Acre	TNWW	70.193926	-147.719966	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay201	PUBH	DEPRESS	Area	0.103972	Acre	TNWW	70.193499	-147.721582	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay202	PUBH	DEPRESS	Area	0.069341	Acre	TNWW	70.193292	-147.722365	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay203	PUBH	DEPRESS	Area	0.373447	Acre	TNWW	70.180872	-147.708785	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay205	PUBH	DEPRESS	Area	0.126969	Acre	TNWW	70.21438	-147.73327	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay206	PUBH	DEPRESS	Area	0.124467	Acre	TNWW	70.213691	-147.735171	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay207	PUBH	DEPRESS	Area	0.078029	Acre	TNWW	70.213676	-147.735933	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay208	PUBH	DEPRESS	Area	0.039428	Acre	TNWW	70.212913	-147.737025	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay209	PUBH	DEPRESS	Area	0.103551	Acre	TNWW	70.212638	-147.737189	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay210	PUBH	DEPRESS	Area	0.10897	Acre	TNWW	70.212483	-147.735456	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay211	PUBH	DEPRESS	Area	0.169394	Acre	TNWW	70.212652	-147.734175	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay212	PUBH	DEPRESS	Area	0.094813	Acre	TNWW	70.212432	-147.732875	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay213	PUBH	DEPRESS	Area	0.061746	Acre	TNWW	70.211849	-147.733845	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay214	PUBH	DEPRESS	Area	0.086072	Acre	TNWW	70.212892	-147.735015	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay215	PUBH	DEPRESS	Area	0.051585	Acre	TNWW	70.213303	-147.73117	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay216	PUBH	DEPRESS	Area	0.152231	Acre	TNWW	70.210811	-147.723747	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay217	PUBH	DEPRESS	Area	0.170808	Acre	TNWW	70.208025	-147.718265	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay218	PUBH	DEPRESS	Area	0.268659	Acre	TNWW	70.195423	-147.71316	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay219	PUBH	DEPRESS	Area	0.551446	Acre	TNWW	70.194679	-147.711873	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay220	PUBH	DEPRESS	Area	0.193771	Acre	TNWW	70.198457	-147.722886	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay221	PUBH	DEPRESS	Area	0.168017	Acre	TNWW	70.198721	-147.723191	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay222	PUBH	DEPRESS	Area	0.193285	Acre	TNWW	70.19897	-147.72406	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay223	PUBH	DEPRESS	Area	0.123459	Acre	TNWW	70.198635	-147.719506	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay224	PUBH	DEPRESS	Area	2.694604	Acre	TNWW	70.19465	-147.746817	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
PUBHFoggyIslandBay227	PUBH	DEPRESS	Area	0.029232	Acre	TNWW	70.208615	-147.723331	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay53	R2UB	RIVERINE	Area	3.539842	Acre	RPW	70.186439	-147.688828	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay67	R2UB	RIVERINE	Area	0.764069	Acre	RPW	70.20312	-147.737061	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay71	R2UB	RIVERINE	Area	0.329566	Acre	RPW	70.205819	-147.740065	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay84	R2UB	RIVERINE	Area	0.150683	Acre	RPW	70.190553	-147.674286	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay86	R2UB	RIVERINE	Area	1.973114	Acre	RPW	70.209803	-147.738503	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay169	R2UB	RIVERINE	Area	0.225393	Acre	RPW	70.179039	-147.702192	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean
R2UBFoggyIslandBay173	R2UB	RIVERINE	Area	0.747623	Acre	RPW	70.180071	-147.699266	FoggyIslandBay	N/A	Adjacent and Neighboring to the wetland complex flowing into the Arctic Ocean

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Lease Stipulations

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Appendix F. Guide to Lease Stipulations

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UNITED STATES
DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

Stipulations for Oil and Gas Lease Sale 124
Outer Continental Shelf
Beaufort Sea
Alaska

Stipulation No. 1--Protection of Archaeological Resources

(a) "Archaeological resource" means any prehistoric or historic district, site, building, structure, or object (including shipwrecks); such term includes artifacts, records, and remains which are related to such a district, site, building, structure, or object, National Historic Preservation Act, as amended, 16 U.S.C. 470w(5)). "Operations" means any drilling, mining, or construction, or placement of any structure for exploration, development, or production of the lease.

(b) If the Regional Supervisor, Field Operations (RSFO), believes an archaeological resource may exist in the lease area, the RSFO will notify the lessee in writing. The lessee shall then comply with subparagraphs (1) through (3).

(1) Prior to commencing any operations, the lessee shall prepare a report, as specified by the RSFO, to determine the potential existence of any archaeological resource that may be affected by operations. The report, prepared by an archaeologist and a geophysicist, shall be based on an assessment of data from remote-sensing surveys and of other pertinent archaeological and environmental information. The lessee shall submit this report to the RSFO for review.

(2) If the evidence suggests that an archaeological resource may be present, the lessee shall either:

(i) Locate the site of any operation so as not to adversely affect the area where the archaeological resource may be; or

(ii) Establish to the satisfaction of the RSFO that an archaeological resource does not exist or will not be adversely affected by operations. This shall be done by further archaeological investigation, conducted by an archaeologist and a geophysicist, using survey equipment and techniques deemed necessary by the RSFO. A report on the investigation shall be submitted to the RSFO for review.

(3) If the RSFO determines that an archaeological resource is likely to be present in the lease area and may be adversely affected by operations, the RSFO will notify the lessee immediately. The lessee shall take no action that may adversely affect the archaeological resource until the RSFO has told the lessee how to protect it.

(c) If the lessee discovers any archaeological resource while conducting operations in the lease area, the lessee shall report the discovery immediately to the RSFO. The lessee shall make every reasonable effort to preserve the archaeological resource until the RSFO has told the lessee how to protect it.

Stipulation No. 2--Protection of Biological Resources

If biological populations or habitats that may require additional protection are identified by the Regional Supervisor, Field Operations (RSFO), in the lease area, the RSFO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RSFO shall give written notification to the lessee of the RSFO's decision to require such surveys. Based on any surveys which the RSFO may require of the lessee or on other information available to the RSFO on special biological resources, the RSFO may require the lessee to:

(1) relocate the site of operations;

(2) establish to the satisfaction of the RSFO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;

(3) operate during those periods of time, as established by the RSFO, that do not adversely affect the biological resources; and/or

(4) modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such findings to the RSFO and make every reasonable effort to preserve and protect the biological resource from damage until the RSFO has given the lessee direction with respect to its protection.

The lessee shall submit all data obtained in the course of biological surveys to the RSFO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RSFO provides written directions to the lessee with regard to permissible actions.

Stipulation No. 3--Orientation Program

The lessee shall include in any exploration or development and production plans submitted under 30 CFR 250.33 and 250.34 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the Regional Supervisor, Field Operations. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns which relate to the sale and adjacent areas. The program shall be formulated by qualified instructors experienced in each pertinent field of study and shall employ effective methods to ensure that personnel are informed of archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals, and to ensure that personnel understand the importance of not disturbing archaeological resources and of avoidance and nonharassment of wildlife resources. The program shall also be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program also shall include information concerning avoidance of conflicts with subsistence activities. The program also shall include presentations and information about all pertinent lease sale stipulations and information to lessees provisions.

The program shall be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program. This record shall include the name and date(s) of attendance of each attendee and shall be kept onsite for so long as the site is active, not to exceed 5 years.

Stipulation No. 4--Transportation of Hydrocarbons

Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to any recommendation of the Regional Technical Working Group, or other similar advisory groups with participation of Federal, State, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Regional Supervisor, Field Operations.

Stipulation No. 5--Industry Site-Specific Bowhead Whale-Monitoring Program

Lessees shall conduct a site-specific monitoring program during exploratory drilling activities to determine when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these activities. The lessee shall provide its proposed monitoring plan to the Regional Supervisor, Field Operations (RSFO), for review and approval no later than 60 days prior to commencement of drilling activities. Information obtained from this site-specific monitoring program shall be provided to the RSFO in accordance with the approved monitoring plan. This stipulation will remain in effect until termination or modification by the Department of the Interior after consultation with the National Marine Fisheries Service.

This stipulation applies to the following blocks for the following time periods: (Official Protraction Diagram [OPD])

SPRING MIGRATION AREA

April 15 to June 15

OPD	Blocks Included
NR 4-1	770-771, 813-815, 856-858, 899-901, 942, 985-986.
NR 4-2	241-242, 283-286, 496, 538-539, 579-583, 621-625, 663-667, 705-710, 749-752, 793-794.
NR 5-1	243-254, 261-264, 287-300, 305-308, 333-338, 341-346, 348-352, 377-383, 386-390, 394-396, 421-426, 428-434, 438-440, 465-466, 468-470, 473-484, 509-510, 512-515, 519-528, 553-554, 557-561, 565-572, 597, 602-607, 611-616, 655-660, 699-704.
NR 5-2	221-224, 265-269, 309-315, 353-360, 397-405, 441-451, 485-499, 529-545, 573-591, 617-637, 661-683.
NR 6-1	682-684.

FALL MIGRATION AREAS

Western Blocks - September 15 through October 31

OPD	Blocks Included
NR 4-1	416-419, 460-463, 500-507, 542-551, 584-595, 626-639, 669-683, 714-727, 759-771, 804-815, 841-858, 884-901, 925-942, 969-986.

NR 4-2	231-242, 275-286, 314-325, 358-368, 397-410, 441-453, 485-496, 529-539, 573-583, 617-625, 661-667, 705-710, 749-752, 793-794.

Central Blocks - September 1 through October 31

OPD	Blocks Included
NR 5-1	243-254, 261-264, 287-300, 305-308, 333-338, 341-346, 348-352, 377-383, 386-390, 394-396, 421-426, 428-434, 438-440, 465-466, 468-470, 473-484, 509-510, 512-515, 519-528, 553-554, 557-561, 565-572, 597, 602-607, 611-616, 641, 647-653, 655-660, 685, 691-704, 729-731, 737-748, 775-777, 779-780, 785-792, 821-826, 831-836, 867-868, 871, 875-879, 912-913, 915-921, 957-960, 962-965, 1001-1003, 1008.
NR 5-2	221, 265-267, 309-312, 353-356, 397-401, 441-447, 485-492, 529-537, 573-587, 617-637, 661-683, 705-727, 749-771, 794-815, 841-859, 886-889, 891-903, 929-930, 932-934, 938-947, 970-972, 974-978, 982-991.
NR 5-3	35, 37, 41-44, 85-86.
NR 5-4	1-2, 6-11, 16-23, 46-53, 56-57, 60-67, 93-97, 100-111, 139-144, 147-152, 154-155, 184-188, 191-194, 228-231, 233-237, 273-277, 279-283, 288, 318-321, 324, 326-328, 331-332, 362-369, 373, 375-376, 407-412, 414-417, 452-459, 496-500, 541-542.
NR 6-1	682-684, 726-738, 770-784, 814-829, 858-874, 902-913, 916-921, 946-957, 960-967, 990-1001, 1005-1012.
NR 6-2	969.
NR 6-3	22-44, 66-88, 110-132, 154-176, 198-220, 241-246, 249-264, 285-289, 291, 296-308, 329-333, 339, 341-352, 373-376, 384, 386-396, 426-429, 431-440, 469-484, 517, 519-520, 522-528, 566-572, 611-616, 659, 660.
NR 6-4	1-8, 45-52, 89-96, 133-140, 177-182, 221-225, 265-270, 272, 309-316, 353-357, 360, 397-402, 441-447, 485-492, 529-536, 573-578, 617-622, 661-666, 706-712, 755-756.

Eastern Blocks - August 1 through October 31

OPD	Blocks Included
NR 6-4	9-23, 53-67, 97-111, 141-155, 185-199, 229-244, 273-275, 278-288, 317-319, 323-332, 361, 363-364, 369-376, 406-410, 415-420, 450-455, 459-464, 493-500, 503-508, 537-549, 552, 582-592, 626-627, 669-671, 682, 713-716, 723, 725, 757-761, 763-764, 767-768, 806-812, 849-860, 894-902, 940-944, 986-987.

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NR 7-3	134, 178-181, 221-227, 265-274, 309-321, 353-368, 397-415, 441-446, 448-462, 485-490, 492-508, 529-552, 575-596, 618-640, 663-684, 708-725, 727, 751-766, 768-770, 794-802, 804-810, 813-814, 816, 846, 851-856, 860, 894-901, 937-940, 942-944, 948, 982-984, 987-989.
NR 7-4	485, 529-532, 573-579, 617-623, 661-667, 706-710, 749, 751-754, 793-796, 798, 842, 882, 886, 925, 969-971.
NR 7-5	15, 20-22, 60-69, 105-113, 150-157, 196-201, 242-245, 286-289.
NR 7-6	3-4, 46-48, 89-91, 133-135, 177-179, 221-222, 265-266, 309.

Stipulation No. 6--Subsistence Whaling and Other Subsistence Activities

All exploration and development and production operations shall be conducted in a manner that minimizes any potential for conflict between the oil and gas industry and subsistence activities, particularly the subsistence bowhead whale hunt.

Prior to submitting an exploration plan or development and production plan to the lessor for activities proposed during the bowhead whale migration period, the lessee shall contact the potentially affected communities, Wainwright, Barrow, Kaktovik, or Nuiqsut, and the Alaska Eskimo Whaling Commission to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or measures which could be implemented by the operator to reduce or eliminate any conflict. Through this consultation, the lessee shall make reasonable efforts to assure that exploration, development, and production activities are compatible with whaling and other subsistence hunting activities and will not result in undue interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and any unresolved conflicts shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how mobilization of the drilling unit and crew and supply boat routes will be scheduled and located to minimize conflicts with subsistence activities. Communities, individuals, and other entities who were involved in the consultation shall be identified in the plan. The lessee shall notify the Regional Supervisor, Field Operations, of all complaints received from subsistence hunters during operations and of steps taken to resolve such complaints.

The lessee shall send a copy of the exploration plan or development and production plan to the potentially affected communities and the Alaska Eskimo Whaling Commission at the same time they are submitted to the lessor to allow concurrent review and comment as part of the lessor's plan approval process.

Subsistence whaling activities occur generally during the following periods:

April to June: Barrow whalers use lead systems off Point Barrow and west of Barrow in the Chukchi Sea. Wainwright whalers use lead systems between Wainwright and Peard Bay.

August to October: Kaktovik/Nuiqsut hunters use the area circumscribed from Anderson Point in Camden Bay to a point 30 kilometers north of Barter Island to Humphrey Point east of Barter Island. The area of use may extend from Thetis Island to Flaxman Island seaward of the barrier islands.

September to October: Barrow hunters use the area circumscribed by a western boundary extending approximately 15 kilometers west of Barrow, a northern boundary 50 kilometers north of Barrow, then southeastward to a point about 50 kilometers off Cooper Island, with an eastern boundary on the east side of Dease Inlet. Occasional use may extend eastward as far as Cape Halkett.

Stipulation No. 7--Oil-Spill-Response Preparedness

Lessees must be prepared to respond to oil spills, which includes training of personnel for familiarization with response equipment and strategies, and conducting drills to demonstrate readiness. Prior to approval of exploration or development and production plans, lessees shall submit for review and approval oil-spill-contingency plans (OSCP's) in accordance with 30 CFR 250.42. The OSCP must address all aspects of oil-spill-response readiness including an analysis of potential spills and spill-response strategies; type, location, and availability of appropriate oil-spill equipment; and response times and equipment capability for the proposed activities. The plan must also address response drills and training requirements. The lessee shall conduct drills under realistic conditions to the extent necessary to demonstrate continued readiness and response capability for appropriate environmental conditions: e.g., solid-ice, open-water, and broken-ice conditions. For production operations, drills shall be conducted at least semiannually. Drills shall include deployment of onsite response equipment and additional equipment, available from a cooperative or other sources identified in the OSCP, to the extent necessary to demonstrate adequate response preparedness for the type, location, and scope of proposed activities and anticipated environmental conditions.

Stipulation No. 8--Agreement Between the United States of America and the State of Alaska

This stipulation applies to the following blocks or portions of blocks referred to in this Notice as disputed: NR 5-3, Teshekpuk, block 44; NR 5-4, Harrison Bay, blocks 1, 373, 375-376, 407-409, 416-417, 452-455, 496-500, 541-542; NR 6-3, Beechey Point, blocks 373, 375, 472-476, 517, 519-520, 522-524, 561-562, 564, 566-569, 605-610, 652-656, 659-660, 698-701, 743-746, 788-789, 792, 836; and NR 6-4, Flaxman Island, blocks 706-707, 755, 793, 894-896, 940-942.

This lease is subject to the "Agreement between the United States of America and the State of Alaska Pursuant to Section 7 of the Outer Continental Shelf Lands Act and Alaska Statutes 38.05.137 for the Leasing of Disputed Blocks in Federal Outer Continental Shelf Oil and Gas Lease Sale 124 and State Oil and Gas Lease Sale 65" (commonly referred to as the "Agreement"), and the lessee hereby consents to every term of that Agreement. Nothing in that Agreement or this Notice shall affect or prejudice the legal position of the United States in United States of America v. State of Alaska, No. 84, Original.

Any loss incurred or sustained by the lessee as a result of obtaining validation and recognition of this lease pursuant to the "Agreement," and in particular any loss incurred or sustained by the lessee as a result of conforming this lease with any and all provisions of all applicable laws of the party prevailing in United States of America v. State of Alaska, United States Supreme Court No. 84, Original, shall be borne exclusively by the lessee.

No taxes payable to the State of Alaska will be required to be paid with respect to this lease until such time as ownership of or jurisdiction over the lands subject to this lease is resolved. In the event that the lands subject to this lease or any portion of them are judicially determined to be State lands, the lessee shall pay to the State a sum equivalent to the State taxes which would have been imposed under Alaska law if the lands, or portion thereof determined to be State lands, had been undisputed State lands from the date the lease was executed, plus interest at the annual legal rate of interest provided under Alaska law accruing from the date the taxes would have become due under Alaska law. Such payment shall be in lieu of, and in satisfaction of, the actual State taxes.

Stipulation No. 9--Agreement Regarding Unitization

This stipulation applies to the following blocks or portions of blocks referred to in this Notice as disputed: NR 5-3, Teshekpuk, block 44; NR 5-4, Harrison Bay, blocks 1, 373, 375-376, 407-409, 416-417, 452-455, 496-500, 541-542; NR 6-3, Beechey Point, blocks 373, 375, 472-476, 517, 519-520, 522-524, 561-562, 564, 566-569, 605-610, 652-656, 659-660, 698-701, 743-746, 788-789, 792, 836; and NR 6-4, Flaxman Island, blocks 706-707, 755, 793, 894-896, 940-942.

This lease is subject to the "Agreement Regarding Unitization for the Outer Continental Shelf Oil and Gas Lease Sale 124 and State Oil and Gas Lease Sale 65 Between the United States of America and the State of Alaska" and the lessee is bound by the terms of that Agreement.

UNITED STATES
DEPARTMENT OF THE INTERIOR
MINERALS MANAGEMENT SERVICE

Stipulations for Oil and Gas Lease Sale 144
Outer Continental Shelf
Beaufort Sea
Alaska

Stipulation No. 1. Protection of Biological Resources

If biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RS/FO shall give written notification to the lessee of the RS/FO's decision to require such surveys.

Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

(1) Relocate the site of operations;

(2) Establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;

(3) Operate during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or

(4) Modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such findings to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection.

The lessee shall submit all data obtained in the course of biological surveys to the RS/FO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions. The RS/FO will utilize the best available information as determined in consultation with the Arctic Biological Task Force.

Stipulation No. 2. Orientation Program

The lessee shall include in any exploration or development and production plans submitted under 30 CFR 250.33 and 250.34 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the Regional Supervisor, Field Operations. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. This guidance will include the production and distribution of information cards on endangered and/or threatened species in the sale area. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation.

The program shall be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program onsite for so long as the site is active, not to exceed 5 years. This record shall include the name and date(s) of attendance of each attendee.

Stipulation No. 3, Transportation of Hydrocarbons

Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to recommendations of any advisory groups and Federal, State, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of an emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the Regional Supervisor, Field Operations.

Stipulation No. 4, Industry Site-Specific Bowhead Whale-Monitoring Program

Lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead whale migration will be required to conduct a site-specific monitoring program approved by the Regional Supervisor, Field Operations (RS/FO); unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with the North Slope Borough (NSB) and the Alaska Eskimo Whaling Commission (AEWC), determine that a monitoring program is not necessary. The RS/FO will provide the NSB, AEWC, and the State of Alaska a minimum of 30 but no longer than 60 calendar days to review and comment on a proposed monitoring program prior to approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced.

The monitoring program will be designed to assess when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these operations. In designing the program, lessees must consider the potential scope and extent of effects that the type of operation could have on bowhead whales. Scientific studies and individual experiences relayed by subsistence hunters indicate that, depending on the type of operations, individual whales may demonstrate avoidance behavior at distances of up to 24 km. The program must also provide for the following:

(1) Recording and reporting information on sighting of other marine mammals and the extent of behavioral effects due to operations,

(2) Inviting an AEWC or NSB representative to participate in the monitoring program as an observer,

(3) Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project (BWASP),

(4) Submitting daily monitoring results to the MMS BWASP,

(5) Submitting a draft report on the results of the monitoring program to the RS/FO within 60 days following the completion of the operation. The RS/FO will distribute this draft report to the AEWC, the NSB, the State of Alaska, and the National Marine Fisheries Service (NMFS).

(6) Submitting a final report on the results of the monitoring program to the RS/FO. The final report will include a discussion of the results of the peer review of the draft report. The RS/FO will distribute this report to the AEWC, the NSB, the State of Alaska, and the NMFS.

Lessees will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the NSB, the AEWC, industry, NMFS, and MMS. The results of these peer reviews will be provided to the RS/FO for consideration in final approval of the monitoring program and the final report, with copies to the NSB, AEWC, and the State of Alaska.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from the NMFS, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. Lessees must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NMFS and advise the lessee if the LOA or IHA will meet these requirements.

This stipulation applies to the following blocks for the time periods listed and will remain in effect until termination or modification by the Department of the Interior, after consultation with the NMFS and the NSB.

SPRING MIGRATION AREA
April 1 through June 15

OPD	Blocks Included
NR 05-01, Dease Inlet	6004 - 6011, 6054 - 6061, 6104 - 6111, 6154 - 6167, 6204 - 6220, 6254 - 6270, 6304 - 6321, 6354 - 6371, 6404 - 6423, 6454 - 6473, 6504 - 6523, 6554 - 6573, 6604 - 6623, 6654 - 6673, 6717 - 6723
NR 05-02, Harrison Bay North	6401 - 6404, 6451 - 6454, 6501 - 6506, 6551 - 6556, 6601 - 6612, 6651 - 6662, 6701 - 6716

CENTRAL FALL MIGRATION AREA
September 1 through October 31

OPD	Blocks Included
NR 05-01, Dease Inlet	6704 - 6716, 6754 - 6773, 6804 - 6823, 6856 - 6873, 6908 - 6923, 6960 - 6973, 7011 - 7023, 7062 - 7073, 7112 - 7123
NR 05-03, Teshekpuk	6015 - 6024, 6067 - 6072
NR 05-02, Harrison Bay North	6751 - 6766, 6801 - 6818, 6851 - 6868, 6901 - 6923, 6951 - 6973, 7001 - 7023, 7051 - 7073, 7101 - 7123

CENTRAL FALL MIGRATION AREA
September 1 through October 31
(continued)

OPD	Blocks Included
NR 05-04, Harrison Bay	6001 - 6023, 6052 - 6073, 6105 - 6123, 6157 - 6173, 6208 - 6223, 6258 - 6274, 6309 - 6324, 6360 - 6374, 6410 - 6424, 6461 - 6471, 6512 - 6519, 6562 - 6566, 6613 - 6614
NR 06-01, Beechey Point North	6901, 6951, 7001, 7051 - 7062, 7101 - 7113
NR 06-03, Beechey Point	6002 - 6014, 6052 - 6064, 6102 - 6114, 6152 - 6169, 6202 - 6220, 6251 - 6274, 6301 - 6324, 6351 - 6374, 6401 - 6424, 6456 - 6474, 6509 - 6524, 6568 - 6574, 6618 - 6624, 6671 - 6674, 6723 - 6724, 6773
NR 06-04, Flaxman Island	6301 - 6303, 6351 - 6359, 6401 - 6409, 6451 - 6459, 6501 - 6509, 6551 - 6559, 6601 - 6609, 6651 - 6659, 6701 - 6709, 6751 - 6759, 6802 - 6809, 6856 - 6859

EASTERN FALL MIGRATION
August 1 through October 31

OPD	Blocks Included
NR 06-04, Flaxman Island	6360 - 6364, 6410 - 6424, 6460 - 6474, 6510 - 6524, 6560 - 6574, 6610 - 6624, 6660 - 6674, 6710 - 6724, 6760 - 6774, 6810 - 6824, 6860 - 6874, 6910 - 6924, 6961 - 6974, 7013 - 7022, 7066 - 7070, 7118 - 7119
NR 07-03, Barter Island	6401 - 6405, 6451 - 6455, 6501 - 6505, 6551 - 6555, 6601 - 6605, 6651 - 6655, 6701 - 6705, 6751 - 6755, 6801 - 6805, 6851 - 6855, 6901 - 6905

Stipulation No. 5. Subsistence Whaling and Other Subsistence Activities

Exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities (including, but not limited to, bowhead whale subsistence hunting).

Prior to submitting an exploration plan or development and production plan (including associated oil-spill contingency plans) to the MMS for activities proposed during the bowhead whale migration period, the lessee shall consult with the potentially affected subsistence communities, Barrow, Kaktovik, or Nuiqsut, the North Slope Borough (NSB), and the Alaska Eskimo Whaling Commission (AEWC) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. Through this consultation, the lessee shall make every reasonable effort to assure that exploration, development, and production activities are compatible with whaling and other subsistence hunting activities and will not result in unreasonable interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and plans for continued consultation shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how activities will be scheduled and located to prevent unreasonable conflicts with subsistence activities. Lessees shall also include a discussion of multiple or simultaneous operations, such as ice management and seismic activities, that can be expected to occur during operations in order to more accurately assess the potential for any cumulative affects. Communities, individuals, and other entities who were involved in the consultation shall be identified in the plan. The RS/FO shall send a copy of the exploration plan or development and production plan (including associated oil-spill contingency plans) to the potentially affected communities, and the AEWC at the time they are submitted to the MMS to allow concurrent review and comment as part of the plan approval process.

In the event no agreement is reached between the parties, the lessee, the AEWC, the NSB, the National Marine Fisheries Service (NMFS), or any of the subsistence communities that could potentially be affected by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the subsistence communities, AEWC, NSB, NMFS, and the lessee(s) to specifically address the conflict and attempt to resolve the issues before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. Upon request, the RS/FO will assemble this group before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The lessee shall notify the RS/FO, of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. Lease-related use will be restricted when the RS/FO determines it is necessary to prevent unreasonable conflicts with local subsistence hunting activities.

In enforcing this stipulation, the RS/FO will work with other agencies and the public to assure that potential conflicts are identified and efforts are taken to avoid these conflicts, (for example, timing operations to avoid the bowhead whale subsistence hunt). These efforts might include seasonal drilling restrictions, seismic and threshold depth restrictions, and requirements for directional drilling and the use of other technologies deemed appropriate by the RS/FO.

Subsistence whaling activities occur generally during the following periods:

<u>August to October</u>: Kaktovik whalers use the area circumscribed from Anderson Point in Camden Bay to a point 30 kilometers north of Barter Island to Humphrey Point east of Barter Island. Nuiqsut whalers use an area extending from a line northward of the Nechelik Channel of the Colville River to Flaxman Island, seaward of the Barrier Islands.

<u>September to October</u>: Barrow hunters use the area circumscribed by a western boundary extending approximately 15 kilometers west of Barrow, a northern boundary 50 kilometers north of Barrow, then southeastward to a point about 50 kilometers off Cooper Island, with an eastern boundary on the east side of Dease Inlet. Occasional use may extend eastward as far as Cape Halkett.

Stipulation No. 6. Agreement Between the United States of America and the State of Alaska

This stipulation applies to the following blocks or portions of blocks referred to in this Notice as disputed: NR 05-03, Teshekpuk, block 6024; NR 05-04, Harrison Bay, blocks 6001, 6421, 6423-6424, 6461-6463, 6470-6471, 6512-6515, 6562-6566, 6613-6614; NR 06-03, Beechey Point, blocks 6401, 6403, 6511-6514, 6562-6563, 6568-6570, 6612-6614, 6616, 6618-6621, 6663-6666, 6668-6669, 6718-6720, 6723-6724, 6768-6771, 6819-6820, 6870-6871, 6874, 6924; NR 06-04, Flaxman Island, blocks 6802-6803, 6857, 6901, 7014-7016, 7066-7067.

This lease is subject to the "Agreement Between the United States of America and the State of Alaska Pursuant to Section 7 of the Outer Continental Shelf Lands Act and Alaska Statutes 38.05.137 for the Leasing of Disputed Blocks in Federal Outer Continental Shelf Oil and Gas Lease Sale 144 and State Oil and Gas lease Sale 86" (referred to as the "Agreement"), and the lessee hereby consents to every term of that Agreement. Nothing in that Agreement or this Notice shall affect or prejudice the legal position of the United States in *United States of America v. State of Alaska*, United States Supreme Court No. 84, Original.

Any loss incurred or sustained by the lessee as a result of obtaining validation and recognition of this lease pursuant to the Agreement, and in particular any loss incurred or sustained by the lessee as a result of conforming this lease with any and all provisions of all applicable laws of the party prevailing in *United States of America v. State of Alaska*, No. 84 Original, shall be borne exclusively by the lessee.

No taxes payable to the State of Alaska will be required to be paid with respect to this lease until such time as ownership of or jurisdiction over the lands subject to this lease is resolved. In the event that the lands subject to this lease or any portion of them are judicially determined to be State lands, the lessee shall pay to the State of Alaska a sum equivalent to the State taxes which would have been imposed under Alaska law if the lands, or portion thereof determined to be State lands, had been undisputed State lands from the date the lease was executed, plus interest at the annual legal rate of interest provided under Alaska law accruing from the date the taxes would have become due under Alaska law. Such payment shall be in lieu of, and in satisfaction of, the actual State taxes.

Stipulation No. 7. Agreement Regarding Unitization

This stipulation applies to the following blocks or portions of blocks referred to in this Notice as disputed: NR 05-03, Teshekpuk, block 6024; NR 05-04, Harrison Bay, blocks 6001, 6421, 6423-6424, 6461-6463, 6470-6471, 6512-6515, 6562-6566, 6613-6614; NR 06-03, Beechey Point, blocks 6401, 6403, 6511-6514, 6562-6563, 6568-6570, 6612-6614, 6616, 6618-6621, 6663-6666, 6668-6669, 6718-6720, 6723-6724, 6768-6771, 6819-6820, 6870-6871, 6874, 6924; NR 06-04, Flaxman Island, blocks 6802-6803, 6857, 6901, 7014-7016, 7066-7067.

This lease is subject to the "Agreement Regarding Unitization for the Outer Continental Shelf Oil and Gas Lease Sale 144 and State Oil and Gas Lease Sale 86 Between the United States of America and the State of Alaska" and the lessee is bound by the terms of that Agreement.

Leasing Activities Information

MMS U.S. Department of the Interior
Minerals Management Service
Alaska OCS Region

Lease Stipulations

Oil and Gas Lease Sale 202
Beaufort Sea
April 18, 2007

Stipulation No. 1. Protection of Biological Resources
Stipulation No. 2. Orientation Program
Stipulation No. 3. Transportation of Hydrocarbons
Stipulation No. 4. Industry Site-Specific Bowhead Whale-Monitoring Program
Stipulation No. 5. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities
Stipulation No. 6. Pre-Booming Requirements for Fuel Transfers
Stipulation No. 7. Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider

Stipulation No. 1. Protection of Biological Resources. If biological populations or habitats that may require additional protection are identified in the lease area by the Regional Supervisor, Field Operations (RS/FO), the RS/FO may require the lessee to conduct biological surveys to determine the extent and composition of such biological populations or habitats. The RS/FO shall give written notification to the lessee of the RS/FO's decision to require such surveys.

Based on any surveys that the RS/FO may require of the lessee or on other information available to the RS/FO on special biological resources, the RS/FO may require the lessee to:

(1) Relocate the site of operations;
(2) Establish to the satisfaction of the RS/FO, on the basis of a site-specific survey, either that such operations will not have a significant adverse effect upon the resource identified or that a special biological resource does not exist;
(3) Operate during those periods of time, as established by the RS/FO, that do not adversely affect the biological resources; and/or
(4) Modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected.

If any area of biological significance should be discovered during the conduct of any operations on the lease, the lessee shall immediately report such findings to the RS/FO and make every reasonable effort to preserve and protect the biological resource from damage until the RS/FO has given the lessee direction with respect to its protection.

The lessee shall submit all data obtained in the course of biological surveys to the RS/FO with the locational information for drilling or other activity. The lessee may take no action that might affect the biological populations or habitats surveyed until the RS/FO provides written directions to the lessee with regard to permissible actions.

Stipulation No. 2. Orientation Program. The lessee shall include in any exploration or development and production plans submitted under 30 CFR 250.201 a proposed orientation program for all personnel involved in exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) for review and approval by the RS/FO. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas. The program shall address the importance of not disturbing archaeological and biological resources and habitats, including endangered species, fisheries, bird colonies, and marine mammals and provide guidance on how to avoid disturbance. This guidance will include the production and distribution of information cards on endangered and/or threatened species in the sale area. The program shall be designed to increase the sensitivity and understanding of personnel to community values, customs, and lifestyles in areas in which such personnel will be operating. The orientation program shall also include information concerning avoidance of conflicts with subsistence, commercial fishing activities, and pertinent mitigation.

The program shall be attended at least once a year by all personnel involved in onsite exploration or development and production activities (including personnel of the lessee's agents, contractors, and subcontractors) and all supervisory and managerial personnel involved in lease activities of the lessee and its agents, contractors, and subcontractors.

The lessee shall maintain a record of all personnel who attend the program onsite for so long as the site is active, not to exceed 5 years. This record shall include the name and date(s) of attendance of each attendee.

Stipulation No. 3. Transportation of Hydrocarbons. Pipelines will be required: (a) if pipeline rights-of-way can be determined and obtained; (b) if laying such pipelines is technologically feasible and environmentally preferable; and (c) if, in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts. The lessor specifically reserves the right to require that any pipeline used for transporting production to shore be placed in certain designated management areas. In selecting the means of transportation, consideration will be given to recommendations of any advisory groups and Federal, state, and local governments and industry.

Following the development of sufficient pipeline capacity, no crude oil production will be transported by surface vessel from offshore production sites, except in the case of an emergency. Determinations as to emergency conditions and appropriate responses to these conditions will be made by the RS/FO.

Stipulation No. 4. Industry Site-Specific Bowhead Whale-Monitoring Program. Lessees proposing to conduct exploratory drilling operations, including seismic surveys, during the bowhead whale migration will be required to conduct a site-specific monitoring program approved by the RS/FO; unless, based on the size, timing, duration, and scope of the proposed operations, the RS/FO, in consultation with the North Slope Borough (NSB) and the Alaska Eskimo Whaling Commission (AEWC), determine that a monitoring program is not necessary. The RS/FO will provide the NSB, AEWC, and the State of Alaska a minimum of 30 but no longer than 60 calendar days to review and comment on a proposed monitoring program prior to approval. The monitoring program must be approved each year before exploratory drilling operations can be commenced.

The monitoring program will be designed to assess when bowhead whales are present in the vicinity of lease operations and the extent of behavioral effects on bowhead whales due to these operations. In designing the program, lessees must consider the potential scope and extent of effects that the type of operation could have on bowhead whales. Experiences relayed by subsistence hunters indicate that, depending on the type of operations, some whales demonstrate avoidance behavior at distances of up to 35 miles. The program must also provide for the following:

(1) Recording and reporting information on sighting of other marine mammals and the extent of behavioral effects due to operations;
(2) Inviting an AEWC or NSB representative to participate in the monitoring program as an observer;
(3) Coordinating the monitoring logistics beforehand with the MMS Bowhead Whale Aerial Survey Project (BWASP);
(4) Submitting daily monitoring results to the MMS BWASP;
(5) Submitting a draft report on the results of the monitoring program to the RS/FO within 60 days following the completion of the operation (the RS/FO will distribute this draft report to the AEWC, the NSB, the State of Alaska, and the National Oceanic and Atmospheric Administration-Fisheries [NOAA]); and
(6) Submitting a final report on the results of the monitoring program to the RS/FO (the final report will include a discussion of the results of the peer review of the draft report and the RS/FO will distribute this report to the AEWC, the NSB, the State of Alaska, and the NOAA Fisheries).

Lessees will be required to fund an independent peer review of a proposed monitoring plan and the draft report on the results of the monitoring program. This peer review will consist of independent reviewers who have knowledge and experience in statistics, monitoring marine mammal behavior, the type and extent of the proposed operations, and an awareness of traditional knowledge. The peer reviewers will be selected by the RS/FO from experts recommended by the NSB, the AEWC, industry, NOAA Fisheries, and MMS. The results of these peer reviews will be provided to the RS/FO for consideration in final approval of the monitoring program and the final report, with copies to the NSB, AEWC, and the State of Alaska.

In the event the lessee is seeking a Letter of Authorization (LOA) or Incidental Harassment Authorization (IHA) for incidental take from the NOAA Fisheries, the monitoring program and review process required under the LOA or IHA may satisfy the requirements of this stipulation. Lessees must advise the RS/FO when it is seeking an LOA or IHA in lieu of meeting the requirements of this stipulation and provide the RS/FO with copies of all pertinent submittals and resulting correspondence. The RS/FO will coordinate with the NOAA Fisheries and advise the lessee if the LOA or IHA will meet these requirements.

This stipulation applies to the following blocks for the time periods listed and will remain in effect until termination or modification by the Department of the Interior, after consultation with the NOAA Fisheries and the NSB.

Spring Migration Area: April 1 through June 15

OPD: NR 05-01, Dease Inlet. Blocks included:

6102-6111	6302-6321	6508-6523	6717-6723
6152-6167	6354-6371	6560-6573	
6202-6220	6404-6423	6610-6623	
6252-6270	6455-6473	6659-6673	

OPD: NR 05-02, Harrison Bay North: Blocks included:

6401-6404	6501-6506	6601-6609	6701-6716
6451-6454	6551-6556	6651-6659	

Central Fall Migration Area: September 1 through October 31

OPD: NR 05-01, Dease Inlet. Blocks included:

6102-6111	6354-6371	6610-6623	6856-6873
6152-6167	6404-6423	6659-6673	6908-6923
6202-6220	6455-6473	6706-6723	6960-6973
6252-6270	6508-6523	6756-6773	7011-7023
6302-6321	6560-6573	6806-6823	7062-7073
			7112-7123

OPD: NR 05-02, Harrison Bay North. Blocks included:

6401-6404	6601-6609	6801-6818	7001-7023
6451-6454	6651-6659	6851-6868	7051-7073
6501-6506	6701-6716	6901-6923	7101-7123
6551-6556	6751-6766	6951-6973	

OPD: NR 05-03, Teshekpuk. Blocks included:

6015-6024	6067-6072

OPD: NR 05-04, Harrison Bay. Blocks included:

6001-6023	6157-6173	6309-6324	6461-6471
6052-6073	6208-6223	6360-6374	6513-6519
6106-6123	6258-6274	6410-6424	6565-6566

OPD: NR 06-01, Beechey Point North. Blocks included:

6901-6911	6951-6962	7001-7012	7051-7062
			7101-7113

OPD: NR 06-03, Beechey Point. Blocks included:

6002-6014	6202-6220	6401-6424	6618-6624
6052-6064	6251-6274	6456-6474	6671-6674
6102-6114	6301-6324	6509-6524	6722-6724
6152-6169	6351-6374	6568-6574	6773

OPD: NR 06-04, Flaxman Island. Blocks included:

6301-6303	6451-6459	6601-6609	6751-6759
6351-6359	6501-6509	6651-6659	6802-6809
6401-6409	6551-6559	6701-6709	6856-6859

Eastern Fall Migration: August 1 through October 31

OPD: NR 06-04, Flaxman Island. Blocks included:

6360-6364	6560-6574	6760-6774	6961-6974
6410-6424	6610-6624	6810-6824	7013-7022
6460-6474	6660-6674	6860-6874	7066-7070
6510-6524	6710-6724	6910-6924	7118-7119

OPD: NR 07-03, Barter Island. Blocks included:

6401-6405	6601-6605	6801-6803	7012-7013
6451-6455	6651-6655	6851-6853	7062-7067
6501-6505	6701-6705	6901-6903	7113-7117
6551-6555	6751-6753	6962-6963	

OPD: NR 07-05, Demarcation Point. Blocks included:

6016-6022	6118-6125	6221-6226	6324-6326
6067-6072	6169-6175	6273-6276	

OPD: NR 07-06, Mackenzie Canyon. Blocks included:

6201	6251	6301	6351

Stipulation No. 5. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence-Harvesting Activities. Exploration and development and production operations shall be conducted in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities (including, but not limited to, bowhead whale subsistence hunting).

Prior to submitting an exploration plan or development and production plan (including associated oil-spill contingency plans) to MMS for activities proposed during the bowhead whale migration period, the lessee shall consult with the directly affected subsistence communities, Barrow, Kaktovik, or Nuiqsut, the North Slope Borough (NSB), and the Alaska Eskimo Whaling Commission (AEWC) to discuss potential conflicts with the siting, timing, and methods of proposed operations and safeguards or mitigating measures which could be implemented by the operator to prevent unreasonable conflicts. Through this consultation, the lessee shall make every reasonable effort, including such mechanisms as a conflict avoidance agreement, to assure that exploration, development, and production activities are compatible with whaling and other subsistence hunting activities and will not result in unreasonable interference with subsistence harvests.

A discussion of resolutions reached during this consultation process and plans for continued consultation shall be included in the exploration plan or the development and production plan. In particular, the lessee shall show in the plan how its activities, in combination with other activities in the area, will be scheduled and located to prevent unreasonable conflicts with subsistence activities. Lessees shall also include a discussion of multiple or simultaneous operations, such as ice management and seismic activities, that can be expected to occur during operations in order to more accurately assess the potential for any cumulative affects. Communities, individuals, and other entities who were involved in the consultation shall be identified in the plan. The RS/FO shall send a copy of the exploration plan or development and production plan (including associated oil-spill contingency plans) to the directly affected communities and the AEWC at the time they are submitted to the MMS to allow concurrent review and comment as part of the plan approval process.

In the event no agreement is reached between the parties, the lessee, the AEWC, the NSB, the National Oceanic and Atmospheric Administration - Fisheries (NOAA), or any of the subsistence communities that could be affected directly by the proposed activity may request that the RS/FO assemble a group consisting of representatives from the subsistence communities, AEWC, NSB, NOAA Fisheries, and the lessee(s) to specifically address the conflict and attempt to resolve the issues before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests. Upon request, the RS/FO will assemble this group if the RS/FO determines such a meeting is warranted and relevant before making a final determination on the adequacy of the measures taken to prevent unreasonable conflicts with subsistence harvests.

The lessee shall notify the RS/FO of all concerns expressed by subsistence hunters during operations and of steps taken to address such concerns. Lease-related use will be restricted when the RS/FO determines it is necessary to prevent unreasonable conflicts with local subsistence hunting activities.

In enforcing this stipulation, the RS/FO will work with other agencies and the public to assure that potential conflicts are identified and efforts are taken to avoid these conflicts.

Subsistence whaling activities occur generally during the following periods:

August to October: Kaktovik whalers use the area circumscribed from Anderson Point in Camden Bay to a point 30 kilometers north of Barter Island to Humphrey Point east of Barter Island. Nuiqsut whalers use an area extending from a line northward of the Nechelik Channel of the Colville River to Flaxman Island, seaward of the Barrier Islands.

September to October: Barrow hunters use the area circumscribed by a western boundary extending approximately 15 kilometers west of Barrow, a northern boundary 50 kilometers north of Barrow, then southeastward to a point about 50 kilometers off Cooper Island, with an eastern boundary on the east side of Dease Inlet. Occasional use may extend eastward as far as Cape Halkett.

Stipulation No. 6 - Pre-Booming Requirements for Fuel Transfers. Fuel transfers (excluding gasoline transfers) of 100 barrels or more occurring 3 weeks prior to or during the bowhead whale migration will require pre-booming of the fuel barge(s). The fuel barge must be surrounded by an oil-spill-containment boom during the entire transfer operation to help reduce any adverse effects from a fuel spill. This stipulation is applicable to the blocks and migration times listed in the stipulation on Industry Site-Specific Bowhead Whale-Monitoring. The lessee's oil-spill-contingency plans must include procedures for the pre-transfer booming of the fuel barge(s).

Stipulation No. 7. Lighting of Lease Structures to Minimize Effects to Spectacled and Steller's Eider. In accordance with the Biological Opinion for the Beaufort Sea Lease Sale 186 issued by the U.S. Fish and Wildlife Service (FWS) on October 22, 2002, and FWS's subsequent amendment of the Incidental Take Statement on September 21, 2004, lessees must adhere to lighting requirements for all exploration or delineation structures so as to minimize the likelihood that migrating spectacled or Steller's eiders will strike these structures.

Lessees are required to implement lighting requirements aimed at minimizing the radiation of light outward from exploration/delineation structures to minimize the likelihood that spectacled or Steller's eiders will strike those structures. These requirements establish a coordinated process for a performance based objective rather than pre-determined prescriptive requirements. The performance based objective is to minimize the radiation of light outward from exploration/delineation structures. Measures to be considered include but need not be limited to the following:

- Shading and/or light fixture placement to direct light inward and downward to living and work structures while minimizing light radiating upward and outward;
- Types of lights;
- Adjustment of the number and intensity of lights as needed during specific activities.
- Dark paint colors for selected surfaces;

- Low reflecting finishes or coverings for selected surfaces; and
- Facility or equipment configuration.

Lessees are encouraged to consider other technical, operational and management approaches to reduce outward light radiation that could be applied to their specific facility and operation.

If further information on bird avoidance measures becomes available that suggests modification to this lighting protocol is warranted under the Endangered Species Act to implement the reasonable and prudent measures of the Biological Opinion, MMS will issue further requirements, based on guidance from the FWS. Lessees will be required to adhere to such modifications of this protocol. The MMS will promptly notify lessees of any changes to lighting required under this stipulation.

These requirements apply to all new and existing Outer Continental Shelf oil and gas leases issued between the 156^0 W longitude and 146^0 W longitude for activities conducted between May 1 and October 31. The MMS encourages operators to consider such measures in areas to the east of 146 ^{0} W longitude because occasional sightings of eiders that are now listed have been made there and because such measures could reduce the potential for collisions of other, non-ESA listed migratory birds that are protected under the Migratory Bird Treaty Act.

Nothing in this protocol is intended to reduce personnel safety or prevent compliance with other regulatory requirements (e.g. U.S. Coast Guard or Occupational Safety and Health Administration) for marking or lighting of equipment and work areas.

Lessees are required to report spectacled and/or Steller's eiders injured or killed through collisions with lease structures to the Fairbanks Fish and Wildlife Field Office, Endangered Species Branch, Fairbanks, Alaska at (907) 456-0499. We recommend that you call that office for instruction on the handling and disposal of the injured or dead bird.

Lessees must provide MMS with a written statement of measures that will be or that have been taken to meet the objective of this stipulation. Lessees must also include a plan for recording and reporting bird strikes that occur during approved activities to the MMS. This information must be included with an Exploration Plan when the EP is submitted for regulatory review and approval pursuant to 30 CFR 250.201. Lessees are encouraged to discuss their proposed measures in a pre-submittal meeting with the MMS and FWS.

Appendix G

National Marine Fisheries Service (NMFS) Alaska Region Statewide Marine Mammal Spill Preparedness and Response Structure; Expectations for Responsible Parties

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Appendix G. 2017 NMFS Marine Mammal Emergency Response Standards

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

National Marine Fisheries Service (NMFS) Alaska Region
Statewide Marine Mammal Spill Preparedness and Response Structure;
Expectations for Responsible Parties

Prepared June 2017

The Oil Pollution Act of 1990 (OPA-90) expanded the federal government's ability to prevent and respond to oil spills. OPA-90 established new requirements for contingency planning by government and industry by expanding the National Contingency Plan to a three-tiered system: 1) the federal government, through the National and Regional Response Team(s) were empowered to direct all public and private response efforts for certain types of spill events through their corresponding Response Plans; 2) Area Committees (composed of federal, state, and local government officials) were required to develop detailed, location-specific Area Contingency Plans; and 3) owners or operators of vessels and certain facilities that pose a serious threat to the environment must prepare their own Facility Response Plans.

In an effort to assist with emergency response preparedness for marine mammals under NMFS jurisdiction in Alaska, the NMFS Alaska Region Protected Resources Division (AKR PRD) has developed the following general guidelines and standards for response capacity by responsible parties.

- **Preparedness and Response Standards and Thresholds (Initial Immediate Response)**
    - Samples: Prepare to sample 50 live or dead pinnipeds (i.e., bearded seal, harbor seal, ribbon seal, ringed seal, spotted seal, northern fur seal, and/or Steller sea lion) the first week. Prepare to sample 5 live or dead cetaceans (i.e., whales and porpoise) the first week. After the first week, the Responsible Party (RP) has the responsibility to fund the storage of carcasses, fund transport to approved facilities for analysis, and fund additional sampling or any live or dead pinnipeds or cetaceans. Sampling shall be performed by an individual or entity approved under NMFS Marine Mammal Health and Stranding Permit #18786.
    - Necropsy: Prepare to necropsy 50 dead pinnipeds and/or cetaceans. Necropsies shall be performed and samples stored by an individual or entity approved under NMFS Marine Mammal Health and Stranding Permit #18786. If mortalities exceed 50 animals, the RP has the responsibility to fund the storage of carcasses and fund transport to approved facilities for analysis.
    - Sample storage: Maintain level of readiness to store 1,000 marine mammal samples, which likely includes multiple samples from individual animals, and therefore, does not

represent 1,000 animals. Samples shall be stored by an individual or entity approved under NMFS Marine Mammal Health and Stranding Permit #18786.

- Cleaning/rehabilitation threshold: The following thresholds apply for live moribund animals whose condition can withstand transport.
    - *Pinnipeds:* The RP should maintain a level of readiness for 25 live pinnipeds to be cleaned and rehabilitated.
        - ✓ This applies to bearded, ringed, ribbon, spotted, harbor, and northern fur seals and Steller sea lions. However, capturing and cleaning oiled adult Steller sea lions is generally not feasible given their size and the difficulties in their collection and transport, as well as danger to response personnel.
        - ✓ It may not be feasible to capture oiled northern fur seals. Human safety must be a primary consideration as it may be dangerous to response personnel to capture oiled fur seal pups because of territorial bulls, and oiled adult fur seals would be extremely dangerous to handle, even if partially debilitated. Also, separating a pup from its mother temporarily may lead to abandonment.
        - ✓ Approved cleaning protocols and practices by species can be found in the Wildlife Protection Guidelines in the Alaska Unified Response Plan and NMFS National Marine Mammal Oil Spill Guidelines.
        - ✓ All cleaned pinnipeds must be tagged prior to release to monitor survivorship. Per a request from the Ice Seal Committee, we recommend that ice seals which are transported outside their region of capture not be released back to the wild after rehabilitation. This request does not apply to ice seals captured and cleaned on-site.

    - *Cetaceans:* The RP should maintain a level of readiness for two live small cetaceans (e.g., young beluga whale, young killer whale, or porpoise) to be cleaned and rehabilitated.

- **Readiness Time Horizon**

    - Maintain readiness for additional sampling, necropsies, sample storage, and cleaning/rehabilitation for up to one year post-spill.
    - After the official closure of a spill response, RPs should remain prepared to support NMFS and wildlife response organizations to respond to oil-affected marine mammals under NMFS jurisdiction.

- **Authority**
  - Response authority for oiled marine mammals under NMFS jurisdiction is always retained by NMFS, and interventions can be authorized only by NMFS on a case by case basis. During a spill, authority to respond to oiled marine mammals may be granted under the NMFS Marine Mammal Health and Stranding Response Permit #18786 issued to Dr. Teri Rowles and her authorized NMFS Co-Investigators. Pre-authorization is not a component of this response structure.
  - In the future, NMFS plans to add a spill response component to language in Regional Stranding Agreements, which would allow agreement holders to respond to non-ESA listed MMPA species in the event of an oil spill. Response to ESA-listed marine mammals would still require authorization under NMFS permit #18786 as specified above.

- **Spill Response Network Model**
  - Preparedness and response shall be led through a NMFS approved contractor (e.g., Alaska SeaLife Center [ASLC]) under U.S. Coast Guard's Oil Spill Removal Organization (OSRO) program, after obtaining authorization through NMFS permit #18786. NMFS will provide guidance regarding: 1) marine mammal response standards, 2) training requirements, and 3) regulatory pathways for response authorizations (e.g., authorizing marine mammal responses pursuant to NMFS permit #18786). NMFS will maintain contact information on trained stranding network members and Incident Command System staff. NMFS-approved wildlife responders will facilitate preparedness for the stranding network as a primary field response participant, along with trained stranding network members. OSROs will need to work with NMFS-approved wildlife response organizations to ensure preparedness levels are sufficient for a rapid response to oiled marine mammal under NMFS jurisdiction. Currently, NMFS does not have the in-house capacity to lead field efforts, so will act in a guidance and oversight capacity through the Wildlife Protection Branch.

- **Adding Stranding Agreement Holders**
  - NMFS will continue to approach qualified entities and individuals throughout Alaska to encourage participation and engagement in the Alaska Marine Mammal Stranding Network. A focused effort is underway to further develop response capacity in the Kodiak and Cook Inlet regions. Training will need to be provided to new stranding network members at annual stranding network meeting or by other mechanisms.

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) manages development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.