APPENDIX A

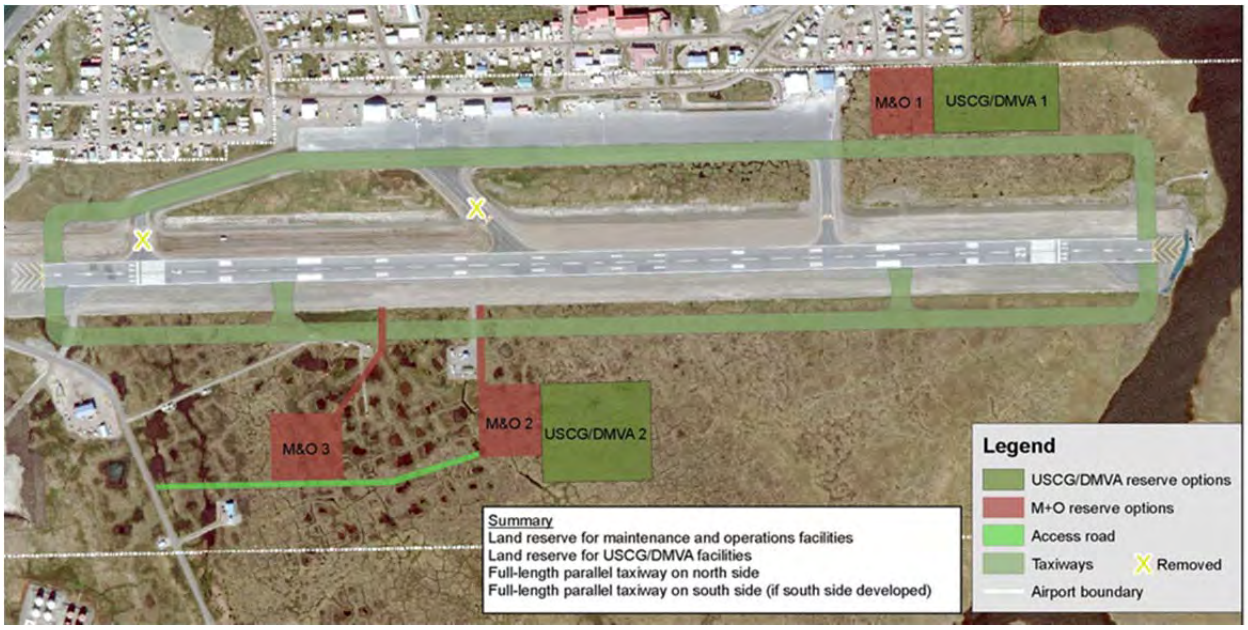
Alternatives Dropped from Further Consideration

Appendix A

Alternatives Dropped from Futher Consideration

Alternatives Dropped from Futher Consideration are described in Section 4.1 of this Environmental Asessment. This Appendix provides figures that illustrate the alternatives that were dropped due to cost or inability to meet the purpose and need.

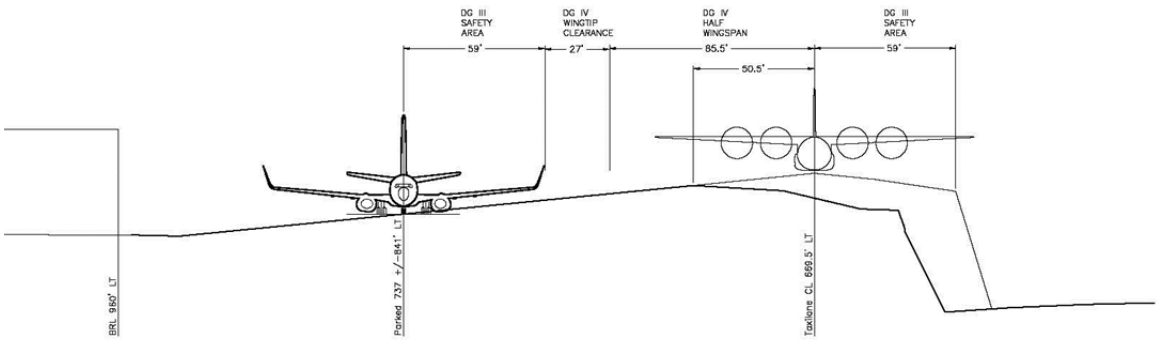
M&O Facility



Taxilane Expansion

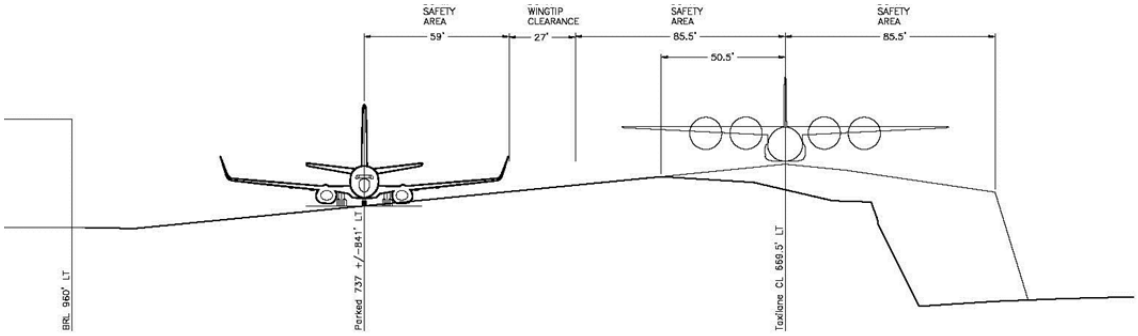
Taxilane option 1 was chosen and is presented as the proposed action in this Environmental Assessment.

Taxilane Option 2: Allows for Large (C-130) type Aircraft to pass 737-800; but with taxilane safety area only being DGIV compliant on the north side.



OPTION 2, DG III, 50.5' Shift Right

Taxilane Option 3: Allows for Large C-130 type aircraft with fully compliant DGIV taxilane safety area widths



OPTION 3, DG IV, 50.5' Shift Right

APPENDIX B

Wetlands Delineation and Preliminary Jurisdictional Determination

WETLAND MAPPING REVIEW, AQUATIC SITE ASSESSMENT, AND WILDLIFE HABITAT EVALUATION AT THE WILEY POST/WILL ROGERS MEMORIAL AIRPORT, BARROW, ALASKA, 2014

FINAL REPORT

Prepared for

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INTRODUCTION

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is proposing 2 improvement projects at the Wiley Post/Will Rogers Memorial Airport (Barrow airport) in Barrow, Alaska, as described in the recent update to the Barrow airport master plan (PDC 2014): (1) the construction of maintenance and operations (M&O) facilities including a pad, access road, and runway access on the south side of the existing runway; and (2) an expansion of the existing North Access Apron. In support of the Environmental Assessment (EA) and the Section 404, Clean Water Act wetlands permit application to be prepared for these projects, ADOT&PF has requested the preparation of an Aquatic Site Assessment (ASA), a wildlife habitat evaluation, and any necessary updates to the existing wetlands and wildlife habitat mapping for the Barrow airport property needed to prepare the ASA and the wildlife habitat evaluation. ABR, Inc.—Environmental Research & Services (ABR) is conducting this work under a subcontract to PDC Inc. Engineers (PDC).

The study area used for this work includes all of the Barrow airport property, which comprises approximately 770 acres, with elevations up to 18 m above sea level (Figure 1). The centroid of the study area is located at 71.285° N 156.770° W, WGS 1984. The legal description for the Barrow airport study area is Umiat Meridian, Township 22N, Range 18, Sections 4–9; and Range 19, Sections 1 and 12.

The study area is within the Arctic Coastal Plain (ACP) ecoregion (Gallant et al. 1995), which is characterized by an arctic climate and is underlain by thick, continuous permafrost. The landscape is typified by low elevations and low topographical relief, dominated by thaw lakes oriented along the prevailing summer wind direction and drained thaw lake basins. Plant communities are dominated by herbaceous plants (typically grasses and sedges) and prostrate shrubs. Lakes and drained lake basins cover over 60% of the Barrow Peninsula (Frohn et al. 2005).

METHODS

Wetlands and wildlife habitats had previously been surveyed and mapped within the Barrow airport property boundaries (HDR 2012). In this study, ABR collected additional field data to

revise the existing wetlands and wildlife habitat mapping, as needed, so as to complete an ASA and wildlife habitat evaluation for the airport property. Field surveys of the Barrow airport property in 2014 were performed in conjunction with field surveys at 3 potential and undeveloped material site locations, which may be used in future airport improvement projects. Field survey and mapping results for the 3 potential material sites will be presented in a separate report to be prepared under the current contract.

FIELD SURVEY

Wetland surveys were performed from 5–6 September 2014 within the Barrow airport study area (Figure 1) by Susan Ives, Erin Johnson and Robert McNown of ABR. Routine wetland determinations were performed following the U.S. Army Corps of Engineers (USACE) 3-parameter approach (Environmental Laboratory 1987, USACE 2007), and standard wetland determination forms (USACE 2007) were completed to confirm wetland status and classification of mapped polygons at each wetland determination plot. To be classified as a wetland, a site must be dominated by hydrophytic plants, have hydric soils, and show evidence of a wetland hydrologic regime. A mobile *Trimble® Nomad™* series GPS unit was used to record the wetlands data (using the *WetForm* database). *WetForm* is a commercially available relational database developed by Ecotone Corporation, which is used to enter wetlands site data in the field and to facilitate the preparation of electronic copies of the 2007 USACE Regional Supplement data form for each wetland determination plot. Photos of soils and vegetation were taken at each wetland determination plot. Physiographic type, surface form type, Viereck et al. (1992) Level IV vegetation class, and observations of wildlife use (e.g., dens, browse, scat) or human activity (e.g., hunting or fishing sign, ATV trails) were also recorded at each plot. Field wetland determination data forms for each plot and plot photographs are provided in Appendix A.

Rapid map-verification plots also were sampled to provide ground-reference data for the mapping of wetlands, vegetation, and wildlife habitats. At map-verification plots, the dominant plant species, Cowardin et al. (1979) water regime, and Viereck et al. (1992) Level IV vegetation class were recorded along with site photographs and GPS locations. The data from map-verification plots were used to improve map accuracy by increasing the number of documented wetland types tagged to particular aerial photosignatures; the map-verification data are provided in Appendix B.

WETLAND MAPPING AND CLASSIFICATION

Wetland boundaries were visually interpreted from image signatures and were digitized on-screen using ArcGIS software, the approach typically used by the U.S. Fish and Wildlife Service's National Wetlands Inventory (NWI) program (Dahl et al. 2009). Digital, high-resolution imagery (Pleiades satellite imagery, 0.5 m resolution, acquired in summer 2013) was provided by ADOT&PF and rectified to align with the SPOT 5 satellite imagery (SPOT5.SDMI.ORTHO) available online from the Geographic Information Network of Alaska (GINA 2015). The SPOT 5 imagery from GINA was selected as the base data layer because it closely matched preliminary design survey data for the airport projects provided by PDC. The rectification process carried out by ABR included stitching the range of Pleiades image tiles covering the study area into a single mosaic using ArcMap mosaic tools. Once the mosaic was complete, 20 control points were selected across the area, as evenly distributed as possible based on features visible in both the SPOT5 and Pleiades imagery. The final rectification method for the Pleiades mosaic was a third-order polynomial, which yielded the least distorted image and the smallest root mean square error.

New mapping and revisions to the original mapping of wetlands and waters prepared by HDR (2012) was done on-screen in ArcMap using the rectified imagery as the base map. Wetlands and waters mapping was done at a scale of 1:2,000 with a minimum map unit size of 0.1 acre.

Wetlands and waters were categorized following the wetland classification of Cowardin et al. (1979), which involves classifying wetlands by dominant vegetation type and water regime, and the map polygons were attributed using NWI annotation (Dahl et al. 2009). In addition to assigning Cowardin classes, each wetland polygon was assigned a physiography class, hydrogeomorphic (HGM) class, Level IV vegetation class, and a microtopography class. Physiographic types represent generalized geomorphic features used to describe landscape position and function (e.g., upland, lowland, lacustrine, and riverine). HGM classes were assigned following Smith et al. (1995), whose classification system is based on geomorphic setting, water source and transport, and hydrodynamics. Level IV vegetation classes follow the Alaska Vegetation Classification System (Viereck et al. 1992), and include dominant plant species and vegetation structure to classify vegetation types throughout Alaska. The

microtopographic classes used follow the periglacial classification system developed by Washburn (1973). The five mapped variables (Cowardin wetland class, physiography class, HGM class, Level IV vegetation class, and microtopographic class) were combined to produce a set of unique land-cover types, which were then aggregated into broader ecologically related categories. For this study, we aggregated the land-cover types into wetland functional classes for descriptive and functional assessment purposes (as described in the Aquatic Site Assessment section below), and wildlife habitat classes to assess potential habitat use by birds and mammals within the study area (as described in the Wildlife Habitat Mapping and Evaluation section below). The crosswalk developed to assign wetland functional classes and wildlife habitat types to mapped wetland polygons is presented in Appendix C.

Wetlands and waters within the study area were assessed to determine if they met the definition of a water of the U.S., subject to jurisdiction under Section 404 of the Clean Water Act, and/or a navigable water of the U.S., subject to jurisdiction under Section 10 of the Rivers and Harbors Act.

AQUATIC SITE ASSESSMENT

The ASA was prepared using a rapid assessment of wetland function based on HGM principles, which has been developed in consultation with the USACE specifically for wetlands on the ACP of Alaska. The ASA method includes ACP-specific wetland function criteria and proposed thresholds to define categorical wetland function rankings. The criteria may be evaluated using available data in the literature or site-specific field data depending on the resources available for the project. The method is applied to wetland functional classes (groups of wetland and water types that share similar ecological functions). To develop wetland functional classes, we integrated information from Cowardin et al. (1979) wetland classes, Viereck et al. (1992) Level IV vegetation classes, broad-scale landscape characteristics (physiography), HGM classes, and microtopographic classes. Wetland functional classes at the Barrow airport were derived using data from the field observations made during the ABR wetland surveys in September 2014, supplemented by the original wetlands mapping and report (HDR 2012).

WETLAND FUNCTIONS

Satellite imagery interpretation, local topography, and review of existing wetland maps and data for the Barrow airport were used to define the environmental conditions and characteristics for each wetland functional class and to determine indicators specific to each function. Functional classes were rated as low, moderate, or high for each wetland function, depending on the indicators present. Eight functions were evaluated as described below.

Flood flow regulation (storage) is the capacity of a wetland to control surface-water flow and subsequently moderate downstream flooding. Snowmelt-generated floods are the dominant, maximum annual flood events in arctic watersheds (Woo 2012, McNamara et al. 1998), particularly in the low-gradient rivers and streams found on the ACP. ACP wetlands and waters are near an annual maximum for surface wetness just after snowmelt, and gradually lose water over the summer as evapotranspiration greatly exceeds precipitation (Mendez et al. 1998). Thus, flood flow regulation was assessed from the standpoint of snowmelt-generated floods, which (1) affect most communities on the ACP as sheet flow, (2) were assumed to fill any storage available in spring, and (3) occur outside (before) the growing season. Since the largest seasonal floods occur at snowmelt and wetland vegetation is largely dormant at that time, physical characteristics are primarily responsible for floodwater retention and storage. For wetlands outside of active riverine channels, the role of polygonal features, specifically the difference between low-center polygons with ice-rich raised polygonal rims and high- and low-center polygons with smaller steep-sided depressions (Liljedahl et al. 2012), were considered in assessing flood water storage. Surface roughness provided by live vegetation was only considered if seasonal flooding from rainfall events was likely to contribute to flooding the wetland (i.e., in riverine systems).

Sediment, nutrient, and toxicant removal is the capacity of a wetland to retain suspended sediment and nutrients and/or toxicants adsorbed to inorganic sediments. The cold temperatures and shallow active (thawed) layer on the ACP limit denitrification, thus this function is assessed from the standpoint of retaining inorganic sediments and adsorption of nutrients and toxicants through settlement. Indicators of floodwater storage as described above are important indicators of this function.

Erosion control and shoreline stabilization is the degree to which a wetland reduces erosion at the edges of relatively permanent flowing waters. No wetland functional classes within the study area abut rivers or streams, thus this function was not assessed.

Organic matter production and export is the capacity of a wetland to make organic matter contributions to the ecosystem through primary production. Field data for the study area (Appendices A and B; HDR 2012) were used to assess production of organic matter through herbaceous or deciduous woody vegetation occurrence, and potential export of organic matter contributions through surface-water connections and flooding.

Threatened and Endangered Species (TES) Support is the capacity of a wetland or water to support threatened or endangered species. There are no threatened or endangered terrestrial mammals in the study area, and with the exception of polar bears(*Ursus maritimus)*, no marine mammals occur in the study area. Polar bear habitat preferences were not assessed, however, because the primary use of terrestrial areas by polar bears is for maternal dens during the winter, and den locations depend on appropriate topographic relief (i.e., physical features affecting snowdrift depth and extent); these physical features are not associated with wetlands and waters.

Two threatened sea duck species, Steller's Eiders (*Polysticta stelleri*) and Spectacled Eiders (*Somateria fischeri*), are present in the Barrow area during the breeding season. To assess wetland support of these species, individual observation and nest locations, as compiled by the U.S. Fish and Wildlife Service's Arctic Landscape Conservation Cooperative (ALCC 2012), were overlaid on the revised wetlands mapping prepared in this report to determine the occurrence of these species in individual wetland types. Only on-the-ground observations were used (i.e., flyover observations were disregarded).

Spectacled Eider habitat preferences for the ACP were determined from detailed aerial and ground-based observations made in the Colville River Delta and northeast NPR-A (Johnson et al. 2014). Preferred Spectacled Eider habitats located within the Barrow airport study area are Shallow Open Water without Islands, Deep Polygon Complex, and Grass Marsh. These habitats are located in the following wetland functional classes: Permanently Flooded Ponds, Deep Polygon Complex, and Flooded Graminoid Marsh.

For the purpose of this ASA, preferred Steller's Eider habitats were defined as those with the greatest number of observations of breeding pairs or the nearest permanent waterbody to nest sites in the Barrow area (Safine 2013). Shallow and deep *Arctophila* ponds accounted for the majority of the habitat use documented in the ground-based nest searches (Safine 2013), which corresponds to the Deep Polygon Complex and Flooded Graminoid Marsh wetland functional classes. Shallow *Carex* ponds and shallow *Arctophila* ponds were the most frequent waterbodies nearest to Steller's Eider nests (Safine 2013); these habitats are located in the following wetland functional classes: Deep Polygon Complex and Flooded Graminoid Marsh.

General avian/mammal habitat suitability is the capacity of a wetland to support a diversity of wildlife species. This function was assessed from both a local and a regional perspective, relying on regional-scale mapping of wetlands and the local-scale results of the Wildlife Habitat Mapping and Evaluation (see below). For this ASA, a particular wetland type was considered to be used by a high diversity of wildlife species if the wetland functional class it occurred in within the study area contained habitats important to at least half of the assessed species (i.e., >5 mammal species and >15 bird species).

Disproportionately high habitat use, in relation to habitat availability, generally indicates habitat preference and this was taken into account when assessing habitat suitability at a regional scale. Because regional habitat mapping is not available for the Barrow area, digital NWI mapping (USFWS 2014a) for palustrine, lacustrine, and riverine systems in the Northwest Coast watershed (HUC 19060202) on the ACP was used to assess the regional rarity of wetlands and waters occurring on the Barrow airport property. A threshold of 1% occurrence in areal coverage in the Northwest Coast watershed NWI mapping was used to define rarity of wetlands and waters and to augment the assessment of habitat suitability for birds and mammals in the study area.

Fish habitat suitability was evaluated by assessing the degree to which a wetland or water directly supports fish. Only those wetlands and waters with at least a seasonal, intermittent connection to known or likely fish-bearing waters have the potential to perform this function. Aerial imagery and field data (Appendices A and B; HDR 2012) were used to assess the size and depth of surface waters, presence and type of vegetation, likely presence of spawning or resting

areas, and connections to other waters. Direct information on fish occurrence in the Barrow area also was assessed when evaluating the fish habitat suitability function.

Educational, scientific, recreational, or subsistence use reflects the degree to which a wetland provides direct support of hunting and gathering activities, local travel, and/or education. Some scientific research in the Barrow area has been conducted to support the authorization of proposed developments, but basic research in arctic ecosystems also has been conducted. The criteria used to determine if the study area is important for educational or scientific use included whether long term research sites or permanent sample plots were directly impacted. Established trails visible in aerial imagery or documented in field data were indicative of local travel. Opportunistic subsistence may occur as resources are available, due to the proximity of the study area to Barrow, although access to the airport property generally should be restricted by the Federal Aviation Administration (FAA).

PROPOSED MITIGATION RANKING CATEGORIES

As part of the Section 404 permitting and wetland mitigation process, wetlands are typically categorized according to their overall functional capacity. While the final mitigation ranking categories will be determined by USACE during the permitting process, each wetland functional class mapped in the study area was placed into 1 of the following 3 proposed mitigation ranking categories following the guidelines in the USACE *Ratios for Compensatory Mitigation* (USACE 2014) and the U.S. Fish and Wildlife Service (USFWS) Part 501 FW 2 Mitigation Policy and Appendix 2 (USFWS 1993a, b).

Category I — Wetlands that: (1) provide documented habitat for threatened or endangered species; (2) represent a high quality example of a rare wetland type; (3) are rare within a given region; (4) provide habitat for very sensitive or important wildlife or plants; and/or (5) are undisturbed and contain ecological attributes that are impossible or difficult to replace within a human lifetime, if at all (USACE 2014).

For this study, a wetland functional class was given Category I status if the following ASA criteria were met: (1) contained TES preferred habitat as documented by long-term studies applicable to the study area, (2) was within an established critical habitat boundary for TES, or (3) was rated high for all evaluated functions. Long-term habitat preference studies rely on a

large pool of observations, during appropriate seasons, and typically use statistical analyses to identify preferred habitats thus are considered more appropriate than single observations to determine TES use.

Category II — Wetlands that can be important for a variety of wildlife species and can be critical for the watershed depending on where they are located. In contrast to Category I wetlands, Category II wetlands do not provide critical habitat for threatened or endangered species or species of concern. Generally these wetlands are pristine, not fragmented, are common but more productive and sustain higher biodiversity compared to Category III wetlands (USACE 2014).

For this study, a wetland functional class was given Category II status if the class was rated high for 2 or more, but not all, evaluated functions.

Category III — Wetlands that are usually plentiful in the watershed, and often supporting low biodiversity. Category III wetlands are not rare or unique, and overall productivity and species diversity are relatively low. These wetlands are affected by human activities, or by fire or other natural events, and are not considered to be pristine. As a result, in some cases these wetlands require less than 1:1 mitigation ratios (USACE 2014).

For this study, a wetland functional class was given Category III status if the following ASA criteria were met: (1) rated high for 1 or fewer functions, or (2) if disturbed, the wetlands in the functional class were degraded to the point of substantially altering original functions without providing new functions.

WILDLIFE HABITAT MAPPING AND EVALUATION

Wildlife habitat types in the study area were derived by integrating 5 mapped variables: Cowardin et al. (1979) wetland class, Viereck et al. (1992) Level IV vegetation class, broad-scale landscape characteristics (physiography), HGM wetland class, and microtopography class. This process is similar to that used for classifying wetland functional classes, except that upland vegetation types as well as wetlands are included, and in the wildlife habitat classification vegetation and landscape data are aggregated by characteristics considered important to wildlife such as food availability, nest and den site characteristics, and security, escape, and shelter habitats (cover). These factors may be directly related to vegetation structure, forage quality or

quantity, physiographic location, the spatial arrangement of habitats, and/or the temporal availability of habitats.

For the habitat evaluation, data on wildlife habitat use in the Barrow area for commonly occurring birds and mammals were compiled from several sources. The incidental observations of wildlife recorded during the wetland field surveys in September 2014, and observations made during systematic wildlife surveys conducted between 2004 and 2008 in the Barrow area (Parrett and Johnson 2004; Cyr and Johnson 2005; Attanas and Johnson 2006, 2007 and 2008) were reviewed. We also reviewed previous wildlife studies conducted in the Barrow area (Pitelka 1974; Johnson and Herter 1989; Larned et al. 2006, 2012; Quakenbush et al. 2004, Safine 2013) to identify which bird and mammal species are likely to regularly occur in the area and which wildlife habitats they typically use. When Barrow-specific wildlife habitat data were not available, we used data from studies conducted on the Alaskan ACP (Derksen et al. 1979, Rothe et al. 1981, Field et al. 1993, MacDonald and Cook 2009; Johnson et al. 2014).

For 2 species listed as threatened under the Endangered Species Act (ESA)—Spectacled Eider and Steller's Eider—we reviewed the locations of historical field observations compiled in the USFWS Arctic Landscape Conservation Cooperative Threatened Eider Geodatabase (ALCC 2012). For 1 species that was recently removed from the ESA candidate list (79 FR 59195)—Yellow-billed Loon (*Gavia adamsii*)—we reviewed the locations of historical field observations compiled in the USFWS Arctic Landscape Conservation Cooperative Yellow-billed Loon Geodatabase (ALCC 2014). We also plotted recent unpublished nest site location data from 2008–2014 for the study area (USFWS 2014b) to document the locations of recent nesting by Steller's and Spectacled Eiders.

When spatial coordinates were available for the wildlife observations compiled from the sources note above, locations were directly overlaid on the wildlife habitat types mapped in this study to determine the habitats being used at the time of observation. When only descriptive information was available for the habitats used in a given study, the habitats described in that study were cross-walked to the habitats mapped in this study to determine which habitats in the study area correspond to those observed to be used. For each species expected to occur commonly in the study area, the habitats mapped in this study were then assessed as important (regularly used at some point in the life cycle, e.g., for breeding, denning, migration) or not

important (infrequently used or avoided completely). In this habitat evaluation, the amount and spatial location of the habitat patches available in the study area also were taken into account (i.e., small patches of available habitat are less attractive than larger patches and habitats directly adjacent to disturbed areas will be less used by some species).

RESULTS AND DISCUSSION

FIELD SURVEY

All wetland determination and map-verification plots were accessed on foot from existing roads in the Barrow area (i.e., no ORVs were employed). While working on Barrow Airport property, the field team was accompanied by an airport employee escort. No native allotments were traversed by the field crew during the survey work.

Standard U.S. Army Corps of Engineers (USACE) 3-parameter wetland determinations were completed at 3 field plots (Figure 2, Appendix A) and map-verification information was collected at 17 plots (Figure 2, Appendix B). Field plots were sampled in representative wetland and wildlife habitat types on the Barrow Airport property.

The growing season on the ACP typically extends from mid-June through mid-September (Markon 2001). Prior to the field surveys, an early season (warm) snow fall had occurred in Barrow and vegetation had begun senescence by the time the survey work started. Although vascular plants were not in the growing phase during the field surveys, the field crew was able to identify species and estimate the percentage plant cover values required for standard USACE wetland determinations. For example, the thin snow cover present on some plots was easily brushed away facilitating plant identification and cover value estimates. At plots with substantial snow cover, plant identification and cover estimates were made by clearing small areas (approximately 0.25 m × 0.25 m) throughout the plot and estimating cover values for the species present.

WETLAND MAPPING AND CLASSIFICATION

We identified 16 Cowardin classes in the Barrow airport study area: 5 waters, 9 wetlands, and 2 upland classes (Table 1). As no development is proposed in marine waters and shores (M1UBL and M2USP, respectively), they are excluded from further discussion.

Results of field-based wetlands map revisions and classification were generally in agreement with HDR (2012) linework. Field data and aerial imagery indicated that there was less seasonal flooding than originally mapped. Very small features traditionally mapped as part of a larger complex (i.e., polygonal troughs and the basins of low-centered polygonal tundra) were merged with the surrounding polygons to create more ecologically meaningful boundaries. NWI coding for patterned communities (i.e., low-centered, high-relief, high-density polygons; high-centered, low-relief polygons; mixed high- and low-centered polygons) was updated to reflect the predominant Cowardin class, with full descriptions of included Cowardin classes and vegetation types presented below.

WATERS

Permanently Flooded Lake (L1UBH, 38.46 acres, Figure 2) was mapped in one location in the Barrow airport study area: upper Isatkoak Lagoon, the large north-south trending waterbody located off the eastern end of the runway. Isatkoak Lagoon is approximately 160 acres in size, and was dredged and divided into 3 sections during airport construction (PDC 2014). The hydraulically connected upper and middle sections of Isatkoak Lagoon are separated by a causeway, and the freshwater upper lagoon serves as the community's water supply (PDC 2014).

Permanently Flooded Ponds (impounded) (PUBHh, 1.86 acres, Figure 2) were mapped in three locations in the Barrow airport study area: small impounded thermokarst ponds adjacent to gravel fill and surrounded by narrow Permanently Flooded Nonpersistent Emergent (impounded) (PEM2Hh) fringe wetlands. These small ponds are shallow enough to freeze fast during the winter.

Seasonally Flooded Unconsolidated Shore (excavated) (PUSCx, 4.96 acres, Figure 2) was mapped in one location in the Barrow airport study area within an active material site at the west end of the runway. Comparison of earlier imagery with the current imagery indicates that this area is often flooded but the boundaries change rapidly as material is extracted from the pit. Impacts to wetlands as a result of active gravel mining activities within the airport property boundaries are not addressed in this report.

WETLANDS

Permanently Flooded Nonpersistent Emergent (impounded) (PEM2Hh, 12.64 acres, Figure 2) wetlands were mapped as narrow fringes around impounded ponds, one shallow water thermokarst pit, and narrow expanses adjacent to gravel fill. *Arctophila fulva* (Arctic pendantgrass) dominates this shallow water community.

Semipermanently Flooded Persistent Emergent (PEM1F, 63.54 acres, Figure 2) wetlands were mapped south of the runway, in the western half of the study area. PEM1F wetlands comprised a mosaic of intermixed wetland types where low-centered polygons have particularly deep centers formed by settlement of ice-rich soils. Permanently flooded nonvegetated polygon centers (PUBH) are fringed by fresh grass or sedge marsh (PEM2H and PEM1H or PEM1F, respectively). Broad low rims of saturated or seasonally flooded/saturated sedge-shrub tundra (PEM1B and PEM1E, respectively) separate the centers. Water (PUBH) forms a substantial portion of this class, but neither water nor a single vegetation type is dominant. Dominant species include *Arctophila fulva*, *Carex aquatilis* (water sedge), *Eriophorum angustifolium* (tall cottongrass), and *Salix rotundifolia* (least willow).

Semipermanently Flooded Persistent Emergent (impounded) (PEM1Fh, 27.52 acres, Figure 2) wetlands were mapped adjacent to gravel fill. PEM1Fh wetlands had shallow standing water, and were dominated by *Carex bigelowii* (Bigelow's sedge), *Poa arctica* (Arctic bluegrass), and *Eriophorum angustifolium*. *Arctophila fulva*, *Cochlearia officinalis* (spoonwort), and *Senecio congestus* (marsh fleabane) are salt-tolerant species that were present in low covers. Small patches of barren ground are present in this community.

Semipermanently Flooded Nonpersistent Emergent (impounded) (PEM2Fh, 4.17 acres, Figure 2) wetlands were mapped in one impoundment between the Barrow airport runway and the apron. Dominant species included unidentified grass and *Carex aquatilis* in 4–6 inches of standing water.

Seasonally Flooded/Saturated Persistent Emergent (PEM1E, 28.50 acres, Figure 2) wetlands were mapped in areas with mixed high- and low-centered polygons. High-centered, low-relief polygons comprised PEM1/SS1B, PEM1B, and PEM1E wetlands typically dominated by *Carex bigelowii*, *Poa arctica*, *Luzula nivalis* (Arctic woodrush), and *Salix rotundifolia*. Low-lying

polygonal troughs and low-centered polygons are predominantly wet sedge meadow (PEM1F) with shallow surface water, typically dominated by *Carex aquatilis* and *Eriophorum angustifolium*. Deeper low-centered polygon basins are permanently flooded, either sparsely vegetated (PUBH) or dominated by *Arctophila fulva* (PEM2H).

Seasonally Flooded/Saturated Persistent Emergent (impounded) (PEM1Eh, 11.96 acres, Figure 2) and Saturated Persistent Emergent (impounded) (PEM1Bh, 19.90 acres, Figure 2) wetlands were mapped between the active material site and a gravel road. This wetland was dominated by *Poa arctica* and *Carex aquatilis*, with small areas of *Arctophila fulva*-dominated permanently flooded wetlands (PEM1H).

Saturated Persistent Emergent (PEM1B, 122.84 acres, Figure 2) and Saturated Persistent Emergent/Deciduous Scrub-Shrub (PEM1/SS1B, 174.08 acres, Figure 2) wetlands were mapped throughout the Barrow airport study area, comprising both high-centered, low-relief polygonal tundra and nonpatterned tundra along level to gently sloping terrain surrounding Isatkoak Lagoon. Typical dominant species include *Carex bigelowii*, *Poa arctica*, *Luzula nivalis*, and *Salix rotundifolia* and *S. pulchra* (tealeaf willow) shrubs. Low-lying polygonal troughs are predominantly wet sedge meadow (PEM1F) with shallow surface water, typically dominated by *Carex aquatilis* and *Eriophorum angustifolium*.

UPLANDS

One small Upland (U, 1.03 acres, Figure 2) area was mapped between Isatkoak Lagoon and the runway (HDR 2012, see datasheet 069). The dwarf willow community was dominated by *Salix pulchra*, *Petasites frigidus* (Arctic coltsfoot), and *Poa arctica*. Dry, sandy silt loam soils did not meet any hydric soil indicators. Upland (fill) (Us, 245.35 acres, Figure 2) comprised the existing Airport development and active material site.

PROPOSED JURISDICTIONAL STATUS

Upper Isatkoak Lagoon trends north-south through the study area (Figure 1). Though separated from the middle lagoon by a causeway, the two are hydraulically connected (PDC 2014). An intermittent connection between the middle lagoon and lower lagoon (sewage lagoon) is assumed, with the lower lagoon at least intermittently connecting to the nearshore waters of

the Chukchi Sea. All wetlands and waters within the study area are likely jurisdictional due to their direct surface and/or shallow subsurface connections to Isatkoak Lagoon.

AQUATIC SITE ASSESSMENT

Wetlands were aggregated into eight wetland functional classes (Table 2, Figure 3), which are a combination of Cowardin et al. (1979) wetland classes, Viereck et al. (1992) Level IV vegetation classes, broad-scale landscape characteristics (physiography), hydrogeomorphic (HGM) class, and microtopography (Appendix D). Wetland functional classes at the Barrow airport were derived using data from the field observations made during the ABR wetland surveys in September 2014, supplemented by the original wetlands mapping and report (HDR 2012). ASA results are summarized in Table 3 and discussed below; the data used in the ASA are presented in Appendix D.

WETLAND FUNCTIONS

Flood flow regulation performance was considered to be high in 2 wetland functional classes that are characterized by depressional HGM classes and had ample storage capacity: Permanently Flooded Lakes and Deep Polygon Complex. Five wetland functional classes with limited to moderate surface roughness present during spring snowmelt (e.g., polygonal features, tussocks) and moderate storage capacity were considered to be moderately functioning for flood flow regulation: Permanently Flooded Ponds, Flooded Graminoid Marsh, Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra, Patterned Saturated Sedge-Shrub Tundra, and Impounded Disturbed Wetlands. One wetland functional classes with limited storage capacity and limited surface roughness was considered to be low functioning for flood flow regulation: Nonpatterned Saturated Sedge-Shrub Tundra.

The results for sediment, nutrient (N and P), and toxicant removal generally mirrored the results for flood flow regulation because physical characteristics important for floodwater retention were also important for settlement. Permanently Flooded Lakes and Permanently Flooded Ponds scored high for sediment, nutrient, and toxicant removal due to favorable conditions for sedimentation (and thus adsorbed nutrient and toxicant) settling. Deep Polygon Complex and Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra also scored high

because of the seasonal flooding, surface roughness provided by polygonal rims, and thick surface organics that can be effective at retaining heavy metals.

Erosion control and shoreline stabilization was not assessed because no wetland functional classes in the study area occur adjacent to rivers or streams.

Organic matter production and export performance was considered to be low in Permanently Flooded Lakes and Permanently Flooded Ponds because the unvegetated waterbodies have limited to no organic matter production. Nonpatterned Saturated Sedge-Shrub Tundra scored low for organic matter production and export performance due to the lack of surface water necessary for export. All other wetland functional classes, including Flooded Graminoid Marsh fringes to Permanently Flooded Ponds, scored moderate (the lack of surface water outflow, outside of spring flooding, precluded high scores for this function for these functional classes).

Threatened and endangered species (TES) support was considered to be high for 3 wetland functional classes: Permanently Flooded Ponds, Flooded Graminoid Marsh, and Deep Polygon Complex. Each of these wetland functional classes includes habitats known to be preferred for Steller's and/or Spectacled Eiders, and at least one documented occurrence of Steller's and/or Spectacled Eiders (excluding flyovers) has been made in the habitats in these functional classes. Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra and Patterned Saturated Sedge-Shrub Tundra scored moderate for TES support; although preferred habitats for threatened eiders are not present in these classes, at least one documented occurrence of Steller's and/or Spectacled Eiders was recorded in the habitats in these functional classes. The low scoring wetland functional classes (Permanently Flooded Lakes, Nonpatterned Saturated Sedge-Shrub Tundra, and Impounded Disturbed Wetlands) did not include preferred habitats for threatened eiders. Only documented occurences within the Airport study area were considered in this evaluation. Documented occurences within potential material site boundaries are considered in their separate report.

Permanently Flooded Lakes and Permanently Flooded Ponds scored low for general avian and mammal habitat support because they did not support a high diversity of either birds or mammals. Deep Polygon Complex, Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra, and Patterned Saturated Sedge-Shrub Tundra scored high because each of these

functional classes supported a high diversity of birds and mammals, was generally undisturbed, and were characterized by at least moderate interspersion of vegetation and open water, which is an attractive habitat feature for a number of bird and mammal species. The remaining wetland functional classes scored moderate for this function because disturbance, ubiquity, and/or a low diversity of bird and mammal species precluded a high score.

Permanently Flooded Lakes scored high for fish habitat suitability because Isatkoak Lagoon does not freeze fast during the winter and is known to support at least ninespine stickleback (*Pungitius pungitius*). No other wetland functional classes in the study area had even an intermittent connection to a fish-bearing water, and thus the other functional classes were not assessed for fish habitat suitability.

Permanently Flooded Lakes scored high for educational, scientific, recreational, or subsistence use because Isatkoak Lagoon serves as the community water source, is assumed navigable and thus is a public trust land, and serves as an access corridor to subsistence resources in the winter months. The wetland functional classes occurring only west of Isatkoak Lagoon scored low because they are located within the Barrow airport boundaries and thus are inaccessible for recreation or subsistence use. Nonpatterned Saturated Sedge-Shrub Tundra scored moderate for this function because this wetland functional classes was located east of Isatkoak Lagoon and thus was accessible for subsistence activities, and visible trails were present.

PROPOSED MITIGATION RANKING CATEGORIES

Three wetland functional classes (Permanently Flooded Ponds, Flooded Graminoid Marsh, and Deep Polygon Complex) are proposed as Category I, based on documented preferred habitat for TES (Table 3, Figure 4). Permanently Flooded Lakes and Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra are proposed as Category II based on the number of high scores. The remaining wetland functional classes (Patterned Saturated Sedge-Shrub Tundra, Nonpatterned Saturated Sedge-Shrub Tundra, and Impounded Disturbed Wetlands) are proposed as Category III because they generally scored moderate for all evaluated functions and in some cases are disturbed.

WILDLIFE HABITAT MAPPING AND EVALUATION

In this study, 8 wildlife habitat types were found to occur in the Barrow airport study area (Table 4). A crosswalk table depicting the relationships among the NWI types, wetland functional classes, and wildlife habitat types mapped in this study is presented in Appendix C. Moist Sedge-Shrub Meadow is the primary wildlife habitat type, occupying 47 percent of the study area (358.31 acres; Figure 5). Also prevalent in the study area is Human Modified Barrens and Human Modified Water (245.36 and 4.96 acres, respectively); these types include all roadways and airport runways, gravel fill, material sites, buildings, and human-created ponds. Deep Polygon Complex is the only other relatively abundant habitat type in the study area; this type is located predominantly in the depressional area south of the runway (63.54 acres; Figure 5). Deep Open Water consists of the southern arm of Isatkoak Lagoon, near the east end of the runway (38.46 acres). Both Aquatic Graminoid Marsh (16.81 acres) and Nonpatterned Wet Meadow (27.52 acres) are strongly associated with Human Modified Barrens and are primarily found adjacent to roadways and gravel fill. Similarly, Shallow Open Water without Islands (1.86 acres) primarily consists of the small ponds adjacent to roadways and gravel fill, indicating that these waterbodies are strongly influenced by human modifications to the landscape.

There are 3 federally protected threatened species that may occur in the Barrow airport study area: polar bears, Steller's Eiders, and Spectacled Eiders. Polar bears are distributed throughout the drifting ice zone in the Beaufort and Chukchi seas off the coast of northern Alaska (MacDonald and Cook 2009). During the summer months, they are found almost exclusively in the drifting ice zone in offshore waters. Polar bears frequently occur in nearshore waters especially around Point Barrow in the spring and fall and less frequently on land in Barrow during the winter. Polar bears are often attracted to populated areas by human garbage or remnants of subsistence harvests such as whale or caribou carcasses. They may use any of the habitats present in the study area, particularly in the winter when there is continuous snow and ice cover. However, because of the infrequent occurrence of polar bears in populated areas in Barrow, the disturbance activities and directed wildlife hazing associated with the airport, and the lack of sources of putrescible garbage on the airport property, the wildlife habitats in the study area are expected to be infrequently used by polar bears. Because of this, polar bears were

considered uncommon in the study area and their use of wildlife habitats was not assessed in this study.

In Alaska, Steller's Eiders currently nest almost exclusively around Barrow (USFWS 2002). During surveys between 1993 and 2003, at least 3 nests were recorded (in 1999) on the south side of the airport (Quakenbush et al. 2004). In later surveys, 1 nest was found each year in 2006 and 2007 east of the airport (Rojek 2007 and 2008). In ground-based surveys between 2004 and 2008, no Steller's Eider nests were found in the immediate vicinity of the Barrow airport (Parrett and Johnson 2004, Cyr and Johnson 2005, Attanas and Johnson 2006, 2007 and 2008); however, birds were observed within 400 m of the area proposed for the M&O facilities (ABR 2013). In annual surveys conducted by the USFWS between 2008 and 2013, the area immediately adjacent to the Barrow airport was not surveyed (Safine 2015, personal communication). In aerial surveys in the Barrow area in recent years, breeding Steller's Eider pairs were regularly found near town (Obritschkewitsch and Ritchie 2012). There have been no Steller's Eider's nests located since 2007 within the Barrow airport study area.

Steller's Eiders nest on the rims of low-center polygons or near the shores of lakes, ponds and lagoons with emergent *Arctophila fulva* or *Carex aquatilis* (Quakenbush et al. 2004). In the study area, these aquatic habitats are dominated by *Arctophila fulva* and were classified as Aquatic Graminoid Marsh. Steller's Eiders' annual nesting propensity is intermittent and may depend on concurrent nesting of Snowy Owls and Pomarine Jaegers (Quakenbush et al. 2004, Quakenbush and Suydam 1999). In the Barrow airport study area, they may nest within Moist Sedge-Shrub Meadow or Deep Polygon Complex habitats. Steller's Eiders may also use Aquatic Graminoid Marsh and Shallow Open Water without Islands during the pre-nesting and/or brood-rearing periods.

Spectacled Eiders nest along the coast in northern Alaska from Wainwright to Demarcation Point (Gabrielson and Lincoln 1959, Dau and Kischinski 1977, Petersen et al. 2000), with the highest density found in the Barrow area (Larned et al. 2012). Spectacled Eiders nest in similar habitats as do Steller's Eiders, preferring polygon rims and islets in Deep Polygon Complex and Patterned Wet Meadow habitat types (Johnson et al. 2008), and shorelines and islands in ponds and lakes. The species has a strong tendency to nest near water (Anderson et al. 2000, Petersen et al. 2000). Shallow Open Water without islands is a preferred pre-nesting habitat for Spectacled

Eiders in the NPR- A (Johnson et. al 2014). During surveys between 1991 and 2010, no Spectacled Eider nests were located in the Barrow airport study area (ALCC 2012).

The Yellow-billed Loon (*Gavia adamsii*) was a candidate species for listing under the ESA and was recently removed from the candidate list (79 FR 59195). In Alaska, this species nests from St. Lawrence Island through western Alaska and the ACP. Although no Yellow-billed Loon nests have been recorded in the study area, Yellow-billed Loons were observed flying over the vicinity of the airport during surveys between 2004 and 2008 (Parrett and Johnson 2004, Cyr and Johnson 2005, Attanas and Johnson 2006, 2007 and 2008). Breeding pairs were regularly observed on lakes to the south of Barrow during surveys between 1992 and 2005 (Larned et al. 2006). Yellow-billed Loons generally prefer to nest on low islands or shorelines of large, deep lakes with gently sloping shores (Johnson and Herter 1989).

During the wetland field surveys in September 2014, biologists observed Snowy Owls in the Moist Sedge-Shrub Meadow habitat type as well as brown lemmings and Greater White-fronted Geese on and near Human Modified Barrens. Although we did not conduct formal wildlife surveys in the study area, numerous surveys have been conducted in the region (e.g., Parrett and Johnson 2004, Cyr and Johnson 2005, Larned et al. 2006, Attanas and Johnson 2006, 2007 and 2008, Larned et al. 2012, Obritschkewitsch and Ritchie 2012) and these surveys provide information on which species are most likely to occur in the study area and which habitats are commonly used. Two of the most heavily used wildlife habitats in the study area are Moist Sedge-Shrub Meadow and Deep Polygon Complex. In the habitat evaluation conducted for this study, Moist Sedge-Shrub Meadow was found to be important for 34 common bird and mammal species, including songbirds, shorebirds, small mammals, furbearers, and large mammals, and Deep Polygon Complex was found to be important for 33 species (Table 4). The remaining habitat types were found to be of lower importance to wildlife due to the proximity to airport and community infrastructure and associated disturbances. In addition, the Barrow airport actively hazes wildlife away from the runway for safety reasons, which reduces the likelihood of use by all wildlife.

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Table 1. Waters, wetlands, and uplands acreage within the Barrow airport study area.

NWI Code [a]	Code Description	Acres
	Waters	
M1UBL	Subtidal Marine Waters	3.38
M2USP	Irregularly Flooded Intertidal Shore	9.82
L1UBH	Permanently Flooded Lakes	38.46
PUBHh	Permanently Flooded Pond (impounded)	1.86
PUSCx	Seasonally Flooded Unconsolidated Shore (excavated)	4.96
	Waters Total	58.48
	Wetlands	
PEM2Hh	Permanently Flooded Nonpersistent Emergent (impounded)	12.64
PEM1F	Semipermanently Flooded Persistent Emergent	63.54
PEM1Fh	Semipermanently Flooded Persistent Emergent (impounded)	27.52
PEM2Fh	Semipermanently Flooded Nonpersistent Emergent (impounded)	4.17
PEM1E	Seasonally Flooded/Saturated Persistent Emergent	28.50
PEM1Eh	Seasonally Flooded/Saturated Emergent (impounded)	11.96
PEM1B	Saturated Persistent Emergent	122.84
PEM1Bh	Saturated Persistent Emergent (impounded)	19.90
PEM1/SS1B	Saturated Persistent Emergent/Deciduous Shrub-Scrub	174.08
	Wetlands Total	465.15
	Uplands	
U	Upland (undisturbed)	1.03
Us	Upland (fill)	245.35
	Uplands Total	246.38
	TOTAL	770.01

[a] National Wetland Inventory (NWI) annotation based on the Cowardin et al. (1979) classification system.

Table 2. Wetland functional class descriptions for the Barrow airport study area.

Wetland Functional Class	Description
Waters	
Permanently Flooded Lakes (38.46 acres)	Isatkoak Lagoon is a deep (>2 m) freshwater lake approximately 160 acres in total size, and the only lacustrine (L1UBH) feature within the study area. Isatkoak Lagoon was dredged and split into three sections during airport construction, and is the community's water supply.
Permanently Flooded Shallow Ponds (1.86 acres)	Shallow (<2 m) thaw ponds <20 acres in size, mapped as NWI code PUBHh. Permanently Flooded Shallow Ponds are impounded waters adjacent to gravel fill that freeze to the bottom during winter months. These ponds are depressional HGM features fed by surface runoff.
Wetlands	
Flooded Graminoid Marsh (12.64 acres)	This aquatic vegetation community occurs as narrow fringes around impounded ponds, in shallow thermokarst pits, and in permanently flooded impoundments adjacent to gravel fill. Similar to thaw ponds, these communities are depressional HGM features primarily fed by surface runoff. Comprising NWI code PEM2Hh, dominant species include *Arctophila fulva* (Arctic pendant grass) and *Hippuris vulgaris* (common mare's tail).
Deep Polygon Complex (63.54 acres)	Mosaic of vegetation where low-centered polygons have particularly deep (>0.5 m) centers formed by thaw settlement of ice-rich soils. This patterned community was mapped as PEM1F, and comprises a mosaic of wetland and vegetation types. Permanently flooded nonvegetated polygon centers (PUBH) are fringed by fresh grass or sedge marsh (PEM2H and PEM1H or PEM1F, respectively). Broad low rims of saturated or seasonally flooded/saturated sedge-shrub tundra (PEM1B and PEM1E, respectively) separate the centers. Water (PUBH) forms a substantial portion of this class, but neither water nor a single vegetation type is dominant. Dominant species include *Arctophila fulva* (Arctic pendantgrass), *Carex aquatilis* (water sedge), *Eriophorum angustifolium* (tall cottongrass), and *Salix rotundifolia* (least willow). This deep, low-centered polygon community is a depressional HGM type fed by surface runoff.
Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra (28.50 acres)	Mapped as NWI code PEM1E, this patterned community comprises mixed high and low-centered polygonal tundra with finely intermixed wetland and vegetation types. High-centered, low-relief polygons are described below, in Patterned Sedge-Shrub Tundra. Low-lying polygonal troughs and low-centered polygons are predominantly wet sedge meadow (PEM1F) with shallow surface water, typically dominated by *Carex aquatilis* (water sedge) and *Eriophorum angustifolium* (tall cottongrass). Deeper low-centered polygon basins and polygonal troughs are permanently flooded, either sparsely vegetated (PUBH) or dominated by *Arctophila fulva* (Arctic pendantgrass, PEM2H). This community is a flat HGM type, with precipitation the dominant hydrologic source during the growing season.

Table 2. Continued.

Wetland Functional Class	Description
Patterned Saturated Sedge-Shrub Tundra (223.33 acres)	Mapped as PEM1/SS1B, PEM1B, and PEM1E, this patterned community comprises high-centered, low-relief polygonal tundra. Polygons are dominated by mesic sedge, sedge-grass, or sedge-willow tundra (a combination of PEM1B, PEM1E, PEM1/SS1B, and PSS1/EM1B), with typical dominant species *Carex bigelowii* (Bigelow's sedge), *Poa arctica* (Arctic bluegrass), *Luzula nivalis* (Arctic woodrush), and *Salix rotundifolia* (least willow). Low-lying polygonal troughs are predominantly wet sedge meadow (PEM1F) with shallow surface water, typically dominated by *Carex aquatilis* (water sedge) and *Eriophorum angustifolium* (tall cottongrass). This community is a flat HGM type, where precipitation is the dominant hydrologic source during the growing season.
Nonpatterned Saturated Sedge-Shrub Tundra (73.59 acres)	Mapped as PEM1/SS1B, this nonpatterned community is located in level to gently sloping terrain surrounding Isatkoak Lagoon, and is typically dominated by either mesic sedge-grass or sedge-shrub tundra. Dominants include *Salix pulchra* (tealeaf willow), *S. rotundifolia* (least willow), *Carex bigelowii* (Bigelow's sedge), *Poa arctica* (Arctic bluegrass), and *Luzula nivalis* (Arctic woodrush).This community is a flat HGM type, where precipitation is the dominant hydrologic source during the growing season.
Impounded Disturbed Wetlands (68.51 acres)	This functional class encompasses a variety of wetland types, all of which are affected by development in the vicinity of the Barrow airport. Narrow, linear stretches of wet sedge-grass tundra (PEM1Fh and PEM2Fh) are impounded by airport and road fill, while wet sedge meadow (PEM1Eh) dominates the concave areas between fill. One excavated water (PUSCx) is included in this functional class, located within the bounds of an active material site immediately southwest of the Barrow Airport. This functional class is a depressional HGM type, located in topographic depressions with surface runoff the dominant hydrologic source.

Table 3. Aquatic Site Assessment results and proposed mitigation ranking categories within the Barrow airport study area.

Wetland Functional Class	Category	Flood Flow Regulation	Sediment/ Nutrient/ Toxicant Removal	Erosion Control and Shoreline Stabilization	Organic Matter Production and Export	TES Support	Avian / Mammal Habitat Suitability	Fish Habitat Suitability	Education/ Science/Rec/ Subsistence Use
Permanently Flooded Lakes	II	High	High	N/A	Low	Low	Low	High	High
Permanently Flooded Ponds	I	Moderate	High	N/A	Low	High	Low	N/A	Low
Flooded Graminoid Marsh	I	Moderate	Moderate	N/A	Moderate	High	Moderate	N/A	Low
Deep Polygon Complex	I	High	High	N/A	Moderate	High	High	N/A	Low
Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra	II	Moderate	High	N/A	Moderate	Moderate	High	N/A	Low
Patterned Saturated Sedge-Shrub Tundra	III	Moderate	Moderate	N/A	Moderate	Moderate	High	N/A	Low
Nonpatterned Saturated Sedge-Shrub Tundra	III	Low	Low	N/A	Low	Low	Moderate	N/A	Moderate
Impounded Disturbed Wetlands	III	Moderate	Moderate	N/A	Moderate	Low	Moderate	N/A	Low

Table 4. Habitat associations of birds and mammals known to occur commonly in the Barrow airport study area (x indicates a wildlife habitat considered important for a species)[a].

		Wildlife Habitat (acres)							
		Moist Sedge-Shrub Meadow (358.31)	Nonpatterned Wet Meadow[b] (27.52)	Aquatic Graminoid Marsh (16.81)	Shallow Open Water w/out Islands (1.86)	Deep Polygon Complex (63.54)	Deep Open Water w/out Islands (38.46)	Human Modified Barrens (245.36)	Human Modified Water (4.96)
BIRDS									
Greater White-fronted Goose	*Anser albifrons*	x	x	x	x	x	x	x	x
Tundra Swan	*Cygnus columbianus*	x		x			x		
Northern Shoveler	*Anas clypeata*			x	x		x		
Northern Pintail	*Anas acuta*			x	x		x		
Green-winged Teal	*Anas crecca*			x	x		x		
Steller's Eider	*Polysticta stelleri*	x		x	x	x	x		
Spectacled Eider	*Somateria fischeri*	x		x	x	x	x		
King Eider	*Somateria spectabilis*	x		x	x	x	x		
Long-tailed Duck	*Clangula hyemalis*	x		x	x	x	x		
Red-throated Loon	*Gavia stellata*	x[c]		x			x		
Pacific Loon	*Gavia pacifica*	x[c]		x			x		
Yellow-billed Loon	*Gavia adamsii*			x			x		
American Golden-Plover	*Pluvialis dominica*	x				x			
Semipalmated Plover	*Charadrius semipalmatus*	x				x		x	
Dunlin	*Calidris alpina*	x	x	x		x			
Pectoral Sandpiper	*Calidris melanotos*	x	x	x		x			
Semipalmated Sandpiper	*Calidris pusilla*	x	x			x			
Western Sandpiper	*Calidris mauri*	x	x			x			
Long-billed Dowitcher	*Limnodromus scolopaceus*	x	x	x	x	x			
Red-necked Phalarope	*Phalaropus lobatus*			x	x	x			
Red Phalarope	*Phalaropus fulicarius*			x	x	x			
Pomarine Jaeger	*Stercorarius pomarinus*	x	x			x			

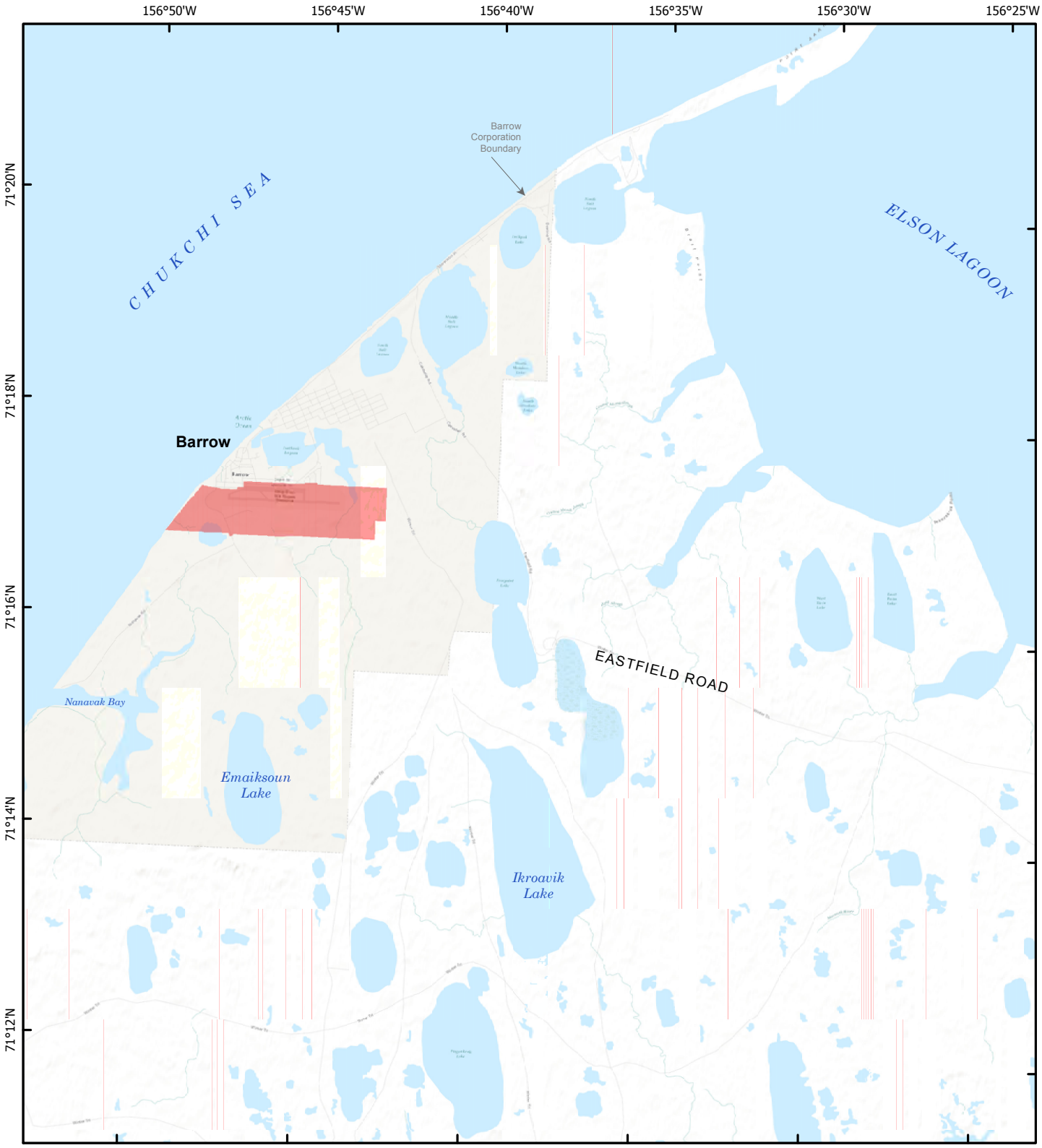
Table 4. Continued.

		Wildlife Habitat (acres)							
		Moist Sedge-Shrub Meadow (358.31)	Nonpatterned Wet Meadow[b] (27.52)	Aquatic Graminoid Marsh (16.81)	Shallow Open Water w/out Islands (1.86)	Deep Polygon Complex (63.54)	Deep Open Water w/out Islands (38.46)	Human Modified Barrens (245.36)	Human Modified Water (4.96)
Parasitic Jaeger	*Stercorarius parasiticus*	x	x			x			
Glaucous Gull	*Larus hyperboreus*	x	x	x	x	x			
Arctic Tern	*Sterna paradisaea*	x			x	x			
Snowy Owl	*Bubo scandiacus*	x				x			
Common Raven	*Corvus corax*	x	x			x		x	
Lapland Longspur	*Calcarius lapponicus*	x	x			x			
Snow Bunting	*Plectrophenax nivalis*	x	x			x			
Savannah Sparrow	*Passerculus sandwichensis*	x	x	x		x			
Redpoll spp.	*Acanthis spp.*	x	x			x			
MAMMALS									
Brown lemming	*Lemmus trimucronatus*	x	x			x			
Collared lemming	*Dicrostonyx groenlandicus*	x				x			
Root vole (tundra vole)	*Microtus oeconomus*	x	x			x			
Barren ground shrew	*Sorex ugyunak*	x	x			x			
Arctic fox	*Vulpes lagopus*	x				x		x	
Brown bear	*Ursus arctos*	x				x		x	
Ermine (short-tailed weasel)	*Mustela erminea*	x	x			x			
Least weasel	*Mustela nivalis*	x	x			x			
Caribou	*Rangifer tarandus*	x	x			x		x	

[a] Species listed are likely to be common in the study area during some portion of their life cycle (e.g., breeding/mating, migration, staging, denning). Uncommon or rare species that could occur sporadically (e.g., polar bears) are not listed. Habitat use for birds and mammals was determined from field observations in the study area (Parrett and Johnson 2004, Cyr and Johnson 2005, Attanas and Johnson 2006, 2007 and 2008) or from available literature (Pitelka 1974, Norton et al. 1993, Johnson and Herter 1989, Larned et al. 2006, 2012, Quakenbush et al. 2004, MacDonald and Cook 2009).

[b] In the study area, this type includes only Impounded Disturbed Wetlands (see Appendix C).

[c] Margins of Moist Sedge-Shrub Meadow can be used by these loon species when the habitat occurs adjacent to waterbodies.



Barrow Airport

Notes: Background Layer from ESRI Online

0 1 2 3 km

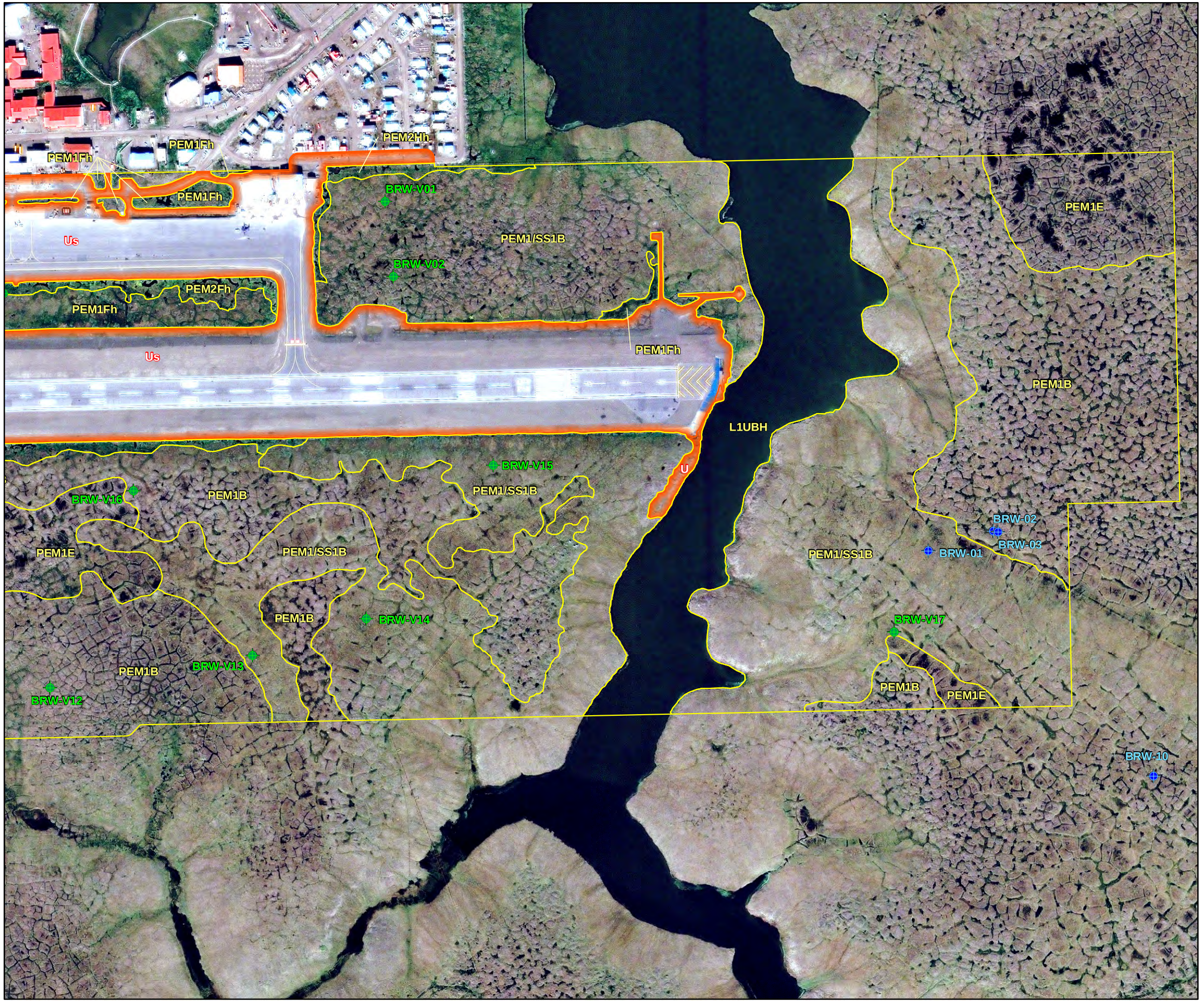
0 0.5 1 1.5 2 mi

Figure 1.
Study Area Location

map prepared by:
ABR, Inc. environmental research & services

12 February 2015

Barrow_Airport_Wetlands_SA_14-226.mxd



NWI Code[1]	Description
Waters	
L1UBH	Permanently Flooded Lake
Wetlands	
PEM2Hh	Permanently Flooded Nonpersistent Emergent (impounded)
PEM1F	Semipermanently Flooded Persistent Emergent
PEM1Fh	Semipermanently Flooded Persistent Emergent (impounded)
PEM2Fh	Semipermanently Flooded Nonpersistent Emergent (impounded)
PEM1E	Seasonally Flooded/Saturated Persistent Emergent
PEM1B	Saturated Persistent Emergent
PEM1/SS1B	Saturated Persistent Emergent/Deciduous Scrub-Shrub
Uplands	
U	Upland
Us	Upland (fill)

[1] Follows National Wetlands Inventory (NWI) map conventions and Cowardin et al. (1979) classification system.

Wetland
Upland
Wetland Determination Plot
Verification Plot

0 100 200 Meters
0 500 1,000 Feet

N
W
E
S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 2 East. Barrow Airport Wetlands and Waters

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_Wetlands_East_final_14-226.mxd

NWI Code[1]	Description
Waters	
M1UBL	Subtidal Marine Waters
M2USP	Irregularly Flooded Intertidal Shore
PUBHh	Permanently Flooded Pond (impounded)
PUSCx	Seasonally Flooded Unconsolidated Shore (excavated)
Wetlands	
PEM2Hh	Permanently Flooded Nonpersistent Emergent (impounded)
PEM1F	Semipermanently Flooded Persistent Emergent
PEM1Fh	Semipermanently Flooded Persistent Emergent (impounded)
PEM2Fh	Semipermanently Flooded Nonpersistent Emergent (impounded)
PEM1Eh	Seasonally Flooded/Saturated Persistent Emergent (impounded)
PEM1E	Seasonally Flooded/Saturated Persistent Emergent
PEM1B	Saturated Persistent Emergent
PEM1Bh	Saturated Persistent Emergent (impounded)
PEM1/SS1B	Saturated Persistent Emergent/Deciduous Scrub-Shrub
Uplands	
Us	Upland (fill)

[1] Follows National Wetlands Inventory (NWI) map conventions and Cowardin et al. (1979) classification system.

Wetland
Upland
Wetland Determination Plot
Verification Plot

0 100 200 Meters
0 500 1,000 Feet

N
W
E
S

Original mapping by HDR, 2012, modified by ABR, Inc.
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Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 2 West. Barrow Airport Wetlands and Waters

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_Wetlands_West_final_14-226.mxd

Wetland Functional Class

- Permanently Flooded Lakes
- Permanently Flooded Graminoid Marsh
- Patterned Seasonally Flooded/ Saturated Sedge-Shrub Tundra
- Patterned Saturated Sedge-Shrub Tundra
- Nonpatterned Saturated Sedge-Shrub Tundra
- Impounded Disturbed Wetlands
- Not Assessed – Uplands and Nearshore Waters

0 100 200 Meters

0 500 1,000 Feet

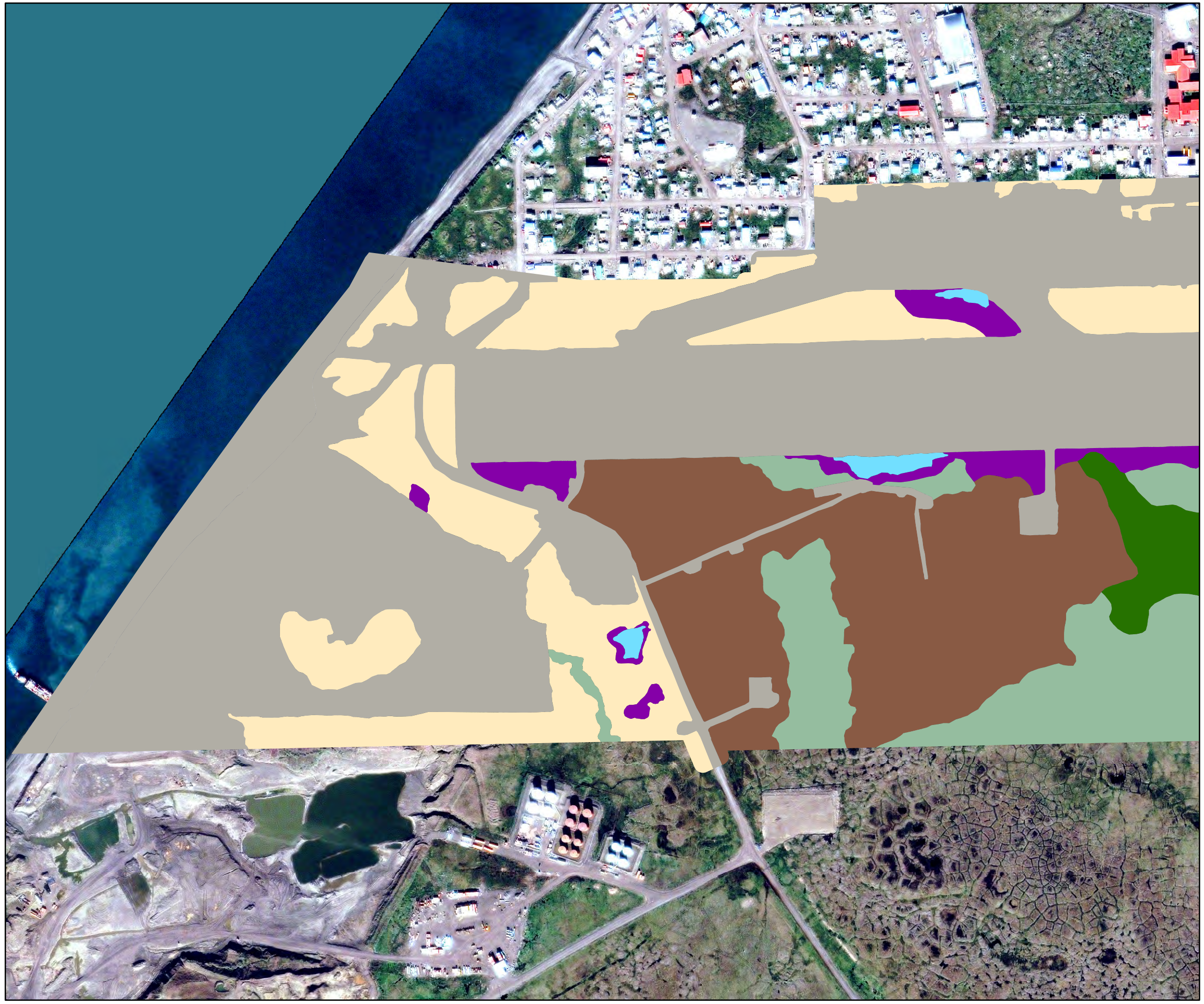
N W E S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 3 East. Barrow Airport Functional Classes

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_FuncClass_East_final_14-226.mxd



Wetland Functional Class

- Permanently Flooded Shallow Ponds
- Permanently Flooded Graminoid Marsh
- Deep Polygon Complex
- Patterned Seasonally Flooded/ Saturated Sedge-Shrub Tundra
- Patterned Saturated Sedge-Shrub Tundra
- Impounded Disturbed Wetlands
- Not Assessed – Uplands and Nearshore Waters

0 100 200 Meters

0 500 1,000 Feet

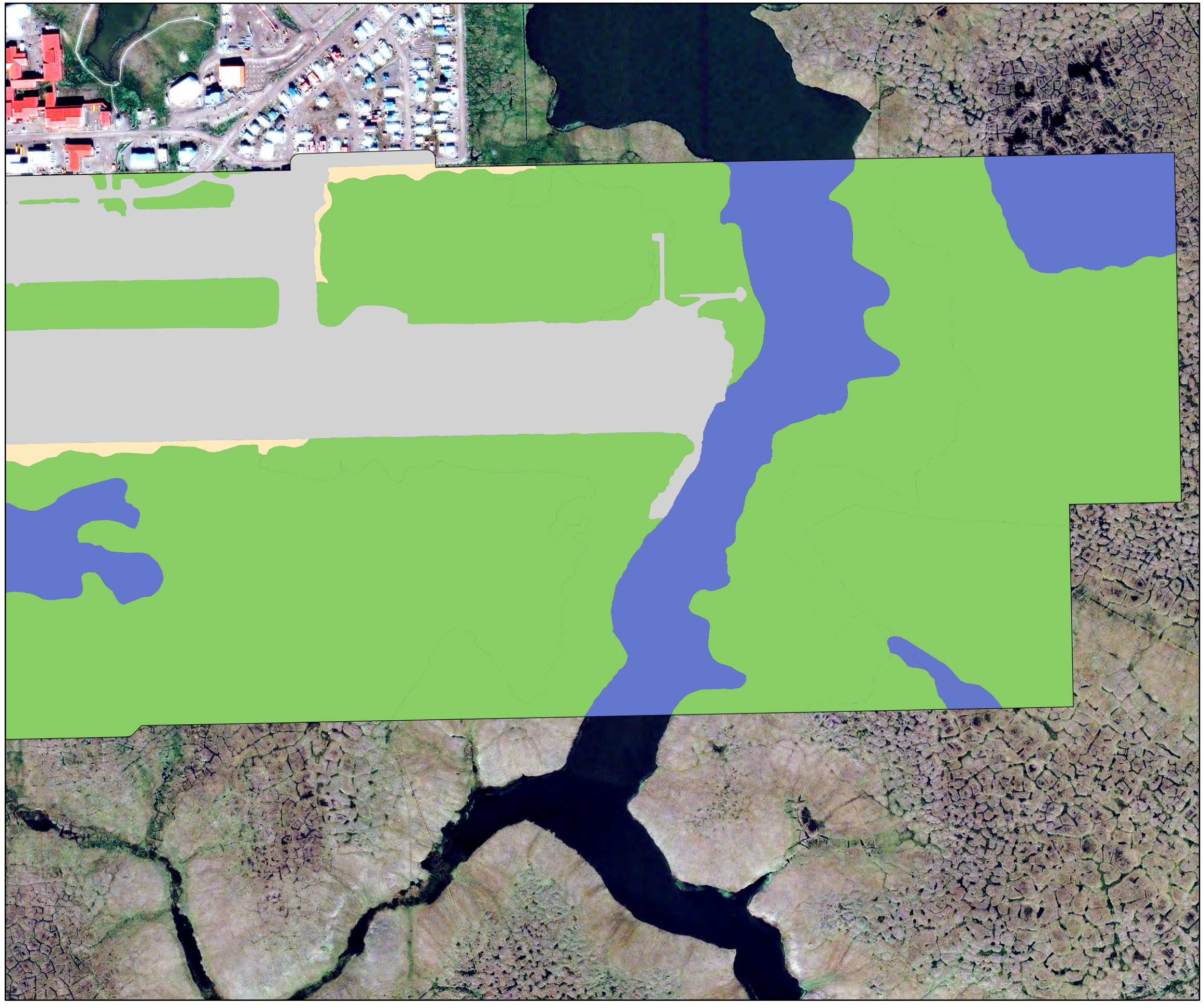
N W E S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 3 West.
Barrow Airport
Functional Classes

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_FuncClass_West_final_14-226.mxd



Proposed Mitigation Ranking Categories

- Category I
- Category II
- Category III
- Not Assessed - Uplands and Nearshore Waters

0 100 200 Meters

0 500 1,000 Feet

N
W
E
S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 4 East. Barrow Airport Proposed Categories

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_PropCats_East_final_14-226.mxd

Proposed Mitigation Ranking Categories

- Category I
- Category II
- Category III
- Not Assessed - Uplands and Nearshore Waters

0 100 200 Meters

0 500 1,000 Feet

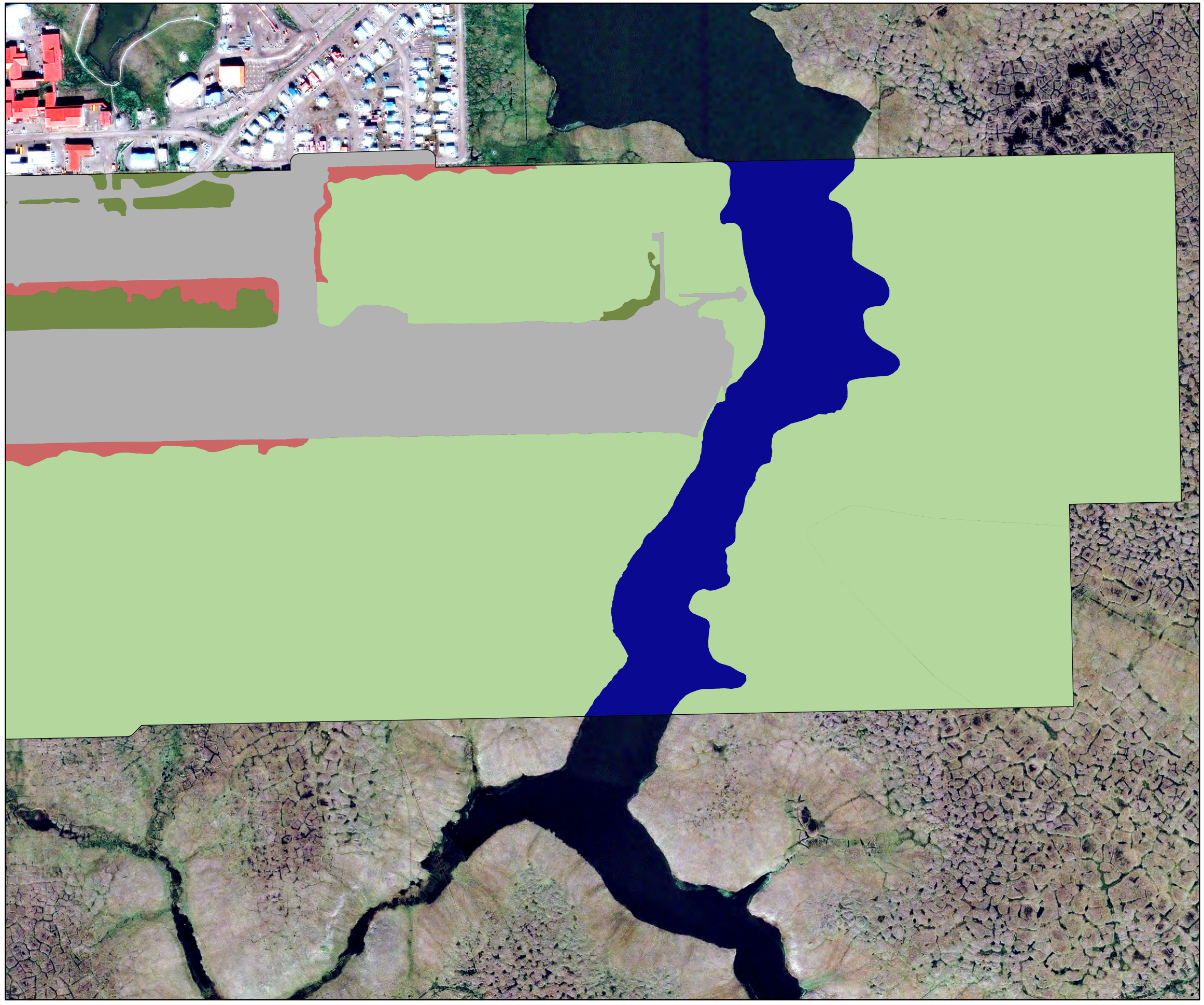
N
W E
S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 4 West. Barrow Airport Proposed Categories

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_PropCats_West_final_14-226.mxd



Wildlife Habitat

- Deep Open Water without Islands
- Aquatic Graminoid Marsh
- Deep Polygon Complex
- Nonpatterned Wet Meadow
- Moist Sedge-Shrub Meadow
- Human Modified Barrens

0 100 200 Meters

0 500 1,000 Feet

N W E S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 5 East. Barrow Airport Wildlife Habitats

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_Habitats_East_final_14-226.mxd

Wildlife Habitat

- Nearshore Water
- Shallow Open Water without Islands
- Aquatic Graminoid Marsh
- Deep Polygon Complex
- Nonpatterned Wet Meadow
- Moist Sedge-Shrub Meadow
- Human Modified Waters
- Human Modified Barrens

0 100 200 Meters

0 500 1,000 Feet

N W E S

Original mapping by HDR, 2012, modified by ABR, Inc.
Pleiades imagery acquired August 11, 2013 at a resolution of 0.5m.
Further rectified by ABR to best match the SPOT5 pseudo-natural color imagery available via Alaska Mapped and the Statewide Digital Mapping Initiative from the UAF Geographic Information Network of Alaska (GINA) on http://www.alaskamapped.org/
Map projection: Alaska State Plane Zone 6, NAD 1983, U.S. feet. Map scale when printed at 11"x17" is 1:6,500 or 1"=542'.

Figure 5 West. Barrow Airport Wildlife Habitats

Map prepared by:
ABR Inc.—Environmental Research & Services

12 March 2015 | Barrow_Airport_Habitats_West_final_14-226.mxd

Appendix A. Wetland Determination Data Forms

WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Barrow | Borough/City: North Slope Borough | Sampling Date: 06-Sep-14

Applicant/Owner: ADOT&PF | Sampling Point: **BRW-01**

Investigator(s): SLI/EKJ | Landform (hillside, terrace, hummocks etc.): Flat

Local relief (concave, convex, none): none | Slope: 0.0 % / 0.0 ° | Elevation: 10

Subregion : Northern Alaska | Lat.: 71.281895 | Long.: -156.726673333333 | Datum: WGS84

Soil Map Unit Name: | **NWI classification: PEM1B**

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

Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◉ No ○

Are Vegetation ☐ , Soil ☑ , or Hydrology ☐ naturally 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 ◉ No ○	**Is the Sampled Area within a Wetland?** **Yes ◉ No ○**
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks: mesic sedge-willow tundra. salix cover possibly underestimated. smooth feature in aerial imagery. three snowy owls observed in this community.

VEGETATION - Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
Total Cover:	0		
Sapling/Shrub Stratum	50% of Total Cover: 0	20% of Total Cover: 0	
1. Salix rotundifolia	15	☑	FAC
2. Salix pulchra	5	☑	FACW
3.	0	☐	
4.	0	☐	
5.	0	☐	
6.	0	☐	
7.	0	☐	
8.	0	☐	
9.	0	☐	
10.	0	☐	
Total Cover:	20		
Herb Stratum	50% of Total Cover: 10	20% of Total Cover: 4	
1. Poa arctica	10	☑	FAC
2. Saxifraga hieraciifolia	0.1	☐	FAC
3. Arctagrostis latifolia	5	☑	FACW
4. Luzula nivalis	3	☐	FAC
5. Stellaria longipes	1	☐	FAC
6. Carex bigelowii	2	☐	FAC
7.	0	☐	
8.	0	☐	
9.	0	☐	
10.	0	☐	
Total Cover:	21.1		
	50% of Total Cover: 10.55	20% of Total Cover: 4.22	

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: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL Species	0	x 1 =	0
FACW Species	10	x 2 =	20
FAC Species	31.1	x 3 =	93.30
FACU Species	0	x 4 =	0
UPL Species	0	x 5 =	0
Column Totals:	41.1 (A)		113.3 (B)

Prevalence Index = B/A = 2.757

Hydrophytic Vegetation Indicators:

☑ Dominance Test is > 50%

☑ Prevalence Index is ≤3.0

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

☐ Problematic Hydrophytic Vegetation [1](Explain)

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

Plot size (radius, or length x width) 5m

% Cover of Wetland Bryophytes (Where applicable)

% Bare Ground 0

Total Cover of Bryophytes 80

Hydrophytic Vegetation Present? **Yes ◉ No ○**

Remarks: thin, patchy snow. early enough in day (0915) that veg covered with frost. likely underestimating herbaceous spp due to late season. abundant lichens (dactylina, thamnolia, flavocetraria cucculata, cladonia, cladinna). trace saxifrage. salpul shiny red stem, persistent stipules.

SOIL

Sampling Point: **BRW-01**

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

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-1									Fibric Organics	
1-2									Hemic Organics	
2-5	2.5Y	5/2	70	7.5YR	4/4	30	C	PL	Clay Loam	
5-12	10YR	4/2	95						Sandy Clay Loam	5% fine gravels

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix [2] Location: PL=Pore Lining. RC=Root Channel. M=Matrix

Hydric Soil Indicators:

- ☐ 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.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):
Type: seasonal frost (frozen)
Depth (inches): 12

Hydric Soil Present? Yes ◉ No ○

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one is sufficient)

- ☐ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ 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)
- ☑ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ◉	No ○	Depth (inches):	9
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches):	1

Wetland Hydrology Present? Yes ◉ No ○

Recorded Data (stream gauge, monitor well, aerial photo, previous inspection), if available:

Remarks:

BRW-01

PEM1B

Hydric Soil Indicators: Alaska Redox with 2.5Y Hue

Wetland Hydrology Indicators: High Water Table (A2), Saturation (A3)

WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Barrow | Borough/City: North Slope Borough | Sampling Date: 06-Sep-14

Applicant/Owner: ADOT&PF | Sampling Point: **BRW-02**

Investigator(s): SLI/EKJ | Landform (hillside, terrace, hummocks etc.): Polygonal Tundra

Local relief (concave, convex, none): none | Slope: 0.0 % / 0.0 ° | Elevation: 40

Subregion : Northern Alaska | Lat.: 71.282605 | Long.: -156.723945 | Datum: WGS84

Soil Map Unit Name: | **NWI classification: PEM1B**

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

Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◉ No ○

Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ naturally 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 ◉ No ○	**Is the Sampled Area within a Wetland?** **Yes ◉ No ○**
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks: flat-topped polygonal tundra. BRW-02 captures mesic sedge-grass tundra polygon tops, BRW-03 captures troughs.

VEGETATION - Use scientific names of plants. List all species in the plot.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
Total Cover:	0		
Sapling/Shrub Stratum	50% of Total Cover: 0	20% of Total Cover: 0	
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
Total Cover:	0		
Herb Stratum	50% of Total Cover: 0	20% of Total Cover: 0	
1. Poa arctica	10	☑	FAC
2. Saxifraga cernua	0.1	☐	FACW
3. Stellaria longipes	1	☐	FAC
4. Luzula nivalis	10	☑	FAC
5. Arctagrostis latifolia	5	☐	FACW
6. Carex bigelowii	15	☑	FAC
7. Petasites frigidus	0.1	☐	FACW
8.	0	☐	
9.	0	☐	
10.	0	☐	
Total Cover:	41.2		
	50% of Total Cover: 20.6	20% of Total Cover: 8.24	

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: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL Species	0	x 1 =	0
FACW Species	5.2	x 2 =	10.4
FAC Species	36	x 3 =	108
FACU Species	0	x 4 =	0
UPL Species	0	x 5 =	0
Column Totals:	41.2 (A)		118.4 (B)

Prevalence Index = B/A = 2.874

Hydrophytic Vegetation Indicators:

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

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

Plot size (radius, or length x width) 5m

% Cover of Wetland Bryophytes (Where applicable)

% Bare Ground 0

Total Cover of Bryophytes 80

Hydrophytic Vegetation Present? **Yes ◉ No ○**

Remarks: see BRW-01 notes re season, snow cover, and lichens.

SOIL

Sampling Point: **BRW-02**

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

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type[1]	Loc[2]	Texture	Remarks
0-3									Fibric Organics	
3-7	10YR	4/2	100						Silt Loam	
7-12									Fibric Organics	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix [2] Location: PL=Pore Lining. RC=Root Channel. M=Matrix

Hydric Soil Indicators:

- ☐ 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.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):
Type: seasonal frost (frozen)
Depth (inches): 12

Hydric Soil Present? Yes ◉ No ○

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ 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)
- ☑ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches):	11

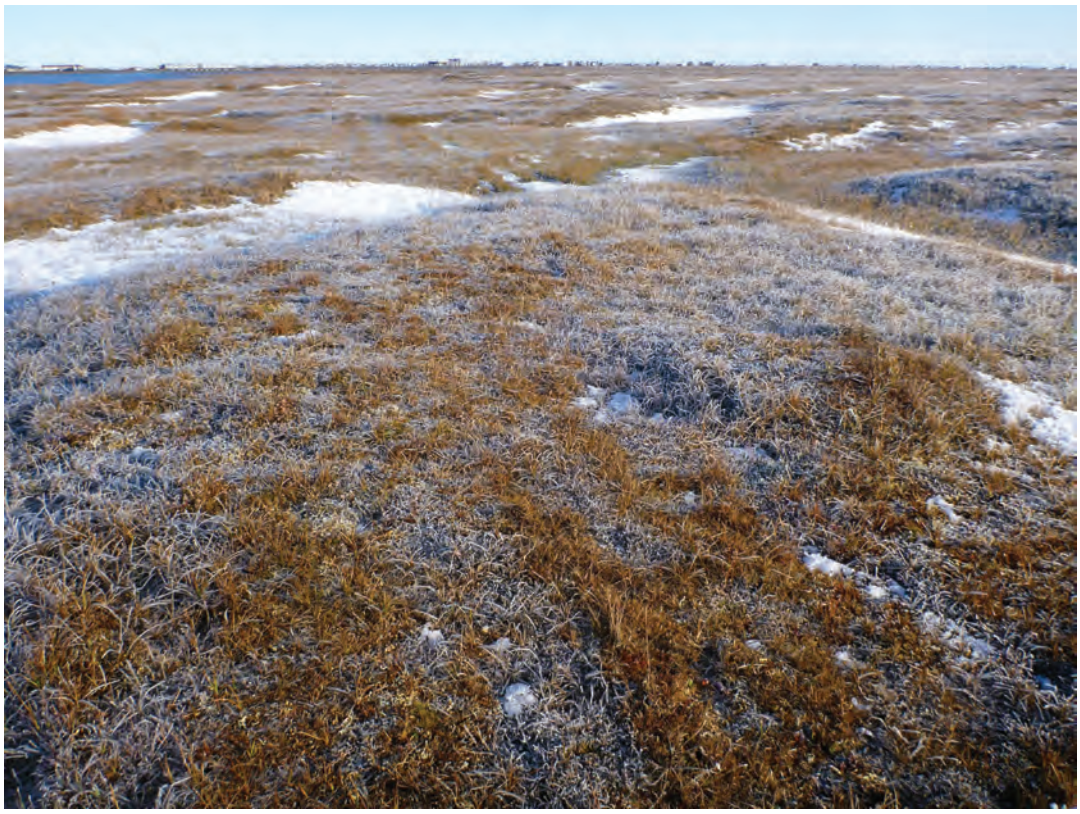
Wetland Hydrology Present? Yes ◉ No ○

Recorded Data (stream gauge, monitor well, aerial photo, previous inspection), if available:

Remarks:

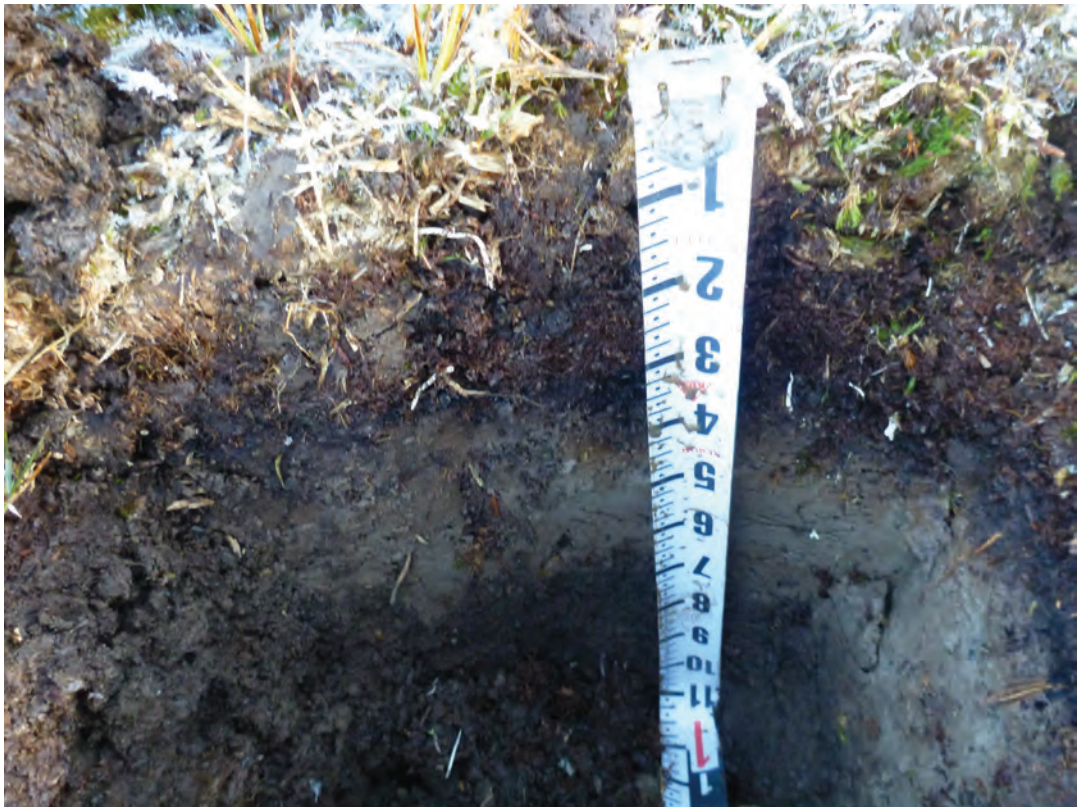
BRW-02

PEM1B



Hydric Soil Indicators: Histic Epipedon (A2)

Wetland Hydrology Indicators: Shallow Aquitard (D3), FAC-neutral Test (D5)



WETLAND DETERMINATION DATA FORM - Alaska Region

Project/Site: Barrow | Borough/City: North Slope Borough | Sampling Date: 06-Sep-14

Applicant/Owner: ADOT&PF | Sampling Point: **BRW-03**

Investigator(s): SLI/EKJ | Landform (hillside, terrace, hummocks etc.): Polygonal Tundra

Local relief (concave, convex, none): concave | Slope: 0.0 % / 0.0 ° | Elevation: 40

Subregion : Northern Alaska | Lat.: 71.282605 | Long.: -156.723945 | Datum: WGS84

Soil Map Unit Name: | **NWI classification: PEM1F**

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

Are Vegetation ☐ , Soil ☐ , or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ◉ No ○

Are Vegetation ☐ , Soil ☑ , or Hydrology ☐ naturally 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 ◉ No ○	**Is the Sampled Area within a Wetland?** **Yes ◉ No ○**
Hydric Soil Present?	Yes ◉ No ○	
Wetland Hydrology Present?	Yes ◉ No ○	

Remarks: polygonal tundra, wet sedge tundra trough. polygon characterized by BRW-02

VEGETATION - Use scientific names of plants. List all species in the plot.

Tree Stratum	Absolute % Cover	Dominant Species?	Indicator Status
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
Total Cover:	0		
50% of Total Cover: 0		20% of Total Cover: 0	
Sapling/Shrub Stratum			
1.		☐	
2.		☐	
3.		☐	
4.		☐	
5.		☐	
6.		☐	
7.		☐	
8.		☐	
9.		☐	
10.		☐	
Total Cover:	0		
50% of Total Cover: 0		20% of Total Cover: 0	
Herb Stratum			
1. Eriophorum angustifolium	20	☑	OBL
2. Carex aquatilis	10	☑	OBL
3.	0	☐	
4.	0	☐	
5.	0	☐	
6.	0	☐	
7.	0	☐	
8.	0	☐	
9.	0	☐	
10.	0	☐	
Total Cover:	30		
50% of Total Cover: 15		20% of Total Cover: 6	

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: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL Species	30	x 1 =	30
FACW Species	0	x 2 =	0
FAC Species	0	x 3 =	0
FACU Species	0	x 4 =	0
UPL Species	0	x 5 =	0
Column Totals:	30 (A)		30 (B)

Prevalence Index = B/A = 1.000

Hydrophytic Vegetation Indicators:

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

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

Plot size (radius, or length x width) 2m

% Cover of Wetland Bryophytes (Where applicable)

% Bare Ground 98

Total Cover of Bryophytes 0

Hydrophytic Vegetation Present? **Yes ◉ No ○**

Remarks:

SOIL

Sampling Point: **BRW-03**

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 %	Redox Features Type[1]	Redox Features Loc[2]	Texture	Remarks

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix [2] Location: PL=Pore Lining. RC=Root Channel. M=Matrix

Hydric Soil Indicators:

- ☐ 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.

[4] Give details of color change in Remarks.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? **Yes** ◉ **No** ○

Remarks:
inundated -- assume hydric soil

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one is sufficient)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ 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)
- ☐ Shallow Aquitard (D3)
- ☑ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches):	6
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	

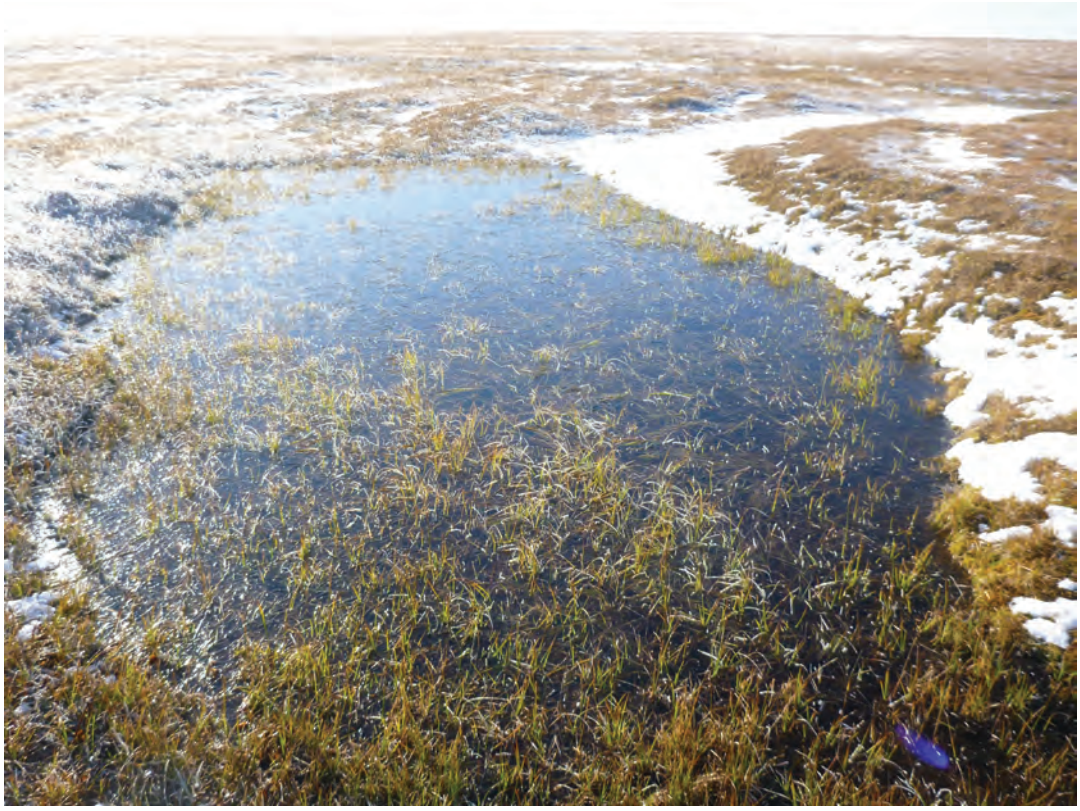
Wetland Hydrology Present? **Yes** ◉ **No** ○

Recorded Data (stream gauge, monitor well, aerial photo, previous inspection), if available:

Remarks:
polygonal trough.

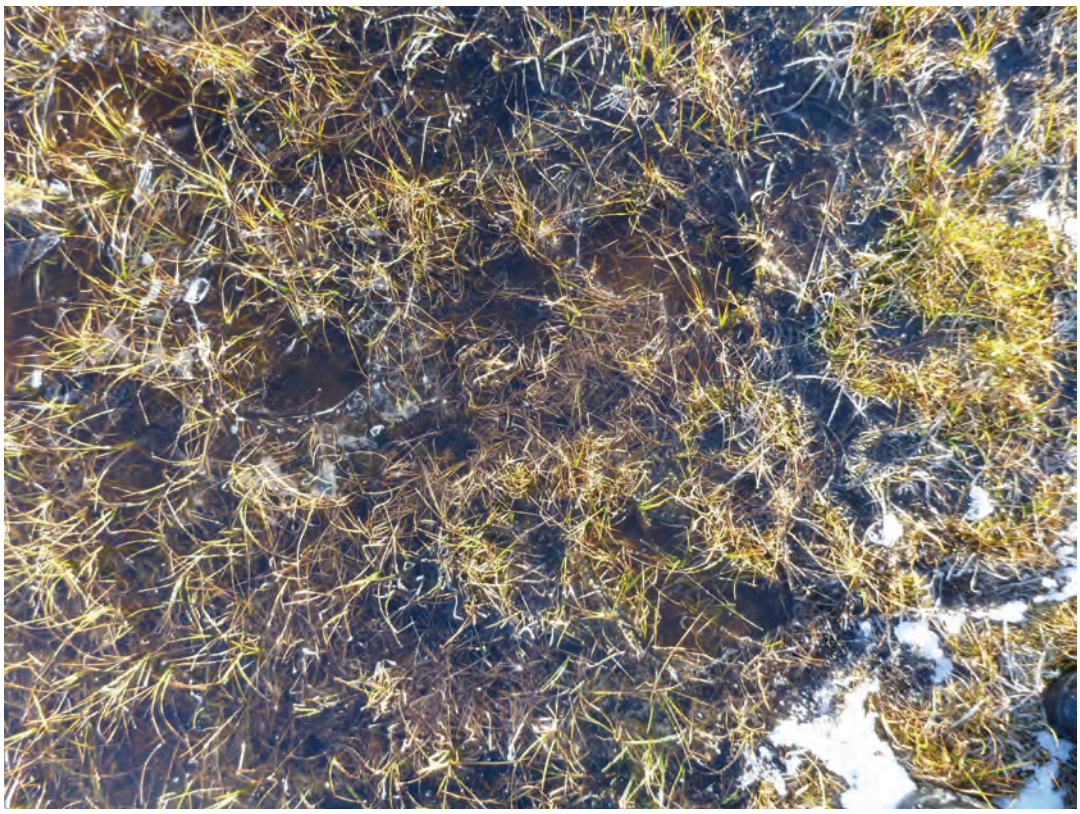
BRW-03

PEM1F



Hydric Soil Indicators: Other--inundated, assume hydric soil

Wetland Hydrology Indicators: Surface Water (A1)



Appendix B. Map-Verification Sample Plots

BRW-V01: PEM1/SS1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Carex bigelowii, Eriophorum* sp., *Luzula arctica, Poa* sp., *Petasites frigidus, Arctophila fulva*
Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: High center polygons, PEM1B polygon tops and PEM1F troughs. Species list captures polygon tops and troughs.

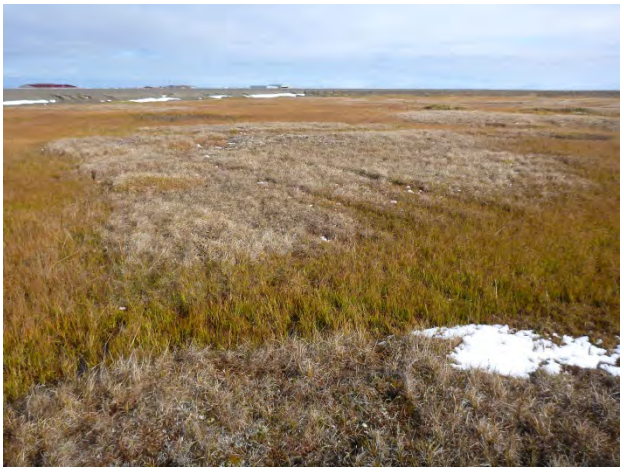
BRW-V02: PEM1/SS1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Eriophorum* sp., *Carex bigelowii, Salix planifolia pulchra, Arctophila fulva, Poa* sp., *Petasites frigidus*
Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: PEM1B high center polygons with shrub component. PEM1F troughs. Scattered shallow *Arctophila fulva* ponds.

BRW-V03: PEM1Fh
Barrow Airport Study Area
Date: 9/6/2014
Dominant Species: *Carex bigelowii, Poa* sp., *Arctophila fulva, Carex aquatilis, Petasites frigidus, Poa alpigena, Saxifraga cernua, Cochlearia officinalis, Eriophorum* sp.
Wetland Functional Class: Impounded Disturbed Wetlands
Wildlife Habitat: Nonpatterned Wet Meadow
Field Notes: Overall level, but slight changes in microtopography drive a mosaic of saturated to semi-permanently flooded codes. Area ponds in spring per DOT.

BRW-V04: PEM2Fh
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Carex aquatilis*, unknown grass
Wetland Functional Class: Impounded Disturbed Wetlands
Wildlife Habitat: Aquatic Graminoid Marsh
Field Notes: Mapped as PEM1B by HDR. Small impoundment next to runway. Unsure if big enough to map separately, 4-6" of water. Unknown grass, not *Arctophila fulva*.

BRW-V05: PEM1Fh
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Eriophorum angustifolium, Arctophila fulva, Luzula arctica, Senecio congestus, Eriphorum* sp., unknown grass
Wetland Functional Class: Impounded Disturbed Wetlands
Wildlife Habitat: Nonpatterned Wet Meadow
Field Notes: Very similar to BRW-V03, but with more barren ground and generally slightly drier (though still with standing surface water at the end of the growing season.

BRW-V06: PEM1F
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Eriophorum angustifolium, Salix rotundifolia, Carex bigelowii, Arctophila fulva, Luzula arctica, Salix planifolia pulchra, Poa* sp., *Eriophorum* sp.
Wetland Functional Class: Deep Polygon Complex
Wildlife Habitat: Deep Polygon Complex
Field Notes: Scattered flat-top polygons in midst of wet sedge-grass. PEM1B polygons, PEM1F to PEM2H wet low-lying areas.



BRW-V07: PEM1F
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Arctophila fulva*
Wetland Functional Class: Deep Polygon Complex
Wildlife Habitat: Deep Polygon Complex
Field Notes: Small *Arctophila fulva* pond, mapped as PEM1F by HDR. Actually PEM2H, water 12 inches with H2S odor.

BRW-V08: PEM2Hh
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Arctophila fulva, Hippuris vulgaris*
Wetland Functional Class: Flooded Graminoid Marsh
Wildlife Habitat: Aquatic Graminoid Marsh
Field Notes: Narrow *Arctophila fulva* fringe around PUBH. Impounded by runway with water greater than 12 inches deep and H_2S odor. Cloudy water, cannot see bottom.

BRW-V09: PEM1F
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Arctophila fulva, Hippuris vulgaris*
Wetland Functional Class: Deep Polygon Complex
Wildlife Habitat: Deep Polygon Complex
Field Notes: Stringer of PEM2H *Arctophila fulva* community. Water 18 inches deep with H_2S odor. Gravel pad and road as mapped by HDR.

BRW-V10: PEM1/SS1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Luzula arctica, Eriophorum angustifolium, Carex aquatilis, Petasites frigidus, Salix planifolia pulchra, Poa* sp.
Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: Flat top PEM1B polygons with PEM1E troughs. Abundant *Dactylina* lichen. HDR maps complex troughs dominant, but polygons really seem to be dominant feature.

BRW-V11: PEM1F
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Carex aquatilis, Eriophorum angustifolium, Salix planifolia pulchra, Luzula arctica, Saxifraga cernua, Eriophorum* sp., *Poa* sp.
Wetland Functional Class: Deep Polygon Complex
Wildlife Habitat: Deep Polygon Complex
Field Notes: Low centered polygons, predominantly wet. Code PEM1F, polygon rims PEM1B. *Arctophila fulva* in deep water areas (outside plot).

BRW-V12: PEM1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Luzula arctica, Carex aquatilis, Carex bigelowii, Petasites frigidus, Eriophorum* sp., *Poa* sp.
Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: PEM1B polygons with PEM1E troughs. HDR maps with shrub component, but no woody species in plot. Trace *Salix* sp. while hiking through community.

BRW-V13: PEM1/SS1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Salix planifolia pulchra, Poa* sp., *Luzula arctica, Arctagrostis latifolia, Salix rotundifolia, Petasites frigidus, Potentilla* sp., *Stellaria longipes*
Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: A little microtopography, but generally a level mesic community. HDR line work good, but seems to misinterpret smooth photosignature for wet community.

BRW-V14: PEM1/SS1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Salix planifolia pulchra, Poa* sp., *Arctagrostis latifolia, Carex bigelowii, Petasites frigidus*
Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: Nearly identical to BRW-13.

BRW-V15: PEM1/SS1B
Barrow Airport Study Area
Date: 09/06/14
Dominant Species: *Poa* sp., *Luzula arctica, Petasites frigidus, Carex bigelowii, Saxifraga cernua*
Wetland Functional Class: Nonpatterned Saturated Sedge-Shrub Tundra
Wildlife Habitat: Moist Sedge-Shrub Meadow
Field Notes: Trace *Salix* sp. while hiking to plot.

BRW-V16: PEM1B

Barrow Airport Study Area

Date: 09/06/14

Dominant Species: *Arctagrostis latifolia, Luzula arctica, Carex aquatilis, Eriophorum angustifolium, Salix planifolia pulchra, Salix rotundifolia, Petasites frigidus, Eriophorum* sp., *Poa* sp.

Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra

Wildlife Habitat: Moist Sedge-Shrub Meadow

Field Notes: Flat top polygons (PEM1B) with shallow wide troughs (PEM1E). Majority of community is PEM1B.

BRW-V17: PEM1/SS1B

Barrow Airport Study Area

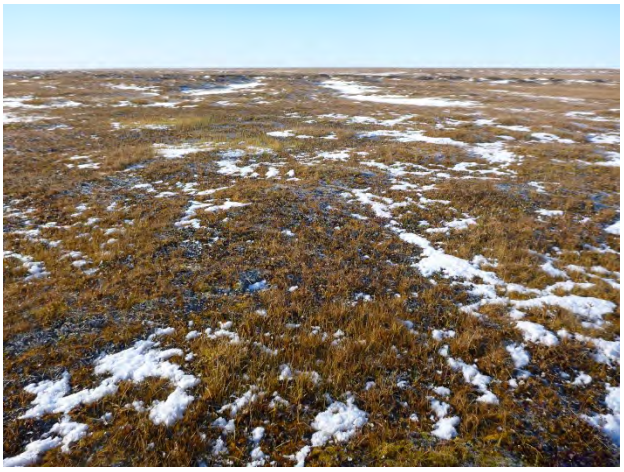
Date: 09/07/14

Dominant Species: *Poa arctica, Salix planifolia pulchra, Arctagrostis latifolia, Petasites frigidus*

Wetland Functional Class: Patterned Saturated Sedge-Shrub Tundra

Wildlife Habitat: Moist Sedge-Shrub Meadow

Field Notes: Mapped as PEM1F by HDR. Nearly identical to BRW-01—saturated sedge-shrub tundra.



Appendix C. Crosswalk between mapped NWI wetland types, wetland functional classes, and wildlife habitats.

NWI	Wetland Functional Class	Wildlife Habitat
M1UBL	Marine and Estuarine Waters	Nearshore Water
M2USP	Marine and Estuarine Waters	Nearshore Water
L1UBH	Permanently Flooded Lakes	Deep Open Water without Islands
PUBHh	Permanently Flooded Ponds	Shallow Open Water without Islands
PUSCx	Impounded Disturbed Wetlands	Human Modified Water
PEM2Hh	Flooded Graminoid Marsh	Aquatic Graminoid Marsh
PEM2Fh	Impounded Disturbed Wetlands	Aquatic Graminoid Marsh
PEM1F	Deep Polygon Complex	Deep Polygon Complex
PEM1Fh	Impounded Disturbed Wetlands	Nonpatterned Wet Meadow
PEM1E	Patterned Saturated Sedge-Shrub Tundra	Moist Sedge-Shrub Meadow
PEM1E	Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra	Moist Sedge-Shrub Meadow
PEM1Eh	Impounded Disturbed Wetlands	Moist Sedge-Shrub Meadow
PEM1/SS1B	Nonpatterned Saturated Sedge-Shrub Tundra	Moist Sedge-Shrub Meadow
PEM1/SS1B	Patterned Saturated Sedge-Shrub Tundra	Moist Sedge-Shrub Meadow
PEM1B	Patterned Saturated Sedge-Shrub Tundra	Moist Sedge-Shrub Meadow
PEM1Bh	Impounded Disturbed Wetlands	Moist Sedge-Shrub Meadow
U	Uplands	Moist Sedge-Shrub Meadow
Us	Uplands	Human Modified Barrens

Appendix D. Aquatic Site Assessment Data Forms

Functional Class: Permanently Flooded Lakes
NWI Code(s): L1UBH
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. N/A		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. Y		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y	The presence of a permanently flooded lake indicates surface water storage.	Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y	Although scattered channelized inputs to Isatkoak Lagoon are visible in the aerial imagery, the vast majority of flood water enters as sheet flow during spring breakup.	Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. Y		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**4 (Y): High**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y		Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. N/A		Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. N/A		Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 Y	Although no sediment cores were collected from Isatkoak Lagoon, sediments from natural deposition are assumed present.	Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. N/A		Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**2 (Y): High**		

Functional Class: Permanently Flooded Lakes
NWI Code(s): L1UBH
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. N		As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. N/A		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**0 (Y): Low**		

Functional Class: Permanently Flooded Lakes
NWI Code(s): L1UBH
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. N	Niether Steller's nor Spectacled Eiders have been observed in this community within the study area (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. N	Not a preferred habitat for Spectacled Eiders (Johnson et al. 2014), nor for Steller's Eiders (based on habitat use in Safine 2013).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): Low**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. Y		Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. N	Deep Open Water without Islands was important habitat for fewer than 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. N	Deep Open Water without Islands was important habitat for fewer than 1/2 of assessed birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. N	No documentation of well-developed emergent component to Isatkoak Lagoon.	A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. N	A recent remote sensing study indicated that thaw lakes accounted for 21.5% of the land area on the Barrow Peninsula (Frohn et al. 2005). L1UBH polygons account for over 10% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202).	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**1 (Y): Low**		

Functional Class: Permanently Flooded Lakes
NWI Code(s): L1UBH
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. Y		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. Y	PDC (2014) states that ninespine stickleback (*Pungitius pungitius*) are known to occur in the upper and middle portions of Isatkoak Lagoon and that the upper lagoon was stocked with Arctic grayling (*Thymallus arcticus*), though few to none may have survived.	A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. Y	Deep waters could potentially support whitefish spawning.	Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**3 (Y): High**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. Y	For the purpose of this ASA, Isatkoak Lagoon is assumed navigable and thus a public trust land.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. Y	PDC (2014) states that the lagoon is used as an access corridor to subsistence activities further south during winter months.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. Y	PDC (2014) states that the lagoon is the Barrow water supply. While not technically a subsistence use, this is a consumptive use by the entire community.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): High**		

Functional Class: Permanently Flooded Ponds
NWI Code(s): PUBHh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. N/A		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. Y		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y		Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y		Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. N/A		Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. N/A		Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 Y	Sediment deposits assumed present at bottom of ponds.	Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. N/A		Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**2 (Y): High**		

Functional Class: Permanently Flooded Ponds
NWI Code(s): PUBHh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. N	Permanently Flooded Grass Marsh surrounding ponds is assessed seperately.	As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. N/A		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**0 (Y): Low**		

Functional Class: Permanently Flooded Ponds
NWI Code(s): PUBHh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. Y	A pair of Steller's Eiders were observed in shallow thermokarst pond immediately south of runway in 2006 (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. Y	Spectacled Eider preferred habitat (Johnson et al. 2014).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**2 (Y): High**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. N	The majority of ponds in this study area are immediately adjacent to the Barrow Airport runway.	Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. N	Shallow Open Water without Islands was important habitat for fewer than 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. N	Shallow Open Water without Islands was important habitat for fewer than 1/2 of assessed birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. N		A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. N	PUBH polygons account for over 1% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202).	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): Low**		

Functional Class: Permanently Flooded Ponds
NWI Code(s): PUBHh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Ponds are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. N	Gravel roads in vicinity, but accessing this land requires an escort by the Airport Manager.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. N	Subsistence activities would not be possible as accessing this land requires an escort by the Airport Manager.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): Low**		

Functional Class: Flooded Graminoid Marsh
NWI Code(s): PEM2Hh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. N		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. Y		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y	The permanently flooded water regime indicates surface water storage.	Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N/A		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y		Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. N	As *Arctophila fulva* is a non-persistent aquatic grass, it does not provide surface roughness during spring snowmelt-generated floods.	Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. Y		Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 N		Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. N		Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Flooded Graminoid Marsh
NWI Code(s): PEM2Hh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. Y		As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. Y		Increased surface water promotes increased decomposition (Bayley and Mewhort 2004), which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Flooded Graminoid Marsh
NWI Code(s): PEM2Hh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. Y	Multiple observations of Steller's Eiders have been documented within Flooded Graminoid Marsh in the Barrow airport study area (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. Y	Preferred habitat for both Spectacled Eider (Johnson et al. 2014) and Steller's Eider (Safine 2013).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**2 (Y): High**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. N	The majority of Aquatic Graminoid Marsh polygons in this study area are immediately adjacent to the Barrow Airport runway.	Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. N	Aquatic Graminoid Marsh was important habitat for fewer than 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. Y	Aquatic Graminoid Marsh was important habitat for more than 1/2 of assessed Birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. Y		A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. Y	PEM2H polygons account for less than 1% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202).	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		

Functional Class: Flooded Graminoid Marsh
NWI Code(s): PEM2Hh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Polygons are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. N	Gravel roads in vicinity, but accessing this land requires an escort by the Airport Manager.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. N	Subsistence activities would not be possible as accessing this land requires an escort by the Airport Manager.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): Low**		

Functional Class: Deep Polygon Complex
NWI Code(s): PEM1F
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. Y		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. Y		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y	The semi-permanently flooded water regime indicates surface water storage.	Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N/A		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**4 (Y): High**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y		Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. Y		Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. Y		Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 N		Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. Y	Data collected by HDR (2012) in this community document relatively thick surface organics in the low center polygon basis (see datasheets for points 002, 003).	Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**4 (Y): High**		

Functional Class: Deep Polygon Complex
NWI Code(s): PEM1F
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. Y	Field data collected in this community document deciduous woody and over 30% vegetation (HDR 2012, see datasheets for points 001–003; Appendix B, BRW-V06, BRW-V07, BRW-V09, and BRW-V11).	As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. Y		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Deep Polygon Complex
NWI Code(s): PEM1F
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. Y	Multiple observations of Steller's Eiders have been documented within Deep Polygon Complex in the Barrow airport study area (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. Y	Preferred habitat for both Spectacled Eider (Johnson et al. 2014) and Steller's Eider (Safine 2013).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**2 (Y): High**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. Y		Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. Y	Deep Polygon Complex was important habitat for over 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. Y	Deep Polygon Complex was important habitat for over 1/2 of assessed birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. Y		A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community (Adamus et al. 1991).
5. Wetland or water is considered rare at a regional scale.	5. N/A	PEM1F polygons account for over 8% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202). Extensive, detailed habitat mapping of the Barrow Peninsula to distinguish Deep Polygon Complex from more typical Wet Sedge Tundra PEM1F is not available. Thus, the data to determine rarity for this type is not available at this time.	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**4 (Y): High**		

Functional Class: Deep Polygon Complex
NWI Code(s): PEM1F
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Polygons are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. N	Gravel roads in vicinity, but accessing this land requires an escort by the Airport Manager.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. N	Subsistence activities would not be possible as accessing this land requires an escort by the Airport Manager.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): Low**		

Functional Class: Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. Y		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. N		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y	Standing water in polygonal troughs and low center polygon basins indicates surface water storage.	Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N/A		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y	Standing water in polygonal troughs and low center polygon basins.	Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. Y	Mixed high and low center polygons comprise this community.	Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. Y	Standing water in polygonal troughs and low center polygon basins.	Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 N		Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. Y	Field data document thick surface organics (HDR 2012, see datasheets for point 059).	Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**4 (Y): High**		

Functional Class: Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. Y	Field data document over 30% herbaceous vegetation (HDR 2012, see datasheets for point 059).	As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. Y		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. Y	Multiple observations of Steller's Eiders have been documented within Patterned Seasonally Flooded-Saturated Sedge-Shrub Tundra in the Barrow airport study area. Steller's Eider nests have been observed in this community, both south of the runway and east of Isatkoak Lagoon (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. N	Not a preferred habitat for Spectacled Eiders (Johnson et al. 2014) or Steller's Eiders (based on habitat use in Safine 2013).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**1 (Y): Moderate**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. Y		Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. Y	Moist Sedge-Shrub Meadow was important habitat for over 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. Y	Moist Sedge-Shrub Meadow was important habitat for over 1/2 of assessed birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. Y		A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. N	PEM1/SS1E polygons account for over 15% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202).	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**4 (Y): High**		

Functional Class: Patterned Seasonally Flooded/Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Polygons are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. N	Gravel roads in vicinity, but accessing the majority of these polygons requires an escort by the Airport Manager. No visible trails in this community east of Isatkoak Lagoon.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. Y	Subsistence activities would not be possible west of Isatkoak Lagoon, as accessing this land requires an escort by the Airport Manager. Subsistence activities would be possible east of Isatkoak Lagoon, and are assumed to take place for the purpose of this assessment.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**1 (Y): Low**		

Functional Class: Patterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E, PEM1B, PEM1/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. N		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. N		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y	Standing water in polygonal troughs indicates surface water storage (see Appendix B, BRW-V01, BRW-V02, BRW-V10, BRW-V12, BW-V13, BRW-V14, BRW-V16; see Appendix A, BRW-02, BRW-03).	Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N/A		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**2 (Y): Moderate**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y	Standing water in polygonal troughs (see Appendix B, BRW-V01, BRW-V02, BRW-V10, BRW-V12, BW-V13, BRW-V14, BRW-V16; see Appendix A, BRW-02, BRW-03).	Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. N		Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. Y	Standing water in polygonal troughs (see Appendix B, BRW-V01, BRW-V02, BRW-V10, BRW-V12, BW-V13, BRW-V14, BRW-V16; see Appendix A, BRW-02, BRW-03).	Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 N		Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. Y	Thick surface organics documented on high center, low relief polygons (see Appendix A, BRW-02).	Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**3 (Y): Moderate**		

Functional Class: Patterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E, PEM1B, PEM1/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. Y	Field data collected in this community document deciduous woody and over 30% herbaceous vegetation (HDR 2012, see datasheets for points 060–061; Appendix B, BRW-V01, BRW-V02, BRW-V10, BRW-V12, BRW-V13, BRW-V14, BRW-V16; see Appendix A, BRW-02, BRW-03).	As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. Y		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Patterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E, PEM1B, PEM1/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. Y	Multiple observations of Steller's Eiders have been documented within Patterned Saturated Sedge Tundra in the Barrow airport study area. Steller's Eider nests have been observed in this community, both south of the runway and east of Isatkoak Lagoon (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. N	Not a preferred habitat for Spectacled Eiders (Johnson et al. 2014) or Steller's Eiders (based on habitat use in Safine 2013).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**1 (Y): Moderate**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. Y		Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. Y	Moist Sedge-Shrub Meadow was important habitat for over 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. Y	Moist Sedge-Shrub Meadow was important habitat for over 1/2 of assessed birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. Y		A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. N	PEM1E, PEM1B, and PEM1/SS1B polygons combined account for over 40% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202).	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**4 (Y): High**		

Functional Class: Patterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM1E, PEM1B, PEM1/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Polygons are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. N	Gravel roads in vicinity, but accessing the majority of these polygons requires an escort by the Airport Manager. No visible trails in this community east of Isatkoak Lagoon.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. Y	Subsistence activities would not be possible west of Isatkoak Lagoon, as accessing this land requires an escort by the Airport Manager. Subsistence activities would be possible east of Isatkoak Lagoon, and are assumed to take place for the purpose of this assessment.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**1 (Y): Low**		

Functional Class: Nonpatterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. N		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. N		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. N		Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N/A		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**1 (Y): Low**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. N	No surface water is present outside of spring flooding.	Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. N		Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. N	No surface water is present outside of spring flooding.	Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 N		Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. N	Field data in this community, but outside of Barrow Airport bounds, document thin surface organics (Material Sites Appendix A, BRW-22, BRW-24).	Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**0 (Y): Low**		

Functional Class: Nonpatterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. Y	Field data collected in this community document deciduous woody and over 30% herbaceous vegetation (HDR 2012, see datasheets for point 064; Appendix B, BRW-V15; Material Sites Appendix A, BRW-22, BRW-24).	As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. N		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**1 (Y): Low**		

Functional Class: Nonpatterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. N	Niether Steller's nor Spectacled Eiders have been observed in this community within the study area (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. N	Not a preferred habitat for Spectacled Eiders (Johnson et al. 2014) or Steller's Eiders (based on habitat use in Safine 2013).	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): Low**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. Y		Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. Y	Moist Sedge-Shrub Meadow was important habitat for over 1/2 of assessed mammals (see Habitat Evaluation in accompanying report).	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. Y	Moist Sedge-Shrub Meadow was important habitat for over 1/2 of assessed birds (see Habitat Evaluation in accompanying report).	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. N		A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. N	PEM1/SS1B polygons account for over 30% of NWI mapping (USFWS 2014a) in the Northwest Coast watershed (HUC 19060202).	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		

Functional Class: Nonpatterned Saturated Sedge-Shrub Tundra
NWI Code(s): PEM/SS1B
HGM: Flat

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Polygons are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. Y	Visible trails in this community east of Isatkoak Lagoon.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. Y	Subsistence activities would not be possible west of Isatkoak Lagoon, as accessing this land requires an escort by the Airport Manager. Subsistence activities would be possible east of Isatkoak Lagoon, and are assumed to take place for the purpose of this assessment.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Impounded Disturbed Wetlands
NWI Code(s): PUSCx, PEM1Fh, PEM1Eh, PEM1Bh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
A. Flood Flow Regulation (Storage)			Assessing the ability of ACP wetlands to store runoff or delay downslope movement of surface water. Riverine and estuarine waters below the OHWM do not perform this function (N/A). Wetlands that do not seasonally flood (e.g. pingos, etc) do not perform this function (N/A). Surface water storage by wetlands in permafrost regions can be significant, while the conventional view that subsurface storage is an effective modulator of stormflow is a misconception in permafrost regions (Woo 2012).
1. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	1. N		Tussocks, low to tall (>20cm height) woody stems, and polygonal features provide surface roughness, which delays downslope movement of floodwaters by slowing velocity. These are persistent features, present during spring snowmelt-generated flooding.
2. Wetland or water is a depressional HGM class or has depressional features capable of storage.	2. Y		HGM depressions occur in topographic depressions with closed contours, and flow vectors are from surrounding areas toward the center of the depression, allowing the accumulation of surface water. Ice-rich, raised polygonal rims act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012, Woo 2012).
3. Wetland or water shows signs of storage (i.e. fluctuating water levels, algal mats, and/or lodged debris).	3. Y	Polygons with semi-permanently flooded and seasonally flooded water regimes indicate surface water storage. Airport Manager stated that impoundments adjacent to runway hold water in spring.	Visible signs of storage indicate that a wetland is capable of, and has in the past, retained additional water.
4. Floodwaters enter and flow through wetland predominantly as sheet flow rather than channel flow.	4 Y		Floodwater entering as sheet flow, rather than channelized flow, is more likely to interact with surface roughness features.
5. Waterbody is lake (>20 acres) (N/A if assessing wetlands).	5. N/A		Lakes (>20 acres) have substantial storage capacities, and modulate snowmelt-dominated streamflow regimes (Arp et al. 2012, Woo 2012).
Rating Criteria: 4 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		
B. Sediment, Nutrient (N and P), Toxicant Removal			ACP soils have a relatively shallow active layer of unfrozen soil during the growing season. Cold temperatures and shallow active layer limit the ability of ACP wetlands to perform denitrification, thus this function focuses on the removal of inorganic sediments and adsorbed toxicants and nutrients through settlement. Sediment retention is used as a proxy for toxicant removal as many toxicants adsorb to sediments, and sediment retention is relatively easy to assess.
1. Slow-moving or still water is present.	1. Y		Slow or still-moving water allows sediments and adsorbed toxicants to settle out of the water column, as opposed to swift-moving water that suspends sediments/toxicants.
2. Dense tussocks, low to tall woody vegetation present, or raised polygonal rims are present (N/A if assessing waters).	2. N		Tussocks and low to tall (>20cm height) woody stems provide surface roughness, which slows water velocity and allows sediments and adsorbed nutrients and toxicants to settle out of the water column. Raised polygonal rims provide surface roughness, which delays downslope movement of floodwaters by slowing velocity, and also act as micro-depressions for long-term storage over the growing season (Liljedahl et al. 2012). These are persistent features, present during spring snowmelt-generated flooding.
3. At least moderate interspersion of vegetation and water is present. Surface water patches should account for >10% areal coverage (N/A if assessing waters).	3. Y	Field data indicate at least moderate vegetation/surface water interspersion (HDR 2012, see datasheets for points 032 and 033; Appendix B, BRW-V03, BRW-V04, BRW-V05).	Rooted vegetation takes up nutrients directly from the soil, which may encourage nutrients to move from water to soil to maintain equilibrium.
4. Sediment deposits are present, providing evidence of deposition during natural flood events.	4 N		Visible signs of sedimentation indicate that a wetland is capable of, and has in the past, allowed sediments and presumably adsorbed nutrients and toxicants to settle out of the water column.
5. Thick surface organic horizon and/or abundant fine organic litter is present (N/A if assessing waters).	5. Y	Field data indicate thick surface organics (HDR 2012, see datasheets for points 032 and 033).	Organic soils are effective at retaining heavy metals, some of which can be bound into long-term complexes with peat, particularly in cool climates.
Wetlands Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 1–2 (Y) = High, 0 (Y) = Low	**3 (Y): Moderate**		

Functional Class: Impounded Disturbed Wetlands
NWI Code(s): PUSCx, PEM1Fh, PEM1Eh, PEM1Bh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
C. Erosion Control and Shoreline Stabilization			Assesses the ability of a wetland to stabilize banks through anchoring soils and dissipating erosive forces. This function is typically only performed by wetlands directly abutting a relatively permanent channelized water. Neither waters nor wetlands that do not abut relatively permanent channelized waters perform this function (N/A). Depending on the mapping and classification some individual wetlands that do not actually directly abut a relatively permanent water (rivers and streams) may be included in this assessment.
1. Wetland has dense, energy absorbing vegetation bordering the watercourse and no evidence of erosion.	1. N/A		Plants bind soils with their root systems, and slow incoming waves or currents through increased surface roughness.
2. Soils are not predominantly sandy or silty, and are not ice rich.	2. N/A		Sandy and silty soils (Dunne ald Leopold 1978) and ice rich permafrost are more susceptible to erosion.
3. Historical aerial photography (if available) indicates stable shoreline features.	3. N/A		Visible evidence of stable shorelines indicates a lack of historical erosion, which may be due any one or a combination of factors including bank erodability, erosive force, or protection afforded by adjacent wetlands.
Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): N/A**		
D. Organic Matter Production and Export			Organic matter production and export assesses primary production and subsequent flushing of organic material to downstream waters. Wetlands that are not flooded at least every 10 years do not perform this function as flooding is the transport mechanism for moving organics to downstream waters. If no flooding occurs, production may be high but no carbon is exported.
1. Wetland has at least 30%, or water has at least 10%, cover herbaceous vegetation. Woody plants are predominantly deciduous.	1. Y	Field data indicate at least 30% herbaceous vegetation (HDR 2012, see datasheets for points 032 and 033; Appendix B, BRW-V03, BRW-V04, BRW-V05).	As summarized by Adamus et al. (1991) herbaceous vegetation is generally more productive than aquatic bed, scrub-shrub, or forested wetland vegetation. Higher productivity generates more carbon available for export. Deciduous woody species produce higher quality litter than evergreen woody species, which have recalcitrant litter with high concentrations of lignin and phenolic compounds (Wardle 2002).
2. At least 10% of wetland is seasonally flooded (N/A for waters).	2. Y		Surface water controls many differences between wetland types, including decomposition (Bayley and Mewhort 2004). Increased surface water promotes increased decomposition, which may facilitate carbon export (Adamus 2013).
3. Surface water outflow occurs outside of spring flooding.	3. N		A longer duration of surface water outflow provides more opportunity for organic matter export. While the vast majority of ACP wetlands flood during spring breakup, fewer have surface water outflow later in the growing season, when small beaded streams can stop flowing and waterbodies become disconnected.
Wetlands Rating Criteria: 3 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low Waters Rating Criteria: 2 (Y) = High, 0–1 (Y) = Low	**2 (Y): Moderate**		

Functional Class: Impounded Disturbed Wetlands
NWI Code(s): PUSCx, PEM1Fh, PEM1Eh, PEM1Bh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
E. TES Support			Assesses the ability of a wetland or water to support Threatened or Endangered Species (TES) per the Endangered Species Act (ESA) and species or subspecies of fish or wildlife in Alaska per the Alaska Department of Fish and Game (ADF&G) as defined by Alaska Statute 16.20.190.
1. Wetland or water contains documented occurrence of a state or federally listed threatened or endangered species.	1. N	Niether Steller's nor Spectacled Eiders have been observed in this community within the study area (ALCC 2012).	A documented occurrence confirms use by TES for at least some aspect of life history, even if the community isn't a preferred or designated critical habitat.
2. Wetland or water contains documented critical habitat, designated by the U.S. Fish and Wildlife Service (USFWS) and/or the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries).	2. N		NOAA Fisheries and USFWS, the two federal agencies responsible for adminstering the ESA, are required to designate critical habitat for listed species. Critical habitat is specific geographic areas containing features essential to the conservation of an endangered or threatened species, including areas not currently occupied but necessary for recovery.
3. Wetland or water is a known preferred habitat for state or federally listed threatened or endangered species.	3. N	While this disturbed functional class contains some wet and flooded NWI types it was not considered a preferred habitat for Spectacled Eiders (Johnson et al. 2014) or for Steller's Eiders (based on habitat use in Safine 2013) because of very close proximity to human development.	If specific work on habitat preference in the study area (e.g. Johnson et al. 2014) is not available, a literature review will be necessary to identify habitat preferences.
Rating Criteria: 2–3 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): Low**		
F. General Avian and Mammal Habitat Suitability			Assesses whether the wetland or water supports a high diversity of birds and mammals. Characteristics of the wetland or water, landscape setting, and documented species diversity are considered.
1. Wetland or water is undisturbed by human habitation or development.	1. N	Community is immediately adjacent to Barrow Airport and associated development (gravel roads, material source).	Anthropogenic disturbance tends to reduce the diversity of birds and mammals using an area.
2. Wetland or water is used by a high diversity of mammal species.	2. Y	Impounded Disturbed Wetlands contain habitat types important for over 1/2 of assessed mammals (see Habitat Evaluation in accompanying report): Moist Sedge-Shrub Meadow and Nonpatterned Wet Meadow.	If no systematic wildlife surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
3. Wetland or water is used by a high diversity of avian species.	3. Y	Impounded Disturbed Wetlands contain several habitat types important for over 1/2 of assessed birds (see Habitat Evaluation in accompanying report): Moist Sedge-Shrub Meadow, Aquatic Graminoid Marsh.	If no systematic avian surveys were conducted in the project area or near vicinity, a review of previous wildlife studies will identify which species are likely to regularly occur and what habitats they occupy (see Habitat Evaluation in accompanying report).
4. Interspersion of vegetation and water is at least moderate (surface water patches accounting for 5–10% areal cover, or continuous cover of surface water with a well-developed emergent component).	4. Y	Field data indicate interspersion is at least moderate (HDR 2012, see datasheets for points 032 and 033; Appendix B, BRW-V03, BRW-V04, BRW-V05).	A greater variety of vegetation and cover types is present in communities with high vegetation-water interspersion. Communities with high vegetation water interspersion may support species adapted to open water, edge environments, and well-vegetated components of the community.
5. Wetland or water is considered rare at a regional scale.	5. N	Impounded wetlands are an artifact of human development and will not be considered rare.	Disproportionately high habitat use, in relation to habitat availability, may indicate habitat preference. Habitat availability must be assessed at a larger, regional scale rather than the project mapping which is limited to construction boundaries
Rating Criteria: 4–5 (Y) = High, 2–3 (Y) = Moderate, 0–1 (Y) = Low	**3 (Y): Moderate**		

Functional Class: Impounded Disturbed Wetlands
NWI Code(s): PUSCx, PEM1Fh, PEM1Eh, PEM1Bh
HGM: Depressional

Function and Indicators	Rating	Project Rationale	Arctic Coastal Plain (ACP) Rationale
G. General Fish Habitat Suitability			Applicable to all waters, and wetlands with perennial or intermittent surface water connection to a fish bearing water. Sheet flow during spring snowmelt is not considered a sufficiently reliable connection to fish-bearing waters for this function to be applicable.
1. Water has sufficient size and depth of open water so as not to freeze completely during winter (N/A for wetlands).	1. N/A		Assessing whether the wetland or water provides overwintering habitat, which is limited on the ACP.
2. Fish are present.	2. N/A		A documented occurrence confirms use by fish for at least some aspect of life history.
3. Herbaceous and/or woody vegetation is present in wetland and/or buffer to provide cover, shade, and/or detrital matter.	3. N/A		Overhanging vegetation provides refuge from predators, shade to maintain water temperatures, and detrital matter contributions to the food web.
4. Suitable spawning areas are present.	4. N/A		Assesses the presence of suitable spawning habitat, including aquatic vegetation, deep lakes, mixed gravels.
5. Juvenile rest areas present.	5. N/A		Assesses the presence of suitable juvenile rest areas, including flooded wetlands, and pools with organic debris or overhanging vegetation.
Wetlands Rating Criteria: 2–4 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low Waters Rating Criteria: 2–5 (Y) = High, 1 (Y) = Moderate, 0 (Y) = Low	**0 (Y): N/A**		
H. Educational, Scientific, Recreational, or Subsistence Use			Consumptive (e.g. hunting, fishing, food gathering) and non-consumptive uses, as well as educational and scientific use are assessed.
1. Site has documented scientific or educational use.	1. N		Scientific use assess the wetland has been used in scientific studies (peer-reviewed or grey literature), excluding studies necessitated by NEPA or project-permitting. Educational assesses the educational value of the wetland to the community (e.g. contains interpretive signs, is historically used for ecology or species identification classes, is a known long term research site with established permanent sample plots, etc.).
2. Wetland or water is in public ownership.	2. N	Polygons are located within Barrow Airport boundaries.	Wetlands or waters in public ownership are more accessible to a variety of people.
3. Accessible trails are available.	3. N	Gravel roads in vicinity, but accessing this land requires an escort by the Airport Manager.	Visible or established trails demonstrate that the wetland or water is accessible, and may be used for recreational or subsistence purposes.
4. Wetland or water supports subsistence activities (e.g., hunting, fishing, berry picking).	4. N	Subsistence activities would not be possible as accessing this land requires an escort by the Airport Manager.	Observed or documented consumptive use confirms that a community is used for subsistence purposes.
Rating Criteria: 3–4 (Y) = High, 2 (Y) = Moderate, 0–1 (Y) = Low	**0 (Y): Low**		