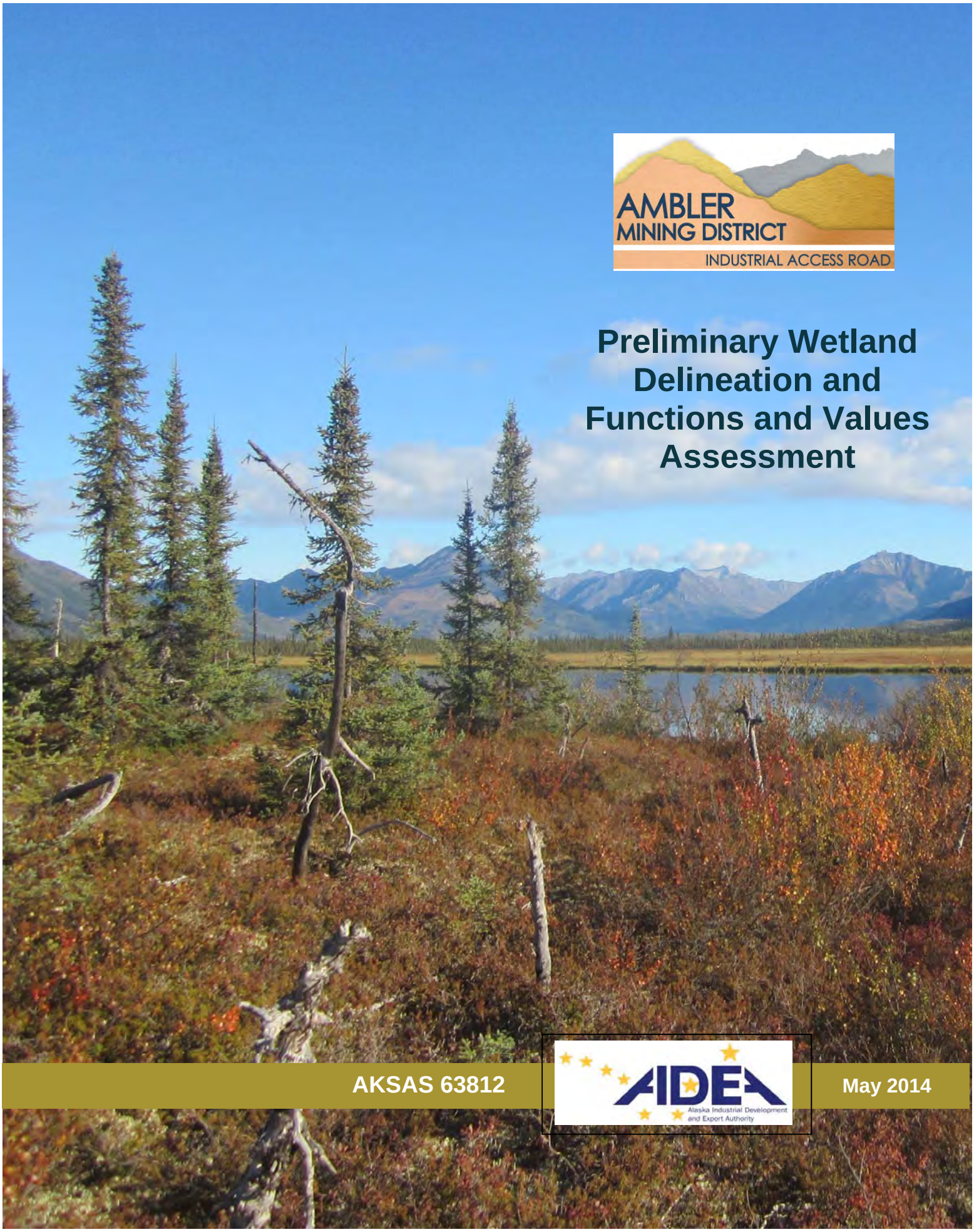


# Preliminary Wetland Delineation and Functions and Values Assessment

AKSAS 63812

AIDEA
Alaska Industrial Development and Export Authority

May 2014

# AMBLER MINING DISTRICT INDUSTRIAL ACCESS ROAD

# PRELIMINARY WETLAND DELINEATION AND FUNCTIONS AND VALUES ASSESSMENT

**Prepared on behalf of:**

AIDEA
Alaska Industrial Development and Export Authority
813 West Northern Lights Boulevard
Anchorage, Alaska 99503

**Prepared by:**

DOWL HKM
4041 B Street
Anchorage, Alaska 99503
(907) 562-2000

W.O. 60693
May 2014

# TABLE OF CONTENTS

**Page**

**TABLES** **Page**



**APPENDICES**



## LIST OF ACRONYMS

AIDEA .... Alaska Industrial Development and Export Authority
AMDIAR .... Ambler Mining District Industrial Access Road
CWA .... Clean Water Act
DOT&PF .... State of Alaska Department of Transportation and Public Facilities
FAA .... Federal Aviation Administration
FAC .... Facultative
FACW .... Facultative wetland
GANPP .... Gates of the Arctic National Park and Preserve
GIS .... Geographic Information Systems
HUC .... hydrological unit code
KNWR .... Kanuti National Wildlife Refuge
LiDAR .... Light Detection and Ranging
MP .... milepost
NA .... not applicable
OHWM .... ordinary high water mark
PFC .... proper functioning condition
PUBH .... Open Water Ponds
PWD .... Preliminary Wetland Delineation
RGL .... *Alaska Regulatory Guidance Letter*
RPW .... relatively permanent waters
TNW .... traditionally navigable waterway
U.S. .... United States
USDOI .... United States Department of the Interior
USACE .... United States Army Corps of Engineers
USEPA .... United States Environmental Protection Agency

## EXECUTIVE SUMMARY

The Alaska Industrial Development and Export Authority is proposing a controlled-access industrial road from the Dalton Highway to the Ambler Mining District in Northwest Alaska. The industrial access road is designed to provide needed surface access to this District, which is a highly mineralized area with known deposits of copper, zinc, lead, silver, and gold. Mineral exploration and mine development in the District have been limited by the lack of surface access.

The State of Alaska Department of Transportation and Public Facilities initiated reconnaissance studies on the Ambler Mining District Industrial Access Road in 2010. The State of Alaska Department of Transportation and Public Facilities studied several potential surface corridors from the Ambler Mining District to road or rail infrastructure to the east and to potential port sites to the west. The reconnaissance studies identified the Brooks East Corridor as the most feasible surface transportation corridor for the Ambler Mining District Industrial Access Road project.

A wetland delineation study was completed for the project's Study Area in 2012 and 2013. The Study Area is defined as a 2,000-foot-wide corridor centered on the proposed road alignment. The Study Area also includes areas proposed for maintenance stations and material sites, as well as access roads to the material sites.

The 68,067-acre Study Area is comprised of: 39,949 acres of potentially jurisdictional wetlands, 1,115 acres of Waters of the United States, and 27,003 acres of uplands.

# 1.0 INTRODUCTION

The Alaska Industrial Development and Export Authority (AIDEA) is proposing a controlled-access industrial road from the Dalton Highway to the Ambler Mining District in Northwest Alaska. The industrial access road is designed to provide needed surface access to the District, which is a highly mineralized area with known deposits of copper, zinc, lead, silver, and gold. Mineral exploration and mine development in the District have been limited by the lack of surface access.

The State of Alaska Department of Transportation and Public Facilities (DOT&PF) initiated reconnaissance studies on the Ambler Mining District Industrial Access Road (AMDIAR) in 2010. DOT&PF studied several potential surface corridors from the Ambler Mining District to road or rail infrastructure to the east and to potential port sites to the west. The reconnaissance studies identified the Brooks East Corridor as the most feasible surface transportation corridor for the AMDIAR project.

This report documents the preliminary wetland delineation (PWD) completed for the project's Study Area in 2012 and 2013. This PWD details the classification and mapping of wetland and upland habitat types observed within the project Study Area. It also includes a functional value assessment for both wetland and riverine habitat types.

## 1.1 Project Background

## 1.2 Study Area

The Study Area is defined as a 2,000-foot-wide corridor centered on the proposed road alignment, beginning at the Ambler River and ending 200 miles east at the Dalton Highway (Figure 1). It also includes ancillary sites proposed for maintenance stations, landing strips, and material sites, as well as access roads to the material sites.

The route begins at the Ambler River and extends east along the northern edge of the Cosmos Hills. Prior to reaching the Gates of the Arctic National Park and Preserve (GANPP), the proposed road diverges into two alternative routes through the GANPP, referred to as the northern and southern alignments. The alternative alignments converge into a single route again on the north side of the Helpmejack Hills, east of the GANPP. The proposed road continues east,

remaining north of the Alatna Hills. The proposed road would cross the Koyukuk River downstream from the John River confluence. It continues south of Bettles and Evansville, following the existing winter trail, bearing to the east/southeast along the northern boundary of the Kanuti National Wildlife Refuge (KNWR), terminating at the Dalton Highway near milepost (MP) 136. Communities closest to the Study Area include: Ambler, Kobuk, Shungnak, Alatna, Allakaket, Bettles, and Evansville.

### 1.2.1 Ancillary Sites

Ancillary sites include proposed material sites, maintenance stations, landing strips, and access roads, all of which connect to the proposed road alignment at various intervals throughout the Study Area. Material sites are spaced approximately every 10 miles along the proposed roadway. Landing strips are located near proposed maintenance facilities (approximately every 60 miles). Study Area boundaries for access roads connecting ancillary sites to the main project are 500-feet-wide and centered on the proposed access road centerline.

### 1.2.2 Ecological Regions

The 68,067-acre (106.4-square-mile) Study Area crosses two North American ecological regions (Level I): Tiaga and Northwestern Forested Mountains (Figure 2). These ecological regions are further divided into ecological sub-regions (Level III), based on climate, topography, soils, vegetation, and landform. The Study Area crosses two sub-regions: Interior Forested Lowlands and Uplands and Interior Highlands. The Study Area traverses rolling lowlands (0 to 5 percent slopes) and rounded low mountains (slopes greater than 5 percent). The lowlands are dominated by thick organic bryophyte mats with permafrost and a continental climate. These low mountains share characteristics of the lowlands (permafrost and a continental climate) but tend to have shallower mineral soils. Each ecological sub-region is prone to and/or exhibits natural fire succession; however, fire was most prevalent within the Interior Highlands.

### 1.2.3 Watershed Boundaries

The Study Area bisects watershed boundaries of both the Koyukuk River and Kobuk-Selawik Rivers basins. Surface water flows from the Koyukuk River basin drain into the Pacific Ocean. Flows from the Kobuk-Selawik Rivers basin drain to the Arctic Ocean. Each watershed basin is

further divided into distinct sub-basins (Figure 3), distinguished by an 8-digit hydrological unit code (HUC). Seven sub-basins are contained within the Study Area (Table 2).

**Table 1: Hydrological Unit Codes**

| HUC | Sub-basin Name |
|---|---|
| 19040601 | Upper Koyukuk River |
| 19040602 | South Fork Koyukuk River |
| 19040603 | Alatna River |
| 19040605 | Allakaket |
| 19040608 | Koyukuk Flats |
| 19050302 | Upper Kobuk River |
| 19050303 | Middle Kobuk River |

### 1.2.4 Precipitation

Two weather stations are in close proximity to the Study Area; one is located approximately 1.5 miles northeast at the Bettles Airport[1], and the second is approximately 45 miles northeast in Wiseman[2].

Precipitation recorded at the Bettles Airport station during spring months preceding the 2012 and 2013 field seasons was below average (both 54 percent). Recorded summer precipitation was normal (99 percent of average) in 2012 and below normal (59 percent of average) in 2013. Overall annual precipitation for both 2012 and 2013 was normal (93 and 103 percent of average), indicating a healthy winter snowpack to make up for spring and summer deficits.

## 2.0 METHODS

This PWD was completed in accordance with *Part IV of the Corps of Engineers Wetlands Delineation Manual* (United States Army Corps of Engineers (USACE), 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (Version 2.0)* (USACE, 2007). This effort included preliminary data gathering and analysis, a

[1] Bettles Federal Aviation Administration (FAA) Airport Weather Station No. 500761
[2] Wiseman Weather Station No. 509869

field investigation, post-field data review, and mapping using Geographic Information Systems (GIS) tools.

## 2.1 Preliminary Mapping and Classification

High-resolution aerial imagery from Aero-Metric (2012) was used to extrapolate and map potential wetland and upland habitat types within the Study Area. Information gathered from the preliminary data review and analysis was used to develop the preliminary sampling plan for the field investigation.

## 2.2 Field Methods

Environmental Specialists conducted field investigations of the Study Area in the summers of 2012 and 2013. The Study Area was divided into 110 perpendicular transects off the centerline, including the northern and southern alignments through the GANPP. Teams consisted of two environmental specialists and one subsistence advisor. Each field team was responsible for sampling pre-determined locations. Such locations were assigned based upon preliminary aerial interpretation of distinct vegetation communities and verified by ground truthing. Larger tracts of a particular habitat type received more sample points than smaller tracts. Photographs were taken at each sampling location (one photo per cardinal direction and one for the soil pit) to document vegetation, hydrology, topography, and other general community characteristics.

At each full sample point, soil pits were excavated to depths of at least 20 inches, or to the presence of a restrictive layer (e.g., permafrost, bedrock, or clay). Sample locations were considered a full sample point only upon excavation of a soil pit. In areas where vegetation was similar to a previously observed full sample point, it was assumed soil and hydrologic characteristics would be similar, and, thus, a photograph point was recorded. Photograph points were used to extrapolate site characteristics from full sample points to project map units across the larger Study Area.

Soil characteristics of texture, color, redoximorphic concentrations, organic depths, and sulfuric odor were recorded to document hydric indicators. Soil color was determined using *Munsell Soil-Color Charts* (2000). Hydrologic indicators documented ordinary high water marks (OHWM) and the presence or absence of inundation, high water table, soil saturation, and permafrost.

Vegetation species, stratum (tree, shrub, or herbaceous), and percent aerial coverage of each species were recorded on wetland determination data forms specific for the Alaska Region (Appendix B). Taxonomic nomenclature and the wetland indicator for each species followed the USACE's published guide, *The National Plant List: 2013 Wetland Rating* (Lichvar, R.W., 2013). Data sheets were reviewed and habitat boundaries were subsequently mapped using GIS.

## 2.3 Classification Systems of Habitats

Wetland habitats were dually classified according to the system guidelines outlined in the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin, et al., 1979) and the *Alaska Vegetation Classification* (Viereck, et al., 1992).

The Cowardin classification differentiates distinct wetland types by evaluating landscape position, plant community structure, and hydrologic conditions. Cowardin wetland systems include: Marine, Estuarine, Riverine, Lacustrine, and Palustrine habitats, whereas upland habitats are grouped into a single community.

Contrastingly, the Viereck classification system does not distinguish between wetland and upland habitat types; however, it allows for a hierarchical evaluation of distinct vegetation communities based on dominant growth forms (tree, shrub, or herbaceous), canopy height, percent aerial cover, general soil moisture, salinity, and dominant vegetation. Viereck was used to characterize both wetland and upland habitats.

## 2.4 Functions and Values Assessment

Wetland functions result from both biotic and abiotic processes performed within a wetland ecosystem (e.g., flood attenuation, nutrient cycling, etc.). The value of a particular wetland function is based on human use and judgment of the worth, merit, quality, and importance attributed to those processes performed by the wetland (USACE, 1999).

The functional rating of a wetland was recorded on data sheets using criteria outlined in the *Alaska Regulatory Guidance Letter (RGL), ID No. 09-10* (USACE, 2009). The ratings are a qualitative approach to assess wetland habitats, based upon ten processes or attributes. Results rank wetland habitats as having low, moderate, or high value, which subsequently allows comparisons of wetland habitat types within hydrologic units.

Riverine habitats are areas with defined channel beds, banks, or flowing water. These habitats were assessed using the U.S. Department of the Interior (USDOI), Bureau of Land Management, Technical Report 1737-15, *Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas* (USDOI, 1998). The proper functioning condition (PFC) assesses whether streams/rivers are functioning properly, functioning at risk, non-functional, or unknown.

## 2.5 Final Mapping

Using ArcMap GIS, a geo-referenced aerial photograph from 2012 was used as a base to digitally map wetlands, vegetation community boundaries, and riverine habitats and to then calculate habitat size. Final mapping was based on aerial photograph interpretation, site photographs, Light Detection and Ranging (LiDAR) two-foot contours, and 1:24,000 scale hydrologic stream data. Field data was used to ground truth aerial photograph interpretations of preliminarily mapped communities.

## 2.6 Preliminary Jurisdictional Determination

Waters of the United States (U.S.), including wetlands, were analyzed to determine whether they are subject to Clean Water Act (CWA) jurisdiction under the USACE/U.S. Environmental Protection Agency (USEPA) 2007 CWA Guidance. The 2007 guidance requires a hydrological connection between wetlands and a traditionally navigable waterway (TNW): in this case, both the Kobuk and the Koyukuk Rivers.

## 2.7 Limitations to Methods

Limitations to the methods employed for this delineation have been identified as the following:

1. Size of project

- Sole access to this widely varying terrain occurred via helicopter
    - Data collection was limited to available and suitable landing sites
    - Helicopter landings were restricted within 0.5 miles of known raptor nests
- Aerial interpretation - densely vegetated habitats precluded identification of small drainages (less than 12 feet wide)

- The Viereck forest standard was used to map Viereck and Cowardin forest habitats

2. Multiple land owners

- Access was restricted to primarily State and Federal lands

3. Fire effects in the Study Area

- Consumed vegetation cover (mainly tree stratum)
- Devastated organic soil layers
- Increased depth to permafrost
- Altered hydrologic paths

4. Data collection spanned a two-year period

- Data was collected at different times within the growing season
  - Late-season field identification of vegetation was difficult, as vegetation inflorescence was lacking or absent
- Willow species were identified only to the genus level (based on consultation with the USACE). Field teams chose to identify wetland indicator status of willow species as:
  - Facultative wetland (FACW) in 2012, based on half of all willow species present in Alaska being ranked as FACW
  - Facultative (FAC) in 2013, based on examination of willow species inventory for Arctic Alaska, which identifies over half of observed willow species in the region as FAC

5. Technological complications

- Moisture inhibited camera function

## 3.0 RESULTS

The 68,067-acre Study Area is comprised of: 39,949 acres of potentially jurisdictional wetlands, 1,115 acres of Waters of the U.S., and 27,003 acres of uplands (Table 2).

**Table 2: Wetland, Upland, and Waters of the United States Summary**

| Habitat Type | Acres | Percentage of Study Area |
|---|---|---|
| Wetlands | 39,949 | 58.7 |
| Waters of the United States | 1,115 | 1.6 |
| Uplands | 27,003 | 39.7 |
| **Total** | **68,067** | 100.0 |

During field investigations, wetland classifications were grouped by larger reoccurring vegetation communities. Results are discussed according to Cowardin class of the larger habitat type and then distinguished by subclass.

## 3.1 Wetland, Waters of the United States, and Upland Habitat Classification

Table 3 summarizes the acreages of wetlands, waters of the U.S., and upland habitats within the Study Area. Each of these habitats can be classified based on topography, vegetation, hydrology, and soils. Classification is based on Cowardin and Viereck classification systems. The Cowardin Classification system distinguishes between wetland types based on observed vegetation, soils, and hydrologic characteristics. The Viereck classification system distinguishes between community types based on a top-down assessment of dominant vegetation by height and aerial cover.

**Table 3: Wetlands, Waters of the United States, and Uplands Acreages**

| Habitat Type | Acres | Cowardin | Viereck |
|---|---|---|---|
| **Wetlands** | | | |
| Forest | 18,965 | PFO | IA1, IA2, IA3, IC1, IC2, IC3 |
| Scrub-shrub | 19,042 | PSS | IIA1, IIA2, IIA3, IIB1, IIB2, IIC1, IIC2 |
| Emergent Marsh | 1,942 | PEM | IIIA2, IIIA3 |
| **Subtotal** | **39,949** | -- | -- |
| **Waters of the United States** | | | |
| Lake | 9 | L1UB | -- |
| Pond | 145 | PUBH | -- |
| River | 961 | R2, R3 | -- |
| **Subtotal** | **1,115** | -- | -- |
| **Uplands** | | | |
| Upland Forest | 21,213 | Upland | IA1, IA2, IA3, IB1, IB2, IB3, IC1, IC2, IC3 |
| Upland Scrub-shrub | 5,556 | Upland | IIA1, IIA2, IIA3, IIB1, IIB2, IIC1, IIC2 |
| Upland Meadow | 163 | Upland | IIIA1 |
| Barren | 71 | Upland | Bare |
| **Subtotal** | **27,003** | -- | -- |
| **Total** | **68,067** | -- | -- |

**Cowardin Classifications**:

PFO4 - Palustrine Forested Needle-leaved Evergreen
PSS1 - Palustrine Scrub-shrub Broad-leaved Deciduous
PSS4 - Palustrine Scrub-shrub Needle-leaved Evergreen
PEM1 - Palustrine Emergent Marsh Persistent
PUBH - Palustrine Open Water Unknown Bottom
L1UB - Lacustrine Limnetic Unconsolidated Bottom
R2 - Riverine Lower Perennial
R3 - Riverine Upper Perennial

**Viereck Classifications**:

IA1 - Closed Needle-leaved Forest
IA2 - Open Needle-leaved Forest
IA3 - Needle-leaved Woodland
IB1 - Closed Broad-leaved Forest
IB2 - Open Broad-leaved Forest
IB3 - Broad-leaved Woodland
IC1 - Closed Mixed Forest
IC2 - Open Mixed Forest
IC3 - Mixed Woodland
IIA1 - Closed Dwarf Tree Scrub
IIA2 - Open Dwarf Tree Scrub
IIA3 - Dwarf Tree Scrub Woodland
IIB1 - Closed Tall Scrub
IIB2 - Open Tall Scrub
IIC1 - Closed Low Scrub
IIC2 - Open Low Scrub
IIIA1 - Dry Graminoid Herbaceous
IIIA2 - Mesic Graminoid Herbaceous
IIIA3 - Wet Graminoid Herbaceous

Wetland habitats account for just over half of the Study Area (58.7 percent). Uplands make up 39.7 percent, and waters of the U.S. account for the remaining 1.6 percent of the Study Area. The following sections discuss each habitat type in more detail.

### 3.1.1 Wetland Habitats

Wetland habitat types comprise 58.7 percent of the Study Area and are identified as areas established with hydrophytic vegetation, hydric soils, and positive wetland hydrology. Wetlands consist of: 47.5 percent Palustrine Forest (PFO), 47.7 percent Palustrine Scrub-shrub (PSS), and 4.9 percent Palustrine Emergent (PEM). These habitats are correlated to the Viereck classification system.

#### *3.1.1.1 Palustrine Forested Wetlands (PFO)*

The Palustrine Forested habitat is dominated by woody vegetation greater than six (6) meters (19.7 feet) tall and exceeding 25 percent aerial cover. Forested habitats occur at higher elevations and are influenced by high water tables, instead of by prolonged inundation during the growing season. Three distinct subclasses of the forested wetland habitat type occur: 1 percent Forest Needle-leaved (PFO4), 91 percent Needle-leaved Forest/Broad-leaved Scrub-shrub (PFO4/SS1), and 8 percent Needle-leaved Forest/Needle-leaved Scrub-shrub (PFO4/SS4). These subclasses are distinguished by type of understory observed.

Viereck classifications for forested wetland habitats include: needle-leaf forest (IA) and mixed forest (IC). Modifiers describing vegetation cover consist of: 1 (closed canopy)[3], 2 (open canopy)[4], and 3 (woodland)[5].

Water regimes for forested wetlands exhibit one of two hydrologic modifiers: saturated (B) or temporarily flooded (C).

##### *3.1.1.1.1 Needle-leaved Forest (PFO4)*

This needle-leaved forest habitat is interspersed within PFO4/SS1 habitat, where aerial interpretation of dominant vegetation within this habitat consists of: Black Spruce (*Picea mariana*) and White Spruce (*Picea glauca*) with no understory.

[3] 60 – 100 percent aerial cover
[4] 25 – 59 percent aerial cover
[5] 10 – 24 percent aerial cover

#### *3.1.1.1.2 Needle-leaved Forest/Broad-leaved Scrub-shrub (PFO4/SS1)*

This needle-leaved forest/broad-leaved scrub-shrub habitat is typically located on floodplains, moderate slopes, and along the edges of open water ponds. The dominant vegetation understory consists of: Black Spruce, Cloudberry (*Rubus chamaemorus*), Alpine Blueberry (*Vaccinium uliginosum*), Rusty Labrador-Tea (*Rhododendron groenlandicum*), Swamp Birch (*Betula nana*), and multiple Willow species (*Salix spp*.). Representative sample points for this habitat include: T4-18, T5-33, T11-72, T36-230, T36-234, T41-258, T110-574, T125-663, and T144-760.

#### *3.1.1.1.3 Needle-leaved Forest/Needle-leaved Scrub-shrub (PFO4/SS4)*

This needle-leaved forest/needle-leaved scrub-shrub habitat is typically located near a transition of a PFO4/SS1 habitat with an upland. Dominant vegetation observed within this habitat consists of: Black Spruce, Northern Mountain Cranberry (*Vaccinium vitis-idaea*), Alpine Blueberry, and Swamp Birch. Representative sample points for this habitat include: T116-604, T138-739, and T142-773.

### *3.1.1.2 Palustrine Scrub-shrub Wetlands (PSS)*

The Palustrine Scrub-Shrub wetland habitat is dominated by woody vegetation less than 3 meters (9.8 feet) tall with more than 30 percent aerial cover and a tree canopy with less than 25 percent aerial cover. This habitat is located at lower elevations, in drainages, and on the fringes of open-water ponds. Five Cowardin subclasses occur within this larger habitat type: 32 percent Broad-leaved Deciduous Shrubs (PSS1), 18 percent Broad-leaved Deciduous/Needle-leaved Evergreen Shrubs (PSS1/4), 6 percent Needle-leaved Evergreen Shrubs (PSS4), 44 percent Broad-leaved Deciduous/Persistent Emergent Marshes (PSS1/EM1), and less than 1 percent Needle-leaved Evergreen/Persistent Emergent Marshes (PSS4/EM1).

Viereck classifications for wetland scrub-shrub habitats include: dwarf trees (IIA), tall shrub (IIB), and low shrub (IIC). Vegetation modifiers for all habitats are 1 (closed canopy) and 2 (open canopy). Modifier 3 (woodland) is only for dwarf trees.

Each of these subclasses exhibit one of three hydrologic modifiers: saturated (B), temporarily flooded (C), or permanently flooded (H).

#### *3.1.1.2.1 Broad-leaved Deciduous Shrubs (PSS1)*

This scrub-shrub habitat type is typically located on hillsides and drainages. Dominant vegetation observed within this habitat consists of: Rusty Labrador-Tea, Swamp Birch, Black Spruce, White Spruce, Sitka Alder (*Alnus viridis*), and Alpine Blueberry. Representative sample points for this habitat include: T1-1, T5-28, T27-159, T126-664, and T146-803.

#### *3.1.1.2.2 Broad-leaved Deciduous/Needle-leaved Evergreen Shrubs (PSS1/4)*

Similarly, the mixed scrub-shrub habitat type also occurs in depressions and drainages. Dominant vegetation observed within this habitat consists of: Swamp Birch, Northern Mountain Cranberry, Swollen Beaked Sedge (*Carex rostrata*), Alpine Blueberry, Black Crowberry (*Empetrum nigrum*), Rusty Labrador-Tea, Tussock Cotton-Grass (*Eriophorum vaginatum*), Cloudberry, Black Spruce, Tall Cotton-Grass (*Eriophorum angustifolium*), White Spruce, Bluejoint (*Calamagrostis Canadensis*), Willow species, Woodland Horsetail (*Equisetum sylvaticum),* Leatherleaf (*Chamaedaphne calyculata),* Field Horsetail (*Equisetum arvense*), and Running Ground-Pine (*Lycopodium clavatum*). Representative sample points for this habitat include: T2-9, T4-27, T5-34, T100-503, T123-651, T127-678, T128-684, and T143-752.

#### *3.1.1.2.3 Needle-leaved Evergreen Shrubs (PSS4)*

This habitat occurs on flat terrain at lower elevations. Dominant vegetation observed within this habitat consists of: Small Cranberry (*Vaccinium oxycoccos*), Black Spruce, Cloudberry, Rusty Labrador-Tea, and Alpine Blueberry. Representative sample points for this habitat include: T2-10, T35-193, T147-774, and T142-746.

#### *3.1.1.2.4 Broad-leaved Deciduous/Persistent Emergent Marsh (PSS1/EM1)*

The mixed broad-leaved scrub-shrub and emergent herbaceous understory is typically associated with drainages, small streams, and open-water ponds with more than 30 percent aerial vegetation cover. Dominant vegetation consists of: Willow species, Bluejoint, Northwest Territory Sedge (*Carex utriculata*), Tall Cottongrass, Black Spruce, Alpine Blueberry, Black Crowberry, Montana Sedge (*Carex media*), Purple Marshlocks (*Comarum palustre*), Sweetgale (*Myrica gale*), Swollen Beaked Sedge, Dwarf Red Raspberry (*Rubus pubescens*), Field Horsetail, and

Small Cranberry. Representative sample points for this habitat include: T3-14, T5-29, T37-207, T43-266, T109-564, T130-691, T136-731, and T146-770.

#### *3.1.1.2.5 Needle-leaved Evergreen/Persistent Emergent Marsh (PSS4/EM1)*

This needle-leaved evergreen scrub-shrub/persistent emergent marsh habitat is located sporadically as depressions within PFO habitats and as raised mounds within PEM1 habitats. Dominant vegetation observed within this habitat type consists of: Black Spruce, Alpine Blueberry, Tussock Cotton-Grass, Bog-Rosemary (*Andromeda polifolia*), Small Cranberry, Rusty Labrador-Tea, Swamp Birch, and Northern Mountain Cranberry. Representative sample points for this habitat include: T6-36, T127-673, T130-690, T144-756, and T145-762.

### *3.1.1.3 Palustrine Emergent Wetlands (PEM)*

Emergent persistent habitats are located in depressions, along stream banks, and along the fringes of open-water ponds where groundwater is above or near the surface for most of the growing season. Two Cowardin subclasses compose the emergent wetlands within the Study Area: 33 percent Emergent Persistent (PEM1) and 67 percent Emergent Persistent/Scrub-shrub (PEM1/SS1).

The Viereck classification for emergent marsh habitats is wet graminoid herbaceous (IIIA3).

Water regimes for emergent wetlands exhibit one of three hydrologic modifiers: saturated (B), temporarily flooded (C), or permanently flooded (H).

#### *3.1.1.3.1 Emergent Persistent (PEM1)*

Emergent habitats occur mainly along streams and open water ponds. Dominant vegetation observed within this habitat consists of: Alpine Blueberry, Willow species, Purple Marshlocks, Swollen Beaked Sedge, Dwarf Red Raspberry, Dwarf Birch (*Betula nana*), Tussock Cotton-Grass, Bluejoint, Black Spruce, Northwest Territory Sedge, Field Horsetail, Tall Cotton-Grass, Bog-Rosemary, and Mud Sedge (*Carex limosa).* Representative sample points for this habitat include: T2-11, T3-19, T8-49, T36-238, T41-260, T110-583, and T124-656.

#### *3.1.1.3.2 Emergent Persistent/Broad-leaved Shrubs (PEM1/SS1)*

This wetland type occurs equally along the fringes of open-water ponds and streams. Dominant vegetation observed within this habitat consists of: multiple Willow species, Dwarf Red Raspberry, and Bluejoint. Sample points taken within this habitat type include: 210 and T103-521.

### 3.1.2 Waters of the United States Habitats

The CWA's definition of "Waters of the U.S." includes wetlands. The habitats identified in this report as Waters of the U.S. are floatable water bodies per 33 CFR (Code of Federal Regulations) Part 328, Definition of Waters of the U.S. Waters of the U.S. comprise 1.6 percent of the Study Area (see Table 3). The Cowardin classifications within this habitat consist of: 1 percent Lacustrine Littoral Unconsolidated Bottom (L1UB), 13 percent Palustrine Unconsolidated Bottom (PUB), less than 1 percent Riverine Lower Perennial (R2), and 86 percent Riverine Upper Perennial (R3).

The Viereck classification does not apply to waters of the U.S., as it is designed to classify vegetation communities.

#### *3.1.2.1 Lacustrine Littoral Unconsolidated Bottom (L1UB)*

Lacustrine littoral unconsolidated bottom is characterized by areas inundated with over six inches of water and surface area larger than 20 acres. Only small portions (9.4 acres) of L1UB occur within the Study Area.

#### *3.1.2.2 Palustrine Unconsolidated Bottom (PUB)*

Palustrine unconsolidated bottoms (ponds) are areas inundated for prolonged periods during the growing season by six or more inches of water for areas less than 20 acres in size. These depressional features are geographically dispersed across the Study Area. Representative photographic points include: T8-49, T17-122, T17-124, T18-105, 181, T104-526, T104-529, T107-557, and T108-563.

#### *3.1.2.3 Riverine Lower Perennial (R2)*

Riverine lower perennials identified by aerial interpretation are streams or rivers characterized by low to moderate gradients, moderate to high sinuosity, moderate to high width/depth ratios, and substrates varying from silts to gravels.

#### *3.1.2.4 Riverine Upper Perennial (R3)*

Riverine upper perennials are streams or rivers characterized by moderate to high gradients, typically low sinuosity, low width/depth ratios, and substrates varying from organic matter to boulders. Representative photographic points include: D-5, D-10, T6-39, T11-69, T17-101, T26-178, T101-509, T109-573, and T142-775.

### 3.1.3 Upland Habitats

Upland areas comprise 39.7 percent of the Study Area (see Table 3) and are typically located at higher elevations and on steeper slopes. The Viereck classification system is used to distinguish changes in vegetation, as the Cowardin system lumps all uplands into one classification.

Forest habitats account for the majority (78.5 percent) of the uplands in the Study Area. Scrub-shrub habitats make up another 20.6 percent of the uplands. Meadow and barren habitats comprise less than 1 percent of the upland habitats in the Study Area.

#### *3.1.3.1 Upland Forest (IA, IB, and IC)*

Upland forested habitats are dominated by woody vegetation greater than meters (19.7 feet) tall, with more than 25 percent aerial cover. These habitats are located at higher elevations and exhibit increased depths to permafrost, have mineral soil, or lack soil development. This habitat contains Viereck classifications of: 85 percent needle-leaved forest (IA), 2 percent broad-leaved forest (IB), and 13 percent mixed forest (IC). This classification is further defined by the amount of aerial cover of the tree stratum: greater than 60 percent (1), between 25 to 59 percent (2), and between 10 to 24 percent (3).

IA habitats have a minimum of 10 percent aerial coverage of needle-leaved trees and are located upslope from Palustrine forests, Palustrine shrubs, and on elevated floodplains. Dominant vegetation observed within this habitat consists of: Prickly Rose (*Rosa acicularis*), Dwarf Marsh Violet (*Viola epipsila*), Willow spp., Mountain Deathcamas (*Zigadenus elegans*), Elegant Milk-

Vetch (*Astragalus eucosmus*), Small-Flower Thimbleweed (*Anemone parviflora*), Fowl Bluegrass (*Poa palustris*), Alaska Paper Birch (*Betula neoalaskana*), Steven's Meadowsweet (*Spiraea stevenii*), Interrupted Club-Moss (*Lycopodium annotinum, also known as Spinulum annotinum*), Black Spruce, Sitka Alder, Swamp Birch, Alpine Blueberry, Field Horsetail, Running Ground-Pine, Northern Mountain Cranberry, Black Crowberry, Cloudberry, Rusty Labrador-Tea, White Spruce, and Bluejoint. Sample points for this habitat include: 26, 30, 147, 208, T10-64, T27-155, T28-161, T28-186, T35-222, T100-504, T101-511, and T120-631.

IB habitats range from 10 to greater than 60 percent of broad-leaved tree stratum located on steep slopes or ridgelines. Dominant vegetation observed within this habitat consists of: Alaska Paper Birch, Black Spruce, Swamp Birch, Bluejoint, White Spruce, Alpine Blueberry, Field Horsetail, Northern Bog Club-Moss (*Lycopodium inundata),* Rusty Labrador-Tea, Cloudberry, Black Crowberry, Interrupted Club-Moss, Norway Sedge (*Carex norvegica),* Sitka Alder, Common Red Raspberry (*Rubus idaeus*), Narrow-leaf Fireweed (*Chamaenerion angustifolium),* Willow species, False Toadflax (*Geocaulon lividum*), Balsam Poplar (*Populus balsamifera*), Dwarf Red Raspberry, Larkspur-Leaf Monkshood (*Aconitum delphiniifolium*), Russet Buffalo-Berry (*Shepherdia Canadensis*), Quaking Aspen (*Populus tremuloides*), Northern Mountain Cranberry, Meadow Fescue (*Festuca pratensis*), American Twinflower (*Linnaea borealis*), and Mountain Deathcamas. Representative observation points for this habitat include: 7, 129, 169, 191, T11-67, T110-585, T110-592, T120-633, and T123-646.

IC habitats range from 10 to greater than 60 percent mixed tree stratum located upslope from Palustrine forests and Palustrine shrubs and on elevated floodplains. Dominant vegetation observed within this habitat consists of: White Spruce, Quaking Aspen, Alpine Blueberry, Northern Mountain Cranberry, Black Crowberry, False Toadflax, Rusty Labrador-Tea, Balsam Poplar, Prickly Rose, American Twinflower, Bluejoint, Dwarf Marsh Violet, Black Spruce, Swamp Birch, Willow species, and Norway Sedge. Representative observation points for this habitat include: T14-83, T21-140, T21-146, T22-127, and T22-131.

#### *3.1.3.2 Upland Scrub-shrub (IIB, IIC, and IID)*

The upland shrub habitats are dominated by woody vegetation less than six meters (19.7 feet) tall. These habitats are located where groundwater is typically greater than 12 inches beneath the

ground surface for most of the growing season. This habitat contains Viereck classifications of 50 percent tall shrub (IIB), 50 percent low shrub (IIC), and less than 1 percent dwarf shrub (IID). This classification is defined by aerial coverage of the shrub stratum being greater than 75 percent as closed (1) and as open (2) when aerial coverage is between 25 and 75 percent.

IIB habitats consist of woody vegetation greater than 1.2 meters (four feet) tall and occur in a variety of locations ranging from flat floodplains to steep slopes. Dominant vegetation observed within this habitat consists of: Willow species, Fowl Bluegrass, Purple Marshlocks, Field Horsetail, Black Spruce, Norway Sedge, Sitka Alder, Meadow Horsetail (*Equisetum pretense)*, Small-Flower Thimbleweed, Alaska Paper Birch, Black Crowberry, Alpine Blueberry, and Bluejoint. Representative observation points for this habitat include: 108, 141, T1-2, T104-531, and T107-555.

IIC habitats consist of woody vegetation ranging from 0.25 to 1.2 meters (ten inches to four feet) high in locations varying from flat floodplains to steep slopes. Dominant vegetation observed within this habitat consists of: Alpine Blueberry, Black Crowberry, Swollen Beaked Sedge, Swamp Birch, Golden-Hardhack (*Dasiphora fruticosa*), Tall Cotton-Grass, Serpent-Grass (*Bistorta vivipara*), Black Spruce, Black Crowberry, Northern Mountain Cranberry, Cloudberry, Rusty Labrador-Tea, Dwarf Red Raspberry, Bluejoint, Balsam Poplar, Willow species, Narrow-leaf Fireweed, and Woodland Horsetail. Representative observation points for this habitat include: 112, 115, 137, T4-21, T10-68, T45-247, T102-517, and T124-654.

IID habitats consist of woody vegetation less than 0.25 meters (ten inches) tall and located at higher elevations with shallow soil development. Dominant vegetation observed within this habitat consists of: Black Spruce, Swamp Birch, Alpine Blueberry, Rusty Labrador-Tea, Interrupted Club-Moss, and Norway Sedge. Representative observation points for this habitat include: 214 and T10-66.

#### *3.1.3.3 Upland Meadow (IIIA)*

This upland habitat is dominated by non-woody herbaceous vegetation. These habitats are located where groundwater is typically greater than 12 inches beneath the ground surface for most of the growing season. Dominant vegetation observed within this habitat consists of:

Bluejoint, Alpine Blueberry, Tussock Cotton-Grass, Swollen Beaked Sedge, and Common Mare's-Tail (*Hippuris vulgaris*). A representative observation point for this habitat is: T5-35.

## 3.2 Hydrologic Connection

Waters of the U.S., including wetlands, were analyzed under the USACE/USEPA June 2007 CWA Guidance, to evaluate the hydrologic connection to TNW. Based on 2012 and 2013 observations, tributaries flow throughout most of the growing season and are relatively permanent waters (RPW). Wetlands within each HUC are adjacent to these RPW, which eventually flow into a TNW.

The Study Area crosses seven hydrologic sub-basins based on eight-digit HUC boundaries (Figure 3). Half of the mapped wetlands are connected to the Kobuk River via tributaries or RPW. The remaining wetlands are connected to the Koyukuk River via tributaries or RPW. TNWs within the Study Area are the Kobuk and Koyukuk Rivers, flowing to the Arctic and Pacific Oceans respectively.

HUC hierarchy is based on common draining points:

- Alaska (19) Region

  Yukon River Basin (1904) Sub-region

  - Koyukuk River (190406) Basin

    Upper Koyukuk (19040601)

    South Fork Koyukuk (19040602)

    Alatna River (19040603)

    Allakaket (19040605)

    Koyukuk Flats (19040608)

  Northwest Basin (1905) Sub-region

  - Kobuk-Selawik Rivers (190503) Basin

    Middle Kobuk River (19050303)

    Upper Kobuk River (19050302)

## 3.3 Functions and Values Assessment

Functions performed by wetlands and waters of the U.S. are biotic (e.g., general habitat suitability, native plant species richness) and abiotic (e.g., sediment removal, nutrient and toxicant removal) processes. The value of wetland functions is based on human use of these habitats and judgment of worth, merit, quality, and importance of the processes they perform. Wetland and pond (PUB) habitats are evaluated using the *Alaska Regulatory Guidance Letter (RGL), ID No. 09-01* (USACE, 2009). Riverine habitats are evaluated using the *Technical Report 1737-15* (USDOI, 1998).

Functions and values worksheets for wetlands, ponds, and riverine habitats can be found in Appendix C.

### 3.3.1 Wetland and Pond Habitats

Wetland habitats and ponds were evaluated based on ten attributes and were rated as low, moderate, high, or not applicable (NA). Attributes include: flood flow attenuation, sediment removal, nutrient and toxicant removal, erosion control and shoreline stabilization, production of organic matter and its exports, general habitat suitability, general fish habitat, native plant species richness, education and scientific, and uniqueness and heritage.

#### *3.3.1.1 Forested Wetland Assessment*

Forested wetland habitats account for 47 percent of wetlands. Highest-rated functions provided by this habitat include: nutrient and toxicant removal, general habitat suitability, and native plant richness. The overall functional value for this habitat range is low, except in HUCs 19050303, 19050302, and 19060402, where it has been adjusted based on rarity within these HUCs ranging from moderate to high.

#### *3.3.1.2 Scrub-shrub Wetland Assessment*

Scrub-shrub wetland habitat accounts for 48 percent of wetlands. Highest-rated functions provided by this habitat include: flood flow alteration, nutrient and toxicant removal, and general habitat suitability. The overall functional value for this habitat is moderate to high, except in HUCs 19050303 and 19050302, where it is low, since it is the most common wetland type.

#### *3.3.1.3 Emergent Wetland Assessment*

Emergent wetland habitat is the least abundant (5 percent) wetland. Highest-rated functions provided by this habitat include: flood flow alteration, nutrient and toxicant removal, erosion control and shoreline stabilization, and general habitat suitability. The overall functional value for this habitat is high, due to its relative rarity, except in HUC 19050303 where it is more common and thus considered of moderate value.

#### *3.3.1.4 Pond Assessment*

Pond habitats account for 13 percent of waters of the U.S., which comprise less than 2 percent of the total Study Area. Highest-rated functions provided by this habitat include: sediment removal, nutrient and toxicant removal, erosion control and shoreline stabilization, and general habitat suitability. The overall functional value for this habitat is considered high due to its relative rarity.

### 3.3.2 Riverine Habitats

Riverine habitats were evaluated based on three attributes (hydrology, vegetation, and erosion/deposition) and were rated as proper functioning condition (PFC), functional-at risk, nonfunctional, or unknown.

#### *3.3.2.1 Riverine Upper Perennial Assessment*

Riverine upper perennial are the most common (86 percent) waters of the U.S. encountered in the Study Area. The majority of these rivers and streams are rated as PFC, except for rivers and streams located mainly along the eastern portion of the Study Area, where fires have occurred within the past five (5) years.

#### *3.3.2.2 Riverine Lower Perennial Assessment*

Riverine lower perennial are the least common (0.1 percent) waters of the U.S. These low-gradient streams have high beaver activity and are rated as PFC.

### 3.3.3 Functions and Values Modification

Wetland and riverine values are also a function of their prevalence within a HUC boundary. Waters of the U.S. (PUBH, L1UB, R2, and R3) and wetland habitats were ranked by prevalence

as abundant (≥ 50 percent), common (between 15 and 50 percent), or rare (≤ 15 percent). Wetland habitats rare in a given HUC have their functional rating increased by one classification (e.g., from low to moderate). Wetland habitats abundant in a given HUC have their functional rating decreased by one classification (e.g., from high to moderate).

# 4.0 DISCUSSION

## 4.1 Fire Effects

Fire is a natural or man-made disturbance, capable of transforming landscapes by altering chemical, biological, and/or physical processes. Common transformations observed after a fire include:

- removal of vegetation strata(s),
- loss of organic soils,
- increased depth to permafrost,
- higher soil temperatures, and
- intensified erosion.

Features most commonly disturbed by fire are key indicators used to delineate wetlands. With the removal or alteration of these indicators, a wetland could mistakenly be delineated as upland habitat, and additional care must be taken during the examination of these disturbed areas. However, once chemical, biological, and/or physical processes surpass key thresholds, the changes become permanent, and the habitat stabilizes as upland.

Based on differences between aerial mapping and field observations, potential wetland habitats affected by fire are in one of three states: initial, stabilizing, or final. In the initial state, typically zero (0) to nine (9) years after a fire, drastic shifts are observed from hydrophytic to non-hydrophytic vegetation, loss of organic soils, and depth to permafrost. During the stabilization state, typically ten (10) to nineteen (19) years after a fire, the chemical, biological, and physical processes have begun to stabilize by increasing shrub/tree stratum and/or accumulation of surface organics; however, significant features (e.g., forested areas or organic layers) may not have returned to pre-fire levels. The final state typically occurs 20 years or longer after the fire occurs. The original landscape habitat will have transitioned back to pre-fire condition, to another wetland habitat (e.g., from forested wetland to emergent), or permanently converted to an upland habitat, except for forested wetlands. Forested wetland areas have been observed to be woodlands or young forests, fifty (50) years after a fire event.

## 5.0 REFERENCES

Aero-Metric. *High-Resolution Color Aerial Photography of Proposed Corridor*. 2012.

Collet, D.M. *Willows of Southcentral Alaska*. Kenai Watershed Forum, 2002, 109 pp.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. *Classification of Wetlands and Deepwater Habitats of the United States*, FWS/OBS-79/31. Washington, D.C.: U.S. Department of the Interior, Fish and Wildlife Service, Office of Biological Services, 1979.

Hultén, E. *Flora of Alaska and Neighboring Territories: A Manual of the Vascular Plants*. Stanford, California: Stanford University Press, 1968.

Johnson, D., L.J. Kershaw, and A. MacKinnon. *Plants of the Western Boreal Forest and Aspen Parkland*. Lone Pine, 1995.

Lichvar, R.W. *The National Wetland Plant List*. Hanover, New Hampshire: Cold Regions Research and Engineering Laboratory, 2012.

Lichvar, R.W. *The National Wetland Plant List: 2013 Wetland Ratings.* Phytoneuron 2013-49: 1-241, 2013.

Munsell Color (Firm). *Soil Color Charts*, Revised Edition. Baltimore, Maryland: Kollmorgen Instruments Corporation, 2000.

Parker, C. L. *Vascular Plant Inventory of Alaska's Arctic National Parklands: Bering Land Bridge National Preserve, Cape Krusenstern National Monument, Gates of the Arctic National Park and Preserve, Kobuk Valley National Preserve, and Noatak National Preserve*. (Final Report). Fairbanks, Alaska: Arctic Network, National Park Service Alaska Region (ARCN) Inventory and Monitoring Program (I&M). Report No. NPS/AKRARCN/NRTR-2006/0I, 2006.

Pojar, J. and A. MacKinnon (eds.). *Plants of the Pacific Northwest Coast*. Vancouver, British Columbia: Lone Pine, 2004.

Pratt, V.E. *Field Guide to Alaskan Wildflowers*. Anchorage, AK: Alaskakrafts, 1989.

Tande, G., and R. Lipkin. *Wetland Sedges of Alaska*. University of Alaska Anchorage, Environment and Natural Resources Institute, Alaska Natural Heritage Program, Anchorage Alaska, 2003.

United States Army Corps of Engineers (USACE). *Alaska District Regulatory Guidance Letter* (RGL), ID No. 09-01. 2009.

United States Army Corps of Engineers (USACE). *The Highway Methodology Workbook Supplement: Wetland Functions and Values; A Descriptive Approach*, NAEEP-360-1-30a. New England District: USACE, 1999.

United States Army Corps of Engineers (USACE). *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region*, (Version 2.0). 2007.

United States Army Corps of Engineers (USACE) Environmental Laboratory. *Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-87-1. Vicksburg, Mississippi: USACE, Waterways Experiment Station, 1987.

United States Department of the Interior (USDOI) Bureau of Land Management. *Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas*, Technical Reference 1737-15. USDOI, 1998.

United States Fish and Wildlife Service (USFWS) Branch of Resource Mapping and Support. *National Wetlands Inventory*. Accessed online January 30, 2014 at http://www.fws.gov/wetlands/index.html.

United States Geological Survey (USGS). *Ambler River (A-1), Alaska Quadrangle Map*, 1:24,000, Series (Topographic). Fairbanks, Alaska: USGS, 1952.

United States Geological Survey (USGS). *Ambler River (A-2, A-3), Alaska Quadrangle Map*, 1:24,000, Series (Topographic). Fairbanks, Alaska: USGS, 1952.

United States Geological Survey (USGS). *Bettles (D-2, D-3, D-4), Alaska Quadrangle Map*, 1:24,000, Series (Topographic). Fairbanks, Alaska: USGS, 1952.

United States Geological Survey (USGS). *Hughes (D-2, D-3, D-4), Alaska Quadrangle Map*, 1:24,000, Series (Topographic). Fairbanks, Alaska: USGS, 1952.

United States Geological Survey (USGS). *Survey Pass (A-1 through A-6), Alaska Quadrangle Map*, 1:24,000, Series (Topographic). Fairbanks, Alaska: USGS, 1952.

United States Geological Survey (USGS). *Wiseman (A-4, A-5, A-6), Alaska Quadrangle Map*, 1:24,000, Series (Topographic). Fairbanks, Alaska: USGS, 1952.

Utah State University. Utah Climate Center. *Bettles Airport, Alaska*: Accessed online January 23, 2014 at http://climate.usurf.usu.edu/reports/por_pcpn.php?stn=USW00026533&unit=EN&network=direct:ghcn&sidebar=0

Utah State University. Utah Climate Center. *Wiseman, Alaska*: Accessed online January 23, 2014 at http://climate.usurf.usu.edu/reports/por_pcpn.php?stn=USC00509869&unit=EN&network=direct:ghcn&sidebar=0

Viereck, L.A. and E.L. Little. *Alaska Trees and Shrubs*, Second Edition. Fairbanks, Alaska: University of Alaska Press, 2007.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. *The Alaska Vegetation Classification*. Gen. Tech. Rep. PNW-GTR-286. Portland, Oregon: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, 1992, 278 pp.

Western Regional Climate Center. *National Climatic Data Center (NCDC) 1981-2010 Monthly Normals.* Bettles Federal Aviation Administration Airport (500761), Alaska: Accessed online January 23, 2014 at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak0761

Western Regional Climate Center. *National Climatic Data Center (NCDC) 1981-2010 Monthly Normals*. Wiseman (509869), Alaska: Accessed online January 23, 2014 at http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?ak9869