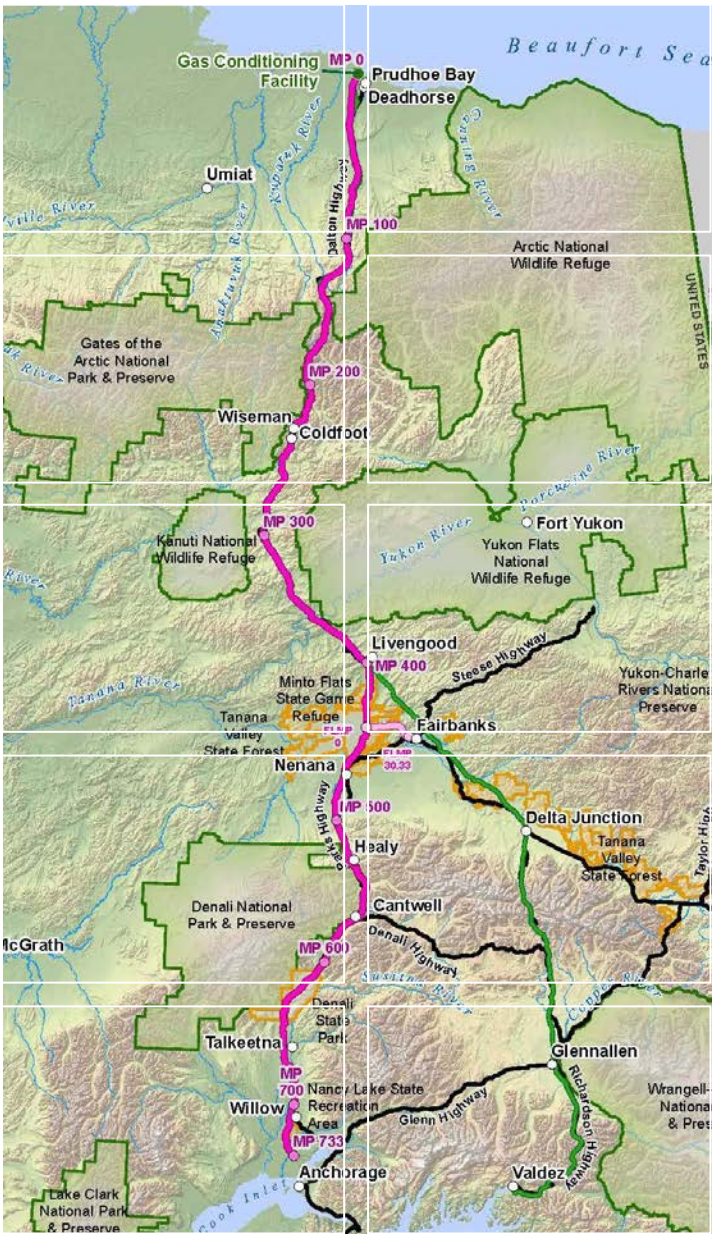




Prepared for:

US Army Corps of Engineers
Alaska District

Alaska Stand Alone Pipeline Project

Final Supplemental Environmental Impact Statement

Chapter 3: Affected Environment

June 2018

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Alaska Stand Alone Pipeline Project

Final Supplemental Environmental Impact Statement

Chapter 3: Affected Environment

June 2018

United States Army Corps of Engineers, Alaska District

In Cooperation with:

U.S. Bureau of Land Management
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration
U.S. National Park Service
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
Alaska Department of Natural Resources, State Pipeline Coordinator's Section

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ACRONYMS & ABBREVIATIONS

-..... not applicable
$..... Dollar
%..... percent
°C ..... Degrees Celsius
°F ..... Degrees Fahrenheit
µ..... micron
µbar..... microbar
µg/L..... micrograms per liter
µS/cm..... micro-Siemens per centimeter
AAC..... Alaska Administrative Code
AAAQS ..... Alaska Ambient Air Quality Standards
ACCS..... Alaska Center for Conservation Science
ACEC..... Areas of Critical Environmental Concern
ACP..... Arctic Coastal Plain
ACS..... American Community Survey
ADCCED..... Alaska Department of Commerce and Community Economic Development
ADEC ..... Alaska Department of Environmental Conservation
ADF&G ..... Alaska Department of Fish and Game
ADHSS ..... Alaska Department of Health and Social Services
ADNR..... Alaska Department of Natural Resources
ADOLWD ..... Alaska Department of Labor and Workforce Development
ADOT&PF ..... Alaska Department of Transportation and Public Facilities
AEIC ..... Alaska Earthquake Information Center
AES ..... ASRC Energy Services Alaska, Inc.
AFFID..... Alaska Freshwater Fisheries Index Database
AFS..... Air Force Station
AGDC..... Alaska Gasline Development Corporation
AHRS..... Alaska Heritage Resource Survey
AIDS ..... acquired immunodeficiency syndrome
AKEPIC ..... Alaska Exotic Plant Information Clearinghouse
AKNHP..... Alaska Natural Heritage Program
AMS..... American Meteorological Society
ANCSA ..... Alaska Native Claims Settlement Act
ANILCA..... Alaska National Interest Lands Conservation Act
ANHA ..... Alaska Natural History Association
ANS ..... Aquatic Nuisance Species
ANTHC..... Alaska Native Tribal Health Consortium
AOU..... American Ornithologists' Union
APA ..... Alaska Power Authority

APDES..... Alaska Pollutant Discharge Elimination System
APSC ..... Alyeska Pipeline Services Company
AP&T..... Alaska Power and Telephone Company
AQRV ..... air quality related values
ARRC..... Alaska Railroad Corporation
AS..... Alaska Statute
ASAMM ..... Aerial Surveys of Arctic Marine Mammals
ASAP ..... Alaska Stand Alone Pipeline
ASTt..... Arctic Small Tool tradition
ATDP..... Alaska Traditional Diet Project
ATV ..... All-terrain vehicles
AWC..... Anadromous Waters Catalog
ANWR..... Arctic National Wildlife Refuge
BACT ..... Best Available Control Technology
BART ..... Best Available Retrofit Technology
BCR..... Bird Conservation Region
BEA..... U.S. Bureau of Economic Analysis
BGEPA ..... Bald and Golden Eagle Protection Act
bgs..... below ground surface
BIA..... Bureau of Indian Affairs
BLM ..... Bureau of Land Management
BLMRB ..... Big Lake Maintenance and Response Base
BLS..... U.S. Bureau of Labor Statistics.
BOEM ..... Bureau of Ocean Energy Management
BPXA ..... BP Exploration (Alaska), Inc.
BTU..... British thermal unit
C ..... Carbon
CAA..... Clean Air Act
CAAA..... Clean Air Act Amendments
CAM ..... Compliance Assurance Monitoring
CCP..... Comprehensive Conservation Plan
CDC ..... Center of Disease Control
CDP..... census designated place
CERCLA..... Comprehensive Environmental Response, Compensation & Liability Act
CEQ..... Council on Environmental Quality
CFR ..... Code of Federal Regulations
cfs ..... cubic feet per second
CGF..... Central Gas Facility
CH_4..... methane
CHC..... Community Health Center
CMS ..... Continuous Monitoring System
CNG..... Compressed Natural Gas
CO..... Carbon Monoxide

CO_2..... Carbon Dioxide
CO_2-e ..... Carbon Dioxide Equivalent
CPM..... Continuous Parameter Monitor
CRMP ..... Cultural Resources Management Plan
CSESP ..... Chukchi Sea Environmental Studies Program
CSIS..... Community Subsistence Information System
CSU ..... Conservation System Unit
CT..... Census Tract
CWA ..... Clean Water Act
CWMP..... Comprehensive Waste Management Plan
CWS..... community water system
CY ..... Cubic yard
DA Application..... Department of the Army Application for Permit
DEW ..... Distant Early Warning
DH..... Dock Head
DHRMA..... Dalton Highway Recreation Management Area
DO..... dissolved oxygen
DOD..... U.S. Department of Defense
DOI ..... U.S. Department of the Interior
DPS ..... Distinct Population Segment
DWPP..... Drinking Water Protection Program
EED..... Environmental Evaluation Document
EFH..... Essential Fish Habitat
EIA ..... U.S. Energy Information Administration
EIS..... Environmental Impact Statement
ENP..... Eastern North Pacific
ENSTAR..... ENSTAR Natural Gas Company
EO ..... Executive Order
EPA..... U.S. Environmental Protection Agency
ESA ..... Endangered Species Act
ESMU..... Eastside Susitna Management Unit
ETT..... Enforcement Targeting Tool
Exxon..... ExxonMobil Production Company
FAA ..... Federal Aviation Administration
FC..... fecal coliform
FEIS..... Final Environmental Impact Statement
FEMA ..... Federal Emergency Management Agency
FERC..... Federal Energy Regulatory Commission
FLPMA..... Federal Land Policy and Management Act
Fluor ..... Fluor Corporation
FNG ..... Fairbanks Natural Gas, LLC
FNSB..... Fairbanks North Star Borough
FR..... Federal Register

FTA ..... Federal Transit Administration
FTE..... Full-time Equivalent
gal..... gallon
GCF..... Gas Conditioning Facility
GDF..... gasoline dispensing facility
GHG..... Greenhouse Gas
GIS ..... Geographic Information System
GMU ..... Game Management Unit
GP ..... General Permit
GVEA ..... Golden Valley Electric Association
H_2O ..... water
HAP ..... Hazardous Air Pollutant
HC..... Hydrocarbon
HCV..... hepatitis C virus
HDD ..... Horizontal Directional Drilling
HEA ..... Homer Electric Association
HEC ..... Health Effects Category
HGM..... Hydrogeomorphic
HIA ..... health impact assessment
HIV ..... human immunodeficiency virus
HPOI..... hydrologic point of interest
HPSA ..... health professional shortage area
HRSA..... Health Resources and Services Administration
HUC..... Hydrologic Unit Code
Hz..... hertz
IAI ..... Impact Assessment Inc.
IBA ..... Important Bird Area
ID ..... Identification
IGU ..... Interior Gas Utility
IHLC..... Iñupiat History Language and Culture
ILI..... in-line inspection
INHT ..... Iditarod National Historic Trail
IPCC..... Intergovernmental Panel on Climate Change
IUCN ..... International Union for Conservation of Nature
IWC..... International Whaling Commission
km ..... kilometer
KOP ..... key observation point
kW..... kilowatt
kWh ..... kilowatt-hour
Lat. ..... Latitude
LDN ..... day-night average sound level
$L_{EQ(24)}$..... 24-hour equivalent continuous level
Long..... Longitude

Lower 48..... Lower Continental 48 U.S. States
LNG ..... liquefied natural gas
LPG ..... Liquefied Petroleum Gas
LWCF ..... Land and Water Conservation Fund
m ..... meters
MACT..... Maximum Achievable Control Technology
Mat-Su ..... Matanuska-Susitna
Max ..... maximum
MBTA ..... Migratory Bird Treaty Act
MEA..... Matanuska Electric Association
MG/day ..... million gallons per day
mg/L ..... milligrams per liter
mi. ..... mile
mi^2 ..... square miles
min..... minimum
mL ..... milliliters
ML&P ..... Municipal Light and Power
MLLW ..... mean lower low water
MLV..... Mainline valves
MMBTU ..... million British thermal units
MMBTU/hr ... million British thermal units per hour
MMPA..... Marine Mammal Protection Act
MMS ..... Mineral Management Services
MOA..... Memorandum of Agreement
MP..... Mile Post
MSFCMA ..... Magnuson-Stevens Fish Conservation and Management Act
mtDNA..... mitochondrial DNA
MUA ..... medically underserved area
MUP..... medically underserved population
MW ..... megawatt
N..... Nitrogen
N_2O ..... nitrous oxide
NAAQS..... National Ambient Air Quality Standards
NAM..... No Adverse Modification
NCIMA..... Northern Cook Inlet Management Area
NEPA..... National Environmental Policy Act
NESHAP ..... National Emission Standards for Hazardous Air Pollutants
NGL ..... Natural Gas Liquids
NGLEP ..... Natural Gas Liquid Extraction Plant
NHD ..... National Hydrography Dataset
NIDCD ..... National Institute on Deafness and Communication Disorder
NIHL..... noise-induced hearing loss
NLAA..... Not Likely to Adversely Affect

NLAM ..... Not Likely to Adversely Modify
NLCD ..... National Land Cover Dataset
NLJE ..... Not Likely to Jeopardize Existence
N/m² ..... Newtons per square meter
NMFS..... National Marine Fisheries Service
No. ..... Number
NOA ..... Notice of Availability
NOAA ..... National Oceanic and Atmospheric Administration
NOx ..... nitrogen oxides
NPFMC ..... North Pacific Fishery Management Council
NPP..... National Park and Preserve
NPR-A ..... National Petroleum Reserve - Alaska
NPS ..... National Park Service
NRA..... National Recreation Area
NRHP ..... National Register of Historic Places
NSB ..... North Slope Borough
NSPS..... New Source Performance Standard
NSR..... New Source Review
NTNCWS..... Non-Transient Non Community Water System
NTU ..... nephelometric turbidity units
NWI ..... National Wetlands Inventory
NWR..... National Wildlife Refuge
NWT ..... Northwest Territory
OC..... organochlorine compound
O&M..... Operations and Maintenance
Off-ROW ..... off right-of-way
OHA ..... Office History and Archaeology
OHV..... off-highway vehicle
Owl Ridge..... Owl Ridge Natural Resource Consultants, Inc.
P..... phosphorus
PA ..... Programmatic Agreement
PAC..... potentially affected community
PBU..... Prudhoe Bay Unit
PCB ..... polychlorinated biphenyls
PCE ..... power cost equalization
PEM ..... palustrine emergent wetland
PFO ..... palustrine forested wetland
pH ..... measure of the acidity or alkalinity of a solution
PHMSA ..... Pipeline and Hazardous Materials Safety Administration
pig ..... Pig refers to a pipeline inspection gage
PJD ..... Preliminary Jurisdictional Determination
P.L. ..... Public Law
PM..... Particulate Matter

PM_{10} ..... Particulate Matter of 10 µ in diameter or smaller
$PM_{2.5}$..... Particulate Matter of 2.5 µ in diameter or smaller
POP..... persistent organic pollutant
ppb..... parts per billion
ppm..... parts per million
PSD ..... Prevention of Significant Deterioration
psig ..... pound per square inch gauge
PSS ..... palustrine shrub wetland
PSY..... pipe storage yard
Pt. ..... Point
Pt-Co..... platinum cobalt units
PWS ..... Prince William Sound
RAC ..... Russian-American Company
REAA..... Regional Educational Attendance Area
RMP ..... Resource Management Plan
RNA..... Research Natural Areas
ROW ..... right-of-way
RS ..... Revised Statute
s/tons ..... short tons
SB ..... Southern Beaufort Sea
SCORP..... Statewide Comprehensive Outdoor Recreation Plan
SDH ..... Social Determinants of Health
SDWA..... Safe Drinking Water Act
SEIS..... Supplemental Environmental Impact Statement
SHPO..... State Historic Preservation Officer
SIP ..... State Implementation Plan
SMAP..... Susitna Matanuska Area Plan
SO_2 ..... Sulfur Dioxide
SPL..... sound pressure level
spp. ..... several species
SpUD ..... Special Use District
SRA ..... State Recreation Area
SRB&A..... Stephen R. Braund & Associates
SRMA ..... Special Recreation Management Area
ssp. ..... Subspecies
STB..... Surface Transportation Board
STP ..... Seawater Treatment Plant
stpy ..... short tons per year
s.u. ..... standard units
TAH..... petroleum hydrocarbon
TAPS..... Trans-Alaska Pipeline System
TB ..... tuberculosis
TCC..... Tanana Chiefs' Conference

TDS ..... total dissolved solids
Temp..... Temperature
TLUI..... Traditional Land Use Inventory
TMDL ..... total maximum daily load
TNCWS ..... Transient Non Community Water System
TPY ..... tons per year
TSS ..... total suspended solids
UNFCCC..... United Nations Framework Convention on Climate Change
UA..... University of Alaska
UAF ..... University of Alaska Fairbanks
U.S..... United States
USACE ..... U.S. Army Corps of Engineers
U.S.C. ..... U.S. Code
USCG..... U.S. Coast Guard
USDA..... U.S. Department of Agriculture
USDOT ..... U.S. Department of Transportation
USFS ..... U.S. Forest Service
USFWS ..... U.S. Fish and Wildlife Service
USGS..... U.S. Geological Survey
VdB ..... vibration decibels
VOC ..... volatile organic compound
VRM..... Visual Resource Management
WELTS..... Well Log Tracking System
WERC ..... Water and Environmental Research Center
WNP ..... Western North Pacific
WQS..... Water Quality Standards

3. AFFECTED ENVIRONMENT

3.1. Introduction

As noted in Chapter 1, Purpose and Need, this Supplemental Environmental Impact Statement (SEIS) focuses on the changes between the current proposed Alaska Stand Alone Pipeline (ASAP) Project (collectively referred to as the "Project") and the previous alignment presented in the 2012 Final Environmental Impact Statement (FEIS) (United States [U.S.] Army Corps of Engineers [USACE], 2012a). To avoid repetition, this chapter summarizes the description of the physical, biological, and socioeconomic environment within the entire proposed Project Area, incorporating by reference the previous analysis. The following sections describe in detail those resources that may be affected by the new alignment for the proposed Project.

The information in this chapter provides the baseline for the assessment of impacts of the three alternatives (including the proposed Project) described in Chapter 4, Environmental Consequences.

3.2. Soils & Geology

3.2.1. Introduction

This section describes the soils and geology encountered in the proposed Project Area. It also describes some of the geomorphic processes that would affect, and be affected by the proposed Project. The description of soil and geologic resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data presented in the Environmental Evaluation Document (EED) (Alaska Gasline Development Corporation [AGDC], 2016b) as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

Significant changes and refinements have been proposed that have the potential to impact soil and geologic resources. Much of the information provided in the 2012 FEIS was preliminary, and in many cases, current estimates have been revised due to Project refinement rather than significant Project changes, which include:

- Winter dredging of a navigation channel and turn basin at West Dock;
- Nearshore disposal of dredge material on bottomfast sea ice;
- The surface layer (a thin layer that typically consists of a combination of loose surficial herbaceous material containing small shrubs, vegetation, and woody debris, overlaying a thin organics layer and weak, compressible mineral soils) to be segregated and replaced in select select areas, consistent with the AGDC planning document, *Segregation of the Surface Layer* (AGDC 2017g);
- Increase in the volume of required fill from 13.1 million cubic yards to 25 million cubic yards needed from gravel sources as a result of Project refinement;

- Decrease from 546 potential borrow sources to 91 borrow sources, including 89 new sites and two existing sites (5,200 acres of land total); and
- Increase from 133 access roads to 298 new access roads totaling 174.4 miles.

The diameter of the pipe is proposed to increase from 24 inches to 36 inches. This results in deeper, wider trenches and a large increase in the amount of material to be handled. Overall, the proposed Project footprint is expected to increase from 4,100 acres of permanent impacts and 10,900 acres of temporary impacts originally presented in the 2012 FEIS, to more than 21,493 acres of total impacts. This includes approximately 9,705 acres of impacted wetlands and 11,788 acres of impacted uplands. Impacted wetlands would include approximately 8,015 acres of permanent impact and 1,690 acres of temporary impact.

This section focuses on ecoregions and geomorphic processes. Since the proposed Project route traverses a wide variety of terrain and soil types, land features are presented in the context of ecoregions. Ecoregions are defined as ecologically distinct areas based on climate, terrain, soils, and vegetation. Each of the nine ecoregions crossed by the proposed pipeline route is discussed in Section 3.2.3, Ecoregions.

A variety of geomorphic processes and resulting terrain features are encountered in the proposed Project Area, including mass wasting; permafrost degradation/aggradation and frost action; seismicity; and glacial, fluvial, and coastal processes. These processes and features are discussed in Section 3.2.4, Geomorphic Processes. Pipeline construction and pipeline operations and maintenance would be impacted by soil and geomorphic processes present. However, the impacts that pipeline construction and operation and maintenance would have on soil and geomorphic processes are equally important.

Paleontological resources are present in the proposed construction area. These resources are discussed in Section 3.2.5, Paleontological Resources.

A number of definitions are useful in describing the natural environment along the proposed pipeline route:

- **Aufeis:** A surface ice mass formed during the winter by successive freezing of sheets of water that may seep from the ground, or from a spring or river (Neuendorf *et al.,* 2005).
- **Frost-susceptible soil:** Soil that contains sufficient fine particles to promote capillary flow. Such soil can retain sufficient water resulting in the formation of ice lenses and frost heaving during repeated freeze thaw cycles.
- **Permafrost:** Any soil, subsoil, or other surficial deposit, or even bedrock, in which a temperature below freezing has existed continuously for two years or longer (Neuendorf *et al.,* 2005).
- **Gelifluction:** The progressive downslope flow of earth material in an area that is subject to intense freezing cycles and exhibits permafrost weathering and erosion

characteristics (Neuendorf *et al.,* 2005); can occur on slope angles of less than half a degree.

- **Liquefaction:** The transformation of saturated, cohesionless soil from a solid to a liquid state as a result of increased pore pressure and reduced effective stress (in response to severe ground shaking resulting from an earthquake) (Neuendorf *et al.,* 2005).
- **Retrogressive thaw:** A slope failure or slump resulting from thawing of ice-rich permafrost (Neuendorf *et al.,* 2005).
- **Solifluction:** The slow viscous downslope flow of waterlogged soil; the flow occurs in areas underlain by frozen ground (not necessarily permafrost) that acts as a downward barrier to water percolation, initiated by frost action and augmented by meltwater resulting from alternate freezing and thawing of snow and ground ice (Neuendorf *et al.,* 2005).
- **Thaw-susceptible soil:** Frozen ground that loses its structural integrity when it thaws.

3.2.2. Summary

The proposed Project includes construction and operation of a 36-inch pipeline over a route extending approximately 733 miles (mi) from Alaska's North Slope to existing natural gas distribution infrastructure in Southcentral Alaska. The proposed Project route crosses nine of the 32 Alaska ecoregions, as defined by Nowacki *et al.,* (2001). Soils and vegetative covers tend to be similar within an ecoregion. As a result, the proposed pipeline would encounter significant differences in soil and geology along its length.

Of particular concern to the proposed ASAP Project is the interaction between the pipeline, pipeline construction activities, and the frozen (or unfrozen) condition of the soil. Pipeline design would need to address a number of other geomorphic process including mass wasting; potential seismic events; and glacial, fluvial, and coastal processes.

Construction would include excavation of a trench 6 to 8 feet deep along the pipeline corridor. In accordance with 49 Code of Federal Regulation (CFR) 192.327(a), the proposed pipeline would typically be buried with a minimum cover of 30 inches of "normal soil" or 18 inches of consolidated rock. The active zone is defined as those soils located above permafrost, which freeze and thaw annually.

3.2.3. Ecoregions

Ecoregions in Alaska were defined through an interagency, multidisciplinary approach for mapping and managing Alaska's natural resources at the landscape level. The development of ecoregions required a cooperative consensus between the U.S. Forest Service (USFS), U.S. National Park Service (NPS), U.S. Geological Survey (USGS), The Nature Conservancy, and many other agencies and private organizations. Ecoregion

units are delineated along gradients of climate, vegetation, and disturbance processes (Gallant *et al.,* 1995). USGS has delineated 32 ecoregions in the state of Alaska (Nowacki *et al.,* 2001). These regions have distinctive geology and receive generally uniform solar radiation and moisture. Nine of these ecoregions are traversed by the proposed Project (Figure 3.2-1). Because the ecoregions trend east to west (based on the angle of insolation and similar climate) and the proposed pipeline route transverses north to south, the route would encounter significant differences in soil and geologic properties along its length.

M:\Projects\0255086 ASAP Wetlands Review CONFIDENTIAL\maps\FEIS 2018\Fig_3-2-1_Ecoregions.mxd

Beaufort Sea

BEAUFORT COASTAL PLAIN

Deadhorse

Umiat

BROOKS FOOTHILLS

BROOKS RANGE

DAVIDSON MOUNTAINS

U.S.A.

CANADA

BROOKS RANGE

Wiseman

KOBUK RIDGES AND VALLEYS

Bettles

YUKON-OLD CROW BASIN

Stevens Village

RAY MOUNTAINS

YUKON RIVER LOWLANDS

Livengood

Rampart

Chena Hot Springs

Minto

Tanana

Fox

YUKON-TANANA UPLANDS

Fairbanks

Anderson

Big Delta

Healy

KUSKOKWIM MOUNTAINS

McKinley Park

Cantwell

TANANA-KUSKOKWIM LOWLANDS

Nikolai

ALASKA RANGE

Talkeetna

COPPER RIVER BASIN

COOK INLET BASIN

Chickaloon

Willow

Susitna

Big Lake

Anchorage

City
ASAP v6.1 Mainline
FBX v4.1 Lateral
International Border
Intermontaine Boreal
Alaska Range Transition
Pacific Mountains Transition
Arctic Tundra

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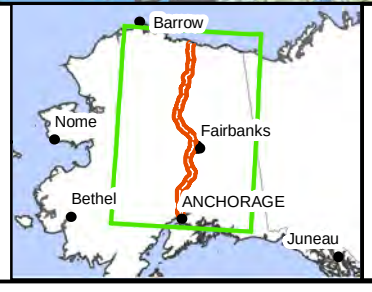
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CHKD: S.W.
DRWN: J.S.V.
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Figure 3.2-1: ALASKA STAND ALONE PIPELINE ECOREGIONS

0 25 50 100 150 Miles



N

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Table 3.2-1 shows the starting and ending Mile Posts (MPs) for where the proposed pipeline would enter and leave each ecoregion. The table also presents the length of pipeline percentage in each ecoregion. The Gas Conditioning Facility (GCF) would be located in the Beaufort Sea Coastal Plain Ecoregion. The Denali National Park and Preserve (NPP) Route Variation (Alternative 2) would be located in the Alaska Range Ecoregion. The Fairbanks Lateral would be located entirely within the Yukon-Tanana Uplands Ecoregion.

Table 3.2-1 Alaska Ecoregions and the Alaska Stand Alone Pipeline

Ecoregion [a]	Starting Mile Post	Ending Mile Post	Length (mi)	Percent (%)
Beaufort Coastal Plain	0.0	61.5	61.5	8%
Brooks Foothills	61.5	142.9	81	11%
Brooks Range	142.9	251.3	108	15%
Kobuk Ridges and Valleys	251.3	256.5	5	1%
Ray Mountains	256.5	428.8	172	23%
Tanana-Kuskokwim Lowlands	428.8	441.3	13	2%
Yukon-Tanana Uplands	441.3	453.5	12	2%
Tanana-Kuskokwim Lowlands	453.5	514.9	61	8%
Alaska Range	514.9	613.9	99	13%
Cook Inlet Basin	613.9	733.5	120	16%
Totals			**733.5**	**100%**

a Ecoregions of Alaska (Nowacki *et al.,* 2001)

The proposed pipeline route does not pass near prime farmland, prime forestland, or prime rangeland soils. In addition, no soils designated as unique farmlands or farmlands of statewide importance have been designated in Alaska.

The portion of the Beaufort Sea that would be impacted by the proposed Project is described in the next subsection. Each ecoregion traversed by the proposed pipeline is described in subsequent subsections, presented from north to south as shown in Table 3.2-1.

3.2.3.1. Dredge and Disposal Areas in the Beaufort Sea

Nearshore dredging at West Dock and disposal of dredged material in Prudhoe Bay are new elements of the proposed Project that were not assessed in the 2012 FEIS (USACE, 2012a). Water depths within the nearshore areas of Prudhoe Bay are relatively shallow and range from approximately 2 feet to 8 feet (based on mean lower low water [MLLW]). Due to the shallow depths, dredging is proposed in order to accommodate access to West Dock for offloading of Project modules.

Stump Island, part of the Return Island group, lies just west of West Dock and is a barrier island approximately 2 miles long (National Oceanic and Atmospheric Administration [NOAA], 2015a). Gwydyr Bay lies between the Return Islands and the mainland. Gwydyr Bay generally has depths of 3 to 5 feet, but "there is little water" at the east end of the bay (NOAA, 2015a). Prudhoe Bay has shoals across most of its entrance; the bay proper has depths of 6 to 9 feet.

The tidal range throughout this area is very low, approximately 0.6 feet. Currents in this area "are irregular and unpredictable but seem to be caused mostly by winds and moving ice" (NOAA, 2015a).

The physical composition of the seafloor substrate in the general vicinity of the proposed dredging was assessed during a vibracore sampling effort conducted in 2011. Although sediment types vary somewhat by location, silty fine SAND and sandy SILT are typical materials found in the area (AGDC, 2016b).

The proposed dredging would require removal of approximately 250,000 cubic yards (CYs) of material from the navigational channel leading into West Dock, to a water depth of 9 feet below MLLW. Dredging would be conducted over an area approximately 500 feet wide by 5,400 feet long. Dredge spoils would be disposed in 1-foot to 2-foot piles over a 100-acre area in southern Prudhoe Bay. Additional information on proposed dredging activities is available in the ASAP West Dock Dredge and Disposal Plan (AGDC, 2016o).

3.2.3.2. Beaufort Coastal Plain Ecoregion

Over the first 62 miles of the pipeline, the Beaufort Coastal Plain Ecoregion rises gradually from sea level to an elevation of approximately 500 feet above mean sea level. Massive ground ice is widespread throughout the area, appearing as vertical wedges, films, lenses, pore-fillings, and segregated masses. The dominant surface soils in the Beaufort Coastal Plain consist of 8 to 12 inches of ice-rich organic silt, which overlays permafrost. Coarse sands and gravels are present in shallow soils along historic flood plains, such as the Sagavanirktok River, and are generally found to lie deeper in other areas (Alyeska Pipeline Services Company [APSC], 2007). This area is characterized by a network of polygonal ground features created by freeze and thaw cycles impacting the active layer. Numerous thermokarst lakes (thaw lakes) have also been formed by permafrost processes. Shallow thaw bulbs may be present beneath active river channels and lakes at depths greater than 6 feet (Kreig and Reger, 1982).

Within this ecoregion, the proposed pipeline would run parallel to the Sagavanirktok River, which grades from a braided river system to a meandering channel as it flows north toward the Beaufort Sea. The braided nature of the river channels reflects the availability of abundant bedload and the highly seasonal discharge regime. During summer, the gradual melt of snowbanks provides moisture for mass wasting (solifluction) to occur on slopes (French, 2007). Sheet ice from successive stream bank overflows is present on various sections of the floodplain during winter (APSC, 2007) and can persist into the summer in many areas.

The Beaufort Coastal Plain Ecoregion is underlain by thick, continuous permafrost, with an average temperature of less than 19 degree Fahrenheit (°F) (Brown *et al.,* 1997; Ferrians, 1965). Most of the North Slope belongs to the continuous permafrost zone with a thickness greater than 200 meters, and can reach maximum depths more than 600 meters in Prudhoe Bay (USACE, 2012a).

3.2.3.3. Brooks Foothills Ecoregion

The Brooks Foothills Ecoregion features glacial moraines composed primarily of coarse-grained till covered with loess, extensive glacial outwash deposits, and low-elevation bedrock landforms (U.S. Bureau of Land Management [BLM] and Alaska Natural History Association [ANHA], 1993). The proposed Project Area in this ecoregion is drained primarily by the north-flowing Sagavanirktok River, which is characterized by a braided river system. Sedimentary rock outcrops are exposed to form elevated bluffs along the flanks of the river.

Upland depressions are partially filled with ice-rich peat and organic-rich slope wash deposits. The Brooks Foothills are underlain by continuous permafrost, with an average temperature of less than 19°F (Brown *et al.,* 1997). Although exact thickness of the permafrost is uncertain, records from other parts of the northern Brooks Range and Arctic Foothills (for example, Ferrians, 1965) suggest that its base probably occurs between 490 and 820 feet in depth (Hamilton, 2003). Massive ground ice, up to 50 percent by volume (Kreig and Reger, 1982), is common in the tills of this region. Near-surface permafrost promotes solifluction. Solifluction and gelifluction are widespread in the Brooks Foothills Ecoregion. Solifluction is most active during spring and early summer when the active layer generally is saturated with moisture released by thawing that remains confined above the surface of impermeable frozen ground. Movement rates up to 2 inches per year are common, but more rapid rates up to 4 or even 6 inches per year have been recorded on some solifluction slopes (Hamilton, 2003). Permafrost free zones or thaw bulbs are likely to occur only beneath waterbodies with depths greater than 6 feet (French, 2007). In the floodplain of the Sagavanirktok River continuous permafrost is present adjacent to the active channel.

Aufeis may accumulate during freeze-up and in winter. In shallow braided streams, small icing mounds, 3 to 10 feet high, may develop in response to localized restrictions of flow by ice freezing to the bed of the braid bars (French, 2007). Aufeis can also occur on major drainages.

3.2.3.4. Brooks Range Ecoregion

The Brooks Range Ecoregion is comprised of rugged, formerly heavily glaciated, east-west trending mountains rising from the Brooks Foothills to elevations ranging from 4,000 to 8,000 feet (Wahrhaftig, 1965). In crossing the Brooks Range, the proposed pipeline would reach its maximum elevation of approximately 4,800 feet above mean sea level at Atigun Pass.

Erosional landforms associated with former alpine glaciers, such as cirques and U-shaped valleys, are common throughout the Brooks Range. Talus slopes, alluvial fans, moraines, and outwash fans are well developed at the bases of valleys and cirques. Drainages in the north Brooks Range discharge through the Sagavanirktok River to the Arctic Ocean; drainages in the south discharge to the Bering Sea via the Atigun and Dietrich rivers.

Bedrock in the Brooks Range includes folded and thrusted sedimentary rocks (exposed in the northern flank of the range), deformed metamorphic rocks (in the central and southern Brooks Range) (Moore *et al.,* 1994). Surficial deposits of the Brooks Range are fluvial, lacustrine, alluvial, glacial, and glaciofluvial sediments (Hamilton, 2003).

Coarse-grained sands and gravels underlie the Atigun River and Dietrich River valleys within the proposed Project Area. Windblown silts and sands are present in the Atigun River floodplain (Kreig and Reger, 1982). Near the toes of steep-sloped alluvial fans, moraines, talus, and unsorted, coarse to very-coarse sediments are common. In previously scoured glacial basins (*e.g.*, Galbraith Lake), lacustrine silt and clay may overlie coarse-grained glaciofluvial and glacial deposits.

The Brooks Range is underlain predominantly by continuous permafrost that has an average temperature of 19°F to 27°F (Brown *et al.,* 1997). Ground ice contents vary from up to 15 percent ice in fluvial silts and sands, to 25 to 95 percent ice in lacustrine silts and clays near Galbraith Lake. In river valleys, vegetated areas of moraine, fan, and alluvial deposits are continuously frozen from the base of the active layer to more than 50 feet below ground surface in the northern Brooks Range (Kreig and Reger, 1982). Permafrost depth trends from north (deeper) to south (shallower). Due to seasonal variations and the heat from water within river channels, permafrost can be discontinuous within the alluvium underlying major active rivers (Ferrians, 1965; Kreig and Reger, 1982).

3.2.3.5. Kobuk Ridges and Valleys Ecoregion

The Kobuk Ridges and Valleys Ecoregion consists of low ridges and lowlands south of the Brooks Range (Wahrhaftig, 1965). The proposed Project Area follows the floodplain of the Middle Fork Koyukuk River These lowlands are underlain by unconsolidated sediments. Igneous rocks (both extrusive and intrusive) are exposed at the surface of ridges (BLM and ANHA, 1993). Coarse-grained glacial and glaciofluvial sediments are distributed near the main channels of the Middle and South Fork Koyukuk rivers. Away from the channels, soils consist of fine-grained silt and clay of aeolian and lacustrine origins that overlie coarse-grained glacial tills (Hamilton, 1994). Thaw lakes are well developed in the silt of the lowlands between the Middle and South Fork Koyukuk rivers.

This ecoregion is underlain by discontinuous permafrost with an average temperature of 27°F to 30°F (Brown *et al.,* 1997). The proposed Project Area within the Kobuk Ridges and Valleys Ecoregion is primarily within a continuous permafrost zone.

3.2.3.6. Ray Mountains Ecoregion

The Ray Mountains Ecoregion consists of rounded hills rising from 2,000 to 4,000 feet and extends to the Hess River, marking the location of the Rampart Trough (Wahrhaftig, 1965). The Ray Mountains supported glaciers in the past, but are now completely unglaciated. Unconsolidated surface deposits are principally colluvial and aeolian in

origin. The northern portions of the Ray Mountains are composed primarily of metamorphic rock, with some igneous intrusions present (BLM and ANHA, 1993).

South of the Rampart Trough, to the Tanana River, the Yukon-Tanana Uplands are characterized by rounded hills with gentle-sided slopes. Where the proposed pipeline would cross the Ray Mountains, elevations generally range from about 400 feet to about 2,200 feet. The proposed pipeline would cross perpendicular to the valleys and ridgelines, resulting in significant changes in elevations over short distances. The valleys are generally a quarter-mile to half-mile wide and contain alluvium (APSC, 2007).

Most streams in this area are tributaries of the Yukon and Tanana rivers (Wahrhaftig, 1965). Streams flow either northeast to the Yukon River or southeast to the Tanana River These two rivers transport silt that is redeposited on slopes and the tops of the hills by aeolian processes in the region. Several major lowlands are drained by the Yukon River and Hess Creek.

The soils of the Ray Mountains depend, in part, on their distance from the Tanana and Yukon rivers. In areas farther from the rivers, residual soils from weathered bedrock are dominant on hilltops and are generally a few feet thick. In valley bottoms, soils can be more than 40 feet thick, are a combination of colluvium, fluvial sand and gravel, and weathered bedrock (Kreig and Reger, 1982). Loess is common on the Ray Mountains near the Tanana and Yukon rivers. Silt is transported by wind from river floodplains and redeposited as a blanket over coarser-textured soils and bedrock far from the rivers.

Areas south of the Yukon River are underlain with discontinuous permafrost with an average temperature of 27°F to 30°F (Brown *et al.*, 1997), which generally becomes thinner from north to south. Frozen ground may be absent near major stream channels (Ferrians, 1965). However, permafrost may be present in areas where a river channel has migrated, as permafrost can aggrade due to the absence of heat from the water that previously occupied the channel. Near the Yukon and the Tanana rivers, loess deposits on the uplands can contain ice as thick as 55 feet (Kreig and Reger, 1982). Lowlands, where re-transported silts accumulate, may have thicker ice-rich soils. In uplands, where loess is thin or absent, the ice content of colluvium or weathered bedrock is substantially lower. The soils in valley bottoms, surrounding rounded hills, are ice-rich and more than 50 feet deep in many locations (Kreig and Reger, 1982). Thermokarst lakes are common in valley bottoms throughout the region.

3.2.3.7. Tanana-Kuskokwim Lowlands Ecoregion

The Tanana-Kuskokwim Lowlands Ecoregion comprises a broad geographic depression between the Ray Mountains and Yukon-Tanana Uplands to the north and the Alaska Range to the south. Outwash fans from the Alaska Range are present in the lowlands. Near the heads of these fans, rivers flow through broad terraced valleys that can be up to several hundred feet deep. Glacial moraines are present on the upper elevations of some alluvial fans (Wahrhaftig, 1965). Windblown silt and sand dominate the surface material in the Tanana-Kuskokwim Lowlands, originating from the braided floodplains

and outwash plains of the major rivers in the region. The central and eastern parts of this ecoregion are drained by the Tanana River. Coarse-grained sand and gravel are common near the active channels of major rivers (Péwé, 1975; Kreig and Reger, 1982).

The lowlands and terraces have shallow and discontinuous permafrost, with an average temperature of 27°F to 30°F (Brown *et al.*, 1997). The permafrost can be more than 50 feet thick in areas, but is absent under rivers. Isolated masses of permafrost are present in areas with coarse-grained sediments (Ferrians, 1965; Kreig and Reger, 1982). Thermokarst lakes are well developed on the terraces and low-lying areas away from the heads of the alluvial fans.

3.2.3.8. Yukon-Tanana Uplands Ecoregion

The Yukon-Tanana Uplands Ecoregion consists of rounded hills with gentle side slopes. The proposed pipeline would cross this ecoregion for about 12 miles before returning to the Tanana-Kuskokwim Lowlands Ecoregion. The valleys in the Yukon-Tanana Uplands Ecoregion are generally a quarter-mile to a half-mile wide and contain alluvium (Wahrhaftig, 1965). They flow either northeast to the Yukon River or southeast to the Tanana River. The two rivers supply the silt (left behind by retreating glaciers as well as from modern erosional processes) that is redeposited by wind as loess on slopes and hilltops. Several major lowlands are drained by the Yukon, Tolovana, Tatalina, Chatanika, Chena, and Salcha rivers in this ecoregion and by Hess Creek in the Ray Mountains Ecoregion.

The Fairbanks Lateral, a 30.33-mile long section of 12-inch pipe connecting the Mainline and Fairbanks, also lies within the Yukon-Tanana Uplands Ecoregion. From the tie-in, the Fairbanks Lateral pipeline would traverse east, following the Murphy Dome and Old Murphy Dome Roads, and then extend southeast into Fairbanks.

The bedrock of Murphy Dome is a very resistant, tor-forming metasandstone (Alaska Department of Natural Resources [ADNR], 2008a). This area has never been glaciated (Péwé, 1975). During past glacial periods, aeolian loess was transported by winds and blanketed the area. This loess was reworked into thick slopewash and alluvial aprons that are visible in road cuts along Murphy Dome Road. The broad valleys surrounding Murphy Dome are filled with thick alluvial deposits and overlying silt and peat.

The soil types on the uplands in part depend on the distance from the Yukon and Tanana rivers. In areas far from the rivers, residual soils from weathering bedrock are dominant on hilltops and are generally a few feet thick.

This ecoregion is underlain by discontinuous permafrost with a temperature of 27°F to 30°F (Brown *et al.*, 1997). Depth to the base of permafrost generally decreases from north to south. Near the main channels of major streams, frozen ground may be absent (Ferrians, 1965). However, as a stream channel migrates, permafrost can redevelop due to the ground refreezing in the absence of the heat of water that once occupied the channel. Near the Yukon and Tanana rivers, the thick windblown silt on the uplands can

contain ice upwards of 55 feet thick (Kreig and Reger, 1982). The lowlands between the uplands where re-transported silts accumulate may have even thicker ice-rich soils.

3.2.3.9. Alaska Range Ecoregion

The Alaska Range Ecoregion is comprised of a belt of flat-topped, east-trending hills (Wahrhaftig, 1965), separated by lowlands composed of moraines and outwash plains of Pleistocene glacial origin. The Alaska Range proper is characterized as rugged glaciated terrain, generally at 6,000 to 9,000 feet in elevation. At 20,310 feet, Denali is the highest point in this ecoregion. The proposed pipeline would reach elevations of up to approximately 2,400 feet as it crosses the Alaska Range.

Slope gradients, which are almost always greater than 5 degrees on hillslopes, exceed 25 degrees on some mountains. Gelifluction features are well developed and landslides and avalanches frequently sweep the steep, scree-lined slopes (Gallant *et al.,* 1995). Rock glaciers and glacial landforms, including cirques, U-shaped valleys, moraines, outwash fans, and alluvial fans, are common. Alaska Range drainages north of Broad Pass discharge into the Nenana River, which flows north through Windy Pass to the Tanana River. Locally, fine-grained loess covers outwash deposits in the lowlands (Wahrhaftig, 1965). Most of the range drains into the Tanana River. Streams are swift and braided, and most rivers head in glaciers (Wahrhaftig, 1965).

Permafrost is discontinuous in the Alaska Range, with an average temperature of 30°F to 32°F (Brown *et al.,* 1997). Ice-rich permafrost and thermokarst lakes develop in the lowlands, where loess is deposited. Permafrost is generally absent on south-facing slopes.

3.2.3.10. Cook Inlet Basin Ecoregion

The Cook Inlet Basin Ecoregion is bound on the north and west by the Alaska Range and on the east by the Talkeetna Mountains. Elevations range from sea level to 2,000 feet. The Cook Inlet Basin Ecoregion surface deposits are primarily composed of glacial moraines, till, lake clays, and peats, which grade into fine-grained, stratified proglacial deposits near the margin of Cook Inlet. Relatively flat, rolling topography, swampy terrain, and prominent outwash deposits represent the common landscapes seen in the Cook Inlet Basin Ecoregion. The southeast portion of Cook Inlet Basin Ecoregion contains poorly sorted tills and silty gravels, along with fluvial deposits from the Susitna River and its associated drainages (Wahrhaftig, 1965).

Soils of the Cook Inlet Basin Ecoregion typically consist of peats and bogs in low-lying areas that are flanked by morainal deposits, till, and outwash landforms. Permafrost, ranging from discontinuous in the north to absent in the south, varies throughout the Cook Inlet Basin Ecoregion. Isolated ice lenses may exist below peat-covered bogs. At its southern extent, permafrost exists only in isolated lenses as relic ice beneath thick peat bogs. Permafrost is unlikely near Cook Inlet (Gallant *et al.,* 1995).

3.2.4. Geomorphic Processes

Several geomorphic processes and features are encountered in the proposed Project Area, including mass wasting; permafrost degradation/aggradation and frost action; seismicity; glacial, fluvial, and coastal processes are described in the following sections. Geomorphic processes, such as these, must be considered in pipeline engineering, design, siting, and construction because of the potential to impact pipeline stability and operations.

3.2.4.1. Mass Wasting

Mass wasting is a general term used to describe geologic processes that are primarily driven by the action of gravity on either consolidated or unconsolidated material. These processes include avalanches, rock falls, slides, and slumps, as well as solifluction and gelifluction in cold regions. Where freezing and thawing of moisture-rich soil is very active, frost propagation can fracture rocks. Depending on the water, ice, and snow content, as well as slope angle, transport processes may include frost creep, rockfalls or slides, solifluction, and slopewash. These processes produce depositional landforms such as talus at the bases of fans and valley bottoms.

A unique example of mass wasting is frozen debris lobes, which are slow-moving landslides developed in frozen ground. Frozen debris lobes are flowing westward down a mountain slope near MP 196.1 of the proposed Project (approximately MP 219 of the Dalton Highway). More than 10 other frozen debris lobes exist along the Dalton Highway corridor, but frozen debris lobe 'A' is closest to transportation infrastructure (AGDC, 2016b). It consists of rock, sand, silt, woody debris, and ice, and is 65 feet tall and 560 feet wide at its front. The movement of lobe 'A' has accelerated in recent years and is presently estimated to be approximately 18 feet (5.5 m) per year. The lobe is approximately 97.44 feet from the Dalton Highway and could reach the highway in fewer than 6 years (University of Alaska [UA] Fairbanks [UAF], 2016). The rate of movement may accelerate because of a warming climate.

3.2.4.2. Permafrost Degradation/Aggradation

Permafrost can occur in both soils and bedrock, and is encountered in all ecoregions traversed by the proposed Project. Figure 3.2-2 shows the approximate extent of permafrost along the proposed pipeline route. Based on its extent, permafrost is classified as continuous (covering from 90 to 100 percent of an area), discontinuous (50 to 90 percent coverage), sporadic (10 to 50 percent coverage), or isolated patches (up to 10 percent coverage) (Brown *et al.,* 1997). Data shown in Figure 3.2-2 is from Jorgenson *et al.* (2008) and was developed using a terrain-unit approach where climate and surficial geology data were used to predict permafrost extent. Thus, the figure presents a generalized understanding of the extent of permafrost.

Using data specific to the proposed pipeline route, AGDC assessed the extent of permafrost. For the proposed Project, AGDC considers permafrost to be continuous

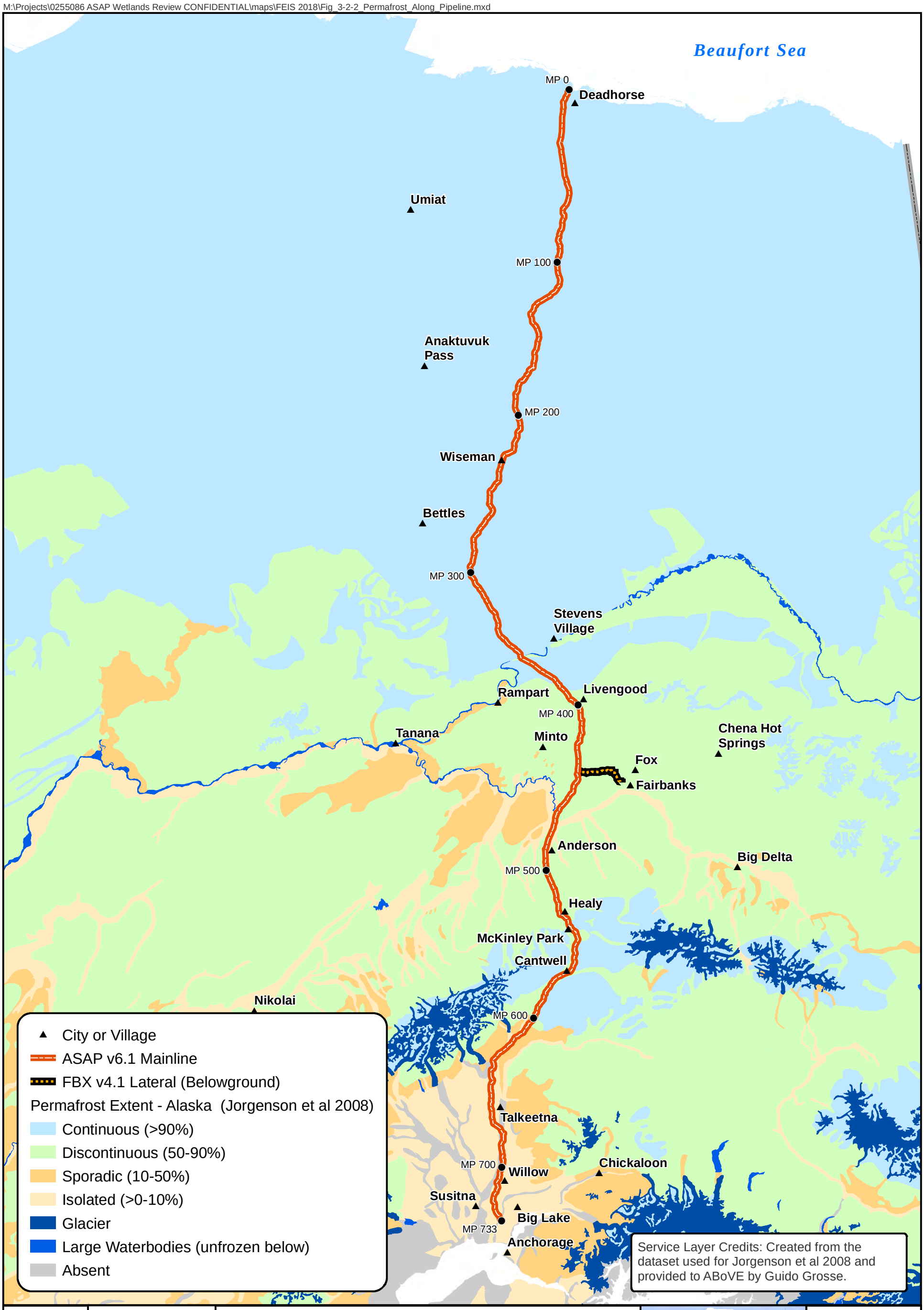
from approximately MP 0-168 (the north side of Atigun Pass), discontinuous from approximately MP 168-634, and sporadic from approximately MP 634 to the terminus. Areas where the pipeline crosses thaw bulbs formed by rivers are considered by AGDC to be discontinuous permafrost. The depth of the active layer, which undergoes seasonal freeze-thaw cycles, in the proposed Project Area ranges from 1 foot to about 15 feet.

Generally, the ice content in the soil or bedrock is related to the porosity and the moisture content of the material before it is frozen. However, moisture migration during freeze-thaw cycles can create massive ice formations. Higher ice content generally occurs in fine-grained soils, as compared to coarse-grained soils. The latter, in turn may have higher ice content than fractured bedrock. Although permafrost and ice content are not synonymous, many important engineering challenges in dealing with permafrost are related, directly or indirectly, to the water or ice content of soil. Moisture in the form of ice may or may not be present in permafrost (French, 2007). Across the North Slope ground ice, excess ice volume in the top 5 meters of soil, ranges from low (<10 percent by volume) to high (>40 percent by volume) (Jorgenson *et al.,* 2008). Variable ground ice concentrations are present throughout the Brooks Range, where buried glacial ice may be present. South of the Brooks Range, ground ice generally ranges from low to moderate (10 percent to 40 percent by volume), with isolated areas of high ground ice concentrations.

Permafrost stability can be disrupted naturally by climate change, forest fires, or formation or drainage of lakes or artificially by human-impacted means. Permafrost degradation occurs as a result of progressive warming of soils resulting in the thawing of near-surface permafrost and extension of the active layer deeper below ground surface. In areas of massive ground ice, permafrost degradation results in a significant decrease in the volume of soil present. Permafrost aggradation is the result of cooling soil temperatures and the propagation of permafrost. Both degradation and aggradation can be triggered by natural or artificial influences.

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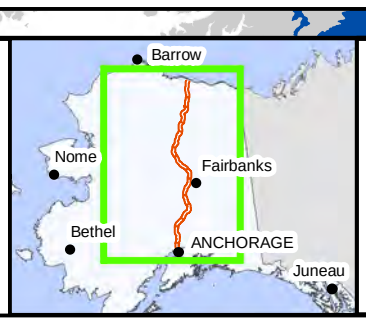
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PROJ. No.: 0416166

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

Figure 3.2-2: PERMAFROST ALONG PIPELINE ALIGNMENT ALASKA STAND ALONE PIPELINE

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The stability of permafrost is significantly impacted by surface conditions including the presence and health of overlying vegetation and color of surface layer materials. In permafrost regions, healthy vegetation serves to insulate the underlying soils and minimizes spread of the active zone. The color of surface layer materials directly impacts the albedo of an area, with lighter colors reflecting more solar radiation and darker colors warming more quickly when exposed to sunlight.

The interaction of these factors causes periglacial areas to undergo a constant cycle of change. For instance, melting of massive ice can cause the formation of thermokarst lakes. The water surface traps heat more efficiently than tundra vegetation. For a while, continued melting causes an expanding thaw bulb under the lake and results in the lake growing. Eventually, melting ice wedges and other thermokarst features can result in an outflow stream draining the lake. This turns the lake into a marsh. As increasing vegetation forms in the depression, a vegetative mat forms (increasing insulation). As vegetation increases, the albedo also increases. This results in a shrinking of the active zone and upward expansion of permafrost.

3.2.4.3. Frost and Thaw Action

Frost heaving commonly occurs in silt-rich, frost-susceptible soils (common in areas that have been glaciated). Frost heaving is caused by the expansion of soil volume due to the formation of ice within pore spaces, and by drawing water to the freezing front of ice lenses. If a frozen soil is subjected to warming, and the contained ground ice melts, the liquid water content in the soil increases. If the water is prevented from draining due to the presence of underlying frozen or other confining layers, the soil may become saturated and its mechanical strength is reduced. This weakening can be significant in soils composed of loose sand or non-plastic silt (thaw-susceptible soils) and can be exacerbated if the soil is subjected to stress, such as seismic vibrations.

Thermokarst features are formed in the active layer by the repeated freezing and thawing of ice within a given soil. Freezing of ice wedges causes them to expand. When they partially thaw, melt water may accumulate in the void and the next freezing cycle again expands the wedge. When ice-rich permafrost thaws, it can leave local voids and potentially cause the ground surface to subside. Subsidence is most pronounced in ice-rich soils, especially those with large bodies of ground ice. Such subsidence can result in thermokarst lakes. Generally, frost heave, subsidence, thermokarst features, and solifluction are more likely to occur in silt and clay-rich soils. Areas of coarse-grained sediment and bedrock tend to be more coherent, better drained, thaw stable, and exhibit these features less frequently.

3.2.4.4. Seismicity

Based on review of existing data and imagery, helicopter reconnaissance, and field investigations, Koehler *et al*. (2015) identified 12 faults or fault systems that potentially intersect the proposed pipeline route. The faults were assessed based on relative tectonic

activity (active, potentially active, not active). A summary is presented in Table 3.2-2. This subsection summarizes information on these 12 faults/fault systems and other faults, which have been discussed in relation to the proposed ASAP pipeline route.

Table 3.2-2 Active or Potentially Active Faults that Cross or Extend toward the Proposed ASAP Pipeline Route

Fault [a]	Relative Activity
Tozitna fault	Not active
Kaltag Extension fault	Not active
Victoria Creek Fault	Not active
Minto fault	Not a fault where investigated
Northern Foothills thrust	Active
Backthrust faults of the Northern Foothills thrust	Active
Stampede–Little Panguingue Creek fault	No recent activity
Healy Creek fault	Potentially active
Healy fault	Potentially active
Park Road fault	Active
Denali fault	Active
Castle Mountain fault	Active

a "Investigation of Potentially Active Tectonic Faults along the Route of the Proposed Alaska Stand Alone Pipeline, Livengood to Cook Inlet, Alaska" (Koehler *et al.,* 2015)

The northern portion of the proposed Project Area, from the Beaufort Coastal Plain to the Brooks Range, experiences regionally low seismicity (Figure 3.2-3). The Beaufort Coastal Plain, Brooks Foothills, and Brooks Range Ecoregions have experienced three earthquakes in the last 50 years within 50 miles of the proposed Project Area that were greater than magnitude 5.0.

Investigations along the Tozitna, Kaltag Extension, and Victoria Creek faults indicate that they are not faults that have been active during the Holocene (Koehler *et al.*, 2015). Very little is known about the seismic potential of the Kobuk fault, a strike-slip fault approximately 40 miles away from the proposed Project Area, on the southern flank of the Brooks Range (Freymueller *et al.*, 2008).

The Dall City seismic zone (which incorporates the Dall Mountain Fault) could generate earthquakes producing strong ground motion in the proposed Project Area. Very little is known about this seismic zone that generated a magnitude 5.2 in 1969 and five earthquakes greater than magnitude 5.0 in 1985, the largest of which was a magnitude 6.1 (Alaska Earthquake Information Center [AEIC], 2016).

South of the Yukon River, the proposed Project would cross two seismic zones that trend northeast through the Ray Mountains ecoregion, including the Minto Flats and Fairbanks seismic zones. The Minto Flats seismic zone (Minto fault) is a northeast-southwest striking zone of earthquakes between the Tintina Fault to the north and the Denali Fault to the south. The Minto Flats seismic zone is characterized by frequent, moderate-magnitude earthquakes (Koehler *et al.,* 2015). The north end of the Minto Flats seismic zone was the locality of a magnitude 6.0 earthquake in 1995

(Freymueller *et al.*, 2008). The pipeline route appears to parallel, but not cross the Minto fault (Koehler *et al.*, 2015).

The Kaltag and Tintina faults extend through the region; however, the location and kinematic connection between these faults is poorly defined. Both faults are thought to be active and although the proposed alignment does not cross these structures, they could generate strong ground motion. This region has experienced 23 earthquakes in the last 50 years that were greater than magnitude 5.0 within 50 miles of the proposed Project Area (AEIC, 2016).

The Fairbanks seismic zone runs 75 miles from the Alaska Range Foothills to northeast of Fairbanks. No single fault has been identified as the source of the Fairbanks seismic zone, but instead, consists of a network of northeast trending high angle faults with sinistral and normal displacements (Kolker, 2007). The Fairbanks seismic zone has been the locality of several earthquakes, including a magnitude 7.3 in 1904, magnitude 7.2 in 1947, magnitude 6.1 in 1967, magnitude 5.2 in 1981, and magnitude 7.2 in 1947 (AEIC, 2016).

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Beaufort Sea
BEAUFORT COASTAL PLAIN
Deadhorse
Umiat
BROOKS FOOTHILLS
BROOKS RANGE
Anaktuvuk Pass
DAVIDSON MOUNTAINS
U.S.A.
CANADA
Kobuk Fault
Wiseman
Bettles
YUKON-OLD CROW BASIN
KOBUK RIDGES AND VALLEYS
Dall Moubtain Fault
Stevens Village
RAY MOUNTAINS
YUKON RIVER LOWLANDS
Tintina Fault
NORTH OGILVIE MOUNTAINS
Livengood
Rampart
Kaltag Fault
Minto
Tanana
Chena Hot Springs
Fox
YUKON-TANANA UPLANDS
Fairbanks
Anderson
Big Delta
Northern Foothills Fold and Thrust Belt
KUSKOKWIM MOUNTAINS
Healy
Healy Creek Fault
McKinley Park
Cantwell
ALASKA RANGE
Denali Fault
TANANA-KUSKOKWIM LOWLANDS
Talkeetna
COPPER RIVER BASIN
COOK INLET BASIN
WRANGELL MOUNTAINS
Willow
Chick
Castle Mountain Fault
Susitna
Big Lake
Anchorage
CHUGACH - ST. ELIAS MOUNTAINS

City or Village
Earthquake Epicenter
Fault Lines
ASAP v6.1 Mainline
FBX v4.1 Lateral
International Border
Intermontaine Boreal
Alaska Range Transition
Pacific Mountains Transition
Arctic Tundra

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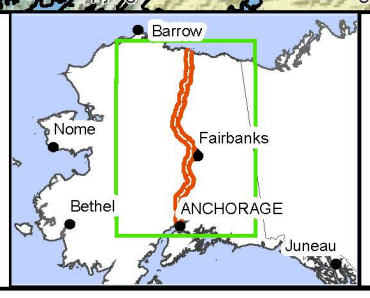
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DATE: MAR 2018
CHKD: S.W.
DRWN: J.S.V.
PROJ. No.: 0416166

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

Figure 3.2-3: ALASKA STAND ALONE PIPELINE EARTHQUAKES AND FAULTS

0 25 50 100 150 Miles



N

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The Alaska Range Transition has seen the most seismic activity since 1960 with 88 earthquakes greater than magnitude 5.0 within 50 miles of the proposed Project Area and includes the Alaska Range and Cook Inlet Basin ecoregions (AEIC, 2016) (Figure 3.2-3). On the north side of the central Alaska Range, there is an active, northward-vergent fold and thrust belt called the Northern Foothills Fold and Thrust Belt. This belt has been seismically active through the last 3 million years, and extends from the area near Denali to east of the Richardson Highway (Tok River Valley) (Freymueller et al., 2008; Bemis, 2010) (Figure 3.2-3).

The Stampede–Little Panguingue Creek fault is characterized by a low uplift rate and might accommodate slip that steps north from the Healy Creek fault. The fault extends across the proposed pipeline route; however, it does not show evidence of recent activity (Koehler *et al.,* 2015). The Healy Creek fault is a major, steeply north dipping reverse fault that is defined on the east side by the Nenana River and is part of the Northern Foothills Fold and Thrust Belt. On the high terrace, immediately east of the Nenana River, the Healy Creek fault forms a prominent scarp more than 6 miles long. The Healy Creek fault extends through the pipeline corridor and the Nenana River (Koehler *et al.*, 2015). Both the Healy Creek fault and nearby Healy fault are considered potentially active (Koehler *et al.,* 2015).

Investigations along the Park Road fault indicate that the fault does not show recent activity at the proposed Project footprint. The fault does show recent offset for Alternative 2. The fault is considered active (Koehler *et al.,* 2015).

A major fault in the proposed Project Area is the Denali fault (including the Hines Creek branch that runs through the Denali NPP). The Denali fault is several hundred miles long with movement recorded in several locations along its length (APSC, 2007; Plafker *et al.,* 1994). Two large earthquakes, magnitude 7.2 and 7.9, occurred on the Denali fault in 1912 and 2002, respectively.

The Castle Mountain fault is the only known active fault in the greater Anchorage area with an identified surface rupture. The fault lies along the southern margin of the Talkeetna Mountains (Freymueller *et al.,* 2008) (Figure 3.2-3). Both the 62-mile long eastern and 39-mile long western parts of the fault are seismically active. The fault produced light to moderate magnitude 5.7 and 4.6 earthquakes in 1983 and 1996, respectively. The most recent significant earthquake along the western portion of the fault was about 650 years ago, which suggests the possibility a significant earthquake (approximately magnitude 6.0) may be expected in the near future (USACE, 2012a).

Southern Alaska, particularly south of the Chugach Mountains, has experienced considerable seismic activity in recent history. However, most earthquakes occur along the Alaska-Aleutian megathrust, which has produced four major earthquakes in recent history, including a magnitude 9.2 in 1964 (USGS, 2014), a magnitude 7.5 in 1979, a magnitude 7.8 in 1988, and a magnitude 7.9 in 1987 (AEIC, 2016). Additionally, a

magnitude 7.1 earthquake occurred along the Alaska Peninsula on January 24, 2016; it is assumed to be associated with the megathrust.

3.2.4.5. Glacial Processes

Comparison of the proposed pipeline route to the USGS National Land Cover Database indicates that the proposed route is at least 0.64 miles away from areas of perennial ice and snow. No direct glacial impacts are anticipated along the pipeline route. However, much of the route has been impacted by glacial process in the past.

Rocks and sediments are added to glaciers through various processes. Glaciers erode the terrain principally through two methods: abrasion and plucking. Plucking occurs when subglacial water penetrates the fractures and freezes, which acts like a lever that loosens the rock by lifting it and separating the fractures from the bedrock. Abrasion occurs when the rocks frozen into the bottom of the ice act like grit in sandpaper, resulting in landforms such as U-shaped valleys, cirques and moraines, and rivers with high sediment content (National Snow and Ice Data Center, 2011).

3.2.4.6. Fluvial Processes

Fluvial processes comprise the motion of sedimentation and erosion on a riverbed and the subsequent deposition of the eroded material. In addition to the effects of normal mechanical erosion, which includes both bank erosion and stream bottom erosion, running water also has the ability to thaw permafrost. The thawing of permafrost is evidenced by the existence of taliks, or unfrozen zones, beneath the channels of all rivers that do not freeze to their bottoms during winter. Where large river channels are incised within ice-rich or relatively unconsolidated sediments, lateral erosion can form thermo-erosional niches, often greater than 30 feet deep. This process can cause bank collapse, which often occurs in large blocks along ice wedges. This process occurs widely along the banks of the Yukon River (French, 2007).

3.2.4.7. Coastal Processes

Coastlines change shape and location in response to natural forces and human activities. The primary section of coast that would be impacted by the proposed Project is Prudhoe Bay and the area around West Dock on the Beaufort Sea. Sand and other materials are moved onto and off beaches by currents and waves. During major storms, waves and storm surges can move large amounts of coastal sediments and can flood vast coastal areas in a matter of hours. Coastlines move as a way to achieve equilibrium with the forces acting against them. Barrier islands, such as Stump Island, move along the coast, driven by longshore currents. Headlands are eroded back, moving the coast inland. Sediment deposited on river deltas act to extend the coast out into the water. Coastlines also move inland in response to changes in sea level.

Coastal erosion in northern Alaska has been accelerated by a number of factors. Later freeze up of sea ice in the fall has combined with fall storms to created higher sea states and more erosion. This has accelerated the impacts of thawing permafrost in some areas.

Coastal retreat at the northern pipeline terminus has the potential to impact the dock facility serving the proposed Project, due to the moderate-high rates of erosion and bank retreat in the Prudhoe Bay area. Prudhoe Bay has experienced effects of northern Alaska's coastal erosion problem. The GCF is situated about a ½-mile from the nearest shoreline of Prudhoe Bay and behind an existing central natural gas facility.

Scour or seabed gouging is a process that occurs when floating ice drifts into shallower areas. The deepest portion of the ice comes into contact with and scours the seabed. This can result in long, narrow furrows most often called gouges, or scours. Sea depths in the vicinity of Prudhoe Bay can vary as much as 6 feet due to iceberg groundings (NOAA, 2015a). The ASAP West Dock Dredge and Disposal Plan (AGDC, 2016o) proposes to use scour to redistribute dredged materials away from the near shore environment over time.

The ASAP Department of the Army Application for Permit (DA Application) (AGDC, 2016a) includes winter dredging of navigation channel and turn basin at West Dock. Materials would be dredged to a depth of 9 feet below MLLW. The material is proposed to be disposed of nearshore on bottom fast sea ice, approximately 7.5 miles southeast of West Dock. Coastal erosion and accretion would continue to impact both the dredged area and the disposal area.

3.2.5. Paleontological Resources

Paleontological resources are defined as any physical evidence of past life, including fossilized remains, impressions, and traces of plants and animals. Fossils occur throughout Alaska and range from single-celled organisms to large vertebrates, including Mesozoic dinosaurs, marine reptiles, and Pleistocene megafauna. Paleontological evidence in Alaska varies and, with respect to the proposed Project Area, can be characterized broadly. Fossilized plants of marine and terrestrial origin, as well as invertebrate and vertebrate animal specimens, have been found in the area of the proposed Project. The highest densities of fossils have been located along riverbeds.

The North Slope is particularly rich in paleontological remains. The oldest fossil recovered from the North Slope, a tooth plate from a vertebrate fish found in Middle Devonian strata, was dated at 380 million years ago (Lindsey, 1986). Post-Devonian sedimentation on the North Slope has, in some cases, accumulated up to 20,000 feet of fossil-bearing strata. Marine invertebrate fossils include bryozoans, brachiopods, pelecypods, gastropods, ostracods, cephalopods, crinoids, trilobites, belemnites, ammonites, and corals. By the Middle Jurassic and through the Cretaceous (about 160 to 65 million years ago), trees and terrestrial plants appear throughout North Slope fossil assemblages, recording transgressions and regressions of ancient seas. Twelve types of dinosaurs from the Late Cretaceous have been found, most of which were primarily located along the banks of the Colville River (BLM, 2001). Fewer invertebrate fossils occur in Tertiary beds along the Beaufort Coastal Plain. No fossils are known that date from Oligocene or Miocene formations.

Marine and terrestrial mammal (such as otter, seal, whale, mammoth, moose, caribou, muskoxen, bison, antelope, camel, horse, and steppe lion) and bird fossils have been found in Quaternary glacial deposits along the Colville River. Fossils of Pleistocene voles and megafauna, including mammoth, mastodon, antelope, muskoxen, elk, moose, and saber-toothed cats, have been found in frozen silts and peat bogs along the South Fork Koyukuk, Yukon, and Tanana rivers in the Ray Mountains. Invertebrate fossils (pelecypods, gastropods, and insects) also occur in a variety of Quaternary deposits (Péwé, 1975).

Paleontological resources along the Sagavanirktok River, located approximately 7 to 10 miles away from the proposed Project Area, consist of small fossils of invertebrates, shells, and corals found in the metamorphosed rocks of the Brooks Range. These fossils have been examined and collected by scientists, particularly members of USGS, over the past 30 years. They provide information useful in dating formations and establishing the geological sequence related to life forms (Reifenstuhl, 1991).

The Cantwell Formation is rich in fossils dating from the Late Cretaceous period to the early Tertiary period. The formation contains the first record of dinosaurs discovered in the Alaska Range (Fiorillo, *et al*. 2005). It has yielded numerous dinosaur tracks (hadrosaurs and small, medium, large, and very large-sized theropods) in Denali National Park and Preserve.

3.3. Water

3.3.1. Introduction

This section discusses water resources in the proposed Project Area. The description of water resources is based on information provided in the 2012 FEIS (USACE, 2012a), as well as recent, publicly available literature and reports relevant to environmental resources within the proposed Project Area. The information provided here summarizes the detailed descriptions presented in the 2012 FEIS, incorporating updates based on new data, as needed.

Here we discuss the surface water, groundwater and floodplains potentially impacted by the preconstruction, construction, and operational activities along the proposed 733-mile proposed Project right-of-way (ROW). It includes the Fairbanks Lateral, aboveground facilities, and support facilities that are part of Alternative 1 (proposed Project), as well as the Denali NPP Route Variation (Alternative 2). AGDC has proposed mitigation measures to reduce impacts to water resources, which are discussed in detail in in Chapter 4, Environmental Consequences, and Appendix M, Mitigation Measures.

The revised Project alignment does not result in substantial revisions to the affected environment for water resources described in the 2012 FEIS (USACE, 2012a). There have been no substantive changes to the federal, state, or local regulations applicable to the proposed Project. Traversed watersheds remain the same and the characteristics of the potentially affected watersheds, surface waters, groundwater, and floodplains remain unchanged. The following information focuses on data, methods, or analyses that have been substantially updated since the 2012 FEIS.

The definition of a stream has been modified from the 2012 FEIS to include only the waterbodies that meet USACE's definition of a stream (provided below in Section 3.3.5.1, Types of Surface Waterbodies). This resulted in the reclassification of 179 streams in the 2012 FEIS, to waterbodies. Waterbodies include all inundated areas regardless of whether or not they meet USACE's definition of a stream or wetland, as they will be considered in the pipeline engineering design process. Waterbodies include jurisdictional wetlands, as well as streams, which are defined as having seasonally flowing water (at least in most years), having bed and bank as well as an ordinary high water mark.

A second significant change between the 2012 FEIS Project description and the current Project description is the addition of West Dock DH3 for receiving barge loads of material. This made providing details for the dredging and disposal operation necessary. Dredging and disposal would include:

- Characterization and testing of the dredge channel and the disposal location;
- Winter dredging of a navigation channel and turn basin at West Dock;

- Modification to DH3 and widening of the causeway road; and
- Disposal of dredge material on bottomfast sea ice in Prudhoe Bay, landward of the Territorial Sea Boundary.

The proposed dredging and material disposal locations are discussed in Chapter 2, Section 2.2.3 (Use of West Dock [Dock Head 3] at Prudhoe Bay and disposal of dredge material nearshore), and Section 2.4.3 (Use of Dock Head 2, Ocean Disposal of Dredge Material). The current water and sediment quality at West Dock are discussed Section 3.3.8. The regulatory requirements for the dredging and disposal action are summarized in Attachment 4 of the ASAP West Dock Dredge and Disposal Plan (AGDC, 2016o).

3.3.2. Summary

The proposed Project Area crosses 13 Hydrologic Unit Code (HUC) 8 watersheds, which are potentially affected by the proposed activity and the alternatives. A watershed is an area of land that drains all of the streams and rainfall to a common outlet such as the outflow of a reservoir, mouth of a bay, or any point along a stream channel (USGS, 2011c). Watershed boundaries divide one drainage basin from another and consist of surface water lakes, streams and wetlands, and all the underlying groundwater. The total drainage area of all 13 watersheds that are traversed by the proposed Project Area is 51,013.3 square miles (mi^2).

USGS defines water resources by region (Alaska), subregion (Arctic, Interior-Yukon, and Southcentral), accounting unit, and cataloging unit, or watershed (USGS, 1987). USGS collects and disseminates reliable, impartial, and timely information required to understand water resources in the U.S. Much of the information discussed in this section has been obtained from the USGS Water Data for Alaska. These water resources include surface water, groundwater, water quality, and water use collected within or near the proposed Project ROW. Additional information was obtained from Alaska Department of Environmental Conservation (ADEC) and U.S. Environmental Protection Agency (EPA), sources as noted.

This section also describes the federal, state, and local rules and regulations for water use in Alaska. Water resources for the Arctic, Interior-Yukon, and Southcentral regions are discussed in detail in relation to potential preconstruction, construction, and operational impacts of the proposed Project.

3.3.3. Federal, State, and Local Regulations and Rules

Project construction and operation activities have the potential to impact water resources. Water resources are regulated by federal, state, and local agencies as summarized in Table 3.3-1. AGDC would complete the necessary permitting requirements in order to comply with regulations for water use and disturbance. The water use limits are set in Alaska Administrative Code (AAC) Section 11 AAC 93.035 to determine if any of the water uses are expected to exceed regulatory limits (from each separate requested water source). AGDC would be required to submit an application for

Temporary Use of Water to the appropriate permitting authority and be issued the temporary water use authorization before beginning the requested water use, withdrawal, impoundment, or diversion.

The State of Alaska water quality criteria are provided in the Water Quality Standards (WQS) 18 AAC 70 (ADEC, 2016a). These standards specify the degree of degradation that may not be exceeded in a waterbody as a result of human actions within State of Alaska's jurisdiction (ADEC, 2016a). Protected water use classes and subclasses, water quality criteria, and WQS are provided in 18 AAC 70.020 and the Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances (ADEC, 2008b). The WQS for each waterbody depends on the designated use of that waterbody. Designated uses for fresh water include water supply (drinking, agricultural, aquaculture, and industrial) and water recreation (contact recreation and secondary recreation).

ADEC Division of Water, Wastewater Discharge Authorization Program issued a General Permit (GP) AKG320000 on June 14, 2017, which authorizes discharges associated with the gas pipeline construction, operations, and maintenance, including: domestic wastewater, gravel pit dewatering, excavation dewatering, hydrostatic test water, stormwater, mobile spill response, and secondary containment dewatering. Examples of allowable discharges related to mobile spill response include treated or uncontaminated monitoring well purge water, drip pan water, shop melt water, and melted snow and ice collected in small drums due to small vehicle drips or spills while mobilized during winter operations. This GP would preclude the need for multiple Alaska Pollution Discharge Elimination System permits, which could include: AK002000 – Excavation Dewatering, AK003000 – Hydrostatic and Aquifer Pump Testing, AKR06000 – Multisector GP, AKR100000– Construction GP, and AKG572000 – Secondary Treatment to Surface Water.

Alaska's Integrated Water Quality Monitoring and Assessment Report is a statewide water quality assessment that identifies impaired waters (ADEC, 2017a). The criteria for an impaired waterbody include the freshwater WQS for color; fecal coliform bacteria; dissolved gas; dissolved inorganic substances; petroleum hydrocarbons, oils and grease; pH; radioactivity; residues; sediment; temperature; toxic and other deleterious organic and inorganic substances; and turbidity.

Table 3.3-1 Federal, State, and Local Water Regulations

Agency	Regulation	Description
Federal		
All Federal Agencies	Executive Order 11990, Protection of Wetlands	The purpose of this Order is to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet these objectives, federal agencies, in planning their actions, are required to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The Order applies to: acquisition, management, and disposition of federal lands and facilities construction and improvement projects which are undertaken, financed or assisted by federal agencies; and federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
	Executive Order 11988, Floodplain Management	This Order requires federal agencies to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "*each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities*" for the following actions: • Acquiring, managing, and disposing of federal lands and facilities; • Providing federally-undertaken, financed, or assisted construction and improvements; and • Conducting federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities.
U.S. EPA	Safe Drinking Water Act (SDWA) (42 United States Code [U.S.C.] Section 300 et seq.) – Sole Source Aquifer Protection Program (Section 1424(e))	The SDWA protects drinking water and its sources (*i.e.*, rivers, lakes, reservoirs, springs, and groundwater wells). This does not include private wells supplying fewer than 25 individuals. Any federally funded or partially federally funded projects with the potential to contaminate designated sole source aquifers require an EPA review. Sole source aquifers are defined as supplying at least 50 percent of the drinking water consumed for the area overlying the aquifer.
U.S. EPA	Section 402, Clean Water Act (CWA) (22 U.S.C. § 1342 et seq.) – National Pollutant Discharge Elimination System (NPDES): Point Source and Stormwater Discharges	Under Section 402 of the CWA (22 U.S.C. § 1342 et seq.), the EPA oversees ADEC's administration of the Alaska Pollutant Discharge Elimination System (APDES) program, which regulates the discharge of pollutants from a point source into waters of the U.S. for facilities and construction. Point-source discharges that require an APDES permit include, but are not limited to: sanitary and domestic wastewater, dewatering of gravel pits and construction areas, excavation dewatering, and hydrostatic test water, and storm water discharges (40 CFR 122).

Agency	Regulation	Description
	Section 404, CWA: (33 U.S.C. § 1344 et seq.) – Discharge of Fill Material to Waters of the U.S.	In 1972, Section 404 of the CWA established a program to regulate the discharge of dredged or fill material into waters of the U.S. The Rivers and Harbors Act of 1899 defined navigable waters of the U.S. as "those waters that are subject to the ebb and flow of the tides and/or are presently used, or have been used in the past, or maybe susceptible to use to transport interstate or foreign commerce." The CWA built on this definition and defined waters of the U.S. to include tributaries to navigable waters, interstate wetlands, wetlands, which could affect interstate or foreign commerce, and wetlands adjacent to other waters of the U.S. The Secretary of the Army, acting through the Chief of Engineers, is authorized to issue permits for the discharge of dredged or fill material into waters of the U.S. Selection of discharge sites must be in accordance with guidelines developed by the EPA in conjunction with the Secretary of the Army; these guidelines are known as the 404(b)(1) Guidelines.
Federal Emergency Management Agency (FEMA)	National Flood Insurance Act of 1968	The U.S. Congress established the National Flood Insurance Program with passage of the National Flood Insurance Act of 1968. The Flood Insurance Program is a pre-disaster flood mitigation and insurance program designed to reduce the exorbitant cost of disasters. It is a voluntary program that provides a *quid pro quo* approach to floodplain management and makes federally backed flood insurance available to residents and business owners in communities that agree to adopt and adhere to sound flood mitigation measures that guide development in their floodplains. FEMA is responsible for administering the National Flood Insurance Program and programs that provide assistance for mitigating future damages from natural hazards. In addition, FEMA is required by statute to identify and map the Nation's flood-prone areas and to establish flood-risk zones in such areas.
USACE	Section 404, CWA (33 U.S.C. Section 1344 et seq.) – Discharge of Fill Material to Waters of the U.S.	The Secretary of the Army, acting through the Chief of Engineers, is authorized to issue permits for the discharge of dredged or fill material into waters of the U.S. The public is notified and given the opportunity to comment and/or request a public hearing. Selection of discharge sites must be in accordance with guidelines developed by the EPA in conjunction with the Secretary of the Army; these guidelines are known as the 404(b)(1) Guidelines. USACE is responsible for the day-to-day administration and permit review. Permit review and issuance follows a sequential process that encourages avoidance of impacts, ensures minimization of impacts and, finally, requires compensatory mitigation for unavoidable impacts to the aquatic environment.

Agency	Regulation	Description
USACE	Section 10 of the Rivers and Harbors Act (33 U.S.C. Section 403) – Navigable Waters of U.S. Dredge and Fill Permit	Section 10 requires authorization from the Chief of Engineers and authorization by the Secretary of War for the construction of any structure in or over any navigable water of the U.S., the excavation/dredging or deposition of material in this water, or any obstruction or alteration in navigable water. Structure or work outside the limits defined for navigable waters of the U.S. requires a permit if the structure or work affects the course, location, condition, or capacity of the waterbody. Under Section 404, the Secretary of the Army, acting through the Chief of Engineers, is authorized to issue permits for the discharge of dredged or fill material into waters of the U.S.
U.S. Coast Guard (USCG)	Section 9 of the Rivers and Harbors Act (22 U.S.C. Section 403) – Bridge Permit	Section 9 requires authorization from USACE to construct any dam or dike in a navigable water of the U.S. The construction of bridges and causeways requires permits under Section 9, but the authority to issue permits with respect bridges and causeways was transferred to the USCG in 1966 when the U.S. Department of Transportation (USDOT) was created. However, USACE authorization is required for the discharge of dredged or fill material into waters of the U.S. associated with dams, dikes, bridges, and causeways under Section 404 of the CWA.
State		
ADNR	Temporary Water Use Permit (Alaska Statute [AS] 46.15)	Permit may be issued if the amount of water to be used is significant, the use continues for less than five consecutive years, and the water to be used is not appropriated. A significant amount of water is defined by 11 AAC 93.035(a) and (b) as the consumptive use of more than 5,000 gallons of water from a single source in a single day; the regular daily or recurring consumptive use of more than 500 gpd from a single source for more than 10 days per calendar year; the non-consumptive use of more than 30,000 gpd (0.05 cubic feet per second) from a single source; or any water use that may adversely affect the water rights of other appropriators or the public interest.
ADEC	Section 401 of CWA – Section 401 Certification	Pursuant to Section 401 of the CWA, a federal agency cannot issue a permit or license for an activity that may result in a discharge to waters of the U.S., until the state has granted or waived a 401 Certification. This review and certification process is generally initiated as a part of the federal permitting process and results in conditions placed on the federal permit to satisfy WQS. ADEC, Division of Water is the issuing authority.
	Water Quality Standards, 18 AAC 70	This regulation specifies water quality standards.
	Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances	This manual contains specific water quality criteria and standard for toxic and other deleterious organic and inorganic substances

Agency	Regulation	Description
	Drinking Water Program, 18 AAC 80	Requires public water systems comply with the state drinking water regulations, in accordance with the Federal Safe Drinking Water Act and Amendments, for the public health protection of the residents and visitors to the State of Alaska.
	APDES: Point Source and Stormwater Discharges	As described above, the CWA allows a state to administer the NPDES Program for discharges to state waters, with the EPA's approval of a state's NPDES Program. On October 31, 2012, ADEC assumed full authority to administer the wastewater discharge permitting and compliance program in Alaska. ADEC Division of Water, Wastewater Discharge Authorization Program has developed GP AKG320000 - Statewide Oil and Gas Pipelines, which authorizes discharges to freshwaters and certain land disposals associated with the gas pipeline construction, operations, and maintenance. The GP combines several discharge authorizations to eliminate the need to apply for several GP authorizations or individual permits. The Statewide Oil and Gas Pipelines GP do not apply to areas of Alaska where EPA maintains federal jurisdiction for Discharges to Waters of the US (*e.g.,* Denali National Park, Metlakatla, Facilities with 301 (h) waivers, etc.). However, under Section 401 of the CWA, a federal agency cannot issue a permit or license for an activity that may result in a discharge to waters of the US until the U.S. state where the discharge originates has granted or waived 401 certification. The central feature of CWA Section 401 is the state's ability to grant, grant with conditions, deny, or waive certification.
Local		
Fairbanks North Star Borough (FNSB)	Flood Management Regulations (FNSB Code Chapter 15.04)	Applies to special flood hazard areas in the FNSB that are subject to periodic inundation of floodwaters, which can cause loss of life or property, health or safety hazards, the disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the local tax base, all of which adversely affect the public health, safety and welfare.
Matanuska-Susitna (Mat-Su) Borough	Flood Plain Development Permit, including both the Mat-Su Borough Flood Hazard Development Permit and the Elevation Certificate (MSB 17.29)	A Flood Plain Development Permit is required before any development within a Federally Designated Flood Hazard Area. A Flood Plain Development Permit (issued by Mat-Su Borough) must include both the Mat-Su Borough Flood Hazard Development Permit and the Elevation Certificate. An Alaska registered Architect or Engineer must certify the Development Permit Application and either a Registered Engineer or Surveyor must complete the elevation certificate
North Slope Borough (NSB)	Coastal Management Plan (NSB Code 19.70.050)	Policies that identify general and specific courses of action to achieve region wide goals and the implementation of incremental activities and organizations for the coastal management program. Subject uses include location and construction of pipelines.

Agency	Regulation	Description
City of Nenana	Land Use Permit form the Municipality of Nenana (City of Nenana Code of Ordinances Section 7.215 Land Use Permit)	A permit is required before construction or development begins within any Special Flood Hazard Area.

The federal CWA Section 305(b) requires the State of Alaska to monitor and report on surface and groundwater quality of all surface and ground waterbodies; and to list the ones that do not meet WQS under Section 303(d). ADEC solicits water quality data and information for waterbodies in accordance with EPA guidance (ADEC, 2010). ADEC evaluates the data and information available and assigns each waterbody into one of five categories as follows:

- Category 1. All WQS for all designated uses are attained.
- Category 2. Some WQS for the designated uses are attained, but data and information to determine if the WQS for the remaining uses are attained, are insufficient, or absent.
- Category 3. Data or information is insufficient to determine if the WQS for any designated uses are attained.
- Category 4. The waterbody is determined to be impaired but does not need a total maximum daily load (TMDL). A TMDL is a calculation of the maximum amount of pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant (EPA, 2012b).
    - Category 4a. An established and EPA–approved TMDL exists for the impaired water.
    - Category 4b. Requirements from other pollution controls have been identified to meet WQS for the impaired water.
    - Category 4c. Failure to meet a water quality standard for the impaired water not caused by a pollutant; instead the impairment is caused by a source of pollution such as nuisance aquatic plant, degraded habitat, or a dam that affects flow.
- Category 5. WQS for one or more designated uses are not attained and the waterbody requires a TMDL or recovery plan. Category 5 waters are identified on the Section 303(d) list of impaired waters.

The most current data on impaired waterbodies are available in Alaska's Public Notice Draft, Integrated Water Quality Monitoring and Assessment Report (ADEC, 2017a).

3.3.4. Watershed Characteristics

Water resources are divided into three subregions: Arctic, Interior-Yukon, and Southcentral, as shown on Figure 3.3-1.

3.3.4.1. Arctic Hydrologic Subregion

The Arctic Hydrologic Subregion includes the area from the Arctic Coastal Plain (ACP) and the Arctic Foothills to the north side of the Brooks Range ending at Atigun Pass (the continental divide) (Trans-Alaska Pipeline System [TAPS] Owners, 2001).

The Arctic Hydrologic Subregion has continuous permafrost (ExxonMobil Production Company [Exxon], 1982). The surficial geology of the ACP consists of coastal deposits of inter-stratified alluvial and marine sediments, as well as local areas of geologic drift. The elevations of the Coastal Plain vary from sea level to about 600 feet. This area is poorly drained due to permafrost and flat terrain, and has many lakes. Low mountains, rolling plateaus, and tundra plains characterize the Arctic Foothills. In the north, the foothills have ridge elevations that range from 600 to 1,200 feet. The foothills consist of undifferentiated glacial and glacio-fluvial deposits. The surficial geology is mostly fine-grained quaternary deposits associated with sloping hills. There are few bedrock exposures and few lakes. The Brooks Range is rugged with peak elevations ranging from 6,000 to 8,000 feet. Slope deposits consist of dominantly coarse rubble deposits with a high percentage of bedrock exposure undifferentiated alluvium (Exxon, 1982).

As shown on Figure 3.3-1, the proposed Project Area starts at Prudhoe Bay located in the Kuparuk River watershed on the tundra coastal plain. The proposed Project Area remains just west of the Sagavanirktok River, until it reaches the Arctic foothills, where it veers away from the Sagavanirktok River and crosses through the upper reaches of the Kuparuk River watershed, and then very briefly through the upper reaches of the Lower Colville River watershed[1]. The proposed Project Area enters the Brooks Range near Galbraith Lake (headwaters of the Sagavanirktok River), and continues to Coldfoot.

[1] The portion in the Lower Colville River watershed is so small that it is not discussed as part of the proposed Project Area.

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Beaufort Sea

Prudhoe Bay

Deadhorse

Arctic Sub region

Kuparuk River
Kuparuk River Watershed

Sagavanirktok River
Sagavanirktok River Watershed

U.S.A.

CANADA

Colville River

Umiat

MP 0

MP 50

MP 100

MP 150

MP 200

MP 250

MP 300

MP 350

MP 400

MP 450

MP 500

MP 550

MP 600

MP 650

MP 700

Dietrich River
Upper Koyukuk River Watershed

Middle Fork Koyukuk River
Upper Koyukuk River Watershed

Middle Fork-North Fork Chandalar Rivers
Chandalar Rivers Watershed

North Fork Koyukuk River
Upper Koyukuk River Watershed

Kobuk River

Wiseman

Bettles

Interior-Yukon Sub region

South Fork Koyukuk River
South Fork Koyukuk River Watershed

Yukon River

Yukon River
Ramparts-Yukon River Watershed

Kanuti River
Kanuti River Watershed

Stevens Village

Tolovana River
Tolovana River Watershed

Rampart

Livengood

Tanana

Minto

Chena Hot Springs

Fox

Yukon River

Tanana River
LowerTanana River Watershed

Fairbanks

Nenana River
Nenana River Watershed

Nenana

Anderson

Big Delta

Interior-Yukon Sub region

Tanana River
Tanana Flats River Watershed

Healy

McKinley Park

Cantwell

Chulitna River
Chulitna River Watershed

Southcentral Sub region

Susitna River

Susitna River
Lower Susitna River Watershed

Talkeetna

Chickaloon

Willow

Big Lake

City or Village
Mile Post
International Border
ASAP v6.1 Mainline
FBX Centerline
River
Study Area
Hydrological Region
Hydrological Unit

Data Source: USGS national Hydrography Dataset
http://nhd.usgs.gov/data.html
Downloaded February, 2016
Basemap: ESRI Topographic

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DATE: MAR. 2018
CHKD: K.A.
DRWN: J.S.V.
PROJ. No.: 0416166

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Figure 3.3-1: HYDROLOGICAL UNIT SUBREGIONS AND WATERSHEDS ALONG THE PROPOSED PROJECT ROW ALASKA STAND ALONE PIPELINE

0 25 50 100 150 Miles

ALASKA

CANADA

N

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3.3.4.1.1. Watershed Characteristics

The proposed Project Area in the Arctic Hydrologic Subregion consists of the Sagavanirktok River and Kuparuk River watersheds. The proposed Project ROW is located primarily in the Sagavanirktok River watershed, with small areas extending into the Kuparuk River watershed, as shown in Figure 3.3-1. The watersheds contain numerous ponds, lakes, and streams. Ponds include flooded tundra ponds, shallow and deep-water ponds with varying depths and presence and type of aquatic vegetation (Truett and Johnson, 2000). Lakes found on the coastal plain vary in depth where they are shallowest near the coast and get deeper near the foothills of the Brooks Range (Truett and Johnson, 2000). Three lake types have been described by Bendock and Burr (1985), as oxbow, thaw and deflation; and five lake types by Moulton and George (2000): tapped, low perched, high perched, drainage, and tundra lakes. The lakes were classified by origin under Bendock and Burr (1985) and by fish access by Moulton and George (2000).

Three main types of streams occur in the subregion: mountain streams, spring streams, and tundra streams (Truett and Johnson, 2000). Mountain streams originate from the Brooks Range and include braided and interconnected channels. Spring streams are spring fed tributaries that feed upper reaches of mountain streams and are not present in the coastal plain. Tundra streams drain the Brooks Range, foothills and coastal plain. Beaded streams are tundra streams characteristic of permafrost underlain areas which typically have small pools or ponds linked by stream channels (Truett and Johnson, 2000).

3.3.4.1.1.1. Sagavanirktok River Watershed[2]

The Sagavanirktok River originates in the Brooks Range. Its headwaters are characterized by steep slopes and stream channel braiding from high velocity flows. The gradient decreases northbound from the Arctic Foothills to the Coastal Plain towards the Beaufort Sea, causing deposition of sediments and the formation of alluvial fans (BP Exploration (Alaska), Inc. [BPXA], 1995). Besides the Sagavanirktok River, the watershed contains numerous ponds, lakes, and streams as described above.

3.3.4.1.1.2. Kuparuk River Watershed[3]

The Kuparuk River watershed characteristics are similar to the Sagavanirktok River watershed in that the Kuparuk River has split channels and drains the Brooks Range foothills and coastal plain areas. The landscape that both rivers flow through is parallel to each other, and has similar geomorphology. The Kuparuk River, however, is considered a tundra stream due to drainage of tundra covered slopes (surface water) (Truett and Johnson, 2000). The Sagavanirktok River receives water from both surface

[2] HUC 19060402 (5,279.63 mi^2)

[3] HUC 19060401 (4,295.93 mi^2)

runoff (tundra) and perennial springs (groundwater) which results in different water chemistry than the Kuparuk River.

3.3.4.2. Interior-Yukon Hydrologic Subregion

This hydrologic subregion consists of the Yukon River Drainage, which flows into the Bering Sea. The region includes the south side of the Brooks Range, the Yukon-Tanana Uplands, the Tanana River Valley, and the north side of the Alaska Range (TAPS Owners, 2001). Similar to the north side of the Brooks Range, the south side of the Brooks Range is rugged with continuous permafrost. Slopes are steep through the lower reaches of the Dietrich River, where valleys widen and become U-shaped. The Dietrich River floodplain is wide and braided. The Yukon–Tanana Uplands consist of rounded hills and ridges at elevations of 2,000 to 4,000 feet. The Tanana River Valley is a wide, lowland depression, with discontinuous permafrost. The north side of the Alaska Range rises to peaks of 6,000 to 9,000 feet. The Alaska Range has discontinuous permafrost (TAPS Owners, 2001).

3.3.4.2.1. Watershed Characteristics

The proposed Project Area traverses the following watersheds: North Fork Koyukuk River, South Fork Koyukuk River, Kanuti River, Yukon River, Tolovana River, Lower Tanana River Nenana River, and Tanana Flats (Table 3.3-2; Figure 3.3-1). Since the proposed Project Area only briefly crosses the Chandalar River, Yukon Flats, and Chena River (Fairbanks Lateral) watersheds, they are not discussed in the SEIS.

3.3.4.2.1.1. Upper Koyukuk River Watershed[4]

The Dietrich River originates in the Brooks Range near Atigun Pass and flows south to join the Middle Fork Koyukuk. The North Fork Koyukuk joins the Middle Fork Koyukuk near Bettles to form the Upper Koyukuk west of the proposed Project (southwest of Bettles). The towns of Wiseman and Bettles are located within this watershed. The proposed Project Area crosses the Middle Fork Koyukuk River in this watershed.

3.3.4.2.1.2. South Fork Koyukuk River Watershed[5]

The South Fork of the Koyukuk River originates in the foothills of the south side of the Brooks Range, at Twin Lakes just east of Wiseman. The South Fork of the Koyukuk River flows west into the Upper Koyukuk and eventually joins the Yukon River well west of the proposed Project. The proposed Project Area crosses the South Fork Koyukuk River in this watershed.

[4] HUC 19040601 (6,927.10 mi^2)

[5] HUC 19040602 (2,313.29 mi^2)

3.3.4.2.1.3. Kanuti River Watershed[6]

The Kanuti River flows west to join the Koyukuk and then the Yukon River west of the proposed Project Area. Only a small portion of proposed Project Area crosses through upper reaches of this watershed. The proposed Project Area crosses the Kanuti River in this watershed.

3.3.4.2.1.4. Ramparts-Yukon River Watershed[7]

The Yukon River enters this watershed just west of Stevens Village. The proposed Project crosses the Yukon River in the Yukon River Watershed, just west of Stevens Village. The Yukon River flows past Rampart and leaves the Yukon River Watershed flowing west at Tanana. The proposed Project also crosses the Tolovana River in this watershed.

3.3.4.2.1.5. Tolovana River Watershed[8]

The Tolovana River originates outside of the Minto Flats Game Refuge near Minto, and flows south to join the Tanana River, which flows west and north to the Yukon River well west of the proposed Project Area.

3.3.4.2.1.6. Lower Tanana River Watershed[9]

A small portion of the proposed Project Area crosses the very upper reaches of this watershed and the Tanana River near the westernmost boundary of this watershed.

3.3.4.2.1.7. Tanana Flats Watershed[10]

The watershed includes the Tanana River from about the Village of Tanana to Nenana. Many watersheds contribute to the Tanana Flats watershed. The proposed Project Area crosses this watershed on the western most edge of the watershed near Nenana. Portions of the watershed are in the Alaska Range.

3.3.4.2.1.8. Nenana River Watershed[11]

The Nenana River originates in the Alaska Range. It flows west, then north along the highway (and Project Area) starting at Cantwell, then through McKinley Village, Lignite, Healy, and Anderson. It joins the Tanana River at Nenana. The proposed Project would also cross the Nenana River.

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[6] HUC 19040604 (3,353.66 mi^2)

[7] HUC 19080404 (4032.53 mi^2)

[8] HUC 19040509 (3,361.59 mi^2)

[9] HUC 19040511 (4,684.76 mi^2)

[10] HUC 19040507 (4,470.87 mi^2)

[11] HUC 19040508 (3,896.17 mi^2)

Table 3.3-2 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds near the Proposed Project – Interior-Yukon Hydrologic Subregion

Watershed & USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
Upper Koyukuk (19040601)						
15564864	Dietrich River Tribe near Wiseman	2004-2011	8	1,954 (2004)	2,146[b] (2009)	98
15564868	Snowden Creek near Wiseman	1968-2004	29	1,630 (1993)	1,678[d] (1991)	441
15564875	Koyukuk River near Wiseman	1968-1994	16	1,090 (1979)	1,114[d] (1973)	14,455
15564877	Wiseman Creek at Wiseman	1971-1994	11	1,096 (1974)	1,140[c,d] (1994)	704
15564879	Slate Creek at Coldfoot	1981-2011	31	1,035 (2007)	1,070[d] 1984)	1,643
South Fork Koyukuk (19040602)						
15564887	Bonanza Creek Tribe near Prospect Camp	1975-2011	37	1,009 (1976)	1,066 (2009)	156
Kanuti (19040604)						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ramparts-Yukon River (19040404)						
15453610	Ray River Tribe near Stevens Village	1977-2011	35	584 (1980)	622[d] (1994)	82
15453500	Yukon River near Stevens Village	1964-2011	36	204 (1999)	300 (1992)	496,639
15457800	Hess Creek near Livengood	1971-2011	16	389 (1974)	518 (2009)	5,466
Tolovana (19040509)						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lower Tanana (19040511)						
n/a	n/a	n/a	n/a	n/a	n/a	n/a
Tanana Flats (19040507)						
15515500	Tanana River at Nenana	1948-2011	51	330 (1996)	357[d] (1967)	84,782
Nenana (19040508)						
15518300	Nenana River near Rex	1965-1968	4	678 (1965)	702[d] (1968)	32,350
15518080	Lignite Creek near Healy	1986-2011	26	1,298 (2011)	1,311[d] (1986)	642

Watershed & USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
15518000	Nenana River near Healy	1951-1979	29	1,262 (1973)	1,284[d] (1967)	22,017
15517980	Dragonfly Creek near Healy	1990-2008	19	1,474 (1994)	1517 (2007)	88
15516198	Slime Creek at Intertie near Cantwell	1990-1995	6	2,195 (1991)	2,206[c] (2007)	158
15516000	Nenana River near Windy	1951-1981	28	2,095 (1969)	2,110[d] (1962)	6,954

Source: USGS, 2010e (Disclaimer: The data from the USGS National Water Information system web database may not have received Directors approval, is provisional and subject to revision)
a "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.
b Gauge height affected by backwater.
c Gauge height not the maximum for the year.
d Gauge height at different site and (or) datum.

3.3.4.3. Southcentral Hydrologic Subregion

This hydrologic subregion includes the area south of the Alaska Range, including the south side of the Alaska Range and the Mat-Su Valley. The Alaska Range reaches from Lake Iliamna, northward through Denali NPP, and then eastward to Tok and the Wrangell-St. Elias mountains.

3.3.4.3.1. Watershed Characteristics

The south side of the Alaska Range descends into the Mat-Su Basin. The Alaska Range trends east to west and possesses discontinuous permafrost (TAPS Owners, 2001). The proposed Project Area includes the Chulitna River and Lower Susitna River watersheds.

3.3.4.3.1.1. Chulitna River Watershed[12]

The Chulitna River originates in the Alaska Range south of Broad Pass on the Parks Highway. The headwaters are glacier-fed and flow south along the Parks Highway to Talkeetna, where it joins the Susitna River and discharges into the Lower Susitna River watershed. The proposed Project Area generally follows the Parks Highway.

3.3.4.3.1.2. Lower Susitna River Watershed[13]

The Lower Susitna River originates in the Talkeetna Mountains (in the Upper Susitna watershed), which joins with the Chulitna River and flows south through the Lower

[12] HUC 19020502 (2,590.87 mi^2)

[13] HUC 19020505 (3,703.25 mi^2)

Susitna watershed and into the Cook Inlet. Much of the Upper and Lower Susitna River watersheds are low-lying, low gradient areas that moderate the influence of the mountainous terrain (Surface Transportation Board [STB], 2011). The proposed Project Area intersects the Lower Susitna watershed, starting at Talkeetna and ending at the proposed Project terminus near Big Lake.

3.3.5. Surface Water

Surface water is defined as water that is on the Earth's surface including streams, rivers, lakes, estuaries, and reservoirs (USGS, 2011b). The proposed Project Area encounters numerous rivers, lakes, streams, and wetlands along the 733-mile route. There are no estuaries found within the proposed Project Area. Impacts to wetlands within the proposed Project Area are discussed in detail in Section 3.5, Wetlands.

The proposed Project would cross approximately 491 surface waterbodies; of those, 9 are planned for crossing using the horizontal directional drilling (HDD) construction method. Types of surface waterbodies crossed by the pipeline include wetlands, streams and inundated areas that do not meet USACE's definition of a wetland or a stream. Locations where the pipeline crosses a waterbody that meets USACE definition of a stream are included in Appendix F, Stream Crossings. All other waterbody crossings are discussed in Section 3.5, Wetlands. Waterbodies (based on the National Hydrologic Dataset) within a 2-mile study corridor (1 mile on either side of the pipeline route described in the 2012 FEIS) are provided in Appendix G. A supplemental table has been added to Appendix G that lists all waterbodies within 0.25 mile of the current route in locations the current route deviated more than 1 mile from the previous route. Approximately 2,309 waterbodies are included in this corridor.

3.3.5.1. Types of Surface Waterbodies

The types of surface waterbodies found within and surrounding the proposed Project Area include wetlands and streams as defined by USACE as well as inundated areas that do not meet USACE definition of a wetland or stream, but are important to consider for pipeline engineering and design. For the purposes of this SEIS, each type of surface waterbody is defined as follows:

- Stream/River: USACE defines a stream or river as having seasonally flowing water (at least in most years), having bed and bank as well as an ordinary high water mark. The term ordinary high water mark is defined by the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas.

- Wetland: USACE defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3(b)). Wetlands are discussed in detail in Section 3.5 of this SEIS.

The proposed Project (including the Mainline and access roads) crosses 310 streams that meet the above definition. Streams crossed by the proposed Project can be classified into the following National Hydrography Dataset (NHD) categories:

- Perennial: Contains water throughout the year, except for infrequent periods of severe drought.
- Intermittent: Contains water for only part of the year, but more than just after rainstorms and at snowmelt
- Canal: An artificial open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft.
- Artificial Path: An abstraction to facilitate hydrologic modeling through open waterbodies to act as a surrogate for lakes and other waterbodies.

Approximately 22.7 acres of upper perennial streams are located inside the Project footprint. Upper perennial streams connect intermittent streams with large stem main body rivers. These streams provide important fishery habitat, especially spawning and rearing habitat for salmon. These streams are also usually large enough to provide connectivity for human transportation, ranging from canoes to airboats.

Lower perennial waterways totaling 142.1 acres are located inside the Project footprint and are described as the largest freshwater features, (*i.e.,* Yukon River). The purpose of these rivers is bulk water transfer across the landscape, often with high degrees of sedimentation. Riverine discharge and sediment flux drive many of the landscape features including eroding riverbanks and creating large oxbow lakes. These rivers provide important fishery and wildlife habitat, and generally have significant histories providing transportation services to human development.

Intermittent streams totaling 31.5 acres are located inside the Project footprint. Intermittent streams convey water seasonally, during most years. Despite this seasonality, these streams are still important for wetland function during the high flows of summer. Intermittent streams are numerous throughout the ecoregion, providing summer habitat for fish. During the winter, these streams either freeze or dry up due to decreased runoff and precipitation. Fish that use the streams in the summer must migrate back to main stem channels during the winter.

There are 0.2 acres of waterbodies inside the Project footprint that were classified as unknown riverine. All other acreages of waterbody classifications are described in Section 3.5, Wetlands.

AGDC has identified several waterbodies that do not meet the definition of a stream, but will be considered in the pipeline engineering design process. AGDC refers to these waterbodies as hydrologic points of interest (HPOIs). Lakes and ponds are common throughout the proposed Project Area, and the alignment has been routed to avoid them when practicable. These water retention features buffer the effects of floods on the ecosystem, and provide habitat heterogeneity. Many are important fish habitat year-round and bird nesting habitat during the summer.

3.3.5.2. Surface Water Availability

The USGS NHD is a digital vector dataset used in Geographic Information System (GIS) analyses, which include data on lakes, ponds, streams, rivers, dams and stream gauges. The USGS NHD does not provide water depth information. Specific data includes flow networks, discharge rates, and water quality. The rivers and streams that the proposed Project would cross are shown in Appendix F (Stream Crossings). The location (latitude/longitude and nearest pipeline MP) and type for all surface waters within the study corridor provided in Appendix J (Fish Stream List). Appendix G includes a supplement to the 2012 FEIS waterbody crossing table and includes any waterbodies that are within 0.25 mile of the current pipeline route that are beyond the original 1-mile buffer. While the State of Alaska has an abundance of surface water, according to the ADNR, very little data have been collected on this resource on a statewide basis. Water availability data was collected by AGDC for the Arctic Hydrologic Subregion.

3.3.5.2.1. Arctic Hydrologic Subregion Surface Water Availability

AGDC's 2010 Lake Studies Completion Report, Prudhoe Bay to Galbraith Lake, provides lake areas and maximum depth for 32 lakes with potential to be utilized for water withdrawal. The results of the 2010 study are provided in Table 3.3-3. See Section 3.7, Fish, Table 3.7-1, and Figure 3.7-1 for additional characteristics of selected lakes within the Arctic Hydrological Subregion.

Table 3.3-3 Summary of Surface Area (square feet) and Maximum Depth (feet) for Lakes Sampled in the Arctic Hydrologic Subregion

Lake Name	Surface Area (square feet)	Maximum Depth (feet)
DNR001	240.28	-4.00
DNR002	431.52	NA
DNR003	269.84	-2.75
DNR004	536.71	-6.00
DNR005	137.38	-10.50
DNR006	28.93	-8.50
DNR007	46.75	-7.25
DNR009	181.39	-3.75
DNR013	62.18	-4.75
DNR016	259.82	-7.75
DNR019	120.25	-5.25

Lake Name	Surface Area (square feet)	Maximum Depth (feet)
DNR020	15.94	-12.00
DNR021	37.56	-3.50
DNR022	28.71	-6.75
DNR024	33.13	-20.00
DNR025	67.02	-8.25
DNR028	67.00	-37.00
DNR029	56.50	-20.00
DNR030	17.52	-10.50
DNR031	20.85	-13.50
DNR033	17.91	-9.50
DNR034	8.00	-24.00
DNR035	13.88	-64.00
DNR036	27.06	-44.00
DNR037	20.84	-9.50
DNR038	19.86	-23.00
DNR039	22.63	-64.00
DNR040	87.80	-55.00
DNR042	15.19	-27.00
DNR044	10.51	-43.00
DNR045	44.89	-26.00
Galbraith Lake	NA	NA

Source: AGDC, 2011a
NA= Not Available

3.3.5.3. Surface Water Use

Surface water use is dependent on the surrounding population and activities occurring in that area. USGS compiles data on water use in the U.S. at the county level (borough or census area) (USGS, 2010b). Table 3.3-4 illustrates the 2005 (most recent) estimated fresh surface water withdrawal data for the boroughs and census areas along the proposed Project ROW, in million gallons per day (MG/day). Boroughs and census areas are shown on the FEMA Floodplain Map (Figure 3.3-8). Commercial, wastewater release, and hydroelectric power in-stream use data was not collected for 2005 (Kenny *et al.*, 2009). Drinking water protection areas traversed by the proposed pipeline route are provided in Appendix G of the 2012 FEIS. These figures were not updated as part of this SEIS because the route changes are not significant enough to be visible at the scale of the figure provided. Finer scale maps of ADEC designated Drinking Water Protection Areas are available on ADEC's interactive mapping website (http://www.arcgis.com/home/webmap/viewer.html?webmap=13ed2116e4094f9994775af9a62a1e85).

Table 3.3-4 The 2010 Estimated Fresh Surface Water Withdrawals by Borough or Census Area (MG/day)

Borough or Census Area	Public Supply	Domestic Self-Supplied	Industrial Self-Supplied	Irrigation	Livestock	Aqua-culture	Mining	Thermo-electric Power	Total (MG/day)
North Slope	0.45	0.01	0.00	0.00	0.00	0.00	0.70	0.00	1.16
YKCA	0.04	0.00	0.00	0.00	0.00	0.88	0.37	0.00	1.29
FNSB	0.00	0.00	0.00	0.00	0.02	0.04	10.43	31.70	42.19
Denali	0.00	0.00	0.00	0.00	0.00	0.07	0.10	23.20	23.37
Mat-Su	0.00	0.00	0.00	0.02	0.04	20.43	1.63	0.00	22.12

Source: Maupin *et al.*, 2014

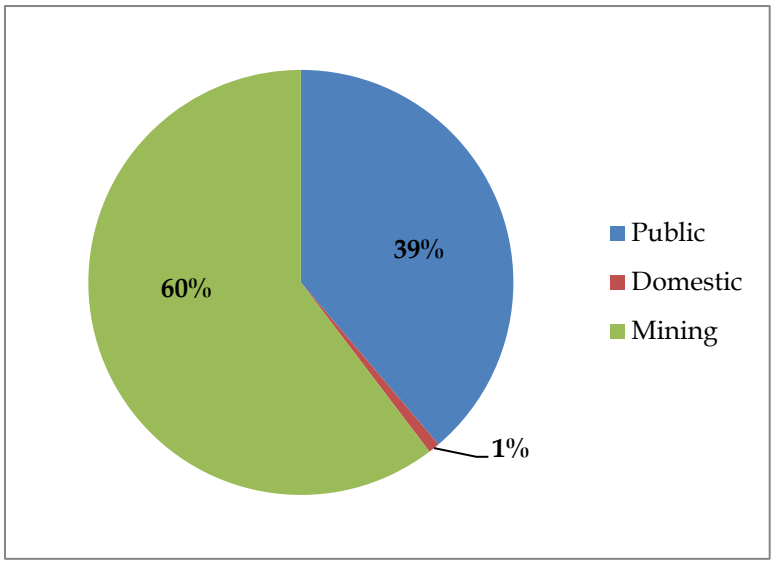
Descriptions of the types of water uses in Table 3.3-4 are provided below (USGS, 2009):

- Public-supply water is withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public suppliers provide water for a variety of uses, such as domestic (not self-supplied), commercial, industrial (not self-supplied), thermoelectric-power, and public water use.
- Domestic self-supplied water use is for indoor household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and outdoor purposes such as watering lawns and gardens (self-supplied water use is withdrawn from a groundwater or surface-water supply source by a user rather than being obtained from a public supply).
- Industrial self-supplied water is used for fabrication, processing, washing, and cooling.
- Irrigation water is applied by an irrigation system to assist crop and pasture growth, or to maintain vegetation on recreational lands such as parks and golf courses.
- Livestock water is used for livestock watering, feedlots, dairy operations, and other on-farm needs.
- Aquaculture water is associated with the farming of organisms that live in water (such as finfish and shellfish) and off stream water use associated with fish hatcheries.
- Mining water is for the extraction of naturally occurring minerals including solids (such as coal, sand, gravel, and other ores), liquids (such as crude petroleum), and gases (such as natural gas).
- Thermoelectric-power water is used in the process of generating electricity with steam-driven turbine generators (refers only to self-supplied thermoelectric-power withdrawals, otherwise included in "public-supply water use" category).

3.3.5.3.1. Arctic Hydrologic Subregion Surface Water Use

As shown in Figure 3.3-2, the 2010 estimated fresh surface water use for the NSB was 60 percent for mining, and 39 percent for public supply. Domestic self-supplied water accounts for 1 percent of the surface water use. As previously mentioned, data on surface water use are available by borough or census area. Borough boundaries are shown on Figure 3.3-8. The NSB intersects with Sagavanirktok River and Kuparuk River watersheds. The surface water use for the NSB is shown in Table 3.3-4.

Figure 3.3-2 2010 Fresh Surface Water Use (Percent) for the North Slope Borough



Source: USGS, 2010b

3.3.5.3.2. Interior-Yukon Hydrologic Subregion Surface Water Use

Borough and census area boundaries are shown on Figure 3.3-8. Unlike the Arctic Hydrologic Subregion, the proposed Project Area in the Interior-Yukon Hydrologic Subregion crosses through several different boroughs and census areas. The Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts-Yukon River, and Lower Tanana River watersheds are all within the Yukon-Koyukuk Census Area (YKCA). The estimated surface water use is primarily for mining (90 percent) with the remaining 10 percent used for public water systems (USGS, 2010f).

The Tolovana River Watershed is situated half in the YKCA and half in the FNSB. Total water use in the FNSB is much greater than the total water use in the Yukon-Koyukuk River watershed; therefore, for the purposes of this SEIS, the average water use for the Tolovana River Watershed is represented by the FNSB water use estimates. The Tanana Flats Watershed is also represented by the FNSB estimates. In the FNSB, three quarters (75 percent) of the water use for these watersheds is for thermoelectric power, and one quarter (25 percent) for mining. The Nenana River Watershed is located in the Denali

Borough. The surface water use in this watershed is exclusively for thermoelectric power.

3.3.5.3.3. Southcentral Hydrologic Subregion Surface Water Use

The Southcentral Hydrologic Subregion intersects with the proposed Project in both the Mat-Su Borough and the Municipality of Anchorage (Figure 3.3-8). The Chulitna River and Lower Susitna River watersheds are entirely encompassed within the Mat -Su Borough. Based on data provided previously in Table 3.3-4, surface water is used primarily for aquaculture (93 percent) with 7 percent for mining.

3.3.5.4. Surface Water Quality

Surface water quality data are sparse in Alaska. Some sources include EPA's Enforcement Targeting Tool (ETT) (formerly the Significant Non-Complier list), USGS, and ADEC Division of Water. The ETT is a tool created by EPA to help state Drinking Water Programs track public water systems that are deemed by EPA to be significantly out of compliance with SDWA regulations. USGS provides information on Alaska's rivers and streams, groundwater, and water quality, and operates the most extensive satellite network of stream-gauging stations in the state (USGS, 2011c). Note that the ETT is not necessarily indicative of water quality. While a permit violation may imply that surface water quality is affected, it is not a direct indication of the quality of the surface water.

ADEC's Division of Water role is to protect and improve water quality in Alaska by establishing standards for keeping water clean, and regulating discharges into waters and wetlands (ADEC, 2011). ADEC cooperates with USGS, the EPA, and the National Water Quality Monitoring Council to maintain a significant collection of water quality data using the Water Quality Portal. Water Quality Portal access can be found at https://www.waterqualitydata.us/. In addition, ADEC has published Alaska's 2014/2016 Public Notice Draft, Integrated Water Quality Monitoring and Assessment Report, which lists impaired waterbodies (ADEC, 2017a).

An impaired waterbody is one that is polluted to the point where it does not meet its designated use. For example, a waterbody designated for swimming could become impaired if pollution increased to the point where it was not desirable or safe for people to swim. A lake designated for aquatic life could become impaired if it became polluted to the point where certain types of fish that used to thrive there could no longer live. As a waterbody becomes impaired, the existing aquatic ecosystem changes for the worse, fish or wildlife habitat is degraded, and in extreme cases, public health may be threatened. Impaired waterbodies located near the pipeline route are discussed by respective hydrologic subregion.

Select water quality data are provided in AGDC's 2010 Lake Studies Completion Report, Prudhoe Bay to Galbraith Lake, which provides water quality parameters for 32 lakes located within the Arctic Hydrologic Subregion and the Surface Transportation Board's

FEIS for the Alaska Railroad Corporation (ARRC) Construction and Operation of a Rail Line Extension to Port Mackenzie, Alaska. The UAF Water and Environmental Research Center (WERC) website provides some water quality data (*i.e.*, dissolved oxygen [DO] and conductivity) from 2005 through 2008 for a few lakes found in the Kuparuk Watershed. These data are discussed under the respective hydrologic subregion.

The UAF WERC website includes minimal (2005-2008) water quality data for a few lakes over a few months in the year, all located in the National Petroleum Reserve - Alaska (NPR-A) and Kuparuk watershed.

There are relatively few (200) USGS stream gauge sampling sites in Alaska in relation to the amount of surface water present. Available USGS data are often out of date and usually do not cover many water quality parameters. Two or three representative stream gauges were identified within each watershed (or HUC) within or as close as possible to the proposed Project Area (USGS, 2010d). Data were considered representative if collected after 1970. For the proposed Project Area along the existing TAPS ROW, data collected prior to 1977 were not considered representative because it pre-dates the TAPS project development. Data sites were initially selected based on:

- Collection date (post-1977 or post-1970, as described above);
- Proximity to the proposed Project Area (no further than 10 miles from the proposed Project Area);
- Proximity to each other (no further than about 50 miles apart along the proposed Project alignment); and
- Parameters monitored (vegetation - done for at least two of the selected parameters such as temperature and color).

In instances where gauges were located within 10 miles of each other, the site with the most recent data was selected. If sampling sites were not available within 50 miles of the proposed Project, the next closest data point was included. A discussion on the representative data for a given watershed is presented in the following sections, which describe the surface water quality of each hydrologic subregion in detail. Because the designated use which identifies the applicable WQS in 18 AAC 70.020 for each waterbody studied is not available, the water quality at selected locations has been compared to the water quality standard for the most stringent designated use.

The selected USGS surface water quality sampling sites are discussed more specifically in the following sections under the respective hydrologic subregions.

ADEC's Drinking Water Program requires public water systems (both surface water and groundwater) in the State of Alaska to comply with drinking water regulations in 18 AAC 80 in accordance with the federal SDWA (ADEC, 2017b). Public water systems are divided into the following categories:

- Community Water System (CWS):
  - Expects to serve, year round, at least 25 individuals.
  - Is expected to serve, year round, at least 15 residential service connections.
- Non-Transient Non Community Water System (NTNCWS):
  - Regularly serves the same 25 or more individuals for at least 6 months of the year.
- Transient Non Community Water System (TNCWS):
  - Is not a CWS or NTNCWS.
  - Regularly serves at least 25 individuals each day for at least 60 days of the year.
- Private Water Systems:
  - Is not a CWS, NTNCWS, or TNCWS system, and is not a private well or a duplex.
- The types of contaminants that are regulated include:
  - Bacteria, viruses (from septic systems, etc.) and parasitic protozoans;
  - Lead and copper;
  - Nitrate and nitrite (commonly from septic systems and manure piles);
  - Heavy metals like arsenic and cadmium;
  - Volatile organic compounds (VOC) like benzene and gasoline;
  - Synthetic organic contaminants like pesticides and herbicides; and
  - Other organic compounds like dioxin and polychlorinated biphenyls (PCBs).

ADEC is not responsible for overseeing private water systems. A public water system can be assumed to be generally in compliance with existing EPA standards, unless they are on EPA's ETT list. The ETT lists systems that exhibit serious, frequent, or persistent non-compliance with drinking water regulations and meets the ETT criteria as defined by EPA's enforcement targeting formula (EPA, 2014). As of January 2016, the there are no public water systems (sourced primarily by surface water) within 15 miles of the proposed Project (ADEC, 2016b). Sections 3.3.5.4.1 (Arctic), 3.3.5.4.2 (Interior-Yukon), and 3.3.5.4.3 (Southcentral) describe the surface water quality for each hydrologic subregion in the proposed Project Area.

3.3.5.4.1. Arctic Hydrologic Subregion Surface Water Quality

Existing surface water quality was evaluated using the publicly available data described in Section 3.3.5. The Arctic Hydrologic Subregion has no public water systems with surface water as a primary source listed on EPA's ETT (ADEC, 2011). USGS surface water and groundwater-monitoring sites are those that meet the selection criteria described in Section 3.3.5. None of the selected USGS stream gauge sampling sites are located within the proposed Project Area ROW. The proposed Project Area in both the Kuparuk River and Sagavanirktok River watersheds generally follows the existing TAPS ROW. For the Kuparuk River watershed, one site (Ku-S1) was found that met the selection criteria. Data were collected at Site Ku-S1 in 1986. The Sagavanirktok River watershed also had only one site (Sag-S4) that met the selection criteria. The data for Sag-S4 were collected in 1979 (post 1977), after the TAPS project was completed.

Although there has been localized population growth in certain areas of the Kuparuk and Sagavanirktok River watersheds since data were collected, there has not been any major population growth or other major construction projects near these sites. Although Ku-S1 is 10 miles from the proposed Project Area, the land use activity is likely similar (barring a potential oil spill) to the majority of the proposed Project Area in the Kuparuk River watershed. The Sag-S4 site is within a half mile of the proposed Project Area, and is likely representative of present surface water quality for the majority of the watershed (except where population growth has occurred near Prudhoe Bay).

The data from Ku-S1 indicates that the fresh surface water in the Kuparuk River watershed met the most stringent state WQS (provided in 18 AAC 70.020), where sufficient information was available with one exception (Table 3.3-5). The data for Sag-S2 indicate that the water quality exceeds the WQS for drinking water supply, but does not exceed the WQS for aquaculture (total dissolved solids [TDS] may not exceed 1,000 milligrams per liter [mg/L]).

Note that a given sampling site may have data for other WQS or criteria (for example, sulfate, nitrates, or iron), but only data for the selected WQS and criteria are shown. The Ku-S1 site and Sag-S4 sites are far apart; therefore, pre-1977 data are included in Table 3.3-5 for additional sites Sag-S1, Sag-S2, and Sag-S3. The data in Table 3.3-5 illustrate water quality sampled at five locations over an 11-year period within two watersheds (Kuparuk and Sagavanirktok). These results would likely be highly variable and not a true analysis of the actual water quality of the watersheds due to infrequent sampling at separate locations. The variability of the results would be dependent on when the sample was taken (seasonal changes), and changes due to the sampling location. Additional water quality sampling would be required to obtain a true and accurate assessment of water quality in the Kuparuk and Sagavanirktok watersheds.

Water quality studies were conducted annually by UAF WERC between 2005 and 2007 in six lakes over a few months in the Kuparuk watershed. These studies provided some general water quality results for tundra lakes. Blackburn *et al.,* (2007) stated that dissolved oxygen concentration declined from December to March, and was higher near

the water's surface than measurements taken at the bottom of the lake. The pH levels were higher in December versus February, but were lower near the water's surface for all months. Electrical conductance (micro-Siemens per centimeter [µS/cm]) was similar across all months sampled (December to April) and higher at the water's surface.

Table 3.3-6 provides ADEC's classification of waterbodies in the Arctic Hydrologic Subregion, including the Sagavanirktok and Kuparuk rivers. Neither waterbody is identified as impaired under Section 303(d) of the CWA. Most of the waterbodies remain unclassified, but it is expected that they would fall under Category 1 (ADEC, 2010). Waterbody classification definitions are provided in Section 3.3.5.1. Categories provided in table 3.3-6 may have changed since the 2012 FEIS was published, but no new waterbodies have been classified as Category 5 since the development of the 2012 FEIS; however, two new waterbodies have been proposed for Category 5 listing in the 2014/2016 Integrated Water Quality Monitoring and Assessment Report. This classification is not official until the EPA approved their listing (ADEC, 2017a).

AGDC's 2010 Lake Studies Completion Report, Prudhoe Bay to Galbraith Lake, provides water quality parameters for 32 lakes located within the Arctic Hydrologic Subregion (Table 3.3-7). Sampling locations are shown on Figure 3.7-2 in Section 3.7, Fish. The data for the 32 Lakes in the Arctic Hydrologic Subregion indicate that the fresh surface water in the in this subregion meet the most stringent state WQS listed below, with the exception of three locations for temperature, four locations for DO and two locations for pH.

Table 3.3-5 Summary of Surface Water Quality – Arctic Hydrologic Subregion

Watershed and Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Selected WQS (as described in Section 3.3.5.4)	NA	NA	15	NA[a]	Greater of: 15 or the natural condition	>4 and <17[b]	>6.0 and <8.5	NA[c]	500[d]	200[5]
Kuparuk River (19060401)										
15896000	Ku-S1	8/21/1986	7.4	0.60	--	12.7	6.9	39.0	0.0	54
Sagavanirktok River (19060402)										
694943148451300	Sag-S1	9/21/1975	0.5	--	3	14.3	7.6	--	133	--
692200148433000	Sag-S2	5/2/1975	0.0	--	5	--	8.0	--	563	--
15910200	Sag-S3	9/16/1975	2.5	--	--	--	--	--	--	--
15904900	Sag-S4	5/23/1979	6.5	--	--	--	7.8	--	--	--

Source: USGS, 2010c (Disclaimer: The data from the USGS NWI system web database may not have received Directors approval and are therefore provisional and subject to revision)
a Unable to specify turbidity WQS because turbidity is dependent upon both natural turbidity and specific use for each waterbody.
b Aquaculture in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.
c There is insufficient information is available to determine if the data meet the WQS for FC. In a 30-day period, the geometric mean may not exceed 20 FC/100 mL, and not more than 10% of the samples may exceed 40 FC/100 mL.
d In addition, neither chlorides nor sulfates may exceed 250 mg/L.
e Insufficient information is available to determine whether measurable increase in concentration of settleable solids above natural conditions has taken place, so the sediment data are compared to the second most stringent criteria: water supply for agriculture. In addition to meeting the 200 mg/L standard, the water must also be free of particles of 0.074 mm or coarser.
°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
mL = milliliters
mm = millimeters
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available
Representative data sites are bolded, parameters that may exceed a WQS are highlighted gray.

Table 3.3-6 ADEC Waterbody Classification – Arctic Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Kuparuk River	0	0	Kuparuk River	0	0
Sagavanirktok River	0	Sagavanirktok River to Simpson Lagoon	Colleen Lake, Lake McDermott, and Sagavanirktok River	0	0

Source: ADEC, 2010

Table 3.3-7 Summary of Water Quality Data for 32 Lakes in the Arctic Hydrologic Subregion

Lake Name	Sample Date	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (mg/L)	pH Metered	pH Litmus Paper	Color of Water Observed
Selected WQS (as described in Section 3.3.5.4)		15	>4 and <17[a]	NA	NA	>6.0 and <8.5	>6.0 and <8.5	NA
DNR001	7/8/2010	15	13.05	380		7.6	6.5	Hummic Muddy
DNR002	7/9/2010	16	0.29	244		7.8		Muddy
DNR003	7/9/2010	14	12.43	296	0.18	7.4		Muddy
DNR004	7/9/2010	18	11.67	327	0.18	7.5		Clear
DNR005	7/9/2010	15	14.8	191		8.6		Unknown value
DNR006	7/10/2010	14	13.4	147		7.8		Clear
DNR007	7/10/2010	14	11.82	142	0.09	7.8		Hummic
DNR009	7/11/2010	12	10.11	183	0.11	6.8		Unknown value
DNR013	7/12/2010	15	10.84	159	0.09	7.6		Clear
DNR016	7/12/2010	14	20.6	90	0.05	6.9		Hummic
DNR019	7/13/2010	14	12.38	114	0.07	6.8		Hummic
DNR020	7/17/2010	14	11.2	51		6.9		Muddy
DNR021	7/17/2010	14	11.72	3	0	6.8		Muddy
DNR022	7/13/2010	13	10.81	29	0.02	6.1		Hummic
DNR024	7/14/2010	16	10.54	44	0.01	7.3		Clear
DNR025	7/14/2010	13	16	27		6.3		Muddy

Lake Name	Sample Date	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Specific Conductance (µS/cm)	Salinity (mg/L)	pH Metered	pH Litmus Paper	Color of Water Observed
DNR028	7/15/2010	14	20	62		7.1		Clear
DNR029	7/17/2010	14	20.26	46	0.03	6.4		Clear
DNR030	7/14/2010	13	11.07	25	0.01	6.9		Muddy
DNR031	7/13/2010	13	9.58	101	0.06	6.5		Hummic
DNR033	7/14/2010	16	10.68	133	0.08	6.6		Hummic
DNR034	7/16/2010	13	10.78	84	0.05	7.1		Hummic
DNR035	7/16/2010	13	15.4	113	0.07	7.1		Clear
DNR036	7/15/2010	12	11.71	10	0.01	6.5		Clear
DNR037	7/15/2010	11	11.52	18	0.01	5.8		Hummic
DNR038	7/16/2010	14	13.4	20	0.01	6.9		Clear
DNR039	7/17/2010	13	10.53	19	0.01	5.9		Clear
DNR040	7/16/2010	11	9.61	25	0.02	5.9		Hummic
DNR042	7/17/2010	12	10.81	146	0.09	7.3		Hummic
DNR044	7/16/2010	13	11.37	194	0.12	8.1		Clear
DNR045	7/16/2010	7	12.47	78	0.05	7.1		Hummic
Galbraith	7/16/2010	12	9.91	138	0.09	7.1		Clear

Source: AGDC, 2011a

a Aquaculture in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.

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3.3.5.4.2. Interior-Yukon Hydrologic Subregion Surface Water Quality

The Interior-Yukon Hydrologic Subregion has no public water systems with surface water as a primary source listed on EPA's ETT (ADEC, 2011). None of the selected USGS surface water quality sites are within the proposed Project Area footprint. The proposed Project Area that crosses the Upper Koyukuk, South Fork Koyukuk, Kanuti, Ramparts-Yukon River, and part of the Tolovana watersheds generally follows the existing TAPS ROW. The data in Table 3.3-8 illustrates water quality sampled at 11 locations over a 33-year period within eight watersheds. The infrequent historical sampling at these sites would not adequately portray the actual water quality in these watersheds. The variability of the results would be dependent on when the sample was taken (seasonal changes), years apart, and changes due to the sampling location. Additional water quality sampling would be required to obtain a true and accurate assessment of water quality in these interior watersheds. Sampling the water chemistry and quality seasonally throughout a full year would provide more detailed characterization of the surface water by drainage.

One USGS surface water-monitoring site within the Upper Koyukuk River watershed (UK-S2) met the selection criteria listed in Section 3.3.4 and is in very close proximity to the proposed Project Area. Considering this site was sampled in 1978, after the construction of TAPS, and that there has not been any major population growth or other major construction projects in the watershed since then, it is reasonable to assume the data represent current surface water quality in the proposed Project Area. For UK-S2, the fresh surface water in the Upper Koyukuk River watershed met the WQS for temperature and pH for all water uses. The other two sites sampled in this watershed as shown in Table 3.3-8 (UK-S1 and UK-S3), were sampled before 1977 when TAPS was built. Therefore, data from those sites may or may not represent local water quality.

The South Fork Koyukuk River and Kanuti River watersheds had no sites that met the selection criteria listed in Section 3.3.4. One site (SFK-S1) was sampled in 1975, and a second site (Ka-S1) was sampled in 1972, prior to TAPS construction in 1977.

The Ramparts-Yukon River watershed had one site (Ra-S1) that met the selection criteria listed in Section 3.3.4, and was recently sampled in 2005. There has not been any major population growth or other major construction projects in the watershed since 2005. Given that Ra-S1 is close to the proposed Project Area, it is reasonable to assume the data represent current surface water quality in the proposed Project Area. Based on available data, the Ramparts-Yukon River watershed met the most stringent WQS for drinking water, agriculture, and water recreation (see Table 3.3-8), with the exception of the level of sediment.

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Table 3.3-8 Summary of Surface Water Quality from USGS Stream Gauge Sites – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Selected WQS (as described in Section 3.3.5.4)	NA	NA	15	NA[a]	Greater of: 15 or the natural condition	>4 and <17[b]	>6.0 and <8.5	NA[c]	500[d]	200[e]
Upper Koyukuk River (19040601)										
675538149511100	UK-S1	3/15/1972	1.5	--	--	11.6	7.9	--	--	--
15564875	UK-S2	3/16/1978	2.0	--	--	--	7.3	--	--	--
671546150121600	UK-S3	6/20/1972	8.0	--	10	10.4	8.4	--	116	--
South Fork Koyukuk (19040602)										
15564887	SFK-S1	5/18/1975	0.0	--	--	--	<5.5	--	--	--
Kanuti River (19040604)										
662603150380700	Ka-S1	3/14/1972	0.0	--	5	7.8	7.2	--	82	--
Ramparts –Yukon River (19040404)										
15453500	Ra-S1	8/22/2005	13.4	--	--	11.6	7.9	--	140	616
Tolovana (19040509)										
652753148374900	To-S1	3/14/1972	0.5	--	20	0.4	7.6	--	184	--
Lower Tanana (19040511)										
N/A – see TF-S1										
Nenana River (19040508)										
15518250	Ne-S1	8/25/1972	11.5	--	130	--	7.0	--	48	--
15518040	Ne-S2	7/31/1991	7.3	85	80	11.0	7.8	--	148	--
15516200	Ne-S3	9/27/1972	1.0	--	0.0	--	7.6	--	95	--
Tanana Flats (19040507)										
15515500	TF-S1	8/30/2005	10.9	--	--	10.7	7.9	--	E 167	1090

Source: USGS, 2010c (Disclaimer: The data from the USGS NWI system web database may include data that have not received Directors approval and is provisional and subject to revision)

a Unable to specify turbidity WQS because turbidity is dependent upon both natural turbidity and specific use for each waterbody.

b Aquaculture in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.

c There is insufficient information is available to determine if the data meets the WQS for FC. In a 30-day period, the geometric mean may not exceed 20 FC/100 mL, and not more than 10% of the samples may exceed 40 FC/100 mL.

d In addition, neither chlorides nor sulfates may exceed 250 mg/L.
e Insufficient information is available to determine whether measurable increase in concentration of settleable solids above natural conditions has taken place, so the sediment data is compared to the second most stringent criteria: water supply for agriculture. In addition to meeting the 200 mg/L standard the water must be free of particles of 0.074 mm or coarser.
°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
mL = milliliters
mm = millimeter
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated
N/A means not available
Representative data sites are bolded, parameters that may exceed a WQS are highlighted gray.

The Tolovana River watershed had no sites that met the selection criteria listed in Section 3.3.4. One site (To-S1) near the TAPS ROW was sampled in 1972, and may or may not represent local water quality due to the age of the samples and because TAPS was built in 1977. Note that Goldstream Creek in the Tolovana watershed is included in ADEC's list of impaired waters, as described in more detail below.

No data from sample sites were available near the proposed Project Area in the Lower Tanana River watersheds.

The proposed Project Area is not adjacent to the TAPS ROW in the Nenana River watershed where three sites (Ne-S1, Ne-S2, and Ne-S3) met the selection criteria listed in Section 3.3.4. These sites were sampled in 1972, 1991, and 1972, respectively. There has been population growth in this corridor since 1972. Based on the data collected in 1991 from Ne-S2, the fresh surface water in the Nenana River watershed met the WQS for temperature, dissolved oxygen, pH, and TDS for all water uses, but it did not meet the WQS for turbidity or color for drinking water, agriculture, and water recreation (Table 3.3-8).

The Tanana Flats watershed, sampled in 2005, had one site (TF-S1) that met the selection criteria. The land use has not changed significantly since this time; therefore, it is likely representative of current conditions. Based on available data for this site (located near the proposed Project Area), the surface water quality met the most stringent WQS parameters with the exception of the level of suspended sediment (Table 3.3-8).

Table 3.3-9 illustrates ADEC's classification of waterbodies in the Interior-Yukon Hydrologic Subregion. There is one waterbody in Category 5, which lists impaired waters identified under Section 303(d) of the CWA. While most of the waterbodies remain unclassified, it is likely that they would be placed in Category 1 (ADEC, 2010). Waterbody classification definitions are provided in Section 3.3.5.1. Categories provided in Table 3.3-9 may have changed since the table was created for the 2012 FEIS, but no new waterbodies have been classified as Category 5.

Goldstream Creek, in the Tolovana River watershed, is listed as impaired (Category 5) by ADEC, as described below. Large volumes of fine sediment have been deposited in Goldstream Creek over time since the 1900s due to hydraulic stripping and dredging from placer gold mining in the Goldstream Valley (ADF&G, 1987). As a result, Goldstream Creek has a constant elevated level of turbidity and total suspended solids (TSS).

Table 3.3-9 ADEC Waterbody Classification – Interior-Yukon Hydrologic Subregion

Watershed	Category 1 Unclassified	Category 2	Category 3	Category 4	Category 5 (Section 303(d)) Impaired
Upper Koyukuk River	0	0	0	0	0
South Fork Koyukuk River	0	0	0	0	0
Kanuti River	0	0	0	0	0
Rampart-Yukon River	0	0	Minook Creek	0	0
Tolovana River	0	0	Chatanika River	0	Goldstream Creek
Lower Tanana River	0	0	0	0	0
Nenana River	0	0	Lignite Creek	0	0
Tanana Flats	0	0	Bear Creek Birch Lake McDonald Creek Pile Driver Slough Quartz Lake Shaw Creek	0	0

Source: ADEC, 2017a

3.3.5.4.3. Southcentral Hydrologic Subregion Surface Water Quality

The Southcentral Hydrologic Subregion has no public water systems with surface water as a primary source listed on EPA's ETT (ADEC, 2011). None of the selected USGS surface water quality sites are located within the proposed Project Area; this segment of the proposed Project is not within close proximity to the TAPS ROW. The Chulitna River watershed has five sites (Chu-S1 to Chu-S5) that met the selection criteria based on data collected in 2000, 1974, 1985, and 2012 respectively. There has been population growth in this corridor since 1985, so the 2000 data collected at Chu-S1 is probably the most representative data available. Based on available Chu-S1 data, the fresh surface water in the Chulitna River watershed met the WQS the most stringent state WQS (provided in 18 AAC 70.020) (Table 3.3-10).

The Lower Susitna River watershed has four sites (LS-S1 to LS-S4) that met the selection criteria based on data collected in 1985, 1983, 1973, and 2012 respectively (Table 3.3-10). In this area, the proposed Project is not within close proximity to the TAPS ROW. Similar to the Chulitna watershed, population growth has also in this corridor since 1985 so it is difficult to determine whether data from these sites still represent local water quality.

At the time of sampling, fresh surface water met the most stringent state WQS for most parameters except:

- Sediment concentrations exceeded the WQS for the second most stringent criteria, agricultural use, at CHU-S3 and LS-S1 for SS.
- Temperature exceeded the WQS for drinking water supply use, but was below the agricultural use criteria (30 degrees Celsius [°C]).

Note that Big Lake and Cottonwood Creek are included in ADEC's list of impaired waters, as described in Section 3.3.3.

In 2008, the STB Section of Environmental Analysis collected surface water quality data at selected streams near the Port MacKenzie Rail Line Extension (STB, 2011), as shown in Table 3.3-11. STB-2, STB-S6, and STB-S11 exceeded WQS for temperature for drinking water use, but were within the WQS for agricultural use (30°C).-

Table 3.3-10 Summary of Surface Water Quality – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment mg/L)
Selected WQS (as described in Section 3.3.5.4)	NA	NA	15	NA[a]	Greater of: 15 or the natural condition	>4 and <17[b]	>6.0 and <8.5	NA[c]	500[d]	200[e]
Chulitna River (19020502)										
15292302	Chu-S1	9/7/2000	5.3	--	--	13.2	7.5	--	E 35	<1
624431150070600	Chu-S2	6/11/1974	14.0	--	3	--	--	--	30	--
15292410	Chu-S3	9/17/1985	3	--	--	--	--	--	--	544
15292400	Chu-S4	7/11/2012	--	220	--	--	--	--	--	--
15293200	Chu-S5	6/26/2012	8.7	--	--	--	--	--	--	--
Lower Susitna River (19020505)										
15292780	LS-S1	6/25/1985	9.2	190	--	10.5	8.2	--	73	488
15294012	LS-S2	7/26/1983	14.0	--	--	9.7	7.0	--	--	--
614300150064900	LS-S3	6/19/1973	15.5	--	4	--	7.6	--	78	--
15292800	LS-S4	7/2/2012	12.7	--	--	--	--	--	--	--

Source: USGS, 2010c (Disclaimer: The data from the USGS NWI system web database may include data that have not received Directors approval and is provisional and subject to revision)
a Unable to specify turbidity WQS because turbidity is dependent upon both natural turbidity and specific use for each waterbody.
b Aquaculture in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.
c There is insufficient information is available to determine if the data meets the WQS for FC. In a 30-day period, the geometric mean may not exceed 20 FC/100 mL, and not more than 10% of the samples may exceed 40 FC/100 mL.
d In addition, neither chlorides nor sulfates may exceed 250 mg/L.
e Insufficient information is available to determine whether measurable increase in concentration of settleable solids above natural conditions has taken place, so the sediment data is compared to the second most stringent criteria: water supply for agriculture. In addition to meeting the 200 mg/L standard the water must be free of particles of 0.074 mm or coarser.
°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
mL = milliliters
mm = millimeter
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available

Table 3.3-11 Stream Surface Water Quality Data Collected in 2008 by OEA for the Port MacKenzie Rail Extension Project

Longitude	Latitude	Map ID	Dissolved Oxygen (mg/L)	Temperature (°C)	Turbidity (NTUs)	Total Dissolved Solids (mg/L)	pH (s.u.)	Conductivity (µS/cm)	Port Mackenzie Segment and MP
Selected WQS (as described in Section 3.3.5.4)			>4 and < 17[a]	15	NA[b]	500[c]	>6.0 and <8.5	NA	NA
-150.137363000	61.441757000	STB-S1	9.9	13.8	4	130	7.6	201	C1-2.6
-150.114200000	61.472380000	STB-S2	11.9	16.7	120	120	7.5	179	H-0.8
-150.153980000	61.377590000	STB-S3	10.0	14.7	92	140	7.1	200	MW-11.0
-150.136320000	61.368830000	STB-S4	12.3	6.2	15	160	6.9	240	MW-10.1
-150.072770000	61.306850000	STB-S5	9.7	12.8	4	100	7.5	160	MW-4.6
-150.063967000	61.810311000	STB-S6	11.9	15.6	64	80	7.2	127	MP-190.3
-150.063740000	61.791420000	STB-S7	10.1	13.6	27	60	6.8	80	MP-189
-150.124950000	61.778160000	STB-S8	11.8	11.4	12	50	6.2	70	W-24.0
-150.148625000	61.735021000	STB-S9	11.5	11.9	27	80	7.3	118	W-20.9
-150.158330000	61.678370000	STB-S10	7.2	13.7	9	80	6.9	120	W-16.7
-150.211930000	61.592310000	STB-S11	10.7	18.9	54	60	7.1	90	W-10.0
-150.138240000	61.472220000	STB-S12	12.3	14.1	5	70	7.6	110	W-0.6

Source: STB, 2011

a Aquaculture in estuaries and tidal tributaries may not be less than 5.0 mg/L except where natural conditions cause this value to be depressed.

b Unable to specify turbidity WQS because turbidity is dependent upon both natural turbidity and specific use for each waterbody.

mg/L = milligrams per liter

c In addition, neither chlorides nor sulfates may exceed 250 mg/L.

°C = degrees Celsius

NTU = nephelometric turbidity units

pH = measure of acidity or alkalinity of a solution

s.u. = standard units

µS/cm = micro-Siemens per centimeter -

Table 3.3-12 shows ADEC's classification of waterbodies in the Southcentral Hydrologic Subregion. There are three waterbodies included in Category 5, which are impaired waters identified under Section 303(d) of the CWA. Most of the waterbodies remain unclassified, but ADEC expects that most would be in Category 1 (ADEC, 2017a). Waterbody classification definitions are provided in Section 3.3.5.1.

Table 3.3-12 ADEC Waterbody Classification – Southcentral Hydrologic Subregion

Watershed	Category 1	Category 2	Category 3	Category 4	Category 5 (Section 303(d))
Chulitna River	0	0	0	0	0
Lower Susitna River	0	Cottonwood Creek	Birch Creek Canoe Lake Cottonwood Lake Deshka River Finger Lake Goose Bay Goose Creek Kalmbach Lake Little Susitna River Meadow Creek Memory Lake Montana Creek (Talkeetna) Nancy Lake Susitna River Wasilla Creek Wasilla Lake Willow Creek	Lake Lucille Big Lake	Cottonwood Creek
Kenai Peninsula	0	Kenai River	0	0	Kenai River
Matanuska-Susitna Borough	0	0	0	Little Susitna River	Little Susitna River

Source: ADEC, 2017a

Cottonwood Creek, in the Lower Susitna River watershed, the Kenai River, and the Little Susitna River are listed as impaired waterbodies by ADEC. Category 4a waterbodies listed as having an EPA-approved TMDL include Lake Lucille and Big Lake in the Lower Susitna River watershed and the Little Susitna River. The Category 5 listing is described below. Big Lake was removed from the Category 5 list in 2012 and placed on the Category 4a list because a TMDL has been developed for petroleum hydrocarbons (ADEC, 2017a).

3.3.5.4.3.1.1. Impaired Waterbodies

3.3.5.4.3.1.1.1. Cottonwood Creek

Seven miles of Cottonwood Creek located in Wasilla are of concern due to WQS for fecal coliform (FC) bacteria. ADEC (2010) stated:

> *Cottonwood Creek (13 miles) was Section 303(d) listed in non-attainment of the residues standard for foam and debris in 2002/2003. ADEC has received numerous complaints about foam in Cottonwood Creek and foam was observed in the creek in 1998, 2000, 2001, and 2002. Through grant funds, an intensive water quality evaluation was conducted on Cottonwood Creek beginning in September 2004 and continuing through June 2006 for a TMDL assessment. Water quality sampling conducted in 2004 and 2005 indicated that the foam present in Cottonwood Creek is most likely naturally occurring. However, hydrologic changes within the watershed may be influencing the amount and timing of the foam. Continued water quality sampling in 2006 focused on determining the extent of FC bacteria and temperature exceedances discovered during the sampling for foam, as well as further investigation of the foam. Foam and temperature were determined to be naturally occurring hence meeting WQS. FC bacteria exceeded WQS, and the source(s) is unknown. Cottonwood Creek is now in Category 2 for attainment of the residues (foam) standard and impaired for FC bacteria.*

Additionally, The Kenai River was included on the Catergory 5, Section 303(d) impared list as a result of turbidty along with 8.5 reiver miles of the Little Susitna Rive, from one mile upstream of the Little Susitna River Public Use Facility boat launch to 7.5 river miles downstream of the boat launch (ADEC, 2017a).

3.3.6. Groundwater

Groundwater is water that flows or seeps downward and saturates soil or rock, supplying springs and wells (USGS, 2011b). Groundwater replenishes streams, rivers, and wetland habitats with fresh water from an aquifer. An aquifer is a geological formation or structure, which stores or transmits water, such as to wells and springs (USGS, 2011b). There are different types of aquifers, characterized based on aquifer composition.

Course-grained alluvial[14] and glacial-outwash deposits present in lowland areas in Alaska are likely to yield large quantities of water, if the deposits are not frozen. Such deposits present in Fairbanks and Anchorage are known to yield large quantities of water. Course-grained alluvial and glacial-outwash deposits intersect the pipeline corridor in the Yukon River Valley, around Fairbanks and the Tanana River Valley, and

[14] A general term for clay, silt, sand, gravel or similar unconsolidated detrital material, deposited during comparatively recent geologic time by a stream or other body of running water, as a sorted or semi-sorted sediment.

in the Susitna River Valley (USGS, 2000). Depth to first groundwater within the proposed Project corridor is reported to range from a few feet deep to more than 400 feet deep (ADEC, 2008a).

As of 2008, groundwater was a source of drinking water for about 50 percent of Alaska's population, and 90 percent of the state's rural residents. Groundwater is a source for 83 percent of Alaska's 1,602 public drinking water systems (ADEC, 2008a). Estimated fresh groundwater withdrawals in the proposed Project Area are provided in Table 3.3-13.

Table 3.3-13 2010 Estimated Fresh Groundwater Withdrawals by Borough or Census Area (MG/day)

Borough or Census Area	Public Supply	Domestic Self-Supplied	Industrial Self-Supplied	Irrigation	Livestock	Aqua-culture	Mining	Thermo-electric Power	Total
North Slope	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.04
Yukon-Koyukuk	0.17	0.02	0.00	0.00	0.00	0.29	0.00	0.00	0.48
FNSB	7.45	2.60	0.45	0.20	0.02	0.01	0.00	0.70	11.43
Denali	0.01	0.12	0.00	0.05	0.00	0.02	0.00	0.60	0.80
Mat-Su	1.57	4.22	0.19	0.51	0.02	5.11	0.01	0.00	11.63

Source: USGS, 2010b

Groundwater quality information for the proposed Project Area was obtained through public sources including ADNR's Well Log Tracking System (WELTS), ADEC's Drinking Water Watch Program, EPA's ETT, and USGS. Arsenic has been documented to occur in groundwater in some areas of the proposed Project footprint. As of April 2010, ADEC listed 33 contaminated sites within a 1,000-foot radius from the federal ROW of the Parks Highway.

Groundwater is protected under ADEC regulation from reported contaminated sites, storage tanks, spill response, and specific waste disposal activities. ADEC has implemented a community-based effort to protect groundwater sources for public drinking water under the Drinking Water Protection Program (DWPP). The DWPP includes three components: source water assessments, groundwater protection, and wellhead protection under the requirements of the SDWA. Source water is where the drinking water originates; it could be from groundwater through a well, or surface water through a lake or river. Source water assessments identify the potential contamination risk in order to prioritize protection efforts for public water systems. Drinking water protection areas traversed by the pipeline route are provided in Appendix G of the 2012 FEIS.

This figure was not updated as part of this SEIS because changes to the pipeline route are insignificant at the scale provided. Finer scale maps of ADEC designated Drinking Water Protection Areas are provided on ADEC's interactive mapping website (http://www.arcgis.com/home/webmap/viewer.html?webmap=13ed2116e4094f9994775af9a62a1e85). Table 3.3-14 identifies drinking water wells within 500 feet of the proposed pipeline route.

Table 3.3-14 Drinking Water Wells within 500 Feet of the Proposed Pipeline Route

Location Description	Well Depth (feet)	Distance From Proposed Pipeline	Easting Alaska State Plane, Zone 4 (U.S. feet)	Northing, Alaska State Plane, Zone 4 (U.S. feet)
Lynx Creek Camp	175	33	1818761.5632	3563110.1171
Parks Highway, M228.5, USS 5545	127	42	1819789.4537	3561567.1280
Parks Highway, M230.0	131	42	1819789.4537	3561567.1280
Talkeetna, L008 & L009	40	65	1594149.6582	3038016.1485
Petersville Road, M1.5	43	65	1594149.6582	3038016.1485
Trapper Creek	71	65	1594149.6582	3038016.1485
Petersville Road, M2.1	58	65	1594149.6582	3038016.1485
Trapper Creek	185	65	1594149.6582	3038016.1485
Troublesome Creek Wayside	64	89	1601802.1873	3151576.5381
Parks Highway, M238.0, Denali NPP	172	122	1821450.3990	3560516.6486
Montana Creek Campground, PWSID 221321	59	217	1630282.402	2960940.598
Susitna Landing, Plat 80	219	234	1627429.0449	2891584.7967
Happy Creek, Fairbanks	187	237	1959066.2449	3982986.4323
Lynx Creek Store, PWSID 391702	100	253	1819042.712	3563047.290
Parks Highway, M214.0	40	262	1835557.1444	3457142.8009
Parks Highway, M210.7, Cantwell	38	262	1835557.1444	3457142.8009
Denali NPP, River Estates	420	354	1820974.3068	3560067.2800
McKinley Village	120	396	1819093.6023	3561800.3283
Talkeetna Area	53	399	1594434.7159	3035678.1178
Trilby Avenue	233	405	1955634.9605	3991625.1834
Happy Creek, Fairbanks	NA	410	1958316.6601	3985603.5764
Parks Highway, M238.0, Denali NPP	285	447	1821113.7978	3559964.2203
Myrtle A L08	265	451	1958325.5553	3985254.0024

Source: ADNR WELTS database, December 2017

3.3.6.1. Groundwater Availability

Groundwater is readily available throughout most of Alaska, except in areas of thick permafrost. The ADNR's WELTS (ADNR, 2011a) was used to obtain well yield and depth to groundwater. Most of Alaska's aquifers consist of unconsolidated materials derived from glaciers, rivers, and streams. The aquifers that produce groundwater are usually unconfined (*i.e.*, not covered by a layer of silt or clay). In permafrost free areas,

the groundwater table generally follows surface topography. The depth to groundwater varies from a few feet to more than 400 feet across Alaska (ADEC, 2008a).

WELTS provide information on private wells by meridian, township, range, and section. The information includes owner, date of completion, depth, well status, date of entry, and sometimes remarks. The remarks sometimes provide the well yield and depth to groundwater. The WELTS information found within the proposed Project Area is discussed under the appropriate hydrologic subregion below.

3.3.6.1.1. Arctic Hydrologic Subregion Groundwater Availability

Groundwater availability is limited in the Arctic Hydrologic Subregion due to permafrost; however, groundwater occurs above, below and locally within permafrost (Williams, 2007). At temperatures ranging from 32°F to 40°F, groundwater is more viscous and moves more slowly than in temperate regions (Williams, 2007). Table 3.3-15 presents data on private wells in the Arctic Hydrologic Subregion from WELTS (ADNR, 2011a).

3.3.6.1.2. Interior-Yukon and Southcentral Hydrologic Subregion Groundwater Availability

Groundwater is available in the Interior-Yukon Hydrologic Subregion because permafrost is not continuous. Permafrost is discontinuous to sporadic in the Mat-Su Borough so groundwater is available in the Southcentral Hydrologic subregion. Tables 3.3-16 and 3.3-17 present WELTS data on private wells in the Interior-Yukon and Southcentral Hydrologic Subregions (ADNR, 2011a).-

Table 3.3-15 Well Data from WELTS – Arctic Hydrologic Subregion

Meridian	Township	Range	Section	No. of Wells (WELTS)	Location	Well Depth (feet below ground level)	Static H_2O Level (feet below ground level)	Flow Rate (gallons per minute)	Date Well Completed
Umiat	15	29	19	1	Arctic Village	200	Unknown	Unknown	4/27/1967
Umiat	15	2	17	1	Anaktuvuk Pass (B9 Well 1)	147	13.6	100	6/26/1994
Umiat	15	2	17	1	Anaktuvuk Pass (B9 Well 2)	138	15.3	6	6/28/1994
Umiat	7	14	9	1	TAPS (03 PW-1, Pipe M104)	30	3.0	40	9/02/1983
Umiat	7	14	9	1	TAPS (03 PW-2, Pipe M104)	39	5.4	Unknown	5/13/1990
Umiat	7	14	9	1	TAPS (03 PW-2, Pipe M104) near Oksrukuyik	37	5.0	Unknown	11/21/1992
Umiat	12	12	8	1	TAPS 04 (Pipe M144) near Atigun River	171	143	Unknown	10/26/1978
Umiat	7	14	16	1	TAPS Pump Station 03 (PW-3)	40	5.5	4.5	5/12/1990
Umiat	9	11	29	1	Dalton Highway (Toolik Lake Research Station)	117	72	35	5/31/2006

Source: ADNR, 2011a

Table 3.3-16 Well Data from WELTS – Interior-Yukon Subregion

Meridian	Township	Range	Section	No. of Wells (WELTS)	Location	Well Depth (feet below ground level)	Static H_2O Level (feet below ground level)	Flow Rate (gallons per minute)	Date Well Completed
Umiat	7S	14E	3	1	Denali NPP Hotel & Riley Creek & Toklat Camps	404, 158, 130	Unknown	Unknown	1963
Umiat	7S	14E	25	10	R23B&C (Various)	74 - 141	37 - 99	5 - 55	1982 - 2006
Fairbanks	29N	12W	1	1	R7 (South of Clear, AK - 388 Pit (M388 of Railroad)	180	110	50	4/16/1998
Fairbanks	19N	4W	19	2		420, 180	6, 2	10, 8	1974
Fairbanks	13N	11W	36	2	R7 (McKinley Creekside Cabins)	97 , 120	42, 55	70, 100	2003, 2005
Fairbanks	1N	1W	35	1	Denali Grizzly Bear Park 3	165	82	19.5	4/26/1993
Fairbanks	1N	1W	36	9	8 in R7, 1 in R10	47 - 440	40 - 258	2 - 300	1983 - 2004
Fairbanks	1N	2W	5	1	McKinley Village, Denali Homestead L5b	190	135	20	6/23/2001
Fairbanks	1N	2W	6	15	14 in R7, 1 in R8	180 - 440	38 - 228	3 - 20	1983 - 2003
Fairbanks	1N	2W	7	35	R10 (Spinach Creek, Frenchman Drive, Foxfire Subd.)	150 - 400	45 - 268	0.5 - 18	1974 - 2000
Fairbanks	1N	3W	8	4	R10 (Various)	59 - 247	8 - 180	10 - 15	1954 - 1982
Fairbanks	4S	8W	7	6	Region 7	180 - 394	90 - 170	2.5 - 30	1983 - 1997
Fairbanks	8S	9W	16	1	R10 (TL1607, Trilby Avenue)	233	83	4-5	4/19/2001
Fairbanks	8S	9W	18	2	Parks Highway M227.2 & M227.4	249, 158	195, 115	30, 25	11/3&6/98
Fairbanks	8S	9W	21	2	R10 (Fairbanks)	164, 252	Unknown	Unknown	Unknown

Meridian	Township	Range	Section	No. of Wells (WELTS)	Location	Well Depth (feet below ground level)	Static H_2O Level (feet below ground level)	Flow Rate (gallons per minute)	Date Well Completed
Fairbanks	8S	9W	22	2	R10 (Sheep Creek Road #830, TL2210; Fairbanks)	322	DRY?		
Fairbanks	10S	8W	19	1	Parks Highway M227.8, Denali NPP	186	132	5	10/12/1999
Fairbanks	12S	8W	26	7	R10 (Various)	150 - 400	91 - 150	3 - 12	1954 - 1997
Fairbanks	13S	7W	1	1	Little Coal Creek	225	Dry	Dry	11/11/1983
Fairbanks	13S	7W	27	7	R10 (Sheep Creek; Happy Creek; Nine Mhill Road 688, TL2732)	196 - 300	80 - 110	9 - 25	1979 -1984
Fairbanks	14S	7W	35	9	R10 (Various)	85 - 200	50 - 134	5 - 18	1963 - 2010
Fairbanks	14S	7W	36	4	R10 (Various)	124 - 233	56 - 80	1 - 2.5	1961 - 1974
Fairbanks	15S	6W	11	9	R10 (Murphy Dome Rd; Drouin Spring)	92 - 270	71 - 234	4 - 15	1975 - 1989
Fairbanks	15S	6W	14	1	R7 (Cantwell)	40	4	40	2002
Fairbanks	15S	6W	16	1	R10 (Skyline Heights 1 L11 B2)	365	300	10	7/9/2007
Fairbanks	15S	7W	33	2	R7 (Cantwell)	40, 40	12, 10	25, 40	1996
Fairbanks	20S	10W	14	2	Old Wood Road 1069 / Old Nenana Highway	380	210	8	8/1/1998
Seward	32N	3W	34	18	R7	43 - 760	12 - 116	1.5 - 150	1984 - 2000
Seward	26N	5W	26	2	R6 (TAPS 06, Pipe M355, Elev. 877 feet, Near Yukon River)	800, 275	606, flowing	30, 20	1976, 1975
Seward	26N	5W	21	1	Denali NPP Riverside RV Park	160	80	60	6/23/1996
Seward	24N	5W	24	4	R7	138 - 480	127 - 270	0.5 - 20	1998 - 2004

Meridian	Township	Range	Section	No. of Wells (WELTS)	Location	Well Depth (feet below ground level)	Static H_2O Level (feet below ground level)	Flow Rate (gallons per minute)	Date Well Completed
Seward	22N	4W	23	1	Marion Creek Campground 1	50	18.5	90	7/31/1993
Seward	21N	4W	2	1	M25.5 Parks Highway, Healy	280	155	7	3/31/1981
Seward	21N	4W	12	3	Healy Area	100, 80, 73	73, 53, 63	15, 30, 15	1995 - 1998
Seward	21N	4W	13	26	R7, R8, R10	60 - 360	39 - 238	2 - 70	1984 - 2005
Seward	20N	5W	7	1	Yukon River Bridge	240	142	21.4	6/17/1974
Seward	20N	4W	20	1	Parks Highway M260.0 Rock Creek	40	9	7	6/24/2001
Seward	16N	4W	7	2	R7 (ASLS 85-237 Tr A; Parks Highway M264.5, Healy - No well data)	400	265	250	6/9/2000
Seward	16N	4W	15	1	R7 (Quota L20 B13)	220	190	10	1985
Seward	15N	4W	12	1	R7 (Rex Trail)	515	426	6	8/27/2000
Seward	15N	4W	14	2	R7 (Parks Highway M278 & M276)	229, 216	190, 192	10, 10	1986, 2001

Source: ADNR, 2011a

Table 3.3-17 Well Data from WELTS – Southcentral Subregion

Meridian	Township	Range	Section	No. of Wells (WELTS)	Location	Well Depth (feet below ground level)	Static H_2O Level (feet below ground level)	Flow Rate (gallons per minute)	Date Well Completed
Fairbanks	1N	2W	18	1	R23C (Susitna Landing L05 Plat80)	219	19	60	9/20/2000
Fairbanks	15S	6W	20	4	R23C (McKinley View Estates; Parks Highway M135.0)	60 - 260	42 – 65	0.7 - 200	1970 - 2004
Fairbanks	2N	1E	3	5	R23C (Parks Highway M147.0, Byers Lake; Byers Creek Landing)	59 - 259	24.5 – 108	2.83 - 20	1995 - 1996
Fairbanks	1N	2W	19	1	R23C (Caswell Area)	145	24	40	7/27/2001
Fairbanks	12S	8W	30	1	R23B (Spacious Kashwitna ES L6 B1)	61	35	600	9/28/1985
Fairbanks	15S	6W	31	4	R23C (Parks Highway M191)	70 - 100	40 – 53	6 - 40	1988 -1997
	19N	4W	32	5	R23C (Timber Park)	37 - 60	10.1	40	1984 - 1998
Fairbanks	1N	2W	29	5	R23C (Sunshine Area)	38 - 96	18 – 65	7.5 - 40	1984 - 1987
Fairbanks	1N	2W	32	3	R23A&C (Mat-Su HS; Sunshine HS; Montana Creek, Talkeetna)	60 - 120	38	50	1972 - 1991
Fairbanks	1N	2W	13	3	R23C (Matsu Sunshine Landfill)	33, 70, 42	no wells	no wells	no wells
Fairbanks	1N	3W	14	2	R23C (Parks Highway M102.8, Sunshine)	146, 174	80, 67	10, 40	1985, 1997
Fairbanks	1N	2W	20	1	R23C (Trapper Creek)	40	29	24	5/22/1996
Fairbanks	14N	4W	13	1	PARKS Highway M188.5	285	127	45	5/21/1973
Fairbanks	14S	7W	15	1	R23C (Wheatley L01 B2, Susitna River Road)	89	75	10	10/18/2007
Fairbanks	17S	7W	4	1	Denali Highway M133.5, Cantwell	50	14	50	5/15/1992

Meridian	Township	Range	Section	No. of Wells (WELTS)	Location	Well Depth (feet below ground level)	Static H_2O Level (feet below ground level)	Flow Rate (gallons per minute)	Date Well Completed
Seward	30N	5W	29	2	R23A (Goose Creek Estates L02 B1&B3)	60, 65	22.25	40	1999
Seward	29N	5W	32	2	R23C (Parks Hwy M 84.5 & 85.0)	87	30	10, 65	1974, 2003
Seward	26N	5W	32	1	R23C (Parks Highway M114.2)	40	6	40	6/7/1991
Seward	24N	4W	17	3	R23C (Parks Highway M094.5)	60 - 82	44	12, 36	1983, 2002
Seward	24N	4W	30	3	R23B (Various)	60, 61, 85	32, 36, 50	7, 20, 18	1991 - 2004
Seward	24N	5W	13	1	R23B (L012, 4500 E Willow Circle)	100	26	16	10/24/2007
Seward	23N	4W	7	1	R23C (L009, Kashwitna Area)	128	18	20	8/28/1991
Seward	23N	4W	8	4	R23C (Montana Creek)	40 - 75	15 - 21	4, 40	2000 - 2003
Seward	23N	4W	17	2	R23C (Sheep Creek Area; Willow)	50, 80	42, 20	20	1984, 1996
Seward	23N	4W	29	2	R22C & R23B (Willow);	55, 112	10, 38	33, 38	1965, 2007
Seward	22N	4W	4	2	R23C (Troublesome Creek)	64, 101	9.5, 77	50, 10	1983
Seward	20N	4W	6	6	R23B (Willow Area)	69 - 191	3 feet above – 50 feet below GL	25 - 126	1979 - 1988
Seward	20N	5W	29	11	R23C (Trapper Creek)	34 - 250	6 - 37	6 - 75	1973 - 1996
Seward	16N	5W	35	3	R23A (Pt. Mackenzie Agricultural Project)	40 - 241	40 - 239	2 - 28	1982, 1984
Seward	14N	4W	6	13	(Pt. Mackenzie Agricultural Project)	39 - 320	18 - 120	20 - 200	1984, 1997

Source: ADNR, 2011a

3.3.6.2. Groundwater Use

Similar to surface water uses, groundwater use is dependent on the surrounding population and activities in the area. Groundwater is a source for 83 percent of Alaska's 1,602 public drinking water systems (ADEC, 2008a). In general, groundwater in Alaska is suitable for domestic, agriculture, aquaculture, commercial, and industrial uses with moderate or minimal treatment (ADEC, 2010).

USGS provides information on groundwater withdrawals in "Estimated Use of Water in the United States in 2010" (Maupin *et al.*, 2014). Table 3.3-13 illustrates the 2005 USGS data on groundwater withdrawals for the boroughs and census areas in the proposed Project Area. The definitions of water use categories are listed previously under surface water.

Groundwater withdrawals associated with hydrostatic testing, camp use, trench dewatering, ice roads and pads, etc. may require a Temporary Use Permit, as described in Section 3.3.3 above.

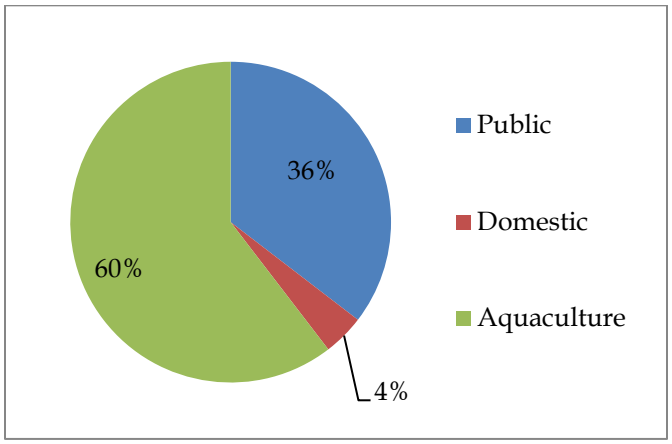
3.3.6.2.1. Arctic Hydrologic Subregion Groundwater Use

As with surface water, for the purpose of the affected environment, the water use for the Arctic Hydrologic Subregion is reflected by the NSB groundwater use provided in Table 3.3-13. The 2010 estimate for fresh groundwater use for the NSB was 75 percent industrial self-supplied and 25 percent public supply.

3.3.6.2.2. Interior-Yukon Hydrologic Subregion Groundwater Use

The Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Yukon River, Tanana, and Lower Tanana River watersheds are all located entirely within the YKCA. Based on data provided previously in Table 3.3-13, the groundwater use is (80 percent) aquaculture, 36 percent public supply, and 4 percent used for domestic self-supplied (Figure 3.3-3).

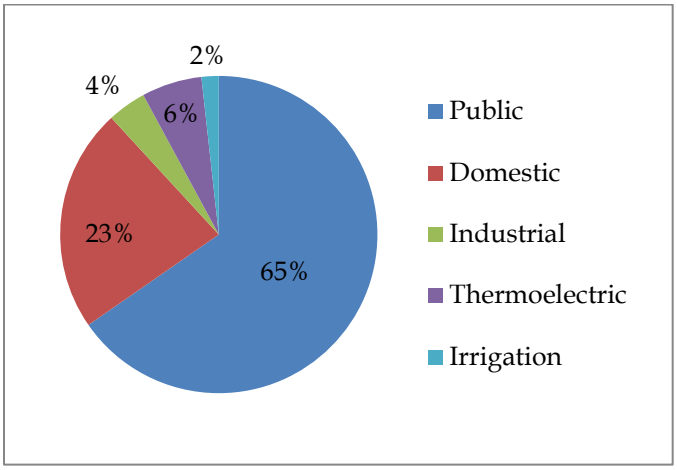
Figure 3.3-3 Upper Koyukuk River, South Fork Koyukuk River, Kanuti River, Ramparts-Yukon River, and Lower Tanana River Watersheds – 2010 Fresh Groundwater Use (Percent)



Source: USGS, 2010b

The Tolovana and Tanana Flats watersheds are represented by the FNSB estimates. As shown in Figure 3.3-4 well over half (65 percent) is used for public supply, about a quarter (23 percent) for domestic self-supplied, and 6 percent for thermoelectric power with lesser amounts four percent and 2 percent for industrial and irrigation uses, respectively.

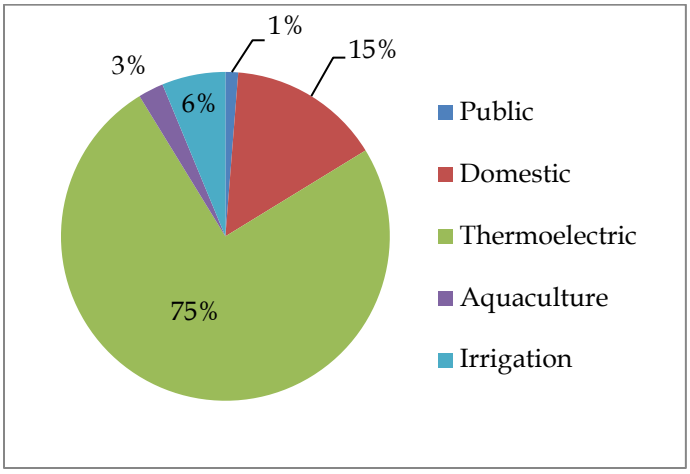
Figure 3.3-4 Tolovana River and Tanana Flats Watersheds – 2010 Estimated Fresh Groundwater Use (Percent)



Source: USGS, 2010b

The Nenana River watershed is located within the Denali Borough. As shown in Figure 3.3-5, the groundwater use in this watershed is 75 percent thermoelectric power, 15 percent domestic self-supplied, 6 percent irrigation, 3 percent aquaculture, and 1 percent use for public supply.

Figure 3.3-5 Nenana River Watershed – 2010 Estimated Fresh Groundwater Use (Percent)

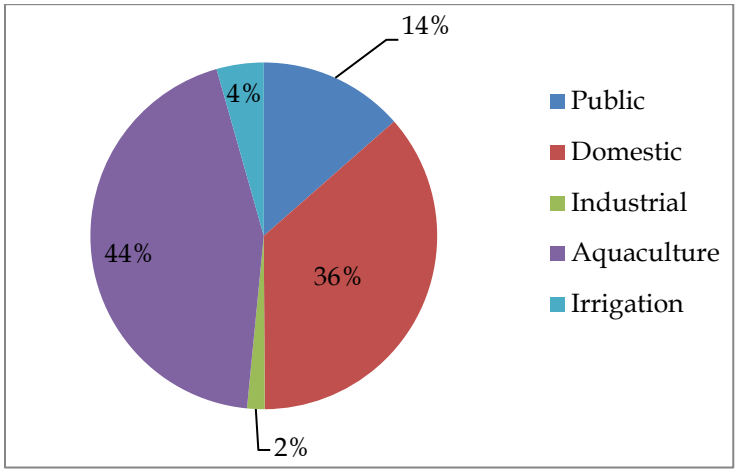


Source: USGS, 2010b

3.3.6.2.3. Southcentral Hydrologic Subregion Groundwater Use

The Southcentral Hydrologic Subregion consists of a couple boroughs and census areas. The largest portion of groundwater use, approximately 44 percent, is used to aquaculture, 36 percent is used for domestic self-supplied, about 14 percent for public supply, 4 percent for irrigation and 2 percent for industrial self-supplied use as shown in Figure 3.3-6.

Figure 3.3-6 Chulitna & Lower Susitna River Watersheds – 2010 Fresh Groundwater Use (Percent)



Source: USGS, 2010b

3.3.6.3. Groundwater Quality

Groundwater quality data are sparse in Alaska. Possible sources of data are ADNR's WELTS, ADEC's Drinking Water Watch Program, EPA's ETT, and USGS. The WELTS database does not have water quality data from wells located within the proposed Project Area (ADNR, 2011a). As of January 2016, there are no public water systems listed on EPA's ETT list within 15 miles of the proposed Project (ADEC, 2016b). Note that the ETT is not necessarily indicative of water quality. While a permit violation may imply that surface water quality is affected, it is not a direct indication of the quality of the surface water. This information is discussed under the respective hydrologic subregion in the following sections.

The same general criteria described in the discussion of surface water above, were used for representative USGS groundwater quality sites. Sections 3.3.6.1, 3.3.6.2, and 3.3.6.3 describe known groundwater (including availability, use, and quality) for each hydrologic subregion in the proposed Project Area. Additional concerns regarding groundwater quality are related to arsenic, contaminated sites, and groundwater recharge areas (STB, 2011). ADEC is not responsible for overseeing private water systems. Rather, the owner of a private well is responsible for the water quality and its safety for drinking. EPA rules do not apply to private wells (although some state rules do); therefore, EPA recommends that well owners have their water tested annually (EPA, 2012a).

3.3.6.3.1. Arsenic

Arsenic has been documented to occur in groundwater in some areas of the proposed Project footprint. In January 2009, EPA listed eight water systems in Alaska that were out of compliance with the federal arsenic standard. Most were located in the Mat-Su Valley. One was located at Willow Elementary, one at the Willow Area Community Center, and one at the Talkeetna Water and Sewer System (White, 2009).

3.3.6.3.2. Contaminated Sites

As of March 2016, ADEC listed 14 existing and former contaminated sites located within 1,000 feet of the proposed Project Area. Of these sites found, nine have been designated as Cleanup Complete, indicating both soil and groundwater meet the most stringent levels established by state regulations. Two sites are designated as Cleanup Complete with Institutional Controls, indicating there are restrictions in place that apply to site operators, as well as current and future operations. Two of the remaining sites are designated as open, indicating there are ongoing activities to monitor, remediate, or assess site conditions. One site is listed in the Comprehensive Environmental Response, Compensation, and Liability (CERCLA) Information System, but is not listed on the National Priorities List. These sites are illustrated in Figure 3.3-7.

ADEC regulates the cleanup of contaminated sites to protect human health and the environment using a risk-based approach. Through its Spill Prevention and Response Division ADEC protects groundwater from contamination under its Contaminated Site Program and Prevention, Preparedness, and Emergency Response Program. Human health and the environment are also managed under ADEC's Division of Environmental Health, and include the following programs: Drinking Water, Environmental Health Laboratory, Pesticides, and Solid Waste.

No brownfield sites are currently listed within 1,000 feet of the proposed Project Area. AGDC would route the pipeline to avoid known contaminated areas to the extent practicable to minimize potential liability and to avoid negatively impacting the remedy that is in place for the CERCLA sites.

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Beaufort Sea
Prudhoe Bay
Deadhorse
MP 0
MP 50
MP 100
MP 150
MP 200
MP 250
MP 300
MP 350
MP 400
MP 450
MP 500
MP 550
MP 600
MP 650
MP 700
Umiat
Wiseman
Bettles
Stevens Village
Rampart
Tanana
Minto
Livengood
Fox
Fairbanks
Chena Hot Springs
Anderson
Big Delta
Healy
McKinley Park
Cantwell
Talkeetna
Chickaloon
Willow
Big Lake
Susitna
Anchorage
NATIONAL PETROLEUM RESERVE
ARCTIC NATIONAL WILDLIFE REFUGE
GATES OF THE ARCTIC NATIONAL PARK
YUKON FLATS NATIONAL WILDLIFE REFUGE
KANUTI NATIONAL WILDLIFE REFUGE
KOYUKUK NATIONAL WILDLIFE REFUGE
WHITE MOUNTAINS NATIONAL RECREATION AREA
YUKON-CHARLEY RIVERS NATIONAL PRESERVE
MINTO FLATS STATE GAME REFUGE
NOWITNA NATIONAL WILDLIFE REFUGE
TANANA VALLEY STATE FOREST
DENALI NATIONAL PARK
DENALI NATIONAL PRESERVE
TETLIN NATIONAL WILDLIFE REFUGE
NELCHINA PUBLIC USE AREA
WRANGELL-ST.ELIAS NATIONAL PRESERVE
SUSITNA FLATS STATE GAME REFUGE
Lake Clark National Preserve
U.S.A.
CANADA

- City or Village
- Mile Post

Contaminant Status Within 1,000 ft Buffer

- Cleanup Complete
- Cleanup Complete - Institutional Controls
- Open
- FRS Site
- International Border
- Roads
- ASAP v6.1 Mainline
- FBX Centerline
- Park/Refuge

Data Source: Ak. Dept. Environmental Conservation
https://dec.alaska.gov/spar/csp/db_search.htm
USEPA - FRS, Brownfield & CERCLIS
https://www.epa.gov/enviro/geospatial-data-download-service
Downloaded February, 2016
Basemap: ESRI Topographic

Copyright:© 2013 National Geographic Society, i-cubed

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CHKD: K.A.
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Figure 3.3-7: CONTAMINATED SITE ALASKA STAND ALONE PIPELINE

0 25 50 100 150 Miles

ALASKA CANADA

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3.3.6.3.3. Arctic Hydrologic Subregion Groundwater Quality

The Arctic Hydrologic Subregion does not have public water systems with groundwater as the primary source listed on EPA's ETT (ADEC, 2011). Water is brackish or saline in bedrock beneath permafrost in much of the continuous permafrost zone draining to the Arctic Ocean, although fresh water is discharged from springs along faults bounding the limestone of the Lisburne Group of the Brooks Range (Williams, 2007). Little information exists on the quality of groundwater from permafrost and low temperatures. The restricted circulation of groundwater may result in higher concentrations of dissolved solids (Williams, 2007).

There are no USGS groundwater quality sites with water quality data in the Arctic Hydrologic Subregion of the proposed Project Area. The closest USGS groundwater-sampling site in the Arctic Hydrologic Subregion is located in the Northwest Coast Hydrologic Unit. This site is approximately 197 miles away from the proposed Project Area; therefore, it is not considered representative and is not included in this analysis.

3.3.6.3.4. Interior-Yukon Hydrologic Subregion Groundwater Quality

The Interior-Yukon Hydrologic Subregion has no public water systems with groundwater as a primary source listed on EPA's ETT (ADEC, 2011). None of the selected USGS groundwater quality sites in the Yukon-Koyukuk Hydrologic Subregion are located within the proposed Project Area. The proposed Project ROW in this subregion generally follows the TAPS ROW.

The data available in the Upper Koyukuk River watershed are relatively recent (2003), but only cover a few parameters, and this site is located in Anaktuvuk Pass, not within the proposed Project Area. There were no USGS groundwater monitoring sites with water quality data found in the South Fork Koyukuk or Ramparts-Yukon River watersheds. The Kanuti River watershed had data (Ka-G1) near the TAPS ROW, but was collected before the TAPS was constructed, and therefore, may not be representative.

The Tolovana River watershed had no sites that met the selection criteria. Site To-G1, near Minto, may represent the groundwater quality in the proposed Project Area because this site was not affected by the development of the TAPS. Data are fairly old (collected in 1971) however. This site approximately 10 miles from the proposed Project Area. Site To-G1 met the WQS for color, pH, and TDS for all water uses (Table 3.3-18).

The Lower Tanana River watershed had no sites that met WQS selection criteria (Table 3.3-17). Similar to To-G1, data were collected in 1971 and the site is more than 10 miles from the proposed Project Area. Site LT-G1 met groundwater WQS for color, pH, and TDS for all water uses. There are no groundwater quality data for the Nenana River watershed after 1970.

The Tanana Flats watershed had no sites that met the selection criteria (Table 3.3-18). Site TF-G1 is listed but is fairly distant from the proposed Project Area and data were collected in 1979. Although there has likely been some population growth in this

corridor since 1979, this is the most representative data for this watershed (Table 3.3-18). The data from TF-G1 shows the groundwater quality in this area met the WQS for temperature and pH for all water uses.

Table 3.3-18 Summary of Groundwater Quality – Interior-Yukon Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Upper Koyukuk River (19040601)											
680805151443001	UK-G1	9/10/2003	1.7	--	--	12.0	7.8	--	--	E-143	--
South Fork Koyukuk (19040602)											
N/A - see Ka-G1											
Kanuti River (19040604)											
66273410383601	Ka-G1	5/2/1974	3.0	--	6	--	8.3	--	--	--	--
Ramparts-Yukon River (19040404)											
N/A - see Ka-G1											
Tolovana (19040509)											
650920149202501	To-G1	5/10/1971	--	--	5	--	7.2	--	--	366	--
Lower Tanana (19040511)											
645320149105501	LT-G1	5/10/1975	--	--	5	--	7.2	--	--	366	--
Nenana River (19040508)											
N/A											
Tanana Flats (19040507)											
644235147090001	TF-G1	8/30/1979	9.0	--	--	--	7.2	--	--	--	--

Source: USGS, 2010c (Disclaimer: The data from the USGS NWI system web database may not have received Directors approval, is provisional and subject to revision)
°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
mL = milliliters
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available-

3.3.6.3.5. Southcentral Hydrologic Subregion Groundwater Quality

The Southcentral Hydrologic Subregion has two public water systems with groundwater as a primary source listed on the EPA's ETT with a score of 11 or higher (ADEC, 2011). These include:

- Bluffview Acres Water System located in Wasilla (AK2223624) (Community Water System) for arsenic; and
- East Big Lake Water System located in Big Lake (AK2224581) (Non Transient Non Community System) for arsenic and LCR.

None of the selected USGS groundwater quality sites in the Southcentral Hydrologic Subregion are within the proposed Project Area. USGS groundwater monitoring sites did not have water quality data for the Chulitna River watershed.

The Lower Susitna River watershed had three sites (LS-G1, LS-G2, and LS-G3) that met the selection criteria; however, there has been substantial population growth since 1977 when LS-G2 data were collected. Only LS-G1 and G3 are considered representative of the proposed Project Area. At LS-G1, the fresh groundwater in the Lower Susitna River watershed met the WQS for temperature and pH for all water uses. At LS-G3, the fresh groundwater in the Lower Susitna River watershed met the WQS for temperature, pH, and TDS for all water uses (Table 3.3-19).

Table 3.3-19 Summary of Groundwater Quality – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Map ID	Date Collected	Temp (°C)	Turbidity (NTUs)	Color (Pt-Co units)	Dissolved Oxygen (mg/L)	pH (s.u.)	Strontium (µg/L)	Fecal Coliform (col. per 100 mL)	Total Dissolved Solids (mg/L)	Suspended Sediment (mg/L)
Chulitna River (19020502)											
N/A											
Lower Susitna River (19020505)											
621019150070401	LS-G1	6/13/1991	5.5	--	--	--	6.6	--	--	--	--
615937150025001	LS-G2	6/2/1977	--	--	11	--	--	--	--	98	--
61391014949301	LS-G3	7/12/2000	5.0	--	--	--	7.5	--	--	E 182	--

Source: USGS, 2010c (Disclaimer: The data from the USGS NWI system web database may not have received Directors approval, is provisional and subject to revision)
°C = degrees Celsius
NTU = nephelometric turbidity units
Pt-Co = Platinum Cobalt units
mg/L = milligrams per liter
mL = milliliters
pH = measure of the acidity or alkalinity of a solution
s.u. = standard units
µg/L = micrograms/liter
E means estimated, N/A means not available-

3.3.7. Floodplains

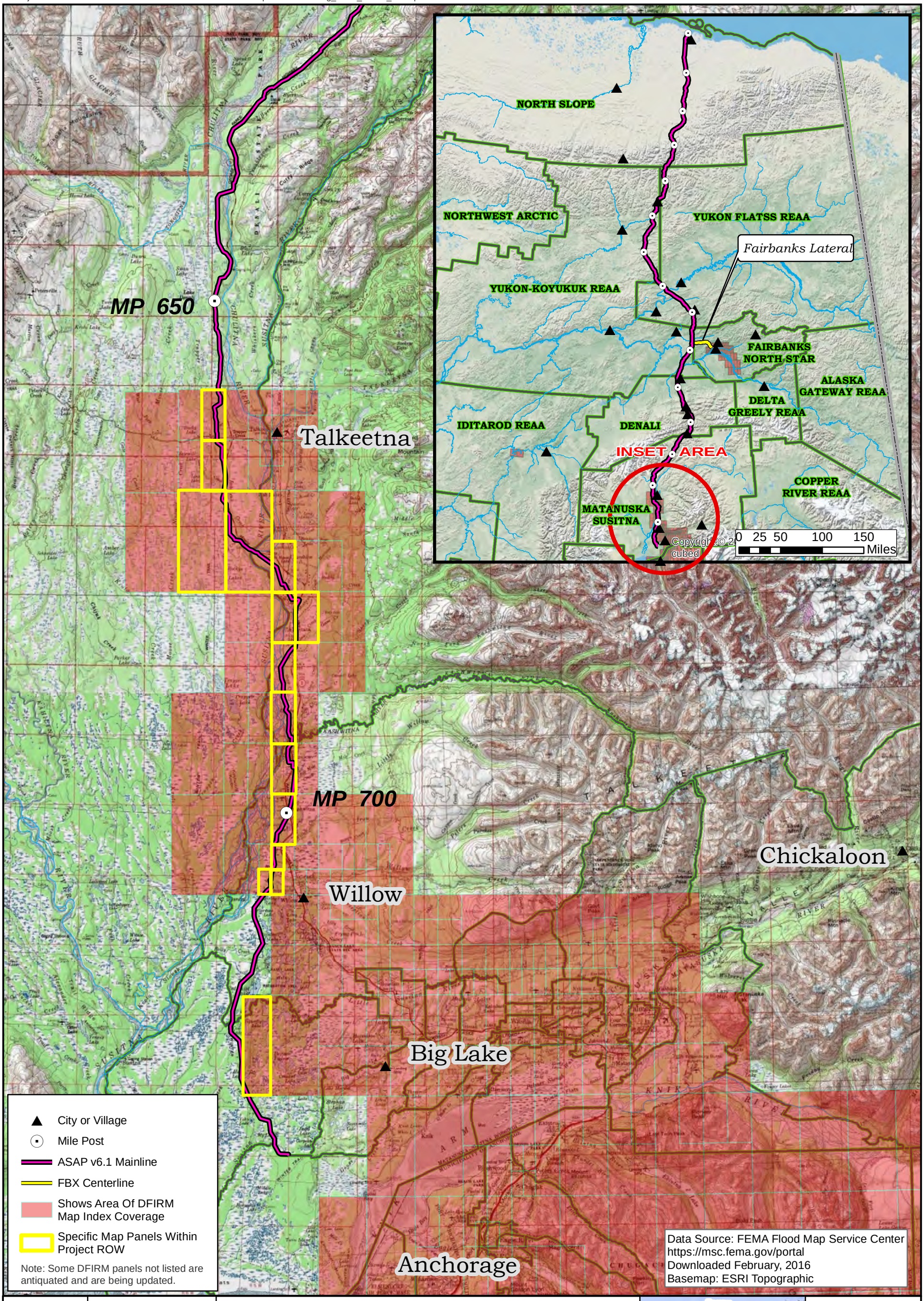
Floodplains are the strip of relatively flat land bordering a stream channel that is inundated at times of high water (USGS, 2010a). Floodplains are valuable hydrological and ecological resources that serve many functions including: the storage of storm water, erosion and sediment control, nutrient input and wildlife habitat. Populated areas along floodplains can be considered a hazardous area for property development, since floodplains can become inundated during flooding.

Executive Order (E.O.) 11988 requires federal agencies to avoid to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The magnitude (quantity) and timing of peak flows for rivers and streams are dependent on the amount of precipitation and the characteristics of the watershed.

FEMA provides the most detailed floodplain data. FEMA Flood Insurance Rate Maps are based on historic, meteorological, hydrologic, and hydraulic data. These maps can be used to identify special flood hazard areas and predict 100-year floods. Figure 3.3-8 and Appendix H present available FEMA Floodplain Maps near the proposed Project Area by borough or census area (FEMA, 2011). The available FEMA mapping data available for the proposed Project Area is entirely within the Mat-Su Borough (Figure 3.3-8).

Areas within the proposed Project footprint that are not mapped by FEMA are designated as having possible but undetermined flood hazard risks. For a number of waterbodies near the proposed Project Area for which FEMA maps were not available, USGS gauging station peak stream flow data were reviewed and used to assess potential floodplain risk. Peak stream flow is the highest elevation of water flow measured at the gauge. The locations of these gauging stations for the Arctic, Interior-Yukon, and Southcentral subregions along with an outline of the estimated high water locations are shown in Appendix H. For each of these subregions, the peak stream flow for a given range of years is identified and shown on a USGS topographic map. The data available are varied, and is described for each individual stream gauge in the respective hydrologic subregions below.

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PROJ. No.: 0416166

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Figure 3.3-8: FEMA FLOODPLAINS
ALASKA STAND ALONE PIPELINE

0 2.5 5 10 15 20 25 Miles

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3.3.7.1. Arctic Hydrologic Subregion Floodplains

The Sagavanirktok River floodplain spans 4 miles wide in its northern most reaches before it empties into the Beaufort Sea (BLM, 2002). It is characterized by a meandering river that becomes braided due to low discharge from the flat Arctic Coastal terrain (BLM, 2002). Other smaller streams in the Arctic Subregion drain thermokarst lakes. The Sagavanirktok River floodplain possess characteristic tundra ponds, lakes and streams as discussed in the watershed characteristics section noted above.

Peak surface water flows usually occur in July and August. There is minimal stream flow during the winter, which can result in aufeis formation. Maximum water levels often occur during spring runoff from snowmelt, and from aufeis, which can back up stream flow (BLM, 2002). Permafrost allows little surface water storage capacity in the watershed resulting in peak pulse flows, which tend to increase and decrease rapidly (BLM, 2002). The rivers experience high erosion in the summer, due to flooding when the streambed and banks thaw (USACE, 2012a).

The proposed Project Area for the Sagavanirktok River floodplain is located entirely in the NSB, and there are no available FEMA floodplain maps for the borough (FEMA, 2011). However, flooding is identified as a hazard with a moderate probability of occurrence in the NSB (NSB, 2005a). The ACP is known for its cold and desert-like conditions with precipitation ranging between 5 and 7 inches, which are primarily in the form of snow (Truett and Johnson, 2000). In the NSB, flooding can be caused by runoff events, snow melt floods, groundwater flooding, ice jam floods, flash floods, fluctuating lake levels, alluvial fan floods, and glacial outburst floods (depending on the topography, location and bodies of water, streams or rivers). For the NSB as a whole, the risk of a flood from runoff events, snowmelt, ice jams, flash floods, and alluvial fan floods are categorized as "low level" hazards. Groundwater flooding is possible, but risk is minimized by construction of elevated structures. The risk of lake level fluctuation is little or none (NSB, 2005a). Specific communities (for instance Utqiagvik and Anaktuvuk Pass) are identified as potentially subject to floods, but the Sagavanirktok and Kuparuk rivers are not mentioned (NSB, 2005a).

There are five USGS stream gauge stations on the Sagavanirktok River with peak stream flow data from near the proposed Project Area. Table 3.3-20 summarizes the period of data on record, minimum and maximum known water elevation above sea level, the mean peak stream flow by cubic feet per second (cfs). The high water mark (maximum water stage) represents from 11 to 34 years of data, but probably do not reflect a 100-year flood (a flood that has a 1 percent chance of occurring in any year).

Table 3.3-20 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds near the Proposed Project – Arctic Hydrologic Subregion

Watershed & USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
Kuparuk River (19060401)						
15896000	Kuparuk River near Deadhorse	1971-2011	41	32.12 (1999)	37.60 (1978)	49,320
Sagavanirktok River (19060402)						
15910300	Sagavanirktok River Tribe near Happy Valley Camp	1997-2011	15	928 (2006)	974 (2000)	405
15910000	Sagavanirktok River near Sagwon	1969-1979	11	986 (1975)	1018 (1969)	21,130
15908000	Sagavanirktok River near Pump Station 3	1983-2011	29	1,133 (1988)	1,173[b,c] (2000)	19,295
15904900	Atigun River Tributary near Pump Station 4	1976-2009	36	2,777 (2006)	2806 (1999)	648
15904800	Atigun River near Pump Station 4	1992-2008	12	3,134 (1992)	3175 (2003)	502

Source: USGS, 2010e (Disclaimer: Data from the USGS NWI system web database may not have received Directors approval, is provisional and therefore subject to revision)
a "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.
b Gauge height affected by backwater.
c Gauge height not the maximum for the year.

3.3.7.2. Interior-Yukon Hydrologic Subregion Floodplains

Peak flows from rivers that originate on the south side of the Brooks Range (Upper Koyukuk) are triggered by intense rainfall (BLM, 2002). The rivers originating in the Alaska Range (Nenana) are characterized by low winter flows and wide braided channels with aufeis. The headwaters of the other rivers exist either in the area between the Brooks Range and the Alaska Range (South Fork Koyukuk, Kanuti, Tolovana, Tanana Flats, and Lower Tanana); or the watershed does not include the headwaters of the associated river (Yukon River in the Ramparts-Yukon River watershed).

The proposed Project Area in the Interior Hydrologic Subregion is in the YKCA and the Denali Borough. There are no available FEMA floodplain maps for either of these areas (FEMA, 2011). There are six USGS stream gauge stations with mean peak stream flow data available near the proposed Project Area in the Interior Yukon Hydrologic

Subregion. Table 3.3-21 summarizes the mean peak stream flow, elevation data, and years of record at these gauging stations.

3.3.7.3. Southcentral Hydrologic Subregion Floodplains

The timing of peak river flows in this region depend largely on the gradient of the watershed and is reflected in annual rainfall-runoff hydrographs. The proposed Project Area in the Southcentral Hydrologic Subregion is located within the Mat-Su Borough. The FEMA mapping data available for the proposed Project Area is entirely within the Mat-Su Borough. Figure 3.3-9 and Appendix H present available FEMA Floodplain Maps near the proposed Project Area by borough or census area (FEMA, 2011).

There are four USGS stream gauge stations with peak stream flow data available near the proposed Project Area in the Southcentral Hydrologic Subregion. Table 3.3-21 summarizes the period of record for these stream gauges, the minimum and maximum water elevation and the mean peak stream flow.

Table 3.3-21 USGS Stream Gauge Record, Water Elevation and Mean Peak Stream Flow in Watersheds Near the Proposed Project – Southcentral Hydrologic Subregion

Watershed and USGS Site ID	Description	Period of Record[a]	Number of Water Years on Record	Minimum Known Elevation (feet above sea level) (Year of Record)	Maximum Known Elevation (feet above sea level) (Year of Record)	Mean Peak Stream Flow (cfs)
Chulitna (19020502)						
15292400	Chulitna River near Talkeetna	1958-2006	28	510 (1969)	547 (2006)	44,318
15293200	Kashwitna River near Willow	2011-2012	1	265 (2011)	269 (2012)	978
Lower Susitna (19020505)						
15292800	Montana Creek near Montana	1963-2011	17	243 (2010)	270[c] (1986)	4,121
15292990	Sheep Creek near Willow	1984-1986	4	223 (1986)	230 (1986)	2,853
15293000	Caswell Creek near Caswell	1963-1987	25	170 (1970)	199 (1986)	136
15292780	Susitna River at Sunshine	1971-1987	7	282 (1983)	332 (1971)	139,571

Source: USGS, 2010e (Disclaimer: Data from the USGS NWI system web database may not have received Directors approval, is provisional and therefore subject to revision)
a "Water year" is defined as the 12-month period October 1 for any given year through September 30 of the following year.
b Discharge is an historic peak.

3.3.8. Nearshore Beaufort Sea

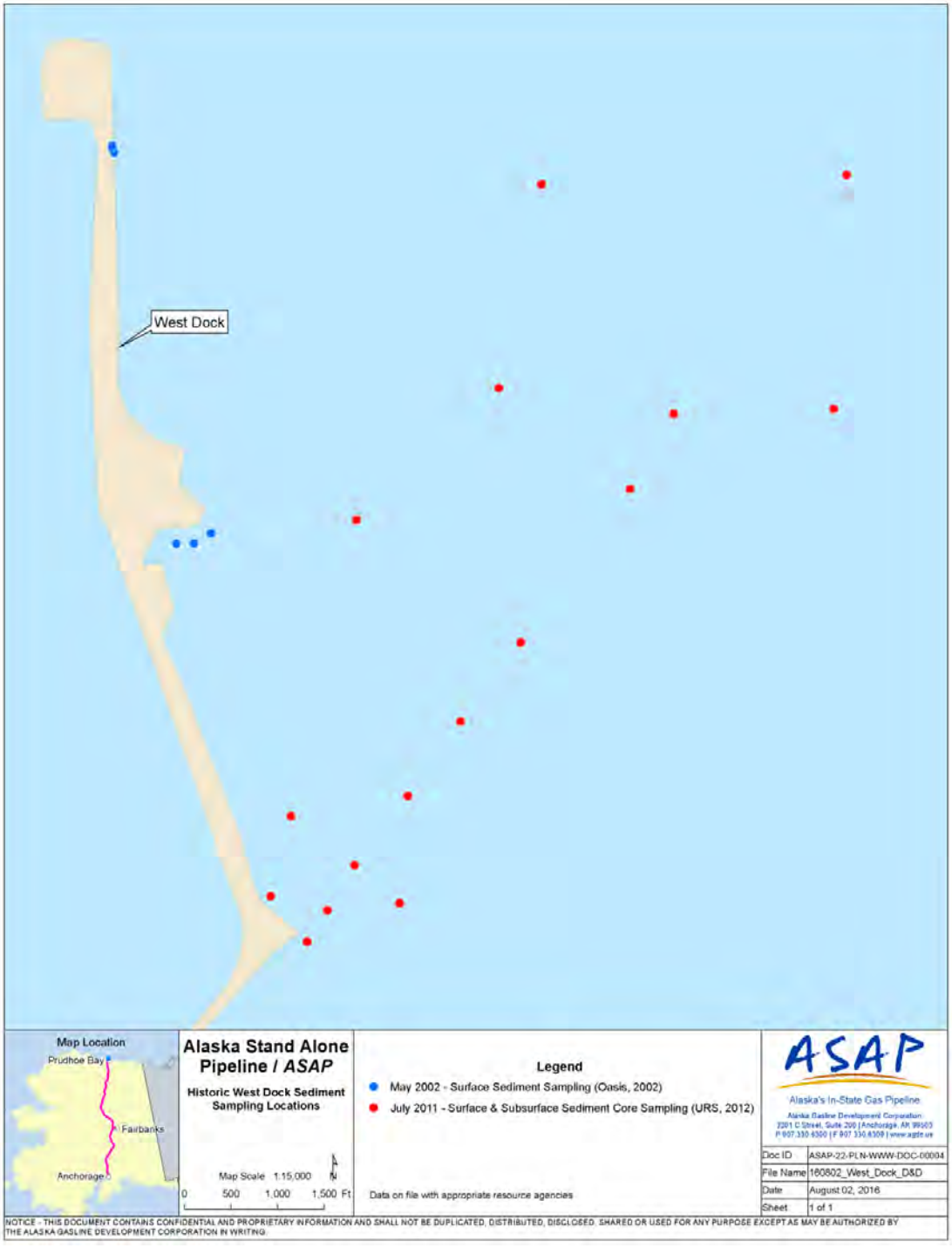
As described in Section 3.3.1, dredging and disposal operations would take place in Prudhoe Bay and the Beaufort Sea. This section provides and overview of the current sediment and water quality in these areas.

3.3.8.1. Beaufort Sea Sediment Sampling

Chemical analysis of potential dredge sediment is required (CWA 404[b][1] guidelines, CFR, Title 40, 230.60) prior to dredging and discharging dredge spoils. Sediment sampling indicates that sediments at West Dock have not resulted exceedances of ADEC Method Two cleanup levels (ADEC, 2016d) or USACE screening levels for dredge materials (USACE, 1998) for organic or inorganic particulates, with the exception of arsenic due to high background levels. Sediment composition has been characterized following recent core sampling on the east side of West Dock (Figure 3.3-9), with sediment cores ranging from 8 to 11 feet in length (URS Corporation, 2012).

Furthermore, in May 2002, OASIS Environmental, Inc., now ERM Alaska, Inc., completed geotechnical and environmental testing activities along the east side of the West Dock causeway (Figure 3.3-9), including at DH3, as part of a dredge permitting process. This work determined the suitability of dredged materials for reuse in other natural environments.

Figure 3.3-9 Sediment Sampling Locations



OASIS Environmental, Inc. completed geotechnical and environmental testing analysis for both organic and inorganic constituents. Sample results were below ADECs' Method Two Soil Cleanup Levels for Arctic Zone – Direct Contact or Migration to Groundwater, except for arsenic, which is a naturally occurring metal in Alaska and is often found in concentrations above the regulatory cleanup level (ADEC, 2009). Although residual range organics levels are well below ADEC's Arctic Zone Direct Contact cleanup standards (22,000 milligrams per kilogram) (ADEC, 2017c), they are significantly higher than other petroleum hydrocarbon levels found at the sampling area. There are indications that this may be naturally occurring material, and not significantly higher than background concentrations.

3.3.8.2. Beaufort Sea Water Quality

Beaufort Sea waters are influenced by wind and storms, spring river runoff, and sea ice formation and melt. Water quality in the Beaufort Sea naturally varies throughout the year related to seasonal biological activity and naturally occurring processes, such as formation of surface ice, seasonal plankton blooms, naturally occurring hydrocarbon seeps, seasonal changes in turbidity due to terrestrial runoff, and localized upwelling of cold water from the Barrow Canyon. The NSB requires water quality monitoring of the waterbody as a condition to conduct oil and gas operations adjacent and within the waterbody. Monitoring for temperature and salinity of Nearshore Beaufort Lagoons is performed on an annual basis during the ice-free periods, as required by the NSB. Data and information transmitted to ADEC and EPA in 2002 support that this waterbody is attaining the WQS for temperature and dissolved inorganic substances (ADEC, 2016a).

Rivers and streams that flow into the Beaufort Sea contribute substantial freshwater to the marine system. This affects salinity, temperature and other aspects of water quality, which is particularly prominent in a band of water that runs along the seacoast. Spring melt and river runoff greatly influence the characteristics of the inshore and nearshore Beaufort Sea. This freshwater influx creates a band (2 to 10 kilometers [km] [1.24 to 6.21 mi] wide) of brackish waters along the coast that then diminishes in late summer due to decreased runoff and mixing by wind (BOEM, 2014). Spring melt and floods carry river plumes from the Sagavanirktok River under and on top of the riverine and sea ice. The Sagavanirktok River plumes have been detected through constituent monitoring as far as 15 to 20 miles (24.14 to 32.19 km) north from the river mouth (USACE, 2012a; Alkire and Trefry, 2006).

Anthropogenic (human-generated) pollution in the Beaufort Sea is primarily related to aerosol transport and deposition of pollutants; pollutant transport into the region by sea ice, biota and currents); discharges from international ship traffic; and effects from increasing carbon dioxide in the atmosphere (AMAP, 1997; 2002; Hopcroft *et al.*, 2006). The greatest degree of ocean acidification worldwide is predicted to occur in the Arctic Ocean. This amplified scenario in the Arctic is due to the effects of increased freshwater input from melting ice and snow and increased carbon dioxide uptake by the sea as a result of sea ice retreat (Steinacher *et al.,* 2009).

3.4. Vegetation

3.4.1. Introduction

This section discusses vegetation resources in the proposed Project Area. The description of vegetation resources summarized information provided in the 2012 FEIS (USACE 2012a), data presented in the ASAP EED (AGDC, 2016b), as well as recent publicly available literature, in light of changes and updates to the proposed Project. Specifically, the following information, data, methods, or analyses have been substantially updated from the 2012 document:

- The segment lengths within each ecoregion crossed by the proposed Project have changed due to changes in the proposed pipeline route;
- The ASAP Project is now proposed to be primarily outside of existing ROWs; major alignment shifts occurred on the North Slope, at Minto Flats/Summer Ridge, Anderson/Clear, and the Nancy Lake State Recreation Area (SRA);
- The National Land Cover Dataset (NLCD) was updated in 2011; data used in the 2012 FEIS was from the 2001 dataset. The 2011 data is used in the analysis and figures in this section;
- A map of documented non-native plants within 5 miles of the proposed Project Mainline is included as Figure 3.4-1;
- The number of rare and sensitive plants that could occur within the proposed Project corridor has increased due to recently updated data sources and new sources of information used for the assessment. A map of documented rare and sensitive plants within 5 miles of the proposed Project Mainline is included as Figure 3.4-2;
- A discussion regarding marine vegetation and the marine ecosystem has been added due to proposed Project design changes at West Dock, which includes winter dredging, nearshore dredge material disposal, sealift construction, and widening of the causeway road; and
- Biologically unique landscapes and communities of conservation concern crossed by the proposed Project have changed, with the most significant concerns occurring in the ACP, Minto Flats State Game Refuge, Tanana Valley State Forest, Denali NPP, Denali State Park, and the Nancy Lake SRA.

This section describes the ecoregions and vegetation communities identified within a 10-mile-wide corridor along the proposed 733-mile proposed Project ROW, 30-mile lateral line to Fairbanks, and the Denali NPP Route Variation that is part of Alternative 2. The proposed Project corridor begins near Prudhoe Bay and ends in the Mat-Su Borough southwest of Big Lake. Additionally, it includes the aboveground facilities, and extra work areas outside the ROW. AGDC has proposed mitigation measures to reduce impacts to vegetation, which are included in Chapter 4, Environmental Consequences, and Appendix M, Mitigation Measures. See Section 4.9 for Effects to Vegetation and

Appendix M for a discussion of how the proposed Project would mitigate losses to vegetation resources.

3.4.2. Summary

The proposed Project Mainline route and lateral line to Fairbanks would affect approximately 1,121.1 acres of vegetation communities within the variable width construction ROW, temporary workspaces, camps, and staging areas. The approximate acreage of affected vegetation for the proposed permanent operations Project Mainline route and ancillary facilities (*e.g.,* access roads, material sites, a gas conditioning facility, and compressor) is approximately 17,616 acres. The Denali NPP Route Variation route would affect approximately 88.8 acres of vegetation communities. Vegetation communities considered in these calculations include the land cover types: cultivated crops, developed – open space, deciduous forest, dwarf shrub, emergent herbaceous wetlands, evergreen forest, grassland/herbaceous, mixed forest, moss, pasture/hay, sedge/herbaceous, shrub/scrub, and woody wetlands.

The proposed Project route crosses nine Alaska ecoregions, as defined by Nowacki *et al.,* (2001) and work is proposed in the nearshore Beaufort Sea at West Dock. The land cover types crossed by the proposed Project include barren land, cultivated crops, deciduous forest, developed (high, medium, low intensity, and open space), dwarf shrub, emergent herbaceous wetlands, evergreen forest, grassland/herbaceous, mixed forest, moss, open water, pasture/hay, perennial ice/snow, sedge/herbaceous, shrub/scrub, and woody wetlands.

Additionally, the proposed Project route crosses biologically unique landscapes and vegetation communities of conservation concern. The most significant of these crossings include Minto Flats State Game Refuge, Tanana Valley State Forest, Denali NPP, Denali State Park, and the Nancy Lake SRA. The proposed Project route could also potentially impact various traditionally used native plants (see Section 3.16, Subsistence, for plants used by Native Alaskans). A total of 64 non-native species and 50 rare or sensitive plant species are known to occur within 5 miles of the proposed Project Mainline. Of the 321 total rare and sensitive plant species known in Alaska, 164 of these could occur within the proposed Project ROW, according to species range maps.

3.4.3. Vegetation Communities

The proposed Project would cross a diverse array of vegetation communities extending from the ACP to the Cook Inlet Basin in Southcentral Alaska. Many biologically unique landscapes or areas of conservation concern are crossed or are adjacent to the proposed Project. The following discussion includes a broad perspective based on the ecoregions present along the proposed route, with detailed descriptions of the vegetation communities (land cover types) within a 10-mile-wide corridor (further described in Section 3.4.4).

Regions with biologically unique landscapes or areas of conservation concern that are crossed or are adjacent to the proposed Project include:

- the ACP;
- Arctic National Wildlife Refuge (NWR);
- Gates of the Arctic NPP;
- Kanuti NWR;
- Yukon Flats NWR;
- Minto Flats State Game Refuge;
- Denali NPP;
- Denali State Park;
- Tanana Valley State Forest;
- Willow Mountain Critical Habitat Area;
- Willow Creek SRA;
- Goose Bay State Game Refuge;
- Nancy Lake SRA; and
- Susitna Flats State Game Refuge.

3.4.3.1. Ecoregions

Each ecoregion includes a complex of terrestrial and wetland vegetation types. The distribution and extent of which are strongly influenced by elevation, soil characteristics, temperature, and moisture. General descriptions of the vegetation and wetland communities within each ecoregion crossed by the proposed Project are primarily derived from Nowacki *et al.,* (2001), Viereck *et al.,* (1992), and the TAPS ROW Renewal FEIS (BLM, 2002).

The nearshore Beaufort Sea and nine terrestrial ecoregions would be crossed by the proposed Project. Table 3.4-1 includes the ecoregion traversed by each segment of the ROW. A description of each ecoregion is included below and shown in Figure 3.2-1 in Section 3.2.3.

Table 3.4-1 Ecoregions Crossed by Project Segment

Project Segment	Unified Ecoregion of Alaska	Level II Ecoregion	Mainline MP Start	Mainline MP End
West Dock	Nearshore Beaufort Sea	--	--	--
MP 0 to MP 175	Beaufort Coastal Plain	Arctic Tundra	0	61.5
	Brooks Foothills	Arctic Tundra	61.5	142.9
	Brooks Range	Arctic Tundra	142.9	175.0
MP 175 to MP 356	Brooks Range	Arctic Tundra	175.0	251.3
	Kobuk Ridges and Valleys	Intermontane Boreal	251.3	256.5
	Ray Mountains	Intermontane Boreal	256.5	356.0
MP 356 to MP 440	Ray Mountains	Intermontane Boreal	356.0	428.8
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	428.8	440.0
Fairbanks Lateral (MP 0 to 0.5)	Tanana-Kuskokwim Lowlands	Intermontane Boreal	--	--
Fairbanks Lateral (MP 0.5 to MP 30)	Yukon-Tanana Uplands	Intermontane Boreal	--	--
MP 440 to MP 566	Tanana-Kuskokwim Lowlands	Intermontane Boreal	440.0	441.3
	Yukon-Tanana Uplands	Intermontane Boreal	441.3	453.5
	Tanana-Kuskokwim Lowlands	Intermontane Boreal	453.5	514.9
	Alaska Range	Alaska Range Transition	514.9	566.0
MP 566 to MP 707	Alaska Range	Alaska Range Transition	566.0	613.9
	Cook Inlet Basin	Alaska Range Transition	613.9	707.0
MP 707 to MP 733	Cook Inlet Basin	Alaska Range Transition	707.0	733.5

Sources: Nowacki *et al.,* 2001; Viereck *et al.,* 1992; BLM, 2002

3.4.3.2. Nearshore Beaufort Sea

The majority of the coastal Beaufort Sea does not have a rocky substrate, but one characterized by silt and sand. Where cobbles and boulders do occur, a diverse assemblage of organisms can be found in association. Benthic algal communities occur throughout the Beaufort, but they are especially dense at the Boulder Patch east of Prudhoe Bay in Stefansson Sound (Busdhosh *et al.,* 1985). The dominant species occurring in the algal communities in the Boulder Patch and surrounding Beaufort Sea nearshore habitats are kelp: *Laminaria solidungula, L. saccharina, Saccharina latissimi,* and *Alaria esculenta* (Busdhosh *et al.,* 1985; Wilce and Dunton, 2014). These kelp species are most abundant in water depths of 4 to 7 meters (Busdhosh *et al.,* 1985).

3.4.3.3. Beaufort Coastal Plain Ecoregion

The Beaufort Coastal Plain ecoregion is a windy and treeless plain, which progressively ascends from the Beaufort Sea coast southward to the foothills of the Brooks Range. A dry, polar climate dominates this flat to rolling landscape. Permafrost is continuous across the area, except under large rivers and thaw lakes. The prevalence of thaw lakes and saturated soils results in wetland plant communities characterized by sedges, grasses, and mosses as the predominant vegetation features. Small areas of wet tundra occur in shallow water and primarily support wet sedge meadow tundra and wet sedge-grass meadow community types (Walker *et al.,* 1980; Walker and Acevedo, 1987). Sites with deeper water (up to 3 feet), typically support grass marsh communities (BLM, 2002).

In locations of increased surface elevation, vegetation communities support dwarf shrubs, cushion plants, lichens, and graminoid plants (grasses and grass-like plants) that are adapted to the better-drained soils (Walker, 1985). Tussock tundra, characterized by tussock cottongrass (*Eriophorum* spp.), occurs within more moist locations with decreased surface elevation. These sedges are generally 4 to 24 inches tall and often are interspersed with low shrubs much shorter than the sedges (Viereck *et al.,* 1992).

Dry tundra community types occur on well-drained soils such as the margins of old lake basins and rivers, and on soils formed from stream gravel deposits. These communities are predominantly sedge-*Dryas* tundra and *Dryas* dwarf shrub tundra (Walker, 1985). Dwarf shrubs characterize the latter community type, less than 8 inches tall, primarily species of *Dryas* (Viereck *et al.,* 1992). *Arctophila fulva* is a common and important wetland species in this ecoregion, and is discussed in detail in Section 3.5, Wetlands.

3.4.3.4. Brooks Foothills Ecoregion

The Brooks Foothills ecoregion primarily consists of broad exposed ridges and gently rolling hills that create the northern flank of the Brooks Range. Within these long, linear ridges and buttes are narrow alluvial valleys, glacial moraines, and outwash plains. Most of the surface is covered with colluvial and eolian deposits. The ecoregion has a dry polar climate that is warmer and wetter than the Beaufort Coastal Plain. Continuous permafrost under the surface inhibits drainage, and leads to saturated soils and a predominance of wetland vegetation communities. Vegetation is dominated by vast expanses of mixed shrub-sedge tussock tundra, interspersed with willow thickets along rivers and small drainages and *Dryas* tundra on ridges. Calcareous areas are found along the lower foothills, which support sedge-*Dryas* tundra (Nowacki *et al.,* 2001).

The most common vegetation type of the foothills is tussock tundra, which predominates on old glacial moraines. Dwarf shrub communities occur on rocky moraine ridges. Active floodplains and small drainages support willow and alder shrub communities. Inactive floodplains support extensive wet sedge meadows (Viereck *et al.,* 1992).

Uplands occur on south-facing sandstone outcrops and on exposed till. However, most low-lying areas support wetlands. The valley bottoms and hill slopes have poorly drained soils with thick organic layers (Walker *et al.,* 1989). Silty soils, particularly on upper slopes, are thick enough to impede surface water drainage and remain saturated. Wetland plant communities of the northern foothills include tussock tundra, open low mixed shrub-sedge tussock tundra, open low mesic shrub birch ericaceous shrub, open low willow shrub, and wet sedge meadow tundra.

3.4.3.5. Brooks Range Ecoregion

The Brooks Range ecoregion contains the east-west trending Brooks Mountain Range. The high, central component contains steep angular summits covered with rubble and scree, while the eastern and western sections have less rugged topography with fast-

moving streams and rivers. The region has a dry polar climate with short, cool summers and long, cold winters. Alpine tundra is prevalent at higher elevations, while valleys have some needle-leaf and broadleaf forests.

The most common plant communities on the upper slopes and ridges are ericaceous dwarf shrub tundra, *Dryas*-sedge dwarf shrub tundra, and *Dryas* dwarf shrub tundra on the more exposed sites. These communities occur on well-drained soils and are dominated by shrubs less than 8 inches tall. Taller shrubs, if present, are relatively sparse, and the herbaceous species typically exceed the shrubs in height (Viereck *et al.,* 1992). Trees are generally absent. Pond margins and stream banks support open low willow-sedge shrub tundra, with shrubs commonly 8 to 20 inches tall and few, if any, trees. Wet sedge meadow tundra communities are generally found within drained lake basins and valley depressions (Cooper, 1986).

Much of the vegetation is located in or along floodplains. Floodplain vegetation communities on river terraces are typically open low alder-willow shrub communities and trees are generally absent or scarce (Viereck *et al.,* 1992). On the south side of the Brooks Range, lower mountain slopes and valleys support sedge tussocks and shrubs. The Arctic tree line is restricted to the south side of the range. Here, sparse conifer-birch forests and tall shrublands occur in the larger valleys (Viereck *et al.,* 1992).

3.4.3.6. Kobuk Ridges and Valleys Ecoregion

The Kobuk Ridges and Valleys ecoregion is comprised of a series of paralleling ridges and valleys that expand southward from the Brooks Range. Grand, glacier-carved valleys contain large rivers that begin in the Brooks Range. The broad, U-shaped valleys are lined with both alluvial and glacial sediments, while the ridges are covered with rubble. Most of the area is underlain by thin to moderately thick permafrost. Long, cold winters and short, cool summers make up the dry continental climate that is prevalent in the area.

Vegetation communities include open spruce, and closed mixed forest mosaic and open and closed spruce forest. Forests and woodlands largely dominate, with black spruce in wetland bogs; white spruce and balsam poplar along rivers; and white spruce, white birch, and trembling aspen on well-drained uplands. Tall and short shrublands of willow, birch, and alder communities occur on ridges. Trees become increasingly sparse, less robust, and restricted to lower elevations in the west where forests are slowly invading along rivers and streams (*e.g.,* lower Noatak River) (Nowacki *et al.,* 2001).

3.4.3.7. Ray Mountains Ecoregion

The Ray Mountains ecoregion comprises an overlapping series of compact ranges in an east-west direction. Bedrock is generally covered in rubble, resulting in shallow and rocky soils. Permafrost is largely discontinuous. The climate is continentally influenced, with dry, cold winters and relatively moist, warm summers.

The distribution of community types is influenced primarily by slope, aspect, elevation, parent material, and succession following wildfire (Viereck *et al.,* 1986). Large differences in the vegetation of north- and south-facing slopes result from the dry continental climate and low sun angle. Vegetation distribution is also affected by the presence or absence of permafrost, which is often related to slope and aspect (Viereck *et al.,* 1986).

The vegetation is dominated by black spruce woodlands, while white spruce, birch, and aspen are restricted to warm, south-facing slopes. White spruce, balsam poplar, alders, and willows dominate floodplains. Shrub birch and *Dryas*-lichen tundra prevail at higher elevations.

3.4.3.8. Yukon-Tanana Uplands Ecoregion

The Yukon-Tanana Uplands ecoregion contains broad, rounded mountains of moderate height. Most surfaces are comprised of bedrock and coarse rubble on ridges, colluvium on lower slopes, and alluvium in the deeply incised, narrow valleys (ADF&G, 2006). The climate is strongly influenced by continental forces, generating warm summers and very cold winters (ADF&G, 2006). Discontinuous permafrost underlies north-facing slopes and valley bottoms (ADF&G, 2006).

Vegetation is dominated by white spruce, birch, and aspen on south-facing slopes, black spruce on north-facing slopes, and black spruce woodlands and tussock and scrub bogs in valley bottoms (ADF&G, 2006). Floodplains of headwater streams support white spruce, balsam poplar, alder, and willows. Above the treeline, low birch-ericaceous shrubs and *Dryas*-lichen tundra dominate (ADF&G, 2006). Forest fires, which influence vegetation composition and distribution, are frequent due to the high incidence of lightning strikes (ADF&G, 2006).

3.4.3.9. Tanana-Kuskokwim Lowlands Ecoregion

The Tanana-Kuskokwim Lowlands ecoregion is an alluvial plain that slopes gradually northward from the Alaska Range. Soils are composed primarily of sediments of fluvial and glaciofluvial origin that are capped by varying thicknesses of eolian silts and organic soils. The climate is dry continental, characterized by cool summers and cold winters. Permafrost cover is thin and discontinuous.

Boreal forests dominate the landscape, with black spruce in bogs; white spruce and balsam poplar along rivers; and white spruce, white birch, and trembling aspen on south-facing slopes. The coldest, wettest areas on permafrost flats support birch-ericaceous shrubs and sedge tussocks. Wet lowlands, where permafrost is near the surface, are the principal location for black spruce forests. Lowland areas with a shallow active layer over permafrost also support open black spruce-tamarack forest (Viereck, 1975).

3.4.3.10. Alaska Range Ecoregion

The Alaska Range ecoregion is a mountain range comprised of a complex mix of folded, faulted, and deformed metamorphic rocks. Avalanches and landslides often move down the steep, scree-covered slopes. Discontinuous permafrost lies under shallow and rocky soils. Vegetation biomass is greatest on lower slopes, valley bottoms, and low elevation drainages.

The distribution of plant communities is primarily determined by slope and aspect. The soils of upper hillsides and ridge tops are shallow and gravelly. Vegetation on these well-drained, windswept, alpine sites consists of dwarf shrub communities. Slopes and drainages that are more protected support communities of dwarf and tall shrubs (BLM, 2002). Lower slopes and valleys support open coniferous forests and woodlands consisting primarily of open white spruce forest or open black spruce-white spruce forest communities. Open white spruce forest occurs near the treeline and on inactive floodplains. Open black spruce-white spruce forest is generally restricted to areas near the treeline on north-facing slopes (Viereck *et al.*, 1992).

3.4.3.11. Cook Inlet Basin Ecoregion

The Cook Inlet Basin ecoregion is a gradually sloping lowland, with fine-textured lacustrine deposits surrounded by lesser amounts of coarse-textured glacial tills and outwash. The basin contains numerous lakes, ponds, wetlands, and several meandering river systems. The area is generally permafrost free and climatically influenced by both maritime and continental forces, providing moderate fluctuations of seasonal temperature and abundant precipitation.

Vegetation communities in this ecoregion support black spruce forests and woodlands. Ericaceous shrubs are dominant in open bogs. Mixed forests of white and Sitka spruce, aspen, and birch grow on better-drained sites and grade into tall shrub communities of willow and alder on slopes along the periphery of the basin (Nowacki *et al.*, 2001).

3.4.4. Ten-mile-wide Corridor

A 10-mile-wide corridor (5 miles on each side of the centerline) was used to provide a more detailed perspective of the vegetation communities present along the proposed Project. This information was derived from the 2011 NLCD (MRLC Consortium, 2016). Due to the methods used to derive NLCD information, some vegetation characterizations may differ from actual field conditions (*i.e.*, cleared ROW may be depicted as mixed forested areas). Additionally, the raster pixels used for the NLCD are relatively coarse, 30 meter by 30 meter, or 4,047 square meters per acre.

Twenty land cover types are found within a 5-mile buffer of the proposed Project Mainline, Fairbanks Lateral line, work at West Dock, and the Denali Alternative route. These are listed and shown in Figure 3.2-1. The 20 land cover types are summarized for the proposed route across nine Project segments: West Dock; MP 0 to MP 175; MP 175 to MP 356; MP 356 to MP 440; Fairbanks Lateral (MP 0 to MP 30); MP 440 to MP 566;

MP 566 to MP 707; MP 707 to MP 733 (End); and the Denali NPP Route Variation (a component of Alternative 2). Wetland vegetation communities are discussed thoroughly in Section 3.5 (Wetlands) and are not discussed in detail here. Terminology for vegetation follows the 2011 NLCD classification (MRLC Consortium, 2016). Figure 3.4-3 (Maps 1-6) illustrates the 2011 NLCD composition of the 10-mile-wide corridor.

3.4.4.1. Project Segments

3.4.4.1.1. West Dock

The marine segment of Project work at West Dock consists of 159.3 acres of open water in the coastal Beaufort Sea. Approximately 59.3 acres of sea floor would be dredged and approximately 100 acres of seafloor at the dredge placement area would receive the dredged material. The benthic community beneath the Project work may include vegetation such as kelp communities. However, the extent of vegetation around West Dock is likely minimal because of frequent ice scouring action and continual movement of fine sediments, which hinders growth of marine vegetation in this area. The 10-mile wide corridor along this segment is composed of 68 percent open water (primarily the Beaufort Sea), 18 percent sedge/herbaceous, 8 percent emergent herbaceous wetlands, 5 percent perennial ice/snow, and 1 percent developed (low intensity) vegetation cover types (Figure 3.4-3, Map 1). Note that the southern end of this corridor segment overlaps with the beginning of the MP 0 to MP 175 segment because of the 5-mile buffer applied to the centerline.

3.4.4.1.2. MP 0 to MP 175

The segment from MP 0 to MP 175 begins in the open water and sedge dominated vegetation community of the coastal plain southbound, to the dwarf scrub of the Brooks Range foothills. It then continues into the scrub/shrub and barren land of the Brooks Range and ends just south of Atigun Pass in the center of the Brooks Range. The corridor along this segment is composed of 40 percent of dwarf shrub, 31 percent sedge/herbaceous, and 14 percent barren land, with open water, shrub/scrub, emergent herbaceous wetlands comprising the less predominant vegetation covers (Figure 3.4-3, Maps 1, 2, and 3).

3.4.4.1.3. MP 175 to MP 356

The segment from MP 175 to MP 356 begins in the center of the Brooks Range just south of Atigun Pass, in scrub/shrub and barren land. It then continues into the intermontane boreal region of interior Alaska (Kobuk Ridges and Valleys and Ray Mountains), and ends at the Yukon River crossing. Within this boreal region, the corridor increases in forest composition. The corridor along this segment is composed of 51 percent shrub/scrub, 16 percent evergreen forest, and 11 percent dwarf shrub, with barren land, deciduous forest, grassland/herbaceous, and woody wetlands comprising the less predominant vegetation covers (Figure 3.4-3, Maps 3, 4, and 5).

3.4.4.1.4. MP 356 to MP 440

The segment from MP 356 to MP 440 begins at the Yukon River crossing and ends near Minto Flats and Murphy dome, where the lateral line to Fairbanks would begin. This segment is in the intermontane boreal region of interior Alaska in the Ray Mountains and Tanana-Kuskokwim Lowlands ecoregions. The corridor along this segment is composed of 26 percent shrub/scrub, 24 percent evergreen forest, 17 percent deciduous forest, and 13 percent mixed forest, with woody wetlands and grassland/herbaceous comprising the less predominant vegetation covers (Figure 3.4-3, Maps 5 and 6).

3.4.4.1.5. Fairbanks Lateral (MP 0 to 30)

The Fairbanks Lateral segment follows several existing road ROWs on the north side of Murphy Dome, but the majority of the proposed Project ROW for the lateral segment would be new (Figure 3.4-3, Map 6). The corridor along this segment is composed of 27 percent deciduous forest, 11 percent mixed forest, 10 percent woody wetlands, with shrub/scrub, developed (low intensity), open water, and grassland herbaceous comprising the less predominant vegetation covers. The Fairbanks Lateral segment is primarily in the Yukon-Tanana Uplands ecoregion. Note that the western end of this corridor segment overlaps with the end of the MP 356 to MP 440 segment and the beginning of the MP 440 to MP 566 segments because of the 5-mile buffer applied to the centerline.

3.4.4.1.6. MP 440 to MP 566

The MP 440 to MP 566 segment begins near Minto Flats and Murphy Dome, where the lateral line to Fairbanks would originate in the Tanana-Kuskokwim Lowlands. The segment ends adjacent to Cantwell, in the center of the Alaska Range. Evergreen forests, deciduous forests, forested wetlands, and some mixed forests dominate the first part of the corridor. In the Alaska Range, it is primarily evergreen forests, scrub/shrub vegetation, and barren land. The corridor along this segment is composed of 32 percent evergreen forest, 25 percent shrub/scrub, 12 percent deciduous forest, and 10 percent woody wetlands, with barren land, mixed forest, dwarf shrub, and open water comprising the less predominant vegetation covers (Figure 3.4-3, Maps 6, 7, and 8).

3.4.4.1.7. MP 566 to MP 707

The segment from MP 566 to MP 707 begins adjacent to Cantwell in the center of the Alaska Range and ends adjacent to Willow in the Cook Inlet Basin ecoregion. The remainder of the Alaska Range ecoregion and is dominated by scrub/shrub before it descends into the Cook Inlet Basin ecoregion, where shrub/scrub is the dominant vegetation type (Figure 3.4-3, Maps 7, 8, and 9). Within the Cook Inlet Basin, the Project corridor is composed of 24 percent shrub/scrub, 17 percent deciduous forest, 16 percent mixed forest, and 9 percent woody wetlands, with emergent herbaceous wetlands, barren land, evergreen forest, open water, and dwarf shrub comprising the less predominant vegetation covers.

3.4.4.1.8. MP 707 to MP 733 (End)

The segment from MP 707 to the end begins adjacent to Willow and ends at the terminus southwest of Big Lake, all in the Cook Inlet Basin Ecoregion. The Cook Inlet Basin ecoregion is dominated by deciduous and mixed forest (Figure 3.4-3, Map 9). The corridor along this segment is composed of 23 percent mixed forest, 21 percent deciduous forest, 17 percent woody wetlands, 13 percent emergent herbaceous wetlands, and 13 percent evergreen forest, with open water, cultivated crops, and shrub/scrub comprising the less predominant vegetation covers.

3.4.4.1.9. Denali National Park & Preserve Route Variation

The Denali NPP Route Variation (a component of Alternative 2) is comprised of similar vegetation communities within the Alaska Range (Figure 3.4-3, Map 7). The route variation shows a prominence of evergreen forests (39 percent), scrub/shrub vegetation (35 percent), barren land (9 percent), and dwarf shrub (8 percent), with deciduous forest, open water, and woody wetlands comprising the less predominant vegetation covers. See Figure 3.4-3, 2011 NLCD Composition of the 10-Mile-Wide Corridor (Maps 1 - 6).

3.4.5. Non-native, Invasive, and Noxious Plants

Alaska has remained relatively free of the widespread invasion of non-native plants seen in the continental U.S. However, controlling and prohibiting their introduction and proliferation are important management issues. The U.S. Department of Agriculture (USDA) defines non-native, invasive, and noxious plants as (2010):

> *Non-native species: With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.*
>
> *Invasive species: Those species whose introduction does, or is likely to, cause economic or environmental harm or harm to human health. For the purpose of this policy only, a plant species is considered "invasive" only when it occurs on the Federal or State-specific noxious weed list or a list developed by the State-specific Department of Agriculture with their partners and approved by the State Technical Committee, which prohibits or cautions its use due to invasive qualities.*
>
> *Noxious weeds: Those plant species designated as such by the Secretary of Agriculture, Secretary of the Interior, or by State law or regulation. Generally, noxious weeds will possess one or more of the characteristics of being aggressive and difficult to manage, parasitic, a carrier or host of deleterious insects or disease, and being non-native, new to, or not common to the U.S. or parts thereof.*

Not all non-native species are invasive or noxious plants that cause damage to natural ecosystems. Invasive plants reproduce aggressively, outcompeting and displacing native plants as they become established. The Alaska Center for Conservation Science (ACCS), in cooperation with state and federal agencies currently tracks the distribution of 393 species of non-native plants in Alaska (ACCS, 2016). Documented locations of infestations obtained from many plant surveys in Alaska are stored in the database, Alaska Exotic Plant Information Clearinghouse (AKEPIC), which is used for management purposes.

ADNR and USDA regulate noxious weed seed as prohibited or restricted in transport or sale within the State of Alaska (11 AAC 34). No person may plant in this state any agricultural, vegetable, tree, shrub, or flower seed containing any prohibited noxious weeds listed in 11 AAC 34.020(a) or any restricted noxious weeds in excess of the maximum allowable tolerances listed in 11 AAC 34.020(b), except as provided in 11 AAC 34.030, without express written approval of the director. No person may use, sell, offer, expose for sale, give away, or transport for feeding, seeding, or mulching purposes any seed or grain screenings containing any prohibited noxious weed seed listed in 11 AAC 34.020(a) or any restricted noxious weeds in excess of the maximum allowable tolerances listed in 11 AAC 34.020(b), except as provided in 11 AAC 34.030, and except as allowed by the director for sale or transport of screenings.

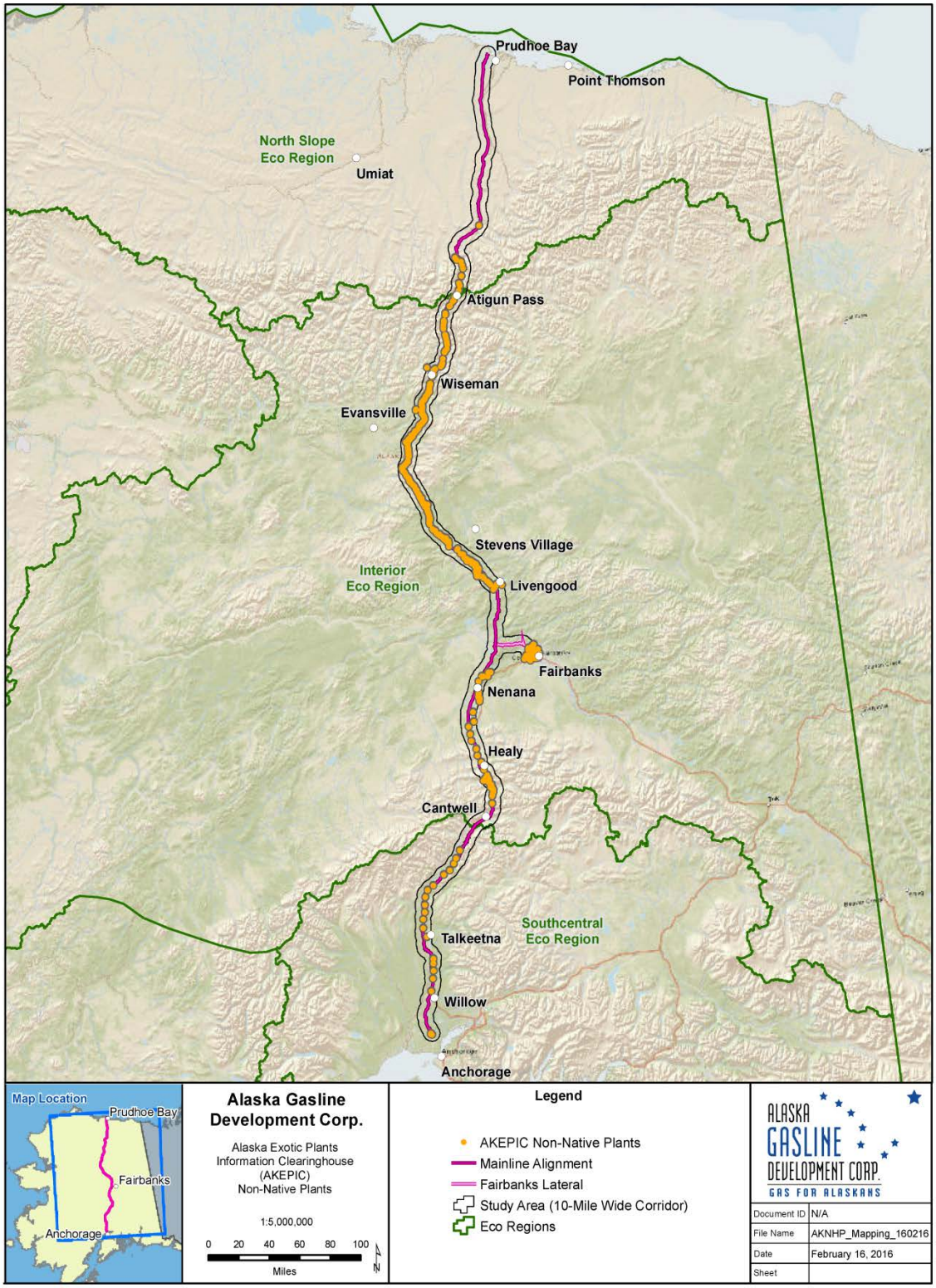
Alaska regulations only prohibit movement of material containing prohibited noxious weeds. Restricted noxious weed seed are permissible for planting in Alaska up to the tolerance per pound established under 11 AAC 34.020(b). Nine plant species are listed as restricted noxious weeds and 14 species are listed as prohibited noxious weeds (ADNR, 2010b). The distinguishing factor between the two types is that restricted noxious weeds can be controlled by ordinary agricultural means, while prohibited noxious weeds cannot. E.O. 13112 was issued to prevent the introduction of invasive species to provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause. The prohibited noxious weed species known to occur within the 10-mile wide corridor include quackgrass (*Elymus repens*), orange hawkweed (*Hieracium aurantiacum*), and field sowthistle (*Sonchus arvensis*); the restricted noxious weed species include butter-and-eggs, also known as yellow toadflax (*Linaria vulgaris*), common plantain (*Plantago major*), annual bluegrass (*Poa annua*), and bird vetch (*Vicia cracca* spp. *cracca*).

A comprehensive survey of non-native plants, invasive species, and noxious weeds has not been conducted along the entire proposed Project Area. The Project proponent's wetlands survey crews identified invasive plants along almost all roadways and disturbed areas while in route to survey locations during its 2010-2015 field studies. Invasive species were common on the road shoulders and narrow regions bordering natural vegetation. Non-native plants are well documented along many road and utility corridors in Alaska (Lapina and Carlson, 2004), especially the Dalton Highway (Cortés-Burns *et al.,* 2008) and George Parks Highway corridors (ACCS, 2015), and the TAPS corridor (McKendrick, 2002; APMC, 1992). Along these corridors, non-native plant

populations are frequently found in disturbed sites, including road construction and revegetation areas, parking lots, campgrounds, and Alaska Department of Transportation and Public Facilities (DOT&PF) stations (Cortés-Burns *et al.,* 2008). Given the proposed Project's (Alternative 1) and Denali NPP Route Variation's (Alternative 2) close proximity to existing road and utility corridors along much of the alignment, it is likely that many non-native plants exist within the corridor. The Denali NPP has been surveying and treating infestations of invasive plants in the park entrance area since the 1990s (NPS, 2009a). Figure 3.4-1 shows where these non-native species have been documented within the 10-mile wide corridor.

See Appendix M, Mitigation Measures, for non-native species mitigation and monitoring and a description of how the proposed Project would mitigate and monitor non-native and invasive species in the ROW.

Figure 3.4-1 Non-native Plants Documented within 5 Miles of Proposed Project Mainline



Source: ACCS, 2015

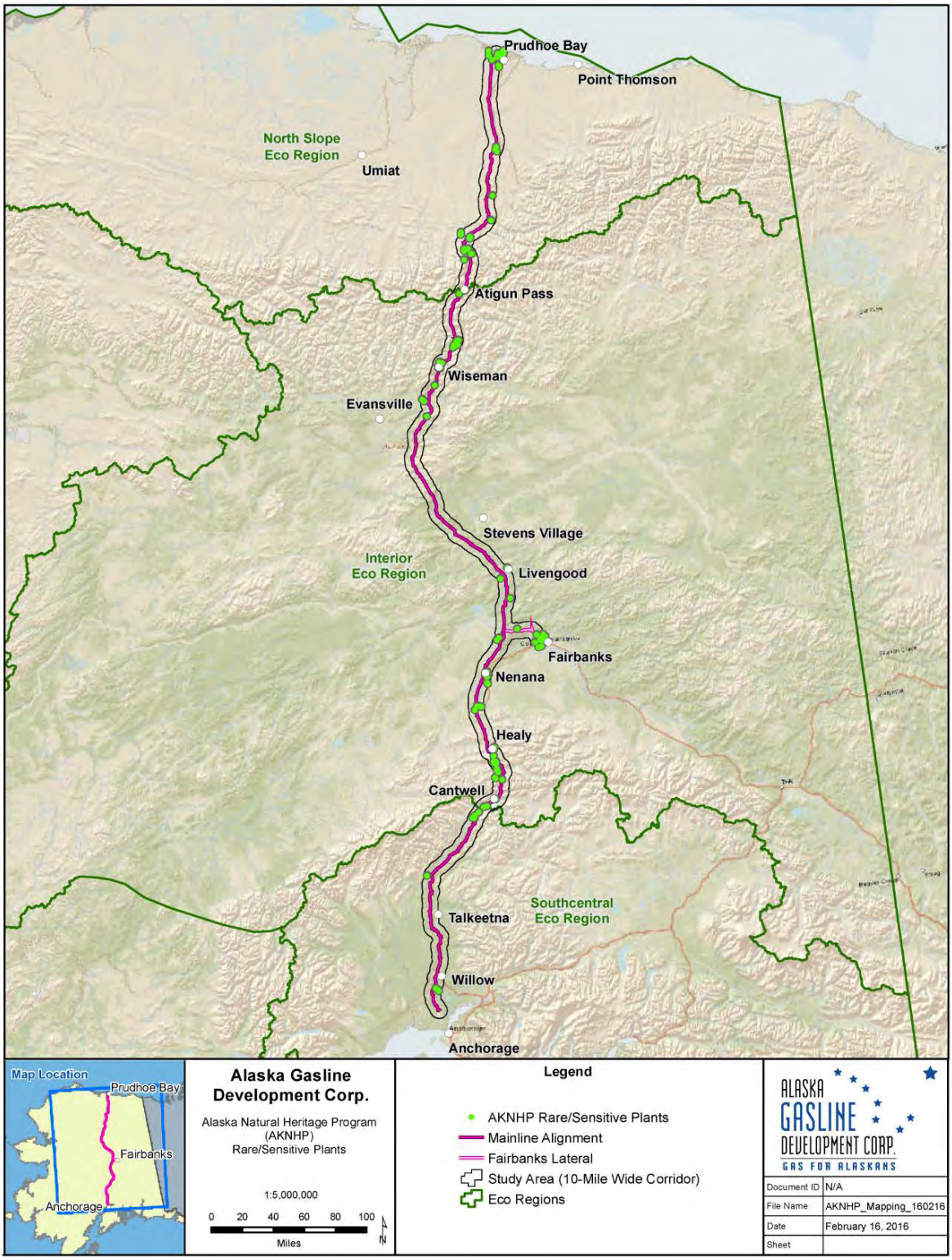
3.4.6. Rare and Sensitive Plants

A summary of the federally protected and candidate species with the potential to occur in the proposed Project Area is included in Section 5.8.3. However, there are no Endangered Species Act (ESA) of 1973 listed or candidate plants within the proposed Project Area to date. The Aleutian shield fern (*Polystichum aleuticum*), is currently the only listed plant in Alaska (U.S. Fish and Wildlife Service [USFWS], 2014a). A comprehensive survey of rare and sensitive plant species has not been conducted along the entire proposed Project route. The following section is intended to describe the potential for the occurrence of rare and sensitive plant species, not federally listed under the ESA along the proposed Project route.

A list of rare and sensitive plants was obtained from two sources, the Alaska Rare Plant List maintained by UA through the Alaska Natural Heritage Program (AKNHP) (AKNHP, 2015) and the BLM Alaska Sensitive Animal and Plant List (BLM, 2010a). Sensitive taxa are identified by the Regional Forester for which population viability is a concern as evidenced by significant current or predicted downward trends in populations or habitat (AKNHP, 2015). The BLM defines a sensitive species as one in danger of rapidly dwindling to extinction, listing that species on the BLM Sensitive Species list (BLM, 2010a). The sensitive species designation is normally used for species that occur on BLM public lands and for which BLM has the capability to significantly affect the conservation status of the species through management (BLM, 2010a).

The probability of occurrence along the proposed Project route was estimated from species range maps and rare plant inventories relevant to the proposed Project. For all species on the rare and sensitive plants lists, range maps from USDA PLANTS database (USDA, 2016) were examined for occurrences within the proposed Project route. Where USDA (2016) source data were lacking, additional range map and occurrence map sources were consulted to supplement the information. These additional sources include Hultén (1968), the UA Anchorage Rare Plant Field Guide (UA Anchorage, 2015), UA Museum of the North's herbarium database (UA Museum of the North, 2016), Flora of North America (eFloras, 2016), NatureServe Explorer (NatureServe Explorer, 2015), Carroll *et al.,* (2003), Global Biodiversity Information Facility (Global Biodiversity Information Facility, 2016), Roland (2004), and Carlson *et al.,* (2006). Species locations documentation within 5 miles of Project Mainline (Figure 3.4-2) are from the AKNHP database (AKNHP, 2015).

Figure 3.4-2 Rare & Sensitive Plants Documented within 5 Miles of Proposed Project Mainline



Source: ACCS, 2015

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Beaufort Sea

West Dock

MP 0

Project Segment
MP 0 - 175

Deadhorse

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 1, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 0.5 1 2 3 4 5 Miles



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Beaufort Sea

MP 0

Deadhorse

Project Segment
MP 0 - 175

Dalton Highway

MP 50

Data Source: National Landcover Data, 2011

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

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Figure 3.4-3: MAP 2, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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MP 100

Dalton Highway

Project Segment
MP 0 - 175

MP 150

Brooks Range

Atigun Pass

Project Segment
MP 175 - 356

Data Source: National Landcover Data, 2011

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

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Figure 3.4-3: MAP 3, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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Project Segment
MP 175 - 356

MP 200

Nolan

Wiseman

Dalton Highway

MP 250

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 4, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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MP 300

Project Segment
MP 175 - 356

Dalton Highway

MP 350

Stevens Village

Project Segment
MP 356 - 440

Ray
Mountains

Rampart

MP 400

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 5, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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Livengood
MP 400
Project Segment
MP 356 - 440
ElliottHighway
Minto
Fairbanks Lateral
Fox
Fairbanks
MP 450
MP 450
Parks Highway
Project Segment
MP 440 - 566
Anderson
MP 500

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 6, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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MP 500

Healy

Project Segment
MP 440 - 566

McKinley Park

MP 550

Alaska Range

Cantwell

Parks Highway

Project Segment
MP 566 - 707

MP 535

McKinley Park

MP 540

Denali National Park
Route Variation
(Parks Highway)

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- Denali National Park Alternative
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 7, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles

ALASKA CANADA

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MP 550

Project Segment
MP 440 - 566

Cantwell

Denali Highway

Parks Highway

Alaska Range

Project Segment
MP 566 - 707

MP 600

MP 650

Talkeetna

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 8, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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Talkeetna

Project Segment
MP 566 - 707

Parks Highway

MP 700

Willow

Project Segment
MP 707 - 733

Wasilla

Big Lake

Anchorage

Legend

- City or Village
- Mile Post
- Roads
- ASAP v6.1 Mainline
- 10 Mile Corridor

Land_Cover

- Woody Wetlands
- Shrub/Scrub
- Sedge/Herbaceous
- Perennial Ice/Snow
- Pasture/Hay
- Open Water
- Moss
- Mixed Forest
- Grassland/Herbaceous
- Evergreen Forest
- Emergent Herbaceous Wetlands
- Dwarf Shrub
- Developed, Open Space
- Developed, Medium Intensity
- Developed, Low Intensity
- Developed, High Intensity
- Deciduous Forest
- Cultivated Crops
- Barren Land

Data Source: National Landcover Data, 2011

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Figure 3.4-3: MAP 9, 2011 NLCD
ALASKA STAND ALONE PIPELINE

0 5 10 20 Miles



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3.5. Wetlands

This section discusses wetland resources in the proposed Project Area. The description of wetland resources is based on information provided in the 2012 FEIS as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the 2012 FEIS (USACE, 2012a), including the proposed alignment changes. Specifically, the following information, data, methods, and/or analyses have been substantially updated in this section from the 2012 document:

- An expanded description of the wetland resources encountered within the proposed Project Area and figures, which illustrate the proposed pipeline route relative to regional ecosystems and wetlands. The description of wetland resources is based on information from field surveys conducted by ASRC Energy Services Alaska, Inc. (AES), aerial photography, and National Wetlands Inventory (NWI) mapping;
- The wetland types crossed by the proposed Project, percentages of each type, tables, charts, and referenced figures have been updated using wetland data for the proposed Project alignment;
- The ASAP Project is now proposed to be primarily outside of existing ROWs; major alignment shifts occurred on the North Slope, at Minto Flats / Summer Ridge, Anderson / Clear, and the Nancy Lake SRA; however, the proposed Project is within the BLM Utility Corridor Resource Management Planning Area from MP 121 to 354;
- Under the newest alignment, the first 6 miles of pipeline that were originally supported aboveground on vertical support members spaced roughly every 60 feet, would now be buried;
- A discussion regarding marine waters and wetlands has been added due to proposed Project design changes at West Dock, which includes winter dredging, nearshore dredge material disposal, sealift construction, and temporary widening of the causeway road;
- The hydrogeomorphic (HGM) wetland types have been adjusted: “Mineral Soil Flats” and “Extensive Peatlands” have been combined into one category “Flats,” “Estuarine Fringe” has been eliminated.
- Biologically unique landscapes and communities of conservation concern, which include wetlands crossed by the proposed Project, have changed, with the most significant concerns occurring in the ACP, Minto Flats State Game Refuge, Tanana Valley State Forest, Denali NPP, Denali State Park, Susitna River area, Chulitna River area, Nancy Lake SRA, and the Susitna Flats State Game Refuge.
- Since the DSEIS, USACE completed an extensive quality assurance/control review of the Applicant's wetland mapping data. In USACE’s review, they identified approximately 797.91 additional acres of wetland within the project footprint that

had not previously been accounted for (8,906.92 acres in DSEIS and 9,704.83 acres in the PFEIS). The additional acreage results in an 8.2% increase in wetland impacts.

3.5.1. Introduction

This section describes the classification and composition of wetlands identified within the proposed Project vicinity. The proposed Project vicinity for wetland mapping includes a 2,000-foot wide corridor centered on the Project's 733-mile Mainline. Several proposed Project features that extend outside of the 2,000-foot corridor include access roads, material sites, the GCF, HDD pads, camps, work at DH3 expansion, the 30-mile lateral line to Fairbanks, and the Denali NPP Route Variation. The proposed Project vicinity, mapped for wetlands and uplands in the 2015 Wetlands and Waters of the U.S. Delineation Report for v6.1 Route (AES, 2015), and ancillary Project feature footprint data, dated February 19, 2016, combined is further referred to as the "wetland mapping corridor." The wetland-mapping corridor begins at West Dock in Prudhoe Bay and ends in the Mat-Su Borough southwest of Big Lake. AGDC's proposed analysis methodology, affected environment, and environmental consequences are summarized below and discussed in detail in Chapter 4. Proposed mitigation measures to reduce impacts to wetland resources are discussed in Appendix M, Mitigation Measures.

Wetlands are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (33 CFR 328.3(b)). Section 404 of the CWA establishes programs to regulate the discharge of dredged or fill material into waters of the U.S., including wetlands. Wetlands regulated by USACE under Section 404 require positive evidence of hydrophytic vegetation, hydric soils, and wetlands hydrology for some portion of the growing season for a determination that an area is a federally regulated wetland. Some exceptions may exist and are limited to those instances identified in the 1987 USACE Wetlands Delineation Manual (USACE, 1987) and the Alaska Regional Supplement to the 1987 Manual. In furtherance of the National Environmental Policy Act (NEPA), Executive Order - Protection of Wetlands is defined as the avoidance, to the extent possible, of the long and short term adverse impacts associated with the destruction or modification of wetlands and the avoidance of direct or indirect support of new construction in wetlands wherever there is a practicable alternative.

3.5.2. Summary

The proposed Project route would cross various wetland types in Alaska, including palustrine, lacustrine, riverine, and marine waters and wetlands. Wetlands of special concern that may be crossed by the proposed Project include wetlands within the ACP, Minto Flats State Game Refuge, Tanana Valley State Forest, Denali NPP, Denali State Park, Susitna River area, Chulitna River area, Nancy Lake SRA, and the Susitna Flats State Game Refuge. Other sensitive wetland types include those that are protected by various easements and wetlands that provide important habitat for wildlife and

threatened and endangered (T&E) species. Impacts and affected acreages to wetlands are discussed in Section 4.9, Wetlands.

3.5.3. Analysis Methodology

A multi-year wetland and upland analysis was conducted along the 733-mile proposed Project within the 2,000-foot "planning corridor," and the 30-mile lateral line to Fairbanks. A Wetlands and Waters of the U.S. Delineation Report for v6.1 Route was developed by AES in support of USACE permitting, which includes the wetland analysis data from 2008-2015 (AES, 2015). Additional data was collected in 2015 and 2016 for the Revision 6.1 alignment and ancillary Project feature footprints (AES, 2016). Areas outside of the 2,000-foot planning corridor include access roads, material sites, the GCF, HDD pads, camps, DH3 expansion, and the Denali NPP Route Variation. Ancillary Project features located beyond the 2,000-foot planning corridor are assigned an indirect impact buffer. Specifically, a 350-foot buffer was placed around any proposed pads or infrastructure, and a 50-foot buffer was placed along access roads. The proposed Project's vicinity and buffers were mapped for wetlands and uplands boundaries and are provided in the latest version (February 2016) of the in the 2015 Wetlands and Waters of the U.S. Delineation Report for v6.1 Route (AES, 2016).

Five main components were included in the development of the 2015 Wetlands and Waters of the U.S. Delineation Report for v6.1 Route: preliminary data gathering and analysis, wetlands classification, HGM functions assessment, post-field data review, and final mapping. The 2015 Wetlands and Waters of the U.S. Delineation Report for v6.1 Route mapped wetlands by interpreting data at two scales: (1) within the 300-foot wide (150 feet on each side of the centerline) construction corridor, and (2) the 2,000-foot (1,000 feet on each side of the centerline) planning corridor. The 2,000-foot planning corridor provides a broad spatial context for the proposed Project Area, while the construction corridor provides a conservative estimate of the specific wetland habitat that would receive direct impacts from the proposed Project. Data provided in the 2016 GIS data (AES, 2016) divides the data into Project-related permanent and temporary impact categories, which are discussed in Section 4.9, Wetlands.

The 300-foot construction corridor (150 feet on either side of the centerline) desktop analysis was field verified to confirm wetlands and uplands at field target locations throughout the length of the pipeline. The remaining portion of the planning corridor was interpreted primarily from aerial photographs and the select field target locations chosen for field verification (AES, 2012; AES, 2015). Areas with field-verified characteristics that met the three wetland criteria (vegetation, soils, and hydrology), as outlined in the USACE Wetland Delineation Manual (USACE, 1987) and the Regional Supplement to the USACE Wetland Delineation Manual: Alaska Region (USACE, 2007) were classified as wetlands. All wetland acreage calculations for the proposed Project were completed by ASRC AES using spatial analysis from 2012, 2015, and 2016. In areas of poor aerial photo coverage, best professional judgment was used to make a correlation based on the same aerial photography layers for currently mapped features.

AGDC proposed two classification systems to characterize the wetlands within the proposed Project Area: The USFWS' NWI by Cowardin *et al.* (1979), Classification of Wetlands and Deepwater Habitats, and the Magee and Hollands (1998) HGM classification. The NWI classification is based largely on biotic characteristics (*e.g.*, vegetation), whereas the HGM classification describes the wetland's position in the landscape and its function using geomorphic and hydrologic characteristics. Both classification systems were used to provide information needed for a robust basis for wetland comparisons. For example, forested wetland vegetation is very slow to recover from disturbances compared to emergent wetlands, which can recover much more quickly. Regardless of the type of wetland impacted, slope wetlands are more susceptible to hydrologic changes resulting from soil and vegetation changes. Using both systems as described above provides effective characterization of wetlands when considering potential impacts.

A request for Preliminary Jurisdictional Determination (PJD) was included in the 2015 Wetlands and Waters of the U.S. Delineation Report for v6.1 Route as Section 6.0 (AES, 2015). The request for PJD and the proposed classification methodology has been submitted to USACE and are currently pending review.

3.5.4. Wetlands Classification

The proposed Project corridor crosses a wide variety of wetland classes as it proceeds from the nearshore Beaufort Sea southbound and connects with the Beluga Pipeline southwest of Big Lake (see the wetland mapbook provided as Appendix I, which is Attachment L of the CWA 404 Application). Wetlands are important to the ecosystem for many reasons. They support numerous species of plants and provide necessary habitat for fish, wildlife, and insects throughout various stages of their life cycles. Wetlands provide feeding, breeding, rearing, and cover habitat for numerous animals. Wetlands also act as filters while providing flood control, sedimentation, erosion control, and the stabilization of shorelines.

Wetland classes transected by the proposed Project corridor can be grouped into major classifications using the NWI classification system, which is used as the National Wetlands Classification Standard:

- Forested Wetlands (PFO) – Forested wetlands include broadleaf, needle-leaf, and mixed forest wetland communities. These wetlands are typically dominated by an over story of black spruce (*Picea mariana*), with an understory of alder (*Alnus* spp.), Labrador tea (*Ledum* spp.), and horsetail (*Equisetum* spp.), among others. Forested wetlands function to increase nutrient export, modify stream flow, and improve water quality.
- Scrub/shrub Wetlands (PSS) – Scrub/shrub wetlands include broadleaf, needle-leaf, and mixed shrub communities. These wetlands are commonly dominated by swamp birch (*Betula nana*), sweetgale (*Myrica gale*), bluejoint reedgrass (*Calamagrostis canadensis*), horsetail (*Equisetum* spp.), marsh cinquefoil (*Comarum palustre*), and

sedges (*Carex* spp.). These wetlands often function similar to forested wetlands in that they increase nutrient export and improve water quality. They also support extensive bird nesting and animal browsing.

- Emergent Wetlands (PEM) – Emergent wetlands are dominated by graminoid species, sedges and grasses, with scattered shrubs. These can function to buffer floodwaters, moderate stream flow, facilitate nutrient export, and provide critical habitat for juvenile fish, waterfowl, and other wildlife.
- Other Palustrine Waters and Wetlands (PAB, PUB) – Other palustrine wetlands not discussed above include ponds. Ponds are smaller than lakes (less than 20 acres), are small, shallow, permanent or intermittent waterbodies.
- Lacustrine (L) – Lacustrine waters and wetlands (lakes) are located in a depression or dammed channel, have little or no vegetation, and have a large area.
- Riverine (R) – Riverine waters and wetlands are those associated with channels (streams and rivers). Water is almost always flowing in a riverine system. Riverine systems can be further divided into subsystems: lower perennial, upper perennial, and intermittent.
- Marine (M) – Marine waters and wetlands occur in the open ocean overlying the continental shelf and coastline. Plants in the marine environment are influenced by exposure to wave action, texture and nature of the substrate, variation in the tides, and water temperature. Vegetation in Alaska marine waters and wetlands is primarily kelp and other species of algae.

Wetlands crossed by the proposed Project corridor were also classified into six HGM classes. Note that the marine wetland category does not fall into an HGM class.

- Flats - These wetlands are created by the vertical accretion of organic and inorganic matter. The water source for flats is typically precipitation and overland flow with water loss due to saturation, seepage to groundwater, and by evapotranspiration. Bogs, muskegs, and large playas are common examples. Flat wetlands are commonly associated with permafrost soils. They primarily function to store surface water and provide wildlife habitat, most notably for waterfowl;
- Depressional – These wetlands occur in topographic depressions. Their water source is precipitation, groundwater discharge, and both interflow and overland flow from adjacent wetlands. These wetlands store surface water and provide groundwater recharge and wildlife habitat;
- Lacustrine Fringe – These wetlands occur adjacent to ponds and lakes and are largely maintained by an elevated water table, precipitation, and groundwater discharge. They function to store floodwater and detritus (organic material) and provide habitat for wading birds and juvenile fish;
- Slope – These wetlands occur where there is groundwater discharge to the surface. They are normally found along elevation gradients. They do not store surface water,

or recharge groundwater. Instead, they mediate surface flow to other wetlands and waterbodies; and

- Riverine – These waters and wetlands occur in floodplains and riparian corridors. Their water source is primarily overbank flow, supplemented by overland flow and precipitation. Riverine waters and wetlands can moderate stream flow, store floodwaters, and facilitate nutrient export.

3.5.5. Wetland Mapping Corridor

The wetland mapping corridor (2,000-feet wide, centered on the Project centerline, plus the ancillary Project features and their associated mapping buffers) was selected to provide ample coverage area for pipeline placement optimization (AES, 2015), and represents the proposed Project Area for those wetland resources, which may be subject to either permanent and temporary, direct or indirect impacts as a result of the proposed construction. The wetland-mapping corridor attempts to provide a quantifiable landscape context for understanding the wetland composition by region. The wetland compositions relative to the Project alignment and facilities locations are presented in the wetland map book included as Attachment L of the CWA 404 Application.

The wetland-mapping corridor is composed of 51.6 percent wetlands, totaling approximately 105,233 acres. Field wetland delineations were supplemented with publicly available NWI data. To describe these wetlands using the NWI classification, the wetlands were summarized into five classes: palustrine scrub/shrub (53.1 percent); palustrine emergent wetlands (32.4 percent); palustrine forested (8.4 percent); riverine (3.9 percent); and lacustrine, marine, and other palustrine wetlands (2.2 percent) (Figure 3.5-1). A complete list of wetland subgroups that are summarized into the primary classes as noted above is presented in Table 3.5-1. Mapped wetland acres and their NWI classifications are presented in Table 3.5-2. Using the HGM classification, of these wetlands evaluated, 68.9 percent are mineral soil flats, 13.9 percent are slope, 7.6 percent are depressional, 7.2 percent are riverine, 1.6 percent are organic soil flats, and 0.8 percent are estuarine fringe, marine, and lacustrine fringe (Figure 3.5-2). Mapped wetland acres and their HGM functional classification are presented in Table 3.5-3.

Table 3.5-1 Wetland and Water Subgroups Located within the Wetland Mapping Corridor

Palustrine Forested (PFO)		Palustrine Scrub/Shrub (PSS)			Palustrine Emergent (PEM)	Other Palustrine, Lacustrine, and Riverine (P, L, and R)			Marine (M)
Broadleaf Forest (PFO1)	Needleleaf Forest (PFO4)	Broadleaf Scrub/Shrub (PSS1)	Needleleaf Scrub/Shrub (PSS4)	Mixed & Other Scrub/Shrub (PSS)		Palustrine Waters (PAB, PUB)	Lacustrine Waters (L)	Riverine Waters (R)	
PFO1/4B	PFO4/1B	PSS1	PSS4/1B	PSS/EM1B	PEM/SS1B	PAB/EM1H	L1UB	R2UB	M1UB
PFO1/SS1B	PFO4/EM1B	PSS1/4B	PSS4/1C	PSS/EM1C	PEM/SS1C	PAB/SS1F	L1UBH	R2UBH	M2US
PFO1/SS1E	PFO4/SS1B	PSS1/4C	PSS4/3B	PSS/EM1E	PEM1/FO4B	PABH	L1UBH/EM1B	R2US	
	PFO4/SS1C	PSS1/4E	PSS4/EM1B	PSS/EM1F	PEM1/SS1B	PUB/ABH		R3SB	
	PFO4/SS4B	PSS1/4H	PSS4/EM1C	PSS/EM1H	PEM1/SS1C	PUB/EM1F		R3UB	
	PFO4/SS4C	PSS1/EM1B	PSS4/EM1F	PSS/PFO4B	PEM1/SS1E	PUB/EM1H		R3UB/USC	
	PFO4B	PSS1/EM1B/C	PSS4/FO4B	PSS3/FO4B	PEM1/SS1F	PUBF		R3US	
	PFO4C	PSS1/EM1C	PSS4B		PEM1/SS1H	PUBH		R3US/SS1C	
	PFO4H	PSS1/EM1E	PSS4C		PEM1/SS4B	PUBH/EM1B		R4SB	
		PSS1/EM1F	PSS4E		PEM1/SS4C			R4UB	
		PSS1/EM1H			PEM1/USC			R4UB/USC	
		PSS1/FO1B			PEM1A			R4US	
		PSS1/FO4B			PEM1B			R5SB	
		PSS1/FO4C			PEM1C			R5UB	
		PSS1/PFO4B			PEM1E				
		PSS1/SS1B			PEM1F				
		PSS1/SS4B			PEM1H				
		PSS1/USC			PEM4/SS1B				
		PSS1B							
		PSS1B/C							
		PSS1C							
		PSS1E							
		PSS1F							
		PSS1H							

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Figure 3.5-1 NWI Classes of Wetlands and Waters within the Wetland Mapping Corridor

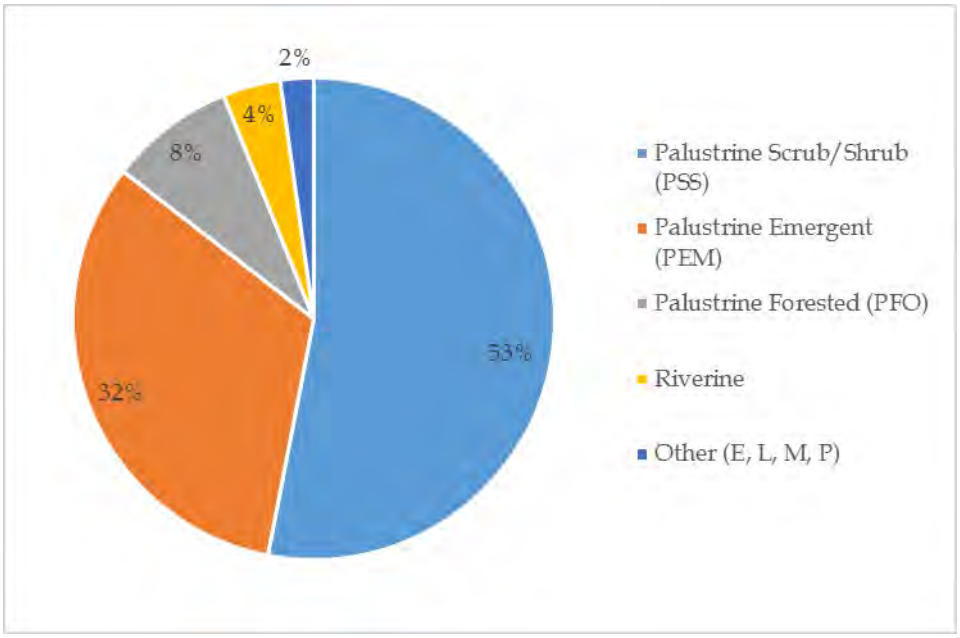


Figure 3.5-2 HGM Functional Classes of Wetlands and Waters within the Wetland Mapping Corridor

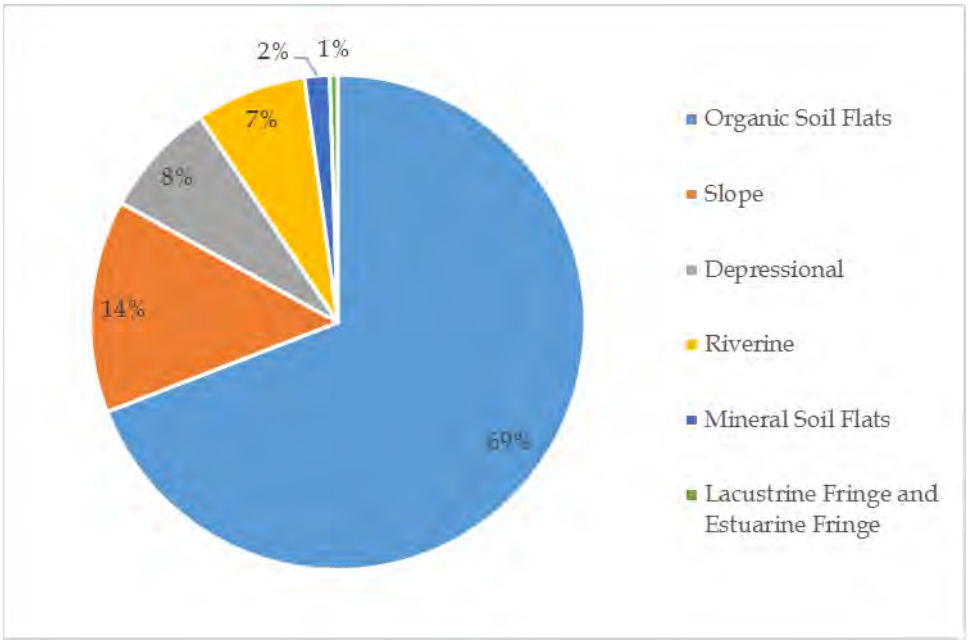


Table 3.5-2 Wetland Type (Acres) Mapped in the Wetland Mapping Corridor

Wetland Type	Acres within Wetland Mapping Corridor
Palustrine Forested (PFO)	8,844.93
Palustrine Scrub/Shrub (PSS)	55,836.72
Palustrine Emergent (PEM)	34,116.92
Other Palustrine Waters (PAB, PUB)	1,430.64
Riverine Waters (R)	4,083.96
Lacustrine Waters (L)	419.33
Estuarine Waters (E)	173.58
Marine Waters (M)	326.89
Total Wetland Acres	**105,232.96**
Upland	*98,817.25*
Total Acres	*204,050.22*

Table 3.5-3 HGM Functional Class (Acres) Mapped in the Wetland Mapping Corridor

HGM Functional Class	Acres within Wetland Mapping Corridor
Depressional	7,951.89
Mineral Soil Flats	72,509.54
Organic Soil Flats	1,731.97
Riverine	7,589.59
Slope	14,583.88
Estuarine Fringe	173.58
Lacustrine Fringe	365.61
Marine	326.89
Total Wetland Acres	**105,232.96**
Upland	*98,817.25*
Total Acres	*204,050.22*

3.6. Wildlife

3.6.1. Introduction

The description of terrestrial wildlife resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

Wildlife discussed in this chapter includes large and small terrestrial mammals, waterbirds (in marine, freshwater, and terrestrial habitats), upland game birds, and landbirds that inhabit the area associated with the proposed Project at some point in their life history (*i.e.*, breeding, migration, feeding, nesting, calving, rearing, molting, and staging). This section does not discuss wildlife that are listed as endangered, threatened, or candidate species under the ESA of 1973, which are discussed in Section 3.10, Threatened and Endangered Species. Additionally, marine mammals are discussed separately in Section 3.8, Marine Mammals.

Specifically, the following information, data, methods, and/or analyses have been substantially updated from the 2012 FEIS document:

- Species descriptions have been updated to include the most recent population estimates and life history information;
- Habitat associations in the wildlife tables have been updated and enhanced;
- Several bird species have been added to tables as the 2012 FEIS bird list was incomplete;
- A list of species of greatest conservation need has been added as Table 3.6-2;
- Range maps are now provided for big game species occurring in the proposed Project Area; and
- The wood bison (*Bison bison athabascae*) has undergone regulatory changes and a small population has been released; however, the release area is not within the proposed Project Area (they were originally proposed to be released in Minto Flats).

3.6.2. Regulatory Setting

Most Alaskan terrestrial wildlife is either protected by federal regulation or managed by the Alaska Department of Fish and Game (ADF&G). Federal regulations protecting various avian species include the Migratory Bird Treaty Act (MBTA) of 1918 (amended in 1936 and 1972), which prohibits the taking of migratory birds, unless authorized by the Secretary of Interior. For the implementation of the MBTA, USFWS' definition of "take" includes activities such as pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting an animal. E.O. 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of migratory birds and their habitats, and requires the evaluation of the effects of federal actions on

migratory birds, with an emphasis on species of concern. Federal agencies are required to support the intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory birds when conducting agency actions (66 CFR 3853, January 17, 2001).

In 2017, USFWS circulated recommendations regarding time periods of when to avoid vegetation clearing; preventing "take" that would result in a violation of the MBTA Table 3.6-1.

Table 3.6-1 Recommended Periods to Avoid for Vegetation Clearing During Migratory Bird Breeding

Region	Habitat Type			
	Forest or Woodland	Shrub or Open	Seabird Colonies (including cliff and burrow colonies)	Eagles[e]
Northern	NA	June 1 – July 31[a,c]	May 20 - September 15	March 1 – August 31
Interior	May 1 – July 15[a,b]		May 1 – July 20[d]	March 1 – August 31
South-central	May 1 – July 15[a,b]		April 15 – September 7	March 1 – August 31

Source: USFWS, 2017a
a Raptors may nest two or more months earlier than other birds.
b Canada geese and swans begin nesting April 20.
c Black scoter are known to nest through August 10.
d Seabird colonies in Interior refer to terns and gulls.
e Eagles and eagle nests have additional protections under the Eagle Act, and a permit may be required to conduct activities near an eagle nest. Contact the U.S. Fish and Wildlife Service's Alaska Region Eagle Permit Program (https://www.fws.gov/alaska/eaglepermit/) for further information if an eagle or eagle nest is located in your project area.

The Bald and Golden Eagle Protection Act (BGEPA) of 1940 (and amended several times since then) is the primary law protecting bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos,* respectively). The BGEPA prohibits the "take" of eagles without a permit (16 U.S.C. 668-668c). The BGEPA defines "take" to include "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb," and prohibits the take of individuals and their parts, nests, or eggs. USFWS expanded this definition by regulation to include the term "destroy" to ensure that "take" includes destruction of eagle nests. The term "disturb" is further defined by regulation as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause…injury to an eagle, a decrease in productivity, or nest abandonment" (50 CFR 22.3).

BLM has the responsibility for the designation and protection of sensitive species on BLM (public) managed lands. Sensitive species require special management considerations to promote their conservation and reduce the likelihood and need for future listing under the ESA. BLM Alaska evaluates potential Project impacts on BLM

Alaska-sensitive animals and plants. Alaska-sensitive animals and plants are determined in coordination with recommendations by AKNHP, ADF&G, and USFS. BLM also evaluates both federal candidate species and federal delisted species within 5 years of delisting. BLM-sensitive plants and BLM-sensitive fish are discussed in Section 3.4, Vegetation, and Section 3.7, Fish, respectively.

USFWS refuge system has the responsibility to administer a national network of lands and waters for the conservation, and management of wild lands and the perpetuation of diverse and abundant wildlife, to include restoration of the fish, wildlife, and plant resources and their habitats. The Alaska USFWS refuge system evaluates potential Project impacts on Alaska's-sensitive animals and plants. Alaska's sensitive animals and plants are determined in coordination with recommendations by the various state and federal agencies in Alaska.

Federal, State of Alaska, and Audubon special status species that may occur within the proposed Project Area are presented in Table 3.6-2. Bald and golden eagles are not included in this list, as they are protected under the BGEPA. USFS also maintains a sensitive species lists in coordination with the various Alaska state and federal agencies. The Alaska Wildlife Action Plan has produced a list of species of greatest conservation need (ADF&G, 2015a). The list includes mammals, fish, and bird species. While there is overlap with the federal agencies special species list, the state is far more encompassing (see Appendix A of ADF&G, 2015a). BLM Instruction Memorandum BLM IM-AK-2010-018 (BLM, 2010b) presents the revised BLM-Alaska list of sensitive species.

Kittlitz's murrelet and yellow-billed loon were previously identified as candidate species in Alaska. However, USFWS published 12-month findings in the Federal Register on October 3, 2013 and October 1, 2014, respectively, which concluded that listing these species was no longer warranted. They are no longer "candidate" species; however, several federal agencies, as well as the State of Alaska, classify them as species of conservation concern.

Table 3.6-2 List of Species of Greatest Conservation Need that may occur within the Proposed Project Area

Species	
Common Name	**Scientific Name**
Birds	
Alder flycatcher[d]	*Empidonax aldorum*
American golden-plover[c,d]	*Pluvialis dominica*
American kestrel[d]	*Falco sparverius*
American peregrine falcon[a,d]	*Falco peregrinus anatum*
American pipit[d]	*Anthus rubescens*
American redstart[d]	*Setophaga ruticilla*
American tree sparrow[d]	*Spizella arborea*
American three-toed woodpecker[d]	*Picoides tridactylus tydactilus*
Ancient murrelet[d]	*Synthliboramphus antiquus antiquus*

Species	
Common Name	**Scientific Name**
Arctic peregrine falcon[a,d]	*Falco peregrinus tundrius*
Arctic tern[c,d]	*Sterna paradisaea*
Arctic warbler[d]	*Phylloscopus borealis*
Bank swallow[d]	*Riparia riparia*
Bar-tailed godwit[c,d]	*Limosa lapponica*
Barn swallow[d]	*Hirundo rustica*
Belted kingfisher[d]	*Megaceryle alcyon*
Bering Sea rock sandpiper[a]	*Calidris ptilocnemis tschuktschor*
Black brant[a,d]	*Branta bernicla nigricans*
Black guillemot[a,d]	*Cepphus grylle*
Black oystercatcher[c,d]	*Haematopus bachmani*
Black scoter[a,d]	*Melanitta nigra*
Black turnstone[c,d]	*Arenaria melanocephala*
Black-bellied Plover[d]	*Pluvialis squatarola squatarola*
Blackpoll warbler[a,d]	*Dendroica striata*
Black-backed woodpecker[d]	*Picoides arcticus*
Black-legged kittiwake[d]	*Rissa tridactyl*
Black-tailed godwit[a]	*Limosa limosa*
Bohemian waxwing[d]	*Bombycilla garrulous,*
Boreal chickadee[d]	*Poecile hudsonicus*
Boreal owl[d]	*Aegolius funereus*
Bristle-thighed curlew[a,c,d]	*Numenius tahitiensis*
Brown creeper[d]	*Certhia americana occidentalis*
Buff-breasted sandpiper[a,c,d]	*Tryngites subruficollis*
Cassin's auklet[d]	*Ptychoramphus aleuticus aleuticus*
Chestnut-backed chickadee[d]	*Poecile rufescens*
Chipping sparrow[d]	*Spizella passerine*
Common eider (Pacific population) [d]	*Somateria mollissima*
Common murre[d]	*Uria aalge inornata*
Common redpoll[d]	*Carduelis flammea*
Dunlin[c,d]	*Calidris alpina*
Dusky Canada goose[a,b,d]	*Branta canadensis occidentalis*
Fox sparrow[d]	*Passerella iliaca*
Glaucous gull[d]	*Larus hyperboreus*
Glaucous-winged gull[d]	*Larus glaucescens*
Golden-crowned kinglet[d]	*Regulus satrapa*
Golden-crowned sparrow[d]	*Zonotrichia atricapilla*
Gray jay[d]	*Perisoreus canadensis*
Gray-cheeked thrush[a]	*Catharus minimus*
Gray-crowned rosy-finch[d]	*Leucosticte tephrocotis*
Gray-headed chickadee[d]	*Poecile cinctus lathami*
Gyrfalcon[d]	*Falco rusticolus*
Hairy woodpecker[d]	*Picoides villosus sitkensis*

Species	
Common Name	**Scientific Name**
Harlequin duck[a]	*Histrionicus histrionicus*
Hermit thrush[d]	*Catharus guttatus*
Herring gull[d]	*Larus smithsonianus*
Hoary redpoll[d]	*Acanthus hornemanni*
Horned grebe[c,d]	*Podiceps auritus*
Horned lark[d]	*Eremophila alpestris arcticola*
Horned puffin[d]	*Fratercula corniculata*
Hudsonian godwit[a,c,d]	*Limosa haemastika*
Killdeer[d]	*Charadrius vociferous*
King eider[a,d]	*Somateria spectabilis*
Kittlitz's murrelet[a,b,d]	*Brachyramphus brevirostris*
Lapland longspur[d]	*Calcarius lapponicus*
Lesser sandhill crane[d]	*Grus canadensis canadensis*
Lesser yellowlegs[c,d]	*Tringa flavipes*
Lincoln's sparrow[d]	*Melospiza lincolnii*
Long-billed dowitcher[d]	*Limnodromus scolopaceus*
Long-tailed duck[a,d]	*Clangula hyemalis*
Long-tailed jaeger[d]	*Stercarius longicaudus*
Marbled murrelet[a,d]	*Brachyramphus marmoratus*
Mew gull[d]	*Larus canus brachyrhynchus*
Northern flicker[d]	*Colaptes auratus luteus*
Northern hawk owl[d]	*Surnia ulula*
Northern goshawk[a,b]	*Accipiter gentilis laingi*
Northern harrier[d]	*Circus cyaneus*
Northern shrike[d]	*Lanius excubitor*
Olive-sided flycatcher[a,c,d]	*Contopus cooperi borealis*
Orange-crowned warbler[d]	*Vermivora celata*
Osprey[b]	*Pendion haliatus*
Pacific wren[d]	*Troglodytes pacificus*
Peale's peregrine falcon[a,d]	*Falco peregrinus pealei*
Pectoral sandpiper[d]	*Calidris melanotos*
Peregrine falcon[c,d]	*Falco peregrinus*
Pigeon guillemot[d]	*Cepphus columba columba*
Pine grosbeak[d]	*Pinicola enucleator*
Pine siskin[d]	*Carduelis pinus*
Pomarine jaeger[d]	*Sterocarius pomarinus*
Red phalarope[d]	*Phalaropus fulicarius*
Pacific golden-plover[c,d]	*Pluvialis fulva*
Red knot[a,c,d]	*Calidris canutus roselaari*
Red-breasted sapsucker[d]	*Sphyrapicus ruber*
Red-tailed hawk[d]	*Buteo jamaicensis alascensis*
Red-throated loon[a,c,d]	*Gavia stellata*
Red-winged blackbird[d]	*Agelaius phoeniceus*

Species	
Common Name	**Scientific Name**
Rock sandpiper[c,d]	*Calidris ptilocnemis*
Rough-legged hawk[d]	*Buteo lagopus*
Ruby-crowned kinglet[d]	*Regulus calendula grinnelli*
Rufous hummingbird[d]	*Selasphorus rufus*
Rusty blackbird[a,c,d]	*Euphagus carolinus*
Sabines's gull[d]	*Xema sabini*
Sanderling[d]	*Calidris alba rubida*
Savannah sparrow[d]	*Passerculus sandwichensis*
Semipalmated sandpiper[d]	*Calidris pusilla*
Short-billed dowitcher[c,d]	*Limnodromus griseus caurinus*
Short-eared owl[a,c,d]	*Asio flammeus*
Smith's longspur[c,d]	*Calcarius pictus*
Song sparrow[d]	*Melospiza melodia*
Snow bunting[d]	*Plectrophenax nivalis*
Snowy owl[d]	*Bubo scandiacus*
Solitary sandpiper[c,d]	*Tringa solitria*
Spotted sandpiper[d]	*Actitus macularius*
Steller's jay[d]	*Cyanocitta stelleri*
Surfbird[a,d]	*Aphriza virgata*
Surf scoter[a]	*Melanitta perspicillata*
Swainson's thrush[d]	*Catharus ustulatus*
Thick-billed murre[d]	*Uria lomvia arra*
Townsend's warbler[a,d]	*Dendroica townsendi*
Tree swallow[d]	*Tachycineta bicolor*
Trumpeter swan[a,b,d]	*Cygnus buccinators*
Tufted puffin[d]	*Fratercula cirrhata*
Tule white-fronted goose[a,d]	*Anser albifrons gambelli*
Upland sandpiper[c,d]	*Bartramia longicauda*
Varied thrush[d]	*Ixoreus naevius*
Wandering tattler[d]	*Tringa incana*
Western screech owl[d]	*Megascops kennicottii*
Western sandpiper[d]	*Calidris mauri*
Western wood-pewee[d]	*Contopus sordidulus*
Whimbrel[c,d]	*Numenius borealis*
White-crowned sparrow[d]	*Zonotrichia leucophyrys*
White-winged crossbill[d]	*Loxia leucoptera*
White-winged scoter[d]	*Melanitta deglandi*
Wilson's warbler[d]	*Cardenella pusilla pileolata*
Yellow warbler[d]	*Setophaga petechial*
Yellow-billed loon[a,c,d]	*Gavia adamsii*
Mammals	
Alaska hare[a,d]	*Lepus othus*
Alaska marmot[d]	*Marmotya broweri*

Species	
Common Name	**Scientific Name**
Alaskan tiny shrew[a,d]	*Sorex yukonicus*
American water shrew[d]	*Sorex palustris*
Arctic fox[d]	*Vulpes lagopus*
Arctic ground squirrel[d]	*Urocitellis parryii*
Barren ground shrew[d]	*Sorex ugyunak*
Canada lynx[a]	*Lynx Canadensis*
Collared pika[d]	*Ochotona collaris*
Common shrew[d]	*Sorex cinerus streatori*
Dusky (montane) shrew[d]	*Sorex monticolus*
Little brown bat[d]	*Myotis lucifugous*
Meadow jumping mouse[d]	*Zapus hudsonius*
Meadow vole[d]	*Microtus pennsylvanicus*
Nearctic brown lemming[d]	*Lemmus trimucronatus*
Northern bog lemming[d]	*Synaptomys borealis*
Northern collared lemming[d]	*Dicrostonyx groenlandicus*
Northern flying squirrel[d]	*Glaucomys sabrinus*
Northern red-backed vole[d]	*Myodes rutilus*
Red squirrel[d]	*Tamiaciuris hudsonicus*
Singing vole[d]	*Microtus miurus*
Snowshoe hare[d]	*Lepus americanus*
Taiga vole[d]	*Microtus xanthognathus*
Tundra shrew[d]	*Sorex tundrensis*
Tundra vole (also known as root vole)[d]	*Microtus oeconomus*

Source: ADF&G, 2015a
a Denotes BLM Sensitive Species
b Denotes USFS Sensitive Species
c Denotes USFWS Bird of Conservation Concern
d Alaska Species of Greatest Conservation Need

The affected environment and general descriptions by proposed Project Area are discussed below.

3.6.3. Summary

Large terrestrial mammals commonly found along the proposed Project ROW include moose (*Alces alces*), caribou (*Rangifer tarandus*), Dall sheep (*Ovis dalli*), and bears (*Ursus* spp.). Muskoxen (*Ovibos moschatus*) are also present within limited areas of the ACP. The wood bison has undergone recent regulatory changes; on May 7, 2014, USFWS published a final rule in the Federal Register for the establishment of a nonessential experimental population of wood bison, a species that is classified as threatened in Alaska under the ESA (79 FR 26175). One of the release areas considered for the species was within the Minto Flats region near the proposed Project Area; however, a site near Shageluk, Alaska (outside the Project Area) was instead chosen for release and monitoring in spring 2015. There are no confirmed plans to date for any reintroduction of wood bison to the Minto Flats. This species is not described in Table 3.6-2 or in the

remainder of the document because it would not occur in the proposed Project Area. Common terrestrial mammals and their habitat descriptions are described in Table 3.6-4.

Birds that could occur within or near the proposed Project Area are discussed below (Tables 3.6-5 through 3.6-8). Information used to analyze avian use of the proposed Project Area was obtained from USFWS waterfowl breeding pair survey areas (Larned *et al.,* 2010; Mallek and Groves, 2009), the AKNHP, Alaska Audubon, and Alaska bird-specific conservation plans (Boreal Partners in Flight Working Group, 1999; Alaska Shorebird Group, 2008).

Several animals are valued as game for subsistence, sport hunting, and trapping uses. Big and small game animals, furbearers, waterfowl, and upland game birds could occur within the proposed Project Area year-round, with most sport hunting concentrated in the fall.

3.6.4. Terrestrial Mammals

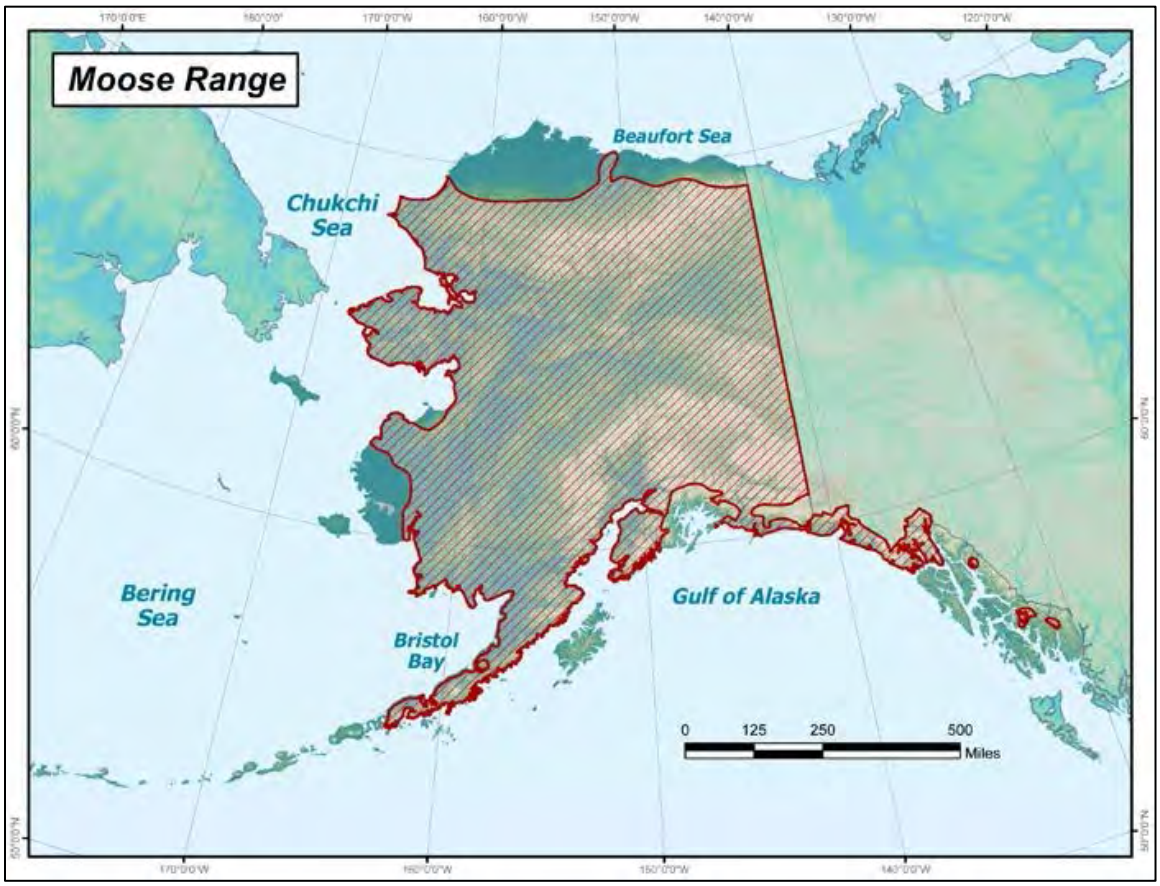
3.6.4.1. Moose

The moose is the largest member of the deer family, ranging in size from 800 to 1,600 pounds and distinguished by the large palmate (*i.e.*, broad and flat) antlers of the males (ADF&G, 2016a). Moose are generally associated with northern forest and found in Alaska from the Stikine River in Southeast Alaska to the Colville River on the North Slope (Figure 3.6-1) (ADF&G, 2016a). Moose populations are less common in coastal portions of the ACP north of the Brooks Range. They are especially abundant on timberline plateaus, along the major rivers of Southcentral and Interior Alaska, and in recently burned areas that have generated dense stands of willow, aspen, and birch shrubs (ADF&G, 2016a). Moose range from aquatic and riparian floodplain areas to sub-alpine willow-dominated areas. Sedge meadows, ponds, and lakes with extensive aquatic vegetation, riparian and subalpine willow stands, and forested areas provide important summer habitat for moose. Important winter habitat includes shrub-dominated alpine and riparian areas, and forested areas. Riparian areas along the major rivers and tributary streams are particularly important during winter. Most moose make seasonal movements to calving, rutting, and wintering areas (ADF&G, 2016a). Moose population statuses and trends vary across the state. Populations north of the Brooks Range are declining (ADF&G, 2014a), whereas Central and Southwest region populations are reported to be stable (ADF&G, 2015b,c).

Sensitive periods include calving during mid-May to early June, rutting during late September and early October, and winter foraging from January through May. Areas throughout and adjacent to the proposed Project Area that may be important to calving include the Minto Flats State Game Refuge, the Susitna Flats State Game Refuge, and the Goose Bay State Game Refuge.

In Game Management Unit (GMU) 26, moose are generally associated with narrow strips of shrub communities along drainages except during calving and summer when some dispersal occurs, and they may move extensively within and between North Slope drainages (Lenart, 2012). Wildfire is important for maintaining moose forage habitat (MacDonald and Cook, 2009).

Figure 3.6-1 Moose Range



Source: ADF&G, 2016k

Moose are distributed throughout GMU 25 in low densities, with higher densities in riparian habitats in late winter and in early winter along the upper Sheenjek and Coleen rivers, reflecting some movement between higher elevation early winter range and lower elevation late winter and summer ranges (Caikoski, 2012). In GMU 24A, moose use broad riparian habitats year-round with short seasonal migrations; in the northern habitats, moose are found at tree line areas during early winter and move to river bottoms during late winter and summer (Stout, 2012). Moose densities in GMU 20C and 20F are generally low due to limited habitat, although, there are some riparian areas, subalpine hills, and burn areas with habitat suitable for moose (Hollis, 2012). Moose are distributed throughout GMU 20B with both non-migratory and migratory subpopulations. Migratory populations move from the Chena and Salcha river drainages from February to April to summer range on the Tanana Flats in GMU 20A,

where most remain during the summer and return to the foothills from August through October (Young, 2012). Moose distribution in GMU 20A varies widely, with both non-migratory and migratory populations. Migratory populations travel from the surrounding foothills in the Alaska Range's Chena and Salcha river drainages to summer range on the Tanana Flats where they remain through June, returning to the foothills from July through October (Young, 2012). In GMU 13E, moose concentrate in subalpine habitats during rutting and post-rutting, with winter distributions dependent on snow depth and wolf distribution and moose movements occurring earlier with lower densities in riparian habitats (Schwanke, 2012). In GMU 16A, moose abundance fluctuates with winter severity and has likely declined due to predation with additional mortality from malnutrition and highway accidents (Peltier, 2012a). In GMU 14B, moose make annual movements that cross management unit boundaries into GMU 16A and 14A; movements make moose in these units vulnerable to collision mortality from trains and vehicles (Peltier, 2012b,c,d).

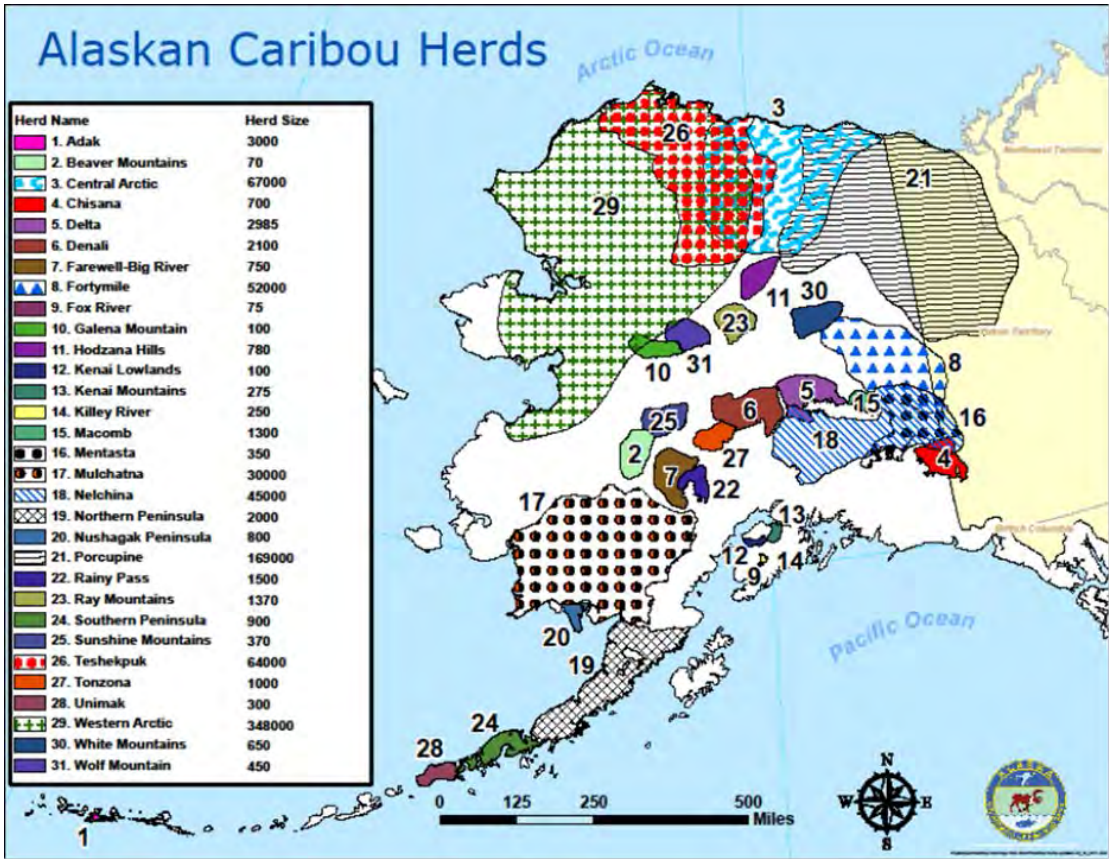
3.6.4.2. Caribou

Caribou from nine herds, defined by calving areas, range through the proposed Project Area (Figure 3.6-2). Sensitive periods include calving in May to June, summer insect season in late June through mid-August, rut in September to October, and winter foraging from November through March. The most sensitive of these periods are calving (May to June) and rutting (September to October). Herd ranges often overlap, and animals from different herds can mix during winter. Spring calving areas are the traditional center of distribution and define herds; caribou calve above timberline or along the coast in windswept rolling hills. Caribou seek summer ranges in the mountains or along the coast for relief from biting insects. This species is nomadic and may travel long distances to find adequate lichens and sedges. Caribou browse in both boreal forest and tundra habitats (MacDonald and Cook, 2009).

The Central Arctic caribou herd calves between the Colville and Canning rivers in GMU 26B; their summer range extends from just west of the Colville River delta east and inland within 30 miles to the Katakturuk River, and their winter range includes northern and southern foothills and mountains of the Brooks Range (Lenart, 2013a). Caribou migrate through Anaktuvuk Pass twice a year (spring and fall) but the numbers and specific time varies from year to year.

The Teshekpuk caribou herd is located within GMU 26A. The calving distribution is geographically distinct from both the Central Arctic and Western Arctic herds. This herd exhibits fidelity to calving areas surrounding Teshekpuk Lake, extensive use of coastal habitats between Cape Halkett and Utqiagvik for insect relief, and broad use of the coastal plain west of the Colville drainage in late summer. All three herds have extensive overlaps in fall and winter ranges (Philo *et al.,* 1993; Prichard *et al.,* 2001; Person *et al.,* 2007; Yokel *et al.,* 2009; Wilson *et al.,* 2012).

Figure 3.6-2 Caribou Herd Ranges



Source: ADF&G, 2018

The Porcupine caribou herd migrates between Alaska and Yukon and Northwest Territories in Canada; their calving distributions vary with snow cover. In 2007, calving was concentrated near the Malcolm and Firth rivers, Yukon; summer range in Alaska was concentrated between the Jago and Aichilik rivers south into the Brooks Range; fall distribution in Alaska includes the Richardson Mountains into the upper Sheenjek and Chandalar river drainages; winter distributions in Alaska were concentrated around Arctic Village between the Sheenjek and East Fork Chandalar rivers in 2007-2008 (Caikoski, 2013).

The Ray Mountains caribou herd calves on the southern slopes of the Ray Mountains, summers in alpine areas of the Spooky Valley area around Mount Henry Eakins and south of the upper Tozitna River and winters on the northern slopes of the Ray Mountains (Pamperin, 2013).

The White Mountain caribou herd calves primarily in the higher elevations east of Beaver Creek, including the Nome, Fossil, Cache, and Preacher creek drainages. ADF&G reports that some scattered calving also occurs west of Beaver Creek. Postcalving aggregations may be found from mid-June to late July east of Beaver Creek to Mount Prindle. This herd has been found north of Beaver Creek, wintering in upper Hess and

Victoria creeks and the upper Tolovana River drainages, and in the Preacher Creek drainage west of Circle. An identified shift of caribou away from the western wintering area was detected after the western wintering area burned in 1988; most of the herd was observed to winter in the Preacher Creek drainage between regulatory years 2004–2009 and the Beaver and Preacher creek drainages between regulatory years 2010–2011. The White Mountain and Fortymile herds mixed in autumn 2008; ADF&G suggests a portion of the White Mountain herd remained with the Fortymile herd when the Fortymile caribou herd traveled back toward the core of their traditional range and may account for the noted population decline between regulatory years 2010–2011 (Young, 2013a).

The Fortymile caribou herd ranges across portions of the upper Fortymile, Tanana, and Yukon river drainages in both Alaska and Yukon Territory, Canada. The herd has been documented using the Fortymile, upper Charley, upper Goodpaster, and upper Salcha drainages for calving between 2011 and 2013. Winter range includes the White Mountains and Birch Creek areas near the Steese Highway. Smaller portions of the herd have been seen distributed in the eastern portion of its winter range, primarily near the Top of the World Highway between Boundary, Alaska in the U.S. and Dawson, Yukon in Canada (Gross, 2013).

The Delta caribou herd historically occupied the foothills of the central Alaska Range between the Parks and Richardson highways, north of the divide separating the Tanana and Susitna drainages. In recent years, the herd has also been detected in the upper Nenana and Susitna drainages, north and south of the Denali Highway. Calving areas include areas between the Delta and the Little Delta rivers in southeastern Unit 20A (Davis *et al.*, 1991); extending into the foothills between Dry Creek and the Delta River (Valkenburg *et al.*, 1988). More recently, calving areas have included the upper Wood River, Dick Creek, upper Wells Creek, and the upper Nenana and Susitna river drainages (Valkenburg *et al.*, 2002). During the remainder of the year, the herd has typically been distributed among the northern foothills from the Delta River to the Nenana River. Steep population declines were detected between 1989 and 1993, and remain at lower numbers. This herd is known to mix with the Macomb, Nelchina and Denali herds (Young, 2013b).

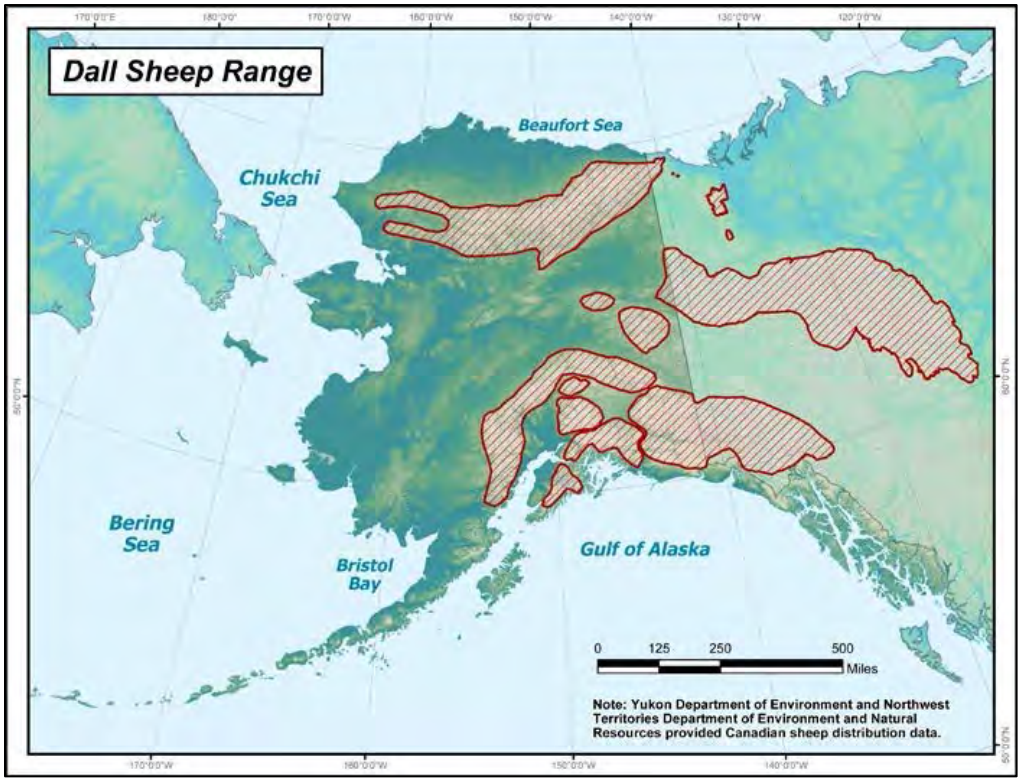
The Nelchina caribou herd calves in the eastern Talkeetna Mountains from the Little Nelchina River north to Fog Lakes where they remain after calving into early summer. The fall range extends from the Denali Highway across the Alphabet Hills and the Lake Louise flats as far east as the Gulkana River, and winter range extends from Cantwell east across GMU 13A and 13B and northeast into GMU 11, 12, and 20E (Schwanke and Fobbins, 2013).

The Denali caribou herd is centered within the Denali NPP. Wintering grounds include the Stampede and Kantishna hills. Calving areas are found near Cantwell and Stampede (Boertje, 1984).

3.6.4.3. Dall Sheep

Dall sheep occur throughout the proposed Project Area ROW in alpine and subalpine habitats in the Brooks Range, Alaska Range, Talkeetna Mountains, and the Chulitna-Watana Hills (Figure 3.6-3) (Craig and Leonard, 2009). Dall sheep habitat is described as subalpine grass/low shrub in dry, mountainous terrain. During late winter, Dall sheep are restricted to snow-free areas; the summer range is larger without the inhibitions of snow and ice. Mineral licks are essential during the spring (MacDonald and Cook, 2009). Sensitive periods include lambing in mid-May to late June, which is concurrent with mineral lick site use. Rams visit ewe wintering areas during the rut (Summerfield, 1974). Dall sheep move from wintering areas to lambing areas in May to mid-June and to rutting areas from late September to late October. Dall sheep move to winter areas in late November through December (Hollis, 2011a).

Figure 3.6-3 Dall Sheep Range



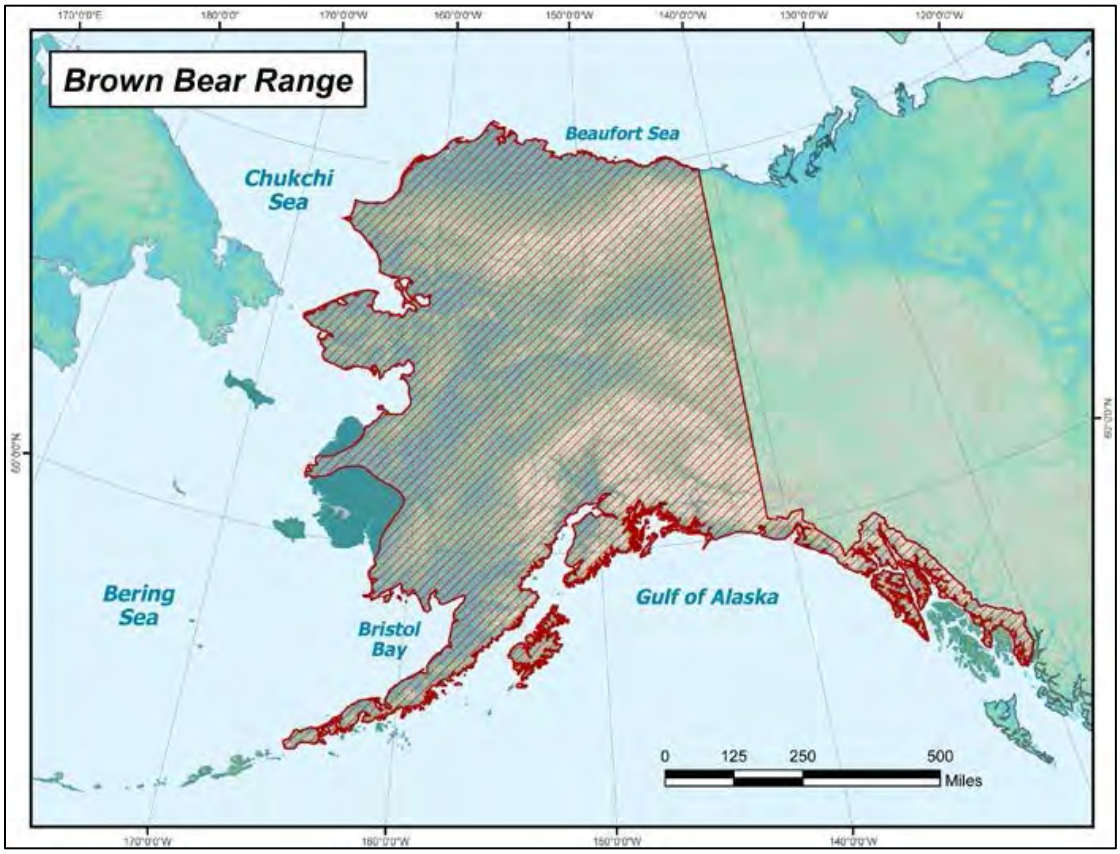
Source: ADF&G, 2016k

3.6.4.4. Bears

Brown bear (*Ursus arctos*) habitat is generally found in areas of open tundra, grasslands, mountain meadows, muskeg, and sedge flats. Den sites are often on hillsides (MacDonald and Cook, 2009). Brown bear densities in GMU 26 are generally highest in the foothills and mountains of the Brooks Range and lowest on the ACP where riparian habitats are used extensively (Figure 3.6-4) (Lenart, 2013c; Carroll, 2013). Brown bear densities are higher in the mountainous portion of GMU 20A and 20C for the Central

and Lower Tanana Valley and Middle Yukon river drainages (Young, 2013c). Brown bear populations in the upper Cook Inlet have been influenced by agricultural settlement, development, and urbanization; population estimates are confounded by forest cover (Coltrane, 2013; Peltier, 2013a). ADF&G estimates brown bear densities of 120 brown bears for Subunit 16A and 798 bears for Subunit 16B (Peltier, 2013b). Further refinements of these estimates are anticipated in the future.

Figure 3.6-4 Brown Bear Range

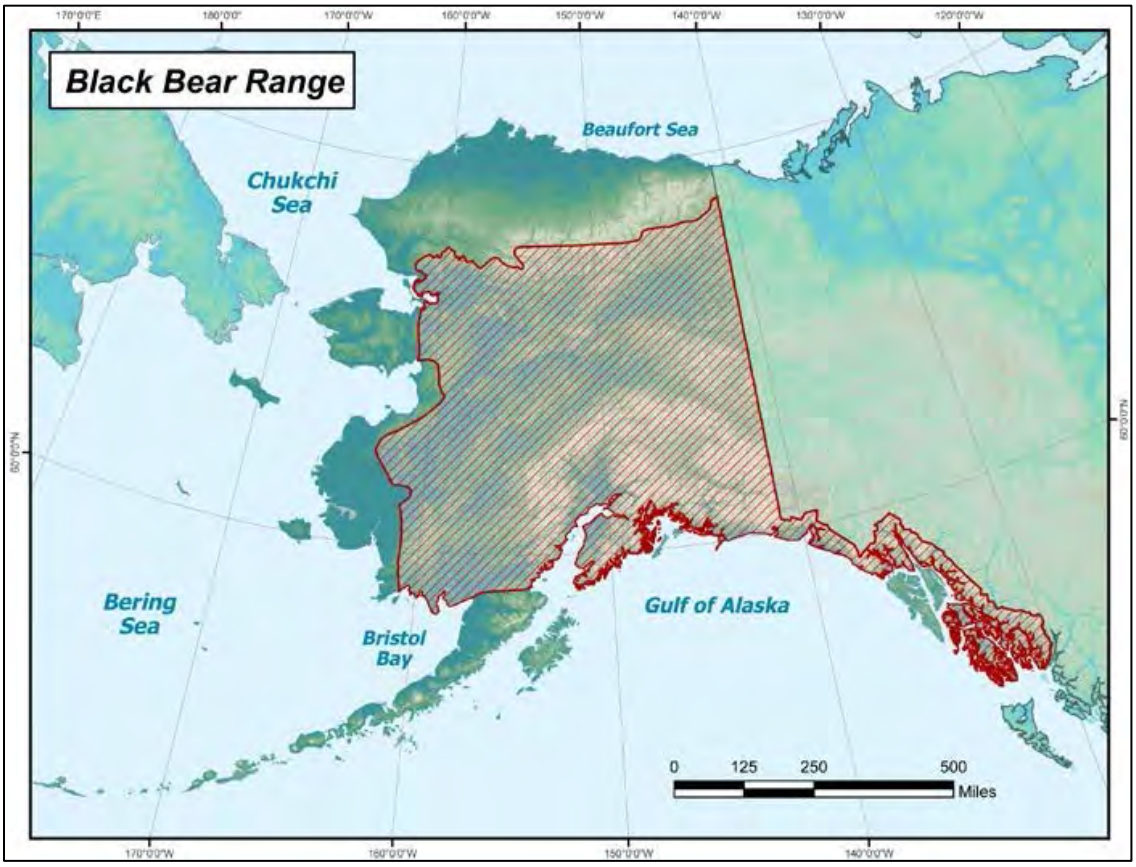


Source: ADF&G, 2016k

Black bears (*Ursus americanus*) are usually found in forested habitats, preferring semi-open areas with fruit-bearing shrubs and herbs, lush grasses, and succulent forbs (MacDonald and Cook, 2009). Black bears are considered abundant in GMU 13 (Robbins, 2011). Black bears live throughout Interior and Southcentral Alaska (Figure 3.6-5). Distributions shift seasonally with bears using moist lowlands with early growing vegetation in spring, and berries in open meadow or alpine areas in fall (Hollis, 2011b).

The most sensitive period for brown bears and black bears is the denning period, which begins in late September and extends to October with emergence in April and May. Seasonal availability of salmon affects distributions of both brown and black bears (Robbins, 2011).

Figure 3.6-5 Black Bear Range

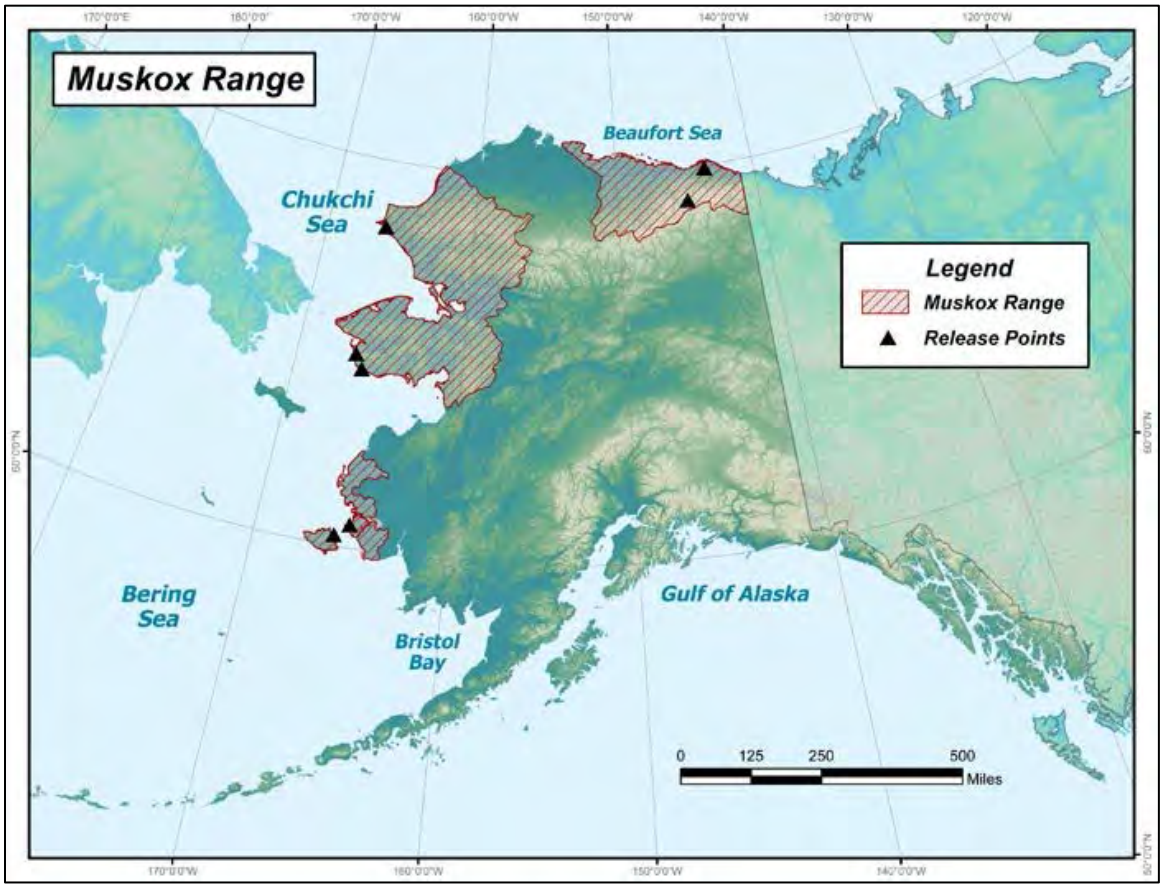


Source: ADF&G, 2016k

3.6.4.5. Muskoxen

Muskoxen occur on the ACP and Brooks Range foothills in GMU 26B. They are found primarily near Beechey Point, Deadhorse, and along the Sagavanirktok and Ivishak rivers, with a few animals reported on the south side of the Brooks Range (Figure 3.6-6) (Lenart, 2013b). This species is social and gregarious. During the summer muskoxen uses moist habitats and riparian vegetation; winter habitat includes windswept hilltops and slopes (MacDonald and Cook, 2009). Muskoxen aggregate in larger groups 6 to 60 during the winter and remain in one location for long periods of time; they split into smaller groups of 5 to 20 animals during the summer and moving more frequently (Lenart, 2013b). Sensitive periods for muskoxen include calving in April to June and in winter from November to February.

Figure 3.6-6 Muskoxen Range



Source: ADF&G, 2016k

3.6.4.6. Furbearers and Other Small Mammals

The terrestrial mammals that are hunted or trapped in the proposed Project Area are included in Table 3.6-3. A summary of furbearers and other small mammals within the proposed Project Area is presented in Table 3.6-4. The AKNHP assimilates and synthesizes information concerning terrestrial vertebrates to aid land management planning and species conservation in Alaska. The program is a central repository of biological information on rare animal species in Alaska and tracks occurrence records and range data for more than 760 animal species. These data are publicly available through the Biotics Animal Data Portal. Range information presented in Table 3.6-3 for furbearers and other small mammal species were obtained from AKNHP.

Fur harvest for the GMUs crossed by the proposed Project was dominated by American marten, American beaver, red fox, Canadian lynx, ermine, and river otter (ADF&G, 2013).

Table 3.6-3 Terrestrial Mammals Hunted or Trapped in GMUs Crossed by the Proposed Project Area

Species	Marten	Beaver	Red Fox	Lynx	Ermine	River Otter	Coyote	Wolf
2013 Total for State (Reported)	4279	1142	1141	921	733	673	326	240

Source: ADF&G, 2013

Small terrestrial mammals use a wide variety of habitats, including forests, river and stream banks, ponds, and marshes. American beavers, American mink, North American river otter, and weasels are associated with riparian and wetland areas. Most medium to small sized terrestrial mammals are associated with some type of den or cover for giving birth and for shelter during winter months.

The proposed Project crosses many different habitats that are home to a wide variety of animals, most of which are considered game. Small terrestrial mammals such as Arctic ground squirrels, red squirrels, lemmings, voles, and shrews are important prey species for bears, wolves, wolverines, coyotes, foxes, American marten, ermine, raptors, and owls. Table 3.6-4 illustrates the most common terrestrial mammals and their habitats.

Table 3.6-4 Common Furbearers and Other Small Mammals that Occur along the Proposed Project ROW

Common and Scientific Names	Assessed Occurrence by Geographic Regions in Alaska (North to South)							Habitat Association
	Arctic	Koyukuk	Yukon	Tanana	Kuskokwim	South Central	Copper	
Furbearers								
American beaver (*Castor canadensis*)		√	√	√	√	√	√	Found in lakes, ponds, marshes, rivers and streams over most of mainland Alaska, north to near crest of Brooks Range. Common to abundant in suitable habitat (MacDonald and Cook, 2009).
American marten (*Martes americana*)		√	√	√	√	√	√	Found in most forested regions of Alaska, adapted to variety of forested habitats, optimum habitat is mature old-growth spruce with well-established understory, and abundant rodents and other prey (MacDonald and Cook, 2009).
American mink (*Neovison vision*)	√	√	√	√	√	√	√	Found throughout much of Alaska south of the Brooks Range, associated with marine and freshwater systems; riparian habitats, lakeshores, marshes, stream banks, lower densities and larger population fluctuations in interior populations (MacDonald and Cook, 2009).

Common and Scientific Names	Assessed Occurrence by Geographic Regions in Alaska (North to South)							Habitat Association
	Arctic	Koyukuk	Yukon	Tanana	Kuskokwim	South Central	Copper	
Arctic fox (*Vulpes lagopus*)	√							Occur along Arctic coast, adapted to life in cold harsh environment, Arctic tundra, rocky beaches, and pack ice. Den in sandy soil along river banks, on hills, common and sometimes abundant; populations fluctuate with food availability (MacDonald and Cook, 2009)
Arctic ground squirrel (*Spermophilus parryii*)	√	√	√	√	√	√	√	Widely distributed across Alaska, occur in tundra, meadow, riverbank and lakeshore habitats where well-drained permafrost-free sites provide vantage, vegetation, and soils for burrows. Colonial and locally abundant over much of range, burrows, hibernates. The Arctic subspecies (*Spermophilus parryii kennicottii*) occurring north of the Brooks Range is considered a conservation concern (ADF&G 2006).
Canada Lynx (*Lynx canadensis*)		√	√	√	√	√	√	Found primarily in interior forests of Alaska, uncommon to common and periodically abundant, prefer forests with dense understory, populations fluctuate with snowshoe hare (MacDonald and Cook, 2009).
Common muskrat (*Ondatra zibethicus*)		√	√	√	√	√	√	Found throughout much of Alaska south of the Brooks Range, inhabit fresh, brackish, saltwater marshes, ponds, lakes, rivers, streams, widespread and common, sometimes abundant (MacDonald and Cook, 2009).
Coyote (*Canis latrans*)	√	√	√	√	√	√	√	Thrive in diverse habitats; prefer broken and open country in Alaska, not especially abundant, common in Tanana, Matanuska, and Susitna drainages (MacDonald and Cook, 2009).
Ermine (*Mustela erminea*)	√	√	√	√	√	√	√	Found throughout Alaska, use wide variety of habitats, common and widespread, populations fluctuate with small mammal prey, prefer edge habitats, near meadows, stream banks, lakeshores, beaver ponds, cover of rock talus, shrub thickets, stumps, logs (MacDonald and Cook, 2009).
Hoary marmot (*Marmota caligata*)				√	√	√	√	Found in mountainous regions south of Yukon river in Alaska, prefer rocky tundra habitats on sides of canyons and valleys in mountains, common in suitable habitat (MacDonald and Cook, 2009)

Common and Scientific Names	Assessed Occurrence by Geographic Regions in Alaska (North to South)							Habitat Association
	Arctic	Koyukuk	Yukon	Tanana	Kuskokwim	South Central	Copper	
Least weasel (*Mustela nivalis*)	√	√	√	√	√	√	√	Found throughout Alaska, wide variety of forest and tundra habitats, prefer meadows, marshes, riparian habitat with abundant small mammal prey (MacDonald and Cook, 2009).
North American river otter (*Lontra canadensis*)		√	√	√	√	√	√	Occur throughout most of Alaska south of the Brooks Range, semi aquatic, inhabits wide variety of coastal marine and freshwater habitats (MacDonald and Cook, 2009).
Northern flying squirrel (*Glaucomys sabrinus*)			√	√	√	√	√	Probably occurs throughout much of forested Alaska, but distribution poorly documented. Occurs in wide variety of boreal forests and coastal rain forests; assumed association with mature and old-growth forests, uses tree cavities, snags for shelter (Smith, 2007; Mowrey and Zasada, 1984; Bakker and Hastings, 2002).
Red fox (*Vulpes vulpes*)	√	√	√	√	√	√	√	Occur throughout most of mainland Alaska; live in wide variety of habitats, common south of Arctic tundra (MacDonald and Cook, 2009). Also inhabits the North Slope area north of the Brooks Range.
Red squirrel (*Tamiasciurus hudsonicus*)		√	√	√	√	√	√	Throughout most of forested Alaska, from near crest of the Brooks Range, common within core range, characteristic of coniferous forest but also occur in mixed hardwood forests and occasionally beyond tree line in riparian shrub thickets (MacDonald and Cook, 2009), uses cavities, middens for food storage and shelter.
Wolf (*Canis lupus*)	√	√	√	√	√	√	√	Widely distributed in Alaska, populations generally stable, thrive in a wide variety of climates and terrains, found where suitable prey populations exist in Alaska (MacDonald and Cook, 2009).
Wolverine (*Gulo gulo*)	√	√	√	√	√	√	√	Widely distributed throughout Alaska, range great distances and occupy a variety of habitat types; reproductive dens usually long, complex snow tunnels with no associated trees or boulders; not abundant (MacDonald and Cook, 2009).

Common and Scientific Names	Assessed Occurrence by Geographic Regions in Alaska (North to South)							Habitat Association
	Arctic	Koyukuk	Yukon	Tanana	Kuskokwim	South Central	Copper	
Woodchuck (*Marmota monax*)			√	√	√	√		Restricted to between Yukon River to south side of the Alaska Range from Nenana to the Alaska-Yukon border, rare to uncommon within range prefer open, well-drained grassy areas and open deciduous forest with grasses, forbs and shrubs (MacDonald and Cook, 2009).
Small Game Animals								
Snowshoe hare (*Lepus americanus*)		√	√	√	√	√	√	Found throughout taiga in Alaska; inhabit forests, shrubby woodlands and riparian shrub thickets, generally common and periodically very abundant (MacDonald and Cook, 2009).
North American porcupine (*Erethizon dorsatum*)	√	√	√	√	√	√	√	Occur in wide variety of habitats from closed forest to open shrub tundra, common and widespread throughout most of Alaska (MacDonald and Cook, 2009).
Unclassified Mammals								
Brown lemming (*Lemmus trimucronatus*)	√	√	√	√	√	√		Occurs in variety of Arctic, alpine tundra, and taiga habitats, usually associated with wet sedge-grass tundra, spruce bogs, wet meadows; densities vary year to year (MacDonald and Cook, 2009).
Northern collared lemming (*Dicrostonyx groenlandicus*)	√	√			√			An animal of the Arctic tundra zone, collared lemmings are generally found occupying higher, dryer, rockier tundra than *Lemmus*. In winter, they may retreat to lower meadows where the blanket of snow is thicker (MacDonald, 2003).
Northern bog lemming (*Synaptomys borealis*)			√	√	√	√	√	Northern bog lemmings are generally restricted to open habitats in the boreal and coastal forest zones of Alaska. They prefer damp meadows, marshes, bogs, and fens that have an abundance of grasses, sedges, mosses, and other low vegetation (MacDonald, 2003).
Cinereus shrew (*Sorex cinereus*)		√	√	√	√	√	√	Common and widespread throughout Alaska; abundance can fluctuate year to year, wide variety of habitats, but may be especially abundant in riparian areas with dense ground cover (MacDonald and Cook, 2009).

Common and Scientific Names	Assessed Occurrence by Geographic Regions in Alaska (North to South)							Habitat Association
	Arctic	Koyukuk	Yukon	Tanana	Kuskokwim	South Central	Copper	
Alaska tiny shrew (*Sorex yukonicus*)		√	√	√	√	√	√	The tiny shrew appears to be a widespread, but scarce, inhabitant of the taiga zone of Alaska. Data suggests they occupy a diversity of forest, woodland, shrub, and tundra habitats at elevations that range upward to the edge of trees (MacDonald, 2003).
Water shrew (*Sorex palustris*)						√	√	This shrew is seldom found far from water-adjacent cover. They occur along lakes, ponds, streams, rivers, and marshes where sheltering banks, low vegetation, tree roots or other debris offer protection. (MacDonald, 2003).
Pygmy shrew (*Sorex hoyl*)			√	√	√	√	√	A species of the boreal forest, this shrew tolerates a variety of habitats including forests, meadows, shrub thickets, marshes, and bogs (MacDonald, 2003).
Barren ground shrew (*Sorex ugyunak*)	√							This shrew is restricted to Arctic coastal tundra habitats, and appears to favor low sedge-grass meadows and thickets of dwarf willow and birch (MacDonald, 2003).
Tundra shrew (*Sorex tundrensis*)	√	√	√	√	√	√	√	The tundra shrew inhabits a variety of alpine and Arctic habitats as well as forest, shrub, meadow, and mossy bog habitats within the taiga. It seems to favor drier situations than other sympatric shrew species (MacDonald, 2003).
Dusky shrew (*Sorex monticolus*)		√	√	√	√	√	√	Common, sometimes abundant, and widespread throughout Alaska south of the Brooks Range, uses a wide variety of habitats, dense moist or wet understory ground cover (MacDonald and Cook, 2009).
Collared pika (*Ochotona collaris*)			√	√		√	√	Occur in mountains of east-central and southern Alaska; may be locally common, form colonies in mountainous terrain. Rock slides, talus slopes, and large boulders near meadows and vegetated patches (MacDonald and Cook, 2009)
Little brown myotis (*Myotis lucifugus*)				√	√	√	√	Most common and widespread bat in Alaska, in numerous habitats but especially forested regions at roosts and maternity colonies. Unknown if overwinters at northern latitudes or if they migrate to hibernacula (MacDonald and Cook, 2009).

Common and Scientific Names	Assessed Occurrence by Geographic Regions in Alaska (North to South)							Habitat Association
	Arctic	Koyukuk	Yukon	Tanana	Kuskokwim	South Central	Copper	
Northern red-backed vole (*Clethrionomys gapperi*)	√	√	√	√	√	√	√	Common and widespread throughout mainland Alaska although densities may fluctuate between years. Most abundant in forested, woodland, and shrub habitats (MacDonald and Cook, 2009).
Root vole (*Microtus oeconomus*)	√	√	√	√	√	√	√	Broadly distributed across Alaska; densities fluctuate between years, uses variety of open herbaceous habitats, most abundant in wet sedge and grass-forb meadows and bogs (MacDonald and Cook, 2009).
Taiga vole (*Microtus xanthognathus*)		√	√	√				Communal groups of taiga voles inhabit fire-successional and riparian, boreal, sphagnum forest habitats near streams and other moist areas. The availability of an abundant supply of rhizomes of horsetail (*Equisetum*) and fireweed (*Chamerion*) for winter food and good burrowing conditions are major requirements of taiga voles (MacDonald, 2003).
Meadow vole (*Microtus pennsylvanicus*)	√	√	√	√	√	√	√	A species of Alaska's taiga zone, meadow voles prefer wet meadows, grassy riparian areas, and open grassland (MacDonald, 2003).
Singing vole (*Microtus miurus*)	√	√	√			√	√	Singing voles inhabit a variety of alpine and Arctic tundra habitats on well-drained sites, sometimes along streambanks. The burrow systems of this semi-colonial species are often associated with willows (*Salix*) and rocky areas (MacDonald, 2003).

Source: AKNHP, 2016
√ = Indicates that the species occurs in geographic region.

3.6.5. Birds

This section discusses the more common bird species within the proposed Project Area, by general avian group: shorebirds, seabirds, waterfowl and other waterbirds, upland birds, and landbirds. Tables 3.6-5 through 3.6-8 present bird species that are common in at least one of the biogeographic ecoregions crossed by the proposed Project, as presented in Birds of Alaska (Armstrong, 2008). The bioregions presented in Armstrong (2008) follow Kessel and Gibson (1978). Abundance descriptions follow Isleib and Kessel (1973) and are as follows:

- Common: Species occurs in all or nearly all proper habitats, buts some areas of presumed suitable habitat are occupied sparsely or not at all and/or the region regularly hosts large numbers of the species.

- Uncommon: Species occurs regularly, but utilizes very little of the suitable habitat, and/or the region regularly hosts relatively small numbers of the species; not observed regularly even in proper habitats; and
- Rare: Species occurs, or probably occurs, regularly within the region, but in very small numbers.

As discussed in Section 3.6.2, Regulatory Setting, migratory birds are protected by the MBTA (16 U.S.C. 703–712; 40 Stat. 755, as amended), which prohibits the take of any migratory bird without authorization from USFWS.

3.6.5.1. Shorebirds and Seabirds

This section discusses common shorebirds and seabirds that occur within the proposed Project Area. Shorebirds are a diverse group of birds that belong to the Order *Charadriiformes*, suborder *Charadrii*. For the purpose of this section, seabirds include gulls and terns. Table 3.6-5 presents the common shorebirds and seabird species, occurrence and habitat association within the proposed Project Area.

Shorebirds have unique physical and behavioral characteristics that are adapted to a wide range of environments. Habitats include coastal, saline, and freshwater wetlands, flooded agricultural fields, interior grasslands, and Arctic tundra. Shorebirds have small bodies with long, thin legs for wading. Beaks come in a variety of shapes and sizes, and each is designed for a specific foraging substrate.

The majority of shorebirds breeding in Alaska are long-distance migrants, often travelling thousands of miles between Arctic nesting grounds and wintering grounds in more temperate North America, or Central and South America. Migration routes typically follow coastlines or interior water sources. Staging areas and stopover sites in Alaska provide abundant food resources crucial for supplying the energy needed to complete migration.

The Alaska Shorebird Conservation Plan (Alaska Shorebird Group, 2008) provides detailed information on important areas by Alaska's five Bird Conservation Regions (BCRs). Areas crossed by the proposed Project Area include BCR 3 (Arctic Plains and Mountains); BCR 4 (Northwestern Interior Forest); and BCR 5 (Northern Pacific Rainforest).

Seabirds spend most of their lifecycle at sea; this group of birds have become highly specialized and adapted to life on the sea. Seabirds primarily feed at sea either by themselves or in large feeding flocks. Most rest and sleep on the sea, while others roost on land for a few hours a day. All seabirds return to land to lay eggs and raise their young; some gather on remote islands and rocky outcroppings, forming colonies. Seabirds eat small marine fish, squid, shellfish, and a variety of crustaceans (*i.e.,* krill and crabs). Denlinger (2006) provides species descriptions and distributions for many Alaska seabird species.

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Table 3.6-5 Common Shorebirds and Seabirds that Occur along the Proposed Project ROW

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Shorebirds					
American golden plover	*(Pluvialis dominica)*	C	C	C	Breeds on drier tundra in moss, especially in low vegetation on rocky slopes; migration uses tidal flats (Johnson and Connors, 1996).
Semipalmated plover	*(Charadrius semipalmatus)*	U	C	C	Breeds on gravelly or sandy beaches of lakes, ponds, rivers, glacial moraines on ground in sand, gravel or moss in well-drained habitats; for migration, uses lakes, ponds, rivers, glacial moraines, tidal flats (Johnson and Herter, 1989; Kessel, 1989).
Black-bellied plover	*(Pluvialis squatarola)*	U	R	C	Nests on the ground on dry tundra ridges near wet tundra areas. During migration uses tidal flats and freshwater and saltwater shores (Armstrong, 2008).
Greater yellowlegs	*(Tringa melanoleuca)*	-	R	C	Breeds in muskegs, wet bogs with small wooded islands, and forests (usually coniferous) with abundant clearings. Habitat characterized by wet, hummocky ground, covered with mosses, lichens, and sedges interspersed with slightly higher and drier areas of low shrubs (sweet gale, dwarf birch) and grasses. Generally, breeding areas have many small ponds, lakes, or sometime sloughs, and scattered tall trees for perching (Elphick and Tibbitts, 1998). Uses tidal flats, lakes ponds during migration.
Lesser yellowlegs	*(Tringa flavipes)*	-	C	C	The Lesser yellowlegs typically nests in open boreal forest and forest/tundra ecotone with scattered shallow wetlands. Typical habitat components in breeding territories include trees or shrubs, logs, grassy meadows, and marshy pools with well-vegetated margins. Its nesting sites are generally drier and more densely vegetated than those of the Greater yellowlegs. The rest of the year, it utilizes a wide variety of wetland habitats ranging from tidal marshes to alpine lakes and including freshwater marshes, mud and salt flats, swamps, sewage lagoons, sloughs, wet meadows, puddles, flooded agricultural fields, and reservoirs. Habitat use in winter is often strongly tied to rainfall patterns as changing water levels cover or expose foraging habitat (Tibbitts and Moskoff, 1999).
Least sandpiper	*(Calidris minutilla)*	U	C	C	Breeds in grass-sedge marshes near tidal flats, freshwater marshes, and muskegs. Nests on the ground in both wet and dry, grassy areas. During migration uses tidal flats, lakes, ponds, and marshes (Armstrong, 2008).
Western sandpiper	*(Calidris mauri)*	U	R	C	Breeds on dry areas of tundra, nesting on the ground in areas with short vegetation. During migration uses tidal flats and beaches (Armstrong, 2008).

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Baird's sandpiper	*(Calidris bairdii)*	C	U	U	Nests on the ground in drier tundra areas. During migration uses lakes, ponds, tidal flats, and beaches, often in drier areas.
Pectoral sandpiper	*(Calidris melanotos)*	C	U	C	Breeds in grassy areas, on the ground in wet tundra. During migration uses sedge-grass areas of tidal flats, grassy marshes, and grassy edges of lakes and ponds.
Semipalmated sandpiper	*(Clicris pusilla)*	C	C	U	Nests in a range of upland dry to moist and wet tundra habitats near water and typically focus their foraging along marsh and pond edges (Gratto-Trevor, 1992); during migration, uses tidal flats, beaches, lakeshores.
Spotted sandpiper	*(Actitis macularia)*	U	C	C	Breeds almost anywhere there is freshwater, including along the perimeter of lakes and rivers, coastal grassy beaches, man-made clearings, and roadsides. Typical breeding habitat is the edge of an open or semi-open area adjacent to water, with low ground cover, such as shrub-dotted or lightly treed meadows or grassland. Prefers shores with rocks, wood, or debris (Harrison, 1978).
Rock sandpiper	*(Calidris ptilocnemis)*	-	-	C	In Cook Inlet and outer Prince William Sound (PWS), restricted to mud and mixed mud and sand flats. Also may be found on shore-fast ice, large pieces of ice grounded, algae covered rocky intertidal habitat, piers, breakwaters (Gill *et al.,* 2002).
Whimbrel	*(Numenius phaeopus)*	U	C	C	Nests in wet, flat, dwarf shrub tundra, dry dwarf-shrub ridges and steep slopes, and rolling, open, usually moist tundra among sedge hummocks (Murie, 1963; Skeel and Mallory, 1996). Areas characterized by abundant berry-producing shrubs (McCaffery, pers. comm., in Skeel and Mallory, 1996).
Dunlin	*(Calidris alpine)*	C	-	C	Breeds in moist wet grassy tundra dominated by low center polygons and ponds and coastal sedge-grass Marshes and graminoid meadows. Shoreline silt barrens important to post-breeding (Warnock and Gill, 1996). Occur on unvegetated intertidal flats during post breeding.
Long-billed dowitcher	*(Limnodromus scolopaceus)*	C	U	C	Breeds in wet tundra, nesting on the ground in wet, marshy areas. Uses tidal flats and ponds, especially muddy areas during migration (Armstrong, 2008).
Short-billed dowitcher	*(Limnodromus griseus)*	-	-	C	Nests in muskegs (Gabrielson and Lincoln, 1959). Sedge meadows, sedge-hummocks, moss-grass on Copper River Delta and bogs in floodplains of major rivers in western Alaska commonly used for nesting (Mickelson *et al.,* 1980)
Ruddy turnstone	*(Arenaria interpres)*	U	R	C	Breeds in dry tundra areas and dunes, nesting in depressions on the ground. During migration uses rocky shores, tidal flats, and beaches (Armstrong, 2008).

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Black turnstone	*(Arenaria melanocephala)*	-	-	C	Breeds on wet tundra, on the ground in grassy areas near ponds. During migration uses rocky shores, tidal flats, and beaches (Armstrong, 2008).
Surfbird	*(Aphriza virgate)*	-	U	C	Breeds in alpine tundra along mountain ridges in interior mountains. Dry frequently stony alpine tundra with lichens, dwarf shrubs, scree or rock fields. Mostly occupies habitat on summits and upper slopes of steep ridges. Also may breed near coastal areas. Nests in rocky areas with clumps of vegetation (Armstrong, 2008).
Red-necked phalarope	*(Phalaropus lobatus)*	C	C	C	Breeds in wet tundra, freshwater marshes, ponds, lakes; nests on ground in wet grassy areas; during migration, uses inshore and offshore marine waters, tidal ponds, sloughs, ponds, lakes (Hilden and Vuolanto, 1972; Reynolds, 1987).
Red phalarope	*(Phalaropus fulicaria)*	C	-	C	Breeds in wet tundra near ponds and lakes, nesting on the ground. During migration uses inshore and offshore marine waters (Armstrong, 2008).
Common snipe	*(Gallinago delicata)*	C	C	C	Breeds in sedge bogs, fens, willow and alder swamps, marshy edges of ponds, rivers, and brooks. Require wet organic soils rich in food with clumps of cover throughout the year. Inhabits marshes, swamps, wet meadows, wet pastures, wet fallow fields, and marshy edges of streams and ditches during winter. Migration and winter uses grass meadows on tidal flats and freshwater marshes (Walton *et al.,* 2013).
Seabirds					
Bonaparte's gull	*(Larus philadelphia)*	-	U	C	Breeds in coniferous woods near lakes and ponds, nesting in low conifers. During migration and in winter, uses tidal flats, beaches, inshore marine waters, lakes, and salmon streams (Armstrong, 2008).
Sabine's gull	*(Xema sabini)*	C	-	U	Nests in wet tundra, near lakes, ponds, and tidal flats. During migration and winter, uses inshore and offshore marine waters, tidal flats, and beaches (Armstrong, 2008).
Mew gull	*(Larus canus)*	R	C	C	During the breeding season uses tundra, lakes, rivers, streams, and islands. Nests on tundra, in trees, on stumps, and in cavities in the sand by water. During migration season and in winter uses inshore and offshore marine waters, tidal flats, beaches, lakes, rivers, rocky shores, and reefs (Armstrong, 2008).
Herring gull	*(Larus argentatus)*	U	U	C	Breeds in lakes, rivers, islands, tidal flats and beaches; nests on ground; for migration and winter uses lakes, rivers, tidal flats, beaches, garbage dumps, inshore marine water – often more inland than other gulls (USFWS, 2008).

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Glaucous-winged gull	*(Larus glaucescens)*	-	R	C	Nests in colonies on flat, low islands, cliff ledges, and rocky beaches; uses tidal flats, beaches, inshore marine waters; for migration and wintering, uses various habitats often associated with salmon streams (USFWS, 2008).
Glaucous gull	*(Larus hyperboreus)*	C	R	R	Nests in colonies on cliff ledges on ground on tundra or on barrier islands; for migration and winter uses tidal flats, beaches, inshore marine waters (USFWS, 2008).
Black-legged kittiwake	*(Rissa tridactyla)*	C	-	C	Breeds on sea cliffs and in inshore marine waters, nesting on cliff ledges. During migration and in winter uses inshore and offshore marine waters, tidal flats, beaches, rocky shores, and reefs (Armstrong, 2008).
Long-tailed jaeger	*(Stercornarius longicaudus)*	C	C	R	Breeds in wet coastal tundra and drier upland tundra in interior Alaska. During migration uses inshore and offshore marine waters (Armstrong, 2008).
Parasitic jaeger	*(Stercorarius parasiticus)*	C	R	C	Breeds in wet tundra, tidal flats, beaches, and coastal marshes; nesting on the ground in depressions. During migration uses tundra, tidal flats, beaches, coastal marshes, and inshore and offshore marine waters (Armstrong, 2008).
Pomarine jaeger	*(Stercorarius pomarinus)*	C	-	C	Breeds in low, wet tundra in areas interspersed with lakes and ponds. Nests on the ground in slight depressions. During migration uses inshore and offshore marine waters (Armstrong, 2008).
Arctic tern	*(Sterna paradisaea)*	U	U	C	Nests in colonies or scattered pairs on sand, gravel, moss; uses tidal flats, beaches, glacial moraines, rivers, lakes, marshes; during migration uses inshore and offshore marine waters, tidal flats, beaches, rivers, lakes (USFWS, 2008).

a Biogeographic region occurrence source: Birds of Alaska (Armstrong 2008), which follows Kessel and Gibson (1978)
b Abundance data obtained from Birds of Alaska (Armstrong 2008): C= common; U= uncommon; R= rare. A species was included in this table only if it was listed by Armstrong (2008) as common in one or more of the biogeographic regions crossed by the proposed Project. "-" indicates that the species is not listed for the region in Armstrong (2008).

3.6.5.2. Waterfowl and Other Waterbirds

Table 3.6-6 presents the common waterfowl and other waterbird species, occurrence, and habitat association within the proposed Project Area. Waterfowl include ducks, swans, and geese. For the purpose of this section, "other waterbirds" include loons, grebes, and cranes.

All waterfowl and other waterbirds are considered migratory. Waterfowl from the Pacific, Central, and Mississippi Flyways are known to breed or migrate within the proposed Project Area. Most bird species migrate through the proposed Project Area and use it for staging or stop over uses during the spring and fall migration periods. Some birds may winter in Cook Inlet near the southern end of the proposed Project Area.

Waterfowl are hunted by both subsistence and non-subsistence users in Alaska. Hunting seasons are set and regulated by USFWS and ADF&G. Waterfowl are harvested primarily in fall; however, subsistence hunting may occur year-round.

The proposed Project ROW would be located near three Important Bird Areas (IBAs), which provide important habitat for breeding, migrating, and staging waterbirds. These areas include:

- The Kahiltna Flats – Petersville Road, Global IBA: Kahiltna floodplain contains one of the largest concentrations of trumpeter swan nesting sites in the upper Cook Inlet wetlands at the base of the Kahiltna Glacier. This area is used by molting post-breeders, and greater white-fronted geese young-of-the-year;
- The Susitna Flats – Globally IBA: Spring and fall migrant ducks, geese, and swans exceed 100,000 birds in spring with peak densities in early May. This area is used by lesser sandhill cranes and swans for migration staging (Audubon Alaska, 2010); and
- The Minto Flats State Game Refuge – One of the highest quality waterfowl habitats in Alaska, which sustains one of the largest trumpeter swan breeding populations in North America. Minto Flats is also an important spring and fall waterfowl staging area, particularly for geese and swans.

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Table 3.6-6 Common Waterfowl and Other Waterbirds that Occur along the Proposed Project ROW

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Waterfowl					
Brant	(*Branta bernicla*)	C	-	U	Nests in lowland, coastal tundra. Preferred nest sites are on peninsulas or islets in large wetland complexes, some of which are subject to tidal action. During migration uses saltwater bays and estuaries (USFWS, 1993).
Canada goose	(*Branta canadensis*)	C	C	C	Various habitats near water. Various subspecies use wide variety of habitats from tundra to south coastal wetlands; usually associated with wetlands, lakes, and ponds. Nest throughout Alaska, large aggregations during migrations. Nests in shrubs and meadows. In interior Alaska, breeds along stream banks, river islands, and beaver ponds in boreal regions (Mowbray *et al.*, 2002).
Greater white-fronted goose	(*Anser albifrons*)	C	C	C	Nests are located in moderate to dense shrub cover of grasses and sedges or dwarf shrubs, most commonly on slough banks, lake shores, and lower edges of pingos. Broods use wet to dry sedge meadows dominated by small ponds near nesting areas and tidal riverine systems used during wing molt. Midcontinent geese breed in alluvium lowlands on stream deltas, low sedge cotton grass moss meadows, tussock lowlands, tundra ponds with *Carex aquatilis, Arctophila fulva* emergents ecotone, taiga forests and bogs, raised polygon edges, hummocky ground, inland tributary stream edges, and dwarf and occasionally tall-shrub tundras of birch and willow (Ely and Dzubin, 1994).
Snow goose	(*Chen caerulescens*)	C	C	C	Nests in Arctic, often in colonies; migrates through central Alaska. In western Canadian Arctic, breeds on coastal areas characterized by stretches of low sandy or silty ridges and narrow beaches interspersed with river deltas, barrier islands, spits, and lagoons with permafrost related features and an abundance of small lakes (Mowbray *et al.*, 2000).
Tundra swan	(*Cygnus columbianus*)	U	C	C	Breeds on tundra lakes, ponds, and pools, primarily in coastal deltas and less frequently inland to treeline. Prefers lakes with pondweed (*Potamogeton* spp.) (Monda, 1991; Spindler and Hall, 1991). On the Colville River Delta, prefers large lakes that are connected to a river channel or are partially drained, and utilize polygon lakes and moist tundra near the water's edge (Earnst, 1992). Primary emergent vegetation includes *Carex aquatilis* and *Arctophila fulva*, and primary moist vegetation includes *Carex* spp., *Puccinellia phryganodes, Dupontia fisheri,* and *Stellaria humifusa* (Limpert and Earnst, 1994).

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Mallard	(*Anas platyrhynchos*)	R	C	C	Marshes, sloughs, lakes, rivers throughout Alaska; less common in Arctic and brackish waters. Nest usually within 0.8 km of water (Palmer, 1976). In the Yukon, this species nests among shrubs, and other low vegetation associated with lakes, rivers, and wetlands, and females and young utilize marshy areas (Alexander *et al.,* 2003).
Gadwall	*(Anas strepera)*	-	U	C	Inhabits sedge-grass marshes. Nests in heavy vegetation often several yards from water (Armstrong, 2008).
American wigeon	*(Anas americana)*	U	C	C	Breeds in freshwater marshes, sloughs, ponds, marshy edges of lakes. In the Yukon, breeds in coastal plains near major river deltas that are underlain by continuous permafrost with polygonal ground and other permafrost – related features. Vegetation is a mosaic of dry tussocks, wet sedge, and low shrub tundra with tall brush (>3 m) in drainage courses and around lakeshores (Salter *et al.,* 1980). In Alaska, breeds as far north as the coastal tundra (Bellrose, 1980). Migration and winter in shallow coastal bays; less common in Arctic.
Green-winged teal	*(Anas crecca)*	U	C	C	Breeds in freshwater ponds, marshes, and shallows of lakes surrounded by woods. In B.C., breeds from sea level to 1,525 m in grassy, brushy, or lightly wooded upland habitat near freshwater marshes (in the interior) and in sloughs and ponds associated with estuaries in coastal areas (Campbell *et al.,* 1990). Nests in areas with dense emergent vegetation on islands and lake edge, and in the Yukon, nests among shrubs, grasses, and other low vegetation in wooded and open areas (Alexander *et al.,* 2003). For migration, uses brackish intertidal areas near mouths of streams; less common in Arctic.
Northern shoveler	*(Anas clypeata)*	R	C	C	Breeds in shallow, often muddy, freshwater marshes, sloughs, and lakes; for migration, uses coastal saltwater mud flats and shallow freshwater areas (American Ornithologists' Union [AOU], 1983).
Northern pintail	*(Anas acuta)*	C	C	C	Most widely distributed and abundant dabbling duck in Alaska. Breeds in shallow, often muddy, freshwater areas with surrounding cover, such as ponds, marshes, sloughs, and creeks. Nests on ground, often in dense grass or sedge (Armstrong, 2008). For migration, uses salt and brackish waters along coast
Greater scaup	(*Aythya marila*)	U	C	C	Greater scaup breeds on tundra or low forest next to tundra, nests in dense vegetation next to freshwater lakes and ponds (Kessel *et al.,* 2002). Lesser scaup breeds in fresh to moderately brackish, seasonal and semi-permanent wetlands and lakes with emergent vegetation such as bulrush, cattail, and river bulrush. Usually nests on dry or moist soil in wet-meadow zone of wetlands (Austin *et al.,* 1998). Both winter in coastal saltwater.
Lesser scaup	(*Aythya affinis*)	-	C	R	

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Utqiagvik's goldeneye	(*Buchephala islandica*)	-	C	C	Nests in cavities, lakes, and ponds surrounded by trees (Eadie *et al.*, 1995). Utqiagvik's goldeneye may also use rocks or cliffs. Prefers alkaline to freshwater lakes in parkland areas and to a lesser extent, subalpine and alpine lakes, beaver ponds, and small sloughs. Preferred lakes have high conductivity levels, usually without fish, and are at least 1 m deep (Eadie *et al.*, 2000). Winters in inshore marine waters, lakes and rivers with open water.
Common goldeneye	(*Bucephala clangula*)	-	C	C	
Bufflehead	(*Bucephala albeola*)	-	C	C	Nests in cavities, lakes, and ponds surrounded by trees. Breeds in freshwater, permanent ponds with no outlet or only seasonal outflow, and small lakes. Ponds with extensive emergent or submergent vegetation avoided. Nests in cavities, commonly created by Northern flickers, so limited to nesting in woodland areas. In Alaska, nests in coniferous forest mixed with poplars (Gauthier, 1993). Winters in inshore marine waters, lakes and rivers with open water.
Common merganser	(*Mergus merganser*)	-	R	C	Inhabits lakes and rivers bordered by forests mature enough to provide suitable tree cavities. Spaces among tree roots, and holes in banks may be used in some areas. Northern limit of breeding range follows limit of open boreal forest. Prefers large bodies of water surrounded by conifers or mixed forests, oligotrophic, moderate to high pH with inorganic sediments and plentiful fish. During the winter, inhabits large lakes, reservoirs, rivers, coastal bays, estuaries, and harbors (Mallory and Metz, 1999).
Red-breasted merganser	(*Mergus serrator*)	R	R	C	Prefers dense cover along inlands waters and small islands and uses wooded shorelines along rivers and lakes (Titman, 1999). Prefer larger, deeper lakes rather than small ponds (Sea Duck Joint Venture, 2004). Winter inshore marine or freshwaters.
Common eider	(*Somateria mollissima*)	C	-	U	Prefers small islands, islets, and low-lying points of land. Sometimes nest on islands or islets in freshwater lakes, ponds, lagoons, near outlet to the sea (Cornish and Dickson, 1997). Vegetation at nest sites variable and can range from rocky substrate to coniferous forests (Goudie *et al.*, 2000). Migration and winter uses inshore marine waters.
King eider	(*Somateria spectabilis*)	C	-	U	Nests on ponds and lakes on coastal Arctic tundra. On the ACP, they selected nest sites close to water, on islands and in areas with high willow cover, but not near conspecifics or glaucous gull nests (Bentzen *et al.*, 2009). During migration, and winter use inshore marine waters.
Harlequin duck	(*Histrionicus histrionicus*)	R	U	C	Nests along cold, rapidly flowing streams, often surrounded by forest, on ground close to water protected by dense vegetation; prefers braided streams with loafing areas. In winter uses inshore marine waters, rocky shorelines (Robertson and Goudie, 1999).

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Long-tailed duck	(*Clanula hyemalis*)	C	C	C	Nests near and raises broods on freshwater (including offshore islands with freshwater ponds and tundra vegetation). Often nests on islands or peninsulas in lakes. Breeding birds use shallow sedge (*Carex*) or pendant grass (*Artophila*)-dominated ponds and braided streams while pre-, post-, and non-breeding birds prefer deep Artophila-dominated ponds and deep open lakes (Robertson and Savard, 2002). Access to locally abundant, high-quality foods during egg laying and incubation may be critical to breeding long-tailed ducks, allowing females to maintain relatively high nest attendance without compromising body condition (Kellett *et al.*, 2005). Emergent vegetation may be important escape cover; nests are often concealed by vegetation, low-growing shrubs or spruce trees (*Picea* spp.), or overhanging boulders, and broods are usually reared on ponds with emergent vegetation (Todd, 1996).Winters in inshore marine waters.
Black scoter	(*Melanitta nigra*)	R	R	C	Nests near lakes, ponds, or rivers in brushy tundra and woodlands on ground (AOU, 1983).
Surf scoter	(*Melanitta perspicillata*)	U	C	C	Not well known, probably near freshwater in shrubby, or rocky cover or woodland (Anderson *et al.*, 2015).
White-winged scoter	(*Melanitta fusca*)	U	C	C	High densities on interior lakes and streams on ground under shrubs and trees (Walton *et al.*, 2013). Winters on inshore marine waters.
Other Waterbirds					
Pacific loon	(*Gavia pacifica*)	C	C	C	Breeds on freshwater lakes on Arctic and subarctic tundra and taiga with varying topography and in both treeless and forested areas (Bergman and Derksen, 1977). All ponds used contained ninespine stickleback with no other fish. Vegetation was dominated by bur-reed, marsh five-finger, sedges, and mare's tail; submergent vegetation primarily pondweeds (Petersen, 1989). Other wetland types used include basin complex lakes, beaded streams, shallow ponds, deep lakes with abrupt shores, sublittoral shelves, and coastal wetlands (Russell, 2002). For migration, and winter uses inshore and offshore marine waters.
Common loon	(*Gavia immer*)	R	C	C	Breeds on lakes in coniferous forests; nest mound of vegetation near water often on small islands (McIntyre, 1988). Nest adjacent to water near drop-off steep enough for underwater approach; prefers open view of territory (McIntyre, 1983), generally near cover. Opportunistic; readily uses marshes, sedge mats, cranberry bogs, floating bogs and logs (Olson and Marshall, 1952; Palmer, 1962; Vermeer, 1973; Alvo, 1981; McIntyre, 1988). Winters in inshore marine waters.

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Red-throated loon	(*Gavia stellata*)	C	U	C	Breeds on ponds and small lakes, nest on shoreline or islands. Usually select marshy islands for nest sites, although often build nests on dry shores (Davis, 1972). Uses smaller nesting lakes than any of the other loon species (Palmer, 1962; Cramp and Simmons, 1977; Bergman and Derksen, 1977; Merrie, 1978). Small ponds thaw sooner than large ponds, thus allowing nesting to begin earlier (Johnson and Herter, 1989). Migrates and winters in inshore marine waters.
Yellow-billed loon	(*Gavia adamsii*)	R	C	U	Arctic Alaska, most abundant west of Colville River, nests on large lakes and slow-moving rivers usually near the coast; lakes in low-lying tundra regions, almost entirely beyond the tree-line, where it nests on islands and shorelines and forages for fish and invertebrates in nearby waters. Uses coastal marine waters (North, 1994).
Horned grebe	*(Podiceps auritus)*	-	C	C	Breeds in freshwater ponds, sloughs, and lakes, usually in areas containing emergent vegetation. Nests are floating platforms of vegetation and mud, anchored to growing vegetation in shallow lakes. During winter and migration, they inhabit inshore marine waters (Armstrong, 2008).
Red-necked grebe	*(Podiceps grisegena)*	-	C	C	Breeds in freshwater lakes, marshes, and slow-moving rivers. Nests float and are placed in vegetation along margins of shallow lakes. Winters in inshore marine waters (Armstrong, 2008).
Sandhill crane	(*Grus canadensis*)	U	C	U	Breeds lowland tundra marshes or bogs surrounded by shrubs or forest; nest on ground. Migration, tidal flats, muskegs – during migration, roosts at night on exposed and shallow submerged river bars in large rivers (Tacha *et al.*, 1992).

a Biogeographic region occurrence source: Birds of Alaska (Armstrong 2008), which follows Kessel and Gibson (1978)
b Abundance data obtained from Birds of Alaska (Armstrong 2008): C= common; U= uncommon; R= rare. A species was included in this table only if it was listed by Armstrong (2008) as common in one or more of the biogeographic regions crossed by the proposed Project. "-" indicates that the species is not listed for the region in Armstrong (2008)

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3.6.5.3. Upland Game Birds

Non-migratory birds, such as upland game birds (grouse and ptarmigan) and non-native birds, such as European starling (*Sturnus vulgaris*), rock pigeon (*Columba livia*), and house sparrow (*Passer domesticus*), are not protected by the MBTA. Table 3.6-7 illustrates the common bird species, occurrence, and habitat association within the proposed Project Area.

Table 3.6-7 Common Upland Game Birds that Occur along the Proposed Project ROW

Common Name	Scientific Name	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Upland Game Birds					
Spruce grouse	*(Falcipennis canadensis)*	-	C	U	Inhabits white spruce and paper birch woodlands, black spruce bogs. Males display in May; nests on the ground, at base of spruce tree or beneath log, eggs hatch mid-June. In winter, loaf and feed on spruce trees and needles (ADF&G, 2008a).
Ruffed grouse	*(Bonasa umbellus)*	-	C	-	Most abundant in dense stands of aspen or birch, established after fire or timber harvest. Males establish breeding territories previous fall, display during spring. Nest beside a stump, under a fallen tree, beneath overhanging shrubs along forest edges or openings (ADF&G, 2016b).
Willow ptarmigan	*(Lagopus lagopus)*	C	C	U	Inhabits willow-lined waterways, tall bushes important habitat feature; wetter places with luxuriant vegetation. Males establish breeding territories by late April or early May, nests on ground under shrub at edge of opening. Flocks form in September; move southward to wintering areas as much as 100 miles away during October and November, move northward in February with peak movement in April (ADF&G, 2016d).
Rock ptarmigan	*(Lagupus mutus)*	U	C	C	Inhabits slopes and high valleys with shin-high shrubs with low herbs and grasses. Breed in hilly or mountainous tundra throughout Alaska. They appear to prefer very low herbaceous, and dwarf alpine plants that are intermingled with rock and gravel ridges and alpine valleys. Nest under low shrubs or in open, nest sites not re-used, eggs hatch in June. Flocks form in September and move to low-elevation wintering areas (ADF&G, 2016e).

a Biogeographic region occurrence source: Birds of Alaska (Armstrong, 2008), which follows Kessel and Gibson (1978)
b Abundance data obtained from Birds of Alaska (Armstrong, 2008): C = common; U = uncommon; R = rare. A species was included in this table only if it was listed by Armstrong (2008) as common in one or more of the biogeographic regions crossed by the proposed Project. "-" indicates that the species is not listed for the region in Armstrong (2008)

3.6.5.4. Landbirds

The term "landbird" is an informal name that represents a large and diverse group of birds; landbirds include the passerines (primarily), owls, raptors, and woodpeckers. Table 3.6-8 illustrates the common bird species, occurrence, and habitat association within the proposed Project Area. Landbirds breeding in tundra and boreal forest habitats include short-distance migrants, long-distance migrants, and resident species.

Two IBAs gained status because they are important to one or more species of landbirds during breeding and migration staging in Alaska:

- The Alaska Range Foothills – State IBA: contains one of the highest reported densities of nesting golden eagles in North America, substantial numbers of nesting gyrfalcons and other subalpine nesting birds; and
- The Kahiltna Flats – Petersville Road – Global IBA: This area supports significant multi-species assemblages and concentrations including eight landbirds of conservation concern (Audubon Alaska, 2010): gray-cheeked thrush, golden-crowned sparrow, varied thrush, bohemian waxwing, Arctic warbler, white-winged crossbill, blackpoll warbler, and olive-sided flycatcher.

Table 3.6-8 Common Landbirds that Occur along the Proposed Project ROW

Common Names	Scientific Names	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Raptors					
Bald eagle	(*Haliaeetus leucocephalus*)	-	U	C	Breeds in mature and old-growth forests near (<2 km) large bodies of water (Buehler, 2000). Nests in trees, less frequently on cliffs or ground (Sherrod *et al.,* 1976). Wintering habitat: aquatic with some open water with tall trees for perching (Steenhof, 1978; Stalmaster and Newman, 1979; Sabine and Klimstra, 1985; Chester *et al.,* 1990; Buehler *et al.,* 1992).
Golden eagle	(*Aquila chrysaetos*)	U	C	R	General habitat is open and semi-open habitats. Breeding habitat in northern and interior Alaska is rugged, mountainous terrain near or above timberline. Also, breeds along bluffs and cliffs along rivers below treeline and sea cliffs in northwest Alaska. In Denali NPP, breeds in alpine and subalpine habitats. Forages on alpine tundra at edges of subalpine scrub in southwest Alaska and tundra river valleys. During winter, forages at edges of woodland shrub habitat in valley floors, riparian areas, and dwarf shrub habitat in Alaska (Kochert *et al.,* 2002; McIntyre and Adams, 1999).
Sharp-shinned hawk	(*Accipiter striatus*)	-	C	C	Breeds in large stands of young, dense, deciduous, coniferous, and mixed pine-hardwood forests and pine plantations. Nests usually in tree crotch or on branch next to trunk, most often 3 to 18 m up, hidden by thick foliage, usually in conifer in north. May build new nest, reuse old one, or modify old bird or squirrel nest. Nests generally seem to be in a stand of dense conifers near a forest opening (Meyer, 1987). The foraging habitat during the breeding season is essentially the same as that chosen for nesting, and the birds appear to avoid open, deciduous forests (Meyer, 1987).
Red-tailed hawk	(*Buteo jamaicensis*)	-	C	U	Uses coniferous forests and deciduous woodlands with open areas for hunting; nests in trees or on cliffs (Johnsgard, 1990).
Rough-legged hawk	*(Buteo lagopus)*	C	C	R	Uses upland tundra with cliffs and rocky outcrops; nests on coastal, riverine, or upland cliffs or trees (Bechard and Swem, 2002).
American kestral	(*Falco sparverius*)	-	C	R	Uses forest edges and openings; nests in tree cavities (Johnsgard, 1990).
Great horned owl	*(Bubo virginianus*)	-	C	C	Wide variety of habitats, including deciduous, mixed, or conifer forests. Prefers open and secondary growth woodlands, swamps, agricultural areas, and orchards (Houston *et al.,* 1998). Uses existing tree nests of a variety of species or may nest in cavities of trees, snags, cliffs, buildings, artificial nests, or on ground (Houston *et al.,* 1998).

Common Names	Scientific Names	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Northern hawk owl	*(Surnia ulula*)	-	C	U	Moderately dense coniferous or mixed coniferous-deciduous forests near marshes or open areas with suitable perches for hunting (Duncan and Duncan, 1998). Open areas may be muskegs, scrubby spruce, forest glades, swamps, meadows, burned areas, or logged areas (Cramp, 1985; Voous, 1988). Extends to tree line, including taiga/tundra ecotone (Duncan and Duncan, 1998). In Alaska, occurs in open-canopy forests or forest edges (Meehan and Ritchie, 1982) and old mature spruce stands (de la Torre, 1990).
Short-eared owl	*(Asio flammeus)*	C	C	C	Preferes open country including lowland tundra, todal falts, muskegs, and freshwater marshes. Nests on the ground in grass-lined depressions (Armstrong, 2008).
Boreal owl	(*Aegolius funereus*)	-	C	U	Breeds, roosts, and forages, in boreal forests of Alaska characterized by black and white spruce, aspen, poplar, birch, and balsam fir (Bondrup-Nielson, 1984; Meehan and Ritchie, 1982). Primarily mature or old-growth forests. Nests in natural cavities or those excavated by Pileated woodpeckers and Northern flickers. Will use nest boxes (Hayward and Hayward, 1993). Nests in Fairbanks within closed canopy, deciduous or mixed forest (Meehan and Ritchie, 1982).
Songbirds and Other Birds					
Belted Kingfisher	*(Ceryle alcyon)*	-	C	U	Prefers rivers, streams, lakes, ponds, sloughs, and inshore marine waters. Nests in burrows that it excavates in sandy, clay, or gravelly banks.
Northern flicker	*(Colaptes* auratus*)*	-	C	U	Nests in holes in trees or stumps; most common in mixed forests, shrub habitats, infrequently observed. Requires dead trees, dead limbs, or trees with heart rot to excavate nesting cavities (Moore, 1995).
Alder flycatcher	(*Empidonax alnorum*)	-	C	U	Breeds in shrub thickets near water or wetlands (Bent, 1942; Gabrielson and Lincoln, 1959). Shrubs include willow and alder (Gabrielson and Lincoln, 1959; Harrison, 1975; Godfrey, 1986). Shrubs often border a stream, river, lake, pond, swamp, marsh, or bog (Bent, 1942). In central Alaska highest densities in tall shrubs (Spindler and Kessel, 1980)
Hammond's flycatcher	*(Empidonax hammondii)*	-	C	-	Breeds in riparian deciduous forests and in dry upland mixed and deciduous forests with closed canopies. Nests on tree limbs, 15 to 50 feet above ground (Armstrong, 2008).
Say's pheobe	*(Sayornis saya)*	U	U	R	Inhabits open areas and cliffs in mountains and uplands. Nests on shelves or in crevices of cliffs and on buildings (Armstrong, 2008).
Horned lark	*(Eremophila alpestris)*	U	C	R	Breeds on the ground in alpine tundra. During migration uses drier, grassy areas of tidal flats and alpine meadows (Armstrong, 2008).

Common Names	Scientific Names	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Violet-green swallow	*(Tachycineta thalassina)*	-	C	C	Inhabits open woodlands, near human settlements. Nests in holes, cavities, and crevices in trees, cliffs, and buildings (Armstrong, 2008).
Tree swallow	*(Tachycineta bicolor)*	-	C	C	Inhabits wooded areas near water, especially when dead trees are abundant. Nests in tree cavities and sometimes in buildings and bird boxes (Armstrong, 2008).
Cliff swallow	*(Hirundo pyrrhonota)*	U	C	U	Prefers water and open land near human settlements. Nests on buildings, under bridges, and on cliffs, especially along rivers (Armstrong, 2008).
Bank swallow	*(Riparia riparis)*	-	C	U	Usually found near water, especially rivers. Nests in holes in clay and sand banks near rivers, creeks, and lakes, and along highways (Armstrong, 2008).
Gray jay	(*Perisoreus canadensis*)	-	C	R	Widely distributed throughout central Alaska. Inhabits coniferous and mixed coniferous-deciduous forest; spruce is typically present (Strickland and Ouellet, 1993).
Black-billed magpie	*(Pica hudsonia)*	-	C	C	During breeding season inhabits thickets in riparian areas, often associated with open meadows and grasslands (Trost, 1999).
Common raven	(*Corvus corax*)	-	-	C	Prefers heavily contoured landscapes. Found in a variety of habitats including coniferous and deciduous forests, tundra, seacoasts, human settlements, grasslands, and mountains (Boarman and Heinrich, 1999).
Black-capped chickadee	*(Poecile atricapillus)*	-	C	U	Inhabits deciduous and mixed deciduous-coniferous forests (Foote *et al.,* 2010) and extends into tall shrub thickets in some areas of its range (*e.g.*, in Brooks Range, Kotzebue Sound, etc. [Kessel and Gibson, 1978]).
Boreal chickadee	(*Poecile hudsonicus*)	-	C	R	Inhabits boreal forests, including young and mature spruce and sometimes balsam fir. In northern Alaska, occurs in a variety of forests, including spruce, mixed spruce, alder, and willow (Gabrielson and Lincoln, 1959; Irving, 1960).
American Dipper	*(Cinclus mexicanus)*	R	U	C	Inhabits fast-moving streams and occasionally ponds, lakeshores, and saltwater beaches (when streams are frozen). Nests on rock walls or perpendicular banks bordering streams, often behind waterfalls (Armstrong, 2008).
Arctic warbler	*(Phylloscopus borealis)*	C	C	-	Inhabits willow thickets, nesting on the ground in grass or moss (Armstrong, 2008).
Ruby-crowned kinglet	(*Regulus calendula*)	-	U	C	Coniferous forests and mixed woodlands; nests in conifers; widely distributed, uses more open woodland and muskeg woodland habitats (AOU, 1983).

Common Names	Scientific Names	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Grey-cheeked thrush	*(Catharus minimus)*	C	C	U	Inhabits deciduous-coniferous woodlands, shrub thickets, and coniferous forests. Nests in bushes and low trees (Armstrong, 2008).
Swainson's thrush	(*Catharus ustulatus*)	-	C	U	Strongly associated with coniferous forests (Garrett and Dunn, 1981). In Alaska taiga, found in forests where canopy cover, tree height, and canopy thickness were greater (Kessel, 1998).
Hermit thrush	*(Catharus guttats)*	-	U	C	Inhabits the edges of coniferous forests, mixed deciduous-coniferous woodlands, and shrub thickets. Nests usually on the ground (Armstrong, 2008).
American robin	(*Turdus migratorius*)	R	C	C	Wide variety of habitats primarily mixed forests, and shrubs; nests in crotches of trees (Howell, 1942).
Varied thrush	(*Ixoreus naevius*)	-	C	C	Occurs in wet coastal forests of southeast and taiga forests of north central and eastern Alaska. Found in spruce forests, balsam poplar, and dense alder stands (Kessel, 1989; George, 2000). Thick, wet, mossy forests and deciduous shrub and thickets. May forage in open tundra (Kaufman, 1996; Armstrong, 2008).
American pipit	*(Anthus rubescens)*	C	C	C	Inhabits tidal flats, saltwater beaches, fields, alpine meadows, lakeshores, ponds, rivers, and streams. Nests on the ground on drier ridges and foothills and above timberline (Armstrong, 2008).
Bohemian waxwing	*(Bombycilla garrulus)*	-	C	U	Breeds in wet muskegs, nesting in coniferous trees. Winters in usually any habitat where there are fruit-bearing shrubs and trees (Armstrong, 2008).
Orange-crowned warbler	(*Vermivora peregrina*)	-	C	C	Breeds in deciduous woodlands, shrub thickets, and coniferous forest edges where low deciduous growth is present (Armstrong, 2008). In central Alaska, found in all habitats except forests dominated by conifers, with highest densities in shrub thickets (Spindler and Kessel, 1980).
Yellow-rumped warbler	*(Dendroica coronata)*	-	C	U	Breeding habitat predominately mature coniferous and mixed coniferous-deciduous habitats (Hunt and Flaspohler, 1998).
Wilson's warbler	*(Wilsonia pusilla)*	-	C	C	Inhabits shrub thickets and mixed deciduous-coniferous woodlands. Nests on or near the ground in shrub thickets (Armstrong, 2008).
Yellow warbler	*(Dendroica petechia)*	R	C	U	Inhabits woodlands and shrub thickets, nesting in shrubs or trees, usually near the ground (Armstrong, 2008).
Townsend's warbler	*(Denroica townsendi)*	-	C	U	Inhabits and nests in coniferous forests and mixed deciduous-coniferous woodlands (Armstrong, 2008).

Common Names	Scientific Names	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Northern waterthrush	*(Seiurus noveboracensis)*	-	C	U	Inhabits deciduous trees and heavy brush bordering streams, lakes, ponds, and swamps. Nests on the ground beneath logs, roots, or stumps, or in mossy banks (Armstrong, 2008).
Savannah sparrow	(*Passerculus sandwichensis*)	C	C	C	In northern regions of their range, usually inhabit dwarf willows or birches and feed in conifers. Inhabits grassy meadows, cultivated fields, lightly grazed pastures, roadsides, coastal grasslands, sedge bogs, edges of salt marshes, and the tundra (Wheelwright and Rising, 2008). In Alaska, found in open places, especially grassy fields (Armstrong, 2008). In the taiga of Alaska, avoids closed-canopied forest and medium and tall shrub thickets. Found in low vegetation, such as grasses and areas with some low shrub cover (Kessel, 1998).
Fox sparrow	(*Passerella iliaca*)	U	C	C	Subspecies are widespread in Alaska; tall shrubs, forest edges; nests on ground under shrubs or low in trees or shrubs (Spindler and Kessel, 1980; Austin, 1968).
Golden-crowned sparrow	*(Zonotrichia atricapilla)*	R	U	C	Inhabits willow and alder thickets, usually near timberline. Nests on the ground, under shrubs. During migration favors brushy areas (Armstrong, 2008).
White-crowned sparrow	(*Zonotrichia leucophrys*)	U	C	C	Requires grass, bare ground for foraging, dense shrubs or small conifers for roosting and nest cover, water, and tall coniferous trees on periphery of territory (DeWolfe and DeWolfe, 1962). Subspecies *gambelii* occupies a wide range of habitats including farmland, alpine meadows, grass, and dense shrublands (DeWolfe, 1967).
American tree sparrow	*(Spizella arborea)*	U	C	U	Inhabits shrub thickets, from sea level to timberline, on tundra where willows occur. Nests on the ground and in low bushes (Armstrong, 2008).
Lincoln's sparrow	*(Melospiza lincolnii)*	-	C	C	Inhabits shrubs, and salt and freshwater marshes. Nests on the ground in marshy areas (Armstrong, 2008).
Dark-eyed Junco	(*Junco hyemalis*)	R	C	C	In Alaska, breeding habitat consists of old growth to earlier seral stages. Absent from closed dense canopy cover with low light, scant ground cover. Most abundant in shrub/forb and sapling/shrub, lakeshore old growth, and muskeg (Kessler and Kogut, 1985).
Lapland longspur	(*Calcarius lapponicus*)	C	C	C	In wet hummocky tundra meadows, often on relatively flat ground, but also on drier well-vegetated slopes (Williamson and Emison, 1971).
Snow bunting	*(Plectrophenax nivalis)*	C	U	U	Inhabits tundra, nesting in various locations including on buildings, beneath rocks, and in crevices. During migration and winter prefers open fields, shoreline, and roadsides (Armstrong, 2008).

Common Names	Scientific Names	Occurrence[a,b]			Habitat Association
		North	Central	South Coastal	
Redpolls	(*Carduelis* spp.)	U	C	C	Common redpoll: During breeding season, inhabits open subarctic, largely coniferous forest and scrub. Occurs on the tundra above timberline only where shrubby deciduous and sometimes coniferous vegetation occurs in hollows and sheltered places. Also found in towns in close proximity to humans. During migration and winter, found in open woodland and scrub, among weeds, at field edges, and in towns (Knox and Lowther, 2000). In interior Alaska, most common in tall shrub thickets, mixed forests, deciduous forests, and low and medium shrub thickets (Spindler and Kessel, 1980). In northern Alaska, nests in tall shrubs and driftwood piles along the coast (Johnson and Herter, 1989).

a Biogeographic region occurrence source: Birds of Alaska (Armstrong 2008), which follows Kessel and Gibson (1978)
b Abundance data obtained from Birds of Alaska (Armstrong 2008): C= common; U= uncommon; R= rare. A species was included in this table only if it was listed by Armstrong (2008) as common in one or more of the biogeographic regions crossed by the proposed Project. "-" indicates that the species is not listed for the region in Armstrong (2008)

3.7. Fish

3.7.1. Introduction

The description of fisheries resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

This affected environment fisheries resources section has been revised to include temporary impacts to the marine environment in the West Dock area, and to account for pipeline alignment shifts that add or eliminate some stream crossings. Fish stream surveys specific to the ASAP Project were conducted during the 2011, 2013-2015 field seasons to identify freshwater Essential Fish Habitat (EFH), identify both anadromous and resident fish streams, and provide resource input to assist in determining appropriate stream crossing methods for the pipeline. Results of these surveys is reported in the ASAP Essential Fish Habitat Report (Attachment 6 of the EED; AGDC, 2016b). Information from these surveys has been incorporated into this section with a detailed report included in Tables 1-3 of the ASAP Fish Stream List (Appendix J).

Specifically, the following information, data, methods, and/or analyses have been substantially updated from the 2012 FEIS document:

- Description of the Arctic Region has been expanded to include coastal and marine fish resources near West Dock.
- Description of regional and riverine characteristics has been included.
- The total number of stream or river crossings (per USACE definition) has decreased from 515 (495 on the Mainline and 20 on the Fairbanks Lateral) (USACE, 2012b) to 310 (263 on the Mainline, 7 on the Fairbanks Lateral, and 40 on the access roads).
- 181 streams have been re-classified to waterbodies that do not meet USACE's definition of a stream (see Section 3.3.5.1, Types of Surface Waterbodies).[15]
- Stream crossing modes have been revised and/or defined for the centerline, Fairbanks Lateral, and the access roads.
- Commercial, subsistence, and sport fisheries harvest data has been updated to reflect most recent harvest reports.
- Species lists have been updated with ASAP fish stream survey data.

[15] Drainage features that may exist within a jurisdictional wetland, which do not contain "bed and bank" or other stream related morphological features to support identification as a jurisdictional stream. These drainage areas do constitute a special engineering consideration for construction, and AGDC has elected to call them "hydrologic points of interest" (HPOIs) for the purposes of determining a method of pipeline installation.

3.7.2. Summary

The proposed Project route would affect waters within three major hydrologic regions in Alaska including the Arctic, Interior and Southcentral regions, as well as arctic marine waters near West Dock and southern Prudhoe Bay. The current ASAP Project alignment would cross an estimated 181 fish bearing waterbodies (147 on the Mainline, one on the Fairbanks Lateral, and 33 on the access roads) throughout the three hydrologic regions. Of these waterbodies, 70 support anadromous[16] fish and the majority of these anadromous fish streams are located in the Southcentral Region. Additionally, while the proposed pipeline route does not cross the anadromous Sagavanirktok River or its anadromous tributaries, the active channels of the Sagavanirktok River may be used for material sites. Thirty-six species of fish have been confirmed or have the potential to occur throughout some part of their lifecycle within the proposed Project Area. EFH has been identified for all five species of Pacific salmon and two marine species.

3.7.3. Affected Fish Habitats

This section focuses on fish and fish habitats that currently exist within and immediately adjacent to the 733-mile proposed Project ROW from the ACP to Southcentral Alaska. It includes the 30-mile Fairbanks Lateral, Denali NPP Route Variation, and marine areas in the immediate vicinity of West Dock. Waterbodies in this assessment are those that support fish and fish habitat and include streams, rivers, ponds, lakes, and the nearshore Arctic marine environment. Resident, anadromous, and marine fish species in association with EFH are discussed in this section to illustrate the affected environment of the proposed Project. This section also includes an overview of the fish resources in downstream waters that may be impacted in the event of a spill or materials release; however, impacts to these resources are discussed in Section 4.7, Environmental Consequences. AGDC has proposed mitigation measures to reduce impacts to fish resources, which is included in Section 5.7, Mitigation.

Four main types of fish are included in the waters transected by the proposed Project Area, including anadromous, resident, amphidromous, and marine fish species. Fish that spend most of their lives at sea and return to freshwaters only to spawn are termed anadromous fish. These species primarily include salmon. Fish that reside in freshwater for their entire lifecycle are called resident fish, which include Arctic grayling, burbot, and lake trout (Reynolds, 1997). Amphidromous species move between fresh and marine waters at certain life stages, such as feeding at sea during the summer and spending the winter and spawning in freshwater. Amphidromous fish include Dolly Varden, Arctic cisco, and broad whitefish. Amphidromous species are included with the anadromous species category and streams are defined as having resident or anadromous fish present. Marine fish species spend their entire lives offshore at sea,

[16] As determined by ADF&G, the jurisdictional agency, in its most recent Anadromous Waters Catalog (Johnson and Litchfield, 2015a,b,c).

although some species may migrate into nearshore coastal waters during summer. Examples of marine species include Arctic cod and Arctic flounder.

Anadromous fish species are protected under AS 16.05.871. "Waters Important to Anadromous Fish" [5 AAC 95.010] are defined by the AAC as those waters important for spawning, rearing, or migrating anadromous fishes. *The Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes* (referred to as the "Anadromous Waters Catalog") and its companion, Atlas, identify such waters (ADF&G, 2016f). This catalog is divided into Alaska's six fish and game resource management regions. The ADF&G Anadromous Waters Catalog (AWC) has been updated and released in a recent 2015 revision (Johnson and Litchfield, 2015a,b,c). The volumes that encompass the Arctic, Interior and Southcentral management regions (Johnson and Litchfield, 2015a,b,c) were used to identify waterbodies used by anadromous fish within the proposed Project Area, along with newly identified anadromous streams based on ASAP field efforts from 2010 – 2015.

Anadromous fish may be found in streams not currently designated as anadromous fish streams in the AWC. Waterbodies in the AWC represents less than 50 percent of the streams, rivers and lakes actually used by anadromous species (Johnson, 2015). All species of Pacific salmon known to inhabit Alaskan watersheds migrate through and populate various habitat types seasonally at different times depending on life history stage and watershed of origin (Hilborn, 2003). Larger environmental influences and genetics may also play a role in specific stock run timing (Hodgson and Quinn, 2002; Schindler *et al.,* 2010). Adult immigration and smolt emigration timing is important for determining the proposed Project schedule and design.

3.7.4. Regional and Riverine Characteristics

Alaska's vast area, varied climate, and topography contribute to regional differences in the flow patterns of rivers. This is largely dependent on the amount of precipitation, whether it comes as rain or snow, and if a given river is predominantly fed by glaciers or surface run-off (Oswood *et al.,* 2006). These regional variations have a major influence on stream biota resulting in behavioral and life history adaptations in the invertebrate fauna (Oswood *et al.,* 2006 citing Oswood *et al.,* 1991) and long-distance migrations of some fish species responding to harsh winter conditions by moving to overwintering areas of groundwater upwelling or lakes (Oswood *et al.,* 2006 citing Craig 1989).

In the Arctic Region (from the northern coast of Alaska south to the Brooks Mountain Range), tundra streams provide relatively productive aquatic habitats but fish abundance is low in comparison to the amount of habitat available in the ice-free months (Hemming, 1993). This is because many shallow streams freeze to the bottom and are unavailable as overwintering habitat. Arctic streams typically have no flow from October through April followed by a major peak flow in June because of spring snowmelt (Oswood *et al.,* 2006 citing Craig and McCart, 1975, and Oswood *et al.,* 1989). Overwintering habitat is considered a population-limiting factor. Viable overwintering

habitat occurs where water depths exceed 6.5 feet or where there is a year-round source of warm water (*e.g.,* warm springs). Tundra streams are characterized by extensive shallow water areas supporting emergent and submerged aquatic vegetation and water quality that is suitable for fish production (Hemming, 1993). However, riparian vegetation is relatively sparse which limits terrestrial inputs and potentially limits productivity at higher trophic levels (*e.g.,* fish). Continuous permafrost is the dominant landform feature that controls stream hydrology. Permafrost is ground that remains below 0°C for at least 2 years. Continuous permafrost in the Arctic is ubiquitous except beneath the largest lakes (Oswood *et al.,* 2006). The Arctic Region climate (Arctic Climate Zone) is dry and typified by long winters and very brief ice-free growing seasons.

In the Interior Region (bounded by the Brooks Range to the North and the Alaska Range to the south) streams and rivers flow through rolling hills and across flat topographies through tundra and forested reaches underlain by discontinuous permafrost. Streams and rivers in the Interior are either run-off fed clear water systems or glacier-fed turbid water systems. In some low-lying areas rivers spread out in a meandering pattern and form large, low-relief, lake-studded flats (*e.g.,* the Yukon, Tanana, and Minto Flats; Oswood *et al.,* 2006). The Yukon River Drainage is the main watershed in Interior Alaska and is the fourth largest river in the U.S.; the U.S. portion is 1,400 miles in length. The climate of the Interior is known as the *Continental Zone* (Oswood *et al.,* 2006) and is very dry and typified by warm summers and very cold winters.

In the Southcentral Region (bounded by the Alaska Range to the north and the Gulf of Alaska to the South), river and stream types are more diverse and contain some of the largest salmon runs in the state. In streams with substantial salmon runs, salmon carcasses likely contribute a major subsidy of marine–derived carbon, nitrogen, and phosphorus to stream food webs (Oswood *et al.,* 2006 citing Kline *et al.,* 1990). The Susitna and Copper rivers and associated tributaries are the major catchments draining Southcentral Alaska. The climate of Southcentral is a mixture of the Maritime and Transition climate zones (Oswood *et al.,* 2006). The southcentral coast has a milder, maritime climate influenced by the Gulf of Alaska and the remainder of Southcentral is a transitional zone between the coastal maritime climate and the continental climate of the Interior.

3.7.5. Essential Fish Habitat

The National Marine Fisheries Service (NMFS) along with ADF&G and other agencies work together to identify and protect EFH for federally managed fish species. The Magnuson-Stevens Fish Conservation and Management Act (MSFCMA) defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." Freshwater EFH in Alaska includes all the lakes, streams, ponds, rivers, wetlands, and other bodies of water that have been historically accessible to salmon (Pacific Fishery Management Council, 2013). All five Pacific salmon stocks (pink, sockeye, chum, coho, and Chinook) found in Alaska are protected under the MSFCMA. EFH includes all life stages, including egg (incubation in gravel), larval, juvenile, and

adult in the freshwater and marine environment. These areas are identified in ADF&G's AWC (ADF&G, 2016f). Marine EFH in Alaska is identified in Fishery Management Plans developed by the North Pacific Fishery Management Council (NPFMC) (NMFS, 2016a).

Freshwater EFH within the proposed Project Area is limited to the habitat important for the five species of Pacific salmon. Marine EFH associated with the proposed Project includes the area surrounding West Dock and in southern Prudhoe Bay where two marine EFH species have been identified, Arctic cod, and saffron cod (AGDC, 2015a). These species are discussed further in Section 3.7.6, Arctic Region. Consultation between USACE and NMFS is required through the Essential Fish Habitat Consultation Guidance of the MSA Section 305(b)(4)(A) (2004) and the Anadromous Salmonid Passage Facility Design (NMFS, 2011). Each stream crossing proposed requires an approved ADF&G Fish Habitat Permit, which would include the necessary site-specific fish resource data to comply with permit requirements. The permit application process determines the appropriate site-specific crossing methods (open cut, open-cut isolation, HDD, or bridge) for protection of EFH. AGDC submitted a revised DA Application in 2015, which includes proposed stream crossing modes and an assessment of potential effects on EFH.

Alaska's various anadromous fish species are protected under Alaska Statute (AS) 16.05.871. "Waters Important to Anadromous Fish" [5AAC 95.010] are defined by the AAC as those waters important for spawning, rearing, or migrating anadromous fishes. The 2015 AWC and its companion Atlas identify these freshwaters (ADF&G, 2016f). Of Alaska's six fish and game resource management regions identified in the catalog, the volumes that encompass the Arctic, Interior, and Southcentral management regions (Johnson and Litchfield, 2015a, b, c) were used to identify anadromous waterbodies within the proposed Project Area. Waterbodies in the catalog represents less than 50 percent of the streams, rivers, and lakes actually used by anadromous species. ASAP field efforts from 2010 – 2015 resulted in new anadromous waters nominations for inclusion into the AWC (Johnson, 2015; AGDC, 2016b). However, only ADF&G approved nominations, as documented in the 2015 AWC, are classified as anadromous in the ASAP Fish Stream List (Appendix J) and this SEIS.

3.7.6. Fish Habitat and Species in the Proposed Project Area

The proposed Project route would affect waters within three major hydrologic regions in Alaska, as follows:

- Arctic Region – From the GCF to Atigun Pass (ASAP MP 0.0 to 161), including the Sagavanirktok River and Kuparuk River drainages, as well as nearshore waters in the immediate vicinity of West Dock and in southern Prudhoe Bay.
- Interior Region – From Atigun Pass to Broad Pass (ASAP MP 161 to 568), all within the Yukon River drainage.
- Southcentral Region (Southcentral) – From Broad Pass to terminus near Cook Inlet (ASAP MP 568 to 733.5), including the Susitna and Little Susitna River drainages.

The current ASAP Project alignment would cross an estimated 310 streams (263 on the Mainline, 7 on the Fairbanks Lateral, and an additional 40 on the access road) throughout the three hydrologic regions (Figures 3.7-1 through 3.7-3) (AGDC, 2016b). In addition, the alignment would cross 181 fish-bearing waterbodies that do not meet the USACE definition of a stream (see Section 3.3.5.1, Types of Surface Waterbodies), of which 70 are anadromous waterbodies (Table 3.7-1; Figures 3.7-1 through 3.7-3; Appendix J). While the majority of overall fish-bearing steams are located in the Interior Region, most of the subset of fish-bearing streams that are anadromous are located in the Southcentral Region; Table 3.7-1 includes only crossing locations, and does not include fish-bearing waterbodies impacted by proposed material sites.

Table 3.7-1 Fish-Bearing Waterbody Crossings Hydroregion in the Proposed Project Area

Stream Crossing	Arctic	Interior	Southcentral	Total Crossings
Anadromous Waterbody Crossings[a,b]	1 Mainline	16 Mainline/ 2 Access	40 Mainline/ 11 Access	70
Waterbody Crossings with Resident Fish[b,c]	19 Mainline/ 2 Access	58 Mainline/ 14 Access/ 1 Lateral	13 Mainline/ 4 Access	111
Total Fish Waterbody Crossings	22	91	68	181

a Johnson and Litchfield, 2015a,b,c
b ASAP Fish Stream List (Appendix J; AGDC, 2016b)
c ADF&G Alaska Freshwater Fisheries Inventory Database

Waterbody crossings were determined to support anadromous fish if they: 1) are cataloged anadromous waters (Johnson and Litchfield, 2015a, b, c), or 2) if fish were documented during ASAP fish sampling (as reported in the EFH Report [AGDC, 2016b] and described below). As defined by ADF&G AWC, "waters" include rivers, streams, lakes, and associated braided channels, distributaries, sloughs, backwaters, and estuaries, from a waters mouth, upstream to its "specified upper limit" (the documented upstream limit of anadromous fish use).

During the ASAP Project's 2010, 2011, 2013-2015 field seasons (see EFH Report [AGDC, 2016b]), fisheries scientist identified anadromous species in new areas and submitted nomination forms for acceptance by ADF&G. If accepted, these new anadromous streams would be published in future updates to the AWC. ASAP's field biologists collected fish stream data along the entire ROW and for off-ROW access roads with some exceptions. These exemptions include sampling not conducted for streams already documented by ADF&G in the AWC (as directed by ADF&G), or due to land status restrictions, health and safety concerns, or if fish-bearing waters were unlikely (*e.g.*, if there was no surface flow, very low flows, or other characteristics of non-fish bearing waters). Stream Survey Reports were provided to ADF&G. A consolidated listing of fish species inhabiting waterbodies intersected by the pipeline or access roads is reported in the ASAP Fish Stream List (AGDC, 2016b) and included as Appendix J.

Existing resident fish information was utilized from the Alaska Freshwater Fisheries Inventory Database (AFFID) (ADF&G, 2016g). The AFFID provides foundational data that, along with ASAP's survey efforts, characterize the hundreds of fish streams crossed by the pipeline and off ROW features, and document resident fish species' occurrences. The ASAP Fish Stream List (Appendix J) provides information on the name, location, and species information for streams known to contain fish; select streams that were targeted by ASAP for sampling; ; life stage information (for salmon species only); the year of survey; and the proposed stream crossing mode.

A review of all AWC, AFFID, and ASAP data identified 147 Mainline waterbodies containing fish (57 anadromous), 1 Fairbanks Lateral stream containing fish (0 anadromous), and 33 access road waterbodies containing fish (13 anadromous). A complete list is included as Appendix J.

Neither of the two route alternatives near Denali NPP crosses anadromous fish streams (Johnson and Litchfield, 2015b). The proposed ASAP ROW Denali NPP bypass route crosses multiple narrow creeks, whereas the Denali NPP Route Variation (Alternative 2) crosses fewer but wider waterways, as well as navigable waterways.

Figure 3.7-1 Arctic Region Waters

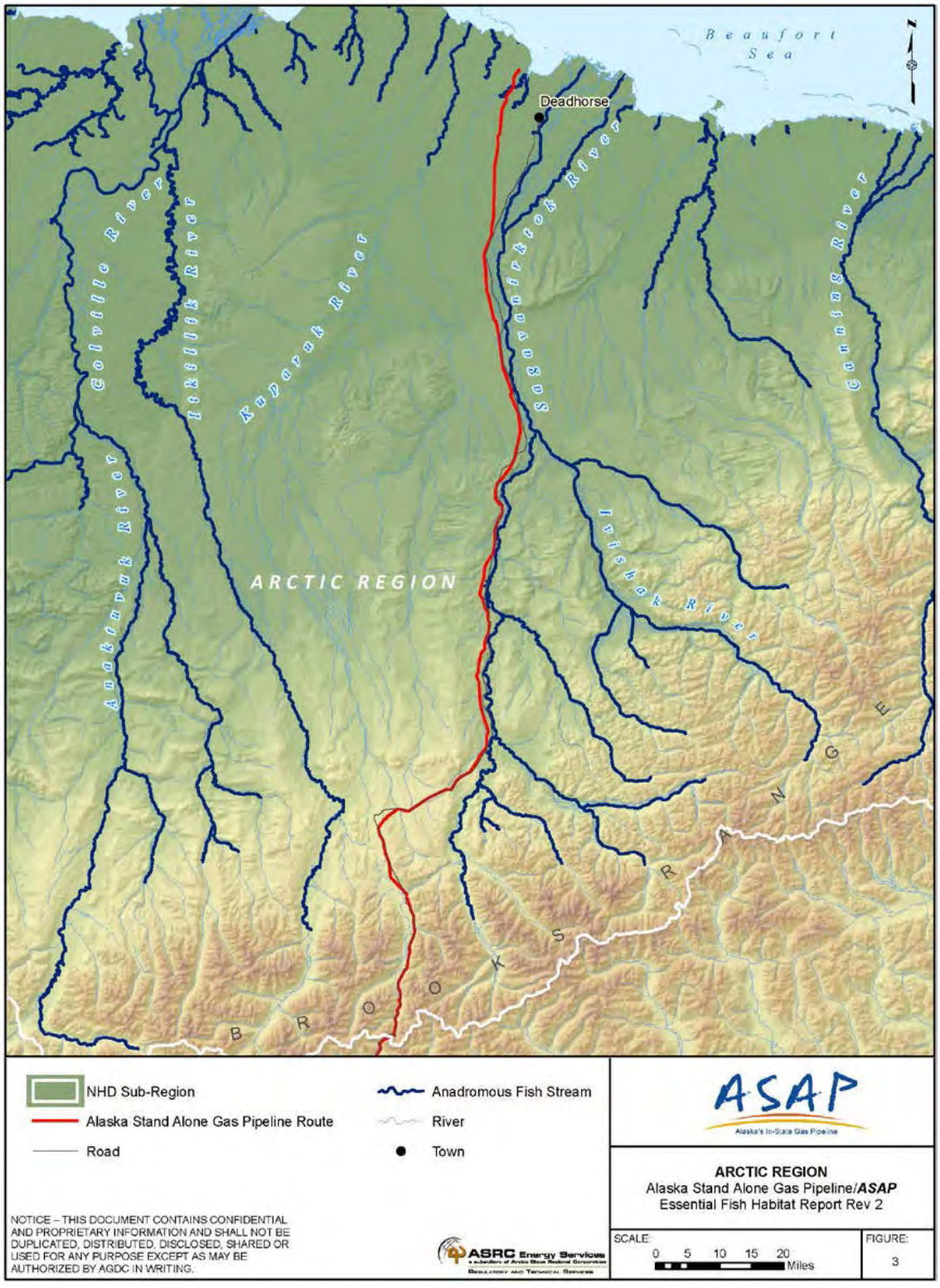


Figure 3.7-2 Interior Region Waters

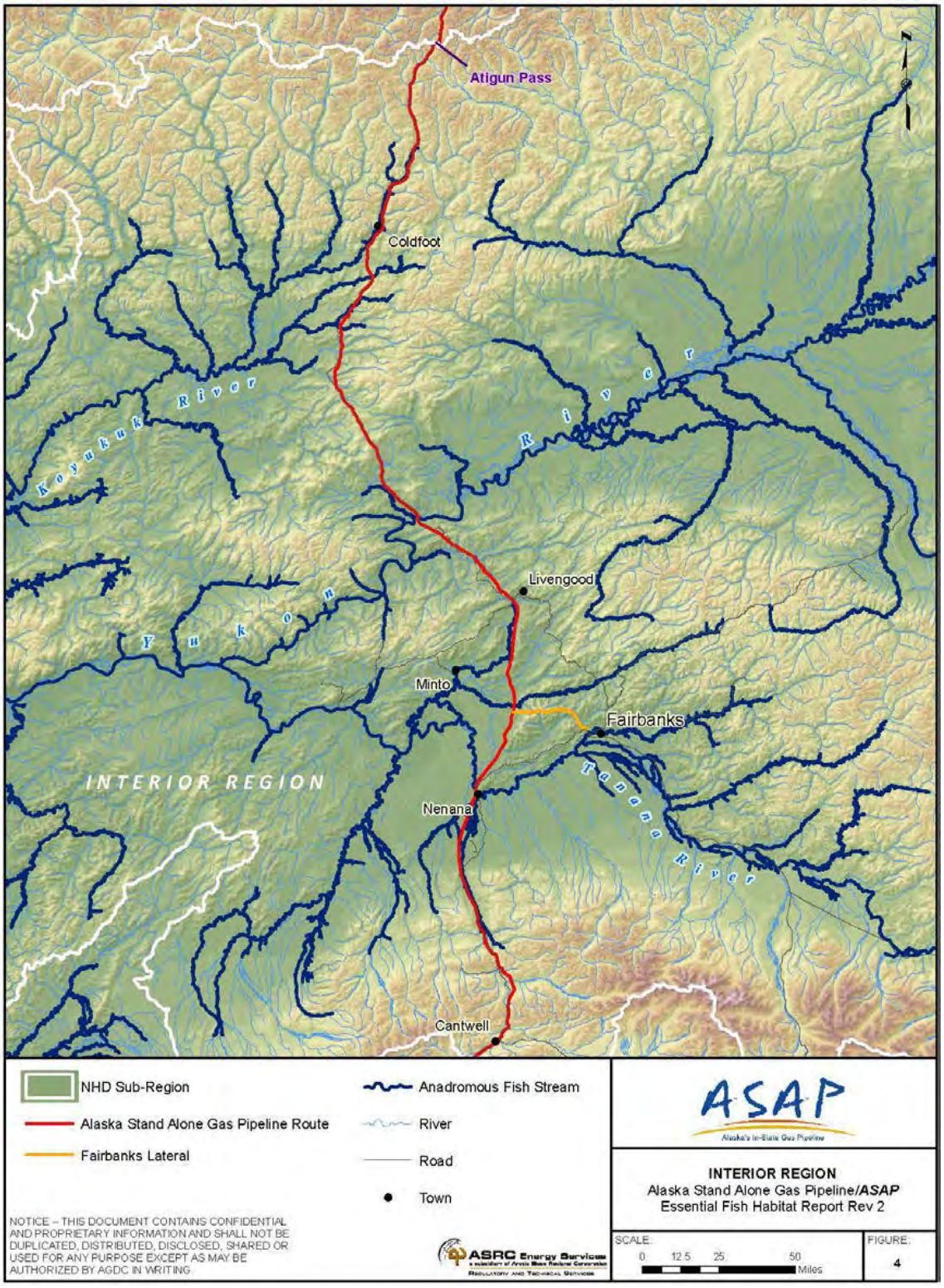
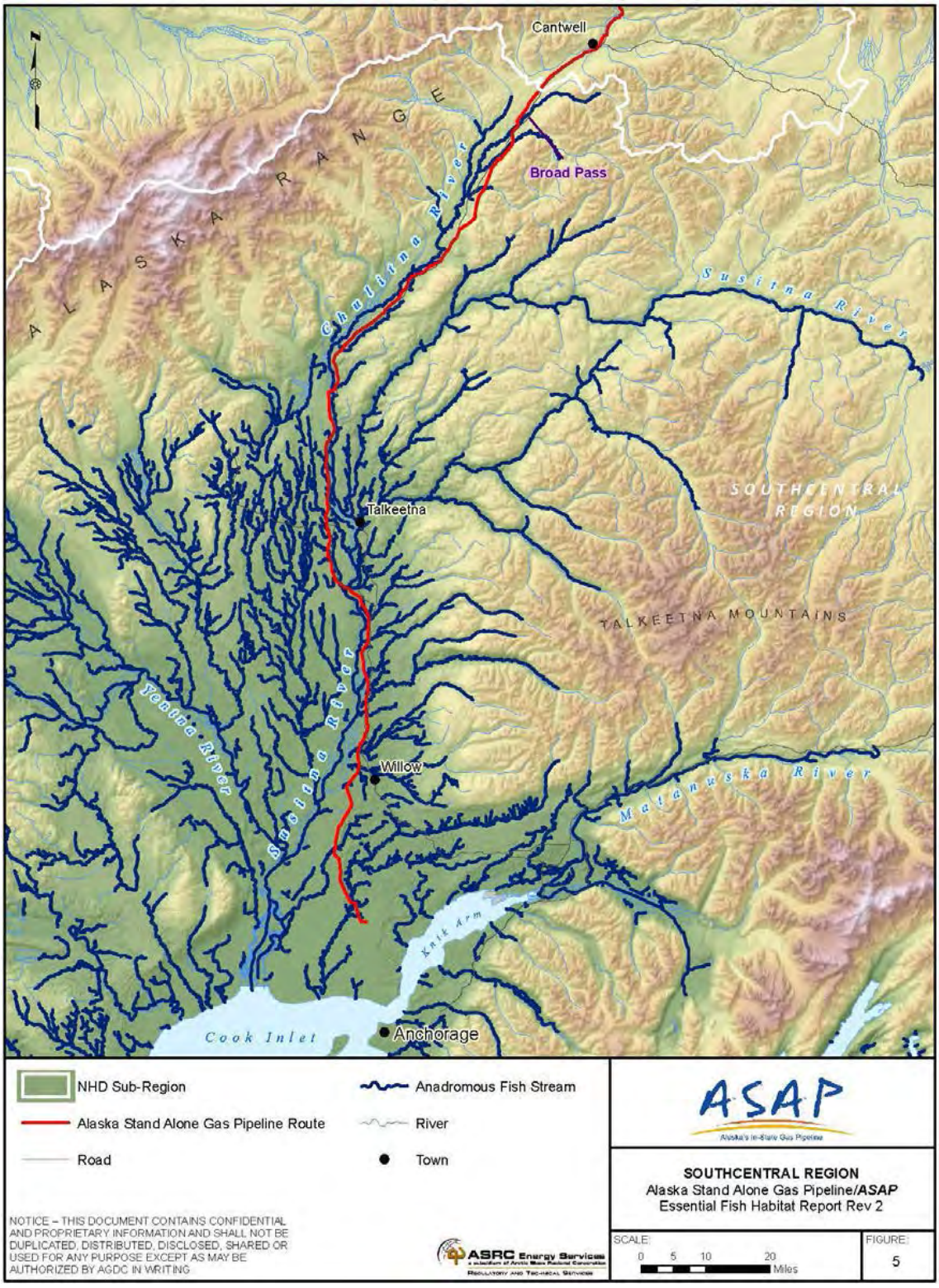


Figure 3.7-3 Southcentral Region Waters



Stream crossing methods have been determined for all crossings based on the ASAP Stream Crossing Construction Mode Determination Manual developed in 2015 (AGDC, 2015b). These include open-cut, open-cut isolation, trenchless technology using HDD, and aerial supported (bridge) crossings. Proposed crossing methods for each fish-bearing waterbody are listed in Appendix J. Potential impacts of crossing methods are discussed in Chapter 4, Environmental Consequences.

The potentially affected fishery resources of the Interior and Southcentral hydrologic regions described in the 2012 FEIS remain valid (USACE, 2012a). Additional fisheries resources for these regions include newly identified fish-bearing waterbodies, based on ASAP field efforts from 2010 – 2015, descriptions of the Alaska brook lamprey (a BLM sensitive species), Aquatic Nuisance Species (ANS), and salmon "stocks of concern" potentially occurring in the proposed Project Area. Proposed Project revisions in the Arctic Region have resulted in identification of new, potentially affected fishery resources in that portion of the Project Area, which encompasses the coastal and marine waters near West Dock. Fisheries resources potentially affected by Project revisions are described below and in Section 3.7.6, Arctic Region.

Thirty-six species of fish have been confirmed or have the potential to occur throughout some part of their lifecycle within the proposed Project Area (Table 3.7-2). Anadromous species have been identified within the proposed Project Area at specified stream crossing locations for both the ASAP centerline and access road crossings; no anadromous species were documented along the Fairbanks Lateral route. Confirmed anadromous species and the life stage present at each fish-bearing waterbody crossing are listed in Appendix J. Confirmed resident fish species at each fish-bearing waterbody crossing are also presented in Appendix J. None of the confirmed fish species are considered to be sensitive species by the BLM (BLM, 2010a). However, one BLM sensitive or "watch" list fish may occur in the proposed Project Area, the Alaskan brook lamprey. Its distribution includes the Chatanika and Chena rivers near Fairbanks (AKNHP, 2016).

Additional descriptions of EFH marine fish species not included in the 2012 FEIS, but have the potential to occur within the proposed Project Area, are presented below, as described in the AGDC EFH report (AGDC, 2015a). Refer to the 2012 FEIS (USACE, 2012a) for original descriptions of the five species of Pacific salmon that have EFH.

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Table 3.7-2 Fish Species Inhabiting Waterbodies Crossed by the Proposed Project

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History
		North Slope	Interior	Southcentral		
Alaska blackfish	*Dallia pectoralis*	X	X	Introduced	No	Occurs throughout mainland Alaska west of Colville River along Arctic coast, also in the Yukon-Tanana drainage as far upstream as Fairbanks. Bottom-dwelling fish found in heavily vegetated swamps and ponds, lakes and rivers. Migrates to deep waters in winter. Natives have used blackfish extensively for food.
Alaska brook lamprey	*Lampetra alaskense*		X	X	No	Found in Chatanika and Chena rivers near Fairbanks and the Alaska Peninsula and Kenai Peninsula. Spawn in spring and summer in shallow streams and lakes. Spend 4 years as ammocoetes (lamprey larva), then matures in the fall, and moves downstream into lake habitat to over winter.
Arctic char	*Salvelinus alpinus*	X	X	X	No	Found in lakes along the northern foothills of the Brooks Range, in a few scattered coastal plain lakes west of the Colville River, and also in a small area of the Interior near Denali NPP, and in Southcentral in Big Lake and nearby lakes.
Arctic cisco	*Coregonus autumnalis*	X	X		Yes	Occur from the Point Barrow area eastward along the Beaufort Sea coast to the Canada border, occurring mainly in the Colville River area, with limited distributions in the Sagavanirktok and Putuligayuk rivers. Tolerant of high salinity and often found in estuaries. One of the most abundant and valued subsistence species along Alaska's North Slope.
Arctic cod	*Boreogadus saida*	X			No	Marine. Circumpolar and ubiquitous in marine waters throughout the Beaufort Sea. Primary component of Arctic marine food chain. Spawn during winter. Schools typically found within transition layers between surface and bottom water masses. Do not actively move into freshwater or low-salinity habitats.
Arctic flounder	*Pleuronectes glacialis*	X			No	Marine. Circumpolar and widely distributed along Beaufort Sea coast in summer. Bottom dwelling species found in shallow coastal waters and often move upriver.
Arctic grayling	*Thymallus arcticus*	X	X	X	No	Widespread in mainland Alaska; both migratory and resident population occur. Winter primarily in cold waters of medium-sized to large rivers and lakes; migrating to rocky streams to breed in spring and then continuing to separate summer feeding grounds.

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History
		North Slope	Interior	Southcentral		
Arctic lamprey	*Lampetra japonica*	X	X	X	Yes	Occur from Arctic coast to Kenai Peninsula; Yukon River into Yukon Territory, Kuskokwim and Tanana river drainages. Adults feed at sea or in lakes; spawn in clear streams. Ammocoetes in muddy margins and backwaters of rivers and lakes.
Bering cisco	*Coregonus laurettae*	X	X	X	Yes	Found in the Yukon River upstream to Ft. Yukon. Primarily freshwater and coastal marine; winter in salt or brackish water near river mouths; undergo extensive spawning migrations up the Yukon River where they spawn in fast-flowing water near beds of loose gravel. Also found in the Knik and Susitna rivers.
Broad whitefish	*Coregonus nasus*	X	X		Yes	Found in the Yukon and Kuskokwim river drainages and in river drainages that empty into the Bering, Chukchi, and Beaufort seas. Primarily found in streams, less often in lakes and estuaries. Spawn over a gravel bottom in the fall. In the Yukon River, broad whitefish are important for local consumption and for commercial purposes. Both spawning and overwintering populations occur in the Sagavanirktok River and Yukon River drainages.
Burbot	*Lota lota*	X	X	X	No	Occupy large clear and glacial rivers and many lakes throughout most of Alaska. Adults are voracious predators, feeding mostly on fish. Burbot spawn under the ice in late winter. The most popular fishing areas are the Yukon and Tanana rivers.
Chinook (king) salmon	*Oncorhynchus tshawytscha*		X	X	Yes	Abundant from the southeastern panhandle to the Yukon River. Major runs in the Yukon, Susitna, and Copper River drainages. Spawning occurs from May through July. Fish hatch in fresh water, spend 3 to 7 years in the ocean, and then return to spawn in their natal streams. Chinook salmon are the most highly prized sport fish in Alaska.
Chum (dog) salmon	*Oncorhynchus keta*	X	X	X	Yes	Most abundant commercially harvested salmon species in the Arctic, northwestern, and Interior Alaska. Spawn in small side channels and other areas of large rivers at upwelling springs; young run to sea right after emerging from gravel. Important year-round source of fresh and dried fish for subsistence and personal use purposes in the Arctic, northwestern and Interior Alaska.

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History
		North Slope	Interior	Southcentral		
Coho (silver) salmon	*Oncorhynchus kisutch*		X	X	Yes	Found in coastal waters of Southeast and South-central Alaska and in the Yukon River to the Alaska-Yukon border. Occur in nearly all accessible bodies of fresh water. Spawn in streams from July to November. Young migrate to sea between 1 and 4 years, remaining at sea for 2 to 3 years. Premier sport fish of Alaska occurs in both fresh and salt water from July to September.
Dolly Varden	*Salvelinus malma*	X	X	X	Yes	Locally abundant in all coastal waters of Alaska. Anadromous and freshwater resident varieties exist. Mature sea-run Dolly Varden spend their lives migrating from wintering fresh water to saltwater summer feeding areas, then back to freshwater rivers to spawn in the fall. One of Alaska's most important and sought-after sport fish.
Eulachon	*Thaleicchthys pacificus*			X	Yes	Found in the Copper River Delta; also the Susitna, and 20-mile rivers in Cook Inlet. Spawn during spring in the lower reaches of rivers or streams with sandy gravel bottoms. Grow to maturity in the sea where they feed mainly on krill. Important as a personal use and subsistence species.
Fourhorn Sculpin	*Myoxocephalus quadricornis*	X			No	Marine. Circumpolar in distribution in brackish and moderately saline waters. Common in coastal waters during summer and may travel upriver. As coastal waters freeze, fish move offshore and spawn in mid-winter.
Humpback whitefish	*Coregonus pidschian*	X	X	X	Yes	Found in all drainages north of the Alaska Range as well as in the Copper and Susitna rivers. Spawn during the fall at the upper reaches of rivers over a gravel bottom at 4 to 5 years of age. Important in the subsistence economy of rural Alaskans.
Inconnu (sheefish)	*Stenodus leucichthys*		X		Yes	Found in the Yukon river drainages along the proposed ROW. Minto Flats and Upper Yukon River populations are year-round residents. Spawn in rivers with a fast current over a bottom composed of differentially sized gravel; sheefish may live to spawn several times.
Lake chub	*Couesius plumbeus*		X		No	Found throughout the Yukon River upstream of Nulato and in its tributaries, including the Tanana drainage. Found most often in shallow, silty lakes and streams in Alaska. Spawns in shallow waters with gravelly bottoms during summer.
Lake trout	*Salvelinus namaycush*	X	X	X	No	Inhabit clear, mountain lakes in the Brooks Range, Alaska Range, and central ACP. Found in turbid glacial lakes on the north side of the Chugach Range and Kenai Peninsula. Spawn over clean, nearshore rocky shoals in fall.

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History
		North Slope	Interior	Southcentral		
Lake whitefish	*Coregonus clupeaformis*			X	No	Occur in the Copper and Susitna river drainages. Found in the deeper, colder areas of lakes and rivers in summer. Moves to shallower areas to spawn in fall.
Least cisco	*Coregonus sardinella*	X	X		Yes	Found from Arctic coast to Bristol Bay and in most lakes and streams north of the Alaska Range and throughout the Yukon and Kuskokwim drainages. Anadromous and landlocked freshwater forms exist. Anadromous forms have an annual migration from freshwater winter habitats to saltwater summer feeding habitats. Mature fish migrate upstream in the fall to spawn in clear streams with gravel bottoms north of the Alaska Range.
Longnose sucker	*Catostomus catostomus*	X	X	X	No	Found throughout mainland Alaska in lakes and streams with clear cold water. Spawns in streams, lakes, or ponds with gravel bottoms and cold water in late spring or early summer.
Ninespine stickleback	*Pungitius pungitius*	X	X	X	Yes	Widespread, occupying marine, brackish, and freshwaters. Prefers shallow vegetated areas in lakes, ponds and pools in slow streams; marine populations most often in marshes and estuaries near shore. Spawns in freshwater during summer months.
Northern pike	*Esox lucius*	X	X	X	No	Occurs in the Colville, Yukon, and Susitna River Basins. Prefers clear vegetated lakes, quiet pools and backwaters of creeks and rivers; spawns in marshy areas. Voracious predator on juvenile salmonids, the Northern pike is native to most of Alaska, but is considered an invasive species south and east of the Alaska Range except for a small population near Yakutat.
Pacific lamprey	*Lampetra tridentata*			X	Yes	Occur along coastal areas from Nome down to California. Remain as an ammocoetes for 4 to 5 years then metamorphose and move to sea. Feed at sea for approximately 1 year, then return to fresh water in the fall and spawn the following spring.
Pink (humpback) salmon	*Oncorhynchus gorbuscha*	X		X	Yes	Occur along Alaska's coasts. Spawn between late June and mid-October, usually within a few miles of the coast or in the intertidal zones. Young run to sea right after emerging from gravel where they remain for 2 years before returning to spawn. Important to commercial and sport fisheries and to subsistence users in Alaska.
Pond smelt	*Hypomesus olidus*	X		X	No	Found in Beaufort Sea drainages and the Copper River drainage. Found in middle and surface water of ponds, lakes and streams. Occasionally enters brackish waters.

Common Name	Scientific Name	Hydrologic Region			Anadromous	Life History
		North Slope	Interior	Southcentral		
Rainbow smelt	*Osmerus mordax*	X		X	Yes	Occur throughout coastal Alaska. Ascend into freshwater streams only a few hundred yards to a mile to spawn.
Rainbow trout (steelhead)	*Oncorhynchus mykiss*		X	X	Yes	Both resident and anadromous forms exist. Occur naturally in the coastal waters of the Upper Cook Inlet and the Copper River drainage. Hatchery-reared fish occur in specific lakes and streams in the Tanana River drainage. Spawn in shallow riffles or suitable clear water streams. One of the most respected and sought after of Alaska's native game fishes. The Gulkana River is the most northern population extent of rainbow trout (BLM, pers. comm., 2012).
Round whitefish	*Prosopium cylindraceum*	X	X	X	No	Widespread on mainland Alaska from North Slope to Taku River. Occur in shallow areas of lakes and clear rivers and streams; rarely in brackish water. Spawn over gravel shoals of lakes and at river mouths.
Saffron cod	*Eleginus gracilis*	X			No	Marine. Found in brackish and marine waters of the Beaufort Sea east to Bathurst Inlet in Canada. Frequently enter rivers. Least abundant marine species nearshore during summer.
Slimy sculpin	*Cottus cognatus*	X	X	X	No	Most widespread sculpin in Alaska and the only sculpin in Interior Alaska. Occupies streams and lakes. Spawn in spring, shortly after breakup.
Sockeye (red) salmon	*Oncorhynchus nerka*		X	X	Yes	Occur in the North Pacific and Arctic oceans and associated freshwater systems. Spawn in rivers, streams, and upwelling areas along lake beaches after spending one to 4 years in the ocean. After hatching in winter, juvenile sockeye salmon may spend up to 4 years in fresh water before migrating to sea. One of the most important commercial and sport fisheries in the state and remain an important mainstay of many subsistence users.
Threespine stickleback	*Gasterosteus aculeatus*	X		X	Yes	Occur primarily along the coastal regions of Alaska south of Nome in marine, brackish, and freshwaters. Anadromous and resident freshwater forms exist. Found in shallow vegetated areas of lakes, ponds, rivers and streams. Nests built on sandy bottom.

Sources: BLM, 2002; Truett and Johnson, 2000; Mecklenburg *et al.,* 2002; Fechhelm *et al.,* 2011; AKNHP, 2016

3.7.6.1. Arctic Cod

Arctic cod occupy the Arctic Ocean including Hudson Bay, Greenland, Iceland, and Alaska's northern coastline down to the Bering Sea. Arctic cod are one of the most abundant fish in the Arctic (Mueter *et al.,* 2013). Summer sampling has shown great variability in catch success, and Arctic cod schools at any location are "both unpredictable and ephemeral" (Fechhelm *et al.,* 2011). They occupy marine waters, and usually stay at depths less than 100 m; preferring the transition layer between the surface and bottom water masses (Moulton and Tarbox, 1987). The patterns of these transition layers can predict the presence of Arctic cod.

Arctic cod are widely distributed in the Arctic Ocean. Year-round, they occur in coastal habitats and may be found 50 to 175 km offshore in the Beaufort and Chukchi seas (Cohen, 1990). Arctic cod feed on crustaceans, worms, small fish, and algae growing on the bottom of sea ice (Jones, 2006). They are typically not found in brackish or freshwater environments (Fechhelm *et al.,* 2011). Arctic cod spawn during the winter under the nearshore pack ice (Pirtle and Mueter, 2011) and use shorefast pack ice to forage and shelter from predators (Pirtle and Mueter, 2011). They are important beluga whale prey species during the summer (Lowry *et al.,* 1986), and they are important consumers of plankton in the Arctic ecosystem (Pirtle and Mueter, 2011).

3.7.6.2. Saffron Cod

Saffron cod occupy nearshore and offshore habitats in the Arctic Ocean, including the Beaufort and Chukchi seas, down to the Gulf of Alaska. They have been found to be the least abundant marine species during nearshore summer sampling (Fechhelm *et al.,* 2011), but are still regularly caught nearshore (Fechhelm *et al.,* 2009). They occur in shallow waters, usually less than 60 m in depth, in the ocean, brackish rivers, and shorelines (Fechhelm *et al.,* 2009; Mecklenburg *et al.,* 2002). Saffron cod can migrate upstream in freshwater over considerable distances (Fechhelm *et al.,* 2011).

Saffron cod spawn during the winter and are found under shorefast and nearshore sea ice, especially with substrates of sand and gravel (NPFMC, 2009; Pirtle and Mueter, 2011). Eggs are broadcast dispersed over the bottom and hatch in the spring (Pirtle and Mueter, 2011). Young saffron cod aggregate with jellyfish for the first months of life. Saffron cod are an important component of beluga whale and seal diets (Lowry *et al.,* 1986).

3.7.6.3. Arctic Region

3.7.6.3.1. Freshwaters

The Sagavanirktok River and the Kuparuk River are the major river drainages along the proposed Project in the Arctic Region. The Sagavanirktok River is approximately 180 miles long and originates on the North Slope of the Brooks Range and flows north to the Beaufort Sea near Prudhoe Bay. The Dalton Highway roughly parallels the river

from Atigun Pass to Deadhorse. The Sagavanirktok River and its numerous tributaries are specified by the ADF&G as anadromous fish habitat providing EFH for chum and pink salmon (Johnson and Litchfield, 2015a). The proposed pipeline route does not cross the Sagavanirktok River or its anadromous tributaries; however, the active channels of the Sagavanirktok River may be used for material sites (AGDC, 2016b). The Kuparuk River is approximately 200 miles long and also originates on the North Slope of the Brooks Range, and flows north to the Beaufort Sea, just west of the Sagavanirktok River. The proposed pipeline route crosses the Kuparuk River at its headwaters in the Brooks Range at approximately MP 131. Only approximately 20 miles of the Kuparuk River, from the mouth at the Beaufort Sea, are mapped as anadromous waters in the AWC. The proposed pipeline route also crosses the Toolik River, a tributary of the Kuparuk, at approximately MP 128.5. The Toolik River is not in the AWC.

A total of 22 fish-bearing waterbodies in the Arctic Region are crossed by the proposed Project alignment (Table 3.7-1). Lake trout, Arctic char, Arctic grayling, Alaska blackfish, Northern pike, broad whitefish, round whitefish, slimy sculpin, ninespine stickleback, Dolly Varden, and burbot can be found in lakes and streams deep enough to support overwintering fish (ADF&G, 2010; 2016g). Waterbodies on the North Slope known to support overwintering fish are considered sensitive from October through April. Fish likely reach or are nearing their overwintering habitats by October prior to the complete freezing of migratory corridors; and likely remain in overwintering habitats at least through March or April before redistributing to summer habitats.

The revised pipeline route reduces the number of anadromous stream crossings in the Arctic Region from six to one, the Putuligayuk River (Appendix J of this SEIS) (USACE, 2012a). The Putuligayuk River is used by broad whitefish, Arctic cisco, and Dolly Varden among others (see Appendix J).

Dolly Varden and broad whitefish are the most common anadromous species known to occur in the Arctic Region relative to the proposed Project Area (Johnson and Litchfield, 2015a). The main channel of the Sagavanirktok River is considered critically sensitive between August through October when Dolly Varden migrate and spawn in spring-fed tributaries (ADNR, 2006a). The main channel of the Sagavanirktok River is also considered critically sensitive between May to June, due to Arctic grayling spawning in tributaries. North of Oksrukuyik Creek, streams and tributaries of the Sagavanirktok River are considered sensitive May to October because they provide foraging habitat for a number of resident species and critically sensitive in spring and fall due to the presence of spawning Dolly Varden. Arctic grayling and ninespine stickleback are the most widespread resident fish found in streams in Arctic Alaska (Truett and Johnson, 2000). The Kuparuk River at the proposed pipeline route crossings is considered sensitive in the summer and critically sensitive in the spring and fall due to the presence of Arctic grayling (ADF&G, 2016g). The Atigun River, and several streams that enter Tee Lake, contain migratory Dolly Varden and are considered critically sensitive from May to October (BLM, 2010b). They also provide overwintering habitat and are considered sensitive from October through April, during the overwintering period.

Sport fishing pressure along the Sagavanirktok River drainage is low compared to subsistence fishing and sport fishing elsewhere in Alaska (Scanlon, 2015). Sport fishermen in this region harvest Dolly Varden, Arctic grayling, burbot, and whitefish (ADF&G, 2010). Most sport fisheries for Dolly Varden target overwintering populations in the fall as the fish return to freshwater or in the spring as they move toward the sea to feed (Scanlon, 2015). No commercial fishing occurs in the Sagavanirktok River drainage (Scanlon, 2015). Regional subsistence fish activities directed at salmon and other species, such as Dolly Varden, and whitefish, provide a food source for the villages of Nuiqsut and Kaktovik (AGDC, 2015a).

Most freshwater Arctic fish populations are limited by the availability of overwinter habitat (Truett and Johnson, 2000). Lakes at least 6.5 feet deep provide fish with open water habitat throughout the winter and prevent eggs from freezing (Craig, 1984; Truett and Johnson, 2000). Although numerous smaller lakes occur in the vicinity of the proposed Project Area on the North Slope, they are often too shallow (*i.e.*, less than 6.5 feet deep) to support winter fish populations. However, if these shallow lakes are connected to a fish bearing stream or river, they will support fish during the summer months. Winter's onset is a period of environmental change that almost always results in migration, either within a given habitat, among habitats of the same system, or among systems (Reynolds, 1997). Craig (1989) stated that the small amount of over-wintering habitat available could be the most important factor limiting population size and causing cyclical fluctuations in fish species abundance (Truett and Johnson, 2000). Lake trout, Arctic char, Arctic grayling, Alaska blackfish, Northern pike, broad whitefish, round whitefish, slimy sculpin, ninespine stickleback and burbot can be found in lakes and streams deep enough to support overwintering fish (ADF&G, 2010; 2016g).

3.7.6.3.2. Marine Waters

The marine waters potentially impacted by the proposed Project include nearshore waters in the immediate vicinity of West Dock and in southern Prudhoe Bay (Figure 2.2-3 in Section 2.2.3). The West Dock causeway extends approximately 2.7 miles from shore and is comprised of three segments connected by two breach bridges: 1) Shore to West Dock 2 (DH2); 2) DH2 to West Dock 3 (DH3); and 3) DH3 to the Seawater Treatment Plant (STP).

Regulatory agencies provided input into the solid fill nature of the causeway on the coastal and marine resources of the Beaufort Sea (Fechhelm *et al.,* 1999). Initially a 50-foot channel breach was designed between DH3 and the STP. After scientific examination and monitoring, the breach was proven ineffective for fish passage due to its size and location (Fechhelm *et al.,* 1999). A secondary 650-foot breach was constructed in 1995-1996 between DH2 and DH3. This breach is considered to have had a positive impact on fish populations, partially due to location and mixing of sea currents (Winters, 2014; Fechhelm *et al.,* 1999; Fechhelm *et al.,* 2001).

Activities such as dredging, dredge material disposal, and the construction of a temporary bridge on the West Dock causeway could affect fishery resources. Activities associated with the temporary barge bridge that would be located adjacent to the large breach on the West Dock causeway may be a fish passage concern to resource agencies. As stated above, the large breach was initially constructed to facilitate fish passage, and it has been viewed as a success. The temporary barge bridge needed to offload the modules would begin construction August 1 and is expected to be in place from mid-August through the end of September, which is during the open water season when fish are still migrating through the nearshore region in the vicinity of West Dock. This temporary bridge would reduce the effective cumulative opening of the 650-foot-wide breach to approximately 72.5 feet at the seafloor and may impact fish movements in the area.

Fish in the vicinity of West Dock have been extensively studied for over 30 years to assess the effects of oil and gas development (Wilson and Gallaway, 1997; McCain *et al.*, 2014). Approximately 28 species of fish have been identified during annual fish sampling with five migratory anadromous species and four marine/estuarine species comprising over 96 percent of the catch (Fechhelm *et al.,* 2011; McCain *et al.,* 2014; Owl Ridge Natural Resource Consultants, Inc. [Owl Ridge], 2015). Primary anadromous species include Arctic cisco, least cisco, broad whitefish, humpback whitefish, and Dolly Varden. The marine/estuarine fish species are Arctic cod, Arctic flounder, fourhorn sculpin, and saffron cod. The descriptions of EFH for the Prudhoe Bay area identify Arctic cod and saffron cod, as well as the marine life stages of pink salmon and chum salmon, as inhabiting the marine waters of the proposed Project Area (NPFMC, 2009; 2012).

The Arctic nearshore marine waters undergo a dramatic seasonal transformation. During most of the year, the area is locked in sea ice. During the summer/fall months the sea ice retreats, and open water can serve as a migratory pathway for adult salmon and other anadromous fish transitioning to freshwater rivers and streams.

Anadromous and amphidromous fish in the Arctic Region spend their winters in the North Slope or Arctic Canadian river systems, and disperse out into the brackish nearshore coastal waters to feed during the Arctic summer (Craig, 1989). Most fish migrating through Prudhoe Bay overwinter in the Colville River, Sagavanirktok River, or Mackenzie River in Canada; however, some may also overwinter in other streams along the North Slope. Young fish are less tolerant to high-saline water (Fechhelm *et al.*, 1999); therefore, their migratory path is usually closer to shore where the melting ice creates a brackish water lens about 0.5 to 2.5 miles wide (Craig and Griffiths, 1981). The West Dock breach is an important transit route during this spring migration (Fechhelm, 1999; Fechhelm *et al.,* 2001), allowing fish to disperse greater distances within habitable waters.

Fish migrate from both the east and west to Prudhoe Bay. During the spring migration, late-June to early-July, young-of-the-year Arctic cisco from the Mackenzie River are

transported via wind-driven currents (typically to the west) along the nearshore coast towards Prudhoe Bay (Fechhelm *et al.,* 1999). Young fish also move from the Colville River eastward towards Prudhoe Bay. In mid- to late-August (fall migration), fish travel to their respective overwintering or spawning grounds. The fall migration may occur via a more offshore route, thus not using the West Dock breach (Winters, 2014).

Summer movements of marine fish, including EFH species, near West Dock and in the Beaufort Sea have been reviewed (Owl Ridge, 2015). Owl Ridge (2015) reported that

> *Estuarine species, such as fourhorn sculpin and Arctic flounder, are abundant in the nearshore region throughout the summer. Directed movements have not been documented, although they do apparently move around through the open water season (McCain et al., 2014). Marine and truly anadromous species, such as Arctic cod, saffron cod, and rainbow smelt, move inshore later in summer when higher salinity offshore water mass moves shoreward (Moulton and Tarbox, 1987). These large-scale movements are independent of any causeway-induced changes to nearshore hydrography, with the onshore-offshore component being dominant. As the nearshore habitat becomes colder and more saline in late season, these species become more abundant (Moulton et al., 1986). The marine and estuarine species likely remain in the nearshore region for the remainder of the open water season and disperse offshore after ice formation.*

Many of the fish moving through the West Dock nearshore area provide an important source of subsistence food for North Slope communities, as well as those in the Canadian Arctic (AGDC, 2015a). Local subsistence fisheries primarily target migratory whitefish and ciscoes (Owl Ridge, 2015). Arctic cod and saffron cod are subsistence harvested during both the summer and winter seasons (Sforma and George, 2013), although there are no data to evaluate the quantity or location of such harvests near the Project Area at West Dock (NPFMC, 2009). No commercial fisheries exist in the Arctic Region of the proposed Project Area, and sport fisheries are assumed minimal (AGDC, 2015a).

3.7.6.4. Interior Region

Major river drainages crossed by the proposed pipeline route in Interior Region include the Koyukuk, Yukon, Tanana, and Nenana rivers. These rivers and numerous tributaries are classified as anadromous fish habitat important for providing EFH for Chinook, chum, and coho salmon (Johnson and Litchfield, 2015b). A total of 18 anadromous stream crossings (16 Mainline and 2 access road crossings) occur along the proposed Project alignment within the Interior Region. An additional two streams crossed by access roads have been nominated for inclusion in the AWC by ASAP fish biologists (see Appendix J). The Interior Region also contains the majority of waterbody crossings with resident fish species (58 on the Mainline, 14 on the access roads, and 1 on the Fairbanks Lateral).

This region is divided into ADF&G districts and subdistricts for management and regulatory purposes. The proposed Project route crosses waterbodies within ADF&G Yukon Subdistrict 5-C (Yukon River) and Subdistrict 6-B (Tanana River).

Commercial fishing for salmon is permissible along the entire length of the Yukon River and the lower 225 miles of the Tanana River (Estensen *et al.,* 2015). Sport fishing pressure is generally light throughout the region with the majority of sport fish harvest occurring in the Tanana River drainage (District 6) (Estensen *et al.,* 2015 citing JTC, 2015). Subsistence fishing has the highest priority among all uses of the resource in the State of Alaska, and whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (AS 16.05.258).

Anadromous fish are known to occur in 18 stream crossings within the proposed Project Area in Interior Alaska (Table 3.7-1). The Yukon River and the South Fork of the Koyukuk River have the most anadromous fish species for this region (Johnson and Litchfield, 2015b).

The Dietrich, Bettles, Middle Fork Koyukuk, South Fork Koyukuk, Kanuti, and Hammond rivers flow into the Koyukuk River, which is a tributary to the Yukon River. The Chandalar, Dall, and Ray rivers flow directly into the Yukon River. The Dietrich and Jim rivers are classified as sensitive year-round and tributaries are designated as sensitive habitats from May through October (BLM, 2010b). The Dietrich River and its tributaries do not support anadromous fish and contain no EFH; however, the Dietrich River is a tributary of the Middle Fork Koyukuk River, which does support anadromous fish (AGDC, 2015a). The Dietrich River flows within 1.5 miles of the eastern boundary of Gates of the Arctic National Park and Preserve.

3.7.6.4.1. The Yukon River

The Yukon River is the longest river in Alaska and it has one of the longest salmon runs in the world. Year-round, the Yukon River is classified as sensitive under general fisheries management for anadromous and resident fish species (Buckwalter, 2009). Presently, all populations of fish in the Yukon River drainage are wild and no stocking to enhance fish populations occurs in this area. Chinook, chum, and coho salmon are harvested in subsistence, commercial, personal use, and sport fisheries along the Yukon River. The Yukon River chum salmon run consists of an earlier summer run and a later fall run (Estensen *et al.,* 2015). Run times for spawning salmon on the Yukon River occur from June to August for Chinook salmon, September to November for Coho salmon, and June to December for chum salmon (Table 3.7-3). The villages along the Yukon River have historically and continue to rely on salmon for their cultural, subsistence, and commercial needs. Salmon are traditionally dried, smoked, and frozen for both human and sled dog consumption. Common methods of fishing on the Yukon River include set gill nets and fish wheels (Estensen *et al.,* 2015).

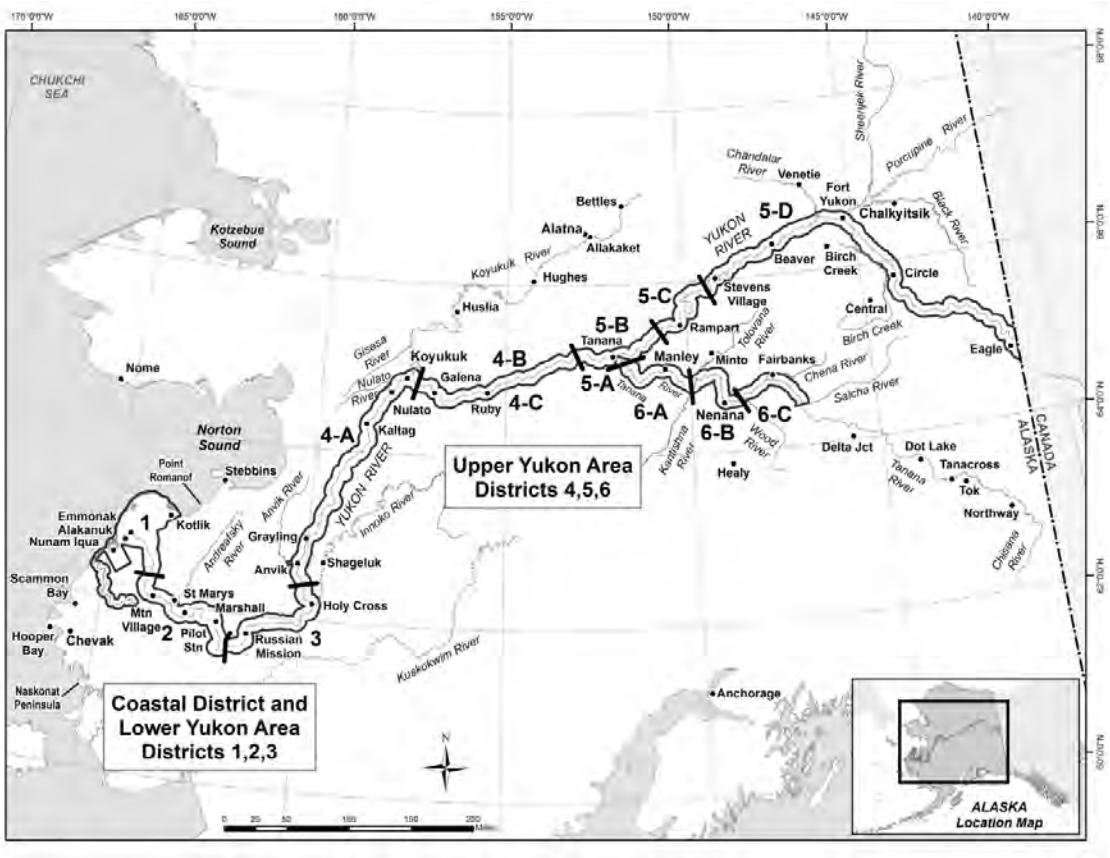
Table 3.7-3 Salmon Spawning Run Periods within Major Drainages of the Proposed Project Area

Species / Major Drainage	May			June			July			August			September			October			November			December		
Chinook																								
Yukon																								
Tanana																								
West Susitna																								
Sockeye																								
Yukon																								
Tanana																								
West Susitna																								
Coho																								
Yukon																								
Tanana																								
West Susitna																								
Pink (even years)																								
Yukon																								
Tanana																								
West Susitna																								
Chum																								
Yukon																								
Tanana																								
West Susitna																								

Source: ADF&G, 2011a
Light grey = salmon present
Dark grey = peak availability

Restrictions to subsistence salmon fishing opportunity in the Yukon River drainage, because of poor Chinook salmon runs since 2007, have limited their harvest in recent years (Estensen *et al.,* 2015). The most recent 5 year averages (2009-2013) of reported subsistence harvested salmon species from portions of Subdistricts 5-C and 5-D and the South Fork of the Koyukuk River were 3,015 Chinook, 936 summer chum, 18,588 fall chum, and 99 coho (Estensen *et al.,* 2015; Figure 3.7-4). Of the non-salmon species, whitefish and Arctic grayling made up approximately 56 and 20 percent, respectively, of the total catch for the same area (Estensen *et al.,* 2015). Subsistence fishery schedules for salmon are consistent with migratory timing as the run progresses upstream with fall subsistence fishing for Subdistrict 5-C beginning mid-August (Estensen *et al.,* 2015).

Figure 3.7-4 Map of the Alaska Portions of the Yukon River Drainage Showing Communities and Fishing Districts



Source: Estensen *et al.*, 2015

Fall chum salmon runs for the Yukon area have been mostly average to above average since 2005 and sufficient for meeting escapement and subsistence needs while providing for a limited commercial harvest (with the exceptions of 2009 and 2010) (Estensen *et al.*, 2015). Between 2009 and 2013, an average of 1,569 fall chum salmon were commercially harvested annually from the Yukon Subdistrict 5-C (Estensen *et al.*, 2015). The fall chum commercial fishing period typically occurs in mid-August (Estensen *et al.*, 2015).

Fishing closures and gear restrictions have been enacted throughout the Yukon River drainage during the Chinook and summer chum salmon migrations to conserve Chinook salmon (Estensen *et al.*, 2015). Chinook and summer chum salmon exhibited poor run strength during 2000, 2001, and 2008 to 2014 (Estensen *et al.*, 2015). The commercial sale of Chinook salmon from the Yukon River drainage was prohibited in 2012; in 2014, commercial harvest of all salmon (Chinook, summer, and fall chum and coho) in District 5C was closed (Estensen *et al.*, 2015). The most recent 5-year average for Alaskan harvest of Yukon River Chinook salmon is approximately 20 percent of the historic long-term average (Schmidt *et al.*, 2015). Chinook salmon returning to the Yukon River are currently classified as a "Stock of Yield Concern" and the ADF&G has

recommended the continuation of this classification to the 2015 Alaska Board of Fisheries (Schmidt *et al.,* 2015).

In general, sport fish salmon in the Yukon River drainage is minor compared to commercial and subsistence harvests (Behr *et al.,* 2015). The recent 5-year (2009–2013) average Yukon River drainage sport salmon harvest was estimated at 464 Chinook, 669 summer chum and 554 coho salmon (Estensen *et al.,* 2015). Sport harvest in the Yukon River drainage is dominated by Arctic grayling, Northern pike, and sheefish (Behr *et al.,* 2015). Fishing pressure is generally light and there are widespread opportunities throughout this region to fish for Arctic grayling, Dolly Varden, Northern pike, burbot, and lake trout (Behr *et al.,* 2015). Broad whitefish and Bering cisco are also important fisheries in the southern Yukon River drainage.

3.7.6.4.2. Tanana River

The Tanana River drains an area of approximately 45,155 mi^2 and is the second largest tributary system that feeds the Yukon River. The main branch of the Tanana River is a glacial river flowing northwest for 570 miles to the Yukon River and formed by the confluence of the Chisana and Nabesna rivers near Tok and the Alaska-Canada border. Important tributary streams to the Tanana River include the Tolovana, Chatanika, and Nenana rivers. These waters are specified as supporting anadromous fish and therefore provide EFH within the proposed Project corridor (Johnson and Litchfield, 2015b).

The proposed Project would cross the Tanana River within the Lower Tanana Management Area and would occur within ADF&G Yukon River Subdistrict 6-B. There are 18 fish species native to the Tanana River drainage. Chinook salmon, coho salmon, Arctic grayling, burbot, lake trout, and Northern pike are the species most sought after by sport anglers in this area (Brase and Baker, 2015). Fish species present, but not often targeted by sport anglers, include chum salmon, Dolly Varden, sheefish, least cisco, humpback, broad, and round whitefish, longnose suckers, Alaska blackfish, lake chub, slimy sculpin, and Arctic lamprey (Brase and Baker, 2015). In addition, although rainbow trout are not native to the Tanana River drainage, the ADF&G raises them in hatcheries and stocks many locations in the Tanana River drainage. Native hatchery raised Arctic char, coho salmon, Chinook salmon, and Arctic grayling are also stocked in selected waters of the Tanana River drainage (Brase and Baker, 2015).

Commercial and subsistence harvest of Chinook, chum, and coho salmon occurs along the Tanana River, with commercial and subsistence fishing periods typically opened concurrently. Run times for spawning salmon on the Tanana River occur in July for Chinook salmon, September to November for coho salmon, and June to November for chum salmon (Table 3.7-3). Summer commercial fishing periods usually occur in late July and into August, depending on run strength and buyer capacity. The first fall season commercial chum salmon fishing period normally occurs in early to mid-September. The most recent 5-year average (2009 to 2013) of commercial salmon

harvested in Subdistrict 6-B was 4,899 summer chum, 13,122 fall chum, and 5,315 coho (Estensen *et al.*, 2015).

As a subsistence resource, an average of 842 Chinook salmon, 9,818 summer chum salmon, 12,338 fall chum salmon, and 6,314 coho salmon were harvested annually (2009 to 2013) in Yukon River District 6 (lower Tanana River) (Estensen *et al.*, 2015). Important subsistence fisheries for whitefish also occur in this area, with a reported average harvest of 3,112 whitefish for the same time period (Estensen *et al.*, 2015).

Sport fishing in the Tanana River drainage occurs throughout the year as angler's fish through the ice on stocked lakes and in the rivers for burbot and Northern pike. Rivers important for sport fishing in or near the proposed Project Area include Chatanika and Nenana Rivers. Harvest of pike is significant at the confluence of Goldstream Creek and Chatanika River from February through March during aggregation of larger females (ADEC, 2015). This area is an identified special harvest area for pike, which requires an ADF&G subsistence use permit with harvest restrictions; there are very few other such locations in the state with this level of pike management interest (ADEC, 2015). This is a congregating area for large pre-spawning female pike, which will later disperse throughout the Minto Lakes area (ADEC, 2015). The most recent 5-year average harvest (2008 to 2012) for winter subsistence Northern pike is 528 fish from an average number of 47 permit holders (Brase and Baker, 2015). In addition, the Minto Flats State Game Refuge encompasses the lower reaches of the Tolovana and Chatanika Rivers and borders the Tanana River. This refuge was established in 1988 to ensure the protection and enhancement of habitat, the conservation of fish and wildlife, and to guarantee the continuation of public uses within the area.

3.7.6.5. Southcentral Region

In the Southcentral Region, the proposed Project route traverses the area south of the Alaska Range within the Chulitna River, Susitna River, and Little Susitna River drainages. More anadromous stream crossings occur in the Southcentral Region than in the Interior and Arctic regions combined. A total of 51 waterbodies crossed by the proposed Project alignment support anadromous fish species in this region and provide EFH for Chinook, chum, coho, pink, and sockeye salmon. An additional six waterbodies along the Mainline and access road crossings in this region have been nominated for inclusion in the AWC by ASAP fish biologists (see Appendix J). Run times for spawning salmon on the Susitna River primarily occur from May to August for Chinook salmon, June to early October for sockeye salmon, July to early October for coho salmon, July to August on even years for pink salmon, and July to September for chum salmon (Table 3.7-3). Non-EFH fish species commonly occurring within the Susitna River drainage include Arctic graying, rainbow trout, Dolly Varden, burbot, eulachon, longnose sucker, threespine and ninespine stickleback, as well as several species of whitefish, lamprey, and sculpin (AGDC, 2015a). Northern pike are common in numerous lakes and streams south of the Alaska Range, though they are considered invasive in Cook Inlet freshwaters (Brase and Baker, 2015).

The proposed Project Area lies within the ADF&G sport fish Northern Cook Inlet Management Area (NCIMA), with the proposed Project route primarily traversing the Eastside Susitna Management Unit (ESMU) then terminating within the Knik Arm Unit. (Little Susitna River drainage) (Oslund *et al.*, 2013). From 1977 to 2011, an annual average of 195,553 fish were harvested by anglers fishing NCIMA waters (Oslund *et al.*, 2013). Coho salmon, rainbow trout, and Chinook salmon accounted for 32, 17, and 12 percent of the average harvest from 1977 to 2011 in the NCIMA (Oslund *et al.*, 2013). The Little Susitna River supports a major Chinook salmon fishery as well as the largest coho salmon fishery in the NCIMA (Oslund *et al.*, 2013).

Popular Chinook salmon sport fisheries within this area include Willow, Little Willow, Caswell, Sheep, Goose, Greys, and Montana creeks, and the Kashwitna River, all of which receive relatively high sport angling effort due to access from the Parks Highway. Several subsistence fisheries have been documented in the Susitna drainage (BLM, pers. comm., 2012).

Chinook and coho salmon have been identified in the upper reaches of the Chulitna River, in the broad pass area of the Southcentral Region (Johnson and Litchfield, 2015c). The Chulitna River provides important Chinook salmon spawning habitat and escapement numbers show the Chulitna River to be one of the most important east side Susitna River tributaries in the proposed Project Area (AGDC, 2015a citing Bentz, 1982).

3.7.6.5.1. Susitna River

The Susitna River originates from glaciers of the Alaska and Talkeetna Mountain ranges and flows about 200 miles in a southerly direction before entering the Cook Inlet across from Anchorage. Chinook salmon have been documented in the Susitna River drainage as far as above Devil's Canyon, east of Denali State Park (BLM, pers. comm., 2012). However, the lower Susitna River drainage system supports extensive and diverse recreational fisheries for the five species of Pacific salmon. The lower Susitna drainage area also has the most aggressive lake stocking program in the state, where more than 90 of the area lakes are stocked with rainbow trout, Arctic grayling, Arctic char, landlocked coho, and Chinook salmon (ADF&G, 2016i). The two most sought-after salmon species are the Chinook and coho salmon. Chinook spawning runs peak during June and July; sockeye runs peak in July and August; and coho runs peak during August of each year (Table 3.7-3). Pink salmon are primarily dominant during even year runs, but are also present in odd years. Excellent fishing opportunities also occur for wild stocks of rainbow trout, Dolly Varden, Arctic grayling, and Northern pike (ADF&G, 2016i). Limited sport fishing opportunities occur for burbot, Arctic char, and lake trout in nearby lakes.

The ESMU accounted for 27 percent of the average NCIMA harvest during 1977 to 2011 with coho salmon, Chinook salmon, pink salmon, rainbow trout, and Arctic grayling dominating the harvest (Oslund *et al.*, 2013). Southcentral salmon stocks of concern

within the proposed Project Area include Willow and Goose Creek Chinook salmon, as well as Susitna River sockeye salmon (Oslund *et al.,* 2013).

No commercial or subsistence fisheries exist in the freshwaters of the Susitna River drainage, though there are commercial sport fishing guides (Powers and Sigurdsson, 2016). A freshwater eulachon (hooligan) Personal Use dip net fish exists in the Susitna River from April 1 through June 15. The proposed Project would parallel the Susitna River where this Personal Use fish occurs.

3.7.7. Fish Stocks of Concern

The proposed Project route would cross six streams containing State of Alaska-designated "Stocks of Concern" (Table 3.7-4). Three levels of concern (yield, management, and conservation) with yield being the lowest level of concern and conservation the highest level of concern are defined under the Policy for the Management of Sustainable Salmon Fisheries (5 AAC 39.222, effective 2000, amended 2001).

Chinook salmon returning to the Yukon River are currently classified as a "Stock of Yield Concern" and the ADF&G has recommended the continuation of this classification to the 2015 Alaska Board of Fisheries (Schmidt *et al.*, 2015). Southcentral salmon stocks of concern within the proposed Project Area include Chinook salmon in Willow, Goose, and Sheep creeks, as well as Susitna River Sockeye salmon (Oslund *et al.,* 2013).

Table 3.7-4 Alaska Fish Stocks of Concern for Streams Impacted by the ASAP Project

System	Species	Area	Year Designated	Level of Concern	Year Last Reviewed
Susitna River Drainage	Sockeye	Cook Inlet	2007	Yield	2010
Chulitna River	Chinook	Cook Inlet	2010	Management	2010
Willow Creek	Chinook	Cook Inlet	2010	Yield	2010
Goose Creek	Chinook	Cook Inlet	2010	Management	2013
Sheep Creek	Chinook	Cook Inlet	2013	Management	2013
Yukon River	Chinook	Yukon	2000	Yield	2012

Sources: Oslund *et al.*, 2013; Schmidt *et al.*, 2015

3.7.8. Aquatic Nuisance Species

The ADF&G has identified several ANS of concern, identifying them as high priority threats (ADF&G, 2002). The designation as a "Priority Species" means that the ANS is considered a significant threat to Alaskan waters and requires immediate or continued management action to minimize the impact on existing ecosystems (ADF&G, 2002). In Southcentral, illegally introduced pike are considered the highest priority threat. Pike have changed the balance of aquatic ecosystems and have caused widespread measurable damage to resident species (primarily rainbow trout and grayling) (ADF&G, 2002). They also have the potential to impact coho salmon stocks in the Susitna River drainage (ADF&G, 2002). Within the proposed Project Area, invasive Northern pike have been reported in Susitna River tributaries and the Little Susitna River (ADF&G, 2016g,h). Other aquatic invasive species that are known to exist in proximity to the proposed Project route and may be present within or near fish streams crossed by the Project include plants (water weed [*Elodea* sp.], reed canary grass [*Phalaris arundinacea*]), invertebrates (New Zealand mudsnail [*Potamopyrgus antipodarum*] and Zebra mussels [*Dreissena polymorpha*]), and a parasite (*Myxobolus cerebralis*) known to cause whirling disease in salmon and trout (AKNHP, 2011a).

3.8. Marine Mammals

3.8.1. Introduction

The description of marine mammals resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

This section discusses the marine mammals that are not listed as endangered, threatened, or candidate species under the ESA of 1973, that may occur within or adjacent to the proposed Project Area. The ESA-listed and candidate species are included in Section 3.10, Threatened and Endangered Species. Specifically, the following information has been updated:

- The Port of Anchorage is no longer under consideration for the development of the proposed Project; all Cook Inlet species have been removed from analysis,
- NMFS released the 2014 Alaska Marine Mammal Stock Assessments, and
- NMFS Aerial Surveys of Arctic Marine Mammals (ASAMM) data has been incorporated in northern species accounts.

3.8.2. Regulatory Setting

All marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972 as amended. The MMPA prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. NMFS has regulatory authority for all marine mammals relevant to the proposed Project with the exception of the sea otter, Pacific walrus, and the polar bear, which are under USFWS responsibility.

Marine mammals that are listed as a strategic stock are defined by the MMPA:

- For which the level of direct human-caused mortality exceeds the potential biological removal level;
- As a species, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or
- As species listed as a threatened or endangered species under the ESA, or is designated as depleted under the MMPA.
    - "Threatened" is defined under the ESA as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (NOAA, 2014).
    - "Endangered" is defined under the ESA as "any species which is in danger of extinction throughout all or a significant portion of its range" (NOAA, 2014).

- "Depleted" is define by the MMPA (NOAA, 2014) as:

  Any case in which the Secretary, after consultation with the Marine Mammal Commission and the Committee of Scientific Advisors on Marine Mammals established under MMPA title II, determines that a species or population stock is below its optimum sustainable population; a state, to which authority for the conservation and management of a species or population stock is transferred under section 109, determines that such species or stock is below its optimum sustainable population; or a species or population stock is listed as an endangered species or a threatened species under the ESA.

The affected environment species by proposed Project Area are discussed below.

3.8.3. Summary

The MMPA protects all marine mammal species that could occur in the proposed Project Area. The species, primary habitat, season of occurrence, incidence to specific port, and the preliminary findings summary of each species are included in Table 3.8-1.

Table 3.8-1 Non-Endangered and Non-Threatened Marine Mammals that May Occur in or Near the Proposed Project Area

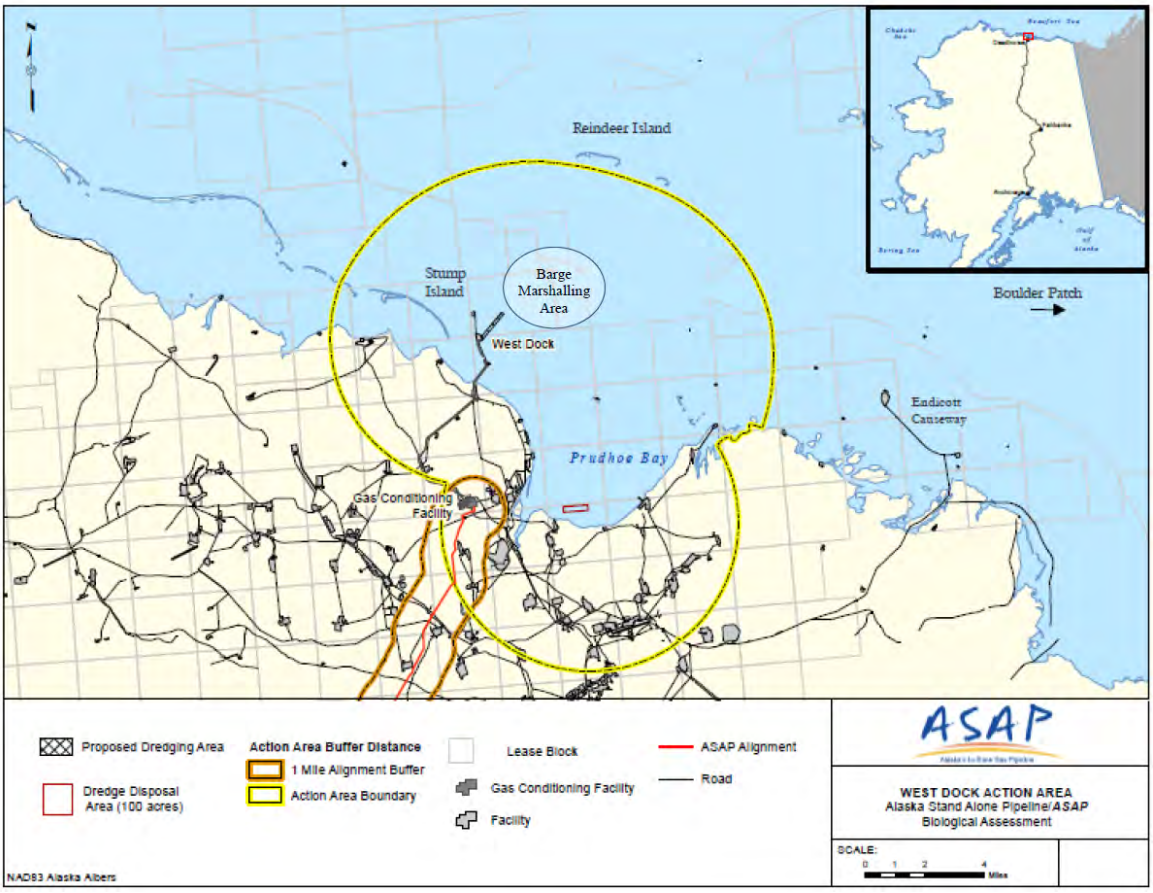
Species	Occurrence in or Adjacent to Project Area	Primary Habitat	Primary Season of Use
West Dock Port			
Gray whale (*Eschrichtius robustus*)	May Occur	Shallow Coastal	Summer
Beluga whale (*Delphinapterus leucas*)	Unlikely	Coastal & Offshore Near Ice	Summer
Killer whale (*Orcinus orca*)	Unlikely	Coastal & Offshore	Summer
Port of Seward			
Harbor seal (*Phoca vitulina*)	May Occur	Haul Out Areas	Year-round
Northern sea otter (*Enhydra lutris kenyoni*)	May Occur	Inshore Coastal	Year-round
Minke whale *Balaenoptera acutorostrata*)	May Occur	Inshore & Offshore	Summer
Gray whale (*Eschrichtius robustus*)	Unlikely	Inshore Coastal	Summer
Killer whale (*Orcinus orca*)	May Occur	Fjords, Coastal & Offshore	Year-round
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	Unlikely	Deep Water	Year-round
Dall's porpoise (*Phocoenoides dalli*)	Unlikely	Deep Water	Year-round
Harbor porpoise (*Phocoenoides phocoena*)	Unlikely	Shallow Water	Year-round

3.8.4. Affected Communities

Since the publication of the 2012 FEIS, revisions have been made to the proposed Project necessitating an SEIS that assesses the new Project components. As described in the introduction, above, recent Project revisions affect the northern portion of the proposed

Project Area (Figure 3.8-1), but do not affect the southern-most Project Area located at the Port of Seward. The Port of Anchorage is no longer within the plan of development, and therefore, there is no need to discuss Cook Inlet species in this section. For completeness, the southern proposed Project Area and species therein have been considered previously and evaluated in the 2012 FEIS.

Figure 3.8-1 Northern Portion of Proposed Project Area Boundary, West Dock



The proposed Project Area is defined as the area in which direct and indirect effects of the action to marine mammal species may occur. The area directly affected by the proposed Project includes the total footprint of the GCF, the pipeline ROW, access roads, and associated permanent and construction support facilities inland from the Beaufort Sea coast. The proposed Project Area at the Port of Seward is an area ¼-mile seaward from the existing ship docking facilities. The proposed Project Area for the sealift and module offload at West Dock in Prudhoe Bay is shown in Figure 3.8-1 and includes West Dock, the navigational channel, and the dredge disposal site summarized in the ASAP West Dock Dredge and Disposal Plan (AGDC, 2016o), as well as any road improvements and gravel pads to be constructed to support the transportation and construction of the GCF. Module transportation from West Dock to the GCF construction site would occur in the summer via the causeway and established land roads encompassed in the

proposed Project Area shown in Figure 3.8-1. Transportation to the winter dredge disposal area(s) is also captured in the proposed Project Area shown in Figure 3.8-1. The area indirectly affected by the proposed Project is delineated by a zone of influence surrounding new infrastructure within which listed species may be affected by disturbance resulting from construction activities and Project operations.

3.8.4.1. Port of Seward Construction

The southern portion of the proposed Project Area for the Port of Seward has not changed. In order to focus efforts of this SEIS on the aspects of the proposed action that are likely to affect marine mammal species within the proposed Project Area, the geographic areas evaluated focus on changes to the Project, and updated species information. Mitigation measures for marine mammals potentially affected by Port of Seward construction activities and Project-related vessel movements, including the harbor seal, northern sea otter, minke whale, gray whale, killer whale, Pacific white-sided dolphin, Dall's porpoise, and harbor porpoise, are included in Chapter 4 and Appendix M. The Steller sea lion also occurs near the Port of Seward. The Eastern Distinct Population Segment (DPS) of the Steller sea lion is not listed; however, it is discussed in Section 3.10, Threatened & Endangered Species, with the Western DPS Steller sea lion, for the ease of the reader.

3.8.4.2. West Dock Construction

West Dock extends approximately 2.7 miles from shore of Prudhoe Bay into the Beaufort Sea (Figures 2.2-3 and 2.2-4 in Chapter 2). West Dock is used regularly to support oil development in the Prudhoe Bay area. Specifically, West Dock is planned to be the primary port for offload of modules during August and September.

Marine construction at West Dock would be required to accommodate the 23-barge lift, as well as module offload and supporting activities. West Dock infrastructure and roads would require modification to accommodate the modules and deliver them to the GCF location. The existing causeway between Dock Head 3 (DH3) and HD2 would not support the tonnage of the large modules. Therefore, a temporary bridge constructed from ballasted barges would be put in place and utilized to bypass the causeway during module offload. Prior to arrival of the barges, winter dredging and screeding of an existing channel would be required to accommodate the barge depth; dredging is proposed for the winter prior to offload. Modifications would be made to the existing dock infrastructure as described in Chapter 2, Project Description.

Improvements at West Dock would begin during the winter pre-construction period, and continue into the first summer season, through the following winter (dredging the navigation channel and turning basin), and be completed the next summer with sea lift construction.

All construction activities would comply with regulatory requirements of NMFS and USFWS for operations at those associated port sites. Potential impacts from West Dock

construction activities are described under the environmental consequences for each marine mammal below. Mitigation measures for marine mammals potentially affected by West Dock construction activities, including the ringed seal, Beaufort Sea beluga whale, grey whale, and killer whale are included in this section.

3.8.5. Marine Mammal Description by Proposed Project Area

Summaries of marine mammals that have the potential to exist in or adjacent to the proposed Project Areas are described below under the port area where they could occur. The information used to write the summaries below, was obtained primarily from the 2012 FEIS, NOAA Fisheries Office of Protected Resources online information, and NOAA Marine Mammal Stock Assessment Reports. The potential for the species to occur in or adjacent to the proposed Project Area was categorized as likely, unlikely, or may occur from documentation noted above (Table 3.8-1). Categorizing a species as "likely" to occur in the proposed Project Area was determined when regular habitat use and distribution overlapped with the proposed Project Area. A species was categorized as "unlikely" to occur in the proposed Project Area if the species does not inhabit the area. Categorizing a species that "may occur" in or adjacent to the proposed Project Area would include some habitat use in the area; the species is not common to the area, but low numbers could exist near the proposed Project Area.

3.8.5.1. Southern Project Area - Port of Seward

The Port of Seward is located at the north end of Resurrection Bay in the Gulf of Alaska (Figure 3.8-2). All marine mammals identified by NMFS that may occur in or adjacent to the proposed Project Area at the Port of Seward are described below. ESA species including the fin whale, humpback whale, and Steller sea lion are discussed further in Section 3.10, Threatened and Endangered Species.

3.8.5.1.1. Harbor Seal

Harbor seals are true seals that are widely distributed across the North Pacific and North Atlantic Oceans. Detailed stock definition and distribution information can be found in the most current Alaska Marine Mammal Stock Assessments (Allen and Angliss, 2015). The following information is taken directly from the document.

Harbor seals inhabit coastal and estuarine waters off Baja California, north along the western coasts of the U.S., British Columbia, and Southeast Alaska, west through the Gulf of Alaska and Aleutian Islands, and in the Bering Sea north to Cape Newenham and the Pribilof Islands. They haul out on rocks, reefs, beaches, and drifting glacial ice, and feed in marine, estuarine, and occasionally fresh waters. Harbor seals generally are non-migratory, with local movements associated with such factors as tides, weather, season, food availability, and reproduction (Scheffer and Slipp, 1944; Fisher, 1952; Bigg 1969, 1981; Hastings *et al.,* 2004). The results of recent satellite tagging studies in Southeast Alaska, Prince William Sound (PWS), and Kodiak are also consistent with the conclusion that harbor seals are non-migratory (Swain *et al.,* 1996; Lowry *et al.,* 2001;

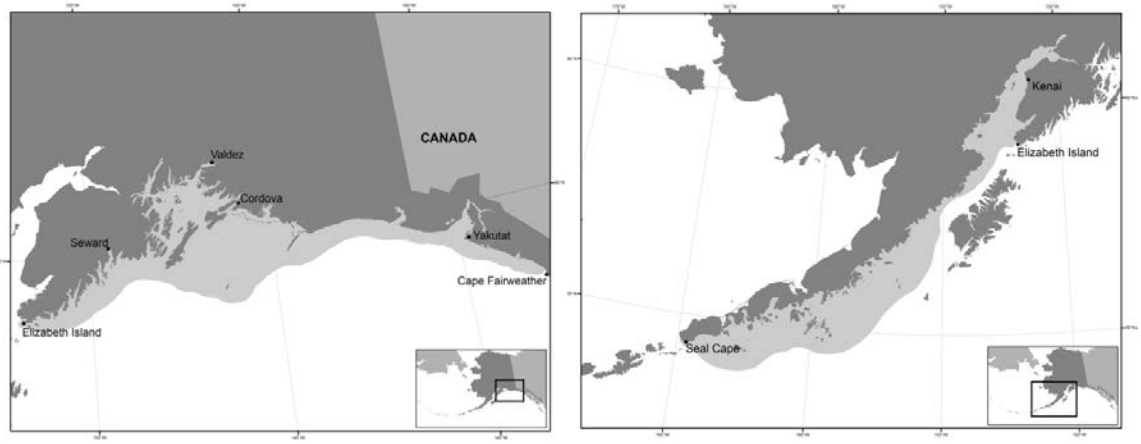
Small *et al.,* 2003). However, some long-distance movements of tagged animals in Alaska have been recorded (Pitcher and McAllister, 1981; Lowry *et al.,* 2001; Small *et al.,* 2003). Strong fidelity of individuals for haul-out sites during the breeding season has been documented in several populations (Härkönen and Harding, 2001), including in Alaska (Pitcher and McAllister, 1981; Small *et al.,* 2005). Harbor seals have declined dramatically in some parts of their Alaska Range over the past few decades, while in other parts, their numbers have increased or remained stable over similar time periods, suggesting areas with independent population dynamics (O'Corry-Crowe *et al.,* 2003).

NMFS and their co-management partner, the Alaska Native Harbor Seal Commission divided Alaska harbor seals into 12 separate stocks in 2010 based largely on the genetic evidence, population trends, observed harbor seal movements, and traditional Alaska Native use areas. The 12 stocks of harbor seals identified in Alaska include:

1. The Aleutian Islands stock;
2. The Pribilof Islands stock;
3. The Bristol Bay stock;
4. The North Kodiak stock;
5. The South Kodiak stock;
6. The PWS stock;
7. The Cook Inlet/Shelikof stock;
8. The Glacier Bay/Icy Strait stock;
9. The Lynn Canal/Stephens stock;
10. The Sitka/Chatham stock;
11. The Dixon/Cape Decision stock; and
12. The Clarence Strait stock.

The two stocks most likely present within the proposed Project Area are the PWS and Cook Inlet/Shelikof stocks (Figure 3.8-2) (Allen and Angliss, 2015).

Figure 3.8-2 Prince William Sound Stock and the Cook Inlet / Shelikof Stock



Source: NMFS, 2015

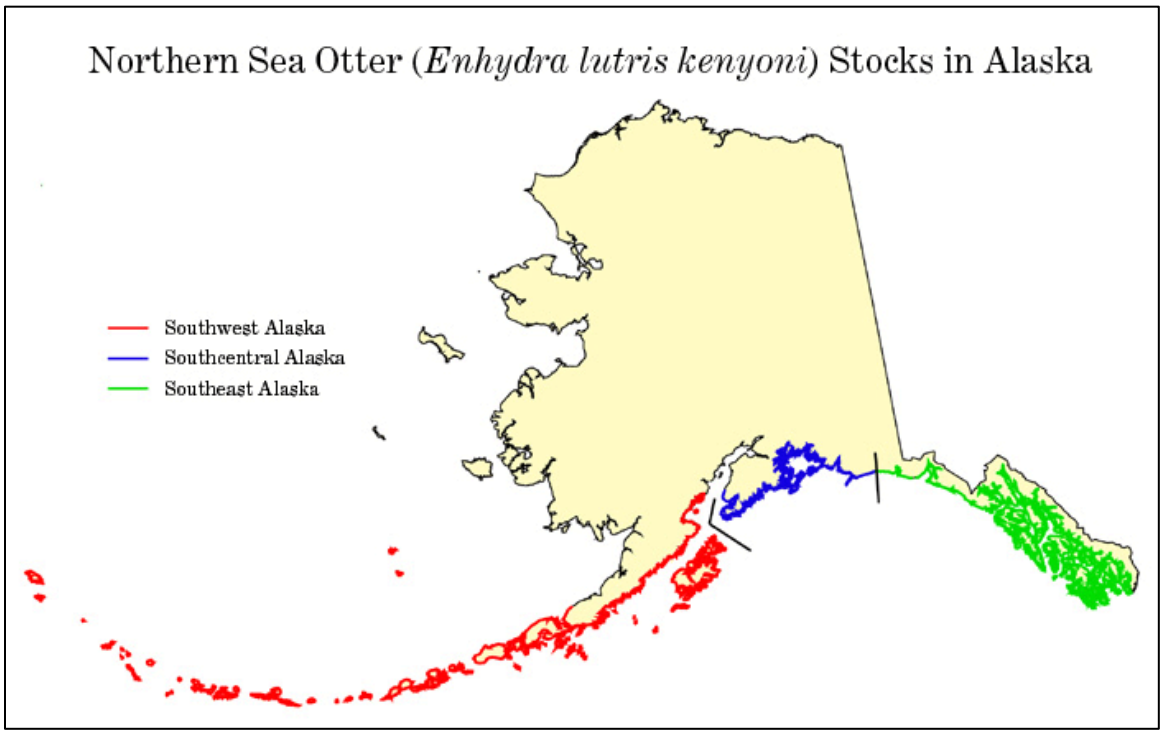
Adult harbor seals are approximately 6 feet long, weigh 245 pounds, and are a blue-gray color with light spots or rings. They primarily eat fish (salmon, eulachon), shellfish, and other invertebrates in shallow and deep-water areas. Harbor seals give birth (pup) during the summer, and use rocks, beaches, ice, and reefs to haul out to rest, to pup, to molt and for thermoregulation.

The harbor seal is one of the most common marine mammals in the Gulf of Alaska. The Gulf of Alaska has numerous fjords, bays, islands, and coastline, which provides optimal habitat for harbor seal haul out areas. The current population estimate for Alaska harbor seals (all 12 stocks) is 152,602 (Allen and Angliss, 2015), and minimum estimates for the PWS stock is estimated at 27,157, and the Cook Inlet / Shelikof stock is 21,896 (Allen and Angliss, 2015).

3.8.5.1.2. Sea Otter

The Northern sea otter measures approximately 4 feet in length and weighs an average of 65 pounds. The sea otter is a densely furred marine mammal that inhabits the nearshore coastal waters from southeast Alaska to the Aleutian Islands. They primarily inhabit waters approximately 40 meters deep to feed on mollusks and crustaceans in the subtidal and intertidal zone. There are three sea otter stocks in Alaska, which include the southeast, south-central, and southwest stocks (Figure 3.8-3).

Figure 3.8-3 Sea Otter Stocks in Alaska



Source: USFWS, 2009b

The Southwest Alaska DPS of the Northern sea otter was listed as threatened on August 9, 2005 (70 FR 152:46366). USFWS designated critical habitat for this population under the ESA of 1973, as amended on October 8, 2009 (74 FR 194:51988). This listed Southwest DPS is well outside of the proposed Project Area. The Southcentral DPS occurs within the proposed Project Area, but is not a federally listed DPS.

Historically, sea otters occurred across the North Pacific Rim, ranging from Japan, north through the Kuril Islands, the Kamchatka Peninsula, the Commander Islands, east across the Aleutian Islands, the Alaska peninsula, Kodiak, Cook Inlet , PWS, and then south through south coastal Alaska and Baja California, Mexico (Kenyon, 1969). The global population was estimated to be between 150,000 (Kenyon, 1969) and 300,000 individuals (Johnson, 1982) in the early 1700s. Prior to large-scale commercial exploitation, indigenous people of the North Pacific utilized sea otters for subsistence. In 1741, following the arrival in Alaska of Russian explorers, extensive commercial harvest over the next 150 years resulted in the near extirpation of the species (Allen and Angliss, 2015).

The current population estimate for the southcentral Alaska stock of Northern sea otter is 12,774; the 2002 Glacier Bay estimate, combined with adjusted estimates for the remainder of the stock, provided a total assessment of 10,563 sea otters for the southeast Alaska stock; the southwest Alaska stock (threatened) is estimated at 47,676 individuals (Allen and Angliss, 2015).

The current population trend for the southeast Alaska stock is believed to be stable; the population trend for the southcentral stock is increasing; overall sea otter population in southwest Alaska has declined by more than 50 percent since the mid-1980s; USFWS states the overall population trend for the southwest Alaska stock is believed to be declining (Allen and Angliss, 2015).

As defined in Allen and Angliss (2015):

> *The ranges of these stocks are defined as follows: (1) Southeast Alaska stock extends from Dixon Entrance to Cape Yakataga; (2) Southcentral Alaska stock extends from Cape Yakataga to Cook Inlet including Prince William Sound, the Kenai Peninsula coast, and Kachemak Bay; and (3) Southwest Alaska stock includes the Alaska Peninsula and Bristol Bay coasts, and the Aleutian, Barren, Kodiak, and Pribilof Islands.*

General information on the biology, food ecology, behavior, and migration of sea otters can be found at the ADF&G website: http://www.adfg.alaska.gov/index.cfm?adfg=seaotter.main. More detailed information is available from the USFWS (2010b) Draft Sea Otter Recovery Plan.

Predation has been shown to contribute to the natural mortality of sea otters; predators include bald eagles, sharks, fox, and killer whales.

The south-central sea otter stock would be the likely stock to coincide with vessel route activity; however, sea otters primarily associate with protected near-shore areas. The Northern sea otter is not typically migratory. Southwestern sea otter populations could potentially come in contact with proposed vessel activity, although unlikely, as these stocks reside along the western shore of Cook Inlet outside the proposed Project Area.

Approximately 5,855 mi^2 of marine waters were designated as critical habitat for the Southwestern DPS. This area occupies the western side of Cook Inlet to the Aleutian Islands (USFWS, 2009b) and is outside of the proposed Project Area.

3.8.5.1.3. Minke Whale

Minke whales are the smallest species of the baleen whales. Detailed stock definition and distribution information can be found in the most current Alaska Marine Mammal Stock Assessments (Allen and Angliss, 2015). The following information is taken directly from the document.

In the North Pacific, minke whales occur from the Bering and Chukchi Seas south to near the equator (Leatherwood *et al.,* 1982). The following information was considered in classifying stock structure according to the Dizon *et al.,* (1992) phylogeographic approach: 1) Distributional data: geographic distribution continuous, 2) Population response data: unknown; 3) Phenotypic data: unknown; and 4) Genotypic data: unknown. Based on this limited information, in 1991 the International Whaling Commission (IWC) recognized three stocks of minke whales in the North Pacific: one in the Sea of Japan/East China Sea, one in the rest of the western Pacific west of the

180° meridian, and one in the "remainder" of the Pacific (Donovan, 1991). The "remainder" stock designation reflects the lack of exploitation in the eastern Pacific and does not indicate that only one population exists in this area (Donovan, 1991). In the "remainder" area, minke whales are relatively common in the Bering and Chukchi Seas and in the inshore waters of the Gulf of Alaska (Mizroch, 1992), but are not considered abundant in any other part of the eastern Pacific (Leatherwood *et al.,* 1982; Brueggeman *et al.,* 1990). Minke whales are known to penetrate loose ice during the summer, and some individuals venture north of the Bering Strait (Leatherwood *et al.,* 1982).

These whales have dark, sleek bodies with white undersides that can reach up to 35 feet in length and 20,000 pounds in weight. They usually occur in small groups of two to three when feeding, but can occur in loose aggregations of up to 400 whales. Minke whales feed primarily on plankton, crustaceans (krill), and small fish (herring, capelin, sand lance, and cod). Minke whales calve in the winter, and mother and calf pairs remain in the lower latitude areas of their range during the overwinter period (Reeves *et al.,* 2002; Jefferson *et al.,* 2008; Shirihai and Jarrett, 2006).

Minke whales have a wide distribution of habitat, from polar (summer) to tropical (winter), and coastal and offshore waters. Older whales migrate higher in latitude to feed during the summer, and immature whales stay in lower latitude areas. There is insufficient data available to determine an accurate population estimate of the Alaska stock of minke whales (Allen and Angliss, 2015). However, the most recent minke whale abundance was estimated to be 1,233 for the Gulf of Alaska to the Central Aleutian Islands (Zerbini *et al.,* 2006a) and is considered provisional by NMFS (Allen and Angliss, 2015).

3.8.5.1.4. Gray Whale

Gray whales are a species of baleen whale, and are the only species in the family *Eschrichtiidae* (Jones and Swartz, 2002). Detailed Eastern North Pacific (ENP) stock definition and distribution information can be found in the most current U.S. Pacific Marine Mammal Stock Assessments (Carretta *et al.,* 2015). The following information is taken directly from the document.

Genetic comparisons indicate there are distinct ENP and Western North Pacific (WNP) population stocks, with differentiation in both mitochondrial DNA (mtDNA) haplotype and microsatellite allele frequencies (LeDuc *et al.,* 2002; Lang *et al.,* 2011; Weller *et al.,* 2013).

During summer and fall, most whales in the ENP population feed in the Chukchi, Beaufort, and northwestern Bering seas. An exception to this is the relatively small number of whales (approximately 200) that summer and feed along the Pacific coast between Kodiak Island, Alaska and northern California (Darling, 1984; Gosho *et al.,* 2011; Calambokidis *et al.,* 2012), referred to as the "Pacific Coast Feeding Group." Three primary wintering lagoons in Baja California, Mexico are utilized, and some females are known to make repeated returns to specific lagoons (Jones, 1990). Genetic substructure

on the wintering grounds is indicated by significant differences in mtDNA haplotype frequencies between females (mothers with calves) using two of the primary calving lagoons and females sampled in other areas (Goerlitz *et al.,* 2003). Other research identified a small, but significant departure from panmixia [random mating in a breeding population] between two of the lagoons using nuclear data, although no significant differences were identified using mtDNA (Alter *et al.,* 2009).

Tagging, photo-identification, and genetic studies show that some whales identified in the WNP off Russia have been observed in the ENP, including coastal waters of Canada, the U.S. and Mexico (Lang, 2010; Mate *et al.,* 2011; Weller *et al.,* 2012; Urbán *et al.,* 2013; Mate *et al.,* 2015). In combination, these studies have recorded 27 gray whales observed in both the WNP and ENP. Despite this overlap, significant mtDNA and nDNA differences are found between whales in the WNP and those summering in the ENP (Lang *et al.,* 2011).

The gray whale is a large baleen whale with a mottled gray color, and has small eyes. They can grow up to 50 feet long and weigh 80,000 pounds. They are benthic filter feeders that sift through mud on the sea floor to feed on amphipods. Unlike most other whales, gray whales do not have a dorsal fin, but possess a dorsal hump. Gray whales travel solitary or in small groups; however, they have been found in large groups on breeding grounds or in concentrated feeding areas. Gray whales feed in shallow (less than 60 m) coastal waters (Moore and DeMaster, 1997; Jones and Swartz, 2002); their summer feeding areas are primarily found along the shelf in the northern and western Bering and Chukchi seas. This species winters off the west coast of Baja, California. Gray whales calve in lagoons typically less than 4 meters deep along the west coast of California in January and February before migrating north to Alaskan waters (Jones and Swartz, 2002).

The ENP population was delisted from the T&E species list in 1994 as a result of the rebounding population size (NMFS, 1994). The most recent abundance estimate (2010–2011) for the Eastern Pacific stock gray whales is 20,990 (Carretta *et al.,* 2015).

3.8.5.1.5. Killer Whale

Killer whales are medium-sized, toothed whales with black backs and white undersides. They are sexually dimorphic, and males can reach 32 feet long and weigh 22,000 pounds; females can reach 28 feet long and weigh 16,500 pounds (Reeves and Leatherwood, 1994). Detailed stock definition and distribution information can be found in the most current Alaska Marine Mammal Stock Assessments (Allen and Angliss, 2015). The following information is taken directly from the document.

Killer whales have been observed in all oceans and seas of the world (Leatherwood and Dahlheim, 1978). Although reported from tropical and offshore waters, killer whales occur at higher densities in colder and more productive waters of both hemispheres, with the greatest densities found at high latitudes (Mitchell, 1975; Leatherwood and Dahlheim, 1978; Forney and Wade, 2006). Killer whales are found throughout the North

Pacific. Along the west coast of North America, killer whales occur along the entire Alaskan coast (Braham and Dahlheim, 1982), in British Columbia and Washington inland waterways (Bigg *et al.,* 1990), and along the outer coasts of Washington, Oregon, and California (Green *et al.,* 1992; Barlow, 1995, 1997; Forney *et al.,* 1995). Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim, 1982) and in the intracoastal waterways of British Columbia and Washington State, where whales have been labeled as 'resident,' 'transient,' and 'offshore' types (Bigg *et al.,* 1990; Ford *et al.,* 2000; Dahlheim *et al.,* 2008) based on aspects of morphology, ecology, genetics, and behavior (Ford and Fisher 1982; Baird and Stacey 1988; Baird *et al.,* 1992; Hoelzel *et al.,* 1998, 2002; Barrett-Lennard, 2000; Dahlheim *et al.,* 2008). Through examination of photographs of recognizable individuals and pods, movements of whales between geographical areas have been documented. For example, whales identified in PWS have been observed near Kodiak Island (Matkin *et al.,* 1999) and whales identified in Southeast Alaska have been observed in PWS, British Columbia, and Puget Sound (Leatherwood *et al.,* 1990; Dahlheim *et al.,* 1997). Movements of killer whales between the waters of Southeast Alaska and central California have also been documented (Goley and Straley, 1994; Black *et al.,* 1997; Dahlheim and White, 2010).

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the Pacific U.S. Exclusive Economic Zone (EEZ):

1. The Alaska Resident stock -occurring from southeastern Alaska to the Aleutian Islands and Bering Sea;
2. The Northern Resident stock -occurring from Washington State through part of southeastern Alaska;
3. The Southern Resident stock -occurring mainly within the inland waters of Washington State and southern British Columbia, but also in coastal waters from southeastern Alaska through California;
4. The Gulf of Alaska, Aleutian Islands, and Bering Sea Transient stock -occurring mainly from PWS through the Aleutian Islands and Bering Sea;
5. The AT1 transient stock occurring in Alaska from PWS through the Kenai Fjords;
6. The West Coast transient stock occurring from California through southeastern Alaska 'Transient' whales in Canadian waters are considered part of the West Coast Transient stock);
7. The Offshore stock - occurring from California through Alaska; and
8. The Hawaiian stock.

The killer whale diet ranges from fish to marine mammals, depending on whether the population is "resident" or "transient." The ENP resident killer whales feed primarily on salmon (Olesiuk *et al.,* 1990); transient populations in the same region feed on harbor

seals, porpoise, gray whale calves, Steller sea lions, and other whales (Ford and Ellis, 1999; Ford *et al.,* 2000).

Killer whales are highly social and depend heavily on underwater sound for communication, feeding, and orientation. Killer whales have specific vocalization types, and multiple dialects are known to exist within the same population among different pods in the ENP (*i.e.*, residents, transients, and offshore) (Ford *et al.,* 2000). Killer whales have different characteristics of morphology, ecology, genetics, and behavior. Resident and transient whales differ by the shape of the dorsal fin, skin pigmentation, primary prey (fish or marine mammals), and social group size and stability. Transient killer whales have a more erect dorsal fin, a different patterned pigmentation, feed entirely on marine mammals, and form small, and stable long-term social groups as compared to resident killer whales (Ford *et al.,* 2000).

As of 2012, an estimated 121 resident whales are thought to inhabit waters off southeastern Alaska; PWS and Kenai Fjords 'resident' numbers are estimated at 751 (Matkin *et al.,* 2003; Matkin *et al.,* 2010 as reported in Allen and Angliss, 2015).

The minimum population estimate for the Gulf of Alaska, Aleutian Islands, and Bering Sea transient stock of killer whales is 587 animals based on the count of individuals using photo-identification (Allen and Angliss, 2015). AT1 killer whales (transients) were first recognized in 1984 in PWS. Leatherwood *et al.,* (1984) and Heise *et al.,* (1991) documented 22 transient-type whales in PWS; individual whales from this group had been photographed as early as 1978 (von Ziegesar *et al.,* 1986). AT1 killer whales are some of the most frequently sighted killer whales in PWS (Matkin *et al.,* 1993, 1994, 1999). These whales are acoustically and genetically different from other transient killer whale pods, which make the AT1 population discrete from the Gulf of Alaska transients. This killer whale population also has a more limited range (200 miles); however, they have been sighted and identified in Resurrection Bay and Aialik Bay year round (Allen and Angliss, 2015). The population size as of the summer of 2013 is seven whales (C. Matkin, North Gulf Oceanic Society, pers. comm., March 21, 2014 as reported in Allen and Angliss, 2015). There has been no recruitment in this population since 1984 (Matkin *et al.,* 2012). The AT1 transient population of killer whale is considered depleted under the MMPA.

3.8.5.1.6. Pacific White-sided Dolphin

Pacific white-sided dolphins have a robust body with short beaks and a large, curved dorsal fin. Their coloring is typically black with gray sides, dorsal fins, and flippers. Their undersides are white, and they have two long white stripes extending from either side of the beak to the tail. Adult males can reach up to 8 feet long, females are 7.5 feet long, and both males and females can weigh between 300 and 400 pounds. The Pacific white-sided dolphin is an extremely social animal, usually seen in schools of 10 to 100; however, they can occasionally be observed in large groups (thousands). They feed primarily on squid and small fish (capelin, sardines, and herring), and often hunt as a

team to herd prey. Calving occurs in the summer months, and females give birth less than every other year (Reeves *et al.,* 2002).

Pacific white-sided dolphins inhabit temperate waters from the continental shelf to the deeper offshore waters. Two stocks have been identified for this species: the North Pacific stock and the California-Oregon-Washington stock. The North Pacific stock inhabits the offshore and coastal areas from the Gulf of Alaska, to the Aleutian Islands (Allen and Angliss, 2015). The current estimated population for the North Pacific stock is 26,880 (Buckland *et al.,* 1993 as reported in Allen and Angliss, 2015).

3.8.5.1.7. Dall's Porpoise

Dall's porpoise are the fastest swimmers of all cetaceans. They are black or dark gray with white on their dorsal fin, tail, and sides. They can reach up to 8 feet long and weigh up to 480 pounds. There are two morphs of this species; the "truei" is commonly associated with the Western Pacific Ocean stock, and the "dalli" is common in the Eastern Pacific population. Individuals from the two morph types can be distinguished by the position and size of the white thoracic patches. The Dall's porpoise typically form groups of 2 to 20, but can be found in groups numbering in the thousands (Reeves *et al.,* 2002; Shirihai and Jarrett, 2006).

Dall's porpoise feed primarily at night on small fish (herring, smelts, and anchovies), squid, octopus, crabs, and shrimp. They can also dive to depths of 1,640 feet when feeding. This species prefers to inhabit temperate waters more than 600 feet deep. Calving occurs between June and September, and calves remain with their mothers less than a year. Dall's porpoise are present all months of the year throughout their range in the ENP (Reeves *et al.,* 2002; Shirihai and Jarrett, 2006).

Two stocks have been identified within this population: the Alaska stock and the California-Oregon-Washington Stock. The estimated population for the Alaska stock is 83,400; however, survey data for this stock is more than 21 years old and has distribution gaps in Bristol Bay and the northern Bering Sea (Allen and Angliss, 2015).

3.8.5.1.8. Harbor Porpoise

Harbor porpoise have small, dark grey, robust bodies with white undersides, and can reach up to 5.5 feet in length and range from 135 to 170 pounds. They exist in small groups of two to five and feed primarily on small fish (herring, capelin), squid, and octopus. Harbor porpoise inhabit coastal and offshore water in temperate and subarctic regions; however, they are primarily found in shallow bays, fjords, and estuaries (Leatherwood and Reeves, 1978). The range of the harbor porpoise in the ENP Ocean encompasses Point Barrow, along the Alaska coast, and down the west coast of North America to Point Conception, California (Gaskin, 1984). Harbor porpoise primarily frequent coastal waters and in the Gulf of Alaska and Southeast Alaska (Dahlheim *et al.,* 2000, 2009), they occur most frequently in waters less than 100 meters deep (Hobbs and Waite, 2010).

Insufficient sample sizes have led to indeterminate conclusions about the genetic structure of harbor porpoise within Alaska; accordingly, harbor porpoise stock structure in Alaska is unknown at this time. Therefore, three harbor porpoise stocks in Alaska are currently recommended based on geographic boundaries:

1. The Southeast Alaska stock -occurring from the northern border of British Columbia to Cape Suckling, Alaska,
2. The Gulf of Alaska stock -occurring from Cape Suckling to Unimak Pass, and
3. The Bering Sea stock -occurring throughout the Aleutian Islands and all waters north of Unimak Pass (Allen and Angliss, 2015).

The Gulf of Alaska harbor porpoise is the most likely stock located near the proposed Project Area; the latest abundance estimate is 31,046 (Allen and Angliss, 2015).

3.8.5.2. Northern Project Area - West Dock Construction

The West Dock Port is located in Prudhoe Bay in the Beaufort Sea. The polar bear, bowhead whale, Pacific walrus, and bearded seal (*Erignathus barbatus*), which inhabit the proposed Project Area, are discussed in Section 3.10, Threatened and Endangered Species. Four marine mammals are not T&E listed that may occur in or adjacent to the proposed Project Area at West Dock. These include the gray whale, beluga whale, ringed seal, and killer whale. Brief summaries of each species are included below.

3.8.5.2.1. Pacific Walrus

3.8.5.2.1.1. Biological Populations and Listing Status

On September 10, 2009, USFWS announced a finding on a petition to list the Pacific walrus as threatened or endangered under the ESA and to designate critical habitat. USFWS found that the petition presented scientific information indicating that listing a subspecies may be warranted. On February 10, 2011, USFWS designated the Pacific walrus as a candidate for ESA protection. The 12-month finding indicated that, while the Pacific walrus warrants protection under the ESA, there are higher priority species that need to be addressed prior to the walrus. It determined that the walrus' status would be reviewed annually and a proposed rule to protect the species under the ESA would be developed in the future. On October 4, 2017, the USFWS determined that the Pacific walrus does not require protection as threatened or endangered under the ESA. This finding follows a comprehensive review and analysis of the best available scientific information. The Pacific walrus currently has no status under ESA, and a section 7 consultation is not required by federal agencies. However, the Pacific walrus is still protected under the MMPA.

3.8.5.2.1.2. Populations Status, Trends, and Abundance

There is no reliable estimate for the size of the Pacific walrus population. Aerial surveys conducted by the U.S. and Russia between 1975 and 1990 produced population

estimates ranging from 201,039 to 234,020 animals. However, these estimates are considered minimum values and are not suitable for detecting trends in population size (Gilbert *et al.,* 1992).

The number of Pacific walrus surveyed within a 122,860-mi^2 area was estimated at 129,000 with 95 percent confidence limits of 55,000 to 507,000 individuals in 2006 (Speckman *et al.,* 2010). This estimate does not account for areas that were not surveyed, some of which are known to have had walruses present. Therefore, the estimate was negatively biased to an unknown degree (Fay, 1982; Burn *et al.,* 2009) which provides assurance that walrus population size was greater than the estimate (NMFS, 2005). Considering this, more surveys would be required to verify any trends in population size and to quantify such changes.

3.8.5.2.1.3. Range

The Pacific walrus is distributed in Russian and Alaskan waters over the continental shelves of the Chukchi and Bering seas, and ranges in the north from the eastern East Siberian Sea to the western Beaufort Sea. Migrations are directly related to the seasonal advance and retreat of the sea ice (Fay, 1982). Pacific walrus are not frequently found in the Beaufort Sea, but they have been sighted east of Utqiagvik (Clarke *et al.,* 2011) and within the proposed Project Area. Movement and haulout locations are correlated with sea ice distribution (Garlich-Miller *et al.,* 2011) and food availability along the continental self. Reduced summer sea ice over the continental shelf in the Chukchi Sea in the past decade has resulted in increased use of land haul-outs by adult females and young during ice-free periods (Jay and Fischbach, 2008).

3.8.5.2.1.4. Life History and Habitat Use

Walruses feed on benthic macroinvertebrates and prefer to forage in areas less than 262-feet-deep (Fay, 1982). Walruses feed on a wide variety of organisms including worms, snails, clams, marine birds, and seals; but most frequently on clams, snails, and polychaete worms (Fay, 1982; Sheffield and Grebmeier, 2009).

Walruses are found in relatively shallow shelf waters along the pack ice margin where ice concentrations are less than 80 percent (Fay, 1982). This ice-covered, shallow continental shelf is important for walruses, as they use this for rest and for calves incapable of deep or long-term diving (Minerals Management Service [MMS], 2007). Walruses use floating sea ice for birthing, nursing, resting, isolation from predators and for passive transport to new feeding areas (USFWS, 2009b). During summer months, most of the population migrates northward from the Bering Sea through the Bering Strait to summer feeding areas over the continental shelf in the Chukchi Sea (Garlich-Miller *et al.,* 2011).

Walruses have the lowest rate of reproduction of any pinniped species (Fay, 1982). Males reach puberty at 6 to 7 years of age; however, they are unlikely to successfully compete for females until they reach full body size at 15 years of age or older (Fay, 1982;

Fay *et al.,* 1984). Females are sexually mature at 4 to 7 years of age (Fay, 1982; Garlich-Miller *et al.,* 2006). Females typically go into oestrus and mate from January through March. A single calf is typically born in May the following year shortly before, or during, the spring migration (Fay, 1982). Both mothers and newborn calves remain on ice floes until calves develop sufficient energy reserves for thermoregulation. Calves are closely attended to by their mothers, and are typically nursed for 1-2 years (Fay, 1982; Fisher and Stewart, 1997). The low birth rate of walruses is offset in part by considerable maternal investment in offspring (Fay *et al.,* 1997). Estimated survival rates through the first year of life range from 0.5 to 0.9 (Fay *et al.,* 1997).

3.8.5.2.1.5. Walruses in the Project Area

The Pacific walrus is found in low numbers in the Beaufort Sea (Garlich-Miller *et al.,* 2011) (see Figure 3.8-4). Some walruses have hauled-out onshore near Kaktovik in the past; however, this is not a frequent event. The Beaufort Sea does not provide the optimal habitat for walruses. Fishcbach *et al.* (2016), mapped walrus coastal haul out locations based on available data from 1852 - 2016. Over the 40-year period, Fischbach *et al*. reported only two walrus haulouts in the Beaufort Sea. Therefore, the likelihood of encountering Pacific walrus in the Action Area is very low.

Figure 3.8-4 Walrus Sightings in the Project Area 1979 - 2012



3.8.5.2.2. Ringed Seal

On February 12, 2018, the Ninth Circuit Court of Appeals upheld the listing of ringed seals as threatened under the ESA. At the time of preparing this SEIS, this decision had not yet been determined. Therefore, the discussion of ringed seals is included with other species not listed under the ESA. Ringed seals are also evaluated in the Biological Assessment attached as Appendix N, Attachment II.

The range of the ringed seal is circumpolar with five subspecies being recognized: the Arctic ringed seal (*Phoca hispida hispida*), the Baltic ringed seal (*Phoca hispida botnica*), the Okhotsk ringed seal (*Phoca hispida ochotensis*), the Ladoga ringed seal (*Phoca hispida ladogensis*), and the Saimaa ringed seal (*Phoca hispida saimensis*). On December 10, 2010, NMFS published a proposed rule to list the Arctic, Okhotsk, Baltic, and Ladoga subspecies as threatened and the Saimaa subspecies as endangered under the ESA (FR 75:77476). A listing of threatened under the ESA for the four subspecies of ringed seals was issued December 28, 2012 (FR 77: 76705).

On March 11 2016, The Ninth Circuit determined that the listing for the Arctic ringed seal, *Phoca hispida hispida*, was not warranted; however, on February 12, 2018, the Ninth Circuit of Appeals ruled that the ringed seal shall receive threatened species protection. Currently the Arctic subspecies of the ringed seal listed as threatened and it is protected under the MMPA. NMFS has proposed designated critical habitat for the Arctic ringed seal, which would include the northern Bering, Chukchi, and Beaufort seas. The public comment period for this proposal closed March 9, 2015. A final ruling has not yet been made on this proposal (79 FR 73010, 2015). A detailed comprehensive description of the distribution, life history, and abundance of ringed seals is included in the status review of the ringed seal recently published by NMFS (Kelly *et al.,* 2010a).

The most recent stock assessment reports indicate that reliable abundance estimates of the Arctic ringed seal population are not available (Allen and Angliss, 2015), but NMFS suggested that the population numbers are in the millions (FR 75:77492). Bengtson *et al.,* (2005) conducted ringed seal surveys in the Chukchi Sea in 1999 and 2000 and found densities higher at nearshore locations. They estimated the Chukchi population at 252,488 animals in 1999 and 208,857 in 2000. Kelly *et al.,* (2010a) provided an estimate for the total population of Arctic ringed seals in the Chukchi and Beaufort Seas of 300,000 seals, based on Bengtson *et al.,* (2005) and Frost *et al.,* (2004) in the late 1990s and 2000. This estimate is thought to be low (Allen and Angliss, 2015).

Reliable data on population abundance trends for the Arctic stock of ringed seals do not presently exist (Allen and Angliss, 2015). Frost *et al.,* (2002) reported that trend analyses based on comparisons of observed seal densities in the central Beaufort Sea suggested a marginally significant but substantial decline of 31 percent from 1980 through 1987 to 1996 through 1999 on all ice types; however, Angliss and Allen (2015) concluded that the apparent decline between the 1980s and the 1990s may have been due to a difference in the timing of surveys rather than an actual decline.

In Alaska, the range of the ringed seal encompasses the Beaufort, Chukchi, and Bering seas and can reach as far south as Bristol Bay in Alaska in years with extensive ice coverage. Throughout their range, ringed seals exhibit an affinity for ice-covered waters.

Ringed seals tend to prefer large ice floes (*i.e.*, greater than 147 feet in diameter) and are often found in the interior ice pack where the sea ice coverage is greater than 90 percent (Simpkins *et al.,* 2003). They remain in contact with ice most of the year and pup on the ice in late winter to early spring. During late April through June, ringed seals are distributed throughout their range from the southern ice edge northward (Burns and Harbo, 1972; Burns *et al.,* 1981; Braham *et al.,* 1984). Ringed seals overwinter on pack and shorefast ice (Bengtson *et al.,* 2005). They create breathing holes in the newly formed ice and maintain them throughout the year by scraping the sides using the nails on their foreflippers (Smith and Hammill, 1981).

The density of ringed seals is dependent upon the availability of food, ice conditions, and water depth. Frost *et al.,* (2004) conducted aerial surveys over the Beaufort Sea coast between Utqiagvik and Kaktovik to assess what variables such as water depth, distance from fast ice, and ice quality have on distribution. They determined that ringed seal density was greatest in intermediate water depths of 16.4 to 115 feet and in areas of smooth ice nearest to the edge of fast ice. Ringed seal densities were estimated from similar surveys flown in 1996 through 1999 in the Alaska Beaufort Sea from Utqiagvik to Kaktovik. Observed seal densities in that region ranged from 0.81 to 1.17 per square km (0.3 to 0.4 square mi) (Frost *et al.,* 2002, 2004). Results of surveys conducted by Frost and Lowry (1999) indicate that, in the Alaskan Beaufort Sea, the density of ringed seals in May through June is higher to the east than to the west of Flaxman Island. These surveys are conducted in the spring when seals are visible on ice, less is known of their distribution during summer months.

Recent tag information suggests winter habitat partitioning between adults and subadult ringed seals in Alaska. Crawford *et al.,* (2012) found subadults traveled south to the ice edge during the late-fall and winter; returning north as ice receded in the spring. Adult movements were more limited and farther from the ice edge. These data suggest that subadults, unhampered by breeding requirements for territory maintenance or pup rearing, move to areas that afford better feeding opportunities, require less energetic costs and limit predation exposure.

Ringed seal seasonal distribution is related to prey availability, stable ice conditions, and physical ice characteristics (McLaren, 1958; Smith and Stirling, 1975). Ringed seals feed primarily on fish (especially Arctic cod, *Boreogadus saida*) and large amphipods (*e.g.*, *Themisto libellula*). Mysids (*e.g.*, *Mysis oculata*), euphausiids (*e.g.*, *Thysanoessa* spp.), shrimps (*e.g.*, *Eualus*, *Lebbeus*, and *Pandalus* spp.), and squid (*e.g.*, *Gonatus* sp.) are all commonly found in the diet of ringed seals and can be very important in some regions, at least seasonally (Chapskii, 1940; Dunbar, 1941; McLaren, 1958; Fedoseev, 1965; Söderberg, 1971; Lowry *et al.,* 1980; Bradstreet and Finley, 1983; Gjertz and Lydersen,

1986; Smith, 1987; Węsławski *et al.,* 1994; Siegstad *et al.,* 1998; Holst *et al.,* 2001; Dehn *et al.,* 2007). Ringed seals purportedly can dive deeper than 500 meters (Born *et al.,* 2004).

Ringed seals start to construct and maintain breathing holes as soon as ice begins to form in late autumn or early winter. These breathing holes are mostly formed in areas with hummocks and pressure ridges but can be very small ice-domes of about 4 cm high and 15 to 25 cm in diameter.

Ringed seals begin constructing subnivean (below snow on ice) lairs in mid-March (Smith *et al.,* 1991). As the ice forms in late autumn, ringed seals maintain breathing holes in new thin ice and cracks with the claws of their foreflippers (Smith and Stirling, 1975; Smith and Hammill, 1981). Subnivean lairs constructed above breathing holes allow access to the sea while providing stable terrestrial platforms with which the species may whelp, raise young and rest, while being sheltered from Arctic winter and early spring climate conditions. Lairs are very often located within ice hummocks and near pressure ridges where snow accumulates (Chapskii, 1940; McLaren, 1958; Smith and Stirling, 1975) and provide protection from the cold, and from predators (Smith *et al.,* 1991). Smith and Stirling (1975) describe lair structure and development. Lairs include single-chambered cavities (simple lairs), multi-chambered cavities (complex lairs), and cavities with one or more small tunnels radiating from the main chamber(s). The latter, subnivean lairs, are typically complex dens for pupping and nursing. While breathing holes may also be maintained in deep cracks in flat ice surface locations, lair construction is dependent on snow drift depths between 50 cm and 65 cm (Kelly *et al.,* 2010a); more than 45 cm snow accumulation is needed for a simple lair and more than 50 to 65 cm for a birth lair (Smith and Stirling, 1975; Lydersen and Gjertz, 1986; Kelly, 1988a; Furgal *et al.,* 1996; Lydersen, 1998; Lukin *et al.,* 2006).

An individual seal maintains numerous breathing holes; however, several seals will utilize the same hole (Smith and Stirling, 1975). Kelly and Quakenbush (1990) reported individual seals using more than one lair. Smith and Stirling (1975) reported Inuit hunters finding two pups in one lair suggesting that pupping lairs may not be exclusive to one mother-pup pair. The distribution and density of lairs and breathing holes in an area has been found to be dependent on the physical characteristics of the sea ice including leads, deep cracks, pressure ridges, and snowdrifts (McLaren, 1958; Smith and Stirling, 1975; Kingsley *et al.,* 1985; Hammill and Smith, 1991). Furgal *et al.,* (1996) suggested that other sea ice physical characteristics and atmospheric conditions, including the protruding angle of an ice ridge, wind direction at the time of drift formation, distance between adjacent ridges, and the opening size in a continuous ridge all influence drift size, depth and placement with respect to the ridge, which translates into distance from the ridge itself.

Ringed seals haul out on sea ice to molt and rest (Vibe, 1950; McLaren, 1958; Smith, 1973, 1987; Smith and Hammill, 1981). Winter snow cover rapidly melts with the warmer temperatures and long hours of sunlight in late spring and early summer; however, the ice surface remains largely intact and serves as a resting substrate for molting seals that

spend considerable time basking in the sun (Smith, 1973; Finley, 1979). Seals frequently begin to haul out on the ice to undergo molt from mid-May through mid-July (McLaren, 1958; Kunnasranta *et al.,* 2002); however, there are regional variations and ice conditions that may affect the timing and length of this biological period. Kelly *et al.,* (2010b) reported that Arctic ringed seals spent more than 60 percent of their time on the ice in June when they were actively molting. Percent time spent in molting activity decreased into late June and July when the proportion of time on the ice dropped to 30 percent (Kelly *et al.,* 2010b).

Ringed seals are capable of breeding annually (McLaren, 1958); however, adult females are capable of suppressing ovulation during years when they have not acquired appropriate energy reserves (Harwood *et al.,* 2000). Arctic ringed seal females ovulate in May and early June (Johnson *et al.,* 1966; Smith, 1973, 1987); implantation takes place 3 to 3.5 months later (McLaren, 1958; Fedoseev, 1975; Smith, 1987). Ringed seal pups are born in the birth lairs between mid-March and late April; nursing will extend to mid-June (38 to 44 days) (Smith *et al.,* 1991); Lydersen and Hammill (1993) suggest the lactation period may last longer (almost 2 weeks longer). Newborn pups do not have a layer of blubber to protect them from the cold. They rely on their white fur, high metabolic rates, and the birth lair for protection from the cold. Nursing pups can, and do, enter the water to escape predation and to forage, but must return to a lair to prevent hypothermia (Smith *et al.,* 1991). Lydersen and Hammill (1993) found ringed seal pups spent, on average, 50.3 percent of their time in the water during the nursing period, diving to 89 meters and staying submerged for 12 minutes. The authors stipulated that these diving capabilities, while the pups were still in white coats, were likely strategies used for predator avoidance during the critical life stage. Pups are subject to intense predation by foxes and polar bears (Smith, 1976; Kingsley, 1990). In some areas, newborn pup mortality from fox predation may be as high as 40 percent (Smith, 1976).

Active lairs and breathing holes are almost unnoticeable and very difficult to locate (Smith and Stirling, 1975). Ringed seal breathing holes and lairs do not occur on bottom fast ice or ice without sufficient water underneath to allow easy passage for a seal. For the purposes of seal management, bottom-fast ice is often assumed to occur down to the 10 feet (3 m) contour. However, ringed seals can be present in areas where the body of water under the ice is as limited as 2 feet and have been observed in low densities in waters between 6 and 10 feet.

BPXA conducted seal surveys near the Northstar Unit located approximately 6 miles from West Dock offshore of Prudhoe Bay to determine baseline conditions prior to the construction of the satellite drilling island. Ringed seal densities close to the Northstar site ranged from 0.39 to 0.63 seals per square km (Moulton *et al.,* 2002). Seal densities prior to construction (1997 - 1999), after a winter of intensive winter construction (2000), after a second winter of more construction and commencement of drilling operations (2001), and finally after drilling and onset of full operations (2002) were not significantly affected by proximity to Northstar (Moulton *et al.,* 2005). Environmental factors such as date, water depth, degree of ice deformation, presence of melt water, and percent cloud

cover had more conspicuous and statistically significant effects on seal sighting rates than did any human related factors (Moulton *et al.,* 2005 as cited in NMFS, 2014).

Ringed seals are associated with sea ice and typically remain with the ice throughout the year (Kelly, 1988a; Kelly *et al.,* 2010b; Bengtson *et al.,* 2005), although in the summer, ringed seals are commonly seen alone or in small groups in open water (Harwood and Stirling, 1992). Large concentrations of ringed seals are not expected near West Dock during activities associated with the proposed Project, partly because they do not tend to travel in large groups and partly due to the normal industrial activity present at West Dock (Figure 3.8-5). However, they are the most frequently encountered seal species in the Prudhoe Bay region (Simpkins *et al.,* 2003).

Figure 3.8-5 Ringed Seal Sightings Near Project Area, 1979-2012



3.8.5.2.3. Gray Whale

The ENP population annually migrates from warm wintering ground lagoons in coastal Baja California and Mexico to summer foraging areas in the Bering and Chukchi seas off northern Alaska and Russia (Jones *et al.*, 1984; Swartz *et al.,* 2006), primarily between Cape Lisburne and Point Barrow, most often in shallow coastal habitat (Moore *et al.,* 2000). Not all eastern gray whales follow this migration pattern. A small subset of the eastern population feeds in coastal water off British Columbia, Washington, and Oregon (Calambokidis *et al.,* 2002, 2010). In addition, gray whale calls have been recorded throughout the winter in the Beaufort Sea near Utqiagvik, Alaska, suggesting that some gray whales remain in Arctic waters during this season (Stafford *et al.,* 2007).

Few gray whales have historically been recorded in the Beaufort Sea east of Point Barrow. Hunters at Cross Island took a single gray whale in 1933 (Maher, 1960). A total of five gray whales (three sightings) were sighted during 30+ years of the Bowhead Whale Aerial Survey Project/ASAMM aerial surveys (database available on the NOAA website). Two of these whales were seen in the Prudhoe Bay area. A single gray whale was also seen on August 1, 2001 near the Northstar production island (Williams and Coltrane, 2002). Several gray whale sightings were reported during both vessel-based and aerial surveys in the Beaufort Sea in 2006 and 2007 (Jankowski *et al.,* 2008; Lyons *et al.,* 2009). In 2008, a multiple species sighting of six animals consisting of bowhead and gray whales were observed during the Liberty seismic survey in Foggy Island Bay close to Narwhal Island (Aerts *et al.,* 2008). A few gray whales have also been observed in the Canadian Beaufort Sea (Rugh and Fraker, 1981), indicating that small numbers have been passing through the Alaskan Beaufort in some years. Clarke *et al.,* (2015) reported sighting a single gray whale north of Cross Island near Prudhoe Bay during a September ASAMM survey flight. Given the infrequent occurrence of gray whales in the Beaufort Sea in summer, the probability of encountering gray whales in the proposed Project Area is low.

The ENP population was delisted from the T&E species list in 1994 because of the rebounding population size (NMFS, 1994). The most recent abundance estimate (2010–2011) for the Eastern Pacific stock gray whales is 20,990 (Carretta *et al.,* 2015).

3.8.5.2.4. Beluga Whale

Beluga whales have a circumpolar distribution; occurring in the Arctic waters of Russia, Canada, and the U.S. They also extend southward into the Chukchi, Bering, and Oshtok Seas, and into the Gulf of Alaska. They are closely associated with openleads and polynyas in ice-covered regions (Hazard, 1988 as cited in Allen and Angliss, 2015).

Five stocks of beluga whales are recognized in Alaska (Allen and Angliss, 2015):

1. Beaufort Sea;
2. Eastern Chukchi Sea;
3. Eastern Bering Sea;

4. Bristol Bay; and
5. Cook Inlet.

Beluga whales of the Beaufort Sea and eastern Chukchi Sea stocks could potentially occur near the proposed Project Area. The most recent population estimate for the Beaufort Sea stock is 39,258 individuals and the eastern Chukchi Sea stock is estimated at 3,710 animals (Allen and Angliss, 2015). The population estimate of the Beaufort Sea stock is based on 1992 data and the size estimate of the eastern Chukchi Sea stock arises from survey efforts in 1989 to 1991. The population trends of both stocks are currently unknown; however, based on available data, there is no evidence that the eastern Chukchi Sea stock is declining (Allen and Angliss, 2015).

In spring, the Beaufort and Chukchi sea stocks of beluga whales use open leads in the sea ice to migrate from their wintering grounds in the Bering Sea to the Arctic to their respective summer grounds in the Beaufort and Chukchi seas. Most animals of the Beaufort Sea stock migrate to the Mackenzie River estuary in the Canadian Beaufort Sea where they arrive in April or May, with some animals arriving as early as March or as late as July (Braham *et al.,* 1977). They typically stay there during July and August to molt, feed, and calve. Later in the summer, they spread out, foraging in offshore waters of the eastern Beaufort Sea, Amundsen Gulf, and other northern waters (Davis and Evans, 1982; Harwood *et al.,* 1996; Richard *et al.,* 2001). Belugas from the Chukchi Sea stock stay in coastal areas or shallow lagoons, such as the Kasegaluk Lagoon, early in the summer. Later in the summer (after mid-July), they move offshore to forage in the icepacked deeper waters along and beyond the continental shelf (Finley 1982; Suydam *et al.,* 2005). Five of 23 beluga whales fitted with satellite tags in Kasegaluk Lagoon (captured in late June and early July 1998-2002) were tracked north into the Arctic Ocean venturing into 90 percent pack ice at 79-80°N (Suydam *et al.,* 2005), suggesting that a significant proportion of the population may be at these high latitudes during the mid- to late summer period. In the fall, the Chukchi and Beaufort Sea stocks both return to their wintering grounds in the Bering Sea following a deep-water route along the continental shelf break or routes farther offshore.

Beluga whales are often seen migrating in large groups (Braham *et al.,* 1977), probably consisting of smaller, permanent social units, such as nursing groups or family units (Brodie, 1989). Beluga whales feed on a variety of fish and invertebrates, their diet varying by season and location (Burns and Seaman, 1985; Hazard, 1988). In the summer, beluga whales feed on a variety of schooling and anadromous fish, particularly Arctic cod. Most feeding is done over the continental shelf and in nearshore estuaries and river-mouths.

In the central and eastern Beaufort Sea, most beluga whales migrate in deep offshore waters along the ice edge more than 60 miles north of the Alaskan coast, both during the spring and fall migration (Clarke *et al.,* 2012, 2013, 2015). Relatively few beluga sightings have been recorded in the nearshore area of Prudhoe Bay. Opportunistic sightings have been recorded from Northstar Island, the STP facility and Endicott. During the 2008

ocean bottom cable seismic survey in Foggy Island Bay, three sightings of eight individuals were observed at about 3 miles east of Endicott Satellite Drilling Island (Aerts *et al.,* 2008). In 2013, two adult belugas were reported at MDI (Endicott) on 10 August for about 2 days. Two weeks later, a large group of belugas (no estimate provided) was seen in the same area. Observers of the 2014 ASAMM aerial survey also recorded higher than normal nearshore beluga sightings than historically seen (Clarke *et al.,* 2015). Based on available information, the chance of encountering beluga whale in the vicinity of the proposed Project Area is low.

3.8.5.2.5. Killer Whale

Killer whale sightings are sporadic and infrequent in the eastern Chukchi Sea. George *et al.,* (1994) documented reports made by Utqiagvik hunters and biologists from the NSB; accounts indicate that a few killer whales are seen each year in the Point Barrow area. There were no sightings of killer whales during 2014 ASAMM or during the 2014 Chukchi Sea Environmental Studies Program (CSESP) 2014 (C. Christman, CLC Research, pers. comm. to J. Clarke, February 27, 2015 as reported in Clarke *et al.,* 2015) in the northeastern Chukchi Sea. Killer whales were acoustically detected in September 2014 in the southcentral Chukchi Sea, although none were seen (Clarke *et al.,* 2015). Killer whales were seen by ASAMM near Utqiagvik and northwest of Point Hope in 2012 (Clarke *et al.,* 2013), and detected acoustically at several recorders in the northeastern Chukchi Sea in summer 2010 (Delarue *et al.,* 2011). Thomas and Koski (2011) reported that killer whales were not seen during aerial surveys conducted nearshore by industry from 2006 to 2010. CSESP marine mammal observers also did not detect killer whales from 2008 to 2010; however, they were seen during CSESP in 2012 (L. Aerts, LAMA Ecological, pers. comm. to J. Clarke, April 12, 2013).

The reported transients in the Chukchi and Beaufort seas over the last 20+ years may be associated with those of the Bering Sea, Aleutian Islands, and Gulf of Alaska stocks. This is currently unconfirmed; therefore, based on available information, the chance of encountering killer whale in the vicinity of the proposed Project Area is considered low.

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3.9. Benthic

3.9.1. Introduction

This section addresses benthic species in the vicinity of West Dock in Prudhoe Bay as well as freshwater species found along the Alternative 1 and 2 corridor waterbody crossings. The information provided here is new and not found in the 2012 FEIS. The description of benthic resources summarizes data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

West Dock is a solid-fill gravel causeway structure located on the northwest shore of Prudhoe Bay, Alaska (Figure 3.9-1). West Dock lies within the PBU and is operated by BPXA. This multipurpose facility is commonly used to offload heavy marine cargo to support Prudhoe Bay oilfield development and operations.

The West Dock causeway was constructed in multiple phases between 1974 and 1981. The original section was built during 1974 and 1975. The first section of West Dock was constructed to be 3,995 feet long, extending from land to DH2. During late summer 1975, the causeway was extended 5,274 feet to DH3. In 1981, a third extension elongated the causeway an additional 5,010 feet to accommodate the STP construction. A 50-foot channel breach was included during the construction of the third extension of West Dock.

The effects of the causeway on coastal currents and nearshore marine resources remained a concern because of the causeway's size and location. Therefore, a 650 feet breach and a causeway bridge were installed between DH2 and DH3 during 1995 and 1996, approximately 21 years after the causeway was constructed out to DH3. In 1993 and 1994, large modules similar to those proposed for the ASAP Project were delivered to West Dock at DH3, with an estimated barge payload weight of 5,400 s/tons.

ASAP proposes to dredge to 9 feet (-9 feet below MLLW) throughout the navigational channel (Figure 1-2 in the ASAP West Dock Dredge and Disposal Plan [AGDC, 2016o]) to accommodate the maximum barge draft of 7.6 feet and allow an additional 1.4 feet of clearance space. Overdredging would mitigate against trench infilling during spring break-up and would eliminate any need for summer dredging. Screeding of the navigational channel to level the seabed to a precise depth would be necessary in early summer prior to barge arrival.

The dredging of the navigational channel leading in to West Dock at DH3 to -9 feet would remove approximately 250,000 CYs of native material. The dredged material is proposed to be placed on the sea floor of Prudhoe Bay, offshore and south-southeast of the dredging location. Dredging activities would take place during the winter.

The proposed Project footprint would impact waterbodies (streams, rivers, HPOIs) at 496 locations (491 crossings and 5 proposed material sites). This includes 315 stream locations and 181 inundated areas (HPOIs) that do not meet USACE's definition of a

wetland or stream. These inundated areas do not meet the definition of a stream or wetland as defined in 33 CFR 328.3(b), but still require special consideration for pipeline design and have been identified by AGDC.

There would be a total of 423 Mainline waterbody crossings, seven Fairbanks Lateral waterbody crossings, 61 access road waterbody crossings, and five in-river material site extraction locations at the Sagavanirktok River to help meet North Slope gravel needs. Of the total waterbody crossings, the proposed ASAP Project would impact 71 anadromous waters[17] at 75 distinct locations (*i.e.*, some waterbodies are crossed more than once). Fifty-seven (57) anadromous waterbodies would be impacted along the Mainline and Fairbanks Lateral.

3.9.2. Project Area

Since the publication of the 2012 FEIS, revisions have been made to the proposed Project, necessitating an SEIS that assesses the new Project components. As described in the introduction, Project revisions affect the northern portion of the proposed Project Area at West Dock (Figure 3.9-1).

The area directly affected by the proposed Project is the total footprint of the dredging activity area and dredge material placement area. The areas indirectly affected by the proposed Project may include nearby areas impacted by summer screeding activities.

[17] The 71 anadromous waters impacted by the total proposed Project footprint are the sum of impacts to waterbodies on the Mainline (57 anadromous waters impacted), access roads (13 anadromous waters impacted), and at material extraction sites (one anadromous water impacted). However, this is a conservative number because of some duplications between Mainline crossings and access road crossings of the same stream.

Figure 3.9-1 Northern Portion of Proposed Project Area, West Dock



3.9.3. Prudhoe Bay Environment

Prudhoe Bay is located on the Beaufort Sea coast immediately west of and adjacent to the mouth of the Sagavanirktok River (Figure 3.9-1). The Putuligayuk River drains into the western edge of the Bay. The Midway Islands, a widely spaced series of barrier islands (Reindeer Island, Argo Island, and Cross Island) are located approximately 20 km offshore to the north. Stefansson Sound is a shallow embayment (10 m) adjoining the Beaufort Sea; the Sound extends from the Midway Islands in the west to Tigvariak Island in the east, and is enclosed by the protecting barrier island chain that consists of Narwhal Island, Cross Island and the Midway Islands. West Dock is located on the main shoreline at the western mouth of Prudhoe Bay; the dock extends approximately 3,000 meters (9842 feet) offshore (Figure 3.9-1). The Return Islands, a 60-km-long chain of barrier islands located 1 to 10 km offshore, are directly west of the dock. The easternmost of these is Stump Island, whose southeast tip is 1.5 km west of the dock head and 1 km from shore (Figure 3.9-1).

Prudhoe Bay is shallow (less than 6 meters deep) and relatively protected from the open water of the Beaufort Sea. Winds blow primarily from the east-to-northeast during the summer open water season. Wind speeds can be swift; approximately 40 percent of September winds may blow at speeds in excess of 15 knots. The easterly winds produce westward-moving waves and currents and transport sediment loaded fresh water from the Sagavanirktok River delta to the west into the shallow Prudhoe Bay (Spight, 1979).

Hydrological research from the West Dock/Prudhoe Bay area shows prevailing winds in the area are typically alongshore Northeasterly and easterly, causing an eddy to form on the western side of West Dock (Fechhelm *et al.*, 1999; 2001). Most nearshore sediment transport along the Arctic coastline is via a longshore, wind-driven current. Westerly winds have been seen in atypical summer seasons (Fechhelm *et al.*, 1994), creating a west-to-east longshore current that redeposits sediment towards the eastern shore of Prudhoe Bay and away from the navigation channel.

Prudhoe Bay begins to ice over in late September, and the surface of the coastal region is frozen by October. By midwinter, the Bay is frozen from the shoreline out to roughly a depth of 2 m. The ice is shore-fast, meaning that it forms in place and is attached to the shore. This freezing process does not disturb the bottom sediment to the extent of gouging and scouring processes attributed to pack ice, but it is thought that the result is similar in that benthic communities are destroyed by the process (Spight, 1979). There is no liquid water under shore-fast ice, except perhaps for brine pockets that form when salt is expelled from the sea ice during the freezing process. The ice remains in the Bay through June (Spight, 1979; Colonell *et al.,* 1992).

Areas deeper than 2 meters may experience ice scouring from grounding ice. Scouring disturbs the sediment bed by crushing and plowing furrows; benthic communities are also disturbed and sometimes crushed. Ice scour disturbance to soft sediments is a regular, predictable event on polar coasts (Barnes *et al.,* 1984). The impact of ice scour

may be similar to the effects of such anthropogenic physical disturbances as seabed dredging and trawling (Messieh *et al.,* 1991; Thrush *et al.,* 1995; Currie and Parry, 1996).

Between late May and early June, prior to the ice-free season on the Bay, rivers including the Putuligayuk and Sagavanirktok rivers undergo spring thaw and discharge spring runoff and sediment load over the shorefast ice. The influx of fresh water introduces sediments, nutrients, and debris from adjacent land to the nearshore marine environment. During the summer open water period, the Beaufort coast is subject to roughly four months of continuous daylight, and by mid-July, the nearshore zone is usually ice-free, so the ocean is open from the shore to the edge of the pack ice (Spight, 1979; Colonell *et al.,* 1992).

The peak discharge period between late May and early June reduces salinity in the nearshore environment of Prudhoe bay to roughly less than 15 parts per thousand; and by early summer the waters in and around Prudhoe Bay are classified as brackish (Spight, 1979; Colonell *et al.,* 1992). The reduction of river influx results in a gradual increase in the salinity of nearshore waters over the course of the summer open water period.

Summer winds along this portion of the Beaufort coast are nearly always alongshore, with easterlies being about twice as frequent as westerlies. These easterly winds are effective in displacing the higher salinity bottom water shoreward, known as upwelling. These wind-driven cold offshore marine waters will often be washed by the relatively warm and brackish waters of a nearby river, producing large fluctuations of salinity and temperature. The cumulative result is a dynamic waterbody characterized by rapid changes in salinity and temperature. With the influx of nutrients in the shallow nearshore zone from both the marine and terrestrial environments, the short summer is a period of intense biological activity (Spight, 1979; Colonell *et al.,* 1992).

3.9.4. Benthic Community

Benthic organisms include invertebrate animals living in or on the sea bottom. Typical kinds of benthic organisms include clams, polychaete worms, snails, mysids, isopods, and amphipods. Many of these organisms spend much of their lives buried in the sediment, while others construct relatively permanent "tubes." Yet others crawl or swim about on the sediment surface.

While Arctic benthic communities may have little direct importance to humans, they are of considerable importance as a food resource for fish, marine mammals, birds, invertebrates and other organisms. Benthic organisms feed on organic deposits, terrestrial debris, microorganisms, and detritus. The benthos in turn becomes valuable food sources for higher trophic level organisms such as fish, marine mammals, and birds. An adequate food supply is important to all organisms and therefore concern about fish, marine mammals, and bird populations can be translated directly into concern about the health of the benthic community.

While Prudhoe Bay is slightly deeper, there are close similarities to benthic fauna inhabiting the shallow (<2 m) lagoons of the Beaufort Sea that are subject to the additional stresses of ice scour during winter months; fast ice often freezes to the bottom followed by erosion when large pulses of river water enter the lagoon during breakup in early summer (Jorgensen *et al.*, 1999). Benthic populations in these estuaries, and to an extent Prudhoe Bay, are composed of particularly well-adapted, short-lived species characterized by rapid growth and high reproduction levels (Emmett *et al.*, 2000), capable of surviving the large salinity fluctuations that are associated with spring run-off.

Spight (1979) documented the benthic community around Prudhoe Bay. This study identified more than 100 species, including roughly 40 species of polychaetes, 15 species of clams, and 30 species of amphipods. Only a few species contributed to the majority of the individuals detected. Spight (1979) found that the benthic communities were also highly variable spatially and temporally. Key species were identified based on the following criteria:

- A major food source for higher trophic level animals like fish, marine mammals, and birds;
- Has a focal role on habitat formation either by presence or habitat manipulation; and
- Importance to benthic community as a whole either by virtue of abundance or relationship to other species.

Carey and Montagna (1982) studied the greater Stefansson Sound of which Prudhoe Bay is part. Phylum, order, and species when classified for the Stefansson Sound and the general Prudhoe Bay area are listed in Table 3.9-1.

Table 3.9-1 Compilation of Benthic Organisms of Stefannson Sound (Carey and Montagna, 1982) and Prudhoe Bay Key Species

Phylum / Subphylum	Class / Subclass	Order	Species
Nematoda (Roundworms)	--	--	--
Annelida	Polychaeta (Annelid worms)	--	*Ampharete vega* *Chaetozone setosa* *Chone* sp. *Prionospio cirrifera* *Pygospio elegans* *Scolecolepides arcticus* *Tharyx* sp. I *Tharyx* sp. II
Arthropoda / Crustacea (nauplii)	Copepoda	Harpacticoida Cyclopoida Calanoida	--
	Ostracoda	--	*Mysis* sp.
	--	Tanaidacea	--
	Acarina	--	--
		Amphipoda	*Pontoporeia affinis* *P. femonita* *Onisimus glacialis*
	--	Isopoda	*Saduria entomon*
	--	Cumacea	--
Kinorhyncha (Mud dragons)	--	--	--
Nemertea / Nemertinea (Ribbon worms)	--	--	--
Mollusca / Pelecypoda (Bivalves)	Gastropoda	--	--
	--	Myoida	*Cyrtodaria kurriana*
Priapulida (Priapulid worms)	--	--	--
Cnidaria	Anthozoa	--	--
Rotifera (Microscopic and near-microscopic pseudocoelomate animals)	--	--	--

Source: Spight, 1979

Benthic organisms, including mysids, are an important food source for various higher trophic levels, including invertebrates (Eley and Lowry, 1978; Schamel, 1978).

Invertebrates may be an important food source for ringed seals in many areas during the openwater season, and have been found to dominate the diets of young seals (Dunbar, 1941; Fedoseev, 1965; Johnson *et al.,* 1966; Lowry *et al.,* 1980; Bradstreet and Finley, 1983; Smith, 1987; Węsławski *et al.,* 1994; Siegstad *et al.,* 1998; Holst *et al.,* 2001). Large

amphipods (*e.g.*, *Themisto libellula*), mysids (*e.g.*, *Mysis oculata*), euphausiids (*e.g.*, *Thysanoessa* spp.), shrimps (*e.g.*, *Eualus, Lebbeus*, and *Pandalus* spp.), and squid (*e.g.*, *Gonatus* sp.) are all commonly found in the diet of ringed seals and can be very important in some regions, at least seasonally (Chapskii, 1940; Dunbar, 1941; McLaren, 1958; Fedoseev, 1965; Söderberg, 1971; Lowry *et al.,* 1980; Bradstreet and Finley, 1983; Gjertz and Lydersen, 1986; Smith, 1987; Węsławski *et al.,* 1994; Siegstad *et al.,* 1998; Holst *et al.,* 2001; Dehn *et al.,* 2007).

Although they can eat a variety of foods (euryphagous), bearded seals are primarily benthic feeders. They are considered foraging generalists with a diverse diet of a large variety of prey items, which include many invertebrate species (Cameron *et al.,* 2010; Vibe, 1950; Kenyon, 1962; Finley and Evans, 1983; Antonelis *et al.,* 1994; Dehn *et al.,* 2007).

A study by Spight (1979) found that the most noticeable characteristic of the benthic samples taken during the open water season was the gradual increase in diversity and abundance of organisms with distance from shore. The overall community was grouped into three major assemblages: organisms in shallow water (less than 1.8 meters deep), those in moderately deep water, and those in the deeper water (greater than 5.5 meters in depth). The study determined that the shallow water community included small, highly reproductive pioneering species. Deeper species were significantly larger, longer-lived, and often sedentary animals (Spight, 1979).

Spight (1979) determined that seasonal effects of ice formation and physical processes are both major factors in the depth related community structure found in Prudhoe Bay. The nearshore environment (less than 2 meters deep) is iced in annually as the ocean freezes to the bottom; presumably all the organisms remaining in nearshore (shallow) areas are impacted (Jorgensen *et al.,* 1999; Spight, 1979). Once the nearshore environment is clear of ice in spring, it must be repopulated from offshore areas. Species that repopulate these shallow waters must be hardy, well-adapted, short-lived species characterized by rapid growth and high reproduction levels and capable of thriving in disturbed habitat (Emmett *et al.,* 2000). Adaptability to rapid fluctuations in the physical processes that include salinity, water temperatures, sedimentation, resuspension, and advection also determines species presence in the shallower waters (Montagna and Kalke, 1992; Spight, 1979). The resulting habitat and oceanic characteristics of the Bay is thought to account for the difference in the fauna species less than 2 meters contour in the shallow waters of the Beaufort Sea (Spight, 1979). Characteristics of the nearshore community, including: low diversity, small biomass, and predominance of small motile forms and pioneer species suggest that migration from offshore occurs annually; population buildup on the nearshore continues through the ice-free season (Spight, 1979).

3.10. Threatened & Endangered Species

3.10.1. Introduction

The description of T&E species resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

This section discusses all species that are federally listed as endangered, threatened, proposed, and candidates for listing by USFWS and NMFS in the proposed Project Area (referred to in ESA Section 7 Consultation as "Action Area"); the State of Alaska no longer maintains a T&E list. Specifically, the following information has been substantially updated:

- The Port of Anchorage is no longer under consideration for the development of the proposed Project; all Cook Inlet species have been removed from analysis;
- NMFS released the 2015 Status Review of the Humpback Whale Under ESA; and
- NMFS released the 2014 Alaska Marine Mammal Stock Assessments.

USACE, as the lead federal agency for the proposed Project, consults with USFWS and NMFS to determine the likelihood of effects on federally listed species. USACE consulted with USFWS and NMFS to determine if listed or proposed ESA species or their designated critical habitat occurs in the vicinity of the proposed Project. As a result, USACE determined that ESA-protected species or habitats may be affected by the proposed Project; therefore, a Biological Assessment was prepared in 2011, has since been updated in 2015 and 2017, and is provided as Appendix N, Attachment II (AGDC, 2017a). USFWS prepared a Biological Opinion in 2012 (USFWS, 2012b) describing the effects of the proposed action on Alaska-breeding Steller's eiders (*Polysticta stelleri*), spectacled eiders (*Somateria fischeri*), and polar bears (*Ursus maritimus*), pursuant to Section 7 of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.). However, according to USFWS, a re-initiation of formal Section 7 consultation would be necessary to determine the proposed Project's impacts on threatened, endangered, and candidate species.

Both USFWS and NMFS authored letters dated December 17, 2010 and December 10, 2010, respectively, which addressed the ESA, the Fish and Wildlife Coordination Act, the MBTA, the BGEPA, the MMPA, and the NEPA. A list of ESA species with the potential to occur in the proposed Project Area were identified in both letters and are discussed in detail below.

3.10.2. Regulatory Setting

USFWS and NMFS are responsible for ensuring compliance with the ESA for species under their jurisdictions. The purpose of the ESA is to conserve species and their habitats. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range, and a species is considered threatened if the

species is likely to become endangered in the future. Proposed species are protected candidate species that are found to warrant listing under the ESA as either endangered or threatened and have been proposed as such in the Federal Register. Candidate species are those species that are petitioned for listing as endangered or threatened under the ESA but that have not been proposed as such in the Federal Register. Candidate species are currently not federally protected and are addressed in this Section. Delisted species are species that were listed as threatened or endangered under the ESA, but have been formally removed from the listing. Delisted species are not ESA-protected and are addressed in their respective sections.

The State of Alaska maintains an ESA list of Alaskan species but no longer maintains a State Species of Special Concern list as of August 15, 2011. Therefore, these previously state listed species have not been included in the following analyses. Several ESA-protected species under the jurisdiction of USFWS could potentially be affected by the proposed Project and are addressed within this section. The BLM sensitive species are addressed in Section 3.4, Vegetation; Section 3.6, Wildlife; and Section 3.7, Fish.

3.10.3. Summary

The ESA protected and candidate species that could occur in the proposed Project Area include nine marine mammal and two avian species; the Eskimo Curlew is currently considered extinct. Critical habitat for one ESA listed species occurs within the proposed Project Area under NMFS jurisdiction. No federally listed plants are known to occur in the proposed Project Area based on inventories conducted to date. Rare and sensitive plant species are discussed in Section 3.4.6. The federal status, critical habitat designation, and the preliminary findings summary of each species are included in Table 3.10-1.

The wood bison has undergone recent regulatory changes; on 7 May 2014; USFWS published a final rule in the Federal Register for the establishment of a nonessential experimental population of wood bison, a species that is classified as threatened in Alaska under the ESA (USFWS, 2014b). One of the release areas considered for the species was within the Minto Flats region near the proposed Project Area; however, a site near Shageluk, Alaska (outside the proposed Project Area) was instead chosen for release and monitoring in spring 2015. There are no confirmed plans to date for any reintroduction of wood bison to the Minto Flats. The wood bison is not described in Table 3.10-1 or in the remainder of the document because it currently does not occur in the proposed Project Area. The Eskimo curlew, a species of shorebird, is considered extinct, and is not discussed further in the document.

Table 3.10-1 ESA Protected and Candidate Species Potentially Occurring in or near the Proposed Project Area

Common Name	Scientific Name	Federal Status	Critical Habitat Designated In/ Near Project Area	Preliminary Findings Summary
Mammals				
Bearded seal[a] (Beringia DPS)	*Erignathus barbatus*	Threatened	Yes	NLAA
Bowhead whale	*Balaena mysticetus*	Endangered	No	NLAA
Fin whale	*Balaenoptera physalus*	Endangered	No	NLAA
Humpback whale[b] WNP DPS; Hawaii DPS; Mexico DPS	*Megaptera novaeangliae*	Endangered; Not Listed; Threatened	No	NLAA
Pacific walrus	*Odobenus rosmarus divergens*	Candidate	No	NLAA (BA) NLJE (BO)
Polar bear	*Ursus maritimus*	Threatened	Yes	NLJE (BA) NLAA (BO)
Ringed Seal[a] (Arctic DPS)	*Phoca hispida*	Threatened	No[c]	NA
Steller sea lion (Western DPS)	*Umatopias jubatus*	Threatened	No	NLAA
Avian				
Spectacled eider	*Somateria fischeri*	Threatened	No	NLAA (BA) NLJE (BO)
Steller's eider	*Polysticta stelleri*	Threatened	No	NLAA
Eskimo curlew	*Numenius borealis*	Endangered	No	No Affect (Considered Extinct)

Sources: ASAP Biological Assessment (Appendix N, Attachment II; AGDC, 2017a); ASAP Biological Opinion (USFWS, 2012b); USFWS, 2014c; USFWS, 2012a

a In two separate decisions, the U.S. District Court for the District of Alaska vacated the Beringia DPS bearded seal listing and the Arctic subspecies of ringed seal listing (Alaska Oil and Gas Association v. Pritzker, Case No. 4:13-cv-00018-RPB; Alaska Oil and Gas Association v. NMFS, Case No. 4:14-cv-00029-RRB). NMFS appealed both decisions to the Ninth Circuit. On October 24, 2016, the Ninth Circuit reversed the district court's decision with regard to the bearded seal listing. On February 12, 2018, the Ninth Circuit of Appeals ruled that the ringed seal shall receive threatened species protection. At the time of preparing this SEIS, this decision had not yet been determined. Therefore, the discussion of ringed seals is included in Section 3.8 Marine Mammals.

b One of the three humpback whale DPS that occur in the Gulf of Alaska and Resurrection Bay was delisted in September 2016 as a result of NOAA's 2015 Status Review of the species (NOAA, 2015b). The Hawaii DPS was delisted, but the WNP DPS remains endangered and the Mexico DPS remains threatened.

c NMFS has proposed designated critical habitat for the Arctic ringed seal, which would include the northern Bering, Chukchi, and Beaufort seas. The public comment period for this proposal closed March 9, 2015. A final ruling has not yet been made on this proposal (79 FR 73010, 2015).

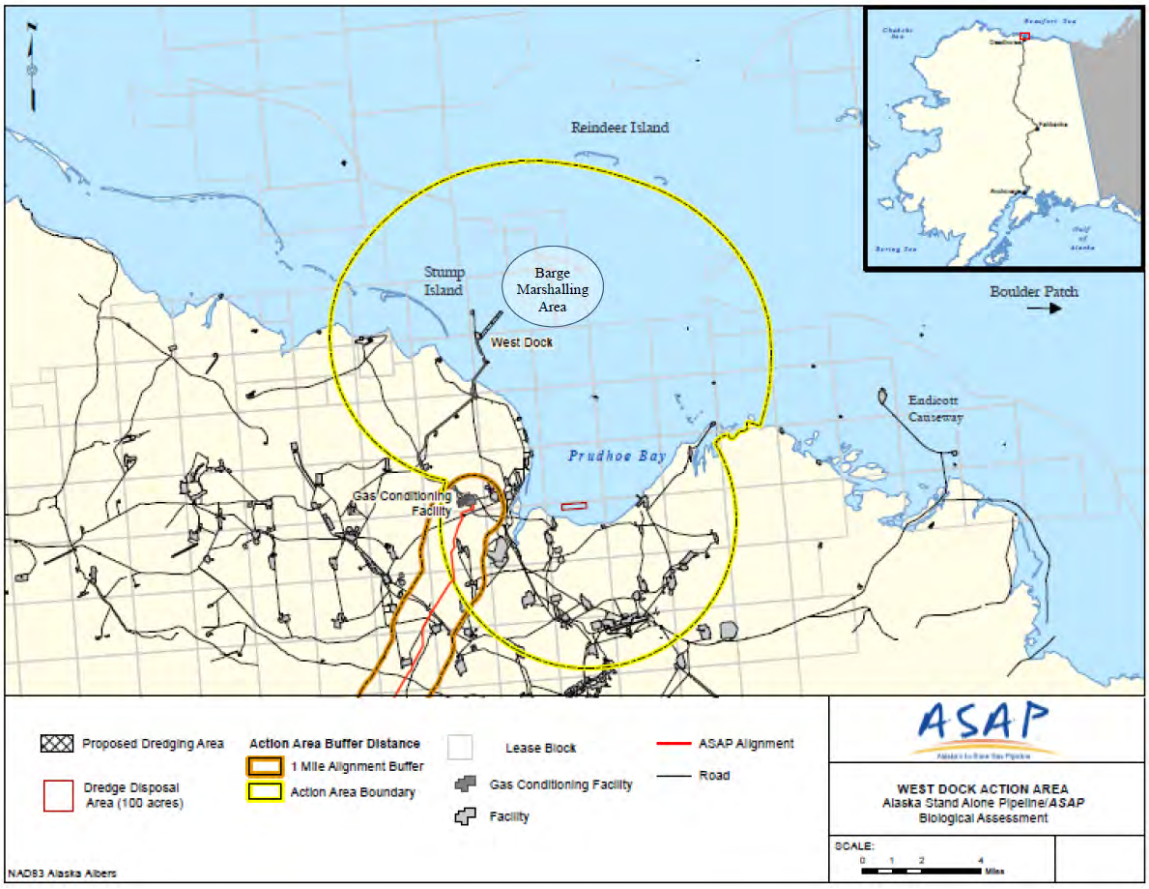
NA – Not Available
No affect – No effect
NLAA – May effect, not likely to adversely affect
NLJE – Not Likely to jeopardize existence
NAM – No adverse modification (applies to Critical Habitat)

NLAM – Not likely to adversely modify (applies to Critical Habitat)
LAM – Likely to adversely modify (applies to Critical Habitat)
DPS – Distinct Population Segment
BO – Biological Opinion
BA – Biological Assessment

3.10.4. Project Area

Since the publication of the 2012 FEIS, revisions have been made to the proposed Project, thus necessitating an SEIS that assesses the new Project components. As described in the introduction above, recent Project revisions affect the northern portion of the proposed Project Area (Figure 3.10-1), but not the southern-most Project Area at the Port of Seward. The Port of Anchorage is no longer under consideration for the development of the proposed Project; therefore, there is no need to discuss Cook Inlet species in this section. For completeness, the southern Project Area and species therein have been considered previously and evaluated in the 2012 FEIS.

Figure 3.10-1 Action Area Boundary, West Dock



The proposed Project Area is defined as the area in which direct and indirect effects of the action to listed species and designated critical habitat may occur. The area directly affected by the proposed Project at West Dock and Prudhoe Bay is the total footprint of

the GCF, the pipeline ROW, access roads, and associated permanent and construction support facilities inland from the Beaufort Sea coast. The area indirectly affected by the proposed Project is delineated by a zone of influence surrounding new infrastructure within which listed species may be affected by disturbance resulting from construction activities and Project operations. This zone of influence is assumed to be 1 mile (1.6 km) either side of the centerline to as far south as 50 miles from the Beaufort Sea Coast for both species of eiders, and as far south as 25 miles from the Beaufort Sea Coast for polar bear.

The proposed Project Area at the Port of Seward is an area ¼-mile seaward from the existing ship docking facilities. The proposed Project Area for the sealift and module offload at West Dock in Prudhoe Bay is shown in Figure 3.10-1 and includes the 185 mi^2 surrounding West Dock, the navigational channel, and the dredge disposal site summarized in the ASAP West Dock Dredge and Disposal Plan (AGDC, 2016o), as well as any road improvements and gravel pads to be constructed to support the transportation and construction of the GCF. Module transportation from West Dock to the GCF construction site would occur in the summer via the causeway and established land roads encompassed in the proposed Project Area shown in Figure 3.10-1. Transportation to the winter dredge disposal area(s) is also captured in the proposed Project Area shown in Figure 3.10-1.

The southern portion of the proposed Project Area for the Port of Seward has not changed. To focus efforts of this SEIS on the aspects of the proposed action that are likely to affect ESA species within the proposed Project Area, the geographic areas evaluated focus on designated critical habitat, updated species information or other portions of the proposed Project Area where there is a likelihood of finding ESA-listed or ESA-proposed species.

All ESA-protected species that may be affected by the proposed Project are found in the marine environment, nearshore areas, or the ACP. With the exception of the two bird species, all species are marine mammals (*i.e.*, whales, walrus, seals, sea lions, and polar bears). Within the proposed Project Area, the range for three species – Spectacled and Steller's eiders, and the polar bear – includes both marine areas of the Beaufort Sea and terrestrial nearshore areas of the ACP of Alaska's North Slope.

3.10.4.1. West Dock Port Construction

Marine construction at West Dock would be required to accommodate the 23-barge lift, as well as module offload and supporting activities. West Dock infrastructure and roads would require modification to accommodate the modules and deliver them to the GCF location. The existing causeway between DH3 and DH2 would not support the tonnage of the large modules. Therefore, a temporary bridge constructed from ballasted barges would be put in place and utilized to bypass the causeway during module offload. Prior to arrival of the barges, winter dredging and screeding of an existing channel would be required to accommodate the barge depth.

As winter activities at West Dock have the potential to disturb denning polar bears or ice seals, AGDC would consult with NMFS and USFWS to mitigate impacts appropriately and would obtain the required permits and authorizations. Potential impacts from West Dock construction activities for marine mammals and avian species are described in detail in Chapter 4, Environmental Consequences.

3.10.5. USFWS Threatened, Endangered and Candidate Species

3.10.5.1. Steller's Eider (Threatened)

3.10.5.1.1. Biological Populations and Listing Status

The Steller's eider is a small sea duck with a Holarctic[18] distribution in Russia and Alaska. Three distinct breeding populations are recognized: the Alaska breeding population, the Russian-Atlantic breeding population, and the Russian-Pacific breeding population. These breeding populations mix in wintering areas in the Bering Sea.

On June 11, 1997, the Alaska-breeding population of the Steller's eider was listed as threatened based on the observed contraction in the breeding range in Alaska and the resulting increased vulnerability of the remaining breeding population to extirpation (Federal Register 62:31748-31757). Potential causes referenced included hunting, ingestion of lead shot, predation, and changes in the marine environment that may have affected eider food resources. Causes of the decline are still poorly understood (USFWS, 2002a); Steller's eiders have essentially all but disappeared as a breeding population from the Yukon-Kuskokwim Delta, where they had historically occurred, possibly in significant numbers. The Alaska-breeding population is the only population listed under the ESA.

3.10.5.1.2. Population Status, Trends, and Abundance

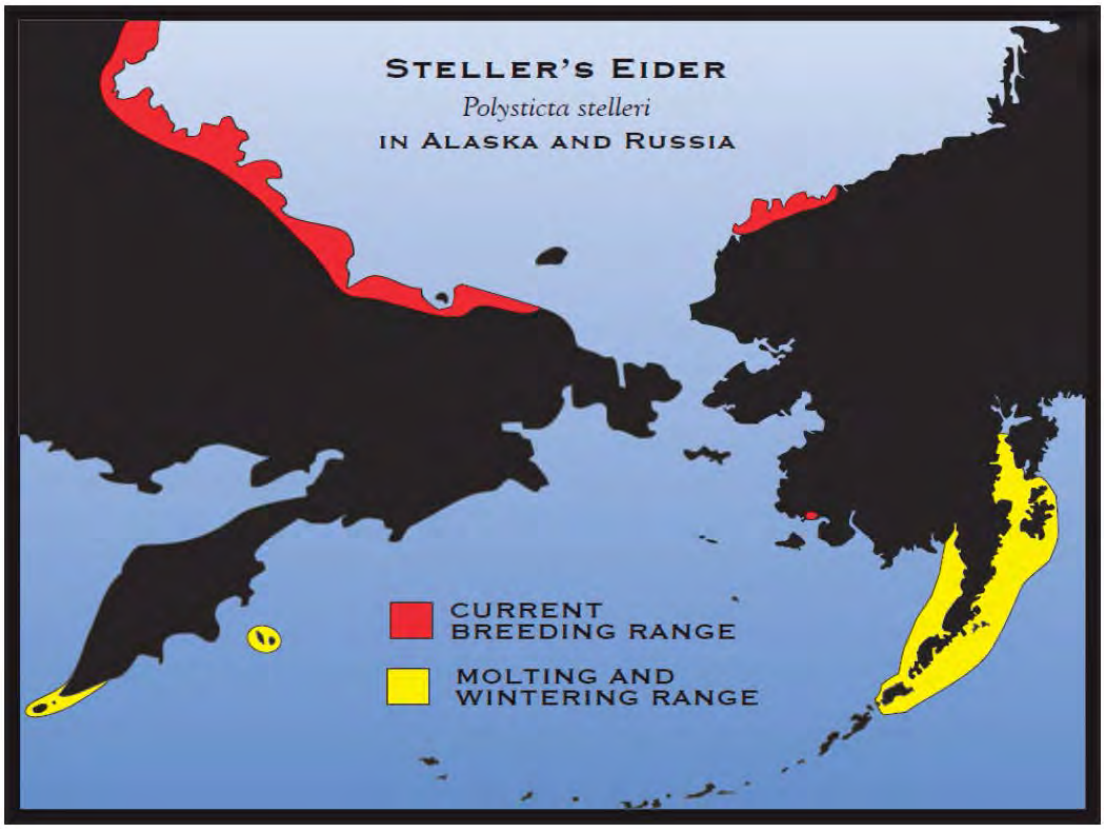
The current world population of Steller's eiders is estimated to be about 110,000 to 125,000 birds, but is thought to have declined by as much as 50 percent in the 1960s, 1970s, and 1980s (ADF&G, 2014b; BirdLife International, 2013). Currently, most of the world's Steller's eiders nest in Russia, with the Alaska breeding population being much smaller than the Russia population, numbering approximately 500 individuals (USFWS, 2011a) to 680 individuals (Stehn *et al.,* 2013). The species has undergone near extirpation in western Alaska. It still breeds on the ACP (Dau *et al.,* 2000), but populations may number as low as 1,000 birds. Stehn *et al.,* (2013), reported the results of 27 consecutive years of aerial surveys and estimated population size at 680 eiders. Based on these aerial surveys, Stehn *et al.* (2013) reported an average growth rate of 0.946 percent for the North Slope subpopulation of Steller's eiders from 1989 to 2012. Although the growth rate is declining, Stehn *et al.* (2013) reported that the data analyzed were imprecise and population trend could not be conclusively supported.

[18] The Holarctic is the terrestrial ecozone that encompasses the majority of habitats found throughout the Nearctic and Palearctic regions combined.

3.10.5.1.3. Range

Range of the Steller's eider in the Pacific is depicted in Figure 3.10-2; however, Steller's eider are also known to winter on the Gulf-side of the Kenai Peninsula, including Resurrection Bay and the Port of Seward (USFWS, 2017b). The nesting distribution for the Alaska breeding population of Steller's eider includes much of the ACP in Alaska. A very small number of breeders also nests in the Yukon-Kuskokwim Delta. The majority of sightings of nesting Steller's eiders have been observed during annual aerial surveys of breeding pairs of waterfowl (Mallek *et al.*, 2007; Stehn *et al.*, 2013) since 1986, and annual eider breeding population surveys (Larned *et al.*, 2006) conducted across the ACP since 1992. These surveys have occurred east of Point Lay and west of Prudhoe Bay, and within about 50 miles of the coast (USFWS, 2002a). The largest concentrations of breeding Steller's eiders in Alaska are found between Utqiagvik and the Colville River Delta, which is considered to be the core of the nesting area (USFWS, 2002a; 2005). Steller's eiders winter in coastal waters along the Aleutian Islands, Kodiak Island, and lower Cook Inlet.

Figure 3.10-2 Range of Steller's Eider in Pacific



Source: USFWS, 2011a

3.10.5.1.4. Life History and Habitat Use

Breeding pairs are formed on wintering grounds. The birds congregate in large numbers in estuaries along the north and south sides of the Alaska Peninsula in the spring, and then migrate north and east to the breeding grounds using coastal waters and offshore leads (Roseneau and Herter, 1984; USFWS, 2002a). Steller's eiders begin migrating into the ACP in late May or early June, when ponds and tundra begin to thaw. Steller's eiders that have arrived on the North Slope, but have not begun to nest, are often associated with deep to shallow *Arctophila* and *Carex* ponds (Rojek, 2006; 2007; 2008).

Nesting in the Utqiagvik area began June 10 to July 1 in 2005, 2006, and 2007 (Rojek, 2006; 2007; 2008). Nest sites are chosen in open tundra or within shrub communities near ponds (Deygtyarev *et al.*, 1999), often on slightly elevated areas near ponds (Murie, 1924; Brandt, 1943; Cramp *et al.*, 1977). USFWS reported that most observed nests in the Utqiagvik area have been found on the rims of low-centered polygons within partially-drained lake basins that contain a mosaic of shallow ponds with emergent sedges, and most are within 330 feet of permanent water (unpublished data summarized in Federal Register 65:13262–13283).

The female and brood move from the nest site to brood habitat in nearby ponds and wetlands; there they feed on aquatic insects and plants until they are capable of flight (Solovieva, 1997). In the Utqiagvik area, hatching was determined to occur July 12 to August 2 in 2005, 2006, and 2007. The distance traveled from the nest to the brooding area was found to range from 328 feet to 2 miles (Rojek 2006; 2007; 2008). Steller's eiders and their broods forage on insect larvae and beetle species in emergent vegetation in shallow ponds.

Females and their broods move to coastal marine waters as the broods fledge. Rojek (2006, 2007, and 2008) reported that broods are fledged in the Utqiagvik area, from the second half of August to early September. Males and unsuccessful hens leave the tundra earlier, being found at small ponds on the tundra nesting ground until the middle or end of July, at which time they move to coastal waters (Rojek, 2006; 2007; 2008). Unsuccessful females may congregate near incubating females until departure (Solovieva, 1997). In unsuccessful years, all birds generally depart the breeding grounds sometime in July (Fredrickson, 2001) or even mid-June (Rojek, 2008).

The birds move to molting areas in Western Alaska, such as the Alaska Peninsula, Izembek Lagoon, Nelson Lagoon, Port Heiden, and the Seal Islands (Petersen, 1981). As sea ice forms in the Arctic Ocean, flocks move south through open leads and eventually arrive at ice-free lagoons along the north and south side of the Alaska Peninsula, the Kenai Peninsula, Cook Inlet, and the eastern Aleutian Islands (USFWS, 2005; USFWS, 2017b). Winter habitat consists of waters typically less than 30 feet deep, so most birds are found within about 1,312 feet of the shore, except where shallows extend further (USFWS, 2002a). In these areas, they dive for mollusks, crustaceans, small fish, and other invertebrates (Petersen, 1981). These prey items are often associated with eelgrass meadows, which provide a substrate for invertebrates (Metzner, 1993).

3.10.5.1.5. Steller's Eiders in the Project Area

From late May through early September, Steller's eiders may be found within or near portions of the proposed Project Area located on the ACP, and in coastal waters near West Dock in the Beaufort Sea (see Figure 3.10-3). In fall and winter, Steller's eider are known to occur in large numbers in Resurrection Bay and near Seward (USFWS, 2017b). No other portions of the proposed Project Area, including other terrestrial portions, are within the range of the species according to published maps, and the eiders would not be expected to occur in these areas.

USFWS conducted annual aerial population surveys for breeding pairs of waterfowl on the entire ACP, including the Prudhoe Bay area, from 1986 to 2006 (Mallek *et al.,* 2007), and conducted separate aerial surveys in the same area specifically for eiders from 1992 to 2006 (Larned *et al.,* 2006). Since 2007, the two survey programs have been combined (Larned *et al.,* 2012; Stehn *et al.,* 2013). The proposed Project Area lies within areas documented by these survey programs as having low densities of nesting or breeding eiders. Since 1986, these surveys have resulted in observations of low numbers of pairs of Steller's eiders in the Prudhoe Bay area.

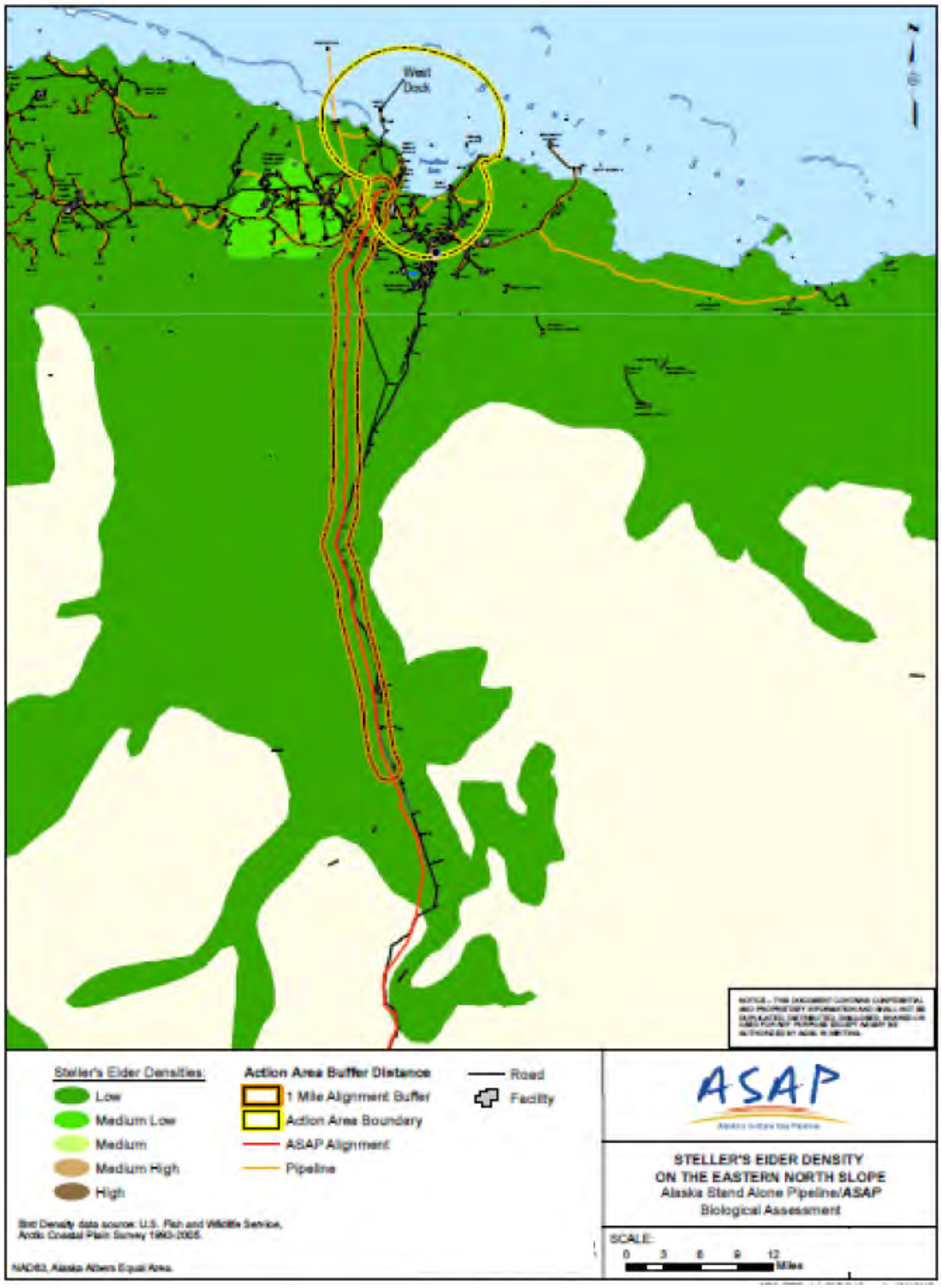
Site-specific surveys for Steller's eider's have not been conducted in the proposed Project Area; however, Troy and Johnson (1987) reported the results of intensive avian surveys conducted for shorebirds and waterfowl in the lagoon waters on either side of West Dock and on the adjacent tundra in July – September 1981 that were part of a monitoring study for the Prudhoe Bay waterflood project. No Steller's eiders were observed along transects in the lagoon waters, but one Steller's eider was observed on the tundra. It was also reported in FR 62:31750 that a few pairs of Steller's eiders were observed on the tundra in the Prudhoe Bay oil fields each year from 1992 to 1994.

Extensive aerial surveys of the bird use of nearshore and offshore waters extended from Utqiagvik to the Canadian border and from the shoreline offshore for distances of up to 62 miles in 1991, 2000, and 2001 (Fischer and Larned, 2004). During those surveys, only three Steller's eiders were observed, representing about 0.01 percent of all observed birds. The observed Steller's eiders were in Smith Bay more than 100 miles to the west of the proposed Project Area.

3.10.5.1.6. Critical Habitat

Approximately 2,830 mi^2 of land and coastal waters in five units were designated as critical habitat for the Alaska breeding population of Steller's eiders in 2001 (FR 66:8849). These areas include the historic breeding range on the Delta (Unit 1), and molting or wintering grounds at the Kuskokwim Shoals (Unit 2), Seal Islands (Unit 3), Nelson Lagoon (Unit 4), and Izembek Lagoon (Unit 5). All designated critical habitat for Steller's eiders is located more than 100 miles from the proposed Project Area.

Figure 3.10-3 Steller's Eider Density on the Eastern North Slope



3.10.5.1.7. Recovery Plan

In September of 2002, USFWS issued a Recovery Plan for the Alaska-breeding population of Steller's eider. The plan is intended to provide strategies, which ultimately will lead to the delisting of the species under the ESA (http://ecos.fws.gov/docs/recovery_plans/2002/020930b.pdf).

The Steller's eider Recovery Plan includes:

- Prevention of further declines in Steller's eider breeding populations in Alaska;
- Protection of current Alaska-breeding populations and their habitat;
- Identification and remedy of causes and recovery obstacles; and
- Determination of size, trends, and distribution of Alaska-breeding subpopulations.

3.10.5.2. Spectacled Eider (Threatened)

3.10.5.2.1. Biological Populations and Listing Status

The spectacled eider (*Somateria fischeri*) is a sea duck that inhabits the northern extent of the Pacific Ocean in the Chukchi and Bering Seas. Three primary breeding populations have been identified: the Russian Arctic population, the ACP of Alaska population, and the Delta population in western Alaska.

The spectacled eider was listed as threatened throughout its range under the ESA in 1993 (FR 58:27474). It is believed that large declines in the populations were due to exposure to lead shot, increased predation, and changes in forage quality in wintering areas of the Bering Sea (USFWS, 2002a).

3.10.5.2.2. Populations Status, Trends, and Abundance

The worldwide population of spectacled eiders was estimated by Larned *et al.* (2012) to be about 369,122 (364,190 - 374,054 90% CI), birds. This estimate was based on the 2010 survey counts of birds wintering in the Bering Sea, and therefore presumably includes many non-breeding birds. It has been estimated that about 4,000 pairs nest annually in the Delta, another 3,000 to 4,000 pairs nest on the ACP, and perhaps 40,000 or more pairs nest in Arctic Russia (USFWS, 2009a). In the Delta area, populations declined drastically in the 1970s, 1980s, and 1990s (USFWS, 2011b). Due to the scarcity of historical data, it is unknown whether such declines ever occurred in Russia or on the ACP. Current survey data suggest that the spectacled eider population on the ACP is generally stable (Stehn *et al.*, 2013).

3.10.5.2.3. Range

The range of the spectacled eider in the Pacific is provided in Figure 3.10-4. Nesting occurs on the ACP from about the Utukok River just south of Icy Cape, north and west to the Shaviovik River, and within this area most of the nesting takes place between Cape Simpson and the Sagavanirktok River (USFWS, 2000), and primarily north of

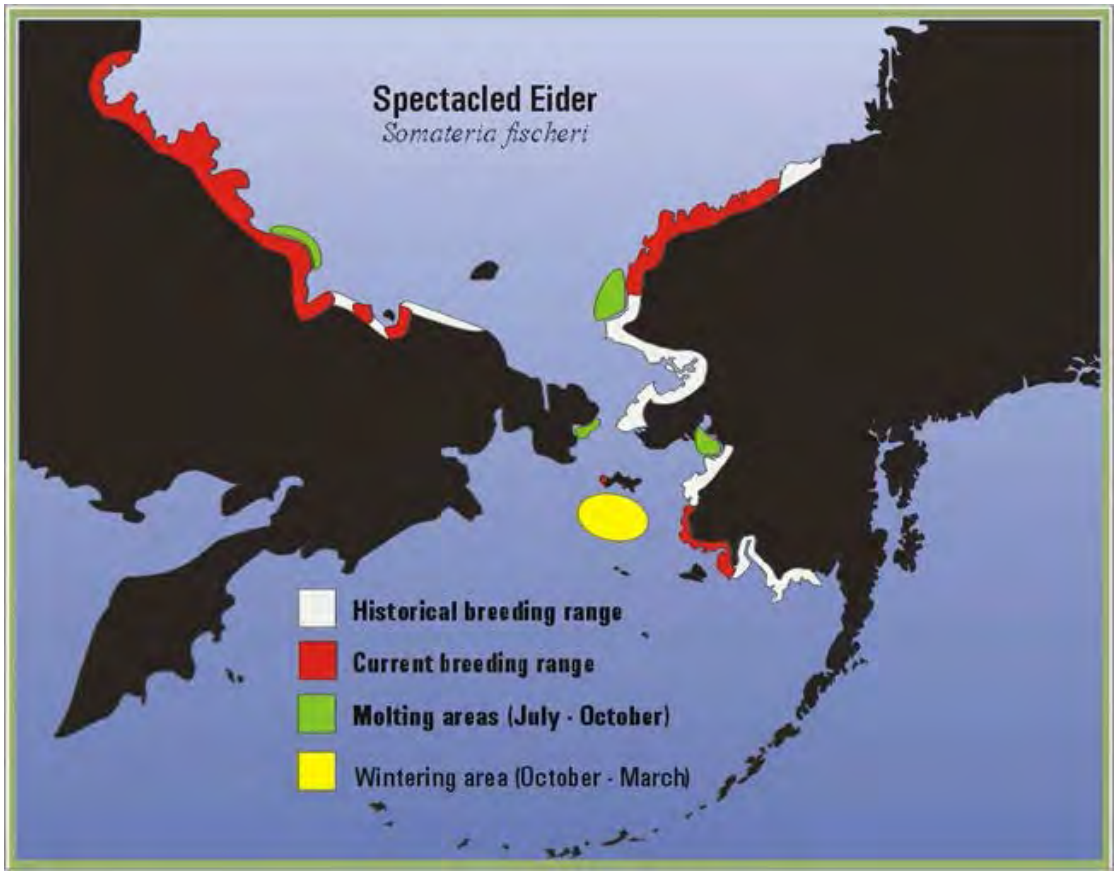
latitude of 70 degrees (USFWS, 2000) or within about 50 miles of the coast (Larned and Balogh, 1997).

Important molting and staging areas include Harrison Bay, Simpson Lagoon, Smith Bay, Peard Bay, Kasegaluk Lagoon, Ledyard Bay, and eastern Norton Sound (LGL, 1992; Larned *et al.*, 1995; Petersen *et al.*, 1999; TERA, 2000; Troy, 2003).

Satellite tracking led to observations of large concentrations of spectacled eiders located southwest of St. Lawrence Island in the Bering Sea; the area is now thought to support the majority of the world's population of wintering spectacled eiders (Petersen *et al.*, 1999). Based on USFWS aerial survey counts, the population was estimated at 363,030 individuals (Larned and Tiplady, 1999).

In early winter, spectacled eiders have been observed south of St. Lawrence Island, moving farther offshore as winter progresses (Petersen *et al.*, 1999). Their late winter habitat is associated with ice cover as the birds search for open water. Flocks gather in ice-free openings (Petersen and Douglas, 2004). In winter, they forage for mollusks, crustaceans, and invertebrates, such as clams, in the open ice leads, to depths of 147 to 230 feet (Lovvorn *et al.*, 2003).

Figure 3.10-4 Range of Spectacled Eider in the Pacific



Source: USFWS, 2011b

3.10.5.2.4. Life History and Habitat Use

Spectacled eiders spend most of their life in the marine environment where they dive to feed on bottom dwelling prey such as mollusks, bivalves, and crustaceans (Petersen *et al.,* 1998). These prey items are part of a benthic community that is highly variable, being influenced by seasonal and decadal weather systems in the North Pacific (Peterson and Douglas, 2004; Grebmeier and Dunton, 2000). This variability, coupled with the extreme energetic requirements of their habitats, may explain as much as 50 percent of winter mortality of female spectacled eiders (Flint *et al.,* 2000).

Spectacled eiders arrive on the ACP breeding grounds in late May or early June (Kistchinski and Flint, 1974; Anderson and Cooper, 1994; Smith *et al.,* 1994). Nesting occurs north of a line connecting the mouth of the Utukok River to a point on the Shaviovik River roughly 15 miles inland from the mouth (USFWS, 2012b). Spectacled eider breeding densities vary along the ACP and are depicted in Figure 3.10-4. Overall densities during the eider breeding population surveys on the ACP have ranged between approximately 0.174 and 0.305 birds per 0.39 mi^2 between 1993 and 2006 (Larned *et al.,* 2006). The density during the 2006 breeding population survey was 0.219 birds per 0.39 mi^2.

In general, breeding spectacled eiders nest near large, shallow, productive thaw lakes, often with convoluted shorelines and/or small islands (Larned and Balogh, 1997), and nest sites are often located within 3.3 feet of a lakeshore (Johnson *et al.,* 1996). Spectacled eiders on the Colville River Delta nest in salt-killed tundra, aquatic sedge with deep polygons, and patterned wet meadow, although only salt-killed tundra seems to be preferred based on an analysis of habitat selection (Johnson *et al.,* 2002; Johnson *et al.,* 2003). Complex shorelines and small islands are characteristic of preferred nesting habitat (Larned and Balogh, 1997). Spectacled eider nests have been found near polygon ponds, polygon series, and polygon series complexes within 3.3 feet of the edge of the waterbody in the Colville River Delta (Bart and Earnst, 2005). At Prudhoe Bay, the highest densities of spectacled eider occurred in ponds with emergent vegetation (sedge or *Arctophilla*) and impoundments. Non-pond habitats were also used both early in the year when they are flooded and for nesting. Hatching success in the Prudhoe Bay area averaged approximately 40 percent (TERA, 1992). In the Kuparuk oil field, nests were observed in basin wetland complexes and aquatic emergent vegetation (both aquatic grass and aquatic sedge) (Anderson *et al.,* 2003). Nests have also been found along the tops of elevated perimeters on permanent water polygons containing emergent sedge or grass (Rothe *et al.,* 1983; North, 1990) and on the edges of deep open lakes (Bergman *et al.,* 1977; Derksen *et al.,* 1981). Spectacled eiders on the ACP nest mainly in areas near the coast rather than at inland locations (Derksen *et al.,* 1981; Burgess *et al.,* 2003). Of 62 nests reported in the Colville River Delta, none was further than 8.1 miles from the coast (Burgess *et al.,* 2003).

Based on a small sample size of band returns, there is some evidence that spectacled eider males, as well as females may exhibit both breeding site and mate fidelity (TERA,

1997). Spectacled eiders lay eggs in the second week of June; clutch sizes vary among years and study sites (Petersen *et al.,* 2000). Average clutch size on the Colville River Delta was reported as 4.32 (sample size (n) = 22) (Bart and Earnst, 2005). Johnson *et al.,* (2008) reported an average clutch size of 4 (sample size (n) = 40) on the Colville River Delta CD-3 oil well pad. Incubation lasts 20 to 25 days and eggs hatch in mid- to late July (Moran, 1995; Warnock and Troy, 1992). Fledging occurs about 50 days after hatching.

Broods are reared in shallow ponds and lakes with emergent vegetation, in basin wetland complexes, as well as on deep, open lakes (Dau, 1974; Kistchinski and Flint, 1974; Derksen *et al.,* 1981; Warnock and Troy, 1992; Anderson and Cooper, 1994; Anderson *et al.,* 1995). Schmidt-Nielsen and Kim (1964), Baudinette *et al.,* (1982), and Moorman (1990) all found that sea duck broods like those of spectacled eiders may exhibit deleterious physiological effects when freshwater is not available. Nesting and brooding areas provide eiders with dietary requirements including mollusks, insect larvae from the Orders *Diptera* (crane flies and midges) and *trichopterans* (caddisflies), crustaceans, emergent plants, and seeds (Kondratev and Zadorina, 1992). Broods are quite mobile and may move as much as 0.5 to 2 miles from the nest site within the first few days after hatching (TERA, 1996). TERA (1996) reported that some broods moved to areas previously used for feeding by females prior to the onset of incubation. In most cases, brood-rearing apparently does not occur in ponds adjacent to nest sites even if suitable habitat is present (TERA, 1995), indicating that not only is the nest site location important, but spectacled eiders may also require a much larger area in the general vicinity of the nest site for brood-rearing. Most broods are raised within 3.1 miles of the nest site (Dau, 1974; Harwood and Moran, 1993; Moran and Harwood, 1994). After an initial post-hatch dispersal in the Prudhoe Bay area, there was a tendency for broods to settle into a particular area for a time, and then abruptly move to a new area. After fledging (approximately 50 days post-hatching), females and young move from freshwater to marine habitats where they eventually rejoin males and molt at fall migration staging areas (Dau, 1974; Kistchinski and Flint, 1974).

Most males depart the breeding grounds in mid-June after the onset of incubation, moving to coastal bays and lagoons to molt and stage for fall migration. Successful females and young of the year begin to depart the breeding grounds in late July and movement continues until the end of August. Early departing females may be non-breeders or have had failed nesting attempts (LGL, 1992; Larned *et al.,* 1995; Petersen *et al.,* 1999; TERA, 2000; Troy, 2003).

3.10.5.2.5. Spectacled Eiders in the Project Area

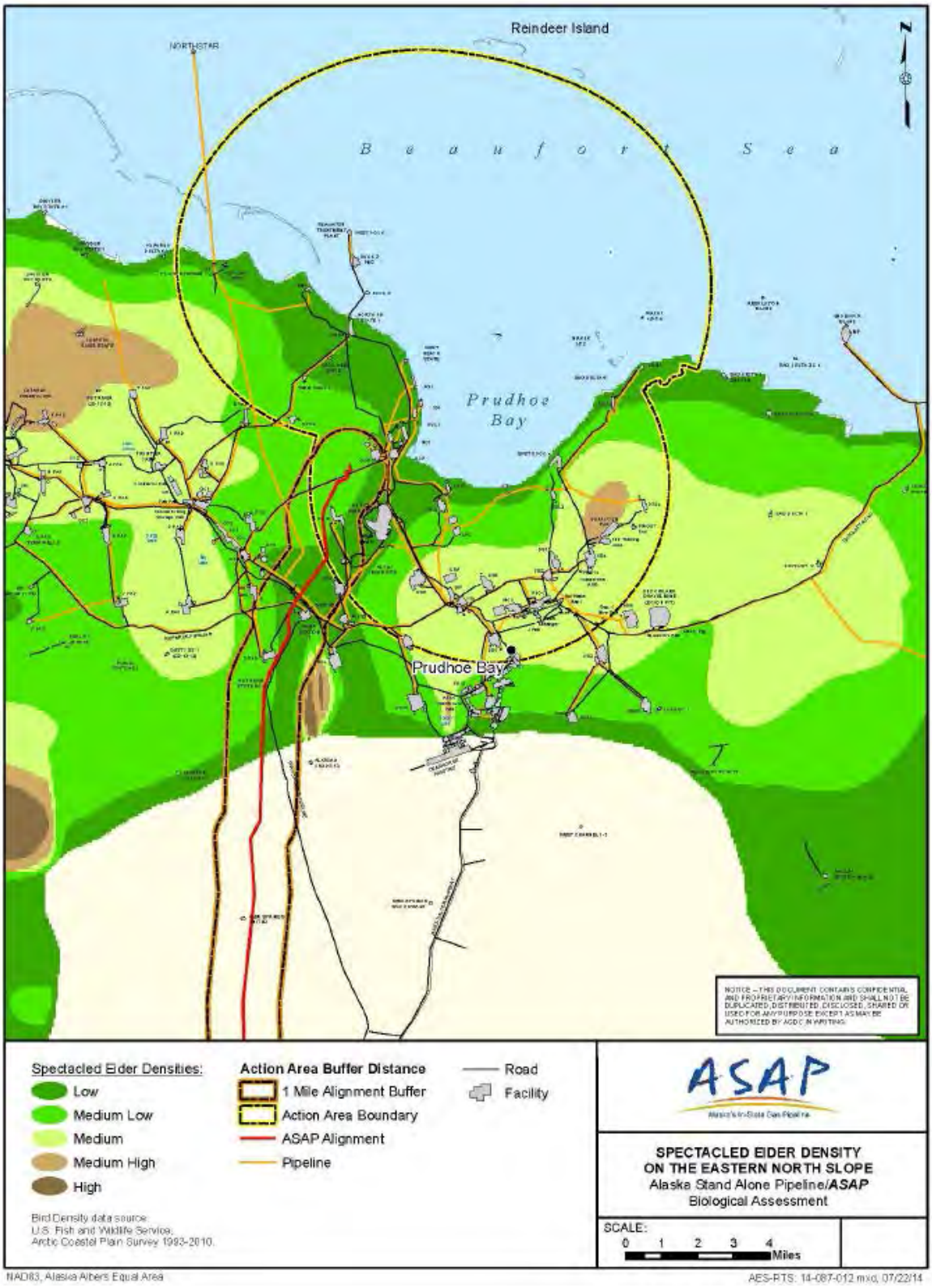
Spectacled eiders may be present in or near the proposed Project Area near the northern coast of Alaska and West Dock, but are not expected near the proposed Project Area in Seward or along the pipeline corridor further than approximately 50 miles from the northern coast (Figure 3.10-5).

Surveys were conducted in offshore waters of the Beaufort Sea to determine the composition and distribution of birds in June, July, and August 1999 - 2001 (Fischer and Larned, 2004). In 1999 and 2000, the area near West Dock at Prudhoe Bay was surveyed. Spectacled eider density was low throughout the entire survey area. In 2001, 15 spectacled eiders were seen between Prudhoe Bay and Utqiagvik, and there were no spectacled eiders observed in the area encompassing West Dock (Fischer and Larned, 2004).

3.10.5.2.6. Critical Habitat

Critical habitat for spectacled eiders was designated by USFWS in 2001 (FR 66:9146) and comprises nesting habitat in the Delta, molting areas in Norton Sound and Ledyard Bay, and wintering habitat south of St. Lawrence Island (Figure 3.10-5). All designated critical habitat is located more than 400 miles from the proposed Project Area.

Figure 3.10-5 Spectacled Eider Density on the Eastern North Slope



3.10.5.2.7. Recovery Plan

In 1996, USFWS finalized a recovery plan, (http://ecos.fws.gov/docs/recovery_plan/960812.pdf), which provided strategies to recover the Alaska-breeding population to pre-ESA status (USFWS, 2002b). The causes for the decline of the spectacled eiders population are not well defined. Possible factors may be similar to those affecting Steller's eiders, as well as other factors, such as impacts from human development and other mechanisms described above.

This recovery plan includes the following actions:

- Coordination of recovery and management plans between government agencies and native and other non-governmental organizations;
- Increasing efforts to reduce mortality of existing populations;
- Quantification and monitoring of existing breeding populations;
- Identification of molting, migration, and wintering area habitats;
- Continued research of demography and biology of the species and development of demographic models; and
- Determination of obstacles to recovery and causes of decline (USFWS, 1996).

3.10.5.2.8. Factors Affecting Both Eider Species

3.10.5.2.8.1. Collisions with Manmade Structures

Flight characteristics of eiders over water place them at risk for collisions with manmade structures (Day *et al.,* 2005). Johnson and Richardson (1982) reported that 88 percent of eiders in their study flew below 32.8 feet, and greater than 50 percent below 16.4 feet. High intensity lights on vessels attract seabirds, including eiders, and result in collisions with the vessel and rigging, especially in poor weather conditions (Russell, 2005). Collisions by eiders with fixed objects, including towers and antennas in the winter range and along migration routes, depend on the proximity of the structure to migration flight paths.

3.10.5.2.8.2. Stochastic Events

Eider demographics may be susceptible to stochastic events due to random or unpredictable changes in factors such as weather, food supply, and populations of predators (Goodman, 1987). Small populations have more difficulty surviving the combined effects of demographic and environmental stochasticity, but larger populations, such as spectacled eider, that depend on the stability of a relatively small area for wintering can also be affected. Disruption of food resources and parasite infections are known to have caused mass mortalities in common eiders (Camphuysen, 2000). Severe weather can be a threat to Arctic sea ducks, and mass eider mortalities have been recorded after late spring storms on the Arctic Ocean (Barry, 1968).

3.10.5.2.8.3. Parasites and Disease

Persson *et al.,* (1974) concluded that parasites were an important mortality factor for common eiders in Sweden. In Scotland, Mendenhall and Milne (1985) found that renal and intestinal coccidiosis caused a 20 to 45 percent loss of common eider ducklings. Although some information exists on helminth worms found in spectacled eiders, the effects of this parasite on population declines are not certain (Schiller, 1955; Dau, 1978). Disease epidemics have not been reported for spectacled eiders, although avian cholera has been attributed with the loss of common eiders in eastern North America (Reed and Cousineau, 1967; Korschgen *et al.,* 1978).

3.10.5.2.8.4. Contamination

Contaminants, such as petroleum-based compounds, have the potential to affect the growth, reproduction, and development of animals at different age classes. Other potential elements that may impact spectacled eiders include mercury and zinc (Stout *et al.,* 2002). Harbors and bays are subjected to heavy maritime traffic and industrial activity related to the commercial fishing industry.

3.10.5.2.8.5. Effects of Research Activities

Research has suggested scientific studies may affect eider nesting grounds by inadvertently attracting predators to nests and broods, causing increased mortality rates to eider eggs and chicks (Bart, 1977; Gotmark, 1992). USFWS (2010a) has determined that although a variety of research activities will be, and have been, conducted on eiders in Alaska, disturbance and predation resulting from such activities do not pose population-level effects.

3.10.5.2.8.6. Lead Poisoning

Regulations requiring the use of non-toxic shot for hunting waterfowl, cranes, and snipe in Alaska were implemented in 1991 (50 CFR 20.134). Although banned, some coastal residents of Alaska still use lead shot for hunting waterfowl. Often, residual lead shot remains on the tundra or in shallow ponds for years, posing a prolonged risk to eiders. Studies by USGS state that up to 50 percent of the successfully breeding female eiders in one area of the Yukon-Kuskokwim Delta may be exposed to lead (Flint *et al.,* 1997). Wilson *et al.,* (2004) found lower levels of lead in ACP breeding populations.

3.10.5.3. Polar Bear (Threatened)

3.10.5.3.1. Biological Populations and Listing Status

Evidence from telemetry surveys, tagging studies, and traditional knowledge has resulted in the recognition of 19 partially discrete polar bear populations (Schliebe *et al.,* 2008). Two recognized polar bear populations occur in Alaska: the Southern Beaufort Sea (SB) stock and the Chukchi/Bering Seas stock. Only the SB stock is found in or near the proposed Project Area.

Because the principal habitat of polar bears is sea ice, it is considered a marine mammal, and included in the species protected under the MMPA. On May 15, 2008, the polar bear was listed as a threatened species range-wide under the ESA (FR 73:28212). This listing was based on the best available science showing that a loss of sea ice would threaten polar bear habitat. The polar bear was listed as a threatened species (likely to become endangered in the foreseeable future).

The SB population occurs between Icy Cape, Alaska on the western boundary and Pearce Point, Northwest Territory (NWT), Canada (Amstrup *et al.,* 1986; Amstrup and DeMaster, 1988; Stirling, 1988). The most current population assessment derived from capture-recapture data collected during 2001 to 2006 estimated 1,526 polar bears in the region in 2006 (Regehr *et al.,* 2006). The status of the SB population is designated as reduced (FR 73:28212, May 15, 2008; page 28,217) and the predicted trend is declining (Aars *et al.,* 2006).

3.10.5.3.2. Populations Status, Trends, and Abundance

The total number of polar bears worldwide is estimated to be about 20,000 - 25,000 bears (Schliebe *et al.,* 2006; Schliebe *et al.,* 2008). The size of the SB population was estimated to be approximately 1,800 animals in 1986 (Amstrup *et al.,* 1986; Amstrup 2000), and may have been as high as 2,500 in the late 1990s (Amstrup *et al.,* 2001). The most recent stock assessment estimated a SB population size of 1,526 polar bears (Regehr *et al.,* 2006 as reported in Allen and Angliss 2015). The SB population of polar bears was thought to be low and declining in the 1960s due to excessive harvest, and to have increased dramatically, (perhaps doubling) between the 1960s and the 1990s (Amstrup, 2000).

In 2006, results from an intensive 5-year mark-recapture study indicated that the SB subpopulation may have declined between the late 1990s and 2006 (Regehr *et al.,* 2006). Subsequent analyses of the 2001 to 2006 data indicates that the survival and breeding of polar bears during this period were affected by sea ice conditions. The population is currently considered to be declining. The harvest of polar bears in the SB region is shared between Canada and the U.S., and since 1988, has been managed under the "Polar Bear Management Agreement for the Southern Beaufort Sea" by the Inuvialuit Game Council of Canada, and the NSB of Alaska. The harvest quota for the SB region is 80 animals (40 for Alaska and 40 for NWT) (Brower *et al.,* 2002). The average annual Alaska harvest from 2003 to 2007 was 33 (a total of 67 males and 33 females) (Allen and Angliss, 2015).

3.10.5.3.3. Range

Polar bears are the apex predators of the Arctic marine ecosystem (Amstrup, 2003) and are distributed throughout regions of Arctic and subarctic waters where the sea is ice-covered for large portions of the year.

3.10.5.3.4. Life History and Habitat Use

Polar bears are common in the Beaufort Sea and are known to occur in small, widely distributed numbers in the proposed Project Area. Over most of their range, polar bears remain on the sea ice year round, as the sea ice is where their prey (mostly ringed seals [*Phoca hispida*]) is accessible. Polar bears generally remain on sea ice and visit land only for short periods when sea ice is prevalent. However, polar bear use of coastal areas during the fall open-water period has increased in recent years and is projected to continue to increase (Hunter *et al.,* 2010; Kochnev *et al.,* 2003; Schliebe *et al.,* 2005). Polar bears derive energy from marine mammal prey obtained on sea ice habitat. The high fat intake from specializing on marine mammal prey allows polar bears to thrive in the harsh Arctic environment (Stirling and Derocher, 1990; Amstrup, 2003; USFWS, 2009a). Over much of their range, polar bears are dependent on ringed seals (Smith, 1980) and where common, bearded seals (Derocher *et al.,* 2002).

Maternal dens typically are located in snowdrifts in coastal areas, stable parts of the offshore pack ice, or on landfast ice (Amstrup and Gardner, 1994). The highest density of land dens in Alaska occur along the coastal barrier islands of the eastern Beaufort Sea and within the ANWR (USFWS, 2009a) (see Figure 3.10-6). Only pregnant female polar bears den; other members of the population (males, solitary females, females with older cubs) remain active throughout winter.

Amstrup and Gardner (1994) studied fidelity to denning locations and found that bears that denned once on pack ice were more likely to den on pack ice than on land in subsequent years. Bears were also found to be faithful to general areas. They are more likely to return to the eastern coastal area to den (if that is where they previously denned), earlier than to the western half of the Alaska coast. Annual variations in weather, ice conditions, prey availability, and the long-distance movements of polar bears (Amstrup *et al.,* 1986; Garner *et al.,* 1990) make recurrence of exact denning locations unlikely to occur. In late October and November, pregnant females find an area to den on land or sea ice; such as a snow bank, slope, or an area of rough ice that is a stable location to excavate a depression (Durner *et al.,* 2001). Because this species does not use the same dens or denning locations from year to year, a female could potentially den within the proposed Project Area in the future (Durner *et al.,* 2003). Polar bear dens have been documented within the proposed Project Area (Durner *et al.,* 2010; Sanzone *et al.,* 2010; Smith, 2010).

Durner *et al.,* (2006) found approximately 50 percent of pregnant females in the Beaufort Sea came ashore to construct maternity dens; Amstrup and Gardner (1994) reported 42 percent of females observed in the Alaskan Chukchi and Beaufort seas and Canadian Beaufort Sea from 1983 to 1991 denned on land. Fischbach *et al.,* (2007) observed the proportion of dens on pack ice declined from 62 percent in 1985–1994 to 37 percent in 1998–2004; among pack ice dens, fewer occurred in the western Beaufort Sea after 1998. The study areas included SB polar bear as well as the eastern portion of the Chukchi Sea polar bear stock and the western portion of the Northern Beaufort Sea stock.

In Alaska, dens are sparsely distributed along a narrow coastal strip with sightings reported up to 30 miles inland (Lentfer and Hensel, 1980) and 38 miles inland (Amstrup and Gardner, 1994). Denning habitat includes areas such as coastal and river banks and bluffs where snow accumulates early.

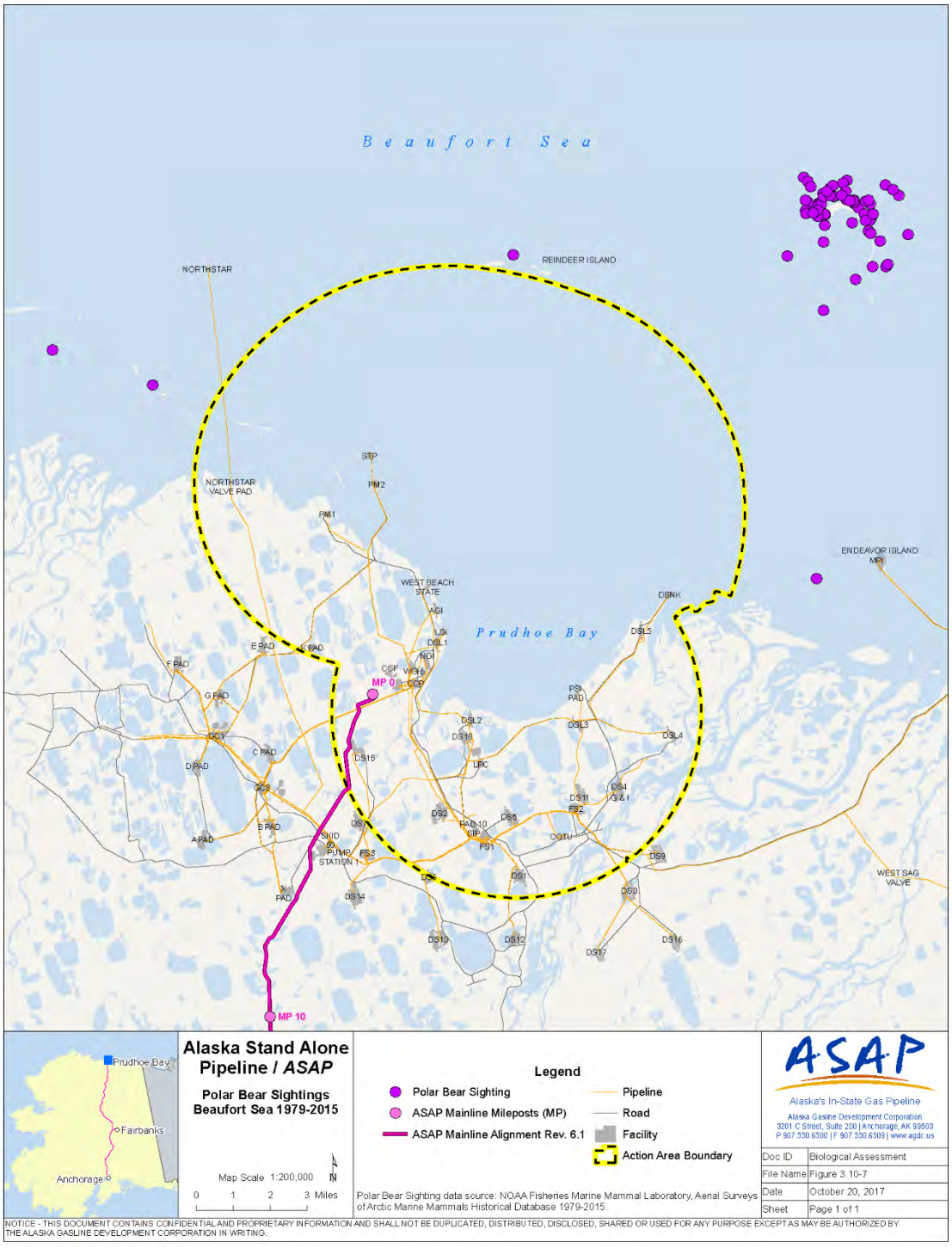
3.10.5.3.5. Polar Bears in the Project Area

Polar bear habitat does exist in the proposed Project Area, though recent surveys place polar bears largely outside of that area (Figure 3.10-7). As described above, polar bears spend the majority of their time on sea ice, coming on land only occasionally. Polar bears may den on sea ice or on land. Some pregnant females from the SB stock come on land to enter dens in late fall. Maternal polar bear denning habitat exists in the proposed Project Area; however, recent surveys have not documented dens within the area's boundary (Figure 3.10-6). AGDC plans to seek and adhere to appropriate mitigation measures directed by USFWS to avoid impacts to polar bear maternity dens, particularly due to noise or visual disturbance during construction. As winter activities have the potential to disturb denning polar bears or ice seals, AGDC would consult with USFWS to mitigate impacts appropriately and would obtain the needed permits and authorizations.

Figure 3.10-6 Maternal Polar Bear Den Locations / Habitat in and Near Project Area



Figure 3.10-7 Polar Bear Sightings in and Near Project Area



3.10.5.3.6. Critical Habitat

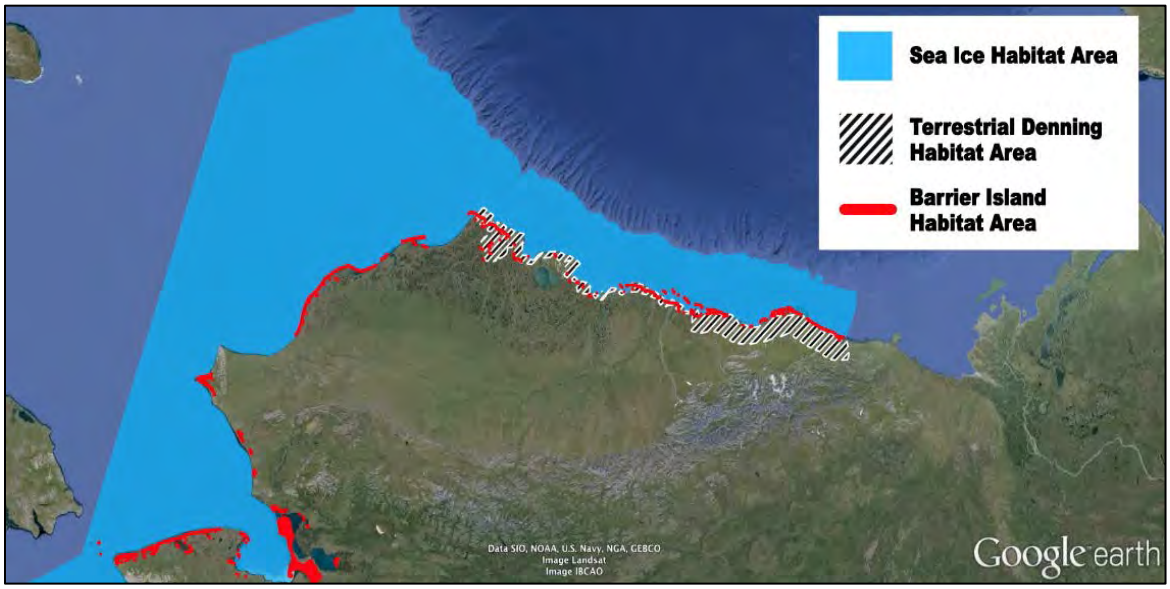
On October 29, 2009, USFWS proposed critical habitat for the threatened polar bear (74 FR 56058) and a final rule designating critical habitat was issued on December 7, 2010 (75 FR 76086). However, the U.S. District Court for the District of Alaska issued a decision to USFWS on January 11, 2013, which vacated and remanded the final rule on polar bear critical habitat in Alaska Oil and Gas Association *et al.* v. Salazar *et al.* (D. Alaska)(3:11-cv-00025-RRB). On February 29, 2016, the 9th Circuit Court of Appeals reinstated, on all points, polar bear critical habitat on the North Slope of Alaska.

There are three types of polar bear critical habitat: sea ice, terrestrial denning, and barrier island (Figure 3.10-8). Each of these types has its own definition and area. Approximately the first 5 miles (8 km) of the proposed Project would fall within the polar bear terrestrial denning critical habitat area. The proposed work at West Dock would fall within the polar bear sea ice critical habitat. The GCF, a material source, approximately the first 2 miles of the Mainline, and several access road segments near Prudhoe Bay would fall within the "no disturbance zone" of the polar bear barrier islands and denning critical habitat area.

USFWS (2010d) defines the types of polar bear critical habitat as follows:

> *Sea Ice Habitat*
>
> *This area located over the continental shelf includes water 300 m and less in depth. Sea ice habitat is essential to most polar bear activities. Polar bears evolved over thousands of years to life in a sea ice environment. They depend on the sea ice-dominated ecosystem to support essential life functions. It provides a platform for hunting and feeding, for seeking mates and breeding, for movement to terrestrial maternity denning areas, for resting, and for long-distance movements.*
>
> *Terrestrial Denning Habitat*
>
> *This area includes lands within 32 km of the northern coast of Alaska between the U.S. Canadian border and the Kavik River and within 8 km between the Kavik River and Barrow. Appropriate terrestrial denning habitat typically occurs near the coast which allows females to prey on seals, so that they can meet their nutritional needs before and after denning. Adult females also select locations that will provide an environment safe from predatory adult males, disturbance, and adverse weather conditions; all risks to which cubs are particularly vulnerable.*
>
> *Barrier Island Habitat*
>
> *This area includes coastal barrier islands and spits along Alaska's coast. Barrier island habitat is used by polar bears for denning, refuge from human disturbances, access to maternal dens and feeding habitat, and travel along the coast.*

Figure 3.10-8 Polar Bear Critical Habitat Areas



Source: KTVA Alaska, 2015

3.10.5.4. Bowhead Whale (Endangered)

3.10.5.4.1. Biological Populations and Listing Status

Four stocks of bowhead whales are recognized worldwide (IWC, 2010): the Western Arctic, Sea of Okhotsk, Spitsbergen, and the recently combined western Greenland/eastern Canada stocks or populations. The Western Arctic stock of bowhead whales is the only stock found within U.S. waters. The bowhead whale is federally designated as endangered. The species was listed as an endangered species on June 2, 1970 (FR35:8495). It is also an Alaska Species of Special Concern. The Western Arctic stock is classified by NMFS as a strategic stock and designated as depleted under the MMPA (Allen and Angliss, 2015).

3.10.5.4.2. Populations Status, Trends, and Abundance

In the late 19th and early 20th century, this stock was overwhelmed by highly successful commercial whaling. The number of bowhead whales plummeted from an estimated population, in 1848, of 10,400–23,000 whales to a rough count of 1,000 to 3,000 individuals in the mid-20th century (Woodby and Botkin, 1993). Commercial whaling of bowheads was outlawed in 1996 by a moratorium from the IWC, although specific exemptions for certain countries exist and limited modern subsistence whaling continues with oversight and quotas regulated by the IWC.

Small stocks occur in the Sea of Okhotsk and the offshore waters of Spitsbergen. These are composed of only tens to hundreds of individuals (Shelden and Rugh, 1995; Zeh *et al.*, 1993). Until recently, available evidence indicated that only a few hundred bowheads were in the Hudson Bay and Davis Strait stocks, but it now appears these should be

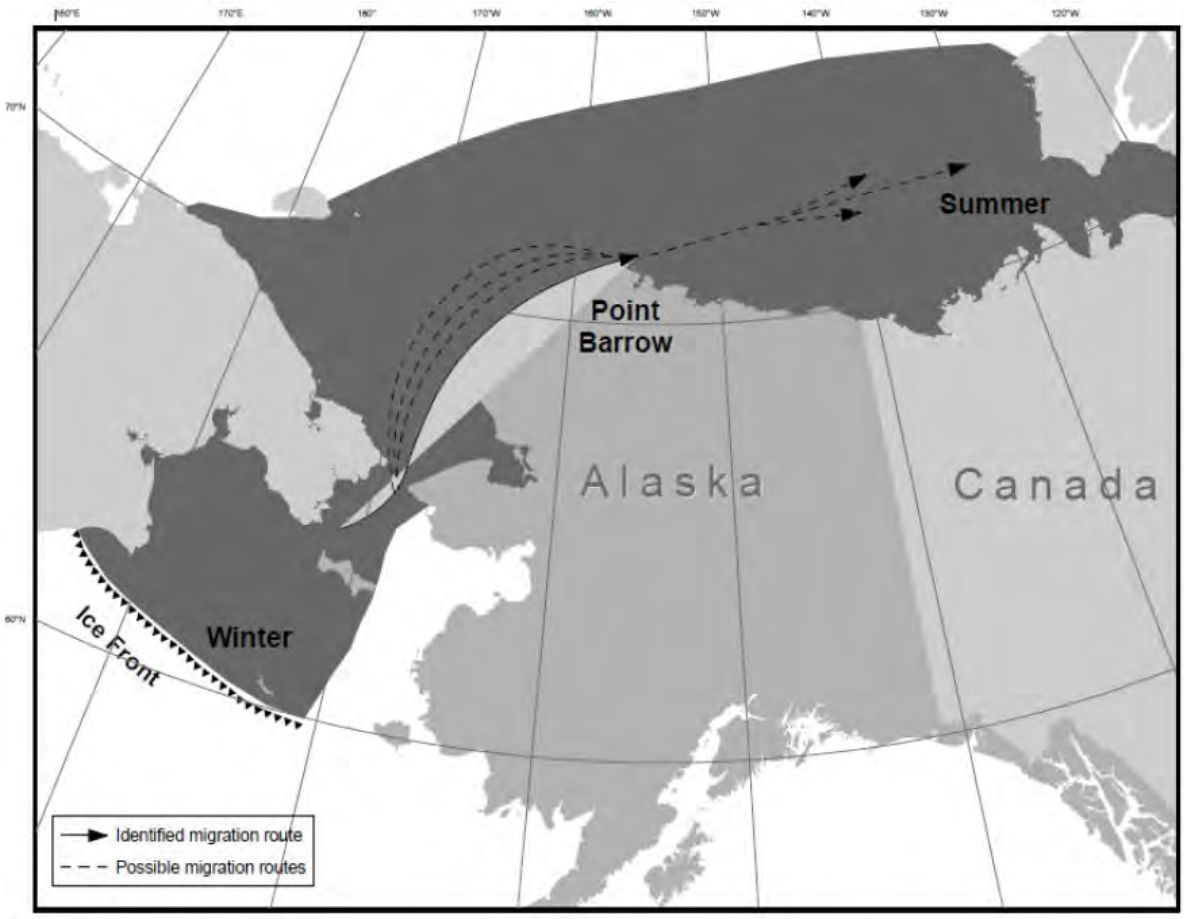
considered one stock based on genetics (Postma *et al.,* 2006), aerial surveys (Cosens *et al.,* 2006), and tagging data (Dueck *et al.,* 2006; Heide-Jørgensen *et al.,* 2006), and the abundance may be over a thousand (Heide-Jørgensen *et al.,* 2007).

In 2011, the NSB successfully completed a new ice-based count of bowhead whales, which estimated the population at approximately 16,892 animals, and an annual growth rate of 3.7 percent (Givens *et al.,* 2013). Calf counts in 2001 were the highest on record, 121 individuals, confirming a growing population (George *et al.,* 2004). Today, some reports suggest Western Arctic stock bowhead whales are approaching the carrying capacity of their habitat (Brandon and Wade, 2004).

3.10.5.4.3. Range

Bowhead whales are distributed seasonally in ice-covered waters of the Arctic and near-Arctic, generally between 60 degrees and 75 degrees North latitude in the Western Arctic Basin (Moore and Reeves, 1993). The majority of bowhead whales overwinter in the central and northwestern Bering Sea (November to March), migrate through the Chukchi Sea in the spring (March through June) following offshore ice leads around the coast of Alaska in continental shelf waters, and spend summers in the Canadian Beaufort Sea (mid-May through September) (Braham *et al.,* 1980; Moore and Reeves, 1993). Bowhead whale distribution and spring and fall migration routes are shown in Figures 3.10-9 and 3.10-10, respectively.

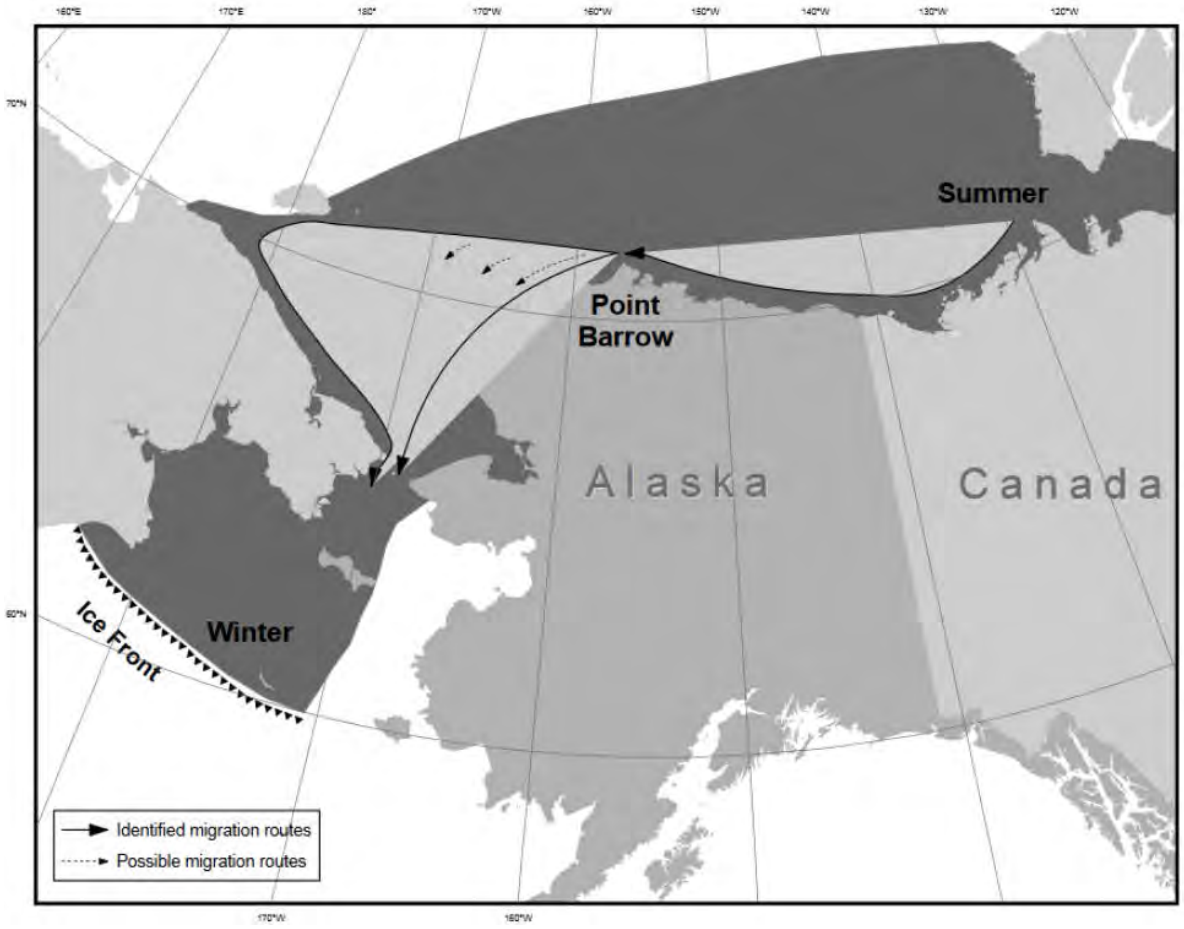
Figure 3.10-9 Distribution and Spring Migration of Western Arctic Stock of Bowhead Whales



Source: Muto *et al.*, 2016

Dark areas depict the approximate distribution of the Western Arctic stock of bowhead whales. The spring migration represented here by lines and arrows follows a route from the Bering Sea wintering area to the Beaufort Sea summering area, mostly along a coastal tangent that constricts somewhat as it goes east past Point Barrow.

Figure 3.10-10 Distribution and Fall Migration of Western Arctic Stock of Bowhead Whales



Source: Muto *et al.*, 2016

Dark areas depict the approximate distribution of the Western Arctic stock of bowhead whales. The fall migration is represented here by lines and arrows showing generalized routes used to travel from the Beaufort Sea (summering area) to the Bering Sea (wintering area).

3.10.5.4.4. Life History and Habitat Use

Most bowheads of the Western Arctic population overwinter in the central and western Bering Sea, where they are associated with polynyas and the marginal ice zone. The amount of feeding that takes place in the Bering Sea is unknown (Richardson and Thomson, 2002); however, most mating is thought to occur there (MMS and NMFS, 2008). The whales congregate in polynyas before migrating in the spring (Moore and Reeves, 1993), passing through the Bering Strait and into the Chukchi Sea from late March to mid-June (C. George, cited in IWC, 2004). Migration through the eastern Chukchi Sea takes place largely in open leads, some or most calving occurs at this time in the Chukchi Sea. Spring whaling takes place at this time by residents of Point Hope, Point Lay, Wainwright, and Barrow. Bowheads have been observed to pass Barrow, entering into the Beaufort Sea from early April to late May (IWC, 2004). Migration

through the Beaufort Sea occurs through lead systems offshore of the barrier islands. The whales arrive on their summering grounds near Banks Island in Canada from Mid-May through June (IWC, 2005). Bowheads move back out of the Canadian Beaufort and into the Alaska Beaufort Sea in August and September, with migration in the Central Beaufort and Prudhoe Bay area continuing from late August through late October (Moore and Reeves, 1993).

Bowheads frequently interrupt their migration to feed (Ljungblad *et al.,* 1986; Lowry 1993; Lowry *et al.,* 2004) and their stops vary in duration from a few hours to a few weeks (MMS, 2002). A commonly used feeding area is in and near Smith Bay, east of Barrow. Less consistently used feeding areas are in coastal and shelf waters near and east of Kaktovik. In 2007 and 2008, bowhead whales also used areas near Camden Bay to feed during their migration (Ireland *et al.,* 2008; Funk *et al.,* 2008). More research is being funded by the former MMS (now the Bureau of Ocean Energy Management [BOEM]) including the Bowhead Whale Feeding Ecology Study to determine the extent to which bowheads might feed in the western Beaufort Sea.

During the fall migration (September - November) bowhead whales typically travel in continental shelf waters that are less than 164 feet deep on their way back to the Bering Sea. Ice cover influences the timing, duration, and path that the whales follow (Treacy, 2002). In heavy ice conditions, bowheads whales divert north and migrate in deeper water further offshore (Moore *et al.,* 2000). Fall whaling for Kaktovik and Nuiqsut residents occurs from late August to mid-September. Traditional Knowledge gathered from local Iñupiat residents suggests that migration pods are segregated by sex and age (Braham *et al.,* 1980). Bowhead whales typically reach the Barrow area in mid-September to late October during their westward migration from the feeding grounds in the Canadian Beaufort.

Fall bowhead whaling near Barrow normally begins in mid-September, but may begin as early as August if whales are present and ice conditions are favorable. Whaling near Barrow may continue into October, depending on the quota and conditions.

Fall surveys of bowhead whales in the Beaufort Sea have been conducted annually by MMS since 1979 (Ljungblad *et al.,* 1986, 1987; Moore *et al.,* 1989; Treacy, 2002; Clarke *et al.,* 2014). Results of those surveys show that bowhead whales tend to migrate to deeper water (farther offshore) in the fall during years with higher-than-average ice coverage (Moore *et al.,* 2000). Most bowhead whales migrate west in water ranging from 50 to 650 feet deep (Miller and Davis, 2002), though some individuals enter shallower water, particularly in light ice years. Ice cover influences the timing, duration, and path that the whales follow (Treacy, 2002).

Bowhead whales feed primarily on copepods and euphausiids (Lowry, 1993; Lowry and Sheffield, 2002). To satisfy energy requirements, bowheads may need to find areas with above-average concentrations of zooplankton (Lowry, 1993).

Bowhead whales are long-lived, slow-growing, late-maturing, and reproduce infrequently (Koski *et al.,* 1993). Females and males become sexually mature around 25 years of age (George *et al.,* 2007). Bowhead whales mate and calve during spring migration (Nerini *et al.,* 1984), and calving occurs every three to four years (Koski *et al.,* 1993). Gestation lasts between 12 and 16 months (Nerini *et al.,* 1984). The majority of bowhead whale mating occurs in March and April (IWC, 2004).

3.10.5.4.5. Bowhead Whales in the Project Area

Bowheads do not occur in the Gulf of Alaska and therefore would not be expected to occur in marine portions of the proposed Project Area at Seward. Most of the bowhead whale population migrates through the Beaufort Sea offshore of West Dock during spring and fall (late August through late October) migrations to and from the summer feeding grounds. The migrations have been monitored by BOEM and NMFS since 1982 (Treacy *et al.,* 2006; Clarke *et al.,* 2014) and industry (Blackwell *et al.,* 2007; Ireland *et al.,* 2009; Reiser *et al.,* 2011; Bisson *et al.,* 2013) over a number of years. A small number of bowhead whales have been seen or heard offshore near Prudhoe Bay in late August. (LGL and Greeneridge, 1996; Blackwell *et al.,* 2004a; Greene *et al.,* 2004; Blackwell *et al.,* 2008). Figure 3.10-11 shows bowhead whale sightings by the former MMS in the Beaufort Sea. However, these survey data indicate that the fall migration off northern Alaska occurs primarily over the continental shelf, mainly in waters 66 to 197 feet deep (Moore *et al.,* 1989; Moore and Reeves, 1993; Treacy, 2002), *e.g.*, generally 12 to 37 miles offshore (Treacy, 2002; Monnett and Treacy, 2005; Treacy *et al.,* 2006).

Monitoring surveys have been conducted annually at the Northstar offshore oil and gas facility since 2001; the survey area is just offshore of West Dock. Over 95 percent of the bowheads observed during these fall surveys occurred more than 13.9 miles offshore in 2001, 14.2 miles in 2002, 8.4 miles in 2003, and 10.1 miles in 2004 (Blackwell *et al.,* 2007). West Dock extends out from the shoreline a total distance of 2.7 miles. The proposed Project Area is partially within a developed area with shallower waters and existing vessel traffic. Therefore, bowhead occurrence in the proposed Project Area is not likely to occur.

Figure 3.10-11 Bowhead Whale Sightings near Project Area 1997 - 2012



3.10.5.4.6. Critical Habitat

No critical habitat has been designated for the bowhead whale. NMFS reported that the designation of critical habitat is not necessary because the population is known to be approaching its pre-commercial whaling population size, the population is increasing, there are no known habitat issues which are slowing the growth of the population, and permitted activities that occur in the petitioned area are already managed by NMFS to minimize impacts to the population (67 FR 55767).

3.10.5.5. Fin Whale (Endangered)

3.10.5.5.1. Biological Populations and Listing Status

Three individual ocean-basin populations of the fin whale have been identified: North Atlantic, North Pacific, and Southern Ocean. Individuals within each ocean-basin population rarely, if ever, mix. Additionally, within each ocean basin population, geographical populations (stocks) also exist. In U.S. waters, four stocks are recognized: Alaska, California/Oregon/Washington, Hawaii, and western north Atlantic (NOAA, 2015c).

The fin whale was listed as endangered under the ESA in 1970 (FR 35:8495) and as depleted under the MMPA throughout their range. No critical habitat has been designated. Since 2007, fin whales have also been listed as endangered on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species.

3.10.5.5.2. Populations Status, Trends, and Abundance

The worldwide population of fin whales is estimated to be 120,000 (MMS and NMFS, 2008). Currently, the population of fin whales in Alaskan waters west of the Kenai Peninsula is estimated to be a minimum of 1,368 (Allen and Angliss, 2015).

3.10.5.5.3. Range

Fin whales appear to be limited by tropical waters and sea ice. Fin whales prefer temperate or cool waters, and tend to avoid areas with very warm water (approximately 60°F [15°C]), areas at the poles close to the ice pack, and small areas of water separated from the open ocean (Jonsgård, 1966a, 1966b; Sergeant 1977; IWC, 1992). The North Pacific population distribution ranges from British Columbia, along the northern Pacific Rim, and to the far eastern Russian coast. The summer distribution of fin whales extends from Baja California to the northern Bering Sea or southern Chukchi Sea and over to Japan (MMS and NMFS, 2008).

The Alaska stock of fin whales can be found in the deep waters of PWS, the Bering Sea, and the Gulf of Alaska. The highest densities of Alaska stock fin whales can be found in the northern part of the Gulf of Alaska and southeastern part of the Bering Sea during the summer (May through October) (MMS and NMFS, 2008). The majority of the Alaska stock fin whales tend to aggregate along the mixing zones between coastal and oceanic waters that correspond roughly with the 656-feet isobaths, or shelf edge, in the northern

North Pacific and Bering Sea (Nasu, 1974). Fin whales may be seen seasonally in the southwestern Chukchi Sea, although there is no indication that such occurrences are typical (MMS and NMFS, 2008). There are no reports of fin whales in the Beaufort Sea (MMS and NMFS, 2008; Clarke *et al.*, 2014), which is outside the published species range (Allen and Angliss, 2015).

3.10.5.5.4. Life History and Habitat Use

The migratory status of the North Pacific population of fin whales is not well known; however, in the winter they have been seen off the southern coast of California and near the Hawaiian Islands; information on movement and range can be found in the most current NMFS Recovery Plan (NMFS, 2010). Age, reproductive state, and stock affinity can all affect migration, as well as their movement inshore or offshore and north or south (NMFS, 2010).

Known fin whale feeding habitats range between the Bering Sea and the southern Chukchi Sea; fin whales are most notably present in the southwestern Chukchi Sea near the Asian coast. Fin whales travel through the Aleutian Islands entering and exiting the Bering Sea to access their summer feeding grounds. They have also been known to travel from the northern Gulf of Alaska through the Shelikof Strait to reach the southeastern and northern Bering Sea (MMS and NMFS, 2008). In recent years, fin whales have been seen regularly around the Pribilof Islands (Baretta and Hunt, 1994 as reported in NMFS, 2010).

Oceanographic changes may become favorable to the expansion of fin whale distribution into more northern waters if Arctic warming continues. Availability of food sources would be the determining factor. The possibility of their distribution expanding into the Chukchi and Beaufort seas could result from long-term continued Arctic warming (MMS and NMFS, 2008).

Fin whales feed primarily on krill or euphausiids, as well as substantial quantities of fish (NMFS, 2010; MMS and NMFS, 2008). The North Pacific population of fin whales favor *Euphausia pacifica*, *Thysanoessa longpipes*, *T. spinifera*, and *T. inermis* species of euphausiids. A significant portion of their diet also consists of large copepods, principally *Calanus cristatus*. A smaller portion of their diet is made up of herring, walleye pollock, and capelin (Nemoto, 1970). In the northern Bering Sea, *Thyanoessa raschii* is the only species of euphausiid that the fin whale is known to feed on. In the Arctic and subarctic, fin whales are thought to feed chiefly on capelin, Alaska pollock, herring, and saffron cod. Above 58 degrees North latitude in the Bering Sea, fish are the primary food source, consisting almost entirely of capelin, pollock, and herring (MMS and NMFS, 2008).

The gestation period for fin whales is less than one year and calving intervals are estimated, based on whaling data, to be two years (NMFS, 2010). Calves are nursed for 6 to 7 months, and mortality rates are estimated to be between 0.04 and 0.06 percent annually. Ice entrapment, attack by killer whales, disease, shark attacks on young

and/or weak fin whales, and crassicaudiosis in the urinary tract are likely to be the principal causes of natural mortality among fin whales, though relatively little is actually known and most studies have been focused on the North Atlantic population (NMFS, 2010).

Low-frequency vocalizations from fin whales occur in the 10 to 200 hertz (Hz) band. The low-frequency sounds have potential to travel a great distance, allowing for the possibility of long-distance communication (Edds-Walton, 1997). The most common vocalizations are in the 18 to 35 Hz band and are long, patterned sequences of short-duration infrasonic pulses (Patterson and Hamilton, 1964). Bouts of long patterned sounds are common in temperate waters and can also occur to a lesser extent in high latitude feeding areas (Clark and Charif, 1998). Fin whales in social groups tend to vocalize rapid pulses in short sequences in the 20 to 70 Hz range. While male reproductive displays typically are vocalized by a series of pulses in a regular repeating pattern that may last for more than a day (Tyack, 1999).

While no studies have been done to directly measure fin whales' sound sensitivity, it is reasonable to assume that fin whales are similar to other large mysticetes and have acute infrasonic hearing (Ketten, 1997).

3.10.5.5.5. Fin Whales in the Project Area

Fin whales are not known to occur in the Beaufort Sea. Fin whales are frequently observed in the northern Gulf of Alaska and southeastern Bering Sea from May to October, they generally congregate near the 656-foot isobath, which is approximately 190 miles from shore according to Alaska Ocean Observing System bathymetry data from 2010. Resurrection Bay is significantly deeper; the 656-foot-isobath is only about 7 miles from the Port of Seward, so fin whales may occur in closer proximity.

3.10.5.5.6. Critical Habitat

No critical habitat has been designated for the fin whale.

3.10.5.6. Humpback Whale (both Threatened and Endangered)

3.10.5.6.1. Biological Populations and Listing Status

A population is defined as the summation of all organisms of the same species, which live in a specific geographical area capable of interbreeding. World population defines the entire grouping of the same species. Populations are further segmented and defined by their geographic boundaries within a smaller area (*e.g.,* the southern hemisphere population of humpback whales). Population stock is a term used for management and conservation purposes; populations are sometimes divided into stocks based on international or geographic boundaries. Simply put, stocks are smaller groupings of a population. A population may have more than one stock.

Populations can be divided genetically, which is called sub-speciation. Sub-species are typically isolated geographically where populations have become genetically distinct.

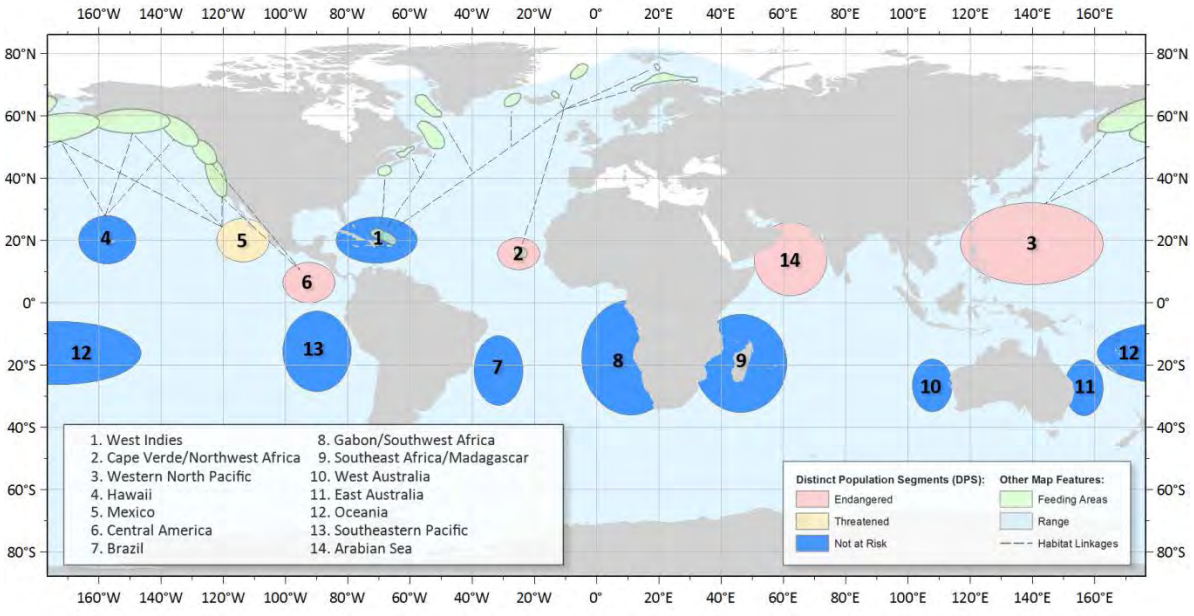
Humpback whales are currently all considered one species with no sub-species designated even though there are considerable differences between the Northern and Southern Hemisphere populations; as well as populations within each. A number of traits, including coloration, timing of reproduction and migratory behavior, diet, and molecular genetic characteristics are distinctly different between the regions. A population inhabiting the Arabian Sea in the Northern Indian Ocean is also markedly divergent in molecular and behavioral characteristics from all other populations globally. Whales from these four areas (North Pacific, North Atlantic, Southern Hemisphere, and Arabian Sea) are so divergent that a taxonomic revision of humpback whales is currently in progress, and it is likely the North Atlantic, North Pacific and Southern Hemisphere groups will be recognized as sub-species at some point in the future.

In the interim, for management purposes, a 2015 Status Review and analysis of DPS was undertaken by NMFS to identify and focus on breeding populations as discrete units, consistent with the language in the ESA that species (including DPS) "interbreed when mature." Information on where a breeding population feeds was also considered in evaluating both the significance and discreteness of that population (Bettridge *et al.,* 2015).

A NMFS review of genetic data, tagging and photographic-ID data, demographic information, geographic barriers, and stranding data, has determined that there are 14 DPSs of humpback globally. Population discreteness was determined by evaluating differences in patterns of genetic variation and information on the rates of exchange of individuals among breeding areas, patterns of geographic occurrence, differences in ecology among feeding and in some cases breeding areas, and the degree of genetic differentiation. Based on this information, the 14 DPSs identified worldwide have been delineated and named after their primary breeding locations (Bettridge *et al.,* 2015). In 2016, NMFS published a final rule changing the status of humpback whales under the ESA, effective October 11, 2016. Under the 2016 ruling, four of the DPS were classified as endangered, one as threatened, and the remaining nine determined to not warrant protection under the ESA. The 14 humpback whale DPS are shown in Figure 3.10-12.

The North Pacific DPS as determined by Bettridge *et al.,* (2015) includes these primary breeding areas: Hawaii, Central America, Mexico, Okinawa/Philippines, and the Western North Pacific(WNP, also known as the Second West Pacific) DPS. The most relevant North Pacific DPS for this assessment (the DPS that occur in Alaska's waters [NMFS, 2016d]) include Hawaii, Mexico, and the WNP. Wade *et al.* (2016) assessed the probability of the North Pacific DPS in waters around Alaska, with results in Table 3.10-2. All three of the humpback whale DPS in Alaska's waters have the potential to occur near the proposed Project Area, in the Beaufort Sea and Resurrection Bay (adjacent to the Gulf of Alaska).

Figure 3.10-12 Humpback Whale DPS Breeding and Feeding Locations



Source: NMFS, 2016c

Table 3.10-2 Probability of Encountering Humpback Whales from each DPS in the North Pacific Ocean in Various Feeding Areas

Summer Feeding Area	Western North Pacific DPS (Endangered)	Hawaii DPS (Not Listed)	Mexico DPS (Threatened)
Aleutian Islands, Bering, Chukchi, Beaufort	4.4%	86.5%	11.3%
Gulf of Alaska	0.5%	89.0%	10.5%
Southeast Alaska / Northern British Columbia	0%	93.9%	6.1%

Source: AGDC, 2017 as cited in Wade *et al.*, 2016

The 2015 Status Review defines the three DPS that occur in Alaska's waters, as follows:

> *Hawaii – The Hawaii DPS consists of humpback whales that breed within the main Hawaiian Islands. Whales from this breeding population have been observed in most known feeding grounds in the North Pacific, but about half of the whales from population migrate to Southeast Alaska and Northern British Columbia. They also commonly utilize northern British Columbia, northern Gulf of Alaska and Bering Sea feeding grounds. This DPS was determined to be discrete based on significant genetic differentiation from other North Pacific breeding areas and evidence for low rates of movement among breeding areas in the North Pacific based on sighting data. The Hawaii DPS was determined to be significant due to the gap that would result in breeding and feeding ranges if it were to go extinct, ecological differences in feeding areas compared to other populations, and marked levels of genetic divergence to other populations.*
>
> *Mexico – The Mexican DPS consists of whales that breed along the Pacific coast of mainland Mexico, the Baja California Peninsula and the Revillagigedos Islands. The Mexican DPS feeds across a broad geographic range from California*

to the Aleutian Islands, with concentrations in California-Oregon, northern Washington – southern British Columbia, northern and western Gulf of Alaska and Bering Sea feeding grounds. This DPS was determined to be discrete based on significant genetic differentiation as well as evidence for low rates of movements among breeding areas in the North Pacific based on sighting data. It was determined to be significant due to the gap in breeding grounds that would occur if this DPS were to go extinct and the marked degree of genetic divergence to other populations. It also differs from some other North Pacific populations in the ecological characteristics of its feeding areas.

Western North Pacific – The existence of this breeding population is inferred from sightings of whales in Aleutian Islands area feeding grounds that cannot be linked to any known breeding population and by the significant genetic differences that were found between Ogasawara and the Okinawa/Philippines DPS. Some of these whales may transit the Ogasawara area in route to unknown breeding grounds further south. This inferred breeding population was considered to be discrete based primarily upon the apparent low exchange with other breeding populations in the North Pacific. Its significance was hard to assess, but it appears to feed primarily in a marine ecosystem (the Aleutian Islands) that is rarely used by whales from other populations. Loss of this population was also considered likely to result in a gap in the range, based on a discrete feeding area and an unknown breeding area.

While breeding areas may be separate, whales from different DPS are thought to mix while in feeding areas in the summer. For the MMPA, stocks are defined by feeding areas where DPS mix. The most recent and nearest stock assessments for this species are those found in the North Pacific. NMFS recognizes four discrete population "centers" (not to be confused with DPS) of humpback whales within the Pacific U.S. EEZ:

1. WNP Stock that migrate between the Aleutian Islands, the Bering Sea, and Russia, and roughly corresponds to the Second West Pacific and Mexico DPS;
2. California / Oregon / Washington Stock, humpback whales that feed off the west coast of the U.S., including animals from both the California-Oregon and Washington-southern British Columbia feeding groups (Calambokidis *et al.,* 1996; Calambokidis *et al.,* 2008; Barlow *et al.,* 2011), winter off the coast of Central America and Mexico, and roughly corresponds to the Mexico DPS; and
3. Central North Pacific Stock that feed from Southeast Alaska to the Alaska Peninsula and roughly corresponds to the Hawaii and Mexico DPS; and
4. IUCN Oceania subpopulation – American Samoa Stock.

Only the WNP, the California/Oregon/Washington, and the Central North Pacific stocks could be expected to occur near the proposed Project Area.

Of the three DPS that occur in Alaska's waters, the WNP DPS is listed as endangered, the Hawaii DPS is not listed, and the Mexico DPS is listed as threatened. These listings

were a result of NOAA's status review of the species (NOAA, 2015b) and the final rule by NOAA. The humpback whale is listed as depleted under the MMPA. In 2008, the IUCN downgraded the status of the humpback whale from a vulnerable species to a species of least concern.

NMFS does not propose to designate critical habitat for the DPSs that occur in U.S. waters because it is not currently determinable; however, the final 2016 ruling does state that critical habitat for the three listed DPSs will be considered in a separate, future rule making (81 FR 62259, 2016).

3.10.5.6.2. Populations Status, Trends, and Abundance

Prior to exploitation, the worldwide population of humpback whales totaled around 125,000 and the North Pacific population was estimated to be 15,000. Post-exploitation, the status (both in numbers and range), was considerably reduced, primarily as a result of intensive commercial whaling (NMFS, 1991). Abundance estimates from Wade *et al.* (2016) suggest that the summer feeding areas in Alaska and northern British Columbia support the majority of the North Pacific population of humpback whale. Wade *et al.* (2016) estimates that in summer, 2,427 individuals occur in the Aleutian Islands/Bering Sea, 2,089 individuals occur in the Gulf of Alaska, and 6,137 individuals occur in Southeast Alaska/northern British Columbia. The current minimum population estimates for the WNP humpback whale stock is 865 with an estimated annual increase of 6.7 percent (Calambokidis *et al.,* 2008); however, this is thought to be biased high as the Central North Pacific stock is estimated at 7,890 individuals (Allen and Angliss, 2015). The trend for the Central North Pacific stock is comprised of regional assessment ranges of 6.6 to 10 percent. A complete trend assessment is not currently available from the data because of differences in methods and areas covered (Allen and Angliss, 2015). Recent estimates of abundance for the entire North Pacific basin were derived and then reanalyzed from the comprehensive data collected during the Structure of Populations, Levels of Abundance and Status (SPLASH) project. A preliminary range of 18,302 – 21,808 individuals was estimated from the SPLASH data (Calambokidis *et al.,* 2008; Barlow *et al.,* 2011).

3.10.5.6.3. Range

Humpback whales are known to occur in all oceans, although less commonly in Arctic regions throughout its range. Nearly all populations undertake seasonal migrations between their tropical and sub-tropical winter calving and breeding grounds and high-latitude summer feeding grounds where they feed intensively on zooplankton and small schooling fishes. Humpback whales in the Northern Hemisphere generally inhabit waters over continental shelves, along their edges and around some oceanic islands. However, humpbacks may also summer offshore, as in the Gulf of Alaska (Bettridge *et al.,* 2015), or in the southern ocean, along the margin of the seasonal pack ice and in waters of the Antarctic convergence. Feeding areas are often associated with cooler temperatures and oceanographic or topographic features that serve to concentrate prey

(Moore *et al.*, 2002; Zerbini *et al.*, 2006b). In winter, most humpbacks are found in temperate and tropical waters of the Northern and Southern Hemispheres (10° - 23° latitude), at a small number of relatively specific locations.

Their summer range is usually in areas with high biological diversity between higher latitudes of 35° and 75° north. This is where they do the majority of their feeding.

Humpback whales in the high latitudes of the North Pacific are seasonal migrants. In Alaska, humpback whales are found from southeastern Alaska, north and west through the Gulf of Alaska, Bering Sea, and into the southern Chukchi Sea.

In the summer, the WNP stock occupies areas along the continental shelf off the Aleutian Islands and the Alaska Peninsula. Some individuals in this stock may still summer along the Russian coast, particularly around Kamchatka Peninsula and the Sea of Okhotsk (Tomlin, 1967). This stock was once considered the center of the entire North Pacific population (Berzin and Rovnin, 1966; Nishiwaki, 1966).

The northern range of this stock now extends throughout the Bering Sea, through the Bering Strait, and into the southern Chukchi Sea. Historically, sightings in the WNP stock's range have been most common south of Nunivak Island and east of the Pribilof Islands (MMS and NMFS, 2008). They have not been documented in the Beaufort Sea. This migratory stock winters around the Hawaiian Islands, the Asian wintering grounds from the Marshall Islands to the Philippines, and along the eastern Pacific coast extending from southern Mexico into Central America, including Guatemala, El Salvador, Nicaragua, and Costa Rica (Calambokidis *et al.*, 2008; Allen and Angliss, 2015).

The Central North Pacific stock can be found throughout southeast Alaska in the summer, as well as in central and western portions of the Gulf of Alaska. This area includes PWS, around Kodiak Island, the Shelikof Strait, the Barren Islands, and the southern coastline of the Alaska Peninsula (MMS and NMFS, 2008). Sightings in offshore waters of the Gulf of Alaska are generally attributed to migration into coastal waters, some feeding may also be occurring on offshore banks (Morris *et al.*, 1983).

3.10.5.6.4. Life History and Habitat Use

The majority of humpback whales that summer in Alaska waters migrate to wintering grounds in the Hawaiian Islands (Hawaii DPS). Six to 11 percent of the whales in the Hawaiian wintering grounds are calves (Herman *et al.*, 1980). A smaller number of individuals may migrate to wintering grounds along the Pacific coast of Baja California and Mexico (Mexico DPS). Most that migrate to this area summer in southeast Alaska and migrate along the relatively shallow coastal waters rather than through deeper, offshore waters as is the case in migration to the Hawaiian Islands. The majority of animals that winter offshore of Baja California and the Pacific coast of California spend their summers off the central California coast. An even smaller number of individuals within the North Pacific population winter near the Mariana, Bonin, and Ryukyu islands and near Taiwan (Second West Pacific DPS) (Nishiwaki, 1966; Ivashin and Rovnin, 1967; Townsend, 1935). The total number that winter in this area is expected to be in the low

100s, though at one point this area did support a shore-based whaling station near Ryukyu Island in the late 1950s and 1960s (NMFS, 1991).

Humpback whales have diverse diets that vary across feeding aggregation areas. While this species feeds heavily on both small schooling fish and on euphausiids (krill); known prey also includes *Clupea* (herring), *Scomber* (mackerel), *Ammodytes* (sand lance), *Sardinops* (sardine), *Engraulis* (anchovy), *Mallotus* (capelin), and krill such as *Euphausia*, *Thysanoessa*, and *Meganyctiphanes* (Baker, 1985; Geraci *et al.,* 1989; Clapham *et al.,* 1997). In the Bering Strait and southern Chukchi Sea, the main source of prey is mysids (NMFS, 1991). Humpback whales utilize flexible feeding strategies, sometimes foraging alone and sometimes cooperatively (Clapham, 1993). They also use the most diverse techniques to obtain their prey of any baleen whale, including bubble nets, bubble cloud and tail flicks (Jefferson *et al.,* 2008). Physical oceanographic factors that contribute to productivity and local distribution of prey (and thus likely feeding areas), are upwelling, converging currents, continental shelves, offshore banks, and edges of continental shelves (NMFS, 1991). Feeding occurs almost entirely in humpback whales' summer range. During the winter, humpback whales primarily subsist on stored fat feeding very little if at all. On average, humpback whales dive 135 to 197 feet to catch their prey (Dolphin, 1987a,b). While they may stay submerged for 21 minutes, the average dive time is 2.8 minutes for feeding whales, 3.0 minutes for non-feeding whales, and 4.3 minutes for resting whales (Dolphin, 1987a,b).

Female humpback whales reach sexual maturity between 4 and 6 years of age, while male humpback whales reach sexual maturity between 7 and 15 years of age. Breeding takes place between December and March and the average gestation period is between 10 and 12 months. Birthing occurs during the same time frame the following year. Sexually mature females typically breed every 2 to 3 years. Females live to be an average of 61 years old, and males live to be an average of 57 years old (NMFS, 1991).

The primary causes of natural mortality among humpback whales are parasites, predation, red-tide toxins, and ice entrapment. Killer whales have been known to prey on humpbacks, usually on young or disabled individuals. Humpback whales have also been observed with shark bites. Ice entrapment is a concern in Newfoundland (NMFS, 1991).

Collisions with vessels and entanglement in fishing gear and collision with vessels are causes of injury and mortality worldwide and are discussed in detail in Chapter 4, Environmental Consequences.

3.10.5.6.5. Humpback Whales in the Project Area

Humpback whales are considered extralimital in the Beaufort Sea (Hashagen *et al.,* 2009) and are therefore not in the proximity of West Dock in Prudhoe Bay. Humpback whales are also found in waters of the Gulf of Alaska and lower Resurrection Bay. Humpback whales are present in Resurrection Bay and have become habituated to vessel traffic in the area.

3.10.5.6.6. Critical Habitat

No critical habitat has been designated for the humpback whale.

3.10.5.7. Steller Sea Lion (Endangered)

3.10.5.7.1. Biological Populations and Listing Status

NMFS listed the Steller sea lion as threatened range-wide under the ESA in April 1990. Critical habitat has been defined for Steller sea lions as a 20-nautical-mile buffer around all major haul-outs and rookeries, as well as associated terrestrial, air and aquatic zones, and three large offshore foraging areas (50 CFR 226.202 on August 27, 1993).

In 1997, the U.S. Steller sea lion population was divided into two DPSs: the Western DPS and the Eastern DPS. This division was based largely on differences in genetics, morphology, and population trends (Baker *et al.*, 2005; Phillips *et al.*, 2009; FR 62:30772). The Western DPS inhabits an area of Alaska from PWS westward to the end of the Aleutian Island chain and into Russian waters (Allen and Angliss, 2015). This segment occurs from 144°W (Cape Suckling, east of PWS), westward to Russia and Japan. The Eastern DPS of Steller sea lions occurs from southeast Alaska southward to California (Allen and Angliss, 2015).

The continued decline of the Western DPS elevated its listed status to endangered on May 5, 1997 (FR 62:30772). The Eastern DPS of Steller sea lion is currently not listed under the ESA but is considered "depleted" under the MMPA, and is classified as a strategic stock. Population surveys suggest that a portion of the Eastern DPS in the northern part of its range (Southeast Alaskan and British Columbia) is stable or increasing, while the remainder of the Eastern DPS and all the Western DPS is still declining (Allen and Angliss, 2015).

3.10.5.7.2. Population Status, Trends, and Abundance

An estimate of the total population size of the Western DPS Steller sea lions in Alaska was calculated by multiplying the best estimate of total pup production by 4.5 (Calkins and Pitcher, 1982). Total pup production in Alaska in 2013 was estimated to be 12,316 using a Bayesian hierarchical model, agTrend (Johnson and Fritz, 2014), and 2013 survey results (DeMaster, 2014). When multiplied by 4.5, this yields a total population estimate of 55,422 for the Alaska Western Steller sea lion population (95 percent credible interval: 52,834 to 58,167).

The most recent population assessment for the Eastern DPS of Steller sea lions is within the range of 60,131 (14,317 × 4.2) and 74,448 (14,317 × 5.2). These estimates are again based on the most current eastern stock pup count (14,317) and includes counts made between 2009 and 2013 (DeMaster, 2014; NMFS, Fisheries and Oceans Canada, Oregon Department of Fish and Wildlife, Washington Department of Fish and Wildlife, unpublished data reported in Allen and Angliss, 2015); using pup multipliers of either 4.2 or 5.2 (Pitcher *et al.*, 2007).

Analysis of data collected through 2013 suggests that there is strong evidence that non-pup counts of western stock Steller sea lions in Alaska increased between 2000 and 2013 (DeMaster, 2014). Regional variation in trends in pup counts in 2000 to 2013 is similar to that of non-pups. However, there are strong regional differences across the range in Alaska, with positive trends east of Samalga Pass (approximately 170°W) and negative trends to the west (Allen and Angliss, 2015).

The eastern DPS stock increase has been driven by growth in pup counts in all regions (NMFS, 2013 as reported in Allen and Angliss, 2015). The eastern DPS stock of Steller sea lion is currently not listed under the ESA but is considered "depleted" under the MMPA, and classified as a strategic stock.

3.10.5.7.3. Range

Steller sea lions range along the North Pacific Ocean rim from northern Japan to California (Loughlin *et al.*, 1984), with centers of abundance and distribution in the Gulf of Alaska and Aleutian Islands. The northernmost rookery in the Bering Sea is on Walrus Island near the Pribilof Islands. In the Gulf of Alaska, the northernmost rookery is on Seal Rocks just outside of PWS (Kenyon and Rice, 1961).

3.10.5.7.4. Life History and Habitat Use

Steller sea lions prefer the colder, temperate to subarctic waters of the North Pacific Ocean. Haul-outs and rookeries usually consist of beaches (gravel, rocky, or sand), ledges, and rocky reefs. In the Bering Sea and Okhotsk Sea, sea lions may also haul-out on sea ice, but this is considered atypical behavior (NMFS, 2008).

During the May to July breeding season, Steller sea lions congregate at rookeries, where adult males defend territories, pups are born, and mating takes place. Non-reproductive animals congregate to rest at haul-out sites where little or no breeding takes place. Sea lions continue to gather at both rookeries and haul-out sites outside of the breeding season (NMFS, 2008).

Steller sea lions forage near shore and in pelagic waters. They are capable of traveling long distances in a season and can dive to approximately 1,300 feet in depth. Steller sea lions are opportunistic predators, foraging and feeding primarily at night on a wide variety of fishes (*e.g.*, capelin, cod, herring, mackerel, pollock, rockfish, salmon, and sand lance), bivalves, cephalopods (*e.g.*, squid and octopus), and gastropods. Prey varies geographically and seasonally, and sea lion may disperse and range far distances to find prey (NMFS, 2007). Steller sea lions have been known to prey on harbor seal, fur seal, ringed seal, and possibly sea otter pups, but this would represent only a supplemental component to their diet (Womble and Conlon, 2010; Pitcher and Fay, 1982; Mathews and Adkison, 2010; Tikhimriov, 1959).

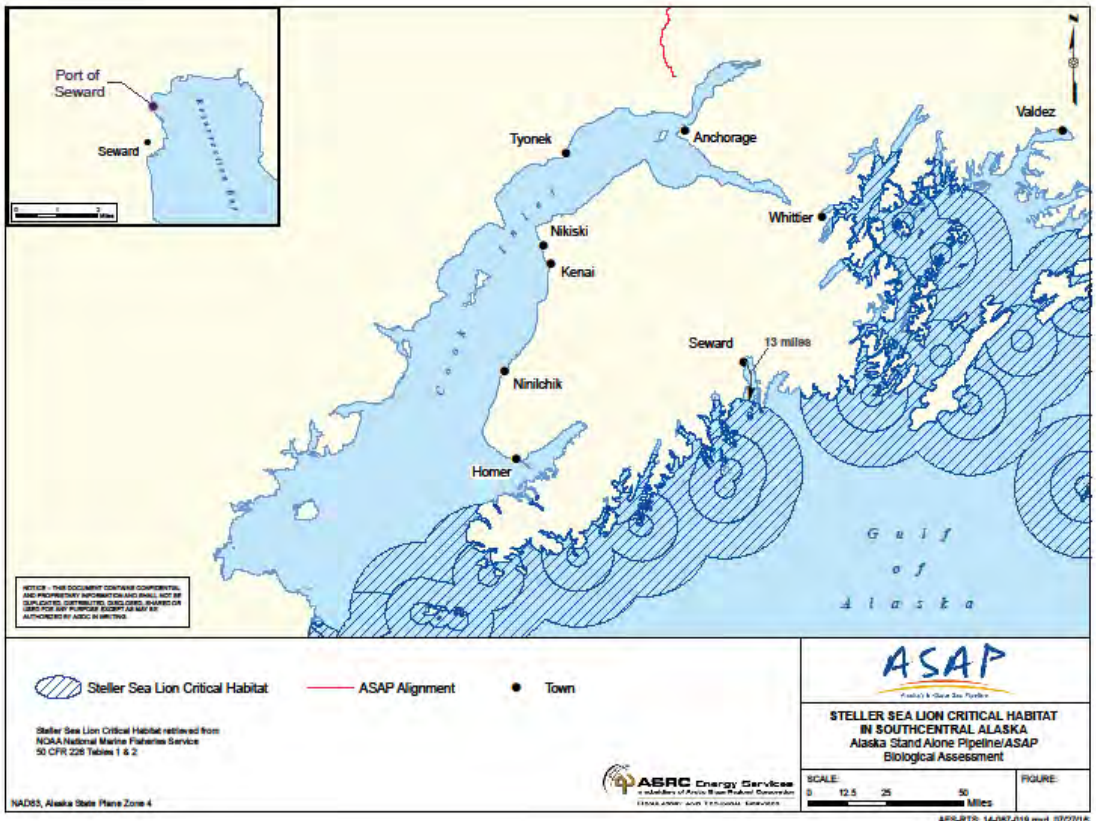
3.10.5.7.5. Sea Lions in the Project Area

Sea lions do frequently occur in the proposed Project Area of the Port of Seward, as well as the greater Resurrection Bay. Vessel traffic is common in the area and sea lions have become accustomed to the disturbances of this local traffic.

3.10.5.7.6. Critical Habitat

On August 27, 1993, NMFS published a final rule to designate critical habitat for the T&E populations of Steller sea lions (FR 58:45269). However, there is no designated Steller sea lion critical habitat in the proposed Project Area, including the proposed Project Area within Resurrection Bay (Figure 3.10-13). Critical habitat nearest to the Port of Seward is associated with the major haul-out at Outer Island and haul-outs at Gore Point located in Gulf of Alaska waters outside Resurrection Bay.

Figure 3.10-13 Steller Sea Lion Critical Habitat near the Project Area



3.10.5.8. Bearded Seal (Threatened)

3.10.5.8.1. Biological Population and Listing Status

There are two DPS of bearded seal, Beringia and Okhotsk, both of which are listed as threatened under the ESA as of December 2012 (FR 77: 76739-76768) and depleted under the MMPA. The U.S. District Court for the District of Alaska vacated the Beringia DPS bearded seal listing (Alaska Oil and Gas Association v. Pritzker, Case No. 4:13-cv-00018-

RPB) however on October 24, 2016, the Ninth Circuit reversed the district court's decision with regard to the bearded seal listing. The plaintiffs have requested rehearing en banc by the Ninth Circuit. The Beringia DPS occurs in Alaska waters in the Bering, Chukchi, and Beaufort seas.

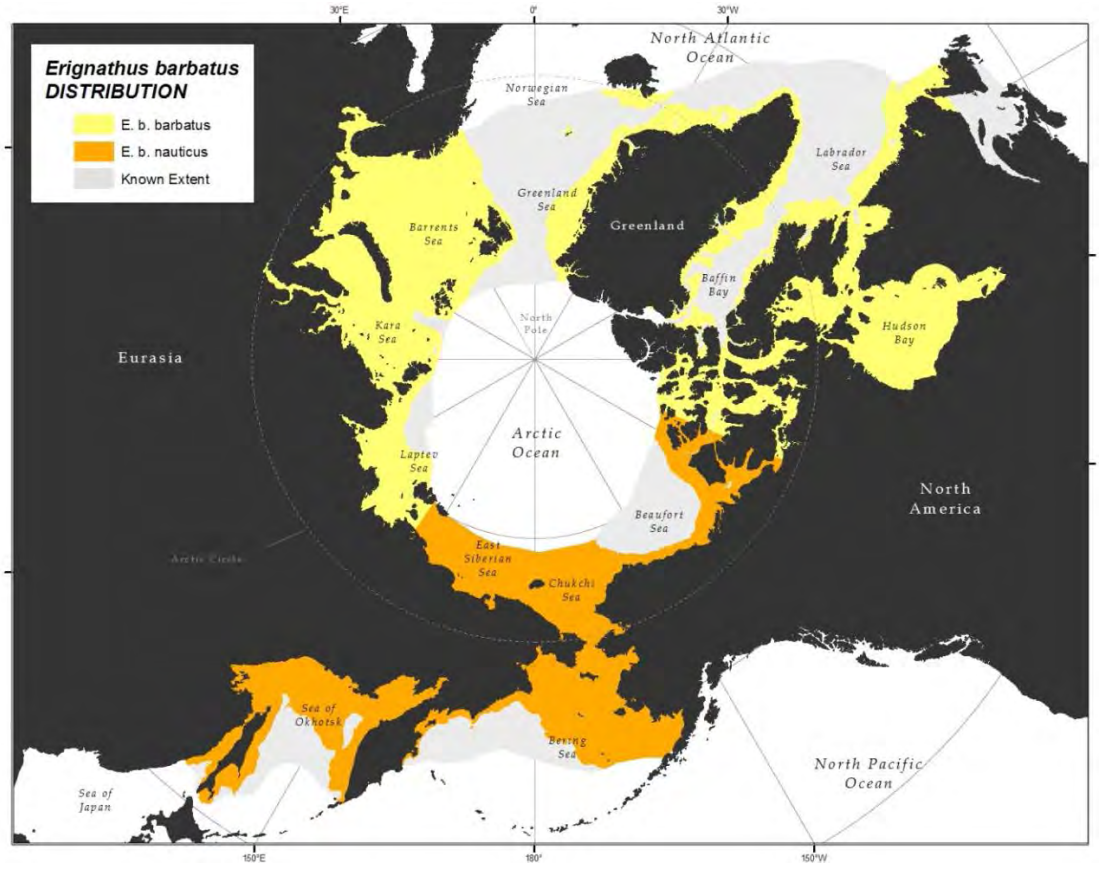
3.10.5.8.2. Population Status, Trends, and Abundance

There is no reliable estimate of bearded seal abundance in Alaskan waters (Allen and Angliss, 2015; Cameron *et al.,* 2010). The abundance in the Bering Sea, based on aerial survey data collected in the central Bering Sea pack ice in 2007, is estimated at approximately 125,000 (Cameron *et al.,* 2010). In the Chukchi Sea, the number of animals is estimated at approximately 27,000, based on data from 1999-2000 spring aerial surveys flown along the coast from Shishmaref to Barrow (Cameron *et al.,* 2010). Aerial surveys of the eastern Beaufort Sea, conducted in June during 1974–1979, resulted in an average estimate of 2,100 individuals (Stirling *et al.,* 1982), uncorrected for animals in the water. As the survey area covered roughly half of the ice-covered continental shelf of the western Beaufort Sea, the estimated number of bearded seals in the Beaufort Sea is thought to be 1.5 times 2,100 or approximately 3,150 (Cameron *et al.,* 2010). Based on these numbers, the Beringia DPS is considered approximately 155,000 bearded seals (Cameron *et al.,* 2010).

3.10.5.8.3. Range

Bearded seals have a circumpolar distribution. In Alaska, they occur over the continental shelf waters of the Bering, Chukchi, and Beaufort seas (Figure 3.10-14) (Burns, 1981).

Figure 3.10-14 Range of Bearded Seal in the Bering, Chukchi, and Beaufort Seas



Source: Cameron *et al.*, 2010

3.10.5.8.4. Life History and Habitat Use

Bearded seals are closely associated with sea ice, specifically pack ice, particularly during breeding, whelping, nursing, molting, and resting periods. Therefore, seasonal movements and distribution of bearded seals are linked to seasonal changes in ice conditions. Bearded seals generally move north in late spring and summer as the ice edge melts and retreats; seals then move south in the fall as sea ice forms to remain associated with their preferred ice habitat (Johnson *et al.*, 1966; Burns, 1967, 1981; Fay, 1974; Burns and Frost, 1979; Simpkins *et al.*, 2003; Frost *et al.*, 2008). As the ice recedes in the spring, bearded seals migrate from their winter grounds in the Bering Sea north through the Bering Strait (mid-April to June) to areas along the margin of the multi-year ice in the Chukchi Sea or to nearshore areas of the central and western Beaufort Sea. Pupping takes place on top of the ice from late-March through May, primarily in the Bering and Chukchi seas. Some pupping occurs on moving pack ice in the Beaufort Sea. Bearded seals do not form herds, although loose aggregations of animals may occur. Spring surveys along the Alaskan coast indicate that bearded seals prefer areas of 70 to 90 percent sea ice coverage, and are typically more abundant 20 to 100 nautical miles from shore than within 20 nautical miles of shore, with the exception of high concentrations nearshore to the south of Kivalina (Bengtson *et al.*, 2005; Simpkins *et al.*,

2003). Studies indicate that bearded seals generally prefer areas of shallow water along the continental shelf (approximately 200 feet deep) (Stirling *et al.,* 1977; Stirling *et al.,* 1982). As the ice forms again in the fall and winter, most seals move south with the advancing ice edge through the Bering Strait and into the Bering Sea where they spend the winter (Burns and Frost, 1979; Frost *et al.,* 2005; Cameron and Boveng, 2007, 2009; Frost *et al.,* 2008). This southward migration is less noticeable and predictable than the northward movements in late spring and early summer (Burns, 1981; Kelly, 1988b). Some bearded seals may overwinter in the Chukchi and Beaufort seas, but conditions are likely not as favorable.

3.10.5.8.5. Bearded Seal in the Project Area

Bearded seals have been observed in the survey area. Aerial and vessel-based surveys associated with seismic programs, barging, and government surveys in this area between 2005 and 2010 reported several sightings of bearded seals (Green and Negri, 2005, 2006; Green *et al.,* 2007; Funk *et al.,* 2008; Hauser *et al.,* 2008; Savarese *et al.,* 2010; Brandon *et al.,* 2011; Clarke *et al.,* 2011). These seals are expected to be occasionally encountered during proposed Project activity at West Dock.

3.10.5.8.6. Critical Habitat

No critical habitat has been designated for the bearded seal.

3.11. Land Use

3.11.1. Introduction

This section summarizes land use information provided in the 2012 FEIS (USACE, 2012a), and describes the known changes to the affected environment for land use since release of the 2012 FEIS based on revisions to the Project design and description. The term "land use" describes the human use of land associated with the proposed Project. Land use, therefore, can include residential, commercial, or industrial uses as well as for recreational and cultural purposes. Recent revisions to the proposed Project, such as changes in the alignment of the Mainline pipeline and the Fairbanks Lateral, results in changes to the previous assessment of the effects of the proposed Project on land use. Information pertaining to ancillary facilities, including material sites, camp locations, ROWs, and additional access roads have been designed since release of the 2012 FEIS, and therefore the potential impacts associated with those facilities are provided in this section.

Project Revision 6.1 alignment has reduced the Mainline ROW length from 737 to 733 miles, a reduction of 4 linear miles or 0.5 percent; and reduced the length of the Fairbanks Lateral from 34 to 30 miles, a reduction of 4 miles or 11.8 percent. The construction ROW corridor has increased from a 100 feet to 120 feet width (due to the increase in the size of the pipe) and the operations and maintenance corridor has changed from 30 feet wide (52 feet on federal lands) to a 53 feet wide permanent ROW with temporary workspaces out to 350 feet. Temporary workspaces would be located adjacent to the construction ROW and would be used for spoil storage, staging, equipment movement, material stockpiles, and pull string assembly associated with HDD installation. A total of 89 material sites would be required; some of these material sites are existing and would be expanded, and some of these material sites would be newly developed. The 2012 FEIS indicated that only existing potential sites would be used.

The following are the primary changes to land use for the Revision 6.1 alignment as compared to the Revision 5 alignment:

- This land use section has been reorganized and simplified since the 2012 FEIS;
- A map book showing all Project features, including the proposed material sites and access roads, can be found in Attachment L of the CWA 404 Application;
- The ASAP Project is now proposed to be primarily outside of existing highway, railroad, and pipeline ROWs; major alignment shifts occurred on the North Slope, at Minto Flats/Summer Ridge, Anderson/Clear, and Nancy Lake SRA;
- The Revision 6.1 alignment bypasses the Clear Air Force Station (AFS) which is managed by the U.S. Department of Defense (DOD), rather than intersecting the AFS; and

- The Revision 6.1 alignment bypasses the City of Anderson on the west side of the Nenana River, rather than intersecting it.

3.11.2. Summary

The majority of the land crossed by the proposed Project is state owned (53 percent) and federally owned (31 percent). Lesser proportions of municipal/borough owned land (8 percent), Alaska Native Village Corporation land (4 percent), privately owned land (3 percent), and native allotments (0.06 percent) would be crossed.

The proposed Project would cross through forested land, agricultural land, easements, and existing transportation and utility corridors, and five state boroughs.

Mitigation measures that would be used to minimize impacts to land are discussed in Section 4.15, Mitigation Measures.

3.11.2.1. Regulatory Setting

This section provides a list of regulations that apply to land use along the Revision 6.1 ROW. The landowner types and the regulations to the proposed Project that have not changed since the 2012 FEIS was published, are summarized in this SEIS, and are discussed in detail in Section 5.9.1.1 of the 2012 FEIS.

In 2015, a change within the state regulatory environment occurred under Senate Bill 70, which authorized ADNR to issue a ROW lease under AS 38.35 (the Pipeline ROW Leasing Act) for a gas pipeline within a specified corridor through four legislatively designated state park and recreation areas that include Denali State Park, Willow Creek SRA, Nancy Lake SRA, and Captain Cook SRA. The current ASAP pipeline alignment crosses three of these areas (Denali, Willow Creek, and Nancy Lake), and legislative action was necessary to facilitate construction and operation of the Project. The action was necessary, as these lands had been previously designated as special use areas, and removed from the public domain by the legislature pursuant to Article VIII, Section 7 of the Alaska Constitution. Senate Bill 70 provided the authority necessary to open an approximately 27,000-acre corridor through these state lands within which a ROW may be selected under AS 38.35 and clarifies that a pipeline ROW lease is a compatible use within the reserves.

Senate Bill 70 requires the planning corridor to be managed as parks and recreational areas until the ADNR Commissioner issues a lease under AS 38.35, and the land within the leasehold be returned to park and recreation land upon termination of the pipeline lease. It further provides supplemental requirements to maintain the public's traditional means of accessing the land and to minimize the impact of a pipeline on the specific values that distinguish these lands as parks and recreational areas. The recreational, scenic, cultural, historical, and habitat values consistent with the original intent of these special use areas must be preserved under Senate Bill 70.

The bill clarified that the ADNR Commissioner's power to delegate condemnation authority to the lessee does not apply within the bounds of these areas. The bill also required that a gas pipeline lease must be issued before January 1, 2020 for these new authorizations to apply.

In September 2013, the U.S. Congress passed the Denali National Park Improvement Act, which authorizes the Secretary of Interior to issue ROW permits for a high-pressure natural gas transmission pipeline in the park, subject to certain terms and conditions. Specifically, the Act requires that any such ROW be located: (1) in non-wilderness areas within the Park boundary; and (2) within, along, or near the approximately 7-mile segment of the George Parks Highway that runs through the park. In addition, the Act requires that a ROW permit may only be issued where the NEPA analysis demonstrates that "the route of the right-of-way is the route through the Denali NPP with the lease adverse environmental effects for the Park."

Title XI of the Alaska National Interest Lands Conservation Act (ANILCA) establishes procedures for siting transportation and utility systems within the federal conservation system units established or expanded by ANILCA under Section 6 of the Alaska Statehood Act (16 U.S.C. 410hh-3233, 43 U.S.C. 1602-1784). In February 2016, Senate Energy and Natural Resources Chairwoman, Lisa Murkowski (R-Alaska), unsuccessfully introduced an amendment to the Senate omnibus energy bill (S. 2012) that would have eliminated a provision of a 2013 law limiting construction of any future natural gas pipeline to a 7-mile segment of the George Parks Highway, which runs near the border of the Denali NPP. Section 1106(a) of ANILCA would apply to the Project if Alternative 2 were selected (through Denali NPP). Section 1106(a) incorporates other relevant portions of Title XI as well, including Section 1104.

A complete list of agencies, statutes, and regulations that apply to this Project are included in Chapter 1, Section 1.12 of this SEIS. A list of the land owners and their associated regulations that pertain to land use in the Revision 6.1 alignment are included below:

3.11.2.2. Federal

- BLM
  - Federal Land Policy and Management Act (FLPMA) of 1976 (43 U.S.C. 1732)
  - Mineral Leasing Act and 43 CFR 2880
  - Section 202 of the FLPMA
  - Revised Statute (RS) 2477
  - Wilderness Act of 1964 (16 U.S.C. 1131-1136, 78 Stat. 890, Public Law [P.L.] 88-57)
  - Alaska Lands Act (P.L. 96-487)

- NPS
  - ANILCA (16 U.S.C. §§ 3101-3233, P.L. 96-487)
  - Section 6(f) of the Land and Water Conservation Fund (LWCF) (16 U.S.C. 4601 et seq.)
  - Denali National Park Improvement Act (P.L. 113-33)
  - Title XI Implementing Regulations (43 CFR 36)
  - NPS ROW regulations (36 CFR 14)
- USFWS
  - Section 302(9)(B) of ANILCA
  - Section 303(2)(B) of ANILCA
- EPA
  - CERCLA and the Superfund Amendments and Reauthorization Act 42 U.S.C. 9601
  - Resource Conservation and Recovery Act of 1976 42 U.S.C. 6901
  - Toxic Substances Control Act 15 U.S.C. 2601

3.11.2.3. State

- ADNR
  - AS 38.04.065 Land Use Planning and Classification and 11 AAC 55.010-.030
  - AS 38.35, the Pipeline ROW Leasing Act
- ADF&G
  - 5 AAC 95.420
- ARRC
  - Permit required prior to use of ARRC-owned lands
- Alaska DOT&PF
  - Chapter 25 Operations, Wheeled Vehicles: Oversize and Overweight Vehicles 17 AAC 25.300
  - Chapter 25 Operations, Wheeled Vehicles: Transportation of Hazardous Materials, Hazardous Substances, or Hazardous Waste 17 AAC 25.200
  - Utility Permits 17 AAC 15.011
- ADEC
  - Resource Conservation and Recovery Act of 1976 in accordance with 42 U.S.C. 6901 and 18 AAC 60.430. – AS 46.03.005, 010

  - Permit Application in accordance with 18 AAC 60.210-.215
  - Oil and Hazardous Substances Pollution Control Regulations in accordance with 18 AAC 75 and AS 46.04.040, AS 46.04.050
  - Wastewater Disposal Regulations in accordance with 18 AAC 72, 18 AAC 73, and AS 46.03, AS 44.46.020, AS 44.46.025, and AS 37.10.052
- Trust Land Office
  - Land Use application in accordance with 11 AAC 99.020. Management of Alaska Mental Health Trust Land
- University of Alaska (UA)
  - Board of Regents' Policy 05.11 – Real Property

3.11.2.4. Local

AS §§ 29.35 and 29.40

- NSB
  - AS 29.10
  - Section 8.0101 of the NSB Charter
  - NSB Land Management Regulations §§ 19.10.010 — 19.70.060
  - NSB Code 19.40.080
  - NSB Code 19.40.090
- YKCA
  - Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010
- City of Nenana
  - Mayoral approval of a Land Use Permit
- Census designated places (CDPs) of Coldfoot, Four Mile Road, Livengood, and Wiseman
  - Planning and zoning within these CDPs are overseen by the state legislature
- FNSB
  - AS § 29.40
  - Zoning Code (Title 18)
- Denali Borough
  - AS 29.10
  - Section 7.01 of the Denali Borough Charter
  - Section 5.25 of the Denali Borough Charter

- Mat-Su Borough
  - AS § 29.40
  - AS § 29.40.010
  - Mat-Su Borough Chapter 15.24 Assembly, Zoning Functions
  - Mat-Su Borough 15.24.015
  - Special Use District (SpUD) ordinances
  - Mat-Su Borough Title 17.02, Mandatory Land Use Permit

3.11.3. Land Owners

3.11.3.1. Federal

The federal government owns parcels within the proposed ROW that are managed by the BLM; the Denali NPP Route Variation crosses additional federal lands managed by NPS. State of Alaska, UA, Ahtna, Inc., and Toghotthele Corporation have selected federally owned lands within the proposed Project ROW.

3.11.3.2. State

The State of Alaska owns the greatest number of parcels within the proposed ROW. Lands owned by the State of Alaska are managed by the ADNR under the guidance of regional land use plans (see Section 3.11.9, Existing Land Use Plans). The proposed Project would utilize portions of state lands. Pursuant to 17 AAC 15.011, Alaska DOT&PF has the authority to grant a permit authorizing an Applicant to construct or install utility facilities within a department ROW on lands owned by the State of Alaska. Portions of the proposed Project would cross trails that were established under RS 2477, as discussed further below. Some RS 2477 trail ROWs traverse State-owned land and are therefore owned by the state. The RS 2477 trail ROW eastments that are not State-owned are addressed under the respective land ownership sections (section 3.11.5).

3.11.3.2.1. ADNR Mental Health Trust Authority

Alaska Mental Health Trust Lands would be intersected by the proposed ROW. The Trust manages approximately 1 million acres across the State of Alaska. Income derived from trust lands is used to fund a comprehensive integrated mental health program for the citizens of Alaska. Resource categories managed by the trust land office include coal, gas, materials, minerals, oil, real estate, and timber (STB, 2010).

3.11.3.2.2. University of Alaska

The UA currently owns and manages approximately 150,000 acres in Alaska. Some of this land would be intersected by the proposed ROW. UA "trust lands" are managed for the use and benefit of the university and are not considered state public domain land.

UA develops, leases, and sells land and resources to generate funds for the UA's Land Grant Trust Fund (STB, 2009).

3.11.3.2.3. Alaska Railroad Corporation

The ARRC is an independent corporation owned by the State of Alaska. The State of Alaska prohibits the ARRC from selling, exchanging, or otherwise conveying a complete interest in its land. However, the ARRC leases non-operating lands to sustain its transportation assets (ARRC, 2011).

3.11.3.3. Local

The cities of Anderson and Nenana have Municipal or Borough parcels within the proposed ROW (Nenana has two and Anderson has eight). Other local governmental entities having ownership of parcels within the proposed ROW include the FNSB and Mat-Su Borough.

3.11.3.3.1. Alaska Native Regional and Village Corporations

In 1971, President Richard Nixon signed into law the Alaska Native Claims Settlement Act (ANCSA). Under ANCSA, aboriginal financial and land claims were settled in exchange for $962.5 million in compensation, as well as approximately 40 million acres (Norris, 2002). The ANCSA established 12 for-profit Alaska Native Village Corporations (a 13th corporation was later added for Alaska Natives living outside the state and was involuntarily dissolved on December 31, 2013). In addition, more than 200 Alaska Native village corporations were created. Both the regional and village corporations own land in and around native villages, with ownership proportionate to the enrolled populations of these corporations during the 1970s. Surface rights to the land are owned by the village corporations, with subsurface rights controlled by regional corporations. In turn, the village and regional corporations are owned by enrolled Alaska Natives (Linxwiler, 2007). Approximately 80,000 Natives are enrolled under ANCSA, and receive 100 shares for the village corporation in which they are enrolled and the same amount for the regional corporation in which they are enrolled (Chance, 1999).

Native corporation land is often held in large tracts and used for subsistence purposes or developed/leased to generate revenue for the corporation. Subsurface right owners within the proposed Project Area include Doyon, Limited and Ahtna, Inc. The Toghotthele Corporation, a Native village corporation representing the Native Village of Nenana, owns surface rights to several parcels within the proposed Project Area.

As private land, uses on land owned by native corporations, are subject to approvals of the surface and subsurface landowners. Doyon, Limited manages its lands for responsible economic development of natural resources, protection of cultural and historic sites, and commercial and non-commercial use by shareholders. Non-commercial use permits may be obtained by shareholders (Doyon, Limited, 2011). Ahtna, Inc. also requires a permit for use of its lands, including a permit fee for public and commercial activities. Ahtna, Inc. lands are managed for mineral exploration, timber

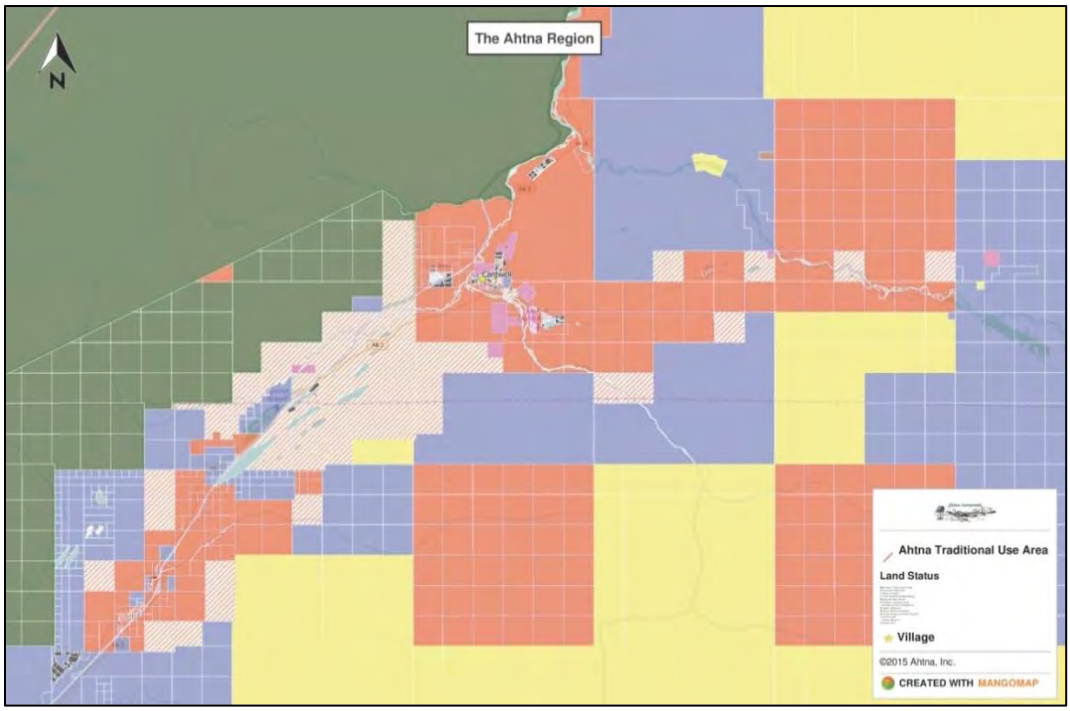
resources, tourism, some types of hunting, and predator control, among other uses (Ahtna, Inc., 2011).

AGDC has documented which of its larger off-ROW features are situated fully or partially on ANCSA-conveyed lands and to list or show the overlap of features with those lands. Features included camps, facility pads, material sources, pipe storage yards (PSYs), and railroad sidings, ranging from 0.69 acres to 79.26 acres. Wherever possible, AGDC selected previously disturbed land for siting these off-ROW features. Fifteen off-ROW features overlap a total of 16 ANCSA-conveyed land parcels.

3.11.3.3.2. Native Allotments

Under the Alaska Native Allotment Act of 1906 (34 Stat. 197, as amended), qualifying Alaska Natives were allotted up to 160 acres of non-mineral land. The proposed Project ROW would intersect only four Alaska Native Allotments awarded under the Act. The Tanana Chiefs' Conference (TCC) manages a trust service with the Bureau of Indian Affairs and acts as trustee for native allotment property owners on behalf of the 42 villages of Interior Alaska. Two of the Native Allotments intersected by the Project are located in the YKCA, one is in the Mat-Su Borough, and one is in the NSB. Figure 3.11-1 shows Native Allotments in the Ahtna region.

Figure 3.11-1 Native Allotments



3.11.3.3.3. Private Landowners

Private lands in the proposed Project Area are used for residential, agricultural, and commercial purposes. As private land, land uses are subject to approvals of the

landowner. AGDC has documented which of its larger off-ROW features are situated fully or partially on private lands and to list or show the overlap of features with those lands. Features included camps, facility pads, material sources, PSYs, and railroad sidings, ranging from 1.48 to 29.69 acres. Wherever possible, AGDC selected previously disturbed land for siting these off-ROW features. Nine off-ROW features overlap a total of 15 private parcels.

3.11.3.3.4. Land Use and Ownership by Project Segment

Land use and land ownership is further described below per proposed Project segment. There are nine segments discussed:

- West Dock
- MP 0 to MP 175
- MP 175 to MP 356
- MP 356 to MP 440
- Fairbanks Lateral (MP 0 to MP 30)
- MP 440 to MP 566
- MP 566 to MP 707
- MP 707 to MP 733 (End)
- Denali NPP Route Variation

Acres of land in each segment that would have permanent facilities or ROW and acres that would be temporarily impacted during construction are described per Project segment here. Table 3.11-1 summarizes the land ownership of each Project segment.

Table 3.11-1 Land Ownership by Project Segment

Spread Segment	Acres
North of MP 0 (West Dock, GCF, & associated Access Roads)	*239.12*
Native Allotment	0.87
State of Alaska	225.50
State of Alaska (Offshore)	12.75
MP 0 – 175	*4,323.85*
Federal	1,469.91
Municipal/Borough	2.10
Private	11.19
River/Stream	293.40
State of Alaska	2,547.26
MP 175 – 356	*5,095.47*
Federal	4,834.01
River/Stream	2.83
State of Alaska	258.63

Spread Segment	Acres
MP 356 – 440	*2,444.55*
Private	29.08
River/Stream	2.34
State of Alaska	2,413.13
Fairbanks Lateral	*696.82*
Federal	0.56
Municipal/Borough	75.15
Private	59.24
Right-of-Way	4.36
State of Alaska	557.52
MP 440 – 566	*3,258.00*
ANCSA Conveyance	708.51
Federal	22.97
Municipal/Borough	502.94
Native Allotment	0.00?
Private	97.27
Right-of-Way	17.81
River/Stream	8.17
State of Alaska	1,900.33
MP 566 – 707	*3,403.74*
ANCSA Conveyance	189.88
Federal	128.29
Municipal/Borough	483.09
Native Allotment	6.79
Private	302.63
Right-of-Way	4.77
River/Stream	12.34
State of Alaska	2275.94
MP 707 – 733	*899.77*
ANCSA Conveyance	13.05
Municipal/Borough	565.03
Private	65.01
Right-of-Way	6.37
River/Stream	0.30
State of Alaska	250.01
Total	***20,361.31***

Note: State of Alaska also includes University of Alaska, Mental Health Trust Authority, and ARRC.

3.11.3.3.5. West Dock

Project work proposed at West Dock includes:

- Addition of a 23-barge sealift;
- Winter dredging of a navigation channel and turn basin at West Dock;

- Nearshore disposal of dredge material on bottomfast sea ice in Prudhoe Bay, landward of Territorial Sea Boundary (in Alternative 1), or ocean disposal of the dredge material seaward of the Territorial Sea Boundary (in Alternative 2);
- Modification to DH3 (in Alternative 1) or DH2 (in Alternative 2) and widening of the causeway road; and
- Temporary bridge composed of two ballasted barges to facilitate offload and transport of large modules (bypass of weight-limited causeway bridge).

The work area includes the dredging of 59.3 acres of jurisdictional waterbody bottoms for creation of the channel and turn basin at DH3. The dredge material would be discharged onto 100 acres of state-owned (high tide line to extent of fill placement) waterbottoms in the coastal Beaufort Sea. Figure 2.2-3 in Chapter 2, Project Description, shows location of West Dock.

3.11.3.3.6. MP 0 to MP 175

Most of the proposed Project ROW along the MP 0 to MP 175 segment would be on state and federal lands. Of the 4,323.85 acres of land that would be crossed by the pipeline within this segment, state land would account for 59 percent and federal land would account for 34 percent.

3.11.3.3.7. MP 175 to MP 356

The proposed Project ROW along the MP 175 to MP 356 segment would be on state and federal lands. Of the 5,095 acres of land that would be crossed by the pipeline within this segment, federal land would account for 95 percent and state land would account for the remaining 5 percent.

3.11.3.3.8. MP 356 to MP 440

The proposed Project ROW along the MP 356 to MP 440 segment would be on state and privately owned land. Of the 2,445 acres of land that would be crossed by the pipeline within the segment, state land would account for 99 percent and private land would account for the remaining 1 percent.

3.11.3.3.9. Fairbanks Lateral (MP 0 to 30)

The majority of the land that would be crossed by the Fairbanks Lateral is under state ownership (80 percent). The segment also would cross 59 acres of land under private ownership (9 percent) as well as municipal/borough owned lands (11 percent).

3.11.3.3.10. MP 440 to MP 566

The proposed Project ROW along the MP 440 to MP 566 segment would be on state, Alaska Native Village Corporations, municipal/borough, and privately owned land. Of the 3,258 acres of land that would be crossed by the pipeline within the segment, state land would account for 58 percent, Native corporations would account for 22 percent,

municipal/borough has 15 percent, and private owners have 3 percent. The remaining land crossed in this segment is federal, ROW, and river/stream areas.

3.11.3.3.11. MP 566 to MP 707

The proposed Project ROW along the MP 566 to MP 707 segment would be on state, municipal/borough, privately owned, Alaska Native Village Corporations, and federal land. Of the 3,404 acres of land that would be crossed by the pipeline within the segment, state land would account for 67 percent, municipal/boroughs would account for 14 percent, private owners have 9 percent, Native corporations have 6 percent, and federal lands account for 4 percent.

3.11.3.3.12. MP 707 to MP 733 (End)

The proposed Project ROW along the MP 707 to MP 733 segment would be on municipal/borough, state, privately owned, and Alaska Native Village Corporation land. Of the 900 acres of land that would be crossed by the pipeline within the segment, municipal/borough would account for 63 percent, state land would account for 28 percent, private owners have 7 percent, and Native corporations have 1 percent. The remaining land crossed in this segment is ROW, and river/stream areas.

3.11.3.3.13. Denali National Park & Preserve Route Variation (Alternative 2)

The Denali NPP Route Variation, part of Alternative 2, would mainly cross federal (81.31 percent) and state (13.39 percent) lands. Municipal/borough lands (4.69 percent and ARRC lands (0.61 percent) would also be crossed by the Denali NPP Route Variation.

3.11.3.3.14. Yukon River Crossing Options

The proposed alternative for crossing the Yukon River is to utilize HDD 1 mile west of the existing Dalton Highway bridge, which also holds TAPS. The second option (Alternative 2) would be to construct a new aerial bridge over the Yukon River in the same location 1 mile west of the existing Dalton Highway bridge. Most of the land that would be impacted is under state ownership on the south side of the river, where a temporary HDD pad would be constructed.

3.11.4. Land Cover

See Section 3.4, Vegetation, for a detailed summary of land cover data for a 10-mile wide corridor surrounding the proposed Project. There are 20 land cover types defined by the NLCD that the proposed Project intersects. Two of the land cover types most relevant to this land use section are discussed below in Section 3.11.4.1, Forested Land and Section 3.11.4.2, Agricultural Land and Prime and Important Farmlands.

3.11.4.1. Forested Land

Approximately 19,037 acres of forested land would be affected by the proposed Project. These forested acres were calculated using the NLCD from 2011 (MRLC Consortium, 2016). Land cover types included as forested are evergreen forest, mixed forest, and deciduous forest. The majority of the forested land total is owned by the State of Alaska, municipalities or boroughs, or the federal government. Table 3.11-2 summarizes acres of forested land within the proposed Project Area.

Table 3.11-2 Acres of Forested Land Impacted by the Proposed Project

Land Owner	Acres of Forested Land (MRLC Consortium, 2016)
Federal: Bureau of Land Management, National Park Service	1,921
State of Alaska: ADNR Mental Health Trust, UA, ARRC	11,641
Alaska Native Village Corporations	736
Native Allotments	13
Municipal/Borough	2,929
Private Landowners	1,600
Right-of-way	197
Total Acres	19,037

3.11.4.2. Agricultural Land and Prime and Important Farmlands

Approximately 24 acres of agricultural land would be affected by the proposed Project. These agricultural acres were calculated using the NLCD from 2011 (MRLC Consortium, 2016). Land cover types included as agricultural are cultivated crops and pasture/hay. The majority of the agricultural land total is owned by the State of Alaska, Municipalities or Boroughs, or the federal government. Land ownership of existing agricultural lands within the proposed Project Area are provided in Table 3.11-3.

Table 3.11-3 Acres of Agricultural Land Impacted by the Proposed Project

Land Owner	Acres of Agricultural Land (MRLC Consortium, 2016)
State of Alaska	5
Municipal/Borough	3.1
Private Landowners	16
Total Acres	24.1

3.11.5. Revised Statute 2477 ROW, 17(b) Easements, and Section-Line Easements Intersected by the Proposed Project

3.11.5.1. Revised Statute 2477 ROW

The proposed Project would intersect several trails established under RS 2477. RS 2477 was enacted in 1866, during a period when the federal government promoted settlement of the West. It was a primary authority under which several state and county highways were constructed over federal lands in the West. RS 2477 are state-owned ROWs described in Section 8 of the Mining Law of 1866 as "The right-of-way for the construction of highways over public lands, not reserved for public uses, is hereby

granted." Although the law was repealed by Congress with the enactment of FLPMA in 1976, the pre-existing rights attributable to RS 2477, ROWs established under the statute remain in effect. Where an RS 2477 ROW exists, a new landowner's title is subject to the ROW, which must still be honored (ADNR, 2001a).

Twenty RS 2477 trails would be crossed by proposed Project construction and operation, as shown in Table 3.11-4. The GCF to MP 540 segment would intersect 14 of these ROWs, and the Fairbanks Lateral and MP 555 to End segment would cross two and four of these ROWs, respectively. No RS 2477 ROW would be intersected by the MP 540 to MP 555 segment.

Table 3.11-4 Revised Statute 2477 Trail ROWs Intersected by the Proposed Project

Project Segment	RS 2477 Trail ROW	File No.	Approximate MP
MP 0 (GCF) to MP 175, MP 175 to MP 356	Hickel Highway	RST 450	62.6, 301.3
MP 175 to MP 356	Wiseman-Chandalar	RST 254	218.4; 218.5
	Caro-Coldfoot	RST 262	240.9[a]
	Coldfoot-Junction Trail 49 (east route)	RST 591	240.9[a]
	Coldfoot-Chandalar Lake Trail	RST 9	240.9[a]; 240.9[a]
	Slate Creek	RST 412	255.3; 240.9[a]
MP 356 to MP 440	Hunter Creek-Livengood	RST 468	399.8
MP 356 to MP 440, MP 440 to MP 566	Dunbar-Brooks Terminal	RST 66	400.9; 437.3; 437.8; 453.5
MP 440 to MP 566	Dunbar-Minto-Tolovana	RST 1595	454.7
	Nenana-Kantishna	RST 346	472.8
	Kobi-McGrath (via Nikolai and Big River)	RST 345	496.2
	Rex-Roosevelt	RST 491	497.1
	Kobi-Kantishna	RST 343	497.1
	Lignite-Kantishna	RST 344	522.2
	Lignite-Stampede	RST 340	522.2
	Healy-Diamond Coal Mine Dirt Road	RST 709	525.9
Fairbanks Lateral	None	--	--
MP 440 to MP 566	Cantwell Small Tracts Road (Lovers Lane)	RST 625	564.3
MP 566 to MP 707	Goose Creek Road	RST 1506	685.3
MP 707 to MP 733 (End)	Nancy Lake-Susitna	RST 149	717.1
	Knik-Susitna	RST 118	728.5
Denali NPP Route Variation	None	--	--

a The Coldfoot-Chandalar Lake Trail, Caro-Coldfoot, Coldfoot-Junction Trail 49 (east route), and Slate Creek trails have coincident routes at these crossings.

Two of the RS 2477 trails in this list are new to Revision 6.1, and two have been removed since the 2012 FEIS. These are shown in Table 3.11-5.

Table 3.11-5 Changes in Revised Statute 2477 Intersections from 2012 FEIS to Proposed Project

Segment	File No.	Approximate MP	Status
Lignite-Kantishna	RST 344	522.2	Added
Lignite-Stampede	RST 340	522.2	Added
Ester Dome – Nugget Creek Trail	RST 1602	--	Removed
Ester-Dunbar	RST 70	--	Removed

3.11.5.2. ANCSA 17(b) Easements

The proposed Project would intersect easements designated under Section 17(b) of ANCSA, which allows reserving easements on lands that would be conveyed to Alaska Native Village Corporations to allow public access to public land and water. 43 CFR 2650.4-7 describes the guidelines that are used in reserving easements in conveyance documents. 17(b) easements are reserved and managed by the federal government.

Eleven 17(b) easements would be crossed by proposed Project construction and operation, as shown in Table 3.11-6. All of the 17(b) easements that the proposed pipeline crosses are between MP 440 and 707.

Table 3.11-6 17(b) Easements Intersected by the Proposed Project

Segment	17(b) Easement Number	Approximate MP
MP 440 to MP 566	7 D9, L	484.6
	21, L	549.4
	17a, L	553.3
	16 C5, L	558.1
	25 C4	558.1
	25 C5	558.2
	15 C5, L	561.4
MP 566 to MP 707	5h D1, L	572.5
	6b C5, L	582.2
	100 C4	584.5
Denali NPP Route Variation	17a, L	--

3.11.5.3. Section Line Easements

The proposed Project would intersect section-line easements, which are public ROW 33, 50, 66, 83 or 100 feet wide that are located along a section line of the rectangular survey system. Some section-line easements are also RS 2477 ROW.

3.11.6. Transportation and Utilities Crossed by the Proposed Project

The proposed Project ROW would cross railroads, utilities (including TAPS), trails, and roads. The proposed Project ROW would intersect railroads seven times. Roads would be crossed 50 times. In addition, trails would be intersected 77 times. The TAPS ROW would be crossed five times.

The Denali NPP Route Variation would intersect railroad ROWs twice. This segment would cross roads twice, but would not cross trails or TAPS.

3.11.7. Waste Generation, Storage, and Disposal

A Comprehensive Waste Management Plan (CWMP) would be developed and implemented to manage reusable materials, recyclable materials, non-hazardous waste, and hazardous waste that is generated by ASAP construction activities. The CWMP would follow Best Management Practices so that waste is minimized, identified, handled, stored, transported, and disposed of in a safe and environmentally responsible manner, and in full compliance with applicable state, federal, and local laws, and regulations.

The majority of solid waste would be generated at construction camps. Other solid waste expected to be generated includes packaging material removed from pipe after it arrives in Fairbanks, construction dunnage (chocks, blocking, and lashing for pipes and components) and woody debris on ROW, and packaging and small containers for materials such as pipe weld coating. Where possible, materials would be reused or recycled to avoid waste generation. Burnable, non-hazardous oily wastes and select hazardous wastes (in limited volumes) would be incinerated to reduce waste volume at most camp locations. Each operating construction camp is anticipated to have at least one mobile, semi-continuous, skid-mounted incinerator system. For 900-man camps or greater, each incineration unit would have the capacity to combust up to 10 tons of burnable waste per day. For 600-man camps or smaller, systems capable of incinerating up to 6 tons of waste per day would be operated. Incineration would be used only where the appropriate permits can be obtained, and any air emissions from permitted incinerators would have been accounted for in the permit actions at the approved facilities (see Section 3.18, Air Quality). Residual ash from waste incineration would be stored in fully enclosed shipping containers and protected from the environment. Ash would be hauled by truck for disposal at one of five permitted, Class II or III landfills. Incineration of acceptable, burnable solid waste is expected to reduce the quantity of waste scheduled for off-site transport and permitted landfill disposal by approximately 90 percent.

Where possible, construction debris (including slash, tree stumps, excess rock, and other material not suitable for backfilling trenches) would be stockpiled for later use in construction, restoration, and revegetation of the pipeline ROW and at construction campsites. Suitable disposal facilities would be used to dispose of waste, depending on location and source of generation. Non-hazardous waste disposal sites, including landfills or monofills, would be utilized for the Project in accordance with ADEC's 18 AAC 60 Solid Waste Regulations. Several existing permitted sites have been identified for Project use:

- NSB Service Area 10 (Oxbow) Landfill, Deadhorse
- FNSB Landfill, Fairbanks
- Denali Borough Landfill, Anderson
- Galbraith Lake Monofill, MP 143

- Five Mile Monofill, MP 353
- Cantwell Monofill, MP 564
- Mat-Su Borough Central Landfill, Palmer
- Kenai Peninsula Borough Central Landfill, Seward

No new disposal sites would be developed for the proposed Project; therefore, no additional land use impacts would occur as a result of solid waste generation.

Domestic wastewater from camps and hydrostatic testing water would be treated and discharged in accordance with the proposed Project's pending APDES permit to be authorized through ADEC Division of Water, Wastewater Discharge Authorization Program. Wastewater would be collected and treated on site by a mobile, modular packaged wastewater treatment plant, capable of treating up to 75 gallons of wastewater per person, per day. Treatment units would be capable of storing up to one season's worth of sludge, or approximately 1 years' worth of waste. Storage tanks would be cleaned at a minimum frequency of once a year. Sludge would be containerized and trucked to a disposal facility permitted to accept the waste.

Excess drilling fluids and cuttings would not carry a regulated hazardous waste designation and would be disposed in upland areas at the nearest material source access road, or other upland area, as authorized by ADEC. Disposal or discharge of drilling fluids would be permitted under either the Alaska Pollutant Discharge Elimination System (APDES) General Permit for Statewide Oil and Gas Pipelines or under individual permits. Individual permits would be required for each HDD location, and approvals or authorizations for disposal or discharge would be required from the landowner, ADEC, and other jurisdictional agencies. AGDC would request authorization from ADNR prior to utilizing any state lands as disposal sites. Impacts to water resources are discussed in Section 4.7, Water.

Hazardous waste would be accumulated and transported offsite for appropriate disposal at a licensed Resource Conservation and Recovery Act disposal facility. AGDC would develop a Spill Prevention and Control Plan, which would outline measures to specify where and how hazardous substances, such as fuel, paint, and solvents, would be stored and handled. AGDC would also develop a Comprehensive Waste Management Plan, which would describe hazardous and non-hazardous waste handling and disposal in detail. Potential health impacts due to industrial wastes and hazardous substances generated during pipeline construction and operation and hazardous substance discharge prevention are discussed in Section 4.21. The primary federal regulations for industrial waste and hazardous substances are contained in the applicable sections of 40 CFR 112, Oil Pollution Prevention; and 40 CFR 300, National Oil and Hazardous Substances Pollution Contingency Act. The primary State of Alaska regulations governing the management of oil and hazardous wastes are contained in 18 AAC 75, Oil and Other Hazardous Substances Pollution Control.

All hazardous materials, including fuels, petroleum products, and liquid and solid materials used during construction, would be stored in temporary containment facilities located at camps and support centers. It is anticipated each hazardous waste accumulation area (containment facility) would consist of approximately two 20-foot shipping containers within a 30-foot by 30-foot lined and bermed secondary containment cell. Examples of such materials that would be stored and used during construction include diesel fuel, gasoline, propane, petroleum oils, and antifreeze. Hazardous waste would be appropriately characterized and transported off site to either Fairbanks, Palmer, or Anchorage for treatment in-state or disposal out-of-state, which is dependent on the nature of the waste.

3.11.8. Existing Zoning

The proposed Project route crosses through four Alaska Boroughs, NSB, FNSB, Denali Borough, and the Mat-Su Borough and one census area, YKCA. Land use and zoning regulations and requirements for each are discussed below.

3.11.8.1. North Slope Borough

NSB Municipal Code Title 19 addresses land use and zoning. The northern portion of the ROW is zoned by the NSB as Resource Development, while the majority of the ROW within the NSB is zoned as Transportation Corridor.

The Resource Development District, according to NSB code (19.40.080), is "intended to address the cumulative impacts of large scale development, and to offer developers quick, inexpensive, predictable permit approvals." The purpose of the Resource Development District is to accommodate large-scale resource extraction and related activities which:

1. Do not permanently and seriously impair the capacity of the surrounding ecosystem to support the plants and animals upon which borough residents depend for subsistence;
2. Are planned, phased and developed as a unit, or series of interrelated units under an approved Master Plan, with provisions made for necessary public and private facilities; and
3. Meet the policies of the Comprehensive Plan and Coastal Management Program as well as the conditions of approval and special policies imposed on each individual Resource Development District at the time of designation (NSB Code 19.40.080).

According to NSB code (19.40.090), the Transportation Corridor District was "established to provide a strip of land to accommodate linear transportation facilities such as roads and pipelines." A development permit is required for development of new transportation facilities, including "gas lines, oil lines, associated roads, pump stations, pipeline maintenance facilities, resource extraction, and necessary supporting developments" within the Transportation Corridor District.

3.11.8.2. Fairbanks North Star Borough

The FNSB Zoning Map and Zoning Code are extensions of the Comprehensive Plan land use categories, and are the administrative tools for implementing land use policies and regulations. Zoning districts establish allowable uses for land. The Fairbanks Lateral would intersect the General Use (GU-1) and Rural Estate (RE-4) land uses. Pursuant to the Zoning Code (Title 18), the installation and maintenance of utility lines are permitted uses in zoning districts.

3.11.8.3. Denali Borough

The proposed Project route and the Denali NPP Route Variation would intersect the Denali Borough. According to the Denali Borough Comprehensive Plan, land in the Borough is zoned unrestricted unless otherwise provided for by ordinance (Denali Borough, 2009). There are no prohibitions on land zoned unrestricted (Ordinance 96-04 § 2).

3.11.8.4. Matanuska-Susitna Borough

The Mat-Su Borough has zoning, land use, and building regulations. Land development in the Borough is subject to Mat-Su Borough Title 17.02, Mandatory Land Use Permit. The Mat-Su Borough has platting authority and a Code Compliance Division. The State Fire Marshal is the State Building Official. While the Mat-Su Borough does not have a Borough-wide zoning code, it regulates land use through special land use districts, residential land use districts, and other mechanisms (STB, 2010).

The proposed Project would enter the Denali State Park SpUD at MP 606.6 and would exit at MP 644.4. The Project would impact approximately 61 acres in the Denali State Park SpUD (40 permanent acres, 21 temporary acres). The Denali NPP Route Variation Alternative does not intersect with the Denali State Park SpUD, as it is located on the north side of the Denali NPP. Structures, except for signs, are required to be set back at least 75 feet from the Parks Highway (17.1.110).

3.11.8.5. Yukon-Koyukuk Census Area

The YKCA is part of the Unorganized Borough, comprising the lands of Alaska not within the boundaries of the state's organized boroughs. Zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

3.11.9. Existing Land Use Plans

This section summarizes existing land use and land management plans applicable to the proposed Project Area.

3.11.9.1. U.S. Bureau of Land Management

Pursuant to Section 202 of the FLPMA, BLM has developed resource management plans (RMPs) to guide BLM's management actions on the public lands covered by each plan.

The proposed Project route (including crossing the Yukon River) intersects BLM lands managed under the guidance of the Utility Corridor and Central Yukon RMPs. Furthermore, the route would intersect BLM lands managed under the guidance of the East Alaska RMP. In addition, BLM is the statutorily-designated federal administrator for the Iditarod National Historic Trail, managed according to the Iditarod National Historic Trail Comprehensive Management Plan (BLM, 1986a), and according to a 1987 Memorandum of Agreement (MOA) between the State of Alaska and BLM, in which the State of Alaska agreed to manage the portion of the Iditarod National Historic Trail (INHT) located on state lands in a manner that protects the historic values of the trail (BLM, 1987).

Finally, the Recreation Management Plan for the Dalton Highway Recreation Management Area (DHRMA) (BLM, 1991b) guides BLM management of numerous recreation facilities located along the Dalton Highway corridor.

3.11.9.1.1. Utility Corridor RMP

The Utility Corridor Proposed RMP FEIS was designed to provide for multiple uses of planning area resources while also providing resource protection for the approximately 6.1 million acres of BLM administered surface lands (of which 5.8 million acres are BLM-administered mineral estate) within the RMP planning area. An overriding priority of the plan is to preserve the utility corridor for the transportation of energy minerals (BLM, 1989). Both the inner and outer corridors within the RMP planning area are designated as FLPMA section 503 ROW corridors under 43 C.F.R 2806.2. The RMP establishes 13 Areas of Critical Environmental Concern (ACECs) and five Special Recreation Management Areas (SRMAs). The RMP recommends the upper Nigu River areas for inclusion in the National Wilderness Preservation System (BLM, 1991a).

Within the RMP planning area, the proposed Project would intersect the Galbraith Lake ACEC and the Toolik Lake Research Natural Areas (RNA) and ACEC. At approximately 56,000 acres, Galbraith Lake ACEC is managed for the preservation of cultural resources, rare/sensitive plants, scenic values, and lambing areas. As both an RNA and ACEC, Toolik Lake RNA (approximately 82,800 acres) is managed for research activities and the preservation of cultural resources. The Dalton Highway and the TAPS both cross the RNA. The RMP specifies that management of the ACECs would not restrict existing or future energy transportation systems.

3.11.9.1.2. Central Yukon RMP

The Central Yukon RMP guides management of 9.5 million acres in west-central Alaska. Under the RMP, the Central Yukon Planning Area is managed for resource development, subsistence, commercial use, and protection of environmental resources. The majority of lands within the planning boundary are open to mineral leasing and mineral location. The plan designates ACECs and eight RNAs for inclusion within the Ecological Reserve System (BLM, 1986b).

3.11.9.1.3. East Alaska RMP

The East Alaska RMP/FEIS guides management of 7.1 million acres in eastern Alaska, including approximately 5.5 million acres that are selected by the State of Alaska or Alaska Natives. Under the RMP, the East Alaska Planning Area is managed to protect and enhance vegetative communities; fish and wildlife resources; natural, cultural, and geological resources; and recreational opportunities. In addition, the planning area is managed to protect and prevent damage to public land resources and to enhance those resources where feasible. The RMP designated the Bering Glacier Research Natural Area, five SRMAs, specific trails, and developed restrictions on off-highway vehicles (OHVs) and snowmobile usage (BLM, 2007).

3.11.9.1.4. Iditarod National Historic Trail Comprehensive Management Plan

The Iditarod National Historic Trail Comprehensive Management Plan is a Congressionally mandated management plan for the collection of trail resources collectively known as the "Iditarod National Historic Trail" (INHT). Under the plan, no single agency or organization manages the entire trail; instead, the plan calls for cooperative management by federal, state, and local agencies. The plan establishes a common guide used to promote the preservation, enjoyment, use, and appreciation of the trail. It also identifies trails and sites comprising the historic trail system, and recommends possible management actions for protecting significant segments, historic remnants, and artifacts for public use and enjoyment. The BLM coordinates the cooperative management of the INHT land and is the primary point of contact for matters involving the entire trail. The BLM's duties under the plan include reviewing for appropriateness and consistency any draft regulations affecting segments of the INHT. State, city, municipal, or borough land managers responsible for trail segments or historic sites identified in the plan are encouraged to enter into cooperative agreements with the Federal government and to collaboratively define actions that are consistent with the plan's management objectives on a segment-by-segment or site-by-site basis (BLM, 1986a; STB, 2010). A 1987 MOA describes the agreement between the State of Alaska and the BLM regarding management of the portions of the INHT located on State lands. The proposed Project route would intersect the Goose Creek to Susitna Station segment of the INHT on state-owned land subject to the INHT at MP 728.2.

3.11.9.1.5. Recreation Management Plan for the Dalton Highway Recreation Management Area

The DHRMA includes those public lands adjacent to the Dalton Highway from a point near the confluence of the Sagavanirktok and Ivishak rivers (about 60 miles south of Prudhoe Bay) and extending south to the Yukon River. The approximately 1.1 million acre DHRMA is managed by the BLM in accordance with the Recreation Management Plan for the DHRMA (BLM, 1991b), with an overall management objective of providing for a variety of developed and semi-primitive motorized recreation opportunities. The

proposed Project route would parallel the Dalton Highway corridor from the North Slope to near Livengood.

3.11.9.2. National Park Service

Lands administered by NPS in the vicinity of the proposed Project ROW include the Gates of the Arctic NPP and the Denali NPP. The proposed Project route would pass through the Brooks Range outside the boundary of the Gates of the Arctic NPP. However, the Denali NPP Route Variation would intersect the boundary of the Denali NPP. The Denali National Park Improvement Act, passed in 2013, authorized NPS to issue permits for construction of a natural gas pipeline in Denali NPP along the Parks Highway.

At 6 million acres, the Denali NPP is one of the largest national parks in the U.S. The park includes a designated wilderness area and an international biosphere reserve. The park is managed according to the Consolidated General Management Plan (NPS, 2008). The Denali NPP is discussed in greater detail in Recreation, Section 3.12.4.3.2.1.

The 8.4-million acre Gate of the Arctic NPP is the central component of a 700- mi^2 portion of the Brooks Range. The Arctic NWR (ANWR) is to the east, and the Noatak Preserve is to the west. The park is managed according to the 1986 General Management Plan, which NPS is currently in the process of amending (NPS, 2011).

3.11.9.3. United States Fish & Wildlife Service

At the nearest points, the proposed Project route is greater than 0.2 miles from the ANWR and greater than 1 mile from the Yukon Flats NWR, both of which are administered by USFWS. Long-term management of each NWR is guided by a Comprehensive Conservation Plan (CCP).

The original CCP for the ANWR was signed into effect in 1988, and is currently being revised by USFWS. In the revised CCP, USFWS will conduct wilderness reviews of most non-wilderness lands in the ANWR, including those within the coastal plain (USFWS, 2010c).

The Yukon Flats NWR CCP recommended 650,000 acres (8 percent of the refuge) in the White-Crazy Mountains for wilderness designation. The Secretary of the Interior has not yet submitted the recommendation to the President, who would then submit it to the U.S. Congress for action. While the CCP does not directly address transportation or utility ROWs, the plan designates refuge lands in the minimal management category (USFWS, 1987).

3.11.9.4. State of Alaska

3.11.9.4.1. Alaska Department of Natural Resources

State plans applicable to the proposed Project Area include the Dalton Highway Master Plan, Tanana Valley State Forest Plan, North Slope Management Plan, Southeast Susitna

Area Plan, Susitna Area Plan, the Public Review Draft Susitna Matanuska Area Plan, the Susitna Basin Recreation Rivers Management Plan, the Tanana Basin Area Plan, Willow Creek SRA Master Plan, Denali State Park Management Plan, and the Scenic Resources along the Parks Highway Inventory and Management Recommendations.

For those lands owned by ADNR, but not covered by a land management plan, ADNR, in coordination with the public, identifies important land resources and how their lands could be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible, multiple uses are allowed on these lands.

The Yukon-Tanana Basin Area Plan and the Susitna Matanuska Area Plans have been developed since the 2012 FEIS, and are located within the proposed Project Area, as described below. In addition to the land management plans listed in the 2012 FEIS, additional land management plans currently under development or revision by the State of Alaska and which intersect the proposed Project Area include the North Slope Management Plan, Eastern Tanana Management Plan, and Nancy Lake SRA Management Plan.

3.11.9.4.2. Tanana Valley State Forest Management Plan

The Tanana Valley State Forest's 1.81 million acres lie almost entirely within the Tanana River Basin. The Tanana Valley State Forest is open to mining, gravel extraction, oil and gas leasing, and grazing, although these activities are not frequently conducted. Timber production is the major commercial activity. The Bonanza Creek Experimental Forest, a 12,400-acre area dedicated to forestry research, is also located within the Tanana Valley State Forest. Management of the Tanana Valley State Forest is guided by the Tanana Valley State Forest Management Plan 2001 Update (ADNR, 2001b).

3.11.9.4.3. North Slope Management Plan

ADNR is currently developing a plan that may classify up to 32,000 acres and identify lands that are suitable for conveyance to the NSB.

3.11.9.4.4. Susitna Matanuska Area Plan

ADNR has revised the state land use plan for more than 9 million acres of state land in the Susitna and Matanuska River valleys. The Susitna Matanuska Area Plan (SMAP) revises the majority of the 1985 SMAP, encompassing most of the land within the Mat-Su Borough. The SMAP designates primary uses on state land, provides general management guidelines for a variety of land uses and resources, and identifies specific management intent for individual units of land (ADNR, 2010a).

3.11.9.4.5. Southeast Susitna Area Plan

The Southeast Susitna Area Plan establishes land use designations, management intent, and management guidelines for more than 250,000 acres of state uplands, shorelands, and tidelands in the lower Susitna Valley. This plan supersedes the 1982 Willow Sub-

Basin Area Plan, a portion of the 1985 South Parks Highway Subregion of the Susitna Area Plan, the 1989 Deception Creek Land Use Plan, and the 1991 Kashwitna Management Plan (ADNR, 2008b).

3.11.9.4.6. Susitna Basin Recreation Rivers Management Plan

The Susitna Basin Recreation Rivers Management Plan governs land and water management practices for state-owned lands along the Little Susitna State Recreation River, including water and riparian habitats and a 1-mile wide corridor of land surrounding the rivers. The plan includes goals and management practices for recreation, fish and wildlife habitat, and public access, among others (ADNR, 1991a).

3.11.9.4.7. Yukon-Tanana Area Plan

On January 3, 2014, ADNR Commissioner adopted the Yukon-Tanana Area Plan. The plan establishes land use designations, management intent and management guidelines for approximately 9 million acres of state land in areas north of the Denali NPP and west of the community of Fairbanks and the Parks Highway. The northern boundary is the Yukon River. This plan supersedes the western portion of the previous area plan, the Tanana Basin Area Plan (1985). The Tanana Basin Area Plan continues as the applicable area plan in the area not covered by the Yukon-Tanana Area Plan until superseded by the Eastern Tanana Area Plan, now under preparation.

The Yukon-Tanana Basin Area Plan guides management of approximately 14.5 million acres of state-owned land and 1.7 million acres of federal land selected for conveyance to the state in the Tanana Basin. The plan designates surface and subsurface uses for each management unit within the seven major planning regions (ADNR, 1991b).

3.11.9.4.8. Willow Creek State Recreation Area Master Plan

The 1990 Willow Creek SRA Master Plan designates compatible and incompatible uses, prioritizes the development of recreational facilities, and provides general guidelines for the management of recreational activities within the approximately 3,583 acre Willow Creek SRA. All lands within the Willow Creek SRA are managed for natural, cultural, or recreational development (ADNR, 1990).

3.11.9.4.9. Susitna Area Plan

The 1985 Susitna Area Plan provided area-wide land management policies, land use designations for specific sites, priorities for implementing, and procedures for review and amendments within an approximately 15.8 million acre planning area (ADNR, 1985). The majority of the plan has since been superseded by the SMAP and the Southeast Susitna Area Plan; however, the current proposed Project alignment intersects an area still guided by the Susitna Area Plan.

3.11.9.4.10. Susitna Matanuska Area Plan

On August 11, 2011, ADNR Commissioner adopted the SMAP. The plan establishes land use designations, management intent and management guidelines for approximately 9 million acres of state land in the Susitna and Matanuska River valleys. This plan supersedes the majority of the 1985 Susitna Area Plan.

3.11.9.4.11. Denali State Park Management Plan

The 325,240-acre Denali State Park is bisected by the George Parks Highway and bordered on the west by the Denali NPP. The Alaska State Legislature created Denali State Park (AS 41.21.150-152) in 1970 for the purposes of tourism related development, the provision of recreational opportunities for Alaskans, and the preservation of the area's natural resources. Recreational resources associated with the Denali NPP are discussed in Section 3.12.4.3.1.2.1. ADNR, Division of Parks and Outdoor Recreation, manages parklands and development of recreational facilities according to the Denali State Park Management Plan. Primary uses of the park are camping, hiking, fishing, viewing Denali, canoeing, rafting, river boating, hunting, and trapping (ADNR, 2006b).

3.11.9.4.12. Dalton Highway Master Plan

The Dalton Highway extends from its junction with Elliott Highway 1 mile west of Livengood up to Deadhorse Airport, 414 miles north. The highway is operated and maintained by the Alaska DOT&PF. The Dalton Highway Master Plan, released by ADNR Division of Mining, Land & Water in 1998, guides management of the highway. The highway is managed for economic development, public safety, and natural resource management. The plan includes mitigation measures and recommendations related to fish and wildlife concerns, off-road access, and future travel impacts (Dalton Highway and Advisory Planning Board, 1998).

3.11.9.4.13. Minto Flats State Game Refuge Management Plan

The Minto Flats State Game Refuge Management Plan contains policies related to transportation/utility corridors through the refuge (ADF&G, 1992). The Minto Flats State Game Refuge is co-managed by ADNR and ADF&G, and is the only ADF&G-managed unit that would be transected by proposed Project facilities. Other special areas managed by ADF&G that would be within the vicinity of the proposed Project features, but would not be transected by the proposed Project facilities, are discussed in Section 3.12, Recreation.

3.11.9.5. Local

3.11.9.5.1. North Slope Borough

The NSB asserts jurisdiction over activities within its boundaries on private and state-owned lands. The NSB adopted a Comprehensive Plan for the Borough on October 11, 2005. The NSB is in the process of developing comprehensive land use plans for the

North Slope villages. None of these villages would be intersected by the proposed Project.

3.11.9.5.2. Yukon-Koyukuk Census Area

The proposed Project route and the Fairbanks Lateral both would intersect the YKCA. This census area is part of the Unorganized Borough comprising the lands of Alaska not within the boundaries of the state's organized boroughs. Planning and zoning within the Unorganized Borough is overseen by the state legislature (Alaska State Constitution, Article X, Section 3 and 6, and AS 29.03.010).

3.11.9.5.3. Nenana

The City of Nenana does not have rigorous land use or zoning designations. Development within the City requires mayoral approval of a Land Use Permit (J. Mayrand pers. comm., 2010).

3.11.9.5.4. Fairbanks North Star Borough

The Fairbanks Lateral would intersect the FNSB, which has developed comprehensive zoning, planning, and land use regulations. The FNSB Planning and Zoning regulations apply outside of incorporated areas within the borough. The FNSB Regional Comprehensive Plan establishes goals, strategies, and actions for the Borough's land uses. The Comprehensive Plan provides land use guidance through its land use map and land use category designations (FNSB, 2005).

The Vision Fairbanks Downtown plan is an element of the Comprehensive Plan and guides development of the downtown core area (FNSB, 2008). The downtown planning area would not be intersected by the proposed Project.

3.11.9.5.5. Denali Borough

The proposed Project route and the Denali NPP Route Variation segments would intersect the Denali Borough. According to the Denali Borough Comprehensive Plan, land in the Borough is zoned unrestricted unless otherwise provided for by ordinance (Denali Borough, 2009). There are no prohibitions on land zoned unrestricted (Ord. 96-04 § 2).

3.11.9.5.6. Matanuska-Susitna Borough

As described within the subsection Regulatory Setting above, the Mat-Su Borough Wide Comprehensive Plan provides general goals and policy recommendations for a 20-year period to address development patterns, technological advances, a growing population, and a diversifying economy (Mat-Su Borough, 2005).

Communities that the proposed Project route would pass through include Trapper Creek, Susitna, Willow, Big Lake, and Point MacKenzie. Each of their community councils currently has or is developing a comprehensive plan. These community

comprehensive plans are consistent with the general goals and recommendations of the Mat-Su Borough Wide Comprehensive Plan.

3.11.9.5.7. Trapper Creek Community Council Comprehensive Plan

The Trapper Creek Community Council. The council is currently developing the Trapper Creek Community Council Comprehensive Plan. The proposed Project route would intersect land covered by this plan.

3.11.9.5.8. Susitna Community Council Comprehensive Plan

Land described by the Susitna Community Council would intersect the proposed Project route. The Susitna Community Council Comprehensive Plan guides the use of public and private lands, and directs community and agency decisions about improvements to roads, trails, and other public services and facilities. The plan also establishes strategies for economic development, environmental protection, and improved local governance (Mat-Su Borough and Agnew, 2005).

3.11.9.5.9. Willow Area Community Comprehensive Plan

The proposed Project route would intersect land described by the Willow Community Council. The Willow Area Community Comprehensive Plan, currently in draft form dated January 2013, was developed by the Willow Community Council to provide for planned and orderly growth in the Willow area while enhancing economic opportunities, respecting individual property rights, and preserving the area's scenic, recreational, rural, agricultural, and residential qualities (Mat-Su Borough, 2009).

3.11.9.5.10. Big Lake Community Council Area Comprehensive Plan Update

Lands described by the Big Lake Community Council would intersect the proposed Project route. The Big Lake Community Council Area Comprehensive Plan Update was developed by the Big Lake Community Council to address the challenges and opportunities facing the community by establishing broad goals and policies intended to guide growth over the next 10 to 20 years (Big Lake Community Council, 2009).

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3.12. Recreation

3.12.1. Introduction

The description of recreational resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project. Specifically, the following information, data, methods, and/or analyses have been substantially updated from the 2012 document:

- As a result of shifts in the proposed Project, the distances between the pipeline and known recreational facilities have changed. In most areas, the alignment remains more than 5 miles from recreation resources, and there are no changes to the affected environment. However, the pipeline alignment is now closer to the following recreational facilities, from north to south:
    - Marion Creek Campground;
    - Arctic Interagency Visitor Center;
    - Arctic Circle Campground;
    - Montana Creek Campground;
    - Willow Creek Campground; and
    - Nancy Lake SRA.
- New parks or recreation features were identified in the vicinity of the proposed Project work in Seward. These include the Kenai Fjords National Park, Chugach National Forest, and Resurrection Bay, which is identified as a recreation feature given its heavy use by recreationists. Descriptions of these areas have been added.
- The current alignment bisects the Willow Creek SRA from north to south, traversing it for 1.6 miles; whereas, the previous route crossed the southeastern portion of the Willow Creek SRA, moving south and westward across it for 2.1 miles.
- In the vicinity of the Montana Creek SRA, the alignment parallels the west side of the Parks Highway approximately 65 feet from the centerline.
- There are no officially designated parks or recreational sites close to the proposed new alignment of the Fairbanks Lateral. Murphy Dome and Old Murphy Dome Roads are popular with all-terrain vehicle (ATV) riders, snowmachine users, hikers, dog mushers, and other recreational users. Hunting, fishing, and camping are also popular recreation activities in this area.
- The Nancy Lake SRA Master Plan was recently updated and the draft plan is publicly available (ADNR, 2013a).
- The Palmer Hay Flats State Game Refuge has been removed from this analysis because it is located approximately 18 miles away from all proposed Project features.

3.12.2. Summary

This section describes existing recreation resources and activities in the proposed Project Area. Section 3.12.4 describes the affected environment, which includes an overview of the related regulatory setting in the proposed Project Area (Section 3.12.3, Regulatory Environment). The impact analysis is presented in Chapter 4, Environmental Consequences.

3.12.3. Regulatory Environment

The regulatory environment associated with recreation resources in the proposed Project Area is based on the jurisdiction of several public land managers in the proposed Project Area, including BLM, NPS, USFWS, ADNR, and ADF&G. These public agencies implement applicable regulations related to recreation on the federal and state lands that comprise most of the land base in Alaska. These regulations include:

- 43 CFR 2930 – Permits for Recreation on Public Lands (Previously 43 CFR 8370);
- FLPMA – 43 CFR 8360 – Visitor Services;
- LWCF of 1965 – Planning, Acquisition, and Development of Recreation Lands;
- Office of Management and Budget Circular A-25 of 1993, revised – User Charges;
- Title 36 CFR, Subpart 71 – Recreation Fees;
- AAC, Title 11, 2 – Parks, Recreation, and Public Use;
- AAC, Title 11, 6 – Lands; and
- Alaska Statutes, Title 16, Chapter 16.05 – Fish and Game Code.

As further identified by NPS during Project scoping, Denali State Park and Nancy Lakes SRA, are considered 6(f) properties under the LWCF Act (16 U.S.C. 4601-4 et seq.). Section 6(f) of the LWCF Act requires that no property acquired or developed with LWCF assistance shall be converted to a use other than public outdoor recreation uses without the prior approval of the U.S. Secretary of the Interior. Moreover, if the Secretary of Interior approves a conversion, other recreation properties of at least equal fair market value and reasonably equivalent recreational usefulness and location must be substituted pursuant to Section 6(f)(3) provisions. This ensures that the area would be committed to outdoor recreation in perpetuity. The proposed Project would cross Denali State Park and Nancy Lake SRA, which would trigger a Section 6(f) review.

From a planning perspective, recreation is addressed at the state level as part of the Alaska Statewide Comprehensive Outdoor Recreation Plan (SCORP) process, which is administered by the ADNR. In addition, recreation resources throughout Alaska are covered in most of the management plans implemented by public land managers, discussed in greater detail in Section 3.11.11, Existing Land Use Plans.

Several of the recreation areas discussed in this section were established as part of the ANILCA of 1980, which placed large areas of Alaska in the nation's conservation,

wilderness, and recreation systems, as well as wild and scenic rivers, forests, wildlife refuges, and parks.

3.12.3.1. Section-Line Easements, Revised Statute 2477 Rights-of-Way, and Section 17(b) Easements

The proposed Project would intersect section-line easements, which are public ROW 33, 50, 66, 83, or 100 feet wide that are located along a section line of the rectangular survey system. Some section-line easements are also RS 2477 ROWs. RS 2477 ROWs are trails that have been established under Alaska RS 2477. Essentially, RS 2477 trails have been established within the ROW associated with the construction of roads, trails, or highways over public lands, which have not been reserved for public uses. These trails provide access to many rural destinations, and are primarily used by snow machines, dogsled teams, and four-wheel ATVs. For more information on RS 2477, refer to Section 3.11, Land Use. A list of RS 2477 ROWs intersected by the proposed Project and a list of changes to these trails since the 2012 FEIS are located in Section 3.11.5.1.

In addition to section-line easements and RS 2477 trails, the proposed Project would intersect Section 17(b) easements. Section 17(b) easements are rights reserved to the U.S. in the form of 60-foot-wide roads and 25- and 50-foot-wide trails granting access to public lands and major waterways across Federal lands property that were transferred to Native corporations. The easement does not grant access to the private lands it crosses. There may be overlap between RS 2477 trails and Section 17(b) easements. A list of Section 17(b) easements intersected by the proposed Project is included in Section 3.11.7.2.

Section-line easements, RS 2477 trails and Section 17(b) easements preserve access to both private and public lands for a variety of purposes, including recreation. Access resulting from section-line easements, RS 2477 trails, and Section 17(b) easements provide a range of recreation opportunities, primarily OHV use and access for fishing and hunting. Details of recreational uses of section-line easements, RS 2477 trails, and Section 17(b) trails transected by the proposed Project pipeline are not known. The proposed Project may not obstruct a public access easement to state-owned land or otherwise render it incapable of reasonable use for the purposes for which it was reserved. The proposed Project would therefore not interfere with the use of section-line easements, RS 2477, and 17(b) easements. Although the buried ASAP line would transect several parcels of land containing trails and easements, AGDC intends for the line not to impede them. AGDC would work with landowners to gain access and would comply with the stipulations on record.

3.12.4. Potentially Affected Communities

There are many recreation opportunities available throughout the State of Alaska. This is primarily attributed to the state's expansive land area, water resources, and abundant natural features. These recreation resources represent the foundation of the tourism industry in the state and help support the tourism-oriented economy of many regions,

including areas within the footprint of the proposed Project. This section describes the recreation environment in the proposed Project Area, focusing on recreational areas and facilities, and typical recreational activities that characterize the area surrounding the pipeline routes considered in this SEIS, as well as management and regulatory considerations related to recreation. This information is intended to provide context to anticipated short- and long-term impacts on recreation presented in Chapter 4, Environmental Consequences, including the potential effects on recreational access and quality of the recreation experience during proposed Project construction and operations.

3.12.4.1. Recreation and Tourism in the Proposed Project Area

Recreation opportunities in Alaska are generally available on most lands in public ownership, as well as large private land holdings and other types of open space and waterbodies. There are approximately 322 million acres of public land in Alaska, most of which is available for recreation (ADNR, 2009a). However, public access for recreation can be difficult due to constraints associated with land ownership, geography and distance, topography, and limited transportation infrastructure. Consequently, many recreation areas in Alaska are accessible only by plane or boat.

Outdoor recreation in Alaska is generally organized into two broad categories: wildland recreation and community-based recreation. Wildland recreation in Alaska includes a wide spectrum of recreation activities, including but not limited to: fishing, hunting, camping, hiking and trail use, horseback riding, mountain biking, snow skiing, snowshoeing, snowmobiling, OHV use, wildlife viewing and bird watching, recreational mining (*e.g.*, gold panning), mountaineering, whitewater rafting, spelunking, dog mushing, ocean kayaking, and power boating. Community-based recreation is centered on family or school-oriented activities in Alaska's more urban areas. The major seasons for wildland recreation tend to center around salmon fishing in the spring and early summer and big game and waterfowl hunting in the fall. Community recreation generally serves the recreational needs of local residents on a year-round basis.

The proposed Project would primarily affect wildland recreation opportunities along the proposed pipeline routes; therefore, wildland recreation is the focus of this section. In total, approximately 168 million acres, or 46 percent of Alaska, is managed for wildland recreation, including areas within national parks, state parks, and national forests (ADNR, 2009a). Recreation facilities, such as campgrounds, trails, trailheads, cabins, and boat launches, are found in some areas managed for wildland recreation. However, with such an expansive land base, these types of facilities are limited in many recreation areas, thereby limiting the types of developed recreational opportunities available to the public. In addition, an extensive system of rivers and lakes throughout the state support a range of recreation uses, including floating, boating, and fishing.

Wildland recreation serves both residents and non-resident visitors, with the latter constituting the basis for a strong tourism industry in the state. Recreation resources are

one of the primary elements driving tourism, the second largest private sector employer in Alaska. Tourism generally peaks during the summer season. In the summer of 2008, more than 1.7 million people visited Alaska, and visitor spending during the summer of 2007 was nearly $1.6 billion (ADNR, 2009a).

Important recreation resources and tourism opportunities are located on public lands and within waterbodies in proximity to the proposed pipeline route, which closely parallels the developed road system providing access to these areas. In addition, the proposed Project route and alternatives are located near Fairbanks and Anchorage, both of which often serve as trip anchor locations for recreational visitors in Alaska.

3.12.4.2. Recreation Management

Recreation management along the proposed Project route is primarily the responsibility of federal and state land management agencies. Generally, management of recreation resources on public lands is addressed under comprehensive land management plans implemented by these entities (for more information on these plans, refer to Section 3.11, Land Use). The management focus of these agencies varies and is often multi-faceted, requiring balancing recreation objectives with other resource considerations. The following is a list of public agencies with land management responsibilities in the proposed Project Area along with an overview of their recreation management objectives.

3.12.4.2.1. Bureau of Land Management (BLM)

BLM in Alaska has management responsibility on vast amounts of public land. There are two BLM district offices in Alaska: the Fairbanks District Office, covering the northern portion of the state; and the Anchorage District Office, covering southern Alaska. As outlined in regional RMPs, the BLM manages public lands in Alaska for multiple uses, including recreation. Applicable RMPs in the proposed Project Area include Utility Corridor RMP, Central Yukon RMP, and East Alaska RMP. Recreation management on BLM lands covers an array of activities and facilities, including trails and waterways. In the proposed Project Area, the BLM also is the administrator for the INHT[19] and has management responsibility for the White Mountains National Recreation Area (NRA) and various public lands and facilities providing recreation opportunities in proximity to the Dalton and Parks highways. The Recreation Management Plan for the DHRMA (BLM, 1991b) guides BLM management of numerous

[19] The BLM is the statutorily designated federal administrator for the INHT, managed according to the INHT Comprehensive Management Plan and a 1988 MOA between the BLM and State of Alaska. Administration of the National Trail by the BLM does not include management of non-federal trail segments or sites. Under the Comprehensive Mangement Plan, no single agency or organization manages the entire trail; instead, the plan calls for cooperative management by federal, state, and local agencies. Nothing in the MOA shall affect or interfere with fulfillment of the obligations and rights of the parties to manage the lands and programs administered by them in accordance with their other land management responsibilities.

recreation facilities located along the Dalton Highway corridor. Management of recreation use along the Dalton Highway corridor is also informed by the Benefits-Based Management Study for the Dalton, Taylor, and Denali Highways (Stegmann *et al.*, 2008).

3.12.4.2.2. National Park Service

NPS manages 17 units in Alaska in an effort to protect representative natural, cultural, and historic features across the state. Lands managed by NPS expanded substantially with ANILCA (1980), which established 11 new management units, including the Alagnak National Wild River, and expanded three existing NPS units, including Denali NPP. Recreation represents an important focus of NPS management. In 2009, there were approximately 2.3 million recreational visitors to NPS units in the Alaska region (NPS, 2009b). Denali NPP is the only NPS park unit located in the proposed Project Area. Tourism plays a large role in managing NPS units, particularly Denali NPP, and provides substantial economic benefits to local communities and the State of Alaska.

3.12.4.2.3. U.S. Fish and Wildlife Service

USFWS plays an important role in recreation management in Alaska, particularly based on its focus on species and habitat conservation in the context of fishing and hunting. Furthermore, USFWS manages a number of NWR in the proposed Project Area that provide wildlife-based recreational opportunities, including the ANWR, Yukon Flats NWR, and Kanuti NWR. From a management perspective, Section 304(g) of ANILCA requires the preparation of a CCP for each unit of the NWR system established or enlarged by the Act. These plans designate areas within a refuge according to their respective resources and values, and establish opportunities for fish and wildlife-oriented recreation.

3.12.4.2.4. Alaska Department of Fish and Game

ADF&G implements the management of sport fisheries, hunting, and wildlife resources at the state level. The Division of Sport Fish focuses on recreational and personal use fisheries, valued at more than $500 million annually (ADF&G, 2011b). The Division of Wildlife Conservation focuses its management efforts on wildlife populations and habitats and is responsible for managing the state game refuge system. Refuges and other conservation areas located near the proposed Project Area include the Minto Flats State Game Refuge, Susitna Flats State Game Refuge, Goose Bay State Game Refuge; and Palmer Hay Flats State Game Refuge, Creamer's Field Migratory Waterfowl Refuge; and Willow Mountain Critical Habitat Area. Of these refuges, the Minto Flats State Game Refuge is the only one that the proposed Project Area intersects.

3.12.4.2.5. Alaska Department of Natural Resources

ADNR Division of Parks and Outdoor Recreation manages the Alaska State Parks system and other recreation features throughout the state. With a focus on recreation, ADNR plays a key role in providing recreation opportunities to local residents and

visitors. ADNR has developed management plans for each of its larger park units, which outline future recreational developments as well as general recreational goals and policies. It also implements the Alaska Recreational Trails Plan, which established an integrated system of trails across the state. Visitation data on individual units are not readily available. However, the National Association of State Park Directors (NASPD, 2010) has compiled aggregate data on the 139 management units the ADNR oversees, including 48 parks and 80 recreation areas, covering nearly 3.4 million acres. In total, the Alaska State Parks system attracted a total of 5.2 million visitors in 2008-2009, which primarily consisted of day users (4.5 million visitors) and overnight visitors (roughly 715,000 annually) served by nearly 2,600 campsites located throughout the state park system. Many of the recreation features in the proposed Project Area under public ownership are managed by ADNR, including: Denali State Park, Montana Creek SRA, Big Lake North State Recreation Site, Rocky Lake State Recreation Site, Big Lake South State Recreation Site, Nancy Lake SRA, Kroto & Moose Creek Recreation River, Goldstream Public Use Area, Willow Creek SRA, Little Susitna Recreation River, Alexander Creek Recreation River, and Talkeetna Recreation River. ADNR also manages the INHT on state land, which includes the portion of the trail that is crossed by the proposed pipeline.

ADNR Division of Forestry has management responsibility for three state forests, which cover about 2 percent of state-owned land. The primary management purpose in state forests is timber management, namely the production and utilization of timber resources. Recreation represents one of several ancillary beneficial uses on state forest land. The Tanana Valley State Forest is located in the proposed Project Area.

ADNR Division of Mining, Land, and Water manages other state lands for multiple purposes. For those lands owned by the state but not covered by a land management plan, ADNR coordinates with the public to identify important land resources and determine how these lands should be used for the maximum public benefit. All resource and land uses, including recreation, are considered and evaluated. Whenever possible, multiple uses are allowed on these lands.

3.12.4.3. Recreation Facilities and Activities

Wildland recreation in Alaska includes a wide spectrum of recreation activities, including but not limited to: fishing, hunting, camping, hiking and trail use, horseback riding, mountain biking, snow-skiing, snowshoeing, snowmobiling, OHV use, wildlife viewing and bird watching, recreational mining (*e.g.*, gold panning), mountaineering, whitewater rafting, spelunking, dog mushing, ocean kayaking, and power boating. The state's road system plays an important role in recreation and tourism by facilitating access to recreational areas and facilities. Public roadways also provide opportunities for viewing wildlife, general sightseeing, scenic driving, and cultural and historic tours. Many of the outdoor activities referenced above commonly occur at the recreational areas and facilities located in proximity to or directly crossed by the proposed Project route and alternatives. These recreation features are described in greater detail below

and organized by pipeline segment, including visitation data where available. Table 3.12-1 summarizes recreation features and their distance away from Project components. See Figures 3.12-1 and 3.12-2 from the 2012 FEIS for a representation of recreation areas in relation to Project components. In most areas, the shifted alignment remains more than 5 miles from recreation resources, and no changes in impacts are anticipated.

Table 3.12-1 Distance between Recreation Features and Nearest Proposed Project Component(s)

Recreation Feature	Nearest Pipeline Milepost	Miles to Nearest Proposed Project Component						
		Mainline	Fairbanks Lateral	Denali NPP Route Variation	Gas Conditioning Facility	Camps, Pads, PSYs, Temp. Workspaces	Material Sites	Access Roads
Alexander Creek Recreation River	720	12.25	--	--	--	--	12.36	12.60
ANWR	146	0.18	--	--	--	0.42	1.95	0.65
Arctic Circle Campground	297	2.00	--	--	--	9.00	1.50	0.01
Big Lake North State Recreation Site	730	10.50	--	--	--	11.03	11.28	2.42
Big Lake South State Recreation Site	730	10.55	--	--	--	10.71	10.69	3.35
Chugach National Forest	733	--	--	--	--	1.75	--	--
Creamer's Field Migratory Waterfowl Refuge	444	--	2.60	--	--	0.56	--	2.59
Denali NPP	534	0.03	--	0	--	0.09	0.20	0.07
Denali State Park	607-644	0	--	--	--	0	0	0
East Fork Chulitna River Campground	590	0.48	--	--	--	3.34	2.04	0.43
Five Mile Campground	352	0.10	--	--	--	0	4.00	0.10
Galbraith Lake Campground	143	2.00	--	--	--	0	0.20	0.10
Gates of the Arctic NPP	188	1.09	--	--	--	1.71	1.83	1.17
Globe Creek Camp	431	5.31	8.83	--	--	10.88	8.76	2.13
Goldstream Public Use Area	444	--	0.90	--	--	1.01	--	2.09
Goose Bay State Game Refuge	733	2.71	--	--	--	2.69	0.04	0.28
Grapefruit Rocks Recreation Area	416	12.04	--	--	--	--	--	5.13
Iditarod Trail	731	0	--	--	--	0.29	1.62	1.55
Kanuti NWR	297	9.50	--	--	--	12.62	8.98	7.33
Kenai Fjords National Park	733	--	--	--	--	13.08	--	--
Kroto & Moose Creek Recreation River	710	3.24	--	--	--	5.68	3.63	3.23
Little Susitna Recreation River	728-729	0	--	--	--	3.19	0.62	0
Marion Creek Campground	236	0.10	--	--	--	--	0.40	0.01

Recreation Feature	Nearest Pipeline Milepost	Miles to Nearest Proposed Project Component						
		Mainline	Fairbanks Lateral	Denali NPP Route Variation	Gas Conditioning Facility	Camps, Pads, PSYs, Temp. Workspaces	Material Sites	Access Roads
Minto Flats State Game Refuge	430-441 454-467	0	0.02	--	--	0	1.01	0
Montana Creek SRA	681	0.02	--	--	--	3.61	2.78	0.80
Nancy Lake SRA	715-717	0	--	--	--	2.69	0.34	0
Nancy Lake State Recreation Site	712	4.54	--	--	--	2.89	6.30	4.12
Prudhoe Bay	0	1.53	--	--	1.42	1.42	1.25	0.01
Resurrection Bay	733	--	--	--	--	12.88	--	--
Rocky Lake State Recreation Site	730	11.34	--	--	--	11.92	12.15	2.94
Susitna Flats State Game Refuge	729	0.05	--	--	--	1.05	2.65	1.19
Talkeetna Recreation River	659	4.13	--	--	--	10.19	6.98	4.16
Tanana Valley State Forest	407-430 447-454	0	0	--	--	0.25	0.05	0
White Mountains NRA	416	--	--	--	--	--	--	2.43
Willow Creek SRA	705-707	0	--	--	--	0	6.66	0
Willow Mountain Critical Habitat Area	696	8.93	--	--	--	9.13	9.44	9.13
Yukon Flats NWR	364	1.73	--	--	--	4.58	1.25	0.63

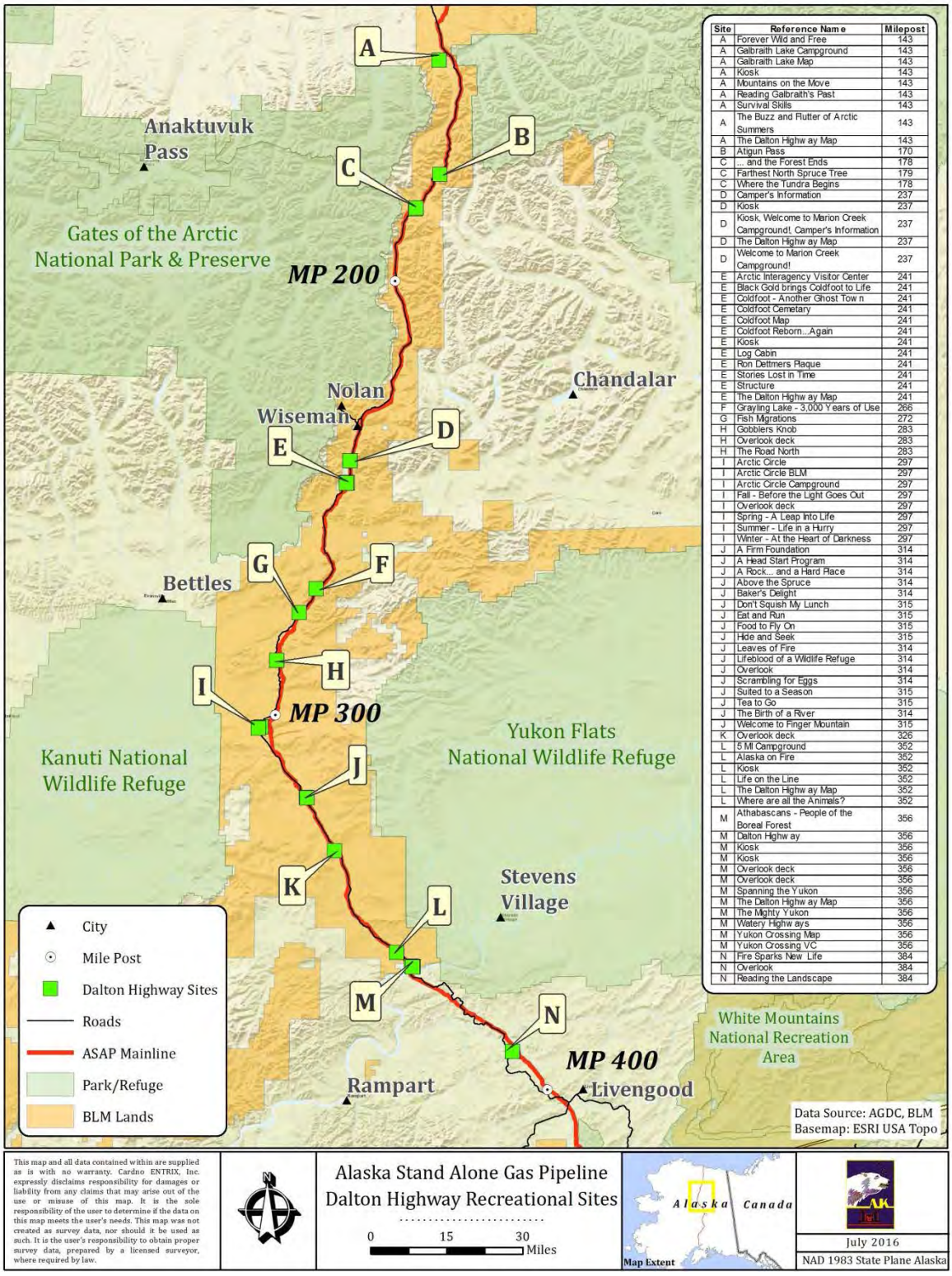
0 = Project Component intersects the Recreation Feature.
-- = Project Component is greater than 15 miles away from the Recreation Feature, impacts not assessed further.

Figure 3.12-1 Recreation Areas



Note: This figure does not reflect the current Rev 6.1 alignment and is to be used for reference to locations of recreational sites only. Additionally, this figure does not show recreation sites near Seward.

Figure 3.12-2 BLM-Administered Recreation Sites along the Dalton Highway



Site	Reference Name	Milepost
A	Forever Wild and Free	143
A	Galbraith Lake Campground	143
A	Galbraith Lake Map	143
A	Kiosk	143
A	Mountains on the Move	143
A	Reading Galbraith's Past	143
A	Survival Skills	143
A	The Buzz and Flutter of Arctic Summers	143
A	The Dalton Highw ay Map	143
B	Atigun Pass	170
C	... and the Forest Ends	178
C	Farthest North Spruce Tree	179
C	Where the Tundra Begins	178
D	Camper's Information	237
D	Kiosk	237
D	Kiosk, Welcome to Marion Creek Campground!, Camper's Information	237
D	The Dalton Highw ay Map	237
D	Welcome to Marion Creek Campground!	237
E	Arctic Interagency Visitor Center	241
E	Black Gold brings Coldfoot to Life	241
E	Coldfoot - Another Ghost Tow n	241
E	Coldfoot Cemetary	241
E	Coldfoot Map	241
E	Coldfoot Reborn...Again	241
E	Kiosk	241
E	Log Cabin	241
E	Ron Dettmers Plaque	241
E	Stories Lost in Time	241
E	Structure	241
E	The Dalton Highw ay Map	241
F	Grayling Lake - 3,000 Y ears of Use	266
G	Fish Migrations	272
H	Gobblers Knob	283
H	Overlook deck	283
H	The Road North	283
I	Arctic Circle	297
I	Arctic Circle BLM	297
I	Arctic Circle Campground	297
I	Fall - Before the Light Goes Out	297
I	Overlook deck	297
I	Spring - A Leap into Life	297
I	Summer - Life in a Hurry	297
I	Winter - At the Heart of Darkness	297
J	A Firm Foundation	314
J	A Head Start Program	314
J	A Rock... and a Hard Place	314
J	Above the Spruce	314
J	Baker's Delight	314
J	Don't Squish My Lunch	315
J	Eat and Run	315
J	Food to Fly On	315
J	Hide and Seek	315
J	Leaves of Fire	314
J	Lifeblood of a Wildlife Refuge	314
J	Overlook	314
J	Scrambling for Eggs	314
J	Suited to a Season	315
J	Tea to Go	315
J	The Birth of a River	314
J	Welcome to Finger Mountain	315
K	Overlook deck	326
L	5 MI Campground	352
L	Alaska on Fire	352
L	Kiosk	352
L	Life on the Line	352
L	The Dalton Highw ay Map	352
L	Where are all the Animals?	352
M	Athabascans - People of the Boreal Forest	356
M	Dalton Highw ay	356
M	Kiosk	356
M	Kiosk	356
M	Overlook deck	356
M	Overlook deck	356
M	Spanning the Yukon	356
M	The Dalton Highw ay Map	356
M	The Mighty Yukon	356
M	Watery Highw ays	356
M	Yukon Crossing Map	356
M	Yukon Crossing VC	356
N	Fire Sparks New Life	384
N	Overlook	384
N	Reading the Landscape	384

Note: This figure does not reflect the current Rev 6.1 alignment and is to be used for reference to locations of recreational sites only.

Public lands in Alaska are also generally conducive to dispersed recreation activities that are located outside designated recreational areas. Dispersed recreational activities include hiking, primitive camping, nature study and wildlife viewing, fishing, cross-country skiing, snowmobiling/snowmachining, dog mushing, rafting/kayaking and swimming activities, which typically do not require the use of improved facilities. However, smaller-scale facilities are often available to support and compliment these dispersed uses, such as interpretive sites, trailheads, and locally designated trails. Dispersed recreation use and facilities are prevalent along the proposed Project route. However, it is difficult to identify all uses and facilities due to the lack of documentation on dispersed use, as well as the extensive length of the route.

3.12.4.3.1. GCF to MP 535.5

The following recreation features are located between the proposed GCF near Deadhorse and MP 535.5 of the proposed pipeline. Not all of the listed recreation areas are intersected by the proposed Project.

3.12.4.3.1.1. Prudhoe Bay

Prudhoe Bay attracts a limited amount of public visitation. For security and safety reasons, access to the area between Deadhorse and Prudhoe Bay is restricted and visitors must be part of a tour to access the Arctic Ocean and surrounding oil fields. Tours are generally available by local tour guides between the end of May and beginning of September. With the exception of Prudhoe Bay, no NSB communities have docks (NSB, 2005a).

3.12.4.3.1.2. Dalton Highway Recreation Management Area

The DHRMA includes those public lands adjacent to the Dalton Highway from a point near the confluence of the Sagavanirktok and Ivishak rivers (about 60 miles south of Prudhoe Bay) and extending south to the Yukon River. The approximately 1.1 million acre DHRMA is managed by the BLM in accordance with the Recreation Management Plan for the DHRMA (BLM, 1991b), with an overall management objective of providing for a variety of developed and semi-primitive motorized recreation opportunities. The primary recreation activities during the summer include sightseeing, wildlife watching, hiking, camping, backpacking, and fishing, with hunting occurring during August and September. Recreational use declines substantially during the winter months and includes dog mushing, hunting and trapping, snow machining, and ski and dog sled touring. Recreation facilities within the DHRMA include the Yukon Crossing Contact Station (near the north end of the Yukon River Bridge), the Arctic Interagency Visitors center in Coldfoot (co-managed by BLM, NPS, and USFWS), and four campgrounds (Five-Mile, Arctic Circle, Marion Creek, and Galbraith Lake campgrounds). In addition, the BLM manages approximately 20 sites with interpretive panels, two trails with interpretive panels, and one living history site within the DHRMA.

Recreational use along the Dalton Highway corridor is managed by BLM according to the benefits-based management-planning framework, which focuses on recreation experiences and benefits in addition to recreational activities. In order to gather more information about the four levels of recreation demand (desired activities, desired settings, desired experiences, and benefits) for summer visitors to the Dalton, Taylor, and Denali Highways and the Fortymile National Wild and Scenic River, the BLM funded the Benefits-Based Management Study for the Dalton, Taylor, and Denali Highways (Stegmann *et al.,* 2008). In-person and follow-up surveys revealed that the activity most often cited as respondents' primary activity along the Dalton Highway was driving/sightseeing (49 percent). The majority (91 percent) of respondents stated that they intended to visit the southernmost portion of the highway (Yukon River up to the Arctic Circle), and visitation rates declined successively for each zone farther north of the Arctic Circle. The primary desired experiences for users of the Dalton Highway were reported to be to explore and experience nature, and the most desirable benefits were related to nature and the outdoors (Stegmann *et al.,* 2008).

3.12.4.3.1.3. The Arctic National Wildlife Refuge

The ANWR, managed by USFWS, is located in Northeastern Alaska. Because there are no roads in the refuge, primary access is by air. However, the Dalton Highway, located west of the ANWR boundary, also serves as a significant access corridor. The ANWR is generally managed to protect its wilderness qualities as outlined in the ANWR CCP (USFWS, 1988). Additionally, there is an area within the coastal plain of the refuge with significant oil and gas resources referred to as "1002 area," which is considered a "Minimal Management" area. Management under this category is directed at maintaining fish and wildlife or other resource values, while maintaining opportunities for recreation. Generally, the wilderness qualities of the refuge facilitate a number of recreation opportunities including hiking, hunting, camping, floating, and climbing. Total recorded visitation in the ANWR was just over 1,000 in 2009, which is relatively consistent with numbers from visits in previous years starting with information from the 1980s. Of this total, approximately 88 percent of visitation is supported by commercial services of a guide and/or air operator (USFWS, 2010c).

3.12.4.3.1.4. Gates of the Arctic National Park and Preserve

The Gates of the Arctic NPP is managed by NPS. It is one of several conservation areas located in the Brooks Range in northern Alaska. The remote location and climate of the Brooks Range is conducive to extreme wilderness recreation activities such as backpacking, river running, mountaineering, and dog mushing. Other outdoor activities include camping, birding, fishing, and hunting. There are no developed facilities or trails in the park and no direct road access, although the Dalton Highway is located just east of the park boundary. Most visitors access the park either by air taxi or by hiking in from the Dalton Highway. The park is open year round. Gates of the Arctic NPP is amending the 1986 General Management Plan and the new plan will outline park management for

the next 15 to 20 years. Since 2004, visitation to Gates of the Arctic NPP has remained relatively constant with nearly 10,000 visitors in 2009 (NPS, 2009c).

3.12.4.3.1.5. Yukon Flats National Wildlife Refuge

The Yukon Flats NWR is managed by USFWS, and was established for multiple purposes: conservation of fish and wildlife populations and habitats; fulfillment of international treaty obligations; continued subsistence uses; and protection of water quality and quantity. The refuge is open for public use, and common activities include boating, camping, hiking, fishing, hunting, wildlife viewing, and photography. River floating is another popular activity with access provided by the Yukon, Porcupine, Sheenjek, and other rivers. The refuge is not accessible by road; visitor access is primarily air or water-based transportation. Commercial recreation guides are also available.

3.12.4.3.1.6. Kanuti National Wildlife Refuge

The Kanuti NWR is managed by USFWS and was established to conserve white-fronted geese, other waterfowl and migratory birds, moose, caribou, and furbearers; fulfill treaty obligations; provide for continued subsistence uses; and ensure necessary water quality and quantity within the refuge. Hunting opportunities on the refuge are limited due to the closure of the Kanuti Controlled Use Area, which is open to subsistence hunting only. However, fishing opportunities are abundant on the refuge. Other recreation opportunities are limited because there are no designated trails, campsites, or public use cabins within the refuge boundaries, although some privately owned lands and cabins exist near refuge lands. The refuge is managed pursuant to the Revised CCP for Kanuti NWR (USFWS, 2008b).

3.12.4.3.1.7. White Mountains National Recreation Area

The White Mountains NRA is managed by the BLM and is located between Elliot and Steese Highways north of Fairbanks. At approximately one million acres, the White Mountains NRA offers opportunities for year-round recreation. Summer visitors typically engage in fishing, hiking, camping, and gold panning. In winter, visitors ski, snowshoe, dog team and snowmobile utilizing the area's trail system. Developed facilities include campgrounds, public-use cabins, trailheads, a gold-panning area, and a departure point for float trips. This area is currently managed under the White Mountain NRA RMP (BLM, 1986b), which is in the process of being integrated into the Eastern Interior Draft RMP/EIS.

3.12.4.3.1.8. Grapefruit Rocks Recreation Area

The Grapefruit Rocks Recreation Area is located on state land off Elliott Highway and managed by ADNR under the Tanana Basin Area Plan (ADNR, 1991b). The area is a popular location for rock climbing, hiking, berry picking, and hunting. It has been

considered for addition to the Alaska state park system; however, it is not currently a state park.

3.12.4.3.1.9. Globe Creek Camp

The Globe Creek Camp is a private youth camp facility located north of Fairbanks. The 40-acre camp provides summer and winter camp programs to local youth. It includes a lodge, cabins, athletic fields, a climbing wall, and a sledding hill. Globe Creek, a recreation resource itself, also traverses the property. Common recreation activities include hiking, obstacle course navigation, archery, sledding, and cross-country skiing. The camp is also in close proximity to hiking trails and areas for snowmobiling.

3.12.4.3.1.10. Tanana Valley State Forest

The Tanana Valley State Forest is managed by ADNR, covering 1.81 million acres within the Tanana River Basin. This area is heavily forested and much of the forest is in timber production. The forest is also open to mining, gravel extraction, oil and gas leasing, and grazing. The Tanana Valley State Forest offers many recreational opportunities including hunting, fishing, trapping, camping, hiking, dog mushing, cross-country skiing, wildlife viewing, snowmobiling, gold panning, boating, and berry picking. This area is managed in accordance with the Tanana Valley State Forest Management Plan (ADNR, 2001b).

3.12.4.3.1.11. Minto Flats State Game Refuge

The Minto Flats State Game Refuge is co-managed by ADF&G and ADNR and was created pursuant to Alaska Statute 16.20.037. The refuge encompasses approximately 500,000 acres, and is located about 35 miles west of Fairbanks between the communities of Minto and Nenana. Access to the refuge is available from an extension of the local road network, by boat on the Tanana River, or by air via flights into refuge waters. There are no developed public use facilities such as campgrounds or picnic areas. Minto Flats has traditionally been an important area for harvesting fish, wildlife, and other resources for Alaska Natives and other local residents. Waterfowl hunting is particularly popular with the refuge producing the highest waterfowl harvest in the state and third highest number of waterfowl hunter days. The refuge is managed pursuant to the Minto Flats State Game Refuge Management Plan (ADF&G, 1992).

3.12.4.3.2. MP 533.5 to MP 551.5

The Denali NPP is the only developed recreation feature located between MP 535.5 and MP 551.5. This park would be intersected if the Denali NPP Route Variation is selected from the proposed Project alternatives.

3.12.4.3.2.1. Denali National Park and Preserve

The Denali NPP is managed by NPS and located in the interior of the state. While all parks are governed by the principles of the NPS Organic Act, each individual park is established to fulfill specific purposes based on the area's unique and nationally significant resources. The specific purposes outlined in the enabling legislation form the foundation for each park's general management plan, which serves as the broad, long-term umbrella plan for managing the park.

The original park, which was called Mount McKinley National Park, was established in 1917 by Congress firstly as "a public park for the benefit and enjoyment of the people" and secondly as a "game refuge." Consistent with these purposes, the statute directed the Secretary of Interior to publish rules and regulations "aimed at the freest use of the said park for recreation purposes by the public and for the preservation of animals, birds, and fish and for the preservation of the natural curiosities and scenic beauties thereof." (39 Stat. 938). The Denali NPP has other important resources and values that are not primary to the park's purpose and significance, but that are important for both park management and visitors. These are resources and values that Denali possesses and has a legal mandate to protect, but which do not account for the establishment of the park and preserve. These other important resources and values include:

- Historic, archeological, and ethnographic resources;
- Paleontological resources;
- Air quality;
- Subsistence resources and opportunities; and
- Scientific research, education, and interpretation about natural ecosystems and geologic features and processes.

Mount McKinley National Park was enlarged and renamed Denali NPP in 1980 when Congress passed ANILCA (16 USC §§ 3101–3233, Pub. L. 96-487). Section 101 of ANILCA describes the broad purposes of the new conservation system units throughout Alaska, including enlarged national parks and preserves such as the Denali NPP. These are the following:

- Preserve lands and waters for the benefit, use, education, and inspiration of present and future generations;
- Preserve unrivaled scenic and geological values associated with natural landscapes;
- Maintain populations of wildlife and fish and their habitat;
- Preserve extensive, unaltered ecosystems in their natural state;
- Protect resources related to subsistence needs;
- Protect historic and archeological sites;

- Preserve wilderness resource values and related recreational opportunities such as hiking, canoeing, fishing, and sport hunting;
- Maintain opportunities for scientific research in undisturbed ecosystems; and
- Provide the opportunity for rural residents engaged in a subsistence way of life to continue to do so.

Section 202 of ANILCA states that the Denali NPP additions are to be managed for the following specific purposes:

- To protect and interpret the entire mountain massif and the additional scenic mountain peaks and formations;
- To protect habitat and populations of fish and wildlife, including, but not limited to, brown/grizzly bears, moose, caribou, Dall's sheep, wolves, swans, and other waterfowl; and
- To provide continued opportunities, including reasonable access, for mountain climbing, mountaineering, and other wilderness recreational activities.

The act states that "the Secretary shall administer, protect, and develop the recreation area in accordance with the provisions of the act of August 25, 1916 (NPS Organic Act), as amended and supplemented, and with any other statutory authority available to him for the conservation and management of natural resources" (16 USC 460dd-3).

The Denali NPP is one of the primary visitor destinations in Alaska. The park is roughly 4.7 million acres (including 2.1 million acres of federally designated wilderness) and the preserve is approximately 1.3 million acres. The prominent feature at the park is Denali (previously known as Mount McKinley), the tallest mountain (highest point) in North America. The peak recreation season lasts from late May to early September. The park is inhabitated by 1 species of amphibian, 38 species of mammals, 14 species of fish (including 3 species of salmon), 172-recorded species of birds, and 758 species of vascular plants. In 2017, the park employed 124 permanent, 16 term, 126 seasonal employees, and 772 volunteers (NPS, 2018).

Common recreation activities at the park include bus tours, backpacking and hiking, mountaineering, cycling, wildlife viewing and photography, sightseeing, fishing, camping, and whitewater rafting. The Denali NPP contains roughly 20 marked foot and/or bike trials and six campgrounds, (including the Riley Creek, Savage River, Sanctuary River, Teklanika River, Igloo Creek, and Wonder Lake campgrounds), and is the only NPP in the country with a kennel of working sled dogs. On average, over 50,000 people a year attend the dog sled demonstrations. During the winter season, additional recreational opportunities are available, including cross-country skiing, dog mushing, snowshoeing, and snowmobiling. Annual visitation to the Denali NPP has averaged approximately 414,000 visitors between 2005 and 2009; in 2017, the park was visited by 642,809 people (NPS, 2009d; NPS, 2018). According to the NPS, visitor

spending totaled $632 million in 2017, generated 8,154 jobs, and resulted in an economic output of $924 million (NPS, 2018).

The park is managed in accordance with the Denali NPP Consolidated General Management Plan (NPS, 2008). The Denali National Park Improvement Act passed in 2013 and authorized NPS to issue permits for construction of a natural gas pipeline in Denali NPP along the Parks Highway.

3.12.4.3.3. MP 551.5 to End

The following recreation features are located between MP 551.5 and the terminus of the proposed Project (MP 733).

3.12.4.3.3.1. East Fork Chulitna River Campground

The East Fork Chulitna River Campground is a primitive camping area approximately 0.4 mile north of the Parks Highway Bridge crossing, just south of Broad Pass, with restrooms and trash service. River access is available for boating and fishing.

3.12.4.3.3.2. Denali State Park

Denali State Park is managed by ADNR and is one of the prominent units in the Alaska State Parks system. The park covers 325,240 acres and is located north of Anchorage and south of Denali NPP along the Parks Highway. It provides visitors with a great variety of recreational opportunities, which are served by developed facilities such as public use cabins (at Byers Lake), campgrounds (including Byers Lake Campground and Lower Troublesome Creek Campground), other lodging, scenic viewpoints, and trailheads. Common outdoor activities at the park include camping, kayaking, cross-country skiing, hiking, and fishing. Equipment rentals, tours, and guide services are also available. This park unit is managed pursuant to the Denali State Park Management Plan (ADNR, 2006b). In addition, ADNR is currently in the process of developing a trail management plan for the park. Denali State Park has been identified as Section 6(f) property under the LWCF (see Section 3.12.3 for more information).

3.12.4.3.3.3. Talkeetna Recreation River, Little Susitna Recreation River, Kroto & Moose Creek, and Alexander Creek Recreation Rivers

The Talkeetna Recreation River, Little Susitna Recreation River, Kroto and Moose Creek, and Alexander Creek Recreation Rivers were established as part of the Recreation Rivers Act of 1988 (AS 41.23.400-510). The Act established mile-wide river corridors along the Little Susitna River, Deshka River (including Moose and Kroto creeks), Talkeetna River, Talachulitna River, Lake Creek, and Alexander Creek. The Susitna Basin Recreational Rivers Management Plan (ADNR, 1991a) was developed pursuant to the Act, which outlines long-term management strategies on state-owned lands surrounding designated river segments, establishes guidelines to reduce conflicts between users, provides opportunities for public use of the rivers, and protects the fish, wildlife, water, and other resources that drive visitation to these rivers. The management plan includes

policies and guidelines related to general management intent, public use sites, special management areas, riparian management areas, recreation, fish and wildlife habitat, commercial uses, shoreline development, and upland development. In the context of recreation, the management plan calls for limits on the duration of camping during the fishing season; a ban on new development of campgrounds; and development of primitive facilities only where there is high public use. The management plan also outlines strategies for individual river systems along a recreation opportunity spectrum that include Class I (primitive recreation), Class II (semi-primitive), and Class III (developed recreation). The Talkeetna Recreation River is included in the management plan as Unit 3, and primarily has a Class II classification near the proposed pipeline. Little Susitna Recreation River is Unit 1 with both a Class I and Class III classification. Kroto and Moose Creek Recreation rivers consist of Units 2f and 2g, respectively, with predominantly a Class I classification. Finally, the Alexander Creek Recreation River is Unit 6 with both a Class II and Class III rating near the proposed pipeline.

3.12.4.3.3.4. Montana Creek State Recreation Site

The Montana Creek State Recreational Site is managed by ADNR and is an 82-acre unit located directly off the Parks Highway. The main recreational activities are camping (36 campsites with RV access), fishing, and trail use, and picnic sites are also available. Although part of the Alaska State Parks system, management at Montana Creek State Recreational Site is contracted to a private concessionaire.

3.12.4.3.3.5. Willow Mountain Critical Habitat Area

The Willow Mountain Critical Habitat Area is co-managed by ADF&G and ADNR and was created pursuant to Alaska Statute 16.20.620. It is located in the Talkeetna Mountain Range east of the Parks Highway between Willow Creek and the Kashwitna River. This remote area is open to public use and is a popular area for moose and ptarmigan hunters. Other recreation uses include dog mushing, cross-country skiing, and snowmobiling, primarily in the winter. Limited fishing activity also occurs along Little Willow and Iron creeks.

3.12.4.3.3.6. Willow Creek State Recreation Area

The Willow Creek SRA is managed by ADNR and is a developed recreation area located along the Parks Highway in the Susitna River valley, west of Willow. At approximately 3,583 acres, its large land area and many water features are conducive to a variety of recreation activities, including camping (140 campsites with RV access), fishing, trail use, and wildlife viewing. Winter recreation also occurs at the Willow Creek SRA, and if the snow depth is adequate to protect underlying vegetation, this area may be opened for the use of snow vehicles (11 AAC 20.260). This state park unit is managed pursuant to the Willow Creek SRA Master Plan (ADNR, 1990), which outlines management of recreation opportunities and makes recommendations for facility development to enhance recreation.

3.12.4.3.3.7. Nancy Lakes State Recreation Area and Site

The Nancy Lakes SRA and Site are managed by ADNR and located south of Willow and north of Anchorage along the Parks Highway. The recreation area is more than 22,000 acres in size and is characterized by a flat, lake-studded landscape that is preserved for recreation purposes. The area is conducive to canoeing, fishing, hiking and camping in the summer, and cross-country skiing, dog mushing and snowmobiling in the winter. Developed campground facilities, trailheads, picnic areas, and public use cabins are available. Included as part of the recreation area are the Nancy Lake Canoe Trail System and Nancy Lake State Recreation Site, which have a range of developed recreational facilities. Nancy Lakes SRA has been identified as Section 6(f) property under the LWCF (see Section 3.12.3 for more information). This state park unit is managed under the Nancy Lake State Recreation Area Management Plan (ADNR, 2013a).

3.12.4.3.3.8. Rocky Lake State Recreation Site

The Rocky Lake State Recreation Site is managed by ADNR and is contracted to a private concessionaire. It is located several miles south of the Parks Highway near Big Lake North State Recreation Site. Common activities at this 49-acre site include boating, camping (10 campsites), and fishing; it also has picnic sites and a boat launch.

3.12.4.3.3.9. Big Lake North State Recreation Site

The Big Lake North State Recreation Site is managed by ADNR and is contracted to a private concessionaire. It is located 13 miles west of Wasilla, several miles off the Parks Highway. It caters to seasonal recreation visitors. Boating and fishing are popular on the lake during the summer months, as are other water-based activities including water sports, such as water skiing, jet skiing, and swimming. The 19-acre facility also provides opportunities for land-based recreation including camping (60 campsites with RV access) and wildlife viewing during the summer, and snowmobiling, dog mushing, and cross-country skiing in the winter. Recreational facilities at the site include picnic shelters and a boat launch.

3.12.4.3.3.10. Big Lake South State Recreation Site

The Big Lake South State Recreation Site is managed by ADNR and is contracted to a private concessionaire. It is a 22-acre site located 2 miles south of the Big Lake North State Recreation Site near the southern terminus of the proposed pipeline. It also provides similar recreational opportunities to the Big Lake North State Recreation Site described above, including camping (20 campsites), fishing, boating, water skiing, and jet skiing, and includes picnic sites and a boat launch.

3.12.4.3.3.11. Susitna Flats State Game Refuge

The Susitna Flats State Game Refuge is co-managed by the ADF&G and ADNR and was created pursuant to Alaska Statute 16.20.036. It is located between Beluga River and

Point MacKenzie on the west side of Cook Inlet. It was created in part to ensure the protection of fish and wildlife populations; particularly waterfowl, moose, bear, and salmon. Another of its purposes is to provide public use of these resources, including hunting, wildlife viewing, photography, and general public recreation. Each year approximately 10 percent of the waterfowl harvest in the state occurs on Susitna Flats. The Susitna River and its tributaries support the second largest salmon-producing system within Cook Inlet. Access is primarily by float plane or boat. Specifically, developed access is limited to the Little Su Public Use Facility within the refuge, which provides boat access to the Little Susitna River; this is an ADF&G-owned facility that ADNR manages through a concessionaire. In addition, there are unimproved, road-accessible access points at several locations along the east boundary of the refuge. The refuge is managed pursuant to the Susitna Flats State Game Refuge Management Plan (ADF&G, 1998).

3.12.4.3.3.12. Goose Bay State Game Refuge

The Goose Bay State Game Refuge is co-managed by the ADF&G and ADNR and was created pursuant to AS 16.20.030. It is located in upper Cook Inlet on the west side of Knik Arm across from Anchorage. Both road and boat access is available to the refuge, including a gravel parking lot at one access point that leads to a trail into the refuge. However, there are currently no improved public access points or public use facilities in the refuge. The wetlands complex provides a good waterfowl hunting area for local hunters. Off-road use of motorized vehicles is restricted in the refuge.

3.12.4.3.3.13. Iditarod National Historic Trail

The INHT is the only national historic trail contained within a single state, and as such, is managed by a number of different agencies. Administering the INHT is the BLM, per the National Trail System Act of 1968. The principal landowner and manager is the ADNR, cooperatively managing with the USFS, the BLM, USFWS, local and regional Native corporations, municipalities, and borough partners. The trail system is managed under the Iditarod National Historic Trail Comprehensive Management Plan (BLM, 1986a) with the accompanying Resource Inventory (1982) and a 1988 MOA between BLM and various State of Alaska land management agencies. The INHT covers nearly 2,600 miles, including both current and historic trails, a number of which are open for public use across state and federal lands. Most notably, several large-scale competitive events use portions of the trail each year, consisting of the Iditarod Trail Sled Dog Race, the Iron Dog snowmachine race, and the Iditarod Trail Invitational. Year-round portions of the INHT are primarily concentrated between the communities of Seward and Knik, with sporadic year-round rural Alaska use. While hiking and wildlife viewing are the primary recreational activities along the southern portion of the INHT, the rural portions of the trail act as vital inter-village travel corridors providing necessary overland access between isolated communities.

3.12.4.3.3.14. Public Lands

Public lands are located throughout the proposed Project Area. In the northern portion of the route, the pipeline would transect lands covered under the Utility Corridor RMP. These lands are managed for multiple uses although the priority of the plan is to facilitate transportation of energy minerals. Along the Dalton Highway, the pipeline would cross lands managed under the East Alaska RMP, as well as lands that would be managed under the Central Yukon RMP (in development). Lands in the Central Yukon RMP planning area that are in proximity to the proposed pipeline are conducive to dispersed recreation opportunities due to the remote character of this area; they also support hunting and fishing in primitive settings. Recreation management goals in the Central Yukon RMP planning area are to maintain existing recreation opportunities and support opportunities for increased public access. Finally, the East Alaska RMP provides management direction relative to a number of recreation resources within river systems including two components of the National Wild and Scenic Rivers system with 138 dispersed campsites, four campgrounds, two major waysides, and 24 developed trailheads (BLM, 2006a,b). As public lands, much of the area covered under these RMPs supports a broad spectrum of dispersed recreation opportunities.

An extensive network of recreational trails is found on both public and private lands throughout the proposed Project Area. Common recreational uses on Alaska trails include, but are not limited to, hiking/walking, bicycling, wildlife viewing, off-highway vehicle use, snowmobiling, and cross-country skiing. Trail management is typically implemented as part of area- or facility-wide management plans, many of which are referenced above. In addition, proposed Project facilities would transect a number of trails in the Mat-Su Borough, including: Crooked Lake Trail; Flathorn Lake Trail; Iditarod Link; Iron Dog; Knik-Susitna Station Trail (Historic Iditarod Trail); Lucky Shot; Nancy Lake - Susitna Trail; Rolly Creek Trail; and the West Gateway Trail System. These local trail systems are managed under the Willow Area Trail Plan (2006), Willow Summer Trails Master Plan (2011), and the Mat-Su Borough Recreational Trails Plan (2008). Lastly, at a broader scale, ADNR administers the Alaska Recreational Trails Plan (ADNR, 2000), which covers trail planning on State lands. Generally, these local and state-level trail plans identify trail systems in their respective regions, future trail needs, allowable trail uses, and funding and management considerations.

3.12.4.3.4. Fairbanks Lateral

The following recreation features are located along the Fairbanks Lateral. Other recreation features are located near this pipeline segment, but are referenced under the GCF to MP 535.5 segment (*i.e.*, Minto Flats State Game Refuge and Tanana Valley State Forest).

3.12.4.3.4.1. Goldstream Public Use Area

The Goldstream Public Use Area (approximately 5 miles northeast of the Fairbanks Lateral terminus) is managed by ADNR and was established by Alaska Statute 41.23.170. The purpose of the 2,000-acre public use area located in the Goldstream Valley is to protect, maintain, perpetuate, and enhance year-round general public recreation, public use, and enjoyment of fish and wildlife. It is included within Management Unit 1H of the Tanana Basin Area Plan (ADNR, 1991b), also administered by ADNR.

3.12.4.3.4.2. Creamer's Field Migratory Waterfowl Refuge

Creamer's Field Migratory Waterfowl Refuge (approximately 4 miles east of the Fairbanks Lateral terminus), managed by the ADF&G, was created pursuant to Alaska Statute 16.20.039. It is a 1,800-acre bird sanctuary located in Fairbanks and associated with the Alaska Bird Observatory. The primary activity at the refuge is bird watching, although other recreation opportunities are also available, including a developed trail system that is used by hikers and for picnicking in the summer, and by dog mushers, cross-country skiers and skijorers (whereby a skier is drawn over ice or snow by a horse, dog, or vehicle) in the winter. Sections of the refuge are open to hunting and trapping during the appropriate seasons. Guided nature walks are also available, as well as a visitor center with historic exhibits and a gift shop. The refuge is managed pursuant to the Creamer's Field Management Plan (ADF&G, 1993).

3.12.4.3.5. Seward

The following recreation features are located near the proposed Project work in Seward.

3.12.4.3.5.1. Kenai Fjords National Park

The Kenai Fjords National park was established through ANILCA and is managed by NPS. The park is 669,984 acres of forest, mountains, glaciers, and coastline on the Kenai Peninsula, located to the west and north of Seward. Popular recreational activities in the area include hiking, biking, camping, kayaking, fishing, bird and wildlife watching, and boat tours.

3.12.4.3.5.2. Chugach National Forest

The Chugach National Forest is located to the north and east of Seward. It is managed by USFS and was established in 1907 from a portion of forest reserve. Recreational uses of the Chugach National Forest include hiking, camping, biking, fishing, bird and wildlife watching, and hunting.

3.12.4.3.5.3. Resurrection Bay

Seward is located in the head of Resurrection Bay. The bay is used heavily by boaters, kayakers, fishermen, and wildlife viewers. The bay remains ice-free in winter, allowing year-round boat access.

3.13. Visual

3.13.1. Introduction

The description of visual resources in the proposed Project Area summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, as well as recent, publicly available literature, in light of changes and updates to the proposed Project. An overview of the types and location of visual resources and management in the proposed Project Area is presented in Section 3.13.3, Potentially Affected Communities. The impact analysis is presented in Section 4.13, Environmental Consequences, and focuses on the extent to which pipeline construction and operations would affect visual resources in proximity (defined generally as within 5 miles) to the pipeline route. The impact analysis is based on the location, duration, and visual contrast of construction and operations activities.

3.13.2. Summary

Recent revisions to the ASAP Project, such as changes in the alignment of the Mainline pipeline and the Fairbanks Lateral (AGDC, 2016a), result in changes to the previous assessment of the effects of the proposed Project on visual resources.

There were minor changes to the affected environment since the 2012 FEIS (USACE, 2012a). Those changes are the result of shifts to the pipeline alignment, placing it in a different visual context. The three alternatives are described in detail in Chapter 2; the components relevant to visual resources are:

- Alternative 1: ASAP Project (Proposed Alternative):
  - Use of DH3 at West Dock, nearshore disposal of dredge material;
  - HDD at the Yukon River; and
  - Pipeline would be buried for the extent of the route, except at elevated bridge crossings, fault crossings, pigging facilities, and valves.
- Alternative 2: Denali NPP Route Variation:
  - Use of DH2 at West Dock, ocean disposal of dredge material;
  - Pipeline above ground from MP 0 to MP 62; and
  - Aerial crossing at the Yukon River.
- Alternative 3: No Action Alternative.

Revisions to the proposed Project that apply to both Alternatives 1 and 2 that change the visual impact assessment from the information provided in the 2012 FEIS include (USACE, 2012a):

- Increasing the pipeline diameter from 24 to 36 inches and minimum permanent ROW to 53 feet;

- Decreasing the length of proposed Mainline pipeline that passes through population areas; and
- Moving the Fairbanks Lateral near Murphy Dome and Old Murphy Dome Roads, instead of along the ARRC corridor.

3.13.3. Potentially Affected Communities

Visual resources are landscape characteristics that have an aesthetic value to local residents and visitors based on their perspective from sensitive viewpoints, such as residences, recreation areas, rivers, or highways. This section discusses the existing visual resources along the proposed Project routes and its proximity to potentially sensitive viewpoints and user groups in order to gauge viewer sensitivity. It also identifies special management and regulatory considerations for visual resources in the proposed Project Area. The purpose of the information presented here is to establish existing conditions relative to visual resources, providing context to identify potential short- or long-term changes to the visual environment resulting from proposed Project construction and operations.

3.13.4. Regulatory Environment

The regulatory environment associated with visual resources focuses primarily on management guidelines for public lands in the proposed Project Area. The proposed Project Area includes federal, state, and private lands. There are no applicable visual resource management guidelines or methodologies to assess the visual impacts to the existing landscape on private or state lands. The BLM is charged with managing the scenic resources of federal public lands through the FLPMA of 1976 (43 U.S.C. 1732). FLPMA states that the scenic quality of federal lands should be protected for the enjoyment of all Americans. To this end, BLM has developed the Visual Resource Management (VRM) system to manage visual resources. Furthermore, the proposed Project Area includes a National Scenic Byway and several State Scenic Byways, which recognize scenic resources in the proposed Project Area. The proposed Project would not cross any river sections designated as wild and scenic. Guidance for management of federal lands and federally designated scenic resources is described below.

3.13.4.1. BLM Visual Resources Management

The VRM methodology has been developed to identify and evaluate scenic resources under the BLM's jurisdiction and to develop management objectives for those resources. The system classifies resources based on scenic quality, viewer sensitivity to visual change, and viewing distance (BLM, 1980a, 1984, 1986a). Based on these three visual criteria, each location is placed into one of four VRM inventory classes with different visual resource management objectives. Classes I and II are the most valued, Class III represents a moderate value, and Class IV is of least value:

- The Class I objective is to preserve the existing character of the landscape, including the natural ecological qualities. Some very limited management activity is permitted.
- The Class II objective is also to preserve the existing character of the landscape and to keep landscape changes at a minimum. "Management activities may be seen, but should not attract the attention of the casual observer" (BLM, 1986c). Landscape changes should reflect the ambient colors, textures, and form of the surrounding features.
- The Class III objective is to keep landscape changes moderate and retain some portion of the existing character of the landscape. Management activities should not attract much attention or dominate the view. Landscape changes should reflect the basic features found in the landscape character.
- The Class IV objective is to allow management activities that require major alterations in the existing character of the landscape. The view may be dominated by management activities. However, the location, disturbance, and blending with the surrounding landscape should be minimized.

Few lands in the proposed Project Area have an established VRM Class rating. This analysis reviews the visual resources based on the general guidelines used to establish VRM classes, but does not determine an Interim VRM Class for lands that are not under BLM jurisdiction have not been assigned a VRM Class. Described below are the VRM guidelines for BLM lands in the proposed Project Area as described in the applicable BLM RMPs.

3.13.4.2. BLM Utility Corridor RMP

The proposed Project Area includes the Utility Corridor, which extends along Dalton Highway MP 56 to MP 300, and provides a route to transport petroleum. The Utility Corridor was established in 1971 by Public Land Order 5150 and dedicated to long-term utility and transportation needs. In January 1991, the BLM Alaska Arctic District Office issued a Record of Decision on the Utility Corridor RMP/EIS that recognizes that, "the primary management direction and use of the BLM-administered lands in the Utility Corridor is for energy transportation," and that, "management must allow for activities which would require major modification of the existing landscape" (BLM, 1991a). According to the RMP/EIS, management of inner corridor lands is to be managed according to Class IV VRM objectives, with every attempt to be made to minimize visual impacts, particularly in high quality (Class A) scenic areas and ACECs, which include Galbraith Lake and Sukakpack Mountain.

3.13.4.3. BLM Central Yukon RMP

The Central Yukon RMP guides management of 9.5 million acres in west-central Alaska. BLM is currently developing an RMP for the Eastern Interior Planning Area, which will replace the Steese National Conservation Area RMP (BLM, 1986d), White Mountain NRA RMP (BLM, 1986b), and the Fortymile Management Framework Plan RMP (BLM,

1980b). The existing RMPs specify that visual resources would be managed where possible to retain the existing character of the landscape. However, no VRM inventory has been conducted in this planning area.

3.13.4.4. BLM East Alaska RMP

Land within the East Alaska RMP/Final EIS planning area, south of the BLM Central Yukon RMP area, is managed to protect and enhance vegetative communities, fish and wildlife resources, recreational opportunities, and natural, cultural, and geological resources (BLM, 2006a). The BLM established VRM inventory classes in the East Alaska planning area in 2003. The proposed Project route would overlap approximately 2 miles with the East Alaska RMP planning area; 0.3 miles are categorized as Class II, 6.0 miles are categorized as Class III, and 1.1 miles are categorized as Class IV.

3.13.4.5. Denali National Park and Preserve

The Consolidated General Management Plan for Denali NPP stipulates that visitor centers and other facilities in the built environment would reflect the wild setting, with designs that consider the effects of scale, materials, color, texture, and continuity so as to minimize visual impacts to park visitors. It is also notes that incompatible uses in the National Park include surface disturbing activities that "unduly change the visual character of the park and preserve." The General Management Plan notes that the Alaska Power Authority (APA) has constructed an intertie transmission line between Willow and Healy, with lines and towers that are partially visible from the national park entrance.

The proposed Project route would be outside of, but potentially visible from Denali NPP. Substantial portions of the Denali NPP Route Variation would be within the boundaries of Denali NPP. Specifically, the route would cross the Park Development Zone, where "lands…are managed to accommodate major development and intensive use. In Denali this zone includes the road corridor and all lands where major facilities exist" (NPS, 2011). Table 3.13-1 lists the Management Areas (a subset of the Park Development Zone) that the Denali NPP Route Variation would cross, and summarizes the visual resources policies of those management areas.

Table 3.13-1 Denali NPP Management Areas Crossed by the Denali NPP Route Variation

Denali NPP Route Variation Segment	Denali NPP Management Area Crossed	Management Area Visual Resources Policies
Nenana River (near ASAP MP 535.5) to Parks Highway MP 235	Motorized Sightseeing Zone I	This sub-zone allows for frequent, year-round traffic that includes commercial vehicles. The visitor experience generally depends on a vehicle and may include some scenery and wildlife viewing.
Parks Highway MP 235 to Nenana River (near ASAP MP 542)	Backcountry Day Use	This sub-zone provides a wilderness threshold feel although it may be close to roads, campgrounds, or other development.

Source: NPS, 2011

The General Management Plan recognizes that this corridor would be "the defined route for other future utility transmission from Anchorage to Fairbanks, and NPS will continue to work with the APA to mitigate the visual impacts of any future development along the Parks Highway and the park boundary" (NPS, 2011).

3.13.4.6. National Scenic Byways Programs

Congress established the National Scenic Byways Program in 1991 to designate roads with distinctive natural, scenic, historic, cultural, archaeological, or recreational qualities unique to their regions. The vision of the Federal Highway Administration's National Scenic Byways Program is "to create a distinctive collection of American roads, their stories and treasured places." The National Scenic Byways Program does not provide management guidance, but rather its mission is, "to provide resources to the byway community in creating a unique travel experience and enhanced local quality of life through efforts to preserve, protect, interpret, and promote the intrinsic qualities of designated byways" (DOT FHWA, 2011). The Parks Highway, connecting Anchorage and Fairbanks, is a National Scenic Byway that provides views of the Alaska Range and Denali. The proposed Project route overlaps with the National Scenic Byway of the Parks Highway.

3.13.4.7. Alaska Scenic Byways Programs

The State of Alaska established a scenic byways program in 1993 to recognize routes that provide access to the state's significant scenic, cultural, and recreational resources. There are two State Scenic Highways in the proposed Project Area: the Dalton Highway (entire length) and the George Parks Highway (from Healy to the southern boundary of Denali State Park). Corridor partnership plans are developed locally by local governments and citizens "to identify key features along the byways and to enhance and promote those features over time." The Dalton Highway Scenic Byway Corridor Partnership Plan, completed in March 2010 (ADNR, 2010c), is an evaluation of the byway's intrinsic qualities (including scenic), and serves as a guideline for the protection of these intrinsic qualities over time. It is not a plan that mandates regulations for viewsheds, nor does it

provide guidance for use of the corridor for pipelines and other utility infrastructure. Similarly, the Corridor Partnership Plan for the Parks Highway developed in 2008 is not a regulatory document, but rather contributes to the communities and places of interest along the corridor by promoting tourism, supporting the local culture, and enhancing the economic base of the region.

3.13.5. Overview of Visual Resources by Segment

The proposed Project would cross a variety of landscapes, including the ACP, the Brooks and Alaska mountain ranges, the Minto Flats, the Tanana Flats, the Nenana River Valley, and the Susitna River Valley. This landscape contains a diversity of vegetation and land cover types, including tundra, waters, dwarf scrub/shrub vegetation, and boreal forest. The proposed action also crosses or parallels a number of travel routes, recreation areas, and populated areas that may be visually impacted. The pipeline parallels two designated scenic byways: the state- and federally-designated Parks Highway Scenic Byway and the state-designated Dalton Highway Scenic Byway.

The Denali NPP Route Variation parallels the Parks Highway through Denali NPP. Since the 2012 FEIS, passage of the Denali Park Improvement Act in September 2013 (P.L. 113-33) allows NPS to approve a ROW through the Denali NPP for a natural gas transmission pipeline; however, ASAP's proposed route has not changed, and still bypasses Denali NPP to the east. The proposed Project route would traverse the Minto Flats State Game Refuge, Susitna State Recreational River, Willow Creek SRA, and Denali State Park. Alternative routes under consideration pass though Denali NPP and are evaluated further in Section 4.15, Environmental Consequences.

The proposed Project route would cross numerous minor roads, trails, the railroad, and rivers (although no rivers would be crossed in sections designated as wild and scenic). Refer to Figure 5.11-1 in the 2012 FEIS to see the Scenic Byways, National Parks and Wildlife Refuges, and Wild and Scenic Rivers in the vicinity of the proposed Project. Table 3.13-2 summarizes the travel routes and observation points from which the proposed Project could be visible. The remainder of this section summarizes visual resources by segment.

As described in Section 2.2.12, Waterbody Crossings, construction of the proposed Project would potentially occur at nighttime. Between approximately early April and early August, nighttime lighting conditions in Alaska rarely include full darkness (NPS, 2017), particularly north of the Arctic Circle. During this portion of the year, a glow is often present along the horizon at night. For the remainder of the year, full darkness is present for extended portions of the night. In rural areas and areas away from major roads, existing sources of artificial light can be apparent for considerable distances during dark-sky conditions, although natural light sources (on nights with clear atmospheric conditions), such as moonlight and the aurora borealis, may reduce the contrast that these existing light sources create.

Table 3.13-2 Pipeline Proximity to Travel Routes or Observation Points

Travel Route or Observation Point	Description of Proposed Action Proximity	Segment				
		ASAP MP 0 to MP 535.5 (Parks Hwy MP 238)	Fairbanks Lateral	ASAP MP 535.5 to MP 551.5 (Parks Hwy MP 238-223)	Denali NPP Route Variation [a]	ASAP MP 551.5 (Parks Hwy MP 223) to End
Populated Areas	Mileage of proposed Project within town or CDP boundaries	91	18	16	15	101
	Acreage of CDP/town within 5 miles of proposed Project	420,398	42,358	54,531	47,005	428,449
Scenic Byway	Proposed Project crossing (underground)	37	0	0	0	6
	Mileage of proposed Project within Byway ROW	253	0	0	15	123
Railroads	Proposed Project crossing (underground)	5	3	0	2	5
Local/ Arterial Roads	Proposed Project crossing (underground)	138	3	1	NA	63
Trail/ Driveway	Proposed Project crossing (underground)	102	6	1	NA	199
Rivers	Proposed Project crossing (nearly all underground)	400	19	6	4	90
Recreation Areas	Acreage within 5 miles of proposed Project: state recreation (forest, park, public use areas, recreational areas, recreation river)	166,918	72,725	0	0	243,811
	Acreage within 5 miles of proposed Project: state game refuge	131,810	4,418	0	0	20,209
	Miles of historic trail within 5 miles of proposed Project	0	0	0	0	10
	Acreage within 5 miles of proposed Project: NWR/ national park	144,547	0	38,968	48,003	78,913
	Miles of proposed Project within state recreation areas/site/park	15	2	0	0	40
	Miles of proposed Project within state game refuge	24	0	0	0	0
	Miles of proposed Project within NWR/national park	0	0	0	7	0

a Incorporates ASAP MP543 to 55.1 535.5 to MP 551.5 including Denali NPP Route Variation, only for Alternative 2.

3.13.5.1. GCF to MP 535.5 (Parks Highway MP 238)

The proposed Project would follow the Dalton Highway for approximately 400 miles. The Dalton Highway, which is designated as an Alaskan scenic byway, begins just a few miles from Prudhoe Bay and ends approximately 414 miles to the south at its junction with the Elliot Highway. This primarily gravel road was originally constructed at a width of 28 feet, but is narrower in some sections due to erosion and wider in some new sections. It is the only road connecting the Beaufort Sea to the area south of the Yukon

River. The Dalton Highway was completed in 1974 by APSC. Its original name was the Haul Road, indicating its purpose to support pipeline construction and maintenance and to provide access to the oil fields as part of the TAPS. The TAPS is predominantly visible from the Dalton Highway as it winds along (and sometimes underneath) the highway. The TAPS is a mostly aboveground pipeline in a maintained 54-foot ROW. Control of the Dalton Highway was transferred to the State of Alaska in 1978; in 1994, the highway was opened to general public use.

An estimated 20,000 to 25,000 recreational visitors travel the Dalton Highway annually. Additionally, commercial truck traffic hauling supplies exceeds recreational visitor travel on the Dalton Highway (ADNR, 2010c). There is also limited bicycle travel on the highway. Several small communities are located along the highway as well, and are described below.

The Dalton Highway traverses a diversity of landscapes and provides views of numerous significant natural features. The following are depictions of these features from the Dalton Highway Scenic Byway Corridor Partnership Plan (ADNR, 2010c):

- ACP (Deadhorse to Last Chance Wayside). Permafrost seals the ground and creates ice features including layers of ice, ice-wedge polygons up to 100 feet in diameter, ice-core mounds (palsas), and conical ice-cored hills (pingos) up to 1,450 feet wide and 230 feet high. The landscape also includes vast wetlands and thaw lakes. The copper-colored Franklin Bluffs can be seen in the northern reach of this section. Buildings and oilfield infrastructure are also visible at the northern terminus at Deadhorse/Prudhoe Bay.
- North Slope (Last Chance Wayside to Galbraith Lake). The remote North Slope is a treeless coastal plain characterized by a vast expanse of low-lying tundra plants. Key natural features in this section are the Sagavanirktok River and Slope Mountain (located at the southern edge of the North Slope). Visible to the south are the mountains of the Brooks Range.
- Brooks Range (Galbraith Lake to Coldfoot). The landscape in this section of the Dalton Highway through the Brooks Range is dominated by mountain peaks and river valleys. The Gates of the Arctic NPP and the ANWR are visible from the highway. Natural features in this section include Sukakpak Mountain (a recognizable marble rock peak in the Brooks Range), Atigun Pass (elevation 4,739 feet, where the Dalton Highway crosses the Continental Divide), Atigun River Valley, and Galbraith Lake.
- Boreal Forest (Coldfoot to Livengood). In this section, the Dalton Highway rolls up and down through the hills and valley bottoms of the Yukon-Tanana uplands. Vegetation includes spruce and birch forests, bogs, creeks, as well as signs of wildfire. This section includes a crossing of the Yukon River (MP 356), views of Yukon Flats NWR, the Arctic Circle, Kanuti NWR, Finger Mountain (rock pinnacles rising straight from the tundra), and Grayling Lake (glacially carved). Two small

communities, Coldfoot and Wiseman, are located along this section of the Dalton Highway, with residential and commercial structures providing a visual contrast to the undeveloped surroundings.

The Dalton Highway ends just before pipeline MP 400, and the proposed pipeline route continues south following minor travel routes and the Tolovana River through the Minto Flats and Tanana Lowlands, which is an alluvial plain that slopes gently upward towards the Alaska Range. Permafrost in this area is discontinuous and vegetation is dominated by a mixture of boreal forests, with such species as black spruce, white spruce, balsam poplar, white birch, and trembling aspen in various microenvironments and wetland areas associated with the Minto Flats and Tanana Lowlands. This section of the proposed Project route also includes a crossing of the Tanana River, south of which the pipeline is routed through relatively undeveloped areas to the west of the Nenana River, until it crosses the Parks Highway at approximately MP 498, just south of the community of Clear. South of the highway crossing, the proposed Project pipeline route would begin to parallel the Parks Highway. At this point, the proposed pipeline route would enter a more developed environment with more visual contrast with infrastructure and buildings following the paved highway through several communities. The proposed pipeline route bypasses to the west of the community of Healy, returning to the Parks Highway corridor south of Healy.

From MP 0 to MP 535.5 (Parks Highway MP 238, just north of Denali NPP), 90.5 miles of the proposed Project route would pass through populated areas (as defined by the U.S. Census Bureau as a town or Census Designated Place). In these populated places, the areas immediately adjacent to the proposed route typically include existing linear utility and road corridors.

In addition, the proposed Project route would also cross the railroad track six times, as well as approximately 140 local and arterial roads within this section. More than 20 RS 2477 trails would be crossed by the proposed Project route. RS 2477 trails provide access to rural destinations and are utilized primarily in the winter by snow-machines, dogsled teams, and four-wheel ATVs. For more information on RS 2477, refer to Section 3.11, Land Use.

3.13.5.2. Fairbanks Lateral

The Fairbanks Lateral traverses from MP 440 to Fairbanks along Murphy Dome to the north end of the Parks Highway. The route passes through rolling hills or domes covered with dwarf scrub vegetation and open spruce stands. In this segment, the proposed Project would cross (underground) a freight and passenger railroad once, cross three roads (underground) and six driveways/trails (ditch).

3.13.5.3. MP 535.5 to MP 550.5 (Parks Highway MP 238 to 223)

The landscape in this segment consists of rolling hills and dwarf scrub vegetation and boreal forests. In the southern section of the proposed Project route, the Nenana River is

visible to the west. The Alaska Range is visible along much of this segment. The Alaska Range landscape visible from this portion of the route and from the Denali NPP Route Variation is predominantly rocky slopes, ice fields, and glaciers barren of vegetation. In this segment, the proposed Project would cross two arterial/local roads.

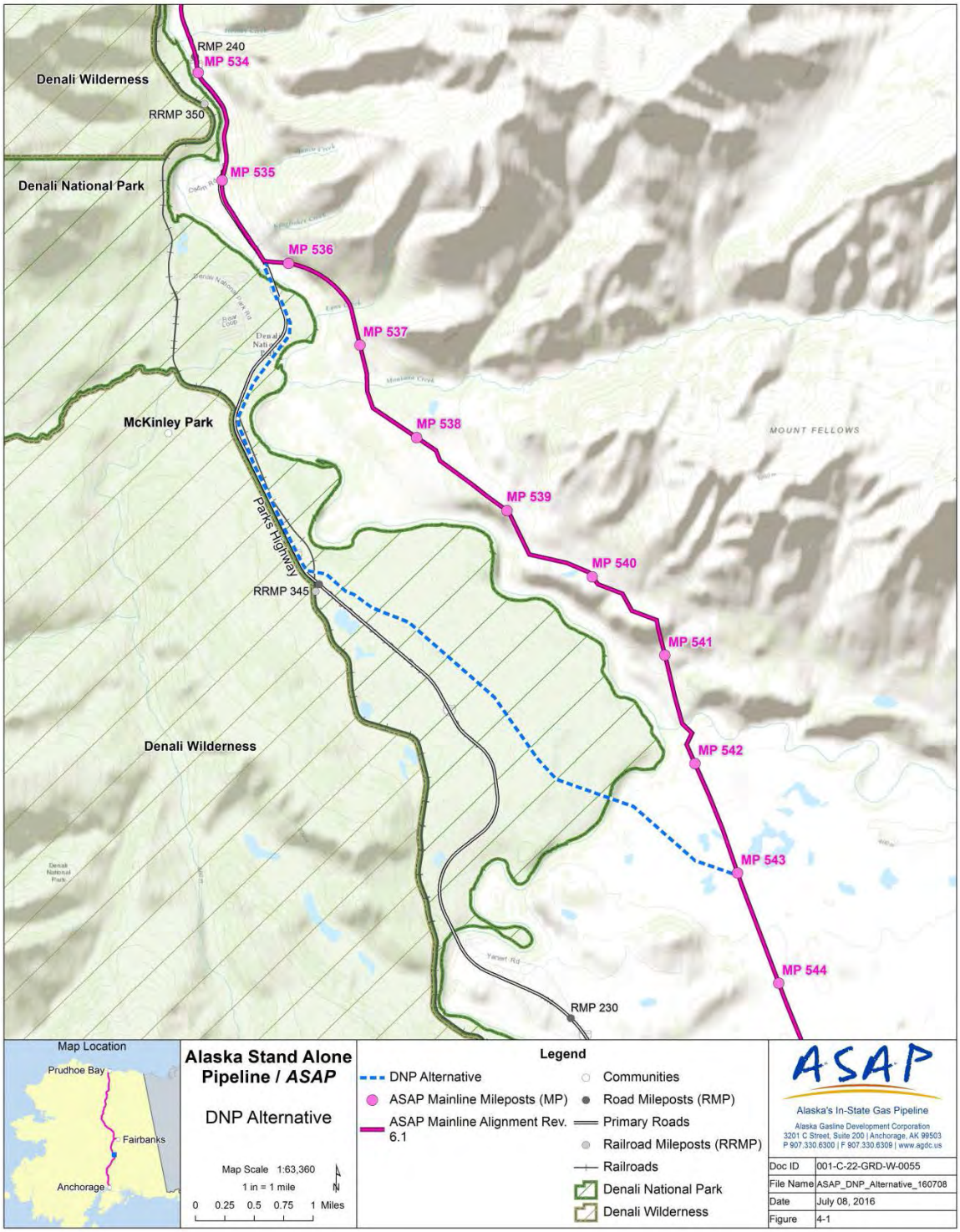
3.13.5.4. Denali National Park and Preserve Route Variation

The ASAP preferred route and the Denali NPP Route Variation are depicted in Figure 3.13-1. The ASAP preferred alternative route begins to parallel Denali NPP at MP 531 at the Moody Bridge (Nenana River) crossing, traversing behind the Denali Village area. At MP 535.8, the preferred alternative route and the Denali NPP Route Variation diverge from one another. The preferred alternative route continues to bypass the park to the east, climbing the ridgeline at a higher elevation, whereas the Denali NPP Route Variation generally parallels the highway corridor into the park on flatter terrain. The southern end of the Denali NPP Route Variation moves southeast to exit the park and avoid construction and operational impacts to the McKinley Village area. The preferred alternative route and Denali NPP Route Variation rejoin each other at MP 543. The lengths of both routes are similar, only differing by about 0.3 miles.

Denali NPP is known for its unique and highly valued scenery (in addition to a wide variety of other characteristics). The Denali NPP Route Variation crosses through the "front country" of Denali NPP, an area characterized by relatively flat taiga and open vistas to both the east and west. As with the MP 535.5 to 550.5 segment of the proposed Project route (see Section 3.13.5.3), the Denali NPP Route Variation provides views of the Alaska Range's rocky slopes, ice fields, and glaciers.

Appendix K of the 2012 FEIS (USACE, 2012a) describes the methodology used for describing baseline visual conditions and visual impacts for the proposed Project, as proposed at that time. While the proposed Project has changed since the publication of the 2012 FEIS, the characterization of the visual environment in Appendix K remains valid. Relevant sections of Appendix K of the 2012 FEIS are summarized below.

Figure 3.13-1 Denali NPP Route Variation

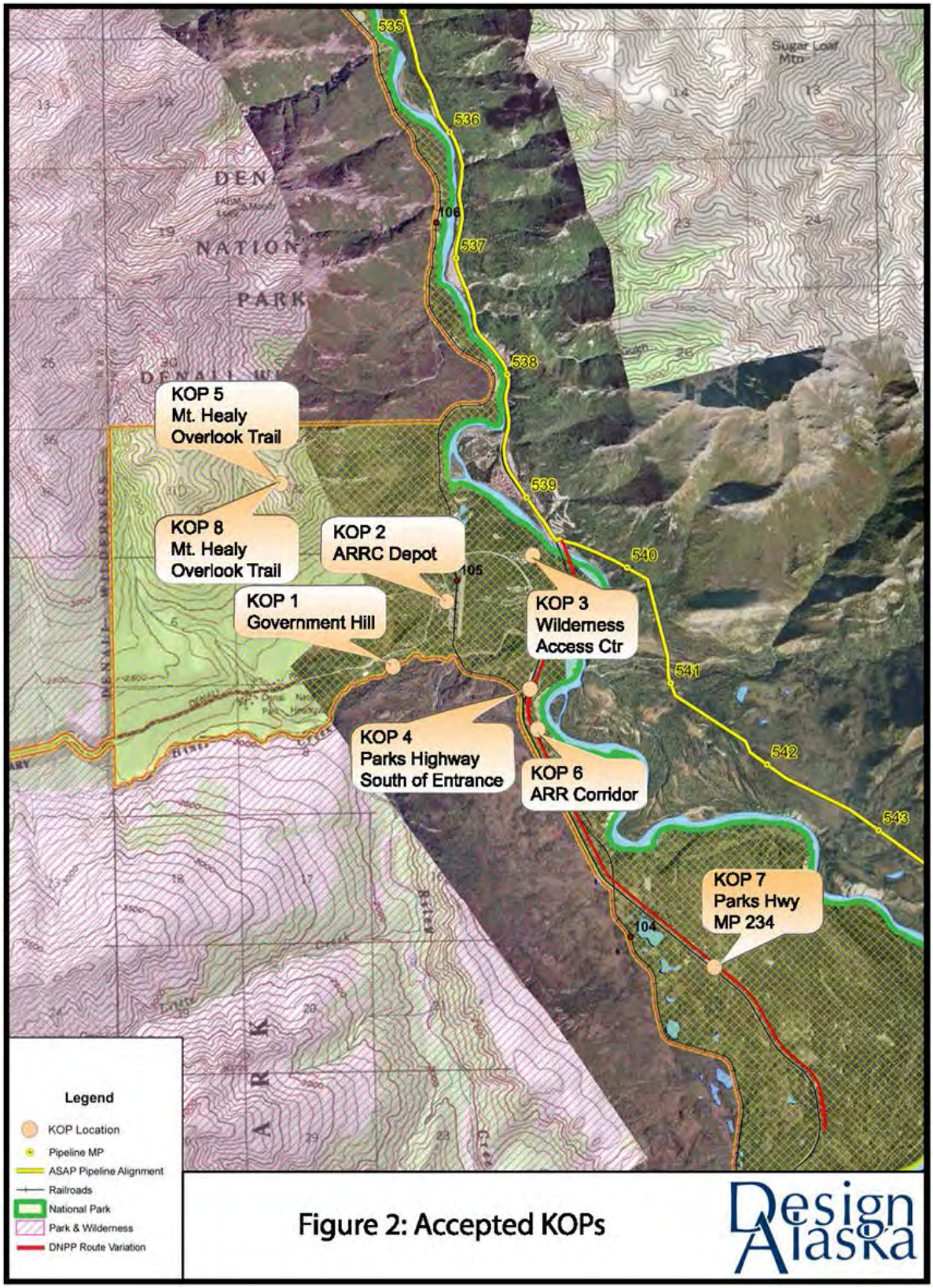


3.13.5.4.1. Key Observation Points

The 2012 FEIS identified seven key observation points (KOPs) in Denali NPP. These points were the basis for visual simulations of the then-proposed ASAP Project, as well as the then-proposed Denali NPP Route Variation. The existing views from these KOPs are described below. Figure 3.13-2 shows the KOPs identified in the 2012 FEIS.

- KOP 1: Government Hill on the Park Road. "Provides a view of the Riley Creek Railroad Bridge and the surrounding natural landscape. Other than the rail bridge and a brief glimpse of vehicles on the Parks Highway, there are no man-made features visible" (USACE, 2012a).
- KOP 2: Alaska Railroad Depot. Offers "an extensive view shed of the project route" (USACE, 2012a).
- KOP 3: Wilderness Access Center. "A major public gathering space. Limited views are provided from the southern parking lot looking to the northeast" (USACE, 2012a).
- KOP 4: Parks Highway South of Entrance. "The location on the Parks Highway…was chosen as a representative location for users who experience views near Denali NPP from the highway. Speeds on this section of the highway are 55 miles per hour (mph) and reduce to 45 mph closer to the Denali NPP entrance. There is limited pedestrian activity" (USACE, 2012a).
- KOP 5: Mt. Healy Overlook Trail (for the then-proposed project, also KOP 8 for the then-proposed Denali NPP Route Variation). "A 4.4-mile (roundtrip) hike that begins near the Denali NPP Visitor Center parking lot. This KOP was suggested by NPS as a representative location for the recreational trail users who visit the park" (USACE, 2012a).
- KOP 6: Alaska Railroad Corridor. The railroad corridor is generally bordered by dense vegetation at the edge of the cleared ARRC ROW. A few locations within the corridor have expansive views of the area surrounding Denali NPP and of the proposed pipeline route. These infrequent sweeping views of the pipeline alignment are visible for short spans of time" (USACE, 2012a).
- KOP 7: Parks Highway MP 234. "A representative view from the main vehicle transportation route surrounding Denali NPP. The Denali NPP Route Variation alignment places the pipeline route offset to the east of the Parks Highway from MP 223 to MP 238" (USACE, 2012a).

Figure 3.13-2 KOPs Identified in the 2012 FEIS (USACE, 2012a)



3.13.5.4.2. VRM Categories

As described in Section 3.13.4.5, the management policies for Denali NPP address visual resources generally, and there are no VRM classes assigned to areas within Denali NPP. To assess the visual impacts of the then-proposed ASAP Project on Denali NPP, based on baseline photography conducted at the time, the 2012 FEIS assigned VRM classes to the views present at each of the KOPs described above. Table 3.13-3 lists the VRM classes identified in Appendix K of the 2012 FEIS.

Table 3.13-3 VRM Classes Identified for Denali NPP KOPs in the 2012 FEIS

2012 FEIS KOP	BLM VRM Class
KOP 1: Government Hill (Park Road)	Class II
KOP 2: Alaska Railroad Depot	Class III
KOP 3: Wilderness Access Center	Class III
KOP 4: Parks Highway, South of Entrance	Class II
KOP 5/KOP 8: Mt. Healy Overlook Trail	Class III
KOP 6: Alaska Railroad Corridor	Class II
KOP 7: Parks Highway MP 234	Class II

Source: USACE, 2012a

3.13.5.5. MP 550.5 to End

The proposed route segment continues to the east of the Parks Highway and detours around the boundaries of Denali NPP before rejoining the Parks Highway north of Cantwell. This segment to Cantwell passes through a populated community with developed structures and infrastructure. The Alaska Range landscape is visible from this segment and further to the south: predominantly rocky slopes, ice fields, and glaciers barren of vegetation. Dwarf scrub communities are common where vegetation does exist.

To the south of Cantwell, significant natural features include Broad Pass, an unforested, low elevation pass that provides views of valleys and mountain peaks of the Alaska Range. Farther to the south, the route parallels the Middle Fork of the Chulitna River and passes through Denali State Park, which provides views of the Denali summit on clear days. Soon after, the route begins paralleling the Susitna River, which flows to Cook Inlet. As the proposed route approaches its terminus, the landscape becomes level to hilly, with vegetation dominated by spruce and hardwood birch forest. The proposed route stays within populated areas for most of the remaining 100 miles and includes such settlements as Trapper Creek and Willow. Natural features visible from the southern route include the Talkeetna Range to the east and numerous lakes, including Nancy Lakes, Rock Lake, Big Lake North, and Big Lake South. From Willow, the proposed route leaves the Parks Highway and follows the Susitna and Little Susitna river valleys.

As the most populated area of the proposed Project, this segment would cross a comparatively high number of travel routes. It would cross the railroad track in five locations, arterial/local roads approximately in 210 locations, and trails or driveways in nearly 200 locations. This segment would also cross 7.4 miles of BLM lands with the following VRM classifications: 0.33 miles of Class II, 6.0 miles of Class III, and 1.1 miles of Class IV.

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3.14. Socioeconomics

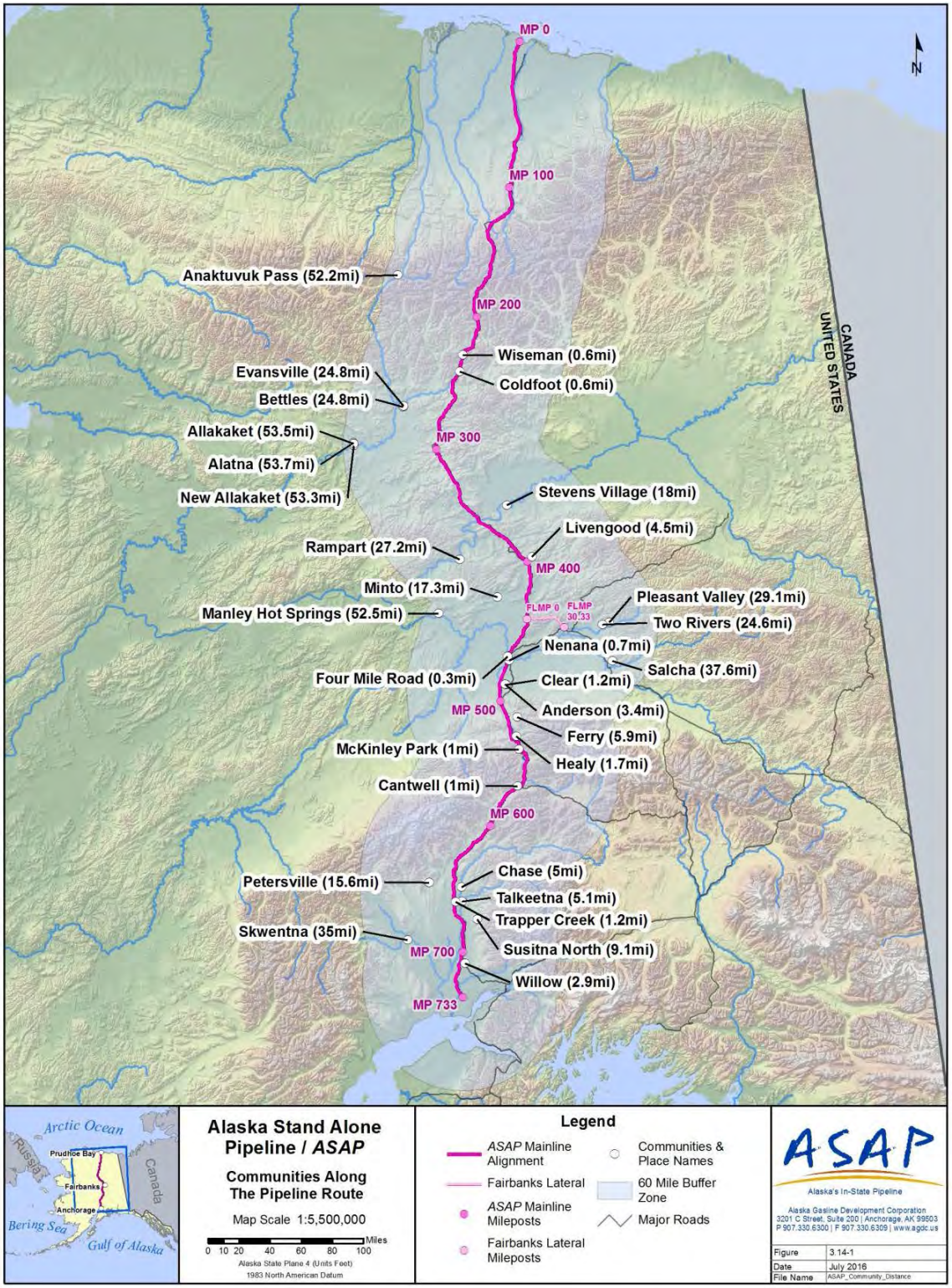
3.14.1. Introduction

This section describes the baseline socioeconomic conditions in the area that could be affected by the proposed Project. Impacts of the alternatives described in Chapter 2 on socioeconomics are discussed in Chapter 4. Key socioeconomic resources addressed in this section include population, employment, housing, income, tax revenue, property values, and environmental justice.

The socioeconomics description builds on information provided in the 2012 FEIS (USACE 2012a), and focuses on new circumstances or information pertinent to the new alternatives that have become available since the publication of the 2012 Final EIS. The most substantial change to this section from the 2012 FEIS is the modification to the route alignment and conceptual design for the proposed Project (Alternative 1), which proposes the transport of utility-grade gas rather than gas rich in NGL. There are 31 communities located within 60 miles of the proposed Project Area that could access natural gas under Alternatives 1 and 2, which are shown in Figure 3.14-1.

Communities that could access natural gas via the Fairbanks Lateral line tie-in or Beluga Pipeline tie-in and other communities, such as Deadhorse/Prudhoe Bay and Nuiqsut, which already have gas service, are not included in the 31 communities. The baseline socioeconomic conditions of the communities that could access natural gas through the proposed Project indirectly, via the Fairbanks Lateral line tie-in, the Beluga Pipeline tie-in, or via truck or barge, are incorporated by reference and the most recent, or most applicable results, are summarized below.

Figure 3.14-1 Communities Located within 60 Miles of the Mainline Pipeline



3.14.2. Summary

The affected environment corresponding to the proposed Project Area is divided into two categories: socioeconomics and environmental justice. The data and methodology used to illustrate the baseline environment are described below.

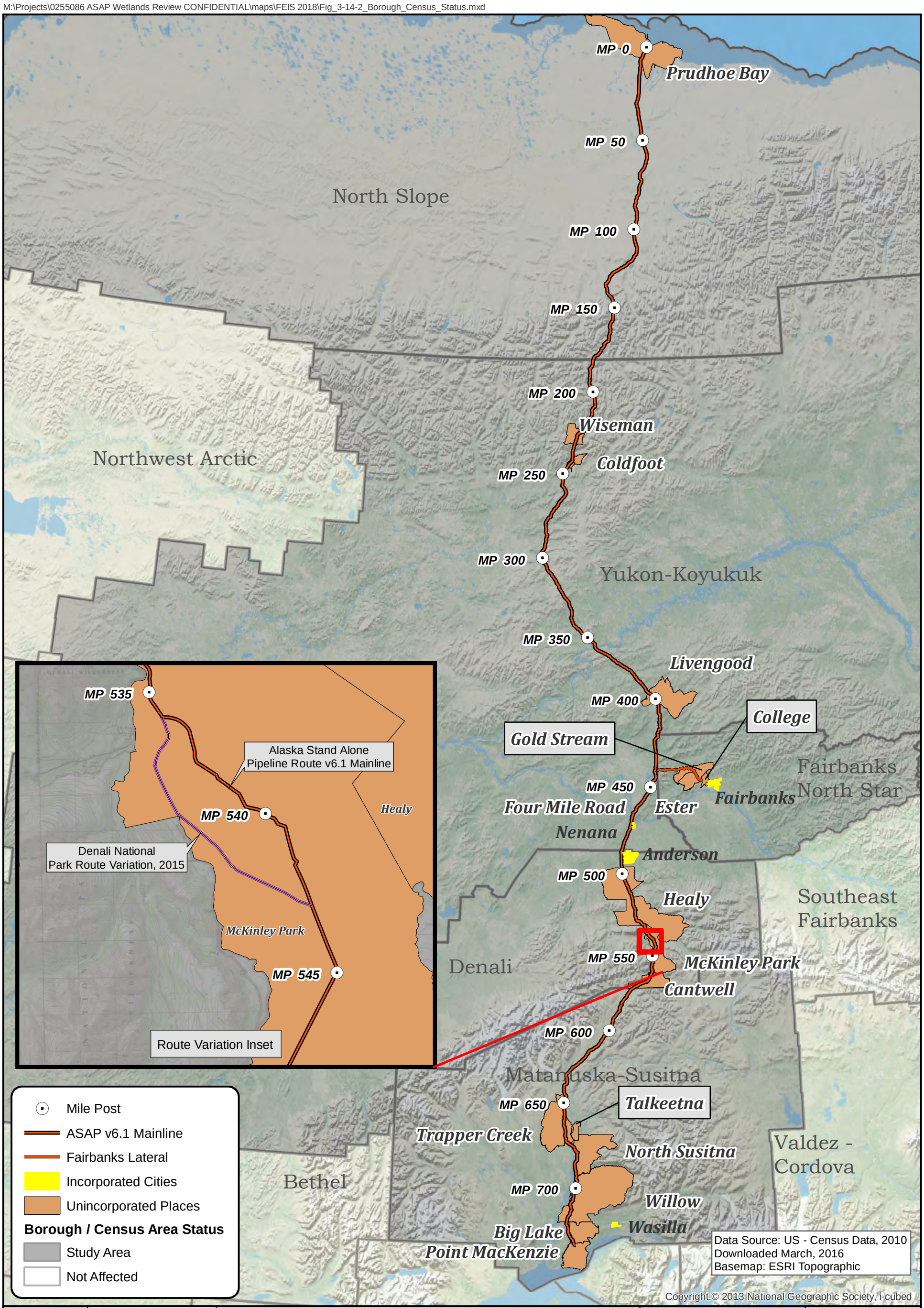
3.14.2.1. Data and Methodology

The proposed Project Area for this analysis includes the four Alaskan boroughs and the single census area traversed by the proposed Project: Denali Borough, FNSB, Mat-Su Borough, NSB, and the YKCA (Figure 3.14-2). In addition to the boroughs described above, the analysis also includes the YKCA portion of the Unorganized Borough. The YKCA is a 148,000-mi^2 portion of Alaska's Unorganized Borough, which encompasses nearly 323,400 mi^2 of the state. This portion of the Unorganized Borough was selected for analysis due to the availability of socioeconomic information and this information is more representative of the area intersected by the proposed Project, versus that of the entire Unorganized Borough. For comparison purposes, information is also often presented for the State of Alaska and the U.S. Both the proposed action (Alternative 1) and the Denali NPP Route Variation (Alternative 2) traverse the Denali Borough. Therefore, no discrepancy exists for the baseline socioeconomic conditions for these alternatives. Figure 3.14-2 illustrates the proposed Project Area as it relates to the socioeconomic analysis.

In accordance with Council on Environmental Quality (CEQ) guidance, (CEQ 1997) minority populations should be identified if the minority population in the proposed Project Area "exceeds 50 percent" or if the percentage of minority population in the proposed Project Area is meaningfully greater than the "minority population percentage in the general population or other appropriate unit of geographic analysis." The concept of environmental justice is rooted in the Civil Rights Act of 1964, which prohibited discrimination in federally assisted programs, and in E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations," issued February 11, 1994. E.O. 12898 was intended to ensure that federal actions and policies do not result in disproportionately high adverse effects on minority or low-income populations.

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DATE: MAR. 2018
CHKD: K.A.
DRWN: J.S.V.
PROJ. No.: 0416166

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

Figure 3.14-2: PROPOSED PROJECT ROUTES AND AFFECTED BOROUGHS AND CENSUS AREAS ALASKA STAND ALONE PIPELINE

0 25 50 100 Miles



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Socioeconomic information and other relevant data are used to address environmental justice in compliance with E.O. 12898. The environmental justice concerns are addressed by determining if low-income or minority populations reside within the proposed Project Area and, if present, whether disproportionate social, environmental, economic, and health effects of the proposed Project are anticipated for these populations. Any disproportionately high environmental, socioeconomic, or health effects on these groups (relative to total population effects) that are predicted to occur as a consequence of the proposed Project and alternatives are identified and characterized. This chapter provides the necessary background and information for which the analysis of environmental justice is based, as presented in Chapter 4.

3.14.3. Potentially Affect Communities

This section presents an overview of population trends, employment, income, unemployment, taxes, housing, and tax revenues in the boroughs/census area, state, and the U.S., as relevant to the alternatives.

3.14.3.1. Population Trends and Projections

At 1.2 people per square mile, Alaska has a low population density compared to the U.S. as a whole, which has an average density of 87.3 people per square mile. While a few boroughs in the proposed Project Area have higher population densities than Alaska overall, the proposed Project Area is relatively sparsely populated when compared to the rest of the U.S. The current and projected population for the four boroughs and the census area in the proposed Project Area are summarized in Table 3.14-1.

As indicated in Table 3.14-1, in 2010 the proposed Project Area had a population of 203,420, an increase of 29 percent from 2000. Nearly 92 percent of this population is located in the FNSB or the Mat- Su Borough. During the 2000–2010 period, population increases were exhibited in the FNSB (18 percent increase), Mat-Su Borough (50 percent) and the NSB (28 percent). The Denali Borough and the YKCA experienced 3-percent and 15-percent population decline over the decade. Both the FNSB (13.3 people per square mile) and Mat-Su Borough (3.61 people per square mile) have population densities greater than Alaska statewide, while all others have lower population densities than statewide estimates.

Table 3.14-1 Project Area Population

Area	Population		Change (2000-2010)	Percentage Change (2000-2010)	Population Density (2010)
	2000[a]	2010[b]			
Denali Borough	1,890	1,830	-60	-3.17%	0.14
FNSB	82,840	97,580	14,740	17.79%	13.25
Mat-Su Borough	59,320	89,000	29,680	50.03%	3.61
NSB	7,390	9,430	2,040	27.60%	0.11
YKCA	6,550	5,590	-960	-14.66%	0.04
Project Area Total	157,990	203,420	45,430	28.76%	0.73
State of Alaska	626,900	710,200	71,500	11.40%	1.24
U.S.	281,421,900	308,745,500	25,584,700	9.10%	87.28

a U.S. Census Bureau 2011a
b U.S. Census Bureau 2010a

Population projections through 2045 for the proposed Project Area, Alaska, and the U.S. are provided in Table 3.14-2. The population in the proposed Project Area is projected to increase by 45 percent during the 2015-2045 period. In keeping with past trends of population growth in this region, nearly all of this population growth is anticipated to occur in the FNSB, Mat-Su Borough and NSB, which are anticipating a population increase of 13 percent, 83 percent and 19 percent, respectively. In contrast, by 2045 the population of the YKCA is anticipated to decline by 19 percent, and the population of the Denali Borough is projected to fall by 15 percent.

The population of the state of Alaska is expected to increase by 22 percent during the 2015-2045 period, which is slightly greater than the projected population increase at the national level of 21 percent (ADOLWD, 2016a). At 45 percent, the projected rate of population increase within the proposed Project Area is greater than both the national and statewide rate of population increase. The ADOLWD (2016a) projections report is available online at http://live.laborstats.alaska.gov/pop/projections/pub/popproj.pdf.

Table 3.14-2 Population Projections (2015-2045)

Area	Population							Change (2015 - 2045)
	2015	2020	2025	2030	2035	2040	2045	
Denali Borough[a]	1,781	1,763	1,726	1,686	1,627	1,573	1,508	-15%
FNSB[a]	98,645	102,237	105,139	107,276	108,869	110,197	111,562	13%
Mat-Su Borough[a]	100,178	113,415	127,144	141,247	155,442	169,418	182,836	83%
NSB[a]	9,895	10,152	10,390	10,634	10,937	11,311	11,765	19%
YKCA[a]	5,493	5,286	5,081	4,866	4,682	4,537	4,449	-19%
Project Area Total[a]	215,992	232,853	249,480	265,709	281,557	297,036	312,120	45%
State of Alaska[a]	737,625	771,529	802,352	829,620	854,104	877,134	899,825	22%
U.S.[b]	321,369	334,503	347,335	359,402	370,338	380,219	389,394	21%

a ADOLWD, 2016a
b U.S. Census Bureau, 2014a and 2014b; U.S.A. populations are to the nearest thousand

Population trends and projections for communities within the proposed Project Area that could potentially access natural gas transported by the proposed Project via a spur line tie-in are summarized in Table 3.14-3. Communities in the proposed Project Area are predominantly rural and sparsely populated. The largest communities are Willow and a grouping of residences known as Susitna North, with populations in 2013 of 2,118 and 1,380, respectively, in 2013 (U.S. Census Bureau, 2014a). Evansville, the smallest community, had an official population in 2010 of only two residents, though it is immediately adjacent to Bettles, with a 2010 population of 14 (AGDC, 2016a). Several Project Area communities lost population between 2000 and 2013. Residents of rural Alaska villages, especially those located on the road system, appear to be migrating to Fairbanks or Southcentral in search of better employment opportunities (USACE, 2012a). Each of the 31 communities in the proposed Project Area has low population densities. The highest population density occurs in Anaktuvuk Pass, which had a density of about 74 persons per square mile.

Table 3.14-3 Population and Housing

Community	Population			Population Density (persons per square miles)	Number of Housing Units	Occupied Housing Units (percent)
	2000[a]	2013[b]	Percent Change	2013[b]	2010[a]	2010[a]
Alaska	626,932	736,399	17.5	1.3	306,967	84.1
NSB						
Anaktuvuk Pass	282	358	27.0	74.1	118	83.9
Yukon-Koyukuk Census Area						
Alatna	35	26	-25.7	0.7	19	63.2
Allakaket	97	108	11.3	35.9	58	75.9
Bettles	43	14	-67.4	8.0	25	36.0
Clear[c]	--	--	--	--	--	
Coldfoot	13	11	-15.4	0.3	11	54.5
Evansville	28	2	-92.9	0.1	25	48.0
Four Mile Road	38	26	-31.6	22.6	17	82.4
Livengood	29	14	-51.7	0.1	34	20.6
Manley Hot Springs	72	127	76.4	2.3	116	35.3
Minto	258	214	-17.1	1.6	94	69.1
Nenana	402	399	-0.7	67.6	215	79.5
New Allakaket	36	68	88.9	27.8	20	90.0
Rampart	45	32	-28.9	0.2	43	23.3
Stevens Village	87	65	-25.3	5.6	52	50.0
Wiseman	21	15	-28.6	0.2	25	20.0
FNSB						
Pleasant Valley	623	717	15.1	23.1	396	78.8
Salcha	854	1,041	21.9	14.1	585	73.3
Two Rivers	482	725	50.4	26.2	348	85.1
Denali Borough						
Anderson	367	235	-36.0	5.4	145	62.1
Cantwell	222	196	-11.7	1.7	200	52.0

Community	Population			Population Density (persons per square miles)	Number of Housing Units	Occupied Housing Units (percent)
	2000[a]	2013[b]	Percent Change	2013[b]	2010[a]	2010[a]
Ferry	29	32	10.3	0.5	43	39.5
Healy	1,000	1,066	6.6	1.6	711	61.0
McKinley Park	142	179	26.1	1.0	422	25.8
MSB						
Chase	41	42	2.4	0.2	209	8.6
Petersville	27	3	-88.9	0.0	179	2.2
Skwentna	111	33	-70.3	0.1	353	5.7
Susitna North	956	1,380	44.4	5.0	1,403	40.6
Talkeetna	772	861	11.5	32.1	744	60.3
Trapper Creek	423	475	12.3	1.5	499	45.1
Willow	1,658	2,118	27.7	3.1	1,912	46.7

a U.S. Census Bureau, 2014b
b ADOLWD, 2014a
c The community of Clear is an unincorporated community of the Denali Borough located 5 miles south of Anderson. Clear encompasses residential homes and businesses; however, Clear Air Force Station primarily employs most of its residents to which population and housing data are unavailable (Denali Borough, 2016).

3.14.3.2. Area Economy

This section describes the economic conditions in the proposed Project Area, including employment by sector, income, unemployment, housing, and tax revenues.

3.14.3.2.1. Employment

Table 3.14-4 presents employment by industry in 2010 for the proposed Project Area, the state, and the U.S., based on 2010 Census data. Some areas exhibit a limited number of businesses or limited employment within a sector. Therefore, employment data are not available at the borough census area level due to confidentiality concerns, presented as (D) or (L)[20] in Table 3.14-4. Employment by industry indicates the composition and importance of specific industries in the regional economy. In all proposed Project Area boroughs and the census areas, the government sectors provide either the highest or the second-highest number of jobs when compared to other sectors of the economy.

Employment within the proposed Project Area (Denali Borough, FNSB, Mat-Su Borough, NSB, and the YKCA) totals 113,987 jobs. Approximately 51 percent of total employment in the proposed Project Area is within the FNSB. The FNSB is home to two military installations: Fort Wainwright Army Installation and Eielson Air Force Base. Military personnel alone account for 15 percent of the borough's total employment, while statewide and nationally, approximately 6 percent and 1 percent of total

[20] (D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals. (L) Less than 10 jobs, but the estimates for this item are included in the totals.

employment, respectively, is military. Furthermore, employment for all government positions in the FNSB accounts for 34 percent of the borough's total employment.

The Denali Borough economy depends heavily on the tourist trade, primarily related to Denali NPP. While tourism is not classified as an economic sector, tourist activity can be gauged by examining the size of the accommodation and food services sector. In the Denali Borough, 45 percent of employment, or 1,046 jobs, are in the accommodation and food services sector. After accommodation and food services, the second highest number of employees is in the government sector with 16 percent of the Borough's total employment. Although not disclosed by the ADOLWD data presented in Table 3.14-4, approximately 100 Air Force National Guard personnel are stationed at Clear Air Force Station near Anderson, and there are nearly 80 NPS employees located at Denali NPP.

Although not disclosed in Table 3.14-4, another important employer for the Denali Borough is the Usibelli Coal Mine. The company reported employment of 140 employees in 2013 (McDowell Group, 2015). The Usibelli Coal Mine has been producing coal in the Denali Borough since 1971 (ADOLWD, 2001).

Approximately 30 percent of employment in the proposed Project Area is located within the Mat-Su Borough. The Mat-Su Borough has the most diverse economy when compared to the boroughs and the census area in the proposed Project Area. Retail trade, government, construction, and health care and social assistance sectors each account for between 10 percent and 14 percent of the borough's total employment. The Mat-Su Borough also has a higher concentration of jobs in the construction and retail trade sectors when compared to the state and the U.S. Furthermore, the Mat-Su Borough is less reliant on employment in the government sector than elsewhere in the state due to the competitive housing market and its location relative to the Anchorage labor market (ADOLWD, 2010).

The NSB accounts for 13 percent of the total employment in the proposed Project Area. Employment within the NSB is highly concentrated in the mining sector (*i.e.*, extraction of naturally occurring minerals such as coal, ore, petroleum and gases), which accounts for 57 percent of the borough's jobs. The majority of NSB mining jobs are related to the extraction of petroleum. For example, in February 2016, approximately 8,950 of the total 10,150 jobs in the production sector of Alaska's Northern Economic Region were for oil and gas extraction and support services (ADOLWD, 2016a). The high concentration of mining employment within the NSB dramatically exceeds statewide concentration of jobs in the mining sector, where total mining employment is 4 percent of total employment.

The YKCA is located within Interior Alaska and employment within the YKCA is highly concentrated in the government sector, with nearly 38 percent of all jobs in the public sector. The concentration of government jobs in the YKCA is much higher than the statewide concentration of jobs in the government sector (23 percent). The YKCA economy can be classified as a mixed economy because spur line of the market, transfer, and subsistence economies are active in the area. In a market economy, residents work

for wages or by selling resources. A transfer economy relies upon subsidies from federal and state sources, while a subsistence economy is based on hunting, fishing and gathering for food (Husky, 1992). Additional detail regarding subsistence and fishing in the YKCA are included in the 2012 FEIS (USACE, 2012a).

Table 3.14-4 Employment by Industry, 2010

Industry	Denali		FNSB		Mat-Su		North Slope		YKCA		Alaska % of Employ-ment	U.S. % of Employ-ment
	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total		
Total Employment	2,302	100.0%	58,538	100.0%	34,142	100.0%	14,940	100.0%	4,065	100.0%	100.0%	100.0%
Farm Employment	0	0.0%	227	0.4%	371	1.1%	0	0.0%	0	0.0%	0.2%	1.4%
Private Nonfarm Employment	1,911	83.0%	38,297	65.4%	28,266	82.8%	13,006	87.1%	2,530	62.2%	76.7%	85.4%
Accommodation & Food Services	1,046	45.4%	4,131	7.1%	2,626	7.7%	523	3.5%	(D)	(D)	7.3%	7.2%
Administrative & Waste Management Services	(D)	(D)	1,404	2.4%	1,255	3.7%	1,367	9.1%	100	2.5%	3.7%	6.2%
Arts, Entertainment & Recreation	133	5.8%	1,253	2.1%	996	2.9%	73	0.5%	(D)	(D)	2.3%	2.3%
Construction	(D)	(D)	3,439	5.9%	3,375	9.9%	(D)	(D)	243	6.0%	5.3%	5.1%
Educational Services	(D)	(D)	(D)	(D)	609	1.8%	(D)	(D)	52	1.3%	1.2%	2.3%
Finance & Insurance	(D)	(D)	1,120	1.9%	756	2.2%	(D)	(D)	49	1.2%	2.5%	5.4%
Forestry, Fishing, & Related Activities	(L)	(L)	(D)	(D)	514	1.5%	24	0.2%	135	3.3%	2.4%	0.5%
Health Care & Social Assistance	(D)	(D)	5,866	10.0%	4,564	13.4%	(D)	(D)	297	7.3%	11.0%	11.3%
Information	(L)	(L)	608	1.0%	611	1.8%	69	0.5%	(D)	(D)	1.6%	1.8%
Management Of Companies & Enterprises	(D)	(D)	185	0.3%	25	0.1%	295	2.0%	(D)	(D)	0.7%	1.2%
Manufacturing	26	1.1%	879	1.5%	544	1.6%	(D)	(D)	(D)	(D)	3.6%	7.0%
Mining	(D)	(D)	2,419	4.1%	769	2.3%	8,455	56.6%	224	5.5%	4.9%	0.9%
Other Services, Except Public Administration	33	1.4%	2,298	3.9%	2,183	6.4%	277	1.9%	225	5.5%	4.5%	5.8%

Industry	Denali		FNSB		Mat-Su		North Slope		YKCA		Alaska % of Employ-ment	U.S. % of Employ-ment
	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total	Jobs	% of Total		
Professional, Scientific & Technical Services	(D)	(D)	2,695	4.6%	1,696	5.0%	250	1.7%	(D)	(D)	5.4%	6.8%
Real Estate & Rental And Leasing	(D)	(D)	1,656	2.8%	1,393	4.1%	(D)	(D)	(D)	(D)	3.4%	4.4%
Retail Trade	116	5.0%	5,713	9.8%	4,776	14.0%	281	1.9%	296	7.3%	9.6%	10.1%
Transportation & Warehousing	113	4.9%	2,551	4.4%	1,125	3.3%	318	2.1%	191	4.7%	5.2%	3.3%
Utilities	(D)	(D)	418	0.7%	192	0.6%	(D)	(D)	19	0.5%	0.5%	0.3%
Wholesale Trade	(D)	(D)	841	1.4%	257	0.8%	(D)	(D)	30	0.7%	1.6%	3.5%
Government & Government Enterprises	391	17.0%	20,014	34.2%	5,505	16.1%	1,934	12.9%	1,535	37.8%	23.2%	13.2%
Federal, Civilian	215	9.3%	3,037	5.2%	198	0.6%	21	0.1%	93	2.3%	3.4%	1.6%
Military	22	1.0%	8,775	15.0%	667	2.0%	50	0.3%	40	1.0%	5.9%	1.1%
State & Local	154	6.7%	8,202	14.0%	4,640	13.6%	1,863	12.5%	1,402	34.5%	13.9%	10.5%
Disclosed Total	1,858	80.7%	57490	98.2%	33771	100.0%	13866	92.8%	3396	83.5%	100.0%	100.0%

Table 3.14-5 summarizes employment in terms of the number of jobs and percentage of jobs held in the top three industries for the communities within the proposed Project Area. Government (federal, state, and local) is among the top employers in most communities, while private sector jobs are more limited. Usibelli Coal Mine's mining operation in Healy is the only large industrial employer among the communities.

Table 3.14-5 Employment and Workers by Industry, 2013

Community	Residents Employed[a]	Percent of Total Employed[a]
Alaska	307,987	Trade, Transportation, and Utilities (20%)
		Educational and Health Services (15%)
		Local Government (14%)
NSB		
Anaktuvuk Pass	152	Local Government (66%)
		Professional and Business Services (21%)
		Construction (5%)
YKCA		
Wiseman	7	Construction (43%)
		Natural Resources and Mining (43%)
		State Government (14%)
Coldfoot	12	Leisure and Hospitality (83%)
		Natural Resources and Mining (8%)
		Professional and Business Services (8%)
Bettles	14	Professional and Business Services (43%)
		Local Government (29%)
		Leisure and Hospitality (14%)
Evansville	--	--
New Allakaket	--	--
Allakaket	113	Local Government (77%)
		Trade, Transportation, and Utilities (7%)
		Educational and Health Services (6%)
Alatna	8	Local Government (88%)
		Leisure and Hospitality (13%)
Stevens Village	34	Local Government (47%)
		Construction (26%)
		Leisure and Hospitality (26%)
Livengood	8	Natural Resources and Mining (50%)
		State Government (38%)
		Professional and Business Services (13%)
Rampart	8	Local Government (50%)
		Construction (13%)
		Natural Resources and Mining (13%)
Manley Hot Springs	57	Local Government (47%)
		Construction (14%)
		Trade, Transportation, and Utilities (12%)
Minto	108	Local Government (57%)
		Leisure and Hospitality (10%)
		Educational and Health Services (8%)
Four Mile Road	14	Local Government (50%)
		Leisure and Hospitality (14%)
		Educational and Health Services (14%)
Nenana	236	Local Government (33%)
		Leisure and Hospitality (18%)
		Trade, Transportation, and Utilities (14%)

Community	Residents Employed[a]	Percent of Total Employed[a]
FNSB		
Salcha	333	Trade, Transportation, and Utilities (20%)
		Local Government (15%)
		Construction (12%)
Two Rivers	330	Trade, Transportation, and Utilities (22%)
		Local Government (12%)
		Educational and Health Services (12%)
Pleasant Valley	264	Trade, Transportation, and Utilities (24%)
		Construction (13%)
		Leisure and Hospitality (12%)
Denali Borough		
Anderson	91	Local Government (35%)
		Professional and Business Services (24%)
		Trade, Transportation, and Utilities (13%)
Cantwell	90	State Government (22%)
		Local Government (20%)
		Leisure and Hospitality (18%)
Clear	--	--
Ferry	10	Trade, Transportation, and Utilities (40%)
		State Government (20%)
		Professional and Business Services (10%)
Healy	476	Natural Resources and Mining (25%)
		Leisure and Hospitality (20%)
		Trade, Transportation, and Utilities (15%)
McKinley Park	100	Leisure and Hospitality (47%)
		Trade, Transportation, and Utilities (17%)
		Educational and Health Services (9%)
Mat-Su Borough		
Chase	16	Natural Resources and Mining (31%)
		Leisure and Hospitality (25%)
		Trade, Transportation, and Utilities (19%)
Petersville	5	Natural Resources and Mining (40%)
		Local Government (20%)
		Leisure and Hospitality (20%)
Trapper Creek	175	Trade, Transportation, and Utilities (33%)
		Local Government (17%)
		Leisure and Hospitality (13%)
Talkeetna	428	Trade, Transportation, and Utilities (27%)
		Leisure and Hospitality (21%)
		Local Government 13%
Susitna North	473	Trade, Transportation, and Utilities (24%)
		Leisure and Hospitality (17%)
		Educational and Health Services (10%)
Skwentna	14	Leisure and Hospitality (29%)
		Natural Resources and Mining (21%)
		Local Government (14%)
Willow	766	Trade, Transportation, and Utilities (22%)
		Educational and Health Services (15%)
		Construction (12%)

Source: ADOLWD, 2014b

[a] Data are for Alaska residents only; nonresidents are not included. In addition, federal workers, military, and the self-employed are not included in this data.

Table 3.14-6 summarizes the number of business licenses held in each community. Business activity is generally limited to small, resource-based tourism and recreation activities, such as sport fishing, hunting lodges, and guiding.

Table 3.14-6 Alaska Business Licenses

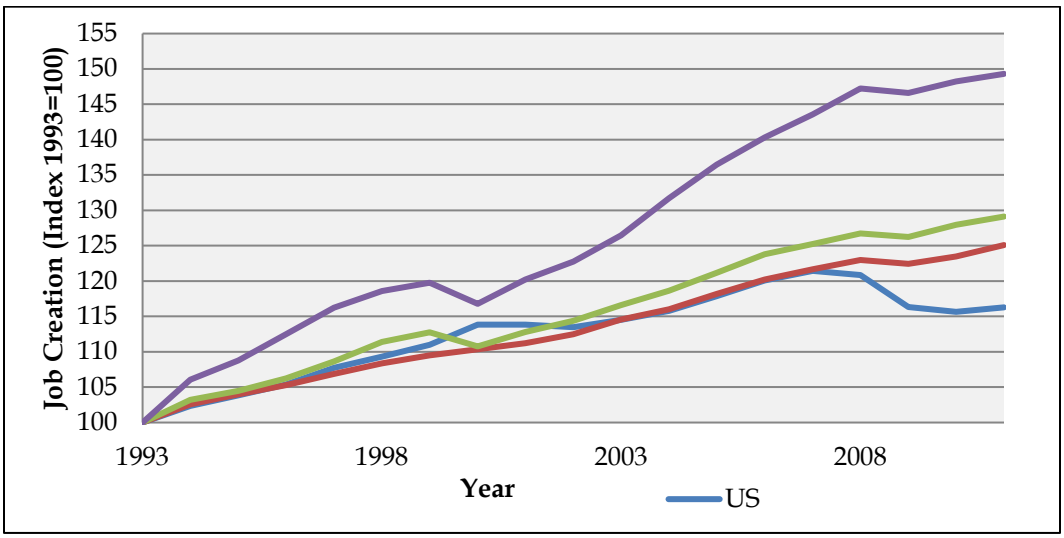
Community	Number of Business Licenses
NSB	
Anaktuvuk Pass	9
Yukon-Koyukuk Census Area	
Wiseman	6
Coldfoot	0
Bettles	9
Evansville	0
New Allakaket	0
Allakaket	3
Alatna	0
Stevens Village	1
Livengood	3
Rampart	4
Manley Hot Springs	17
Minto	4
Four Mile Road	0
Nenana	84
FNSB	
Salcha	87
Two Rivers	61
Pleasant Valley	1
Denali Borough	
Anderson	16
Cantwell	45
Clear	6
Ferry	0
Healy	150
McKinley Park	0
Mat-Su Borough	
Chase	0
Petersville	2
Trapper Creek	77
Talkeetna	289
Susitna North	1
Skwentna	25
Willow	282

Source: ADCCED, 2014

The number of jobs created in the proposed Project Area (Denali Borough, FNSB, Mat-Su Borough, NSB and YKCA) has outpaced job creation in Alaska and the U.S. Figure 3.14-3 highlights the level of historic job creation from 1993 to 2011 within: 1) the total proposed Project Area (purple); 2) the proposed Project Area including Anchorage (green); 3) all of Alaska (orange); and 4) the U.S. (blue) using an index that defines 1993 as the base year, with a job level of 100. For example, if jobs increase by 15 percent over 1993 levels, then the index in Figure 3.14-3 for that point in time is 115. The reader

should bear in mind that jobs depicted in the figure are defined by the place of residence of the workers, rather than the place of employment. In some of the areas of the proposed Project Area, particularly the Mat-Su Borough, several residents are employed elsewhere. In 2008, for example, it was estimated that 44 percent of the employed residents of Mat-Su Borough worked in other areas of the state (Metiva and Hanson, 2008).[21]

Figure 3.14-3 Job Creation in Project Area Compared to Alaska and the U.S.



Source: BLS, 2012 (Specifically the Labor Force Statistics, including the National Unemployment Rate and the Local Area Unemployment Statistics tools)

A 2010 study prepared for the Mat-Su Borough projects that the population growth rate of the Mat-Su Borough population will slow during the next 20 years (Mat-Su Borough, 2010). If Anchorage is not included in the proposed Project Area (Figure 3.14-3), the job growth rate is relatively high. Conversely, with Anchorage included, a significantly lower rate of job growth is predicted in the proposed Project Area which, given the size of the Anchorage population, is likely a more realistic assumption.

3.14.3.2.2. Per Capita Income

Table 3.14-7 highlights the annual per capita income characteristics of the proposed Project Area based on the most recent per capita income data from the 2010-2014 ACS. Annual per capita income has generally increased since the 2005-2009 average in the proposed Project Area (with the exception of the Denali Borough). All other boroughs saw increases in per capita income with per capita income growth in the NSB much higher than exhibited throughout Alaska and the U.S., likely due to high paying jobs

[21] At the request of comments received in the 2012 FEIS, Anchorage has been included in the study area. By including Anchorage in the study area, the data become skewed due to the relatively large population of the city. Anchorage and the FNSB together account for approximately 54 percent of the total Alaska population. Therefore, the economics of the study area appear similar to Alaska as a whole versus the results if Anchorage was not included.

within the borough related to oil and gas production. Most boroughs exhibited an increase in per capita employment greater than the rate within the rest of the state with the exception of the YKCA and the Denali Borough.

Table 3.14-7 Annual Per Capita Income Characteristics of the Project Area

Area	2005-2009 Average[a]	2010-2014 Average[b]	Change	Percent Change
Denali Borough	$44,700	$36,828	-$7,872	-18
FNSB	$28,400	$32,906	$4,506	16
Mat-Su Borough	$24,900	$30,013	$5,113	21
NSB	$24,100	$50,267	$26,167	109
YKCA	$18,500	$20,149	$1,649	9
Alaska	$29,400	$33,129	$3,729	13
U.S.	$27,000	$28,555	$1,555	6

Note: 2005-2009 average per capita income is expressed in 2009 dollars and 2010-2014 average per capita income is expressed in 2014 dollars.
a U.S. Census Bureau 2011a
b U.S. Census Bureau 2010b

3.14.3.2.3. Employment Income

Employment income by industry summarized in Table 3.14-8 is based on 2014 data from the BEA. As illustrated, compensation per employee within the NSB is higher in virtually all sectors when compared to the FNSB, YKCA, and the Mat-Su Borough. Generally, this is also the case when examining the statewide income per employee. However, there are a few examples where this is not the case as follows. Government income per employee in FNSB and for Denali Borough exceeds the NSB per employee earnings. The NSB industry with the highest income per employee is the mining sector with $148,355 per employee. The industry with the highest income per employee in the FNSB and Mat-Su Borough is utilities, while federal government employees in the Denali Borough earn the most relative to other sectors. Construction employees in the YKCA earn the highest income per employee with a per employee income of $92,626. Statewide, the sector with highest income per employee is mining. In light of this, it is important to remember that the data presented in Table 3.14-8 represents average income in the Mat-Su Borough, including income earned by residents who commute to higher paying jobs in Anchorage and elsewhere (*i.e.*, North Slope). Additional information on the relationship between economic trends in Anchorage and the Mat-Su Borough is provided in the 2012 FEIS in Section 5.12.2.1.

There is a marked variation in income across the 31 communities, but the average annual income in most communities is less than the average of the state as a whole. The average yearly wages across all communities was $34,600 in 2013. Government (federal, state, and local) is among the top employers in most communities in the proposed Project Area (AGDC, 2016a).

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Table 3.14-8 Employee Earnings by Industry, 2013[a]

Source	Denali		FNSB		Mat-Su		North Slope		YKCA		State of Alaska		U.S.	
	Earnings	Per Emp[b]	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp
Total Earnings	$127,699	$55,473	$3,695,585	$63,131	$1,603,110	$46,954	$1,810,383	$121,177	$182,288	$44,843	$29,996,580	$64,937	$10,165,263,000	$55,768
Farm earnings	$0	$0	$6,363	$28,031	$6,924	$18,663	$0	$0	$0	$0	$8,825	$10,723	$118,568,000	$45,100
Private nonfarm earnings	$94,308	$49,350	$1,973,926	$51,543	$1,167,984	$41,321	$1,619,092	$124,488	$85,429	$33,766	$20,662,317	$58,355	$8,312,955,000	$53,424
Accommod-ation & food services	$42,031	$40,183	$112,106	$27,138	$55,027	$20,955	$31,394	$60,027	(D)	(D)	$983,398	$29,349	$316,820,000	$24,197
Admin & waste mgmt services	(D)	(D)	$67,204	$47,866	$34,566	$27,543	$100,386	$73,435	$536	$5,360	$851,137	$49,207	$405,052,000	$35,766
Arts, entertainment& recreation	$3,207	$24,113	$13,926	$11,114	$11,896	$11,944	$739	$10,123	(D)	(D)	$164,002	$15,164	$111,540,000	$27,109
Construction	(D)	(D)	$301,757	$87,746	$245,972	$72,881	(D)	(D)	$22,508	$92,626	$2,227,531	$90,414	$560,159,000	$60,444
Educational services	(D)	(D)	(D)	(D)	$18,082	$29,691	(D)	(D)	$77	$1,481	$144,578	$26,173	$169,179,000	$40,077
Finance & insurance	(D)	(D)	$65,836	$58,782	$31,403	$41,538	(D)	(D)	$211	$4,306	$665,260	$57,593	$725,443,000	$73,471
Forestry, fishing & related activities	(L)	(L)	(D)	(D)	$7,648	$14,879	$81	$3,375	$728	$5,393	$311,375	$27,543	$30,207,000	$33,459
Health care & social assistance	(D)	(D)	$345,028	$58,818	$248,653	$54,481	(D)	(D)	$19,033	$64,084	$3,190,328	$62,937	$1,110,349,000	$53,938
Information	(L)	(L)	$38,901	$63,982	$42,937	$70,273	$5,471	$79,290	(D)	(D)	$522,509	$72,925	$334,916,000	$102,915

Source	Denali		FNSB		Mat-Su		North Slope		YKCA		State of Alaska		U.S.	
	Earnings	Per Emp[b]	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp
Management of companies & enterprises	$0	$0	$15,635	$84,514	$1,822	$72,880	$34,219	$115,997	(D)	(D)	$310,198	$92,929	$268,340,000	$118,451
Manu-facturing	$0	$0	$50,557	$57,516	$13,103	$24,086	(D)	(D)	(D)	(D)	$907,579	$54,077	$982,179,000	$77,051
Mining	(D)	(D)	$168,427	$69,627	$7,437	$9,671	$1,254,339	$148,355	$9,710	$43,348	$2,663,127	$118,052	$166,731,000	$103,753
Other services, except public administration	$752	$22,788	$95,887	$41,726	$75,675	$34,666	$21,030	$75,921	$6,925	$30,778	$922,209	$44,331	$376,109,000	$35,425
Professional, scientific & technical services	(D)	(D)	$131,170	$48,672	$80,989	$47,753	$19,615	$78,460	(D)	(D)	$1,986,886	$79,881	$997,175,000	$80,075
Real estate and rental & leasing	(D)	(D)	$64,654	$39,042	$47,947	$34,420	(D)	(D)	(D)	(D)	$668,107	$43,129	$213,035,000	$26,678
Retail trade	$1,519	$13,095	$209,921	$36,744	$158,456	$33,178	$13,194	$46,954	$7,926	$26,777	$1,603,722	$36,347	$608,637,000	$33,130
Transpor-tation & warehousing	$4,958	$43,876	$149,972	$58,789	$52,692	$46,837	$32,687	$102,789	$7,087	$37,105	$1,742,144	$73,178	$344,381,000	$57,410
Utilities	(D)	(D)	$72,985	$174,605	$24,405	$127,109	(D)	(D)	$1,551	$81,632	$300,654	$135,125	$78,725,000	$136,297
Wholesale trade	(D)	(D)	$54,057	$64,277	$9,274	$36,086	(D)	(D)	$345	$11,500	$497,573	$65,608	$513,978,000	$81,024
Government & government enterprises	$33,391	$85,399	$1,715,296	$85,705	$428,202	$77,784	$191,291	$98,910	$96,859	$63,100	$9,325,438	$87,126	$1,733,740,000	$72,104
Federal, civilian	$20,081	$93,400	$293,697	$96,706	$23,018	$116,253	$1,762	$83,905	$7,040	$75,699	$1,611,922	$103,968	$296,864,000	$105,047

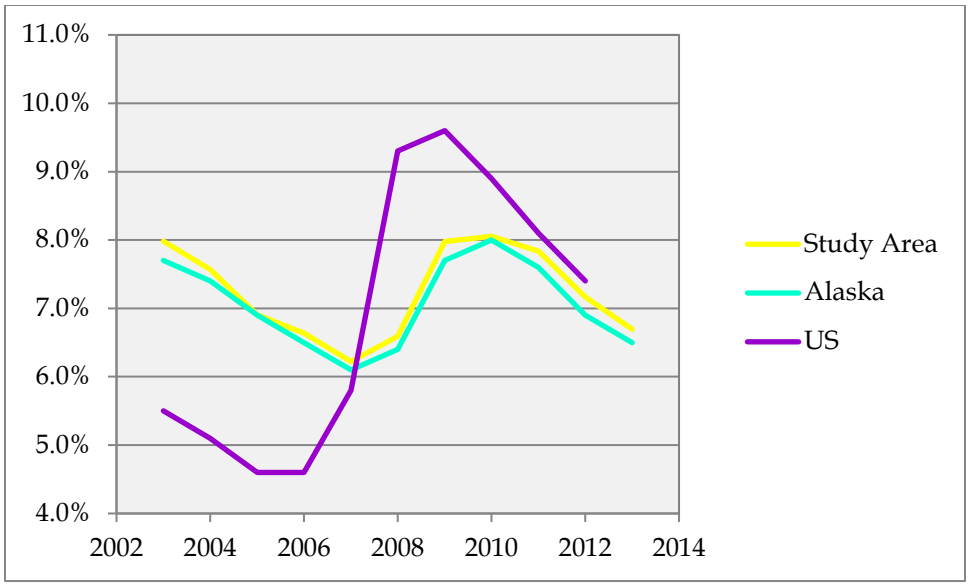
Source	Denali		FNSB		Mat-Su		North Slope		YKCA		State of Alaska		U.S.	
	Earnings	Per Emp[b]	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp	Earnings	Per Emp
Military	$1,443	$65,591	$692,125	$78,875	$21,425	$32,121	$1,598	$31,960	$1,287	$32,175	$2,111,270	$76,894	$137,193,000	$67,516
State & local	$11,867	$77,058	$729,474	$88,939	$383,759	$82,707	$187,931	$100,875	$88,532	$63,147	$5,602,246	$87,435	$1,299,683,000	$67,738

Source: BEA, 2014
(D) Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
(L) Less than 10 jobs for borough or census area within route, but estimates are included in the totals.
a Income reported in thousands of dollars, while income per employee is reported in dollars.
b Per employee earnings estimates were calculated based on the reported earnings and number of employees in each industry.
c Average employee compensation was calculated based on the total reported earnings and number of employees for the industries reported in this table.
Emp - Employee

3.14.3.2.4. Unemployment

The unemployment rate provides insight into the economic health of a region. High unemployment is a sign of an unhealthy economy, which can lead to reduced spending, a decreased tax base, and more unemployment. Alaska has been affected by the recent recession; however, its 2014 unemployment rate of 6.4 percent remains slightly lower than the national average of 7.4 percent (BLS, 2015). Figure 3.14-4 presents the unemployment rate for the proposed Project Area, Alaska, and the U.S. Between 2004 and 2008, the U.S. unemployment was consistently lower than Alaska and the proposed Project Areas (see Figure 3.14-4 and Table 3.14-9). Between 2009 and 2014, however, unemployment rates in Alaska, and the proposed Project Area specifically, were lower than the U.S. as a whole.

Figure 3.14-4 Historic Unemployment Rates



Sources: ADOLWD, 2015; BLS, 2015

As illustrated in Table 3.14-9, the 10-year average unemployment rate (7.2 percent) for the proposed Project Area is slightly higher than the statewide average (7.1 percent) and national average (6.8 percent). Both the FNSB and NSB demonstrate a lower 10-year average unemployment rate than the statewide rate, with unemployment rates of 6.2 and 6.5 percent, respectively. The YKCA has consistently higher unemployment rates than all other boroughs during the 10-year period, with an average unemployment rate of 13.7 percent.

Table 3.14-9 Unemployment Rates (Percentage, 2003-2013)

Year	Denali	FNSB	North Slope	Mat-Su	YKCA	Project Area Weighted Average[a]	State of Alaska	U.S.[b]
2003	8.6	6.9	10.1	8.6	13.3	8.0	7.7	NA
2004	7.9	6.4	10.2	8.3	11.9	7.6	7.4	5.5
2005	6.6	5.8	9	7.6	11.7	6.9	6.9	5.1
2006	5.7	5.6	6.7	7.4	12.9	6.6	6.5	4.6
2007	6	5.3	5.2	6.9	13.3	6.2	6.1	4.6
2008	5.9	5.8	4.1	7.3	13.6	6.6	6.4	5.8
2009	8.2	7.1	4.7	8.9	14	8.0	7.7	9.3
2010	8.9	6.9	5.9	9.1	14.9	8.1	8	9.6
2011	10	6.7	5.4	8.8	15.7	7.8	7.6	8.9
2012	9.8	6.2	5.4	7.9	14.5	7.2	6.9	8.1
2013	8.8	5.8	5	7.3	14.8	6.7	6.5	7.4
Average	7.9	6.2	6.5	8.0	13.7	7.2	7.1	6.8

Source: ADOLWD, 2015
NA - data not available
Project Area weighted average is based on 2010 populations provided in Table 3.14-1
Unemployment rates for the U.S. from BLS, 2015

3.14.3.2.5. Housing

Housing for proposed Project labor is important to consider during the construction phase of the Project. Specifically, it is important to recognize the existing supply of available homes and if an increased demand for homes within the proposed Project Area would have implications for the regional housing market. The most recent housing data available is provided by the 2010 Census, while the most recent median household value data available is from the ACS 2005-2009 data.

Table 3.14-10 presents selected home characteristics for those areas within the proposed Project Area, the state, and the U.S. As of 2010, 88.6 percent of homes nationwide were occupied, while 84.1 percent are occupied statewide in Alaska (U.S. Census Bureau, 2010c). The home occupancy rate within the proposed Project Area (80.2 percent) is slightly lower than the statewide and national average.

The Denali Borough and the YKCA have the lowest occupancy rate (45.5 percent and 54.9 percent, respectively), while the FNSB has the highest at 87.2 percent (U.S. Census Bureau, 2010c). The NSB and the Mat-Su Borough both have 18.8 percent and 23.0 percent vacancy rates, respectively. Throughout the entire proposed Project Area, 19.8 percent of total homes are vacant.

During the 2005–2009 period, the median value of owner-occupied homes were lower in the proposed Project Area (ranging from $89,900 in the YKCA to $205,000 in Mat-Su Borough) than the median home value in Alaska, $221,300 (U.S. Census Bureau, 2010d). The median home value for homes within the NSB, Denali Borough and FNSB at this

time was $143,400, $167,000, and $198,200, respectively. The median home value throughout the U.S. during this same timeframe was $185,400.

Table 3.14-10 Select Housing Characteristics, 2010

	Denali	FNSB	Mat-Su	North Slope	YKCA	Project Area Total	State of Alaska	U.S.
Housing Units	1,770	41,780	41,330	2,500	4,040	91,420	307,000	133,341,700
Occupied Housing Units	810	36,440	31,820	2,030	2,220	73,320	258,100	118,092,800
Occupancy Rate	45.5%	87.2%	77.0%	81.2%	54.9%	80.2%	84.1%	88.6%
Vacant	970	5,340	9,510	470	1,820	18,100	48,900	15,248,900
Vacancy (%)	54.5%	12.8%	23.0%	18.8%	45.1%	19.8%	15.9%	11.4%

Source: U.S. Census Bureau, 2010a
Note: Totals may not sum due to rounding

Within the proposed Project Area, the communities with the largest number of housing units are Willow and Susitna North with a total of 1,912 and 1,402 units, respectively. However, less than half of the units in these communities are occupied year round; most of the other units are for seasonal, recreational, or occasional use.

Table 3.14-11, (AGDC, 2014a) summarizes housing data for each of the 31 communities. A housing unit is defined by the U.S. Census Bureau as a house, apartment, group of rooms, or single room occupied or intended for occupancy as separate living quarters.

Table 3.14-11 Population and Housing

Community	Population			Population Density (persons per square mile)	Number of Housing Units	Occupied Housing Units (percent)
	2000a	2013b	Percent Change	2013b	2010a	2010a
Alaska	626,932	736,399	17.5	1.3	306,967	84.1
NSB						
Anaktuvuk Pass	282	358	27.0	74.1	118	83.9
Yukon-Koyukuk Census Area						
Wiseman	21	15	-28.6	0.2	25	20.0
Coldfoot	13	11	-15.4	0.3	11	54.5
Bettles	43	14	-67.4	8.0	25	36.0
Evansville	28	2	-92.9	0.1	25	48.0
New Allakaket	36	68	88.9	27.8	20	90.0
Allakaket	97	108	11.3	35.9	58	75.9
Alatna	35	26	-25.7	0.7	19	63.2
Stevens Village	87	65	-25.3	5.6	52	50.0
Livengood	29	14	-51.7	0.1	34	20.6
Rampart	45	32	-28.9	0.2	43	23.3
Manley Hot Springs	72	127	76.4	2.3	116	35.3
Minto	258	214	-17.1	1.6	94	69.1
Four Mile Road	38	26	-31.6	22.6	17	82.4

Community	Population			Population Density (persons per square mile)	Number of Housing Units	Occupied Housing Units (percent)
	2000a	2013b	Percent Change	2013b	2010a	2010a
Nenana	402	399	-0.7	67.6	215	79.5
FNSB						
Salcha	854	1,041	21.9	14.1	585	73.3
Two Rivers	482	725	50.4	26.2	348	85.1
Pleasant Valley	623	717	15.1	23.1	396	78.8
Denali Borough						
Anderson	367	235	-36.0	5.4	145	62.1
Cantwell	222	196	-11.7	1.7	200	52.0
Clear	--	--	--	--	--	--
Ferry	29	32	10.3	0.5	43	39.5
Healy	1,000	1,066	6.6	1.6	711	61.0
McKinley Park	142	179	26.1	1.0	422	25.8
Mat-Su Borough						
Chase	41	42	2.4	0.2	209	8.6
Petersville	27	3	-88.9	0.0	179	2.2
Trapper Creek	423	475	12.3	1.5	499	45.1
Talkeetna	772	861	11.5	32.1	744	60.3
Susitna North	956	1,380	44.4	5.0	1,403	40.6
Skwentna	111	33	-70.3	0.1	353	5.7
Willow	1,658	2,118	27.7	3.1	1,912	46.7

a U.S. Census Bureau, 2014b
b ADOLWD, 2014a
c The community of Clear is an unincorporated community of the Denali Borough located 5 miles south of Anderson. Clear encompasses residential homes and businesses; however, Clear Air Force Station primarily employs most of its residents to which population and housing data are unavailable (Denali Borough, 2016).

3.14.3.2.6. Tax Revenue

Table 3.14-12 summarizes 2013 municipal (including borough and census area) taxes collected in the municipalities that have taxing authority. Data on state oil and gas tax revenue is also provided in this section.

Statewide, a total of $1.6 billion in local taxes were collected in 2013. The boroughs and the census area in the proposed Project Area collected approximately $579 million in tax revenue in 2013, or 36 percent of total statewide local tax collection. The NSB collected 60 percent of total local taxes in the proposed Project Area, while the FNSB and Mat-Su Borough collected 19 and 20 percent, respectively. Out of the 19 communities traversed by the proposed Project, only Nenana and Anderson levy a tax. The community of Nenana levies a property tax, along with a sales tax. The community of Anderson levies an 8 percent utility tax, which generated $23,697 in tax revenues for the community in 2013.

Table 3.14-12 Taxable Value, Property Tax, Sales Tax and Other Locally Assessed Tax Revenue, 2013 (millions $)

Municipality	Locally Assessed Value[a]	Total Assessed Value[b]	Property Tax Revenues	Oil & Gas Property Tax Revenues	Sales Tax Revenues	Other Taxes Revenues	Total Revenues[c]
Denali Borough	NA	NA	NA	NA	$0.00	$2.00	$2.00
FNSB	$7,226.00	$8,178.00	$99.00	$9.00	$0.00	$4.00	$112.00
Mat-Su Borough	$7,926.00	$7,990.00	$110.00	$0.10	$0.00	$6.00	$116.10
NSB	$238.00	$19,232.00	$2.00	$347.00	$0.00	$0.00	$349.00
Nenana	$15.00	$19.00	$0.20	$0.00	$0.10	$0.00	$0.30
Anderson[d]	NA	NA	NA	NA	$0.00	$0.00	$0.00
Project Area Total	$15,405.00	$35,419.00	$211.20	$356.10	$0.10	$12.00	$579.40
Statewide Local	$60,136.00	$93,554.00	$882.00	$404.00	$222.00	$101.00	$1,609.00

Source: ADCCED, 2014
a Value of property for municipalities not imposing a property tax are not included.
b Total Assessed Values include Locally Assessed Real Property, Locally Assessed Personal Property, and State Assessed.
c Totals may not sum due to rounding.
d Tax revenue generated by the community of Anderson in 2013 ($23,697) is not illustrated because tax revenues are provided in millions of dollars.

There are four categories of taxes associated with oil and gas production in Alaska: production tax, conservation surcharges, general fund, and Constitutional Budget Reserve (CBR) fund. In 2017, the State of Alaska received a total of $490 million in oil and gas taxes from these four sources (ADR, 2017). CBR fund taxes accounted for the largest share of this revenue at $349 million of the total, while general fund taxes accounted for $140 million. Production tax and conservation surcharges contributed $132 million and $8 million, respectively to the state in 2017.

Five of the 31 communities in the proposed Project Area are incorporated and 16 are in boroughs; the remaining nine communities are unincorporated and are located within what is commonly referred to as the "Unorganized Borough."

3.14.3.3. Public Infrastructure and Services

Table 3.14-13 shows the electric power source and primary home heating fuels currently used by the 31 communities that could potentially access natural gas via a spur line tie-in. Alaska's electrical energy infrastructure differs from that of the rest of the U.S. in that there is no extensive infrastructure of transmission interties that spans the state. Nevertheless, the electrical needs of the larger communities in the proposed Project Area are currently served by public utilities connected to a regional transmission line owned by the Alaska Energy Authority. This grid extends from Fairbanks south through

Anchorage and eventually reaches the tip of the Kenai Peninsula. In the smaller, more remote proposed Project Area communities, electricity is generated by standalone diesel generators that are not tied into the regional grid. For heating, homes and businesses in proposed Project Area communities consume a combination of fuel oil, kerosene, electricity, propane gas, wood, and coal. Electricity is distributed to the Fairbanks area by the Golden Valley Electric Association (GVEA) and is supplied by 10 generation plants fueled by 35 percent natural gas, 28 percent coal, and 25 percent oil.

Table 3.14-13 Electric Power Source, Power Cost Equalization Program & Home Heating Fuels

Community	Electric Utility Operator	PCE (2014)	Top 3 House Heating Fuels (percent of total households)	
			2000	2008-2012 Average
NSB	-	-	Fuel oil, kerosene, etc. (35.5%)	Fuel oil, kerosene, etc. (34.5%)
			Bottled, tank, or LPG (57.9%)	Bottled, tank, or LPG (62%)
			Electricity (4.7%)	Electricity (3.2%)
Anaktuvuk Pass	North Slope Borough	Y	Fuel oil, kerosene, etc. (100%)	Fuel oil, kerosene, etc. (84.9%)
			-	Electricity (12.8%)
			-	Other fuel (2.3%)
Yukon-Koyukuk Census Area	-	-	Fuel oil, kerosene, etc. (56.3%)	Fuel oil, kerosene, etc. (49.4%)
			Wood (42%)	Wood (47.6%)
			Electricity (0.7%)	Bottled, tank, or LPG (1.1%)
Wiseman	Individual generators	N	Bottled, tank, or LPG (42.9%)	-
			Fuel oil, kerosene, etc. (28.6%)	-
			Wood (28.6%)	-
Coldfoot	Individual generators	N	Fuel oil, kerosene, etc. (100%)	-
			-	-
			-	-
Bettles	AP&T	Y	Fuel oil, kerosene, etc. (100%)	Fuel oil, kerosene, etc. (81.8%)
			-	No fuel used (18.2%)
			-	-
Evansville	AP&T	Y	Fuel oil, kerosene, etc. (73%)	Fuel oil, kerosene, etc. (100%)
			Wood (26.7%)	-
			-	-
New Allakaket	AP&T	Y	Fuel oil, kerosene, etc. (100%)	Fuel oil, kerosene, etc. (70.6%)
			-	Wood (29.4%)
			-	-
Allakaket	AP&T	Y	Fuel oil, kerosene, etc. (100%)	Fuel oil, kerosene, etc. (70.6%)
			-	Wood (29.4%)
			-	-
Alatna	AP&T	Y	Fuel oil, kerosene, etc. (66.7%)	Fuel oil, kerosene, etc. (100%)
			Wood (33.3%)	-
			-	-

Community	Electric Utility Operator	PCE (2014)	Top 3 House Heating Fuels (percent of total households)	
			2000	2008-2012 Average
Stevens Village	Stevens Village Energy Systems	N	Wood (65.7%)	Wood (100%)
			Fuel oil, kerosene, etc. (34.3%)	-
			-	-
Livengood	individual generators	N	Fuel oil, kerosene, etc. (63.6%)	Wood (68.8%)
			Wood (36.4%)	Fuel oil, kerosene, etc. (31.3%)
			-	-
Rampart	Rampart Village Council	Y	Wood (63.2%)	Wood (100%)
			Fuel oil, kerosene, etc. (36.8%)	-
			-	-
Manley Hot Springs	Manley Utility Company, Inc.	Y	Fuel oil, kerosene, etc. (53.7%)	Wood (63%)
			Wood (46.3%)	Fuel oil, kerosene, etc. (37%)
			-	-
Minto	Alaska Village Electric Cooperative	Y	Fuel oil, kerosene, etc. (86.1%)	Fuel oil, kerosene, etc. (81.2%)
			Wood (9.7%)	Wood (18.8%)
			Other fuel (4.2%)	-
Four Mile Road	GVEA	N	Fuel oil, kerosene, etc. (89.5%)	Fuel oil, kerosene, etc. (100%)
			Wood (10.5%)	-
			-	-
Nenana	GVEA	N	Fuel oil, kerosene, etc. (78.1%)	Fuel oil, kerosene, etc. (68.9%)
			Wood (19.8%)	Wood (27.7%)
			Electricity (2.1%)	Coal or coke (1.7%)
FNSB	-	-	Fuel oil, kerosene, etc. (76.7%)	Fuel oil, kerosene, etc. (76.7%)
			Electricity (9.6%)	Electricity (6.4%)
			Coal or coke (3%)	Wood (5.6%)
Salcha	GVEA	N	Fuel oil, kerosene, etc. (66.7%)	Fuel oil, kerosene, etc. (59.4%)
			Wood (18.1%)	Wood (30.1%)
			Bottled, tank, or LPG (6.5%)	Bottled, tank, or LPG (6.5%)
Two Rivers	GVEA	N	Fuel oil, kerosene, etc. (76.3%)	Fuel oil, kerosene, etc. (89.3%)
			Wood (13%)	Wood (10.7%)
			Bottled, tank, or LPG (5.9%)	-
Pleasant Valley	GVEA	N	Fuel oil, kerosene, etc. (96.8%)	Fuel oil, kerosene, etc. (58.3%)
			Bottled, tank, or LPG (3.2%)	Wood (41.7%)
			-	-
Denali Borough	-	-	Fuel oil, kerosene, etc. (71.7%)	Fuel oil, kerosene, etc. (54.3%)
			Wood (11.3%)	Wood (24%)
			Coal or coke (8.7%)	Coal or coke (14.1%)
Anderson	GVEA	N	Fuel oil, kerosene, etc. (79.6%)	Fuel oil, kerosene, etc. (76.4%)

Community	Electric Utility Operator	PCE (2014)	Top 3 House Heating Fuels (percent of total households)	
			2000	2008-2012 Average
			Electricity (8.2%)	Wood (14.6%)
			Wood (6.1%)	Coal or coke (6.7%)
Cantwell	GVEA	N	Fuel oil, kerosene, etc. (79.2%)	Fuel oil, kerosene, etc. (71.6%)
			Wood (20.8%)	Wood (27.3%)
		-	-	-
Clear	-	-	-	-
Ferry	Individual generators	N	Coal or coke (57.1%)	Wood (100%)
			Wood (33.3%)	-
			Fuel oil, kerosene, etc. (9.5%)	-
Healy	GVEA	N	Fuel oil, kerosene, etc. (69.4%)	Fuel oil, kerosene, etc. (45.7%)
			Coal or coke (12.3%)	Wood (25%)
			No fuel used (9.5%)	Coal or coke (24%)
McKinley Park	GVEA	N	Fuel oil, kerosene, etc. (84.1%)	Fuel oil, kerosene, etc. (67%)
			Wood (10.1%)	Wood (20%)
			Bottled, tank, or LPG (2.9%)	Bottled, tank, or LPG (13%)
Mat-Su Borough	-	-	Bottled, tank, or LPG (59.8%)	Bottled, tank, or LPG (69.3%)
			Fuel oil, kerosene, etc. (24.2%)	Fuel oil, kerosene, etc. (15.3%)
			Wood (6.4%)	Wood (7.2%)
Chase	Individual generators	N	Wood (100%)	Wood (100%)
			-	-
			-	-
Petersville	Individual generators	N	Bottled, tank, or LPG (100%)	-
			-	-
			-	-
Trapper Creek	Matanuska Electric Association (MEA)	N	Fuel oil, kerosene, etc. (71.8%)	Fuel oil, kerosene, etc. (52.7%)
			Wood (23.3%)	Wood (30.9%)
			Bottled, tank, or LPG (5.3%)	No fuel used (8%)
Talkeetna	MEA	N	Fuel oil, kerosene, etc. (66.1%)	Fuel oil, kerosene, etc. (63%)
			Wood (26.3%)	Wood (31%)
			Other fuel (5.7%)	No fuel used (3.3%)
Susitna North	MEA	N	-	Fuel oil, kerosene, etc. (40.7%)
			-	Wood (33.8%)
			-	Bottled, tank, or LPG (12.5%)
Skwentna	Individual generators	N	Wood (57.1%)	Wood (100%)
			Fuel oil, kerosene, etc. (21.4%)	-
			Bottled, tank, or LPG (21.4%)	-
Willow	MEA	N	Fuel oil, kerosene, etc. (75.4%)	Fuel oil, kerosene, etc. (56.5%)
		-	Wood (9.2%)	Wood (26.4%)
			Bottled, tank, or LPG (6.1%)	Electricity (6.6%)

Sources: U.S. Census Bureau, 2014a and 2014b; Alaska Energy Authority, 2015b

Note: The community of Clear is an unincorporated community of the Denali Borough located 5 miles south of Anderson. Clear Air Force Station primarily employs most of its residents to which data for electric power source and primary home heating fuels are unavailable (Denali Borough, 2016).
LPG - Liquefied Petroleum Gas
PCE - Power Cost Equalization

Table 3.14-13 shows the significant differences in energy prices across Project Area communities, with some communities—generally those least able to afford it—paying among the highest prices in the state. Most communities within the proposed Project Area depend on fuel oil for both electricity generation and space heating. Consequently, high fuel oil prices increase both the cost of electricity and space heating; thus, magnifying financial pressure on households (USACE, 2012a). In contrast, Anchorage residents pay lower energy prices because natural gas is far less expensive than fuel oil (Table 3.14-13).

There are high fixed-costs associated with operating an electric utility, and if the number of customers or levels of consumption are low, these costs must be spread over few customers and kilowatt-hours. The lack of economies of scale leads to costly electricity per unit produced. However, several Project Area communities participate in the Power Cost Equalization (PCE) program, under which the State of Alaska pays a portion of the electric bills for consumers served by utilities participating in the program. The PCE program is effective at lowering residential electricity rates in participating communities so that they are comparable to communities connected to the regional grid.

3.14.4. Environmental Justice

The EPA Office of Environmental Justice provides the following definition of environmental justice (EPA, 2011):

> *The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.*

As previously noted, environmental justice is addressed in the Civil Rights Act of 1964 and E.O. 12898. E.O. 12898 requires (CEQ, 1997):

> *Each federal agency to incorporate environmental justice into its mission by identifying and addressing as appropriate disproportionately high and adverse human health or environmental effects (including social or economic effects) of its programs, policies, and activities implemented both directly and indirectly (for which it provides permitting or funding) on minority populations and low-income populations of the U.S.*

As discussed in the 2012 FEIS (USACE, 2012a), the key socioeconomic parameters addressed here for environmental justice are race/ethnicity and measures of social and economic well-being, including per capita income and poverty rates. Environmental justice analysis is performed at the Census Tract (CT) level for CTs traversed by the proposed Project, with borough/census area and statewide totals used for comparison. CTs are small, statistical subdivisions of counties, borough census areas that were created by the U.S. Census Bureau (U.S. Census Bureau, 2000). Refer to the 2012 FEIS for additional details regarding environmental justice and CTs.

3.14.4.1. Income-Related Measures of Social Well-Being

A component of the rural Alaskan economic system, and in conjunction with a market economy, forms a mixed economy. Despite this, per capita income, median household income, and poverty rates as presented in Table 3.14-14 are widely used indicators of economic well-being. Poverty rates represent the percentage of an area's total population living at or below the poverty threshold established by the U.S. Census Bureau.

Many of the CTs in the proposed Project Area (Figure 3.14-5) have poverty rates that exceed poverty rates of the state and the respective boroughs in which they are located. However, the circumstances may be more complicated than it appears just by comparing rates. For example, three of the four CTs traversed by the proposed route within the Mat-Su Borough have poverty rates ranging from 14.0 to 15.3 percent, which is higher than the overall Mat-Su Borough poverty rate of 10.1 percent and the statewide rate of 9.4 percent. These CTs also have lower median household income compared to the borough and state. The remaining CT in the Mat-Su Borough, CT 600, has more of a mixed picture, with higher median household income and lower poverty rates than the borough and statewide totals, but lower per capita income. The income and poverty comparison in the FNSB is also mixed. The FNSB, CT 1300 exhibits a poverty rate that is higher than the overall borough and statewide poverty rates. Despite this, CT 1300 has higher per capita and household income. Similarly, CT 1900 has a higher poverty rate than that of the borough, but less than overall statewide poverty rate and income within CT 1900 is higher than both the borough and the state.

Measures of income and poverty in the one CT within the Denali Borough (CT 100) indicate greater economic wellbeing than is documented statewide.

Within the NSB, CT 200 has lower per capita income ($18,500) and median household income ($65,000) than the borough, but higher median household income than the state. At 10 percent, the poverty rate is lower than elsewhere in the borough, but higher than the statewide average. For the YKCA, CT 200 has greater economic conditions as measured by poverty and per capita income than the borough. The poverty rate within the YKCA's CT 200 (18.7 percent) is higher than the statewide poverty rate (9.4 percent), but lower than the overall poverty rate of the YKCA.

Table 3.14-14 Income and Poverty Rates (2009 dollars)

Area	Average Per Capita Income (2005-2009)	Average Median Household Income in (2005-2009)	Average Poverty Rate (2005-2009)	Percent Difference in Average Poverty Rate Compared to Borough
Denali Borough	$44,700	$76,300	4.4%	0.0%
Census Tract 100	$44,700	$76,300	4.4%	0.0%
FNSB	$28,400	$65,100	7.6%	0.0%
Census Tract 1300	$37,400	$72,700	11.3%	48.1%
Census Tract 1900	$31,900	$67,100	9.0%	18.1%
Mat-Su Borough	$24,900	$66,100	10.1%	0.0%
Census Tract 100	$18,700	$37,200	15.3%	51.0%
Census Tract 400	$24,300	$55,200	13.1%	29.5%
Census Tract 500	$24,900	$62,600	14.0%	38.1%
Census Tract 600	$22,300	$70,100	7.8%	-49.2%
NSB	$24,100	$66,600	14.7%	0.0%
Census Tract 200	$18,500	$65,400	10.0%	-31.4%
Census Tract 300[a]	--	NA	NA	NA
YKCA	$18,500	$33,700	23.8%	0.0%
Census Tract 200	$21,700	$46,100	18.7%	-21.4%
Alaska	$29,400	$64,600	9.4%	NA
U.S.	$27,000	$51,400	13.1%	NA

Sources: U.S. Census Bureau 2011b and 2011ca ACS reports that the 2005-2009 average population of the NSB Census Tract 300 is zero.

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Deadhorse
MP 0
Prudhoe Bay
000300
MP 50
000200
North Slope
MP 100
MP 150
MP 200
Wiseman
MP 250
Coldfoot
000100
MP 300
Yukon-Koyukuk
000200
MP 350
Livengood
MP 400
College
Gold Stream
001001
000401
000701
000703
000705
001003
000800
001004
000900
001100
Fairbanks
North Star
001900
MP 450
000900
Nenana
Ester
Chena Ridge
001100
000502
000603
000601
000501
Anderson
001700
MP 500
Healy
Southeast
Fairbanks
McKinley Park
000101
000604
000100
MP 550
Denali
000400
000300
000102
Cantwell
000100
000202
000201
000203
000204
MP 600
Matanuska-Susitna
MP 650
000101
000102
Talkeetna
000100
Valdez -
Cordova
Bethel
MP 700
000402
000300
000200
Willow
001300
000401
000502
Big Lake
000604
000100
002301
Anchorage
Municipality
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DENALI WILDERNESS
MP 535
Alaska Stand Alone
Pipeline Route v6.1 Mainline
MP 540
Healy
Denali National
Park Route Variation, 2015
000100
McKinley Park
MP 545
Route Variation Inset

Project Terminus Inset

Mile Post
ASAP v6.1 Mainline
Fairbanks Lateral
Census Tracts
Incorporated Cities
Unincorporated Places

Borough / Census Area Status

Study Area
Not Affected

Data Source: US - Census Data, 2010
Downloaded March, 2016
Basemap: ESRI Topographic

ERM

DATE: MAR. 2018
CHKD: K.A.
DRWN: J.S.V.
PROJ. No.: 0416166

825 W. 8th Ave., Anchorage, AK 99501, (907) 258-4880

Figure 3.14-5: CENSUS TRACTS TRAVERSED BY THE PROPOSED PROJECT AND DENALI NPP ROUTE VARIATIONS ALASKA STAND ALONE PIPELINE

0 25 50 100 Miles

ALASKA
CANADA

N

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3.14.4.2. Race and Ethnicity

In accordance with the CEQ guidance (CEQ, 1997), minority populations should be identified if the minority population in the proposed Project Area exceeds 50 percent or if the percentage of minority population in the proposed Project Area is meaningfully greater than the "minority population percentage in the general population or other appropriate unit of geographic analysis." Borough census areas were used for this analysis rather than geographic borough boundaries. For this analysis, the population percentages of the various racial and ethnic groups within the CTs traversed by the proposed Project Area were compared to the borough census area in which they are located and the borough census area was compared to the state.

Table 3.14-15 presents the racial and ethnic makeup in the CTs and borough census areas traversed by the route alternatives in Alaska and the U.S. based on 2010 Census data. Statewide, 33 percent of residents belong to a racial minority compared with 28 percent nationwide (U.S. Census Bureau, 2010c).

The YKCA has the highest percentage of racial minorities out of all borough census areas in this analysis, with 78 percent of the total population belonging to a minority group, followed by the NSB with 67 percent of the population being a minority. The remaining boroughs in this analysis have concentrations of minority populations that are lower than statewide racial minority estimates.

Approximately 5.5 percent of Alaska residents consider themselves Hispanic or Latino, which is higher than all boroughs/census areas within this analysis other than the FNSB, with 5.8 percent of the population being Hispanic or Latino. Additionally, 3.3 percent of the state's population identifies itself as African American, and the FNSB is the only borough/census area with a higher percentage of this population (4.5 percent). Furthermore, approximately 5.4 percent of the state's population is Asian, which is higher than all boroughs and the census areas within this analysis. Pacific Islanders make up 1 percent of the state's total population, and only the Mat-Su Borough barely exceeds this population concentration.

Statewide, minorities within the "other" category comprise 1.6 percent of the state's total population. In addition, 7.3 percent are multi-race. No boroughs/census areas within this analysis have concentrations of other minorities or multi-racial group that exceed the statewide concentrations.

Most of the CTs traversed by the proposed Project have lower proportions of minority populations than the state. Only two CTs have higher rates in any racial group category than the statewide totals: CT 200 in the NSB is 86.5 percent American Indian or Alaska Native and CT 200 in the YKCA is 48.8 percent American Indian and Alaska Native compared to the statewide percent of 14.8 percent. However, several CTs have a higher percentage of specific minority populations than the boroughs in which they are located. While only one CT in the Mat- Su Borough (CT 600) has a slightly higher concentration of non-white populations than the Mat-Su Borough, three CTs (CT 400, CT 500, and CT

600) have a higher proportion of American Indian and Alaska Native populations than the borough. Furthermore, CT 600 has higher concentrations of African Americans, American Indians and Alaska Natives, Asians, Pacific Islanders, multi-racial groups and Hispanics than the Mat-Su Borough overall. Of the two FNSB CTs traversed by the proposed route, only CT 1300 has a higher concentration of a specific minority group than the borough, with 4.1 percent of Asians compared to 2.7 percent in the borough.

As noted above, the North Slope CT 200 has an American Indian and Alaska Native population that comprise 87 percent of the total CT, which exceeds both the state and the borough proportion. The other CT in the NSB traversed by the proposed Project, CT 300, has a higher concentration of African Americans (1.9 percent), other races (1.2 percent), and Hispanics (3.7 percent) when compared to the NSB concentrations of these minorities (but lower than the statewide concentrations). The only CT within the YKCA traversed by the proposed Project Area, CT 200, has higher concentrations of African Americans (0.3 percent), other races (1.6 percent) and Hispanics (1.8 percent) when compared to the overall YKCA. However, in each instance these concentrations are slightly higher than the overall YKCA concentrations and lower than the state proportions.

Table 3.14-15 Population by Racial and Ethnic Groups

Area	Population	Race					Ethnicity		
	2010	White	African American	American Indian & Alaska Native	Asian	Pacific Islander	Other	Multi Race[a]	Hispanic or Latino
Denali Borough	**1,826**	**1,637**	**10**	**65**	**19**	**1**	**14**	**80**	**42**
	100.0%	**89.6%**	**0.5%**	**3.6%**	**1.0%**	**0.1%**	**0.8%**	**4.4%**	**2.3%**
Census Tract 100	1,826	1,637	10	65	19	1	14	80	42
	100.0%	89.6%	0.5%	3.6%	1.0%	0.1%	0.8%	4.4%	2.3%
FNSB	**97,581**	**75,175**	**4,423**	**6,879**	**2,591**	**396**	**1,446**	**6,671**	**5,651**
	100.0%	**77.0%**	**4.5%**	**7.0%**	**2.7%**	**0.4%**	**1.5%**	**6.8%**	**5.8%**
Census Tract 1300	6,462	5,358	99	390	262	8	35	310	157
	100.0%	82.9%	1.5%	6.0%	4.1%	0.1%	0.5%	4.8%	2.4%
Census Tract 1900	11,684	10,184	123	510	113	13	85	656	335
	100.0%	87.2%	1.1%	4.4%	1.0%	0.1%	0.7%	5.6%	2.9%
Mat-Su Borough	**88,995**	**75,540**	**856**	**4,901**	**1,096**	**221**	**640**	**5,741**	**3,301**
	100.0%	**84.9%**	**1.0%**	**5.5%**	**1.2%**	**0.2%**	**0.7%**	**6.5%**	**3.7%**
Census Tract 100	2,801	2,499	10	131	20	4	12	125	55
	100.0%	89.2%	0.4%	4.7%	0.7%	0.1%	0.4%	4.5%	2.0%
Census Tract 400	4,017	3,485	7	235	27	6	26	231	91
	100.0%	86.8%	0.2%	5.9%	0.7%	0.1%	0.6%	5.8%	2.3%
Census Tract 500	3,612	3,093	8	277	22	3	23	186	108
	100.0%	85.6%	0.2%	7.7%	0.6%	0.1%	0.6%	5.1%	3.0%
Census Tract 600	15,346	12,858	174	870	219	57	68	1,100	643
	100.0%	83.8%	1.1%	5.7%	1.4%	0.4%	0.4%	7.2%	4.2%
NSB	**9,430**	**3,147**	**94**	**5,100**	**425**	**104**	**67**	**493**	**249**
	100.0%	**33.4%**	**1.0%**	**54.1%**	**4.5%**	**1.1%**	**0.7%**	**5.2%**	**2.6%**
Census Tract 200	2,690	266	6	2,328	0	2	2	86	25

Area	Population			Race			Ethnicity		
	2010	White	African American	American Indian & Alaska Native	Asian	Pacific Islander	Other	Multi Race[a]	Hispanic or Latino
	100.0%	9.9%	0.2%	86.5%	0.0%	0.1%	0.1%	3.2%	0.9%
Census Tract 300	2,527	2,168	47	195	41	3	31	42	93
	100.0%	85.8%	1.9%	7.7%	1.6%	0.1%	1.2%	1.7%	3.7%
YKCA	**5,588**	**1,243**	**10**	**3,992**	**14**	**6**	**9**	**314**	**66**
	100.0%	**22.2%**	**0.2%**	**71.4%**	**0.3%**	**0.1%**	**0.2%**	**5.6%**	**1.2%**
Census Tract 200	1,461	640	5	713	4	0	4	95	27
	100.0%	43.8%	0.3%	48.8%	0.3%	0.0%	0.3%	6.5%	1.8%
Alaska	**710,231**	**473,576**	**23,263**	**104,871**	**38,135**	**7,409**	**11,102**	**51,875**	**39,249**
	100.0%	**66.7%**	**3.3%**	**14.8%**	**5.4%**	**1.0%**	**1.6%**	**7.3%**	**5.5%**
U.S.	**308,745,538**	**223,553,265**	**38,929,319**	**2,932,248**	**14,674,252**	**540,013**	**19,107,368**	**9,009,073**	**50,477,594**
	100.0%	**72.4%**	**12.6%**	**0.9%**	**4.8%**	**0.2%**	**6.2%**	**2.9%**	**16.3%**

Source: U.S. Census Bureau, 2011d
a Multi race persons may belong to any race.

3.14.4.3. Environmental Justice Summary

In summary, two CTs traversed by the proposed route have minority populations in excess at or near 50 percent. Specifically, the NSB CT 200 and the YKCA CT 200 have a high concentration of American Indian and Alaska Native population at 86.5 and 48.8 percent, respectively. These are the only CTs in which the concentration of a minority group exceeds the statewide average and the only CTs with a minority population exceeding 50 percent.

Of the ten CTs traversed by the proposed route, all but three have higher poverty rates than the statewide average. Poverty rates in the YKCA and the NSB are much higher when compared to the state, with 23.8 and 14.4 percent of the population impoverished, respectively. While higher than statewide averages, poverty rates for those CTs traversed by the proposed route within the NSB and the YKCA do not exceed the overall poverty rates within their respective borough census area.

Five of the CTs have higher poverty rates than the borough in which they are located. Each of the CTs traversed within the FNSB (CT 1300 and CT 1900) has a higher poverty rate than the FNSB overall poverty rate. Similarly, three CTs traversed by the proposed route within the Mat-Su Borough (CT 100, CT 400, CT 500) have poverty rates that are higher than the overall Mat-Su Borough poverty rate.

3.14.5. Indirect Access to Compressed Natural Gas

In addition to the 31 communities included in this study, the baseline socioeconomic conditions of the communities that could access natural gas through the proposed Project indirectly, via the Fairbanks Lateral line tie-in, the Beluga Pipeline tie-in, or via truck or barge, are incorporated by reference and the most recent, or most applicable results, are summarized below.

3.14.5.1. Fairbanks Lateral

This analysis assumed that the Fairbanks Lateral would transport gas to the existing and planned distribution systems of both Fairbanks Natural Gas, LLC (FNG) and the Interior Gas Utility (IGU), a municipally owned utility formed in 2012 by the FNSB, the City of Fairbanks, and the City of North Pole (IGU, 2014). The current socioeconomic environment for these communities is incorporated by reference. Cardno ENTRIX (2014) and Northern Economics (2012) provided socioeconomic descriptions of the Fairbanks area served by the existing and planned FNG and IGU gas distribution systems.

According to Cardno ENTRIX (2014), currently, FNG provides service to approximately 1,100 natural gas customers within central Fairbanks. FNG purchases gas from the Cook Inlet area of Alaska and, once liquefied, transports the gas by trucks to Fairbanks, where it is stored and re-gassed for distributed to customers. The FSNB currently has an Air Quality Improvement Program, developed to offer reimbursement incentives for replacing and removing solid fuel burning appliances. According to the 2016 Enhanced

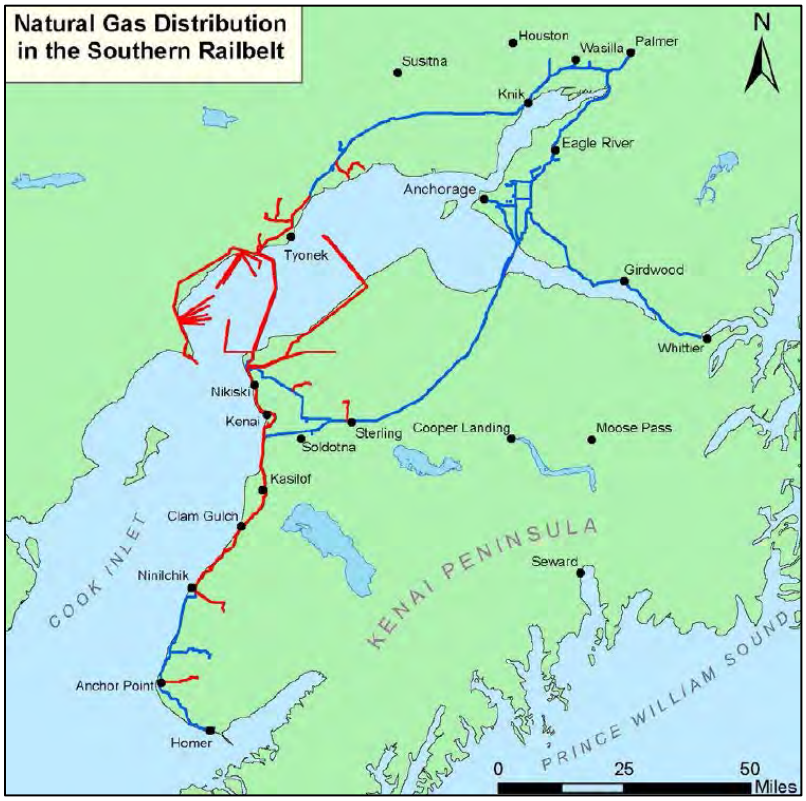
Voluntary Removal, Replacement & Repair Program application, an Applicant could be reimbursed up to $10,000 for replacing a solid fuel-burning appliance with one designed to use natural gas or propane (FNSB, 2016). The following FNSB demographic characteristics may affect homeowner ability to pay and/or their ability to recoup investment costs into a Fairbanks Lateral pipeline.

- Age of residents: The average annual population of the FNSB during the 2007-2011 period is 96,161, while the cities of Fairbanks and North Pole have populations of 31,467 and 2,236, respectively. The population of the FNSB comprises roughly 14 percent of Alaska's total population. Fairbanks and North Pole residents are younger than the population of Alaska overall, and much younger than Homer and Kachemak City.
- Housing type: Homeowner and rental properties. Within Fairbanks, approximately 54 percent of all occupied housing units (7,633 housing units) are rented. This is a much higher proportion of rentals than elsewhere in the FNSB and in other locations throughout Alaska. Reimbursement incentives for replacement of solid fuel burning appliances are applicable only to property owners under the FNSB program.
- Mobility: Of the total population 18 years and older, on average during the 2007-2011 period, 34 percent of the population is not in the same house as they were the previous year. The population of Fairbanks is much more mobile than other communities and locations (Cardno ETTRIX, 2014).

3.14.5.2. Beluga Pipeline

The proposed Project would connect into ENSTAR's distribution system, Beluga Pipeline, southwest of Big Lake. ENSTAR serves much of the Southcentral Region, including the Municipality of Anchorage and communities in the Mat-Su Borough and Kenai Peninsula Borough (Figure 3.14-6).

Figure 3.14-6 Natural Gas Distribution in the Southern Railbelt



Source: USACE, 2012a

NOAA's Final Regulatory Impact Review/4(b)(2) Preparatory Assessment/ Final Regulatory Flexibility Act for the Critical Habitat Designation of Cook Inlet Beluga Whale (Cardno ENTRIX, 2010) describes the socioeconomic conditions in the Municipality of Anchorage, Mat-Su Borough, and Kenai Peninsula Borough. The document is organized into four main components: (1) population trends and projections; (2) income-related measures of social well-being; (3) race and ethnicity; and (4) major industrial sectors. The following is incorporated by reference.

Population trends and projections are described as follows in this document (Cardno ENTRIX, 2010):

> *The Municipality of Anchorage City-Borough, Matanuska-Susitna Borough, and Kenai Peninsula Borough together account for 62 percent of the total population of the State of Alaska. The Municipality of Anchorage is the most populous borough in the State, with a population of 284,994 in 2008. Seventy-one communities within the Municipality of Anchorage include Girdwood, Bird, Indian, Eagle River, Birchwood, and Chugiak. The 2008 populations for Kenai Peninsula was 52,990 individuals, respectively. Palmer, Houston, and Wasilla comprise the incorporated communities within Matanuska-Susitna, while other communities include Knik-Fairview, Butte, Meadow Lake, and Big Lake. Larger*

communities within the Kenai Peninsula include Homer, Kalifornsky, Kenai, Nikiski, and Soldotna.

It is projected that the population in Matanuska-Susitna will continue to increase rapidly, with a rate of growth of 42.2 percent between 2000 and 2010. Beyond 2010, this population is expected to increase by 32.2 percent between 2010 and 2020, and by 11.5 percent between 2020 and 2025. Similar to the State of Alaska, the population of the Municipality of Anchorage is projected to increase over the three time periods, with the highest rate of growth (12.7 percent) during the first decade of the millennium and a cumulative increase of almost 30 percent through 2025 (relative to 2000 levels). Kenai Peninsula is expected to experience a slower population growth rate than the other two boroughs, the State of Alaska, and the U.S.

Income-related measures of social well-being are described as follows in this document (Cardno ENTRIX, 2010):

As derivatives of total personal income, per capita and median household income, poverty rates, and unemployment rates represent widely used economic indicators of social well-being. In 2006, per capita personal income in the Municipality of Anchorage was $49,486, exceeding the statewide level of $43,403 (in 2009 dollars). Conversely, per capita personal incomes in Matanuska-Susitna and Kenai Peninsula were 85.8 percent and 89.0 percent of the statewide average, respectively. Median household incomes for the three boroughs and the State of Alaska all exceeded the national average in 2007. The median household incomes in the Municipality of Anchorage and Matanuska-Susitna in 2007 were $70,227 and $67,239, respectively (in 2009 dollars), exceeding the same figure for of the State of Alaska ($65,050) and Kenai Peninsula ($58,627). A third indicator, poverty rate, represents the percentage of an area's total population living at or below the poverty threshold established by the U.S. Census Bureau. Based on available data for 2007, the poverty rate was 8.0 percent in the Municipality of Anchorage, 9.5 percent in Matanuska-Susitna, 10.3 percent in Kenai Peninsula, and 9.8 percent at the State level. The poverty rate at the national level (13.0 percent) exceeded the same figures for the three boroughs and the State of Alaska. Finally, the unemployment rate represents the percentage of the labor force that is unemployed and is actively seeking employment. In 2008, the Municipality of Anchorage experienced an unemployment rate (5.3 percent), below the national level (5.8 percent). However, the unemployment rate for both Kenai Peninsula (8.2 percent) and Matanuska-Susitna (7.7 percent) exceeded the statewide level (6.7 percent) in 2008.

Race and ethnicity are described as follows in this document (Cardno ENTRIX, 2010):

Generally, the racial and ethnic composition of the Municipality of Anchorage is more diverse, and the compositions of the Matanuska-Susitna and Kenai Peninsula boroughs less diverse, than Statewide conditions. The predominant

> *racial group in each borough is Caucasian, comprising roughly 69.8 percent of the Municipality of Anchorage population, 86.4 percent of the Matanuska-Susitna population, and 85.8 percent of the population of Kenai Peninsula. Within the Municipality of Anchorage and Matanuska-Susitna, the largest racial minority group consists of two or more races (8.5 percent and 6.8 percent, respectively). Compared to the percentage of the U.S. population that is American Indian and Alaska Native (AIAN; 0.8 percent), the three boroughs and the State of Alaska have significant AIAN representation. Statewide, AIAN individuals make up the largest racial minority group (13.4 percent). The percentages for this group within the Municipality of Anchorage (5.5 percent), Matanuska-Susitna (4.5 percent), and Kenai Peninsula (6.9 percent) are also significant.*

Major industrial sectors are describes as follows in this document (Cardno ENTRIX, 2010):

> *Industry sectors are defined by the North American Industry Classification System. Unlike employer establishments, non-employer firms have no paid employees; however, non-employer receipts contribute substantially to a number of sectors. Based on the number of employees within employer establishments, the major industrial sectors common to the three boroughs are health care and social assistance; retail trade; accommodation and food services; and construction. When assessing non-employer receipts, major industrial sectors common to the three boroughs are real estate and rental and leasing; construction; and other services (except public administration).*

3.14.5.3. Truck Transport

As described in the 2012 FEIS, the NGL fractionation facility, which was part of the original Project design, could produce fuel products for customers along the Alaska Highway system in the form of propane and butane (USACE, 2012a). Under the current ASAP Project design, the NGL fractionation facility would not be constructed; therefore, propane and butane would not be produced. However, the transportation of Compressed Natural Gas (CNG) by truck to highway-accessible communities in the state is similar to the delivery of propane described in the 2012 FEIS, and is considered a method of access in this analysis. Currently, Fairbanks Natural Gas Company ships two tanker trucks of LNG to Fairbanks daily from the Titan LNG plant at Point MacKenzie. A larger, prototype trailer with a 13,000 gallon-capacity successfully transported LNG via the road system in 2016. In the fall of 2016, the Alaska Railroad also began shipping CNG via rail from Anchorage to Fairbanks, where the CNG containers would be transferred to the Fairbanks Natural Gas company storage facility (Merritt, 2016). CNG could be used by cars and trucks in Fairbanks; by communities along the Parks and Dalton Highways, including tour buses in Denali NPP; and by Anchorage and other communities on the Kenai Peninsula. The baseline socioeconomic conditions in

communities that could potentially access CNG, via truck or barge, are incorporated by reference in the following documents:

- Overview of Socioeconomic Conditions in Rural Alaska Communities provided by Goldsmith, 2008;
- Descriptions of Energy Use in Rural Alaska including the Studies by Fay *et al.*, 2013; Northern Economics, 2007; and WHPacific, 2012; and
- Studies that have examined the potential of using propane in rural communities in Western and Interior Alaska, including Alaska Energy Authority (2010), Fuhs (2010), PND, Inc. (2005), R.W. Beck (2011), and Schwörer and Fay (2010).

3.15. Cultural Resources

3.15.1. Introduction

This section discusses cultural resources in the proposed Project Area. NEPA's implementing regulations (40 CFR 1508.14) address the human environment, which the regulations define as the "natural and physical environment and the relationship of people with that environment." Furthermore, NEPA's implementing regulations (40 CFR 1508.27(b)(8)) state that the federal agency should consider "The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources." NEPA's regulations do not provide a general age rule for scientific, cultural, or historical resources as opposed to cultural resources on the National Register of Historic Places (NRHP), which are generally over 50 years old. Cultural resources that are eligible for listing in the NRHP are called "historic properties" and must be addressed by federal agencies under Section 106 of the National Historic Preservation Act (NHPA). The specific definition of historic properties as defined in 36 CFR 800.16[l] is "…any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization and that meet the National Register criteria." A property must be shown to be significant in one or more of the four National Register Criteria for Evaluation (event, person, design/construction, or information potential) and must also have sufficient integrity (location, design, setting, materials, workmanship, feeling, and association) in order to be eligible to the National Register as a historic property. In keeping with NEPA, this SEIS analyzes effects to cultural resources; the term "historic properties" is only used when referring to the development of a Programmatic Agreement (PA) that will address the requirements of Section 106 of the NHPA; the term "historic site" or "prehistoric site" is used to designate the time period with which a cultural resource is associated.

The description of cultural resources is based on information provided in the 2012 FEIS (USACE, 2012a) as well as new data relevant to environmental concerns that have become available since the publication of the 2012 FEIS, including cultural resource surveys within the proposed Project Area (AGDC 2014m; 2014n; 2014o; 2015b). The information in this section builds on information provided in the 2012 FEIS, and, in a few instances, replicates the 2012 information with relatively minor changes and updates; other updates include entirely new information or substantially alters existing information.

Specifically, the following information, data, methods, and/or analyses have been substantially updated in this section from the 2012 FEIS:

- The cultural resources section and its subsections have new analyses of locations with indigenous place names to address identified data gaps;
- The affected communities section now includes a discussion of the Nuiqsut Cultural Landscape (Section 3.15.5.1.5) (Brown, 1979; BLM, 2015; Stephen R. Braund & Associates [SRB&A], 2013a);
- Alaska Heritage Resource Survey (AHRS) site and RS 2477[22] trail counts have been updated to account for newly discovered sites since the 2012 FEIS and Project route and design changes; and
- In response to public and agency comments, text has been revised throughout the section, where necessary.

The purpose of this section is to describe cultural resources in the direct and indirect areas of impact for the proposed Project, including surface and subsurface pipelines and ROW, and temporary and permanent ancillary facilities. The impact areas within this NEPA document differ from the proposed Area of Potential Effects within the PA, which are under ongoing development as part of the Section 106 process. As a result of the different Area of Potential Effects (and also the different dates of data acquisition for the AHRS site data), the numbers of cultural resource sites potentially affected and their associated eligibility status differ in some cases from those presented in the PA and AGDC's Cultural Resource Management Plan (CRMP) (AGDC, 2018). The direct impact area consists of the ROW and footprint of proposed Project components where effects may occur. This area includes a 350-foot corridor along the ASAP Mainline and Fairbanks Lateral alignments, a 30-foot buffer of new and improved access roads, and a 90-foot buffer outside all other Project features. The indirect impact area is the 1-mile (1.6 km) geographic area encompassing the ASAP Mainline and Fairbanks Lateral alignments and a 0.5-mile buffer outside new and improved access roads and all other Project features where the character or use of cultural resources could be indirectly altered by the Project through the introduction of visual, auditory, and/or atmospheric effects. One mile broadly encompasses the maximum extent for visual elements that have the potential to diminish the integrity of a cultural resource's significant historic features, particularly in areas of low vegetation and flat topography. Other indirect alterations would typically have the potential to alter the character or use of a cultural resource much closer to the ROW centerline than 1 mile.

Not all areas of the proposed direct and indirect impact areas have been investigated for cultural resources; this section relies on previously documented cultural resources

[22] RS 2477 is found in Section 8 of the Mining Law of 1866 and states, "The right of way for the construction of highways over public lands, not reserved for public uses, is hereby granted." This statute granted states and territories ROWs over federal lands that had no existing reservations or private entries. In Alaska, this law effectively ended in 1969, but due to the time frame in which these ROWs were established (1866-1969), these highways, trails, and other ROWs are considered historical resources and taken into consideration in this SEIS (ADNR, MLW 2013).

(including baseline work conducted for the proposed Project through 2015) for the analysis of impacts. A summary of previous cultural resource survey coverages is presented in Section 3.15.5 for each of the three study regions (North Slope, Interior, and Southcentral). Additional research along the proposed Project would likely result in the documentation of additional cultural resources. This discussion identifies reported cultural resources in the Project Area and the potential for unrecorded cultural resources that may be impacted by the proposed undertaking.

The cultural resources analysis relies on:

- AHRS (reviewed and updated for this SEIS in February of 2017) files located at ADNR, Office of History and Archaeology (OHA) (ADNR, 2017). The AHRS is a database maintained by the ADNR, OHA and is the primary repository for cultural resource site locations in Alaska. The inventory includes objects, structures, buildings, sites, districts, and travel routes, with a general provision that they are over 50 years old. The fundamental use of the AHRS is to record the locations of cultural resource sites so that they may be accounted for in Project planning, and if possible, protected from adverse impacts.
- RS 2477 trail (e.g., public ROW) database maintained by ADNR, Division of Mining, Land and Water (ADNR, Information Resource Management Section, 2016). RS 2477 highways, trails, and other ROWs are considered historical resources.
- NSB (2016) Traditional Land Use Inventory (TLUI) sites. The Iñupiat History Language and Culture (IHLC) created the TLUI database to document place names, landmarks, traditional land use sites, travel routes, and important locations remembered by the Iñupiat. Literature review focused on cultural resources in the proposed Project Area.
- Application of existing laws and regulations regarding the assessment of impacts on cultural resources caused by the proposed Project.
- Results of AGDC-sponsored pedestrian, windshield, and aerial surveys of the proposed Project corridor, including Level I Desktop, Level II Reconnaissance, and Level III Intensive survey levels.
- AGDC's Draft CRMP (AGDC, 2018), which is included as Appendix K, Part II, of this SEIS.

3.15.2. Summary

The proposed Project route may affect multiple types of cultural resources in Alaska. Cultural resources are aspects of the human environment that groups consider culturally important. Cultural resources may include archaeological sites, traditional use areas, travel routes, animals and plants, historic buildings and structures, burials, cultural landscapes, sacred objects, hydrological features, and locations with Native place names. Cultural resources of special concern identified during the NEPA scoping

and NHPA Section 106 consultation processes that may be impacted by the proposed Project include:

- All National Register-eligible and/or listed historic properties, as defined under 36 CFR 800
- Locations with indigenous place names throughout the entire Project
- North Slope Region
  - Gallagher Flint Station National Historic Landmark
  - Galbraith Lake area archaeological sites
- Interior Region
  - Kanuti River area ancestral villages and archaeological sites
  - Rosebud Knob area archaeological sites
  - Bonanza Creek area archaeological sites
- Southcentral Region
  - Montana Creek area ancestral village
  - Fish Creek and Red Shirt Lake area ancestral villages

3.15.3. Federal Regulatory Environment

Under NEPA, federal agencies, "to the fullest extent possible," are to coordinate and conduct studies required by other federal laws and Executive Orders relevant to the proposed Project (43 CFR 1502.25). For cultural resources, these laws and Executive Orders include (National Preservation Institute, 2017; West Virginia Division of Culture and History, 2015):

- Antiquities Act of 1906 (16 U.S.C. 431-433) provides for the protection of historic, prehistoric, and scientific features located on federal lands. It authorizes the President to designate as National Monuments historic and natural resources of national significance located on federally owned or controlled land. The Secretaries of the Interior, Agriculture, and Defense are authorized to issue permits for archaeological investigations on lands under their control to recognized educational and scientific institutions for the purpose of systematically and professionally gathering data of scientific value.
- Historic Sites Act of 1935 (16 U.S.C. 461-467) establishes as a national policy to preservation for public use of historic sites, buildings, and objects. This act led to the eventual establishment within the National Park Service of the Historic Sites Survey, the Historic American Building Survey (HABS), the Historic American Engineering Record (HAER), and the National Historic Landmarks Program.
- National Historic Preservation Act (NHPA) of 1966 (54 U.S.C. 300101 et seq.) sets forth government policy and procedures regarding "historic properties" — that is,

districts, sites, buildings, structures, and objects included in or eligible for the NRHP. Section 106 of NHPA requires that federal agencies consider the effects of their actions on such properties, following regulations issued by the Advisory Council on Historic Preservation (36 CFR 800).

- Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469-469c) amends the 1960 Reservoir Salvage Act by providing for the preservation of significant scientific, prehistoric, historic, and archaeological materials and data that might be lost or destroyed as a result of flooding, the construction of access roads, relocation of railroads and highways, or any other federally funded activity that is associated with the construction of a dam or reservoir.
- Federal Lands Management Policy Act of 1976 (43 U.S.C. 1701-1784) establishes the managing and preserving public lands to protect "the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values."
- American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996) affirms that the federal government will respect and protect the rights of Indian tribes to the free exercise of their traditional religions; the courts have interpreted this as requiring agencies to consider the effects of their actions on traditional religious practices.
- Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-470ll) prohibits the excavation of archeological resources (anything of archeological interest) on federal or Indian lands without a permit from the land manager.
- Abandoned Shipwreck Act of 1987 (43 U.S.C. 2101-2106) asserts U.S. title to abandoned shipwrecks and transfers title to the states.
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 et seq.) requires federal agencies and federally assisted museums to return "Native American cultural items" to the federally recognized Indian tribes or Native Hawaiian groups with which they are associated. NPS regulations are at 43 CFR 10.
- Religious Freedom Restoration Act (42 U.S.C. 21b) states that the federal government will respect and protect the rights of Indian tribes to the free exercise of their traditional religions; the courts have interpreted this as requiring agencies to consider the effects of their actions on traditional religious practices.
- Executive Order 12898, Environmental Justice requires that agencies try to avoid disproportionate and adverse environmental impacts on low-income and minority populations. Impacts may be cultural — for example, impacts on a culturally important religious, subsistence, or social practice.
- Executive Order 13006, Preferential Use of Historic Buildings requires that agencies give priority to using historic buildings in historic districts in central business areas to meet their mission requirements

- Executive Order 13007, Indian Sacred Sites requires that agencies try not to damage "Indian sacred sites" on Federal land and avoid blocking access to such sites by traditional religious practitioners.
- Executive Order 13175, Consultation and Coordination with Indian Tribal Governments, reaffirms the federal government's commitment to tribal sovereignty, self-determination, and self-government. Its purpose is to ensure that all executive departments and agencies consult with Indian tribes and respect tribal sovereignty as they develop policy on issues that impact Indian communities.

The State of Alaska and local governments also have laws and procedures for managing cultural resources. The Alaska Historic Preservation Act of 1971 addresses cultural resources on state land or lands potentially affected by public construction. The state also supports historic preservation at the local level in the form of certified local government programs, which include developing local historic preservation ordinances and plans. Certified local governments along the Project include the North Slope Borough, Fairbanks-North Star Borough, and Matanuska-Susitna Borough.

3.15.4. Public Involvement

Under NEPA, the public has been and continues to be involved through dissemination of draft and final documents, as well as meetings assigned in areas where impacts would occur. Public meetings were held during scoping as well as during the public comment period for the Draft SEIS. These meetings presented a Project overview, regionally specific information, and opportunities for the public to give comment on the record. Adjacent landowners were provided with notices announcing Project details and meetings. Meetings were advertised per USACE's instructions, on the Project website and through newspaper and radio announcements. The Project website continues to be updated with public information and an interactive map viewer is available online for the public to use and inform their comments.

Under NHPA, stakeholders, local Tribes, and local / tribal governments are invited to participate in the process. The lead agency (USACE) organizes consultation with Tribes and stakeholders, just as it did during the FEIS for the draft PA under that process. The Tribes (parties entering consultation with the USACE in government-to-government consultation) and additional consulting parties will be able to comment on the PA, including AGDC's draft CRMP. For additional details regarding Section 106 consultation, see the AGDC's Draft CRMP (AGDC, 2018).

3.15.5. Potentially Affected Communities

The Project Area includes the proposed Project ROW, with 733 miles of new 36-inch-diameter intrastate natural gas transmission pipeline (Mainline), 30-mile, 12-inch pipeline lateral (Fairbanks Lateral), meter stations, Mainline valves (MLVs), pig launcher and/or receiver facilities, and other permanent facilities. Temporary facilities would include construction support facilities such as proposed Project offices, construction

camps, laydown and work pad areas, staging areas, borrow sites, pipe storage areas, fuel storage areas, and access roads.

The proposed Project would cross three ecological regions of the state: the North Slope (approximately MP 0 to 161), the Interior (approximately MP 161 to 568), and Southcentral (approximately MP 568 to 733). The following sections describe the cultural resources within these three regions. These three regions include two major language groups, the Iñupiat and the Athabascans, divided by the Brooks Range, which separates the North Slope from the Interior and Southcentral regions of Alaska. Athabascan language speaking peoples along the route include the Gwich'in, Koyukon, Lower Tanana, Ahtna, and Dena'ina. The Gwich'in, Koyukon, and Lower Tanana speaking peoples live in the Interior, from the Brooks Range to the Alaska Range, and the Ahtna and Dena'ina live south of the Alaska Range in the Matanuska, Susitna, and Copper River valleys.

3.15.5.1. North Slope Region

3.15.5.1.1. Overview of Regional Prehistory (~12,000 Years Ago to 1820s A.D.)

This section summarizes the ancestral cultures of the North Slope Region and Project Area. For a more detailed discussion of the regional and Project Area culture history, refer to the 2012 FEIS. The earliest evidence for human occupation of the North Slope dates to the late Pleistocene and early Holocene around 12,000 years ago (Table 3.15-1). These people were among the earliest migrants into North America from Siberia. As the Holocene era progressed, cultural changes that occurred in the region included the initial appearance of the Northern Archaic tradition at around 7,500 years ago. Archaeological evidence for the Northern Archaic tradition exists throughout the Brooks Range, Arctic foothills, and ACP. The Arctic Small Tool tradition (ASTt) developed on the central Seward Peninsula and spread eastward across the Alaskan Arctic and beyond. ASTt includes the cultures of Denbigh Flint Complex, Choris, Norton, and Ipiutak (Kunz *et al.*, 2003). Approximately 1,600 years ago, evidence of whaling using boats appeared with the Birnirk culture. The Thule culture emerged about 1,000 years ago and is evident in archaeological sites across the North Slope Region, as well as across Canada and Greenland. Thule people are the direct ancestors of the North Slope Iñupiat, who continue to live throughout the region.

Table 3.15-1 Sequence of North Slope Ancestral Cultures

Tradition	Date	Material Culture	Representative Sites
Historic Iñupiat	AD 1826 – present	Stone, metal, trade goods, organic artifacts, plus historic, ethnographic and informant accounts	Bullen Point, Point Hopson, Natvavak
Late Prehistoric (Birnirk, Thule)	2,000 BP – AD 1826	Lithic, wood, leather, bone artifacts, house ruins	Pingok Island, Thetis Island, Niglik, Birnirk, Walakpa, Point Hope, Cape Krusenstern, Nunagiak, Utqiaġvik, Nuwuk
Arctic Small Tool (Denbigh, Choris, Norton, Ipiutak)	4,500 – 1,200 BP	Diminutive lithic microtools, cores, burins, blades	Putuligayuk River, Central Creek Pingo, Onion Portage, Mosquito Lake, Choris, Walakpa, Iyatayet, Point Hope, Coffin, Jack's Last Pingo, HAR-00047, TES-00008, TES-00009, TES-00012
Northern Archaic	6,000 – 3,000 BP	Side-notched points, microblades, bone tools	Putuligayuk River, Kuparuk Pingo, Kurupa Lake, Tuktu
Paleo-Arctic	10,000 – 7,000 BP	Cores and blades, microcores, microtools, bifaces	Putuligayuk River, Jones Pingo, Gallagher Flint Station, Lisburne, Tunalik
Paleoindian	12,000 – 9,800 BP	Extinct fauna, large lanceolate points, bifaces	Mesa, Bedwell, Putu, Hilltop

Sources: Lobdell and Lobdell, 2000; Reanier, 2002; ADNR, OHA, 2017
BP – Before Present (*i.e.*, years ago)

3.15.5.1.2. Overview of Regional History

This section summarizes the history of the region and Project Area. For a more detailed discussion of the regional and Project Area culture history, refer to the 2012 FEIS. Table 3.15-2 provides a synopsis of the regional history. Initial contact between North Slope Iñupiat and Europeans occurred early in the 19th Century with exploration of the Arctic. Contact between the Iñupiat and non-Iñupiaq people dramatically increased with commercial whaling, beginning in 1848. The importance of commercial whaling decreased in the early 20th Century and the influence of other Western activities on Iñupiaq culture increased. Trapping and trading, reindeer herding, missionary work, geological and ethnographic research, and oil and gas development all began near the end of the 19th Century and beginning of 20th Century, some of which continue today.

Table 3.15-2 North Slope Regional History

Time Frame	Historic Theme	Synopsis
1820s-1880s	European/ Euro-American Exploration	• Begins when Captain F.W. Beechey and Sir John Franklin attempted a rendezvous at Point Barrow • Ship crews during this period interact with coastal Iñupiat and document landscape, Iñupiaq people and culture, and name geographic features • Ends with the failed second Franklin Expedition rescue missions
1840s-1900s	Commercial Whaling	• Begins when the first commercial whaling vessel passes through the Bering Strait to the Arctic • Commercial whalers slaughter Arctic whale and walrus populations, introduce venereal disease and epidemics that decimate Iñupiaq population, disrupt indigenous trade networks, establish on-shore whaling stations, and provide an influx of trade goods • Ends when commodities traditionally made from whale oil and baleen lose economic viability to similar products made from petroleum products and other materials (*e.g.*, oil, corsets)
1880s-Present	Ethnographic & Anthropological Research	• Begins with U.S. Army Signal Corps establishing a camp in Barrow to document Iñupiaq culture and other scientific pursuits as part of the first International Polar Expedition • Researchers examine Iñupiaq life and cultural objects, Iñupiaq physical and cultural adaptations for Arctic survival, effects of resource development and cash economy on Iñupiaq culture • Continues today as part of Iñupiaq cultural revival, academic research, and state and federal permitting process
1880s-Present	Military Presence	• Begins when the U.S. Army Signal Corps sets up a scientific station at Pt. Barrow • U.S. Army and Navy personnel explore major North Slope rivers documenting ethnographic, geographic, and travel route information; the military conducts oil and gas exploration of the NPR-A; the Cold War spurs the U.S. military to establish the Distant Early Warning (DEW) line in the 1950s to detect Soviet long-range bombers; end of the Cold War leads to the demobilization and removal of DEW line sites across Alaska • Continues today with increased presence of the U.S. Coast Guard patrolling the Beaufort and Chukchi seas
1890s-Present	Western Religion	• Begins with Sheldon Jackson's arrival and becoming head of education • Missionaries convert Iñupiat to Christianity, build schools and hospitals, help manage reindeer herds, pressure Iñupiat to abandon traditional cultural practices; missionaries eventually singularize efforts to spreading Christianity • Continues today as missionaries seek new converts and multiple denominations continue to establish in North Slope communities

Time Frame	Historic Theme	Synopsis
1890s-Present	Reindeer Herding	• Begins when Sheldon Jackson introduces reindeer herding to the Arctic to provide a stable food source • Incompatibility of reindeer herding with Iñupiaq subsistence practices, competition between Iñupiat and non-Natives, problem-plagued governmental regulations, the checker-boarding of land ownership, and lack of communication between government and academic research and herders contribute to steady decline of reindeer herding on the North Slope (Stern et. al., 1980) • Continues today in some areas of Alaska, but in a greatly reduced form than in the first half of the twentieth century
1890s-1970s	Centralization of Communities	• Begins with schools, post offices, trading posts, and reindeer stations altering Iñupiat settlement patterns through centralization into permanent communities • Kaktovik permanently settled following establishment of trading post by Tom Gordon in 1923 • Anaktuvuk Pass established in 1949 following formation of regular air service, postal office, and a school • Ends with Nuiqsut, Point Lay, and Atqasuk reestablished as permanent communities in the 1970s following passage of ANCSA
1900s-1930s	Trapping and Trading Posts	• Begins with decline in whaling and rising importance of furs as an economic driver • Former whalers such as Charles Brower and Tom Gordon establish trading posts at Barter Island and Demarcation Point. Trading posts, combined with dramatic decreases in the caribou and Iñupiat populations, lure the remaining inland Iñupiat to settle in coastal settlements • Ends when the Great Depression lessens the demand for furs
1900s-Present	Geologic Exploration & Oil and Gas Development	• Begins with Schrader and Peters (1904) and Leffingwell (1919) geologic surveys of the Brooks Range and Canning and Colville Rivers • Early geological exploration leads the way to the creation of the National Petroleum Reserve – Alaska (NPR-A); governmental oil and gas exploration NPR-A eventually leads to private industry investigating areas of the ACP, which leads to the discovery of Prudhoe Bay and construction of the Trans-Alaska Pipeline and Dalton Highway • Exploration continues today with the Greater Mooses Tooth-1 Project and other projects across the North Slope
1930s-Present	Tourism	• Begins with the advent of airplanes and several well-known aviators traveling to Barrow including Charles Lindbergh and Wiley Post in the early 1930s • Continues today in Barrow and other North Slope communities as well as remote areas of the North Slope for hiking, sightseeing, boating, polar bear viewing, and other tourist activities

Sources: BLM, 2015; Chandonnet, 2008; Denfeld, 1994; Ebbley and Joesting, 1943; Haycox, 2009; Leffingwell, 1919; Reanier, 2002; Schneider and Libbey, 1979

3.15.5.1.3. Previously Reported Cultural Resources in the Proposed Project Area – North Slope Region

Previously reported cultural resources in the North Slope Region Project Area include AHRS and TLUI sites, RS 2477 trails, the Nuiqsut Cultural Landscape, and locations with indigenous place names. These sites have been identified through past survey and research projects. AGDC's CRMP provides a detailed breakdown of previous survey coverage for the Project components in the North Slope Region, which are summarized in Table 3.15-3. In total, approximately 48 percent of the Project components in the North Slope Region have undergone pedestrian survey, 1 percent windshield survey, and 19 percent aerial survey, leaving approximately 31 percent of the Project components in the North Slope Region as not surveyed. Of the remaining unsurveyed portions of the Project (2,382 acres), AGDC recommended pedestrian survey for approximately 67 percent, aerial survey at 3 percent, and windshield at less than 1 percent, with no surveys recommended for the remaining 30 percent (AGDC 2017: Appendix F). It should be noted these recommendations do not take into account the recently completed Alaska LNG surveys, which are accounted for in Table 3.15-3, and that may overlap with portions of the proposed Project.

Table 3.15-3 Previous Survey Coverage – North Slope Region

Northern Region	Pedestrian Survey		Windshield Survey		Aerial Survey		No Field Survey		Total[d]
	Acres	%	Acres	%	Acres	%	Acres	%	Acres
Roads[a]	113	18%	28	5%	85	14%	389	63%	614
West Dock and Associated Components	0	0%	0	0%	28	20%	110	79%	140
Storage and Material Sites[b]	633	23%	6	0.2%	420	15%	1,742	62%	2,799
Mainline	3,003	73%	74	2%	978	24%	42	1%	4,097
Other[c]	6	6%	1	1%	1	1%	101	95%	106
Total	3,754	48%	108	1%	1,511	19%	2,382	31%	7,755

a Includes access roads, bridges, existing road upgrades, and ice access roads
b Includes camps, facility pads, material sources, pipe storage, temp workspaces
c Includes dredge disposal, stream crossings, TAPS ROW, vertical support members
dTotal survey acres based on CRMP (AGDC, 2018); individual columns do not always accurately sum to total column as presented in CRMP due to rounding.

3.15.5.1.3.1. AHRS Sites and Trails, TLUI Sites, and RS 2477 Trails

There are 47 previously-reported AHRS sites (including AHRS trails) in the direct impact area (Table 3.15-4) and 124 previously-reported AHRS sites outside of the direct impact area, but within the 1 mile (1.6 km) indirect impact area (Appendix K, Part I, Table T-1) (Figure 3.15-1). There are also three TLUI sites in the indirect impact area (NSB, 2016). The three TLUI sites do not appear on maps in this section and are only listed generically in tables for counting purposes at the request of the NSB. There are four linear transportation features with AHRS numbers (one of the four has two AHRS

numbers) intersecting the direct impact area, with one of these trails (Hickel Highway) also having an RS 2477 designation (Table 3.15-4, Table 3.15-5, Figure 3.15-1). The sites in the direct impact area are primarily prehistoric, with two paleontological sites, and four historic sites that include the Dalton and Hickel highways. Included in the prehistoric are lithic scatters, isolated flakes, and faunal remains. Within the direct analysis area, the State Historic Preservation Officer (SHPO) and associated public agencies have determined that 18 of the sites are eligible for the NRHP; two are treated as eligible under a PA; 17 are not eligible; seven have pending consultation; and three have not had determinations of eligibility. One site, the Gallagher Flint Station Archaeological Site, is listed as a National Historic Landmark.

Table 3.15-4 AHRS Sites in the Direct Impact Area – North Slope Region

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
PSM-00080	PSM-00080	Prehistoric	Lithics, Tent ring	DREJ-S	
PSM-00011	PSM-00011	Prehistoric		DREJ-S	
PSM-00076	ATIGUN II	Prehistoric	Flake fragments, Bone fragments, Surface finds	DOE-S	
PSM-00075	ATIGUN III (BRIDGE SITE)	Prehistoric	Lithic flakes, Bone fragments	DOE-S	
PSM-00049	MOSQUITO LAKE ARCHAEOLOGICAL SITE	Prehistoric	Activity areas, Lithics, Tools, Rock rings	DOE-S	NRXCL
PSM-00199	PSM-00199	Prehistoric	Faunal remains, FCR, Charcoal, Lithics	DOE-P-S	
PSM-00059	Fourth of July Kame	Prehistoric	Animal bones, Lithic flakes	DOE-P-S	
PSM-00577	PSM-00577	Prehistoric	Lithic fragments	DREJ-S	
PSM-00582	PSM-00582	Prehistoric	Lithic scatter		
PSM-00588	PSM-00588	Prehistoric	Lithic scatter, Projectile point	DOE-S	
PSM-00479	PSM-00479	Prehistoric	Isolated find, Lithic, Flake, Pressure, Grey	DREJ-S*	
PSM-00456	PSM-00456	Prehistoric	Isolate, Tci-tho	DREJ-S	
SAG-00106	SAG-00106	Prehistoric	Cache	DREJ-S	
PSM-00596	PSM-00596	Prehistoric	Isolated find, Prehistoric lithic artifact assemblage	DOE-S	
PSM-00477	PSM-00477	Prehistoric	Lithic scatter, Flakes, Chert, Prehistoric	DREJ-S	
PSM-00172	PSM-00172	Prehistoric	Lithic scatter	DOE-P-S	
PSM-00192	PSM-00192	Prehistoric	Activity area, Lithics, Faunal remains	DOE-S	

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
PSM-00050	[NATREG] GALLAGHER FLINT STATION ARCHEOLOGICAL SITE [AHRS] GALLAGHER FLINT STATION ARCHAEOLOGICAL SITE	Prehistoric	Activity Area, Lithics, Pottery, Bone	DOE-S	NHL
PSM-00197	PSM-00197	Prehistoric	Prehistoric lithic scatter	DOE-S	
PSM-00498	PSM-00498	Prehistoric	Lithic remains, Flakes, Blades, Microblades	DOE-S	
PSM-00500	PSM-00500	Prehistoric	Lithic scatter, Flakes, Chert	DOE-P-S	
PSM-00501	PSM-00501	Prehistoric	Isolated find, Lithic, Flake, Chert	DOE-S	
PSM-00572	PSM-00572	Prehistoric	Lithic scatter, Prehistoric	DOE-S	
PSM-00573	PSM-00573	Prehistoric	Lithic scatter	DOE-S	
PSM-00576	PSM-00576	Prehistoric	Lithic scatter	DREJ-S	
PSM-00578	PSM-00578	Prehistoric	Lithic scatter	DOE-S	
PSM-00584	PSM-00584 (Atigutim Nullagvia)	Prehistoric	Lithic scatter	DREJ-S	
PSM-00579	PSM-00579	Prehistoric	Lithic scatter	DREJ-S	
PSM-00607	PSM-00607	Prehistoric	lithic scatter, Flake tool	DOE-S	
PSM-00597	PSM-00597	Prehistoric	lithic isolated find	DOE-P-S	
PSM-00574	PSM-00574	Prehistoric	Lithic isolate	DREJ-S	
PSM-00606	PSM-00606	Prehistoric	Prehistoric	DOE-P-S	
PSM-00605	PSM-00605	Prehistoric	Isolated find	DOE-S	
PSM-00600	PSM-00600	Prehistoric	Lithic scatter	DREJ-S	
PSM-00499	PSM-00499	Prehistoric	Lithic remains, Flakes, Obsidian, Chert	DOE-P-S	
PSM-00603	PSM-00603	Prehistoric	Lithic scatter, Prehistoric	DREJ-S	
PSM-00580	PSM-00580	Prehistoric	Lithic scatter	DREJ-S	
SAG-00109	SAG-00109	Prehistoric	Lithic scatter, FCR, bone fragment, long chert fragment	DOE-S*	
PSM-00604	PSM-00604	Prehistoric	Lithic scatter, Gray chert biface fragment	DOE-S	
PSM-00601	PSM-00601	Prehistoric	Lithic scatter	DOE-S	
PSM-00609	PALEONTOLOGICAL SITE	Paleontological	Paleontological site	DREJ-S*	
SAG-00060	PA, 963	Paleontological	Paleontological Site	DREJ-S*	
SAG-00097	DALTON HWY (MP 1 TO 414)	Historic	Highway	Treated as Eligible	

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
PSM-00570	DALTON HWY (MP 1 TO 414)	Historic	Highway	Treated as Eligible	
SAG-00098	HICKEL HIGHWAY	Historic	Transportation, Winter road		
XBP-00128	OIL EXPLORATION ROAD	Historic, Modern	Road	DREJ-S	
SAG-00076	SAG-00076		Isolate, Wood		

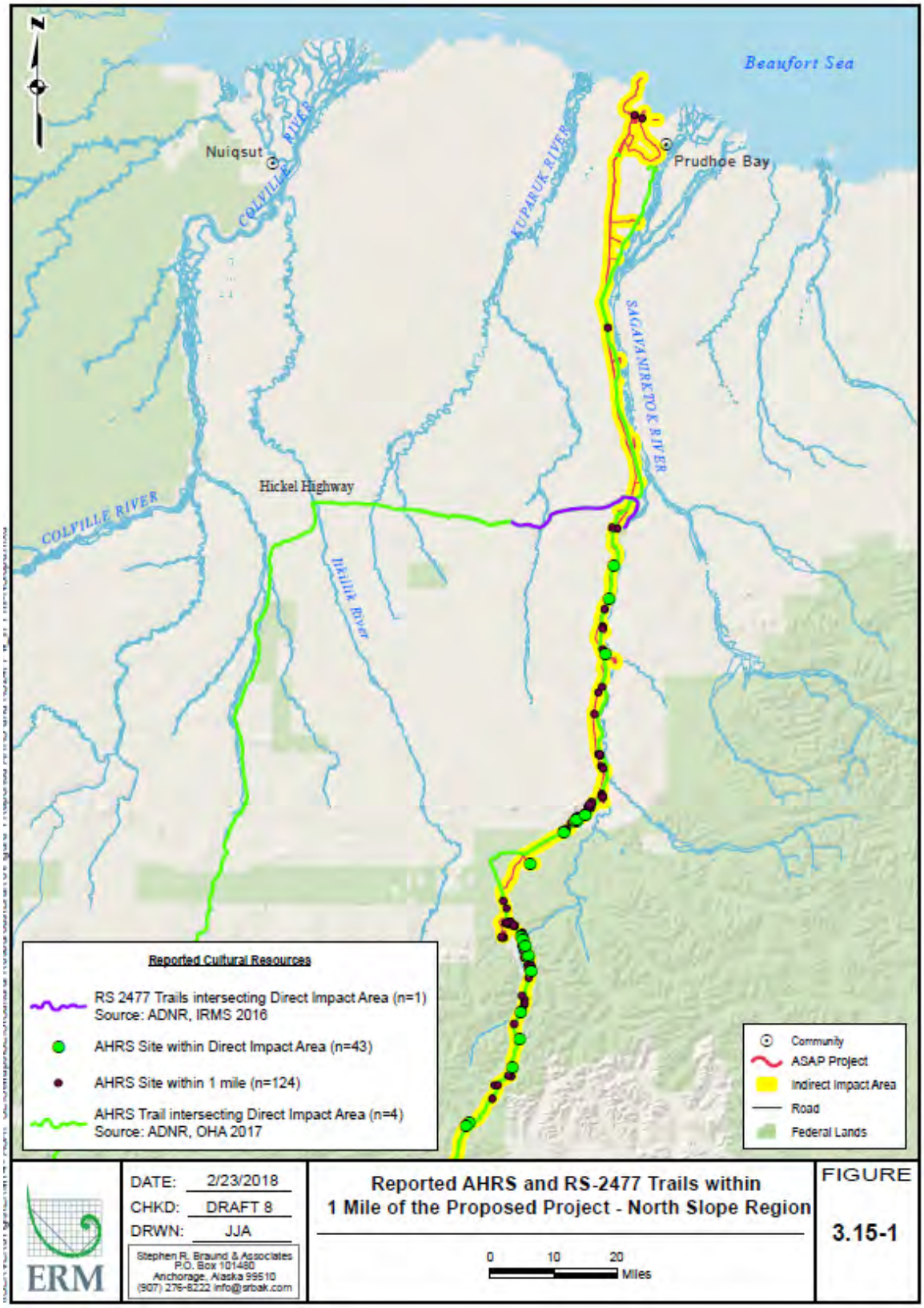
Source: ADNR, OHA, 2017
All data are verbatim from source.
DOE-P-S = Property pending consultation between SHPO and public agency representatives regarding eligibility for NHR.
DOE-S = Property determined eligible for NHR by SHPO and public agency.
DREJ-S = Property determined not eligible for NHR by SHPO and public agency.
NHL = Property listed on the NHR and designated a National Historic Landmark.
NRXCL = Nomination file inactive
*Indicates recommendation by agency; SHPO has not yet reviewed

Table 3.15-5 RS 2477 Trails Intersecting the Direct Impact Area – North Slope Region

Trail ID	Trail Name
RST-450	Hickel Highway

Source: ADNR IRMS, 2016
All data are verbatim from sources

Figure 3.15-1 Reported AHRS and RS-2477 Trails within 1 Mile of the Proposed Project – North Slope Region



3.15.5.1.3.2. Nuiqsut Cultural Landscape

According to NPS's Guide to Cultural Landscape Reports, cultural landscapes are "a geographic area, including both cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, activity, or person, or that exhibit other cultural or aesthetic values" (Page *et al.*, 1998:12). The Nuiqsut Cultural Landscape, reported by the Iñupiaq Village of Nuiqsut and documented by Brown (1979), is a cultural resource that encompasses a large portion of the North Slope Region of the proposed Project's direct and indirect impact areas (Figure 3.15-2) and was not included in the 2012 FEIS. During the late 1970s, Brown (1979; 2001) worked with the Village of Nuiqsut to document this landscape described as an "approximation of their core ideas" and representing their "geographic and spiritual homeland." According to Brown (1979), the Nuiqsut Cultural Landscape has multiple defining characteristics. These characteristics include (Brown, 1979:9):

- TLUI sites;
- Area of current (*e.g.*, 1970s) intensive subsistence use;
- Area of historical extended use; and
- Aboriginal trade routes.

Regarding the importance of this cultural landscape, Brown (1979:12) stated:

> *The Nuiqsut Cultural Landscape is the territory established by ancestors and passed-on by today's families to those of tomorrow. It is a complicated geography that can be shown on a map only if the boundary is a shifting horizon. It is a composite of places and events that people have directly experienced or heard about in songs and stories passed down through generations. Here, in this landscape - recalled in memory culture - is the history, the knowledge, the spirit of thousands of years of Iñupiat experience.*

SRB&A (2013a) reviewed the Nuiqsut Cultural Landscape to incorporate new information that contributes to the cultural landscape since Brown's 1979 work. SRB&A (2013a) assessed these characteristics using current documentation standards for cultural landscapes reported in Page *et al.,* (1998). SRB&A chose the following document standards terminology as the equivalent of Brown's landscape characteristics:

- Cultural sites;
- Cultural traditions;
- Land use; and
- Circulation.

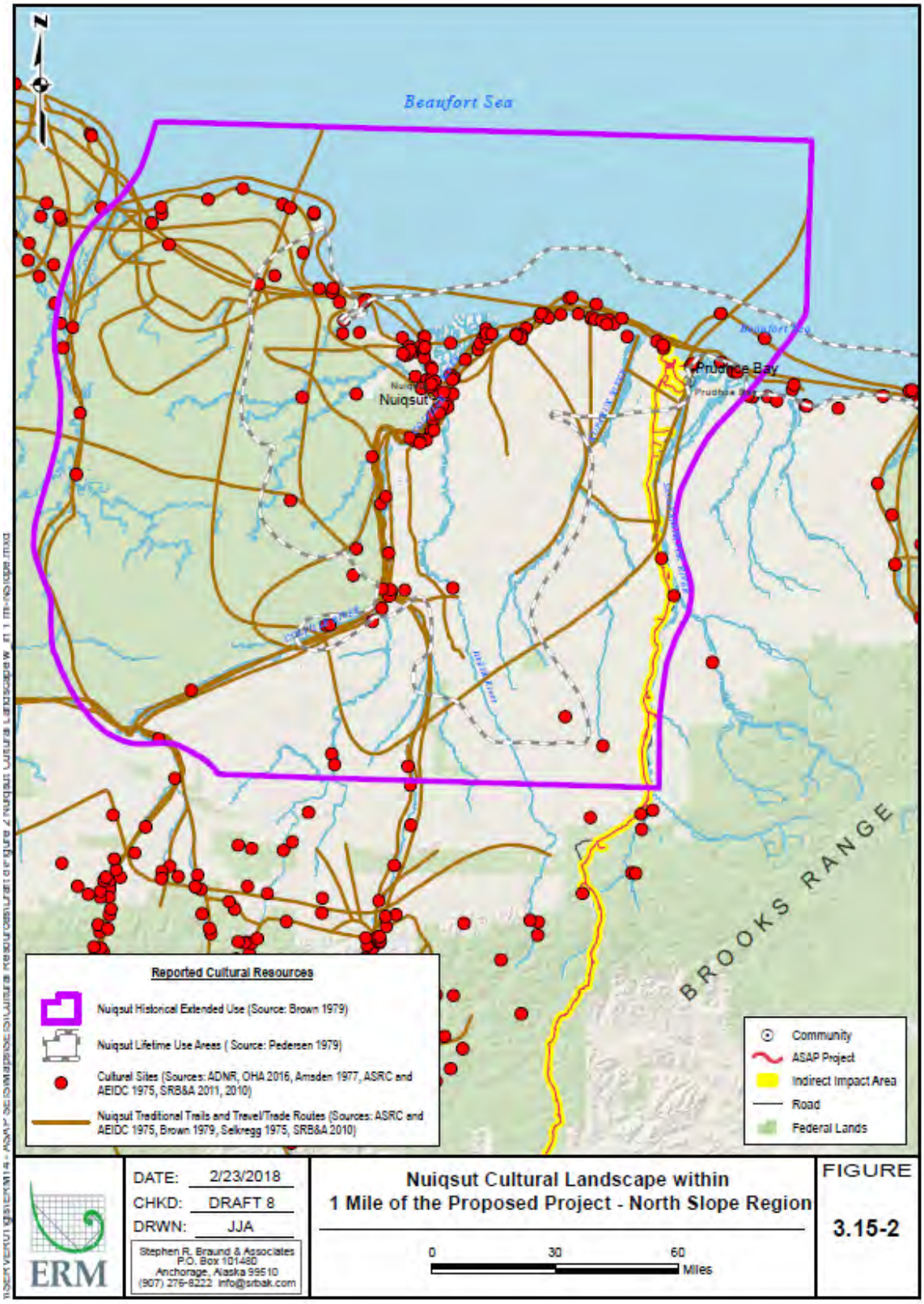
SRB&A (2013a) also added "Natural Systems and Features" as they are integral in defining the other landscape characteristics. Land use includes both historic territories and historic use areas. Circulation features show the historical continuity of movement throughout the landscape by the Iñupiat. Natural systems and features (*e.g.*, rivers,

bluffs, pingos, and wildlife) provide the setting in which cultural activities take place and heavily influence the characteristics of a cultural landscape.

Cultural sites consist of locations defined by one or more of the following descriptors: archaeological, ancestral, historic, traditional, sacred, camp, cabin, birthplace, harvest, and subsistence. In addition to AHRS sites, the cultural sites of the Nuiqsut Cultural Landscape come from oral histories, ethnographic mapping interviews, historical reports, and older archaeological reports whose results were not entered into the AHRS databases. As mentioned above, TLUI data associated with the landscape are not discussed in detail at the request of the NSB; however, six TLUI sites are located within the cultural landscape boundary. Cultural traditions, such as subsistence, passing of indigenous knowledge, trade, and oral histories/storytelling, that occur across the landscape are just as integral to community identity as are the locations in which they take place. Limitations of the non-AHRS data associated with the cultural landscape are that they may include duplicate features documented within or by other studies. Because efforts were not made to reconcile duplicate features within and between data sources, counts of these features are not included in this affected environment. However, these sources provide additional details and context regarding cultural resource sites in the Project Area that are not available in the AHRS and TLUI databases, and the cultural landscape as a whole is addressed in the environmental consequences analysis.

The cultural resources that comprise the Nuiqsut Cultural Landscape are primarily located west of the proposed Project. The Nuiqsut Cultural Landscape characteristics within the direct and indirect impact areas of the proposed Project are focused along the Sagavanirktok River Valley (Figure 3.15-2), one of the major circulation features of the cultural landscape (SRB&A, 2013a). Hall *et al.* (1985) and Wickwire *et al.* (1975) provide some of the most detailed historical ethnographic evidence of use of the Sagavanirktok River as a year-round travel route and ancestral hunting and trapping area. These Sagavanirktok River area characteristics include Iñupiaq cultural sites, trails, travel/trade routes, and other cultural features within the landscape that are associated with ongoing multi-generational customary practices, which generally occur in similar locations as past historic or traditional practices. The Iñupiat and their ancestors have used the Sagavanirktok River since time immemorial. The continuation of these customary practices into current times and at modern sites within the landscape help maintains the Iñupiaq cultural identity and ties to the cultural landscape.

Figure 3.15-2 Nuiqsut Cultural Landscape within 1 Mile of the Proposed Project – North Slope Region



3.15.5.1.3.3. Indigenous Place Names

Indigenous place names are the manifestation of a systematic approach to mapping a group's environment. Place names can provide information about natural and social environments as well as about human populations and their histories. Place names also provide insights into a culture's worldview and its perceptions of features of the environments it inhabits. Place names are a key component for identifying cultural resources in an area, as well as for establishing territorial range and means of travel throughout a traditional territory (Kari, 2006).

Iñupiaq and Northern Athabascan place names have similar analyzable structures in that their place names are generally binomial in structure, consisting of generic and specific terms (Kari, 1996; Müller-Wille, 1990). Generic terms describe the geographic aspect of the name (*e.g.,* canyon, river, lake, ridge) and specific terms modify the generic term by emphasizing "shape and form" (*e.g.,* small, little, big, large, short) and "character" (*e.g.,* locational, situational) (Kari and Fall, 2003; Müller-Wille, 1990). Unlike Northern Athabascan place names, Iñupiaq place names can change over time (Burch, 1981; Kari and Fall, 2003). For the Iñupiat, "[n]ames are given to previously unnamed features, old names fall into disuse and are forgotten, and new names replace earlier ones," whereas for Northern Athabascans "places with forgotten names are left unnamed. New names are never coined by individuals, and Dena'ina [and other Northern Athabascan] places are almost never named after people" (Kari and Fall, 2003).

To assess possible impacts from the proposed Project to locations with indigenous place names in the direct and indirect impact areas, the following methods were used and were based on direction and input received during Section 106 consultation meetings associated with the proposed Project:

- Compile – Reviewed existing sources (*e.g.,* reports, literature, oral histories, Native language dictionaries, and archival materials) to compile indigenous place names near the proposed Project.
- Classify – Kari and Fall's (2003:40-41) semantic classification system assigns each indigenous place name into one of 17 categories based on what the place name is signifying (*e.g.,* customary activities, animals, hydrology) (Table 3.15-6). For the most part, Iñupiaq and Northern Athabascan have "clear, analyzable meanings," although classification can sometimes be a "judgement call" (Kari and Fall, 2003; Müller-Wille, 1990). In addition, place name locations were classified by geographic feature (Uplands, Lowlands, Marine, Riverine, Lacustrine, and Community) (Table 3.15-7).
- Catalog – Used a spreadsheet to record identified place names and their classification by region, which is linked to a geodatabase containing the spatial location of each place names for use in mapping place names (see below). This catalog is provided as Appendix K, Part I (see Tables T-2, T-4, and T-6).
- Map – Used existing place name maps, geodatabases, and locations described in text to produce maps for this SEIS. Place names are frequently identified on maps as

points, even though the place name may represent creeks, rivers, lakes, ancestral and modern village sites, resource locations, mountain range, or another large natural feature that extends for some distance. To capture locations with indigenous place names within the direct and indirect impact areas, a 5-mile (8-km) study area was used to identify geographic features and other locations that may intersect the impact areas whose identifying points were outside of the direct and indirect impact areas.

In the North Slope Region, there are 25 individual locations with Iñupiaq place names, and two cluster areas with nine place names (Figure 3.15-3; Appendix K, Part I, Table T-2). Place name clusters represent groups of geographic features that share a specific term (*e.g.,* Atiġun, Piŋaluum), but have different generic terms (*e.g.,* river, gorge, pass) (Kari, 2006). Place name clusters usually have an "anchoring" geographic feature with other features around it (Kari, 1998). An example of this on the North Slope is the Atiġun "something that is below" (Simon Paneak Museum, 2001) place name cluster, which is anchored by the Atiġun River. Other generic terms in the Atiġun cluster include pass, gorge, two camping areas, and a small stream, which all share the specific term "Atiġun." Overall, the two clusters and 25 individual locations with Iñupiaq place names in the North Slope Region describe aspects of material culture, hydrology, people, animals, fish, and customary activities, and terrain and geology (Appendix K, Part I, Table T-2).

Table 3.15-6 Indigenous Place Name Categories and Description

Place Name Category (Kari & Fall, 2003)	Description	Example
Natural History		
Animals	Places named after wildlife, their behavior, or the harvesting of them (Kari, 1989; Kari and Fall, 2003)	• *That'intnu* 'Otter Creek' - first creek above Kroto Creek on west bank (Kari and Fall, 2003) • *Dets'eni Trona' Mena'* 'Duck Shit Lake' - lake south of Minto Lake (Kari, 2012)
Fish	Places whose importance is derived from fish, their behavior, or the harvesting of them (Simeone & Kari, 2005:22-23)	• *Hwnic'ilaex Na'* 'End of Fish Run Stream' -lower Cantwell Creek, locally "Sinyon Creek" (Kari, 2008) • *Nik'uleht* 'Place that Fish Swim to' - a sockeye spawning location along a gravel beach on upper Red Shirt Lake, possibly bay on northwest end of lake (Kari and Fall, 2003)
Vegetation	Places named after vegetation present or the harvesting of the vegetation	• *K'echan Yela* 'Grass Mountain' - hill without trees, above *Tuch'etl'ghi'ut,* possibly hill 1,007' feet north of bridge on Parks Highway (Kari and Fall, 2003) • *Q'is Kaq'* 'Birchbark Mouth' -mouth of 196 Mile Creek or Grey's Creek (Kari and Fall, 2003)
Insects	Places where insects are a defining characteristic or the landform or hydrological feature resembles an insect in some way	• *Ywsr Kan'* 'bug den' – Grandma Hill (Kari, 2012) • *Tokodroya' Mena'* 'Spider Lake' – West Lake at New Minto (Kari, 2012)

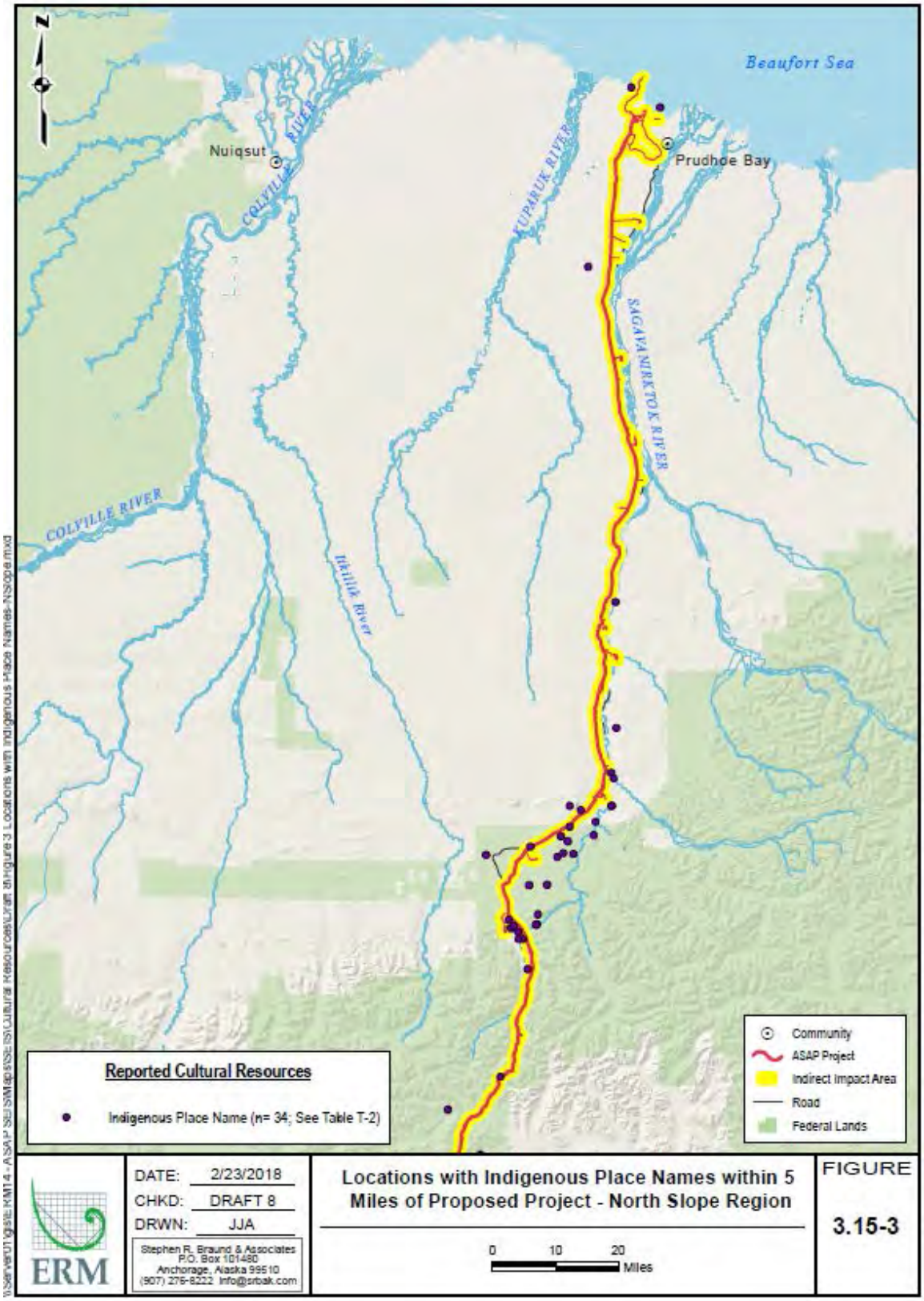
Place Name Category (Kari & Fall, 2003)	Description	Example
Hydrology	Refers to rivers, streams, lakes, and other water bodies and their associated features (Kari, 1989, 1996)	• *Łinghasdlent* 'Where Streams Join' - "The Forks," area at confluence of Chulitna and Talkeetna rivers with the Susitna River (Kari and Fall, 2003) • *Ben Taydlentnu* 'Lake Where Current Is-Stream' - stream flowing into Trapper lake from Rocky Lakes (Kari and Fall, 2003)
Terrain & Geology	"lumps together names that range from being graphic and descriptive of a landform to being metaphoric and/or abstract" (Kari and Fall, 2003)	• *Tuqashi* 'objects that fall in water' (Kari and Fall, 2003) • *K'esugi* 'the ancient one' (Kari and Fall, 2003)
Weather	Indicates unique or significant weather associated with location	• *Łch'ibay Ka'a* 'Big Whirlwind' - possibly mountain 4,680' up Coal Creek (Kari and Fall, 2003) • *Nokhwltonh No' Dochaget* 'Bad Weather Stream Mouth' - mouth of Rotten Slough at Little Gold stream (Kari, 2012)
Direction	Indicates "a specific point, a general area, or a direction to or from a point" (Kari, 1985:472)	• *Dun'e* 'Intermediate Distance Upstream' -the middle Susitna River area, from above Yentna River to Talkeetna River (Kari and Fall, 2003) • *Troth Ghotthit, Troth Yeddha' Ghotthit, Troth Tthit* 'Toward the Water from Indian Potato' - Geist-Fairbanks Road area (Kari, 2012)
Human Activities		
Material Culture	Places that "refer to man-made products including structures and implements" (Kari and Fall, 2003)	• *Hchił Nughik'at* 'Weir Fence is Stretched Down' - Weir site at *Tanłtunt* (Kari and Fall, 2003) • *Łiq'a Hq'atnelt* 'Where Salmon Are Poured' - fish holding pit on bank of *Tanłtunt* (Kari and Fall, 2003)
Foods	Places that "refer to the critical food resources such as salmon, ground squirrel, and caribou." (Kari, 1989:142)	• *Troth Yeddha' Khwn'a, Troth Yetth No', Troth Tthit Khwn'a* 'Indian Potato Ridge Stream Bed' - probably small stream formerly at east end of *Troth Yeddha'*. Probably the outlet of the pond 729 formerly at southeast end of ridge (Kari, 2012) • *Gaał Doh* 'king salmon downstream' - king salmon site at Woodyard (Kari and Raboff, 2011)
Trails	Places referring to "points traversed" or landforms and hydrological features that facilitate travel like streams and passes (Kari, 1989)	• *Yidateni Deghilaaye'* 'Jaw Trail Mountain' - mountains on either side of upper Jack River " (Kari, 2008) • *Kantistaan Na'* 'Trails Ascend Creek' - Windy Creek (Kari, 2008)
Customary Activities	Places whose "names that refer to recurrent activities" or "a resource harvest activity" (Kari and Fall, 2003)	• *Dach'qelqiht* 'Where We Spend the Spring' (Kari and Fall, 2003) • *Nutsahdnghitses* 'Rocks Dammed Across' (Kari and Fall, 2003)
Significant Human Events	Places whose "names appear to derive from a single incident" (Kari and Fall, 2003)	• *Tununiłch'ulyutnu* 'River Where People Killed Each Other in Water' (Kari and Fall, 2003)
Historic Events or Activities	Refers to ancestral and historic "customary or single events" at named places (Kari, 1986, 1989; Kari and Fall, 2003)	• *Qak'ighatnikt* 'Where Glass Pitched a Tent' "said to refer to the first white man, an American, to ascend the Susitna River (Kari and Fall, 2003)

Place Name Category (Kari & Fall, 2003)	Description	Example
Others		
Mythological Events	Places with an "overt reference to mythological events" (Kari and Fall, 2003)	• *Nduk'eyux Dghil'u*, 'Mountain Which Animals Enter' (Kari, 1989)
Unanalyzable	Names that "do not contain recognizable stems or verb forms, and expert speakers such as Shem Pete tended not to give meanings for them" (Kari and Fall, 2003)	• *K'ich'atnu* or *K'enakanen* (Kari and Fall, 2003)
Class Not Clear	Places whose classification is unclear from meaning	
Non Kari and Fall, 2003 Categories		
People	Places named after people (Kari and Fall, 2003)	• *Dghełtayi Betnu* 'Creek of the One That is Strong' (Jim Creek) (Kari and Fall, 2003) • *Delindin Bena* "based on Shem Pete's Russian name" (Delyndia Lake) (Kari and Fall, 2003)
Religious	Places whose religious associations are generally "covert and require some explanation" to "outsides" (Kari, 1989)	• *Ch'chihi Ken* 'Ridge Where We Cry' (Kari, 1989; Kari and Fall, 2003)
Non-Traditional	Places whose "names that have been recorded or suggested in the historic period which are not true oral place names" (Kari and Fall, 2003)	• *Tsaani Na'* 'Brown Bear Creek' - Tsaani Creek, formerly Squaw Creek • *Nuk'dalyut* 'Where a Bridge Extends Across' - bridge across upper Soup Creek (Kari and Fall, 2003)

Table 3.15-7 Indigenous Place Name Geographic Feature Classification

Geographic Feature	Description
Uplands	Elevated landforms such as hills, bluffs, mountains, peaks, ridges, spires
Lowlands	Low lying areas such as valleys, flats, and floodplains
Marine	Oceanic features such as bays, inlets, islands, and coasts
Riverine	Flowing water such as rivers and streams, and associated features such as banks, confluences, mouths, islands, and rapids
Lacustrine	Non-flowing waters such as lakes and marshes and their associated features such as shores and islands
Community	Town and village sites

Figure 3.15-3 Locations with Indigenous Place Names within 5 Miles of Proposed Project – North Slope Region



3.15.5.2. Interior Region

3.15.5.2.1. Overview of Regional Prehistory (12,000 Years Ago to 1830 A.D.)

This section summarizes the ancestral cultures of the Interior Region and Project Area. For a more detailed discussion of the regional and Project Area culture history, refer to the 2012 FEIS. Archaeologists have divided the prehistory of the Interior Region of Alaska into distinct time periods (*e.g.,* Beringia, Transitional, and Taiga), each with associated cultural traditions (Holmes, 2008). The period prior to 13,000 years ago is termed the Beringian period, when the region was still separated from the rest of North America by glaciers, but connected to Siberia via Beringia, a vast plain later inundated to become the Bering Sea (Holmes, 2001). The Younger Dryas climate event separated the Beringian from the Transitional period (13,000 to 9,500 years ago) and brought subsequent changes in climate and geography to the region. Two distinct cultural traditions from the Transitional Period include the end of the East Beringian Tradition and the American Paleo-Arctic or Denali Complex (Table 3.15-8). For the Holocene period, Holmes (2008) proposes a Taiga period with three chronological divisions: Early (9,500 to 6,000 years ago), Middle (6,000 to 3,000 years ago), and Late (3,000 years ago to contact). The Early Taiga period is characterized by the Transitional Northern Archaic Tradition. The Middle Taiga period is considered the ascendance of the Northern Archaic Tradition, marked by the presence of notched base points and associated with the spread of the boreal forest habitat. The Late Taiga period includes the florescence of the Athabascan Tradition at approximately 1,300 years ago (800 A.D.). At the time of historic contact with Euro-Americans, Koyukon and Tanana-speaking Athabascan groups occupied the interior regions of Alaska located closest to the proposed Project Area.

Table 3.15-8 Sequence of Interior Ancestral Cultures

Period	Tradition	Subdivision		Material Culture	Representative Sites
Late Taiga Period (3,000-Historic)	Athabascan (1,300 BP–Historic)	--		Lithics replaced by organic and copper tools; Bow and arrow replaces atlatl	Gulkana, Dixthada
Middle Taiga Period (6,000-3,000 BP)	Northern Archaic (1,300–6,000 BP)	--		Early period notched base points, later stemmed and oblanceolate points, few to no microblades	XMH-00035, -166,-219; Dry Creek Paleosol 4a; Swan Point CZ 1b; Kenai River SEW-214; Graveyard
Early Tiaga Period (9,500-6,000 BP)	Transitional Northern Archaic (6,000–8,500 BP)	--		Microblades decline; notched base points appear	Swan Point CZ2, Annie Lake, Canyon, Owl Ridge Component III
	American Paleo-Arctic	Denali		Wedge shaped microblade cores,	Campus Site, Donnelly Ridge, Swan Point

Period	Tradition	Subdivision		Material Culture	Representative Sites
Transitional Period (13,000-9,500 BP)	(11,500–8,500 BP)			burins, end scrapers, bifaces	CZ3, Owl Ridge Component II,
Beringian Period (Prior to 13,000 BP)	East Beringian Tradition (Prior to 11,500 BP)	Chindadn, Nenana		Teardrop shaped bifacial tools, triangular tools; microblades absent	Owl Ridge Component I, Walker Road Component I
		Swan Point, Dyuktai		Microblades, burins	Swan Point CZ4

Sources: Holmes 2001, 2008; Peregrine and Ember 2001
BP – Before Present (*i.e.,* years ago)

3.15.5.2.2. Overview of Regional History

This section summarizes the history of the Interior Region and Project Area. For a more detailed discussion of the regional and Project Area culture history, refer to the 2012 FEIS. Table 3.15-9 provides a synopsis of the regional Interior history. Major historical themes for Alaska's Interior include Fur Trade, Western Religion, Gold Rush, Military Presence, Native Relations, Transportation, and Land Claims. Contact with Interior Athabascans occurred in the early 19th Century with European fur traders who made their way into the Interior via the Yukon River. Fur traders were shortly followed by various Christian missionaries and priests. A large influx of people came to the Interior with the Gold Rush at the end of the 19th Century. Military explorations also had their beginnings in the late 1880s. The 20th Century brought additional military activities in the form of highway construction and Cold War facilities. Other major themes for the 1900s included enhanced transportation networks, formation of several Native organizations and legislative acts centered on Native relations with the state and federal governments, and major land claim acts following statehood (ANCSA) and the ANILCA.

Table 3.15-9 Alaska Interior History Synopsis

Time Frame	Historic Theme	Synopsis
1830s-1880s	Fur Trade	• Begins with the Russian-American Company (RAC) attempts to extend into the Yukon Valley in 1834 with a major post on the lower Yukon River at Mikhailovskiy Redoubt (St. Michael). • In 1847, the Hudson's Bay Company establishes Fort Yukon on the upper Yukon River. The RAC sold its business to the Alaska Commercial Company (ACC) in 1867, the same year the United States purchased Alaska from Russia. In 1869, steamboats were introduced to help expedite the delivery of furs from the field. • By 1883, the ACC was able to create a monopoly, which lowered the going price for furs trapped by Natives.
1840s-Present	Western Religion	• Begins in 1844, Russian Orthodox priests begin proselytizing on the Yukon River. • Following the Alaska purchase from Russia in 1867, the Roman Catholic Church and Anglican Church began sending missionaries to Alaska. Between 1887 and 1929, several missions and boarding schools were constructed including those in Nulato, Tanana, Allakaket, Nenana, Chena, Salchaket,

Time Frame	Historic Theme	Synopsis
		Tanacross, and Minto, which were used to integrate Native children into Western culture. • Continues today with multiple denominations established in Interior Alaska communities.
1880s-1910s	Gold Rush	• Gold was discovered in Stewart River in Yukon Territory in 1885, at Fortymile River near the U.S.-Canadian border in 1886, and at Circle City on Birch Creek in 1893. • By 1901, gold had been discovered in Fairbanks and the Tanana regions; by 1909, Fairbanks was the second largest city in Alaska. • Between 1910 and 1913, more gold strikes were made attracting more people to the Fairbanks area.
1880s-1960s	Military Presence	• In 1885, Lieutenant Allen explored many major Alaskan river drainages including the Yukon and Tanana rivers. • In 1942, the military completed the construction of the Alaska Highway, terminating in Delta Junction, Alaska with several airfields built alongside some portions of the highway. • In the 1950s and 1960s of the Cold War, the military expanded along the Yukon River with air bases, radar bases, and communication stations including the DEW Line and White Alice Communications System.
1910s-1970s	Native Relations	• Tanana Chiefs' Conference was established in 1915 to address ways to mitigate Western encroachment on Native lands. • In the 1930s, the Bureau of Indian Affairs (BIA) took control of Native education from the church. • In 1967, the Alaska Federation of Natives was formed to pressure the federal government to consider their claims to Native lands laid out by the 1967 Treaty of Cession. • The ANCSA was passed in 1971, which created 12 Alaska Native Village Corporations and the return of 44 million acres of land to these entities.
1920s-1970s	Trans-portation	• The Alaska Railroad was completed in 1923 connecting Seward with Fairbanks. • The Tok Cut-off was constructed in the 1950s to bypass Delta Junction for traffic coming from the Alaska Highway heading to Valdez. • In 1969, the Hickel Highway was constructed, being the first ice road to lead to the North Slope to help bring in goods and allow for further oil exploration and development. • In 1974, the Dalton Highway was constructed as a supply road for the Trans-Alaska Pipeline System.
1950s-1980s	Land Claims	• Alaska Statehood Act of 1958 allowed the soon-to-be-formed state to select lands from federal landholdings. • The ANILCA was formed in 1980 to protect 157 million acres of land, setting some aside as parklands. • Yukon Flats and Kanuti NWR are created in 1980.

Sources: Abercrombie and Glenn, 1899; Allan, 2009; Argonne National Laboratories, 2001; Bockstoce, 2009; Borneman 2007; Chernenko, 1967; Clark 1981; Dall, 1898; Downs, 1992; Ferguson 2005; Haynes and Simeone 2007; Hosley 1981; Paul, 2007; McKennan 1959; Mishler and Simeone, 2004; Neely 2003; Reynolds 1988; Simeone 1995; Slobodin 1981; Thomas, 2005; VanStone, 1974 and 1978

3.15.5.2.3. Previously Reported Cultural Resources in the Proposed Project Area – Interior Region

Previously reported cultural resources in the Interior Region Project Area include AHRS sites, RS 2477 trails, and locations with indigenous place names. These sites have been identified through past survey and research projects. AGDC's CRMP provides a detailed

breakdown of previous survey coverage for the Project components in the Interior Region, which are summarized in Table 3.15-10. In total, approximately 64 percent of the Project components in the Interior Region have undergone pedestrian survey, 2 percent windshield survey, and 3 percent aerial survey, leaving approximately 31 percent of the Project components in the Interior Region as not surveyed. Additionally, the Denali NPP Route Variation, which is located in the Interior Region, has not been surveyed for the Project, although some of the alternative route has been studied in past projects associated with the highway, fiber optic cable, and railroad activities. Of the remaining unsurveyed portions of the Project (2,821 acres), AGDC recommended pedestrian survey for approximately 35 percent, aerial survey at 53 percent, and windshield at less than 1 percent, with no surveys recommended for the remaining 12 percent (AGDC 2017: Appendix F). These recommendations do not take into account the recently completed Alaska LNG surveys, which are accounted for in Table 3.15-10, and that may overlap with portions of the proposed Project.

Table 3.15-10 Previous Survey Coverage – Interior Region

	Pedestrian Survey		Windshield Survey		Aerial Survey		No Field Survey		Total[d]
Interior Region	Acres	%	Acres	%	Acres	%	Acres	%	Acres
Roads[a]	453	27%	100	6%	15	1%	1,082	66%	1,648
Horizontal Directional Drilling	51	39%	0	0%	11	8%	70	53%	132
Storage and Material Sites[b]	884	39%	67	3%	2	0.1%	1,330	58%	2,285
Mainline and Fairbanks Lateral	4,430	88%	30	1%	235	5%	322	6%	5,018
Other[c]	1	6%	0	0%	1	6%	16	89%	18
Total	5,818	64%	198	2%	264	3%	2,821	31%	9,101

a Includes access roads, bridges, existing road upgrades, and ice access roads
b Includes camps, facility pads, material sources, pipe storage, temp workspaces
c Includes dredge disposal, stream crossings, TAPS ROW, vertical support members
d Total survey acres based on CRMP (AGDC 2017); individual columns do not always accurately sum to total column as presented in CRMP due to rounding.

3.15.5.2.3.1. AHRS Sites and Trails, TLUI Sites, and RS 2477 Trails

There are 122 previously reported AHRS sites (including AHRS trails) located within the direct impact area (Figure 3.15-4; Table 3.15-11). There are 356 previously reported AHRS sites located within the 1-mile, indirect impact area in the Interior Region (Table T-3 in Appendix K, Part I, of this SEIS). These sites include cultural materials from multiple periods; a prehistoric archaeological district, prehistoric lithic remains, subsurface flakes, and a campsite; and historic sites associated with mining, the construction of the Dalton, Denali, and Hickel highways, the construction of the Alaska Railroad, and structures. Eighteen of the AHRS sites are historic trails that directly intersect the direct impact area. A total of 17 RS 2477 trails are located in the Interior

Region of the proposed Project Area (Table 3.15-12). The Hickel Highway (RST 450, SAG-00098/BET-00201) includes portions located within the North Slope and Interior regions. Within the direct analysis area, SHPO and associated public agencies have determined that 39 of the sites are eligible for the NRHP, 7 are treated as eligible under a PA, 51 are not eligible, 3 have pending consultation, 1 is a site within a property determined eligible, and 21 have not had determinations of eligibility.

Table 3.15-11 AHRS Sites in the Direct Impact Area – Interior Region

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
WIS-00436	WIS-00436	Prehistoric, Modern	Lithic scatter, Chert flake	DOE-S	
FAI-02288	FAI-02288	Prehistoric, Historic, Protohistoric, Modern	Depressions, CMT	DREJ-S	
HEA-00062	Nenana River Gorge Site	Prehistoric, Historic	Lithics, FCR, Faunal, Pottery, Railroad	DOE-S	
BET-00056	BET-00056	Prehistoric	Lithic remains	DREJ-S*	
BET-00055	BET-00055	Prehistoric	Activity area, Hearth, Lithic remains	DOE-S	
BET-00122	BET-00122	Prehistoric	Lithic remains, Flakes, Endblade		
BET-00018	BET-00018	Prehistoric	Lookout, Lithic flakes, Obsidian		
BET-00082	BET-00082	Prehistoric	Lithic scatter, Flakes		
BET-00083	BET-00083	Prehistoric	Lithic scatter, Flakes	DOE-P-S	
CHN-00006	[DOE] CHN-00006 [AHRS] GOLD CREEK	Prehistoric	Isolated find, Lithic, Flake, Chert	DREJ-S	
HEA-00010	HEA-00010	Prehistoric	Lithics	DREJ-S*	
HEA-00014	COYOTE CREEK SITE	Prehistoric	Isolated find	DREJ-S	
HEA-00015	HEA-00015	Prehistoric	Lithics, Scatter	DREJ-S	
LIV-00038	RUBY RIDGE	Prehistoric	Prehistoric lithic scatter	DREJ-S	
LIV-00055	JUSWON	Prehistoric	Lookout, Lithic remains	DOE-S	
WIS-00005	WIS-00005	Prehistoric	Lithic scatter		
WIS-00006	WIS-00006	Prehistoric	Activity area, Lithic remains	DREJ-S*	
WIS-00020	WIS-00020	Prehistoric		DREJ-S	
WIS-00010	WIS-00010	Prehistoric		DREJ-S*	
WIS-00011	WIS-00011	Prehistoric		DREJ-S*	
CHN-00034	GOLD CREEK	Prehistoric	Lithic remains	DREJ-S	
CHN-00076	CHN-00076	Prehistoric	Lithic scatter	DREJ-S	
BET-00202	BET-00202	Prehistoric	Lithic scatter	DOE-S	

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
BET-00203	BET-00203	Prehistoric	Lithics	DREJ-S	
BET-00204	BET-00204	Prehistoric	Lithic scatter	DREJ-S	
BET-00206	BET-00206	Prehistoric	Lithic scatter	DOE-S	
BET-00207	BET-00207	Prehistoric	Lithic isolate	DREJ-S	
LIV-00552	LIV-00552	Prehistoric	Lithic scatter		
BET-00213	BET-00213	Prehistoric	Lithic scatter	DOE-S	
LIV-00746	LIV-00746	Prehistoric	CMT, Isolated find	DREJ-S	
BET-00251	BET-00251	Prehistoric	Lithic scatter, Prehistoric	DREJ-S	
LIV-00726	LIV-00726	Prehistoric	Buried prehistoric lithic assemblage	DOE-S	
BET-00208	BET-00208	Prehistoric	Lithic scatter		
HEA-00601	HEA-00601	Prehistoric	lithics, flakes		
BET-00139	BET-00139	Prehistoric	Lithic remains, Flakes, Reduction, Obsidian	DREJ-S	
HEA-00607	HEA-00607	Prehistoric			
HEA-00600	HEA-00600	Prehistoric	Subsurface lithic scatter		
HEA-00604	HEA-00604	Prehistoric			
WIS-00441	WIS-00441	Prehistoric	Subsurface lithic scatter, Isolated find	DREJ-S*	
HEA-00597	HEA-00597	Prehistoric	Lithic, Flake		
HEA-00680	HEA-00680	Prehistoric	Small lithic scatter, Surface and subsurface		
CHN-00124	CHN-00124	Prehistoric	Lithic scatter, Flakes	DOE-S	
LIV-00747	LIV-00747	Prehistoric		DREJ-S	
LIV-00402	LIV-00402	Prehistoric	Lithic scatter, Flakes, Flake tool, Nodules	DOE-S	
BET-00183	BET-00183	Prehistoric	Flake, Isolate		
LIV-00394	LIV-00394	Prehistoric	Isolated find, Flake, Basalt	DREJ-S	
HEA-00659	HEA-00659	Prehistoric	Projectile point isolated find, Fragment	DREJ-S	
BET-00074	VICK ROCK-SHELTER	Prehistoric	Rock-shelter, Bone artifacts	DOE-S	
BET-00081	BET-00081	Prehistoric	Lithic scatter, Flakes, Obsidian, Microblade	DOE-S	
LIV-00104	LIV-00104	Prehistoric	Lithic scatter	DOE-S	NRXCL
LIV-00047	LIV-00047, TOLOVANA 10	Prehistoric	Activity area, Lithic remains	DOE-S	NRXCL
LIV-00106	LIV-00106	Prehistoric	Activity area, Lithic remains	DOE-S*	NRXCL
BET-00121	BET-00121	Prehistoric	Camp, Hearth, Lithics		
CHN-00077	CHN-00077	Prehistoric	Lithic scatter	DOE-S	
LIV-00553	LIV-00553	Prehistoric	Lithic scatter, Prehistoric, Retouched chert flake	DOE-S	

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
WIS-00413	WIS-00413	Prehistoric	Lithic flake	DOE-S	
WIS-00435	WIS-00435	Prehistoric	Biface fragment	DREJ-S*	
LIV-00749	LIV-00749	Prehistoric	Buried, Prehistoric, Lithic scatter	DOE-S	
LIV-00284	ROSEBUD KNOB ARCHAEOLOGICAL DISTRICT	Prehistoric	Archaeological	DOE-S	NRXCL
HEA-00661	HEA-00661	Prehistoric	Isolated find, Flake, Lithic	DREJ-S	
LIV-00748	LIV-00748	Prehistoric	Prehistoric, Lithic scatter	DOE-S	
HEA-00657	HEA-00657	Prehistoric	Isolated Find, Subsurface lithic artifact, Chert core		
HEA-00663	HEA-00663	Prehistoric	Small lithic scatter, Flakes, Lithic assemblage	DREJ-S	
LIV-00778	LIV-00778	Prehistoric	Isolated find, Chalcedony endscraper	DOE-S	
HEA-00598	HEA-00598	Prehistoric	Lithic, Flake	DREJ-S	
LIV-00776	LIV-00776	Prehistoric	Lithic scatter, Subsurface, Obsidian flake, Debitage	DOE-S*	
WIS-00437	WIS-00437	Prehistoric	Lithic Scatter	DOE-S	
HEA-00595	HEA-00595	Prehistoric		DOE-S	
HEA-00662	HEA-00662	Prehistoric	Lithic scatter, biface fragment , Prehistoric, Buried	DOE-S	
HEA-00596	HEA-00596	Prehistoric	Lithic scatter	DREJ-S	
WIS-00288	WIS-00288	Prehistoric	Lithic remains, Flakes, Obsidian, Retouch	DOE-S	
BET-00253	BET-00253	Prehistoric	Isolated find	DOE-P-S	
HEA-00658	HEA-00658	Prehistoric	Isolated find, Subsurface lithic artifact, Flake	DOE-S	
LIV-00779	LIV-00779	Prehistoric	Isolated find, Flake		
BET-00250	BET-00250	Prehistoric	Surface lithic scatter, Prehistoric	DOE-S	
LIV-00170	PA, 13	Paleontological		DREJ-S*	
PSM-00186	PSM-00186	Historic	Structural remains, Cans, Nails, Wire		
CHN-00080	CHN-00080	Historic	Trash deposit, Trail	DREJ-S	
LIV-00403	LIV-00403	Historic	Resource, Mining, Prospect pits, Drift	DREJ-S	
HEA-00603	HEA-00603	Historic	Telegraph, Wire, Insulator, Pole	DREJ-S	
WIS-00287	WIS-00287 (BE-11, S4-2)	Historic	Resource, Mining, Shafts, Tailings	DREJ-S	

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
FAI-02296	Log Cabin	Historic	Cabin	DREJ-S*	
FAI-02297	Old trail	Historic	Trail	DREJ-S*	
CHN-00040	PITS 4 AND 5, FORMERLY PART OF CHN-009	Historic		DREJ-S	
CHN-00122	DIETRICH CAMP	Historic	Construction Camp	DREJ-S	
HEA-00401	HEA-00401	Historic	Can scatter, Glass, Faunal remains	DREJ-S	
HEA-00602	HEA-00602	Historic	Timbers, Cans	DREJ-S	
HEA-00606	HEA-00606	Historic	Cabin ruin	DREJ-S*	
CHN-00070	DALTON HWY (MP 1 TO 414)	Historic	Highway	Treated as Eligible	
BET-00201	HICKEL HIGHWAY	Historic	Transportation, Winter road	DREJ-S	
LIV-00501	DALTON HWY (MP 1 TO 414)	Historic	Highway	Treated as Eligible	
PSM-00570	DALTON HWY (MP 1 TO 414)	Historic	Highway	Treated as Eligible	
FAI-02366	NENANA KANTISHNA TRAIL SEGMENT RS2477 346 (NENANA-KNIGHTS ROADHOUSE TRAIL, ARC ROUTE 46C)	Historic	Trail/Road segment	DOE-S	
LIV-00752	ELLIOTT HIGHWAY - SEGMENT C	Historic	Linear - Highway	DREJ-S	
HEA-00450	DENALI HWY (MP 1 TO 134.5)	Historic	Road, Highway	Treated as Eligible	
WIS-00408	DALTON HWY (MP 1 TO 414)	Historic	Highway	Treated as Eligible	
LIV-00751	ELLIOTT HIGHWAY - SEGMENT B	Historic	Linear - Highway	DREJ-S	
WIS-00434	COLDFOOT-CHANDALAR LAKE TRAIL RS 2477 NUMBER 9	Historic	Road		
FAI-02102	DUNBAR-BROOKS TERMINAL TRAIL (SEE ALSO LIV-00556)	Historic	Trail	DOE-S	
LIV-00392	LIVENGOOD TRAM ROAD (ARC Route 63C [Brooks Tram])	Historic	Historic Road	DOE-P-S	
FAI-02119	ALASKA RAILROAD TELEPHONE AND TELEGRAPH LINE	Historic	Communication line	DOE-S*	

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
LIV-00556	DUNBAR-BROOKS TERMINAL TRAIL (SEE ALSO FAI-02102)	Historic	Trail	DOE-S	
FAI-02177	DUNBAR-MINTO-TOLOVANA TRAIL	Historic	Trail	DOE-S	
HEA-00091	STAMPEDE TRAIL (LIGNITE-STAMPEDE TRAIL [RST 344], LIGNITE-STAMPEDE-KANTISHNA VIA CLEARWATER TRAIL [RST 340])	Historic	Trail, Mining	DREJ-S	
FAI-02390	FAI-02390	Historic	Historic site, Surface depressions, CMTs, Wooden crate	DOE-S	
CHN-00125	CHN-00125	Historic	Historic equipment, Artifact scatter	DOE-S	
CHN-00123	CHN-00123	Historic	Historic mining site, Surface can scatter, Artifact scatter	DREJ-S	
FAI-02389	FAI-02389	Historic	Historic activity area, Fuel cans	DREJ-S	
FAI-02386	FAI-02386	Historic	Surface depressions, Subsurface artifacts	DOE-S	
CHN-00018	CHN-00018	Historic	Camp, Shelter, A-frame, Log, Sod	DOE-S	
CHN-00025	CHN-00025	Historic	Can scatter	DXS	
HEA-00188	HEA-00188	Historic			
BET-00198	BET-00198	Historic, Modern	Trap set	DREJ-S*	
HEA-00379	ARRC TIMBER BRIDGE MP 319.0	Historic, Modern	Transportation, Railroad, Bridge	DREJ-S	
BET-00199	BET-00199	Historic, Modern	Trapping traps	DREJ-S	
HEA-00066	BROAD PASS	Historic, Modern	Transportation, Railroad, Artifacts	DOE-S	
FAI-02299	Modern debris	Modern	Debris	DREJ-S	
PSM-00595	PSM-00595			DREJ-S*	
FAI-02298	FAI-02298		Mining, Pits, Ditches, Mounds		
HEA-00619	HEA-00619				
BET-00200	DALTON HWY (MP 1 TO 414)		Highway	Treated as Eligible	
TAN-00118	DALTON HWY (MP 1 TO 414)		Highway	Treated as Eligible	

Source: ADNR, OHA, 2017
All data are verbatim from source.
DOE-K = Property determined eligible for NHR by Keeper of the National Register.

DOE-P-S = Property pending consultation between SHPO and public agency representatives regarding eligibility for NHR.
DOE-S = Property determined eligible for NHR by SHPO and public agency.
DREJ-S = Property determined not eligible for NHR by SHPO and public agency.
DXS = Site or structure within an eligible DOE-S or DOE-K.
NRXCL = Nomination file inactive
*Indicates recommendation by agency; SHPO has not yet reviewed

Figure 3.15-4 Reported AHRS and RS-2477 Trails within 1 Mile of the Proposed Project – Interior Region

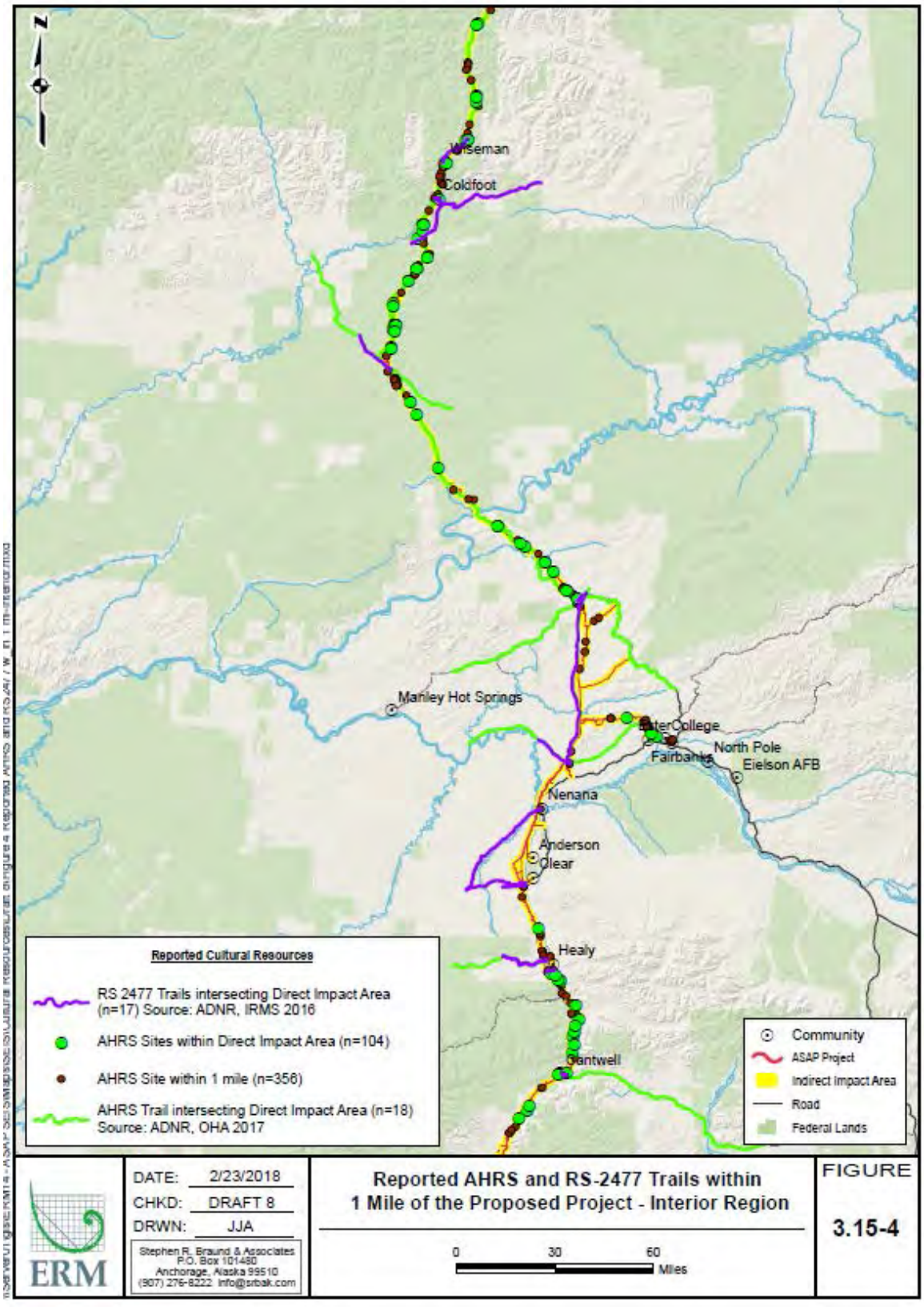


Table 3.15-12 RS-2477 Trails Intersecting the Direct Impact Area – Interior Region

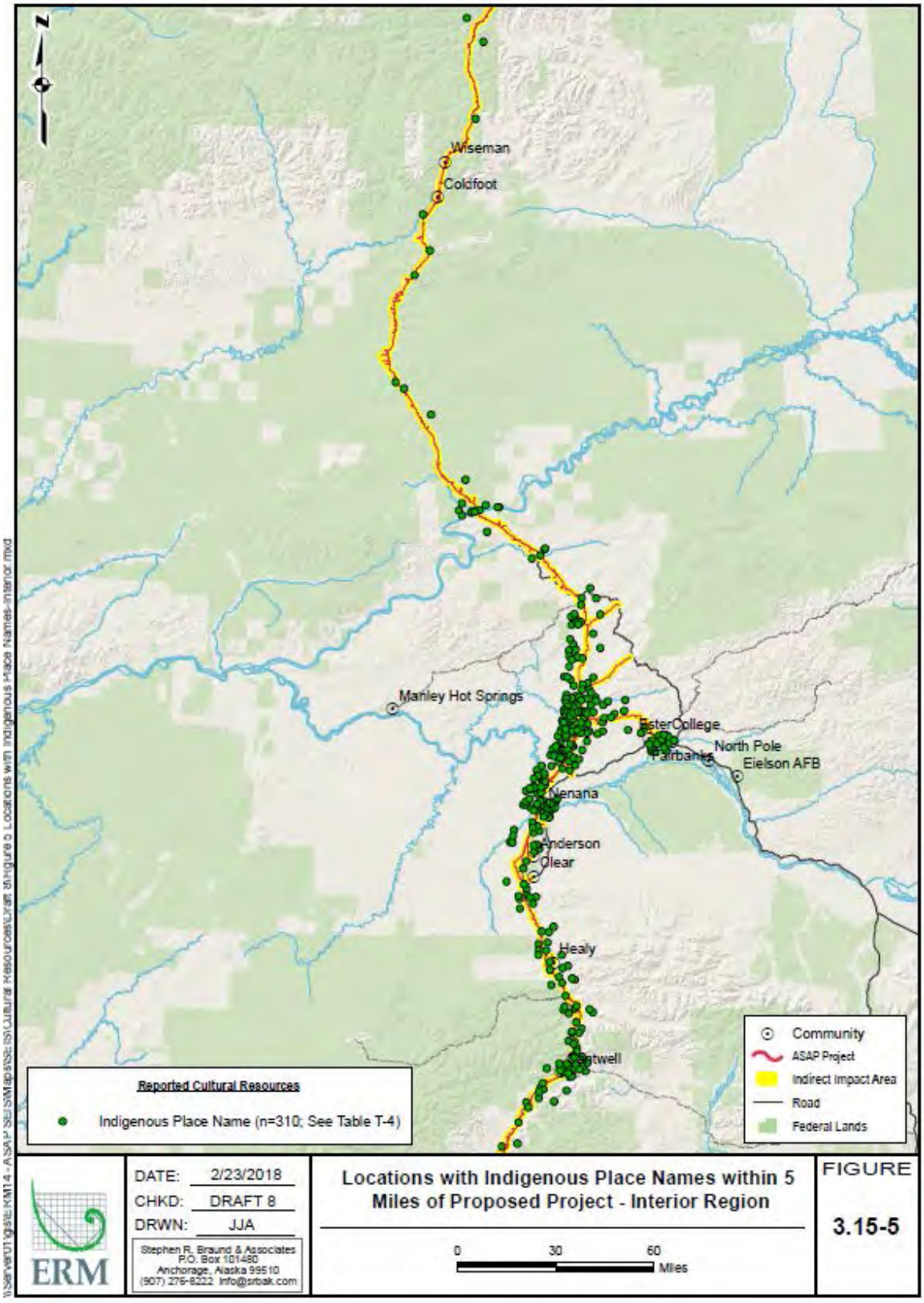
Trail ID	Trail Name
RST 9	Coldfoot-Chandalar Lake Trail
RST 66	Dunbar-Brooks Terminal
RST 254	Wiseman-Chandalar
RST 262	Caro-Coldfoot
RST 340	Lignite-Stampede
RST 343	Kobi-Kantishna
RST 344	Lignite-Kantishna
RST 345	Kobi-McGrath (via Nikolai & Big River)
RST 346	Nenana-Kantishna
RST 412	Slate Creek
RST 450	Hickel Highway
RST 468	Hunter Creek-Livengood
RST 491	Rex-Roosevelt
RST 591	Coldfoot-Junction Trail 49 (east route)
RST 625	Cantwell Small Tracts Road (Lovers Lane)
RST 709	Healy-Diamond Coal Mine Dirt Road
RST 1595	Dunbar-Minto-Tolovana

Sources: ADNR IRMS, 2016

3.15.5.2.3.2. Indigenous Place Names

In the Interior Region, there are 234 individual locations with Athabascan place names and 21 cluster areas with 76 place name (Table T-4 in Appendix K, Part I, of this SEIS) in the proposed Project direct and indirect impact areas (Figure 3.15-5), which is the most of the three study regions. Furthermore, the Interior Region for the Project has the largest diversity of dialects with place names present. There are locations with Ahtna, Gwich'in, Iñupiaq/Kobuk, Koyukon, Upper Kuskokwim, Lower Tanana, Minto, Tanacross, and Upper Tanana place names. Together, the 21 clusters and 234 individual locations with Athabascan place names in the Interior Region consist of 14 of the 17 categories listed by Kari and Fall (2003) and two of the three additional categories (Table 3.15-6).

Figure 3.15-5 Locations with Indigenous Place Names within 5 Miles of Proposed Project – Interior Region



3.15.5.3. Southcentral Region

3.15.5.3.1. Overview of Regional Prehistory (12,000 Years Ago to 1815 A.D.)

This section summarizes the ancestral cultures of the Southcentral Region and proposed Project Area (Table 3.15-13). For a more detailed discussion of the regional and Project Area culture history, refer to the 2012 FEIS. Until about 9,500 years ago, glaciers blocked the mountain passes ringing Cook Inlet, possibly affecting human and animal passage between Southcentral and Interior Alaska. After that time, the mountain passes were ice-free (Reger and Bundtzen, 1990) and people using early core-and-blade technology likely hunted land animals in the Southcentral Region. Elsewhere, core-and-blade technologies are found on the coast, probably the tools of marine-mammal hunters. Analogous to other radiocarbon dated sites in Alaska, Southcentral core-and-blade technologies date from 7,500 to 10,000 years ago (Reger, 2003). The interpretation of the period after these core-and-blade occupations is not clear, probably because several different culture groups with various stone-tool technologies (including Northern Archaic-like sites, Late Ocean Bay, and ASTt) were in the area around 4,000 to 5,000 years ago. Kachemak culture people with a marine-oriented harvest technology spread over much of the Cook Inlet Basin during the period of 2,500 to 1,000 years ago. The Kachemak culture was comprised of ancestral Sugpiaq people that originated in the Kodiak Archipelago (Langdon, 2002). The Dena'ina, an Athabascan-speaking culture, occupied the Southcentral area approximately 1,500 years ago and were characterized by semi-subterranean houses, tools of primarily bone and wood, and exploitation of both a marine and terrestrial subsistence environment (Reger, 2003). Occupation and use of Southcentral Alaska was not confined solely to Dena'ina in the late prehistoric period. Levels at the Beluga Point (ANC-00054) site radiocarbon dated from 600 to 800 years ago show a Sugpiat occupation with characteristic ground slate tools, polished adze bits, and stone scrapers left from repeated uses at this stopover locality (Reger, 1981). The interplay of occupations and a long tradition of orally recorded accounts of both trade and conflict between the Dena'ina and various Sugpiat descended groups of the Alaska Peninsula, Kodiak Archipelago, PWS, and Kenai Peninsula are recounted in several sources, including Kari and Fall (2003), Wrangell (1980), and Znamenski (2003).

Table 3.15-13 Sequence of Southcentral Archaeological Cultures

Tradition	Date	Material Culture	Representative Sites
Euro-American	1780–Present	Industrial manufactures, metal, glass, plastic	ARR, Iditarod National Historic Trail, Matanuska Colony Farms, Independence Mine, Sullivan's Roadhouse
Sugpiat	800 BP–1780 AD, continues to Present	Polished slate projectiles, knives, spear points Occurs contemporaneously with Dena'ina materials.	Beluga Point
Athabascan	1,500 BP–1780 AD, continues to Present	Lithics replaced by organic and copper tools; Bow and arrow replaces atlatl	House and cache pit sites, *Ch'u'itnu* Archaeological District, Red Shirt Lake Village
Kachemak	3,000–1,400 BP	Grooved and notched pebble and cobble weights, toggling harpoon points, ground slate ulus, bone tools, cobble spall tools, adzes	Yukon Island, Yukon Island Bluff, Yukon Fox Farm, Yukon Island West Beach, Cottonwood Creek, Merrill, Chugachik Island
Arctic Small Tool Tradition	4,000–3,000 BP	Burins, gravers, unifaces, abraders, small bifacial points, no ground slate	Chugachik Island, Beluga Point North II
Late Ocean Bay	4,000–5,000 BP	Ground slate lance heads and knives, flaked projectile points, bifaces and unifaces, retouched flakes, stone wedges and cores	SEW-0214, Sylva site, Beluga Point South I and North II
Late Mid-Holocene (Northern Archaic-like)	4,000–5,000 BP	Side notched points, uniface, cobble chopper	SEW-0214, Beluga Point component South III
Early Holocene Core and Blade	10,000–5,000 BP	Wedge-shaped microblade cores, burins, end scrapers, bifaces	SEW-214, KEN-094, SEW-187, Long Lake, Beluga Point

Sources: Workman, 1996; Clark, 2001
BP = Before Present (*i.e.,* years ago)

3.15.5.3.2. Overview of Regional History

This section summarizes the history of the Southcentral Region and Project Area. For a more detailed discussion of the regional and Project Area culture history, refer to the 2012 FEIS. Table 3.15-14 provides a synopsis of the regional Southcentral history. Major historical themes for Alaska's Southcentral Region include European/Euro-American Exploration, Fur Trade, Epidemics, Western Religion, Gold Rush, Early Homesteading and Agriculture, Military Presence, and Oil and Gas Development. Captain James Cook was the first Euro-American to explore into Cook Inlet in 1778 followed quickly by Russian and later American fur traders who sought to exploit the riches of interior fur resources. Along with fur traders came various epidemics that decimated local populations. Western religion in the form of Russian Orthodoxy also came with the early Russian traders. The great Gold Rush of the late early 1900s brought a major influx

of population and attention to the region. For those who remained and settled the area, agriculture and homesteading were major draws. World War II brought the next influx of people and development to the region that continued into the Cold War era and through today. Oil and gas development on the Kenai Peninsula in the 1950s spurred the beginning of an era of oil and gas in Alaska's history that played a key role in Anchorage becoming the major population and economic center of the state.

Table 3.15-14 Alaska Southcentral History Synopsis

Time Frame	Historic Theme	Synopsis
1770s-1790s	European/ Euro-American Exploration	• Begins with Captain James Cook sailing into Cook Inlet in 1778. • Cook's expedition followed by Vancouver in 1794.
1790s-1890s	Fur Trade	• Begins in 1790s with Lebedev-Lastochkin Company establishing trading posts in Cook Inlet. • The Dena'ina use their central geographic position and network of trails to serve as middlemen traders between the Russians and the groups farther in the interior, gathering relatively great wealth in a short time. • Fur trade relations remain prevalent with the Alaska Commercial Company and Dena'ina into the 1890s.
1830s-1840s	Epidemics	• In 1838, a small pox infestation decimates up to half of the Dena'ina populations around Cook Inlet. • Subsequent periodic epidemics cause numerous deaths and long-term debilitating illnesses. • First vaccines beginning in 1840s begin to be put to use and greatly lessen the devastation of diseases on local Dena'ina.
1830s-Present	Western Religion	• In 1838, Russian Orthodoxy spreads through the Cook Inlet region. • By 1845, the first Russian Orthodox mission is erected in Cook Inlet. • In the 1880s and 1890s, Russian Orthodox chapels were established in Dena'ina villages of Tyonek, Knik, Susitna Station, and Eklutna, even though at the time the villages were still seasonal camps. • Continues today with several denominations, including Russian Orthodoxy, present in communities throughout Southcentral.
1890s-1920s	Gold Rush	• Gold prospecting creates the next great influx of Euro-Americans into Upper Cook Inlet, beginning with discoveries on the Kenai Peninsula and Turnagain areas in 1891. • The Gold Rush in the Klondike in 1898 further adds to the change in Alaska from an isolated, ignored outpost to an organized territory. • Early trails spring out from Cook Inlet and into the Interior, most notable of which becomes the Iditarod Trail from Seward to Nome circa 1914 and the future site of the Iditarod Dog Sledding Race.
1900s-Present	Early Homesteading & Agriculture	• Early homesteads established by early settlers and disheartened gold seekers in towns such as Knik, Palmer, and Wasilla during early 1900s. • Anchorage established in 1915 as site of Alaska Railroad headquarters and Alaska Railroad opens up access into the Mat-Su valley and beyond. • Following the construction of the railroad, the Federal Government subdivided lands for homesteads and farms, and, in the 1930s, began a New Deal-era program to resettle farmers from Minnesota to the area and altering the landscape of the Mat-Su valley.

Time Frame	Historic Theme	Synopsis
1940s-Present	Military Presence	• United States entry in World War II in 1941 causes far-reaching consequences in Alaska with tens of thousands of military personnel serving in the Territory, dozens of airfields and bases being built (*e.g.*, Fort Richardson in 1940), the AlCan (Alaska) Highway construction, and billions of dollars of spending on other civilian and military projects. • Cold War concerns lead to Nike missile bases ringing Anchorage to provide defense against aerial attack and bringing a level of development in Anchorage that was similar to that during World War II. • Joint Base Elmendorf-Richardson continues to operate with over 5,000 personnel as one of Alaska foremost military installations.
1950s-Present	Oil and Gas Development	• Major development begins after the 1957 discovery of oil on the Kenai Peninsula. • Several major oil production companies build their headquarters in Anchorage. • By the 1980s, Anchorage is the center of activity in the state of Alaska, due in large part to the economic benefits of oil and gas production in the state.

Sources: Black, 2004; BLM, 1986; Boraas and Legget, 2013; Bush, 1984; Buzzell, 1986; Cook, 1805; De Laguna, 1934; Fall 1981; Fried and Windisch-Cole, 2006; Fortuine, 1992; Miller, 1975; Osgood, 1937; Potter, 1967; Solovjova and Vovnyanko, 2008; Tower, 1981; Townsend, 1981; Unrau 1994; Vancouver, 1801; Znamenski, 2003

3.15.5.3.3. Previously Reported Cultural Resources in the Proposed Project Area – Southcentral Region

Previously reported cultural resources in the Southcentral Region Project Area include AHRS sites, RS 2477 trails, and locations with indigenous place names. These sites have been identified through past survey and research projects. AGDC's CRMP provides a detailed breakdown of previous survey coverage for the Project components in the Southcentral Region, which are summarized in Table 3.15-15. In total, approximately 48 percent of the Project components in the Southcentral Region have undergone pedestrian survey, less than 1 percent windshield survey, and 11 percent aerial survey, leaving approximately 41 percent of the Project components in the Southcentral Region as not surveyed. Of the remaining unsurveyed portions of the Project (1,775 acres), AGDC recommended pedestrian survey for approximately 87 percent, aerial survey at 11 percent, and windshield at less than 1 percent, with no surveys recommended for the remaining 1 percent (AGDC 2017: Appendix F). It should be noted these recommendations do not take into account the recently completed Alaska LNG surveys, which are accounted for in Table 3.15-15, and that may overlap with portions of the proposed Project.

Table 3.15-15 Previous Survey Coverage – Southcentral Region

Southcentral Region	Pedestrian Survey		Windshield Survey		Aerial Survey		No Field Survey		Total[d]
	Acres	%	Acres	%	Acres	%	Acres	%	Acres
Roads[a]	160	24%	1	0.1%	15	2%	493	73%	671
Horizontal Directional Drilling	59	30%	0	0%	21	11%	115	59%	195
Storage and Material Sites[b]	97	11%	2	0.2%	4	0.5%	779	88%	883
Mainline	1,794	69%	5	0.2%	431	17%	365	14%	2,594
Other[c]	1	5%	0	0%	1	5%	22	100%	22
Total	2,109	48%	8	0.5%	472	11%	1,775	41%	4,363

a Includes access roads, bridges, existing road upgrades, and ice access roads
b Includes camps, facility pads, material sources, pipe storage, temp workspaces
c Includes dredge disposal, stream crossings, TAPS ROW, vertical support members
d Total survey acres based on CRMP (AGDC 2017); individual columns do not always accurately sum to total column as presented in CRMP due to rounding.

3.15.5.3.3.1. AHRS Sites and Trails, TLUI Sites, and RS 2477 Trails

There are 34 previously-reported AHRS sites (including AHRS trails) in the direct impact area (Table 3.15-16) and 118 previously-reported AHRS sites outside of the direct impact area, but within the 1-mile (1.6 km) indirect impact area (Table T-5 in Appendix K, Part I, of this SEIS) (Figure 3.15-6). These sites include a mix of prehistoric/protohistoric house pits, cache pits, and other cultural depressions as well as historic sites associated with railroad development and historic dog sledding (*i.e.*, roadhouses). The Iditarod Dog Sledding Multiple Property is located within the area and consists of a collection of resources significant between the years 1967 and 1978 to the history of dog sledding- and mushing-related activities (HDR Inc., 2015). Ten previously reported AHRS trails – many associated with the Iditarod multiple property – intersect with the direct impact area. A total of three RS 2477 trails are located in the Southcentral Region of the proposed Project Area (Table 3.15-17). Within the direct analysis area, SHPO and associated public agencies have determined seven of the sites are eligible for the NRHP, 13 are not eligible, one has pending consultation, and 13 have not had determinations of eligibility.

Table 3.15-16 AHRS Sites in the Direct Impact Area – Southcentral Region

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
TAL-00208	TAL-00208	Prehistoric, Modern	Flakes and tephra samples, Small flakes	DREJ-S	
TYO-00164	TYO-00164 [SEE ANC-02998 ALSO]	Prehistoric, Historic	Trail, Postal route, Linear district		
TYO-00178	TYO-00178	Prehistoric	Depression		
TYO-00208	TYO-00208	Prehistoric	House pit, Arctic entry		
TAL-00189	TAL-00189	Prehistoric	Cache pits		
TYO-00179	TYO-00179	Prehistoric	Depressions		
TLM-00327	TLM-00327	Prehistoric	Lithics, Flakes, Prehistoric	DOE-S	
TYO-00224	IDITAROD SLED DOG RACE TRAIL	Historic, Modern	Trail, Dog sled	DOE-S*	
TAL-00125	MONTANA CREEK BRIDGE	Historic, Modern	Bridge, Transportation, Road	DREJ-S*	
TYO-00201	WILLOW AIRPORT	Historic, Modern	Airstrip, Revetments, WWII, Cold War		
HEA-00066	BROAD PASS	Historic, Modern	Transportation, Railroad, Artifacts	DOE-S	
HEA-00605	HEA-00605	Historic	Domestic, Debris, Tent site	DREJ-S	
TAL-00183	Derelict 1959 Chevrolet Apache	Historic	Isolated Find	DREJ-S	
HEA-00061	BROAD PASS ROADHOUSE	Historic	Roadhouse	DREJ-S*	
TYO-00205	TYO-00205	Historic	Privy pit		
TYO-00084	KNIK-RAINY PASS TRAIL (IDITAROD NATIONAL HISTORIC TRIAL - PRIMARY TRAIL)	Historic	Trail, INHT	DOE-S	
TYO-00170	IRON DOG TRAIL	Historic	Trail		
TYO-00184	ALMOND LAKE TRAIL	Historic	Trail		
TAL-00117	PETERSVILLE ROAD (TALKEETNA-CACHE CREEK ROAD)	Historic	Wagon road	DREJ-S	
TAL-00181	SAWMILL CREEK CABIN	Historic	Historic, Cabin ruin	DOE-S	
TAL-00180	TAL-00180	Historic	Historic, Buried, Semi-subterranean structure	DOE-S	
TAL-00193	TAL-00193	Modern	Truck	DREJ-S	
TAL-00195	TAL-00195	Modern	Marten box trap	DREJ-S	
TAL-00196	TAL-00196			DREJ-S	
TYO-00204	TYO-00204		Pits		

AHRS	Site Name	Period	Resource Description	Eligibility Status	National Register Status
TAL-00188	TAL-00188		Cache pits, Trenches	DOE-P-S	
TAL-00194	TAL-00194		Dozer cut	DREJ-S	
TYO-00317	TYO-00317		CMTs	DREJ-S*	
TYO-00315	TYO-00315		Cache Pit, House Pit		
TAL-00186	TAL-00186		Cache pit	DREJ-S	
TAL-00207	GOOSE CREEK ROAD (RST 1506)		Road/trail	DREJ-S	
TYO-00226	RED SHIRT LAKE - NANCY LAKE TRAIL SYSTEM				
TYO-00228	USGS BASE MAP WINTER TRAIL 1		Trail	DOE-S	
TYO-00225	NANCY LAKE - SUSITNA TRAIL				

Source: ADNR, OHA, 2017
All data are verbatim from source.
DOE-P-S = Property pending consultation between SHPO and public agency representatives regarding eligibility for NHR
DOE-S = Property determined eligible for NHR by SHPO and public agency
DREJ-S = Property determined not eligible for NHR by SHPO and public agency
*Indicates recommendation by agency; SHPO has not yet reviewed

Figure 3.15-6 Reported AHRS and RS-2477 Trails within 1 Mile of the Proposed Project – Southcentral Region

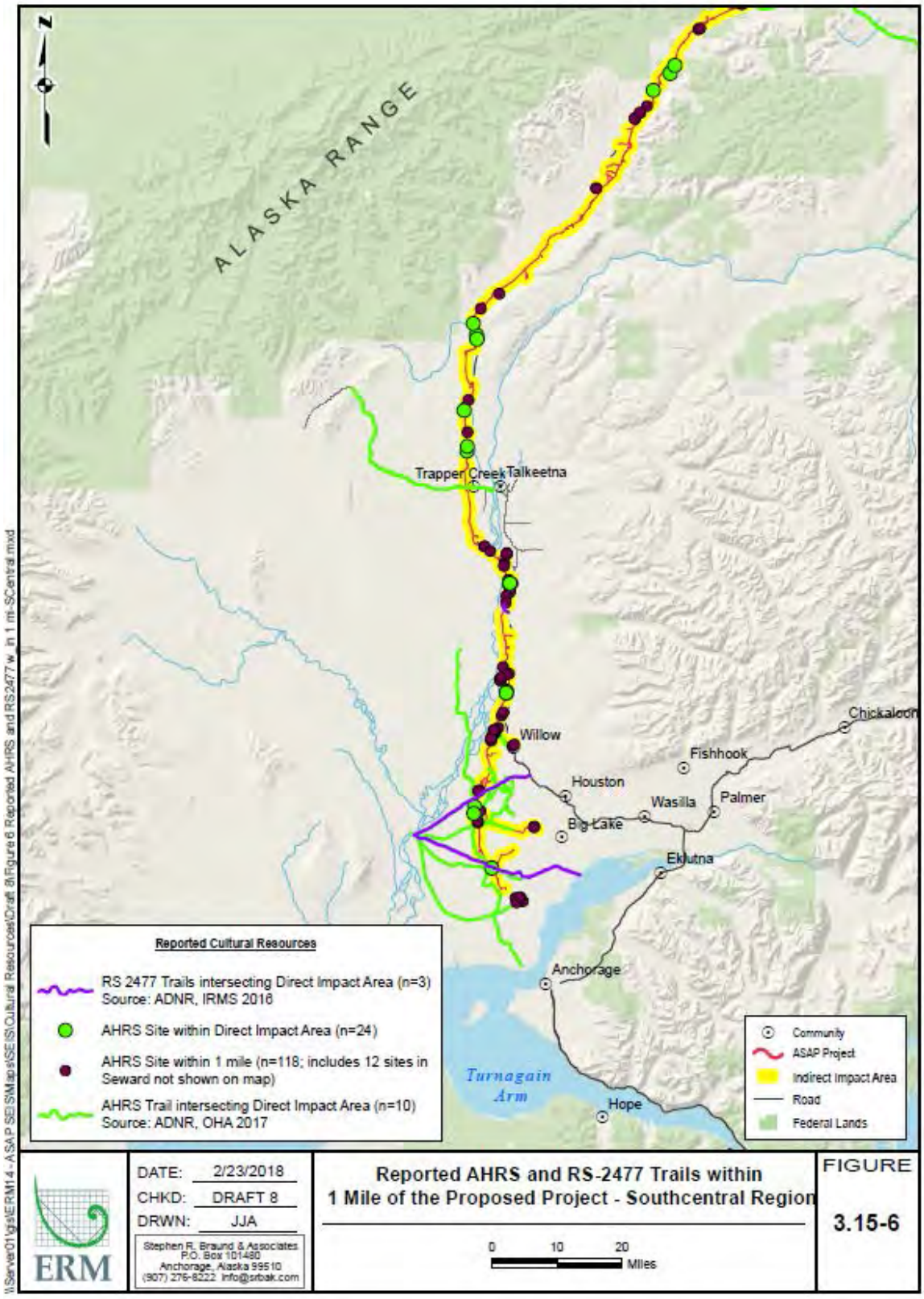


Table 3.15-17 RS-2477 Trails Intersecting the Direct Impact Area – Southcentral Region

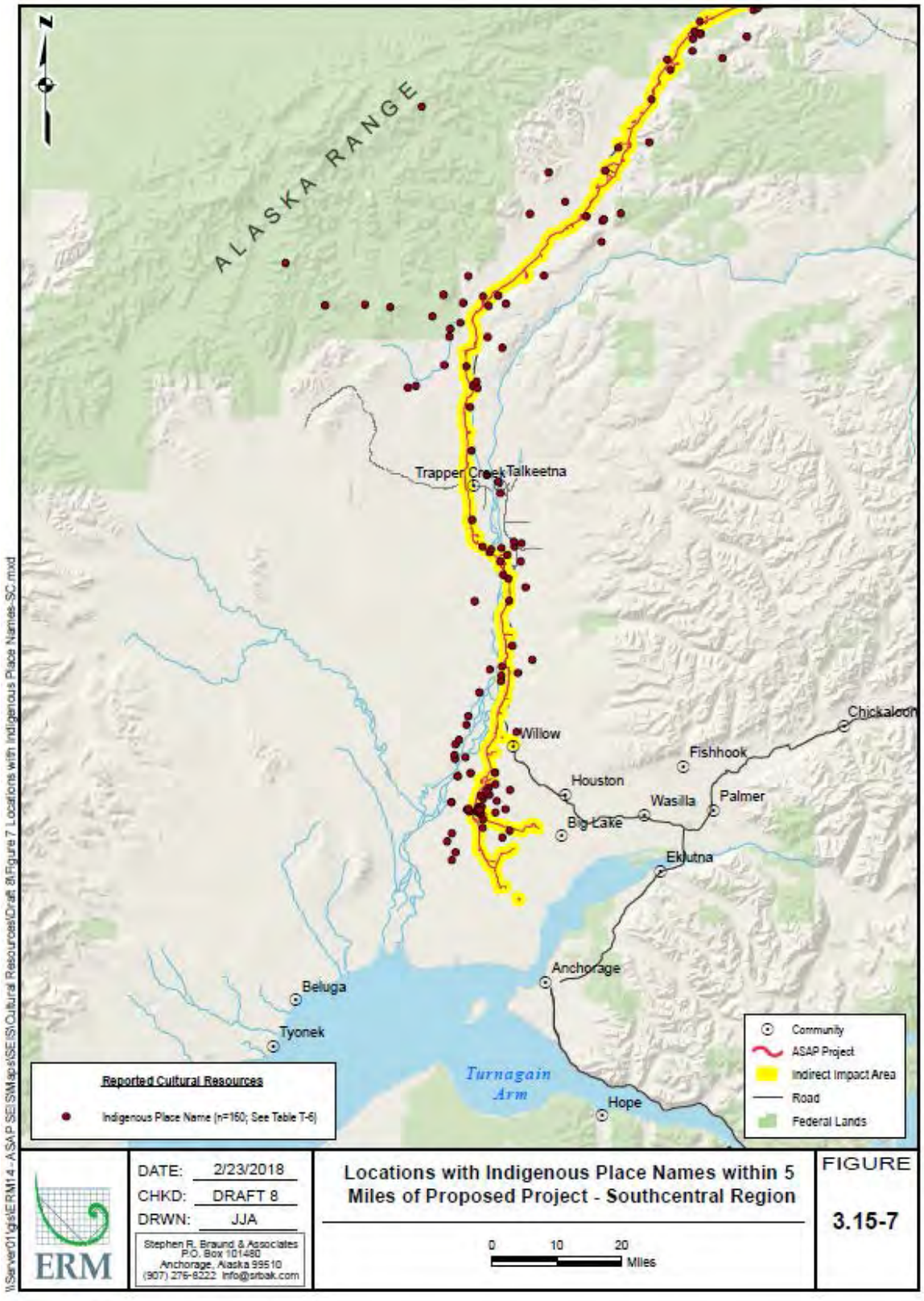
Trail ID	Trail Name
RST 118	Knik-Susitna
RST 149	Nancy Lake-Susitna
RST 1506	Goose Creek Road

Sources: ADNR IRMS, 2016
All data are verbatim from source

3.15.5.3.3.2. Indigenous Place Names

In the Southcentral Region, there are 100 individual locations with Athabascan place names and 16 cluster areas with 60 place names (Table T-6 in Appendix K, Part I, of this SEIS) in the proposed Project direct and indirect impact areas (Figure 3.15-7). Southcentral Regional place names are predominantly Dena'ina followed by some Ahtna place names and two Lower Tanana place names concentrated in the northern part of the region. Similar to the Interior Region, the Southcentral Regional place names include examples of most (n=13) of the categories in Kari and Fall's (2003) semantic classification system and two of the three additional categories (Table 3.15-6). Just as with the Interior Region, the Southcentral regional indigenous place names marked locations in uplands, lowlands, lacustrine, riverine, and community settings and did not have any place names identifying locations in a marine setting, which is because the proposed Project stops short of the Cook Inlet coast (Table 3.15-7).

Figure 3.15-7 Locations with Indigenous Place Names within 5 Miles of Proposed Project – Southcentral Region



3.16. Subsistence

3.16.1. Introduction

Subsistence use is central to the customs and traditions of many cultural groups in Alaska, including the Iñupiat of the North Slope and Athabascans of Interior and Southcentral Alaska. Subsistence customs and traditions encompass processing, sharing, redistribution networks, and cooperative and individual hunting, fishing, and ceremonial activities. Both federal and state regulations define subsistence use to include the customary and traditional use of wild renewable resources for food, shelter, fuel, clothing, and other uses (ANILCA, Title VIII, Section 803, and Alaska Statute 16.05.940[33]). A recent USACE study (ResourceEcon *et al.*, 2011) conducted a literature review of existing subsistence definitions and provided a proposed definition of subsistence which addresses the economic, social, cultural, and nutritional elements and components of subsistence that have not been emphasized in previous definitions. In part, this definition reads as follows (ResourceEcon *et al*., 2011):

> *Subsistence refers to a way of life in which wild renewable resources are obtained, processed, and distributed for household and communal consumption according to prescribed social and cultural systems and values…*
>
> *…The Subsistence way of life satisfies to various degrees and in various contexts, the economic, social, cultural, and nutritional needs of subsistence-based communities.*

Subsistence fishing and hunting are traditional activities that help transmit cultural knowledge between generations, maintain the connection of people to their land and environment, and support healthy diet and nutrition in almost all rural communities in Alaska. The ADF&G estimates that the annual wild food harvest in rural areas of Southcentral Alaska is approximately 1.4 million pounds, or 184 pounds per person per year. In the Interior area of Alaska, annual wild food harvest is approximately 3.2 million pounds, or 320 pounds per person per year. The annual wild food harvest in the Arctic area of Alaska (home to the North Slope Iñupiat) is approximately 10 million pounds or 438 pounds per person per year (Fall, 2014). Subsistence harvest levels vary widely from one community to the next. Sharing of subsistence foods is common in rural Alaska and can exceed 80 percent of households giving or receiving resources (ADF&G, 2016j). The term "harvest" and its variants – harvesters and harvested – are used as the inclusive term to characterize the broad spectrum of subsistence activities, including hunting, fishing, and gathering.

Subsistence is part of a rural economic system called a "mixed, subsistence-market" economy, wherein families invest money into small-scale, efficient technologies to harvest wild foods (Fall, 2014). According to Wolfe and Walker (1985), fishing and hunting for subsistence resources provide a reliable economic base for many rural regions and these important activities are conducted by domestic family groups who have invested in fish wheels, gill nets, motorized skiffs, and snowmachines. Subsistence

is not oriented toward sales, profits, or capital accumulation (commercial market production), but is focused toward meeting the self-limiting needs of families and small communities. Participants in this mixed economy in rural Alaska augment their subsistence production by cash employment. Cash (from commercial fishing, trapping, and/or wages from public sector employment, construction, firefighting, oil and gas industry, guiding, tourism, or other services) provides the means to purchase the equipment, supplies, and gas used in subsistence activities. The combination of subsistence and commercial-wage activities provides the economic basis for the way of life so highly valued in rural communities (Wolfe and Walker, 1985). As one North Slope hunter observed, "The best mix is half and half. If it was all subsistence, then we would have no money for snowmachines and ammunition. If it was all work, we would have no Native foods. Both work well together" (Alaska Consultants Inc. SRB&A, 1984).

Participation in subsistence activities promotes transmission of traditional knowledge from generation to generation and serves to maintain people's connection to the physical and biological environment. The subsistence way of life encompasses cultural values such as sharing, respect for elders, respect for the environment, hard work, and humility. In addition to being culturally important, subsistence is a source of nutrition for residents in an area of Alaska where food prices are high. While some Alaskans earn income from employment, they and other residents also rely on subsistence to supplement their diets throughout the year. Furthermore, subsistence activities support a healthy diet and contribute to residents' overall well-being.

The description of subsistence use summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

The following information, data, methods, and / or analyses have been substantially updated in this section from the 2012 document:

- Increase in study communities from 46 to 51. Reasons for the increase in study communities are as follows:
    - New subsistence data published since 2012 FEIS (*e.g.,* Holen *et al.,* 2012, 2014, 2015; La Vine *et al.,* 2013; Brown *et al.,* 2014)
    - Identification of additional older existing data (*e.g.,* Betts, 1997; Tomrdle and Miraglia, 1993)
    - Use of ESRI shapefile that contains data from the 2010 U.S. Census for Alaska at the place level (U.S. Census Bureau, 2010; ADOLWD, 2012a). The definition of places includes all incorporated cities as well as CDPs. The previous files used to study community selection in the 2012 FEIS had community locations represented by a particular location (point) rather than a CDP area (polygon).
- Condensing a number of CDPs in the urban areas of Fairbanks, Wasilla, and Palmer into single study communities due to their similar demographics, history, economic

characteristics, and lack of subsistence documentation, as well as all being located within federally designated non-rural subsistence areas.

- Expanding the compilation of subsistence use area and timing of subsistence activity data (including harvest amount by month) to include resource specific (*e.g.,* caribou, non-salmon fish) studies to provide a more comprehensive picture of subsistence uses. Previously only "all resources" studies were used.
- Revising text throughout the section where necessary in response to public and agency comments on the 2012 FEIS.

A total of 51 communities met the criteria for subsistence study communities for the ASAP SEIS based on documented use areas that intersect with and/or are within 30 miles of the proposed Project. If subsistence use area data are not available for a community, the community qualified as a study community if it is located within 30 miles of the proposed Project. Subsistence uses occur along nearly the entire length of the proposed Project in all three study regions: North Slope, Interior, and Southcentral. Communities located closest to the proposed Project and/or with use areas that are bisected by the Project include: Wiseman, Coldfoot, Livengood, Minto, Four-Mile Road, Nenana, Anderson, Ferry, Healy, McKinley Park, Cantwell, Trapper Creek, Talkeetna, Susitna North, and Willow. Key subsistence resources, in terms of pounds harvested, for study communities include bowhead and other marine mammals (North Slope); caribou; moose; whitefish, trout, and other non-salmon fish; and all species of salmon except pink salmon. Subsistence activities occur year round for all study communities, with the greatest peaks in activity usually occurring during the late summer/early fall months.

3.16.2. Regulatory Environment

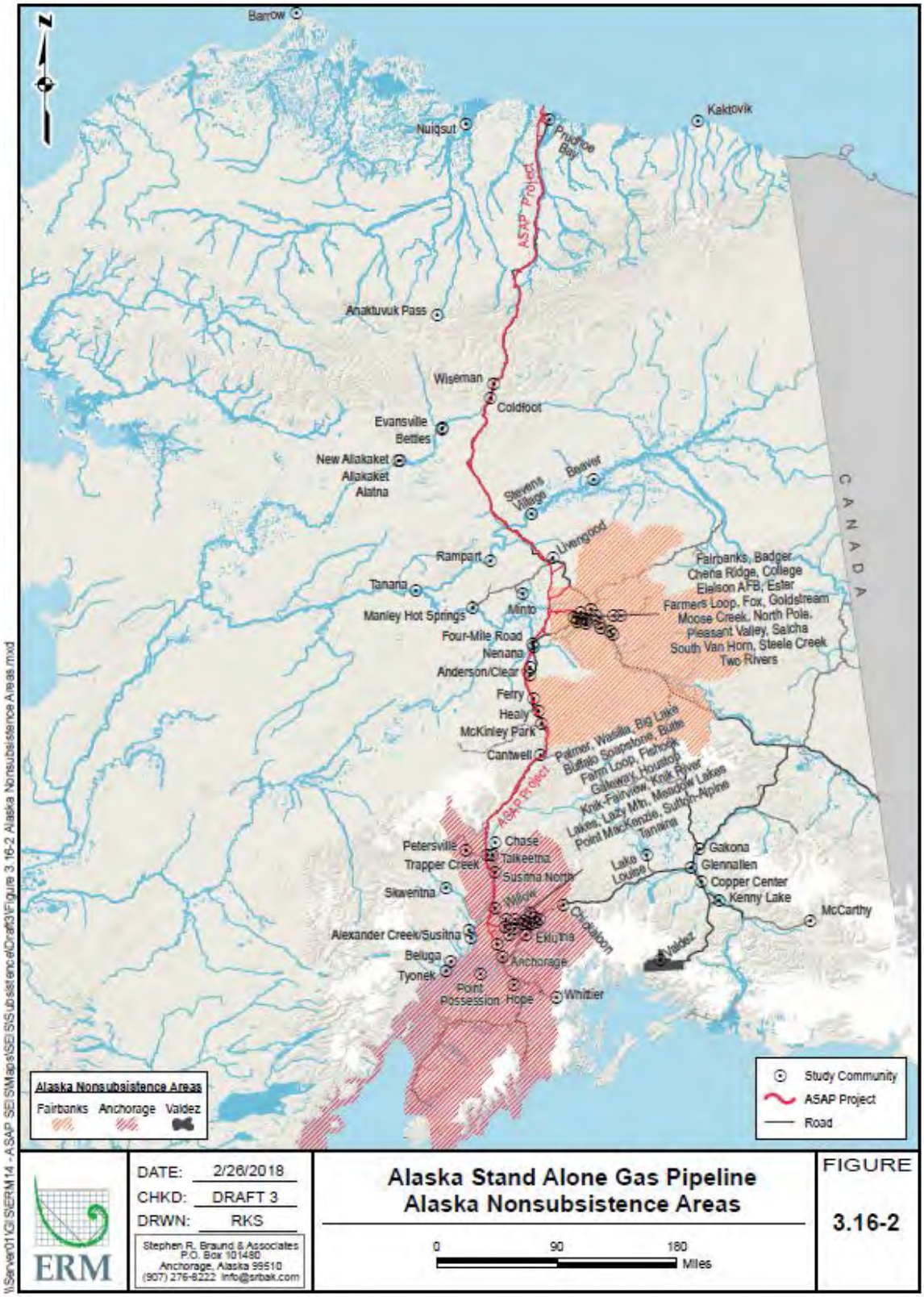
Alaska and the federal government regulate subsistence hunting and fishing in the state under a dual management system. The federal government recognizes subsistence priorities for rural residents on federal public lands, while Alaska considers all residents to have an equal right to participate in subsistence hunting and fishing when resource abundance and harvestable surpluses are sufficient to meet the demand for all subsistence and other uses. Much of the land traversed by the proposed Project is owned by the state and federal governments and managed by government agencies, including the ADNR, the U.S. Department of the Interior (DOI) BLM and DOD. Portions of the GCF to MP 533.5 segment would be located in the vicinity of, but would not intersect, lands managed by USFWS and NPS.

3.16.2.1. Federal Regulations

The U.S. Congress adopted ANILCA recognizing that "the situation in Alaska is unique" regarding food supplies and subsistence practices. The Act specifies that any decision to withdraw, reserve, lease, or permit the use, occupancy, or disposition of public lands must evaluate the effects of such decisions on subsistence use and needs

(16 U.S.C 3111-3126). In 1990, the USDOI and the U.S. Department of Agriculture established a Federal Subsistence Board to administer the Federal Subsistence Management Program (55 FR 27114). The Federal Subsistence Board, under Title VIII of ANILCA and regulations at 36 CFR 242.1 and 50 CFR 100.1, recognizes and regulates subsistence practices for rural residents on federal lands. Federal regulations recognize subsistence activities based on a person's residence in Alaska, defined as either rural or non-rural. Only individuals who permanently reside outside federally designated non-rural areas are considered rural residents and qualify for subsistence harvesting on federal lands under federal subsistence regulations. However, federal subsistence regulations do not apply to certain federal lands, regardless of residents' rural designations. These include lands withdrawn for military use that are closed to general public access (50 CFR 100.3). Non-rural areas are depicted on Figure 3.16-1.

Figure 3.16-1 Federally Designated Nonrural Areas



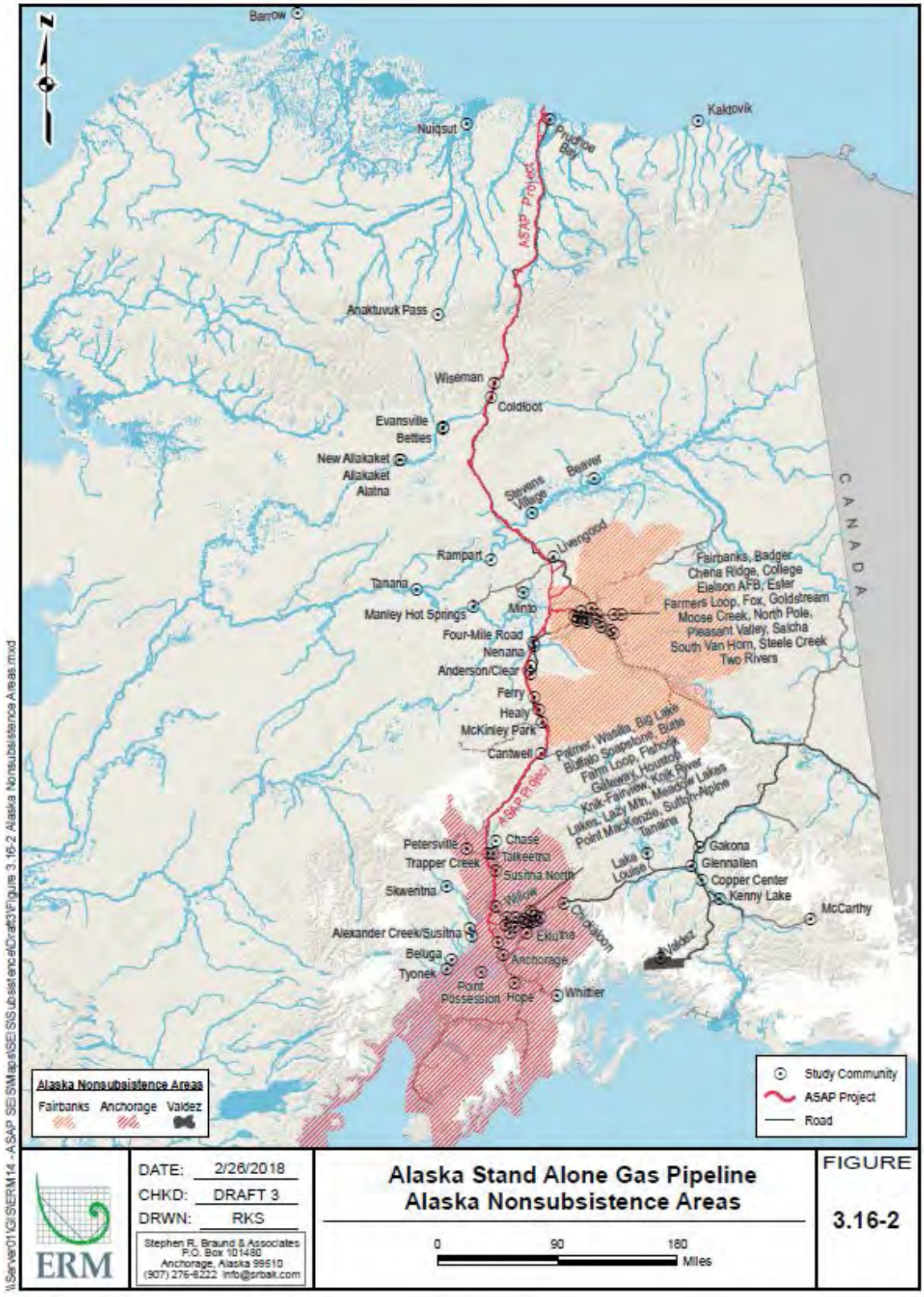
3.16.2.2. State Regulations

The Alaska Board of Fisheries and the Alaska Board of Game have adopted regulations enforced by the state for subsistence fishing and hunting on all State of Alaska lands and waters, and lands conveyed to ANCSA groups. State law is based on AS 16 and Title 5 of the AAC (05 AAC 01, 02, 85, 92, and 99) and regulates state subsistence uses. Under Alaska law, when there is sufficient harvestable surplus to provide for all subsistence and other uses, all residents qualify as eligible subsistence users.

The State distinguishes subsistence harvests from personal use, sport, or commercial harvests based on where the harvest occurs, not where the harvester resides (as is the case under federal law). More specifically, state law provides for subsistence hunting and fishing regulations in areas outside the boundaries of "non-subsistence areas," as defined in State regulations (5 AAC 99.015). According to these regulations, a non-subsistence area is "an area or community where dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area of community" (5 AAC 99.016).

Activities permitted in these non-subsistence areas include general hunting and personal use, sport, guided sport, and commercial fishing. There is no subsistence priority in these areas; therefore, no subsistence hunting or fishing regulations manage the harvest of resources. Non-subsistence areas in Alaska include the areas around Anchorage, Mat-Su Valley, Kenai, Fairbanks, Juneau, Ketchikan, and Valdez (Fall, 2014). State non-subsistence areas in relation to the proposed Project are depicted on Figure 3.16-2.

Figure 3.16-2 Alaska Nonsubsistence Areas



3.16.3. Potentially Affected Communities

The subsistence study area for the proposed Project includes communities that may harvest subsistence resources within or near the proposed Project Area, use proposed Project Area lands to access other lands for wildlife harvests, or harvest resources, which migrate through the proposed Project Area and are later harvested in other areas. Three criteria were developed for the 2012 FEIS for including communities within the affected environment discussion. These are:

- The community's documented subsistence use area intersects the proposed Project, regardless of the location of the community itself (*i.e.,* the community could be located well outside the range of the affected subsistence use area);
- The community's documented subsistence use area is within 30 miles of the proposed Project, regardless of the location of the community itself (*i.e.,* the community could be located well outside the range of the affected subsistence use area); or
- There are no use area data are available, and the community itself is located within 30 miles of the proposed Project.

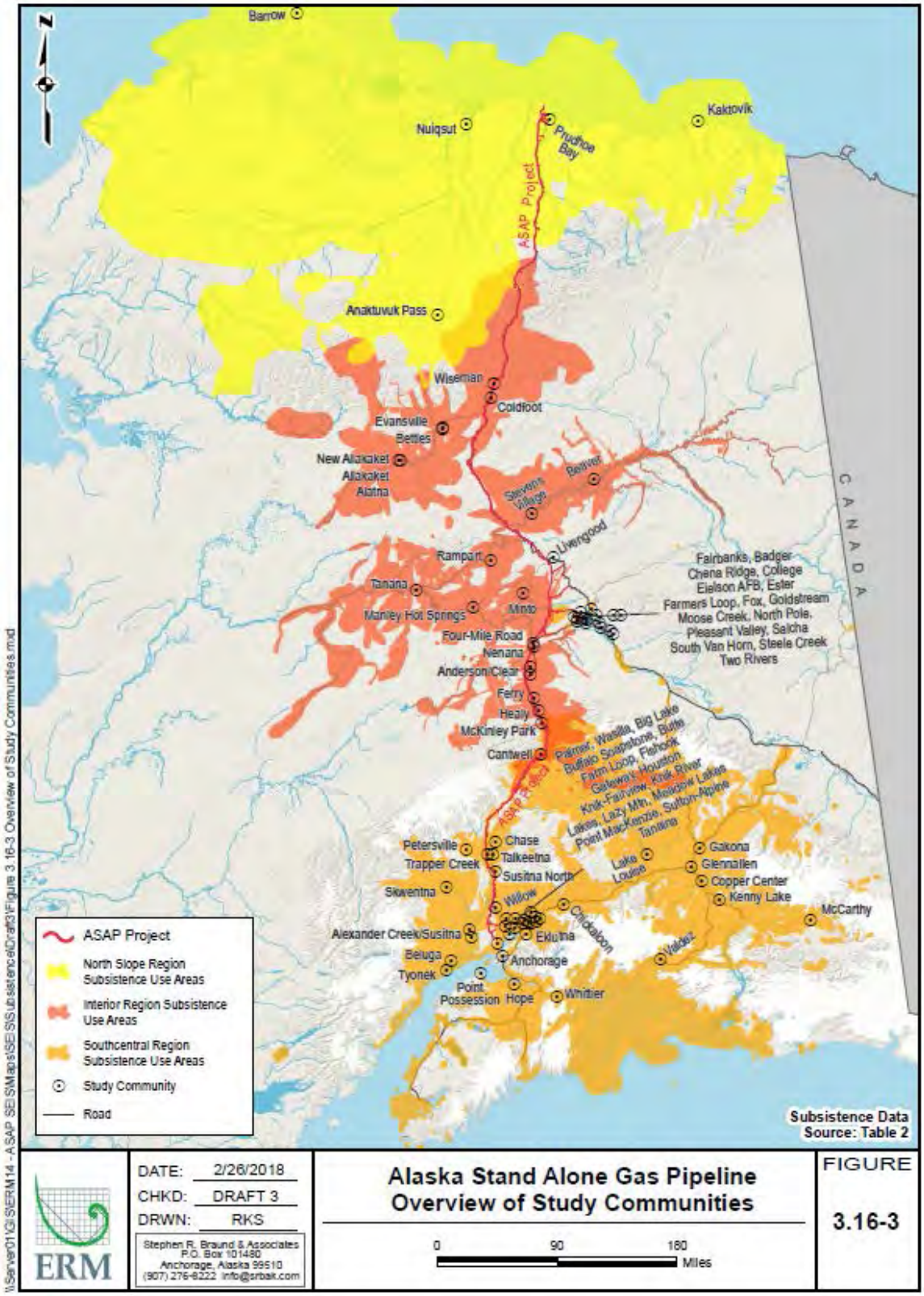
Based on a compilation and analysis of subsistence use area data that have been collected over the last 40 years within the State of Alaska, the extent of community subsistence use areas often varies between study years, in some cases by large distances. The study team selected 30 miles as a conservative estimate that would encompass the variability in use areas over time. In addition, communities whose subsistence use areas are 30 miles away may still be affected if migrating resources are disrupted and not available at the usual time and place where subsistence users can harvest them. Table 3.16-1 represents the list of 51 communities that satisfy the three criteria. See Figure 3.16-3 for an overview of the study communities in relation to the proposed Project.

Table 3.16-1 Communities for Subsistence Analysis in the SEIS

Study Region	Community with Federally Recognized Tribe	Other Communities	Total No. of Communities
North Slope	Anaktuvuk Pass, Barrow, Kaktovik, Nuiqsut	Prudhoe Bay[e]	5
Interior	Alatna, Allakaket[a], Beaver, Evansville, Manley Hot Springs, Minto, Nenana, Rampart, Stevens Village, Tanana	Anderson, Bettles, Coldfoot, Fairbanks[b], Ferry, Four Mile Road, Healy, Livengood, McKinley Park, Wiseman	20
Southcentral	Cantwell, Chickaloon, Copper Center, Eklutna, Gakona, Tyonek, Wasilla[c]	Beluga, Chase, Glennallen, Hope, Kenny Lake, Lake Louise, McCarthy, Municipality of Anchorage, Palmer[d], Petersville, Point Possession, Skwentna, Susitna, Susitna North, Talkeetna, Trapper Creek, Valdez, Whittier, Willow	26

a Given the proximity of the Allakaket and New Allakaket CDPs to each other and their similar demographics, history, economic characteristics, these two CDPs are collectively referred to as Allakaket.
b Given the proximity of these CDPs (Badger, Chena Ridge, College, Eielson AFB, Ester, Fairbanks, Farmers Loop, Fox, Goldstream, Moose Creek, North Pole, Pleasant Valley, Salcha, South Van Horn, Steele Creek, and Two Rivers) to each other and their similar demographics, history, economic characteristics, and lack of subsistence documentation, as well as all being located within the Fairbanks nonrural area, these CDPs are collectively referred to as Fairbanks.
c Given the proximity of these CDPs (Big Lake, Houston, Knik-Fairview, Fishhook, Gateway, Lakes, Meadow Lakes, Point MacKenzie, and Tanaina) to each other and their similar demographics, history, economic characteristics, and lack of subsistence documentation, as well as all being located within the Wasilla-Palmer nonrural area, these CDPs are collectively referred to as Wasilla. Wasilla includes the federally recognized Knik tribe.
d Given the proximity of these CDPs (Buffalo Soapstone, Butte, Farm Loop, Knik River, Lazy Mountain, and Sutton-Alpine) to each other and their similar demographics, history, economic characteristics, and lack of subsistence documentation, as well as all being located within the Wasilla-Palmer nonrural area, these CDPs are collectively referred to as Palmer.
e Prudhoe Bay is an industrial settlement with group quarters.

Figure 3.16-3 Overview of Study Communities



3.16.4. Community Subsistence Patterns

This SEIS characterizes the subsistence affected environment by examining the subsistence patterns of the 51 potentially affected communities (PAC) identified in Table 3.16-1. Due to the large scale of the proposed Project, community subsistence patterns that may be potentially affected by the proposed Project are discussed by three geographical areas including the North Slope, Interior, and Southcentral regions. Discussing the subsistence patterns by community within geographical regions allows for the identification of potential impacts at a community level but also allows for discussion of impacts that occur over a large area and may affect multiple communities within a region.

If available, seasonal round data (*i.e.,* timing of subsistence activity), harvest data, and subsistence use areas are described for each community. The ADF&G is the primary repository for these types of data for many study communities. Harvest data are available through the ADF&G's Community Subsistence Information System (CSIS) and federally sponsored harvest data studies (*e.g.*, data from the USDOI Mineral Management Services [MMS], now the Bureau of Ocean Energy Management [BOEM], are often included in the CSIS [ADF&G, 2016j]). In general, subsistence use areas, seasonal round data, and in-depth descriptions of the data are available in the technical reports associated with each subsistence study.

Table 3.16-2 lists the 51 study communities and associated sources of harvest data, seasonal round data, and subsistence use areas identified by the study team, including updated information since the 2012 FEIS. Subsistence harvest information, seasonal round data, and subsistence use area maps are also available in baseline studies done for EISs and federally or academically funded studies. While all residents of Alaska may qualify as subsistence users under state regulations, the majority of previous state-sponsored subsistence studies have focused on those communities where the "mixed, subsistence-market" economy is the driving economic force in the community. As such, non-rural areas of the state that do not rely on the mixed subsistence economy have had far fewer, if any, comprehensive subsistence studies that characterize their seasonal round, harvest data, and subsistence use areas. Because a number of communities lack subsistence data and documentation, this EIS is not able to characterize their subsistence uses, and thus it is difficult to analyze the impacts for all potentially affected study communities.

In a number of cases, the studies that do exist for potentially affected study communities are two or more decades old, and caution is advised when using older data to characterize current uses. These older data, however, represent the best available information and are sometimes the only subsistence data that exist for a community. Changes to resource availability, competition, and access to use areas occur over time and communities adapt their subsistence patterns in response to these changes. Communities with multiple study years may be the best indicators of a region's subsistence uses, as trends may be identifiable across study years.

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Table 3.16-2 Subsistence Harvest Data, Seasonal Round & Use Area Studies Reviewed for this Subsistence Analysis

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
North Slope Region						
Anaktuvuk Pass	1992 (Fuller and George 1999); 1994-1995 (Brower and Opie 1996); 1996-1997, 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003 (Bacon *et al.*, 2009); 2011 (Holen *et al.*, 2012)	1986-1991 (Adams *et al.*, 2008); 1990-1991 (Pedersen and Opie 1991); 1991-1992 (Pedersen and Opie 1992); 1993-1994 (Pedersen and Opie 1994); 2006-2007 (Pedersen and Nageak 2009)	2001-2002, 2002-2003 (Pedersen and Hugo 2005)	ND	Spearman *et al.*, 1979, Brower and Opie 1996, Fuller and George 1999, Bacon *et al.*, 2009, Pedersen and Nageak 2009, Holen *et al.*, 2012	Lifetime to 1979* (Pedersen 1979); Lifetime to 1985* (Hall *et al.*, 1985); 1994-2003* (SRB&A 2003a); 2001-2002, 2002-2003 (Pedersen and Hugo 2005); 2006-2007 (Pedersen and Nageak 2009); 2001-2010* (SRB&A 2013c); 2011* (Holen *et al.*, 2012)
Barrow	1987, 1988, 1989 (SRB&A and ISER 1993); 1992 (Fuller and George 1999); 1995-1996, 1996-1997, 2000, 2001, 2003 (Bacon *et al.*, 2009)	2003-2007 (Braem *et al.*, 2011)	ND	2005, 2007, 2008 (Naves 2010)	Schneider *et al.*, 1980, SRB&A and ISER 1993, Brower and Opie 1996, Fuller and George 1999, Edaw Inc. 2008, Bacon *et al.*, 2009, SRB&A 2010a, Braem *et al.*, 2011	Lifetime to 1979* (Pedersen 1979); 1979-1983 (Braund and Burnham 1984); 1987-1989* (SRB&A Unpublished); 1987-1989* (SRB&A and ISER 1993); 1994-2003* (SRB&A 2003a); 1997-2006* (SRB&A 2010a)
Kaktovik	1985, 1986 (ADF&G 2016); 1992 (Pedersen 1995a); 1992 (Fuller and George 1999); 1994-1995 (Brower *et al.*, 2000); 2002-2003 (Bacon *et al.*, 2009)	1981-1982, 1982-1983 (Pedersen and Coffing 1984); 1983-1984 (Coffing and Pedersen 1985); 1985-1986, 1986-1987, 1987-1988 (Pedersen 1990); 1990, 1991 (ADF&G 2016)	2000-2001, 2001-2002 (Pedersen and Linn 2005)	ND	Jacobsen and Wentworth 1982, Pedersen and Coffing 1984, Coffing and Pedersen 1985, IAI 1990b, Pedersen 1990, Pedersen *et al.*, 1991, Fuller and George 1999, Brower *et al.*, 2000, Pedersen and Linn 2005, EDAW Inc. 2008, Bacon *et al.*, 2009, SRB&A 2010a	Lifetime to 1979 (Pedersen 1979); 1923-1983* (Pedersen *et al.*, 1985); 1989* (Pedersen *et al.*, 1991); 1994-2003 (SRB&A 2003b); 2000-2001, 2001-2002 (Pedersen and Linn 2005); 1996-2006* (SRB&A 2010a)

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
Nuiqsut	1985 (ADF&G 2016j); 1992 (Fuller and George 1999); 1993 (Pedersen 1995b); 1994-1995 (Brower and Hepa 1998); 1995-1996, 2000-2001 (Bacon *et al.*, 2009)	2002-2007 (Braem *et al.*, 2011); 2008 (SRB&A 2010b); 2009 (SRB&A 2011); 2010 (SRB&A 2012); 2011 (SRB&A 2013b); 2012 (SRB&A 2014); 2013 (SRB&A 2015)	ND	ND	Brown 1979, Hoffman *et al.*, 1988, Brower and Hepa 1998, Fuller and George 1999, EDAW Inc. 2008, Bacon *et al.*, 2009, Galginaitis 2009a, Galginaitis 2009b, Galginaitis 2010, SRB&A 2010a, SRB&A 2010b, Braem *et al.*, 2011, SRB&A 2011, SRB&A 2012, SRB&A 2013b, SRB&A 2014, SRB&A 2015	Lifetime to 1979* (Pedersen 1979); Pre-1979* (Brown 1979); 1973-1986* (Pedersen 1986); 1994-2003* (SRB&A 2003a); 1995-2006* (SRB&A 2010a); 2001-2007 (Galginaitis 2009a); 2008 (Galginaitis 2009b); 2008 (SRB&A 2010b); 2009 (Galginaitis 2010); 2009 (SRB&A 2011); 2010 (SRB&A 2012); 2011 (SRB&A 2013b); 2012 (SRB&A 2014); 2013 (SRB&A 2015)
Prudhoe Bay	ND	ND	ND	ND	ND	ND
Interior Region						
Alatna	1982 (Marcotte and Haynes 1985)[a]; 1983 (McGee *et al.*, 1984)[a]; 1984 (Strong and McIntosh 1985)[a]; 2011 (Holen *et al.*, 2012)	1997-1998, 1998-1999, 1999-2000, 2001-2002 (Andersen *et al.*, 1998, 2000, 2001, 2004a); 2002-2003 (Brown *et al.*, 2004)	2002 (Andersen *et al.*, 2004b)	ND	Marcotte and Haynes 1985; Andersen *et al.*,1998; Andersen *et al.*, 2000; Andersen *et al.*, 2001; Andersen *et al.*, 2004a; Andersen *et al.*, 2004b; Brown *et al.*, 2004; YRDFA 2008; Holen *et al.*, 2012	1981-1983* (Marcotte and Haynes 1985); 2011* (Holen *et al.*, 2012)
Allakaket	1982 (Marcotte and Haynes 1985); 1983 (McGee *et al.*, 1984)[a]; 1984 (Strong and McIntosh 1985)[a]; 2011 (Holen *et al.*, 2012)	1997-1998, 1998-1999, 1999-2000, 2001-2002 (Andersen *et al.*, 1998, 2000, 2001, 2004a); 2002-2003 (Brown *et al.*, 2004)	2002 (Andersen *et al.*, 2004b)	ND	Marcotte and Haynes 1985; Andersen *et al.*,1998; Andersen *et al.*, 2000; Andersen *et al.*, 2001; Andersen *et al.*, 2004a; Andersen *et al.*, 2004b; Brown *et al.*, 2004; YRDFA 2008; Holen *et al.*, 2012	1981-1983* (Marcotte and Haynes 1985); 2011* (Holen *et al.*, 2012)

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
Anderson	1987 (ADF&G 2016j)	ND	ND	ND	ND	ND
Beaver	1984-1985 (Sumida 1989), 2011 (Holen *et al.*, 2012)	2008-2009, 2009-2010 (Van Lanen *et al.*, 2012)	2005 (Koskey and Mull 2011)	2000 (Andersen and Jennings 2001)	Sumida 1989, Andersen and Jennings 2001, SRB&A 2007a, Koskey and Mull 2011, Holen *et al.*, 2012, Van Lanen *et al.*, 2012	1930-1986* (Sumida 1989); 1997-2006* (SRB&A 2007a); 2011* (Holen *et al.*, 2012)
Bettles	1982 (Marcotte and Haynes 1985)[b]; 1983 (McGee *et al.*, 1984)[b]; 1984 (Strong and McIntosh 1985)[b]; 2011 (Holen *et al.*, 2012)	1997-1998, 1998-1999, 1999-2000, (Andersen *et al.*, 1998, 2000, 2001); 2002-2003 (Brown *et al.*, 2004)	2002 (Andersen *et al.*, 2004a)	ND	Marcotte and Haynes 1985, Andersen *et al.*, 1998, Andersen *et al.*, 2000, Andersen *et al.*, 2001, Andersen *et al.*, 2004a, Brown *et al.*, 2004, Holen *et al.*, 2012	1981-1983* (Marcotte and Haynes 1985); 2011* (Holen *et al.*, 2012)
Coldfoot	2011 (Holen *et al.*, 2012)	ND	ND	ND	Holen *et al.*, 2012	2011* (Holen *et al.*, 2012)
Evansville	1982 (Marcotte and Haynes 1985)[b]; 1983 (McGee *et al.*, 1984)[b]; 1984 (Strong and McIntosh 1985)[b]; 2011 (Holen *et al.*, 2012)	1997-1998, 1998-1999, 1999-2000, (Andersen *et al.*, 1998, 2000, 2001); 2002-2003 (Brown *et al.*, 2004)	2002 (Andersen *et al.*, 2004a)	ND	Marcotte and Haynes 1985; Andersen *et al.*, 1998; Andersen *et al.*, 2000; Andersen *et al.*, 2001, Andersen *et al.*, 2004a, Brown *et al.*, 2004, Holen *et al.*, 2012	1981-1983* (Marcotte and Haynes 1985); 2011* (Holen *et al.*, 2012)
Fairbanks (including Badger, Chena Ridge, College, Eielson AFB, Ester, Fairbanks, Farmers Loop, Fox, Goldstream, Moose Creek, North Pole, Pleasant Valley, Salcha, South Van Horn, Steele	ND	ND	ND	ND	ND	ND

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
Creek, and Two Rivers)						
Ferry	ND	ND	ND	ND	ND	ND
Four Mile Road	ND	ND	ND	ND	ND	ND
Healy	1987 (ADF&G 2016j)	ND	ND	ND	ND	Pre-1987* (Wolfe *et al.*, Unpublished)
Livengood	ND	ND	ND	ND	ND	ND
Manley Hot Springs	2012 (Brown *et al.*, 2014)	2004 (ADF&G 2016j)	2004 (ADF&G 2016j)	ND	Betts 1997; Brown *et al.*, 2014	1975-1995* (Betts 1997); 2012* (Brown *et al.*, 2014)
McKinley Park	1987 (ADF&G 2016j)	ND	ND	ND	ND	Pre-1987* (Wolfe *et al.*, Unpublished)
Minto	1983-1984 (Andrews 1988); 2012 (Brown *et al.*, 2014)	2004 (ADF&G 2016j)	1994 (Marcotte 1995); 2004 (ADF&G 2016j)	ND	Andrews 1988; Brown *et al.*, 2014	1960-1984* (Andrews 1988); 1960-1985 (Andrews and Napoleon 1985); 2012* (Brown *et al.*, 2014)
Nenana	ND	2004 (ADF&G 2016j	2004 (ADF&G 2016j)	ND	ND	1981-1982* (Shinkwin and Case 1984)
Rampart	ND	ND	ND	2000 (Andersen & Jennings 2001)	Betts 1997; Andersen and Jennings 2001	1975-1995* (Betts 1997)
Stevens Village	1983-1984 (Sumida 1988)	2008-2009, 2009-2010 (Van Lanen *et al.*, 2012)	ND	2000 (Andersen and Jennings 2001)	Sumida and Alexander 1985, Sumida 1988, Van Lanen *et al.*, 2012	1974-1984 (Sumida and Alexander 1985); 1974-1984* (Sumida 1988)

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
Tanana	1987 (Case and Halpin 1990)	1996 (ADF&G 2016j), 1997-1998, 1998-1999, 1999-2000, (Anderson *et al.*, 1998, 2000, 2001) 2002-2003 (Brown *et al.*, 2004)	2006 (Brown *et al.*, 2010)	ND	Case and Halpin 1990, Brown *et al.*, 2004, Brown *et al.*, 2010	1968-1988* (Case and Halpin 1990); 2006 (Brown *et al.*, 2010)
Wiseman	1991 (Scott 1998); 2011 (Holen *et al.*, 2012)	ND	ND	ND	Scott 1998, Holen *et al.*, 2012	1992* (Scott 1998), 2011* (Holen *et al.*, 2012)
Southcentral Region						
Municipality of Anchorage	ND	1995, 1996, 1997 (Wolfe and Mishler 1996, 1997, 1998); 1998 (Wolfe and Hutchinson-Scarbrough 1999); 2000 (Wolfe 2001); 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008 (Wolfe *et al.*, 2002, 2003, 2004, 2005, 2006, 2008, 2009a, 2009b)	ND	ND	ND	ND
Beluga	1982, 1984 (Stanek 1987); 2005-2006 (Stanek *et al.*, 2007)	ND	ND	ND	Stanek 1987; SRB&A 2007b, Stanek *et al.*, 2007	1925-1962, 1984 (Stanek 1987); 1983* (ADF&G 1985); 1987-2006* (SRB&A 2007b); 2005-2006 (Stanek *et al.*, 2007)
Cantwell	1982-1983 (Stratton and Georgette 1984); 1999 (Simeone 2002); 2012 (Holen *et al.*, 2014)	ND	ND	2000 (ADF&G 2016j)	Simeone 2002, Holen *et al.*, 2014	Lifetime to 2000* (Simeone 2002); 1964-1984* (Stratton and Georgette 1985); 1968-1986* (Stanek *et al.*, 1988)[c]; 2012* (Holen *et al.*, 2014)
Chase	1986 (Stanek *et al.*, 1988); 2012 (Holen *et al.*, 2014)	ND	ND	ND	Stanek *et al.*, 1988, Holen *et al.*, 2014	1968-1986* (Stanek *et al.*, 1988)[d]; 2012 (Holen *et al.*, 2014)
Chickaloon	1982-1983 (Stratton and Georgette 1984)	ND	ND	ND	ND	1964-1984* (Stratton and Georgette 1985)

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
Copper Center	1982-1983 (Stratton and Georgette 1984); 1987-1988 (McMillan and Cuccarese 1988); 2010 (La Vine *et al.*, 2013)	ND	2001 (Simeone and Kari 2005)	2000 (ADF&G 2016)	McMillan and Cuccarese 1988, La Vine *et al.*, 2013	1964-1984* (Stratton and Georgette 1985); 2001 (Haley and Nemeth 2005); 2010* (La Vine *et al.*, 2013)
Eklutna	ND	ND	ND	ND	ND	Unspecified (SRB&A Unpublished-b)
Gakona	1982-83 (Stratton and Georgette 1984); 1987 (McMillan and Cuccarese 1988); 2012 (La Vine and Zimpleman 2014)	ND	2001 (Simeone and Kari 2005)	ND	McMillan and Cuccarese 1988; La Vine and Zimpleman 2014	1964-1984* (Stratton and Georgette 1985); 2001 (Haley and Nemeth 2005); 2012* (La Vine and Zimpleman 2014)
Glennallen	1982-1983 (Stratton and Georgette 1984); 1987 (McMillan and Cuccarese 1988); 2013 (Holen *et al.*, 2015)	ND	2001 (Simeone and Kari 2005)	ND	McMillan and Cuccarese 1988; Holen *et al.*, 2015	1964-1984* (Stratton and Georgette 1985); 2013* (Holen *et al.*, 2015)
Hope	1990 (ADF&G 2016j)	ND	2002-2003 (Fall *et al.*, 2004)	ND	Fall *et al.*, 2004	Pre-1991* (Seitz *et al.*, 1992)
Kenny Lake	1982-1983 (Stratton and Georgette 1984); 1987-1988 (McMillan and Cuccarese 1988); 2012 (La Vine and Zimpleman 2014)	ND	2001 (Simeone and Kari 2005)	ND	McMillan and Cuccarese 1988; La Vine and Zimpleman 2014	1964-1984* (Stratton and Georgette 1985); 2012* (La Vine and Zimpleman 2014)
Lake Louise	1982-1983 (Stratton and Georgette 1984); 1987-1988 (McMillan and Cuccarese 1988); 2013 (Holen *et al.*, 2015)	ND	2001 (Simeone and Kari 2005)	ND	McMillan and Cuccarese 1988; Holen *et al.*, 2015	1964-1984* (Stratton and Georgette 1985); 2013* (Holen *et al.*, 2015)
McCarthy	1982-1983 (Stratton and Georgette 1984); 1987-1988 (McMillan and Cuccarese 1988); 2012	ND	2001 (Simeone and Kari 2005)	ND	McMillan and Cuccarese 1988; La Vine and Zimpleman 2014	1964-1984* (Stratton and Georgette 1985); 2012* (La Vine and Zimpleman 2014)

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
	(La Vine and Zimpleman 2014)					
Palmer (including Buffalo Soapstone, Butte, Farm Loop, Knik River, Lazy Mountain, and Sutton-Alpine)	ND	ND	ND	ND	ND	ND
Petersville	1985 (Fall and Foster 1987)	ND	ND	ND	ND	ND
Point Possession	ND	ND	ND	ND	ND	ND
Skwentna	1982, 1984 (Stanek 1987), 2012 (Holen *et al.*, 2014)	ND	ND	ND	Fall *et al.*, 1983, Stanek 1987, Holen *et al.*, 2014	Pre-1983* (ADF&G 1985); 1925-1962, 1984 (Stanek 1987); 1982* (Fall *et al.*, 1983), 2012* (Holen *et al.*, 2014)
Susitna (*i.e.*, Alexander Creek)	1982, 1984 (Stanek 1987); 2012 (Holen *et al.*, 2014)	ND	ND	ND	Holen *et al.*, 2014	1925-1962, 1984 (Stanek 1987); Pre-1985* (ADF&G 1985), 2012* (Holen *et al.*, 2014)
Susitna North	ND	ND	ND	ND	ND	ND
Talkeetna	1985-1986 (Fall and Foster 1987); 2012 (Holen *et al.*, 2014)	ND	ND	ND	Holen *et al.*, 2014	2012* (Holen *et al.*, 2014)
Trapper Creek	1985-1986 (Fall and Foster 1987); 2012 (Holen *et al.*, 2014)	ND	ND	ND	Holen *et al.*, 2014	1985* (ADF&G 1985); 2012* (Holen *et al.*, 2014)
Tyonek	1983-1984 (Fall *et al.*, 1984); 2005-2006 (Stanek *et al.*, 2007); 2013 (Jones *et al.*, 2015)	2005, 2006 (ADF&G 2016j); 1980-1982 (Foster 1982b); 1996, 1997 (Wolfe and Mishler 1997, 1998); 1998 (Wolfe and Hutchinson-Scarbrough 1999); 2000 (Wolfe 2001); 2001, 2002, 2003, 2004, 2007, 2008	1980-1982 (Foster 1982b)	2000 (ADF&G 2016j)	Foster 1982b, Fall *et al.*, 1984, SRB&A 2007b, Stanek *et al.*, 2007, Jones *et al.*, 2015	Pre-1981* (Foster 1982b); Pre-1982 (Stanek *et al.*, 1982); 1978-1984* (Fall *et al.*, 1984); 1981 (Foster 1982a); 1987-2006* (SRB&A 2007b); 2005-2006* (Stanek *et al.*, 2007); 2013* (Jones *et al.*, 2015)

Community	Harvest Data by Study Year (Source)				Seasonal Round	Use Area (*=All Resources)
	All Resources	Mammals	Fish	Birds		
		(Wolfe *et al.*, 2002, 2003, 2004, 2005, 2009a, 2009b)				
Valdez	1991-93 (Miraglia and Tomrdle 1995)	1995, 1996, 1997 (Wolfe and Mishler 1996, 1997, 1998); 1998 (Wolfe and Hutchinson-Scarbrough 1999); 2000 (Wolfe 2001); 2001, 2002, 2003, 2004, 2007, 2008 (Wolfe *et al.*, 2002, 2003, 2004, 2005, 2009a, 2009b)	ND	ND	Fogarty *et al.*, 2000	Pre-1993* (Tomrdle and Miraglia 1993)
Wasilla (Big Lake, Houston, Knik-Fairview, Fishhook, Gateway, Lakes, Meadow Lakes, Point MacKenzie, and Tanaina)	ND	ND	ND	ND	ND	ND
Whittier	1990 (ADF&G 2016j)	ND	ND	ND	ND	Pre-1991* (Seitz *et al.*, 1992)
Willow	ND	ND	ND	ND	ND	ND

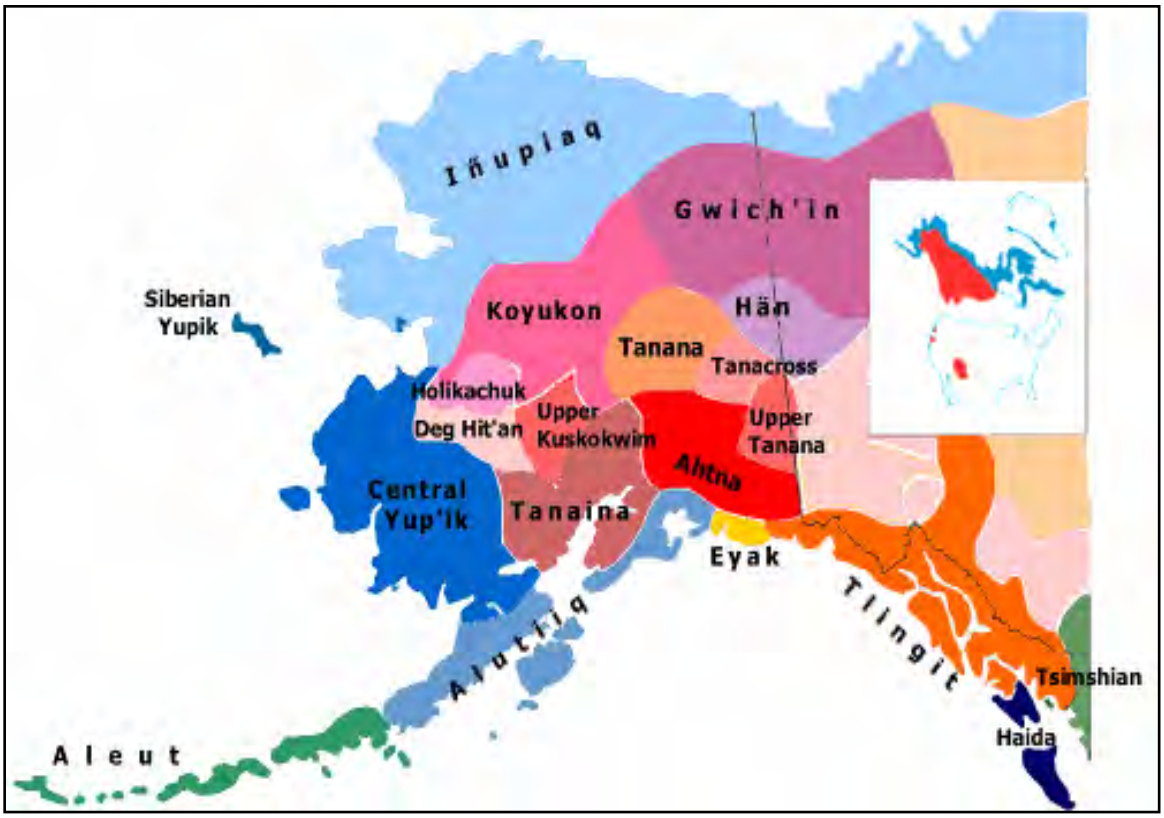
a Harvest study years for Alatna/Allakaket combined
b Harvest study years for Bettles/Evansville combined
c Includes Hurricane/Broad Pass use areas
d Includes Chulitna/Gold Creek use areas
ND = No Data: No current (*e.g.*, post-1960) systematically collected subsistence harvest, seasonal round, or use area data discovered for this community

3.16.5. North Slope Region

The North Slope Region is the geographical area north of the Brooks Range to the Beaufort Sea. The Brooks Range, Arctic Foothills, and ACP ecoregions comprise the North Slope environment. The ACP is primarily a flat tundra environment with poor drainage and numerous lakes; the Arctic Foothills are characterized by treeless rolling hills and plateaus with defined drainage patterns; and the Brooks Range is comprised of rugged mountain terrain shaped by Pleistocene glaciations and dwarf scrub vegetation (Gallant, 1995). Low mean annual temperatures and annual precipitation typify climate in all three regions.

The Iñupiat were the indigenous populations that inhabited the North Slope at the time of European contact. The Iñupiat were comprised of two cultural groups, the Tareumiut who inhabited coastal areas of the ACP and the Nunamiut who inhabited the Brooks Range and Arctic Foothills areas. Both groups spoke the Iñupiaq language, which was spoken in other areas of Alaska including Northwestern Alaska and the Seward Peninsula as well as into Canada (Figure 3.16-4). The coastal Iñupiat harvested from a marine and terrestrial mammal and fish resource base, while their inland neighbors relied mostly on terrestrial mammals, primarily caribou, and fish for their subsistence harvests. More often Iñupiaq groups and territories were defined based on kinship ties and place in which they lived (Spencer, 1984). For example, people who resided near Point Barrow (*Nuvuk*) were known as the Nuvugmiut, people who resided along the lower and middle Colville River were known as the Kukpigmiut, and the Killikmiut were the "people of the Killik River" (Spencer, 1984; Hall, 1984; Burch, 1980). Burch (1980) identified approximately six societies inhabiting the North Slope Region circa 1816 to 1842 and noted that each of these groups had a distinct area with which they identified. Burch termed these six societies as the Colville River, ACP, Barrow, Northwest Coast, Utukok River, and Point Hope societies.

Figure 3.16-4 Alaska Native Languages Map



Iñupiat still occupy the North Slope today and often harvest subsistence resources from specific camps where multiple resource harvest opportunities are available in each season. Harvests tend to be concentrated near communities, along rivers and coastlines, or at particularly predictable and productive sites. The distribution, migration, and seasonal, more extended cyclical variation of animal populations makes determining what, where, and when a subsistence resource will be harvested a complex activity. Areas that might be used infrequently can still be quite important harvest areas (BLM, 1978). Subsistence use areas include areas where formerly highly mobile Iñupiat families ranged for trapping, fishing, sealing, and bird hunting before the 1950s, when mandatory school attendance and economic factors such as a decline in fur prices compelled families to permanently settle in one of a few centralized communities. The advent of snowmachines and ATVs, including four-wheelers and amphibious and tracked rigs, reduced the time needed to return to former use areas far from the main communities, but increased the need for cash employment to pay for the purchase, maintenance, and supplies for the new equipment (Ahtuangaruak, 1997; Impact Assessment Inc. [IAI], 1990a, 1990b; Worl and Smythe, 1986). Modern technology has allowed for far ranging subsistence trips over a shorter period of time. An evolution of the nomadic subsistence residence pattern is the base camp system for harvesting freshwater and land-based resources using modern technology, where camps, cabins, caches, and tent platforms are pre-positioned in places central to a set of resource

harvest areas, and hunting and fishing expeditions are based out of these locations (IAI, 1990b).

The North Slope Region encompasses the study communities of Barrow, Nuiqsut, Prudhoe Bay, Kaktovik, and Anaktuvuk Pass (Figure 3.16-3). All but Prudhoe Bay are communities with federally recognized tribes. These tribes have traditional and current resource uses, including customary and traditional, educational, and ceremonial uses in or near the proposed Project Area. See the following discussion for a description of the five communities and their subsistence use areas, harvest patterns, and seasonal round.

3.16.5.1. Community Descriptions

3.16.5.1.1. Anaktuvuk Pass

Anaktuvuk Pass is in the Brooks Range just south of the continental divide in a low pass connecting the drainages of the Anaktuvuk and John Rivers, 60 miles west of the Dalton Highway. The 2010 population was 324, of whom 83 percent were Alaska Native (U.S. Census Bureau, 2016a). The area has been used by the interior Iñupiat people, called the Nunamiut, for at least 500 years and by Iñupiat predecessor groups for at least 4,000 years. The modern village began in 1949 with the establishment of a trading post, followed by a post office in 1951 and a church in 1958. Residents incorporated as a fourth-class city in 1959. A permanent school was established in 1961, and the community was reclassified as a second-class city in 1971 (Hall *et al.*, 1985). The Naqsragmuit Tribal Council is a federally recognized tribe.

3.16.5.1.2. Barrow

Barrow is situated near Point Barrow or Nuvuk, the demarcation point between the Chukchi and Beaufort seas, where the sea ice is prone to cracking open, creating leads for sea mammals to breathe. The 2010 population was 4,212, of whom 61 percent were Alaska Native (U.S. Census Bureau, 2016a). The Native Village of Barrow is a federally recognized tribe. The Iñupiat name for the modern Barrow area is Ukpeagvik, meaning "the place where we hunt snowy owls." A main subsistence focus has been marine mammal (*e.g.*, walrus and seal) hunting and whaling in particular. Barrow is one of 11 Alaska Eskimo bowhead-whaling communities. Bowhead whale hunting is the key activity in the organization of social relations in the community and represents one of the greatest concentrations of effort, time, money, group symbolism, and significance (SRB&A and ISER, 1993). Other harvested resources, such as caribou, waterfowl, and several varieties of fish, are vital for subsistence and available near Barrow.

3.16.5.1.3. Kaktovik

Kaktovik is located on the northeast coast of Barter Island on the Beaufort Sea between the Okpilak and Jago Rivers, surrounded by the ANWR. The location was formerly used by Iñupiat people from Canada and Alaska when trading with Athabascan Indians from the interior (IAI, 1990b). The 2010 population was 239 of whom 89 percent were Alaska

Native (U.S. Census Bureau, 2016a). The Native Village of Kaktovik is a federally recognized tribe. Kaktovik, one of the 11 Alaska Eskimo bowhead-whaling communities, was established in its contemporary form in 1923, when the Gordon family moved their trading post from Demarcation Point to Barter Island to be closer to Tom Gordon's Iñupiat relatives. While few settled there in a permanent year-round sense, the trading post became a center of annual travel for Iñupiat people from Barrow to Herschel Island. By the late 1920s, reindeer herding was a commercial undertaking in the region, with families herding reindeer in their normal hunting and trapping territories until the practice ended in the late 1930s, concurrent with the death of Tom Gordon and the closure of his trading post. The community dispersed again, with some moving to Herschel Island or Barrow, but soon a U.S. Geodetic Survey base camp was built on Tigvariak Island and preparations for the Distant Early Warning (DEW) Line site at Barter Island drew Iñupiat people back to Kaktovik for jobs. The Bureau of Indian Affairs (BIA) opened a school in 1951. The community started bowhead whaling again in the early 1960s (IAI, 1990b). The community relies primarily on marine mammals, caribou, fish, and birds.

3.16.5.1.4. Nuiqsut

Nuiqsut's location on the Colville River, some 35 miles upstream from the Beaufort Sea, is a prime area for fish and caribou harvests, and although less advantageous for marine mammal harvests, residents do travel to the ocean to harvest them. The 2010 population was 402, with 87 percent of residents Alaska Native (U.S. Census Bureau, 2016a). The Native Village of Nuiqsut is a federally recognized tribe. The Colville River is the largest river system on the North Slope and supports the largest overwintering areas for whitefish (Craig, 1987). Twenty-seven families from Barrow permanently resettled Nuiqsut in 1973. The Nuiqsut area was formerly a place where Iñupiat and Athabascan people gathered to trade and fish, maintaining connections between the Nunamiut of the inland areas and the Taremiut of the coast (Brown, 1979). The ANCSA allowed Iñupiat from Barrow who wished to live in a more traditional manner to select the site for resettlement, and many of those who moved there had some family connection to the area (IAI, 1990a). Easy access to the main channel of the Colville River for fishing, hunting, and ease of movement between upriver hunting sites and downriver whaling and sealing sites was the primary reason for selection of the site (Brown, 1979).

Nuiqsut is one of 11 Alaska Eskimo whaling communities. Many of those who resettled Nuiqsut were experienced whalers and crew who remembered past whale harvests before the temporary abandonment of the settlement (IAI, 1990a). Nuiqsut whale hunting is based from Cross Island, approximately 70 miles northeast of Nuiqsut and approximately 15 miles from West Dock on the west side of Prudhoe Bay. Nuiqsut whalers travel approximately 100 miles from Nuiqsut to the Cross Island whaling camp. Nuiqsut whaling occurs in the fall when the whales migrate closer to shore, because the spring migration path is too distant from shore for effective hunting with small boats. Some Nuiqsut residents also participate in Barrow's spring whale hunt through close

family ties in that community (Fuller and George, 1999). Nuiqsut residents primarily harvest fish, caribou, marine mammals, and birds.

3.16.5.1.5. Prudhoe Bay

Prudhoe Bay, which includes the industrial area of Deadhorse, is located adjacent to the Beaufort Sea on the North Slope, approximately 54 miles east of the community of Nuiqsut. The area is a slightly elevated plain with numerous lakes and areas of water-saturated tundra; offshore islands and ice pack protect the coastal plain from most erosion. Before contact the Prudhoe Bay area was an area used by Iñupiat for hunting, fishing and whaling, and several families now resident in other communities had cabins and camps there (IAI, 1990a; 1990b). In 1968, the largest oil pool in North America was discovered by Atlantic Richfield Company (ARCO), resulting in a rush to develop the physical and legal infrastructure of Alaska so that production could begin (Coates, 1991). Oil development and production at Prudhoe Bay became the nucleus for expanding networks of oil and gas production wells at neighboring fields (IAI, 1990a, 1990b). Today, Prudhoe Bay and the central camp of Deadhorse are key centers for support and expansion of the oil industry and part-time home to hundreds of workers who work 1 or 2 weeks on and 1 or 2 weeks off for 12 hour or longer daily shifts (Hoefs, 2014). The U.S. Census Bureau (2016a) reported that the population of Prudhoe Bay/Deadhorse in 2010 was 2,174, 7.8 percent of whom were Alaska Native. This number likely reflects temporary or part-time residents of Prudhoe Bay who are employed by oil-drilling or oil-production and -support companies and work in shifts based out of Prudhoe Bay (Alaska Department of Commerce and Community Economic Development [ADCCED], 2016). Along with oil field unit operator policies that prohibit hunting within their operation areas, Prudhoe Bay lies within the ADF&G "Prudhoe Bay Closed Area," which surrounds much of the industrialized areas around Prudhoe Bay and is closed to the taking of big game.

3.16.5.2. Subsistence Use Areas

Residents of Barrow, Nuiqsut, Kaktovik, and Anaktuvuk Pass utilize an expansive area from which they harvest subsistence resources (Figure 3.16-5); no use area data exist for the community of Prudhoe Bay. These use areas represent the combination of several mapping studies conducted in each of the communities during different years. Anaktuvuk Pass, Nuiqsut, and Kaktovik all have newer subsistence use area data (including additional older data recently identified or resource-specific use areas) since the publication of the 2012 FEIS (Table 3.16-2).

The combined use areas for these four communities extend from the Chukchi Sea coast and headwaters of the Colville River in the west to the border of Canada and beyond in the east. Marine resources are hunted in the Beaufort and Chukchi seas and the most southern use areas extend far into the Brooks Range and along the Noatak River. Snowmachines are the primary mode of transportation to access winter and spring use areas; boat is the primary mode of transportation in the summer and fall and some areas

are accessed by ATV as well during the ice-free months. Whereas other North Slope study communities utilize boats during the summer to access marine and river use areas, Anaktuvuk Pass residents travel to summer use areas primarily by ATV.

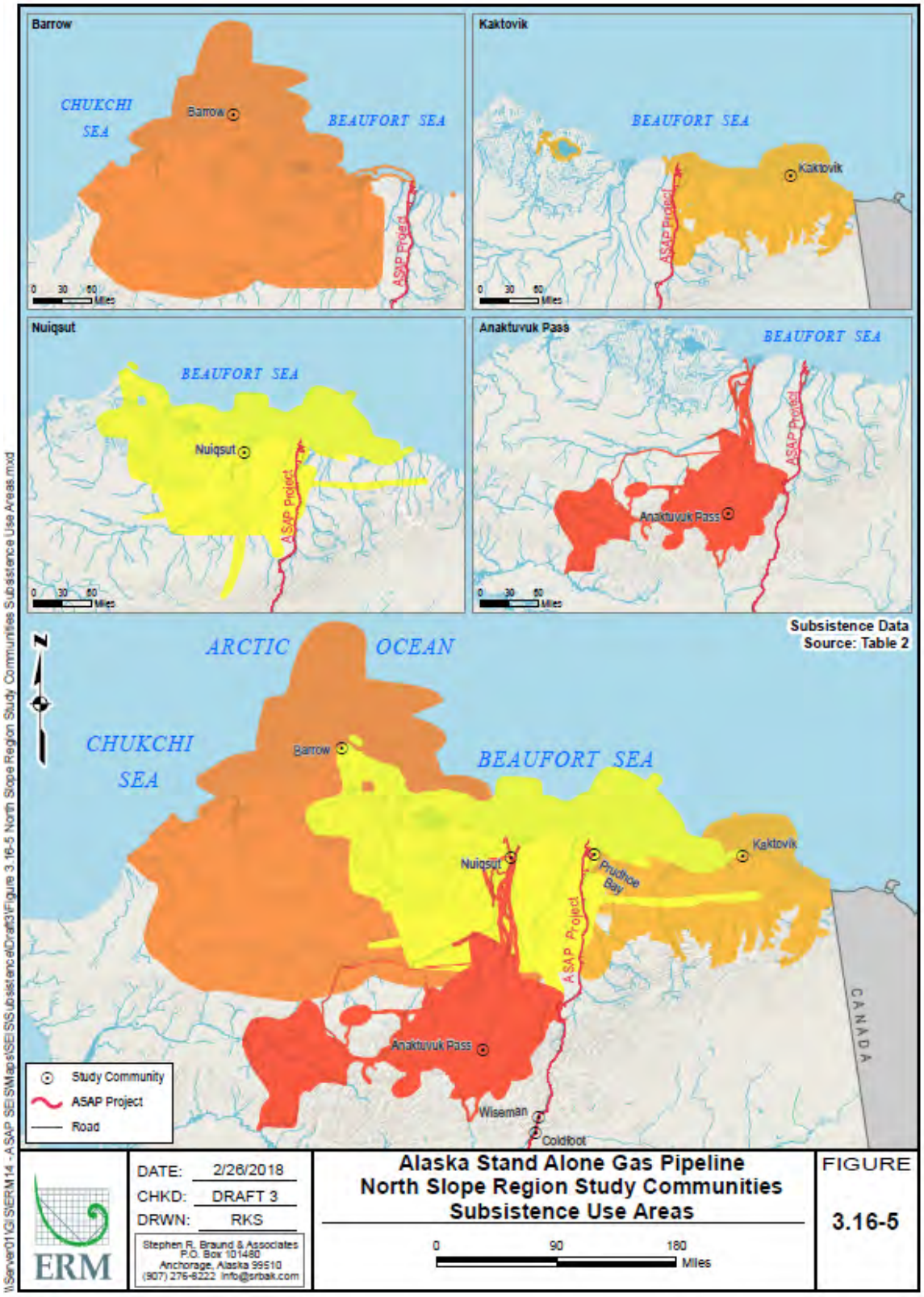
Anaktuvuk Pass subsistence use areas are primarily located within the Brooks Range region around the community with some use to the north towards Nuiqsut and to the west along the Noatak River (Figure 3.16-5). Anaktuvuk Pass is the only North Slope study community that does not utilize the marine environment. Because of their inland location, residents rely heavily on land mammal resources, particularly caribou, as they migrate through Anaktuvuk Pass. A portion of the Anaktuvuk Pass use area intersects with the proposed Project.

Barrow subsistence use areas include the large expanse of open tundra areas south of the community and into the Arctic foothills near the Colville River (Figure 3.16-5). The furthest extent of marine use occurs directly north of the community and closer areas are located along the coast west and east of Barrow in both the Chukchi and Beaufort seas. Barrow use areas intersect a small portion of the proposed Project, and marine use areas may potentially be crossed by barging routes associated with the Project.

Nuiqsut inland subsistence use areas are located as far west as Barrow and as far east as Kaktovik; however, the majority of their use occurs west of the Dalton Highway and south along the Colville River area to the foothills of the Brooks Range (Figure 3.16-5). Offshore use areas are located north of the community and toward the east in the vicinity of Cross Island, the community's base for fall whaling activities. Nuiqsut use areas intersect the proposed Project, and marine use areas may be potentially crossed by barging routes associated with the Project.

Kaktovik subsistence use areas are nearly all located east of the Dalton Highway and extend into Canada (Figure 3.16-5). Kaktovik residents share close family ties with the Aklavik and Inuvik communities in Canada. South of the community, use areas reach into the mountains of the Brooks Range. Offshore use areas for marine resources are located directly north of the community and along the coastline to the east and west. A small portion of Kaktovik's use area intersects with the proposed Project.

Figure 3.16-5 North Slope Region Study Communities Subsistence Use Areas

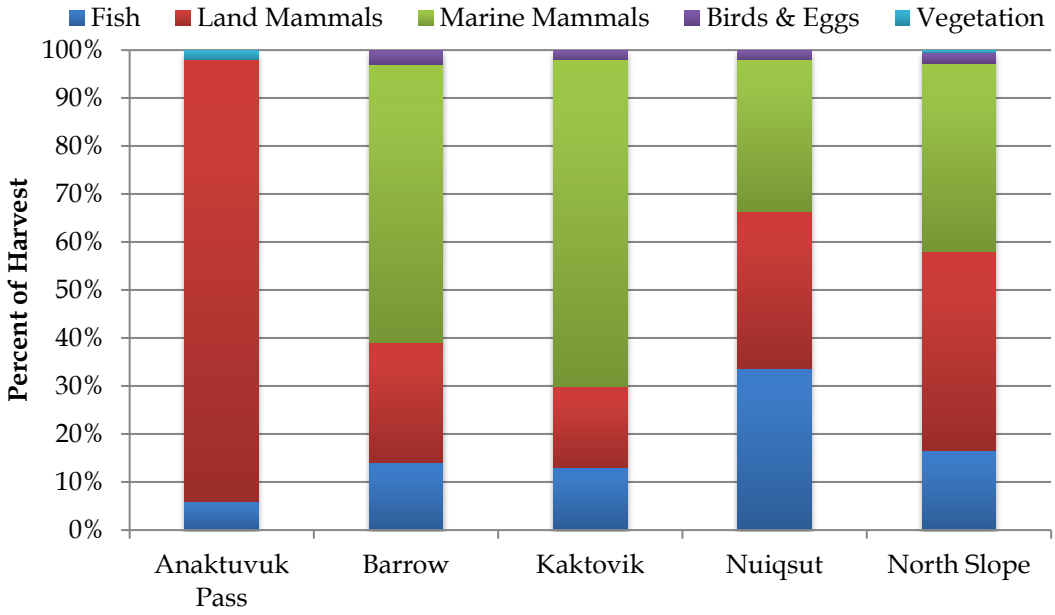


3.16.5.3. Subsistence Harvest Patterns

Comprehensive all-resources harvest data exist for four of the five North Slope study communities (Figure 3.16-6). Anaktuvuk Pass has updated harvest data since the publication of the 2012 FEIS (Table 3.16-2). All of the North Slope study communities with subsistence data, utilize a broad base of subsistence resources with the majority of harvests coming from marine mammals (except for Anaktuvuk Pass), land mammals, and fish (Figure 3.16-6). Vegetation and birds/eggs also contribute to the subsistence harvest.

Anaktuvuk Pass, which is the only North Slope study community not situated on or near the coast, relies more heavily on a land-mammal, resource base supplemented by fish, vegetation, birds, and eggs. In Barrow and Kaktovik, marine mammals contribute the most to the overall harvest, while marine mammals, land mammals, and fish contribute an approximately equal percentage to the overall harvest in Nuiqsut. The average of all North Slope study communities shows that marine mammals and land mammals comprise more than 80 percent of total harvested pounds for the region (Figure 3.16-6).

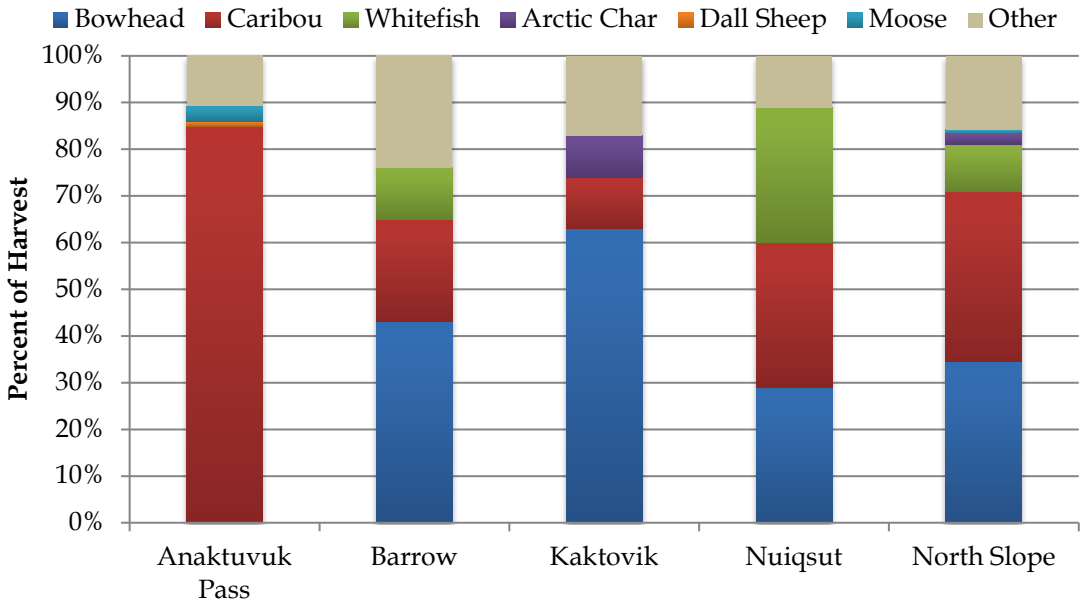
Figure 3.16-6 Percent of Harvest by Resource Category – North Slope Region



Notes: Most recent study year data shown for all study communities.
Sources: Anaktuvuk Pass 2011 (Holen *et al.*, 2012); Barrow 1989 (SRB&A and ISER, 1993); Kaktovik 1992 (Pedersen, 1995a); Nuiqsut 1993 (Pedersen, 1995b)

Figure 3.16-7 displays the top three species contributing to each community's overall harvest. Caribou (79 percent) is the most important contributor to Anaktuvuk Pass' harvest. Dall sheep (8 percent) and moose (3 percent) contribute a much smaller percentage but are still important resources. The remaining 10 percent of the harvest is represented by other species. The top two species for Barrow, Nuiqsut, and Kaktovik are bowhead and caribou. Whitefish round out the top three in Nuiqsut and Barrow, while Arctic char is the third most harvested species in Kaktovik. For all four study communities combined, bowhead and caribou represent 70 percent of the region's total subsistence harvest as measured in edible pounds.

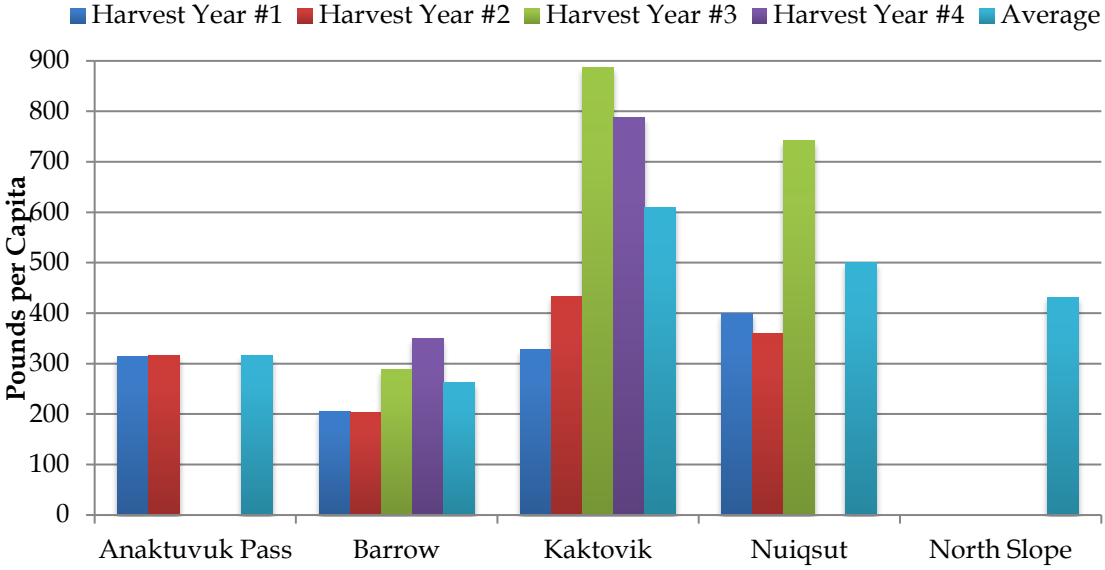
Figure 3.16-7 Percent of Harvest by Top Three Species – North Slope Region



Notes: Most recent study year data shown for all study communities.
Sources: Anaktuvuk Pass 2011 (Holen *et al.*, 2012); Barrow 1989 (SRB&A and ISER, 1993); Kaktovik 1992 (Pedersen, 1995a); Nuiqsut 1993 (Pedersen, 1995b)

Residents in the North Slope study communities have reported harvests ranging from more than 250 pounds per person to nearly 900 pounds a person (Figure 3.16-8). As Figure 3.16-8 shows, harvest amounts can vary from year to year and certain resources such as bowhead (which can contribute as much as 25,000 pounds to a community's total harvest) can make a major difference in a community's per capita harvest during a given study year. For example, during Kaktovik's first harvest study, residents did not harvest a bowhead and reported a per capita harvest of just over 300 pounds; in Kaktovik's third harvest study however, residents reported harvesting three bowhead whales resulting in a per capita harvest of nearly 900 pounds. The average per capita harvest for the North Slope study communities for all study years is just over 400 pounds.

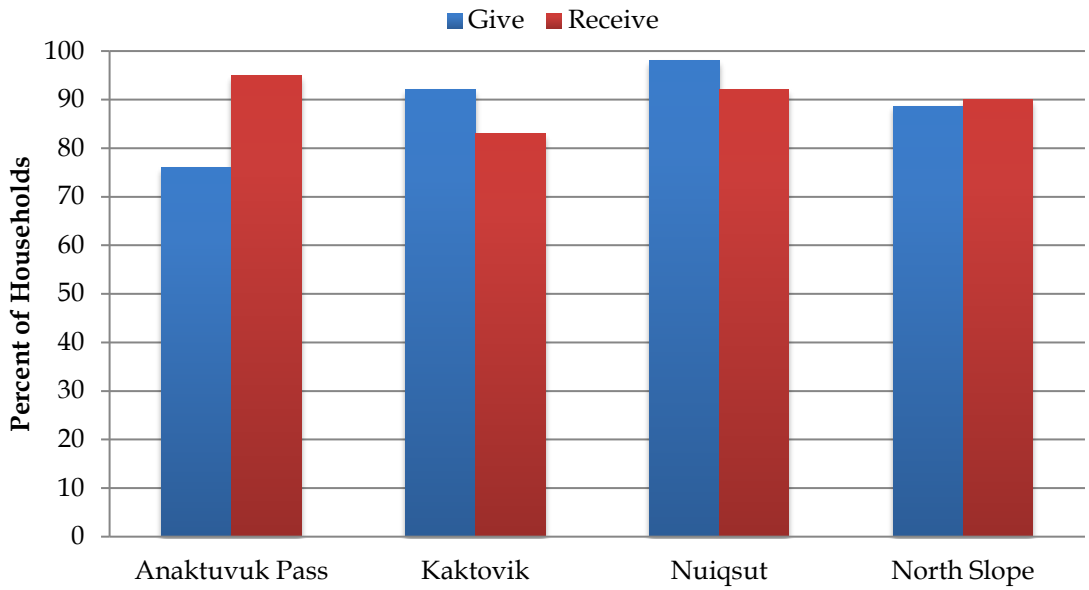
Figure 3.16-8 Per Capita Harvest by Study Community – North Slope Region



Sources: Anaktuvuk Pass 1992 (Fuller and George, 1999), 2011 (Holen *et al.*, 2012); Barrow 1987-1989 (SRB&A and ISER, 1993), 1992 (Fuller and George, 1999); Kaktovik 1985, 1986 (ADF&G, 2016); 1992 (Fuller and George, 1999); 1992 (Pedersen, 1995a); Nuiqsut 1985 (ADF&G, 2016j); 1992 (Fuller and George, 1999); 1993 (Pedersen, 1995b)

In addition to harvesting subsistence resources to meet their household needs, subsistence harvesters share their harvests with other members of the community and with other communities in the region. In the North Slope Region, Anaktuvuk Pass, which does not have access to marine resources, often receives marine mammals from Utqiagvik, Nuiqsut, and/or Kaktovik, and in turn, shares caribou with these communities. Figure 3.16-9 shows the percent of households within Anaktuvuk Pass, Kaktovik and Nuiqsut sharing and receiving subsistence foods from other households within the community. Household sharing information is not available for Utqiagvik. More than 90 percent of households in both Nuiqsut and Kaktovik reported giving subsistence foods to other households during the study year and nearly three-quarters of Anaktuvuk Pass households gave subsistence foods. More than 80 percent of all households reported receiving subsistence foods in the three study communities with a high of 95 percent in Anaktuvuk Pass.

Figure 3.16-9 Percent of Households Sharing Subsistence Resources – North Slope Region



Notes: Most recent study year data shown for all study communities.
Sources: Anaktuvuk Pass 2011 (Holen *et al.*, 2012) Kaktovik 1992 (Pedersen, 1995a); Nuiqsut 1993 (Pedersen, 1995b)

3.16.5.4. Seasonal Round

Data on the seasonal round are available for the communities of Utqiagvik, Nuiqsut, Kaktovik, and Anaktuvuk Pass in the North Slope Region. Table 3.16-3 is a compilation of the seasonal round data for communities in the region and depicts the subsistence timing for residents of the North Slope Region employing the most recent available data for each community. A month is shaded if two or more communities in the region reported subsistence activity for a particular resource during that month. Individual North Slope Region study communities may utilize additional months for a specific resource or harvest additional resources (*e.g.*, egg gathering in Nuiqsut) that are not depicted in Table 3.16-3. Seasonal subsistence activities for the individual study communities are summarized in Table 3.16-4 through Table 3.16-7. These tables include synthesized information from various sources to show a general depiction of the seasonal round of subsistence activities in these communities based on the most recent data available and provide a more comprehensive/updated picture of the timing of subsistence activities than the 2012 FEIS.

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Table 3.16-3 North Slope Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■
Marine Non-Salmon						■	■	■	■	■		
Salmon							■	■	■	■		
Caribou	■	■	■	■	■	■	■	■	■	■	■	■
Moose		■	■	■			■	■	■	■		
Bear	■	■	■	■	■	■	■	■	■	■	■	■
Muskox			■					■	■	■		
Dall Sheep			■	■					■		■	■
Furbearers	■	■	■	■	■			■	■	■	■	■
Small Land Mammals		■	■	■	■	■	■	■	■			
Marine Mammals			■	■	■	■	■	■	■	■	■	
Upland Birds	■	■	■	■	■	■	■		■	■	■	■
Waterfowl				■	■	■	■	■	■	■		
Marine Invertebrates								■				
Plants and Berries						■	■	■	■			

Sources: Bacon *et al.*, 2009 (2002-03); Brower *et al.*, 2000 (1994-95); Brower and Hepa, 1998a (1994-95); EDAW Inc., 2008 (2004); Fuller and George, 1999 (1992); Galginaitis, 2004a (2001), 2004b (2002); 2006 (2004), 2008b (2005), 2008a (2006), 2009b (2007); Galginaitis and Funk, 2005 (2003); Holen *et al.*, 2012 (2011); Libbey *et al.*, 1979 (pre-1979); Pedersen *et al.*, 1991 (pre-1989); Pedersen and Hugo, 2005 (2001-02, 2002-03); Pedersen and Linn, 2005 (2000-01); SRB&A, 2010a (1996-2006), 2013a (2001-2010)
(Utqiagvik) Caribou includes reindeer hunting activities. Bear includes polar bear hunting activities.

Table 3.16-4 Anaktuvuk Pass Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon													2000s
Salmon													1990s
Caribou													2010s
Moose													2010s
Bear													2010s
Dall Sheep													2010s
Goat													2010s
Furbearers													2010s/2000s
Small Land Mammals													2010s/2000s
Upland Birds													2010s/2000s
Waterfowl													2010s/2000s
Plants and Berries													2010s/2000s

Sources: Bacon *et al.*, 2009 (2000-01, 2001-02, 2002-03); Pedersen and Hugo, 2005 (2001-02, 2002-03); Holen *et al.*, 2012 (2011); SRB&A, 2013a (2001-2010)

Table 3.16-5 Utqiagvik Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Marine Non-Salmon		■	■		■	■	■	■	■	■	■	■	2000s
Salmon						■	■	■	■	■			1990s/2000s
Caribou	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Moose		■	■	■	■	■	■	■	■				1980s/2000s
Bear	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Dall Sheep			■						■				1990s/2000s
Muskox			■						■				2000s
Furbearers	■	■	■	■	■	■			■	■	■	■	2000s
Small Land Mammals		■		■	■								1990s/2000s
Marine Mammals	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Upland Birds	■	■	■	■	■	■	■		■	■	■	■	1990s/2000s
Waterfowl				■	■	■	■	■	■	■	■		2000s
Marine Invertebrates				■		■	■	■	■	■			1990s/2000s
Plants and Berries					■	■	■	■	■				1990s/2000s

Sources: Bacon *et al.*, 2009 (2000, 2001, 2003); Fuller and George, 1999 (1992); SRB&A, 2010a (1997-2006)
Caribou includes reindeer hunting activities. Bear includes polar bear hunting activities.

Table 3.16-6 Kaktovik Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Marine Non-Salmon						■	■	■	■				2000s
Salmon							■	■	■				1990s
Caribou	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Moose	■	■	■	■			■	■	■	■	■	■	1990s/2000s
Bear									■	■	■		2000s
Dall Sheep			■	■							■	■	2000s
Muskox	■	■	■					■		■	■	■	1990s/2000s
Furbearers	■	■	■	■	■			■		■	■	■	2000s
Small Land Mammals			■	■	■	■		■	■	■			1980s/2000s
Marine Mammals			■	■	■	■	■	■	■	■	■		2000s
Upland Birds				■	■	■					■		1990s/2000s
Waterfowl				■	■	■	■	■	■	■			2000s
Marine Invertebrates								■					2000s
Plants and Berries							■	■	■				1990s/2000s

Sources: Bacon *et al.*, 2009 (2002-03); Brower *et al.*, 2000 (1994-95); EDAW Inc., 2008 (2004); Fuller and George, 1999 (1992); Pedersen *et al.*, 1991 (pre-1989); Pedersen and Linn, 2005 (2000-01); SRB&A, 2010a (1996-2006)

Table 3.16-7 Nuiqsut Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Marine Non-Salmon									■	■			1990s
Salmon							■	■					2000s
Caribou	■	■	■	■	■	■	■	■	■	■	■	■	2000s/2010s
Moose								■	■				2000s
Polar Bear	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Muskox								■	■	■			2000s
Furbearers	■	■	■	■			■	■	■	■	■	■	2000s
Small Land Mammals					■	■	■	■	■				1970s
Marine Mammals				■	■	■	■	■	■	■			2000s
Upland Birds			■	■	■	■			■	■			1990s/2000s
Waterfowl				■	■	■	■	■	■				2000s
Eggs						■							1990s
Plants and Berries								■	■				1990s

Sources: Bacon *et al.,* 2009 (2000-01); Brower and Hepa, 1998a (1994-95); EDAW Inc., 2008 (2004); Fuller and George, 1999 (1992); Galginaitis, 2004a (2001), 2004b (2002); 2006 (2004), 2008b (2005), 2008a (2006), 2009b (2007); Galginaitis and Funk, 2005 (2003); Libbey *et al.,* 1979 (pre-1979); SRB&A, 2010a (1995-2005), 2013 (2008, 2009)

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Spring (April-May) subsistence activity in the North Slope Region varies among communities; however, the common focus is on waterfowl migrating through the area, with Utqiagvik also emphasizing spring bowhead whale hunting. Of the five North Slope Study communities, the spring bowhead whale hunt is particular to Utqiagvik; Nuiqsut and Kaktovik participate in harvests of bowhead only during the fall migration. Spring marks the end of furbearer hunting and trapping and the beginning of intensified harvests of freshwater fish. Seal harvests are a focus of the coastal communities starting in the spring, while large land mammal harvests, including caribou and moose also occur for all communities during this time. Upland bird and small land mammal harvests also occur during the spring. Muskox hunting may also occur in March.

Fish harvests continue and intensify over the summer (June-August) with the addition of harvests of salmon and marine non-salmon fish. Caribou subsistence activity occurs year-round, but is particularly common during the summer months as the caribou seek relief from insects in coastal areas. Residents of the North Slope Region diversify large land mammal subsistence activities during the summer with harvests of moose, bear, and muskox, and coastal communities also focus on marine mammal resources, such as bearded seals and walrus, utilizing the open water offshore. Marine invertebrates may also be taken in later summer. Hunting furbearers begins again in late summer, and waterfowl harvests continue through the summer and into the fall migration. The timing of plant and berry harvests is limited due to a brief growing period and occurs over the summer months into early fall.

Fall (September-October) in the North Slope Region is a particularly important time for coastal communities to harvest migrating bowhead whales. Subsistence activity for moose, Dall sheep, muskox, and freshwater fish, particularly Arctic cisco, burbot, and broad whitefish, also amplifies during the fall months. Caribou remain a targeted resource over the fall months and subsistence activity for other marine mammals such as seals and walrus decreases. Upland bird hunting also resumes in the fall.

Winter (November-March) is the prime time for hunting and trapping furbearing animals; upland birds are also taken throughout winter. Kaktovik and Anaktuvuk Pass also hunt Dall sheep in the early winter (November and December) and again in late winter/early spring. Freshwater fishing declines in most communities; however, fishing for burbot in Nuiqsut intensifies over the winter. Caribou harvests remain a focus over the winter, particularly in Anaktuvuk Pass. Marine mammals, specifically ringed seals, continue to be targets through the winter in the coastal communities though to a lesser extent than during the rest of the year.

3.16.6. Interior Region

The Interior Region is a diverse geographical area located south of the Brooks Range and north of the Alaska Range comprised of highlands, forested lowlands, bottomlands, and flats that are drained by the Koyukuk, Yukon, and Tanana rivers. The Interior Highlands, Interior Forested Lowlands and Uplands, Interior Bottomlands, and Yukon

Flats ecoregions characterize this environment. The Interior Highlands are low rounded mountains interspersed with glaciated rugged peaks with dwarf scrub vegetation and open spruce stands. The Interior Forested Lowlands and Uplands have a continental climate, lack Pleistocene glaciations, and have a predominance of forests. The landscape of the Interior Bottomlands is flat and poorly drained terrain along large rivers surrounded by forests and wetlands. Finally, the Yukon Flats ecoregion is similar to the Interior Bottomlands but differs in that it has more extreme climate and less precipitation (Gallant, 1995).

The people residing in this region are primarily descendants of Athabascan-language speaking groups with regional and linguistic distinctions. Athabascan-language groups in the Interior Region near the proposed Project corridor include Koyukon and Tanana. The Athabascan-language speaking peoples of Interior Alaska in the late prehistoric and early historic period typically lived in small bands along river drainages and lakes. Koyukon-speaking people lived along the Koyukuk and Yukon rivers and their tributaries. Tanana-speaking bands lived along the Tanana River from near the Kantishna River confluence east beyond the present border with Canada (McKennan, 1981) (Figure 3.16-4). Interior people in communities such as Alatna and Beaver may also speak Iñupiaq or have Iñupiaq heritage. Alatna and Beaver include Iñupiat people from Kobuk and Utqiagvik, respectively, who moved to those areas just before the turn of the 20th Century in search of better living conditions, trade, and to escape what they perceived as "crowding" where they came from. Centuries of conflict and cooperation along the borders between the Iñupiat and Athabascans have created blurred boundaries between peoples especially in the upper Koyukuk River drainage, where some researchers theorize that Athabascan people once lived in the Brooks Range in the vicinity of Anaktuvuk Pass and other mountain valleys (Raboff, 2001).

The timing and location of harvests favored small, family centered bands that in some cases gathered together for salmon harvests or trade, but for most of their history were dispersed on the landscape in small camps. Bands in close proximity often shared a dialect or language, but over the vast spaces of the interior regions, changes accumulated such that the differences constitute a dialectical or linguistic boundary. These boundaries are exclusively linguistic, as across the Interior, material culture, technology, food-harvesting techniques and social culture are very similar. Caribou were hunted using drivelines and snares. Moose could be snared or stalked. Bears could be snared, stalked, or harvested from their dens during the winter. Fish were harvested with a variety of traps and weirs as well as spears and arrows. Grouse, ptarmigan, Arctic hares, and other small mammals were trapped and snared. These resources were then used or stored in an array of caches both above and below ground for later use or trade. Travel was on foot or by birch bark canoe, with some use of boats made of fresh animal hides stretched over a wooden frame if the hunters had traveled far up a stream drainage and successfully harvested animals (VanStone, 1974).

The Interior of Alaska includes a variety of Alaska Native peoples as well as more recent residents of various ethnic backgrounds. Athabascan peoples in the Yukon River

drainages traditionally relied on a mix of salmon, caribou, moose, freshwater fish, small mammals, birds, and seasonal vegetation for subsistence. Modern Athabascan and other Interior residents use snowmachines, light planes, ATVs, and outboard-equipped boats to access the same suite of subsistence resources today. Subsistence resource harvests are limited by the time available to harvest them in a mixed subsistence and wage economy, regulations intended to manage fish, game, and migratory waterfowl, and the costs of fuel and equipment needed to harvest game (Andersen and Alexander, 1992). Further limitations on subsistence harvesting occur where road access enables urban sport hunters to compete for resources on an even footing with local hunters, particularly where snowmachines and ATVs allow broad land access at high speeds (Simeone, 2002).

The Interior Region encompasses 20 study communities (Table 3.16-1). Of the 20 communities, 10 are federally recognized tribes and include Alatna, Allakaket, Beaver, Evansville, Manley Hot Springs, Minto, Nenana, Rampart, Stevens Village, and Tanana. These tribes have traditional and current resource uses, including customary and traditional, educational, and ceremonial uses in or near the proposed Project Area. Other communities within this region included in this analysis are Anderson, Bettles, Coldfoot, Fairbanks, Ferry, Four Mile Road, Healy, Livengood, McKinley Park, and Wiseman. Based on the available information, the following discussion provides a description of the 20 communities and their subsistence harvest patterns, seasonal round, and use areas. For ease of discussion and analysis, the communities within the Interior Region are further subdivided into the Yukon River and Tanana River subregions.

3.16.6.1. Community Descriptions

3.16.6.1.1. Yukon River Subregion

3.16.6.1.1.1. Alatna

The 2010 Alatna population reported by the U.S. Census Bureau (2016a) showed 32 residents, 97 percent of whom were Alaska Native. Alatna is located downstream from and across the river from Allakaket at a site that was formerly a trading village, where Kobuk and Koyukon people met to trade products from the coast for the furs of the Interior (Marcotte and Haynes, 1985). The modern community began in 1914 when several Kobuk River Iñupiaq families settled there, where a small Gold Rush era boomtown had left an abandoned trading post. After the flood of 1964, the community rebuilt on the same location, but after the 1994 floods, the community was moved to high ground farther downstream. The Alatna Tribal Council is a federally recognized tribe.

3.16.6.1.1.2. Allakaket

Allakaket and its environs were the location of a seasonal trading camp, where Athabascans would trade with Iñupiat people who had descended the Alatna River (Raboff, 2001). Allakaket, which is the Athabaskan word for "mouth of the Alatna River"

was established as a permanent residential location in 1906 when the Reverend Hudson Stuck established a mission school for Native children, the St. John's in the Wilderness Episcopal Mission (ADCCED, 2016). A post office was established in 1925. The general vicinity of the confluence of the Alatna River with the Koyukuk River was referred to as Alatna until 1938, when the name for the primarily Koyukon mission community was changed to Allakaket and the Iñupiaq community across the river became Alatna. In 1978, a clinic and airport were constructed for village residents. The community was flooded in 1964 and 1994, and rebuilt afterwards; following the 1994 flood a new housing development was built on an adjacent hill, but many rebuilt on the floodplain (ADCCED, 2016). In 2010, the population was 105 persons (including New Allakaket CDP), of whom 95 percent were Alaska Native (U.S. Census Bureau, 2016a). The Allakaket Tribal Council is a federally recognized tribe.

3.16.6.1.1.3. Beaver

The community of Beaver is located on the north bank of the Yukon River in a floodplain area called the Yukon Flats. The community was established in 1910 during a gold rush on the Chandalar River following the construction of a government road from the site north to the gold fields near Caro. Thomas Carter and H.E. Ashelby established a trading post there in 1910. Frank Yasuda, a Japanese-American trader from Utqiagvik, arrived with his extended family in 1911 and became a partner in the trading post. The present community is composed of North Slope and Kobuk Iñupiat and Koyukon and Gwich'in Athabascans (ADCCED, 2016). In 2010, the population was 84 people in residence in Beaver, 98 percent of whom were Alaska Native (U.S. Census Bureau, 2016a). The Beaver Tribal Council is a federally recognized tribe.

3.16.6.1.1.4. Bettles

Bettles is a primarily Euro-American community with a zero percent Alaska Native population during the most recent census (U.S. Census Bureau, 2016a). In 2010, the U.S. Census population was 12. Old Bettles was founded during the 1899 Koyukuk River gold rush at the end of steamboat navigation and hosted a post office from 1901 to 1956. New Bettles grew around a Federal Aviation Administration (FAA) runway built in 1948 some 6 miles from Old Bettles. This airfield was used to service Cold War defense sites such as the DEW Line radar sites and the White Alice Communications System sites, and to explore Naval Petroleum Reserve – Alaska properties (AirNav, LLC., 2010; ADCCED, 2016; Anderson, 2010).

3.16.6.1.1.5. Coldfoot

Coldfoot is located at the mouth of Slate Creek on the east bank of the Middle Fork Koyukuk River at MP 175 of the Dalton Highway, formerly known as the North Slope Haul Road. The 2010 census reported the population was 10, of whom 10 percent were Alaska Native (U.S. Census Bureau, 2016a). Slate Creek was the point on the Koyukuk River where prospectors supposedly got "cold feet" and turned around. In 1902,

Coldfoot had two roadhouses, two stores, seven saloons, a post office, and a gambling house. In 1912, however, the town was abandoned as gold rushes took place to the north on Nolan and Wiseman creeks (ADCCED, 2016). The community now services individuals traveling along the Dalton Highway (*e.g.*, motel, restaurant, gas station) as well as holding a few limited government jobs for a state trooper, state Fish and Wildlife officer, and BLM office.

3.16.6.1.1.6. Evansville

Evansville is located adjacent to the community of Bettles and had a population of 15 in 2010, with 53 percent Alaska Native (U.S. Census Bureau, 2016a). Wilford Evans, owner and proprietor of a tow and barge company in Allakaket, established a lumber mill at the site before World War II, and later built a lodge and general store. In 1948, the FAA built an airfield nearby which became the center for a new town. Evansville is immediately adjacent to Bettles and has a mixed population of Koyukon and Iñupiaq residents, some of whom came to the area from Alatna and Allakaket with Evans (Anderson, 2010; ADCCED, 2016). The Evansville Tribal Council is a federally recognized tribe.

3.16.6.1.1.7. Rampart

Rampart City was a gold rush boomtown established in 1897 on the south bank of the Yukon River in a low range of mountains that form a figurative "rampart" or defensive wall dividing the Yukon Flats from downstream. The community boomed in 1898 and by 1903 a community of 10,000 had been built, and then subsequently abandoned, as gold strikes were made in other areas of the region. Places such as Nome, Fairbanks, Anvil Creek, and the Upper Koyukuk River drew boomers away. Koyukon Athabascans from area communities moved into the community and concentrated there over time. A USDA experimental farm was operated on the north bank from 1900 to 1925. Gold mining, salmon canning, and forest products have provided income for residents in the past (ADCCED, 2016). The school closed for lack of students in 1999 and many families were forced to relocate for this reason. The 2010 population was 24 with 96 percent Alaska Native (U.S. Census Bureau, 2016a). The Rampart Village Council is a federally recognized tribe.

3.16.6.1.1.8. Stevens Village

Stevens Village is located on the north bank of the Yukon River, 17 miles upstream of the Dalton Highway Bridge (ADCCED, 2016). The community was established by three Koyukon-speaking brothers, Old Jacob, Gochonayeeya, and Old Steven, for whom the village was named when he became chief in 1902 (ADCCED, 2016). The community is the farthest east community where Koyukon Athabascan is the majority population (Sumida, 1988). The community cut wood to sell to miners and to supply steamboats heading upriver from St. Michaels en route to Fort Yukon and other communities in the Upper Yukon River region. A trading post handled furs as well as serving gold miners

in the region. The population in 2010 was 78, of whom 85 percent were Alaska Native (U.S. Census Bureau, 2016a). Due to the recent closure of the school and post office, many residents of Stevens Village have moved away and now live in Fairbanks or other nearby communities. Previous residents of Stevens Village still return to the community for subsistence and ceremonial purposes. The Stevens Village Indian Reorganization Act Council is a federally recognized tribe.

3.16.6.1.1.9. Wiseman

Wiseman is located off the Dalton Highway on the Middle Fork of the Koyukuk River at the confluence with Wiseman Creek, some 260 miles north of Fairbanks. The population in 2010 was 14, none of whom was Alaska Native (U.S. Census Bureau, 2016a). Wiseman is the successor city to Coldfoot, 13 miles south, and was established in 1907 at the end of a horse drawn barge route to gold mines further upstream. Many structures from the peak occupation of the community are still present and standing. The community was connected to the road system in 1974, when the TAPS haul road was built, and public access was allowed in 1994 (ADCCED, 2016). Today residents of Wiseman own and operate several small businesses that cater to tourists traveling on the Dalton Highway or in to the Brooks Range.

3.16.6.1.2. Tanana River Subregion

3.16.6.1.2.1. Anderson

The community of Anderson is located on a 6-mile spur road off the George Parks highway that includes the Clear Air Force Station. The community is located north of the Alaska Range approximately 76 miles southwest of Fairbanks. In 2010, the U.S. Census estimated the Anderson population to be 246, 3 percent of which were American Indian or Alaska Native (U.S. Census Bureau, 2016a). Anderson is named after Arthur Anderson who homesteaded in the area in the 1950s and who subdivided and sold his homestead to civilian workers at the Clear Air Force Station during the construction of the base in 1959-1961. In 1961, the first elementary school was built for the community and in 1962, Anderson incorporated as a city (ADCCED, 2016). Today residents of Anderson own and operate several local businesses that cater to the Air Force Station, local population, and tourists, and work for local government.

3.16.6.1.2.2. Fairbanks

Fairbanks is located on the Chena River near its confluence with the Tanana River some 357 miles north of Anchorage on the George Parks Highway. The 2010 population was 31,535, 10 percent of whom were Alaska Native (U.S. Census Bureau, 2016a). The total population for the FNSB, which includes Fairbanks and several outlying CDPs (including study community CDPs of Badger, Chena Ridge, College, Eielson AFB, Ester, Fairbanks, Farmers Loop, Fox, Goldstream, Moose Creek, North Pole, Pleasant Valley, Salcha, South Van Horn, Steele Creek, and Two Rivers), was 97,581 in 2010. Fairbanks has the second largest city population in Alaska. Koyukon and/or Tanana Athabascans

had used the vicinity for centuries, and the UAF campus is one of the older known sites in Interior Alaska (Mobley, 1996). Fairbanks was established as Barnette's Cache in 1901, where Captain E.T. Barnette established a trading post on the Chena River. A year later, gold was discovered 16 miles north at Pedro Dome, and the community was named for Indiana Senator Charles Fairbanks. In 1903, Judge James Wickersham moved the district court from Eagle, on the Yukon River, to Fairbanks. Barnette was mayor and rapidly established a steam heat plant, electrical power plant, telephone service, fire, police and sanitation ordinances, and the Washington Alaska Bank. As Fairbanks continued to grow into the hub of Interior Alaska, it became the county seat, home of the courthouse, jail, and other government services, and in 1923 the terminus of the ARRC. Gold mining in surrounding areas and transportation of goods to mining towns on the river system continued to contribute to the local economy. In 1940, the Air Corps established Ladd Field in Fairbanks. In World War II, Fairbanks and Ladd Field became a center of military aviation as aircraft were ferried through and transferred to Soviet pilots in the Lend-Lease program (DOD undated), and construction of the Alaska Highway and other defense-based infrastructure helped Fairbanks grow through the Cold War years. In 1961, the Army assumed control of Ladd Air Force Base and renamed it to Fort Wainwright (USACE, 2011). In the 1970s, Fairbanks was a construction hub for the TAPS, connecting the North Slope to tidewater oil facilities at Valdez (ADCCED, 2016).

3.16.6.1.2.3. Ferry

The community of Ferry is located primarily on the northeast bank of the Nenana River at Mile 371 of the Alaska Railroad. While some residents live off the George Parks Highway on the southwestern bank of the Nenana River the majority of the community is located on the opposite bank and is accessible only by a narrow walkway on a railroad trestle during most of the year. The 2010 census population of Ferry was 33 persons, 3 percent of whom identified as Native American or Alaska Native (U.S. Census Bureau, 2016a). Ferry was established in 1922 as an Alaska Railroad station and section house; establishment of these facilities attracted homesteaders and some of these homesteads are still occupied today. In 2011, GVEA developed the Eva Creek Wind Project, the largest wind project in Alaska at the time, in the Ferry area (Eva Creek Wind Project, 2016). Development of this project involved significant improvements to the Ferry Trail, the most important thoroughfare for the community. Today, the residents of Ferry value their small and relatively isolated community and rely heavily on locally harvested resources.

3.16.6.1.2.4. Four Mile Road

Four Mile Road is a CDP that is located north of Nenana and 50 miles southwest of Fairbanks on the George Parks Highway. The Four Mile Road area is associated with economic growth in the Nenana area (ADCCED, 2016). It is located across the Tanana River near the hill known as Toghotthele, which had significance to the Alaska Natives residing along this stretch of the river (Shinkwin and Case, 1984). According to the latest

2010 census, 43 individuals reside in Four Mile Road, 30 percent of who are Native (U.S. Census Bureau, 2016a).

3.16.6.1.2.5. Healy

Healy is located at the confluence of Healy Creek and the Nenana River, 78 miles southwest of Fairbanks, originally on a 2.5-mile spur road off the George Parks Highway just north of the entrance to Denali NPP. Today residents live on both sides of the Parks Highway with the majority living in subdivisions around Otto Lake, south of Dry Creek, and off of the Stampede Trail. In 2010, Healy had a population of 1,021, of whom 2 percent were Alaska Native (U.S. Census Bureau, 2016a). Healy was established as a town in 1904, but coal mining became its major business in 1921 (ADCCED, 2016; Stewart, 1921). Coal mining is still an important industry in Healy with many residents working for Usibelli Mine located to the north of Healy Creek and east of the Nenana River. Tourism and guiding are also important industries in Healy and a number of locally owned and operated businesses cater to seasonal tourism and non-local hunters.

3.16.6.1.2.6. Livengood

Livengood is located 80 road miles northwest of Fairbanks on the Elliott Highway just south of the junction with the Dalton Highway. The 2010 population was 13, of whom 23 percent were Alaska Native (U.S. Census Bureau, 2016a). Gold was discovered on Livengood Creek in 1914 and a mining camp was established that winter, with a post office built in 1915 and operating until 1957 (ADCCED, 2016).

3.16.6.1.2.7. Manley Hot Springs

Manley Hot Springs is located on the north side of the Tanana River approximately 40 miles southwest of Minto and 65 river miles upstream from the confluence with the Yukon River. The U.S. Census Bureau (2016a) reported that the 2010 population of Manley Hot Springs was 89, 13.5 percent of whom were Alaska Native. Originally named "Hot Springs," the community was established in the early 1900s as an important supply station for miners in the Eureka and Tofty mining districts as well as for steam ships moving up the Tanana River (ADCCED, 2016). In 1907, The Hot Springs Resort and Hotel was constructed by Frank Manley and catered to guests taking overland stagecoaches from Fairbanks. The community grew and a bakery, clothing stores, and other businesses were established (ADCCED, 2016). At its peak, the population of Hot Springs surpassed 500. In 1913, the Hot Springs Resort burned down and the closure of the resort, in combination with the decrease in mining activity, resulted in all but 29 residents leaving Hot Springs. Due to significant man-made changes in the local landscape, earlier or prehistoric use of the hot springs has not been found but ethnographic data indicates the hot springs were used by the Alaska Native people from surrounding communities to treat the sick (Brown *et al.,* 2014). The name of the community was officially changed to "Manley Hot Springs" in 1957, after which a small school was established. The Manley Hot Springs Village is a federally recognized tribe.

3.16.6.1.2.8. McKinley Park

McKinley Park is a community that formed at the entrance to Denali NPP on the George Parks Highway. Today the community is located approximately 5 miles south of the National Park entrance on the east side of the George Parks Highway. The 2010 population was 185, none of whom was Alaska Native (U.S. Census Bureau, 2016a). The community is primarily comprised of people who work at Denali NPP or who provide services during the local tourist season. The population of the community increases during the peak tourist season (May to September), and then shrinks to a smaller number of year-round residents during the off-season winter months.

3.16.6.1.2.9. Minto

Minto is a predominantly Alaska Native community located on the Tolovana River some 50 air miles west of Fairbanks (the village is located on the road system 130 miles from Fairbanks). The 2010 population was 210, of whom 90 percent were Alaska Native (U.S. Census Bureau, 2016a). The current site of Minto, a seasonal hunting camp since at least 1900, was established as a permanent community from 1969 to 1971 when the BIA resettled residents from the site of Old Minto, which is located on the Tanana River 20 miles to the south. The community was relocated into a planned community on the road system to escape flooding and erosion at the Old Minto site. Minto people lived out on the land in a number of small communities, camps, and trapline areas until Old Minto was established in 1917 as a semi-permanent settlement for small family-based groups who lived on the Minto Flats for much of the year (Andrews, 1988). Old Minto had a BIA school by 1937, but area residents did not live in Minto year-round until the 1950s (ADCCED, 2016). They moved seasonally in search of game and furbearers for trade, traveling on the river systems of the flats and over a system of trails and portages, with some traveling as far as Fort Yukon, Tanana, and Rampart during the year (Andrews, 1988). Residents primarily speak Tanana, with some speaking Koyukon Athabascan languages. The Native Village of Minto is a federally recognized tribe.

3.16.6.1.2.10. Nenana

Nenana is located on the south bank of the Tanana River on the ARRC and Parks Highway, 55 miles south of Fairbanks. It lies in the western extent of Tanana Athabascan territory in an area with some of the oldest known archaeological sites in the state, the 11,000 to 12,000-year-old Nenana Complex. The 2010 population was 378, of whom 38 percent were Alaska Native (U.S. Census Bureau, 2016a). The community was originally called Tortella, an English language interpretation of "Toghotthele," meaning "mountain that parallels the river" (ADCCED, 2016). Toghotthele Hill, is an important local landmark and is located directly north of the community. In legendary times, it was a place where humans and animals could talk to one another (Shinkwin and Case, 1984). The community was founded after the turn of the 20th Century when three bands began to live for some or all of the year near an Episcopalian mission (1905) and a fur trading post (1903) (ADCCED, 2016; Shinkwin and Case, 1984). These bands included

the Tanana-speaking Nenana-Toklat and Wood River bands, while the third band, Mouth of Toklat, spoke Koyukon. The Euro-American population increased dramatically with the construction of the ARRC beginning in 1916 (Shinkwin and Case, 1984). The town served as the starting place for the 1925 serum run to Nome, the inspiration for the Iditarod sled dog race (ADCCED, 2016). The town continues to be a river port, rail depot, and highway stop for freight and tourists and is the location of the Nenana Ice Classic, a statewide spring breakup lottery. The Nenana Native Association is a federally recognized tribe.

3.16.6.1.2.11. Tanana

Tanana is located at the confluence of the Tanana and Yukon rivers. Tanana's population in 2010 was 246, of whom 87 percent were Alaska Native (U.S. Census Bureau, 2016a). The confluence had long been the location of a trade fair called Nuklukayet, where people from all along the Yukon River drainages would gather to trade goods; however, the name was not specific to a certain location and a number of places were given that name (de Laguna, 2000). Tanana people were primarily speakers of Koyukon Athabascan. The Native Village of Tanana is a federally recognized tribe.

3.16.6.2. Subsistence Use Areas

The subsistence use areas for the Interior Region cover an expansive and diverse geographical area as shown on Figure 3.16-10 (Yukon River subregion) and Figure 3.16-11 (Tanana River subregion). These use areas represent the combination of several mapping studies years in each of the communities during different years. Alatna, Allakaket, Beaver, Bettles, Coldfoot, Evansville, Manley Hot Springs, McKinley Park, Minto, Rampart, Stevens Village, and Wiseman all have newer subsistence use area data (including additional older data recently identified or resource-specific use areas) since the publication of the 2012 FEIS (Table 3.16-2). A number of study communities in this region, particularly non-rural ones (*e.g.*, Fairbanks and outlying CDPs), have had no subsistence use area mapping studies conducted in their community.

Figure 3.16-10 shows subsistence use areas in the Yukon River subregion for nine of the 20 Interior Region communities. The combined use area for Yukon River subregion study communities is primarily concentrated along the two major rivers in the area: the Koyukuk and the Yukon. The use areas centered along the Koyukuk River are from northern communities including Alatna, Allakaket, Evansville, Bettles, Wiseman, and Coldfoot. These areas extend from the west and south along the Yukon River near Hughes to as far east as the Middle Fork Chandalar River. The northernmost use areas are located north of Toolik Lake along the Dalton Highway. The subsistence use areas centered along the Yukon River are from Rampart, Stevens Village, and Beaver. These areas extend from an area just east of the confluence of the Yukon and Tanana rivers along the length of the Yukon River to Circle and further east along the Black River near the Canadian border. Overland use areas do not extend as far off of the Yukon River as they do in the Koyukuk River area.

Figure 3.16-10 Interior Region Study Communities Subsistence Use Areas – Yukon Subregion

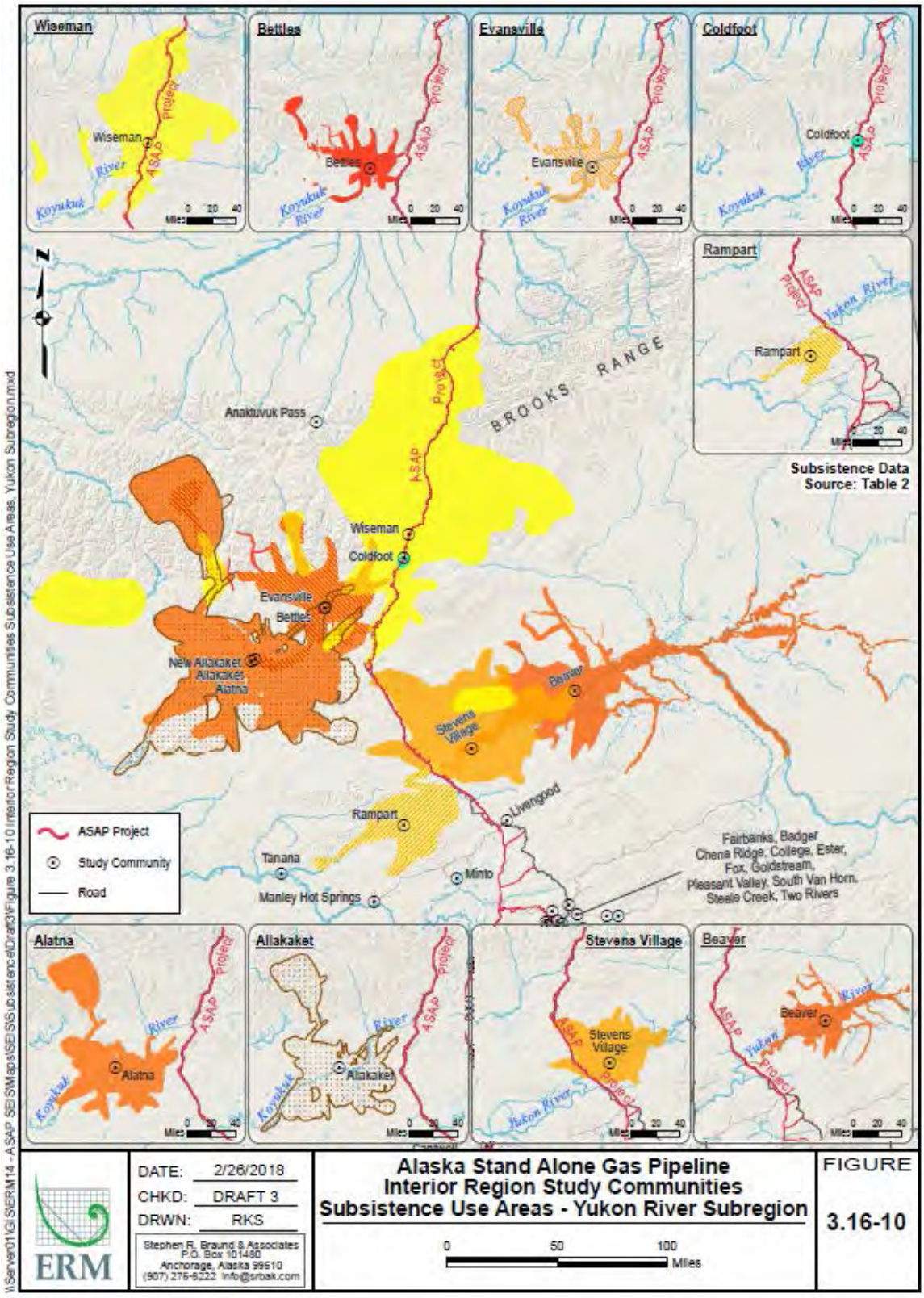


Figure 3.16-11 Interior Region Study Communities Subsistence Use Areas – Tanana River Subregion

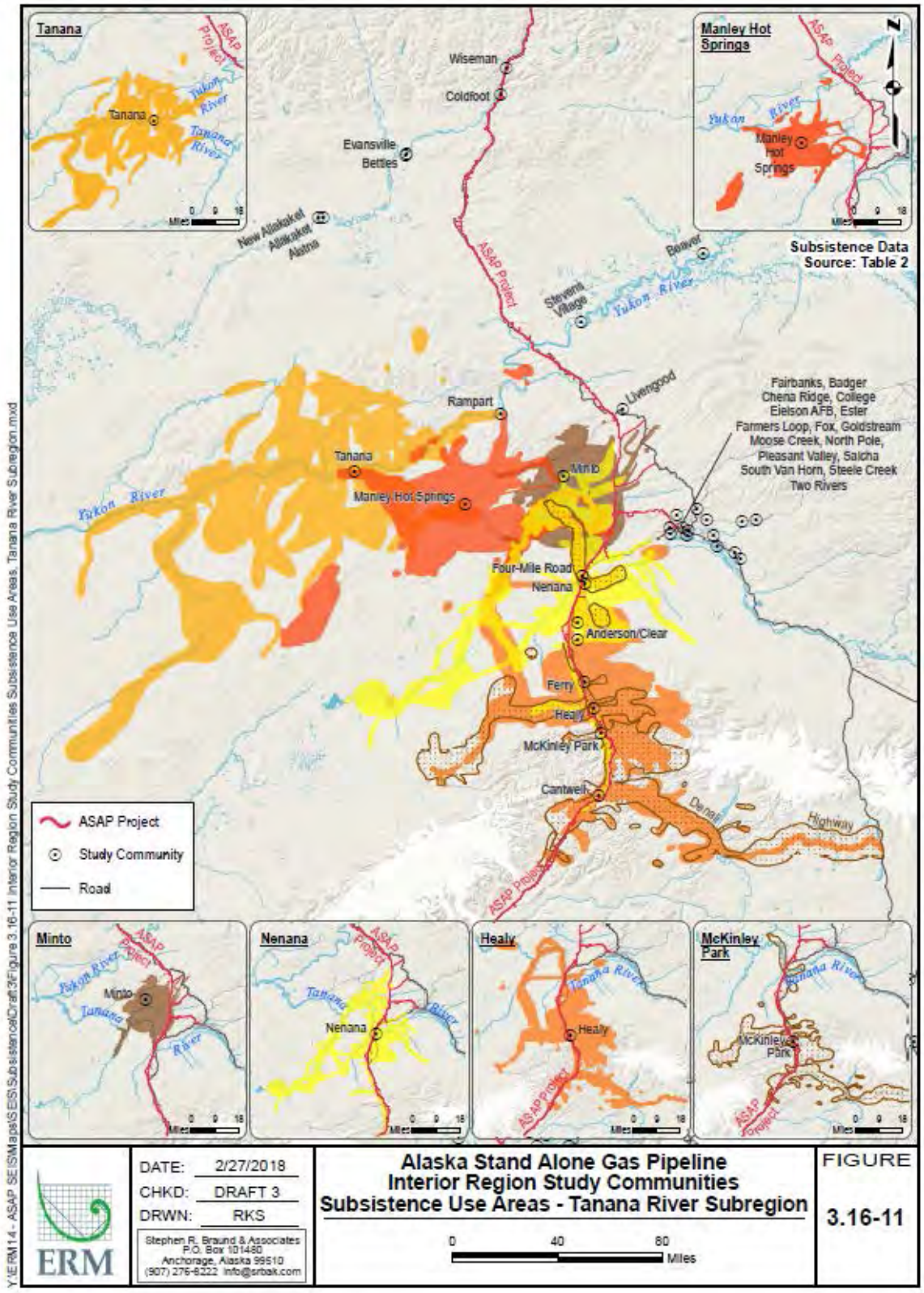


Figure 3.16-11 shows the cumulative area of Tanana River subregion subsistence use areas and include use areas from six study communities (Minto, Manley Hot Springs, Tanana, Nenana, Healy, and McKinley Park). The combined use area is highly concentrated on the major rivers of the region (*e.g.*, Yukon, Tanana, Nowitna, Kantishna, and Toklat) and the George Parks, Denali, and Elliot highways. The largest overland use areas are located south of Minto in the Minto Flats, north and south of the Yukon River near Tanana, and east of the George Parks Highway. The overall extent of Tanana River region study communities' subsistence use areas stretches from the Nowitna River in the west to the Denali Highway area near Paxson in the east with northernmost and southernmost use areas located in an area north of Rampart and along the George Parks Highway south of Cantwell.

Residents use boats to travel along rivers for both subsistence harvesting and for traveling. For those study communities with access to the road system (*e.g.*, Wiseman, Nenana, Healy, McKinley Park), the roads can be important use areas as well as transportation corridors that allow residents to access other subsistence use areas. Inland areas off the road system are often accessed using ATVs. Planes, while not the primary mode of travel for many residents, are used to access certain subsistence use areas. Similar to other areas within the state, snowmachines are the primary mode of transportation to winter use areas; however, a few harvesters may still use dog teams.

3.16.6.2.1. Yukon River Subregion

Alatna use areas (including a 1980s mapping study that combined Alatna/Allakaket use areas) are located west of the Dalton Highway and stretch in a continuous use area westward along the Koyukuk River; the farthest north use areas are located near the headwaters of the Alatna River in the Brooks Range (Figure 3.16-10). The southern extent of Alatna use areas are concentrated around the Kanuti River area. Alatna use areas do not intersect the proposed Project but are located within 5 miles of the proposed Project footprint.

Allakaket use areas (including a 1980s mapping study that combined Alatna/Allakaket use areas) are similar to those of neighboring Alatna, but occur over a slightly larger overland area and extend farther southwest along the Koyukuk River past the confluence with Indian River (Figure 3.16-10). Similar to Alatna, Allakaket use areas do not intersect the proposed Project but are located within 5 miles of the proposed Project footprint.

Beaver subsistence use areas, as documented from existing data, are largely riverine oriented including use of the Yukon, Hodzana, Hadweenzic, Porcupine, and Black rivers (Figure 3.16-10). Overland use areas are primarily concentrated around the community. The overall extent of Beaver use areas stretches from the Dalton Highway in the west to the east near Salmon Fork. The southernmost use areas occur near the community of Circle along the Yukon River; the northernmost use areas occur along Government Trail

north of Beaver. The westernmost boundary of Beaver subsistence use areas are within 1 mile of the proposed Project footprint.

Bettles use areas (including a 1980s mapping study that combined Bettles/Evansville use areas) are all located west of the Dalton Highway with a continuous use area extending west and south as far as Alatna and Allakaket (Figure 3.16-10). Discontinuous use areas are located farther west and north in the upper reaches of the Alatna River in the Brooks Range; other areas are located on the lower reach of the Alatna River as well as in Iniakuk Lake. The Koyukuk, John, and Wild rivers are important use areas and facilitate travel into hunting areas farther inland. A small portion of Bettles' subsistence use areas intersect with the proposed Project.

Coldfoot consists primarily of a truck stop servicing freight transportation along the Dalton Highway from southern Alaska to the Prudhoe Bay oil fields. An airstrip, post office, and several tour guides also operate in the vicinity. Most of the people in Coldfoot are non-resident employees of these facilities, a fact reflected by the limited subsistence activities in the area. The Coldfoot subsistence use area is concentrated around the truck stop and along the highway south for several miles (Figure 3.16-10). The only reported subsistence use areas in Coldfoot reported for the 2011 time period was for vegetation; this area is bisected by the proposed Project.

Evansville use areas (including a 1980s mapping study that combined Bettles/Evansville use areas) are similar to those of neighboring Bettles with the exception that Evansville utilizes Wild Lake and does not have use areas west of the community surrounding Iniakuk River and north into the Brooks Range in overland areas between the John and Iniakuk rivers (Figure 3.16-10). A small portion of Evansville subsistence use areas intersect with the proposed Project.

Rampart subsistence use areas are centered on the community and extend west along the Yukon River, overland to the south to approximately the Elliot Highway, and intersect the Dalton Highway where it crosses the Yukon River (Figure 3.16-10). The eastern edge of Rampart subsistence use areas intersects with the proposed Project.

The majority of Stevens Village subsistence use areas are centered on either side of the Yukon River throughout the Yukon Flats (Figure 3.16-10). Use areas are located as far west as the Ray River on the west side of the Dalton Highway and east along the Yukon River as far as the neighboring community of Beaver. To the north, subsistence use areas have been documented north of Lone Mountain and as far south as Rogers Creek. Stevens Village subsistence use areas intersect the proposed Project.

Wiseman residents have reported a continuous area of subsistence use centered on the Dalton Highway extending approximately 30 to 50 miles on either side of the highway and occurring from the Toolik Lake area in the north to an area approximately 50 miles south of the community along the Dalton Highway (Figure 3.16-10). Additional discontinuous use areas are located west of Wiseman along the Kobuk, Alatna, and John

rivers, and also south of the community along the South Fork Koyukuk River and an area south of Lone Mountain. Wiseman use areas are bisected by the proposed Project.

3.16.6.2.2. Tanana River Subregion

Healy residents access use areas along the Nenana, Tanana, and Kantishna rivers; residents also utilize areas along the George Parks Highway both north and south of the community and along the entirety of the Denali Highway (Figure 3.16-10). Overland use areas extend from the George Parks Highway east along Healy Creek to the Wood River and to the west of the community to the Toklat River. Due to its proximity to the Denali NPP, where hunting is restricted, a majority of Healy use areas are located to the north and east of the community. Isolated use areas include two lakes west of the Kantishna River, at Deadman Lake, and a lake in the Clearwater Mountains. Healy subsistence use areas are bisected by the proposed Project.

Manley Hot Springs use areas are primarily located between the community of Tanana in the west and the community of Minto in the east and are centered north and south of the Elliott Highway (Figure 3.16-11). The northernmost extent of their use areas is located along the Yukon River just south of the Dalton Highway. A large use area near the Chitanatala Mountains represents the southernmost and westernmost Manley Hot Springs use areas that have been documented. A small portion of Manley Hot Springs eastern subsistence use areas intersect with the proposed Project.

McKinley Park use areas are primarily centered along the George Parks and Denali highways (Figure 3.16-11). To the north, use areas have been documented to the Tolovana River near Minto; the southernmost use areas occur along the George Parks Highway alongside the Chulitna River. Similar to Healy, due to its proximity to the Denali NPP, where hunting is restricted, a majority of McKinley Park use areas are located to the north, south, and east of the community. Overland use areas to the west are located as far as the Kantishna area, and use areas to the east extend as far as the terminus of the Denali Highway near Paxson. McKinley Park subsistence use areas are bisected by the proposed Project.

Minto use areas extend from the community in all directions. Use areas have been documented to the northwest along the Elliott Highway to the Eureka Dome area and to the southwest along the Kantishna River (Figure 3.16-11). To the east, subsistence use areas extend throughout the Minto Flats including along the Tatalina and Chatanika rivers, along the Elliott Highway, and southeast along the Tanana River to the community of Nenana. The northernmost use areas are located near Sawtooth Mountain, with an isolated use area located along the Yukon River. The eastern portion of Minto use areas is bisected by the proposed Project.

Nenana subsistence activities are centered on the rivers and road systems near the community, as well as some overland areas in between (Figure 3.16-11). Use areas include the Tanana River and watershed upstream from the community almost to Fairbanks, and downstream to its confluence with the Kantishna River. In the southwest,

use areas extend far upstream on the Kantishna River including many of the tributary streams, sloughs, and lakes along its length. In the north, subsistence activities have been documented along the Tolovana River and in the smaller waterways, lakes, and wetlands of the Minto Flats between the Tolovana and the Tanana rivers. Use areas have also been documented along the Parks Highway from south of Cantwell north almost to Fairbanks. Nenana subsistence use areas are bisected by the proposed Project.

Tanana residents have reported use areas that center on the Yukon and Tanana rivers and smaller tributaries, as well as inland areas to the north and south of the community (Figure 3.16-11). Use areas are located as far west at Ruby, to the south along the Nowitna River, east beyond Rampart along the Yukon River, and past the Ray Mountains in the north. Tanana subsistence use areas do not intersect the proposed Project but are located within 20 miles of the proposed Project footprint.

3.16.6.3. Subsistence Harvest Patterns

Comprehensive all-resources harvest data exist for 14 of the 20 Interior study communities (see Figures 3.16-12 and 3.16-13). Alatna, Allakaket, Beaver, Bettles, Coldfoot, Evansville, Manley Hot Springs, Minto, and Wiseman all have newer harvest data since the publication of the 2012 FEIS (Table 3.16-2).

In this region, fish and land mammals are the primary contributors to the total subsistence harvest. In most communities, vegetation and birds/eggs comprise less than 5 percent of the total harvest. Unlike the study communities on the North Slope, the Interior study communities do not harvest marine mammals, although a few communities (*e.g.*, Anderson and Healy) did report harvest of marine invertebrates. In the Yukon River subregion, more communities show a greater reliance on land mammals (average of 58 percent of total harvest for region) than fish (32 percent) (Figure 3.16-12). Conversely, Tanana River subregion study communities reported an average 74 percent of the total harvest from fish compared to 21 percent from land mammals (Figure 3.16-13). Birds/eggs and vegetation also comprise a greater percent of the total harvest in the Yukon River subregion (10 percent) than in the neighboring Tanana River subregion (5 percent).

Figures 3.16-14 and 3.16-15 show the top three species harvested by each study community in the respective Interior subregions in terms of percent of total harvest. In both subregions, residents reported moose among the top three resources more commonly than any other land mammal, although caribou were also reported frequently in the Yukon River subregion, with Anderson the only Tanana River subregion community reporting caribou in the top three. Moose harvests ranged from a low of 5 percent (Stevens Village) to a high of 57 percent of the total harvest (Wiseman). Black bear was the only other mammal that ranked among the top three species harvested (Alatna). Chum salmon were identified as the top fish species harvested in the two subregions (11 percent and 38 percent respectively). Sheefish, whitefish, Chinook salmon, northern pike, coho salmon, and sockeye salmon comprised the remaining top

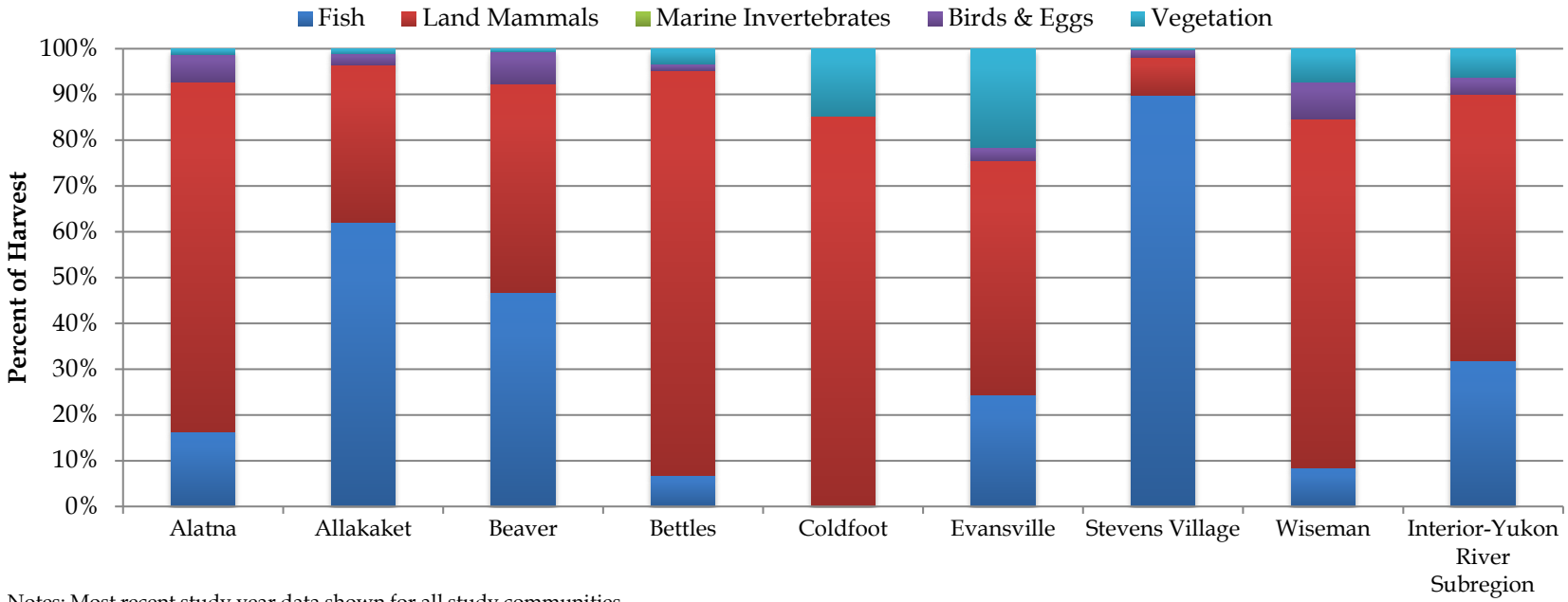
species harvested by Interior study communities. Other than fish and large land mammals, berries and ptarmigan were the only other two resources identified in the top three (Coldfoot and Wiseman). Other species not shown in Figures 3.16-14 and 3.16-15 (*e.g.*, waterfowl, hare, grayling, plants, and beaver) are also important contributors to the overall subsistence harvest and are represented in the "Other" category. For several of the communities, the "Other" category represented over one quarter of the subsistence harvest with ranges between 0 percent (Coldfoot) and 47 percent (Allakaket).

Of all three study regions described in this section, the Interior Region has the greatest range of per capita harvests for communities (Figures 3.16-16 and 3.16-17). These data ranged from a low of 38 pounds per capita for Coldfoot to a high of 1,139 pounds per capita for Stevens Village. According to Case and Halpin (1990), Tanana had a per capita harvest of 2,157 pounds; however, residents reported approximately 1,357 pounds per capita being used for dog food. Harvests of subsistence resources for dog food qualify as a subsistence use protected under both state and federal law. Per capita harvest amounts for other communities in Figures 3.16-16 and 3.16-17 may also include foods harvested to feed to dogs; however, unlike for Tanana, the specific amount of food that was given to dogs is unknown. As the figures show, many of the communities have only one study year with per capita information, and subsistence harvests can vary greatly from year to year. Characterizing a community's subsistence harvests is most accurate when multiple data years are available. The average per capita harvest for the two subregions for study communities with harvest data are similar, with an average of 439 pounds per person in the Yukon River subregion and 426 pounds in the Tanana River subregion.

Subsistence harvesters in the region distribute harvested foods through sharing and trade networks within the community and in some cases with other nearby communities. Figures 3.16-18 and 3.16-19 show the percent of households giving and receiving subsistence resources based upon data from 13 of the 20 communities. Sharing of subsistence foods is a traditional activity that has always been a key characteristic of the subsistence way of life, particularly among Alaska Natives. As shown in the two figures, the percentage of households sharing is higher among communities with primarily Native populations (*e.g.*, Alatna, Beaver, Minto, and Tanana) versus those communities with a mixed or non-native population (*i.e.*, Coldfoot, Anderson, Healy, and McKinley Park). In some Native communities, 100 percent of households reported receiving subsistence foods. The average percent of households sharing for study communities is highest in the Yukon River subregion (82 percent giving/99 percent receiving) with a lower percentage in the Tanana River subregion (56 percent giving/ 82 percent receiving).

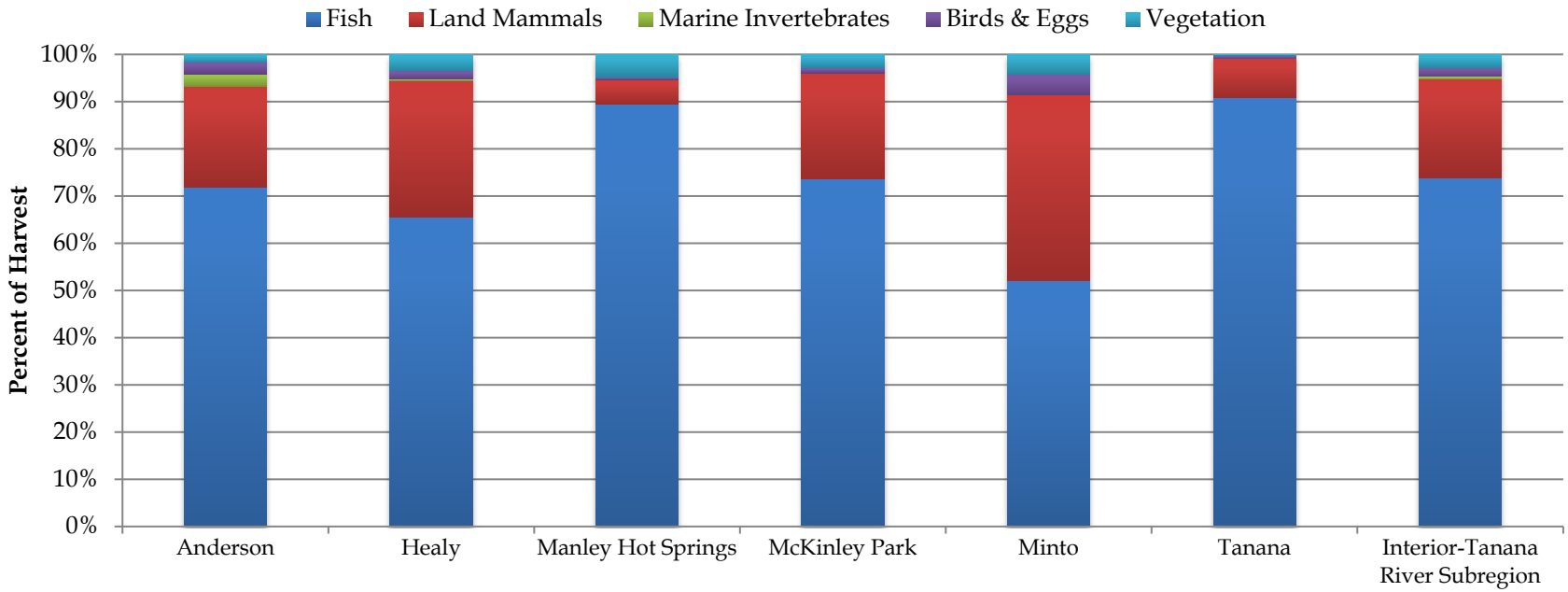
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Figure 3.16-12 Percent of Interior Harvests by Resource Category – Yukon River Subregion



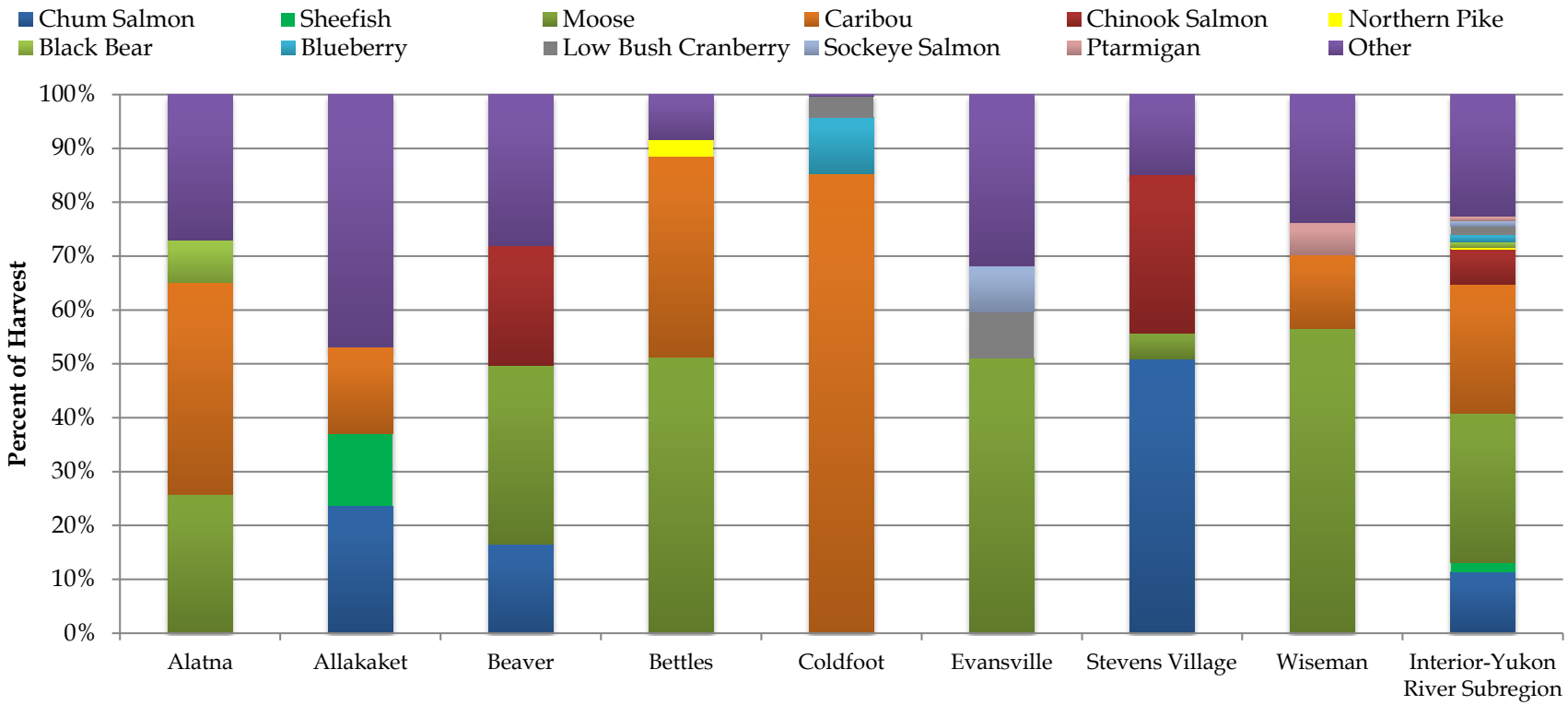
Notes: Most recent study year data shown for all study communities.
Sources: Alatna 2011, Allakaket 2011, Beaver 2011, Bettles 2011, Coldfoot 2011, Evansville 2011, Wiseman 2011 (Holen *et al.*, 2012); Stevens Village 1983-84 (Sumida, 1984)

Figure 3.16-13 Percent of Interior Harvests by Resource Category – Tanana River Subregion



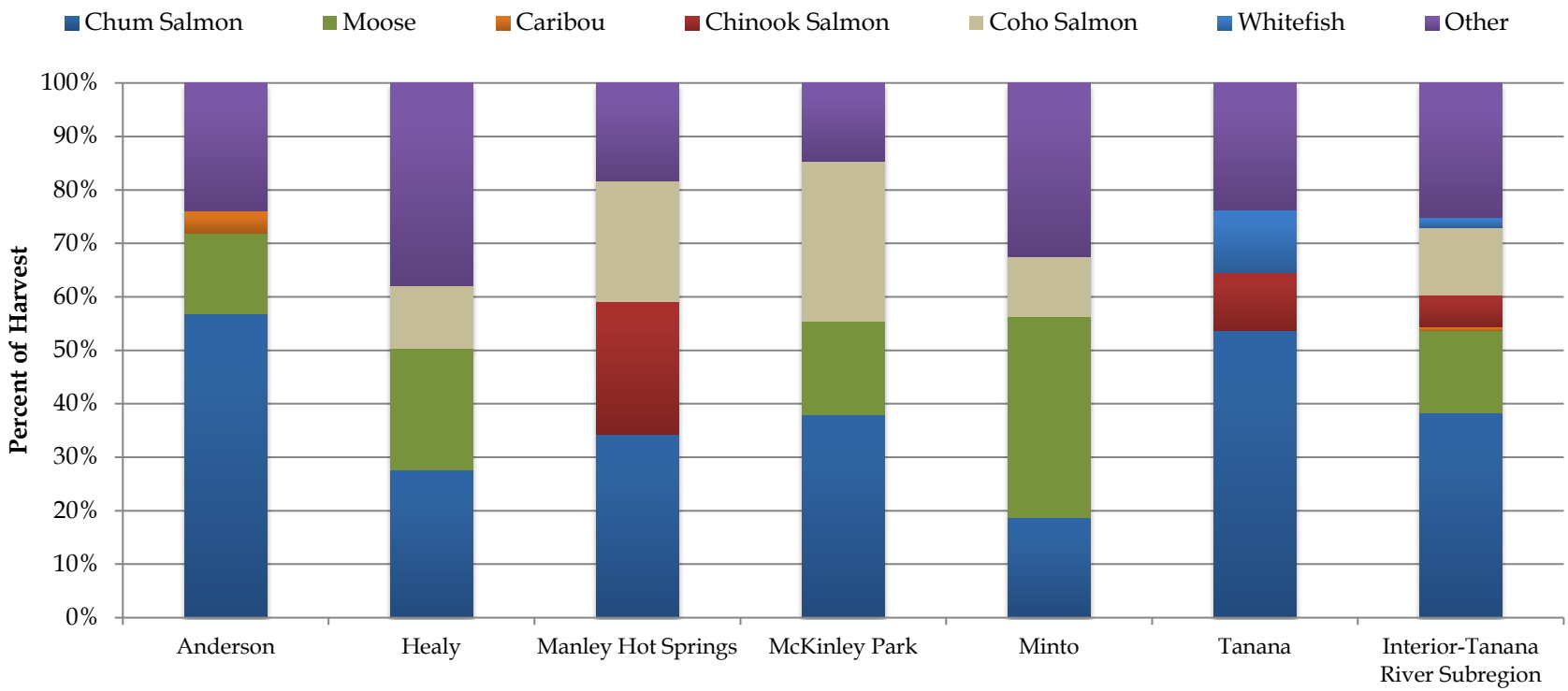
Notes: Most recent study year data shown for all study communities.
Sources: Anderson 1987, Healy 1987, McKinley Park 1987 (ADF&G, 2016j); Manley Hot Springs 2012, Minto 2012 (Brown *et al.*, 2014); Tanana 1987 (Case and Halpin, 1999)

Figure 3.16-14 Percent of Interior Harvests by Top Three Species – Yukon River Subregion



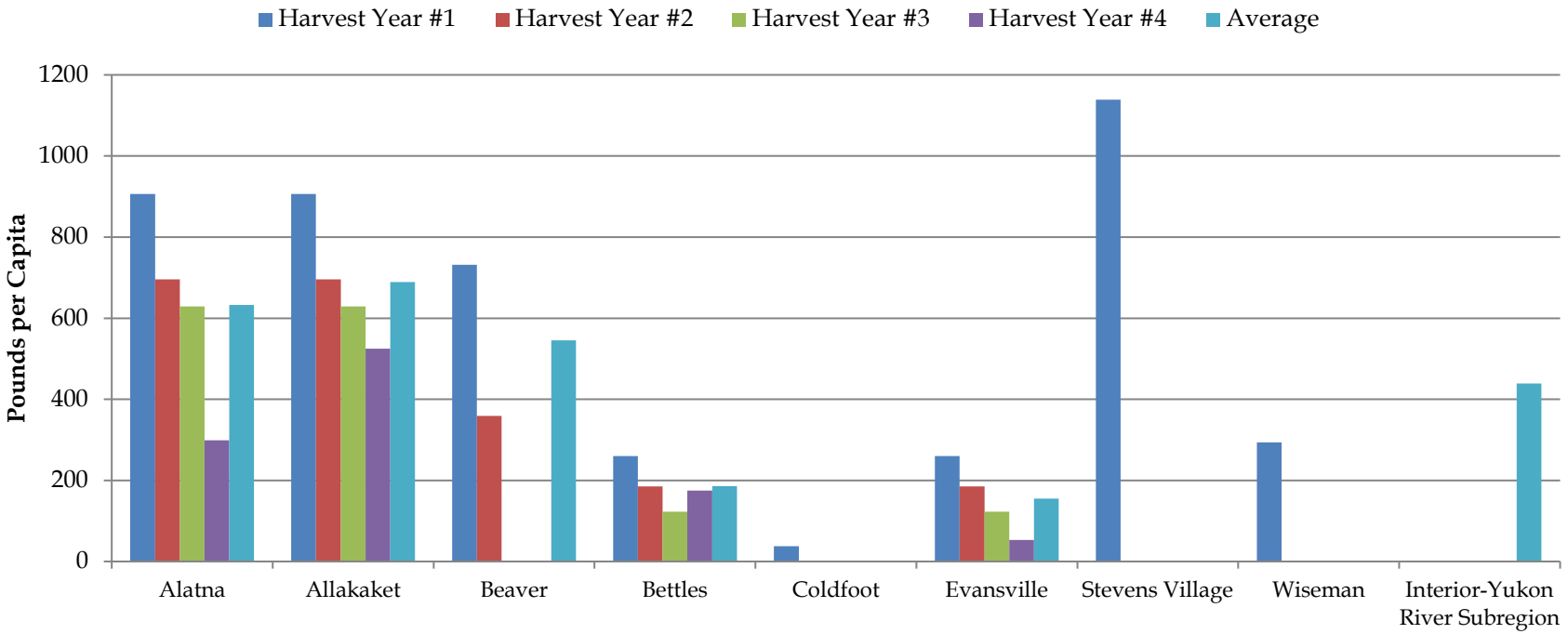
Notes: Most recent study year data shown for all study communities.
Sources: Alatna 2011, Allakaket 2011, Beaver 2011, Bettles 2011, Coldfoot 2011, Evansville 2011, Wiseman 2011 (Holen *et al.*, 2012); Stevens Village 1983-84 (Sumida, 1984)

Figure 3.16-15 Percent of Interior Harvests by Top Three Species – Tanana River Subregion



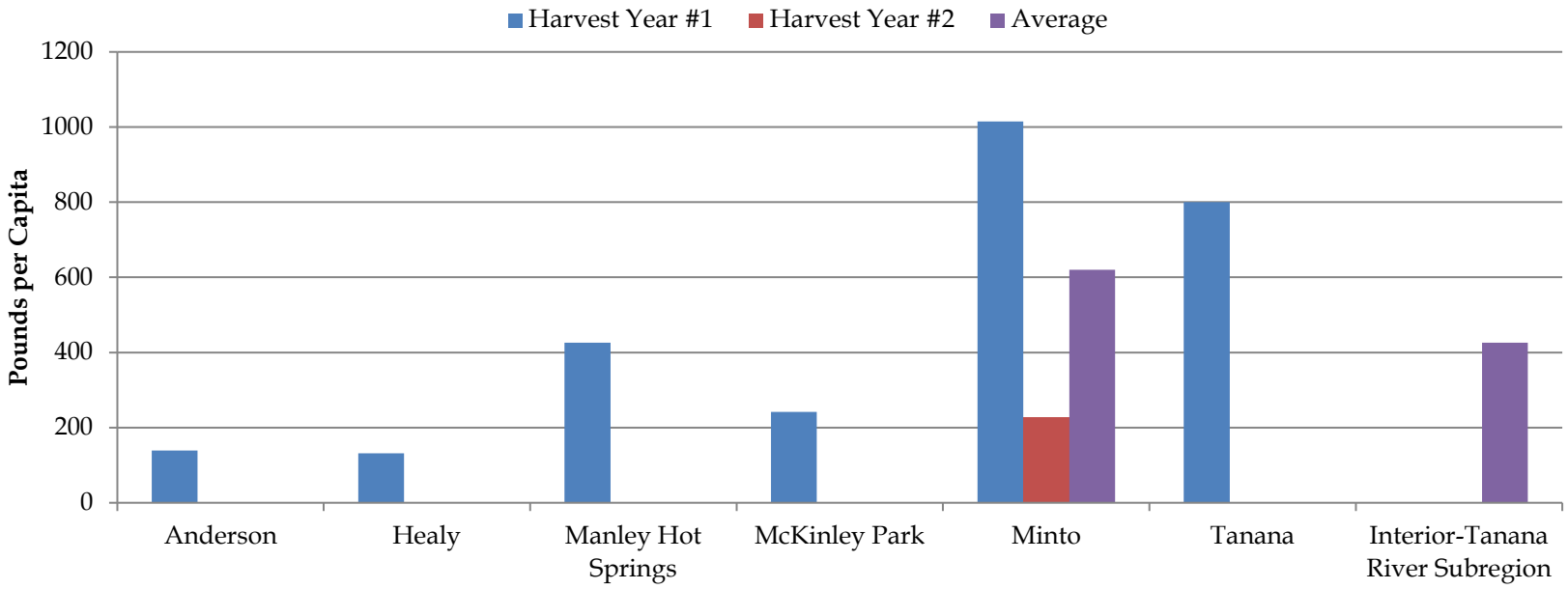
Notes: Most recent study year data shown for all study communities.
Sources: Anderson 1987, Healy 1987, McKinley Park 1987 (ADF&G, 2016j); Manley Hot Springs 2012, Minto 2012 (Brown *et al.,* 2014); Tanana 1987 (Case and Halpin, 1999)

Figure 3.16-16 Per Capita Interior Harvests by Study Community - Yukon River Subregion



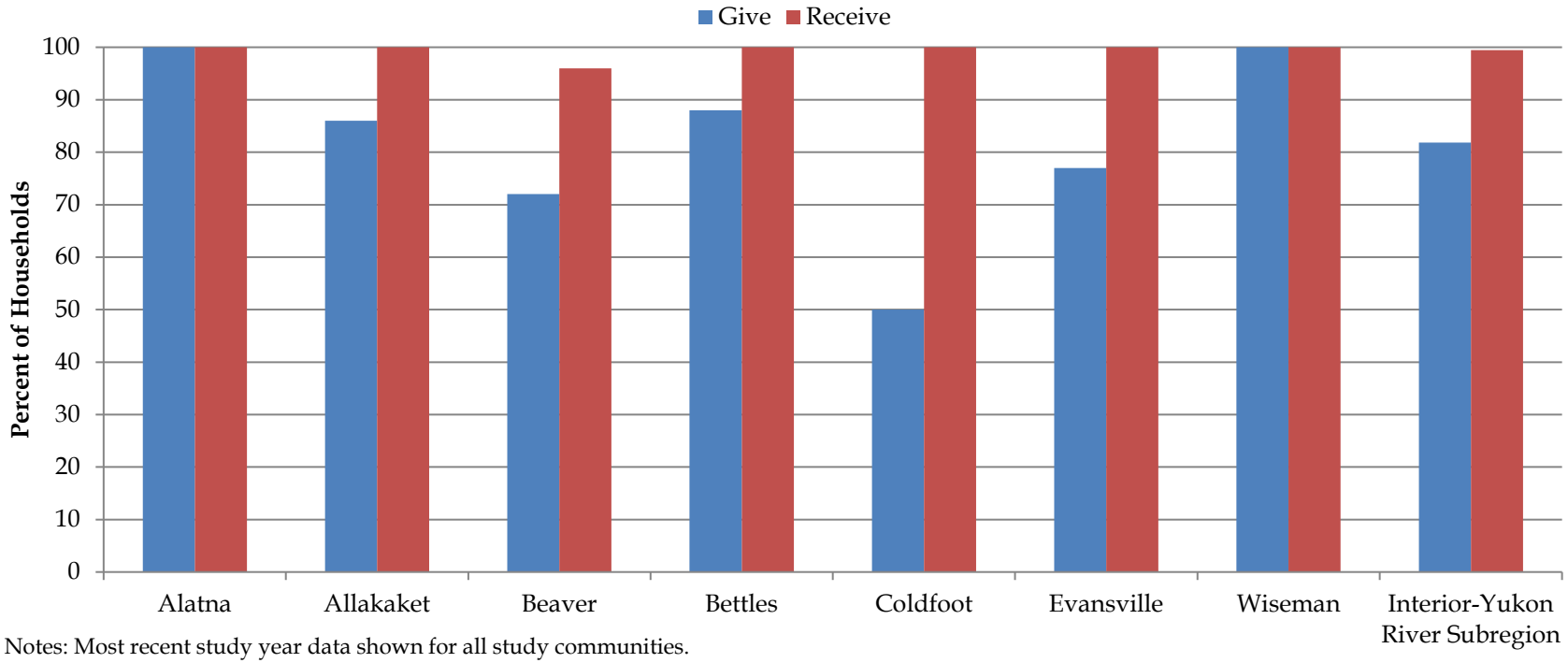
Notes: Harvest Years #1, #2, and #3 show combined harvest data for the two study communities of Alatna/Allakaket and Bettles/Evansville.
Sources: Alatna 2011, Allakaket 2011, Beaver 2011, Bettles 2011, Coldfoot 2011, Evansville 2011, Wiseman 2011 (Holen *et al.*, 2012); Beaver 1985 (Sumida, 1989); Stevens Village 1983-84 (Sumida, 1984)

Figure 3.16-17 Per Capita Interior Harvests by Study Community – Tanana River Subregion



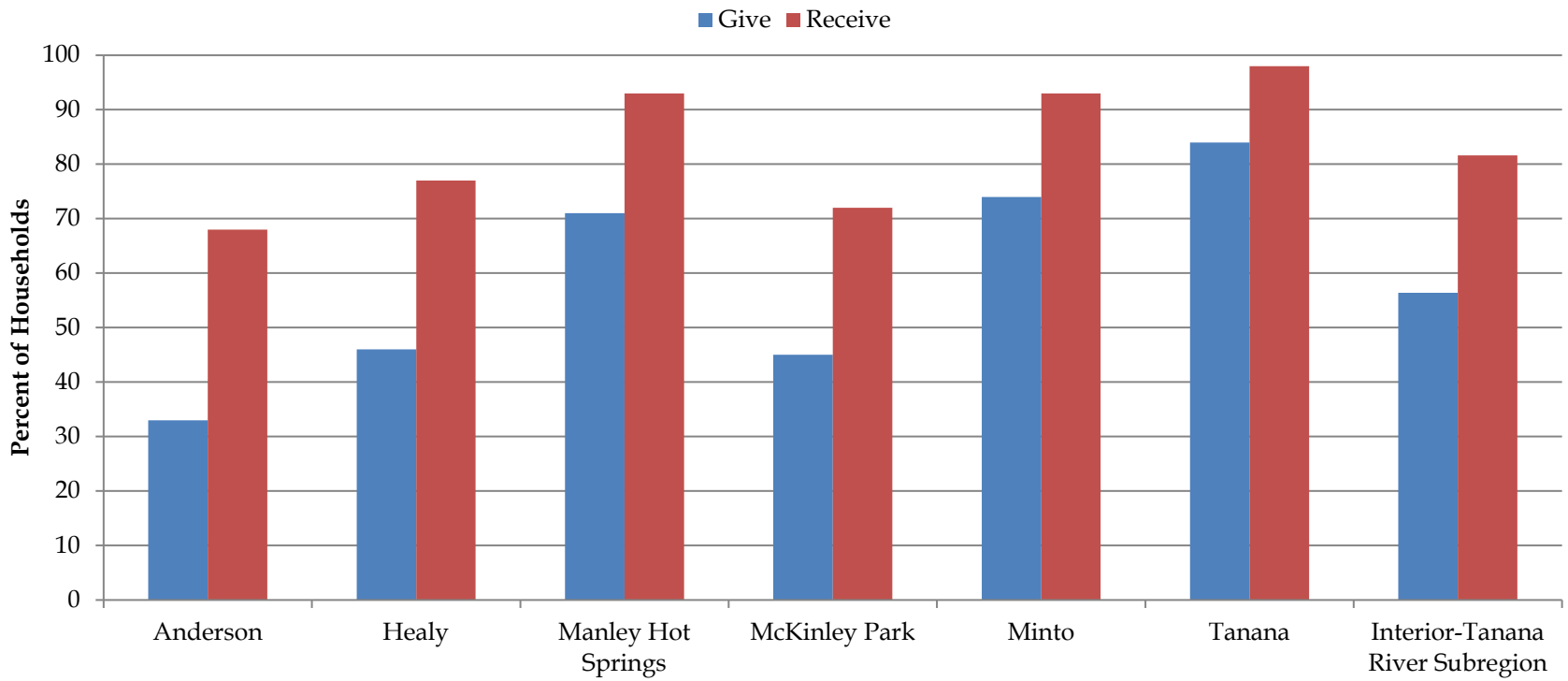
Notes: Tanana per capita harvest adjusted from 2157 pounds because 1357 pounds was fed to dogs. (Case and Halpin, 1990)
Sources: Anderson 1987, Healy 1987, McKinley Park 1987 (ADF&G, 2016j); Manley Hot Springs 2012, Minto 2012 (Brown *et al.,* 2014); Minto 1983-84 (Andrews, 1988); Tanana 1987 (Case and Halpin, 1999)

Figure 3.16-18 Percent of Interior Households Sharing Subsistence Resources – Yukon River Subregion



Notes: Most recent study year data shown for all study communities.
Sources: Alatna 2011, Allakaket 2011, Beaver 2011, Bettles 2011, Coldfoot 2011, Evansville 2011, Wiseman 2011 (Holen *et al.,* 2012)

Figure 3.16-19 Percent of Interior Households Sharing Subsistence Resources – Tanana River Subregion



Notes: Most recent study year data shown for all study communities.
Sources: Anderson 1987, Healy 1987, McKinley Park (ADF&G, 2016j); Manley Hot Springs 2012, Minto 2012 (Brown *et al.*, 2014); Tanana 1987 (Case and Halpin, 1999)

3.16.6.4. Seasonal Round

Data on seasonal round are available for 11 Interior Region study communities. In the Yukon River subregion, these communities include the following: Alatna, Allakaket, Beaver, Bettles, Evansville, Stevens Village, Rampart, and Wiseman. In the Tanana River subregion, data on the timing of subsistence activities are available for the communities of Minto, Manley Hot Springs, and Tanana. Tables 3.16-8 and 3.16-9 represent a compilation of data on the timing of subsistence activity for communities in the two regions and are based on the most recent available data for each community. A month is shaded if two or more communities in the region reported subsistence activity for a particular resource during that month. Individual Yukon and Tanana study communities may utilize additional months for a specific resource or harvest additional resources (*e.g.*, caribou hunting in Tanana) that are not depicted in the regional tables (Tables 3.16-8 and 3.16-9). The timing of subsistence activities for 11 Interior Region study communities are summarized in Tables 3.16-10 through 3.16-20. These tables include synthesized information from various sources to show a general depiction of the seasonal round of subsistence activities in these communities based on the most recent data available and provide a more comprehensive/updated picture of the timing of subsistence activities than the 2012 FEIS.

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Table 3.16-8 Interior Seasonal Round of Subsistence Activities – Yukon River Subregion

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater Non-Salmon			■	■	■	■	■	■	■	■	■	■
Salmon						■	■	■	■	■		
Caribou	■	■	■	■	■			■	■	■	■	■
Moose	■	■	■	■	■	■	■	■	■	■	■	■
Bear			■	■	■	■	■	■	■	■	■	
Dall Sheep								■	■			
Furbearers	■	■	■	■	■						■	■
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■
Upland Birds	■	■	■	■	■				■	■	■	■
Waterfowl				■	■	■	■	■	■			
Plants and Berries						■	■	■	■			
Wood	■	■	■	■	■	■	■	■	■	■	■	■

Sources: Andersen *et al.*, 1998 (1997-98), 2000 (1998-99), 2001 (1999-00), 2004a (2002); Andersen and Jennings, 2001a (2000); Betts, 1997 (pre-1997); Holen et al., 2012 (2011); Koskey and Mull, 2011 (2005); Marcotte and Haynes, 1985 (1982); Scott, 1998 (1991-1993); SRB&A, 2007a (1996-2007); Sumida, 1988 (1984-85); Sumida and Alexander, 1985 (1984); Van Lanen *et al.*, 2012 (2008-09 and 2009-10)

Table 3.16-9 Interior Seasonal Round of Subsistence Activities – Tanana River Subregion

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater Non-Salmon			■	■	■	■	■	■	■	■	■	■
Salmon						■	■	■	■	■		
Moose	■	■	■	■	■	■		■	■	■		■
Bear					■	■	■	■	■	■		
Furbearers	■	■	■	■							■	■
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■
Upland Birds	■	■	■	■	■			■	■	■	■	■
Waterfowl				■	■	■	■	■	■	■		
Plants and Berries						■	■	■	■			
Wood	■	■	■	■						■	■	■

Sources: Andrews, 1988 (1960-84); Betts, 1997 (pre-1997); Brown *et al.*, 2004 (2002-03); Brown *et al.*, 2010 (2006); Brown *et al.*, 2014 (2012); Case and Halpin, 1990 (1987)

Table 3.16-10 Alatna Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon					■	■	■	■	■	■	■		1980s/2000s
Salmon						■	■	■	■				1980s
Caribou	■	■	■	■	■			■	■	■	■	■	1960s/2010s
Moose	■	■	■					■	■	■	■	■	1980s/2010s
Bear					■	■	■	■	■	■	■		1980s/2010s
Dall Sheep							■	■	■				1980s/2010s
Furbearers	■	■	■	■	■						■	■	1980s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Upland Birds	■	■	■	■					■	■	■	■	1980s
Waterfowl				■	■	■		■	■				1980s
Plants and Berries							■	■					1980s
Wood	■	■	■						■	■	■	■	1960s

Sources: Anderson *et al.,* 2004a (2002); Holen *et al.,* 2012 (2011); Marcotte and Haynes, 1985 (1982, 1961-62, 1968)

Table 3.16-11 Allakaket Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon					■	■	■	■	■	■	■		1980s/2000s
Salmon						■	■	■	■				1980s
Caribou	■	■	■	■	■			■	■	■	■	■	1960s/2010s
Moose	■	■	■					■	■	■	■	■	1980s/2010s
Bear					■	■	■	■	■	■	■		1980s/2010s
Dall Sheep							■	■	■				1980s/2010s
Furbearers	■	■	■	■	■						■	■	1980s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Upland Birds	■	■	■	■					■	■	■	■	1980s
Waterfowl				■	■	■		■	■				1980s
Plants and Berries							■	■					1980s
Wood	■	■	■						■	■	■	■	1960s

Sources: Anderson *et al.,* 2004a (2002); Holen *et al.,* 2012 (2011); Marcotte and Haynes, 1985 (1982, 1961-62, 1968)

Table 3.16-12 Beaver Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon					■	■	■	■	■	■	■		2000s
Salmon					■	■	■	■	■				2000s
Caribou	■	■	■	■							■	■	1980s
Moose	■	■	■	■	■	■	■	■	■	■	■	■	2000s/2010s
Bear				■	■	■	■	■	■	■			2000s/2010s
Furbearers	■	■	■								■	■	1980s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2000s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Waterfowl				■	■	■	■	■	■				2000s
Plants and Berries							■	■	■				2000s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	2000s

Sources: Anderson and Jennings, 2001 (2000); Holen *et al.,* 2012 (2011); Koskey and Mull, 2011 (2005); SRB&A, 2007a (1996-2007); Van Lanen *et al.,* 2012 (2008-09 and 2009-10)

Table 3.16-13 Bettles Seasonal Round of Subsistence Activities

Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon					■	■	■	■	■	■	■	■	1980s/2000s
Salmon						■	■	■	■				1980s
Caribou	■								■			■	2010s
Moose	■	■	■						■	■	■	■	1980s/2010s
Bear					■	■	■	■	■	■	■		1980s/1990s
Dall Sheep								■	■				1980s
Furbearers	■	■	■	■	■						■	■	1980s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Upland Birds	■	■	■	■					■	■	■	■	1980s
Waterfowl				■	■	■		■	■				1980s
Plants and Berries							■	■	■				1980s

Sources: Andersen *et al.,* 1998 (1997-98), 2000 (1998-99), 2001 (1999-00), 2004a (2002); Holen *et al.,* 2012 (2011); Marcotte and Haynes, 1985 (1982)

Table 3.16-14 Evansville Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon					■	■	■	■	■	■	■	■	1980s/2000s
Salmon						■	■	■	■				1980s
Caribou	■	■	■					■				■	1990s
Moose	■	■	■						■	■	■	■	1980s/2010s
Bear					■	■	■	■	■	■	■		1980s/1990s
Dall Sheep								■	■				1980s
Furbearers	■	■	■	■	■						■	■	1980s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Upland Birds	■	■	■	■					■	■	■	■	1980s
Waterfowl				■	■	■		■	■				1980s
Plants and Berries							■	■	■				1980s

Sources: Andersen *et al.*, 1998 (1997-98), 2000 (1998-99), 2001 (1999-00), 2004a (2002); Holen *et al.*, 2012 (2011); Marcotte and Haynes, 1985 (1982)

Table 3.16-15 Rampart Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon			■	■	■	■	■	■	■	■	■		1990s
Salmon						■	■	■	■	■			1990s
Caribou				■	■			■	■				1990s
Moose	■	■	■	■	■	■	■	■	■	■	■	■	1990s
Bear	■	■	■	■	■	■	■	■	■	■	■	■	1990s
Furbearers	■	■	■								■	■	1990s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1990s
Upland Birds	■	■	■	■					■	■	■	■	1990s
Waterfowl				■	■	■	■	■	■				1990s/2000s
Plants and Berries						■	■	■	■				1990s
Wood	■	■	■	■						■	■	■	1990s

Sources: Betts, 1997 (pre-1997); Andersen and Jennings, 2001a (2000)

Table 3.16-16 Stevens Village Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon			■	■	■	■	■	■	■	■	■	■	1980s
Salmon						■	■	■	■	■	■	■	1980s
Moose			■	■	■	■	■	■	■	■			1980s/2000s
Bear			■	■	■	■	■	■	■	■			1980s/2000s
Furbearers	■	■	■	■	■	■	■				■	■	1980s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Upland Birds	■	■	■	■	■				■	■	■	■	1980s
Waterfowl				■	■	■		■	■	■			1980s/2000s
Plants and Berries						■	■	■	■	■			1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: Andersen and Jennings, 2001 (2000); Sumida, 1988 (1984-85); Sumida and Alexander, 1985 (1984); Van Lanen *et al.*, 2012 (2008-09 and 2009-10)

Table 3.16-17 Wiseman Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Caribou		■	■	■	■			■	■	■	■		1990s/2010s
Moose			■						■				1990s/2010s
Bear				■	■				■	■			1990s
Dall Sheep			■					■	■	■			1990s/2010s
Furbearers	■	■	■	■							■	■	1990s
Plants and Berries							■	■	■				1990s
Wood	■	■	■			■	■	■	■		■	■	1990s

Sources: Holen *et al.*, 2012 (2011); Scott, 1998 (1991-1993)

Table 3.16-18 Manley Hot Springs Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1990s
Salmon						■	■	■	■	■			1990s
Moose	■	■	■						■	■	■	■	1990s/2010s
Bear					■	■	■	■	■				1990s/2010s
Furbearers	■	■	■	■							■	■	1990s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1990s/2010s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	1990s/2010s
Waterfowl				■	■	■	■	■	■	■			1990s/2010s
Plants and Berries						■	■	■	■				1990s
Wood	■	■	■	■						■	■	■	1990s

Sources: Betts, 1997 (pre-1997); Brown *et al.,* 2014 (2012)

Table 3.16-19 Minto Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon			■	■	■	■	■	■	■	■	■		1980s
Salmon							■	■	■	■			1980s
Moose	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Bear					■	■	■	■	■	■	■		1980s/2010s
Dall Sheep												■	2010s
Furbearers	■	■	■	■	■	■					■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds									■	■	■	■	1980s/2010s
Waterfowl				■	■	■		■	■	■			1980s/2010s
Plants and Berries						■	■	■					1980s
Wood	■	■	■	■						■	■	■	1980s

Sources: Andrews, 1988 (1960-84); Brown *et al.,* 2014 (2012)

Table 3.16-20 Tanana Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon				■	■	■	■	■	■	■	■	■	1980s/2000s
Salmon						■	■	■	■	■			1980s
Caribou		■	■	■				■			■	■	1980s/2000s
Moose	■	■	■	■	■	■		■	■	■		■	1980s/2000s
Bear				■	■	■	■	■	■	■			1980s/2000s
Furbearers	■	■	■								■	■	1980
Small Land Mammals	■	■			■	■	■	■	■	■	■	■	1980
Upland Birds	■	■	■	■	■			■	■	■	■	■	1980
Waterfowl				■	■	■	■	■	■	■			1980
Plants and Berries							■	■	■	■			1980
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980

Sources: Brown *et al.,* 2010 (2006); Case and Halpin, 1990 (1987); Brown *et al.,* 2004 (2002-03)

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3.16.6.4.1. Yukon River Subregion

Spring (April-May) in the Yukon River subregion is characterized by warming temperatures, breakup on the rivers, and lengthening days (Table 3.16-8). Spring marks a decrease in seasonal harvests of furbearers and upland birds; however, it also marks the beginning of the waterfowl hunting season, as ducks and geese arrive in the area. Yukon River residents occasionally harvest small land mammals, including marten, hare, and beaver, in the springtime, but harvest by month data show harvests more commonly occurring over the winter months (Van Lanen *et al.*, 2012; Holen *et al.*, 2012). Fishing for non-salmon fish occurs in the region during the springtime, either through the ice or after breakup in the open water. Harvests of caribou, bear, and moose may also occur in the springtime in a number of communities.

During summer (June-August), residents of the Yukon River subregion focus on fishing and collecting plants and berries. Salmon abundance varies throughout the region and therefore harvesting salmon is a strong focus of some communities, including Beaver, Allakaket, Alatna, Rampart, and Stevens Village, while other communities located further from the major salmon rivers (*i.e.*, Coldfoot, Wiseman, Bettles, Evansville) focus their fishing endeavors on non-salmon fish. Berries are a particularly important resource in the region; they are among the highest-used resources (in terms of the percentage of households using) in many of the communities (Holen *et al.*, 2012). Most large land mammal subsistence activity, more commonly a fall activity, commences at the end of the summer in August, though communities may also take bear and moose occasionally in June and July. Harvests of waterfowl also occur during the summer months.

Many subsistence activities that occur over the summer, including fishing, waterfowl hunting, and large land mammal hunting, continue or amplify during the fall (September-October). Caribou and moose are particularly important resources for the northern communities in the Yukon River region (*i.e.*, Wiseman, Coldfoot, Evansville, and Bettles), and by weight make up the majority of the annual subsistence harvest in these communities. Moose and caribou harvests most commonly occur in the month of September but residents may harvest both species during the late fall and into the winter months. Dall sheep and bear harvests occur in early fall and berry picking may also continue from the summer into the early fall. Fall in the Yukon River marks the end of waterfowl subsistence activity and the beginning of harvests of upland birds, such as grouse and ptarmigan. Wood is collected year-round and in the fall is a particularly important resource to harvest and prepare for heating through the upcoming winter.

During the winter season (November-March), focus shifts to harvests of small land mammals and furbearers as watersheds freeze over and create conditions for travel to trapping grounds. Pelts of the small mammals and furbearers are prime over the winter season and residents of the region hunt or trap for the pelts and/or meat of small mammals for subsistence purposes. Large land mammal harvests, including caribou, moose, and bears, occur over the winter months (bear earlier in the winter), although

moose and bear harvests occur with more frequency during other seasons. Ice fishing for non-salmon fish occurs over winter months. Residents of the Yukon River subregion harvest upland birds throughout the winter and into the spring as the annual cycle of subsistence activities begins again.

3.16.6.4.2. Tanana River Subregion

Spring (April-May) in the Tanana River subregion is a transitional time when winter subsistence activities wane and activities that continue throughout the summer begin (Table 3.16-9). Subsistence activity for upland birds and furbearers declines in early spring as residents of the region shift focus to non-salmon fish and waterfowl as they migrate through the area. Spring is a primary harvest time for bear in the region and the occasional moose. Spring marks a decline of small land mammal harvests in general, though beaver, porcupine, and muskrat subsistence activity continues.

Summer (June-August) in the Tanana River is characterized by intensified fishing activities. Salmon fishing begins in June and continues through the fall as different species navigate the watersheds of the region. Non-salmon fish harvests, including whitefish and sheefish harvests, occur along with the summer salmon fishing. Waterfowl subsistence activity continues through the summer, as do harvests of small land mammals. Subsistence activity for upland birds begins in late summer and continues into the spring. Residents of the region may target bear and moose in summer (except July for moose); however, harvests at that time are only occasional; in general, moose harvests are limited to the regulated fall and winter seasons, although residents of the region may harvest potlatch moose at any time. The emergence and ripening of vegetation in the region during the summer months allows for harvests of plants and berries.

The focus on fishing continues into the fall (September-October) with harvests of coho salmon and non-salmon fish; however, large land mammal harvests begin to intensify at this time. Moose subsistence activity is primarily in September and is the most common large land mammal resource harvested in the region. Bear subsistence activity continues and is particularly common in the fall in Tanana and Minto. Waterfowl subsistence activity intensifies to peak activity with the fall migration, particularly in Manley Hot Springs and Tanana. Ripe berries are collected into early fall and wood collection begins at the end of fall to prepare for the upcoming winter.

The focus of subsistence activity shifts in the winter (November-March), with the end of salmon fishing and the slowing of non-salmon fishing. Residents primarily harvest small land mammals and upland birds for fresh meat over the winter season. Furbearer pelts are in prime condition over the winter and residents report peak activity during this time. Moose subsistence activity may occur during the winter months, and wood collection continues to maintain a heating fuel supply.

3.16.7. Southcentral Region

Southcentral Alaska is divided into three primary ecoregions: Cook Inlet, Copper Plateau, and PWS. The Cook Inlet ecoregion is located in Southcentral Alaska and is surrounded by the Alaska Range and Pacific Coast Mountain ecoregions. Cook Inlet is characterized by a mild climate, level to rolling topography, and spruce and hardwood forests; the region was heavily glaciated during the Pleistocene epoch, which had a major shaping factor in the landscape's topography (Gallant, 1995). The Susitna and Matanuska rivers, two major rivers in this region, drain into Cook Inlet, a long glacially formed fjord in Southcentral Alaska. The Copper River Basin lies primarily within the Copper Plateau ecoregion. The region is surrounded by the Wrangell-Saint Elias Mountains to the east, the Alaska Range to the north, the Chugach Mountains to the south, and the Talkeetna Mountains to the west. During glacial times, this area was covered by a large lake and today is comprised of level to rolling terrain interspersed with lakes, wetlands, and black spruce forests (Gallant, 1995). The PWS region is located on the borders of the Pacific Coastal Mountains and Coastal Western Hemlock-Sitka Spruce Forests ecoregions. The upland areas adjacent to these communities can be covered by glaciers or ice fields. The lowland soils are often ephemeral, covering thick layers of glacial till, stony moraines, or bedrock (Gallant, 1995).

Much of the Southcentral Region was the province of the Ahtna, primarily located in the Copper River Basin, and the Dena'ina (or Tanaina), the only group of Athabascan speakers in Alaska to live on a marine coast (Figure 3.16-4). As such, the Dena'ina had access to marine mammal resources such as seals, belugas, and occasionally larger whales, as well as a seasonal abundance of salmon and other fish, waterfowl, moose, caribou, and Dall sheep. Marine mammal fat was harvested for local use and for trade with neighboring groups such as the Ahtna, Tanana, and Upper Kuskokwim Athabascans. Occasionally, hostile relations occurred with neighboring Alutiiq peoples from PWS, the outer Kenai Peninsula, and Kodiak Island. Dena'ina speakers shared the upper Susitna and upper Matanuska valleys with their Ahtna speaking neighbors on a friendly basis, intermarrying and sharing hunting and fishing territories. When the Russians arrived in the late 1770s, the Dena'ina began fur trading with the Russian companies and later the Russian American Company (a state-chartered monopoly), as well as with explorers from Britain, France, and Spain. Following the purchase of Alaska by the U.S. in 1867, the Dena'ina continued much as they had under the Russians until the ARRC construction project began in 1915. Dena'ina people worked on the railroad in several capacities, and direct contact and economic opportunity drew Dena'ina people to places where they could both subsist on wild foods and take advantage of employment opportunities and access to imported goods.

The Ahtna speaking peoples that lived in the Copper River Basin were very similar to the Yukon River drainage peoples save for language, and they had close relationships with the Upper Tanana and Tanana peoples and Dena'ina people in Cook Inlet. The Ahtna people were particularly close to the Dena'ina in both the Upper Susitna valley and the Matanuska River valley (de Laguna and McClellan, 1981). Family centered

bands pursued game in their territories, gathering to harvest salmon during the summer and fall runs in the Copper River and its tributaries, and then dispersing to harvest resources in the mountains in the fall and winter, with families staying in central winter villages and men often in hunting and trapping camps. Early in the 20th Century, people began centralizing at missions and communities for part of the year, and following World War II nearly all Ahtna people lived in one of several communities along the road system of the Copper River Basin (de Laguna and McClellan, 1981).

Unlike the other regions previously discussed in this section, much of the proposed Project within the Southcentral Region lies within the Alaska's Anchorage-Matsu-Kenai non-subsistence area (Figure 3.16-2). Under state definitions, all harvests of wildlife and fish within this non-subsistence area do not qualify as subsistence activities and are instead managed under general sport hunting regulations, or by personal use or sport fishing regulations. All residents outside the federally designated Wasilla-Palmer, Valdez, and Anchorage non-rural areas are considered rural and are eligible for subsistence harvesting on federal lands (Figure 3.16-1). However, there are no major tracts of federal public lands in or near the proposed Project within the Southcentral area, and any harvests of fish or wildlife on proposed Project Area lands within the Southcentral Region do not qualify as federal subsistence activities.

The Southcentral Region encompasses 26 study communities (Table 3.16-1). Of the 26 communities, seven are federally recognized tribes and include Cantwell, Chickaloon, Copper Center, Eklutna, Gakona, Knik (in Wasilla), and Tyonek. These tribes have traditional and current resource uses, including customary and traditional, educational, and ceremonial uses in or near the proposed Project Area. The other 19 communities within this region included in this analysis are the Municipality of Anchorage, Beluga, Chase, Glennallen, Hope, Kenny Lake, Lake Louise, McCarthy, Palmer, Petersville, Point Possession, Skwentna, Susitna, Susitna North, Talkeetna, Trapper Creek, Valdez, Whittier, and Willow. Based on available information, the following discussion provides a description of the 26 communities and their subsistence harvest patterns, seasonal round, and use areas. For ease of discussion and analysis, the communities within the Southcentral Region are further subdivided into the Cook Inlet subregion and Copper River/PWS subregion.

3.16.7.1. Community Descriptions

3.16.7.1.1. Cook Inlet Subregion

3.16.7.1.1.1. Beluga

The community of Beluga is located 40 miles west of Anchorage along the west side of Cook Inlet and 8 miles north of the neighboring community of Tyonek. The 2010 population was 20, with 10 percent Alaska Native (U.S. Census Bureau, 2016a). The area surrounding both Beluga and Tyonek was part of the area occupied by the Dena'ina Athabascan. Trading settlements were established in the area by the Russians in the late

18th Century, followed by the Alaska Commercial Company trading post and a saltery in 1896 (ADCCED, 2016). Many of the homes are seasonally used; some residents work at the Chugach Electric Association power plant and others offer sport fishing and hunting guide services.

3.16.7.1.1.2. Cantwell

Cantwell is located on the Parks Highway 28 miles south of Denali NPP and 211 miles north of Anchorage. The community is the site where the Denali Highway intersects with the ARRC and the Parks Highway (Simeone, 2002). The 2010 population was 219, with 16 percent of residents Alaska Native (U.S. Census Bureau, 2016a). Ahtna speakers from the upper Susitna River drainage used the Broad Pass area near Cantwell for hunting. The first Euro-Americans in the area mined the Valdez Creek basin for gold. In 1916, railroad construction lured both groups to the construction camp of Cantwell, which became the "jumping off" place for travelers to the Valdez Creek mines. In the 1920s and 1930s, improvements, including Alaska Road Commission cabins, were made to the 55-mile trail to the mines. In 1921, the government established commercial reindeer herds in Broad Pass with herds driven from government herds at Goodnews Bay; the enterprise failed by 1928. A film, Lure of the Yukon, was filmed in Cantwell in 1923. In 1950, construction of the Denali Highway was begun and by its 1957 completion provided the only road access to Denali NPP until the Parks Highway was built in 1971. Once the Parks Highway was built, the community reoriented itself away from serving the railroad to serving the needs of highway travelers with two gas stations, a lodge, store, bed and breakfast, and a post office (Simeone, 2002). The Native Village of Cantwell is a federally recognized tribe.

3.16.7.1.1.3. Chase

Chase was established along the Alaska Railroad route north of Talkeetna at MP 236.2 during land disposal sales in the 1970s (Stanek *et al.*, 1988). Even after the construction of the George Parks Highway in 1971, access to Chase continues to be solely by rail, foot, or other non-highway vehicle means. Residents of the Chase area choose to live there for quality of life reasons, including desires to live closer to nature, at a slower pace, removed from sources of pollution, and a perceived healthier lifestyle (Stanek *et al.*, 1988). In 2010, Chase had a population of 34 residents. None of the 34 residents identified themselves as Native (U.S. Census Bureau, 2016a).

3.16.7.1.1.4. Chickaloon

Chickaloon is an unincorporated community in the Mat-Su Borough northeast of Sutton, spread out along the Chickaloon River road. The 2010 population was 272, with 6 percent Alaska Native (U.S. Census Bureau, 2016a). A Dena'ina village was located at this site, called Nuk'din'iytnu, and was the farthest inland Dena'ina village going east from Cook Inlet (Stratton and Georgette, 1985). The village was later repopulated by Ahtna speakers from the Tyone Lake vicinity and renamed Chickaloon after the last

Dena'ina chief, named Chiklu. In 1913, the Navy organized an expedition to the Matanuska coal field, which established a camp at Chickaloon. At Chickaloon the Navy mined 1,000 tons of coal for tests, with 900 pounds sent to Pittsburgh, Pennsylvania for coking tests and 800 tons sent to Seattle by sled, rail, and ship for testing in a warship (USACE, 2012a). The community was soon connected by rail to Anchorage and Seward and became the center of a coal-mining district that included a number of small towns in the vicinity. Coal mining was consolidated in nearby Eska soon after construction of the railroad to Chickaloon with occasional production at other mines in the district, but Chickaloon never became a major coal production center (Barnes and Payne, 1956). The Chickaloon Native Village is a federally recognized tribe, which operates the Ya Ne Dah Ah (Ancient Teachings) School in Moose Creek (ADCCED, 2016).

3.16.7.1.1.5. Eklutna

Eklutna is located near the river of the same name where it joins Cook Inlet, 25 miles northeast of Anchorage, and has been the site of a railroad station, Native school, and village. The 2010 population was 54 persons, of whom 74 percent were Alaska Native (U.S. Census Bureau, 2016a). The Native Village of Eklutna is a federally recognized tribe. The site of the present community of Eklutna was once the junction of several Dena'ina trails used during annual moves from winter villages to fish camps along the shore. Remains of several nichił (winter semi-subterranean multi-family dwellings) and accounts from Dena'ina elders indicate long Dena'ina occupation in the area (Kari and Fall, 2003). Fran Seager-Boss (in Kari and Fall, 2003) stated that a number of Dena'ina families of Russian Orthodox faith moved to the present site of Eklutna in 1897 "to distance themselves from the traders and miners at Knik." In 1924, the Department of the Interior's Bureau of Education built and maintained the Eklutna Industrial School, moving the orphanage for Indian children from Tyonek to Eklutna. In 1961, "the Eklutna Tribal Council was formed by several people living in the village because too much land was being taken from the reserve set aside for the Village of Eklutna" (Stephan, 1996).

3.16.7.1.1.6. Hope

Hope is located on the south side of Turnagain Arm at the end of the 17-mile Hope Highway near the mouth of Resurrection Creek. Hope was established as a mining camp in the late 1800s for mining that occurred in the Resurrection Creek vicinity (ADCCED, 2016). In 2010, the U.S. census reported 192 people living in Hope, 4 percent of whom were American Indian or Alaska Native (U.S. Census Bureau, 2016a).

3.16.7.1.1.7. Lake Louise

Lake Louise is located 35 miles northwest of Glennallen at the end of a 20-mile spur road that extends north from the Glenn Highway. Traditionally, the vicinity hosted several Ahtna villages and numerous prehistoric sites (Stratton and Georgette, 1984). During the 1940s the area was homesteaded (ADCCED, 2016) and in 1953, the spur road was built to connect military recreation facilities on the lake to the Glenn Highway, which also

allowed civilian recreationalists to visit the lake. Today the area is a designated SRA (ADCCED, 2016). The area has a wide diversity of subsistence and sport hunting and fishing resources including the Nelchina Caribou Herd (Stratton and Georgette, 1984). The 2010 census reported that Lake Louise had 46 residents with 2 percent of residents listed as Native (U.S. Census Bureau, 2016a).

3.16.7.1.1.8. Municipality of Anchorage

Anchorage is located in Southcentral Alaska at the upper end of Cook Inlet near the mouth of the Knik River. Anchorage is the most populated city in Alaska and approximately 41 percent of the State's population resides within the Anchorage municipality (includes Eklutna, Chugiak, Eagle River, Rainbow, Indian, Bird Creek, Girdwood, and Portage). The 2010 population of the Anchorage municipality was 291,826 people, with 8 percent Alaska Native (U.S. Census Bureau, 2016a). At the time of first European contact in upper Cook Inlet, the Anchorage area was occupied by the K'enaht'ana, or Knik Arm Dena'ina, speakers of the 'Upper Cook Inlet' dialect of the Athabascan language (Fall, 1981). Beginning in 1915, thousands of individuals moved to Anchorage to find jobs associated with the construction of the ARRC. Throughout the 1940s and into the 1950s, more growth occurred in Anchorage with the development of the Fort Richardson military base. The construction of the Trans-Alaska Pipeline in the 1970s brought additional development and growth to the region. Today, Anchorage serves as a hub for Alaska's transportation, government agencies, communications, development industries, and finance and real estate market (ADCCED, 2016).

3.16.7.1.1.9. Palmer

Palmer is a small farming and residential community named after George Palmer, a trader with a post in Knik beginning in 1875, and the site of the 1935 Matanuska Valley Colony. It is located on the Glenn Highway, 7 miles from the junction with the George Parks Highway. The 2010 population was 5,937, of whom 9 percent were Alaska Native (U.S. Census Bureau, 2016a). The total population for the Mat-Su Borough which, includes Palmer and several outlying CDPs (including study community CDPs of Buffalo Soapstone, Butte, Farm Loop, Knik River, Lazy Mountain, and Sutton-Alpine), was 88,995 in 2010. Some descendants of the 203 families who came to Palmer in 1935 from Michigan, Wisconsin, and Minnesota for the Matanuska Valley Colony agricultural project remain in the area (ADCCED, 2016). Palmer hosts the Alaska State Fair. The City of Palmer was formed in 1951 and is today classified as a small city (ADCCED, 2016).

3.16.7.1.1.10. Petersville

Petersville is a CDP centered along the Petersville Road network west of the Trapper Creek CDP and the George Parks Highway. Petersville is a former mining town and in the late 1930s was the location of a post office that serviced the Yentna-Cache Creek mining district in the Upper Susitna drainage (Orth, 1967). According to the 2010 census, there were four residents in four households, 25 percent of whom identified as Native

(U.S. Census Bureau, 2016a). According to the latest census, most of the housing units in the Petersville CDP (174 of 179) are occupied for seasonal, recreational, or occasional use. Small-scale mining, recreational mining, hunting, and trapping take place in the region primarily from the Petersville Road.

3.16.7.1.1.11. Point Possession

Point Possession is an unincorporated community on the northern end of the Kenai Peninsula. The 2010 U.S. Census reported three people in three households residing in Point Possession. The U.S. Census further reported that the remaining 211 houses in Point Possession were seasonally, recreationally, or occasionally used. None of the three residents was Alaska Native (U.S. Census Bureau, 2016a). Point Possession was once the location of "Possession Village" and it is reported that Captain Cook landed here when he first traveled to Alaska in 1777. The land was purchased by the Federal Government in 2009 and is now part of the Kenai NWR. Early census records show members of the Knik Tribe once lived at Point Possession (ADCCED, 2016).

3.16.7.1.1.12. Skwentna

The community of Skwentna is located along the Skwentna River at its junction with Eight Mile Creek approximately 70 miles northwest of Anchorage. Today, Skwentna consists of a small community center at the Eight Mile Creek confluence where the Skwentna Roadhouse is located as well as the local post office; however, the majority of residents live in several dispersed settlements including the areas around Shell Lake, Fish Lake, and Lake Creek (Holen *et al.,* 2014). The Skwentna and nearby Yentna rivers were utilized by the Dena'ina who inhabited the region at the time of contact with European explorers and traders. During the Alaska Gold Rush period in the early 1900s, the Skwentna area served as an important stop along the Iditarod Trail. The area was later homesteaded and also the site of a U.S. Army radar station and recreation camp at Shell Lake (ADCCED, 2016). In 2010, the population was 37 individuals with no individuals reporting Alaska Native or American Indian descent (U.S. Census Bureau, 2016a).

3.16.7.1.1.13. Susitna

The Susitna CDP, which includes the community of Alexander Creek, is located on the west bank of the Susitna River at the foot of Mount Susitna, some 30 air miles northwest of Anchorage and west of Big Lake in the Mat-Su Borough. The 2010 population was 18, of whom zero percent were Alaska Native (U.S. Census Bureau, 2016a). Although there is no federally recognized tribe, a number of Alaska Native families continue to own land and cabins in the area, and Alexander Creek is considered a Native group under ANCSA. The location was once a Dena'ina village called Tuqen Kaq and trading place for bands living along the Susitna River and its tributaries. USGS first noted this village in 1898 and described it as a large village with abundant resources; however, several epidemics in the early 1900s left few survivor and those who did remain moved to the

nearby Native Village of Tyonek (ADCCED, 2016). Susitna became a port for gold prospectors and others traveling up the river by steamboat, and a post office operated there from 1906 to 1943 (Browne, 1913). A number of sport fishing lodges once operated out of Alexander Creek; however, these businesses have been impacted by declining numbers of salmon and many of these businesses have been closed. Today, several families live in Alexander Creek with a larger number of households moving seasonally between the Anchorage-Matsu area and Alexander Creek. A number of residents are retired and enjoy living in this remote area of Alaska.

3.16.7.1.1.14. Susitna North

Formerly known as the Y CDP, Susitna North is the populated area between Willow and Talkeetna on the Parks Highway, bounded by the Susitna and Talkeetna rivers on the north and west, the Talkeetna Mountains on the east, and the Kashwitna River on the south. The tract includes populated areas around the Sunshine and Montana Creek (ADCCED, 2016). The 2010 U.S. census reported 1,260 residents in the Susitna North CDP of which less than 5 percent reported being American Indian or Alaska Native (U.S. Census Bureau, 2016a).

3.16.7.1.1.15. Talkeetna

Talkeetna is located at the confluence of the Susitna and Talkeetna rivers, 112 railroad miles north of Anchorage. It is connected to the George Parks Highway at MP 98 by the 14-mile Talkeetna Spur Road. The 2010 population was 876, of whom 4 percent were Alaska Native (U.S. Census Bureau, 2016a). Talkeetna was established as a fur trading post and mining town in 1896 and by 1910 was a steamboat port for the Susitna River and its tributaries. In 1915, Talkeetna became a district center for construction of the ARRC. The onset of World War I and America's entry into the conflict severely depleted the community population (Fall and Foster, 1987). Today, Talkeetna is a tourism hub, serving sightseers and mountain climbers attempting the summit of Denali and other peaks in the Alaska Range (ADCCED, 2016).

3.16.7.1.1.16. Trapper Creek

Trapper Creek is located between MP 107 and 133 of the George Parks Highway in the Mat-Su Borough. The 2010 population was 481, of whom 6 percent were Alaska Native (U.S. Census Bureau, 2016a). The vicinity was long used by Dena'ina people for hunting, fishing, and trapping. Homesteaders were allowed entry to the area starting in 1948 and a prominent group from Detroit, Michigan moved to the area in 1959. They called themselves the "Fifty-Niners." The Parks Highway was completed to Trapper Creek in 1967. Prior to this the road extended only to the Susitna River crossing approximately 10 miles south of the community, and residents were required to travel over land from that area or from Talkeetna to access the community. The Parks Highway was completed to Fairbanks in 1971 (ADCCED, 2016). Today, Trapper Creek includes a mix of permanent residences and recreational cabins.

3.16.7.1.1.17. Tyonek

Tyonek is a Dena'ina Athabascan village located on a bluff above Cook Inlet some 43 miles southwest of Anchorage. Tyonek is comprised of residents centralized from several smaller communities, including Old Tyonek, Beluga, Robert Creek, and Timber Camp (ADCCED, 2016). The 2010 population was 171, of whom 88 percent were Alaska Native (U.S. Census Bureau, 2016a). The Native Village of Tyonek is a federally recognized tribe. Tyonek has long been a Dena'ina Athabascan community, and was present when Russian and English explorers passed through in the late 18th Century. A Russian fur trading post was located there in the 1790s, but was destroyed in a conflict between the Russians and their Aleut workers and the Dena'ina. A new trading post was later established and operated for many years under the Russians and was sold to the Alaska Commercial Company as part of the sale of Alaska to the U.S. In 1880, gold rushes on Turnagain Arm made Tyonek the port of choice for miners and prospectors. In 1896, a salmon saltery that was later turned into a cannery was built at the mouth of the nearby Chuitna River. This facility was washed out by powerful storms coming from Turnagain Arm. The population of Tyonek and the surrounding villages were once much larger however, disease epidemics in 1836-1840, 1904, and 1918 devastated the population of the Susitna River basin. The Iditarod Trail route to gold rushes in the north and interior of the state drew more people to Knik and Susitna Station; the establishment of Anchorage in 1915 drew even more people away from Tyonek, while the Bureau of Indian Affairs established the Moquawkie Indian Reservation for the tribe. The town was moved to the bluff top in 1930 after a storm flooded the original site. In 1965, the tribe affirmed the right to sell oil and gas leases on its reservation lands through a court judgment. ANCSA extinguished the reservation in 1971 (ADCCED, 2016).

3.16.7.1.1.18. Wasilla

Wasilla is located 43 miles northeast of Anchorage on the Parks Highway, between the Matanuska and Susitna valleys. The 2010 population was 7,831 persons, of whom 5 percent were Alaska Native (U.S. Census Bureau, 2016a). The total population for the Mat-Su Borough, which includes Wasilla and several outlying CDPs (including the study community CDPs of Big Lake, Houston, Knik-Fairview, Fishhook, Gateway, Lakes, Meadow Lakes, Point MacKenzie, and Tanaina), was 88,995 in 2010. The community was named for the local Dena'ina chief Wasilla, a variation of his Russian Orthodox baptismal name Vassiliy. The community was established in 1917 at the crossing of the Carle Wagon Road and the ARRC, with the former becoming the Wasilla Fishhook Road. The crossroads served as a transshipment point for mining supplies supporting gold mining in the Talkeetna Mountains. The Susitna Valley Colonists came through Wasilla en route to the Palmer colonies and some homesteads were established in the Wasilla vicinity. Today the community serves as a suburb for Anchorage (ADCCED, 2016). The Knik Tribal Council, which has ancestral ties to the Mat-Su Valley, is located in Wasilla and is a federally recognized tribe.

3.16.7.1.1.19. Willow

Willow is located between MP 60 and 80 of the George Parks Highway. The 2010 population was 2,102, of whom 5 percent were Alaska Native (U.S. Census Bureau, 2016a). The area was used by Dena'ina people for hunting and fishing, and was used as a camp en route to the Talkeetna Mountains via Willow and Cottonwood Creeks. In 1897, gold was discovered on Willow Creek, and supplies and equipment were brought to the area from Knik. The ARRC connected to the community in 1917 and a station house was built in 1920. An airfield and a radar station were built there during World War II, and after the war, a lodge was constructed. Gold mining continued through the 1950s, and in 1954, Willow Creek was the most productive mining district in Alaska. In 1971, the Parks Highway was built through Willow; in 1976, voters selected Willow for the new state capital, but funding for moving the capital from Juneau was defeated in November 1982 (ADCCED, 2016).

3.16.7.1.2. Copper River / Prince William Sound Subregion

3.16.7.1.2.1. Copper Center

Copper Center (also known in Ahtna as *Tl'aticae'e* meaning "rear water – mouth") is located approximately 14 miles southeast of the community of Glennallen on the west-bank of the Copper River at its confluence with the Klutina River (ADCCED, 2016; Kari, 2008). Copper Center was established as a small trading post in 1896 that boomed with the 1898 Gold Rush and its incorporation on the Valdez-Eagle Trail. Due to the ebb and flow, and development in the region and the volatility of sources of income (*i.e.*, fur prices), the population of Copper Center fluctuated throughout the 20th Century and in 2010, the U.S. Census Bureau (2016a) reported the population of Copper Center to be 328, of whom 48.5 percent were Native (Stratton and Georgette, 1984). Today, the Native Village of Kluti-Kaah represents the Alaska Native community in Copper Center and is a federally recognized tribe.

3.16.7.1.2.2. Gakona

Gakona (Ggax Kuna', meaning "Rabbit River" in Ahtna) is a community located at the confluence of the Copper and Gakona rivers approximately 6 miles northeast of Gulkana on the Tok Cutoff of the Glenn Highway (ADCCED, 2016; Kari, 2008). Gakona was originally an Ahtna firewood and fish camp and later a permanent village. During the Gold Rush, Gakona was positioned at the junction between the Valdez-Eagle and Valdez-Fairbanks trail; in 1904, Doyle's Roadhouse was built. The roadhouse was an important stopping off point for travelers as it had several important amenities including a trading post and post office. The Gakona Lodge was built in the late 1920s to accommodate increased traffic as the Eagle Trail increased in size (La Vine and Zimpelman, 2014). Today the Gakona Lodge contains many relics from the gold rush period and is now listed on the National Register of Historic Places (ADCCED, 2016). Local businesses include a restaurant, bar, motel, and sawmill, as well as a local dog-sled maker. The U.S. Census Bureau (2016a) reported a 2010 Gakona population of 218, with

19.7 percent of the population listed as Native. The Native Village of Gakona is a federally recognized tribe.

3.16.7.1.2.3. Glennallen

Glennallen is located at the junction of the Glenn Highway with the Richardson Highway approximately 14 miles northwest of Copper Center. The Ahtna place name for the Glennallen area is Ciisik'e Na' (no translation provided) (Smelcer, 2011). Glennallen was named for two U.S. Army officers, Major Edwin Glenn and Lieutenant Henry Allen, who explored the Copper River Basin in the late 1800s. It is one of a few communities in the Copper River region not built on the site of a previously existing Native village (ADCCED, 2016). Glennallen originated in the 1940s when army troops were stationed there to build a road and airfield. Glennallen boomed during pipeline construction, and TAPS passes through the town and provides employment year-round for many residents (Stratton and Georgette, 1984). Glennallen continues to be a regional economic and services center with several federal and state agency offices, schools, medical and legal offices, as well as highway services for travelers (Stratton and Georgette, 1984). The U.S. Census Bureau (2016a) reports that the 2010 population for Glennallen was 438 individuals, of whom 7.7 percent were Native. While the area of and around Glennallen has historically been occupied by the Ahtna, Glennallen is now a primarily non-Native community (ADCCED, 2016).

3.16.7.1.2.4. Kenny Lake

Kenny Lake is located off the Richardson Highway, approximately 9 miles northeast of the community of Tonsina. The community of Kenny Lake was settled in the 1950s and 1960s as a homestead community. It has no readily identifiable town center; rather it consists of an array of farms and residences spread along the Edgerton Highway between miles 1.5 and 15 on a bluff dividing the Copper and Tonsina rivers (Stratton and Georgette, 1984). La Vine and Zimpelman (2014) note that within the Kenny Lake CDP several small faith-based farm communities exist including Sapa and Edgerton farms. These communities consist of families who work as a single unit to develop large farms and harvest resources as a community. The U.S. Census Bureau (2016a) reports that the population of Kenny Lake during 2010 was 355, of whom approximately 8 percent were Alaska Native or Native American. Kenny Lake was established as an agricultural-based community and does not include a federally recognized tribe.

3.16.7.1.2.5. McCarthy

McCarthy is a former mining town associated with the Kennecott copper mine (now preserved by NPS). The community is located 61 miles east of Chitina off the Edgerton Highway on the Kennecott River at the mouth of McCarthy Creek. Before industrial copper mining and the development of the railroad began in 1900, the region was home to numerous camps of Ahtna people who moved seasonally throughout the region, returning to preferred sites along the Chitina River for salmon fishing (Stratton and

Georgette, 1984). By 1911, the Copper River and Northwestern railroad connected the communities in the area to Cordova, and homesteaders raised food for miners and associated workers. McCarthy was the unregulated complement to the comparatively strict company town of Kennecott, connected by rail (Jansen, 1975). The region's economy collapsed in 1938 with the closing of the mines and railroad (Jansen, 1975; Stratton and Georgette, 1984). Since the 1960s, the community has been accessed by air or by a summer "pioneer" road developed atop the rail bed built in 1911 (La Vine and Zimpelman, 2014). At the 2010 census there were 28 residents; 3.6 percent were Native (U.S. Census Bureau, 2016a). Those who live in McCarthy and the surrounding area live a relatively remote life; McCarthy has no school or health care services and mail delivery only occurs twice a week. Residents provide their own power and collect drinking water from local springs. Today, McCarthy residents depend on income from tourism associated with Wrangell St. Elias National Park, which surrounds the community, or make a living by producing and harvesting resources from the land (La Vine and Zimpelman, 2014).

3.16.7.1.2.6. Valdez

Valdez is located on the north side of Port Valdez in northern PWS. Port Valdez was named by the explorer Don Salvador Fidalgo in 1790 (Orth, 1967). During the gold rush in 1898 the town, now called Old Valdez, was established near the head of the fjord and it became a seaport and the end of roads leading into the Copper River basin and eventually to Fairbanks (Orth, 1967). In 1900, a military fort, Fort Liscum, was established across the fjord and served as a telegraph station and supported mapping and exploration of PWS and the Copper River Basin. The Alaska Road Commission continued improving the trails into roads, eventually allowing travel by car to Fairbanks. In 1964, Old Valdez was destroyed by a 9.6 magnitude earthquake. Tsunami waves and the initial tremor destroyed much of Old Valdez and other coastal Alaskan communities such as Seward, Whittier, and villages on Kodiak Island. The earthquake's epicenter was in Port Valdez but the effects were felt well north of the Alaska Range in communities such as Minto, Nenana, and Fairbanks. Today, the Trans-Alaskan Pipeline ends in Port Valdez, the terminal of which is located on the south side of the fjord near the Fort Liscum location. The community was once again struck with disaster in 1989 when an oil tanker struck Bligh Reef spilling millions of gallons of crude oil into PWS. The Exxon Valdez Oil Spill required a massive cleanup effort in Port Valdez and many other coastal Alaskan communities (ADCCED, 2016). In 2010, the U.S. Census (2016a) reported 3,976 people lived in Valdez of which 5 percent were American Indian or Alaska Native. Although not formally listed as a federally recognized tribe, the Valdez Native Tribe is a non-profit organization formed in 1974 to provide services (Indian health or BIA services) to Natives living in the Valdez area.

3.16.7.1.2.7. Whittier

Whittier is located on the western side of PWS in the head of Passage Canal some 60 miles southeast of Anchorage. The community is name after the nearby Whittier Glacier named by the U.S. Coast and Geodetic Survey in 1915 for the poet John Greenleaf Whittier (Orth, 1967). The community is located on the Pacific shore of the Kenai Peninsula and is located at the end of a portage used for centuries to connect Cook Inlet and PWS (ADCCED, 2016). In 1941, the U.S. Army chose the Whittier location as a year-round ice free port alternative in case of disruptions at the Seward port. The site was abandoned for a brief period of time only to be reactivated during the Cold War. Today, the portage consists of one tunnel, the Anton Anderson Memorial Tunnel, which was bored through the mountain to allow for the movement of goods and people to and from the port in Whittier (ADCCED, 2016). The 2010 U.S. Census reported 220 people living in Whittier of which almost 6 percent were American Indian or Alaska Native (U.S. Census, 2016a).

3.16.7.2. Subsistence Use Areas

The cumulative areas of Southcentral Region subsistence use areas is shown on Figures 3.16-20 through 3.16-22 and include use areas from all Southcentral Region study communities except the Municipality of Anchorage, Palmer, Petersville, Point Possession, Susitna North, Wasilla, and Willow. These use areas represent the combination of several mapping studies in each of the communities over multiple years. Cantwell, Chase, Copper Center, Gakona, Glennallen, Hope, Kenny Lake, Lake Louise, McCarthy, Skwentna, Susitna, Talkeetna, Trapper Creek, Tyonek, Valdez, and Whittier all have newer subsistence use area data (including additional older data recently identified or resource-specific use areas) since the publication of the 2012 FEIS (Table 3.16-2).

The cumulative area of the Cook Inlet subregion subsistence use areas are shown in Figure 3.16-20 and include use areas from 12 study communities (Beluga, Cantwell, Chase, Chickaloon, Eklutna, Hope, Lake Louise, Skwentna, Susitna, Talkeetna, Trapper Creek, and Tyonek). The combined use area for these study communities covers an expansive overland area east of the Alaska Range with large continuous use areas occurring on the west side of Cook Inlet, along the Susitna River drainage, and along the George Parks and Glenn highways. Use areas are located as far north as Healy; isolated use areas occur as far south as the offshore environment at the tip of the Kenai Peninsula. To the east, a number of use areas have been documented along the Richardson Highway and near Valdez. Marine use areas occur primarily along the west side of Cook Inlet, along the east side of Cook Inlet south of Kenai, and in PWS.

Figure 3.16-20 Southcentral Region Study Communities Subsistence Use Areas – Cook Inlet Subregion Overview

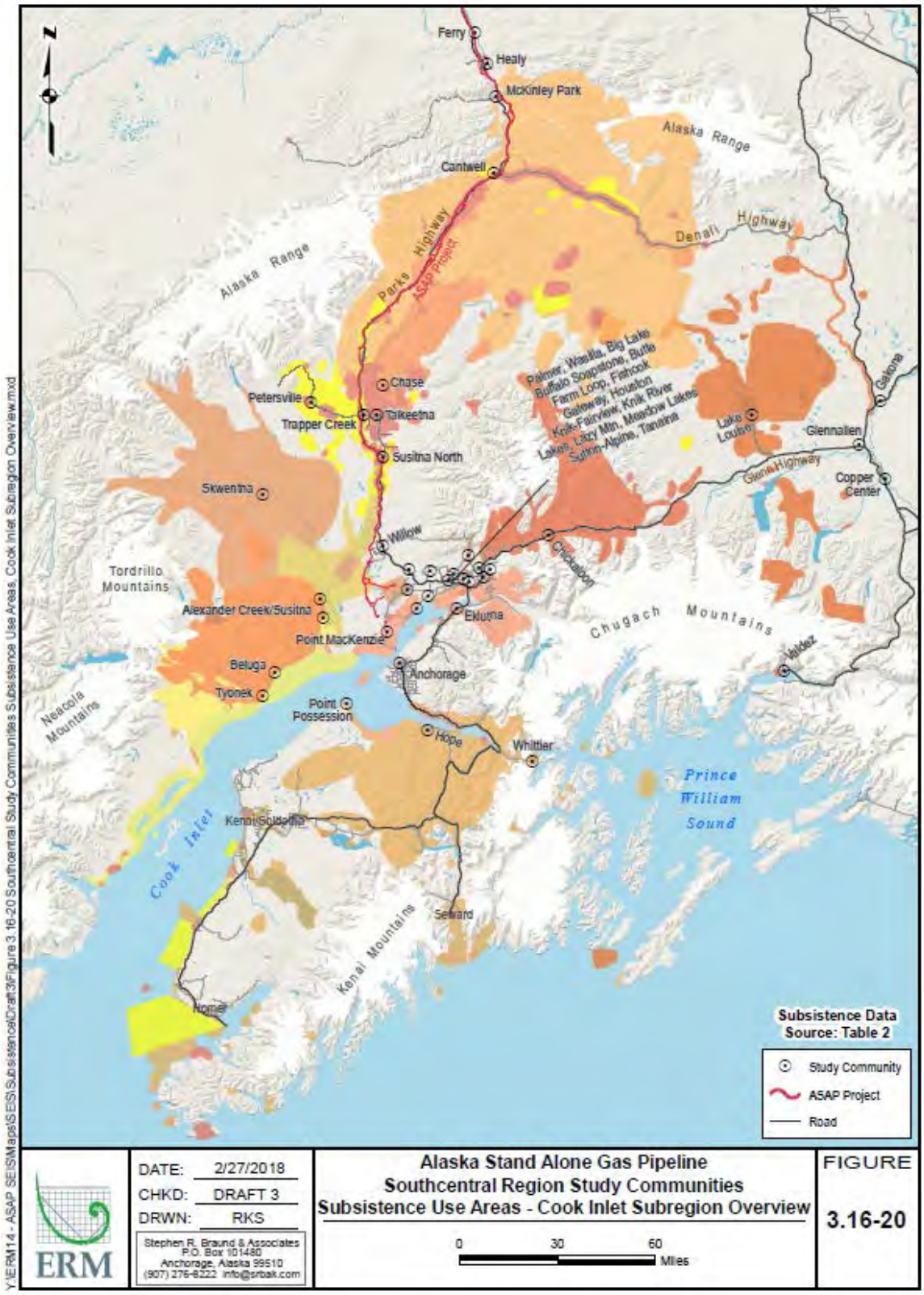


Figure 3.16-21 Southcentral Region Study Communities Subsistence Use Areas – Cook Inlet Subregion Insets

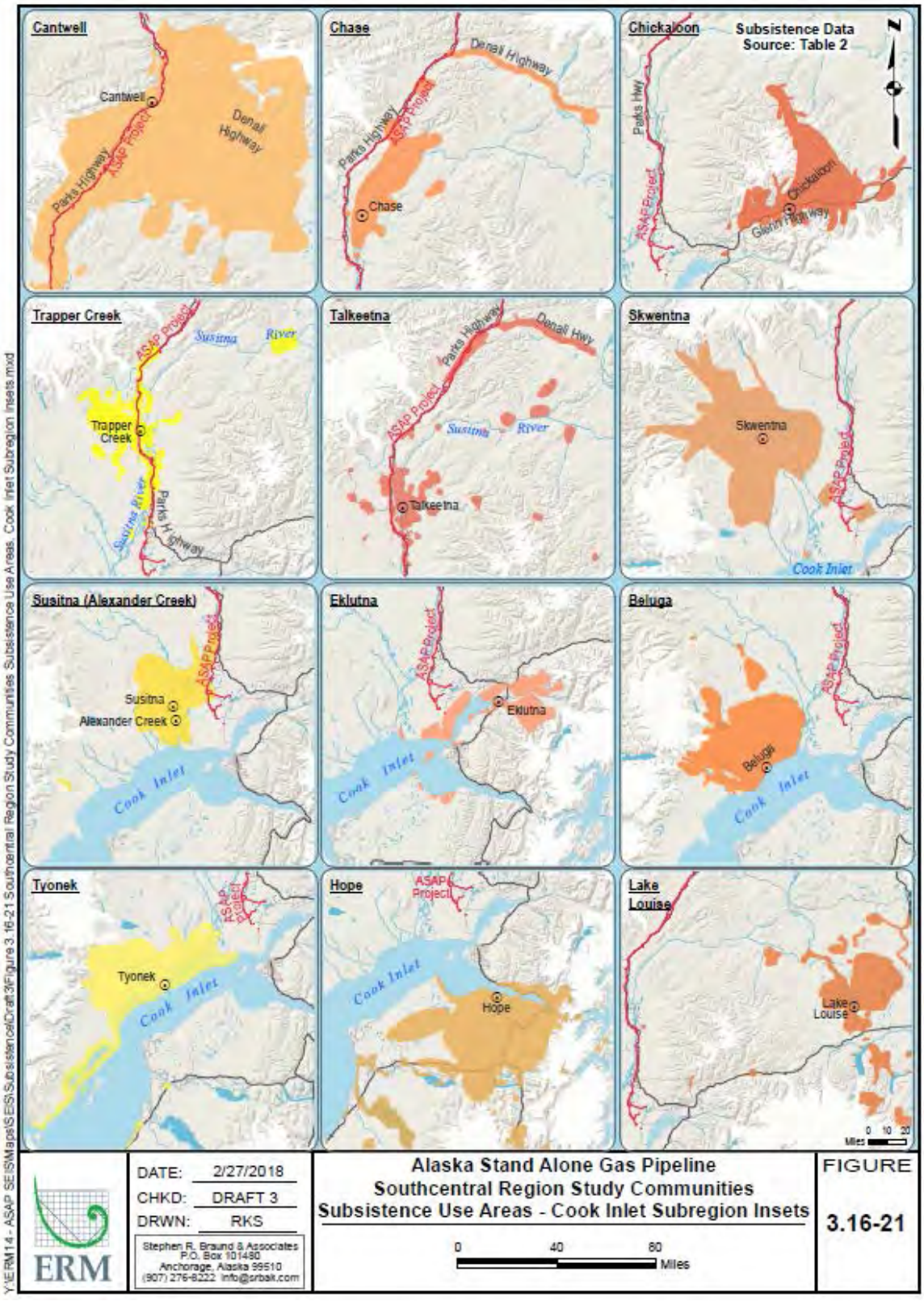
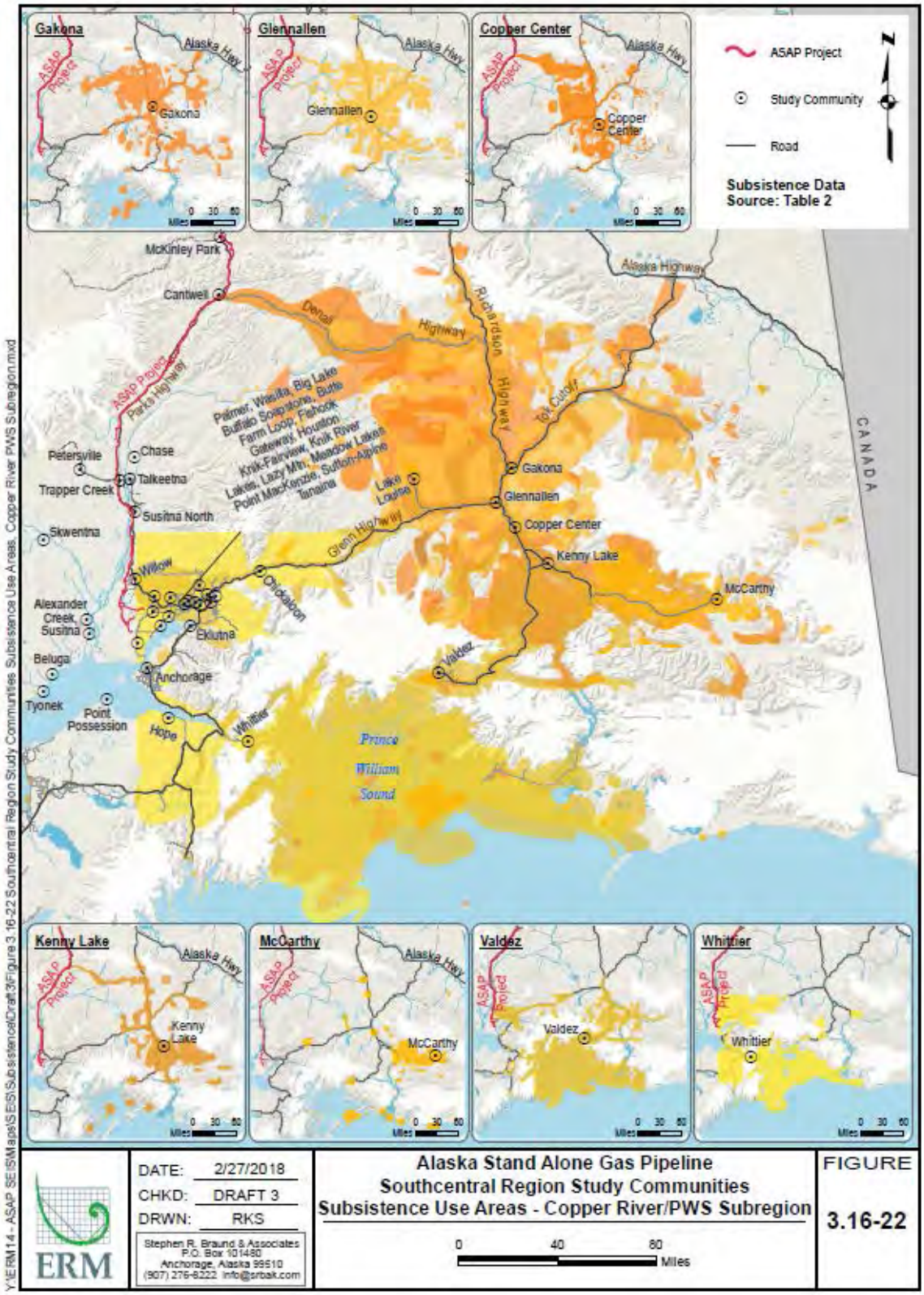


Figure 3.16-22 Southcentral Region Study Communities Subsistence Use Areas – Copper River/PWS Subregion



The cumulative area of Copper River/PWS subregion subsistence use areas is shown in Figure 3.16-22 and includes use areas from seven study communities (Copper Center, Gakona, Glennallen, Kenny Lake, McCarthy, Valdez, and Whittier). The combined use area covers the majority of the Copper River Basin with use areas along the Richardson, Glenn, and Edgerton highways, Nabesna Road, and overland areas spreading east and west from these major transportation corridors. Use areas are located as far west as the terminus of the Denali Highway at Cantwell and along the Parks Highway near Willow, and as far north as near the junction of the Richardson and Alaska highways near Delta Junction. Continuous use areas are located throughout PWS and on the Kenai Peninsula. Isolated use areas are also located in the east as far as the Wrangell Mountains near the Canadian border.

While roads can provide access to certain use areas within the Cook Inlet region, these areas experience much more competition; more productive use areas are often accessed by other means of transportation. Communities west of the Parks Highway and on the west side of Cook Inlet primarily rely on boats, snowmachines, and ATVs to access their use areas. Planes are also used by some residents. Communities along the Glenn Highway rely more heavily on tracked or wheeled transportation to access use areas rather than boats, as many of the rivers are not as easily navigated as those in western Cook Inlet. In Copper River, modern transportation such as snowmachines, planes, ATVs, and boats are used to access subsistence use areas. PWS communities rely heavily on boat transportation to access use areas throughout the Sound. Many communities are characterized by a mixed subsistence and wage economy. Because all the study communities in this area are accessible by road, competition from non-local hunters is higher than in other more remote areas of the state and access issues are also a subsistence concern.

3.16.7.2.1. Cook Inlet Subregion

Beluga residents' documented subsistence use area extends along the northern shore of Cook Inlet from the mouth of the Susitna River to west of Tyonek, and inland along the Chuit, Beluga, and Theodore rivers (Figure 3.16-21). Overland use areas span across the river systems from the western banks of the Susitna River to the Chakachatna River. Isolated use areas are documented to the north near Beluga Mountain, along the Skwentna and Hayes rivers, and near Flat Horn Lake. Beluga subsistence use areas do not intersect the proposed Project but are located within 10 miles of the proposed Project footprint.

Cantwell use areas cover an area from Healy Creek in the north to the western-running Susitna River in the south, with additional isolated use areas located further south on Kosina Creek (Figure 3.16-21). The subsistence use area expands to the Clearwater Mountains in the east and to the West Fork of the Chulitna River in the west. Smaller isolated areas exist west of the Parks Highway along Ohio Creek, south of McKinley Village, and east of the highway in the Talkeetna Mountains. In addition to use areas specifically documented for Cantwell residents, Stanek *et al.*, (1988) documented use

areas for households living near the Cantwell area, specifically near Broad Pass and Hurricane, from 1968 to 1986. Much of Broad Pass and Hurricane's use areas are located along the George Parks Highway from Trapper Creek to Cantwell. Subsistence activities also extend west along the Petersville Road, east along the Talkeetna River, east along the Susitna River near Stephan Lake, and east along the Denali Highway to the Clearwater Mountains and into Deadman and Big lakes. Cantwell subsistence use areas are bisected by the proposed Project footprint.

The Chase subsistence use area occurs along the Susitna River and expands overland and along drainages to the east of the Susitna River (Figure 3.16-21). Chase subsistence users follow the Susitna River from the Talkeetna area as far north as its confluence with Portage Creek. The use area extends to the east along the Talkeetna River and into the Talkeetna Mountains. Isolated use areas exist on the Chulitna River, Susitna River, and near the junction of the Parks Highway and Talkeetna Spur Road. In addition to use areas specifically documented for Chase residents, Stanek *et al.,* (1988) documented use areas for households living near the Chase area, specifically near Chulitna and Gold Creek, from 1940 to 1986. The majority of use areas are located between Curry and Hurricane, as well as areas extending east of the Alaska Railroad into the Talkeetna Mountains and along the Chunilna Creek and Susitna River. Two additional use areas are located along the Talkeetna River south of Stephan Lake and along the East Fork near the George Parks Highway. A few small portions of Chase subsistence use areas to the west of the community intersect with the proposed Project footprint.

Chickaloon subsistence harvesters have reported using the Glenn Highway, Matanuska River and its tributaries, and the Talkeetna River to access hunting, fishing, and gathering locations (Figure 3.16-21). North of Chickaloon, residents reported continuous use areas stretching into the Talkeetna Mountains and upper reaches of the Talkeetna River. To the east, residents of Chickaloon reported harvesting resources around the Caribou Creek drainage, with discontinuous use areas reported further east into the Eureka area on both sides of the Glenn Highway. West of the community, residents reported harvesting resources to Moose Creek with some areas reported near Hatcher Pass and in Rabbit Slough. Chickaloon use areas do not intersect the proposed Project but are located within 20 miles of the proposed Project footprint.

Eklutna residents identified use areas east of the community, around Eklutna Lake and the surrounding mountains, along with an area east of the Glenn Highway along the Knik and Matanuska rivers into Friday Creek (Figure 3.16-21). West of the Glenn Highway, Eklutna residents identified use areas south of Wasilla and along the west side of Knik Arm to the Little Susitna River. Smaller use areas exist on Fire Island and along the coast in the Anchorage and Chugiak areas. Additional use areas were identified around Chickaloon Bay to Point Possession and in the mouth of the Susitna River. Use areas also extend along western Cook Inlet to the West Foreland area. Eklutna use areas do not intersect the proposed Project but are located less than 1 mile from the proposed Project footprint.

Lake Louise use areas extend as far west as Kosina Creek in the Susitna Drainage Basin and as far east as the Canadian border near Logan Glacier in the upper Chitina River (Figure 3.16-21). Continuous overland use areas are reported in the vicinity of Lake Louise along the Tyone River, the West Fork of the Gulkana River, and around Crosswind and Ewan lakes. Smaller use areas were reported along the Gulkana River, in the drainages around Tazlina, Klutina, and Tonsina lakes, and southeast of McCarthy along the upper Chitina River. Lake Louise subsistence use areas do not intersect the proposed Project but isolated use areas are located within 3 miles of the proposed Project footprint.

Talkeetna use areas are located mostly within the Susitna River drainage along the George Parks and Denali highways, from the Clearwater Mountains into the Talkeetna Mountains in the north to Knik Arm in the south, with a concentration of continuous use areas around Talkeetna both to the east and along the Petersville Road to the west (Figure 3.16-21). Isolated use areas also occur in the Clearwater Mountains, at Deadman and Big lakes, in several areas along the upper Susitna River, and in other areas throughout the Mat-Su Valley. Additionally, use areas off the extent of the map for fish and marine invertebrates are located in several locations throughout Cook Inlet. Talkeetna use areas are bisected by the proposed Project.

Trapper Creek subsistence users travel as far north as Cantwell, south to the confluence of the Deshka and Susitna rivers, west of Peters Creek, and east near the Nelchina River (Figure 3.16-21). Trapper Creek use areas primarily follow the Chulitna and Susitna rivers and associated tributaries. Isolated use areas occur mainly along drainage systems; one is documented along the Susitna River south of Deadman Lake and another use area surrounds the community of Chase. To the north, Trapper Creek residents use an isolated portion of the Denali Highway corridor, including areas west of the Susitna River. Small use areas are identified near Cantwell and the East Fork of the Jack River. East of the Talkeetna Mountains, Trapper Creek residents use an area near the Nelchina River for subsistence purposes. Similar to Talkeetna residents, Trapper Creek use areas were also reported farther south off the map extent in Cook Inlet for salmon, non-salmon fish, and marine invertebrates. Trapper Creek use areas are bisected by the proposed Project.

Skwentna subsistence use areas have been documented in a large area surrounding the Yentna and Skwentna drainage systems of the Alaska Range (Figure 3.16-21). The use areas span an area along the eastern flanks of the Alaska Range to the flats east of the Kahiltna and Yentna rivers. Use areas occur as far north as the headwaters of the Yentna River and south into overland areas just north of Beluga Lake. Isolated use areas also occur at the mouth of the Susitna River and upriver from the mouth, and in the Big Lake area. Additional use areas off the map extent have been reported for marine invertebrates in Cook Inlet waters as well as for deer on Kodiak Island. Skwentna use areas do not intersect the proposed Project but are located within 2 miles of the proposed Project footprint.

The use area for Susitna (*i.e.*, Alexander Creek) residents occurs from the mouth of the Susitna River in the south to the confluence with the Kashwitna River in the north (Figure 3.16-21). Alexander Creek use areas extend from Red Shirt Lake in the east and encompass overland areas around Alexander Lake down to Theodore River in the west. An isolated use area was reported inland from Cook Inlet along the McArthur River. The eastern edge of Susitna subsistence use areas intersects with the proposed Project.

Tyonek residents use a large portion of the marine environment on the west side of Cook Inlet from Tuxedni Bay in the south to the Little Susitna River in the north (Figure 3.16-21). The eastern side of Cook Inlet along the shore from Anchor Point to Clam Gulch is also utilized for subsistence purposes. The subsistence use area on the west side of Cook Inlet extends to the north from the McArthur and Chakachatna rivers and overland between the Beluga and Chakachatna rivers just south of Beluga Lake. Residents have also reported traveling 10 to 20 miles inland from the Cook Inlet shoreline. Tyonek use areas do not intersect the proposed Project but are located within 15 miles of the proposed Project footprint.

3.16.7.2.2. Copper River/PWS Subregion

Copper Center use areas cover a sprawling, discontinuous region that is largely defined by the road systems (Figure 3.16-22). Use areas along the Richardson Highway extend from the Tiekel River valley in the south to Delta Junction in the north and along the Glenn Highway from between Glacier View and Chickaloon in the west to Slana Slough in the east. Other use areas parallel the entirety of Nabesna Road and the Denali and Edgerton highways. Off-road use areas are predominately located in the Copper River Basin and encompass much of the lake and river systems associated with Lake Louise, Tangle Lakes, Tazlina Lake, and Klutina Lake. Use areas were reported along the Copper and Chitina rivers as well as their tributaries. Smaller, more isolated use areas are located in the mountains and foothills surrounding the Copper River Basin from the Talkeetna Mountains in the west, Chugach Mountains in the south, and from the Wrangell Mountains to the Alaska Range in the east and north. A small portion of Copper Center subsistence use areas intersect with the proposed Project near the western end of the Denali Highway.

Gakona use areas cover a large geographic area, which is concentrated north of the community on either side of the Richardson Highway and Tok Cut-off of the Glenn Highway and, to a lesser extent, southeast of the community as far as the Chitina, Tasnuna, and Bremner rivers (Figure 3.16-22). A number of use areas also occur in PWS. Gakona subsistence use areas do not intersect the proposed Project but are located within 28 miles of the proposed Project footprint.

Glennallen is located at the junction of several major road systems, which are all used to access residents' use areas (Figure 3.16-22). Similar to other Copper River region communities, use areas are generally located along the road systems of the region. Glennallen residents reported using the Richardson Highway from north of Paxson

almost to Valdez in the south; the entirety of the Denali and Edgerton highways; the Glenn Highway from Chickaloon past Mentasta Lake on the Tok Cutoff of the Glenn Highway; and as far as Nabesna on the Nabesna Road. Off road use areas south of the Glenn Highway include the Tazlina and Klutina watersheds, areas between the Chugach Mountains and the Richardson Highway, and large areas between the highway and the Wrangell Mountains. Use areas extend northwest from the Glenn Highway through the Lake Louise watershed to locations along the Susitna River, and northwest as far as the Alaska Range. Other large use areas extend off the Denali Highway between the Susitna River and Paxson, north from the Edgerton Highway and south from the Nabesna Road into the Wrangell Mountains. Isolated use areas were reported on either side of the Wrangell and Saint Elias mountain ranges east of McCarthy and south of the Chitina River. Glennallen subsistence use areas do not intersect the proposed Project but are located within 2 miles of the proposed Project footprint.

Kenny Lake use areas are concentrated in the area between the Wrangell and Chugach mountains, but also extend north along the Richardson Highway into the Alaska Range, along the entire Denali Highway, along the Tok Cutoff to Mentasta Lake, and along Nabesna Road (Figure 3.16-22). Use areas along the Glenn Highway extend west and north as far as Lake Louise, and south to include the Klutina Lake system. Isolated use areas were identified in the Wrangell Mountains north of the community, on either side of the upper Chitina River, and around Valdez. A small portion of Kenny Lake subsistence use areas intersect with the proposed Project near the western end of the Denali Highway.

McCarthy use areas ranged between Lake Louise in the west and the upper Nizina River in the east (Figure 3.16-22). A continuous overland use area is located north of the Chitina River extending into the Wrangell Mountains. Additional use areas are reported south of the Chitina River and are located along the Hanagita River, near Tana River, along the Bremner River, Copper River and around Tebay Lakes. Several isolated use areas were also reported south of Mount Drum. Other areas off the map extent are located in the Brooks Range near Wiseman; this one use area near Wiseman intersects with the proposed Project.

Valdez use areas extend from Willow in the west along the roads to McCarthy in the east; from north of Glennallen south along the Richardson Highway to Valdez; and at several locations along the roads south of Anchorage and onto the Kenai Peninsula (Figure 3.16-22). Off-road use areas include the entirety of PWS and the Gulf of Alaska between Montague Island and Controller Bay; two locations in Resurrection Bay; along the Copper, Chitina, and Klutina rivers; and at various locations on the north side of the Chugach Mountains. Use areas extend along the coast of the Gulf of Alaska to Controller Bay. Valdez subsistence use areas do not intersect the proposed Project but are located within 1 mile of the proposed Project footprint.

The use areas for Whittier extend across much of Southcentral Alaska with concentrations in PWS and the Gulf of Alaska, on the Kenai Peninsula, and off the road system in the northern Chugach and southern Talkeetna mountains (Figure 3.16-22). The Pacific use areas include the Gulf of Alaska from Controller Bay in the east to the south side of the Kenai Peninsula in the west, and north into all but a few small areas in the waters of PWS. Small use areas are scattered along the southeast side of the Kenai Peninsula, and encompass the road system north from Seward as far as Anchorage, and west past Cooper Landing. Overland areas on the Kenai Peninsula include the upper Kenai River watershed, and areas on either side of the Seward Highway. Smaller, isolated use areas were reported in the Chugach Mountains bordering Anchorage, along the Glenn Highway as far as Glacier View, along the Parks Highway to Willow, on the road system along Knik Arm, and in the mountains on either side of Knik River. Smaller, isolated areas were reported at the Chitina/Copper river confluence, along the Richardson Highway, and in the northeastern Chugach Mountains. A portion of Whittier subsistence use areas intersect with the proposed Project near Willow.

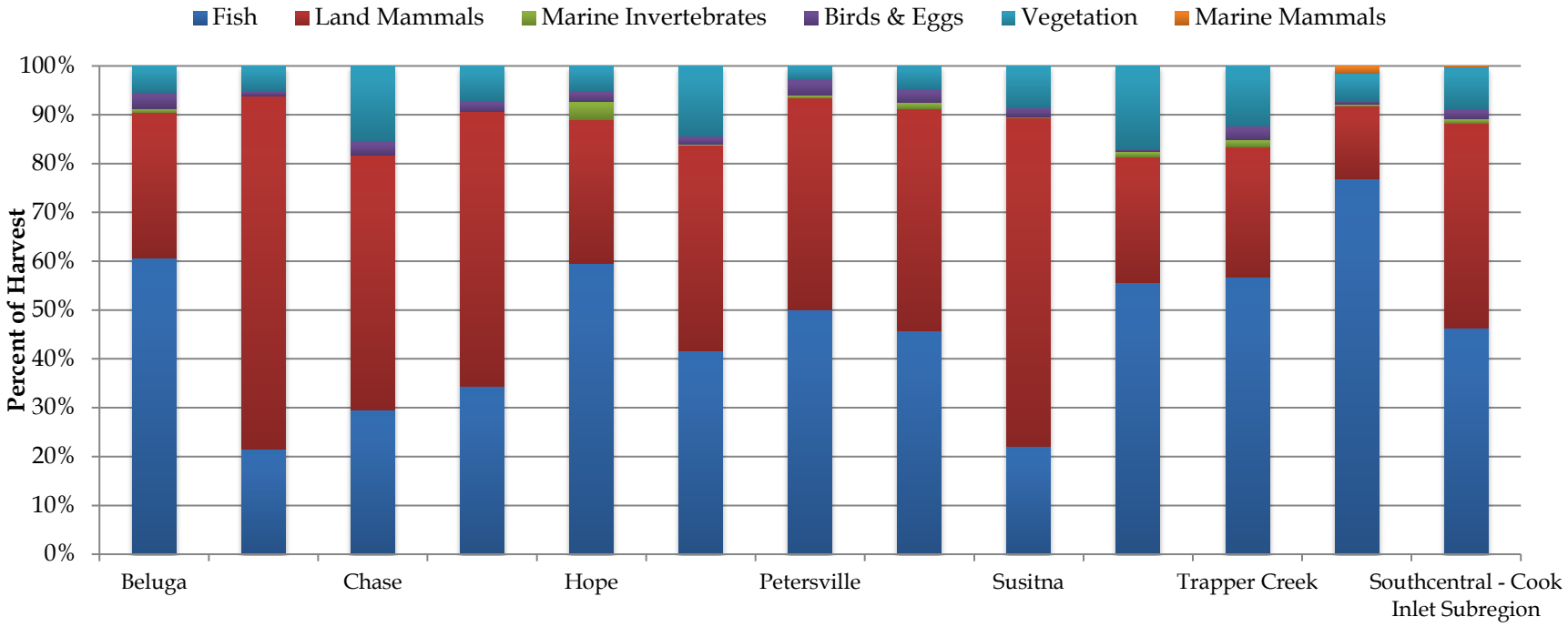
3.16.7.3. Subsistence Harvest Patterns

Comprehensive all-resources harvest data exist for 19 of the 26 Southcentral study communities (see Figures 3.16-23 and 3.16-24). Cantwell, Chase, Copper Center, Gakona, Glennallen, Kenny Lake, Lake Louise, McCarthy, Skwentna, Susitna, Talkeetna, Trapper Creek, and Tyonek all have newer harvest data since the publication of the 2012 FEIS (Table 3.16-2).

In both the Cook Inlet and Copper River/PWS subregions, study communities near the coast or with access to major rivers (*e.g.*, Beluga, Kenny Lake, Talkeetna, Tyonek, Valdez) generally rely more heavily on fish for the majority of their subsistence harvest; whereas study communities located farther inland (Cantwell, Chase, and Chickaloon) rely on land mammals for the majority of their harvests (see Figures 3.16-23 and 3.16-24). On average, the Copper River/PWS study communities show a greater overall reliance on fish than land mammals (66 percent vs. 24 percent); whereas the Cook Inlet study communities are more evenly distributed (46 percent versus 42 percent, respectively). Fish harvests (in terms of edible pounds) range from a low of 22 percent of the total harvest (Cantwell and Susitna) to a high of 77 percent (Copper Center and Tyonek). Land-mammal harvests range from 14 percent (Whittier) to 72 percent (Cantwell). Combined, marine invertebrates, birds/eggs, and vegetation comprise from 3 to 20 percent of the harvests across the study communities. Tyonek, Valdez, and Whittier reported 1 to 3 percent of their harvest from marine mammals.

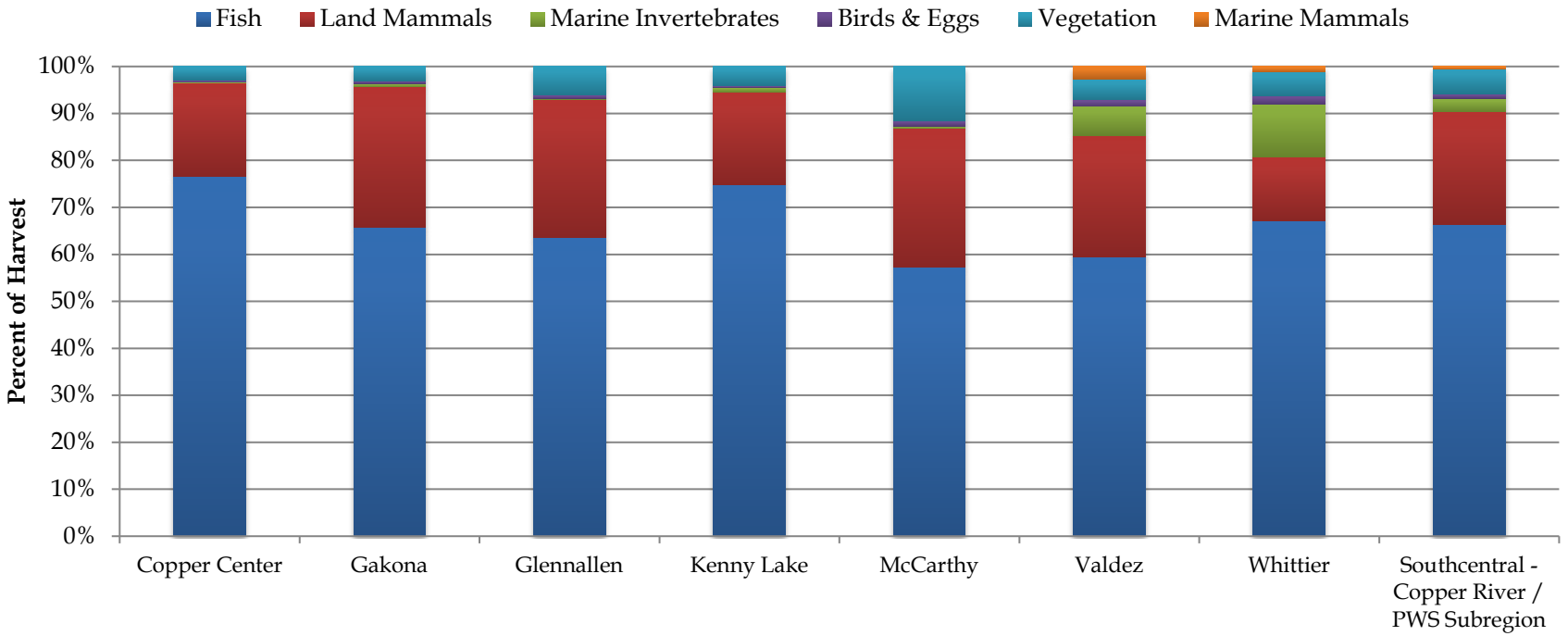
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Figure 3.16-23 Percent of Southcentral Harvests by Resource Category – Cook Inlet Subregion



Notes: Most recent study year data shown for all study communities.
Sources: Beluga 2005-06 (Stanek *et al.*, 2007); Cantwell 2012, Chase 2012, Skwentna 2012, Susitna 2012, Talkeetna 2012, Trapper Creek 2012, (Holen *et al.*, 2014); Chickaloon 1982-83 (Stratton and Georgette, 1984); Hope 1990 (ADF&G, 2016a); Lake Louise 2013 (Holen *et al.*, 2015); Petersville 1985 (Fall and Foster, 1987); Tyonek 2013 (Jones *et al.*, 2015)

Figure 3.16-24 Percent of Southcentral Harvests by Resource Category – Copper River/PWS Subregion



Notes: Most recent study year data shown for all study communities.
Sources: Copper Center 2010 (La Vine *et al.,* 2013); Gakona 2012, Kenny Lake 2012, McCarthy 2012 (La Vine and Zimpleman, 2014); Glennallen 2012 (Holen *et al.,* 2015); Valdez 1993 (Miraglia and Tomrdle, 1995); Whittier 1990 (ADF&G, 2016j)

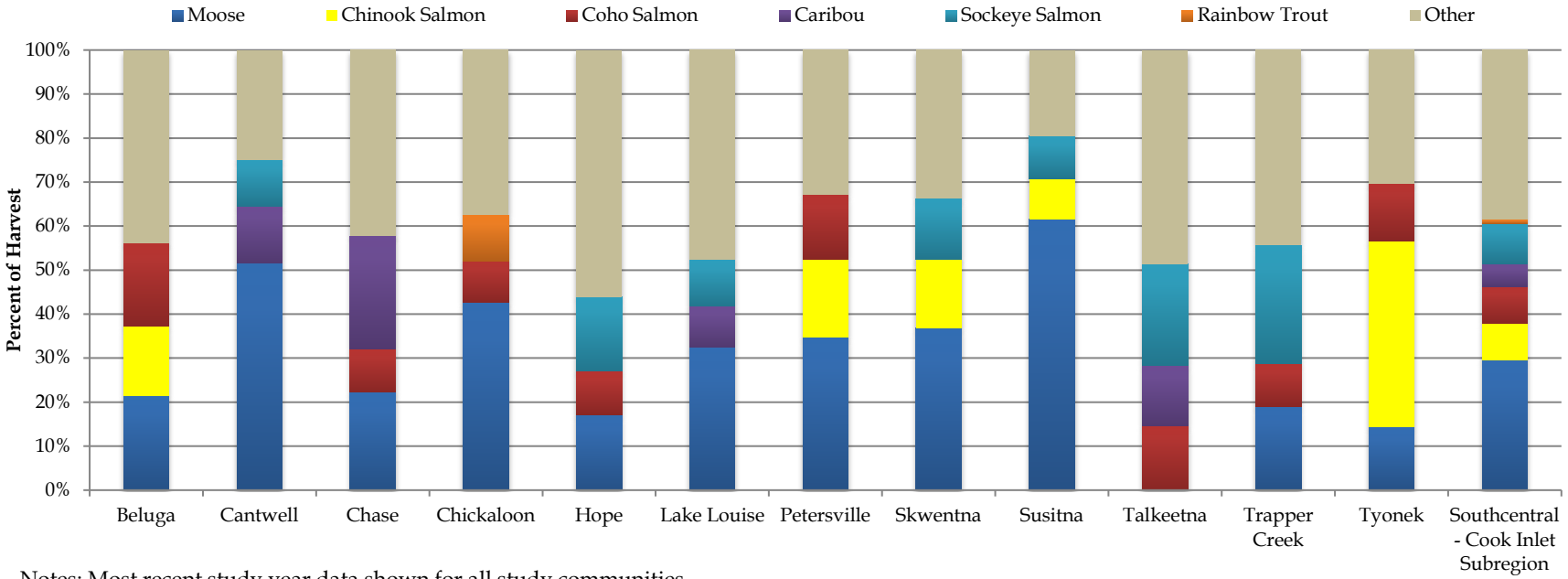
Figures 3.16-25 and 3.16-26 display the top three species harvested by Southcentral study communities. These species include moose, three species of salmon, caribou, rainbow trout, and halibut. Moose represents the number one species harvested, accounting for 17 to 52 percent of the total harvest, in all Cook Inlet study communities except Chase, Talkeetna, Trapper Creek, and Tyonek. Salmon are the number species harvested in Talkeetna, Trapper Creek, and Tyonek; and in Chase, caribou were the number one species harvested. Conversely, fish species (*i.e.*, sockeye, coho, or halibut) are the number one species harvested in the Copper River/PWS study communities, although moose are consistently in the top three for each of these communities. In every Southcentral Region community, salmon represents one of the top three species harvested in terms of edible pounds; in Kenny Lake, residents reported 52 percent of their total harvest coming from sockeye salmon. On average, moose accounted for nearly 30 percent of the total harvest in the Cook Inlet subregion and sockeye salmon contributed one-third in the Copper River/PWS subregion. Other species not shown in the figures (*e.g.*, black bear, hare, clams, ptarmigan, ducks, and berries) are also important contributors to the overall subsistence harvest and are represented in the "Other" category. For the two subregions the "Other" category equaled 35 and 38 percent of the total harvest (substantially higher than in the North Slope and Interior regions) and in Hope, Valdez, and Whittier, "Other" resources comprised over half of the harvest.

Southcentral Region per capita harvest amounts are shown in Figures 3.16-27 and 3.16-28 and range from 25 pounds (Kenny Lake) to 301 pounds (Beluga, Skwentna, Susitna). Communities with an average of over 200 pounds per person over all study years include Beluga, Chase, Skwentna, Susitna, and Tyonek; no communities in the Copper River/PWS subregion reported an average of more than 200 pounds per person, although, the most recent study in Copper Center reported a harvest of 277 pounds per person for a single study year, the highest in the region. The average per capita harvest for the region equals 174 pounds in Cook Inlet and 122 pounds in Copper River/PWS, the lowest of all study regions. Again, those communities in more remote regions of the Southcentral Region Project Area or with a higher Native population reported the highest per capita harvest amounts.

Like other study regions, households in the Southcentral Region frequently share their harvests with other members of the community or even with other nearby communities. In the Southcentral Region, an average of over 65 percent of households reported giving subsistence food away and nearly 90 percent reported receiving subsistence foods from other households (Figures 3.16-29 and 3.16-30). Susitna households reported the highest percentage of households both receiving and giving away subsistence resources. Petersville residents had the lowest reported rates of sharing among households.

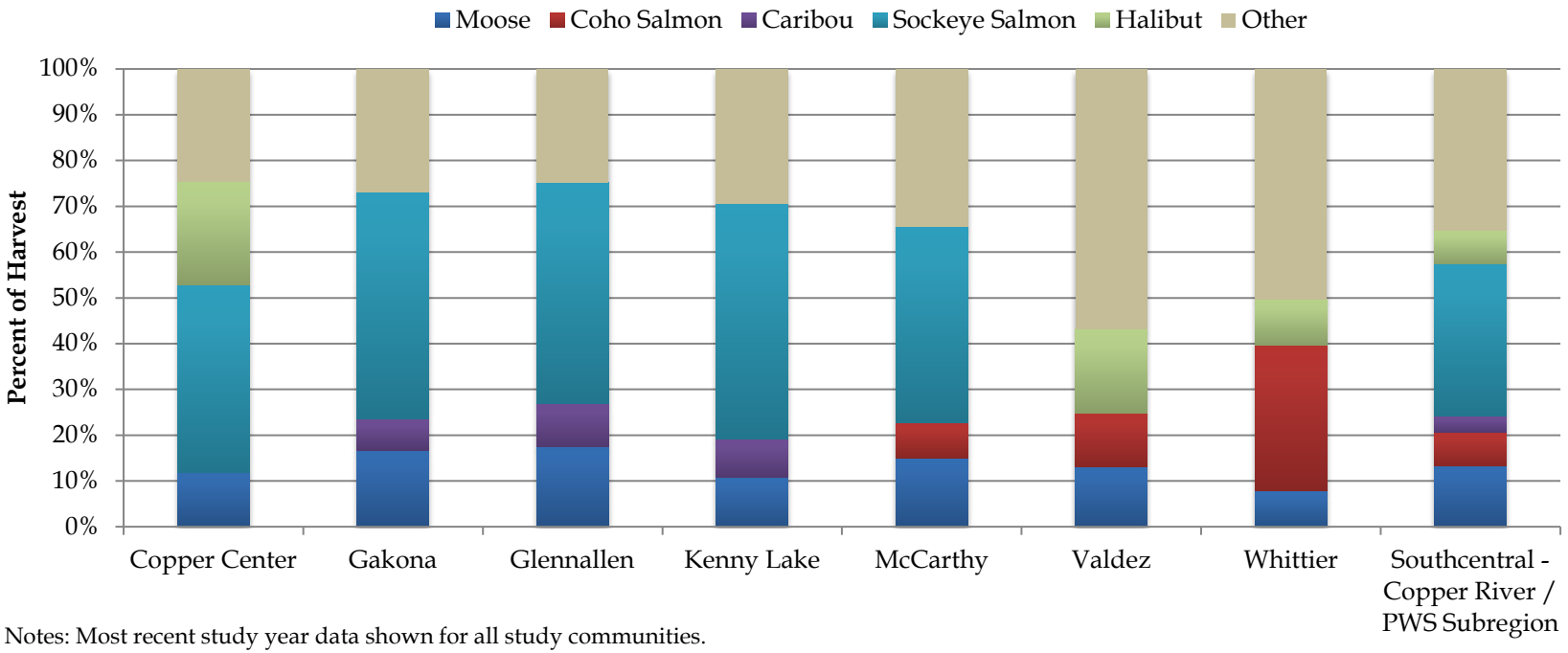
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Figure 3.16-25 Percent of Southcentral Harvests by Top Three Species – Cook Inlet Subregion



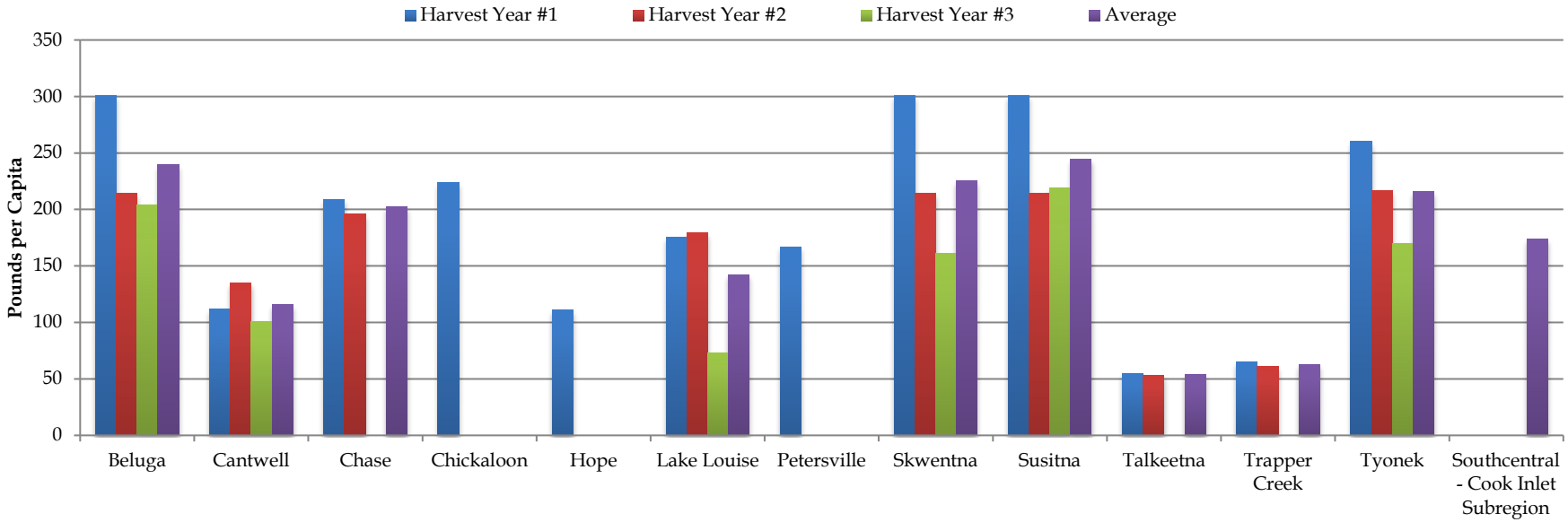
Notes: Most recent study year data shown for all study communities.
Sources: Beluga 2005-06 (Stanek *et al.,* 2007); Cantwell 2012, Chase 2012, Skwentna 2012, Susitna 2012, Talkeetna 2012, Trapper Creek 2012, (Holen *et al.,* 2014); Chickaloon 1982-83 (Stratton and Georgette, 1984); Hope 1990 (ADF&G, 2016j); Lake Louise 2013 (Holen *et al.,* 2015); Petersville 1985 (Fall and Foster, 1987); Tyonek 2013 (Bronwyn *et al.,* 2015)

Figure 3.16-26 Percent of Southcentral Harvests by Top Three Species – Copper River/PWS Subregion



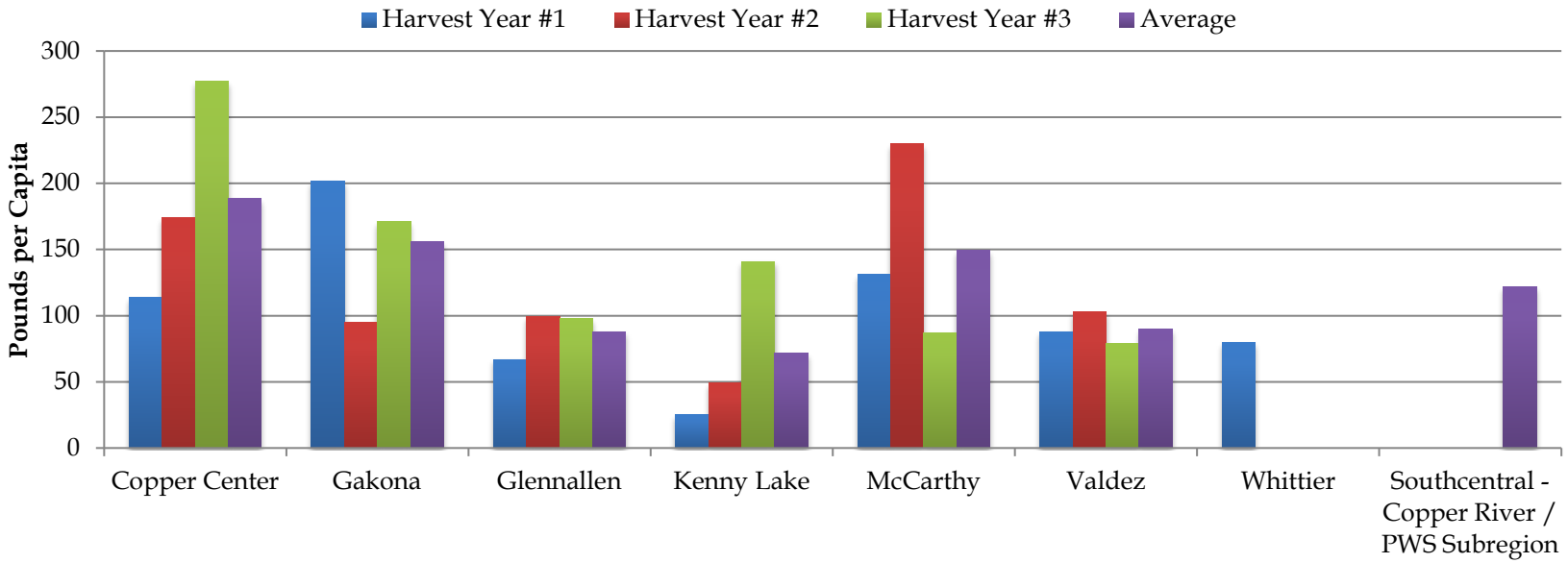
Notes: Most recent study year data shown for all study communities.
Sources: Copper Center 2010 (La Vine *et al.*, 2013); Gakona 2012, Kenny Lake 2012, McCarthy 2012 (La Vine and Zimpleman, 2014); Glennallen 2012 (Holen *et al.*, 2015); Valdez 1993 (Miraglia and Tomrdle, 1995); Whittier 1990 (ADF&G, 2016j)

Figure 3.16-27 Per Capita Southcentral Harvests by Study Community - Cook Inlet Subregion



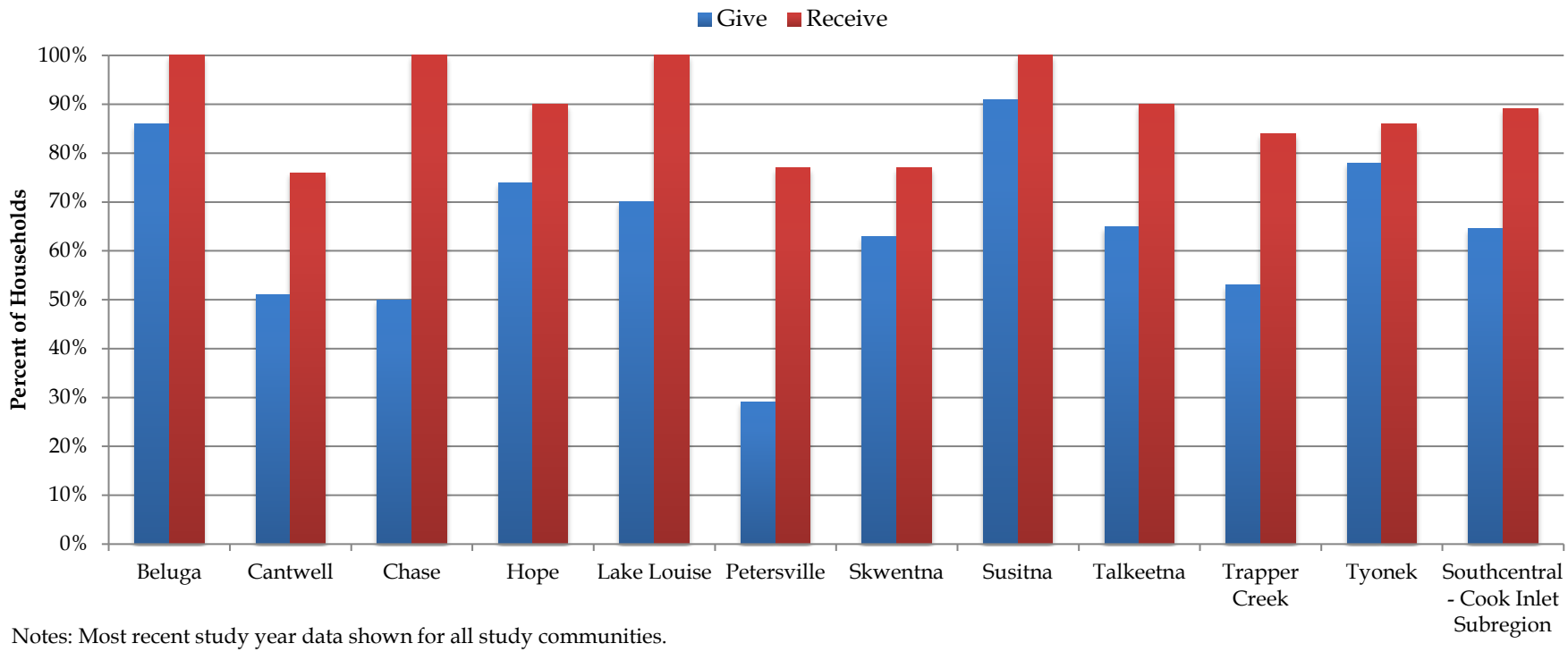
Notes: Harvest Year #1 and #2 for Beluga, Skwentna, and Susitna represent combined data from four communities identified as the Western Susitna Basin.
Sources: Beluga 1982, 1984 (Stanek, 1987), 2005-06 (Stanek *et al.,* 2007); Cantwell 1982-1983 (Stratton and Georgette, 1984), 1999 (Simeone, 2002), 2012 (Holen *et al.,* 2014); Chase 1986 (Stanek *et al.,* 1988); 2012 (Holen *et al.,* 2014); Chickaloon 1982-1983 (Stratton and Georgette, 1984); Hope 1990 (ADF&G, 2016j); Lake Louise 1982-1983 (Stratton and Georgette, 1984), 1987 (McMillan and Cuccarese, 1988), 2013 (Holen *et al.,* 2015); Petersville 1985 (Fall and Foster, 1987); Skwentna 1982, 1984 (Stanek, 1987); 2012 (Holen *et al.,* 2014); Susitna 1982, 1984 (Stanek, 1987); 2012 (Holen *et al.,* 2014); Talkeetna 1985-1986 (Fall and Foster, 1987); 2012 (Holen *et al.,* 2014); Trapper Creek 1985-1986 (Fall and Foster, 1987); 2012 (Holen *et al.*, 2014); Tyonek 1983-1984 (Fall *et al.,* 1984); 2005-2006 (Stanek *et al.,* 2007); 2013 (Jones *et al.,* 2015)

Figure 3.16-28 Per Capita Southcentral Harvests by Study Community Copper River/PWS Subregion



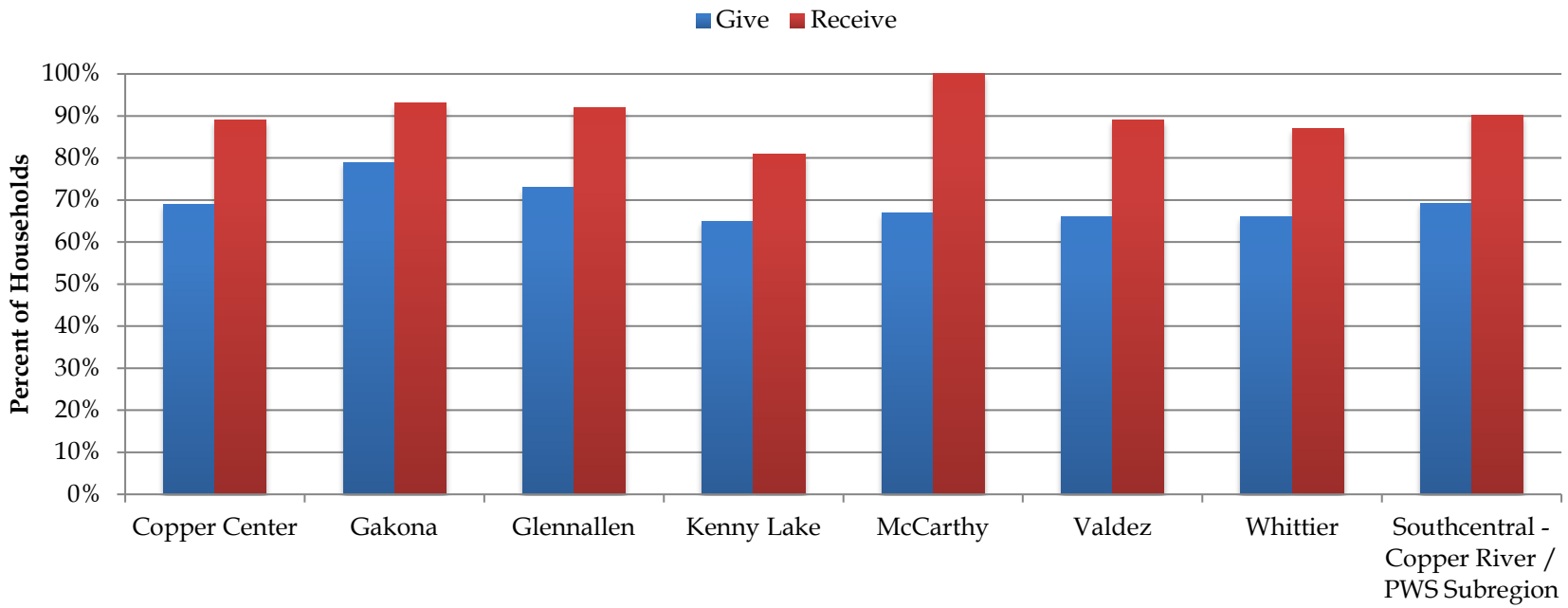
Sources: Copper Center 1982-1983 (Stratton and Georgette, 1984), 1987-1988 (McMillan and Cuccarese, 1988), 2010 (La Vine *et al.*, 2013); Gakona 1982-1983 (Stratton and Georgette, 1984), 1987 (McMillan and Cuccarese, 1988), 2012 (La Vine and Zimpleman, 2014); Glennallen 1982-1983 (Stratton and Georgette, 1984), 1987 (McMillan and Cuccarese, 1988), 2012 (Holen *et al.*, 2015); Kenny Lake 1982-1983 (Stratton and Georgette, 1984), 1987-1988 (McMillan and Cuccarese, 1988), 2012 (La Vine and Zimpleman, 2014); McCarthy 1982-1983 (Stratton and Georgette, 1984), 1987-1988 (McMillan and Cuccarese, 1988), 2012 (La Vine and Zimpleman, 2014); Valdez 1991-93 (Miraglia and Tomrdle, 1995); Whittier 1990 (ADF&G, 2016j)

Figure 3.16-29 Percent of Southcentral Households Sharing Subsistence Resources – Cook Inlet Subregion



Notes: Most recent study year data shown for all study communities.
Source: Beluga 2005-06 (Stanek *et al.,* 2007); Cantwell 2012, Chase 2012, Skwentna 2012, Susitna 2012, Talkeetna 2012, Trapper Creek 2012, (Holen *et al.,* 2014); Hope 1990 (ADF&G, 2016j); Lake Louise 2013 (Holen *et al.,* 2015); Petersville 1985 (Fall and Foster, 1987); Tyonek 2013 (Jones *et al.*, 2015)

Figure 3.16-30 Percent of Southcentral Households Sharing Subsistence Resources – Copper River/PWS Subregion



Notes: Most recent study year data shown for all study communities.
Sources: Copper Center 2010 (La Vine *et al.*, 2013); Gakona 2012, Kenny Lake 2012, McCarthy 2012 (La Vine and Zimpleman, 2014); Glennallen 2012 (Holen *et al.*, 2015); Valdez 1993 (Miraglia and Tomrdle, 1995); Whittier 1990 (ADF&G, 2016j)

3.16.7.4. Seasonal Round

Data on seasonal round are available for 16 Southcentral Region study communities. In the Cook Inlet subregion, these communities include the following: Beluga, Cantwell, Chase, Hope, Lake Louise, Skwentna, Susitna, Talkeetna, Trapper Creek, and Tyonek. In the Copper River/PWS subregion, data on the timing of subsistence activities are available for the communities of Copper Center, Gakona, Glennallen, Kenny Lake, McCarthy, and Valdez. Tables 3.16-21 and 3.16-22 represent a compilation of data on the timing of subsistence activity for communities in the two subregions and are based on the most recent available data for each community. A month is shaded if two or more communities in the region reported subsistence activity for a particular resource during that month. Individual Cook Inlet and Copper River/PWS study communities may utilize additional months for a specific resource or harvest additional resources (*e.g.*, marine mammals in Tyonek; goat in Valdez) that are not depicted on the regional tables provided below (Tables 3.16-21 and 3.16-22). Seasonal subsistence activities for 16 Southcentral Region study communities are summarized in Tables 3.16-23 through 3.16-38. These tables include synthesized information from various sources to show a general depiction of the seasonal round of subsistence activities in these communities based on the most recent data available and provide a more comprehensive/updated picture of the timing of subsistence activities from the 2012 FEIS.

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Table 3.16-21 Southcentral Seasonal Round of Subsistence Activities – Cook Inlet Subregion

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■
Marine Non-Salmon									■			
Salmon					■	■	■	■	■	■	■	
Caribou	■	■						■	■	■	■	
Moose	■	■	■					■	■		■	■
Bear			■	■	■	■	■	■	■	■	■	■
Dall Sheep								■	■			
Furbearers	■	■	■	■					■	■	■	■
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■
Waterfowl				■	■	■		■	■	■	■	
Marine Invertebrates				■	■	■	■	■	■			
Plants and Berries				■	■	■	■	■	■	■		
Wood	■	■	■	■	■	■	■	■	■	■	■	■

Sources: Jones *et al.,* 2015 (2013); Fall *et al.,* 1983 (1982); Foster, 1982 (1978-1982); Holen *et al.,* 2014 (2012); McMillan and Cuccarese, 1988 (1987-88); Simeone, 2002 (1999-00); Stanek *et al.,* 1988 (1986); SRB&A, 2007b (1987-2006)

Table 3.16-22 Southcentral Seasonal Round of Subsistence Activities – Copper River/PWS Subregion

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■
Salmon					■	■	■	■	■			
Caribou	■	■	■					■	■	■	■	
Moose								■	■			
Bear				■	■	■	■	■	■	■		
Dall Sheep								■	■			
Furbearers	■	■	■	■	■	■	■	■	■	■	■	■
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■
Waterfowl	■	■	■	■	■	■			■	■	■	■
Plants and Berries			■	■	■	■	■	■	■			
Wood	■	■	■	■	■	■	■	■	■	■	■	■

Sources: Holen *et al.,* 2015 (2013); La Vine *et al.,* 2013 (2010); La Vine and Zimpleman, 2014 (2012); McMillan and Cuccarese, 1988 (1987-88); Tomrdle and Miraglia, 1993 (1991-92)

Table 3.16-23 Beluga Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Salmon					■	■	■	■	■	■	■		2000s
Moose	■	■	■					■	■		■	■	2000s
Bear	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Furbearers	■	■	■	■					■	■	■	■	2000s
Small Land Mammals	■	■	■	■					■	■	■	■	2000s
Upland Birds	■	■	■	■	■			■	■	■	■	■	2000s
Waterfowl									■	■			2000s
Marine Invertebrates				■	■	■	■	■					2000s
Berries							■	■	■	■			2000s
Plants and Wood	■	■	■	■	■	■	■	■	■	■	■	■	2000s

Sources: SRB&A, 2007b (1987-2006)

Table 3.16-24 Cantwell Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon				■	■	■							1990s
Salmon						■	■	■					1990s
Caribou	■	■						■	■	■	■	■	1990s/2010s
Moose								■	■				1990s/2010s
Bear			■	■	■	■	■	■	■	■			1990s/2010s
Dall Sheep								■	■				1990s
Furbearers			■										2010s
Upland Birds	■											■	1990s
Waterfowl									■	■			1990s
Plants and Berries								■	■				1990s
Wood	■	■	■	■	■	■	■					■	1990s

Sources: Simeone, 2002 (1999-00); Holen *et al.*, 2014 (2012)

Table 3.16-25 Chase Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Marine Non-Salmon					■	■	■	■	■				1980s
Salmon						■	■	■	■	■			1980s
Caribou	■	■						■	■	■	■		1980s/2010s
Moose		■						■	■		■		1980s/2010s
Bear					■			■					1980s/2010s
Furbearers	■	■									■	■	1980s/2010s
Small Land Mammals	■	■	■	■							■	■	1980s
Upland Birds	■	■	■	■							■	■	1980s
Waterfowl								■	■	■			1980s
Marine Invertebrates				■	■	■	■	■	■				1980s
Plants and Berries								■	■	■			1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: Stanek *et al.,* 1988 (1986); Holen *et al.,* 2014 (2012)

Table 3.16-26 Hope Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■			■	■	■	■	■	■			2000s
Salmon					■	■	■	■	■				2000s

Sources: Fall *et al.,* 2004 (2002-03)

Table 3.16-27 Lake Louise Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon					■	■	■	■	■				1980s
Caribou	■	■						■	■				1980s/2010s
Moose								■	■				1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Furbearers	■	■	■								■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds	■	■	■	■				■	■	■	■	■	1980s/2010s
Waterfowl									■	■	■	■	1980s/2010s
Plants and Berries			■	■	■	■	■	■	■				1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: McMillan and Cuccarese, 1988 (1987-88); Holen *et al.,* 2015 (2012)

Table 3.16-28 Skwentna Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon						■	■	■	■	■			1980s
Caribou								■	■	■			1980s/2010s
Moose	■	■	■						■	■	■	■	1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Deer										■			2010s
Dall Sheep								■	■				1980s/2010s
Furbearers	■	■	■								■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Waterfowl				■	■	■			■	■	■		1980s
Plants and Berries				■	■	■	■	■	■	■			1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: Fall *et al.,* 1983 (1982); Holen *et al.,* 2014 (2012)

Table 3.16-29 Susitna Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/Harvest Data
Caribou													2010s
Moose													2010s
Bear													2010s

Sources: Holen *et al.,* 2014 (2012)

Table 3.16-30 Talkeetna Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/Harvest Data
Caribou													2010s
Moose													2010s

Sources: Holen *et al.,* 2014 (2012)

Table 3.16-31 Trapper Creek Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/Harvest Data
Caribou													2010s
Moose													2010s
Bear													2010s

Sources: Holen *et al.,* 2014 (2012)

Table 3.16-32 Tyonek Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Marine Non-Salmon									■	■			1980s
Salmon	■	■	■	■	■	■	■	■	■	■	■	■	2000s
Moose	■	■	■	■		■	■	■	■	■	■	■	2000s/2010s
Bear			■	■	■	■	■	■	■	■	■	■	2000s/2010s
Furbearers	■	■	■	■				■	■	■	■	■	2000s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	2000s/2010s
Marine Mammals				■	■	■	■	■	■				2000s/2010s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	2000s/2010s
Waterfowl				■	■	■	■	■	■	■			2000s/2010s
Marine Invertebrates				■	■	■	■		■				2000s
Plants and Berries						■	■	■	■	■			2000s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	2000s

Sources: SRB&A, 2007b (1987-2006); Foster, 1982 (1978-1982); Jones *et al.,* 2015 (2013)

Table 3.16-33 Copper Center Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon					■	■	■	■	■				1980s
Caribou	■	■	■					■	■	■	■		1980s/2010s
Moose						■		■	■				1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Dall Sheep								■					2010s
Furbearers	■	■	■								■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Waterfowl	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Plants and Berries			■	■	■	■	■	■	■				1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: McMillan and Cuccarese, 1988 (1987-88); La Vine *et al.,* 2013 (2010)

Table 3.16-34 Gakona Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon					■	■	■	■	■				1980s
Caribou	■	■						■	■	■			1980s/2010s
Moose								■	■		■		1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Dall Sheep								■					2010s
Furbearers	■	■	■	■	■				■	■	■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Waterfowl	■	■	■	■	■	■			■	■	■	■	1980s/2010s
Plants and Berries			■	■	■	■	■	■	■				1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: McMillan and Cuccarese, 1988 (1987-88); La Vine and Zimpleman, 2014 (2012)

Table 3.16-35 Glennallen Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon					■	■	■	■	■				1980s
Caribou	■	■	■					■	■	■	■		1980s/2010s
Moose								■	■				1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Bison		■											2010s
Furbearers	■	■	■			■	■				■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds	■	■	■	■	■	■		■	■	■	■	■	1980s/2010s
Waterfowl				■	■	■			■	■	■	■	1980s/2010s
Plants and Berries			■	■	■	■	■	■	■				1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: McMillan and Cuccarese, 1988 (1987-88); Holen *et al.,* 2015 (2013)

Table 3.16-36 Kenny Lake Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon					■	■	■	■	■				1980s
Caribou	■	■						■	■		■		1980s/2010s
Moose								■	■	■			1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Furbearers	■	■	■	■		■	■	■	■	■	■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Waterfowl									■	■	■	■	1980s/2010s
Plants and Berries			■	■	■	■	■	■	■				1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: McMillan and Cuccarese, 1988 (1987-88); La Vine and Zimpleman, 2014 (2012)

Table 3.16-37 McCarthy Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1980s
Salmon					■	■	■	■	■				1980s
Caribou	■	■						■	■	■			1980s/2010s
Moose								■	■				1980s/2010s
Bear				■	■	■	■	■	■	■			1980s/2010s
Deer								■					2010s
Dall Sheep									■				2010s
Furbearers	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1980s/2010s
Upland Birds	■	■	■	■			■	■	■	■	■	■	1980s/2010s
Waterfowl									■	■	■	■	1980s/2010s
Plants and Berries			■	■	■	■	■	■	■				1980s
Wood	■	■	■	■	■	■	■	■	■	■	■	■	1980s

Sources: McMillan and Cuccarese, 1988 (1987-88); La Vine and Zimpleman, 2014 (2012)

Table 3.16-38 Valdez Seasonal Round of Subsistence Activities

Resources	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Most Recent Decade for Subsistence Activity/ Harvest Data
Freshwater Non-Salmon	■	■	■	■	■	■	■	■	■	■	■	■	1990s
Marine Non-Salmon				■	■	■	■	■	■	■			1990s
Salmon				■	■	■	■	■	■				1990s
Caribou								■	■				1990s
Moose								■	■				1990s
Bear				■	■	■			■	■			1990s
Dall Sheep								■	■				1990s
Goat	■								■	■	■	■	1990s
Furbearers	■	■	■	■						■	■	■	1990s
Small Land Mammals	■	■	■	■	■	■	■	■	■	■	■	■	1990s
Upland Birds	■	■	■	■				■	■	■	■	■	1990s
Waterfowl									■	■	■		1990s
Marine Invertebrates	■	■		■	■	■	■	■	■	■	■	■	1990s
Plants and Berries				■	■	■	■	■	■	■			1990s
Wood					■				■	■	■		1990s

Sources: Tomrdle and Miraglia, 1993 (1991-92)

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3.16.7.4.1. Cook Inlet Subregion

Spring (April-May) in the Cook Inlet subregion is characterized by bear and freshwater non-salmon fish subsistence activities (Table 3.16-21). Bear harvests occur as early as March as bears emerge from their dens to feed. Residents capitalize on freshwater fish (*e.g.*, rainbow trout, Arctic grayling, whitefish, and hooligan) in the region through ice fishing in local watersheds and/or with nets or rod-and-reel after breakup in open waters. Residents of the Southcentral Region located on Cook Inlet begin harvests of clams during the spring. Beaver, snowshoe hare, and muskrat are particularly common small land mammal subsistence resources in the spring. Residents also begin to collect early-growing plants such as fiddlehead ferns and mushrooms in the spring. Salmon harvests begin in late spring, either offshore in Cook Inlet or in the Susitna River tributaries for early Chinook salmon. Bird harvests occur during the spring; however, both waterfowl and upland bird subsistence activity is more common at other times of the year.

During the summer months (June-August), residents continue fishing for freshwater non-salmon fish, and harvests of salmon intensify as they migrate through the watersheds of the region. Ducks and geese are commonly harvested in late August, and August also marks the beginning of fall harvests of large land mammals, including caribou, moose, and Dall sheep. Upland bird and small land mammal harvests wane through most of summer but begin to escalate at the close of summer. Residents continue to hunt bear during the summer months and also travel to Cook Inlet to collect clams.

Fall (September-October) marks a shift in focus of subsistence activities. Large land mammals, waterfowl, and upland birds are primary fall targets. The timing of moose hunting in the region varies by community; while most participate in the fall moose hunt in September, some communities (*e.g.*, Skwentna and Alexander Creek) focus on moose harvests more in the winter. Caribou harvests occur more commonly in the northern communities in the region due to their closer proximity to the herds; Beluga and Tyonek do not regularly harvest caribou. Marine non-salmon fish harvests occur during the fall by residents of the region located along Cook Inlet and by those who travel from the north for these resources. Salmon fishing continues with the fall run of coho, as well as non-salmon fishing and harvests of small game. Residents continue to collect clams into the early fall as well as the last of the berries for the season.

During winter (November-March) in the Cook Inlet subregion, residents focus on trapping furbearers and small land mammals and harvesting caribou and moose. Freshwater non-salmon fish continue to be harvested through the ice, and upland birds remain a small game target. Wood collection occurs year-round and is an important source of heat for many Southcentral Region residents. Bears can also be taken in early winter.

3.16.7.4.2. Copper River/PWS Subregion

Spring (April-May) subsistence activities in the Copper River/PWS subregion focus on non-salmon fish and small land mammals and furbearers (Table 3.16-22). Dolly Varden and rainbow trout harvests occur year-round; however, spring marks the beginning of Arctic grayling subsistence activity. Upland bird and waterfowl harvests occur in spring, and bear subsistence activity intensifies in late spring. Spring also marks the beginning of some plant harvesting activities.

Copper River/PWS residents focus on fishing in the summer (June-August). Non-salmon fishing continues and intensifies with the addition of lake trout, the occasional whitefish, and halibut fishing in PWS. Chinook salmon harvests begin in May, although the majority of salmon fishing is more common in the summer months. Summer salmon fishing is dominated by Chinook and sockeye harvests, and coho fishing begins late summer and continues into the fall. Bear and small land mammal (particularly squirrel and beaver) subsistence activities continue into the summer and some upland game birds may also be taken. Recent data suggest squirrels are the most common small land mammal taken over the summer and harvests occur as a form of pest control (La Vine *et al.,* 2013). Summer is particularly important for harvests of summer-ripened berries. With the conclusion of summer comes the beginning of large land mammal harvests and the transition to fall subsistence activities.

Fall (September-October) subsistence activities maintain focus on fishing with the late summer to early fall run of coho and various species of non-salmon fish. September is a particularly important month for large land mammal harvests. Recent data show the bulk of the moose harvests occur in September, and the majority of caribou harvests occur in September and October (La Vine *et al.,* 2013). Dall sheep hunting, which begins in later summer (August), also continues into September. Small land mammal harvests continue through the fall, however, the focus shifts to hare (La Vine *et al.,* 2013). Harvests of upland birds are characterized as predominantly fall through winter activities; however, more recent data for Copper Center show the majority of harvests occurring over the summer (La Vine *et al.,* 2013). Harvests of migratory birds peak in fall, as residents target the fall migration of waterfowl, including mallard, wigeon, and snow geese.

The transition to winter marks the end of salmon, moose, bear, and plant and berry subsistence activity. It also marks the intensification of small land mammal and furbearer subsistence activities. Caribou are also harvested during the winter months (except December). Although residents target small land mammals year-round, harvests of a greater variety of small land mammal species occur over the winter. Residents may continue limited waterfowl subsistence activities into the early winter and upland bird harvests continue throughout winter. Non-salmon fishing continues through the winter as residents fish through the ice for Dolly Varden, rainbow trout, and burbot.

3.17. Public Health

3.17.1. Introduction

The description of public health resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project. Specifically, the following information, data, methods, and/or analyses have been substantially updated from the 2012 document:

- The conceptual design change from Natural Gas Liquids (NGL) to a lean gas scenario eliminated the need for the compressor stations, the Straddle and Offtake Facility, and the Cook Inlet Natural Gas Liquid Extraction Plant (NGLEP).
- Route modifications shortened pipeline length, and refined design information provides greater detail on several Project elements, including access roads, construction worker camps, and workforce requirements.
- These revisions result in changes to the previous assessment of the effects of the proposed Project on public health.
- In this SEIS, PACs include 2010 U.S. census incorporated and unincorporated places that intersect the pipeline, as well as Wasilla and Talkeetna due to their size and proximity to the pipeline route.
- Based on the changes in definition of a PAC and in pipeline routing, the following PACs that were not included in the 2012 FEIS are included in the SEIS: Goldstream, North Susitna, and Point Mackenzie.
- The community "Y" discussed in the 2012 FEIS is now included as the North Susitna community.

Community specific data has been used where available. For community specific data, smaller sample sizes may contribute to a larger margin of error in the data or rates presented.

3.17.2. Project Facilities

The conceptual design change from NGL to utility-grade gas eliminated the need for the compressor stations, the Straddle and Offtake Facility, and the Cook Inlet NGLEP.

3.17.3. Construction Workers and Work Camps

The number of construction camps was reduced from 15 in the previous design, to 13 in the current design. Camps were previously located within the boundaries of the communities of Coldfoot, Livengood, Nenana, Healy, Cantwell, and Talkeetna Junction/North Susitna ("Y"). With the new alignment, camps would only be located within the community boundaries of Livengood and Cantwell. Table 3.17-1 presents the

location, milepost, distance to nearest community, and camp capacity of each proposed work camp.

Work camp facilities would be located in previously cleared and disturbed areas, and are accessible by the use of existing roads. The stationary construction camps would primarily be located in previously disturbed areas that were used for construction of the TAPS, ARRC facilities, or for public events.

Table 3.17-1 Proposed Work Camp Housing and Nearest Communities

Borough	Location	Mile Post	Nearest Community	Distance from Nearest Community (Miles)	Camp Capacity	Camp Staff
NSB	GCF	0.0	Prudhoe Bay	9.94	800	-
	Franklin Bluffs	43.6	Prudhoe Bay	38.02	600	44
	Happy Valley	85.7	Prudhoe Bay	79.60	1,000	44
	Galbraith Lake	144.6	Wiseman	86.23	1,000	44
Yukon-Koyukuk REAA[b]	Dietrich	207.3	Wiseman	24.95	1,000	-
	Prospect	279.2	Wiseman	49.59	600	-
Yukon Flats REAA	Five Mile	353.2	Livengood	64.69	1,000	-
	Livengood	401.0	Livengood	4.04	1,000	-
	Dunbar	453.4	Nenana	15.63	600	44
Denali Borough	Healy	523.3	McKinley Park	11.02	1,000	44
	Cantwell	563.0	Cantwell	0.00	600	44
Mat-Su Borough	Swan Lake	640.9	Talkeetna	19.30	1,000	-
	Rustic Wilderness	697.0	Big Lake	26.00	1,000	-

a The nearest communities were located and distances calculated using the USDOT roads data. These are the nearest communities on a by-road-mile basis, which may differ from what was included in the 2012 FEIS (USACE, 2012a).
b REAA - Regional Educational Attendance Area

In the 2012 FEIS, it was estimated that the proposed Project requires 6,400 construction employees at any given time, with the majority (5,500) required for the construction of the Mainline (USACE, 2012a). Operations and Maintenance activities require approximately 240 employees or contractors. As revised, the proposed Project anticipates pipeline construction labor to peak at nearly 6,000 workers on the pipeline. Additionally, more than 130 workers would be needed to construct the GCF in Alaska. There would also be an additional need for staff to fill management positions, as well as provide craft labor.

The communities potentially affected by the proposed Project remain unchanged since the 2012 FEIS was issued (USACE, 2012a), with the exception that three new communities have been added to this analysis: Goldstream, North Susitna, and Point MacKenzie. Information on community profiles and their baseline health status that were included in the 2012 FEIS has not been updated because it is unlikely that changes have occurred that would affect the assessment of public health impacts. The three new communities' profiles and baseline health statuses are included below in Section 3.17.5, Potentially Affected Communities.

3.17.4. General Assessment Method

The methods for evaluating the scope of the public health affected environment are described in detail in the 2012 FEIS (USACE, 2012a). The State of Alaska does not require a formal health impact assessment (HIA) (World Health Organization, 1999); however, it has developed *Technical Guidance for Health Impact Assessment in Alaska*, also known as the *Alaska HIA Toolkit* (Alaska Department of Health and Social Services [ADHSS], 2015a). The public health analysis conducted as part of the 2012 FEIS (USACE, 2012a) was informed by both the *Alaska HIA Toolkit,* as well as the Human Health section of the *Point Thomson Project EIS* (USACE, 2012c), and is summarized here.

The *Alaska HIA Toolkit* (ADHSS, 2015a) defines eight potentially relevant Health Effects Categories (HECs), which provide the framework for determining the scope of a public health assessment. The toolkit does not address workplace safety and health issues. The toolkit does consider issues where workforce behaviors produce interactions with local communities. Impacts of the proposed Project were analyzed according to these eight HECs, as detailed in Table 3.17-2.

Table 3.17-2 Health Effects Category Table

Health Effects Category	Pathway Description
Social Determinants of Health (SDH)	The SDH are the conditions in which people are born, grow, live, work, and age. These circumstances are shaped by the distribution of money, power, access, and resources at global, national, state, regional, and local levels. The SDH are mostly responsible for health inequities -- the unfair and avoidable differences in health status seen within the state. This category reviews outcomes and determinants related to mental health, maternal and child health, substance use, social exclusion, psychosocial distress, historical trauma, family dynamics, economic status, educational status, social support systems, and employment status.
Accidents and Injuries	This category contains health outcomes and determinants related to accidents and injuries. The key outcomes considered are increases and decreases in intentional and unintentional injuries with fatal and nonfatal results. The key determinants in this category include items such as the presence of law enforcement, traffic patterns, alcohol involvement, distance to emergency services, and the presence of prevention programs.
Exposure to Potentially Hazardous Materials	This category contains health outcomes and determinants that may arise from exposure to hazardous materials. The key health outcomes considered are increases and decreases in documented illnesses or exacerbation of illnesses commonly associated with pollutants of potential concern. These may be mediated through inhalation, ingestion, or physical contact.
Food, Nutrition, and Subsistence Activity	This category includes health outcomes and determinants related to food security, dietary choices, and the consumption of subsistence foods. The key health outcomes considered are nutrient levels, malnutrition or improvements in nutrient intake, and the subsequent increases or decreases in related diseases. The key determinants include diet composition, food security, and the consumption of subsistence foods.

Health Effects Category	Pathway Description
Infectious Disease	This category includes health outcomes and determinants that result from infectious diseases. The key health outcomes include rates of increase or decrease for a range of infectious diseases, such as sexually transmitted infections, respiratory illness, or skin infections. Important health determinants may include immunization rates, and the presence of infectious disease prevention efforts.
Water and Sanitation	This category includes changes to access, quantity, and quality of water supplies. Key determinants reviewed may include distance to clean water, water fluoridation, indoor plumbing, water treatment facilities, adequate volume of water resources, and the existence of community facilities, such as a washateria and/or community showers.
Non-communicable and Chronic Diseases	This category includes health outcomes and determinants related to chronic disease. Important outcomes include increases or decreases in mortality and morbidity rates of cancer, cardiovascular and cerebrovascular diseases, diabetes, respiratory diseases, and mental health disorders. Key determinants for chronic diseases may include smoking rates, rates of alcohol and drug abuse, physical activity levels, presence of recreation centers, as well as cancer screening rates.
Health Services Infrastructure and Capacity	This category considers health outcomes and determinants related to health care access and health care infrastructure. Important outcomes include the increase or decrease in the number of medical evacuations, clinics or hospital visit trends, health expenditures, and medication usage. Health determinants may include distance to health facilities, medevac facilities/aircraft, the presence of community health aides, and the frequency of physician visits to the area.

Source: ADHSS, 2015a

3.17.5. Potentially Affected Communities

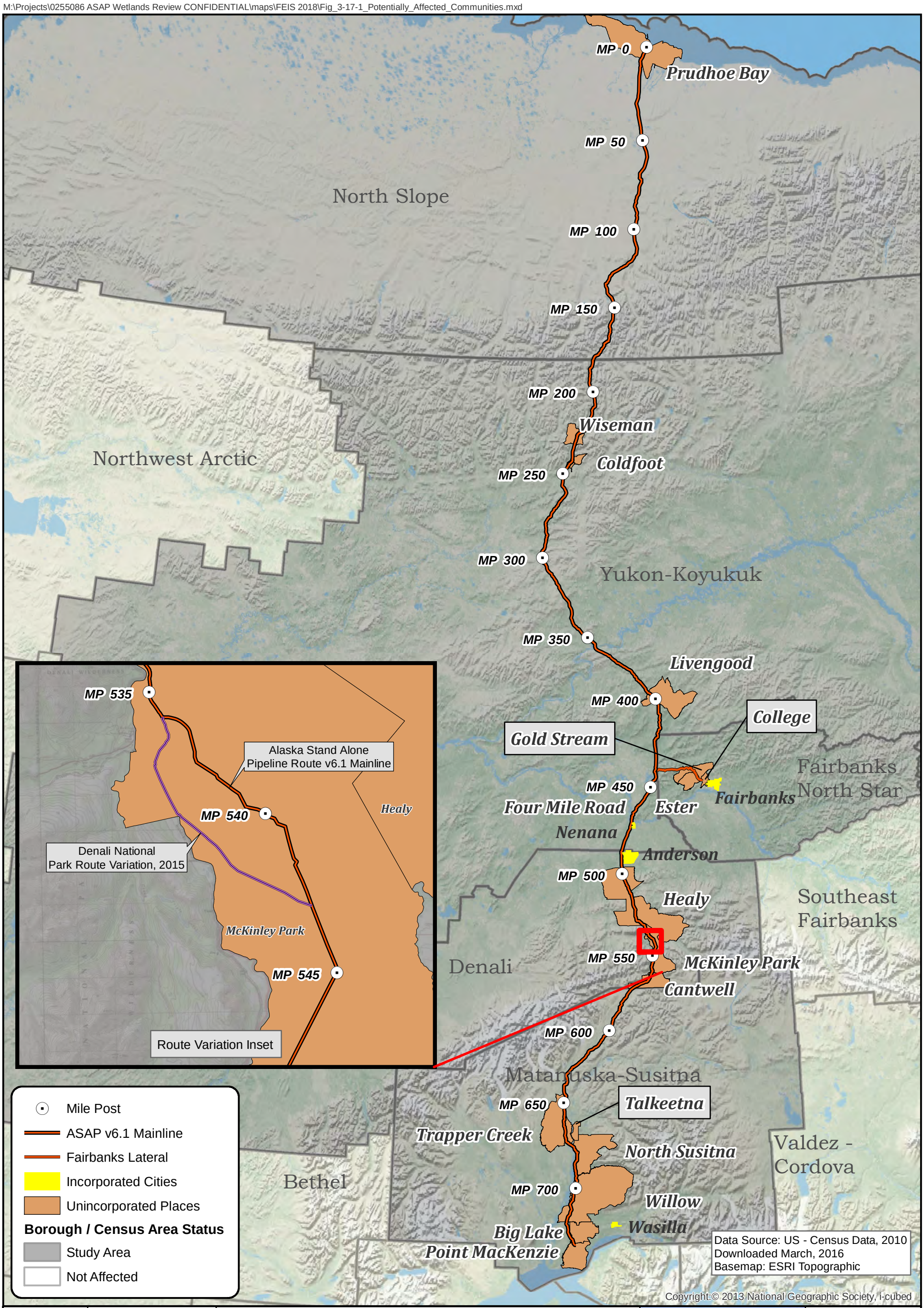
Incorporated cities and unincorporated places with boundaries that would be intersected by the proposed Project ROW were defined as the communities that might experience potential health effects (PACs). While the boundaries of Talkeetna, Fairbanks, and Wasilla would not be intersected by the proposed ROW, these communities are also considered in the analysis as these are nearby major population centers and service areas that would be connected to the proposed pipeline by roads and other infrastructure. Anaktuvuk Pass is not nearby (approximately 55 miles from the Project), not a major population center, and would not be connected to the proposed pipeline by roads or other infrastructure.

Figure 3.17-1 shows the location of these PACs. Table 3.17-3 lists the population for each PAC from north to south and the percentage of each population comprised of American Indian or Alaska Native descent. Four Mile Road was removed this list of PACs because it is no longer within the proposed Project ROW footprint. Detailed profiles of each PAC are presented in Section 5.15 (Public Health) of the 2012 FEIS (USACE, 2012a), except for the three new communities, discussed below. The previously discussed community profiles have not changed substantially since the 2012 FEIS and are therefore not presented in this SEIS. The community profiles are derived from the Alaska Community Database Community Information Summaries (ADCCED, 2011), which contain

information about the accessibility of clean water and healthcare within the PACs, as well as a brief overview of each community's history and accessibility via the transportation network.

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ERM

DATE: MAR. 2018
CHKD: K.A.
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PROJ. No.: 0416166

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Figure 3.17-1: LOCATIONS OF POTENTIALLY AFFECTED COMMUNITIES ALASKA STAND ALONE PIPELINE

0 25 50 100 Miles



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Additional communities are considered in this Public Health section under the discussion of potential effects to food, nutrition, and subsistence. Those PACs not shown in Table 3.17-3 were considered based on historical subsistence use patterns but were not assessed under other HECs due to their distance from the proposed ROW. Table 3.17-3 includes the percent of the population that is Alaska Native. This information is useful to identify whether a proposed action would have a disproportionately high adverse impact on low-income populations, minority populations, or American Indian tribes. Table 3.16-1 in Section 3.16.3 of this SEIS provides a list of all communities for which subsistence resources may be affected.

Section 3.14 (Socioeconomics) provides a demographic overview of the boroughs and census areas crossed by each alternative, including population (see Table 3.14-1) and ethnic and racial composition data at the census block level (see Table 3.14-12). Additional socioeconomic data is presented in this Public Health section within the discussion of determinants of health for the PACs (Section 3.17.6.2). See Section 5.9, Land Use, for information about land use and land ownership along the proposed ROW.

Table 3.17-3 Potentially Affected Communities

Community Name	Borough or Census Area	Population 2000 Census	Population 2010 Census	Percent White (2010)	Percent Alaska Native (2010)
Prudhoe Bay	NSB	5	2,174[a]	85.2	7.8
Wiseman	YKCA	21	14	92.9	0.0
Coldfoot	YKCA	13	10	90.0	10.0
Livengood	YKCA	29	13	69.2	23.1
Ester	FNSB	1,680	2,422	84.6	6.7
College	FNSB	11,402	12,964	73.1	9.5
Goldstream	FNSB	NA	3,557	89.0	3.4
Fairbanks	FNSB	30,224	31,535	66.1	10.0
Nenana	YKCA	402	378	56.1	37.6
Anderson	Denali Borough	367	246	87.8	2.8
Healy	Denali Borough	1,000	1,021	91.5	2.1
McKinley Park	Denali Borough	142	185	94.1	0.0
Cantwell	Denali Borough	222	219	77.2	15.5
Talkeetna	Mat-Su Borough	772	876	91.4	3.7
Trapper Creek	Mat-Su Borough	423	481	86.5	6.4
North Susitna	Mat-Su Borough	NA	1,260	87.5	5.3
Willow	Mat-Su Borough	1,658	2,102	90.8	5.2
Big Lake	Mat-Su Borough	2,635	3,350	86.1	7.0
Point MacKenzie	Mat-Su Borough	111	529	67.7	23.3
Wasilla	Mat-Su Borough	5,469	7,831	83.4	5.2

Sources: U.S. Census Bureau, 2000; U.S. Census Bureau, 2011c; ADCCED, 2016
a While the 2010 Census considered oil workers in its population estimate for Prudhoe Bay, all residents are employees of oil-drilling or oil-production and support companies and most travel to Anchorage or the lower 48 states when off-duty.

The community profile information below (presented from north to south) are derived from the Alaska Community Database Community Information Summaries (CIS), which contain information about the accessibility of clean water and healthcare within the PACs, as well as a brief overview of each community's history and accessibility via the transportation network (ADCCED, 2016). Information regarding grocery and convenience stores within the PACs is limited, and where available, was derived from the Yellow Pages.

3.17.5.1. Goldstream

Goldstream is in the FNSB, located about 14 miles northwest of Fairbanks, and could be considered a suburb of Fairbanks. It was one of the earliest gold mining areas in the Fairbanks region and was settled in 1905. The Department of Labor estimates that the current population is 3,691 individuals. The 2010 census states that approximately 3 percent of the population is Alaska Native.

Approximately 65 percent of the residents are in the workforce. Residents primarily work in Fairbanks, with the most common jobs being retail salespersons, cashiers, scientists, office administration, nurses, and biologists. Residents travel to Fairbanks for health care services and groceries. The Chena/Goldstream Fire Department provides emergency services to the area.

3.17.5.2. North Susitna

North Susitna is a developed area between Willow and Talkeetna in the Mat-Su Borough on the Parks Highway. The community was formerly known as "Y" because the Parks Highway and Talkeetna Spur Road form a "Y" in this area. The Department of Labor estimates that the current population is 1,427 individuals. The 2010 census states that approximately 5 percent of the population of North Susitna is Alaska Native.

About half of the residents are in the workforce, with the most common jobs being cashiers, construction workers, carpenters, and wait staff. The nearest health clinic is on Talkeetna Spur Road, but most residents commute to Wasilla or Palmer for healthcare services and groceries. The Department of Emergency Services for the Mat-Su Borough covers the North Susitna area.

3.17.5.3. Point MacKenzie

Point MacKenzie is approximately 15 miles southwest of Wasilla on the south shore of Knik Arm, in the Mat-Su Borough. The Department of Labor estimates that the current population is 1,920 individuals. The 2010 census states that approximately 23 percent of residents are Alaska Native.

Approximately 39 percent of the residents are in the workforce, with the most common job industries being transportation or utilities, educational services, construction, and natural resources or mining. The nearest health clinics and grocery stores are located in Wasilla.

3.17.6. Baseline Health Status

This section presents the determinants of health, and health status indicators, within Alaska, and in the regions crossed by the proposed Project. The data was compiled for the 2012 FEIS (USACE, 2012a) by reviewing readily available public information from public health agencies and state, regional, and community-level databases and publications. This information has been updated where the following conditions are met: (1) new information is available, (2) information has changed significantly, and (3) the recentness of the data is likely to be integral to the impacts analysis in Chapter 4 of this SEIS.

A joint effort by the ADHSS and the Alaska Native Tribal Health Consortium (ANTHC), called Healthy Alaskans 2020 (ADHSS, 2016), has identified 25 health priorities for Alaska. These leading health priorities include:

- Reducing the rates of cancer, suicide, and interpersonal violence and sexual assault;
- Decreasing alcohol, tobacco, and drug use;
- Increasing disease prevention through vaccines, improved access to in-home water and wastewater services;
- Increasing high school graduation rates;
- Increase the rate of prenatal care;
- Increase access to healthcare; and
- Lowering Alaska's obesity rate.

The current status of these leading health priorities are discussed in the Determinants of Health, and Health Indicator Status sections below.

3.17.6.1. Baseline Health Status Methods

Methods used by the 2012 FEIS (USACE, 2012a) to assess baseline health status for each of the boroughs and census areas crossed by the proposed Project are described here for reference purposes only (for detailed methods, see the 2012 FEIS). Two overarching categories of baseline health information were selected in the 2012 FEIS: determinants of health and health status indicators.

Determinants of health are factors that influence health status and determine health differentials or health inequalities. They include natural, biological factors, such as age, gender and ethnicity; behavior and lifestyles, such as smoking, alcohol consumption, diet and physical exercise; the physical and social environment, including housing quality, the workplace and the wider urban and rural environment; and access to health care. All of these are closely interlinked and differentials in their distribution lead to health inequalities (WHO, 1999). The relevant determinants of health for this SEIS were grouped into behavioral categories at the regional level. Behavioral categories were not

available at the individual community level; however, access to clean water, sewage treatment services, healthcare, and emergency services for each PAC were evaluated.

Health status indicators represent the current health condition of the populations and communities using statistically developed descriptors of general overall health status. These include leading causes of death, death rates, and incidence of chronic diseases and morbidity. Health status indicators thus provide a picture of community health status without necessarily providing insights into the factors or causes that influence health status.

Baseline data for health effect categories identified in the Alaska HIA Toolkit are addressed in the following sections and divided into two categories determinants of health and health status indicators. HECs that were rated with "medium" or "high" potential effect by the proposed Project in the 2012 FEIS are discussed in this SEIS in the sections provided in Table 3.17-4.

Table 3.17-4 Health Effect Categories and Location of SEIS Discussion

Health Effect Category	SEIS Section
Determinants of Health	3.17.6.2
Substance Abuse	3.17.6.2.2.3 - Substance Abuse subsection
Depression, Anxiety, Isolation Leading to Intentional Injury	3.17.6.3.1.7.1 - Intentional Injuries subsection
Economy, Employment and Education	3.17.6.2.1.1 - Educational Attainment for Population 25 Years of Age and Older, Labor Force and Unemployment subsection
Cultural Change Related to Subsistence Activities	3.17.6.2.3 - Subsistence, Food, and Nutrition
Injury	3.17.6.3.1.7
Exposure to Hazardous Materials	3.17.6.3.2.3
Subsistence Foods	3.17.6.2.3 - Subsistence, Food, and Nutrition
Respiratory Exposure	3.17.6.1.5 - Chronic Lower Respiratory Disease subsection
Infectious Disease	3.17.4.3.1 - Infections Disease subsection
Subsistence, Food, and Nutrition	3.17.6.2.3
Non-communicable and Chronic Disease	3.17.4 - Health Effects Category Table; 3.17.6.3.1 – Morbidity and Mortality

The public health assessment presented in the 2012 FEIS determined that the proposed Project would have only a "low" level of impact on the following HECs, during both the construction, and operation and maintenance phases. These HECs were therefore discussed in only limited detail, if at all, in this SEIS Affected Environment section:

- Exposure to Hazardous Materials
- Water and Sanitation
- Health Services Infrastructure and Capacity

The collection of data regarding determinants of health and health status indicators was completed for the 2012 FEIS (USACE, 2012a) by reviewing readily available public

information from public health agencies and state, regional, and community-level databases and publications. Additionally, the comments compiled during the scoping period held as part of the NEPA process were reviewed.

The majority of data provided in this section utilizes the U.S. Census Bureau and ACS, 5-year surveys (2010-2014). Additional data sources included the Center of Disease Control (CDC) and ADHSS.

Although both the data from the 2010 Census and the ACS are compiled by the U.S. Census Bureau, population estimates for the two datasets differ because different survey methodologies were used. The population estimates provided by the 2010 Census differ slightly from the estimates reported by ACS. All ACS estimates should be interpreted as average values over the designated period.

3.17.6.2. Determinants of Health

3.17.6.2.1. Demographics and Socioeconomic Conditions

This section summarizes the demographic and socioeconomic conditions for the PACs, as presented in Section 5.15.3.3 of the 2012 FEIS (USACE, 2012a). Much of this information is provided in Section 3.14 of this SEIS; however, this section provides greater detail on specific communities.

3.17.6.2.1.1. Educational Attainment for Population 25 Years of Age and Older

Table 3.17-5 presents educational attainment for the population 25 years of age and older for each PAC for the 2010 to 2014 5-year period (U.S. Census Bureau, 2014b). Approximately 3 percent of the population 25 and older statewide has less than a ninth grade education. Statewide, approximately 91.8 percent of the population 25 years and older have a high school diploma or some higher level of educational attainment. There are 13 PACs with lower proportions of their 25 and older populations with at least a high school diploma.

Table 3.17-5 Educational Attainment for Population 25 Years of Age and Older

Community	Population 25 Years & Older	Less Than 9th Grade Education	9th to 12th Grade Education, But No Diploma	High School Graduate or GED	Some College, No Degree	Associate Degree	Bachelor Degree	Graduate or Professional Degree
State of Alaska	460,319	3.0%	5.2%	27.5%	28.4%	8.2%	17.9%	9.8%
Anderson city, Alaska	171	1.20%	5.30%	35.10%	35.70%	8.20%	7%	7.60%
Big Lake CDP, Alaska	2,567	3.2%	4.6%	31.6%	33.8%	8.1%	13.2%	5.4%
Cantwell CDP, Alaska	146	2.7%	2.7%	32.2%	30.8%	6.8%	20.5%	4.1%

Community	Population 25 Years & Older	Less Than 9th Grade Education	9th to 12th Grade Education, But No Diploma	High School Graduate or GED	Some College, No Degree	Associate Degree	Bachelor Degree	Graduate or Professional Degree
Coldfoot CDP, Alaska	11	36.4%	0.0%	36.4%	27.3%	0.0%	0.0%	0.0%
College CDP, Alaska	9,203	2.4%	3.8%	19.8%	28.6%	6.2%	20.3%	18.9%
Ester CDP, Alaska	1,788	1.4%	5.9%	19.8%	32.0%	7.9%	18.1%	14.9%
Fairbanks city, Alaska	18,070	2.5%	7.1%	28.1%	30.6%	10.3%	15.1%	6.3%
Goldstream CDP, Alaska	2,718	2.4%	2.7%	7.8%	26.7%	7.7%	19.6%	33.2%
Healy CDP, Alaska	783	8.4%	4.3%	26.1%	24.3%	10.2%	16.9%	9.8%
Livengood CDP, Alaska	10	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%
McKinley Park CDP, Alaska	293	0.0%	3.4%	17.4%	19.5%	9.9%	45.7%	4.1%
Nenana city, Alaska	325	4.9%	14.8%	29.5%	31.4%	11.1%	8.0%	0.3%
Point MacKenzie CDP, Alaska	369	2.7%	18.7%	37.4%	24.1%	9.5%	7.6%	0.0%
Prudhoe Bay CDP, Alaska	2,386	0.8%	3.0%	30.4%	35.2%	14.6%	14.1%	2.0%
Susitna North CDP, Alaska	1,154	2.3%	9.6%	37.4%	19.8%	8.7%	12.0%	10.1%
Talkeetna CDP, Alaska	388	0.3%	9.3%	18.8%	30.2%	2.8%	28.4%	10.3%
Trapper Creek CDP, Alaska	300	5.0%	3.7%	38.3%	34.7%	4.0%	9.7%	4.7%
Wasilla city, Alaska	5,146	2.7%	5.9%	31.8%	29.8%	10.9%	12.9%	6.0%
Willow CDP, Alaska	1,449	2.3%	7.5%	31.2%	34.5%	7.5%	13.9%	3.2%
Wiseman CDP, Alaska	9	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%

Source: ACS, 2014

3.17.6.2.1.2. Poverty Rate

Table 3.17-6 presents the poverty[23] rate for each PAC (U.S Census Bureau, 2014b). For the 2014 data presented, the poverty threshold for Alaska for a family of four was approximately $30,000 (U.S. Department of Health and Human Services, 2016). This is higher than the 2014 poverty threshold of the 48 contiguous states of $24,000; the poverty threshold in Alaska is designed to compensate for the high cost of living in Alaska. Approximately 10 percent of the statewide population is impoverished. Twelve PACs exhibit higher poverty rates than the statewide rate.

[23] The U.S. Census Bureau's definition of poverty: "…[T]he Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is in poverty. If a family's total income is less than the family's threshold, then that family and every individual in it is considered in poverty. The official poverty thresholds do not vary geographically, but they are updated for inflation using Consumer Price Index (CPI-U). The official poverty definition uses money income before taxes and does not include capital gains or noncash benefits (such as public housing, Medicaid, and food stamps)." (U.S. Census Bureau, 2016b)

Table 3.17-6 Poverty Rate

Community	Percent of Population below Poverty Line (Annual Averages Averaged from 2010-2014)
State of Alaska	10.1%
Anderson City, Alaska	0.0%
Big Lake CDP, Alaska	10.5%
Cantwell CDP, Alaska	10.7%
Coldfoot CDP, Alaska	36.4%
College CDP, Alaska	7.0%
Ester CDP, Alaska	12.4%
Fairbanks city, Alaska	13.1%
Goldstream CDP, Alaska	3.3%
Healy CDP, Alaska	8.6%
Livengood CDP, Alaska	0.0%
McKinley Park CDP, Alaska	28.0%
Nenana city, Alaska	15.8%
Point MacKenzie CDP, Alaska	6.4%
Prudhoe Bay CDP, Alaska	4.2%
Susitna North CDP, Alaska	13.7%
Talkeetna CDP, Alaska	11.0%
Trapper Creek CDP, Alaska	29.7%
Wasilla City, Alaska	11.2%
Willow CDP, Alaska	15.6%
Wiseman CDP, Alaska	0.0%

Source: ACS, 2014

3.17.6.2.1.3. Median Household Income

Table 3.17-7 presents the median household income for each PAC and for Alaska, in 2014 dollars (U.S. Census Bureau, 2014b). Given the small sample size for the various communities, there is a large margin of error for some communities' median income estimates. Statewide median household income is nearly 330 percent higher than the median household income in Trapper Creek CDP. Similarly, statewide median household income is 160 percent higher than the median household income in McKinley Park CDP. Thirteen PACs have median household incomes lower than the statewide median income.

Table 3.17-7 Median Household Income

Community	Median Household Income in the Past 12 Months (2014 Dollars)
State of Alaska	71,829
Anderson city, Alaska	86,250
Big Lake CDP, Alaska	66,713
Cantwell CDP, Alaska	60,417
Coldfoot CDP, Alaska	--
College CDP, Alaska	75,871

Community	Median Household Income in the Past 12 Months (2014 Dollars)
Ester CDP, Alaska	62,841
Fairbanks city, Alaska	55,778
Goldstream CDP, Alaska	83,462
Healy CDP, Alaska	97,708
Livengood CDP, Alaska	--
McKinley Park CDP, Alaska	44,076
Nenana city, Alaska	46,607
Point MacKenzie CDP, Alaska	41,111
Prudhoe Bay CDP, Alaska	--
Susitna North CDP, Alaska	49,167
Talkeetna CDP, Alaska	56,094
Trapper Creek CDP, Alaska	21,711
Wasilla city, Alaska	62,622
Willow CDP, Alaska	56,330
Wiseman CDP, Alaska	--

Source: U.S. Census Bureau, 2014b
-- = no median household income is presented because there were either no households or too few households to statistically calculate the median income.

3.17.6.2.1.4. School District Dropout Rate

Table 3.17-8 presents the school district dropout rates for each PAC and for Alaska statewide, for the 2014-2015 school year (ADCCED, 2016; Alaska Department of Education and Early Development, 2015). Statewide the dropout rate for the 2014-2015 year equated to 1.7 percent. Dropout rates for those districts in which the PACs are located are relatively similar to the statewide dropout rates with exception of the Nenana City School District (24.9 percent) and the NSB School District (9 percent) (ADCCED, 2016; Alaska Department of Education and Early Development, 2015).

Table 3.17-8 Number of Schools, Districts, Students, and Dropout Rates

Community	Number of Schools within Community (2015)	School District	Number of Students in School District (2015)	District Dropout Rate (7th to 12th Grades) (2015)
Prudhoe Bay	0	NSB	2,050	9.0%
Wiseman	0	Yukon Koyukuk	1,610	5.0%
Coldfoot	0			
Livengood	0	Yukon Flats	261	10.7%
Ester	0	FNSB	13,926	4.3%
College	1			
Fairbanks	23			
Goldstream	6			
Nenana	2	Nenana City	1,102	24.9%

Community	Number of Schools within Community (2015)	School District	Number of Students in School District (2015)	District Dropout Rate (7th to 12th Grades) (2015)
Anderson	1	Denali Borough	878	8.0%
Healy	2			
McKinley Park	1			
Cantwell	1			
Talkeetna	1	Mat-Su Borough	18,745	2.7%
Trapper Creek	1			
Willow	2			
Susitna North	1			
Big Lake	1			
Wasilla	22			
Point MacKenzie	4			
State of Alaska	507	53 districts in the state	128,580	1.7%

Sourced: ADCCED, 2016; Alaska Department of Education and Early Development, 2015

3.17.6.2.1.5. Labor Force and Unemployment

Table 3.17-9 presents the labor force and unemployment statistics for each PAC for the 2010 to 2014 5-year period (U.S. Census Bureau, 2014b). Statewide average unemployment rate over the 2010 to 2014 period was 8.4 percent. Unemployment rates in seven PACs were higher than the statewide average over the same period.

Table 3.17-9 Statewide Unemployment Rate

Community	Population 16 and Over	In Labor Force	Employed	Unemployed
State of Alaska	560,680	70.8%	62.1%	8.4%
Anderson city, Alaska	204	76.0%	52.0%	4.5%
Big Lake CDP, Alaska	3,068	61.0%	54.1%	11.2%
Cantwell CDP, Alaska	158	61.4%	58.2%	5.2%
Coldfoot CDP, Alaska	11	63.6%	63.6%	0.0%
College CDP, Alaska	12,279	71.4%	64.7%	8.2%
Ester CDP, Alaska	2,373	70.9%	66.0%	6.6%
Fairbanks city, Alaska	24,142	71.9%	50.8%	11.5%
Goldstream CDP, Alaska	3,099	74.9%	73.0%	2.5%
Healy CDP, Alaska	858	71.1%	68.2%	2.0%
Livengood CDP, Alaska	10	0.0%	0.0%	NA
McKinley Park CDP, Alaska	429	93.0%	90.4%	2.8%
Nenana city, Alaska	365	67.1%	53.2%	20.8%
Point MacKenzie CDP, Alaska	451	14.4%	13.7%	4.6%
Prudhoe Bay CDP, Alaska	2,570	98.4%	96.2%	2.1%
Susitna North CDP, Alaska	1,203	43.9%	37.6%	14.4%
Talkeetna CDP, Alaska	424	70.0%	69.8%	0.3%

Community	Population 16 and Over	In Labor Force	Employed	Unemployed
Trapper Creek CDP, Alaska	354	47.2%	42.1%	10.8%
Wasilla city, Alaska	6,193	65.5%	57.4%	10.6%
Willow CDP, Alaska	1,611	58.8%	52.6%	10.5%
Wiseman CDP, Alaska	9	44.4%	44.4%	0.0%

Source: ACS, 2014

3.17.6.2.1.6. Worker Residency Status and Net-migration

Table 3.17-10 presents the worker residency status by occupation for 2014 (ADOLWD, 2016b). Statewide, approximately 20.8 percent of all workers are non-residents. Occupations with the highest levels of non-resident employment include manufacturing (63.9 percent), agriculture, forestry, fishing and hunting (51.9 percent), and mining (34.5 percent) (ADOLWD, 2016b). Migration to and from Alaska from 1970 to the late 1980s was dramatic. In the mid-1970s, TAPS construction was the main driver for increased population migration for that period, with the creation of 60,000 jobs resulting from the oil boom of the 1980s (ADOLWD, 2009). Migration to and from Alaska between the late 1990s to present has remained relatively constant.

Table 3.17-10 Workers and Wages, Major and Selected Industry Categories – Alaska, 2014

Industry	Total		Nonresident			
	Workers	Wages (million)	Workers	Percent	Wages (million)	Percent
Agriculture, Forestry, Fishing, and Hunting	2,424	$55.8	1,257	51.9%	$27.8	49.9%
Mining	22,316	$2,361.9	7,690	34.5%	$752.4	31.9%
Oil and Gas	4,666	$893.8	1,248	26.7%	$237.2	26.5%
Oilfield Services[a]	13,790	$1,155.4	5,216	37.8%	$421.3	36.5%
Utilities	2,580	$188.5	142	5.5%	$6.3	3.3%
Construction	27,763	$1,343.0	6,172	22.2%	$237.0	17.6%
Manufacturing	29,156	$612.7	18,642	63.9%	$277.3	45.3%
Seafood Processing	23,957	$398.2	17,792	74.3%	$257.8	64.7%
Wholesale Trade	7,318	$346.7	688	9.4%	$21.1	6.1%
Retail Trade	49,196	$1,126.9	7,629	15.5%	$90.1	8.0%
Transportation and Warehousing	25,147	$1,194.6	6,488	25.8%	$286.7	24.0%
Air Transportation	7,349	$317.9	1,772	24.1%	$57.2	18.0%
Information	7,551	$401.8	710	9.4%	$25.4	6.3%
Finance and Insurance	8,049	$430.6	637	7.9%	$16.6	3.9%
Real Estate and Rental and Leasing	7,025	$216.3	712	10.1%	$15.6	7.2%
Professional, Scientific, and Technical Services	18,378	$1,027.0	4,359	23.7%	$224.6	21.9%
Management of Companies and Enterprises	2,757	$185.2	566	20.5%	$25.9	14.0%

Industry	Total		Nonresident			
	Workers	Wages (million)	Workers	Percent	Wages (million)	Percent
Administrative Support/Waste Management and Remediation	17,905	$545.3	3,923	21.9%	$90.6	16.6%
Educational Services	2,873	$67.2	669	23.3%	$7.3	10.8%
Health Care and Social Assistance	50,708	$2,108.6	5,101	10.1%	$158.0	7.5%
Arts, Entertainment, and Recreation	7,153	$93.2	2,208	30.9%	$20.5	22.0%
Accommodation and Food Services	42,235	$625.1	12,823	30.4%	$130.0	20.8%
Accommodation	12,523	$200.7	5,704	45.5%	$61.8	30.8%
Food Services and Drinking Places	29,497	$422.9	7,022	23.8%	$67.6	16.0%
Other Services	13,090	$372.7	1,979	15.1%	$36.1	9.7%
Other/Unknown	428	$7.0	156	36.4%	$2.1	30.0%
Local Government	49,949	$1,808.1	3,388	6.8%	$69.8	3.9%
State Government	28,515	$1,357.7	1,949	6.8%	$47.9	3.5%
Total	422,516	$16,475.9	87,888	20.8%	$2,569.0	15.6%

Source: ADOLWD, 2016b
Data exclude the self-employed, fishermen, and other agricultural workers and private household workers. For estimates of fish harvesting employment, visit labor.alaska.gov/research/seafood/seafood.htm
a This industry category includes support activities for oil and gas drilling and related occupations.

3.17.6.2.1.7. Access to Health Care

One of the key determinants of health for Alaska is whether a community or a population is classified as "medically underserved." Table 3.17-11 presents the health professional shortage area (HPSA) and medically underserved area (MUA)/populations (MUP) designations for potentially affected boroughs and census areas (USDHHS, 2017). MUPs and MUAs are designated by the Health Resources and Services Administration as having too few primary care providers, high infant mortality, high poverty, and/or high elderly population (U.S. Department of Health and Human Services, 2011). HPSAs are designated by the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA) as areas that are lacking in primary medical care, dental or mental health providers, and may be geographic, demographic, or institutional. Each borough and census area intersected by the proposed ROW is either characterized as an MUP or contains MUAs within its boundaries. According to the ADHSS, nearly one in five adults (19 percent) in Alaska between the ages of 18 and 64 do not have health care coverage (ADHSS, 2010a).

Congress passed the Patient Protection and Affordable Care Act on March 23, 2010. The stated purpose of the law is to expand access to health insurance to all Americans. Some of the law's provisions became effective in 2010, while others will be phased in through 2020. The majority of the insurance provisions of the Patient Protection and Affordable Care Act became effective January 1, 2014, including the startup of health insurance

exchanges, also referred to as "marketplaces," and the requirement for all Americans to have qualifying minimum essential insurance coverage.

Table 3.17-11 HPSAs and MUAs/MUPs for Potentially Affected Boroughs and Census Areas

Borough or Census Area	HPSA			MUA	MUP
	Primary Care	Dental	Mental		
FNSB	2 CHCs; 3 NATPs	2 CHCs; 2 NATPs	2 CHCs; 3 NATPs	Yes - FNSB	Yes
NSB	Yes; 4 NATPs	Yes; 1 NATP	Yes; 1 NATB	Yes - Prudhoe Bay-Kaktovik Service Area	Yes
YKCA	Yes; 1 CHC	Yes; 1 CHC	Yes; 1 CHC	Yes - Koyukuk-Middle Yukon, McGrath-Holy Cross, and Yukon Flats Service Areas	Yes
Denali Borough	Yes	Yes	Yes	Yes – Low Income – Denali Borough (GE)	Yes
Mat-Su Borough	2 CHCs; 1 NATP; 2 ANTPs	Yes*; 2 CHCs; 1 CF, 1 ANTP	Yes; 2 CHCs; 1 ANTP, 1 CF	Yes – Mat-Su Borough (GE)	Yes

Source: USDHHS, 2017
* - HPSA status proposed for withdrawal
ANTP – Alaska Native Tribal Population
CF – Correctional Facility
CHC - there is at least one Comprehensive Health Center
GE – Governors Exception; MUP designation for populations, which do not necessarily meet the established criteria for a MUA/MUP
NATP – Native American Tribal Population
Yes - in HPSA columns indicates a geographic HPSA designation approved by the HRSA for all or part of the census area or borough

3.17.6.2.2. Lifestyle Choices

3.17.6.2.2.1. Physical Activity

Within the proposed Project Area, the NSB has the highest percentage of adults who are physically inactive (33.5 percent), the highest percentage reported within the State of Alaska, followed by the YKCA (27 percent), Denali Borough (26.1 percent), FNSB (22.9 percent), and the Mat-Su Borough (22.8 percent) (CDC, 2011a).

3.17.6.2.2.2. Tobacco Use

The ADHSS Behavior Risk Factor Surveillance System is one of the primary sources for estimating the prevalence of non-smoking in Alaska. Table 3.17-12 presents the results of the Behavior Risk Factor Surveillance System survey of non-smoking for the 3-year average of 2013-2015, for all Alaskans, and Alaskan natives, for each borough, municipality, or census area crossed by the proposed pipeline route. All results within the proposed Project Area were below the Healthy Alaskans 2020 (ADHSS, 2016)

program goal of at least 83 percent of adults not smoking. The percentage of non-smokers was greater for "all Alaskans" compared to Alaskan Natives.

Usage of smokeless tobacco (*e.g.*, chewing tobacco) is less common among Alaskans and ranged from 3 to 6 percent in 2007 for regions containing PACs. American Indian or Alaska Native people report slightly higher percentage of smokeless tobacco use (11 percent of adults) compared to Alaska non-Native people (4 percent) (CDC, 2009a).

Table 3.17-12 Percentage of Non-Smokers (3-year average 2013-2015)

Area	All Alaskans	Alaska Natives
Anchorage Municipality	82.70%	63.20%
Denali Borough	75.00%	**
FNSB	79.60%	70.20%
Mat-Su Borough	79.80%	64.70%
NSB	62.10%	44.50%
YKCA	59.70%	54.90%

Source: Behavioral Risk Factor Surveillance System, Alaska Department of Health and Social Services, DPH, Section of Chronic Disease Prevention and Health Promotion
** = Data not available due to fewer than 50 responses in the denominator.

3.17.6.2.2.3. Substance Abuse

The illegal use of drugs (*e.g.*, marijuana, cocaine, heroin, and methamphetamine [meth]), abuse of prescription opiate pain medications, and alcohol abuse are included in the category of substance abuse. According to the ADHSS Substance Abuse Prevention Program (ADHSS, 2016):

> *Across the board (all ages), Alaska has one of the highest per capita alcohol consumption rates in the nation and the prevalence of alcohol dependence and alcohol abuse, at 14%, is twice the national average of 7% (Gallup Corp. Telephone survey for ADHSS, Alaska Department of Administration). This is critical information in our efforts to reduce youth substance abuse because we know that alcoholism runs in families, and children of alcoholics are four times more likely than other children to become alcoholics (American Academy of Child & Adolescent Psychiatry).*
>
> *The use of alcohol and other drugs among our states high-school aged students, while high, is very similar to the national statistics for youth substance abuse. Statistics collected through the 2003 Youth Risk Behavior Survey (YRBS) provide an improved, although still grim, picture regarding the current pattern of alcohol use/abuse by Alaskan youth:*
>
> - *75.1% of high school students have used alcohol at least once, down from the 1995 YRBS of 80.1%;*
> - *38.7% had at least one drink of alcohol in the last 30 days, down from 47.5% in 1995; and*

- *26.5% had a binge-drinking episode, down from 31.3% drinking five or more drinks within a couple of hours and in the last 30 days.*

The prevalence of binge drinking (defined as proportion of males having five or more drinks or females having four or more drinks on one occasion within a 30-day span) in Alaska is approximately the same as for the entire U.S. In 2008, 16 percent of Alaskan adults reported engaging in binge drinking. The prevalence was higher in males (22 percent) than females (10 percent). American Indian or Alaska Native people reported significantly higher percentage of binge drinking (26.7 percent) compared to Alaska non-Natives (17.1 percent) during the period of 2007 to 2009 (CDC, 2009a). The highest percentage of binge drinking among Alaska Natives occurs in the Interior Region (22 percent). Percentages of binge drinking are 21 percent in the Arctic Slope Region and 16 percent in the Anchorage/Mat-Su Region for Alaska Natives (ANTHC, 2009).

Between 2010 and 2014, the ADHSS reported the alcohol-induced age-adjusted mortality rate (annual rater per 100,000 population) for the regions crossed by the proposed pipeline as follows: Anchorage/Mat-Su region, 16.5; interior 15.5; and northern 27.4 (ADHSS, 2015c). This rate includes only direct mortality due to alcohol use, and excludes accidents, homicides, and other causes indirectly related to alcohol use.

Marijuana use statistics are difficult to interpret due to differences in survey date, type, and definitions. Approximately 45 percent of Alaska high school-aged students reported ever using marijuana (during their life) in a 2009 survey compared to 37 percent in the rest of the U.S. (CDC, 2009b). According to the Substance Abuse and Mental Health Services Administration (2004) data for 2002 and 2003, 49.3 percent of American Indian or Alaska Native persons aged 12 or older reported having used marijuana sometime during their lifetime compared to 40.5 percent of all Americans. The 2011 Alaska Youth Risk Behavior Survey conducted by ADHSS indicates that 21.2 percent of high school students used marijuana within the last 30 days. Additional statistics on marijuana use statewide are provided in Section 5.15.3.3 of the 2012 FEIS (USACE, 2012a). The Alaska Marijuana Legalization, Ballot Measure 2 was approved on November 4, 2014. As a result of its passage, the measure allowed people age 21 and older to possess up to 1 ounce of marijuana and up to six plants. It also made the manufacture, sale, and possession of marijuana paraphernalia legal.

Meth use has been reported for young Alaskans; estimated meth use for 2002 to 2005 was almost 3 percent of 18 to 25 year olds surveyed (Rivera and Baker, 2010). Alaskan youth are no more likely than youth elsewhere in the U.S. to use cocaine, heroin, meth, or ecstasy. Specific regional data for substance abuse is not available for Alaska.

Heroin use and the abuse of prescription opioids in Alaska, as in the U.S., has increased significantly in recent years. Many people who become addicted to prescription opioids may switch to heroin drug use because it can be cheaper and easier to acquire. According to the U.S. Substance Abuse and Mental Health Services Administration, the annual average number of people in Alaska who used heroin quadrupled during 2002 to

2013, from less than 500 during 2002 to 2005, to approximately 2,000 during 2010 to 2013 (U.S. Department of Health and Human Services, 2015).

3.17.6.2.3. Subsistence, Food, and Nutrition

Outside of federally designated non-rural areas, and state-designated non-subsistence areas (see Figures 3.16-1 and 3.16-2), subsistence harvest makes up a large proportion of the diet of residents in the PACs within the proposed Project Area. The objective of the Alaska Traditional Diet Project (ATDP), conducted by the Alaska Native Health Board and Alaska Native Epidemiology Center in 2004 (Alaska Native Health Board, Alaska Native Epidemiology Center, 2004), is to quantify the intake of subsistence foods among residents of villages in rural Alaska. Results were reported by the participating villages from five regional Tribal Health Corporations. Results reported by the Tanana Chiefs Conference (TCC) are applicable for several villages of Interior Alaska for which subsistence resources may be affected by the proposed Project including the PAC, Nenana. The ATDP did not report data for the villages located within the boundaries of the Arctic Slope Regional Corporation, Ahtena Regional Corporation, or Cook Inlet Region, Inc. that could be affected by the proposed Project. Two additional sources were used for this section: the NSB study of contaminant levels, and nutrient content of subsistence resource species (NSB, 2006); and the ADF&G summary *Subsistence in Alaska: A Year 2012 Update* (ADF&G 2012 subsistence summary) (ADF&G, 2014c), which summarizes subsistence harvest by region.

The amount of wild food harvested is much larger in rural areas as compared to non-rural areas. According to the ADF&G 2012 subsistence summary, in 2012, the wild food harvest (by pounds of usable weight were person per year) in the non-rural areas of Anchorage, Fairbanks-Delta, and the Mat-Su area, was 17 pounds, 20 pounds, and 26 pounds, respectively. In contrast, in the rural areas, the wild food harvest for the areas of rural Southcentral, rural Interior, and the Arctic, was 184 pounds, 320 pounds, and 438 pounds, respectively. The percentage of households using subsistence-harvested fish and game in rural areas by region within the proposed Project Area, was as follows: Arctic (game 92 percent; fish 96 percent); Interior (game 88 percent; fish 92 percent); and Southcentral (game 79 percent; fish 94 percent). Salmon and land mammals made up the highest composition of wild food harvested by rural Alaska residents in 2012.

Of the approximately 47,218 pounds of food reportedly consumed by the 33 survey participants in the region, only approximately 2,522 pounds (5.3 percent) were derived from subsistence foods, including moose, king and silver salmon, blueberries, and cranberries. The remainder (94.7 percent) consisted of store-bought foods. Sugary drinks comprised 31.1 percent of foods consumed by respondents.

According to ATDP findings, subsistence foods contributed substantial amounts of protein, vitamin B12, iron, and omega-3 fatty acids to the diets of respondents in the TCC region. Subsistence foods also contributed to total fat and saturated fat intake, and

were not substantial sources of folate, fiber, calcium, or Vitamin C. For the TCC region, moose, caribou, and salmon together provided 18 percent of respondents' total energy consumed. Additional details on nutrition provided by subsistence foods are presented in the 2012 FEIS (USACE, 2012a).

For those respondents in the TCC region who indicated a decrease in the consumption of traditional foods compared to 5 years prior, the most common reason reported was a lack of transportation to gather and hunt. Only one respondent indicated that decreased consumption of subsistence foods was due to decreased availability of subsistence resources (Alaska Native Health Board, Alaska Native Epidemiology Center, 2004).

3.17.6.3. Health Indicators

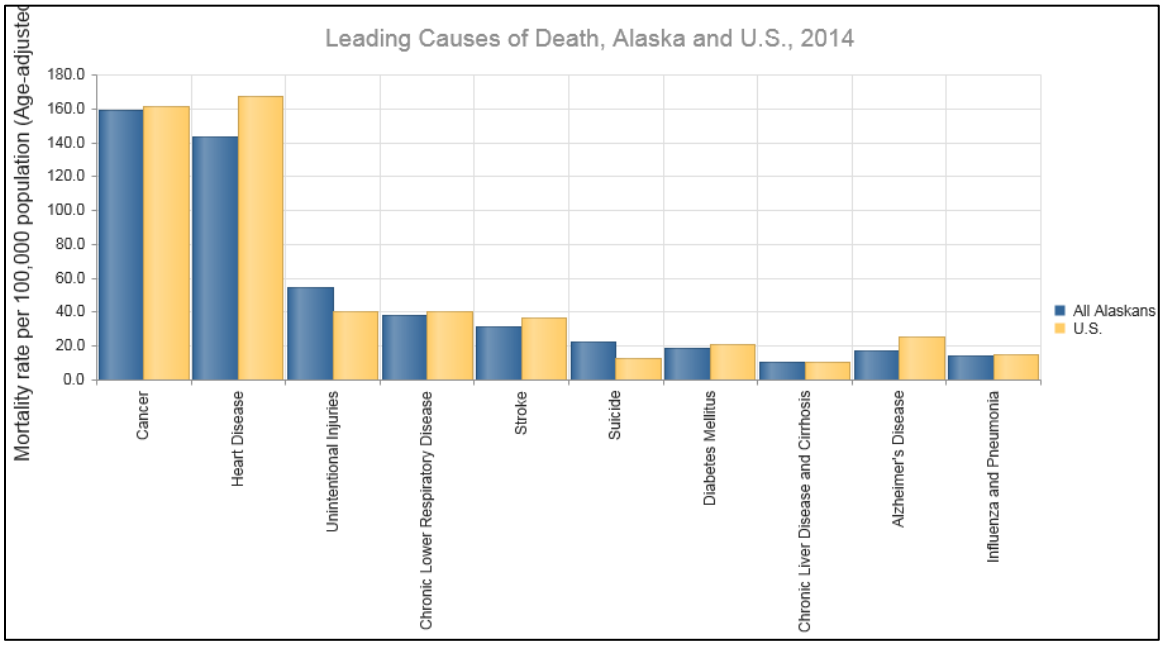
Given their small size, data regarding the health status of individual communities along the proposed alignment are limited; however, some health status indicators are available at the state and borough/census area level. Health indicators were selected based on recent reports by the ADHSS and ANTHC describing important health status indicators for Alaska. References to these reports are provided throughout this section.

3.17.6.3.1. Morbidity and Mortality

Between 2014 and 2016, the average life expectancy in Alaska was 76.2 years. At 69.5 years, the life expectancy for Alaska Natives is substantially lower than for non-Alaska Natives, demonstrating a broad public health discrepancy between Native and non-Native populations. Life expectancies for Asian and White Alaskan residents conversely were 80 and 77.7, respectively (ADHSS, 2017a).

Where data are available, data about the morbidity (illness) and mortality (death) rates for the proposed Project Area are presented below. Figure 3.17-2 (below) presents the leading five causes of death for the state of Alaska in 2014 compared with the U.S. in 2013. The most common chronic disease deaths statewide and within the proposed Project Area include cancer, diseases of the heart (including coronary heart disease), unintentional injuries/accidents, stroke, and chronic lower respiratory disease.

Figure 3.17-2 Leading Causes of Death, Alaska (2014) Compared with U.S. (2013)



Source: ADHSS 2014

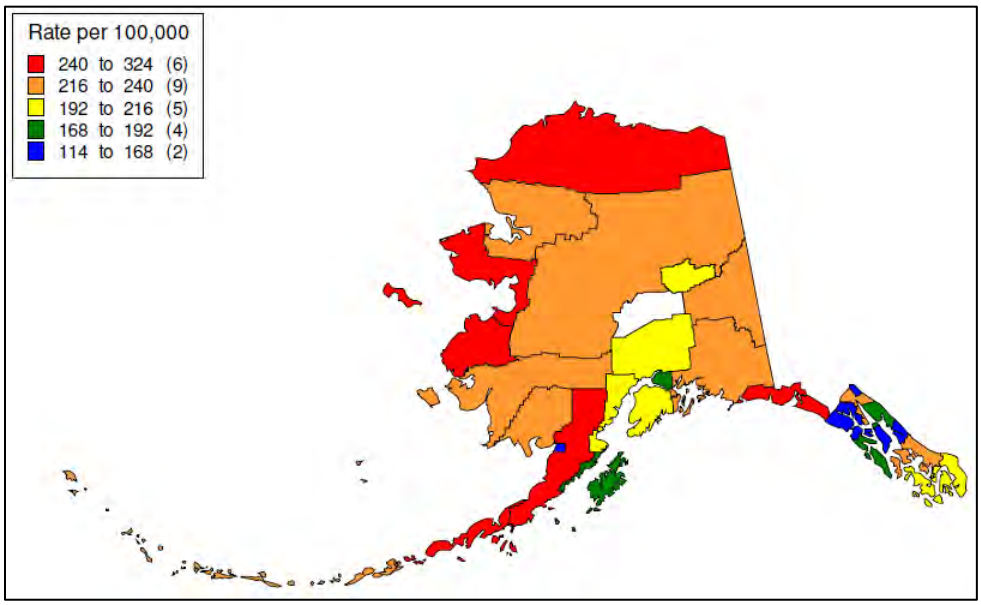
3.17.6.3.1.1. Cancer

As presented in the 2012 FEIS (USACE, 2012a), the sections below present cancer mortality and incidence rates by cancer type and location. ADHSS reports cancer incidence and mortality in Alaska 1996 to 2004 (ADHSS, 2008) provides the most recent summary of cancer incidence and mortality data across the regions crossed by the proposed Project.

3.17.6.3.1.2. Cancer Mortality

Cancer remains the leading cause of death for Alaskans (ADHSS, 2016). As of 2013, the cancer mortality rate (per 100,000) for all cancers for all Alaskans was 167.9 (similar to the U.S. rate of 163.2), compared to a rate of 272.5 for Alaskan Natives. Figure 3.17-3 presents cancer mortality rates by borough or census area, as reported in ADHSS (2008). Cancer mortality rates (per 100,000 people/year) were highest in the NSB (rate of 240 to 324), followed by the YKCA (rate of 216 to 240), FNSB and Mat-Su Borough (rates of 192 to 216), and the Municipality of Anchorage (rate of 168 to 192). Cancer mortality rates were not reported for the Denali Borough (ADHSS, 2008).

Figure 3.17-3 Total Cancer Mortality Rates by Borough/Census Area, 1996-2004



Source: ADHSS, 2008
Note: Small sample sizes for some Borough/Census areas may lead to unstable rates.

Tables 3.17-13 and 3.17-14 provides age-adjusted mortality rates by type of cancer for Alaska for seven types of cancer, with the highest mortality rates shown in descending order (ADHSS, 2017b). Cancer types with the highest mortality rates during this reporting period (1996 to 215) were lung and bronchial, miscellaneous malignant cancers, stomach, esophogial, pancreatic, colon and rectal, kidney and renal, leukemia, and non-Hogkins lymphoma. Cancer mortality rates for the seven leading cancer types for Alaska Natives and Alaska Whites are listed in Tables 3.17-13 and 3.17-14. Note that Tables 3.17-13 and 3.17-14 present some of the same data, with Table 3.17-13 ranked by Alaska Natives, and Table 3.17-14 ranked by Alaska Whites (ADHHS, 2017b).

Table 3.17-13 Cancer Deaths Ranked by Rate for Alaska Natives 1996-2015

	Alaska Natives		Alaska Whites	
Type of Cancer	**Per 100,000**	**No. of Cases**	**Per 100,000**	**No. of Cases**
1. Lung and Bronchus	69.9	857	49.8	3,367
2. Colon and Rectal	35.5	425	14.2	904
3. Misc. Malignant Caners	27.6	335	13.7	892
4. Stomach	15.3	221	2.6	179
5. Pancreas	13.3	176	10.8	723
6. Kidney and Renal	7.9	90	3.9	268
7. Esophagus	6.7	84	4.7	341

Source: ADHSS, 2017b

Table 3.17-14 Cancer Deaths Ranked by Rate for Alaska Whites

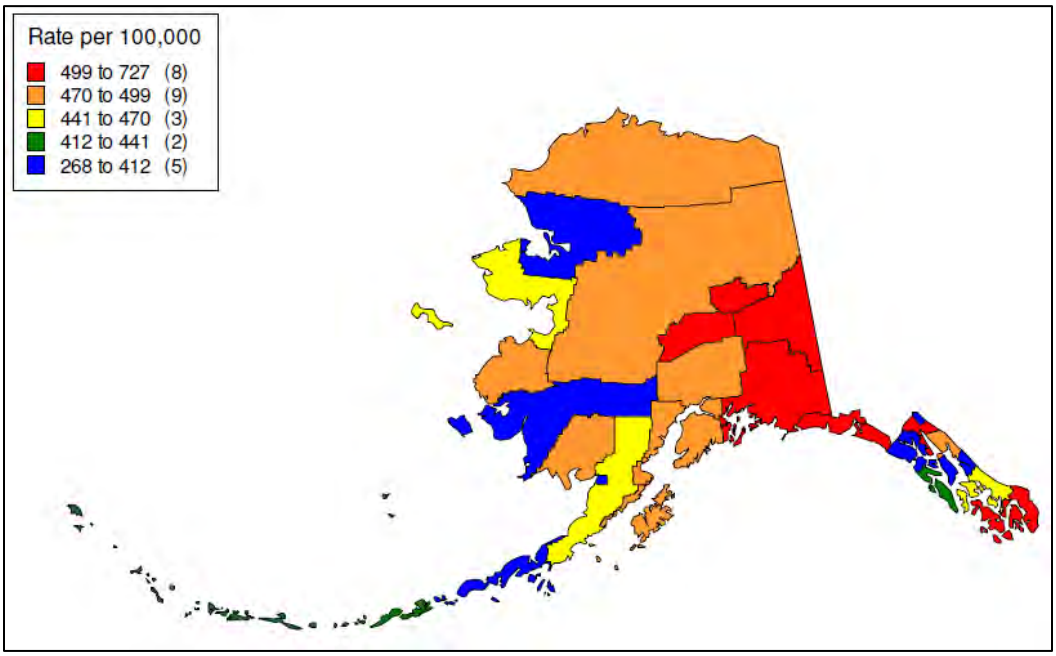
	Alaska Whites		Alaska Natives	
Type of Cancer	**Per 100,000**	**No. of Cases**	**Per 100,000**	**No. of Cases**
1. Lung & Bronchus	49.8	3367	69.9	857
2. Colon and Rectal	14.2	904	35.5	425
3. Misc. Malignant Caners	13.7	892	27.6	335
4. Pancreas	10.8	723	13.3	176
5. Leukemia	7.5	450	4.5	72
6. Non-Hodgkin Lymphoma	7.0	453	4.8	59
7. Esophogus	4.7	341	6.7	84

Source: ADHSS, 2017b

3.17.6.3.1.3. Cancer Incidence

Figure 3.17-4 presents cancer incidence rates by borough or census area, as reported in ADHSS (2008). Cancer incident rates were highest in the FNSB and the Denali Borough (rates of 499-727), followed by the NSB, YKCA, Mat-Su Borough, and the Municipality of Anchorage (rates of 470-499). ADHSS (2008) also presents maps of age-adjusted cancer incident rates by borough/census area over the period 1996 to 2004 for the six types of cancer with the highest incidence.

Figure 3.17-4 Cancer Incidence Rates by Borough/Census Area, 1996-2004



Source: ADHSS, 2008
Note: Small sample sizes for some Borough/Census areas may lead to unstable rates.

Table 3.17-14 and 3.17-15 provides data on cancer incidence rates for Alaska overall, Alaska Whites, Alaska Natives, and the U.S. overall ranked for the leading cancer types in terms of incidence for the years 1996 through 2015 (ADHSS, 2017c). Note that Tables 3.17-15 and 3.17-16 present the same data, with Table 3.17-15 ranked by rate for Alaskan Natives and Table 3.17-16 ranked by rate for Alaska Whites. Cancer types with the highest incident rates during this time period differed slightly between the two populations but similarities included: colon and rectal, lung and bronchus. Cancer incidence rates are significantly higher than the cancer mortality rates because not all types of cancer are fatal and the pattern of relative incidence varies because the probability of survival varies by cancer type.

Table 3.17-15 Cancers Incidence Ranked by Rate for Alaska Natives 1996 - 2015

	Alaska Natives		Alaska Whites	
Type of Cancer	**Per 100,000**	**No. of Cases**	**Per 100,000**	**No. of Cases**
1. Colon and Rectal	102.3	1,293	45.1	3,084
2. Lung and Bronchus	98.1	1,186	70.3	4,659
3. Kidney and Renal	23.6	326	15.9	1,228
4. Stomach	23.4	318	5.5	371
5. Oral and Pharynx	17.2	251	11.5	936
6. Miscellaneous	17.2	208	14.3	923
7. Pancreas	16.4	200	12.2	820

Source: ADHSS, 2017c

Table 3.17-16 Cancers Incidence Ranked by Rate for Alaska Whites

	Alaska Whites		Alaska Natives	
Type of Cancer	**Per 100,000**	**No. of Cases**	**Per 100,000**	**No. of Cases**
1. Lung and Bronchus	70.3	4,659	98.1	1,186
2. Colon and Rectal	45.1	3,084	102.3	1,293
3. Urinary Bladder	27.3	1,751	13.5	157
4. Non-Hodgkin Lymphoma	22.0	1,627	14.8	212
5. Melanoma of the skin	15.9	1,324	2.9	45
6. Kidney and Renal	15.9	1,228	23.6	326
7. Leukemia	14.5	1,018	9.5	168

Source: ADHSS, 2017c

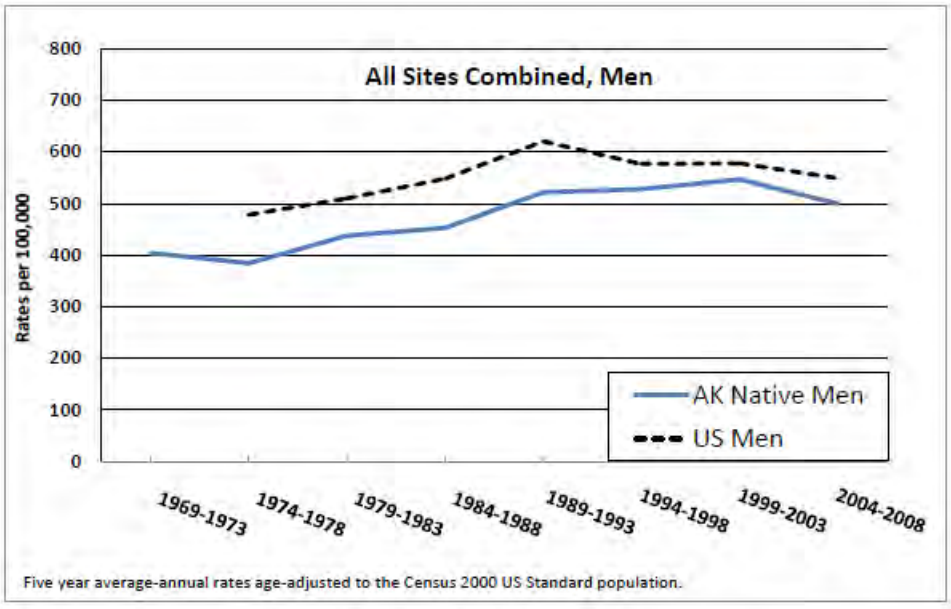
Figures 3.17-5 and 3.17-6 show time trends in age-adjusted cancer incidence rates for Alaska Native men (Figure 3.17-5) and Alaska Native women (Figure 3.17-6) over several 5-year periods, as compared to U.S. Men and U.S. Women.

According to these data:

- Alaska Native males have substantially lower age-adjusted cancer incidence rates than the U.S. White male populations. There is an overall upward trend (increasing incidence) for both populations, but a downward trend (decreasing incidence) in recent years.

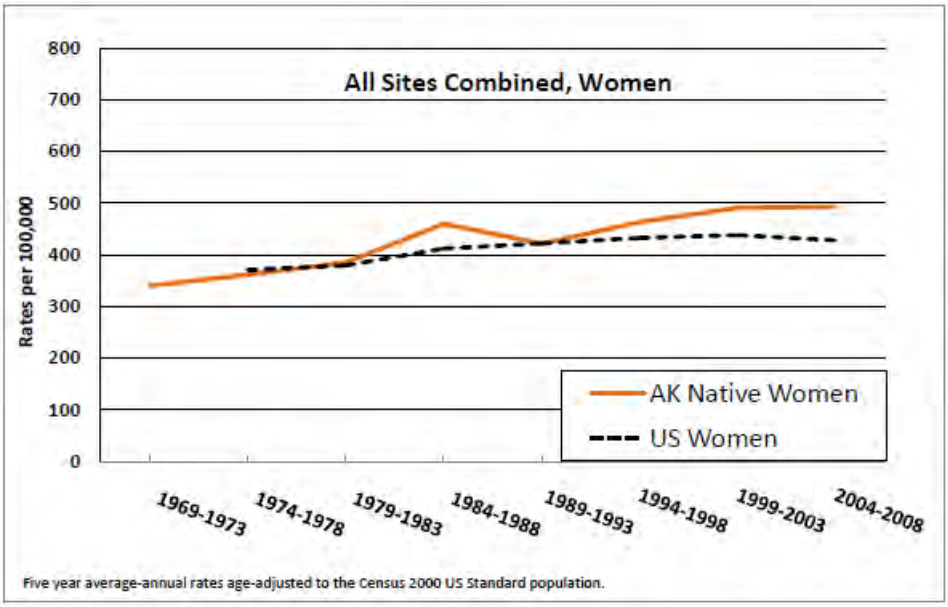
- Alaska Native females have similar age-adjusted cancer incidence rates compared to those found in the U.S. White female population. There is a slight upward trend in age-adjusted incidence rates in each of these populations.
- Throughout most of this time period, Alaska Native males have had slightly higher age-adjusted cancer (all sites) incidence rates than Alaska Native females, though this gap has narrowed in recent years.

Figure 3.17-5 Five-Year Average Annual Age-Adjusted Cancer Incidence Rates Alaska Native Men, 1969-2008 and U.S. Men, 1974-2008



Source: ANTHC, 2012

Figure 3.17-6 Five-Year Average Annual Age-Adjusted Cancer Incidence Rates Alaska Native Women, 1969-2008 and U.S. Women, 1974-2008

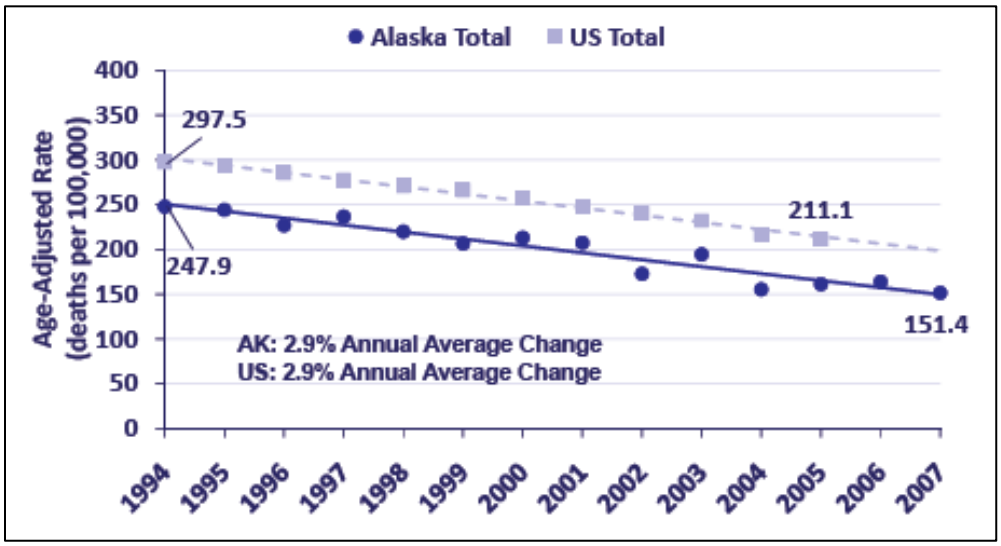


Source: ANTHC, 2012

3.17.6.3.1.4. Heart Disease and Cerebrovascular Disease (Stroke)

More Alaskans die from heart disease and stroke combined than any other cause. Of the approximately 3,500 Alaskans who died in 2007, 766 died from either heart disease or stroke. That translates to more than 3,000 years of productive life lost in a single year due to heart disease and stroke (ADHSS, 2009b). According to the publication Healthy Alaskans 2010 (ADHSS, 2002), heart disease is the second leading cause of death in Alaska, and cerebrovascular disease (stroke) is the fourth leading cause of death in Alaska. Coronary (relating to or denoting the arteries that surround and supply the heart) disease mortality rates in Alaska are higher for men than for women and higher for Alaska Whites than Alaska Natives (ADHSS, 2002). The age-adjusted death rate from diseases of the heart has declined significantly in Alaska since 1994, dropping an average of nearly 3 percent annually through 2007, as indicated by the trend line in Figure 3.17-7.

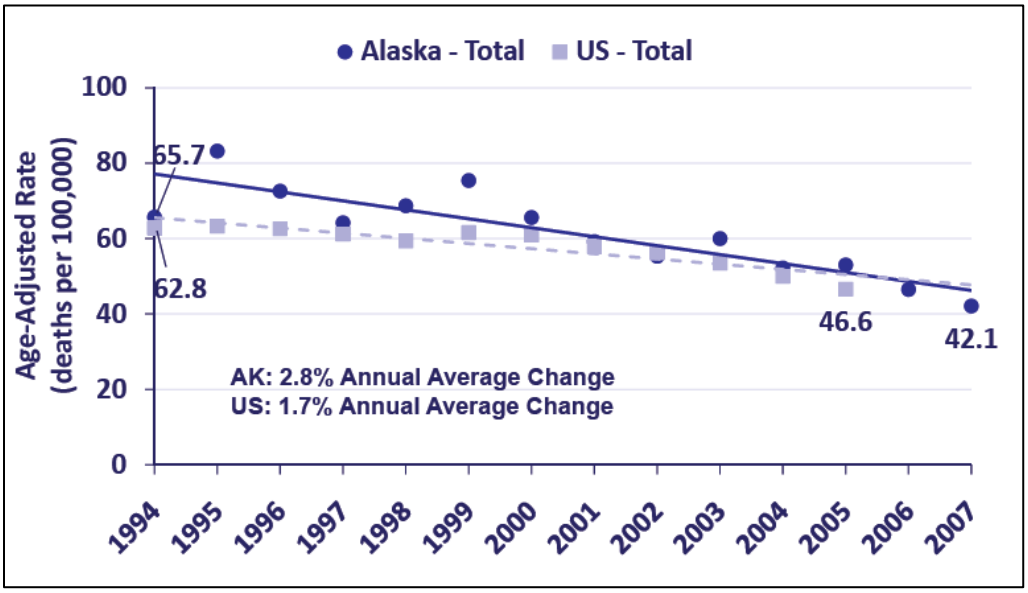
Figure 3.17-7 Trends in Age-Adjusted Rates of Death Due to Diseases of the Heart, Alaska (1994-2007) and U.S. (1994- 2005)



Source: ADHSS, 2009b

As shown in Figure 3.17-8, below, the age-adjusted death rate from stroke in Alaska decreased from 65.7 per 100,000 in 1994 to 42.1 per 100,000 in 2007, for an annual average percent change of 2.8.

Figure 3.17-8 Trends in Age-Adjusted Rates of Death Due to Stroke, Alaska (1994-2007) and U.S. (1994-2005)

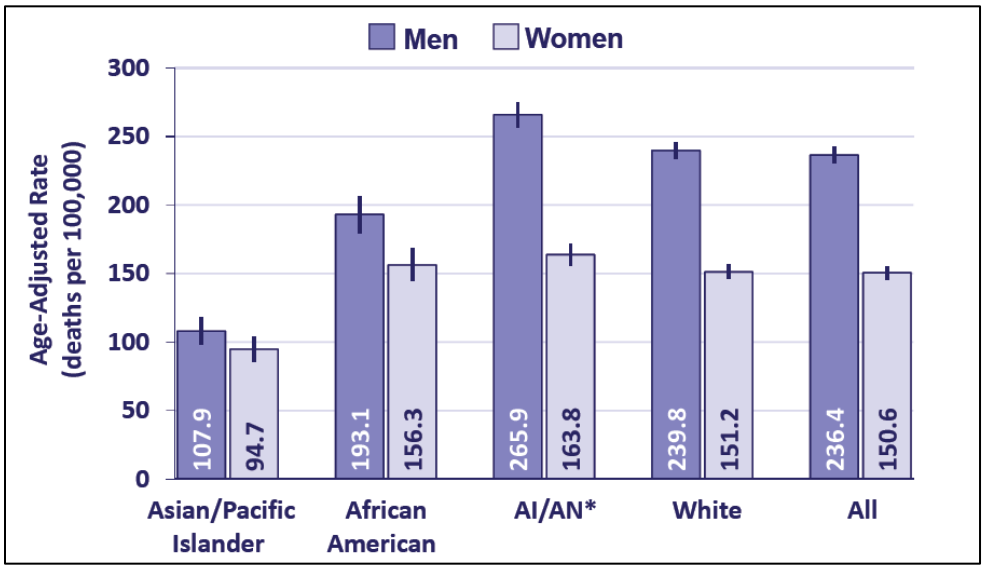


Source: ADHSS, 2009b

During the 14-year period from 1994 to 2007, age-adjusted death rates from diseases of the heart were higher among men compared to women in all racial groups, except

among Asian Pacific Islanders. Among both men and women, the highest age-adjusted rates were seen in American Indian/Alaska Natives (Figure 3.17-9).

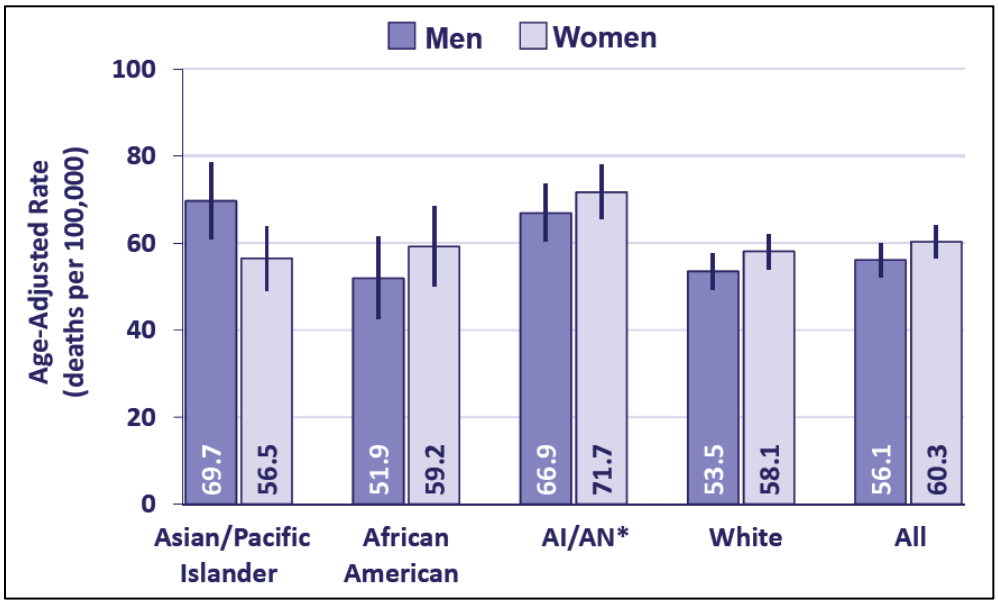
Figure 3.17-9 Age-Adjusted Rates of Death Due to Diseases of the Heart, by Race and Sex, Alaska 1994-2007 (combined)



Source: ADHSS, 2009b
Note: AI/AN- American Indian/Alaskan Native

No significant sex differences were observed in stroke mortality rates, either among all race groups combined or within any single race group (Figure 3.17-10).

Figure 3.17-10 Age-Adjusted Rates of Death Due to Stroke, by Race and Sex, Alaska 1994-2007 (combined)

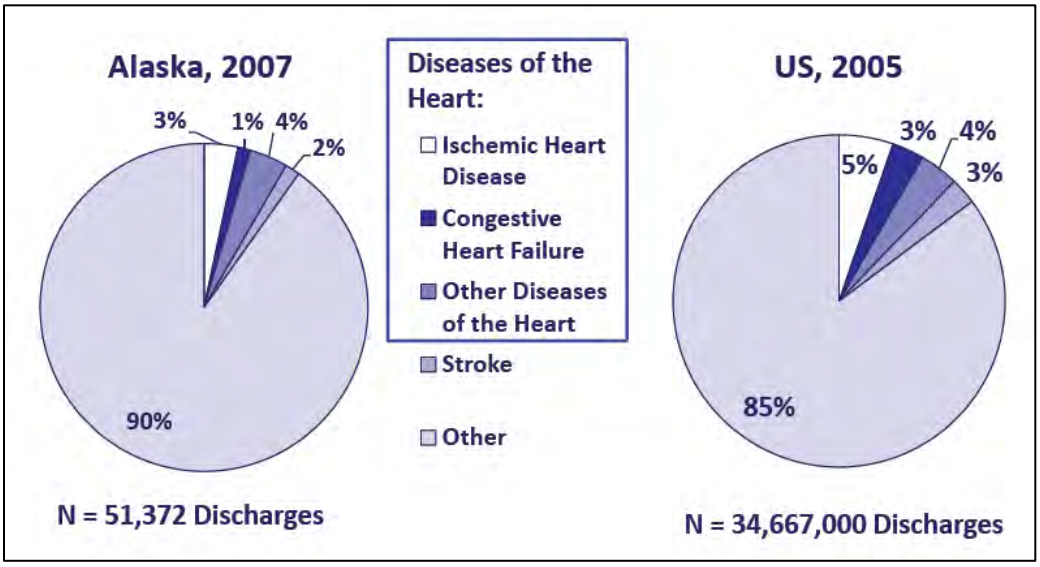


Source: ADHSS, 2009b
Note: AI/AN- American Indian/Alaskan Native

While the number of deaths attributable to heart disease and stroke is reported by the Alaska Bureau of Vital Statistics (ABVS) for the boroughs/census areas, it is difficult to measure the full impact of non-fatal heart disease and stroke in the proposed Project Area, as few population-based morbidity data sources are currently available for analysis (ADHSS, 2009a).

Figure 3.17-11 illustrates Alaska's hospital discharge rates for stroke (2 percent) and heart disease (7 percent) as compared to all discharges in Alaska and the US.

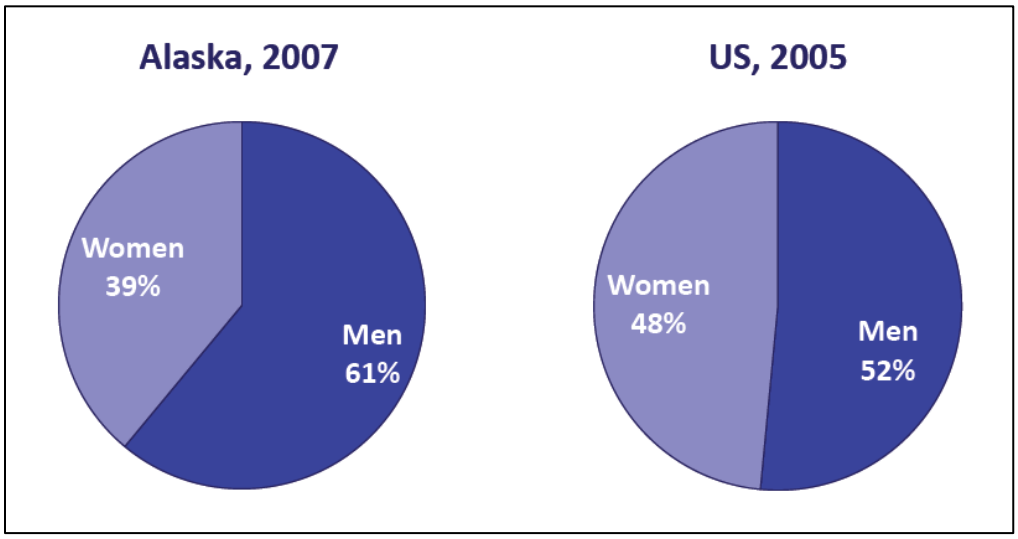
Figure 3.17-11 Heart Disease and Stroke as Primary Hospital Discharge Diagnosis, Alaska 2007, US 2005



Source: ADHSS, 2009b

As shown in Figure 3.17-12, In Alaska there is a significant gender gap in hospital discharges for heart disease and stroke, with males outnumbering females at a level that exceeds their representation in the population at large. In the U.S., both sexes are nearly equally divided.

Figure 3.17-12 Primary Hospital Discharge Diagnosis for Heart Disease and Stroke, by Sex, Alaska 2007, US 2005

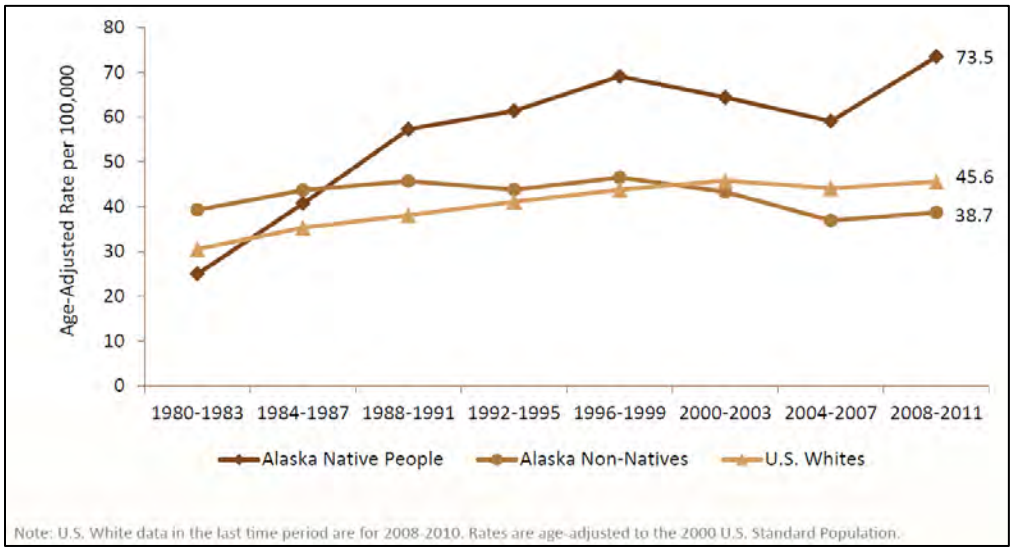


Source: ADHSS, 2009b

3.17.6.3.1.5. Chronic Lower Respiratory Disease

Chronic Obstructive Pulmonary Disease (COPD) mortality rate is the number of deaths due to COPD per 100,000 people of the population. The COPD mortality rate includes deaths from bronchitis, emphysema, and other chronic lower respiratory diseases excluding asthma. Smoking is the primary risk factor for COPD. Figure 3.17-13 shows average annual age-adjusted COPD mortality rates by region for Alaska Natives, Alaska non-Natives, and U.S. Whites (ANTHC, 2011).

Figure 3.17-13 Average Annual Age-Adjusted COPD Mortality Rates per 100,000 Population, 1980-2011



Source: ANTHC, 2011

ANTHC (2011) summarized relevant COPD data for Alaska as follows:

- COPD is the fifth leading cause of death among Alaska Native people, with a mortality rate of 73.5 per 100,000 during 2008-2011.
- Between 1980 and 2011, COPD mortality rates for the Alaska Native population have increased significantly ($p<0.05$) at an average annual increase of approximately 2 percent per year.
- Alaska Native people experienced a COPD mortality rate 1.9 times higher than non-Natives and 1.6 times higher than U.S. Whites ($p<0.01$) in 2008-2011.
- The largest disparities between Alaska Native and non-Native people are seen in the 75+ year age groups.
- The variation in COPD mortality rates by region ranges from a low of 52.8 to a high of 169.4 per 100,000 population.

3.17.6.3.1.6. Diabetes

The percentage of the population of each borough within Alaska diagnosed with diabetes in 2008 ranged from 5.6 to 8.1 percent (age-adjusted), with the NSB reporting the highest percentage. Within the proposed Project Area, the lowest percentages were reported in Denali Borough (6.1 percent), Mat-Su Borough (6.3 percent), and the FNSB (6.4 percent). The YKCA reported a level of 7 percent (CDC, 2011b). Most of these cases were type 2 diabetes, as nationally, according to the National Diabetes Information Clearinghouse (as of 2011) type 2 diabetes accounts for about 90 to 95 percent of all diagnosed cases of diabetes among adults (CDC, 2011b).

3.17.6.3.1.7. Injury

Table 3.17-17 shows the total the number and age-adjusted rates of intentional (suicide and homicide) and unintentional injury fatalities for the PACs and Alaska as a whole (ABVS, 2012). Unintentional age-adjusted death rates are typically much higher than suicide and homicide rates for the various boroughs/census areas and Alaska as a whole.

Table 3.17-17 Intentional and Unintentional Fatal Injuries for Potentially Affected Communities – Number and Age Adjusted Rates[a] by Regional Level for Years 2007-2009

Borough or Census Area	Suicide		Homicide		Unintentional Deaths	
	Number	Rate[a]	Number	Rate[a]	Number	Rate[a]
NSB	9	43.6[b]	1	N/A[c]	16	129.1 [b]
YKCA	9	60.2[b]	3	N/A[c]	20	138.4
FNSB	57	21.7	11	4.3 [b]	106	48.0
Denali Borough	1	N/A[c]	0	N/A [c]	1	N/A [c]
Mat-Su Borough	53	23.2	13	5.0 [b]	117	47.4
State of Alaska	456	22.7	104	5.2	1,025	55.3

Source: ABVS, 2012
a Age-adjusted rates are per 100,000 U.S. year 2000 standard population.
b Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
c Rates based on fewer than 6 occurrences are not reported.

Table 3.17-18 provides a breakdown of unintentional death rates (2007-2009) for the State of Alaska. Table 3.17-19 shows these various causes ranked in descending order of age-adjusted rate (ABVS, 2012). Non-transport age-adjusted rates are higher than for transport accidents and, among non-transport accidents, poisoning rates (which are commonly drug and alcohol overdose) are relatively high compared to the other categories given. The 2012 FEIS also details the role of alcohol in intentional and unintentional injuries within the proposed Project Area (USACE, 2012a).

Table 3.17-18 Unintentional Injury Rates 2007 to 2009, Alaska Total

Broad Category	Sub or Detailed Category	Total Deaths	Age-adjusted Rate [a]
Transport Accidents	Motor vehicle - Other	263	13.2
	Motor vehicle - Snowmachine	48	2.5
	Motor vehicle - ATV	21	1
	Water transport	18	8 [b]
	Air transport	27	1.3
	Other transport	4	N/A [c]
	Total Transport Accidents	**310**	**15.5**
Non-transport Accidents	Falls	73	5.6
	Accidental discharge of firearms	6	3 [b]
	Smoke, fire, and flame	39	1.9
	Drowning and submersion	73	3.6
	Poisoning	348	16.9
	Total Non-Transport Accidents	**715**	**39.8**
	Total	**1,025**	**55.3**

Source: ABVS, 2012
a Age-adjusted rates are per 100,000 U.S. year 2000 standard population.
b Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
c Rates based on fewer than 6 occurrences are not reported.

Table 3.17-19 Unintentional Injury Rates 2007 to 2009, Alaska Total Ranked by Age-Adjusted Rate[a]

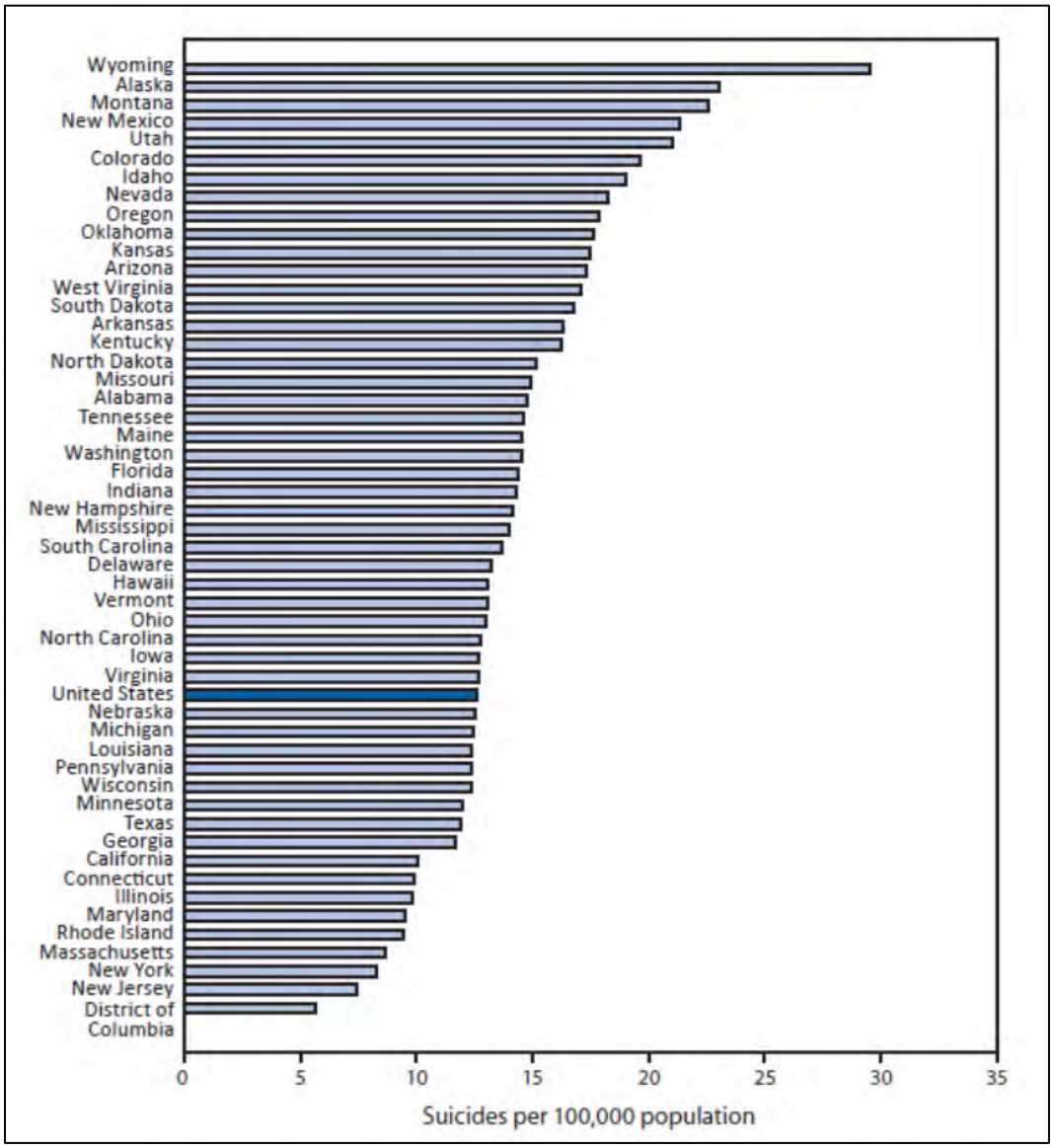
Sub or Detailed Category	Total Deaths	Age-adjusted Rate[a]
Poisoning	348	16.9
Motor vehicle other	263	13.2
Water transport	18	8 [b]
Falls	73	5.6
Drowning and submersion	73	3.6
Accidental discharge of firearms	6	3 [b]
Motor vehicle / Snowmachine	48	2.5
Smoke, fire, and flame	39	1.9
Air transport	27	1.3
Motor vehicle / ATV	21	1
Other transport	4	N/A [c]

Source: ABVS, 2012
a Age-adjusted rates are per 100,000 U.S. year 2000 standard population.
b Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
c Rates based on fewer than 6 occurrences are not reported.

3.17.6.3.1.7.1. Intentional Injuries

Intentional fatal injuries include those that are self-inflicted (suicide) and inflicted by others (homicide). Figure 3.17-14 shows age-adjusted suicide rates by state for 2014 ranked in descending order together with the overall U.S. rate (CDC, 2012a). Alaska had the second highest age-adjusted rate (23.0 per 100,000) among the states, roughly twice the rate for the U.S. as a whole (12.6 per 100,000).

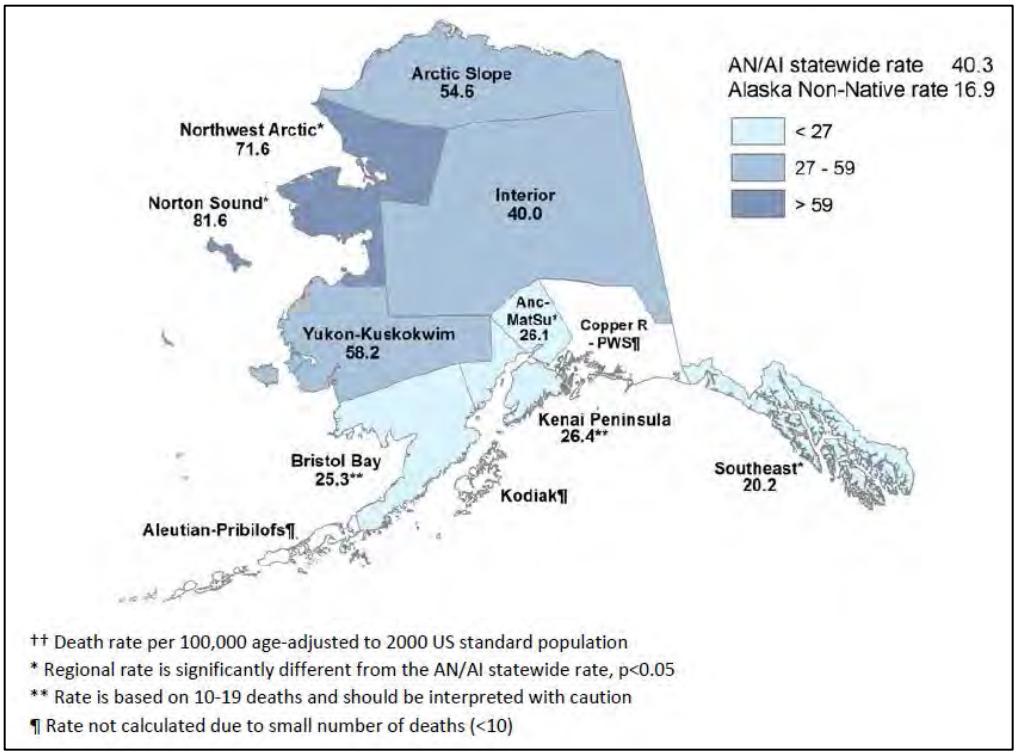
Figure 3.17-14 Age Adjusted Suicide Rates per 100,000



Source: CDC, 2012a

For several years, suicide rates in Alaska have been significantly higher than those for the U.S. as a whole. Figure 3.17-15, below presents a map of age-adjusted suicide death rates for Alaska per 100,000 by borough or census area for the period 2000-2009 (ABVS, 2010b).

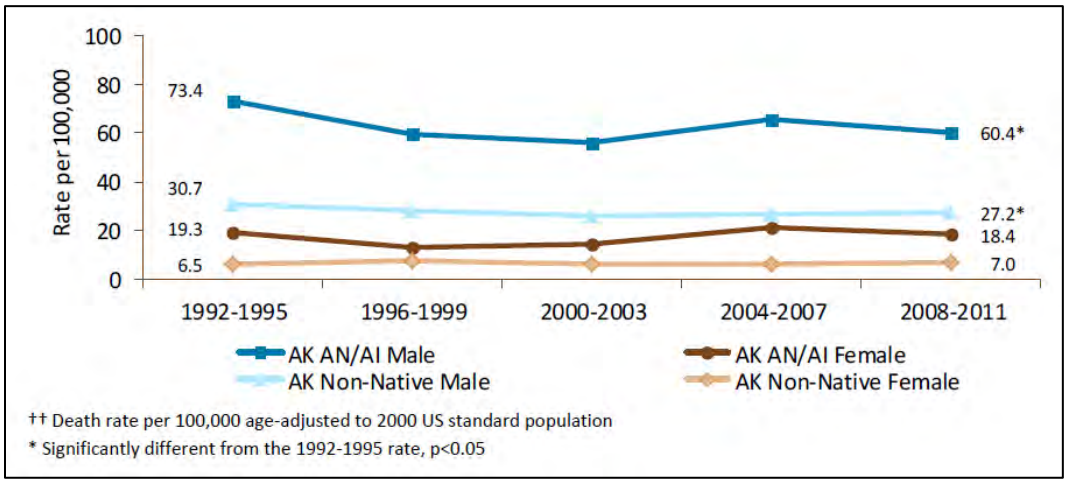
Figure 3.17-15 Suicide Death Rates by Census Area or Borough per 100,000, 2000-2011



Source: ANTHC, 2014

Figure 3.17-16 presents suicide rates over time. Suicide rates have decreased slightly for Alaska Native Males, with the exception of the period between 2004 and 2007.

Figure 3.17-16 Suicide Death Rates by Gender, Race and Year, 1992-2011



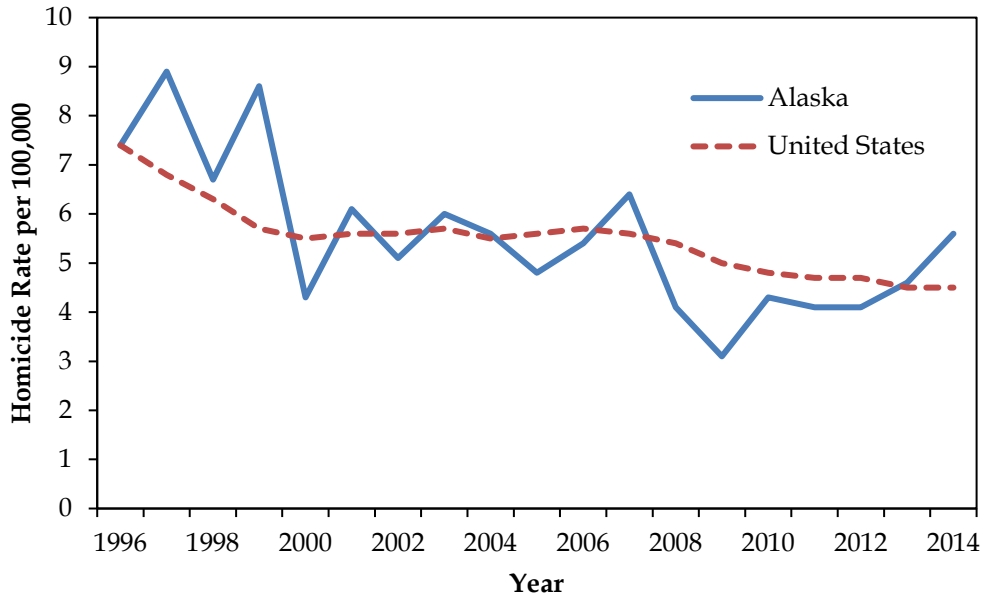
Source: ANTHC, 2014

Suicide rates have increased slightly since 1999 for Alaska Native Females, with the exception of the period between 2008 and 2011, where suicide rates dropped slightly. Suicide rates for non-Natives have remained steady over time. ANTHC provides the following summary of suicide rates in Alaska (ANTHC, 2014):

- During 2002-2011, 478 Alaska Native people died as a result of suicide. This represented 27.8 percent of all injury deaths (1,718).
- Between 1992-1995 and 2008-2011, the suicide death rate decreased 14.4 percent among Alaska Native people (46.4 and 39.7 per 100,000, respectively, $p<0.05$).
- Firearms were the mechanism for over half of the suicide deaths (58.0 percent).
- Alaska Native people aged 20-29 years had the highest suicide death rate of any age group (117.1 per 100,000). The rate for this age group was 2.9 times the age-adjusted rate for all ages (40.3 per 100,000, $p<0.05$).
- Alaska Native males were 3.3 times more likely than Alaska Native females to die from suicide (2002-2011, 63.1 and 19.4 per 100,000, respectively, $p<0.05$).
- Alaska Native people statewide were 2.4 times more likely to die from suicide than non-Natives (2002-2011, 40.3 and 16.9 per 100,000, respectively, $p<0.05$).

Figure 3.17-17, presents the homicide rates per 100,000 for Alaska compared to National rates, for the years 1996-2014. Alaska's homicide rates per 100,000 have been declining and are comparable to nationwide rates. In 2014, Alaska ranked 12th in homicide rate (Death Penalty Information Center, 2016).

Figure 3.17-17 Homicide Rates per 100,000 for the State of Alaska Compared to National Rates 1996–2014



Source: Death Penalty Information Center, 2016

3.17.6.3.1.7.2. Unintentional Injuries

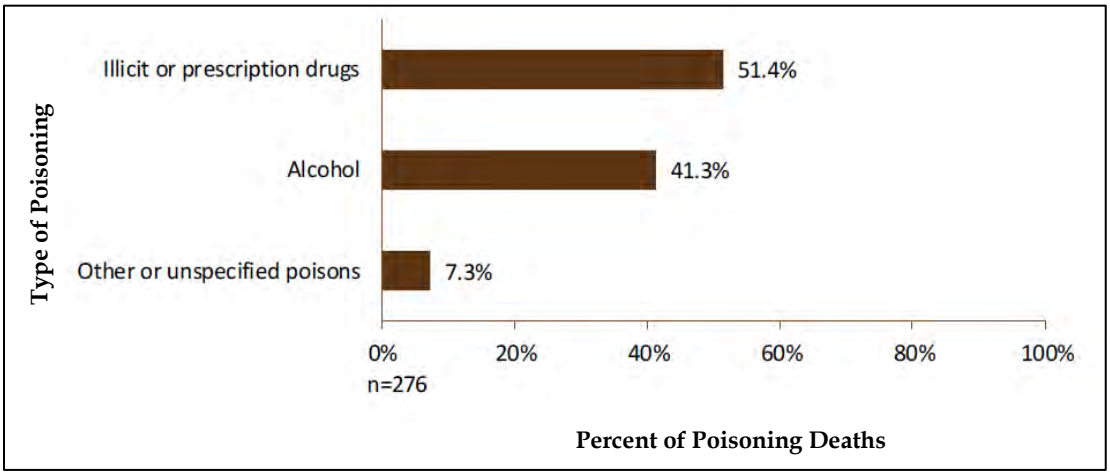
Statewide and throughout the boroughs and census areas of the proposed Project Area, two of the most common causes of unintentional deaths in recent years were poisoning (with the exception of Denali Borough), typically via alcohol or drug overdose, and motor vehicle accidents. Unintentional death caused by drowning and submersion; falls; snowmachine-related deaths; suffocation/choking; air transport accidents; ATV related accidents; exposure to smoke, fire, and flame; and other accidents are also reported (see Table 3.17-20) (ABVS, 2010a). Figure 3.17-18 shows poisonings by type for Alaska Natives from 2002-2011.

Table 3.17-20 Unintentional Injury Deaths for Alaska, 2013

Cause of Death (ICD-10 Codes)	AK Deaths	AK Crude Rate[a]	AK Age-Adjusted Rate[b]
Poisoning (X40-X49)	128	17.4	17.7
Motor Vehicle Accidents [c]	67	9.1	8.9
Falls (W00-W19)	30	4.1	5.5
Drowning and Submersion (W65-W74)	24	3.3	3.5
Air Transport Accidents (V95-V97)	22	3.0	2.9
Suffocation/Choking (W75-W84)	17	2.3*	2.6*
ATV Related Accidents [d]	14	1.9*	1.9*
Water Transport Accidents (V90-V94)	11	1.5*	1.4*
Exposure to Smoke, Fire, Flame (X00-X09)	9	1.2*	1.4*
Snowmachine Related Accidents [e]	9	1.2*	1.2*
Accidental Discharge of Firearms (W32-W34)	2	**	**
Other Transport Accidents	1	**	**
Other Accidental Death	43	5.8	8.0
Total Accidental Deaths	354	48.1	52.4

Source: ADHSS, 2013
a Crude rates are per 100,000 population.
b Age-Adjusted rates are per 100,000 U.S. year 2000 standard population.
c V02-V04,V090,V092,V12-V14,V190-V192,V194-V196,V20-V79,V803-V805,V810-V811,V820-V821,V83-V86,V870-V878,V880-V888
d Deaths to an operator or passenger related to the use of an ATV.
e Deaths to an operator or passenger related to the use of a snowmachine.
* Rates based on fewer than 20 occurrences are statistically unreliable and should be used with caution.
**Rates based on fewer than 6 occurrences are not reported.

Figure 3.17-18 Poisoning Death by Type, Alaska Native People, All Ages, 2002-2011



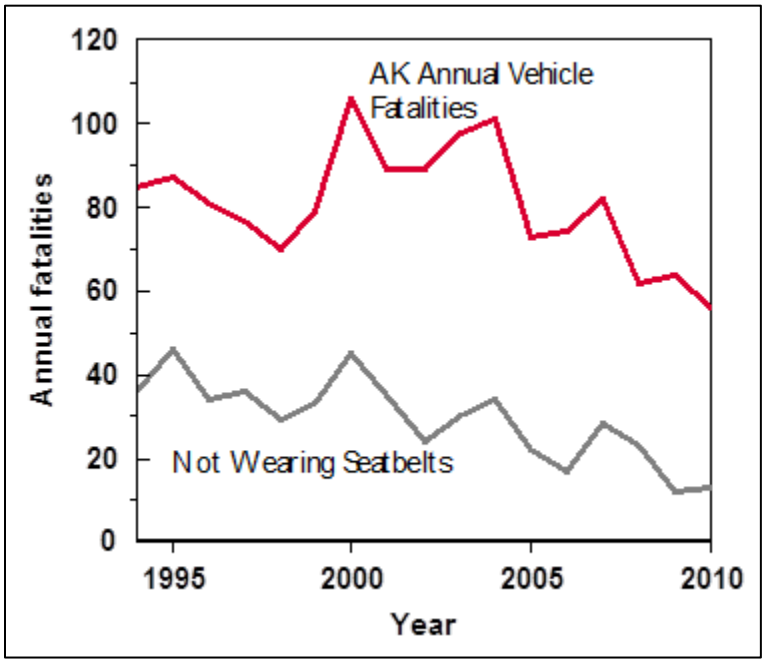
Source: ANTHC, 2014

ANTHC summarizes poisoning deaths as follows (ANTHC, 2014):

- During 2002-2011, 276 Alaska Native people died as a result of unintentional poisoning. This represented 16.1 percent of all injury deaths (1,718).
- Between 1992-1995 and 2008-2011, the unintentional poisoning death rate appears to have increased 360.5 percent among Alaska Native people (8.6 and. 39.6 per 100,000, respectively, $p<0.05$).
- Illicit and prescription drugs were the mechanism for more than half of the unintentional poisoning deaths (51.4 percent).
- Alaska Native people aged 40-49 years had the highest unintentional poisoning death rate of any age group (52.0 per 100,000). The rate for this age group was 1.9 times the age adjusted rate for all ages (27.2 per 100,000, $p<0.05$).
- Alaska Native males and Alaska Native females had similar unintentional poisoning death rates (2002-2011, 25.3 and 22.5 per 100,000, respectively).
- Alaska Native people statewide were 2.4 times more likely to die from unintentional poisoning than non-Natives (2002-2011, 27.2 and 11.5 per 100,000, respectively, $p<0.05$).

Figure 3.17-19, below, shows the number of vehicle fatalities by year from 1994 through 2010 and the number of fatalities not wearing seatbelts. During this time period, on average, 80 persons were killed per year in traffic fatalities on Alaska roads. Among the fatal accidents, 43 percent involved alcohol.

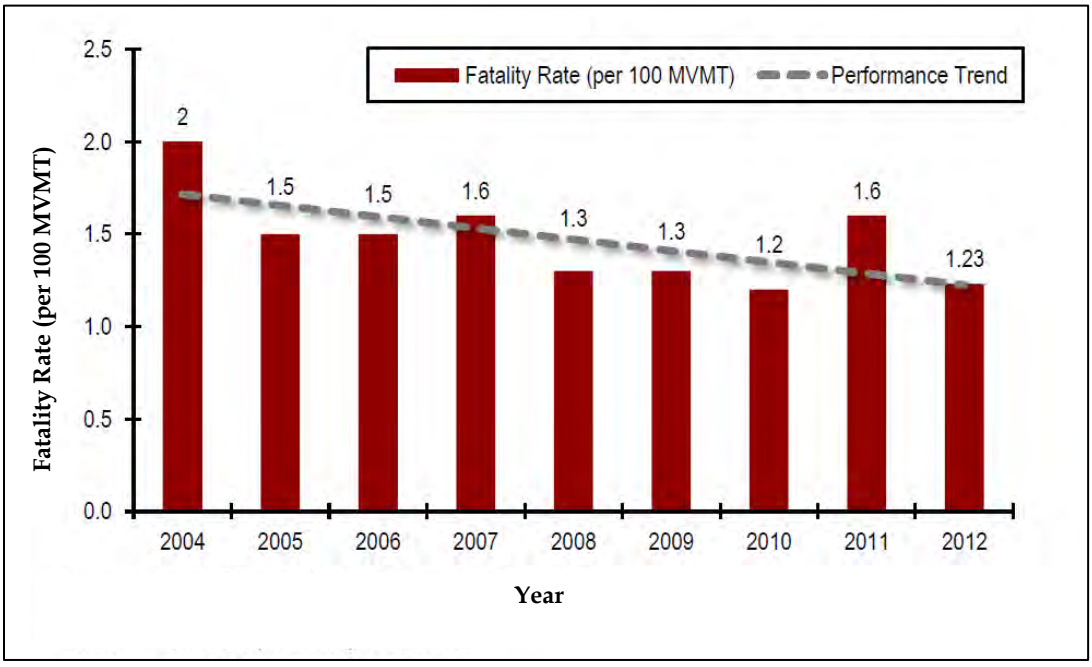
Figure 3.17-19 Annual Vehicle Fatalities & Those Not Wearing Seatbelts in Alaska, 1994-2010



Source: Alaska Highway Safety Office, 2012

Figure 3.17-20, shows fatality rates in Alaska for 2004 to 2012. The trend in Alaska for highway fatality rates has ultimately decreased over this time period.

Figure 3.17-20 Statewide Fatality Rate per 100 Motor Vehicle Miles Traveled

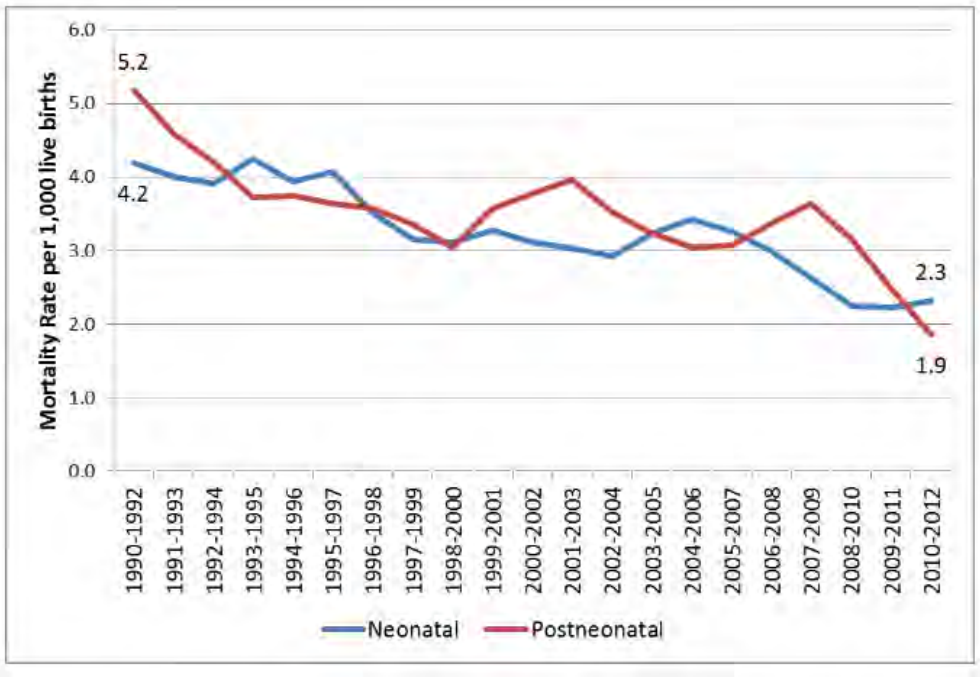


Sources: Alaska Highway Safety Office, 2015; FARS, 2014; 2012 uses preliminary FARS data

3.17.6.3.1.8. Maternal and Child Care

Figure 3.17-21, shows a plot of the neonatal and post-neonatal infant mortality rate for Alaska from 1990 to 2012.

Figure 3.17-21 Alaska Neonatal and Post-neonatal Mortality Rates 1990-2012 (3-Year Moving Averages)



Source: ADHSS, 2012

The following information is provided by the ADHSS Infant Mortality Statistics for Alaska (ADHSS, 2012):

> *In 2012, 58 Alaskans died in infancy: 34 infants were less than 28 days at the time of death (neonatal deaths) and 24 infants were 28 days to 1 year of age at the time of death (postneonatal deaths).*
>
> *In 2012, Alaska's infant mortality of 5.18 per 1,000 live births was ranked 15th among all states and was 15.4 percent lower than the national rate of 5.98 per 1,000 live births. Alaska's neonatal mortality rate of 3.04 per 1,000 live births was the 3rd lowest in the country. Alaska's postneonatal mortality rate of 2.14 per 1,000 live births was ranked 29th among all states.*
>
> *Alaska's infant mortality rates during 2010 and 2011 (3.8 per 1,000 live births for both years) were the lowest ever recorded for the state and were lowest in the nation during those two years. Although Alaska's rate increased in 2012, the rate remained lower than any year prior to 2010.*
>
> *Alaska's infant mortality rate varies by region of the state, with lower rates in the Interior, Anchorage, the Matanuska-Susitna Valley, and the Copper*

River/Kenai Peninsula/Gulf Coast regions, and higher rates in the Northern and Southwest regions.

Historically, Alaska Natives have experienced higher infant mortality rates than non-Natives, though the gap has apparently narrowed over the years (Toffolon-Weiss *et al*., 2008). Comparing risk ratios (RR) between Alaska Native and non-Native infant mortality rates over the period from 1992-2001 the Alaska Maternal-Infant Mortality Review researchers (ADHSS, 2006) concluded that there were several cause specific rate differences that were statistically significant, including sudden infant death syndrome (SIDS) or asphyxia, preterm birth, congenital anomalies, infections, and neglect or abuse (sub-optimal medical care had an elevated RR, but was not statistically significant in this study).

CDC (2012b) reported results of an epidemiological study of postneonatal mortality among Alaska Native infants over the period from 1989 through 2009, these findings are detailed in the 2012 FEIS. In addition, The data presented in the Alaska Maternal and Child Health Data Book (MCH) published by the State of Alaska H&SS (Young *et al*., 2011) help to 'explain' some of the differences between Alaska Native and non-Native infant mortality rates, related to demographics, reproductive health, prenatal health, prenatal substance abuse, maternal health, infant health, child health, and childhood home environment. This study (Young *et al*., 2011) is also summarized in the 2012 FEIS.

3.17.6.3.1.9. Infectious Diseases

This section addresses infectious diseases including sexually transmitted infections, (including chlamydia, gonorrhea, and human immunodeficiency virus [HIV]/acquired immunodeficiency syndrome [AIDS]) and infectious respiratory bacterial or viral illnesses of frequent occurrence in the North Slope and/or Interior regions of the state as determined in the ADHSS Reportable Infectious Diseases in Alaska 2010-2014 Summary.

3.17.6.3.1.9.1. Sexually Transmitted Infections

According to the CDC 2015 State Health Profile for Alaska (CDC, 2015), chlamydia rates are substantially higher for Alaska than the U.S. as a whole. Alaska had the highest chlamydia infection rate in the nation in 2013, with a rate of 789.4 per 100,000 persons.

In Alaska, chlamydia rates reported for American Indian or Alaska Native people are greater than for Whites (CDC, 2011c); rates are also higher for young people, and for women (ADHSS, 2011a). In 2013, reported rates of chlamydia among women (1,113.3 cases per 100,000) that were 2.3 times greater than those among men (491.8 cases per 100,000).

Rates of gonorrhea are also substantially higher for Alaska than in the U.S. In 2010, Alaska's rate of gonorrhea was the second highest in the country. In 2013, Alaska ranked fourth among the 50 states in gonorrheal infections (154.2 per 100,000 persons) (CDC, 2015). As with chlamydia, rates of gonorrhea infection are disproportionately high for women (CDC, 2010b), for American Indian or Alaska Native people (ADHSS, 2011b),

and young adults (CDC, 2010b). Of the 1,135 gonorrhea cases reported in 2013, 771 (68 percent) were in persons aged 20 to 35 years; 594 (52 percent) were in females, and 541 (48 percent) cases were in males (ADHSS, 2014b). During 2013, Alaska experienced a 55 percent increase in gonorrhea cases reported over 2012. The gonorrhea infection rates increased in persons of all races, with the highest increases occurring among African Americans and Asian/Pacific Islanders.

The prevalence of HIV/AIDS in the Alaskan population is low (ADHSS, 2010b). In 2013, an estimated 24 adults and adolescents were diagnosed with HIV in Alaska. Alaska ranked 46th among the 50 states in the number of HIV diagnoses in 2013 (CDC, 2015). From 1982 to 2010, the majority of HIV/AIDS diagnoses occurred in the Anchorage/Mat-Su area, with approximately 80 percent of the cases occurring in what the Alaska HIV/STD Program refers to as "Urban Centers," which include the Municipality of Anchorage and the FNSB (ADHSS, 2010c). The PACs of College, Ester, and Fairbanks occur within these more high-risk Urban Centers. The HIV infection case count in Fairbanks remained stable from 2007 through 2010 and then spiked in 2011. A total of 9 cases of HIV were reported to Alaska Section of Epidemiology between January 1, 2011 and January 31, 2012 (ADHSS, 2014). The remaining PACs lie within "Urban Satellites," "Rural Hubs," or "Rural Areas," which individually account for less than 10 percent of the total HIV/AIDS diagnoses in Alaska.

An ongoing syphilis outbreak, first reported in 2010, persists in Alaska. In 2015, 20 cases of syphilis were reported which represents a 50% decrease from 2014 data (ADHSS, 2016). From 2011 to 2015, the state received an average of 1,189 reports annually of hepatitis C virus (HCV) infection, with 1,542 new reports of HCV infection in 2015 (ADHSS, 2016). These data represent newly reported cases of either acute cases or chronic cases. Rates of HCV reports were highest in the Southeast, Gulf Coast, and Southwest regions (ADHSS, 2016).

3.17.6.3.1.9.2. Infectious Respiratory Bacterial or Viral Illnesses

The Alaska Section of Epidemiology conducts heightened influenza surveillance from October through May, when most influenza activity is occurring; nationally, peak flu activity typically occurs in December or later (ADHSS, 2015b). Methicillin-resistant *Staphylococcus aureus* (MRSA) also typically occurs at rates similar to those seen elsewhere in the U.S.; however, Alaska Natives are more likely to experience methicillin-resistant *Staphylococcus aureus* infection than other groups (ADHSS, 2009a). According to ADHSS:

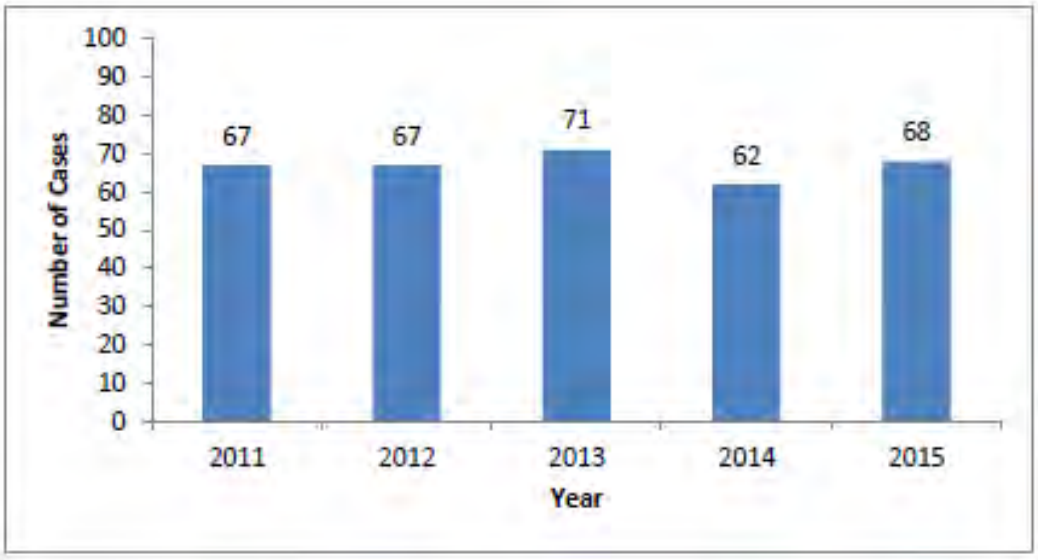
> *Invasive Haemophilus influenzae Type a (Hia) infection has become an important public health problem in Alaska, particularly among Alaska Native children. During 2002 to 2013, the incidence of Hia among children aged less than 1 year living in the Yukon-Kuskokwim Delta region (318.6 per 100,000) was 17 percent higher than the incidence of Hib among all Alaska children aged less than 1 year in 1990 (272.8 per 100,000), the year before the Hib vaccine was*

available in Alaska. Moreover, the Hia rates in Alaska are considerably higher than the U.S. estimated rate of 2.4 per 100,000 for all non-b Hi serotypes, as reported by CDC's Active Bacterial Core Surveillance program for 2011.

Figure 3.17-22 provides reported cases of Tuberculosis by Year, in Alaska, from 2011–2015. According to the ADHSS Reportable Infectious Diseases in Alaska 2011-2015 Summary:

In 2015, 68 cases of tuberculosis (TB) were reported to the Alaska Tuberculosis Control Program, for a rate of 9.2 cases per 100,000. This was the highest rate in the United States in 2015, well above the nationwide rate of 3.0 cases per 100,000. The Southwest and Northern regions of Alaska traditionally have the highest rates of TB, and Alaska Natives and Asians/Pacific Islanders bear a disproportionate burden of TB in Alaska (ADHSS, 2016).

Figure 3.17-22 Report of Tuberculosis by Year — Alaska, 2011-2015



Source ADHSS, 2016

During an outbreak of pertussis (whooping cough) in 2012 and 2013, 358 and 308 cases, respectively, were reported in Alaska. This is significantly greater than the prior years reported cases of 45 and 26 in 2010 and 2011, respectively. The majority of cases affected those in the age group of 0-4, followed by those in the age groups 10-14 and 5-9. Age groups older than 14 years reported significantly fewer cases (ADHSS, 2016). Other states reported increased levels of reported pertussis during this same time.

3.17.6.3.2. Other Baseline Health Data

3.17.6.3.2.1. Oral Health

A 2008 CDC survey indicated that Alaska residents visited a dental clinic in the previous 12 months at nearly the same rate as the national rate (CDC, 2010a). Oral health problems are pronounced among low-income and Alaska Native populations (Indian Health Service, 1999).

3.17.6.3.2.2. Gender-Based Violence and Child Abuse

Alaska has among the highest rates of domestic violence in the nation. At 73.3 cases per 100,000, Alaska has the highest rate of forcible rape of any state in the U.S., nearly 2.5 times the national average of 31.8 cases per 100,000 (CDVSA, 2010). Alaska also has the highest homicide rate for females killed by a male perpetrator, with a rate of 2.87 per 100,000 in 2003. Alaskan children are frequently victims of sexual abuse in a cycle that perpetuates high overall domestic violence rates: the sexual assault rate for Alaskan children is six times the national average. Sexual violence is similarly elevated within the Alaska Native population. For example, in 2006, 31 percent of American Indian or Alaska Native people surveyed as part of a DPHSS study had experienced intimate partner violence in their lifetime, compared to 20.2 percent among Whites surveyed (Utermohle and Wells, 2006). The prevalence of domestic violence and sexual assault in Alaska is accompanied by a shortage of victim services (National Coalition Against Domestic Violence, 2010).

In 2013, national data for comparison purposes is only available for a few of the population indicators on the Alaska dashboard for key issues impacting domestic violence and sexual assault in Alaska (CDVSA, 2015). They include the following:

- Percentage of Alaska high school students experiencing sexual violence in their lifetime was 9.3 percent, compared to 7.3 percent of high school students in the U.S.
- Rate of reported and substantiated child abuse and neglect was 130.1 per 10,000 children (ages 0 to 17) in Alaska, compared to 91.3 per 10,000 children in the U.S.
- Rate of rape reported to law enforcement was 12.5 per 10,000 in Alaska, compared to 3.4 per 10,000 in the U.S.

3.17.6.3.2.3. Exposure to Hazardous Materials

Baseline information for exposure to hazardous materials is described in terms of the baseline health indicators described in Section 3.17.6.3. Water and Sanitation

All wastewater and solid waste associated with construction and construction camps would be managed according to ADEC regulations and under permits obtained from the department, minimizing potential impact to water resources within or adjacent to PACs. The baseline availability, use, and quality of surface water supplies are described in Section 3.3.5., Surface Water, and are summarized below. AGDC's *2010 Lake Studies*

Completion Report, Prudhoe Bay to Galbraith Lake (AGDC, 2011a), provides lake areas and maximum depth for 32 lakes with potential water availability for water withdrawal. The results of the 2010 study are provided in Table 3.3-3. See Section 3.7, Fish, Table 3.7-1, and Figure 3.7-1 for additional characteristics of selected lakes within the Arctic Hydrological Subregion. The location (latitude/longitude and nearest pipeline MP), and type for all surface waters within the study corridor are provided in Appendix J (Fish Stream List). Appendix G includes a supplement to the 2012 FEIS waterbody crossing table and includes any waterbodies that are within 0.25 mile of the current pipeline route that are beyond the original 1-mile buffer

Surface water use is dependent on the surrounding population and activities occurring in that area. USGS compiles data on current water use in the U.S. at the county level (borough or census area) (USGS, 2010b). Table 3.3-4 illustrates the 2005 (most recent) estimated fresh surface water withdrawal data for the boroughs and census areas along the proposed Project ROW, in MG/day. Drinking water protection areas traversed by the proposed pipeline route are provided in Appendix G of the 2012 FEIS.

Surface water quality data are sparse in Alaska. Some sources include EPA's ETT (formerly the Significant Non-Complier list), USGS, and ADEC Division of Water. The ETT is a tool created by EPA to help state Drinking Water Programs track public water systems that are deemed by EPA to be significantly out of compliance with SDWA regulations. USGS provides information on Alaska's rivers and streams, groundwater, and water quality, and operates the most extensive satellite network of stream-gauging stations in the state (USGS, 2011c). Note that the ETT is not necessarily indicative of water quality. While a permit violation may imply that surface water quality is affected, it is not a direct indication of the quality of the surface water.

ADEC's Division of Water role is to protect and improve water quality in Alaska by establishing standards for keeping water clean, regulating discharges into waters and wetlands, and monitoring and reporting on water quality (ADEC, 2011). ADEC's Drinking Water Program requires public water systems (both surface water and groundwater) in the State of Alaska to comply with drinking water regulations in 18 AAC 80 in accordance with the federal SDWA (ADEC, 2017b). ADEC is not responsible for overseeing private water systems. As of January 2016, the there are no public water systems (sourced primarily by surface water) within 15 miles of the proposed Project (ADEC, 2016b). Sections 3.3.5.4.1 (Arctic), 3.3.5.4.2 (Interior-Yukon), and 3.3.5.4.3 (Southcentral) of this SEIS describe the surface water quality for each hydrologic subregion in the proposed Project Area.

The baseline availability, use, and quality of groundwater water supplies is described in 3.3.6, Groundwater, and is summarized below.

Groundwater is readily available throughout most of Alaska, except in areas of thick permafrost. The ADNR's WELTS (ADNR, 2011a) was used to obtain well yield and depth to groundwater. Most of Alaska's aquifers consist of unconsolidated materials derived from glaciers, rivers, and streams. The aquifers that produce groundwater are

usually unconfined (*i.e.*, not covered by a layer of silt or clay). In permafrost-free areas, the groundwater table generally follows surface topography. The depth to groundwater varies from a few feet to more than 400 feet across Alaska (ADEC, 2008a). WELTS provides information on private wells by meridian, township, range, and section. The information includes owner, date of completion, depth, well status, date of entry, and sometimes remarks. The remarks sometimes provide the well yield and depth to groundwater. The WELTS information found within the proposed Project Area is discussed in detail in Section 3.3.6.1.

Similar to surface water uses, groundwater use is dependent on the surrounding population and activities in the area. Groundwater is a source for 83 percent of Alaska's 1,602 public drinking water systems (ADEC, 2008a). In general, groundwater in Alaska is suitable for domestic, agriculture, aquaculture, commercial, and industrial uses with moderate or minimal treatment (ADEC, 2010). USGS provides information on groundwater withdrawals in *Estimated Use of Water in the United States in 2010* Maupin *et al*., 2014). Table 3.3-13 illustrates the 2005 USGS data on groundwater withdrawals for the boroughs and census areas in the proposed Project Area.

Groundwater quality data are sparse in Alaska. Sections 3.3.6.1, 3.3.6.2, and 3.3.6.3 describe known groundwater (including availability, use, and quality) for each hydrologic subregion in the proposed Project Area. Additional concerns regarding groundwater quality are related to arsenic, contaminated sites, and groundwater recharge areas (STB, 2011). ADEC is not responsible for overseeing private water systems. Rather, the owner of a private well is responsible for the water quality and its safety for drinking. EPA rules do not apply to private wells (although some state rules do); therefore, EPA recommends that well owners have their water tested annually (EPA, 2012a).

3.17.6.3.2.4. Health Services Infrastructure and Capacity

There are nine hospitals in the Project Area: five in the Municipality of Anchorage, two in Fairbanks, and one each in Palmer and Utqiagvik. The largest is Providence Alaska Medical Center in Anchorage, with 326 acute care beds as of 2014. All Alaska hospitals use some telemedicine applications to compensate for the cost and transportation obstacles facing patients who live in communities without hospitals (Alaska State Hospital and Nursing Home Association, 2014). Health clinics or federally qualified health centers offering primary care are located in the majority of other communities within the Project Area. Trauma cases and serious illness cases that occur in these communities must be sent to hospitals. Transport in emergency situations usually is by airplane or helicopter. Communities with hospitals that provide air medical services include Anchorage, Fairbanks, Palmer, and Utqiagvik. If a helicopter is required, medevacs can cost $100,000 or more, depending on the distance and route. The average cost of medical evacuation in Alaska with a fixed wing aircraft exceeds $22,000 (Schoenfeld 2013; Alaska Federal Health Care Partnership, 2016). Many Alaska residents have added supplements to their regular insurance plans to cover this service. Most

communities in the Project Area provide emergency medical services, often through local volunteer fire departments. The staff, equipment, and other resources of many of these local volunteer fire departments are limited (ADHSS 2015b).

Table 3.17-21 provides an overview of medical services available within the PACs.

Table 3.17-21 Medical Services in the PACs

Community Name	Borough or Census Area	Hospitals	Health Clinics and Federally Qualified Health Centers	Emergency Medical Services		
				Local Service Available	Level (see notes)	Access (see notes)
Prudhoe Bay	NSB	No	Fairweather Deadhorse Medical Clinic/Prudhoe Bay Operations Center	Greater Prudhoe Bay Fire Dept.	2-Isolated	lh, c, ap
Wiseman	YKCA	No	Wiseman Health Clinic	No	1-Isolated	lh, a, r, s
Coldfoot	YKCA	No	No	Coldfoot Volunteer Fire/EMS Dept.	1-Isolated	hw, a
Livengood	YKCA	No	No	[1]Ester Volunteer Fire Department	1-Isolated	hw, a
Ester	FNSB	No	No	No	1-Highway	hw, a, s
College	FNSB	No	No	[1]Chena-Goldstream Fire & Rescue	3	hw, ap, sp
Goldstream	FNSB	No	No	Chena-Goldstream Fire and Rescue; Fairbanks Fire Dept.; and others	—	—
Fairbanks	FNSB	Fairbanks Memorial Hospital; Bassett Army Community Hospital	Interior Community Health Center; Chief Andrew Isaac Health Center; and others	Nenana Volunteer Fire/EMS Dept.	4	hw, ap, sp
Nenana	YKCA	No	Nenana Clinic	Anderson Fire Dept./EMS	2-Highway	hw, r, ap
Anderson	Denali Borough	No	No	Denali National Park Ambulance	1-Isolated	hw, a, s

Community Name	Borough or Census Area	Hospitals	Health Clinics and Federally Qualified Health Centers	Emergency Medical Services		
				Local Service Available	Level (see notes)	Access (see notes)
Healy	Denali Borough	No	Healy Clinic; Tri-Valley Community Center	Denali National Park Ambulance	2-Isolated	hw, a
McKinley Park	Denali Borough	No	No	Denali National Park Ambulance	1-Isolated	hw, a
Cantwell	Denali Borough	No	Cantwell Clinic	Cantwell Volunteer Ambulance	1-Isolated	hw, a, hp
Talkeetna	Mat-Su Borough	No	Sunshine Community Health Center	Talkeetna Volunteer Fire/EMS Dept.	2-Highway	hw, a, hp
Trapper Creek	Mat-Su Borough	No	No	Trapper Creek EMS	1-Highway	hw, a
North Susitna	Mat-Su Borough	No	No	No	—	—
Willow	Mat-Su Borough	No	Willow Clinic	Willow Volunteer Fire/EMS Dept.	1-Highway	hw, a
Big Lake	Mat-Su Borough	No	No	Big Lake Volunteer Fire/EMS Dept.	2-Highway	hw, a, s
Point MacKenzie	Mat-Su Borough	No	No	No	—	—
Wasilla	Mat-Su Borough	No	Mat-Su Health Services; Providence Matanuska Health Care	Matanuska-Susitna Borough EMS	2-Highway	lh, m, c, fp,

Sources: Alaska LNG, 2017a; ADHSS, 2007
1-Isolated: Limited air or marine highway access to a Level 3 or higher community; road access exceeds 60 miles.
1-Highway: Limited air or marine highway access to a Level 3 or higher community; year-round, 60 minute or less road access.
2-Isolated: Marine highway or daily air access to closest Level 3 or higher community; air service to Level 1 communities in area.
2-Highway: Marine highway or daily air access to closest Level 3 or higher community; year-round, 60 minute or less road access.
3: Daily airline service to Level 3, 4 & 5 communities; air service to Level 1 & 2 communities in area; road or marine highway access all year.
4,5: Daily airline service to Level 2, 3, 4 & 5 communities; road or marine highway access all year.
Access
hw: Linked to the Alaska highway network throughout the year.
sh: Linked to the Alaska highway network during the summer only.
lh: Outlying roads but no linkage to the Alaska highway network.

m: Linked by the Alaska marine highway system.
dglm: Occasional marine highway service.
c: Ocean access without linkage to the marine highway system.
r: Along a river used as a primary transportation route (boating, winter ice road).
l: Along a lake used as a primary transportation route (boating, winter ice road).
a: Authorized landing area with small plane capacity only.
ap: Authorized landing area with regular, scheduled commercial air service.
sp: Designated landing area for float planes (seaplanes).
fp: Landing area available for float planes (seaplanes).
h: Landing area available for helicopters.
"hp: Designated landing area for helicopters.
A "—" indicates that the measure is unavailable.

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3.18. Air Quality

3.18.1. Introduction

This section discusses air quality related requirements in the proposed Project Area. The following information is a combination of air quality information provided in the 2012 FEIS as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the 2012 FEIS. The description of air quality summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

The proposed Project would include construction and operation of access roads, a gas conditioning facility, meter stations, MLVs, and pig launcher/pig receiver facilities. In addition, during construction, mobile and stationary construction camps would be used.

3.18.2. Summary

The baseline data provided in the 2012 FEIS for climate and ambient air pollutant concentrations remain valid for this SEIS. Section 3.18.3 provides an overview of air quality regulatory requirements applicable to the proposed Project during pipeline construction and operation. The proposed Project would intersect three of the five major climate zones of Alaska: the transition zone, the continental zone, and the arctic zone. Site-specific ambient air quality monitoring data are not available in the proposed Project Area, so representative data and representative locations are provided to characterize the background air quality. Available background air quality data confirm that pollutant concentrations in the proposed Project Area comply with the respective National Ambient Air Quality Standards (NAAQS) and Alaska Ambient Air Quality Standards (AAAQS). A summary of the background air quality concentrations is presented in Table 3.18-6, Section 3.18.5.

The only nonattainment areas in Alaska are Fairbanks for $PM_{-2.5}$, and Mendenhall Valley (Juneau) and Eagle River for PM_{-10}. The air quality attainment status for the proposed Project Area is either attainment or unclassifiable/attainment for each of the criteria pollutants, with one exception: the proposed Project's Fairbanks Lateral route would cross into the FNSB nonattainment boundary and would require a General Conformity Determination (EPA, 2011). See Section 3.18.3.12 for further discussion.

3.18.3. Regulatory Requirements

The CAA and its implementing regulations (42 U.S.C. 7401 et seq., as amended in 1977 and 1990) are the basic federal statutes and regulations governing air pollution in the U.S. Table 3.18-1 provides a quick reference of air quality regulations and requirements discussed in this section as well as applicability to the ASAP Project.

Table 3.18-1 Summary of Air Quality Regulations & Requirements Applicable to the ASAP Pipeline

Requirement	Subject (Yes/No)	Other Comments
Title I Visibility Protection Program: Regional Haze	Yes	The proposed Project would likely be subject to the Regional Haze Rule because there are planned camps with potential fossil-fuel combustion sources (PM_{-10}, $PM_{-2.5}$, VOCs, SO_2, nitrogen oxides [NOx]) located within 100 km (62.5 miles) of a Class I area (Denali Nation Park). Regional Haze modeling would need to be performed.
Best Available Retrofit Technology (BART) Rule	No	The proposed Project would not be subject to the BART Rule because the source was not built between 1962 and 1977.
Title I New Source Review (NSR)/Prevention of Significant Deterioration (PSD) Permits	Yes	PSD permit required, as emissions are greater than 250 tons per year (TPY). See Appendix L, Attachment I, for emission estimates.
Title I Minor Permits	Yes	Must comply with preconstruction permits under NSR program.
Title IV Acid Rain	No	Applies to electrical generation using fossil-fired units over 75 MW. Facility has 29 MW of generation capacity.
Title V Operating Permits	Yes	Emissions greater than the Title V operating permit thresholds (100 short tons per year [stpy]) – See Appendix L, Attachment I, for emission estimates.
Title I: New Source Performance Standards (NSPS)	Yes	Must Comply with NSPS Standards Examples that would apply: Subpart A, IIII, KKKK etc. - See Appendix L, Attachment I, for emission estimates.
Title III: National Emission Standards for Hazardous Air Pollutants (NESHAPs) / Maximum Achievable Control Technology (MACT)	Yes	Must comply with NESHAP Standards Subpart YYYY, DDDDD 6C, etc. – See Appendix L, Attachment I, for emission estimates.
Title II: Mobile Source Regulations	Yes	These requirements are imposed on the manufacturers of the engines. New non-road diesel engines must meet Tier 3 emission standards.
Alternative Low-Sulfur Diesel Fuel Transition Program for Alaska	Yes	The proposed Project would be located in parts of urban and rural Alaska, and would be required to comply with the ultra-low sulfur diesel requirements.
Title III: Accidental release prevention program: Chemical Accident Prevention Provisions	No	Would not apply; however, further analysis and confirmation are recommended as the design becomes more finalized.
Compliance Assurance Monitoring (CAM)	Yes	Part of Title V Permit requirement.
General Conformity Rule; and greenhouse gases (GHG)	Yes	Proposed Project emissions are below *de minimis* threshold of 100 TPY; ADEC letter stating exception, non-requirement (provided as Appendix L, Attachment II [ADEC, 2016c]).

3.18.3.1. National Ambient Air Quality Standards

Ambient air quality is regulated by federal, state, and local agencies. EPA has established NAAQS for six criteria pollutants: particulate matter (PM_{-10} particulates and $PM_{-2.5}$ particulates), sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and lead (Pb). The NAAQS were developed to protect human health (primary standards) and human welfare (secondary standards). State air quality standards cannot be less stringent than the NAAQS. Alaska has adopted and/or proposed ambient air quality standards, Alaska Ambient Air Quality Standards (AAAQS), which are the same as the NAAQS for all criteria pollutants. Alaska also has standards for two additional pollutants: ammonia and reduced sulfur compounds. Table 3.18-2 lists the NAAQS and AAAQS for the six criteria pollutants.

Table 3.18-2 National and Alaska Ambient Air Quality Standards

Pollutant	Time Frame	Primary	Secondary
PM_{-10}	Annual	Revoked	Revoked
	24-hour[b]	150 µg/m^3	150 µg/m^3
$PM_{-2.5}$	Annual	12 µg/m^3	15 µg/m^3
	24-hour[e]	35 µg/m^3	35 µg/m^3
SO_2	Annual	0.030 ppm (80 µg/m^3)	NA
	24-hour[b]	0.14 ppm (365 µg/m^3)	NA
	3-hour[b]	NA	0.5 ppm (1,300 µg/m^3)
	1-hour[a]	75 ppb (196 µg/m^3)	NA
CO	8-hour[b]	9 ppm (10,000 µg/m^3)	NA
	1-hour[b]	35 ppm (40,000 µg/m^3)	NA
NO_2	Annual	0.053 ppm (100 µg/m^3)	0.053 ppm (100 µg/m^3)
	1-hour[c]	0.100 ppm	NA
O_3	8-hour[d]	0.070 ppm (149 µg/m^3)	0.070 ppm (149 µg/m^3)
	1-hour	Revoked	Revoked
Pb	3-month rolling	0.15 µg/m^3	0.15 µg/m^3
	Quarterly	1.5 µg/m^3	1.5 µg/m^3

Sources: EPA, 2015a ADEC, 2016d
a Standard is attained when the 3-year average of the annual, 99th percentile, daily maximum, one-hour concentration is less than or equal to 75 ppb, or 196 µg/m3.
b Not to be exceeded more than once a year.
c Standard is attained when the 3-year average of the annual, 98th percentile, daily maximum, one-hour concentration is less than or equal to 100 ppb, or 188 µg/m3.
d Standard is attained when the 3-year average of the annual fourth-highest daily maximum eight-hour average ozone concentration is less than or equal to 0.070 ppm.
e Standard is attained when the 3-year average of the annual 98th percentile 24-hour concentration is less than or equal to 35 µg/m3.

ppm = Part(s) per million
ppb = Part(s) per billion
µg/m3 = microgram(s) per cubic meter

3.18.3.2. Regional Haze

The federal CAA contains requirements to protect and improve visibility in national parks and wilderness area in the country. In 1977, Congress designated certain national parks and wilderness areas as Class I areas, where visibility was identified as an important value. Currently there are 156 Class I areas in the country. Alaska has four Class I areas, including Denali NPP, Tuxedni Wilderness Area, Simeonof Wilderness Area, and Bering Sea Wilderness Area.

The Regional Haze Rule establishes specific State Implementation Plan (SIP) requirements and strategies to adopt when implementing a plan. States must develop long-term plans for reducing pollutant emissions that contribute to visibility degradation and establish goals aimed at improving visibility in Class I areas. The SIP must address haze caused by all sources of pollutants that impair visibility including haze resulting from smoke, vehicles, electric utility and industrial fuel burning, and other activities that generate pollution. Among the required elements of the SIPs, states must include determinations of BART to improve visibility in specially protected areas. BART requirements apply to facilities built between 1962 and 1977 that have the potential to emit more than 250 TPY of a visibility-impairing pollutant.

The proposed Project would not be subject to BART as the source was not built between 1962 and 1977. The proposed Project would likely be subject to the Regional Haze Rule because there are planned camps with potential fossil-fuel combustion sources (PM10, 2.5, VOCs, SO_2, NOx) located within 100 km (62.5 miles) of a Class I area (Denali Nation Park). Regional Haze modeling would need to be performed. Furthermore, EPA and federal land managers responsible for managing Class I areas generally require visibility impact analysis during the NSR/PSD permitting process for new, large emissions sources potentially impacting these areas (see Section 3.18.3.3, below).

3.18.3.3. Title I New Source Review (NSR) / Prevention of Significant Deterioration (PSD) Permits

The NSR permitting program was established as part of the 1977 Clean Air Act Amendments (CAAA). NSR is a preconstruction permitting program that ensures air quality is not significantly degraded from the addition of new or modified major emissions sources. In poor air quality areas, NSR ensures that new emissions do not inhibit progress toward cleaner air. In addition, the NSR program ensures any large, new, or modified industrial source would be as clean as possible, and use the best available pollution control. The NSR permit establishes what construction is allowed, how the emission source is operated, and which emission limits must be met. The four types of NSR permitting include Best Available Control Technology (BACT) analysis, Minor Permits, PSD Permits, and Nonattainment NSR permits.

BACT analysis would be required for the air permit application. ADEC would ultimately decide which regulations apply and which control technology must be used on the equipment to satisfy BACT requirements. The proposed Project would require a

BACT analysis for the GCF because it would be a major source of criteria pollutants and would have a potential to emit greater than 75,000 stpy of CO_2-equivalent (CO_2-e).

The 2015 EED provides an appendix with the GCF Regulatory Review and BACT Analysis. The document was prepared to provide AGDC with a draft of the permit application sections. Comments from this document will be incorporated into the permit application.

For minor permits for pollutants from stationary sources that do not require PSD or nonattainment NSR permits, states are able to customize the requirements of the minor NSR program under a fully approved SIP. ADEC is the lead air permitting authority for the proposed Project. ADEC's air permitting requirements are codified in the 18 AAC 50, Air Quality Control. The AAC incorporates the federal program requirements listed in Section 40 CFR 50-99 and establishes permit review procedures.

PSD permits are required for major sources that are either new or are being significantly modified in an attainment area. Requirements include:

- For a new major source, the PSD threshold level is 100 TPY for sources classified in one of the 28 named source categories listed in Section 169 of the CAA, and 250 TPY for any other type of source, and/or
- For a source that is major for at least one regulated pollutant (*i.e.,* is subject to PSD review), all pollutants that are emitted in amounts equal to or greater than the significant emission rates are also subject to PSD review (*i.e.,* 40 TPY NOx, 100 TPY CO, 40 TPY SO_2, 15 TPY PM_{-10}, 10 TPY $PM_{-2.5}$, 40 TPY VOCs).

Nonattainment NSR permits are required for major sources that are either new or being significantly modified in a nonattainment area. Requirements include:

- For a new major source, the nonattainment NSR threshold level is 100 TPY; and/or
- For a source that is major for at least one regulated pollutant (*i.e.*, is subject to nonattainment NSR review), all pollutants that are emitted in amounts equal to or greater than the significant emission rates are also subject to nonattainment NSR review (*i.e.*, the significant emission rates vary depending on the severity of the nonattainment area and specific pollutant).

For areas that meet the NAAQS, EPA established the PSD program in 40 CFR 52.21 for major new air emissions sources and major modifications to existing major sources of air pollution. ADEC adopted PSD requirements in 18 AAC 50.035 and 18 AAC 50.306. The proposed facility is located in an attainment area under the NAAQS, and the PSD program requirements would apply to the proposed Project.

According to both the federal and ADEC regulations, the proposed GCF would be a major stationary source for PSD if it has the potential to emit more than 250 stpy of any regulated NSR pollutant. The proposed Project would be subject to PSD review because potential facility NOx and CO emissions would be greater than the 250-stpy PSD threshold.

For facilities qualifying for PSD review, a further comparison is required between potential emissions and the PSD significance level for each NSR pollutant. For any pollutant where annual potential emissions are expected to exceed the significance level, a PSD analysis must be performed. As presented in Table 3.18-3, it is expected that GCF emissions would exceed the PSD significance level for all regulated NSR pollutants except SO_2. For those NSR pollutants not included in Table 3.18-3, emissions of these pollutants are either not associated with the proposed Project or would be well less than the significant emission rate presented in 40 CFR 52.21.

Table 3.18-3 Potential Emissions Compared to Permitting Thresholds

Pollutant	Total PTE (stpy)	Title V Major Source Threshold (stpy)	PSD Significance Level[a] (stpy)
NO_x	789	100	40
CO	588	100	100
$PM/PM_{10}/PM_{2.5}$	52	100	25/15/10
SO_2	5.2	100	40
VOC	172	100	40
HAP	11	25 total/10 individual	--
CO_2-e	1,030,000	100,000[b]	--

a HAPs are not a regulated NSR pollutant under the Alaska PSD program.
b Only applies if source already major for another pollutant.

Attainment areas are areas that comply with federal and/or state air quality standards, and are described in detail in section 3.18.6. Under PSD permitting rules, attainment areas are categorized as Class I, Class II, or Class III. Each classification has a defined level of pollutant concentrations (SO_2, NO_2, and PM) that can be added after a baseline date. Class I areas were established primarily as certain national parks and wilderness areas (those above a certain size), and receive special protections under the CAA to help maintain pristine air quality. If a new source or major modification to an existing source is subject to the PSD program requirements and is within 62 miles (100 km) of a Class I area, the facility is required to notify the appropriate federal officials and assess the impacts of the proposed Project on the Class I area. If a major source proposing to locate at a distance greater than 62 miles (100 km) is of such size that the reviewing agency is concerned about potential emission impacts on a Class I area, the reviewing agency can ask the Applicant to perform an analysis of the source's potential emissions impacts on the Class I area. According to 18 AAC 50.015: Air Quality Designations, Classifications, and Control regions, Class I areas in Alaska include:

- Denali National Park, including the Denali Wilderness, but excluding the Denali National Preserve;
- Bering Sea National Wildlife Refuge designated as a National Wilderness Area;
- Simeonof National Wildlife Refuge designated as a National Wilderness Area; and
- Tuxedni National Wildlife Refuge designated as a National Wilderness Area.

Class II areas allow for a higher level of air quality degredation (the Class II PSD increment is higher than the Class I increment); these areas include all other geographic areas in Alaska not classified as Class I or Class III. Class III designations, allow even higher level of air quality degredation and are intended for heavily industrialized zones, can be made only on request and must meet all requirements outlined in 40 CFR 51.166. There are currently no Class III areas in Alaska. Regardless of Class I/II/III status, all areas must attain the NAAQS, or the delegated agency must plan to attain the NAAQS.

If emissions from any of these stationary sources associated with the proposed Project result in emissions greater than the PSD major source threshold (250 TPY as long as the source is not in a listed category), then PSD permitting would be required. In that instance, a federal Class I area impact assessment may also be required based on the distance of the PSD major source to the nearest Class I area. See Chapter 4, Environmental Consequences, for further analysis and applicability.

3.18.3.4. Title I Minor Permits

The State of Alaska requires minor permits under the AAC, Title 18, Chapter 50, Article 5. The regulations provide procedures to ensure construction or modification of a stationary source would not cause a violation of a NAAQS or any applicable portions of the control strategy. Alaska's minor NSR program was originally approved into the SIP by EPA on July 5, 1983, and has been revised several times. Under the current minor

permit program, ADEC specifies source categories and size thresholds that need a permit, assuming a major/PSD permit is not needed. A minor permit is required to construct a new stationary source with a potential to emit greater than the following size thresholds: 15 TPY of PM_{-10}; 40 TPY of NOx; 40 TPY of SO_2; 0.6 TPY of lead; or 100 TPY of CO within 10 km of a nonattainment area. ADEC has also established thresholds for determining when a source needs a minor permit before a modification: 10 TPY of PM_{-10}; 10 TPY of NOx; 10 TPY of SO_2; or 100 TPY of CO within 10 km of a nonattainment area.

The proposed Project would include construction and operation of a gas conditioning facility, meter stations, MLVs, and pig launcher/pig receiver facilities. In addition, during construction, stationary construction camps would be used. If emissions from any of these stationary sources result in emissions greater than the minor permit thresholds, then minor permitting would be required. See Chapter 4, Environmental Consequences, for further analysis and applicability.

3.18.3.5. Title V Operating Permits

Title V of the federal CAA requires individual states to establish an air operating permit program. The requirements of Title V are outlined in 40 CFR 70 and 71, and the permits required by these regulations are often referred to as 70 or 71 permits. Alaska Title V Operation Permit regulations are included in 18 AAC 50, Article 3. The permit covers all air pollution requirements that apply to the source, including emissions limits and monitoring, record keeping, and reporting requirements. It also requires that the source annually report its compliance status with respect to permit conditions to the permitting authority. Operating permits (also known as Title V permits) are required for all major stationary sources. What constitutes a major source varies according to what pollutants are being emitted and the attainment designation of the area where the source is located. In general, a source is considered major for Title V if it emits or has the potential to emit 100 TPY or more of any criteria air pollutant, 10 TPY or more of any hazardous air pollutant (HAP), or 25 TPY or more total HAPs.

If emissions from stationary sources associated with the proposed Project result in emissions greater than the Title V operating permit thresholds, then Title V permitting would be required. Subsequently, a complete Title V permit application would be required no later than 12 months after the date on which the stationary source became subject to AS 46.14.120(b) (*i.e.,* within 12 months after construction of a major source). See Chapter 4, Environmental Consequences, for further analysis and applicability.

3.18.3.6. New Source Performance Standards (NSPS)

The NSPS, codified at 40 CFR 60, established requirements for new, modified, or reconstructed units in specific source categories. NSPS requirements include emission limits, monitoring, reporting, and record keeping. The proposed Project is as described in the last paragraph of the Regulatory Requirements section above. EPA adopted standards for new air pollution sources in 40 CFR 60. The standards relevant to the proposed GCF are discussed in detail in this section.

3.18.3.6.1. 40 CFR 60, Subpart A – General Provisions

Certain provisions of 40 CFR 60, Subpart A apply to the owner or operator of any stationary source subject to a NSPS. The proposed Project would be subject to several NSPSs; therefore, GCF would be required to comply with the provisions of Subpart A, including notification and record keeping, testing, and monitoring requirements. ADEC has a 20 percent opacity limit during advisories and episodes; the Fairbanks Plan also has opacity ordinances. Generally, a 20 percent opacity due to air pollutants leaving the property is considered a violation of air pollution regulations.

3.18.3.6.2. 40 CFR 60 Subpart Dc

Standards of performance for small industrial-commercial-institutional steam generating units for which construction, modification, or reconstruction commenced after June 9, 1989 and that has a maximum design heat input capacity of 29 megawatts (MW) (100 million British thermal units per hour [MMBtu/hr]) or less, but greater than or equal to 2.9 MW (10 MMBtu/hr).

3.18.3.6.3. 40 CFR 60 Subpart Db

Standards of performance for industrial-commercial-institutional steam generating units for which construction, modification, or reconstruction commenced after June 19, 1984 and that has a maximum design heat input capacity of greater than 29 MW (100 million MMBtu/hr).

Standards of performance for commercial and industrial solid waste incineration units, for which construction commenced after November 30, 1999, or for which modification or reconstruction commenced on or after June 1, 2001, would apply if solid waste incineration is used.

3.18.3.6.4. 40 CFR 60 Subpart IIII

The proposed emergency generators would be subject to 40 CFR 60, Subpart IIII. All of the proposed generators are diesel-powered Tier 4 EPA-certified engines that meet the requirements in 40 CFR 1039. These engines would meet or exceed the emission standards required under Subpart IIII. This subpart requires compliance with 40 CFR 60.4200, which establishes standards for non-road compression ignition engines, including the use of ultra-low sulfur diesel.

The EPA has promulgated emission standards for manufacturers of internal combustion engines and mobile diesel equipment, including generators. They have also required fuel providers to lower sulfur content of fossil fuels, thus reducing the formation of sulfur dioxide.

3.18.3.6.5. 40 CFR 60 Subpart KKKK

Subpart KKKK applies to newer stationary combustion turbines manufactured after February 18, 2005, with greater than 10-MMBTU/hr heat input. The proposed stationary

combustion turbines for the GCF exceed this threshold and are subject to the emission limits, and the compliance, monitoring, testing, and reporting requirements of Subpart KKKK.

Subpart KKKK provides specific emission limits for those turbines located north of the Arctic Circle. The location of the GCF would qualify under this distinction, since it would be located at above latitude 66.5°north. The applicable NOx emission limit for each of the combustion turbines would be 96 ppm at 15 percent Oxygen (O_2). Emissions of SO_2 are also regulated under the subpart. SO_2 emissions must be limited to 90 pounds per megawatt-hour gross output, or the turbines must burn fuel that contains a maximum of 0.60 pounds SO_2/MMBTU heat input. Compliance with the subpart's SO_2 limit would be met through use of fuel containing less than the required sulfur content.

Subpart KKKK requires compliance with NOx emissions either with or without the use of water (H_2O) or steam injection. Initial feasibility indicates that injection of H_2O or steam is not a feasible method for NOx reduction for the GCF. If further examination determines that this is a feasible option, then compliance may be demonstrated by installing, calibrating, and operating a Continuous Monitoring System (CMS). The CMS may be engaged to record fuel consumption and the ratio of H_2O or steam to fuel, or it can be a continuous emission monitoring system. For those facilities not complying with the NOx emission limit through H_2O or steam injection, compliance with the emission limit may be demonstrated through annual performance tests. Alternatively, a CMS or a Continuous Parameter Monitor (CPM) may be installed to continuously monitor NOx and a diluent gas (O_2 or carbon dioxide [CO_2]) to determine the hourly NOx emission rate. The parameters to be continuously monitored if opting for the CPM are those parameters representative of NOx emissions, which is dependent on the type of turbine and NOx control being used.

The GCF may opt to determine the sulfur content of the turbines' combustion fuel by monitoring the sulfur content of the fuel or by engaging a fuel with a maximum rating of 0.60 pounds SO_2/MMBTU. If compliance is to be demonstrated through use of a fuel meeting the maximum rating, then retention of fuel quality characteristic records or representative fuel sampling data may be used to demonstrate compliance.

EPA is considering an amendment to the current Subpart KKKK requirements to include emission limitations, monitoring, general compliance requirements, and reporting for CO_2 emissions from stationary combustion turbines with a heat input of 250 MMBTU/hr or more. The proposed GCF combustion turbines are less than 250 MMBTU/hr; therefore, the proposed changes would not apply.

3.18.3.6.6. 40 CFR 60, Subpart OOOO

Crude Oil and Natural Gas Production, Transmission, and Distribution - EPA established VOC and SO_2 emission standards, monitoring, testing, and reporting provisions under Subpart OOOO for facilities engaged in crude oil and natural gas production, transmission, and distribution. The proposed Project is a natural gas

processing facility that would engage the Fluor Corporation (Fluor) Solvent Process. This process is proprietary, and assurances have been provided by the manufacturer and process design team that the equipment and configuration would not be subject to Subpart OOOO. There are not adequate details regarding the Fluor Solvent Process to determine if 40 CFR 60, Subpart OOOO is applicable.

3.18.3.6.7. 40 CFR 60.18, General Control Device Requirements

EPA established operational and design requirements for all new flares used for compliance with 40 CFR 60. Specifically, it requires that such flares operate without visible emissions, have a pilot flame, and meet specific fuel quality standards. The proposed Project would have four flares, and compliance with 40 CFR 60.18 would be required if it is determined that Subpart OOOO is applicable.

3.18.3.6.8. 40 CFR 60, Subpart KKK

EPA established equipment leak standards for onshore natural gas processing plants constructed after January 20, 1984, and on or before August 23, 2011. The GCF would be constructed after August 23, 2011; therefore, Subpart KKK does not apply.

3.18.3.7. Title III: National Emission Standards for Hazardous Air Pollutants (NESHAPs) / Maximum Achievable Control Technology (MACT)

NESHAPs, codified in 40 CFR 61 and 63, regulate HAP emissions. Part 61 was promulgated prior to the 1990 CAAA and regulates only eight types of hazardous substances (asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride). The proposed Project does not appear to include facilities that fall under any one of the source categories regulated by Part 61; therefore, the requirements of Part 61 would not be applicable.

The 1990 CAAA established a list of 189 additional HAPs, resulting in the promulgation of Part 63. Also known as the MACT standards, Part 63 regulates HAP emissions from major sources of HAPs and specific source categories that emit HAPs, as well as certain minor or "area" sources of HAPs. Part 63 regulates any source with the potential to emit 10 TPY of any single HAP or 25 TPY of HAPs in aggregate as a major source of HAPs. The proposed Project would include construction and operation of a gas conditioning facility, meter stations, MLVs, and pig launcher/pig receiver facilities. In addition, during construction, stationary construction camps would be used. As discussed previously and shown in Table 3.18-3, ASAP would not have the potential to emit 10 stpy of any Individual HAP (iHAP) or a total of 25 stpy of all HAPs combined (tHAP). Hence, the GCF would not be considered a major HAP source; instead, for NESHAP applicability, it is considered an area source of HAP emissions. Typical NESHAP applicability for similar source categories includes, but is not limited to the following:

- 40 CFR 63, Subpart CCCCCC – Area Sources: Gasoline Dispensing Facilities - The requirements established by EPA under NESHAP Subpart CCCCC are applicable to

gasoline dispensing facilities (GDFs) at area sources of HAP emissions. The subpart establishes work practice standards and requirements for testing, monitoring, notifications, records, and reporting. The GDF to be installed at the permanent camp would have a throughput of less than 10,000 gallons per month, and as such, the requirements under Subpart CCCCCC are minimal and include work practice standards and record keeping. There are no requirements for testing, notifications, or reporting for GDFs with a monthly throughput less than 10,000 gallons per month.

- 40 CFR 63 Subpart ZZZZ – For new diesel-powered engines, requirements of Subpart ZZZZ are met by compliance with 40 CFR 60, Subpart IIII.
- 40 CFR 63 Subpart DDDDD – National emission standards for HAPs for major sources: industrial, commercial, and institutional boilers and process heaters. The GCF is not a major HAP source, so this subpart would not apply.

AGDC would need to conduct an applicability determination for each emission unit after all equipment is selected to ensure compliance with the limits, monitoring, record keeping, and reporting of the NESHAPs in 40 CFR 61 and 63.

3.18.3.8. Title II: Mobile Source Regulations

Gasoline and diesel engines must comply with EPA mobile source regulations in 40 CFR 86 for on-road engines and 40 CFR 89 and 90 for non-road engines. These regulations are designed to minimize emissions.

The proposed Project would use both on-road and non-road engines that would have to comply with the mobile source regulations. These requirements are imposed on the manufacturers of the engines.

3.18.3.9. Title III: Chemical Accident Prevention Provisions

The chemical accident prevention provisions, codified in 40 CFR 68, are federal regulations designed to prevent the release of hazardous materials in the event of an accident and to minimize potential impacts if a release did occur. The regulations contain a list of substances and threshold quantities for determining applicability to stationary sources. If a stationary source stores, handles, or processes one or more substances on this list in a quantity equal to or greater than specified in the regulation, the facility must prepare and submit a Risk Management Plan. If a facility does not have a listed substance onsite, or if the quantity of a listed substance is below the applicability threshold, the facility does not need to prepare a Risk Management Plan.

The Chemical Accident Prevention Provision/Risk Management Plan (40 CFR 68) would apply if listed substances at threshold quantities are included in the proposed Project. Consequently, upon further design implementation, AGDC would need to conduct stationary source applicability determinations with the Chemical Accident Prevention Provision/Risk Management Plan regulations in 40 CFR 68 to ensure compliance.

Assessment of the chemicals and quantities to be stored, handled, and processed indicate that Risk Management Plan requirements would not apply to the GCF.

3.18.3.10. Air Quality Related Values

Under the Clean Air Act, federal land managers and federal officials with direct responsibility for management of federal Class I parks and wilderness areas are responsible for protecting air quality related values (AQRVs) of those lands. AQRVs are resources such as air, soil, vegetation, and visibility, which are sensitive to air quality and which may adversely be impacted by emissions from new or modified sources. Impacts to AQRVs would be considered as part of the PSD permit application by ADEC. Denali NPP is the only Class I designated park within the proposed Project Area, and is given heighted levels of protection from air quality impacts under the CAA. Other national parks and wilderness areas that would require AQRV analyses include Kenai Fjords National Park and Gates of the Arctic NPP. Table 3.12-1, Distance Between Recreation Features and Nearest Proposed Project Components, includes national parks and wildness areas near the proposed Project ROW.

3.18.3.11. Compliance Assurance Monitoring

EPA developed 40 CFR 64 (CAM) to provide reasonable assurance that facilities comply with emissions limitations by monitoring the operation and maintenance of their control devices. CAM requirements apply to emission units that are equipped with post-process pollutant control devices, have pre-control device emissions equal to or greater than 100 percent of the major source threshold for a pollutant as defined in 40 CFR 70 and Part 71, and are subject to the Title V permit program. To comply with these requirements, a CAM Plan must be developed for each affected pollutant emitted from each affected emission unit. The focus of each CAM Plan would be to ensure and document proper operation of the control device — thereby ensuring compliance with the applicable emission limit.

If the proposed Project has an emission unit that meets the three listed criteria, then CAM requirements would apply. AGDC would need to conduct an applicability determination for each emission unit with the CAM regulations in 40 CFR 64 to ensure compliance. CAM requirements would apply to the GCF Title V permit.

3.18.3.12. General Conformity

The General Conformity Rule was designed to require federal agencies to ensure federally funded or federally approved projects conform to the applicable SIP. Section 176(c) of the CAA prohibits federal actions in nonattainment or PSD maintenance areas that do not conform to the SIP for the attainment and maintenance of NAAQS. General Conformity regulations apply to Project-wide emissions of pollutants for which the proposed Project Areas meet the following criteria:

- Designated as nonattainment (or, for ozone, its precursors NOx and VOC) that

- Not subject to NSR, and
- Greater than the significance thresholds established in the General Conformity regulations or 10 percent of the total emissions budget for the entire nonattainment area.

Federal agencies are able to make a positive conformity determination for a proposed project if any of several criteria in the General Conformity Rule are met. These criteria include:

- Emissions from the project that are specifically identified and accounted for in the SIP attainment or maintenance demonstration; or
- Emissions from the action that are fully offset within the same area through a revision to the SIP, or a similarly enforceable measure that creates emissions reductions so there is no net increase in emissions of that pollutant.

The Fairbanks Lateral would cross into the FNSB nonattainment boundary for $PM_{-2.5}$ and would require a General Conformity determination. A letter from ADEC (provided as Appendix L [ADEC, 2016c]) dated March 9, 2016, indicates that the proposed Project emissions are below the *de minimis* threshold of 100 TPY and so are not required for a full General Conformity analysis.

3.18.3.13. Greenhouse Gases (GHGs)

On October 30, 2009, EPA promulgated 40 CFR 98, the first comprehensive national system for reporting emissions of CO_2 and other GHGs produced by major sources in the U.S. Through this new reporting, EPA would collect comprehensive and accurate data about the production of GHGs in order to track facility emissions and identify opportunities to cut pollution (including GHGs). Approximately 13,000 facilities, accounting for about 85 percent to 90 percent of GHGs emitted in the U.S., are covered under the rule. The reporting requirements apply to suppliers of fossil fuel and industrial chemicals, manufacturers of certain motor vehicles and engines (not including light and medium duty on-road vehicles), as well as large direct emitters of GHGs with emissions equal to or greater than a threshold of 25,000 metric TPY. This threshold is equivalent to the annual GHG emissions from just over 4,500 passenger vehicles.

The direct emission sources covered under the reporting requirement include energy intensive sectors such as cement production, iron and steel production, and electricity generation, among others. The gases covered by the rule are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases, including nitrogen trifluoride and hydrofluorinated ethers. Because CO_2 is the reference gas for climate change, measures of non-CO_2 GHGs are converted into carbon dioxide equivalent (CO_2-e) based on their potential to absorb heat in the atmosphere.

EPA subsequently promulgated additional GHG reporting rules to cover three sectors that were excluded from the 2009 rule – petroleum and natural gas systems, injection

and geologic sequestration of CO_2, and fluorinated GHGs. The rules became effective in December 2010, and required facilities to begin monitoring, recording, and reporting the GHG emissions annually beginning January 1, 2011. The final petroleum and natural gas reporting rule includes the following industry segments: offshore petroleum and natural gas production, onshore petroleum and natural gas production, onshore natural gas processing, onshore natural gas transmission compression, underground natural gas storage, liquefied natural gas storage and its import and export, and natural gas distribution. If the proposed Project has emissions of CO_2-e greater than the applicable threshold or is considered an applicable petroleum and natural gas facility, it would be subject to the federal GHG reporting rule. See Chapter 4, Environmental Consequences, for further analysis and applicability.

On June 2, 2010, EPA issued a final rule that establishes an approach to addressing GHG emissions from stationary sources under the CAA permitting programs. Under this rule, facilities would be required to obtain permits that would demonstrate they are using the best practices and technologies to minimize GHG emissions. The rule sets thresholds for GHG emissions that define when the CAA permits under the NSR, PSD, and Title V Operating Permits programs are required for new or existing industrial facilities.

On June 23, 2014, the U.S. Supreme Court issued its decision in Utility Air Regulatory Group v. EPA, 134 S.Ct. 2427 (2014) ("UARG") that EPA may not treat GHGs as an air pollutant for purposes of determining if a source is a major source required to obtain a PSD or Title V permit. Unless a facility meets the criteria pollutants or HAPs thresholds, they would not be required to complete the PSD process or obtain a Title V permit. However, if they do meet the thresholds requiring a PSD or Title V permit, then EPA can include requirements for GHG emissions. EPA plans further rulemaking that would limit GHG emissions, through 40 CFR 98, as well as the newer regulation of methane (40 CFR 60, Subpart OOOOa). If the proposed Project has emissions of CO_2-e greater than the applicable thresholds, then it would be subject to the federal GHG permitting rule. This supersedes the June 2, 2010 rule.

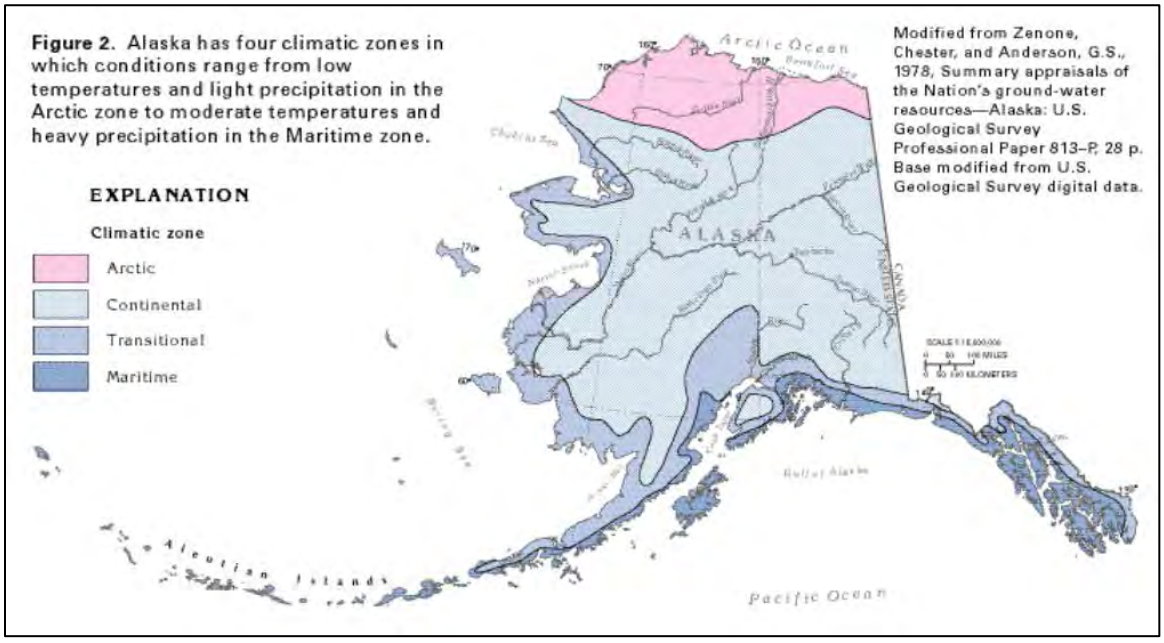
On August 1, 2016, the CEQ released the Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Review. This guidance is intended to facilitate compliance with existing NEPA requirements, and improve efficiency and consistency during the review process of proposed Federal actions. The guidance provides a framework for agencies to consider the effects of the proposed action on climate change by its emission of GHGs and the effects of climate change on the proposed action. Specifically, the guidance advises on the quantification of GHG emissions whenever the tools, methods, and data are available; encourages agencies to determine the appropriate level and extent of quantitative and qualitative analysis is required to comply with NEPA; and councils agencies to consider alternatives that would make the action and affected communities more resilient to the effects of changing climates (CEQ, 2016). This guidance was subsequently withdrawn for further

consideration, effective April 5, 2017, pursuant to Executive Order 13783, "Promoting Energy Independence and Economic Growth" (CEQ, 2017).

3.18.4. Climate

The proposed Project would be constructed in Alaska from the North Slope to Cook Inlet. The proposed Project Area would be located within three of the four major climate zones of Alaska: the transition zone, the continental zone, and the arctic zone or the arctic drainage division (Figure 3.18-1).

Figure 3.18-1 Alaska's Climatic Zones (USGS, 2010f)



The transition zone includes the area between the maritime and continental zones in the southern portion of the Copper River and Cook Inlet. The average annual precipitation in the narrow transitional zone is about 30 inches, and temperatures average about 27°F annually. The arctic zone is characterized by average annual precipitation of less than 20 inches and an average annual temperature of 20°F or less; seasonal variation in temperature is small in this zone. The continental zone extends over about two-thirds of the state and includes the remainder of the Copper River, west-central divisions, and the interior basin. The continental zone is characterized by about 20 inches of average annual precipitation and an average temperature of about 22°F. Temperature extremes are greater in the continental zone than in the other climatic zones (USGS, 2010f). Representative climate data near the proposed Project Area are presented in Table 3.18-4.

Table 3.18-4 Representative Climate Data in the Vicinity of the Proposed Project Area[a]

Location/Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Prudhoe Bay, AK												
Mean maximum temperature (°F)	-11	-13	-10	7	27	44	54	50	38	19	1	-8
Mean minimum temperature (°F)	-23	-27	-25	-10	16	33	39	37	28	9	-10	-20
Mean precipitation (in.)	0.07	0.11	0.04	0.03	0.05	0.17	0.50	0.73	0.84	0.32	0.08	0.10
Mean snowfall (in.)	1.42	2.09	0.98	0.79	2.21	0.79	NA	0.12	3.11	8.12	2.01	2.09
Mean wind speed (mph)	14	14	13	13	14	13	13	13	14	14	13	14
Mean wind direction	NE	NE	NE	N	N	N	N	N	N	N	N	N
Mean morning relative humidity (%)	74	72	73	75	72	84	84	90	89	86	75	73
Mean afternoon relative humidity (%)	74	72	72	74	78	75	72	79	83	85	75	73
Days with fog	20	19	21	20	22	16	15	19	20	19	17	17
Days with thunderstorms	0	0	0	0	0	0	NA	0	0	0	0	0
Wiseman, AK												
Mean maximum temperature (°F)	-4	0	14	32	53	68	69	62	48	25	6	-1
Mean minimum temperature (°F)	-20	-18	-8	9	33	47	49	44	32	12	-7	-17
Mean precipitation (in.)	0.70	0.60	0.70	0.60	0.60	1.40	1.90	2.40	1.70	1.10	0.90	0.90
Mean snowfall (in.)	12.02	8.98	10.01	8.00	0.98	NA	0.00	NA	2.01	12.02	13.00	15.01
Mean wind speed (mph)	7	8	8	9	9	8	7	7	8	8	7	7
Mean wind direction	N	N	N	N	N	N	S	N	N	N	N	N
Mean morning relative humidity (%)	69	68	69	74	74	75	83	89	85	80	74	71

Location/Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean afternoon relative humidity (%)	68	66	63	61	50	48	55	62	65	77	73	71
Days with fog	9	9	9	7	0	2	6	10	8	11	9	11
Days with thunderstorms	0	0	0	0	NA	2	2	NA	NA	0	NA	0
Fairbanks, AK												
Mean maximum temperature (°F)	-1	7	24	41	59	70	72	66	54	32	11	1
Mean minimum temperature (°F)	-18	-14	-2	19	37	49	52	46	36	18	-4	-15
Mean precipitation (in.)	0.50	0.40	0.30	0.30	0.60	1.40	2.00	1.90	1.00	0.80	0.70	0.80
Mean snowfall (in.)	10.01	8.98	5.99	2.99	0.98	0.00	0.00	NA	0.98	10.99	13.00	13.99
Mean wind speed (mph)	5	6	7	8	8	10	9	9	6	7	6	6
Mean wind direction	N	N	N	N	N	SW	SW	SW	N	N	N	N
Mean morning relative humidity (%)	69	68	69	70	64	72	80	87	85	81	74	72
Mean afternoon relative humidity (%)	69	64	54	46	39	44	51	55	57	69	73	72
Days with fog	13	9	4	2	2	2	5	7	6	7	9	12
Days with thunderstorms	NA	NA	0	NA	NA	3	3	1	NA	NA	NA	NA
Healy, AK												
Mean maximum temperature (°F)	-1	7	24	41	59	70	72	66	54	32	11	1
Mean minimum temperature (°F)	-18	-14	-2	19	37	49	52	46	36	18	-4	-15
Mean precipitation (in.)	0.50	0.40	0.30	0.30	0.60	1.40	2.00	1.90	1.00	0.80	0.70	0-80
Mean snowfall (in.)	10.01	8.98	5.99	2.99	0.98	0.00	0.00	NA	0.98	10.99	13.00	13.99
Mean wind speed (mph)	5	6	7	8	8	10	9	9	6	7	6	6
Mean wind direction	N	N	N	N	N	SW	SW	SW	N	N	N	N

Location/Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean morning relative humidity (%)	69	68	69	70	64	72	80	87	85	81	74	72
Mean afternoon relative humidity (%)	69	64	54	46	39	44	51	55	57	69	73	72
Days with fog	13	9	4	2	2	2	5	7	6	7	9	12
Days with thunderstorms	NA	NA	0	NA	NA	3	3	1	NA	NA	NA	NA
Talkeetna, AK												
Mean maximum temperature (°F)	19	25	33	44	56	65	68	64	55	40	26	19
Mean minimum temperature (°F)	1	3	9	22	34	44	49	45	36	24	9	2
Mean precipitation (in.)	1.60	1.50	1.40	1.20	1.40	2.30	3.400	4.40	4.20	2.90	1.80	1.80
Mean snowfall (in.)	20.01	20.01	18.01	10.01	0.98	NA	0.00	0.00	NA	12.02	18.01	23.99
Mean wind speed (mph)	10	9	8	7	8	8	8	7	6	7	8	8
Mean wind direction	NE	N	N	N	S	S	S	S	N	N	N	N
Mean morning relative humidity (%)	74	75	75	80	79	83	88	94	94	86	78	76
Mean afternoon relative humidity (%)	72	66	58	52	50	53	62	65	66	70	73	75
Days with fog	7	7	7	6	3	4	8	10	9	9	7	7
Days with thunderstorms	0	0	0	0	NA	1	1	1	NA	0	0	0
Willow, AK												
Mean maximum temperature (°F)	20	25	32	43	54	62	65	63	55	40	27	20
Mean minimum temperature (°F)	6	9	16	28	39	47	52	50	42	28	14	8
Mean precipitation (in.)	0.91	0.87	0.78	0.59	0.56	1.13	2.02	2.41	2.58	1.73	1.12	1.32
Mean snowfall (in.)	10.80	11.50	9.10	5.20	0.32	0.00	0.00	NA	0.20	7.80	11.78	15.68

Location/Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean wind speed (mph)	3	3	3	3	5	5	3	3	5	3	3	3
Mean wind direction	N	NE	N	N	N	N	N	N	N	N	N	N
Mean morning relative humidity (%)	71	69	68	70	68	71	77	81	78	75	74	77
Mean afternoon relative humidity (%)	71	67	56	53	51	56	64	66	64	66	72	77
Days with fog	12	10	5	4	1	2	4	5	6	8	11	14
Days with thunderstorms	0	0	0	NA	NA	1	1	1	1	NA	0	0

a Historical climate information obtained from http://www.myforecast.com comes from the National Climatic Data Center.
°F = Degrees Fahrenheit
in. = Inches
mph = Miles per hour
NA = Not available
% = Percent

3.18.4.1. Climate Change

The American Meteorological Society (AMS) refers to climate change as any systematic change in the long-term statistics of climate elements (such as temperature, pressure, or winds) sustained over several decades or longer. The AMS also indicates climate change may be due to natural external forcings, such as changes in solar emission or slow changes in the Earth's orbital elements, natural internal processes of the climate system, or anthropogenic forcing. The climate system can be influenced by changes in the concentration of various GHG in the atmosphere that affect the Earth's absorption of radiation (AMS, 2009).

In its Draft Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2014 (EPA, 2016a), EPA provides summary information on the work of the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC) (IPCC, 1990-2013). Key information from the report is summarized below.

The UNFCCC defined climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UNFCCC, 2009). In its Second Assessment Report (IPCC, 1990-2013) of the science of climate change, the IPCC concluded, "human activities are changing the atmospheric concentrations and distributions of GHGs and aerosols. These changes can produce a radiative forcing by changing either the reflection or absorption of solar radiation, or the emission and absorption of terrestrial radiation." Building on this conclusion, the IPCC Third Assessment Report (IPCC, 1990-2013) asserted, "concentrations of atmospheric GHGs and their radiative forcing have continued to increase as a result of human activities."

The IPCC reports that the global average surface temperature of the Earth has increased by 1.1 ± 0.4°F (0.6 ± 0.2°C) during the 20th Century. This value is about 0.27°F (0.15°C) greater than that estimated by the IPCC Second Assessment Report, which reported for the period up to 1994, "owing to the relatively high temperatures of the additional years (1995 to 2000) and improved methods of processing the data."

While the Second Assessment Report concluded, "the balance of evidence suggests there is a discernible human influence on global climate," the Third Assessment Report more directly connects the influence of human activities on climate. IPCC concluded, "In light of new evidence and taking into account the remaining uncertainties, most of the observed warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations."

In its Fourth Assessment Report (IPCC, 1990-2013), IPCC stated warming of Earth's climate is unequivocal, and that warming is very likely attributable to increases in atmospheric GHGs caused by human activities. IPCC further stated changes in many physical and biological systems, such as increases in global temperatures, more frequent

heat waves, rising sea levels, coastal flooding, loss of wildlife habitat, spread of infectious disease, and other potential environmental impacts, are linked to changes in the climate system, and some changes might be irreversible. In its Fifth Assessment Report, the IPCC stated "it is *extremely likely* that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together," of which CO_2 is the most important (IPCC, 2013).

The principal GHGs are CO_2, CH_4, N_2O, and fluorinated gases. Because CO_2 is the reference gas for climate change, measures of non-CO_2 GHGs are converted into CO_2-e values based on their potential to absorb heat in the atmosphere. GHGs occur naturally because of volcanoes, forest fires, and biological processes (such as breathing), and they are also produced by burning fossil fuels in power plants and automobiles, and from industrial and agricultural processes, waste management, and land use changes.

Nationally, CO_2 emissions from fossil fuel combustion represented the largest source (approximately 82 percent) of total weighted GHG emissions from all emission sources in 2014 (EPA, 2016a). The four major fuel consuming end-use sectors contributing to CO_2 emissions from fossil fuel combustion are transportation, industrial, residential, and commercial (*i.e.*, combustion-related emissions from electricity generation are allocated based on aggregate national electricity consumption by each end-use sector).

Table 3.18-5 shows aggregated U.S. and Alaska emissions of CO_2-e for all fossil fuel combustion from these four end-use sectors. Alaska emission estimates were calculated using fuel consumption data from the U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy. Emissions were based on energy consumption using data from existing surveys of energy suppliers that report consumption, sales, or distribution of energy, and conversion factors for each fossil fuel type. U.S. emissions were calculated by EPA based on energy consumption reports from the EIA.

Annual fossil fuel CO_2-e emissions for Alaska and the U.S are reported in Table 3.18-5.

Table 3.18-5 Estimated GHG Emissions from Fuel Combustion

Summary Year	CO_2 Equivalents – Alaska (million tons)	CO_2 Equivalents – U.S. (million tons)
1990	38	6,381
1995	40	6,739
2000	43	7,302
2005	48	7,429
2010	38	7,010
2011	38	6,888
2012	37	6,666
2013	36	6,811

Sources: EPA, 2016a; EPA, 2016b

3.18.5. Ambient Air Quality

Regional background ambient air quality data is presented in the following Table 3.18-6. The information presented in Table 3.18-6 was gathered from publicly available sources from monitoring stations operated by private entities and local, state, and federal agencies, and has been organized to represent the North Slope, Interior Alaska and Alaska Range, and Southcentral and Cook Inlet regions. Results depicted for the North Slope were generated using seven datasets from North Slope oil and gas facilities and remote locations. The Interior data was generated primarily from FNSB, located off the Project Mainline area and is a nonattainment area for $PM_{2.5}$. The majority of southcentral datasets were collected from Anchorage urban areas or areas used to characterize fugitive dust in the Matanuska Valley (Alaska LNG, 2017b).

With the exception of the FNSB nonattainment area, the available data confirms that pollutant concentrations in the proposed Project Area comply with the respective NAAQS and AAAQS.

A detailed description of the data sources used to generate the information depicted in Table 3.18-6 can be found in Appendix L, *Resource Report No.9, Air and Noise Quality*, generated for the proposed Alaska LNG Project.

Table 3.18-6 Regional Background Air Quality Concentrations for the Proposed Project Area

	NSB - Prudhoe Bay	Interior Alaska and Alaska Range[a]	Southcentral Alaska and Cook Inlet[e]
PM_{10}			
24-hour	50 µg/m^3 (33% of AAAQS)[a]	15 – 111 µg/m^3 (10 – 74% of AAAQS)	40 µg/m^3 (26.7% of AAAQS)[a]
$PM_{2.5}$			
Annual	3.7 µg/m^3 (30.8% AAAQS)	1.45 – 13.2[b] µg/m^3 (12.1 – 110% AAAQS)	3.7 µg/m^3 (30.8% of AAAQS)
24-hour	15 µg/m^3 (42.9 % AAAQS)	11.2 – 83.2[b] µg/m^3 (32 – 237.7% of AAAQS)	12 µg/m^3 (34.3% AAAQS)[C]
SO_2			
Annual	1.8 µg/m^3 (2.3% of AAAQS)	1.33 -33.2 µg/m^3 (1.7 – 41.5% of AAAQS)	0.0 µg/m^3 (0% of AAAQS)
24-hour	8.12 µg/m^3 (2.2% of AAAQS)[a]	5.33 – 85.9 µg/m^3 (1.5 – 23.5% of AAAQS)	2.4 µg/m^3 (0.7% of AAAQS)
3-hour	20.96 µg/m^3 (1.6% of AAAQS)[a]	5.33 – 131 µg/m^3 (0.4 – 10.1% of AAAQS)	5.0 µg/m^3 (0.4% AAAQS)
1-hour	9.39 µg/m^3 (4.8% of AAAQS)	146.5 µg/m^3 (74.7% of AAAQS)	5.0 µg/m^3 (2.6% AAAQS)
CO			
8-hour	1.15 mg/m^3 (11.5% of AAAQS)	0.3 – 3.21 mg/m^3 (3 – 32.1% of AAAQS)	1.145 mg/m^3 (11.5% AAAQS)
1-hour	1.15 mg/m^3 (2.9% of AAAQS)	0.7 – 5.41 mg/m^3 (1.8 – 13.5% of AAAQS)	1.145 mg/m^3 (2.9% AAAQS)
NO_2			
Annual	6.0 µg/m^3 (6% of AAAQS)	1.91 µg/m^3 (1.9% of AAAQS)	2.6 µg/m^3 (2.6% of AAAQS)
1-hour	61.69 µg/m^3 (32.8% AAAQS)	26.32 µg/m^3 (14.0 % of AAAQS)	32.2 µg/m^3 (17.1% AAAQS)
O_3			
8-hour	0.056 ppmv (80% of AAAQS)	0.054 – 0.064 ppmv (77.14 – 91.42% AAAQS)	0.047 ppmv (67.1% of AAAQS)[d]

Source: Alaska LNG, 2017b

µg/m^3 = micrograms per cubic meter

mg/m^3 = milligrams per cubic meter

NAAQS = National Ambient Air Quality Standards

ppmv = parts per million in volume

a Concentrations for short-term standards (1 to 24 hours) based on design calculations for the standards

b Includes measured concentrations from the Fairbanks urban PM2.5 nonattainment area

3.18.6. Attainment Status

Areas that violate federal and/or state air quality standards are designated as nonattainment areas for the relevant pollutants. Areas that do comply with federal and/or state air quality standards are designated as attainment areas for the relevant pollutants. Areas with insufficient data are designated as attainment/unclassified areas, and are treated as attainment areas under the CAA. Areas that were previously designated nonattainment and have demonstrated compliance with a NAAQS are designated "maintenance" for 20 years after the effective date of attainment, assuming they remain in compliance with the standard.

Alaska has established a SIP, which describes how the state would comply with the CAA and achieve attainment with federal and/or state air quality standards. It consists of narrative, rules, technical documentation, and agreements the state uses to maintain acceptable air quality and to improve air quality in areas with unacceptable levels of atmospheric contaminants.

Federal funding actions or other approvals in nonattainment and maintenance areas are subject to General Conformity Rule requirements. A General Conformity Determination is required for federally sponsored or funded actions in nonattainment areas, or in certain maintenance areas, when the total direct and indirect net emissions of nonattainment pollutants (or their precursors) exceed specified thresholds (Section 176(c) of the CAA Amendments of 1990). This regulation ensures federal actions conform to the SIP and agency NAAQS attainment plans.

The only nonattainment areas in Alaska are Fairbanks for $PM_{-2.5}$ and Mendenhall Valley (Juneau) and Eagle River for PM_{-10}. The air quality attainment status for the proposed Project Area is either attainment or unclassifiable/attainment for each of the criteria pollutants, with the following exception: the proposed Project's Fairbanks Lateral route would cross into the FNSB nonattainment boundary and would require a General Conformity Determination (USACE, 2012a). Section 3.18.3.12 above provides further discussion.

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3.19. Noise

The description of noise resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on proposed Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project. Specifically, the following information has been substantially updated:

- The community of Ferry has been removed from the analysis; the proposed pipeline route is now more than 5 miles away from the community.
- Several communities have been added to this analysis because they are within 5 miles of the proposed Project Mainline or other Project features. From north to south, these communities include Coldfoot, Goldstream, Trapper Creek, and Big Lake.

3.19.1. Summary

This section discusses the noise that may occur within or adjacent to the proposed Project Area. The description of noise in this section is based on information provided in the 2012 FEIS, as well as new circumstances or information relevant to environmental concerns that have become available since the publication of the 2012 FEIS, including the proposed changes in route. This section describes the airborne noise that may impact the surrounding areas; this section does not discuss underwater noise impacts. Underwater noise impacts and mitigation measures are briefly described under the marine mammals, or fisheries sections. The information provided here is the information provided in the 2012 FEIS.

3.19.2. Regulatory Setting

In 1974, the EPA published the Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (EPA, 1974). This document provides information for state and local agencies to use in developing their ambient noise standards. However, the State of Alaska, and cities in which the proposed Project is located, have yet to establish any noise or vibration regulations that specify acceptable community levels.

The EPA document identified outdoor and indoor noise levels to protect public health and welfare. An 24-hour equivalent continuous level ($L_{EQ(24)}$) of 70 dBA was identified as the level of environmental noise that would not result in any measurable hearing loss over a lifetime. A day-night average sound level (LDN) of 55 dBA outdoors and a LDN of 45 dBA indoors was identified as noise thresholds that would prevent activity interference or annoyance. These levels are not "peak" levels but are 24-hour averages over several years. Occasional high levels of noise may occur. A LDN of 55 dBA is equivalent to a continuous noise level of 48.6 dBA.

3.19.3. Acoustics Principles

The ambient sound level of a region is defined by the total noise generated within the specific environment and is usually comprised of sound emanating from natural and artificial sources. At any location, both the magnitude and frequency of environmental noise may vary considerably over the course of the day and throughout the week. This variation is caused in part by changing weather conditions and the effects of seasonal vegetative cover. The existing noise levels in the proposed Project Area are described below.

Sound is mechanical energy transmitted by pressure waves in a compressible or incompressible medium such as air or water, respectively. When sound becomes excessive, annoying, or unwanted, it is referred to as noise. Noise may be continuous (constant noise with a steady decibel level), steady (constant noise with a fluctuating decibel level), impulsive (having a high peak of short duration), stationary (occurring from a fixed source), intermittent (occurring at the same rate), or transient (occurring at different rates). Noise levels are quantified using units of decibels (dB). The decibel is defined as ten times the base 10 logarithm of the ratio between the two quantities of sound pressure level (SPL) squared, or: $SPL = 10 \log (p^2/p_o^2) = 20 \log (p/p_o)$ dB.

Where p is the sound pressure being measured and po is the reference sound pressure (in air 0.0002 microbar [µbar] or $2x10^{-5}$ Newtons per square meter [N/m^2], in water 0.00001 µbar or $1x10^{-6}$ N/m^2). Sound pressure level (SPL, µbar, 0.1 N/m^2) attenuates with respect to the inverse distance law, where sound pressure is inversely proportional to the distance from the noise source (EPA, 1974; Plog, 1988).

Two measurements used by local, state, and federal agencies that relate the time-varying quality of environmental noise to its known effect on people are: (1) the $L_{EQ(24)}$; and (2) the LDN. The $L_{EQ(24)}$ quantifier is the level of steady sound with the same total (equivalent) energy as the time-varying sound of interest, averaged over a 24-hour period. The LDN quantifier is the $L_{EQ(24)}$ with 10 decibels on the A-weighted decibel scale (dBA) added to nighttime sound levels between the hours of 10 p.m. and 7 a.m. to account for people's greater sensitivity to sound during nighttime hours. The 10th percentile-exceeded sound level, L_{10} (L_{50} and L_{90} can be used also), is the A-weighted sound level, which happens 10 percent or more of the time of the measurement (or 50 percent, 90 percent in case of L_{50}, L_{90}, respectively [EPA, 1974]).

Examples of typical noise levels measured at a typical distance from the source are as follows (EPA, 1974):

- Quiet room: 28 to 33 dBA
- Computer: 37 to 45 dBA
- Refrigerator: 40 to 43 dBA
- Forced hot air heating system: 42 to 52 dBA
- Microwave: 55 to 59 dBA

- Clothes dryer: 56 to 58 dBA
- Clothes washer: 65 to 70 dBA
- Phone: 66 to 75 dBA
- Garbage disposal: 76 to 83 dBA
- Hair dryer: 80 to 95 dBA
- Weed whacker: 94 to 96 dBA

The following relationships occur with regard to increases in noise measured on the A-weighted decibel scale (EPA, 1974):

- A change of 1 dBA cannot be perceived by humans, except in carefully controlled laboratory environments;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference by humans;
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness and can cause an adverse response.

According to the National Institutes of Health, National Institute on Deafness and Communication Disorder (NIDCD), noise-induced hearing loss (NIHL) can occur when one is exposed to harmful noise. Exposure to sounds that are too loud or loud sounds that last a long time can cause damage to sensitive structures, called hair cells, in the inner ear. Once damaged, the hair cells cannot grow back (NIDCD, 2008).

Example sources of noise that can cause NIHL include motorcycles, firecrackers, and small firearms, all emitting sounds from 120 to 150 dBA. In addition, long or repeated exposure to sounds at or above 85 dBA can cause hearing loss. The louder the sound, the shorter the time period before NIHL can occur. Sounds of less than 75 dBA, even after long exposure, are unlikely to cause hearing loss. Although being aware of decibel levels is an important factor in protecting one's hearing, distance from the source of the sound and duration of exposure to the sound are equally important (NIDCD, 2008).

3.19.3.1. Ground Vibration

Ground-borne vibration consists of rapidly fluctuating motions within the ground that have an average motion of zero. The effects of ground-borne vibrations typically cause a nuisance only to people (and likely other animals), but at extreme vibration levels, damage to buildings may occur. Although ground-borne vibration can be felt outdoors, it is typically an annoyance only to people indoors, where the associated effects of the shaking of a building can be notable and because people are moving around less indoors (*e.g.*, seated). Induced ground-borne noise is an effect of ground-borne vibration and only exists indoors, since it is produced from noise radiated from the motion of the walls

and floors of a room and may consist of the rattling of windows or dishes on shelves. Although the perceptibility threshold is about 65 vibration decibels (VdB), human response to vibration is not usually significant unless the vibration exceeds 70 VdB with the threshold of potential architectural damage to fragile structures at about 100 VdB. Human response to different levels of ground-borne noise and vibration is as follows (Federal Transit Administration [FTA], 2006):

- 65 VdB produces a noise level between 25 (low frequency) and 40 dBA (high frequency). Approximate threshold of perception for many humans. Low-frequency sound usually inaudible, mid-frequency sound excessive for quiet sleeping areas;
- 75 VdB produces a noise level between 35 (low frequency) and 50 dBA (high frequency). Approximate dividing line between barely perceptible and distinctly perceptible. Many people find transit vibration at this level annoying. Low-frequency noise acceptable for sleeping areas, mid-frequency noise annoying in most quiet occupied areas; and
- 85 VdB produces a noise level between 45 (low frequency) and 60 dBA (high frequency). Vibration acceptable only if there are an infrequent number of events per day. Low-frequency noise annoying for sleeping areas, mid-frequency noise annoying even for infrequent events with institutional land uses such as schools and churches.

3.19.4. Existing Noise Environment

The proposed Project would be constructed in Alaska from the North Slope to the Beluga ENSTAR Tie-In southwest of Big Lake. Most of the area adjacent to the proposed Project pipeline is undeveloped and sparsely populated and, therefore, ambient noise levels are generally low. However, other areas of the pipeline would be located in more urban and industrial areas with higher ambient noise levels. Consequently, it is estimated that the existing ambient noise level in the proposed Project Area is in the range of 35 dBA (wilderness areas) to 51 dBA (wooded residential) and 59 dBA (urban residential) (EPA, 1978). These are assumed noise levels. Furthermore, the background vibration velocity level is estimated to be less than 50 VdB (FTA, 2006).

Sensitive receptors are those populations that are more susceptible to the effects of noise than the population at large and those located in close proximity to localized sources of noise. More than 95 percent of the proposed Project is located out of range of any sensitive receptor. Sensitive noise receptors within 5 miles of the proposed Project's pipeline facilities are shown in Table 3.19-1. Sensitive noise receptors within 5 miles of the proposed Project's support facilities are shown in Table 3.19-2.

Table 3.19-1 Sensitive Noise Receptors within 5 Miles of Proposed Project Pipeline Facilities[a]

Town	Population	Mainline (miles)	Fairbanks Lateral (miles)	Denali NPP Route Variation (miles)
Anderson	246	3	--	--
Cantwell	219	1	--	--
Coldfoot	10	0.6	--	--
College	12,964	--	1.5	--
Ester	2,422	--	3	--
Fairbanks	31,535	--	1	--
Goldstream	3,557	--	1	--
Healy	1,021	1.5	--	--
Livengood	13	4.4	--	--
McKinley Park	185	1	--	1
Nenana	378	0.5	--	--
Prudhoe Bay	2,174[b]	3	--	--
Talkeetna	876	4.1	--	--
Trapper Creek	481	1	--	--
Willow	2,102	3	--	--
Wiseman	14	0.7	--	--

a Distances estimated using the Interactive Web Mapper, located within 5 miles of the proposed pipeline.
b While the 2010 Census considered oil workers in its population estimate for Prudhoe Bay, all residents are employees of oil-drilling or oil-production and support companies and most travel to Anchorage or the Lower Continental 48 U.S. (Lower 48) when off-duty.

Table 3.19-2 Sensitive Noise Receptors within 5 Miles of Proposed Project Support Facilities[a]

Town	Population	Access Roads (miles)	Camps, Pads, PSYs, Temp. Workspaces (miles)	Material Sites (miles)
Anderson	246	0.4[c]	0.6	2.4
Big Lake	3,350	3.7	--	0.8
Cantwell	219	0	0	0
Coldfoot	10	0	0	0
College	12,964	0	0	--
Ester	2,422	0	0	--
Fairbanks	31,535	0	0	--
Goldstream	3,557	1.3	0	3.6
Healy	1,021	0	0	0
Livengood	13	0	0	0
McKinley Park	185	0	0	0
Nenana	378	0	0	2
Prudhoe Bay	2,174[b]	0	0	0
Talkeetna	876	2.8	2.9	2.7
Trapper Creek	481	0	0	0
Willow	2,102	0	0	0

Town	Population	Access Roads (miles)	Camps, Pads, PSYs, Temp. Workspaces (miles)	Material Sites (miles)
Wiseman	14	0	0	0

a Distances estimated using the "census designated places" as the boundaries of the towns.
b While the 2010 Census considered oil workers in its population estimate for Prudhoe Bay, all residents are employees of oil-drilling or oil-production and support companies and most travel to Anchorage or the Lower 48 states when off-duty.
c An ice access road is proposed to cross the Nenana River to the community of Anderson (0 miles from Anderson).
0 = A Project support facility intersects the census designated places / noise receptor.
-- = Project support facilities are greater than 5 miles away from the census designated places / noise receptor; therefore, impacts not assessed further.

3.19.5. Pipeline Facilities

3.19.5.1. Mainline

3.19.5.1.1. Construction

Construction would increase noise levels in the vicinity of proposed Project activities, and the noise levels would vary during the construction period, depending on the construction phase. Construction noise levels are rarely steady in nature but instead fluctuate depending on the number and type of equipment in use at any given time. There would be times when no large equipment is operating and noise would be at or near ambient levels. In addition, construction-related sound levels experienced by a noise sensitive receptor in the vicinity of construction activity would be a function of distance. Table 3.19-3 lists noise levels produced by typical construction machinery at 50 feet in units of the A-weighted decibel scale (dBA).

Table 3.19-3 Estimated Maximum Noise Levels for Construction Equipment (dBA)

Equipment	dBA from 50 feet
Pickup truck	55
Welding (or cutting) torch	73
Pump (dewatering)	77
Backhoe (with loader)	80
Compactor (ground)	80
Compressor (air)	80
Concrete pump truck	82
Generator (general purpose utility)	82
Excavator (hydraulic)	85
Dozer (crawler tractor)	85
Grader	85
Scraper	85
Concrete mixer truck	85
Crane	85
Pneumatic tool	85
Jackhammer	85

Equipment	dBA from 50 feet
Rock drill	85
Paver (asphalt)	85
Pile driver (impact)	95

Source: DOT FHWA, 2006
dBA = sound level from A-weighted decibel scale.

Ground-borne vibration would also occur in the immediate vicinity of construction activities, particularly if rock drilling, pile driving, or blasting is required. Table 3.19-4 lists vibration levels produced by typical construction machinery and activities at 25 feet in units of VdB.

Table 3.19-4 Vibration Source Levels for Construction Equipment (VdB)

Equipment	VdB from 25 feet
Pile Driver (impact type)	104-112
Pile Driver (sonic or vibratory type)	93-105
Vibratory Roller	94
Large Bulldozer	87
Loaded Trucks	86
Jackhammer	79
Small Bulldozer	58

Source: FTA, 2006
vdB = vibration decibels

AGDC proposes both winter and summer seasons for Mainline construction. Furthermore, pipeline construction equipment would operate 24 hours per day for 6 winter months and 12 hours per day for 4 summer months. Construction would occur simultaneously on all four spreads lasting a total of 2 years, but would only last about 90 to 120 days (3 to 4 months) at any single point along the Mainline. In general, because construction moves through an area relatively quickly, noise and vibration impacts would typically be localized, intermittent, and short-term.

The estimated vibration level at a receptor from construction equipment would be less than 62 VdB, which would be well below the FTA (2006) damage threshold for buildings of 100 VdB (adapted from Table 3.19-3). This level is also below the human perceptibility threshold of about 65 VdB, and therefore, would not constitute an impact.

3.19.5.2. Operations and Maintenance

With respect to natural gas pipeline operations, gas traveling through a buried pipeline would not emit audible noise above the surface or a perceptible level of vibration. In addition, noise levels from routine inspection and maintenance activities associated with the proposed Mainline would not result in perceptible noise or vibration level increases at the nearest sensitive receptor.

3.19.6. Fairbanks Lateral

3.19.6.1. Construction

Pipeline construction equipment would operate 12 hours per day for 4 summer months on the Fairbanks Lateral construction. In general, because construction moves through an area relatively quickly, noise impacts typically would be localized, intermittent, and short-term. According to Table 3.19-1, the nearest sensitive receptor to Fairbanks Lateral construction would be the city of College, approximately 1.7 miles (8,769 feet) from the Fairbanks Lateral. The estimated noise levels from construction activities at this receptor would be approximately 55 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA (adapted from Table 3.19-3). The calculation assumes a terrain coefficient of 0.007 for brush, an integration loss of 3 for berm or rough terrain, and typical usage factors. The exact value would depend on the number of sources operating at this distance.

The estimated vibration level at this receptor from construction equipment would be less than 36 VdB, which would be well below the FTA (2006) damage threshold for buildings of 100 VdB (adapted from Table 3.19-3). This level is also below the human perceptibility threshold of about 65 VdB and, thus, would not constitute an impact.

3.19.6.2. Operations and Maintenance

With respect to natural gas pipeline operations, gas traveling through a buried pipeline would not emit audible noise above the surface or a perceptible level of vibration. In addition, noise levels from routine inspection and maintenance activities associated with the proposed Fairbanks Lateral would not result in perceptible noise or vibration level increases at the nearest sensitive receptor.

3.19.7. Prudhoe Bay

3.19.7.1. Channel Dredging and Access Construction

The nearest sensitive receptor to the GCF construction would be the Prudhoe Bay Oil Field Complex (including the community of Deadhorse), approximately 4 miles from the facility. The West Dock causeway would require widening and infrastructure modifications as described in Chapter 2. Marine dredging and disposal would occur in winter on the ice, and most construction activities would also occur in winter. Some dock improvements and module offloading would occur in late summer. Activities would occur up to 2 years in advance of the sealift to prepare DH3 and the West Dock causeway to allow vibratory pile driving and sheet pile installation, infrastructure improvements, and module movement. Most marine construction activities, with the exception of pile driving, would also occur in winter (on ice); some dock improvements and module offloading would occur in late summer. There are no residential or recreation features within 1 mile from the West Dock. Baseline conditions for marine mammal receptors at the West Dock (Prudhoe Bay) are described in Section 3.8, Marine Mammals.

3.19.8. Gas Conditioning Facility

3.19.8.1. Construction

The nearest sensitive receptor to the GCF construction would be the Prudhoe Bay Oil Field Complex (including the community of Deadhorse), approximately 3.6 miles (18,981 feet) from the facility. The estimated noise levels from construction activities at this receptor would be approximately 55 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA (adapted from Table 3.19-2). The calculation assumes a terrain coefficient of 0.007 for brush, an integration loss of 3 for berm or rough terrain, and typical usage factors. The exact value would depend on the number of sources operating at this distance. This noise level would be perceived as insignificant, thus creating no noise impact (*i.e.*, increase of 0 dBA over estimated ambient levels).

The estimated vibration level at a receptor from construction equipment would be less than 26 VdB, which would be well below the FTA (2006) damage threshold for buildings of 100 VdB (adapted from Table 3.19-3). This level is also below the human perceptibility threshold of about 65 VdB and, thus, would not constitute an impact.

All compression (the need for launchers / receivers) would be incorporated into GCF; no additional above ground facilities would be required at this location.

3.19.8.2. Operations and Maintenance

The GCF would be installed on approximately 90.6 acres and would contain several modular buildings that would house equipment, utilities, workspaces, and personnel. Primary and backup power generation, natural gas compressors, and heating and refrigerant equipment in addition to other ancillary facilities would be located at this facility to drive the natural gas conditioning process.

3.19.9. Construction Camps and Pipeline Yards

3.19.9.1. Construction

As shown in Table 3.19-2, the nearest sensitive receptor to construction camp and pipeline yard construction would be the city of Cantwell, less than 1 mile from the camp/yard. The estimated noise levels from construction activities at this receptor would be approximately 68 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA (adapted from Table 3.19-1). Maximum noise levels could reach up to 73 dBA (L_{MAX}). The calculations assume a terrain coefficient of 0.007 for brush, an integration loss of 3 for berm or rough terrain, and typical usage factors. The exact values would depend on the number of sources operating at this distance.

The estimated noise levels from camp operation at this receptor would be approximately 57 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA (adapted from Table 3.19-2). Maximum noise levels could reach up to 59 dBA (L_{MAX}). The calculations assume a terrain coefficient of 0.007 for brush, an integration loss of 3 for berm or rough terrain,

and typical usage factors. The exact values would depend on the number of sources operating at this distance.

The estimated vibration level at a receptor from construction and camp operations equipment would be less than 72 VdB, which would be well below the FTA (2006) damage threshold for buildings of 100 VdB (adapted from Table 3.19-3).

AGDC would develop and implement a noise abatement program to mitigate construction noise impacts and a construction communications plan to inform adjacent residences of construction activities. Additional mitigation measures to reduce significant impacts from construction are identified in Appendix M, Mitigation Measures.

3.19.9.2. Operations and Maintenance

Construction camps and pipeline yards would no longer be used during the operations phase of the proposed Project.

3.19.10.Material Sites

3.19.10.1. Construction

The nearest sensitive receptor to material site construction would be the city of Cantwell or Wiseman, at less than 1 mile from the site. The estimated noise levels from construction activities at this receptor would be less than approximately 76 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA. Maximum noise levels could reach up to 82 dBA (L_{MAX}) but would be temporary and intermittent. The calculations assume a terrain coefficient of 0.007 for brush, an integration loss of 3 for berm or rough terrain, and typical usage factors. The exact values would depend on the number of sources operating at this distance.

The estimated vibration level at a receptor from construction equipment would be less than 83 VdB, which would be well below the FTA damage threshold for buildings of 100 VdB (adapted from Table 3.19-3).

AGDC would develop and implement a noise abatement program to mitigate noise impacts, and construction communications plan to inform adjacent residences of construction activities. Additional mitigation measures that would reduce significant impacts are identified in Appendix M, Mitigation Measures.

3.19.10.2. Operations and Maintenance

Material sites would no longer be used during the operations phase of the proposed Project.

3.19.11. Denali National Park & Preserve Route Variation

3.19.11.1. Construction

Pipeline construction equipment would operate 12 hours per day for 4 winter months for Denali NPP Route Variation construction. In general, because construction moves through an area relatively quickly, noise impacts typically would be localized, intermittent, and short term. According to Table 3.19-1, the nearest sensitive receptor to Denali NPP Route Variation construction would be McKinley Park, approximately 1 mile from the route. The estimated noise levels from construction activities at this receptor would be approximately 62 dBA (L_{EQ}) using a nominal existing ambient level of 55 dBA (adapted from Table 3.19-2). The calculation assumes a terrain coefficient of 0.007 for brush, an integration loss of three for berm or rough terrain, and typical usage factors. The exact value would depend on the number of sources operating at this distance.

The estimated vibration level at a receptor from construction equipment would be less than 38 VdB, which would be well below the FTA (2006) damage threshold for buildings of 100 VdB (see Table 3.19-3). This level is also below the human perceptibility threshold of about 65 VdB.

3.19.11.2. Operations

With respect to natural gas pipeline operations, gas traveling through a buried pipeline would not emit audible noise above the surface or a perceptible level of vibration. In addition, noise levels from routine inspection and maintenance activities associated with the Denali NPP Route Variation would not result in perceptible noise or vibration level increases at the nearest sensitive receptor.

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3.20. Navigation Resources

3.20.1. Introduction

This section discusses navigation resources and navigable waterways in the proposed Project Area. The description of navigation resources summarizes detailed information provided in the 2012 FEIS (USACE, 2012a), data provided by AGDC on Project design, engineering and plans, as well as recent, publicly available literature, in light of changes and updates to the proposed Project.

Specifically, the following information has been substantially updated:

- The List of USACE Navigable Waterways was refined to include only those waters crossed by the proposed pipeline alignment as opposed to the broader Project Area.
- The Kuparuk River crossing was removed from the List of USACE Navigable Waterways, because the river is not navigable at the proposed crossing point, in its headwaters in the foothills of the Brooks Range (MP 130.8).
- HDD is now the preferred option for crossing the Yukon River. The alternative is to construct a new aerial span over the Yukon River at the same location proposed for HDD.
- A fourth Nenana River crossing was added (via the existing bridge or a new bridge).
- The crossing method for the Susitna River was changed from HDD to use of the existing bridge.
- Estimated seasons for construction of crossings were refined and are shown in Table 3.20-1.
- Project work at West Dock was not discussed in the 2012 FEIS and has been added here.

3.20.2. Summary

The proposed Project would make 11 freshwater crossings over navigable waterways as determined by USACE.

The proposed Project revision affecting marine navigation resources are the construction and offload activities at the West Dock Causeway in the northern proposed Project Area. Prior to offload activities, winter channel dredging and modifications to the existing infrastructure are required. Intertidal and subtidal marine waters around the West Dock Causeway may be affected by sealift operations.

3.20.3. Affected Navigation Resources and Navigable Waterways

This section describes navigation resources and navigable waterways that could be affected by construction and operation of the proposed action and alternatives. Navigable waters are defined as waters that provide a channel for commerce and transportation of people and goods. Additionally, Sections 3.3, Water, 3.7, Fish, and 3.12, Recreation discuss potentially affected environments, including navigable rivers and streams within the proposed Project Area. The detailed regulatory setting as it pertains to navigational resources described in the 2012 FEIS remains valid (see, Section 5.18 of USACE, 2012a). The modification to the West Dock Causeway and dredging at DH 3 was not assessed in the 2012 FEIS and is subject to federal regulations. Chapter 1 of this SEIS describes regulations applicable to the revised proposed Project.

3.20.4. Project Area

The navigation resources included within the proposed Project Area would extend from Prudhoe Bay in the NSB, south to the Mat-Su Borough near Cook Inlet. The Fairbanks Lateral would diverge from the proposed Mainline at approximately MP 440 (Fairbanks Lateral MP 0.0) and extend through Yukon-Koyukuk Borough and FNSB. The proposed Project does not cross the Sagavanirktok River, but parallels it for some distance. Major drainages that would be crossed include the Yukon, Tanana, and Susitna rivers. The proposed Project would make 11 freshwater crossings over navigable waterways as determined by USACE (Table 3.20-1). The Denali NPP Route Variation Alternative would include two crossings within the navigable reach of the Nenana River: an existing bridge north of the canyon commercial area and a buried crossing in the Nenana River northeast of McKinley Park.

The proposed Project Area includes the temporary use (2 years) of Alaska port sites for construction and the transport of materials and equipment. The primary ports include West Dock at Prudhoe Bay for the delivery of GCF modules and the Port of Seward in Resurrection Bay in the Southcentral Region for delivery of pipeline and other materials. The Port of Anchorage in Cook Inlet is likely to be used as a secondary port to the Port of Seward to bring in materials; however, even if the Port of Anchorage is used, no additional construction work would occur there.

ADNR makes navigability determinations for streambed ownership purposes, while the USCG makes navigability determinations to establish jurisdiction and requires a permit for bridges crossing navigable rivers. ADOT&PF's bridge section is responsible for the design and use of bridges under their jurisdiction. As required by the General Bridge Act of 1946, AGDC would submit final designs for all stream crossings and crossing locations to the ADNR, USCG, and ADOT&PF for review prior to the start of construction. Based on this information, these agencies would make a final determination regarding its jurisdiction for particular crossings.

Table 3.20-1 provides all crossings of USACE Navigable Waterways within the proposed Project ROW (*i.e.*, stream crossings).

Table 3.20-1 USACE Navigable Waterways Crossed by the Proposed Pipeline Alignment

Approximate MP	Waterway Name	Crossing Method	Construction Season	USACE Navigability Determination
356.0	Yukon River	HDD, Existing Bridge or New Bridge	Summer	Navigable
401.3	East Fork Tolovana River	Open-Cut	Summer	Navigable – 135 miles (Entire Length)
437.6	Chatanika River	HDD	Winter	Navigable – 139 miles to Long Creek
471.9	Tanana River	HDD	Winter	Navigable
475.0	Nenana River	Open-Cut	Winter	Navigable – 80 miles to Parks Highway Bridge
488.2	Nenana River	Open-Cut	Winter	Navigable – 80 miles to Parks Highway Bridge
530.9	Nenana River	Existing Bridge or New Bridge	Fall	Navigable – 80 miles to Parks Highway Bridge
558.6	Nenana River	Open-Cut	Summer	Navigable – 80 miles to Parks Highway Bridge
673.5	Susitna River	Existing Bridge	Winter	Navigable, but using existing bridge
705.5	Willow Creek	HDD	Winter	Navigable – 4 miles to Parks Highway Bridge
729.1	Little Susitna River	HDD	Winter	Navigable – 84 miles to the Schrock Road Bridge

3.20.5. Commercial and Recreational Port Usage

3.20.5.1. Prudhoe Bay and West Dock

Several shallow-water port facilities exist at Prudhoe Bay, including:

- West Dock, a 13,110-foot long by 40-foot wide gravel causeway with two barge-unloading facilities;
- East Dock, which is no longer used, is a 1,100-foot causeway connected to a 100- by 270-foot wharf constructed from grounded barges; and
- Oliktok Point, which extends 750 feet from the shoreline. The dock is part of seawater treatment facilities (NSB, 2005b).

Because these are shallow water facilities (maximum draft of 10 feet at West Dock), cargo ships and ocean barges must be off-loaded to shallow- or medium-draft vessels for lightering to shore. These ports typically freeze during the winter months, making them inaccessible to marine traffic. Marine transportation needs are expected to increase as new oil and possibly coal development occurs within the NSB. There are minimal port facilities for most NSB communities, even though barge shipment of materials is critical to the economic wellbeing and quality of life for NSB residents, and subsistence use of waterways is extensive.

3.20.5.2. Resurrection Bay and Port of Seward

The City of Seward is situated in the northwest corner of Resurrection Bay, and on the southeast coast of the Kenai Peninsula, 125 highway miles south of Anchorage (City of Seward, 2014).

Since its establishment in 1964, the ice-free harbor has helped Seward become an important supply center for Interior Alaska. The small boat harbor also supports Seward's economy through tourism, recreation, and commercial fishing. The community has capitalized on its road and railroad connections to Anchorage, its cruise ship terminal, and its location as the major access point for visits to the Kenai Fjords National Park and the Chiswell Islands (City of Seward, 2014). A variety of vessels make up Seward's commercial fishing fleet and the area has more than 100 charter boat operators and a dozen tour boat operators. The Small Boat Harbor is a full-service port with 50-ton and 250-ton Travelifts, a 5,000-ton syncrolift, boat repair yards, potable water and power utilities, hardware stores, grocery stores, art galleries, restaurants, and hotels among other amenities (City of Seward, 2016).

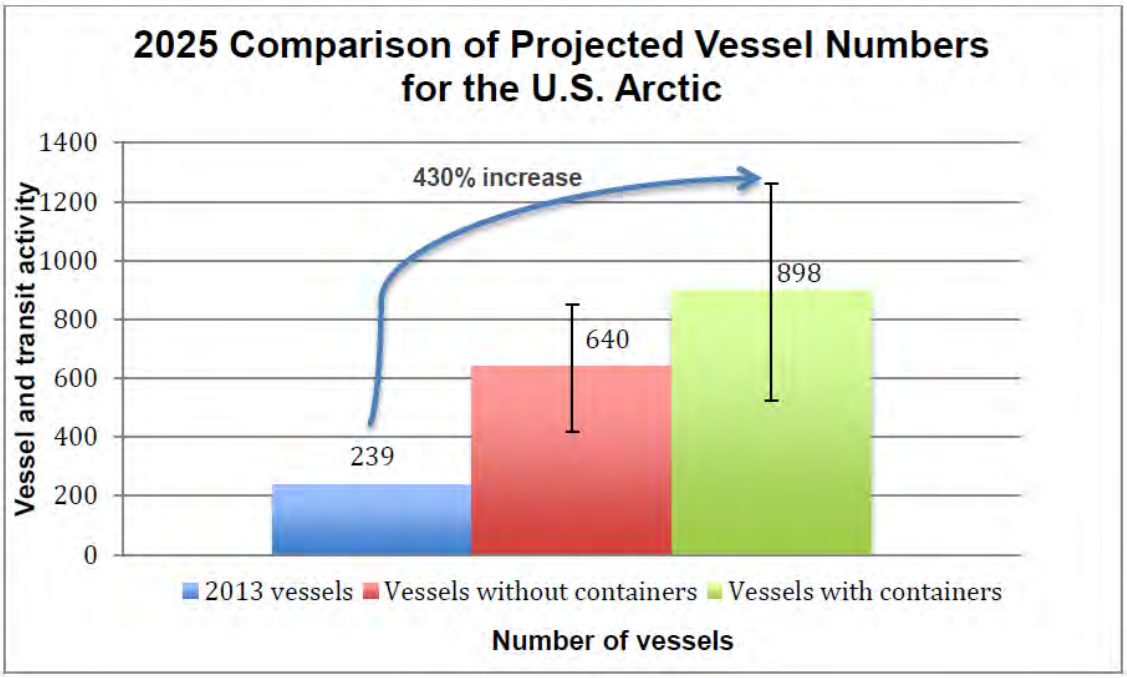
Major renovation projects began in 2000 with the replacement of the aging float system and upgraded utilities. New floats, ramps, and fish cleaning stations have dramatically improved the accessibility to the port's facilities (City of Seward, 2016).

3.20.5.3. Arctic Vessel Use Projections

The vessel traffic in Arctic waters is expected to greatly increase. A study conducted by the International Council on Clean Transportation (2015) suggests that an average of 640 or a maximum of 898 vessels would operate in the Bering Strait and U.S. Arctic by year 2025. This represents a 200 to 275 percent increase from the year 2013. In 2013, there were an estimated 47 unique vessels operating on the U.S. North Slope; a high exploration year would increase that by approximately 130 percent. Figure 3.20-1 shows the projected increase in vessels with and without containers in the U.S. Arctic by year 2025.

Although the total number of vessels and transits is small when compared with other major shipping routes, such as the Great Circle Route in the Pacific, the relative increase in activity is significant for the region. These potentially rapid changes have important implication for infrastructure, but also for environmental readiness and emergency response.

Figure 3.20-1 Projected Vessel Numbers for the U.S. Arctic



Source: International Council on Clean Transportation, 2015

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