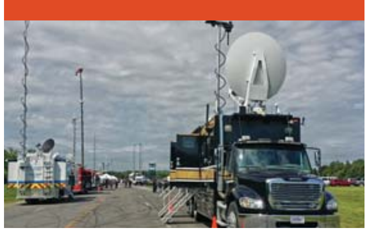
Nationwide Public Safety Broadband Network
Draft Programmatic Environmental Impact Statement for the Non-Contiguous United States

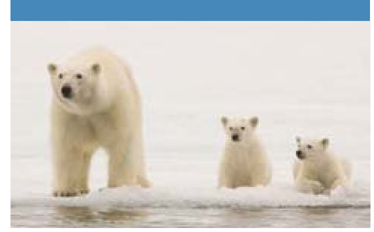
FirstNet®

First Responder Network Authority

Volume 1 - Chapters 1, 2, & 3

Alaska
Hawaii
American Samoa
Guam
Northern Mariana Islands
Puerto Rico
U.S. Virgin Islands





March 2016

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First Responder Network Authority

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for the Non-Contiguous United States

Volume 1

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Cooperating Agencies
Federal Communications Commission
General Services Administration
U.S. Department of Agriculture—Rural Utilities Service
U.S. Department of Agriculture—U.S. Forest Service
U.S. Department of Agriculture—Natural Resource Conservation Service
U.S. Department of Defense—Department of the Air Force
U.S. Department of Energy
U.S. Department of Homeland Security

March 2016

Cover Art Sources:

Map Service. 2015. *OpenStreetMap*. ArcGIS Map Image Layer by Esri. Sourced from: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community.

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ACRONYMS AND ABBREVIATIONS

°F	degree Fahrenheit
°N	degrees north
$\mu g/m^3$	microgram(s) per cubic meter
µPa	micro Pascal
%	percent
A	attained
AAC	Alaska Administrative Code
AAFIS	Alaska Public Safety Identification System
AAQS	Ambient Air Quality Standards
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey (U.S. Census Bureau)
ADEC	Alaska Department of Environmental Conservation
ADFG	Alaska Department of Fish and Game
AGL	above ground level
AIRFA	American Indian Religious Freedom Act
AJRCCM	American Journal of Respiratory and Critical Care Medicine
AKNHP	Alaska National Heritage Program
AKOSH	Alaska Occupational Safety and Health
AKWAS	Alaska Warning System
ALMR	Alaska Land Mobile Radio
ANFIRS	Alaska Fire Incident Reporting System
ANSCA	Alaska Native Claims Settlement Act
ANSI	American National Standards Institute
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
APSIN	Alaska Public Safety Information Network
AQCR	air quality control region
ARFF	Aircraft Rescue and Firefighting
ARMS	Alaska Records Management System
ARPA	Archaeological Resources Protection Act of 1979
AS	Alaska Statute
A.S.A.C.	American Samoa Administrative Code
ASCA	American Samoa Code Annotated
ASCMP	American Samoa Coastal Management Program
ASDMWR	American Samoa Department of Marine and Wildlife Resources
ASEPA	American Samoa Environmental Protection Agency
ASHPO	American Samoa Historic Preservation Office
ASPA	American Samoa Power Authority
ATO	Air Traffic Organization
ATWC	Alaska Tsunami Warning Center
AURORA	Alaska Uniform Response Online Reporting Access
BACT	best available control technology
BCE	before Common Era
BCR	Bird Conservation Regions
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	U.S. Bureau of Labor Statistics
BMP	best management practice
BRFSS	Behavioral Risk Factor Surveillance System
BSAI	Bering Sea/Aleutian Island
BWG	BioInitiative Working Group
CAA	Clean Air Act
CAB	Clean Air Branch
CARB	California Air Resources Board
CBIA	Coastal Barrier Improvement Act of 1990
CBRA	Coastal Barrier Resources Act of 1982
CCP	Comprehensive Conservation Plan
CDC	Center for Disease Control
CDLNR	Commonwealth Department of Lands and Natural Resources
CE	Common Era
CELCP	Coastal and Estuarine Land Conservation Program
CEPD	Caribbean Environmental Protection Division
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFMC	Caribbean Fisheries Management Council
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH_4	methane
CHC	Commonwealth Health Center
CIA	Central Intelligence Agency
CMIP3	Coupled Model Intercomparison Project phase 3
CNMI	Commonwealth of Northern Mariana Islands
CNMIAC	Commonwealth of Northern Mariana Islands Administrative Code
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalents
COMAR	Committee on Man and Radiation
CPA	Commonwealth Ports Authority

CRMP	Coastal Resources Management Program
CSP	Central South Pacific
CUC	Commonwealth Utilities Corporation
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DACA	Deployable Airborne Communications Architecture
DAR	Division of Aquatic Resources (Hawaii)
DAWR	Division of Aquatic and Wildlife Resources (Guam)
dB	decibel(s)
dBA	A-weighted decibel(s)
DBCP	1,2-dibromo-3-chloropropane
dBZ	Z-weighted decibel(s)
DCP	1,2-dichloropropane
DEC	Department of Environmental Conservation
DHHL	Department of Hawaiian Homelands
DLNR	Department of Land and Natural Resources (Hawaii)
DMA	Disaster Mitigation Act of 2000
DNER	Department of Natural and Environmental Resources of Puerto Rico
DOA	Department of Agriculture
DOD	Department of Defense
DOE	U.S. Department of Energy
DOH	Department of Health
DOH-CAB	Hawaii Department of Health, Clean Air Branch
DOT	U.S. Department of Transportation
DPNR	Department of Planning and Natural Resources (U.S. Virgin Islands)
DPS	Department of Public Safety
EA	Environmental Assessment
EAS	Emergency Alert System
EBS	Emergency Broadcast System
EDB	ethylene dibromide
EFH	essential fish habitat
EMS	emergency medical services
ENSO	El Niño/Southern Oscillation
EO	Executive Order
EPCRA	Emergency Planning and Community Right-to-Know Act
ERP	effective radiated power
ESA	Endangered Species Act
ESI	Environmental Sensitivity Index
FAA	Federal Aviation Administration
FAD	Fish Aggregating Device
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FirstNet	First Responder Network Authority
FMP	Fishery Management Plan
FPPA	Farmland Protection Policy Act of 1981
FR	Federal Register
ft	feet
g/hp-hr	grams per horsepower-hour
g/mi	grams per mile
GAP	Gap Analysis Program
GCA	Guam Code Annotated
GDA	Guam Department of Agriculture
GEPA	Guam Environmental Protection Agency
GHG	greenhouse gas
GIS	geographic information system
GMP	General Management Plan
GOA	Gulf of Alaska
GRHP	Guam Register of Historic Places
GWP	global warming potential
H_2S	hydrogen sulfide
HDOH	Hawaii Department of Health
HEI	Health Effects Institute
HHCA	Hawaiian Homes Commission Act of 1920
HIANG	Hawaii Air National Guard
HIARNG	Hawaii Army National Guard
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
HIOSH	Hawaii Occupational Safety and Health Division
hp	horsepower
HRD	(Guam) Historic Resources Division
HRHP	Hawaii Register of Historic Places
HRS	Hawaii Administrative Rules, Revised Statute
HTA	Hawai'i Tourism Authority
HUC	hydrologic unit code
I/M	Inspection/Maintenance
IARC	International Agency for Research on Cancer
IBA	Important Bird Area
IEEE	Institute of Electrical and Electronics Engineers
IFC	International Finance Corporation
in	inches
IPCC	Intergovernmental Panel on Climate Change
IR	ionizing radiation
ITCZ	Intertropical Convergence Zone
IUCN	International Union for Conservation of Nature
kg/gal	kilograms per gallon
KIRC	Kaho'olawe Island Reserve Commission
LAER	lowest achievable emission rate
lb/day	pounds per day
lb/hp-hr	pounds per horsepower-hour

LBJ	Lyndon B. Johnson
Ldn	day-night average sound level
Leq	equivalent noise levels
LNG	liquefied natural gas
LTE	Long Term Evolution
$\mu g/m^3$	microgram(s) per cubic meter
µPa	micro Pascal
m/s	meter per second
MBTA	Migratory Bird Treaty Act
mg/m^3	Milligram(s) per cubic meter
mgd	million gallons per day
MHz	megahertz
MLRA	Major Land Resource Area
mm/s	millimeters per second
MMPA	Marine Mammal Protection Act
MOA	Memorandum of Agreement
MPA	Marine Protected Area
mph	miles per hour
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MTR	Military Training Route
MUID	Map Unit Identification Data
MW	megawatt
mW/cm^2	milliwatts per centimeter squared
N	north; not attained
N_2O	nitrous oxide
NA	not applicable; not assessed
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NANSR	Nonattainment New Source Review
NAWAS	National Warning System
NCA	National Climate Assessment
NCD	non-communicable disease
NCDC	National Climatic Data Center
NCN	no common name
NCRP	National Council on Radiation Protection and Measurements
ND	no data
NE	northeast
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NFIRS	National Fire Incident Reporting System
NHPA	National Historic Preservation Act
NIR	non-ionizing radiation
NMFS	National Marine Fisheries Service
NMHC	non-methane hydrocarbon compounds
NMOG	non-methane organic compounds
NNE	north-northeast
NOAA	National Oceanic and Atmospheric Administration
NOx	nitrogen oxides
NP	National Park
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	nationwide public safety broadband network
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NTIA	National Telecommunications and Information Administration
NVSR	National Vital Statistics Report
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
NWWS	National Weather Wire Satellite System
OHA	Office of History and Archaeology
OIA	Office of Insular Affairs (USDI)
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PAG	Port Authority of Guam
PAHO	Pan American Health Organization
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
PDO	Pacific Decadal Oscillation
PEIS	Programmatic Environmental Impact Statement
PL	Public Law
PM	particulate matter
PM_{10}	particulate matter up to 10 micrometers in diameter
$PM_{2.5}$	particulate matter up to 2.5 micrometers in diameter
POPs	points of presence
ppm	parts per million
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PREQB	Puerto Rico Environmental Quality Board
PR OSHA	The Puerto Rico Occupational Safety and Health Administration
PRASA	Puerto Rico Aqueduct and Sew Authority
PREPA	Puerto Rico Electric Power Authority
PRSHPO	Puerto Rico State Historic Preservation Office
PSD	Prevention of Significant Deterioration
PUAG	Public Utility Agency of Guam
PV	photovoltaic
RAN	radio access network
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act

RF	radio frequency
RIN	Regulation Identification Number
rms	root mean square
ROW	right-of-way
SAAQS	State Air Quality Standards
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SARA	Superfund Amendments and Reauthorization Act of 1986
SCD	State Civil Defense
SE	Standard of Error
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLR	sea level rise
SMA	Special Management Area
SMS	Scenery Management System
SO_2	sulfur dioxide
SOx	sulfur oxides
SPCZ	South Pacific Convergence Zone
SPOC	Single Point of Contact
SRES	Special Report on Emission Scenarios
SSA	sole source aquifer
STATSGO2	State Soil Geographic [Database]
SW	southwest
TAAQS	Territory Ambient Air Quality Standards
TCP	traditional cultural property
TEMCO	Territorial Emergency Management Coordinating Office
TMDL	Total Maximum Daily Load
TOC	total organic compound
tpy	tons per year
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
U.S.	United States
UAMES	University of Alaska Museum Earth Sciences
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Climate Change Research Program
USGS	U.S. Geological Survey
USVIDOH	U.S. Virgin Islands Department of Health
USVIPD	U.S. Virgin Islands Police Department
UVA	University of Virginia
VIC	Virgin Islands Code
VIPA	Virgin Islands Port Authority
VISHPO	Virgin Islands State Historic Preservation Office
VOC	volatile organic compound
vog	volcanic smog
VRM	Visual Resource Management
W	watt(s)
W/m^2	watts per meters squared
WAPA	Water and Power Authority
WHO	World Health Organization
WIMARCS	West Indies Marine Animal Research and Conservation Science
WNP	Western North Pacific
WNW	west-northwest
WPC	watts per channel
WPRFMC	Western Pacific Regional Fishery Management Council

3. ALASKA

This chapter provides details about the existing environment of Alaska and potential impacts related to the Proposed Action.

Russian explorers were the first Europeans to explore Alaska and founded the first permanent settlements in the late 1700s. Alaska was purchased by the United States in 1867, and became the District of Alaska in 1884, thereby establishing the first Alaska government. Alaska became a territory in 1912 and would later become the 49th state in 1959 (*APLIC 2015*). Located in the far northwestern region of North America, Alaska is not bordered by any U.S. states, only Canada to the east.

General facts about Alaska are provided below:

- State Nickname: The Last Frontier
- Area: 570,641 square miles; U.S. Rank: 1 (*U.S. Census Bureau 2010*)
- Capital: Juneau
- Boroughs: 20; 19 organized boroughs and 1 unorganized borough[1] (*State of Alaska 2010*)
- Population: 736,732 people; U.S. Rank: 48 (*U.S. Census Bureau 2010*)
- Most Populated Cites: Anchorage, Juneau, Fairbanks, Sitka, and Ketchikan (*State of Alaska 2010*)
- Main Rivers: Yukon River, Kuskokwim River, Colville River, and Copper River
- Bordering Waterbodies: Arctic Ocean, Pacific Ocean, Beaufort Sea, Bering Sea, and Gulf of Alaska
- Notable Mountain Ranges: Alaska Range, St. Elias Mountains, Wrangell Mountains, Chugach Mountains, Aleutian Range, Coast Mountains, Brooks Range, and Talkeetna Mountains
- Highest Point: Mt. McKinley (20,310 feet) (*USGS 2015*)

Alaska is generally considered to be one of the locations – if not the primary location – where early populations of peoples would have crossed into the Americas from East Asia across the "Bering Land Bridge" (the area of land linking Asia and Alaska that was present during the Ice Age). As a result, Alaska has a long and extensive history of indigenous peoples, many of whom would become the Alaska Native populations and cultures across its regions (*NPS 2015*). At the turn of the 20th century, thousands of miners and settlers came to Alaska during the gold rush. Some Alaska cities also experienced population growth as a result of military base construction during World War II.

[1] The "unorganized borough" consists of more than half of the landmass of Alaska. This area has no locally elected government, with local services provided directly by the state legislature.

When Alaska became a state in 1959, the federal government granted the new state government ownership of lands totaling approximately 105 million acres (28 percent of its total area). In 1971, Congress passed the Alaska Native Claims Settlement Act, which identified Alaska Native villages and corporations, and granted 44 million acres and 1 billion dollars to those entities (*Alaska DNR 2000*). Currently, Alaska Native tribes and tribal corporations own approximately 8 percent of the land in the state (*USGS 2012*). The federal government owns and manages approximately 66 percent of land in the state, much of which is managed in part or whole for forestry or recreation. The state government owns approximately 25 percent of land statewide.

Alaska's topography is highly varied, with several mountain ranges, hills, coastal plains, lowlands, cold-region deserts, lakes, rivers, wetlands, glaciers, and fjords. Due to Alaska's large landmass, the state is divided into eight climatic regions, ranging from temperate rainforest to polar tundra (*ADEC 2012*). High wind (greater than 50 mph) is the most common severe weather phenomenon within the state. Approximately 80 percent of the land in Alaska is permafrost (*USGCRP 2014*).

Alaska is presented with a unique set of challenges for the transportation-related aspects of public safety given its rugged terrain, severe weather conditions, and harsh climate. The majority of the hospitals in Alaska are located in remote areas, often with no other hospitals nearby. Therefore, as air transportation of patients is a necessity, there are many providers for emergency medical air services in the state (*State of Alaska 2007*). Given the size of the state and the percentage of undeveloped land, aviation (including seaplane) is a major form of transportation in Alaska.

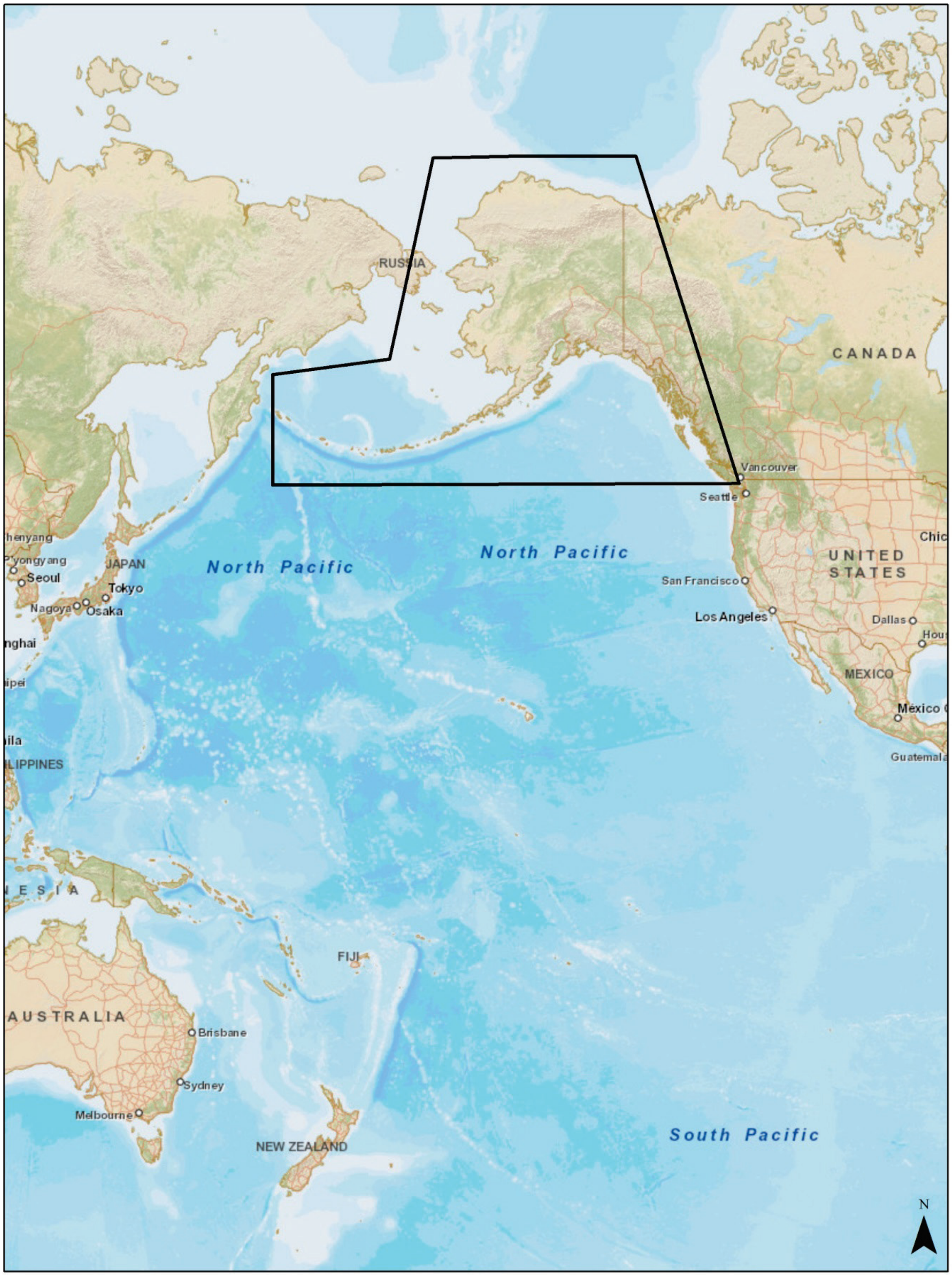
Juneau is the capital and is located in the Panhandle Region of southeast Alaska. Alaska's government is based on its State Constitution, which includes a system of governance with three primary branches: legislative, executive, and judiciary. Alaska's legislative branch has 60 members (20 senators with staggered 4-year terms and 40 representatives who are elected every 2 years); the executive branch is comprised of the Governor's administration and several departments that enforce the laws; and the judicial branch is comprised of the court system that interprets the law (*State of Alaska Legislative Affairs Agency 2011*). The Alaska Department of Environmental Conservation and the Alaska Department of Fish and Game are the state environmental agencies.

Alaska does not currently regulate first responder services. The Alaska Council on Emergency Medical Services advises on emergency medical services policy and program direction. Alaska Occupational Safety and Health, in coordination with OSHA, is the primary regulatory agency responsible for the enforcement of worker safety and health regulations. All the boroughs have their own police departments (*State of Alaska 2015a*); Alaska State Trooper posts are also located through the Unorganized Borough (*Alaska DPS 2015*). The Division of Fire and Life Safety provides fire services in Alaska to prevent loss of life and property from fire and explosion (*State of Alaska 2015b*). The Bureau of Land Management Alaska Fire Service (AFS) provides wildland fire management for Department of the Interior and Native Corporation Lands in Alaska and provides oversight of the Bureau of Land Management Aviation program in Alaska.

The state contains approximately 44,000 miles of coastal shoreline (see Figure 3-1). While Alaska has the largest amount of groundwater resources in the United States, surface water supplies 75 percent of Alaska's water demands for industry, agriculture, mining, fish processing, and public water use (*ADEC 2013*). Alaska's economy is driven largely by the oil and gas industry and the federal government, each of which provide (directly or indirectly) approximately one-third of all statewide jobs. Other important economic sectors include commercial fisheries, mining, tourism, and air cargo (*Goldsmith 2008*). Borough-level unemployment rates range widely.

This chapter contains a discussion of the Affected Environment (see Section 3.1) and Environmental Consequences (see Section 3.2) for each of the 15 resources:

- Infrastructure
- Soils
- Geology
- Water Resources
- Wetlands
- Biological Resources
  - Terrestrial Vegetation
  - Wildlife
  - Fisheries and Aquatic Habitats
  - Threatened and Endangered Species and Species of Conservation Concern
- Land Use, Airspace, and Recreation
- Visual Resources
- Socioeconomics
- Environmental Justice
- Cultural Resources
- Air Quality
- Noise
- Climate Change
- Human Health and Safety



Source: Map Service 2015

Figure 3-1: Alaska Geography

3.1. Affected Environment

This section provides a description of those portions of the environment that could be affected by the Proposed Action in Alaska. This information is used in the assessment of potential impacts from the Proposed Action as described in 3.2, Environmental Consequences; the level of detail in the description of each resource in this section corresponds to the magnitude of the potential direct, indirect, or cumulative impacts of the Proposed Action. The information presented was derived from government data or reports and scientific literature. This section describes the current conditions and characteristics of 15 distinct resources:

- Section 3.1.1, Infrastructure: existing transportation, public safety services and infrastructure, communication services, and other utilities and related emergency operational planning;
- Section 3.1.2, Soils: existing soil resources, features, and characteristics;
- Section 3.1.3, Geology: geologic features and characteristics that would be potentially sensitive to impacts from construction and operation of the Proposed Action, as well as geologic hazards that could potentially affect the Proposed Action;
- Section 3.1.4, Water Resources: surface water, floodplains, nearshore marine waters, and groundwater;
- Section 3.1.5, Wetlands: wetland resources, features, and characteristics;
- Section 3.1.6, Biological Resources: terrestrial vegetation, wildlife, fisheries and aquatic habitats, and threatened and endangered species and species of conservation concern;
- Section 3.1.7, Land Use, Airspace, and Recreation: overview of land use, airspace, and recreational facilities and activities;
- Section 3.1.8, Visual Resources: natural and human-made features, landforms, structures, and other objects;
- Section 3.1.9, Socioeconomics: demographic, cultural, and economic conditions;
- Section 3.1.10, Environmental Justice: demographic data on minority or low-income groups;
- Section 3.1.11, Cultural Resources: known historic properties, traditional cultural properties, and places of cultural or religious significance;
- Section 3.1.12, Air Quality: existing air quality conditions;
- Section 3.1.13, Noise: existing noise conditions;
- Section 3.1.14, Climate Change: setting and context of global climate change effects in Alaska; and historical and existing climate parameters including temperature, precipitation, and severe weather; and
- Section 3.1.15, Human Health and Safety: health profile of the population of Alaska, including basic population health indicators and a discussion of any key community health and safety issues identified.

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3.1.1. Infrastructure

3.1.1.1. Introduction

This section discusses existing infrastructure in the state of Alaska. Information presented in this section focuses on existing transportation, public safety services and infrastructure, communication services, and other utilities and related emergency operational planning that could be augmented, supplemented, or otherwise affected by deployment and operation of the Proposed Action.

Infrastructure consists of the systems and physical structures that enable a population in a specified area to function. Infrastructure includes a broad array of facilities such as utility systems, streets and highways, railroads, airports, buildings and structures, ports, harbors, and other manmade facilities. Individuals, businesses, government entities, and virtually all relationships between these groups depend on infrastructure for their most basic needs, as well as for critical and advanced needs (e.g., emergency response, health care, and telecommunications).

Infrastructure is entirely manmade with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as "developed." Public safety infrastructure is any infrastructure utilized by a public safety entity[1] as defined in the Middle Class Tax Relief and Job Creation Act of 2012, including infrastructure associated with police, EMS, and fire services. This infrastructure includes fire and rescue departments, law enforcement precincts, medical centers and hospitals, transportation assets, and schools and libraries, which can be used as evacuation centers. First responder personnel include dispatch, fire and rescue, law enforcement, and medical professionals throughout the state.

Utilities typically consist of the power, water, sewer, transit, and telecommunications systems that are essential to support daily operations. Changes in land use, population density, and development usually generate changes in the demand for and supply of utilities.

3.1.1.2. Specific Regulatory Considerations

Alaska does not currently regulate first responder services. The Alaska Council on Emergency Medical Services advises on emergency medical services (EMS) policy and program direction.

The *State of Alaska Emergency Operations Plan* was implemented by the State of Alaska, Department of Military and Veterans Affairs - Division of Homeland Security and Emergency Management in 2011 in order to mitigate, prepare for, respond to, and recover from all potential terrorist attacks and natural disasters that occur in the state. The *State of Alaska Emergency Operations Plan* is an all-hazard plan that coordinates the planning process between communities in Alaska and responding state agencies. Based on *Alaska Statute 26.23*, the state and municipalities must assist in the creation and revision of local and inter-jurisdictional disaster planning. In the event that critical infrastructure is damaged in an emergency situation,

[1] The term "public safety entity" means an entity that provides public safety services (47 USC § 1401(26)).

the state will apply resources from the United States (U.S.) Department of Homeland Security, other federal sources, and state agencies (*DMVA/DHS&EM 2011*).

State agencies with regulatory or administrative authority over other state infrastructure are identified in the sections below.

3.1.1.3. Transportation

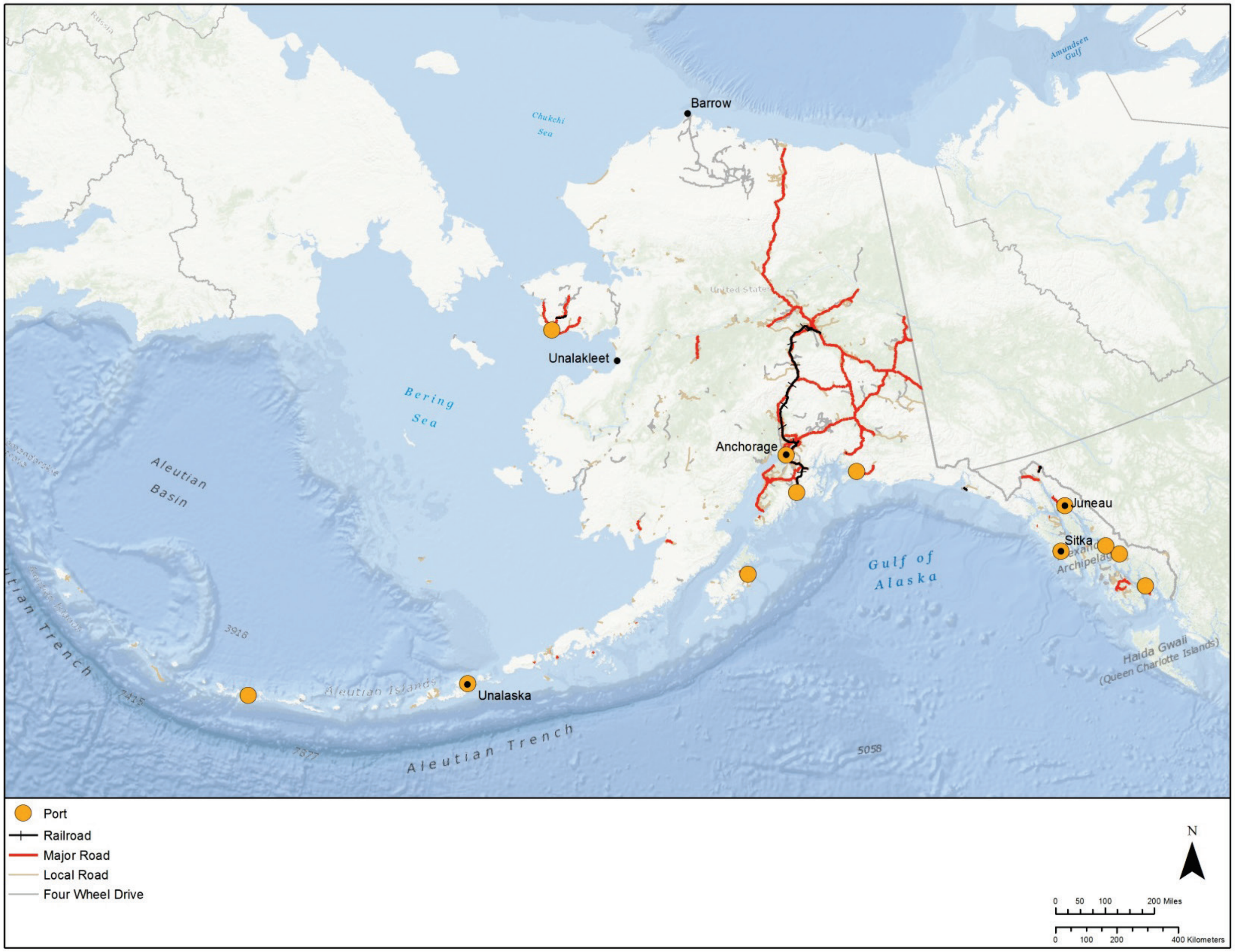
Alaska is presented with a unique set of challenges as it relates to the transportation-related aspects of public safety infrastructure given its rugged terrain, severe weather conditions, and harsh climate. The majority of the land in Alaska is undeveloped, and communities are often widely dispersed. Furthermore, these communities are often not connected by land-based roads and methods of transportation, which make the need for interoperable communications more crucial. These factors play a major role in the availability of adequate infrastructure and equipment during emergency situations and first responder protocols (*Alaska NHTSATAT 2014*).

The Department of Transportation and Public Facilities controls transportation service and critical infrastructure related matters in Alaska. Aviation is a major form of transportation in Alaska given the rugged terrain and vast landscape. There are 287 airports in Alaska, all of which are for public use (*AAA 2012*). Of the 287 airports in Alaska, 20 are also used for commercial purposes (*AirportFlyer.com 2015*); 249 are controlled by the Department of Transportation and Public Facilities; and all remaining airports are owned by the government (*Alaska DOT&PF 2015*). In addition to the commercial and public use airports in the state, there are over 3,000 airstrips, a large number of which are private (*Alaska Chapter Ninety-Nines 2013*).

Additionally, there are 5,500 miles of inland waterways and 55 seaports concentrated primarily along the southern coast (see Figure 3.1.1-1). These ports are used for commercial shipping (including cruise line tourism, cargo, and fishing) activities, ferry terminals, and the accommodation of vessels of various sizes (*Thesing et al. 2006*).

Two railroads operate in the state: the Alaska Railroad Corporation railroad, which extends from Fairbanks to Seward, and the White Pass and Yukon Route, which extends from Skagway to Fraser (as shown in Figure 3.1.1-1). The Alaska Railroad Corporation operates freight and passenger rail service in Alaska on 521 miles of main and branch lines. The White Pass and Yukon Route, a seasonal tourist railroad, operates passenger rail service in Alaska along approximately 20 route miles of rail line (*HDR, Inc. & CDM Smith 2015*).

There are 16,301 public roads in the state, 2,645 of which are designated by the American Society of Civil Engineers as major roads. Nineteen percent of these roads were found to be in poor condition (see Figure 3.1.1-1) (*ASCE 2015; TRIP 2015*). There is a total of 1,522 miles of highway throughout the state. The Alaska Department of Transportation and Public Facilities is the owner of most of the Alaska's national highways (*Maps of World 2014*). There are 1,196 bridges distributed throughout Alaska, 133 of which are structurally deficient.



Source: GNA 2015; Esri 2014a and 2014b

Figure 3.1.1-1: Ports, Railroads, and Roads in Alaska by Location

3.1.1.4. Public Safety Services

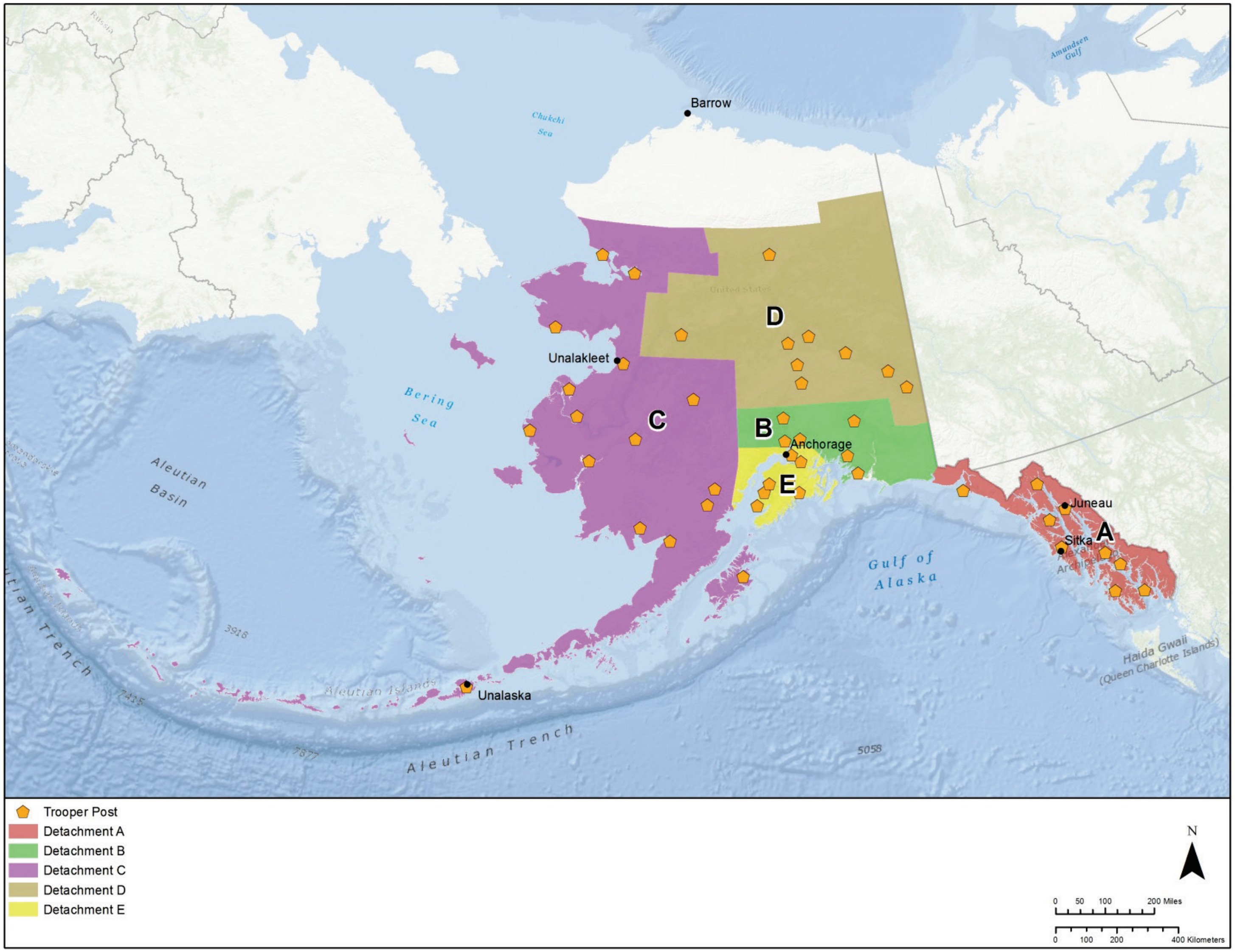
This section provides a description of baseline public safety telecommunications infrastructure conditions as it relates to police services, fire services, EMS, and hospitals in Alaska.

Police Services

The Alaska State Troopers (AST), a division of the Alaska Department of Public Safety, provides police services. The AST are a full-service law enforcement agency and handle both traffic and criminal law enforcement. As Alaska has no counties, there are no county police/sheriffs. However, Alaska does have boroughs, which function somewhat similar to counties in other states except that the boroughs do not cover the entire land area of the state. The area not part of any borough is referred to as the *Unorganized Borough (State of Alaska 2015a)*. Together, Alaskan officials and the U.S. Census Bureau divided the Unorganized Borough into 11 separate, named statistical entities referred to as Census Areas (*U.S. Census Bureau 2012*). All the boroughs have their own police departments (*State of Alaska 2015a*). Alaska State Trooper posts are also located through the Unorganized Borough (*Alaska DPS 2015*).

Currently, there are posts assigned to five different geographic detachments for Alaska State Troopers (as shown in Figure 3.1.1-2) (*State of Alaska 2015a*):

- **Detachment A**: Headquarters (HQ) – Ketchikan; Posts- Haines, Juneau, Klawock, Ketchikan, Petersburg
- **Detachment B**: HQ – Palmer; Posts - Glennallen, Palmer, Mat-Su West
- **Detachment C**: HQ – Anchorage; Posts - Anchorage, Aniak, Bethel, Dillingham, Emmonak, Iliamna, King Salmon, Kodiak, Kotzebue, McGrath, Nome, Saint Mary's, Selawik, Unalakleet
- **Detachment D**: HQ – Fairbanks; Posts- Barrow, Cantwell, Delta Junction, Fairbanks, Galena, Healy, Nenana, Northway, Tok
- **Detachment E**: HQ – Soldotna; Posts - Anchor Point, Cooper Landing, Girdwood, Ninilchik, Seward, Soldotna



Source: Alaska DPS 2015

Figure 3.1.1-2: Alaska State Trooper Detachment Boundaries and Post Locations

Alaska National Guard

In addition to the Alaska State Troopers, the Alaska National Guard also plays a key role in ensuring public safety in the state. The Alaska National Guard is made up of the Alaska Air National Guard and the Alaska Army National Guard. Together the Alaska Air National Guard and the Alaska Army National Guard provide military support in the state during times of war and natural emergencies such as floods, earthquakes, and forest fires. The Alaska National Guard also performs search and rescue operations *(Alaska National Guard 2015)*. Alaska Army National Guard operates 116 armories in 88 different communities throughout Alaska *(GlobalSecurity.org)*. The 176th Wing of the Alaska Air National Guard is located at Joint Base Elmendorf-Richardson with an additional detachment at Eielson Air Force Base (*Air National Guard Undated).*

Fire Services

The Division of Fire and Life Safety provides fire services in Alaska to prevent loss of life and property from fire and explosion (*State of Alaska 2015b*). The Bureau of Land Management (BLM) Alaska Fire Service (AFS) provides wildland fire management for Department of the Interior and Native Corporation Lands in Alaska and provides oversight of the BLM Alaska Aviation program. AFS operates on an interagency basis with BLM, State of Alaska Natural Resources, U.S. Department of Agriculture Fire Service, National Parks Service, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, and U.S. Military in Alaska (*USDOI 2015*).

The Division of Fire and Life Safety manages 270 fire departments distributed throughout Alaska, and AFS controls 15 Fire Area Management Zones with suppression resources centralized at Fort Wainwright in Fairbanks (*USDOI 2015*).

EMS and Hospital Services

EMS is provided under the Alaska Department of Health and Social Services/Division of Public Health – Section of Emergency Programs, EMS Unit. In Alaska there are 24 licensed acute care hospitals, 12 level IV trauma centers, one level II trauma center, and two cardiac specialty care centers. Currently there are no pediatric specialty hospitals, burn centers, or stroke centers in Alaska. The majority of the hospitals in Alaska are located in remote areas, often with no other hospitals nearby. Therefore, air transportation of patients is a necessity; there are many providers for emergency medical air services in the state (*Alaska DHSS 2006*). Anchorage is the only municipality within Alaska that houses three large hospitals, an additional military hospital, and other medical resources close by (*Alaska NHTSATAT 2014*).

As previously stated, Alaska does not currently regulate First Responder services. Alaska Council on Emergency Medical Services advises on EMS policy and program direction. The state provides some regulation for medical air services due to the rugged terrain and lack of roads (*Alaska NHTSATAT 2014*).

3.1.1.5. Communications

Over the years, numerous lives have been lost as a result of the lack of interoperability in public safety telecommunications in America. The Final Report of the Public Safety Wireless Advisory Committee identified three main issues in public safety communications: 1) congested radio frequencies; 2) the inability of public safety officials to communicate with each other due to incompatible equipment, multiple frequency bands, and lack of standardization in repeater spacing and transmission formats; and, 3) the lack of cutting-edge communications technologies (*Public Safety Wireless Advisory Committee 1996*). Large-scale emergency situations like Hurricane Sandy and the September 11 attacks further exposed vulnerabilities in the public safety communications systems, especially as it related to inadequate infrastructure. During Hurricane Sandy, infrastructure that was resilient and could withstand weather-related risks was unavailable, leading to devastating power outages, fuel shortages, and significant road and transit complications (*HSRTF 2013*). Likewise, based on the September 11 attacks, the National Task Force on Interoperability concluded that more effective infrastructure, capable of supporting interoperable radio communications, could have resulted in the preservation of numerous lives (*NTFI 2005*). Additionally, the National Task Force on Interoperability asserts that nationwide, first responders' reliance on numerous separate, incompatible, and often proprietary land mobile radio networks makes it difficult, and at times impossible, for emergency responders from different jurisdictions to communicate, especially during major emergencies that require a multi-jurisdictional response (*NFTI 2005*).

Public Safety Communications

The communication methods used by various public safety services in the state of Alaska are listed in Table 3.1.1-1.

Table 3.1.1-1: Public Safety Communications System

Public Safety Service	Communications Systems
Police Services	• Alaska Land Mobile Radio System (ALMR) • State of Alaska Emergency Alert System (EAS) • Amber Alert System • Silver Alert System • Alaska Automated Fingerprint Identification System (AAFIS) • Alaska Public Safety Information Network (APSIN) • 911 Emergency • Alaska Records Management System (ARMS)
Fire Services	• Alaska Land Mobile Radio System (ALMR) • Division of Fire and Life Safety • Alaska Fire Incident Reporting System (ANFIRS) • National Fire Incident Reporting System (NFIRS)

Public Safety Service	Communications Systems
	• 911 Emergency
EMS/Hospital Services	• Alaska Land Mobile Radio System (ALMR) • 911 Emergency • Alaska Uniform Response Online Reporting Access (AURORA)

Sources: Alaska NHTSATAT 2014; State of Alaska 2015a; State of Alaska 2015b; Public Safety Transition Working Group 2015

All Other Communications

The communication methods used during disaster events and other services in the state of Alaska are listed in Table 3.1.1-2.

Table 3.1.1-2: Other Communication Systems

Public Safety Service	Communications Systems
Transportation	• Alaska Land Mobile Radio System (ALMR) • 511 Traveler Information
Alaska Disaster Officials	• National Warning System (NAWAS) • Alaska Warning System (AKWAS)
Watch/Warning communication	• National Weather Wire Satellite System (NWWS) • Alaska Tsunami Warning Center (ATWC) • Very High Frequency (VHF) Radio System • Emergency Broadcast System (EBS)

Sources: Sokolowski 1990; Alaska DOA 2015; State of Alaska 2011

3.1.1.6. Other Utilities

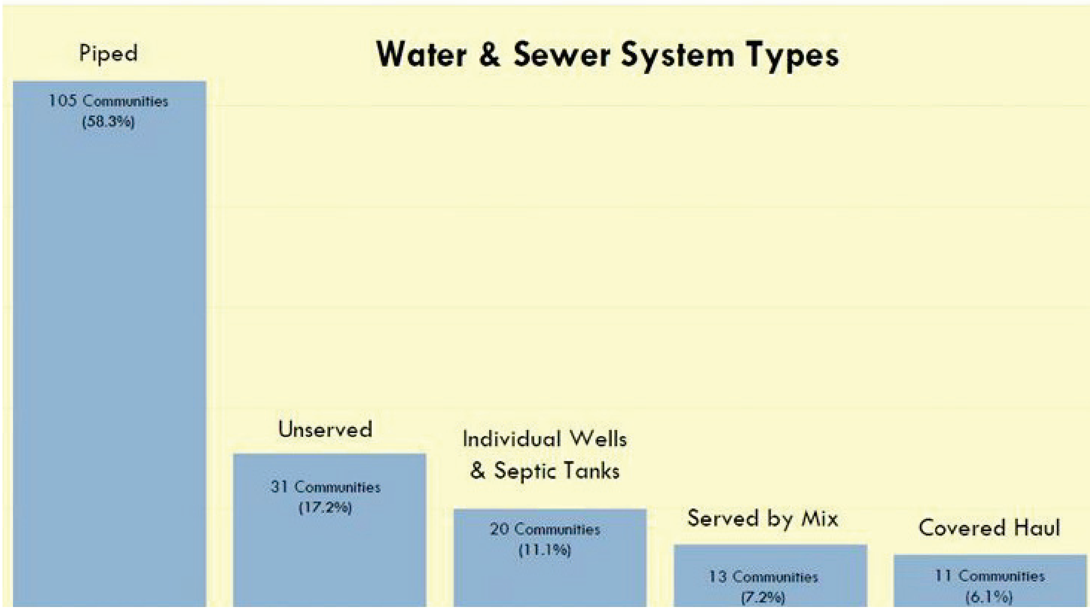
Alaska maintains infrastructure for various public utilities including water, wastewater treatment plants, dams, bridges, power generation plants, refineries, oil exploration, and production facilities.

Energy

In 2010, Alaska had approximately 2,188 megawatts of utility installed capacity, which was capable of generating 6.5 million mega-watt hours of electricity. Fifty-seven percent of electricity in 2010 was generated from natural gas sources, 22 percent from hydroelectric power, 15 percent from oil, 6 percent from coal, and less than 1 percent from wind energy. Sources of electricity vary significantly by region (*Fay et al. 2011*).

Water and Wastewater Service

In rural Alaska, 58.3 percent of communities use piped water and sewer systems, 11.1 percent use individual wells and septic tanks, 7.2 percent are served by mixed systems, 6.1 percent use a covered haul system[2], and 17.2 percent are unserved (as shown in Figure 3.1.1-3) (*State of Alaska 2015c*). The American Society of Civil Engineers estimates $812 million in drinking water infrastructure will be needed in the entire state over the next 20 years (*ASCE 2015*).



Source: State of Alaska 2015c

Figure 3.1.1-3: Rural Alaska Water and Sewer System Types

3.1.1.7. Emergency Operations Plan

According to the American Society of Civil Engineers, Alaska's infrastructure is made up of 20 high hazard dams, and 70 percent of state regulated dams have an emergency action plan. The state also contains 27 miles of levees and six hazardous waste sites on the National Priorities List (*ASCE 2015*).

[2] A covered haul system involves water "piped into the carrier vehicle, withdrawn by similar mechanism into the user's cistern, and in most cases, piped again from cistern to faucet." (*USEPA 1998*)

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3.1.2. Soils

3.1.2.1. Introduction

This section discusses the existing soil resources in Alaska. Information is presented regarding soil features and characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

The Soil Science Society of America defines soil as:

> "(i) The unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants.
>
> (ii) The unconsolidated mineral or organic matter on the surface of the Earth that has been subjected to and shows effects of genetic and environmental factors of: climate (including water and temperature effects), and macro- and microorganisms, conditioned by relief, acting on parent material over a period of time. A product-soil differs from the material from which it is derived in many physical, chemical, biological, and morphological properties and characteristics." *(NRCS 2015*)

Five primary factors account for soil development patterns. A combination of the following variables contributes to the soil type in a particular area (*Anderson et al. 2001*):

- *Parent Material:* The original geologic source material from the soil formed affects soil aspects, including color, texture, and ability to hold water.
- *Climate:* Chemical changes in parent material occur slowly in low temperatures. However, hot temperatures evaporate moisture, which also facilitates chemical reactions within soils. The highest degree of reaction within soils occurs in temperate, moist climates.
- *Topography:* Steeper slopes produce increased runoff, and, therefore, downslope movement of soils. Slope orientation also dictates the microclimate to which soils are exposed, because different slope faces receive more sunlight than others.

3.1.2.2. Specific Regulatory Considerations

The Alaska Department of Environmental Conservation requires stormwater discharge permits for construction projects that require ground disturbance of greater than 1 acre. Permits would require development of, and adherence to, a Stormwater Pollution Prevention Plan to manage construction site runoff. Other local or state-level permits may be required to reduce soil erosion and sedimentation, depending on location and local requirements.[1] There are no other Alaska-specific regulatory considerations for soil resources that pertain to the types of activities associated with the Proposed Action outside of those discussed in Section 1.8, Overview of

[1] See Section 3.2.2 for specific information related to best management practices that would be implemented to reduce or avoid potential impacts to soil resources.

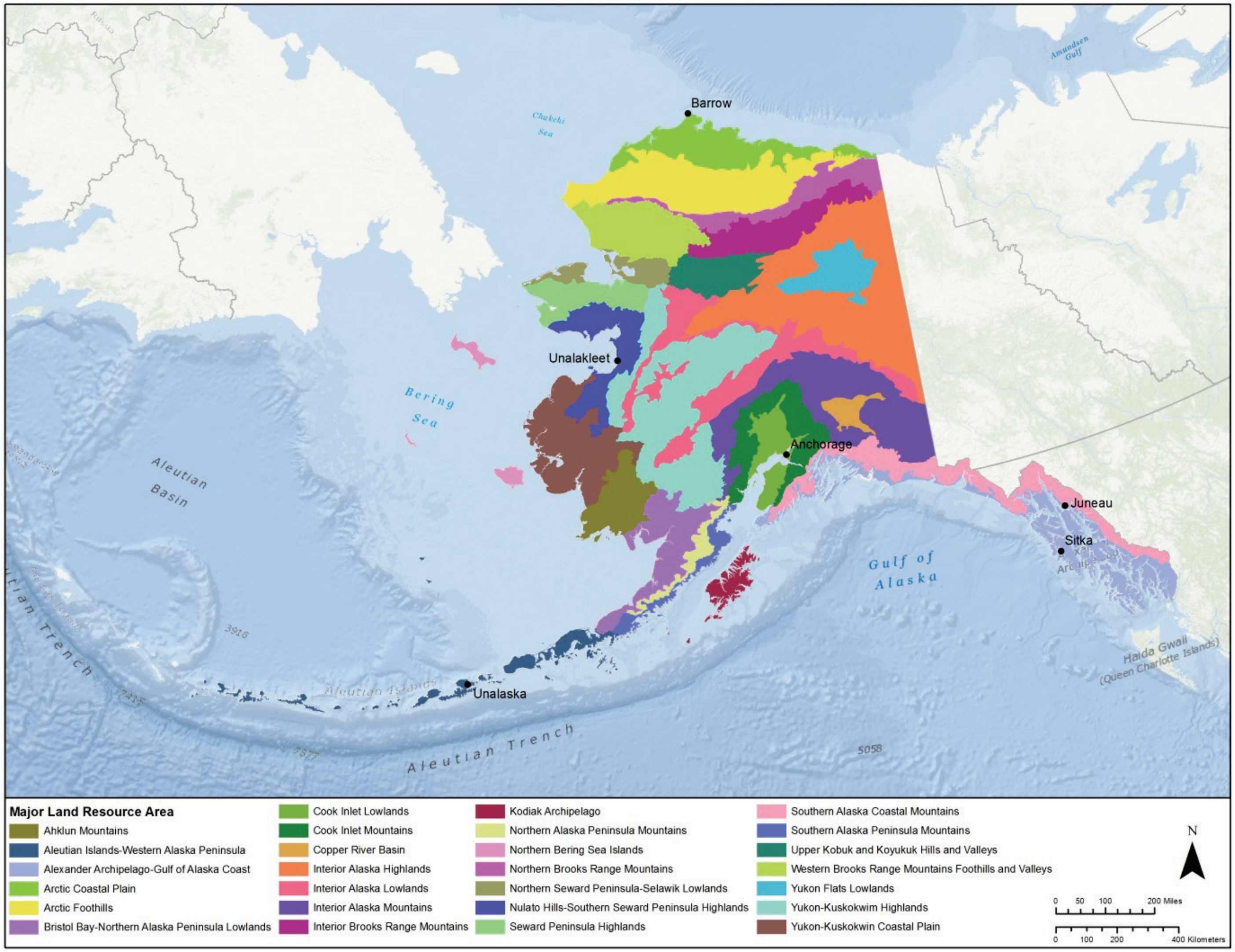
Relevant Federal Laws and Executive Orders, and Appendix C, *Environmental Laws and Regulations*.

3.1.2.3. Environmental Setting

As mentioned above, soil formation occurs due to complex and multiple interactions among geologic material, climate, topography, biological processes (such as vegetation growth and interactions with other organisms), and time. The soil resources present in Alaska were identified, evaluated, and described using information gathered from and characteristics as defined by the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) State Soil Geographic (STATSGO2) soil order and suborder information (STATSGO2 Database 2015) database and the NRCS's Major Land Resource Areas (MLRAs) soil descriptions[2] (*NRCS 2006*).

Land resource regions in Alaska consist of Southern Alaska, Aleutian Alaska, Interior Alaska, Western Alaska, and Northern Alaska. Within these regions, there are 27 total distinct land resource areas (see Figure 3.1.2-1) in Alaska. A summary of the typical physiographic characteristics and general soils characteristics found within each land resource area in Alaska is included in Table 3.1.2-1.

[2] The NRCS categorizes soil resources into land resource units based on significant geographic differences in soils, climate, water resources, or land use. These land resource units are typically coextensive with general soil map units at the state level. Geographically associated land resource units are further grouped into major land resource areas, which are then grouped into land resource regions. These large areas are important for statewide agricultural planning as well as interstate, regional, and national planning.



Source: NRCS 2006

Figure 3.1.2-1: Major Land Resources Areas of Alaska

Table 3.1.2-1: Major Land Resource Areas in Alaska

MLRA Name	Physiographic Characteristics	General Soil Characteristics
Ahklun Mountains	Steep, rugged, low mountains with narrow to broad valleys	Shallow to deep, excessively drained to very poorly drained
Aleutian Islands-Western Alaska Peninsula	Steep, low to moderately high, rounded mountains and isolated, moderately high volcanic cones	Shallow to deep and excessively drained to very poorly drained; nonsoil areas make up 46% (cinder land, rock outcrop, water, riverwash, and beaches)
Alexander Archipelago-Gulf of Alaska Coast	Deep narrow to broad valleys with alluvial and colluvial fans and short footslopes common in valleys along bases of mountains; rocky headlands and sea cliffs common along the coast; central portions of the area consist of strongly sloping to moderately steep outwash plains, alluvial fans, long footslopes and floodplains	Shallow to deep and well drained to very poorly drained
Arctic Coastal Plain	Level to rolling plain rising from the Arctic Ocean to the Artic Foothills (see row below)	All soils have permafrost; shallow to moderately deep to permafrost and poorly drained to very poorly drained
Arctic Foothills	Broad, rounded ridges and mesa-like uplands; also buttes and linear ridges with undulating plains and plateaus	Shallow to moderately deep; moderately well drained to very poorly drained
Bristol Bay-Northern Alaska Peninsula Lowlands	Gently sloping to rolling plains and low or moderate-relief hills bordered by mountain footslopes	Shallow to moderately deep, excessively drained to very poorly drained
Cook Inlet Lowlands	Gently sloping to rolling plains and low or moderate-relief hills bordered by lower slopes of the surrounding mountains; depressions and basins on plains contain thousands of lakes and wetlands	Deep and well drained to very poorly drained
Cook Inland Mountains	Rugged, moderate to high mountains with valley glaciers and ice fields and associated landforms at higher elevations	Shallow to very deep and excessively drained to very poorly drained
Copper River Basin	Nearly level to undulating plains and rolling hills; depressions and shallow basins have lakes and wetlands	Shallow to moderately deep, well to very poorly drained
Interior Alaska Highlands	Moderately steep or steep, moderate to high-relief hills and mountains and narrow to broad flat-bottomed valleys	Shallow to deep to permafrost, excessively well drained to very poorly drained
Interior Alaska Lowlands	Broad, nearly level braided to meandering floodplains, stream terraces, and outwash plains; shallow basins and stream terraces contain lakes and wetlands	Shallow to moderately deep to permafrost and excessively drained to very poorly drained
Interior Alaska Mountains	Rugged high mountains and low rounded hills with large valley glaciers and associated landforms	Shallow to very deep and excessively to poorly drained
Interior Brooks Range Mountains	Rugged, high mountains and narrow, high gradient valleys	Shallow to moderately deep, excessively drained to very poorly drained

MLRA Name	Physiographic Characteristics	General Soil Characteristics
Kodiak Archipelago	Consists of low to moderately high rolling mountains; at lower elevations, broad nearly level valleys are bordered by rolling hills; irregular coastlines have sea cliffs and narrow, steep-walled bays	Shallow to deep and well drained to very poorly drained
Northern Alaska Peninsula Mountains	Rugged, low to moderately high mountains with narrow, steep valleys	Deep, well drained to very poorly drained
Northern Bering Sea Islands	Nearly level to rolling plains and highlands with gentle slopes; some steep volcanic cones, vents, and lava flows	Shallow to moderately deep, well drained to poorly drained
Northern Brooks Range Mountains	Steep, rugged, high mountains and narrow valleys	Shallow to moderately deep, poorly drained to very poorly drained; nonsoil areas make up about 75% (rubble land, rock outcrop, small glaciers)
Northern Seward Peninsula-Selawik Lowlands	Nearly level to rolling plains, river deltas, and extended mountain footslopes	Deep, well drained to very poorly drained
Nulato Hills-Southern Seward Peninsula Highlands	Rolling hills and broad valleys, some low mountains further inland	Shallow to deep, well drained to poorly drained
Seward Peninsula Highlands	Extensive rolling hills, lowlands, and some rugged, moderately high mountains	Shallow or moderately deep, excessively drained to very poorly drained
Southern Alaska Coastal Mountains	Consists of steep and rugged high-relief mountains, glaciers, and ice fields with numerous glacial landforms, narrow to broad valleys, floodplains and stream terraces, and steep alluvial fans	Shallow to deep and well drained to somewhat very poorly drained; nonsoil areas make up more than 90% (rock outcrop, rubble land, glaciers)
Southern Alaska Peninsula Mountains	Rugged, low to moderately high mountains deeply dissected with narrow, high-gradient valleys; glaciers and small ice fields common at upper elevations	Shallow to deep and well drained to very poorly drained; nonsoil areas make up 51 % (rock outcrop, rubble land, glaciers, river outwash, and beaches)
Upper Kobuk and Koyukuk Hills and Valleys	Broad, nearly level river valleys, shallow basins, and rolling uplands	Shallow to deep, excessively drained to very poorly drained
Western Brooks Range Mountain Foothills and Valleys	Floodplains, stream terraces, rolling hills, and upland slopes rising to moderately steep foothills up to rugged, high relief mountains	Shallow to deep, well drained to very poorly drained
Yukon Flats Lowlands	Nearly level to undulating marshy stream terraces and floodplains; numerous lakes, ponds and wetlands in depressions	Shallow to deep in permafrost, excessively drained to very poorly drained
Yukon-Kuskokwim Highlands	Moderate to high relief mountains and narrow, flat-bottomed valleys	Shallow to moderately deep, excessively well drained to very poorly drained
Yukon-Kuskokwin Coastal Plain	Level to rolling delta plain with some isolated low hills	Shallow to deep, excessively drained to very poorly drained. Nonsoil areas make up 40 % (primarily water and beaches)

Source: NRCS 2006

3.1.2.4. Soil Suborder Characteristics

The STATSGO2 soil database identified 21 soil suborders in Alaska. Table 3.1.2-2 provides a summary of the major physical-chemical characteristics of the various suborders found in Alaska, and Figure 3.1.2-2 (below the table) depicts the distribution of those suborders. A summary of the major soil characteristics relevant to the types of activities expected to be associated with the Proposed Action is presented in the table below.

Slope and Runoff and Erosion Potential

Slopes in Alaska range from 0 to 110 percent (flat to very steep). In general, areas with steep or very steep slopes along with organic rich soils tend to result in a moderate to high potential for runoff and erosion, as indicated in Table 3.1.2-2. Soil suborders in Alaska that have severe erosion potential include Cryands, Orthents, Wassents, Cryepts, Gelepts, Umbrepts, Gelolls, and Cryods. Generally, runoff and erosion diminish soil fertility as the topsoil is eroded away; this often leads to increased sedimentation in nearby surface waterbodies and can be exacerbated by ground disturbance activities. In addition, areas with very steep slopes with high potential for runoff and erosion are not well suited as construction locations. As explained in Section 3.1.2.3, Environmental Setting, numerous major land resource areas in Alaska are characterized as having steep slopes.

Drainage Class and Permeability

Most soil suborders in Alaska are characterized as poorly drained and many have water tables near the surface or are found near ponds or wetlands near geomorphic depressions (see Tables 3.1.2-1 and 3.1.2-2). Permeability ranges from slow to fast.

Hydric Soils

Hydric soils are formed under wet conditions, such as in areas prone to flooding or ponding. In order for hydric soils to develop, these areas must be wet long enough during the growing season to develop anaerobic conditions that support the growth of water-tolerant vegetation, such as the vegetation found in certain wetland environments. Hydric inclusions occur in the numerous soil suborders in Alaska as shown in Table 3.1.2-2.

Compaction and Rutting Potential

Compaction and rutting[3] potential for soils found in Alaska is generally moderate to high given the soil textures and drainage classes of the soils present. Of the soils present in Alaska, poorly drained and hydric soils likely have the greatest potential for compaction and rutting. Wet soils tend to have a lower resistance to compaction and rutting than dry soils.

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[3] A soil rut is a sunken track or groove made by vehicle or equipment activity.

Table 3.1.2-2: General Characteristics of Soil Suborders Found in Alaska

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
Andisols	Aquands	Formed in volcanic ash or other volcanic material; found in lower landscape positions and under forest or grass vegetation; some soils are drained and used as cropland or pasture; water table is at or near the surface much of the year.	Consists of moderately decomposed plant material	0 - 20	Low to moderate	Slight to moderate	Very poorly drained	Slow to fast	Yes	Moderate to high
	Cryands	Formed in volcanic ash or other volcanic material under coniferous vegetation; most Cryands used as forest; found in cold climates.	Slightly decomposed plant; very stony slightly decomposed plant material; silt loam	0 - 50	Low to high	Slight to severe	Well drained	Slow to fast	No	Moderate

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments; water table at or near the surface for much of the year; supports vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Very fine sandy loam; slightly decomposed plant material	0 - 2	Low	Slight to moderate	Somewhat poorly drained to poorly drained	Moderate	Some[c]	Moderate
	Fluvents	Commonly found on floodplains; sugarcane, cultivated crops, and improved pasture cover some areas; soils generally have good potential for farming.	Loamy sand, stratified silt loam to fine sand; slightly decomposed plant material	0 - 12	Low to moderate	Slight to moderate	Somewhat poorly drained to well drained	Slow to fast	No	Low to high
	Orthents	Commonly found on recent erosional surfaces; used mostly as rangeland, pasture, or wildlife habitat; Orthents are common Entisols that do not meet criteria for other suborders.	Sandy loam; stratified sand to silt; slightly decomposed plant material	0 - 100	Low to high	Slight to severe	Somewhat poorly drained to somewhat excessively drained	Slow to fast	No	Low to high

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
	Wassents	Like other Entisols, Wassents are soils of recent origin; these soils are submerged for more than 21 hours every day.	Stratified very fine sand to silty clay loam; gravelly silt loam	—	Low	Slight to severe	Very poorly drained	—	Yes	High
Gelisols	Aquepts	Aquepts have poor or very poor natural drainage; if these soils have not been artificially drained, ground water is at or near the soil surface; primarily used for pasture, cropland, forest, or wildlife habitat; likely formed under forest vegetation.	Peat (slightly decomposed organic material)	0 - 12	Low to moderate	Slight to moderate	Poorly drained	Moderate	Yes	Moderate to high
	Histels	Like other Gelisols, these soils are in very cold climates that contain permafrost within approximately 6.5 feet of the surface; Histels have large quantities of organic matter; vegetation consists of mosses, sedges, and shrubs; used as wildlife habitat.	Peat; mucky peat; slightly decomposed plant material	0 - 10	Low to moderate	Slight to moderate	Very poorly drained to well drained	Slow to moderate	Some[c]	Moderate to high

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
	Orthels	Like other Gelisols, these soils are in very cold climates that contain permafrost within approximately 6.5 feet of the surface; vegetation consists of lichens, mosses, sedges, shrubs, and black and white spruce; used as wildlife habitat.	Peat; slightly decomposed plant material	0 - 25	Low to moderate	Slight to moderate	Very poorly drained to well drained	Slow to moderate	Most[c]	Moderate to high
	Turbels	Like other Gelisols, these soils are in very cold climates that contain permafrost within approximately 6.5 feet of the surface; vegetation is mostly mosses, sedges, shrubs, and black spruce; used as wildlife habitat; some areas occur on slopes that receive more sunlight or in areas where fire or land clearing has changed soil temperature enough to allow permafrost to thaw.	Peat; slightly decomposed plant material	0 - 34	Low to Moderate	Slight to moderate	Very poorly drained to well drained	Slow to moderate	Most[c]	Moderate to high

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
Histosols	Fibrists	Organic soils that are wet and slightly decomposed; most soils support natural vegetation of small trees, shrubs, forbs, and grasses; Fibrists are mostly made up of peat.	Peat	—	Low	Slight to moderate	Very poorly drained	Slow to moderate	Yes	Moderate to high
	Hemists	Organic soils that are wet and moderately decomposed; supports natural vegetation and are used as woodland, rangeland, or wildlife habitat; some used as cropland if drained.	Peat; mucky peat	0 - 8	Low	Slight to moderate	Very poorly drained	Slow to moderate	Yes	Moderate to high
	Saprists	Consist of well decomposed organic materials and may be classified as muck; many support natural vegetation and are used as woodland, rangeland, or wildlife habitat; some areas, particularly those with a warmer temperature regime, have been cleared, drained, and used as cropland.	Mucky peat	0 - 35	Low to moderate	Slight to moderate	Very poorly drained	Slow to moderate	Yes	Moderate to high

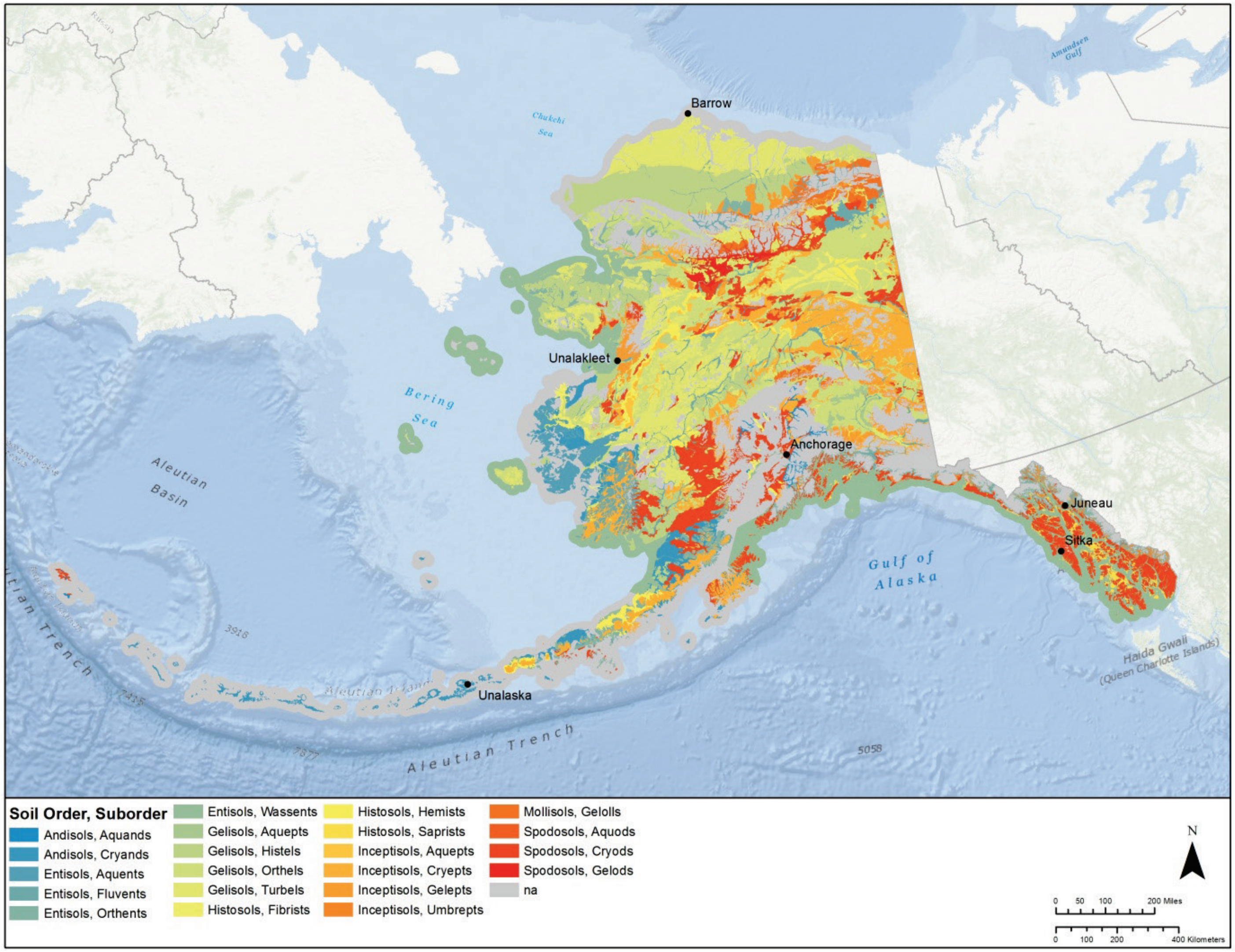
Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
Inceptisols	Aquepts	Aquepts have poor or very poor natural drainage; if these soils have not been artificially drained, ground water is at or near the soil surface; primarily used for pasture, cropland, forest, or wildlife habitat; likely formed under forest vegetation.	Peat; muck	0 - 35	Low to moderate	Slight to moderate	Poorly drained	Slow to moderate	Yes	Moderate to high
	Cryepts	Found in cold regions of high mountains or high latitudes; vegetation is mostly conifers or mixed conifers and hardwoods; most used as forest or wildlife habitat; some used as cropland.	Slightly to moderately decomposed plan material; very channery[d] loam	0 - 85	Low to high	Slight to severe	Well drained to somewhat excessivel y well drained	Moderate	No	Moderate
	Gelepts	Minimal horizon development; very cold climates with average annual soil temperature below freezing; found on steep slopes, young geomorphic surfaces, and resistant parent materials; used for forestry, recreation, and watershed.	Slightly to moderately decomposed plan material	2 - 80	Low to high	Slight to severe	Well drained	Moderate	No	Moderate

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
	Umbrepts	Minimal horizon development; rich in organic matter; occur in hilly to mountainous regions in mid to high latitudes; have distinct dry season.	Moderately decomposed plant material	2 - 100	Low to high	Slight to severe	Moderately well drained	Moderate	No	Moderate
Mollisols	Gelolls	Found in very cold climates with average annual coil temperature below freezing; contains thick, dark surface horizon as a result of organic material.	Slightly decomposed plan material	5 - 70	Moderate to high	Moderate to severe	Well drained	Moderate	No	Moderate
Spodosols	Aquods	Acidic forest soils with subsurface presence of humus that is aluminum and iron rich; wet soils characterized by a shallow water table; vegetation consists of shrubs and trees; used as forest or wildlife habitat.	Moderately decomposed plant material	2 - 35	Low to moderate	Slight to moderate	Poorly drained	Slow to moderate	Yes	Moderate to high
	Cryods	Acidic forest soils with subsurface presence of humus that is aluminum and iron rich; found in cold climates and high latitudes/elevations; vegetation consists of coniferous forest; used as forest or wildlife habitat.	Mucky peat; slightly to moderately decomposed plant material	0 - 110	Low to high	Slight to severe	Moderately well drained to well drained	Slow to moderate	No	Moderate

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Runoff Potential	Erosion Potential	Drainage Class	Permeability[a]	Hydric Soil[b]	Compaction and Rutting Potential
	Gelods	Acidic forest soils with subsurface presence of humus that is aluminum and iron rich; found in very cold climates with average soil temperature below freezing.	Slightly decomposed plant material	8 - 35	Moderate	Moderate	Well drained	Moderate	No	Moderate

Sources: STATSGO2 Database 2015

[a] Permeability refers to the ability and pace of the soil to allow water to pass through it.
[b] Hydric soils are explained in the text above.
[c] Hydric inclusions occur in these soils depending on location in the landscape.
[d] Channers are flat rock fragments ranging from approximately 0.1 inch to 6 inches long.



Source: STATSGO2 Database 2015

Figure 3.1.2-2: Soil Suborder Map of Alaska

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3.1.3. Geology

3.1.3.1. Introduction

This section discusses the geologic resources and hazards in Alaska. Information is presented regarding geologic features and characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action, as well as geologic hazards that could potentially affect the Proposed Action.

The United States (U.S.) Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. The USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and groundwater availability. Several of these elements are discussed in other sections of this Draft Programmatic Environmental Impact Statement, including climate change (Section 3.1.14, Climate Change), biological resources (Section 3.1.6, Biological Resources), human health (Section 3.1.15, Human Health and Safety), and groundwater (Section 3.1.4, Water Resources).

3.1.3.2. Specific Regulatory Considerations

There are no Alaska-specific regulatory considerations that pertain to geologic resources outside of those discussed in Section 1.8, Overview of Relevant Federal Laws and Executive Orders, and Appendix C, *Environmental Laws and Regulations*.

3.1.3.3. Environmental Setting

General Geologic Resources

One of the most active plate boundaries in the world is located in Alaska, the Pacific Plate – North American Plate boundary, which is located along Alaska's southern coastline and the Aleutian Islands.[1] At this boundary, the denser Pacific Plate is forced under the less dense North American Plate at a rate of about 3 inches per year (*USGS 2014*). This process is responsible for the mountain ranges, earthquakes, and volcanoes that are present in Alaska and discussed in greater detail below.

As described in detail in Section 3.1.2, Soils, the general topography and physiographic[2] characteristics of Alaska ranges from steep and rugged mountains to low and broad, nearly level plains.[3] In addition, more than 100,000 glaciers in Alaska cover about 5 percent of the state, although most glaciers in the state are retreating, thinning, or remaining stagnant due to changing climate conditions (*Molina 2013*). Glaciers are large accumulations of ice, snow, rock, sediment,

[1] The Pacific Plate is an oceanic tectonic plate located within portions of the Pacific Ocean. The North American Plate covers North America, Greenland, and surrounding areas as well as a portion of the Atlantic Ocean. Tectonic plates are the solid pieces of rock (or earth) that collide, move apart, or slide past each other over geologic time (*USGS 2014*).

[2] Physiography refers to the description of the Earth's landforms and surface features.

[3] Table 3.1.2-1 in Section 3.1.2, Soils, provides a detailed explanation of the topography and physiographic characteristics and corresponding soil characteristics in Alaska as they relate to the state's 27 distinct land resource areas.

and water that erode the surface of the Earth and transport the eroded material down slope, creating various erosional features and surface deposits (*USGS 2013a*).

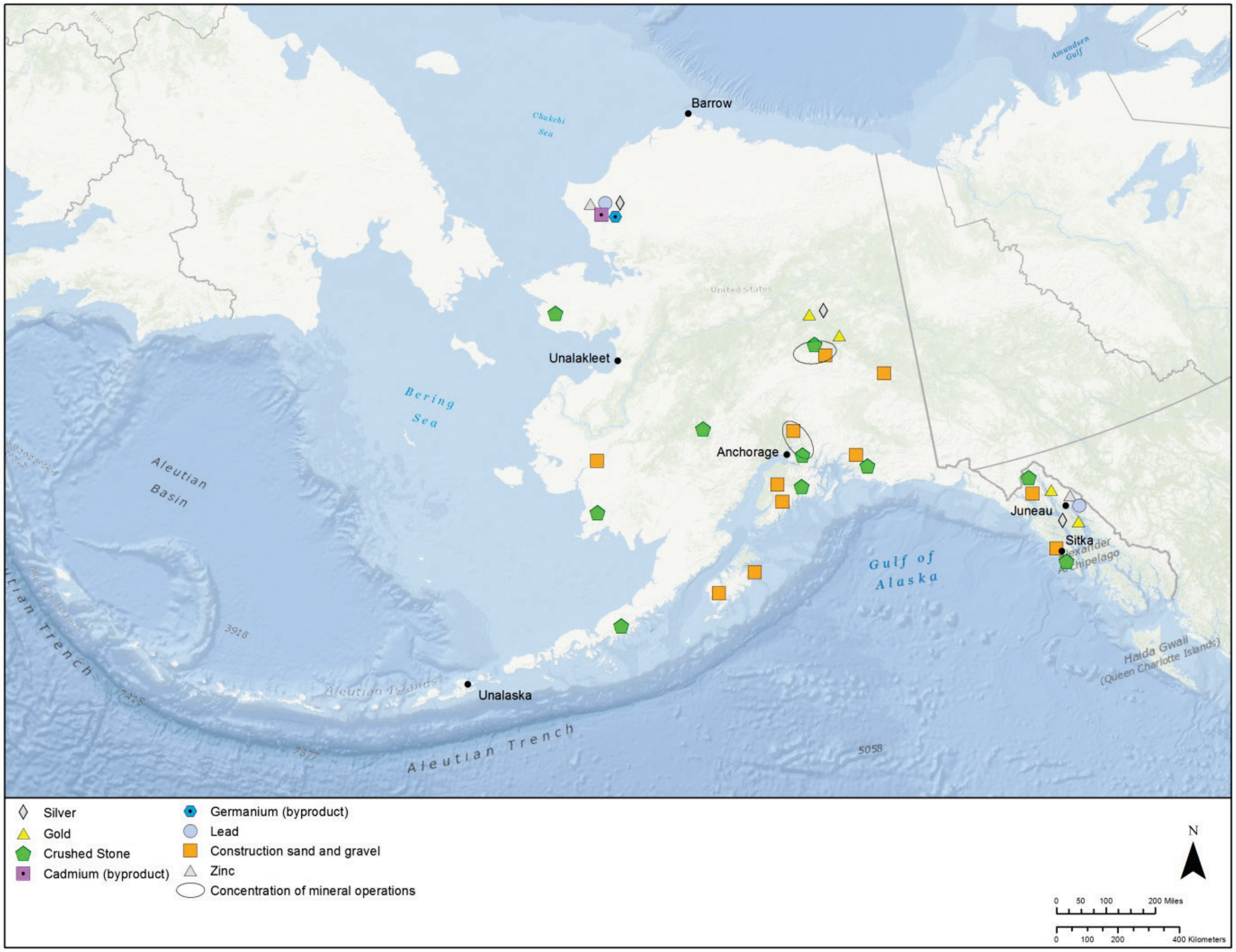
The rocks and unconsolidated sediment deposits found in Alaska range in origin, chemical composition, and age (billions to thousands or years old) (*Miller and Whitehead 1999*). A geographic information system database with detailed geologic formation map units and other associated features, published by quadrangle name, can be found at the USGS Online Spatial Data website (*USGS 2015c*).

Mineral and Fossil Fuel Resources

In 2011, Alaska ranked 5th among the 50 states for nonfuel mineral production value (*USGS 2015a)*. The nonfuel mineral industry in Alaska is dominated by metallic mineral mining. In both 2010 and 2011, zinc, gold, silver, and lead comprised nearly 98 percent of Alaska's total nonfuel mineral production (*USGS 2015a*).[4] Construction sand and gravel, crushed stone, cadmium, copper, and gemstones are also produced in Alaska (*USGS 2015a*). The combined values of lead, silver, zinc, cadmium, and copper mined in 2011 totaled approximately 2.4 billion dollars. Approximately 26,000 kilograms of gold was mined in Alaska in 2011, with a total estimated value of $1.3 billion. Although production volume estimates for gemstones are not available from the USGS, it is estimated that the value of production (based on shipments, sales, or marketable production) was about $70,000 in 2011 (*USGS 2015a*). Figure 3.1.3-1 displays the primary producing areas for each of the mineral resource categories.

According to the U.S. Energy Information Administration, Alaska ranked 13th among the 50 states for total energy production in 2013 (*EIA 2014*). In 2013, Alaska had approximately 2.9 million barrels of crude oil reserves and 7,300 billion cubic feet of natural gas reserves (*EIA 2014*). The Prudhoe Bay field in northern Alaska is one of the largest oil fields in the country, and while production has been steadily decreasing, almost 300,000 barrels of crude oil per day are produced in this area (*EIA 2014*). Alaska ranks 2nd among the 50 states for natural gas production; however, the majority of the natural gas produced is re-injected into oil fields to maintain backpressure and aid in crude oil production (*EIA 2014*). See Section 3.1.1, Infrastructure, for more information related to energy sources in Alaska.

[4] Germanium is a mining by-product associated with zinc production.



Source: USGS 2015a

Figure 3.1.3-1: Primary Mineral Production Areas in Alaska

Paleontological Resources[5]

Alaska is believed to have experienced dramatic changes and diversification of its flora and fauna approximately 15,000 years ago when the Beringia, or the Bering Land Bridge, existed (*APLIC Undated*). Scientists believe the land bridge connected Asia and North America, allowing an exchange of species *(NPS 2015).* The land bridge is also believed to be the route for the first people to arrive and populate the Americas. Records of stone tools and obsidian artifacts indicate the first permanent settlements in Alaska were also approximately 15,000 years ago as people followed herd animals across the land bridge (*APLIC Undated*). Alaska's position as the landing site for the Bering Land Bridge provides insight into the history of multiple continents. The significance of the geographic location, combined with landforms including volcanoes and glaciers, makes Alaska a uniquely rich paleontological resource. Some of the United States' most scientifically significant fossils were unearthed in Alaska. At least 12 different dinosaur fossils have been discovered along Alaska's North Slope and coastal regions since 1961, and at least five wooly mammoths have been discovered in Alaska since 1836 *(BLM 2015).*

The University of Alaska Museum Earth Sciences collection (UAMES) is a resource for obtaining information on Alaskan fossils and has a large collection of arctic dinosaurs and Alaskan Quaternary mammals (*University of Alaska Museum of the North 2014a*). Dozens of research articles have been published using the UAMES collection with topics including, but not limited to, dinosaurs, mastodons, reptiles, brachiopods, and plants (*University of Alaska Museum of the North 2014b*). Digitization of the UAMES paleontological collection is currently in progress and more than 30,000 fossil specimens have been added to an electronic, online database called the Arctos Database (*University of Alaska Museum of the North 2014a*). The Arctos Database can be used to obtain information on fossils based on taxonomy, location, collection date, collector, and more (*Arctos Undated*). In addition, the database has a spatial query function that may be used to generate maps showing the locations of each fossil specimen found, which can be useful in identifying certain areas with numerous identified paleontological resources (*Arctos Undated*). In general, the highest concentrations of paleontological resources occur in the eastern, central, north-central, and east-central portions of Alaska (*Arctos Undated*).

[5] Paleontological resources, or fossils, are the physical remains of plants and animals that have mineralized into or left impressions in solid rock or sediment.

3.1.3.4. Geologic Hazards

Geologic hazards exist in many areas in Alaska, including seismic and volcanic activity, landslides, and land subsidence.

Seismic and Volcanic Activity

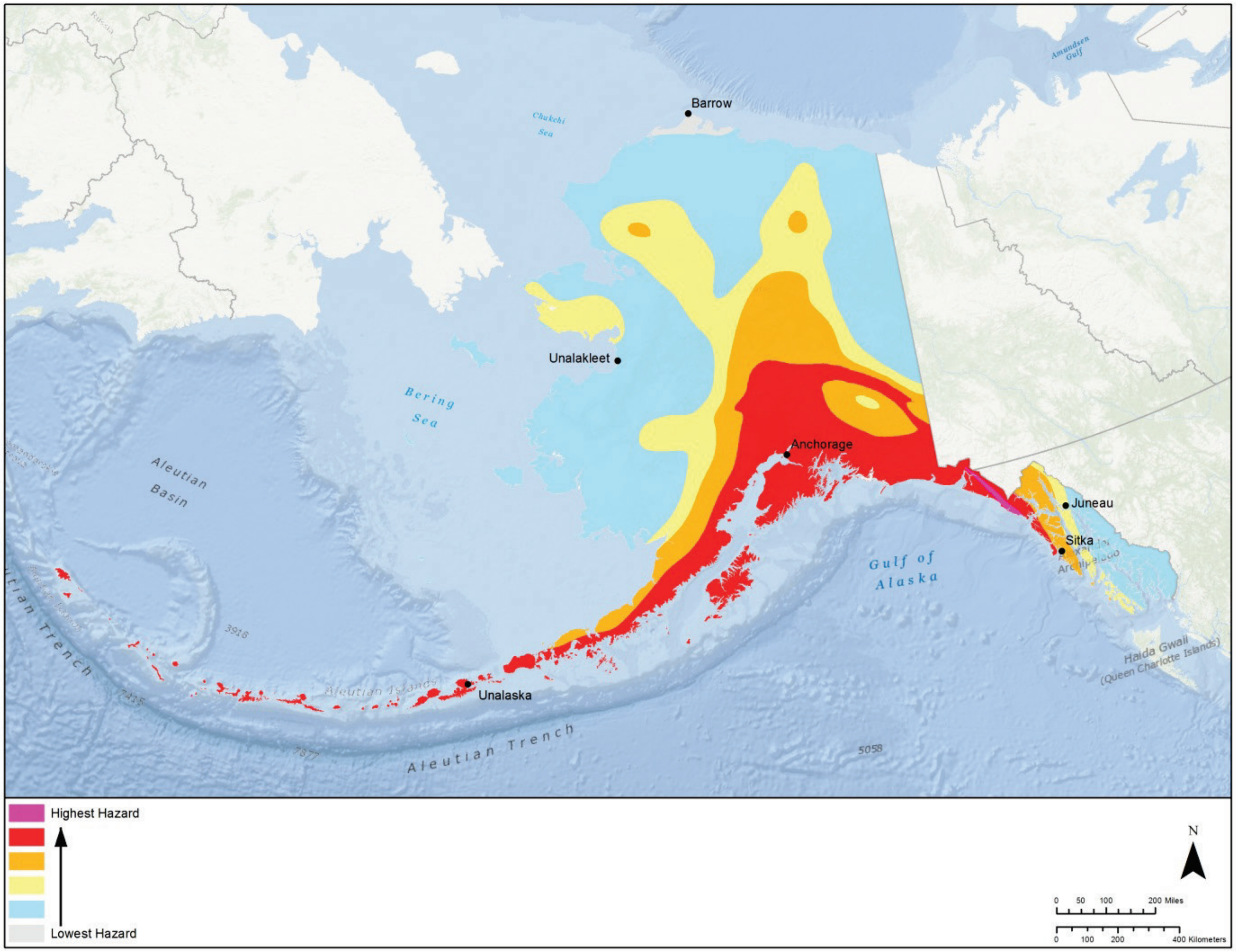
As mentioned above, one of the most active plate boundaries in the world is located in Alaska, the Pacific Plate – North American Plate boundary, located along Alaska's southern coastline and the Aleutian Islands. At this boundary, the denser Pacific Plate is forced under the less dense North American Plate and this process is responsible for the mountain ranges, earthquakes, and volcanoes in the state.

Figure 3.1.3-2 below displays a graphical representation of the areas with the highest and lowest seismic hazard risks.[6] As noted above, most earthquakes occur at the Pacific Plate – North American Plate boundary where these two plates come in contact and slide past each other (*Haeussler and Plafker 2004*). Eight earthquakes of magnitude 8 or more occurred in Alaska from 1899 to 1969, including a 1964 earthquake with a magnitude of 9.2 that damaged infrastructure in the city of Anchorage (*USGS 2015b*).[7] Information related to real-time, historical, and significant earthquakes can be obtained via the USGS Earthquake Hazards Program website (*USGS 2015d*).

Earthquakes can lead to abrupt disturbances of the ocean floor and ocean water that can cause tsunamis. Tsunamis are large ocean waves that form as a result of water displacement (*USGS 1997*). The source of a tsunami in Alaska can originate from anywhere in the Pacific Ocean, or locally as a result of earthquakes near the Pacific Plate – North American Plate boundary (*USGS 1997*). Since 1853, approximately 16 tsunamis with a runup[8] of more than 3 feet have occurred in Alaska (*USGS 2015f*). The 1964 earthquake mentioned above triggered a tsunami that destroyed numerous coastal towns in Alaska and caused destruction along the west coast of the United States, Hawaii, and Canada (*USGS 2015b*).

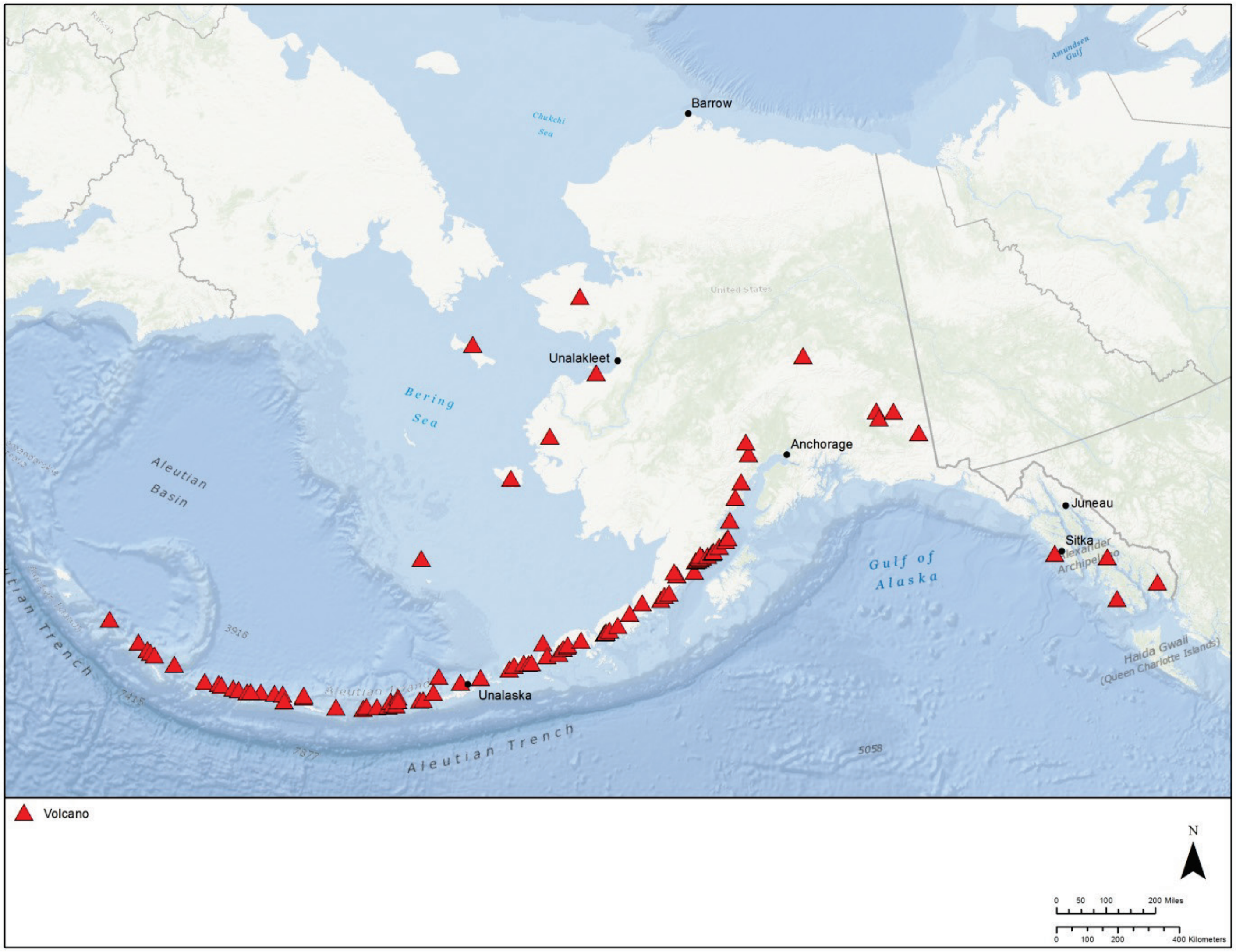
Approximately 90 volcanoes have been active in Alaska in the last 10,000 years, with the majority located just north of the Aleutian Trench (forming the Aleutian Islands; see Figure 3.1.3-3). More than 50 volcanoes have been active since about 1760 (*Alaska Volcano Observatory 2014*). On average, over the past 40 years Alaska has had more than two eruptions per year (*Alaska Volcano Observatory 2014*).

[6] Data from USGS were mapped showing the levels of horizontal ground shaking that have a 10 percent probability of exceedance in 50 years. This map was then simplified and scaled to show the areas ranging from high to low hazard potential.
[7] Earthquakes with magnitudes of 3 or less are generally not felt. Magnitudes greater than 6 can cause widespread damage (*USGS 2012*).
[8] The term runup refers to the height the wave reaches above sea level before washing to shore (*USGS 2015d*).



Source: USGS 2012

Figure 3.1.3-2: General Seismic Hazard Map of Alaska



Source: Smithsonian Institution 2013

Figure 3.1.3-3: Active and Dormant Volcanoes in Alaska

Landslides

The term "landslide" refers to processes that lead to the downhill movement of earth materials due to gravity and other forces (*USGS 2004*). In the United States, the Pacific Coast ranges, the Rocky and Appalachian Mountain areas, and Alaska and Hawaii have the most severe risk for landslide susceptibility due to the abundance of potential factors that may cause slope instability (*American Geosciences Institute 2014*). In Alaska, excessive rainfall, seismic activity, and volcanic activity can trigger local landslides, especially near areas that have steep slopes with loose or unconsolidated material. The 1964 earthquake mentioned above, for example, triggered a rock avalanche that deposited an area of rubble almost 2.5 miles long near Sherman Glacier (*Tarbuck and Lutgens 1996*). That same earthquake resulted in several large landslides that caused extensive damage in Anchorage (*Jibson and Michael 2009*).

The latest USGS landslide hazard map of the U.S. was published in 1982; however, this map did not include the non-contiguous U.S. (*USGS 1982*; *American Geosciences Institute 2014*). The USGS is currently implementing a Landslide Inventory Pilot Project for displaying and analyzing landslide data; Hawaii, Alaska, and U.S. territories are not currently included in the project (*USGS 2015e*).

Land Subsidence

Land subsidence is the downward settling or sudden sinking of the Earth's surface (*USGS 2013b*). The main causes of land subsidence may include groundwater level declines, drainage of organic soils, underground mining, excessive wetting of soils, natural compaction, sinkholes, and thawing permafrost (*USGS 2013b*). As is the case with karst topography[9], land subsidence can also occur in areas with an abundance of underlying soluble rocks and minerals, such as limestone, gypsum, or salt, which have the potential to dissolve in water and wash out from the area (*USGS 2013a*). In Alaska, limestone areas in the temperate rainforests of the southeast portion of the state show the best developed and most well-known karst; however, karst areas are also prevalent in the north and western portions of the state (*Weary and Doctor 2014*).

[9] "Karst is a terrain with distinctive landforms and hydrology created from the dissolution of soluble rocks, principally limestone and dolomite. Karst terrain is characterized by springs, caves, sinkholes, and a unique hydrogeology." (*USGS Undated*)

3.1.4. Water Resources

3.1.4.1. Introduction

This section discusses water resources in Alaska, including surface water, floodplains, nearshore marine waters, and groundwater. Information is presented regarding features and characteristics of these waters that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (wetlands are discussed separately in Section 3.1.5, Wetlands). These resources can be grouped into watersheds, areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and the maintenance of natural infrastructure and ecological services (*USGS 2014*).

3.1.4.2. Specific Regulatory Considerations

Water quality is federally regulated pursuant to the Clean Water Act (CWA) (see Section 1.8.7, Clean Water Act), which is administered by the Alaska Department of Environmental Conservation (ADEC).

The National Flood Insurance Program (NFIP) is a federal program managed by the Federal Emergency Management Administration (FEMA) that allows property owners in participating communities to purchase flood insurance with rates established through the National Flood Insurance Rate Maps. In Alaska, the Department of Community and Economic Development has been designated as the State Coordinating Agency responsible for administering the program. Implemented regulations include the Floodplain/Wetlands Environmental Review Requirements (*10 Code of Federal Regulations 1022.12*) and *Executive Orders 11988* and *13960* (see Section 1.8.10, Executive Order 110988—Floodplain Management, and Section 1.8.14, Executive Order 13690—Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, respectively).

On June 4, 1977, the Alaska Legislature enacted the Alaska Coastal Management Act, which established the Alaska Coastal Management Program to implement the Coastal Zone Management Act (see Section 1.8.8, Coastal Zone Management Act). This program is composed of 33 coastal resource districts that develop and implement their own programs and enforceable policies for the roughly 44,000 miles of Alaska coastline, which has national and international significance for its healthy and diverse ecosystems. The Alaska Coastal Management Program expired on June 30, 2011 (*Alaska Statute 44.66.030*). Efforts by the legislature to revive the program in the 2012 regular and special legislative sessions were unsuccessful. Alaska is currently the only eligible state in the country without an active Coastal Management Program, although previously passed waterbody protections for nearshore waters continue to be in effect (*NOAA 2011*).

The Wild and Scenic Rivers Act (*Public Law 90-542; 16 United States Code 1271 et seq.*) established the National Wild and Scenic River System and prescribed methods and standards for adding rivers to the system. Rivers protected under this act are generally free of impoundments and inaccessible except by trail with watersheds or shorelines that are primitive and unpolluted waters. Some protected rivers may be accessible by roads; however, they maintain many of the primitive and unpolluted qualities of the inaccessible rivers. On protected rivers, federal funding for actions such as construction of dams or other instream activities that would harm the river's free-flowing condition, water quality, or outstanding resource values are prohibited (*Public Law 90-542; 16 United States Code 1271 et seq.*).

3.1.4.3. Environmental Setting

This section describes surface water, floodplain, nearshore marine, and groundwater characteristics in Alaska.

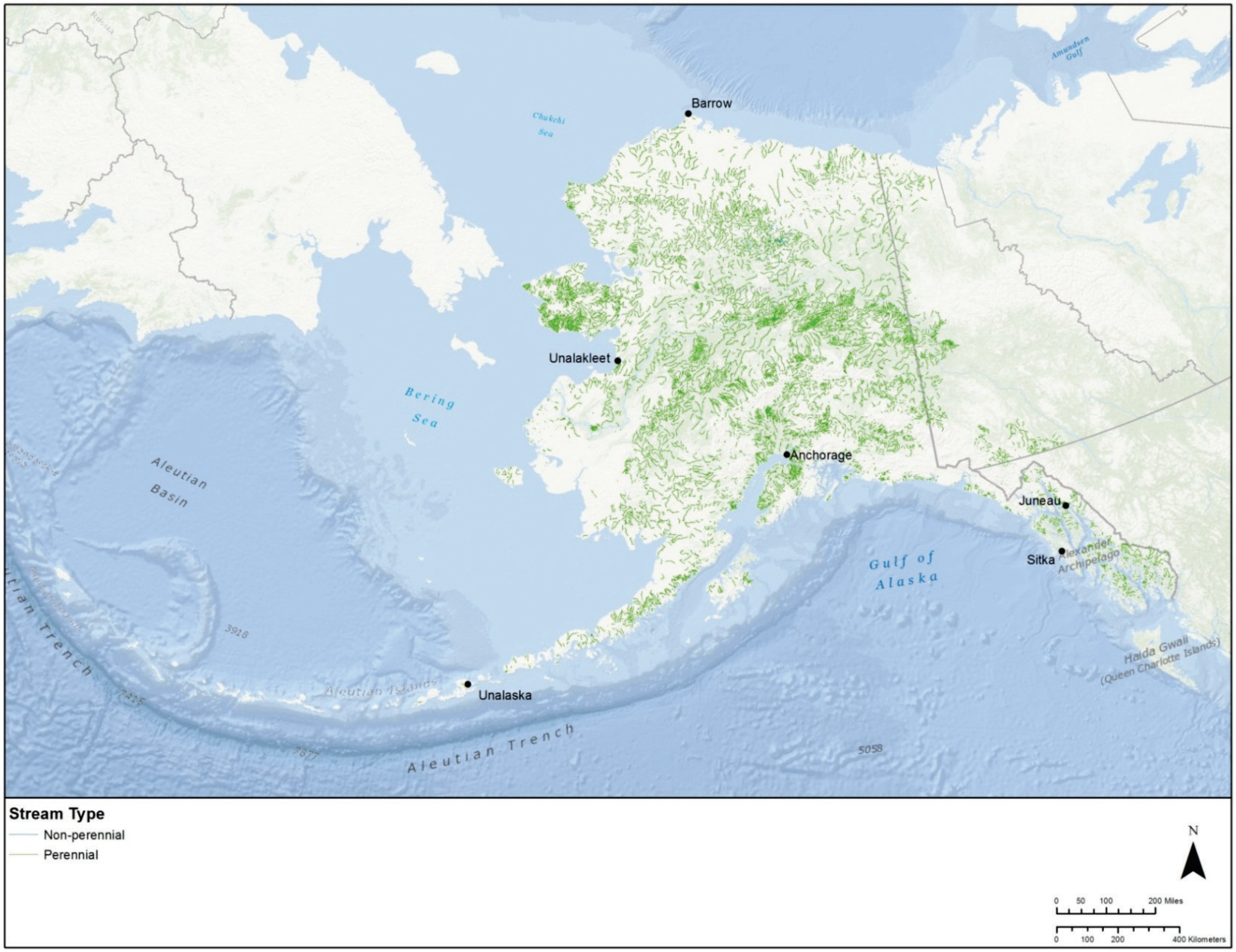
Inland Surface Water Characteristics

Alaska has considerable surface water resources, accounting for nearly 50 percent of all of the surface waters in the United States. Alaska's surface waters include over 700,000 miles of rivers and streams, and over 12 million acres of lakes, ponds, and reservoirs (see Table 3.1.4-1; *ADEC 2013*). Perennial surface waters in Alaska are shown in Figure 3.1.4-1.

Table 3.1.4-1: Total Surface Waters for Alaska

Waters	Size	Units
Rivers and streams	714,004	miles
Lakes, reservoirs, and ponds	12,787,200	acres
Coastal shoreline	44,000	miles

Source: ADEC 2013



Source: USDA Service Center 2015

Figure 3.1.4-1: Spatial Distribution of Alaska Surface Waters

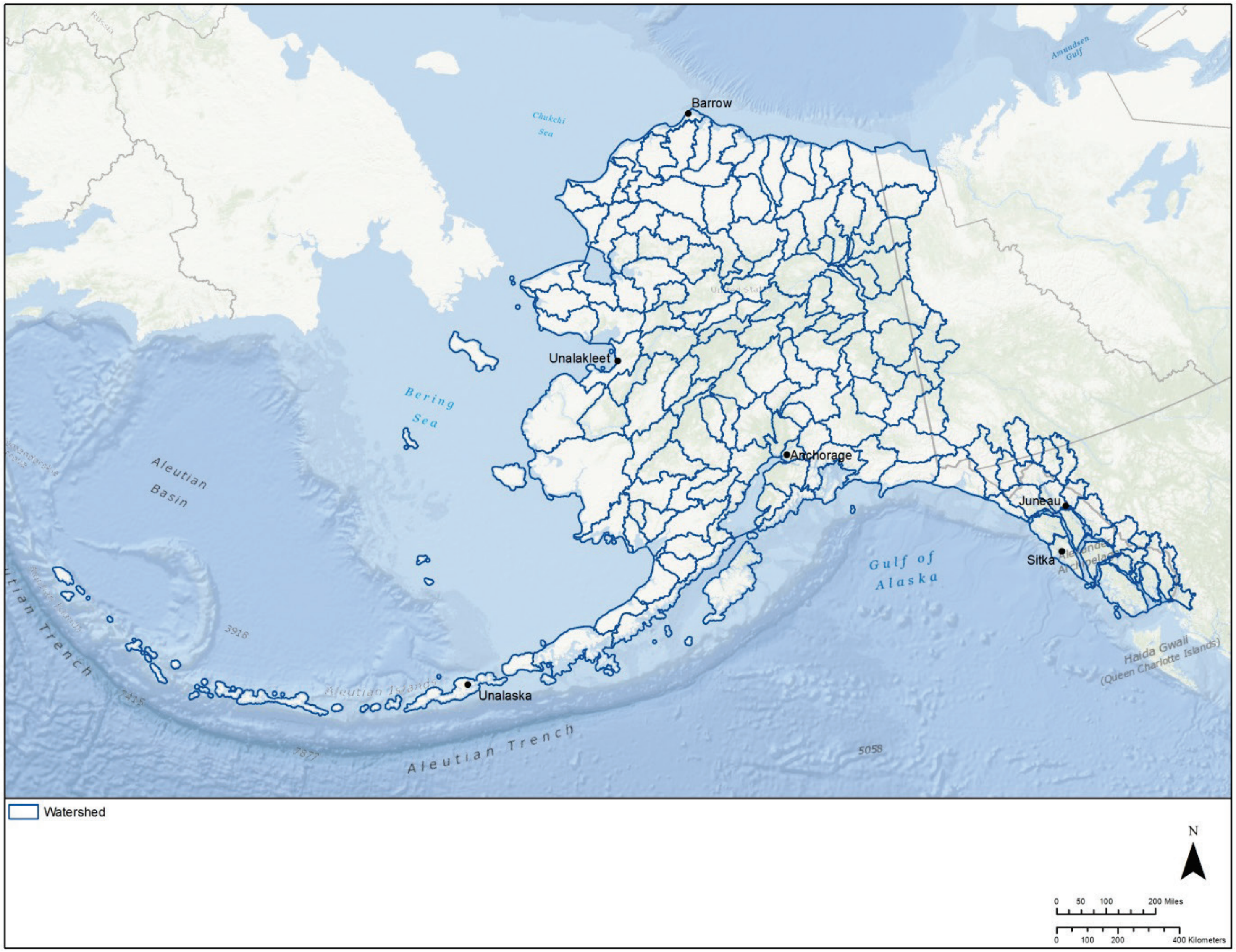
The amount of water in any surface water system is dependent on quantity and timing of precipitation, storage in the watershed, soil permeability, climate and evaporation rates, and watershed land cover. Alaska's geographic size, sparse population, and remoteness contribute to its high percentage of unimpaired surface waterbodies. More than 99.9 percent of Alaska's surface waters are considered unimpaired (*ADEC 2013*). Hydrologic processes are strongly affected by the presence of permafrost, which may thaw seasonally or be continuous throughout the year, particularly in the North Slope. In central Alaska, permafrost is discontinuous and active frost layer at the surface thaws during the summer months (*ADEC 2013*).

The Yukon and Kuskokwim river drainages are the two largest river drainages in Alaska. The Yukon River drains an area of more than 330,000 square miles, making it the fourth largest drainage basin in North America (*Brabets et al. 2000*). The main stem of the Yukon River originates in northwestern Canada and extends through central Alaska, discharging into the Bering Sea (*Brabets et al. 2000*). Major tributaries of the Yukon River include the Tanana, Nenana, and Chena rivers. The Kuskokwim River is the second largest drainage in Alaska, with a main stem approximately 900 miles long. It originates from the headwaters of the Kuskokwim Mountains and flows in a southwest direction to the Bering Sea (*Brabets et al. 2000*). Major watersheds in Alaska are shown in Figure 3.1.4-2.

Surface water supplies 75 percent of Alaska's water demands for industry, agriculture, mining, fish processing, and public water use, and is used for 50 percent of the domestic water supply (*ADEC 2013*). Alaska is sparely populated with approximately one resident per square mile. Urban development is concentrated in a few centers in southcentral and southeastern Alaska (*ADEC 2013*).

Current human-induced stressors to Alaska's surface waters include the following (*ADEC 2013*):

- Sediment, turbidity, and fecal coliform bacteria contamination caused by storm water runoff in urban areas;
- Sediment and turbidity from mining activities;
- Residue and storm water pollution from contaminated military sites, timber or seafood processing, and transfer sites/facilities; and
- Oil spills and fuel leaks from motorized watercraft.



Source: USDA Geospatial Data Gateway 2015

Figure 3.1.4-2: Major Watersheds in Alaska

Table 3.1.4-2 is ADEC's (*2013*) summary of the number of surface waterbodies in each numeric category as described in their Integrated Water Quality Report.

Table 3.1.4-2: Water Quality Summary for Alaska Waterbodies

Water Quality Category	Number of Waterbodies
1 (Meets water quality standards)	Majority of Alaskan Waters
2 (Evidence of water quality problems, but meets standards)	48
3 (Insufficient data)	327
4a (Has a TMDL)	37 (for 44 impairments)
4b (Has a pollution control program)	3
4c (Impaired by a non-pollutant)	0
5 (TMDL needed)	24

Source: ADEC 2013

TMDL = Total Maximum Daily Load[1]

Alaska's process for listing an individual waterbody for failure to meet water quality standards, as required in the CWA Section 303(d), begins with an internal review of existing and new information to determine 1) the presence of pollutants, 2) whether persistent exceedances of water quality standards are occurring, 3) whether impacts on the designated uses are occurring, and 4) the degree to which water quality standards and the other criteria are attained. When a waterbody is placed on the Section 303(d) list, a Total Maximum Daily Load or recovery plan is developed, unless data obtained after the listing indicate that the waterbody is no longer impaired or other measures are undertaken to restore the waterbody (*ADEC 2013*). Total Maximum Daily Loads are a regulatory tool used for impaired waterbodies, and describe a maximum amount of a pollutant that a waterbody can receive while still meeting water quality standards. TMDLs must be developed for all waterbodies on a state or territory's 303(d) list.

ADEC has developed a long-term water quality monitoring and assessment strategy to guide its stewardship of Alaska's marine and fresh waters. The strategy is intended to meet the federal expectations for water quality stewardship activities in the CWA in a manner that is appropriate for Alaska's geography and the remoteness of the majority of Alaska's surface waters. The strategy focuses on what can be done with available financial resources, considering the abundance of Alaska's water resources and need to establish priorities for specific water resources (*ADEC 2013*).

Alaska has 25 streams and rivers with National Wild and Scenic status, accounting for more than 3,210 river miles (*National Wild and Scenic Rivers System 2015*).

Floodplain Characteristics

Floodplains are lowland and flat areas adjoining inland and coastal waters. These areas are often prone to flooding, depending on streamflow amounts and timings. FEMA maps 100-year floodplains on its NFIP Rate Maps, and defines 100-year floodplains as areas that have a 1 percent chance of being flooded in a given year. Regulations for 100-year floodplains include requirements for new development and substantial redevelopments of existing property to have

[1] TMDLs are maximum pollutant amounts a waterbody can receive while still meeting water quality standards.

certain flood resistant qualities. Flood insurance may also be required. Additionally, any fill of the floodplain by new development is limited, so as to not increase flood elevations elsewhere in the floodplain. The 500-year recurrence interval flood is also included on FEMA NFIP floodplain maps; however, these events are rare and the 500-year floodplain is generally not regulated.

FEMA NFIP floodplain maps are available for most of the United States. Often floodplain data are not available in areas where floodplain maps were not created because the areas are not flood prone (sometimes called map "panels not printed"). Alaska's NFIP maps are viewable online on FEMA's Map Service Center[2] (*FEMA 2015*), which allows the user to navigate to any location of the United States and, where data are available, zoom into any area to view flood zones. An example of flood data for Alaska is provided in Figure 3.1.4-3. The land area shown in Figure 3.1.4-3 shows the small town of North Pole, Alaska, a suburb to the east of Fairbanks, in central Alaska. Floodplain hydrology is related primarily to the Tenana River to the south and west of North Pole. This figure also shows floodplains as well as the river's floodway.

Nearshore Marine Characteristics

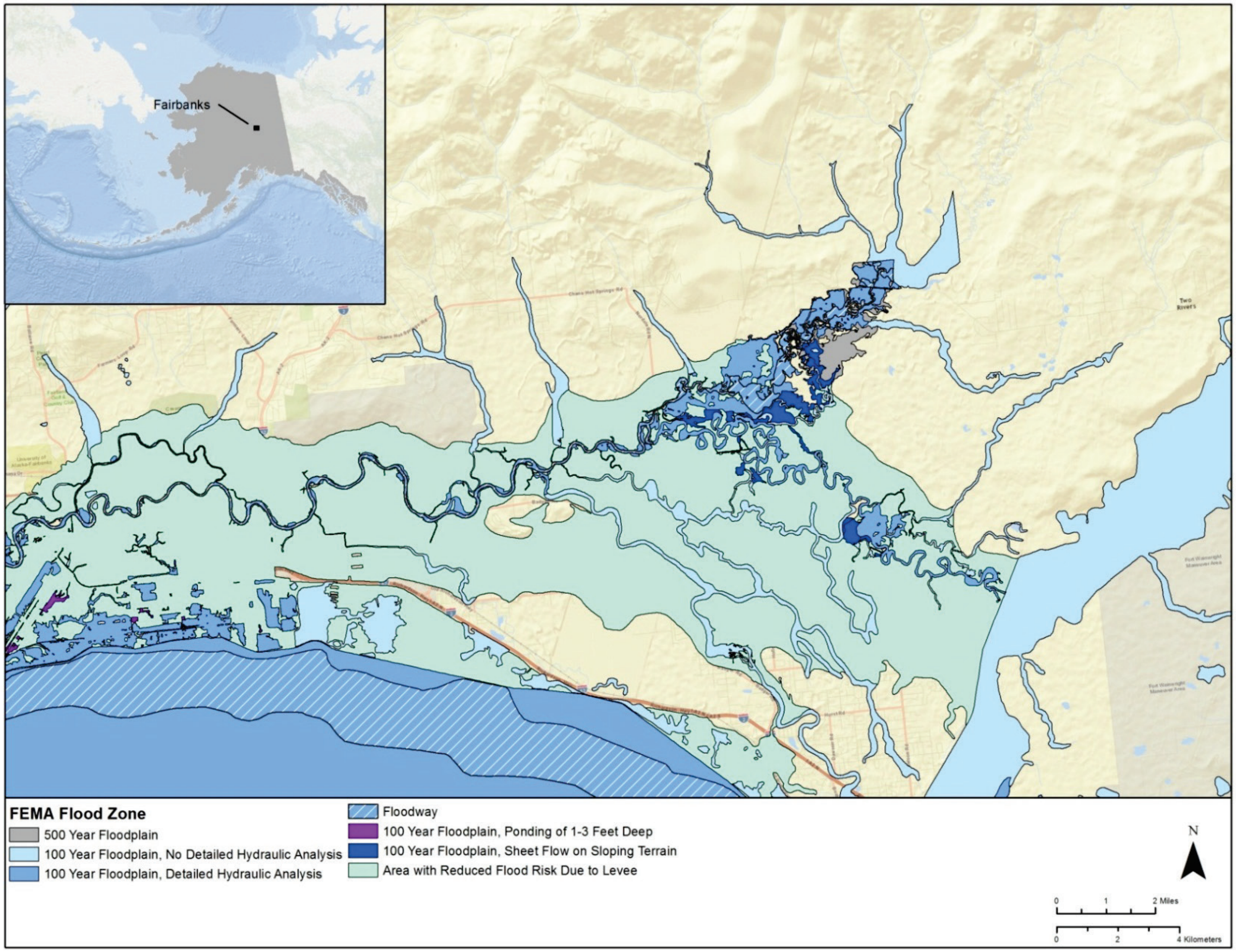
The state of Alaska contains approximately 44,000 miles of coastal shoreline and more than two million acres of estuarine and marine intertidal areas (*ADEC 2013*). Nearshore waters include estuaries[3], bays and harbors, and shorelines. Fresh water from streams, estuaries, and surface water runoff flows into nearshore marine waters.

As discussed in Section 3.1.4.2, Specific Regulatory Considerations, Alaska no longer has a Coastal Management Program. However, previously passed waterbody protections for nearshore waters continue to be in effect under the authority of their implementing state programs, including (*ADEC 2013*):

- State certification of federal permits and activities for meeting water quality standards
- Fish habitat protection
- Water rights appropriations
- Alaska Coastal and Harbor Design Procedures Manual
- Harbor management agreements
- Forest Resources and Practices Act
- Regulations and erosion and sediment control plans for dam construction

[2] https://msc.fema.gov/portal

[3] Estuaries are defined as coastal areas where salt water from the sea mixes with rivers and streams, and may be called bays, harbors, inlets, lagoons, or estuaries.



Source: FEMA 2015

Figure 3.1.4-3: Example Floodplain Map for Alaska Floodplains

Groundwater Characteristics

Groundwater is the water found underground in the cracks and spaces in soil, sand, and rock. It is stored in and moves slowly through geologic formations of soil, sand, and rocks called aquifers. Alaska has the largest amount of groundwater resources in the United States (*ADEC 2013*). However, very few aquifers in Alaska have been studied, and limited water quality data are available for Alaska's aquifers. Groundwater is available throughout Alaska except in areas of deep permafrost in the northern portion of the state. South central and interior Alaska have the greatest dependence on groundwater for public or domestic water supplies relative to the rest of the state. The largest amount of groundwater withdrawal occurs in Anchorage followed by the Fairbanks North Star Borough, Matanuska-Susitna Borough, and finally the Kenai Peninsula Borough (*ADEC 2013*).

As of 2011, 82 percent of Alaska's 1,535 public water systems used groundwater as part of their fresh water supply, representing 34 percent (25.9 million gallons per day) of the total amount of fresh water used by all of Alaska public water systems (*ADEC 2013*). Data for groundwater use in Alaska are most recently available from 2005. Table 3.1.4-3 describes the use of groundwater in Alaska in 2005 (*ADEC 2013*).

Table 3.1.4-3: Alaska Groundwater Withdrawals in 2005

Type of Water Use	Percentage of Total Groundwater Withdrawal
Commercial Aquaculture	90.5
Public Water Systems	5.4
Domestic Water Supplies	2.8
Industrial, Mining, and Power	1.3
Agriculture (Irrigation, Livestock)	0.2

The Safe Drinking Water Act is implemented in Alaska through the delineation of Drinking Water Protection Areas. Local governments and state agencies are encouraged to use these data when reviewing permits of activities that could affect a public drinking water source. Drinking Water Protection Areas are delineated based on the amount of time and distance of travel for pollutants in the area to reach ground and surface drinking water sources (*Alaska Division of Environmental Health 2015*). There are currently no sole-source aquifers[4] designated in Alaska (*USEPA 2014*).

[4] The U.S. Environmental Protection Agency defines sole-source aquifer as an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer.

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3.1.5. Wetlands

3.1.5.1. Introduction

This section discusses wetland resources in Alaska. Information is presented regarding wetland features and characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

Wetlands are a subset of Waters of the United States (U.S.), defined for regulatory purposes by the U.S. Environmental Protection Agency under the Clean Water Act (CWA) 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" (*USEPA 2004*). Similarly, the U.S. Fish and Wildlife Service (USFWS) classification system (*Cowardin et al. 1979)* defines wetlands as "…lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water…" (*Cowardin et al. 1979).* Wetlands can be vegetated or non-vegetated, but where vegetation is present, the plants are adapted for life in saturated or flooded soil. Examples of wetlands include marshes, bogs, ponds, intertidal areas, and estuaries.[1]

In contrast to wetlands, deepwater habitats (referred to as waters) are defined as any "permanently flooded lands lying below the deepwater boundary of wetlands" (*Cowardin et al. 1979)*. Waters are typically non-vegetated, have a bed and bank, and include intermittent, ephemeral, or perennial streams[2], rivers, or standing water (e.g., lakes). Waters are not included in this wetlands section, as they are discussed in Section 3.1.4, Water Resources. The Environmental Protection Agency estimates that "more than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half of such species use wetlands at some point in their lives" (*USEPA 1995*). In addition to providing habitat for many plants and animals, wetlands also provide benefits to human communities. Wetlands store water during flood events, improve water quality by filtering polluted runoff, help control erosion by slowing water velocity and filtering sediments, serve as points of groundwater recharge, and help maintain base flow in streams and rivers. Additionally, wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.

3.1.5.2. Specific Regulatory Considerations

Under Section 404 of the CWA (Section 404) activities that adversely affect Waters of the U.S., including wetlands, must be authorized through a Section 404 permit issued by the U.S. Army Corps of Engineers, and adverse impacts must be mitigated to the extent practicable. Alaska has a large proportion of public land (greater than 90 percent) in comparison to other states in the U.S. (e.g., land owned by local, state, or federal government). See Section 3.1.7, Land Use,

[1] Estuaries are found where salt water from the sea mixes with rivers and streams.

[2] Intermittent streams carry water for part of the year (generally winter and spring), ephemeral streams carry water only as a result of precipitation (any time of year), and perennial streams carry water year round (under normal precipitation conditions) (*NCDEQ Undated*).

Airspace, and Recreation, for a discussion of land ownership in Alaska. Development is often limited or restricted on these public lands, including lands within Alaska State Parks, U.S. Forest Service National Forests, National Parks, and USFWS National Wildlife Refuges (NWRs). The following government agencies are involved in local wetland management and regulation within Alaska: Consolidated Farm Service Agency; U.S. Forest Service; Natural Resource Conservation Service; National Oceanic and Atmospheric Administration; Bureau of Land Management; USFWS; National Park Service; and Alaska Native Regional and Village Corporations. The following Alaska state departments are involved: Department of Environmental Conservation; Department of Fish and Game; Department of Natural Resources; University of Alaska; as well as borough and local governments (*USGS 1996*). Guidance on compliance with Alaska government regulations can be found at the State of Alaska Division of Environmental Conservation Division of Water website[3] (*ADEC 2014*).

3.1.5.3. Environmental Setting

As mentioned above, wetlands are recognized as important for maintaining watershed and environmental health due to their potential to perform various ecological, hydrologic, biogeochemical, and social functions, although not all wetlands perform these functions equally. Typical wetland functions include bank stabilization, flood mitigation, maintenance of water quality, maintenance of fish and wildlife habitat, sediment retention, groundwater discharge and recharge, and maintenance of nutrient retention and export. Their capacity or degree to which they perform individual functions depends on the wetland characteristics including soil type, substrate, type and percent cover of vegetation, water source, landscape position, location within a watershed, and location relative to populated areas (*USGS 1997*). As part of CWA Section 404 permitting, a wetland functional assessment is typically used to place wetlands into one of three categories, with Category 1 wetlands being the highest quality and/or functioning wetlands (and/or rare types); Category 2 wetlands being of moderate to high quality and/or function; and Category 3 wetlands being lower quality and/or functioning wetlands (and/or more common types). While a formal assessment of wetland functions and categorization is beyond the scope of this Draft Programmatic Environmental Impact Statement, potential functions for Alaska wetlands are discussed broadly in the section below.

The U.S. Geological Survey (USGS) published a document titled *The National Water Summary on Wetland Resources* (*USGS 1996*). This document provides a good overview of the diverse environmental settings found in Alaska as they relate to the geologic and hydrologic characteristics that drive the formation of Alaska's wetlands in different regions of the state:

> "Low relief, permafrost, and general abundance of precipitation relative to evaporation and plant transpiration, short cool summers, poorly permeable rocks near the land surface, and large tidal fluctuations help form and maintain extensive wetlands in Alaska. Wetland characteristics continuously change with changes in climate, water supply, soil moisture, salinity, maturation of vegetation communities, tectonic activity, fire, ice

[3] http://dec.alaska.gov/Water/wwdp/wetlands/index.htm

> scour, glacier advance and retreat, and human activities such as draining and filling.
>
> …The State's high mountain ranges, extensive coastline, vast size (one-sixth the total area of the U.S.) and long north-to-south distance are the principal causes for the great differences in climate [which in turn create very diverse wetland types in different regions]. From the northern part of the Arctic Zone to the southern part of the Maritime Zone, average annual precipitation ranges from about 5 to 320 inches, and average annual temperature ranges from 10 to 45 degrees Fahrenheit.
>
> Spring snowmelt supplies the most input to the annual water budget in most Alaskan wetlands. Snowmelt is generally confined to a short time period during spring but produces considerable runoff. During summer, local rain or the melting of snow and glacier ice in upland areas replenishes the water supply of many wetlands. In much of the Southeast and South-central regions of Alaska, precipitation greatly exceeds evaporation."

A detailed description of each of the climatic zones is beyond the scope of this Draft Programmatic Environmental Impact Statement, but general characteristics of wetlands within each climatic zone are provided in Section 3.1.5.4, Wetland Characteristics. For specific information about Alaska's soils, see Section 3.1.2, Soils. The water resources on Alaska are discussed in more detail in Section 3.1.4, Water Resources.

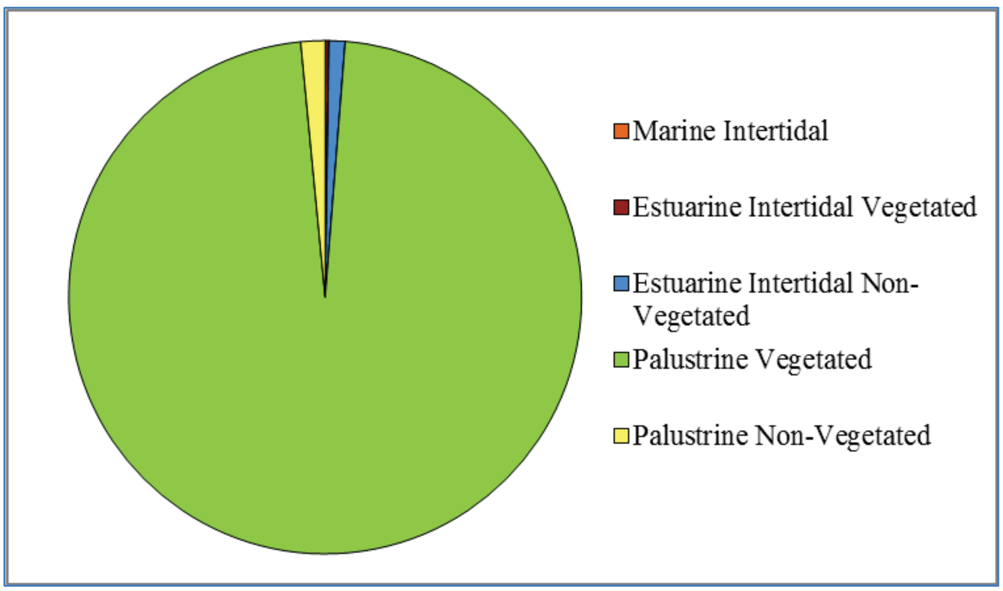
The USFWS National Wetland Inventory (NWI) (*USFWS 2015a*) maps and classifies wetlands using the NWI classification system (*Cowardin et al. 1979*). NWI mapping is only available for portions of Alaska (primarily inhabited areas and areas of potential resource development). Therefore, this assessment relied on an estimate of wetland acreage and types presented in *The Status of Alaska Wetlands* (*Hall et al. 1994*). This document used the wetland acreages and types mapped by NWI in portions of the state to estimate wetland acreage and types in the unmapped areas, using a regional approach. To maintain consistency with the NWI, *Hall et al.* (*1994*) used NWI (*Cowardin et al. 1979*) wetland classifications. For the purpose of this assessment, all areas that are classified by the NWI (per *Cowardin et al. 1979*) as either palustrine,[4] marine intertidal,[5] and estuarine intertidal[6] were included as wetlands. The remaining classifications were unvegetated waters and were not included in this assessment: marine subtidal, estuarine subtidal, lacustrine (lake-based), and riverine (river-based) (*Cowardin et al. 1979*). These waters areas are assessed in Section 3.1.4, Water Resources.

[4] Palustrine wetlands include all nontidal wetlands dominated by trees, shrubs, persistent emergent, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand.
[5] Marine intertidal are areas of open ocean associated with high energy coastline where the substrate is exposed and flooded by tides (*Cowardin et al. 1979*).
[6] Estuarine intertidal are coastal areas usually semi-enclosed by land but have open partially-obstructed access to open ocean. Water is partially diluted by freshwater runoff.

3.1.5.4. Wetland Characteristics

A total of 174,683,900 acres of wetlands are estimated for Alaska (*Hall et al. 1994*), which represents 41 percent of the total area of the state, significantly greater than the approximately 5.5 percent of total area comprised of wetlands in the contiguous U.S. as of 2009 (*Dahl 2011*) (see Table 3.1.5-1).

The large majority of Alaska's wetlands are classified as palustrine (172,503,400 acres), followed by estuarine intertidal (2,131,900 acres), and marine intertidal (48,600 acres) (see Figure 3.1.5-1). See Figures 3.1.5-2, 3.1.5-3, and 3.1.5-4 for examples of wetlands in Alaska. Nearly all of the palustrine wetlands are vegetated, while most estuarine wetlands are unvegetated. Of the palustrine vegetated wetlands, the vast majority is palustrine scrub/shrub wetlands; palustrine emergent and particularly palustrine forested wetlands are far less common (see Table 3.1.5-1). Alaska's wetlands are highly concentrated in the Arctic and Western Alaska (53 percent of Alaska's wetlands), and in interior Alaska (40 percent of Alaska's wetlands) (*Hall et al. 1994)*.



Source: USFWS 2015a

Figure 3.1.5-1: Alaska Wetland Types

Table 3.1.5-1: Acreages, Types, and Descriptions of Wetlands in Alaska

System[a]	Subclass[a]	Veg/Non-Veg	Class[a]	Code[a]	Acres	Physical Description	Hydrology	Vegetation
Marine	Intertidal	NA	All M2 classes	All M2 codes	48,600	Areas of open ocean associated with high energy coastline where the substrate is exposed and flooded by tides	Substrate exposed and flooded by tides; includes the splash zone	Typically unvegetated or with some intertidal vegetation; includes seagrasses, algae, and corals
		Total Marine Intertidal			**48,600**			
Estuarine	Intertidal	Non-Vegetated	Aquatic bed; unconsolidated bottom; unconsolidated shore; rocky shore	E2AB, E2UB, E2US, E2RS	1,771,700	Coastal areas usually semi-enclosed by land but have open partially-obstructed access to open ocean; water is partially diluted by freshwater runoff	Substrate exposed and flooded by tides; Includes the splash zone	NA
		Vegetated	Emergent; scrub/shrub; forested	E2EM, E2SS, E2FO	360,200			Herbaceous emergent, scrub/shrub, or forested vegetation; includes black spruce trees (e.g., *Picea mariana*) and other conifer trees (e.g., Sitka spruce, hemlock, and cedar species), willow shrubs, alder shrubs, ferns, sedges, grasses, and horsetail
		Total Estuarine Intertidal			**2,131,900**			
Palustrine	NA	Non-Vegetated	Unconsolidated shore	PUS	33,000	Unvegetated freshwater wetlands that 1) lack active wave-formed or bedrock shorelines (e.g., lakes), 2) are <20 acres, and 3) are <6 ft deep at low water; Substrate includes rock, sand, other fine materials, or vegetation growing below the water surface; includes ponds	Water <6 feet deep; hydrologic regime ranges from permanently flooded to seasonally/ intermittently flooded, to saturated	NA
			Open water	PUB	2,511,000			NA
			Aquatic beds	PAB	126,200			Vegetation, algae, or moss growing below the water surface
		Total Palustrine Non-Vegetated			**2,670,200**			
		Vegetated	Emergent	PEM	42,000,800	Vegetated freshwater wetlands that 1) lack active wave-formed or bedrock shorelines (e.g., lakes), and 2) are dominated by vegetation, regardless of size; includes bogs, fens, marshes, swamps, and prairies	Hydrologic regime ranges from permanently flooded to seasonally/ intermittently flooded, to saturated	Herbaceous vegetation growing above the water surface; includes sedges and grasses
			Scrub/shrub	PSS	114,510,100			Scrub/shrub vegetation; includes willow (*Salix* sp.) and black spruce (e.g., *Picea mariana*) shrubs, ferns, and grasses.
			Forested	PFO	13,322,300			Forested vegetation; includes alder, cottonwood (e.g., *Populus balsamifera*), black spruce (e.g., *Picea mariana*) and other conifers (e.g., Sitka spruce, hemlock, and cedar species), other woody species, ferns, and grasses
		Total Palustrine Vegetated			**169,833,200**			
		Total Palustrine			**172,503,400**			
Total Wetlands					**174,683,900**			

Sources: USFWS 2015a; Cowardin et al. 1979; USACE 2014

NA= not applicable
[a] System, subclass, class, and code are based on NWI (*Cowardin et al. 1979*), as follows:

- Marine intertidal: M2: marine intertidal;
- Estuarine intertidal: E2AB: estuarine intertidal aquatic bed; E2UB: estuarine intertidal unconsolidated bottom; E2US: estuarine intertidal unconsolidated shore; E2RS: estuarine intertidal rocky shore;
- Palustrine
  - Non-vegetated: PUS: palustrine unconsolidated shore; PUB: palustrine unconsolidated bottom; PAB: palustrine aquatic bed;
  - Vegetated: PEM: palustrine emergent; PSS: palustrine scrub-shrub; PFO: palustrine forested; (*Cowardin et al. 1979*)

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Photo taken in Homer, Alaska; Source: ERM Alaska, Inc.

Figure 3.1.5-2: Palustrine Vegetated Wetland in Alaska

Photo taken above Copper River Delta, Alaska; Source: USFS 2015a

Figure 3.1.5-3: Estuarine Vegetated Wetland in Alaska

Photo taken in Prince William Sound, Valdez Duck Flats, Alaska; Source: USFS 2015b

Figure 3.1.5-4: Marine Intertidal Wetland in Alaska

The USGS's document entitled *The National Water Summary on Wetland Resources* (*USGS 1996*) provides the following overview of the development and maintenance of Alaska wetlands as related to environmental factors including hydrology, permafrost, tidal areas, river deltas, tectonic activity, and fire ecology:

> "Many wetlands throughout Alaska are underlain by poorly permeable materials, such as decomposed peat, bedrock, silt, clay, seasonally frozen soils, or permafrost, that do not readily allow water from snowmelt or rain to pass through. Permafrost, soil having a temperature below freezing for 2 years or more, helps form and maintain wetlands in the Northwest, Arctic, and Interior regions. The extent and thickness of the permafrost decrease southward from a continuous layer as much as several hundred feet thick in the Arctic region to areas generally free of permafrost in the South-central and Southeast regions. In the Arctic coastal plain, thawed soils in the summer commonly are no more than about 3-feet thick, limiting the rooting depth of plants and the infiltration of water. Long winters, cool summers, and the presence of permafrost maintain vast wet expanses under the same precipitation conditions that would produce only deserts in regions having temperate climates.
>
> Alaska has about 34,000 miles of shoreline. Extremely large tidal fluctuations occur daily in southeastern Alaska, Prince William Sound, Cook Inlet, and Bristol Bay, forming expansive tidal flats and salt marshes.

> Alaska's large rivers form extensive deltas. The Yukon-Kuskokwim Delta is one of the world's largest and supports more than 10 million acres of wetland. The deltas of the Colville, Copper, and Stikine Rivers also support vast wetlands. Expansive wetlands, such as the Yukon, Minto, Kanuti, and Koyukuk Flats, also occur adjacent to rivers flowing through large areas of low relief.
>
> Tectonic activities affect the hydrology of Alaska's wetlands. During the 1964 earthquake, the Copper River Delta was uplifted 6 to 13 feet, and the Portage area, which is 40 miles southeast of Anchorage, subsided as much as 8 feet. In the Copper River Delta, some wetlands that were salt marshes before the earthquake have become freshwater systems. Also, in some areas, salt marshes have migrated seaward almost a mile. Kodiak Island and parts of southeastern Alaska are rising because glaciers whose weight had formerly caused land subsidence are melting. The relative fall in sea level is presumably modifying wetlands above the tidal zone and creating wetlands within the new tidal zone.
>
> The productivity of many Alaska wetlands is affected by fires. Fires occur only infrequently in coastal areas, allowing as much as several tens of feet of peat to accumulate in some bogs and fens in southeastern Alaska. Fires, common in interior Alaska, rid marshes of dead grass, sedges, and shrubs and make new shoots available for waterfowl and mammals. Burning of vegetation and peat releases minerals and nutrients from organic litter, usually potassium, calcium, phosphorus, magnesium, chloride, and nitrogen. However, where permafrost is present, a severe fire may cause the relative abundance of plant species to change, especially if the fire removes the insulating organic layer, which in turn causes the top of the permafrost to lower. If the burned area remains undisturbed, wetland conditions will eventually return, but it can take 50 to 100 years to complete the cycle."

The Department of Environmental Conservation (*ADEC 2011*) and *USGS* (*1996*) provide a discussion of several functions provided by Alaska's wetlands. These include:

- Maintain water quality by filtering excess nutrients;
- Provide habitat for fish, wildlife, and plants;
- Provide resources for native Alaskans (e.g., subsistence hunting, fishing, trapping, and food gathering);
- Provide recreational opportunities; and
- Support businesses (e.g., hunting, wildlife observation, and photography).

The major threats to Alaska wetlands are draining and filling for industrial, commercial, or residential development (*USGS 1996*). Certain wetland types may be more sensitive to stressors than others, or may be more difficult to restore or rehabilitate structure and function after disturbance. For example, vegetated wetlands will be more difficult to restore than non-vegetated wetlands, with forested wetlands (e.g., Alaskan black spruce bogs) being the most difficult to restore given the time required for trees to grow, followed by scrub/shrub and emergent wetlands. In addition, in Alaska, replacement of peat bogs in general (whether forested or not) would be considered particularly difficult, as the deep, organic peat deposits take hundreds, if not thousands of years to develop (*USEPA 2015*).

The National Oceanic and Atmospheric Administration has developed a national set of Environmental Sensitivity Index (ESI) maps that includes portions of Alaska. The ESI maps present coastal area resources that may be at risk in the event of an oil spill. These maps provide a sensitivity index for areas considered to be "sensitive shorelines", including coastal wetlands and wetlands providing habitat for sensitive or special status plant and wildlife species (*NOAA 2015*). The ESI maps could therefore be used as a tool to determine potentially sensitive wetland habitats in coastal areas.[7]

A large portion of Alaska's wetlands are located on state or federally protected land. Some examples include the Arctic NWR (19.6 million acres, approximately half of which is wetland) and the Yukon Flats NWR (9 million acres, of which the majority is wetland), which supports the highest density of breeding ducks in Alaska (*USFWS 2015b*).

Alaska wetlands provide habitat for sensitive or special status plant and animal species, as well as economically important species. In northern Alaska, palustrine and estuarine wetlands provide important nesting, breeding, and rearing habitat for threatened spectacled eiders and Steller's eiders (see Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, for more details on wetland habitats important to threatened and endangered species). Although not threatened or endangered in Alaska, among other species, moose and salmon are important to the state's economy and culture through recreation-based businesses and commercial fishing, sport hunting, and subsistence fishing and hunting. Wetlands are key to the maintenance of healthy moose and salmon populations within Alaska. Palustrine and estuarine wetlands located adjacent to anadromous[8] salmon streams and lakes provide slow water rearing habitat during high water periods when streams and rivers overtop their banks and maintain habitat structure and nutrient inputs. Palustrine emergent and scrub/shrub wetlands provide important browse habitat for moose (*ADFG 2006*).

[7] ESI maps and downloadable data can be found at http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-sensitivity-index-esi-maps.html

[8] Anadromous fish are born in freshwater, migrate to the ocean to grow as adults, and then return to freshwater to spawn.

3.1.6. Biological Resources

3.1.6.1. Introduction

Biological resources include 1) terrestrial vegetation, 2) wildlife, 3) fisheries and aquatic habitats, and 4) threatened and endangered species and communities and species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources.

This section discusses existing biological resources in Alaska:

- Terrestrial vegetation, including vegetation types, vegetation communities of conservation concern, and invasive species.
- Wildlife, including wildlife habitat and seasonal characteristics. Species included in this section are terrestrial invertebrates; amphibians and reptiles; terrestrial mammals (game and non-game); marine mammals; and birds occurring in Alaska and in Alaska's offshore environment. Wildlife species and their habitat in Alaska are generally discussed along with select principal species or those of particular interest.
- Fisheries and aquatic habitats, including fisheries features and characteristics. Species included in this section include freshwater, anadromous[1], and marine species of fish and shellfish occurring in Alaska and in Alaska's offshore environment.
- Threatened and endangered species and species of conservation concern. This analysis considers plant and animal species that are federally listed as threatened, endangered, candidate, proposed, or species of concern; species listed by the United States Forest Service and the Bureau of Land Management as sensitive; species that are state-listed as endangered; and/or species that receive specific protection defined in federal or state legislation. This analysis considers species that are known to occur in Alaska for all or part of their life cycle.

3.1.6.2. Specific Regulatory Considerations

Given the expected nature and extent of the Proposed Action, it is likely that a wide range of biological resources could be impacted to varying degrees. Therefore, there are many federal, state, and local laws and regulations as well as executive orders considered as part of this analysis. Each biological resource below contains a brief discussion of laws and regulations specific to its resource. Appendix C, *Environmental Laws and Regulations*, provides a comprehensive list of all applicable laws and regulations that were considered as part of the Proposed Action.

[1] Anadromous fish are born in freshwater, migrate to the ocean to grow as adults, and then return to freshwater to spawn.

3.1.6.3. Terrestrial Vegetation

Introduction

This section discusses terrestrial vegetation resources in Alaska. Information is presented regarding vegetation types and characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

Specific Regulatory Considerations

Related to terrestrial vegetation, and as addressed in Appendix C, *Environmental Laws and Regulations*, Executive Order (EO) 13112 "directs federal agencies to prevent the introduction of invasive plant and other species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species can cause."

Environmental Setting

The general vegetation types and land cover classes present in Alaska were identified, evaluated, and described using information gathered from the United States (U.S.) Geological Survey Gap Analysis Program (*USGS GAP 2011*). Vegetation communities of conservation concern were identified by the Alaska Natural Heritage Program. Finally, introduced, invasive, and noxious plant species are addressed in this section based on information from the U.S. Department of Agriculture Natural Resources Conservation Service PLANTS Database (*USDA NRCS 2003*) as well as well as the Alaska Department of Natural Resources.

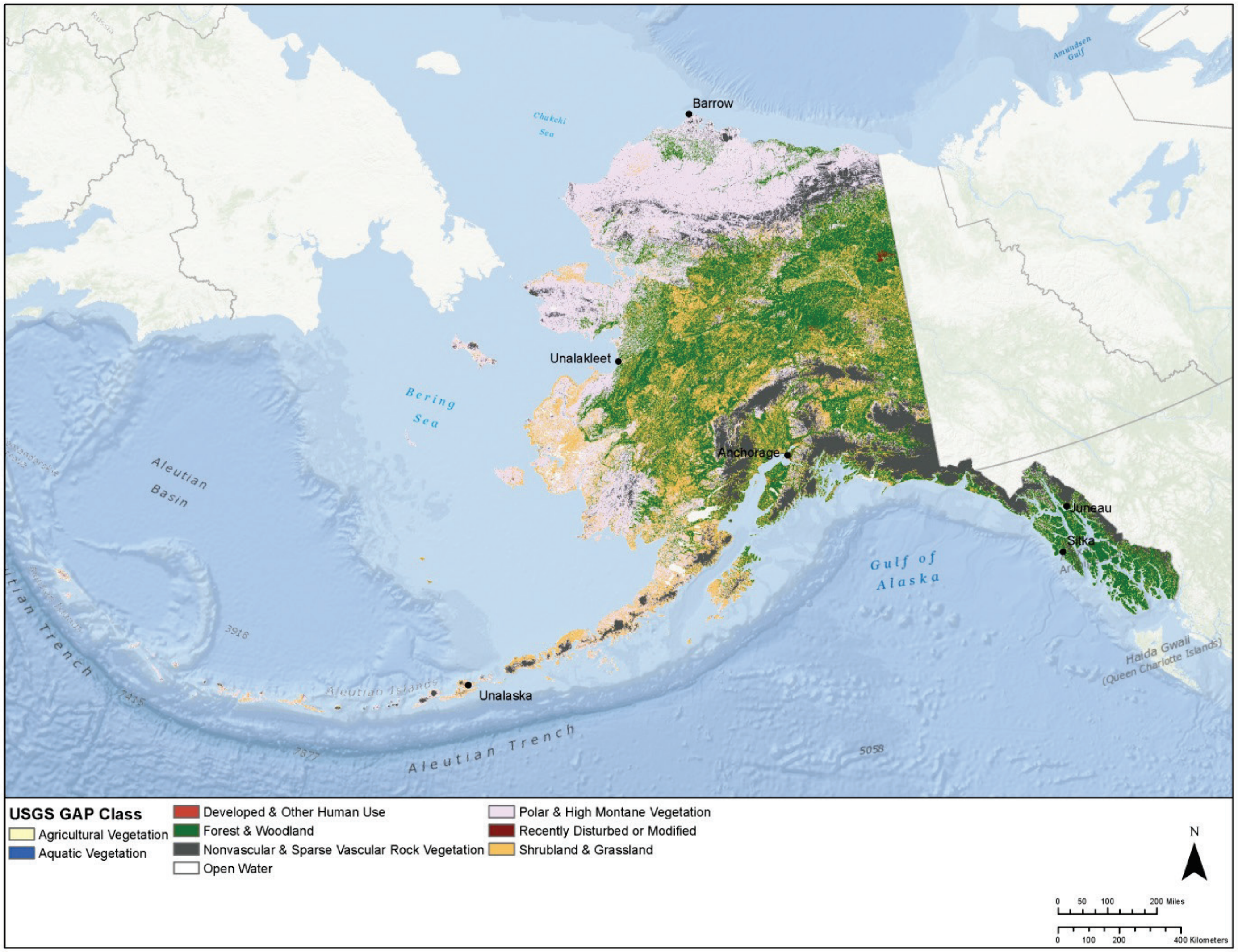
Vegetation Types

Based on the vegetation data provided by Gap Analysis Program, nine general vegetation types or land cover classes were classified in Alaska. Figure 3.1.6.3-1 depicts the distribution of these vegetation types or land cover classes, and Table 3.1.6.3-1 provides a description of each type and their general characteristics.

As shown in Figure 3.1.6.3-1, the majority of the northern and far western portions of Alaska consist of polar and high montane[1] vegetation as well as shrubland and grassland areas. The central portion of the state has the highest percentage of forest and woodland cover, and the southern portion of Alaska consists primarily of nonvascular and sparse vascular[2] vegetation with some forest and woodland, and shrubland and grassland. A major threat to terrestrial vegetation in Alaska includes climate change (*USEPA 2015*).

[1] Montane refers to mountainous areas.

[2] Vascular plants possess conducting tissues to transport nutrients and water throughout the plant. Nonvascular plants, such as mosses, liverworts, hornworts, and algae, do not have the same types of conducting tissues.



Source: USGS GAP 2011

Figure 3.1.6.3-1: Vegetation Types and Land Cover Classes in Alaska

Table 3.1.6.3-1: Vegetation Types/ Land Cover Classes in Alaska

Vegetation Type or Land Cover Class Name	General Description	Vegetation Characteristics
Agricultural Vegetation	Consists of areas with vegetation used for cropland, pasture, and hay as well as actively tilled land	Various crops including corn, soybeans, vegetables, tobacco, and cotton as well as perennial woody crops such as orchards and vineyards; also includes grasses, legumes, or mixtures planted for livestock grazing
Developed and Other Human Use	Includes developed areas with covered impervious surfaces, constructed materials, and vegetation	Various grasses, shrubs, or trees in developed settings use for recreation, erosion control, or aesthetic purposes
Forest and Woodland	Includes temperate and boreal forest areas[a]	Variable depending on location/elevation and other physical characteristics; species may include various shrubs, spruce, hemlock, poplar, aspen, and other conifer or hardwood stands
Nonvascular and Sparse Vascular Rock Vegetation[b]	Consists of sparse vegetation in rocky or snowy/icy areas with minimal soil development	Nonvascular vegetation consists of various mosses; vascular vegetation includes shrubs and grasses
Open Water	Areas of open water including streams, rivers, ponds, and lakes with less than 25 percent cover of vegetation or soil	NA
Polar and High Montane Vegetation[c]	Includes tundra or alpine areas mainly consisting of shrubs, herbs, lichens, and mosses	Low growing shrubs and small trees as well as mosses, herbs, and lichens growing near barren areas with rock or gravelly soils
Recently Disturbed or Modified	Primarily includes recently burned tree cover along with other disturbed or modified vegetated areas	NA
Shrubland and Grassland	Consists of a combination of grasses and shrubs, ferns, and small trees	Primarily includes various grasses, shrubs, and ferns

Source: USGS GAP 2011

NA = not applicable
[a] Boreal forests consist primarily of spruces, pines, and larches. Boreal forests are also commonly known as taiga in Alaska. Temperate forests are found in regions with mild climates and receive heavy rainfall.
[b] Vascular plants possess conducting tissues to transport nutrients and water throughout the plant. Nonvascular plants, such as mosses, liverworts, hornworts, and algae, do not have the same types of conducting tissues.
[c] Montane refers to mountainous areas.

Vegetation Communities of Conservation Concern

Some vegetation communities or types have become of conservation concern because of declining abundance, sensitivity to disturbance, and/or due to the reliance of certain species on the habitat they create. There is currently one plant species protected under the Endangered Species Act in Alaska, the Aleutian shield fern (*Polystichum aleuticum;* see Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern). In addition, the

Alaska Natural Heritage Program has identified a total of 18 biophysical settings[3] or plant associations[4] of concern (see Table 3.1.6.3-2).

Table 3.1.6.3-2: Biophysical Settings and Plant Associations of Concern in Alaska

Biophysical Setting or Plant Association	Region
Biophysical Settings	
Barrier Islands Biophysical Setting	Southern Alaska
Chamaecyparis nootkatensis (yellow cedar) Wetland Biophysical Setting	Southern Alaska
Dwarf Shrub-Lichen Peatland Plateau Biophysical Setting	Western Alaska
Geothermal Springs Biophysical Setting	All Alaska
Inland Dune Biophysical Setting	Interior Alaska, including Cook Inlet
Karst Alpine Herbaceous Meadow and Heath Biophysical Setting	Southern Alaska
Karst Fens Biophysical Setting	Southern Alaska
Steppe Bluff Biophysical Setting	Interior Alaska, including Cook Inlet
Tidal Marshes and Mudflats Biophysical Setting	Northern Alaska
Tidal Marshes and Mudflats Biophysical Setting	Southern Alaska and the Aleutian Islands
Uplifted Tidal Marsh Biophysical Setting	Southern Alaska
Plant Associations	
Artemisia arctica-Trisetum spicatum (boreal sagebrush-spike trisetum) Plant Association	Southern Alaska and the Aleutian Islands
Cochlearia sessilifolia (sessileleaf scurvygrass) Plant Association	Southern Alaska
Picea sitchensis (Sitka spruce) Floodplain Old-growth Forest Plant Association	Southern Alaska
Picea sitchensis/*Calamagrostis nutkaensis* (Sitka spruce/Pacific reedgrass) Plant Association	Southern Alaska
Picea sitchensis/*Oplopanax horridus*/*Circaea alpina* (Sitka spruce/devil's club/enchanter's nightshade) Plant Association	Southern Alaska
Pohlia wahlenbergii-Philonotis fontana (Wahlenber's pohlia moss-philonotis moss) Plant Association	Southern Alaska and the Aleutian Islands
Tsuga heterophylla-Picea sitchensis (western hemlock-Sitka spruce) Karst Forest Plant Association	Southern Alaska

Source: ACCS 2015

As further discussed in Section 3.1.6.4, Wildlife, there are numerous protected areas in Alaska designated to protect sensitive plant and animal species. These areas include national wildlife refuges and state-managed game refuges, critical habitat areas, and wildlife sanctuaries. Alaska also has 212 Important Bird Areas, which are designated for protecting birds and their habitats.

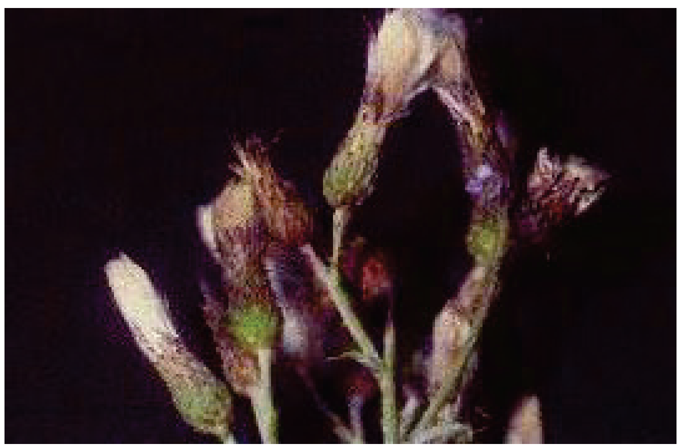
[3] Biophysical settings represent the areas of vegetation that dominate a landscape without human disturbance (*ACCS 2015*).
[4] Plant associations are plant communities of a specific type (or types) and geography (or geographies) (*ACCS 2015*).

Invasive Species

EO 13112 defines an invasive species as a species not native to an area whose introduction causes or is likely to cause harm to the economy or the environment, or harms animal or human health. As mentioned above, the EO "directs federal agencies to prevent the introduction of invasive species, provide for their control, and minimize the economic, ecological, and human health impacts that invasive species can cause."

According the PLANTS Database, there are 17 state-listed noxious weeds identified in Alaska (*USDA NRCS 2003*). The following are some examples of problematic invasive terrestrial plants in the state as described by the Alaska Department of Natural Resources, some of which are more susceptible to becoming established in disturbed areas than others (*ADNR 2010*):

- Canada thistle (*Cirsium arvense*) – considered a top priority invasive species for control, eradication, and prevention; directly competes with and displaces native vegetation; produces chemicals that prevent other nearby plants from thriving; common at low to mid elevations; found in fields, pastures, meadows, roadsides, and disturbed areas (see Figure 3.1.6.3-2).



Source: USDA NRCS 2003

Figure 3.1.6.3-2: Canada Thistle

- European bird cherry (*Prunus padus*) – tree growths up to 30 feet tall and sprouts from trunk, stems, and roots when cut; creates defense chemicals and, although rare, can cause cyanide poisoning in moose; planted in residential landscapes, parks, and near some remote cabins; has invaded riparian zones[5] and stream sides; takes over understory and prevents native plant growth (see Figure 3.1.6.3-3).

[5] Riparian zones are areas near wetlands, rivers, or streams.

Source: NPS Undated

Figure 3.1.6.3-3: European Bird Cherry

- Giant hogweed (*Heracleum mantegazzianum*) – although only documented as occurring in one location (Kake, Alaska), this plant grows up to 10 to 15 feet tall and produces sap that can cause injury to humans (burning of the skin), birds, and other animals; dense canopies allow it to out-compete native vegetation; grows near rivers and streams, roadsides, gardens, and waste/disturbed areas (see Figure 3.1.6.3-4).

Source: USDA 2012

Figure 3.1.6.3-4: Giant Hogweed

- Leafy spurge (*Euphoriba esula*)– deeply rooted perennial herb that grows up to 32 inches tall; can reduce species diversity and out-compete forage populations; grazing animals avoid it due to its toxicity; establishment is promoted by disturbances in soils, which allow it to take over roadsides and developing areas (see Figure 3.1.6.3-5).

Source: USDA Undated

Figure 3.1.6.3-5: Leafy Spurge

- Purple loosestrife (*Lythrum salicaria*) – herbaceous wetland perennial that grows up to 6 to 8 feet tall; takes over wetlands and displaces native vegetation; clogs streams and canals and slows water flow (see Figure 3.1.6.3-6).

Source: USDA 2015

Figure 3.1.6.3-6: Purple Loosestrife

- Smooth cordgrass (*Spartina spp.*) – perennial grass that fills mudflat habitats, transforming them into dense meadows; replaces native wetland vegetation and resulting in loss of habitat for spawning aquatic species (see Figure 3.1.6-7).

Source: USDA NRCS Undated

Figure 3.1.6.3-7: Smooth Cordgrass

- Spotted knapweed (*Centaurea stoebe*) – forms dense stands and decreases diversity of native vegetation; degrades forage quality for wildlife and leads to increase in erosion of topsoil; found in disturbed areas such as cultivated fields and pastures, roadsides and railways, and other rights-of-way (see Figure 3.1.6.3-8).

Source: Snyder and Shepard 2007

Figure 3.1.6.3-8: Spotted Knapweed

As indicated by the PLANTS Database as well as the Alaska Plant Material Center Field Guide, other noxious or invasive plants in Alaska include the following (*USDA NRCS 2003; Alaska Plant Materials Center 2014*):

- Russian knapweed (*Centaurea repens*)
- Whitetop (*Cardaria draba, Cardaria pubescens, Lepidium latifolium*)
- Field bindweed (*Convolvulus arvensis*)
- Quakgrass (*Agropyron repens*)
- Hempnettle (*Galeopsis tetrahit*)
- Galinsoga (*Galinsoga parviflora*)
- Blue-flowering lettuce (*Lactuca pulchella*)
- Austrian fieldcress (*Rorippa austriaca*)
- Horsenettle (*Sonchus arvensis*)
- Garlic mustard (*Alliaria petiolate*)
- Wild oats (*Avena fatua*)
- Bull thistle (*Cirsium arvense*)
- Narrowleaf hawksbeard (*Crepis tectorum*)
- Scotch broom (*Cytisus scoparius*)
- Orange hawkweed (*Hieracium aurantiacum*)
- Yellow-flowered hawkweeds (*Hieracium caespitosum*; *H. umbellatum*)
- Ornamental jewelweed (*Impatiens glandulifera*)
- Oxeye daisy (*Leucanthemum vulgare*)
- Yellow toadflax (*Linaria vulgaris*)
- White and yellow sweetclover (*Melilotus alba; M. officinalis*)
- Reed canarygrass (*Phalaris arundinacea*)
- Wild buckwheat (*Polygonum convolvulus*)
- Japanese knotweed (*Polygonum cuspidatum*)
- Tansy ragwort (*Senecio jacobaea*)
- Perennial sowthistle (*Sonchus arvensis*)
- Common tansy (*Tanacetum vulgare*)
- Western salsify (*Tragopogon dubius*)
- Bird vetch (*Vicia cracca*)

3.1.6.4. Wildlife

Introduction

This section discusses the existing wildlife resources in Alaska. Information is presented regarding wildlife habitat and seasonal characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

Species included in this section are terrestrial invertebrates; amphibians and reptiles; terrestrial mammals (game and non-game); marine mammals; and birds occurring in Alaska and in Alaska's offshore environment. Wildlife species and their habitat in Alaska are generally discussed along with select principal species or those of particular interest.[1] For more information on subsistence use of wildlife and threatened and endangered wildlife species, see Section 3.1.9, Socioeconomics, and Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, respectively.

Specific Regulatory Considerations

Alaska's land mass and marine waters are divided into management boundaries for the purpose of wildlife protection, management, permitting, and licensing (Figure 3.1.6.4-1). Three primary agencies are responsible for wildlife management in Alaska: United States (U.S.) Fish and Wildlife Service (USFWS), Alaska Department of Fish and Game (ADFG), and National Marine Fisheries Service.

Terrestrial mammals are managed by ADFG, except for threatened and endangered species, which are managed by USFWS. All marine mammals are managed by the National Marine Fisheries Service, except for polar bear, northern sea otter, and Pacific walrus, which are managed by USFWS. Birds are managed by both ADFG and USFWS, depending on their life history (e.g., migrants) and human uses.

The ADFG Habitat Division manages land use activities within Alaska's "Special Areas," (state game refuges, state game sanctuaries, and critical habitat areas). These areas are established by the state legislature to "protect and preserve habitat areas especially crucial to the perpetuation of fish and wildlife, and to restrict all other uses not compatible with the primary purpose." Permits are required from the Habitat Division for any habitat altering activity or any activity which disturbs fish or wildlife other than lawful hunting, trapping and fishing (*Alaska Statue 16.20.520-530*).

In Alaska, all native birds except grouse (ruffed [*Bonasa umbellus*], sharp-tailed [*Tympanuchus phasianellus*], spruce [*Falcipennis Canadensis*], and sooty [*Dendragapus fuliginosus*]) and ptarmigan (willow [*Lagopus lagopus*], rock [*Lagopus muta*], and white-tailed [*Lagopus leucura*]), which are protected by the State of Alaska, are protected under the Migratory Bird Treaty Act (MBTA). The ADFG legal framework to manage these upland game bird species is

[1] For a complete list of species, see the Alaska Natural Heritage Program's species tracking lists at http://aknhp.uaa.alaska.edu/zoology/publications/

derived from Article VIII of the Alaska Constitution and implementing statutes. Alaska Statute Title 16 is the primary statute governing the state's management of fish and wildlife.

Subsistence and recreational hunting in Alaska requires licenses and/or permits, which are distributed by ADFG. Guidance on compliance with Alaska government wildlife and habitat regulations can be found at the ADFG and USFWS websites.[2]

Bald and Golden Eagle Protection Act

Alaska has the largest population of bald eagles in the U.S., about 30,000 birds (*ADFG 2015b*). Bald eagles are year-round residents in the state, although some individuals migrate south during the coldest winter months. Bald eagles are strongly associated with water and typically occur along the coast and on and around offshore islands and interior lakes and rivers. The highest nesting densities occur on the islands of southeast Alaska. In late fall and winter, eagles frequently congregate in areas with plentiful food resources. In the Chilkat Valley, over 3,000 birds have been known to congregate in late fall and early winter to feed on spawned-out salmon. In recognition of this important wintering area, the state designated a portion of the Chilkat River as critical habitat for bald eagles.

Golden eagles' range within Alaska extends to the Brooks Range with a limited and scattered distribution in the southeast and rare occurrences in the Aleutians or Alaska Peninsula (*ADFG 2015a*). Golden eagles generally have different habitat preferences than bald eagles, as golden eagles are not so closely related with water. Rather, they prefer open tundra, grasslands, barren areas, or open woodlands, particularly in rugged, hilly, or mountainous areas. Many golden eagles migrate south during winter.

The Bald and Golden Eagle Protection Act affords specific legal protection to bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*). Under this Act, it is a violation to "…take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or in any manner any bald eagle commonly known as the American eagle or any golden eagle, alive or dead, or any part, nest, or egg thereof…." (*16 United States Code [USC] § 668*). The Act defines "take" as pursuing, shooting, shooting at, poisoning, wounding, killing, capturing, trapping, collecting, molesting, or disturbing (*16 USC § 668c*). "Disturb" is defined in regulation *50 Code of Federal Regulations (CFR) 22.3* as the following:

> "...[T]o agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle, (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." (*50 CFR 22.3*)

In fall 2009, USFWS implemented two rules (*50 CFR 22.26 and 22.27*) authorizing limited legal take of bald and golden eagles "when the take is associated with, but not the purpose of an otherwise lawful activity, and cannot practicably be avoided" (*USFWS 2011*).

[2] ADFG: http://www.adfg.alaska.gov/index.cfm?adfg=wildliferegulations.main, http://www.adfg.alaska.gov/index.cfm?adfg=habitatregulations.special; USFWS: http://www.fws.gov/alaska/recreation.htm

Migratory Bird Treaty Act

A migratory bird is any individual species or family of birds that crosses international borders at some point during their annual life cycle to live or reproduce. The MBTA implements four treaties that prohibit take, possession, transportation, and importation of all migratory, native birds (plus their eggs and active nests) occurring in the wild in the U.S., except for house sparrow, European starling, rock pigeon, any recently listed unprotected species in the *Federal Register* (*70 Federal Register 12710*), and non-migratory upland game birds, except when specifically authorized by the USFWS. The MBTA provides that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird or any part, nest, or egg or any such bird unless authorized under a permit issued by the Secretary of the Interior. Some regulatory exceptions apply. "Take" is defined in regulations as: "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (*16 USC § 1532(19)*). In total, more than 1,000 bird species are protected by the MBTA, 58 of which can be legally hunted with a permit as game birds. The MBTA addresses take of individual birds, not population-level impacts, habitat protection, or harassment. Failure to comply with the MBTA can result in criminal penalties. As authorized by the MBTA, the USFWS issues permits to qualified applicants for the following types of activities: falconry, raptor propagation, scientific collecting, special purposes (rehabilitation, educational, migratory game bird propagation, and salvage), take of depredating birds,[3] taxidermy, and waterfowl sale and disposal.

Marine Mammal Protection Act

The Marine Mammal Protection Act 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.[4] The act defines "take" to mean "to hunt, harass, capture, or kill" any marine mammal or attempt to do so. Exceptions to the moratorium can be made through permitting actions for take incidental to commercial fishing and other non-fishing activities; for scientific research; and for public display at licensed institutions such as aquaria and science centers. The act contains provisions allowing for take by Alaska natives for subsistence use or authentic handicrafts and clothing.

Other federal regulations pertaining to wildlife resources are discussed in Chapter 1, Introduction, and Appendix C, *Environmental Laws and Regulations*.

Terrestrial Habitats and Wildlife (Invertebrates, Mammals, Reptiles and Amphibians)

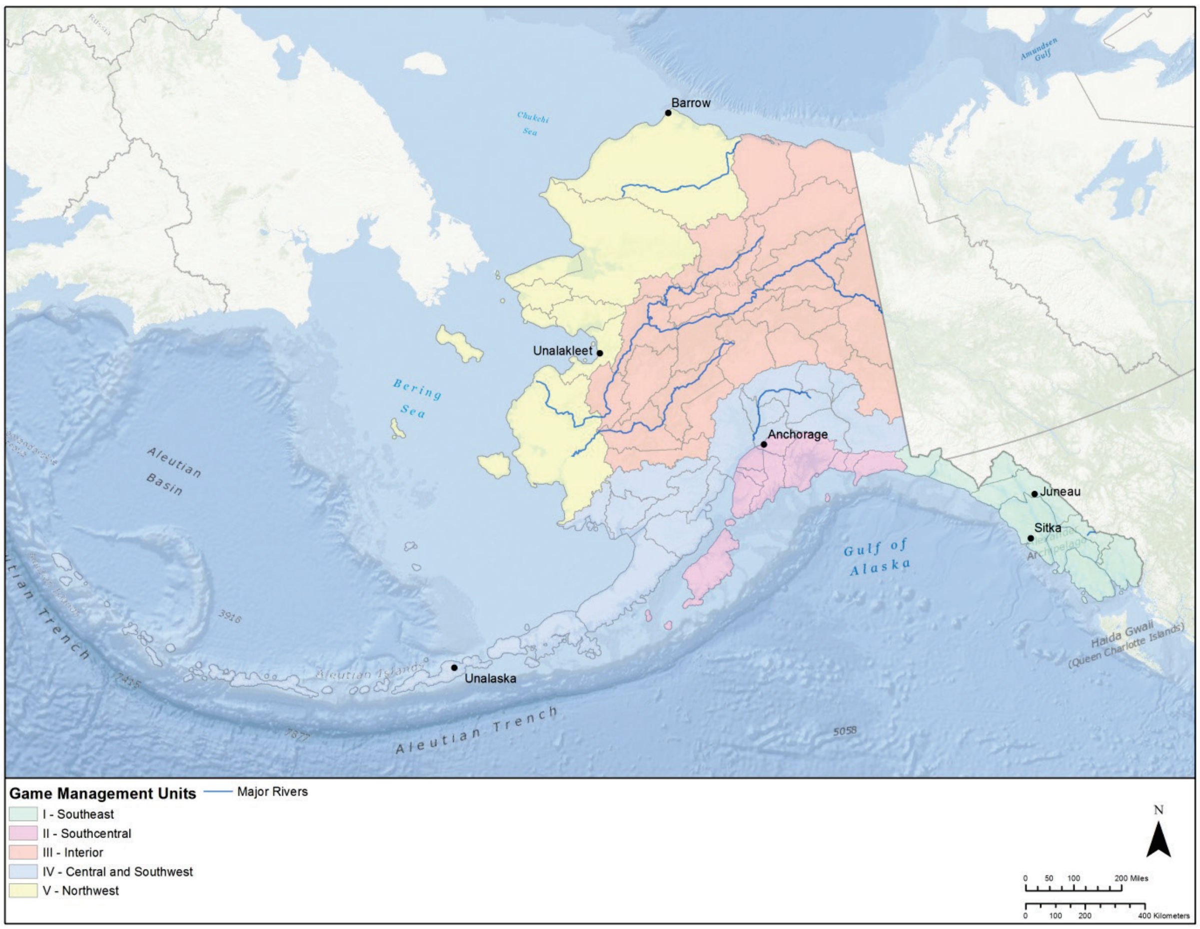
Alaska's terrestrial habitats and wildlife, including game and non-game mammals, amphibians, and terrestrial invertebrates, occupying those habitats are discussed; no terrestrial reptiles inhabit

[3] Birds that cause resource damage, economic loss, or a threat to health and human safety.
[4] U.S. persons and U.S. vessels within and outside the territorial limits of the U.S. The National Oceanic and Atmospheric Administration has consistently interpreted the Marine Mammal Protection Act as applicable to U.S. vessels and citizens throughout the high seas, including exclusive economic zones, as reflected in congressional and other correspondence and international agreements that rely upon jurisdiction over U.S. vessels and citizens in foreign exclusive economic zones (*16 USC §§ 1361-1423h*).

Alaska because they are dependent upon the surrounding temperatures, and necessary body warmth cannot be obtained from Alaska's cold climate. Marine mammals and their respective regions are described, along with select species more likely to be affected by the Proposed Action. Finally, avian conservation areas of Alaska and their bird assemblages are discussed.

Habitat Regions

On a broad scale, Alaska is divided into five major regions by ADFG for management of terrestrial mammals: Southeast, Southcentral, Interior, Central and Southwest, and Northwest (see Figure 3.1.6.4-1). Major regions and wildlife inhabiting those regions are discussed below.



Source: ADFG 2015c

Figure 3.1.6.4-1: ADFG Game Management Regions

Southeast

Southeast Alaska region is made up of both a mainland of rugged coastal mountains and the Alexander Archipelago, consisting of thousands of islands which promote a high level of endemism relative to Alaska (*ADFG 2015d*). Sitka black-tailed deer (*Odocoileus hemionus sitkensis*) are the most wide ranging large mammal, with mountain goats (*Oreamnos americanus*) occurring along steep fjord coasts, moose (*Alces alces*) in mainland river valleys, and a variety of furbearers[5] and small mammals on the mainland and islands (*ADFG 2015d*). Brown and black bears (*Ursus arctos* and *U. americanus*) roam the mainland and some islands, as do gray wolves (*Canus lupus*) (*ADFG 2015d*). An endemic[6] subspecies, the Alexander Archipelago wolf (*C. l. ligoni*), occurs on the southern islands (*ADFG 2015d*). The region supports most of the state's population of amphibians and bats (*ADFG 2015d; AKNHP 2015*).

Southcentral

The Southcentral region, encompassing Kodiak Island, Cook Inlet, and Prince William Sound, represents a variety of habitats including spruce-hemlock forests, alpine tundra, grassy estuaries, and rugged mountains that support a large diversity of species (*ADFG 1986b*). Moose, brown bears, and black bears forage along valley bottoms and in grassy estuaries. The alpine tundra areas of the coastal mountains support mountain goats, Dall sheep (*Ovis dalli dalli*), hoary marmots (*Marmota caligata*), and pikas (*Ochotona collaris*) (*ADFG 2015d*). Kodiak Island is home to the largest brown bears on earth – the Kodiak brown bear (*Ursus arctos middendorffi*) (*ADFG 2015d*). Red fox (*Vulpes vulpes*), river otter (*Lutra Canadensis*), ermine[7] (*Mustela ermine*), tundra vole (*Microtus oeconomus*), and little brown bat (*Myotis lucifugus*) are other native terrestrial mammals found on the Island (*USFWS 2012a*). The Southcentral region supports harvestable populations[8] of brown bears, black bears, moose, sheep, goats, Sitka black-tailed deer, and numerous furbearers (*ADFG 2015e*).

Interior

This area is bordered on the northwest side by the Brooks Range, to the south by the Alaska Range, and to the west by the Seward Peninsula and the Yukon-Kuskokwim River Delta. In the northeast, the region extends to the Beaufort Sea. The interior vegetation is primarily boreal forests of spruce, aspen, birch, poplar, and tamarack woodlands that provide habitat for moose, bears, wolves, and Dall sheep (*ADFG 2015o*). Both wetland and upland communities dot this landscape, creating a mosaic of wildlife habitats (*Hall et al. 1994*). Wet habitats in lowlands provide prime habitat for mink (*Neovison vison*), marten (*Martes americana*), muskrat (*Ondatra zibethicus*), moose, and river otter (*ADFG 2015d*). Several herds of caribou (*Rangifer tarandus granti*) range throughout the lowlands and mountainous areas (*ADFG 2015d*). The Interior

[5] Mammal species traditionally trapped or hunter for their fur, such as marten, lynx, wolverine, and beaver.
[6] Species that are only found in one area or region. Also, (of a disease or condition) regularly found among particular people or in a certain area.
[7] A small carnivorous short-tailed weasel.
[8] Harvesting is the act or process to take or kill wildlife for food, sport, or population control.

region supports harvestable populations of caribou, moose, Dall sheep, brown bear, black bear, and furbearers (*ADFG 1986d*).

Central and Southwest

The southwest portion of this area includes Bristol Bay, the Aleutian Island chain, and the drainages of the Nushagak and Togiak Rivers. Vegetation in the southwest portion varies from extensive wetland complexes to coastal spruce forest to alpine tundra or even barren areas on the Aleutian Islands, supporting a wide range of terrestrial species (*ADFG 1986c*). The Bristol Bay lowlands provide important habitat for moose, brown and black bears, wolverines (*Gulo gulo*), wolves, lynx (*Lynx Canadensis*), martens, and foxes. Beavers are abundant in lakes and ponds, as well brown bears feeding off the salmon-rich rivers (*ADFG 2015d*). The alpine tundra supports many small mammals, including Arctic ground squirrels (*Spermophilus parryii*) and marmots (*Marmota* spp.). Collared lemming (*Dicrostonyx groenlandicus*) and red fox populations are the only native mammals found on the far western Aluetian Islands (*ADFG 2015d*). The Mulchatna Caribou Herd migrates and calves in the southwest portion of this region (*ADFG 2015d*). The central area includes the southern slopes of the Alaska Range and its numerous large river basins. Shrub communities occupy the more protected lower slopes and valley bottoms with some spruce forests occurring, which provide habitat for many of the larger species including moose, brown bears, and caribou (*ADFG 2015d*). Brown bears, gray wolves, and wolverines prey on Dall sheep in the alpine tundra and large migrating caribou herds in the broad valleys (*ADFG 2015d*). The Central and Southwest region supports harvestable populations of caribou, moose, Dall sheep, brown bear, black bear, and furbearers (*ADFG 2015f*).

Northwest

The Northwest region comprises much of the Arctic and western portion of Alaska, including the Seward Peninsula. The northern portion is a relatively flat lowland on the Arctic Coastal Plain extending north from the foothills of the Brooks Range. Several major river deltas run north through the region, draining into the Beaufort and Chukchi seas. Wet sedge tundra and tussock tundra are the dominant vegetation communities providing preferred forage for large concentrations of calving caribou (*ADFG 2015d*). Arctic fox (*Alopex lagopus*) and red fox are found here, as well as the singing vole (*Microtus miurus*) and tundra shrews (*Sorex alaskanus*) (*ADFG 1986a; ADFG 2015d*).The western portion of the Brooks Range is in this region, which supports top level predators such as brown bears, wolverines, and gray wolves that prey on the migrating Western Arctic Caribou herd and the many small mammals and furbearers that inhabit the region (*ADFG 2015d*). The Seward Peninsula area is a transition zone between Arctic and sub-Arctic tundra with a high diversity of wildlife (*ADFG 2015d*). Common terrestrial mammals include brown bears, caribou, and moose as well as arctic foxes, singing voles, and tundra hares. The southern part of the region includes the Yukon-Kuskokwim River Delta that supports vast numbers of birds, mammals, and fish (*ADFG 2015d*). It is prime habitat for mink, muskrat, moose, and river otter, along with many smaller mammals (*ADFG 2015d*).

Wildlife

Terrestrial Invertebrates

Although there are no federal or state listed terrestrial invertebrates in Alaska, declining bird, mammal, and amphibian populations have been linked to invertebrate species that share these habitats (*ADFG 2015s*). The leading factors to these declines are habitat degradation, habitat loss, and pollution (*ADFG 2015s*). Habitat for many terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state. However, the specific habitat requirements of many invertebrate species are poorly understood (*ADFG 2005*). Terrestrial invertebrates found in Alaska include all groups of invertebrates from the most primitive (worms) to the highly evolved (insects) (*ADFG 2005*). The Alaska Comprehensive Wildlife Conservation Strategy (CWCS) document entitled *Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources* (*ADFG 2005*) identified two groups of potentially rare invertebrates in Alaska: the western bumblebee and land snails. Specifically, plants of the tundra such as the artic willow (*Salix arctica*) are reliant upon flies and bumblebees for pollination. The reproductive success of the artic willow by invertebrate pollinators is linked to the healthy populations of caribou, for example, since caribou feed on arctic willow, among other plants (*ADFG 2015s*).

Amphibians and Reptiles

A total of eight amphibian species occur in Alaska; of those, six are native species of amphibians that include the boreal toad (*Anaxyrus boreas*), Columbia spotted frog (*Rana luteiventris*), long-toed salamander (*Ambystoma macrodactylum*), northwestern salamander (*Ambystoma gracile*), rough-skinned newt (*Taricha granulosa*), and wood frog (*Lithobates sylvaticus*). The remaining two are introduced species: the pacific-chorus frog (*Pseudacris regilla*) and red-legged frog (*Rana aurora*) (*Alaska Herpetological Society 2015*). All are known to occur in the temperate rainforests of Southeast Alaska, except for the wood frog which is found throughout the rest of the state (*Alaska Herpetological Society 2015*). The wood frog primarily occurs in wetlands and forests throughout Alaska as far north as the Brooks Range (*AKNHP 2013*). Though rare, four sea turtle species have been observed in the Gulf of Alaska and in southeast Alaska's waters (*AKNHP 2013*). No terrestrial reptiles are known to occur in Alaska.

Terrestrial Mammals

The Alaska Natural Heritage Program (*AKNHP 2013*) has record of 111 species of terrestrial mammals in Alaska, including: 24 carnivores (e.g., bears, lynx, wolves, minks, wolverines), 8 ungulates[9] (e.g., moose, Dall sheep, caribou), 4 lagomorphs[10] (e.g., pikas, hares), 69 rodents (e.g., shrews, mice, voles, squirrels, beavers, etc.), and 6 bats. The only bat species found in the Interior and South Central is the little brown bat (*Myotis lucifugus*), whereas other bat species have been observed in Southeast Alaska (*AKNHP 2015*). Common game and non-game mammals are discussed below.

[9] Classification of mammals having hooves.
[10] Gnawing mammals that feed on plants and have fully furred feet and two pairs of incisors in the upper jaw.

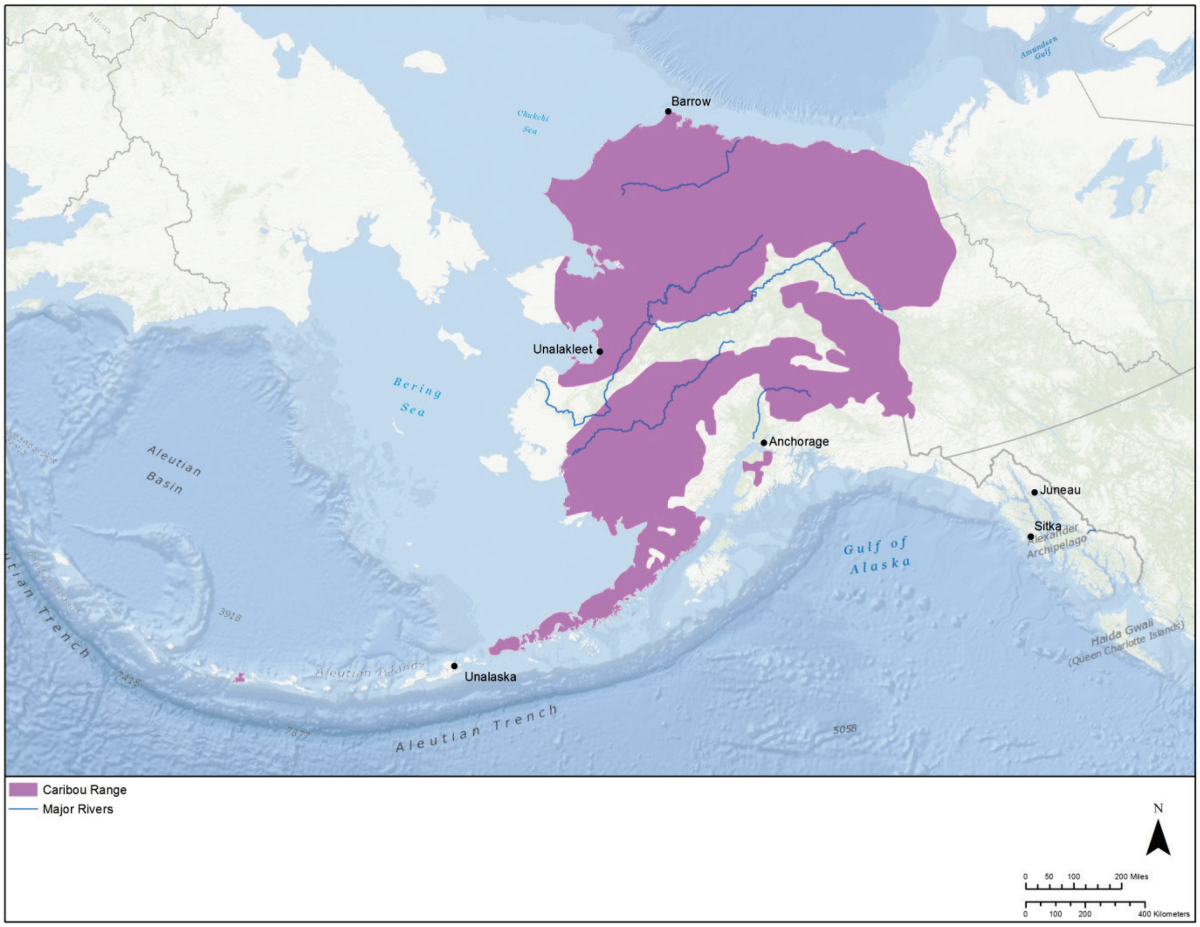
Moose

The moose is the largest member of the deer family, ranging in size from 800 pounds to 1,600 pounds and distinguished by the large palmate (i.e., broad and flat) antlers of the males (*ADFG 2015p*). Moose are generally associated with northern forest and found in Alaska from Stikine River in Southeast Alaska to the Colville River on the Arctic Slope (*ADFG 2015p*). 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 (*ADFG 2015p*). 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,[11] and wintering areas (*ADFG 2015p*). Moose population status and trends vary across the state. Populations north of the Brooks Range are declining (*ADFG 2014a*), whereas Central and Southwest region populations are reported to be stable (*ADFG 2015e; ADFG 2015f*).

Caribou

There are approximately 750,000 caribou in Alaska (including some herds that are shared by Alaska and Canada's Yukon Territory) that are distributed in 32 herds or populations (*ADFG 2015l*).[12] The distribution of caribou herds across Alaska is shown in Figure 3.1.6.4-2. A unique herd uses a distinct calving area that is separate from the calving area of other herds, but different herds may mix on winter ranges. The largest herds are the Western Arctic Herd at approximately 235,000, the Porcupine Caribou Herd at approximately 197,000, the Fortymile Herd at 52,000, the Central Arctic Herd at 51,000, and the Teshekpuk Herd at approximately 32,000 (*ADFG 2013a*). Caribou migrate between calving, summer, and winter ranges to take advantage of seasonally available forage. In general, the winter diet of caribou predominantly consists of lichens, and then shifts toward vascular plants during the spring. Calving occurs in mid-late May in Interior Alaska and in early June in northern and southwestern Alaska (*ADFG 2015l*). Calving grounds are typically located in mountains or on open, coastal tundra. Summer insect relief areas are typically in the high mountains or along seacoasts where wind and cool temperatures offer protection from heat and insects. In winter caribou seek areas of reduced snow cover, south slopes, and windswept ridges with high lichen biomass (*ADFG 2015l*).Population trends vary across the state with notable declines in the Northwest region's caribou populations (*ADFG 2014b*). According to Alaska Department of Fish and Game, herd declines are based on range condition, predation, disease, weather, and resource development (*ADFG 2012a*).

[11] The mating season typically occurs late September to early October.
[12] Spatial data representing the locations of specific herds are not available at present.

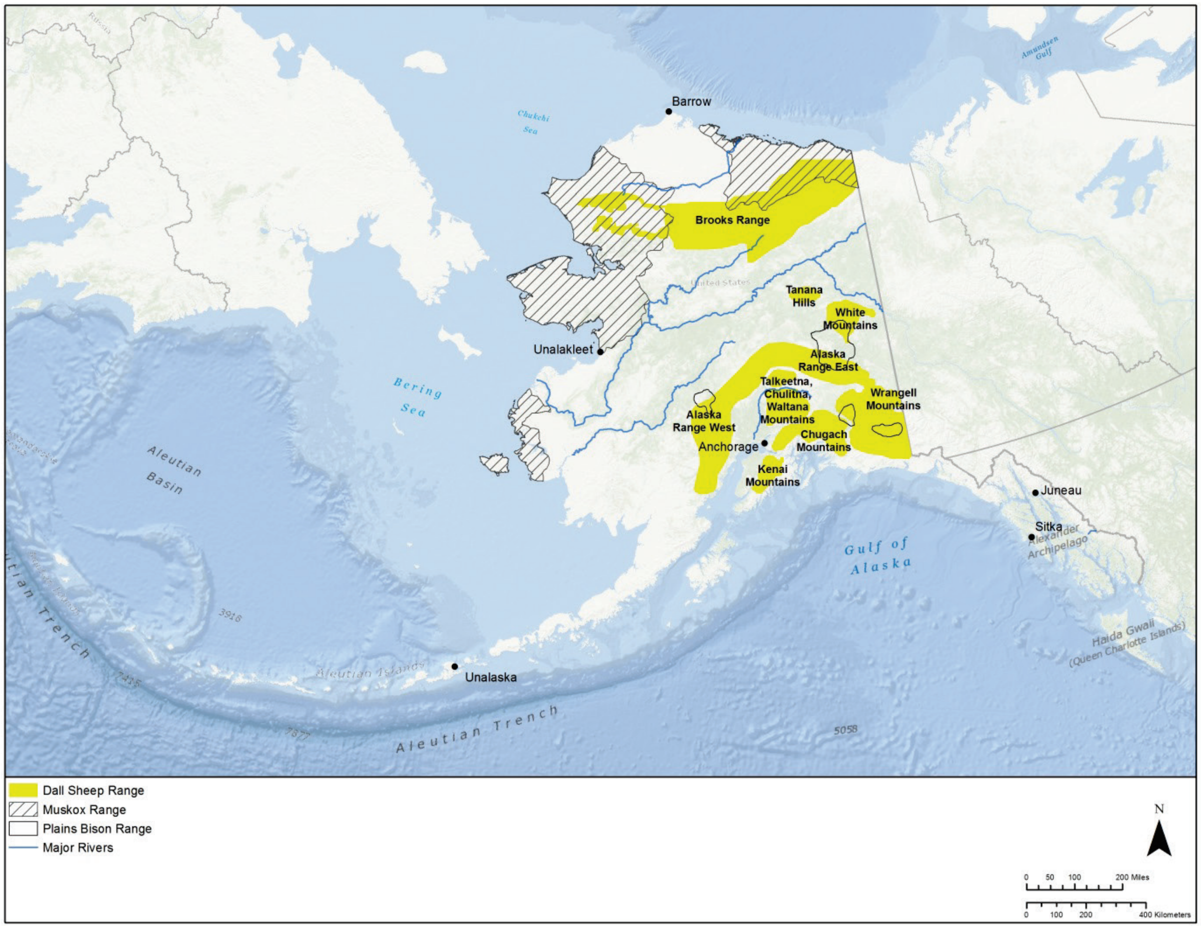


Source: ADFG 2015f

Figure 3.1.6.4-2: Distribution of Alaska Caribou Herds

<u>Dall Sheep</u>

Dall sheep distribution is generally in alpine areas in the subarctic mountain ranges of Alaska. Eight mountain range areas have been identified by ADFG as sheep population areas (*ADFG 2014c*) (See Figure 3.1.6.4-3). Dall sheep habitat generally includes a combination of open alpine ridges, meadows, and steep slopes with rugged "escape terrain" nearby (*Hull 1994*). A 2010 statewide population estimate of 45,000 was reported for the Wild Sheep Working Group of the Western Association of Fish and Wildlife Agencies (*ADFG 2014c*). High variability in population trends exist due to fluctuations in weather (i.e., deep snow or icing events) and predator populations (*ADFG 2014c*). Overall, the statewide population trend appears to be stable or decreasing (*ADFG 2014c*).



Source: ADFG 2015e

Figure 3.1.6.4-3: Dall Sheep, Bison, and Muskox Distributions in Alaska

Brown Bears

Alaska has an estimated 30,000 brown bears statewide (98 percent of the U.S. brown bear population) (*ADFG 2015k*). Brown bears occur throughout Alaska except on islands south of Frederick Sound in Southeast Alaska, west of Unimak in the Aleutian Chain, and Bering Sea islands. Kodiak bears (brown bears from the Kodiak Archipelago) are classified as a distinct subspecies (*Ursus arctos middendorffi*) from those on the mainland (*U. a. horribilis*) (*ADFG 2015k*). In areas of low productivity, such as on Alaska's North Slope, studies have revealed bear densities as low as one bear per 300 square miles (mi^2) (777 square kilometers [km^2]) (*ADFG 2015k*). In areas with abundant food such as the Alaska Peninsula, Kodiak Island, and Admiralty Island, densities as high as one bear per square mile (2.6 km^2) have been found. In central Alaska, both north and south of the Alaska Range, bear densities tend to be intermediate, approximately one bear per 15 to 25 mi^2 (39 to 65 km^2) (*ADFG 2015k*). Brown bears are opportunistic omnivores whose food sources vary by region, season, and year. In addition to vegetation and small mammals, bears prey on ungulates and scavenge their carcasses. Although generally solitary in nature, brown bears often occur in large groups in concentrated feeding areas such as salmon spawning streams, sedge flats, open garbage dumps, or on whale carcasses (*ADFG 2015k*). Brown bear populations are increasing in the Northwest region (*ADFG 2014b*) while in possible decline in the Southwest region (*ADFG 2015f*).

<u>Black Bears</u>

Black bears are the most abundant and widely distributed North American bear, with an estimated population of 100,000 black bears inhabiting Alaska (*ADFG 2015j*). In Alaska, black bears occur over most of the forested areas of the state; depending on the season of the year, they may be found from sea level to alpine areas (*ADFG 2015j*). They are not found on the Seward Peninsula, on the Yukon-Kuskokwim Delta, or north of the Brooks Range. Like brown bears, black bears are opportunistic feeders. In all areas of the state black bear populations are generally stable and support harvest goals (*ADFG 2015j*).[13]

<u>Bison</u>

Two subspecies of bison occur in Alaska: the plains bison (*Bison bison bison*) and the wood bison (*Bison bison athabascae*). The wood bison is listed as threatened under the Endangered Species Act. The ADFG worked with USFWS to develop a federal rule published in 2014 to designate wood bison in Alaska as a “nonessential experimental population” under sections 10(j) of the Endangered Species Act, allowing for activities such as resource development, hunting, trapping, and recreation (*AWBMPT 2015*). Wood Bison are further discussed in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Four herds of plains bison totaling approximately 900 animals graze in Alaska. The largest herd is near Delta Junction, and smaller herds have been established by translocation[14] from the Delta herd to Farewell, Chitina River, and the Copper River (*ADFG 2015i*) (See Figure 3.1.6.4-3). Plains bison tend to remain within a home range, although they often move between seasonal ranges. Alaska’s bison do not remain in single herds, but occur alone or in groups ranging up to 50 animals or more (*ADFG 2015i*). In the Delta Junction area, they migrate up the Delta River corridor in early spring to secluded meadows where they calve. Around August they travel back downstream, eventually moving onto the Delta Junction Bison Range, established to reduce conflicts between bison and agriculture producers and landowners (*ADFG 2012b*). In late fall, they move onto area farms and state lands where they remain throughout the winter. Alaska’s other wild bison herds also show seasonal movement patterns (*ADFG 2015i*). Bison herds are reported to be stable or increasing (*ADFG 2012b*).

<u>Muskox</u>

There are approximately 4,000 muskoxen in Alaska (*ADFG 2015q*). Muskox are found in northcentral, northeastern, and northwestern Alaska, on Nunivak Island, Nelson Island, the Seward Peninsula, the Yukon-Kuskokwim Delta, and in domestic herds across the state (*ADFG 2015q*) (See Figure 3.1.6.4-3). Muskox eat a wide variety of plants, including grasses, sedges,

[13] The Board of Game has authorized a number of programs under which game species may be harvested for cultural and subsistence uses (*ADGF 2015m*).
[14] The capture, transport, and release or introduction from one location to another.

forbs, and woody plants. Muskox are poorly adapted for digging through heavy snow for food, so winter habitat is generally restricted to areas with shallow snow accumulations or areas blown free of snow (*ADFG 2015q*). Muskox populations in Alaska are declining due to weather (and its effects on female body condition, reproductive success, and winter foraging) and predation by brown bears (*Harper 2013*).

Non-game (furbearers)

The term furbearer is used here to describe those species of terrestrial mammals that are routinely sought by trappers who place commercial value on the pelts. Marten is the most important species statewide, and the fur is known as sable. Other furbearers, ranked in order of importance (as defined by trappers considering trapping effort and commercial value of pelts) are lynx, wolf, beaver, red fox, wolverine, mink, coyote, otter, ermine (weasel), Arctic fox, and muskrat (*ADFG 2013b*). In the Arctic region, commonly found furbearers include wolverine, arctic fox, and red fox. In boreal forest regions of Alaska marten, coyote, and lynx can also be found. Based on sealing records, license sales and the annual "Trapper Questionnaire," the ADFG estimates 2,500 to 3,500 trappers in the state (*ADFG 2015c*).

Habitats and Marine Mammals

The Alaska Natural Heritage Program (*AKNHP 2013*) has recorded 41 species of mammals in Alaska's marine environment, including 25 cetaceans (e.g., whales, dolphins, porpoises), 11 pinnipeds (e.g., walrus, seal, sea lion, fur seal), and 5 distinct populations of otter. Alaska's marine environments, particularly those with a shallower continental shelf (i.e., the Bering and Chukchi seas), are rich in primary productivity[15] during the ice free-season. General descriptions of marine environments from the AKNHP are provided below. Descriptions of species more likely to be affected by the Proposed Action, such as those that use terrestrial haulouts,[16] are also summarized briefly. Special-status species are discussed in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Beaufort and Chukchi Seas

The Beaufort and Chukchi seas are the year-round home to polar bear and a few seal species. Other marine mammals that occur here in the summer migrate elsewhere for the winter, such as the Bering Sea (e.g., Pacific walrus) or as far south as Hawaii (e.g., humpback whale). The Chukchi and Beaufort seas provide rich feeding grounds for species such as bearded seal, Pacific walrus, gray whale, beluga whale, and the endangered bowhead whale. Several marine mammal species are highly dependent on sea ice in the Arctic. Animals such as polar bear, ringed seal, bearded seal, spotted seal, ribbon seal, and Pacific walrus all need sea ice to rest on when they are feeding in the Beaufort and Chukchi seas (*AKNHP 2013*).

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[15] Primary productivity refers to the various microorganisms that can convert light energy or chemical energy into organic matter; forming the base of the food web.
[16] Haulouts are areas of land or ice where seals and walrus come ashore to rest, molt or breed.

Bering Sea

Several pinniped species utilize coastal haulouts for resting, breeding, and pupping. Pacific walrus and northern fur seals, for example, congregate in great numbers at specific haulouts every year on Alaska's western coast in the Bering Sea. These haulouts are often restricted-access only for humans, vessels, and aircraft as the animals can easily injure each other in stampedes if they are disturbed. The Bering Sea is also a major migratory path for cetaceans and pinnipeds which use the Chukchi and Bering seas in the summer (ice-free) months. Listed species including the northern fur seal, ringed seal, the gray whale and the bowhead whale are discussed in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern (*AKNHP 2013*).

Gulf of Alaska

The Gulf of Alaska is a major migration pathway for large cetaceans that overwinter in the southern hemisphere or near the equator, and summer in the Bering, Chukchi, and Beaufort seas (e.g., humpback whale, North Pacific right whale, gray whale). Some of the larger cetaceans that occur in the Gulf of Alaska, such as the blue whale and sperm whale, generally do not travel farther north than the Aleutian Islands (*AKNHP 2013*). Listed species and designated critical habitat including the North Pacific right whale are discussed in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

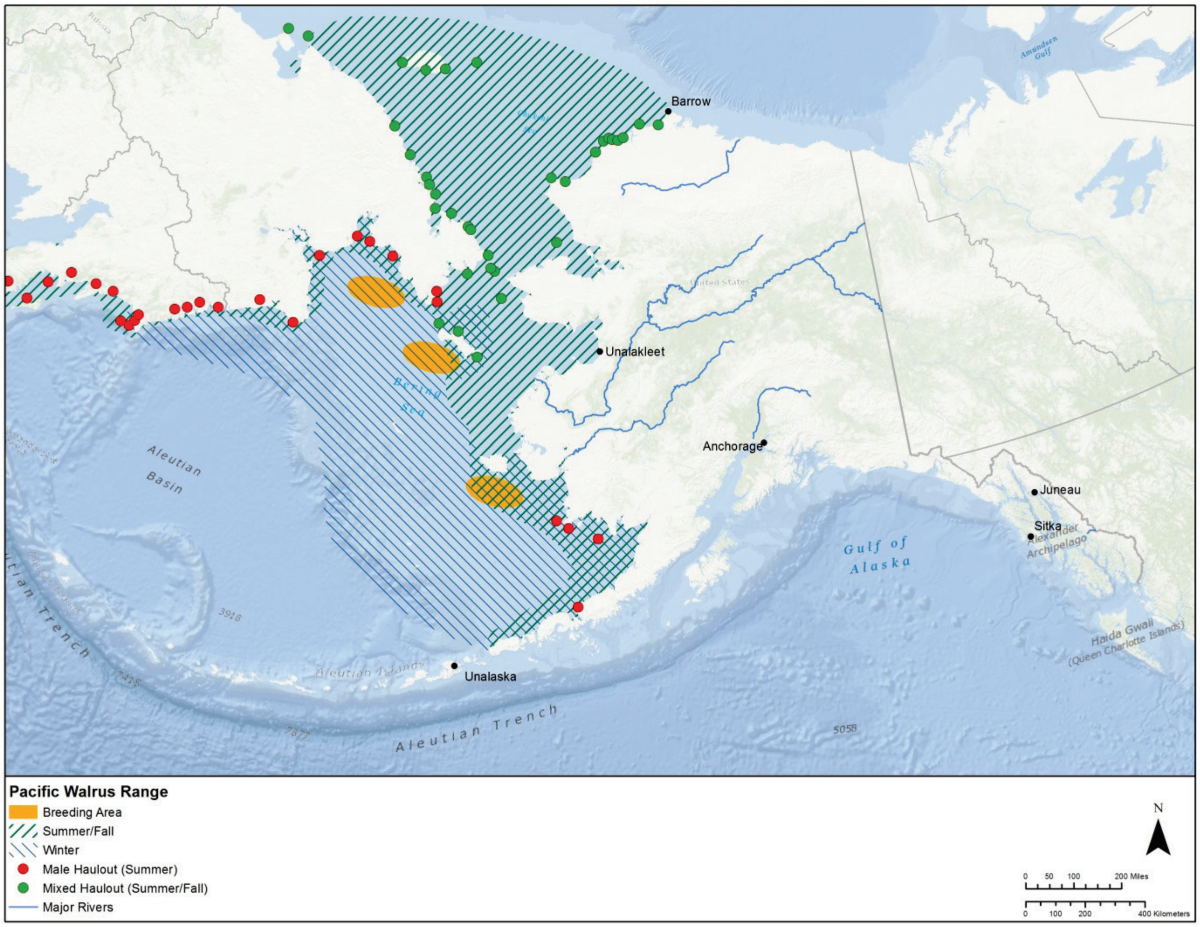
Southeast

Sea otters and Steller sea lions inhabit Southeast Alaska year-round. Humpback and gray whales migrate through the Southeast Passage in the spring and fall (*AKNHP 2013*).

Marine mammals using terrestrial haulouts or occupying nearshore environments are discussed below.

Pacific Walrus

Pacific walruses are typically found in waters 300 feet deep or less that provide foraging areas of soft, fine sands and sediments (*USFWS 2015b*). In some instances, walruses forage among rocky substrates. Clams are most commonly consumed; however, other invertebrates such snails, sea cucumbers, crabs, and segmented worms are frequently eaten (*USFWS 2015b*). The distribution of Pacific walruses varies markedly with the seasons and distribution of pack ice (see Figure 3.1.6.4-4). Almost the entire population occupies the pack ice in the Bering Sea in the winter months. As the Bering Sea pack ice begins to break up and melt in spring, walruses begin to move northward and their distribution becomes less clumped (*USFWS 2015b*). Most of the population spends the summer months in the pack-ice of the Chukchi Sea; however, several thousand animals, primarily adult males, use coastal haulouts such as islands, points, spits, and headlands in the Bering Sea during the ice-free season (*USFWS 2015b*). Major terrestrial haulouts are found in Bristol Bay at Cape Seniavin, Round Island, Cape Pierce, and Cape Newenham (*USFWS 2015b*). When exposed to human activity and its associated sights, sounds, and odors, walruses tend to leave ice floes[17] which leads to calf and yearling mortality (*USFWS 2015b*).



Source: USFWS 2015b

Figure 3.1.6.4-4: Distribution of Pacific Walrus in Alaska

Bearded Seal

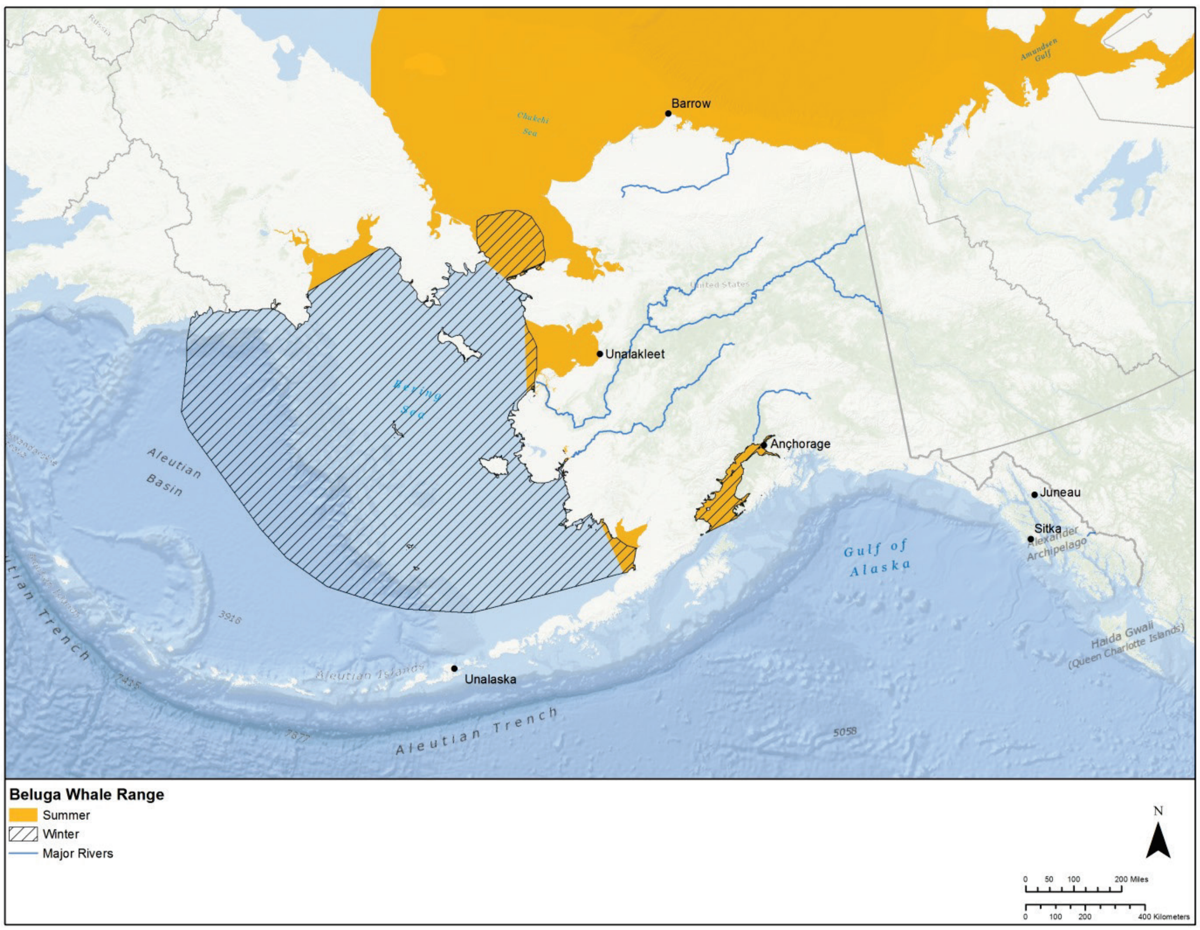
Bearded seals are the largest of all arctic seals and are distributed in the Bering, Chukchi, and Beaufort seas in Alaska (*ADFG 2015g*). Bearded seals occur in association with sea ice, and individuals generally move south as the pack ice advances into the Bering Sea in winter and north as the ice edge recedes into the Chukchi and Beaufort seas in the late spring and summer (*ADFG 2015g*). Leads (narrow, linear cracks), polynyas (semi-permanent areas of open water), and other openings in the sea ice are important features of bearded seal habitat (*ADFG 2015g*). Juvenile bearded seals tend to associate with sea ice less than adults and are often found in ice-free areas such as bays and estuaries. The distribution of bearded seals appears to be strongly associated with shallow water and high biomass of the benthic prey they feed on (*ADFG 2015g*).

[17] A sheet of floating ice where walrus calves are typically born.

They are limited to feeding depths of less than 492 to 656 feet (150 to 200 meters) (*ADFG 2015g*).

Beluga Whales

Within Alaska, there are five different populations of beluga whales: Cook Inlet, Bristol Bay, eastern Bering Sea, eastern Chukchi Sea, and Beaufort Sea (*ADFG 2015h*). The Cook Inlet beluga population is classified as endangered and further described in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern. The eastern Bering Sea, eastern Chukchi Sea, and Beaufort Sea populations winter in the Bering Sea and return to their respective areas during the summer. The Bristol Bay population is believed to remain within the area year round (*ADFG 2015h*). See Figure 3.1.6.4-5 for Beluga whale distributions. Belugas are opportunistic feeders of schooling and anadromous[18] fish with foraging areas over the continental shelf, in nearshore estuaries, and in river mouths (*ADFG 2015h*).



Source: ADFG 2015h

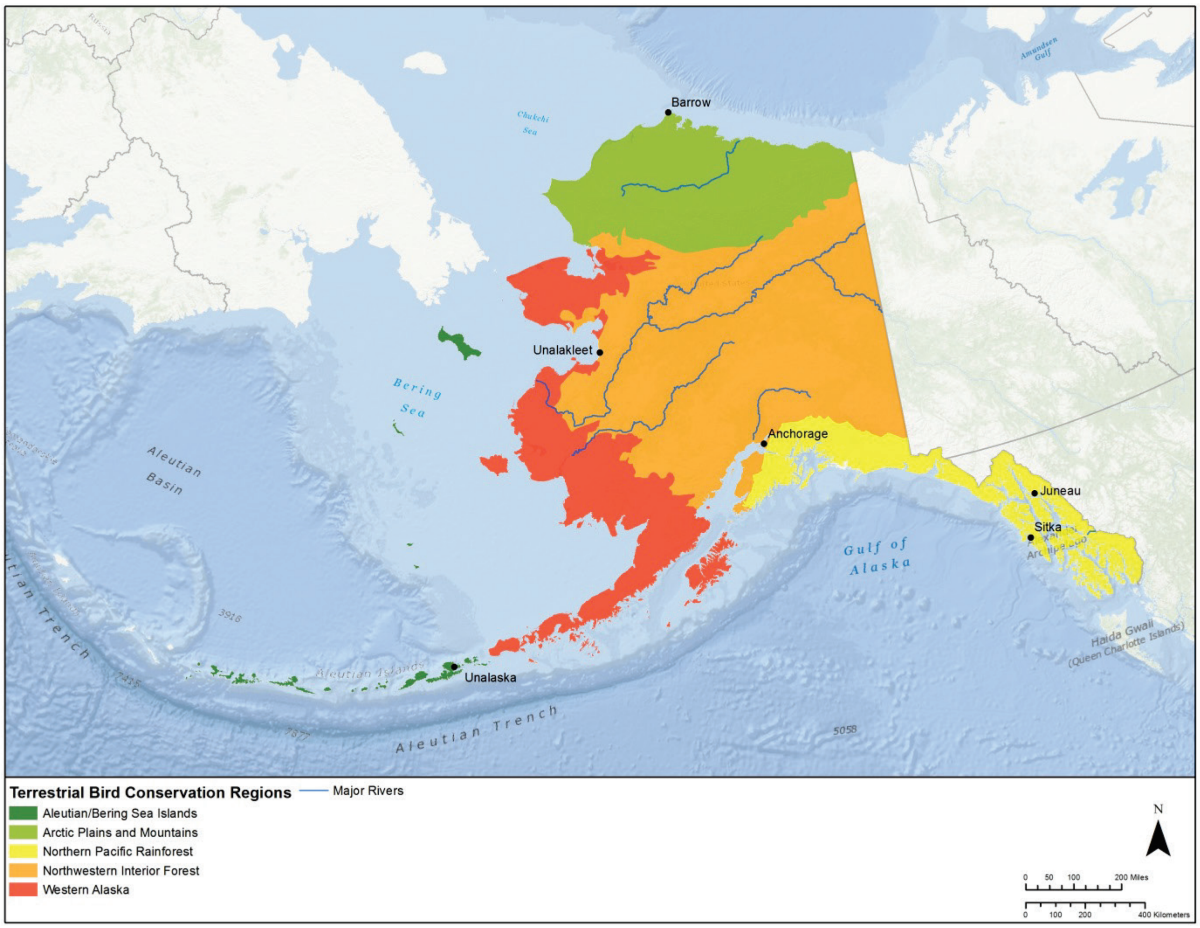
Figure 3.1.6.4-5: Distribution of Beluga Whales in Alaska

[18] Anadromous fish are born in freshwater, migrate to the ocean to grow as adults, and then return to freshwater to spawn.

Habitats and Birds

The University of Alaska Museum, Fairbanks, assembled a list of Alaska's bird species, which includes 505 naturally occurring species (*UAF Museum 2015*).

There are five established Bird Conservation Regions (BCR) in Alaska: the Aleutian and Bering Sea Islands, Arctic Plains and Mountains, Northwest Pacific Rainforest, Northwestern Interior Forest, and Western Alaska Rainforest (see Figure 3.1.6.4-6). The five BCRs in Alaska are described in further detail below.



Source: NABCI 2015

Figure 3.1.6.4-6: Bird Conservation Regions in Alaska

Aleutian and Bering Sea Islands

Included in this region are the Aleutian Islands and the Bering Sea Islands. The Aleutian Islands originated as a volcanic chain extending westward from the Alaskan mainland for 1,100 miles (*NABCI 2000*). The Bering Sea islands include the Pribilofs, St. Matthew, Hall, St. Lawrence, and Little Diomede islands (*NABCI 2000*). Seabird populations utilize the vegetation found at higher elevations, which consists of dwarf shrub communities – mainly willow and crowberry

(*USGS 2014*). Seabirds are the dominant avifauna,[19] including the red-legged kittiwake (*Rissa brevirostris*), least auklet (*Aethia pusilla*), and whiskered auklet (*Aethia pygmaea*), which are specific breeders within this region (*NABCI 2000*). Procellariiforms[20] from the southern hemisphere tend to occur on the offshore waters of the southern Bering Sea and northern Gulf of Alaska during Alaskan summers. However, the breeding diversity of passerines (mainly Lapland longspur [*Calcarius lapponicus*], snow bunting [*Plectrophenax nivalis*], and gray-crowned rosy-finch [*Leucosticte tephrocotis*]) and shorebirds (mainly black oystercatcher [*Haematopus bachmani*], dunlin [*Calidris alpina*], ruddy turnstone [*Arenaria interpres*], rock sandpiper [*Calidris ptilocnemis*]) tend to be low (*NABCI 2000*). Old World species tend to be regular migrants and visitors of the Bering Sea and Gulf of Alaska (*USGS 2014*). One endemic passerine, known as the McKay's bunting (*Plectrophenax hyperboreus*), is listed as a species of conservation and is restricted to this BCR of Alaska (*USDA 2015*).

Arctic Plains and Mountains

The Arctic Plains and Mountains BCR stretches across northern Alaska and encompasses the North Slope of Alaska and the Brooks Range. The North Slope of Alaska is a tree-less coastal plain ascending southward to the foothills of the Brooks Range, composed of thousands of shallow lakes covering up to 50 percent of the surface area (*NABCI 2000*). Due to this wetness, waterfowl and shorebirds dominate the avian community and passerines[21] are scarce. According to the NABCI, the most abundant breeding birds on the coastal plain include northern pintail (*Anas acuta*), king eider (*Somateria spectabilis*), long-tailed duck (*Clangula hyemalis*), American golden-plover (*Pluvialis dominica*), semipalmated sandpiper (*Calidris pusilla*), pectoral sandpiper (*Calidris melanotos*), red-necked phalarope (*Phalaropus lobatus*), and Lapland longspur (*NABCI 2000*). Also noted were taiga passerines, such as gray-cheeked thrush (*Catharus minimus*), yellow warbler (*Setophaga petechia*), and raptors, including gyrfalcon (F*alco rusticolus*) and rough-legged hawk (*Buteo lagopus*), which commonly nest along major rivers (*USGS* 2014). Furthermore, the NABCI have also observed several Old World species, such as the Arctic warbler (*Phylloscopus borealis*) and bluethroat (*Luscinia svecica*), that migrate to the region from the west (*NABCI 2000*). Migratory birds with regular seasonal breeding grounds in the Artic tend to decrease once habitat and food availability becomes limited in the winter; therefore, few bird species overwinter in this region (*USGS 2014*). Northwest Pacific Rainforest

The Northwest Pacific Rainforest is characterized by coastal hemlock-spruce forest and Pacific coastal mountains harboring approximately 350 bird and mammal species (*ACRC Undated*). The narrow coastal temperate rainforest stretches from the western Gulf of Alaska south through British Columbia and the Pacific Northwest to northern California (*NABCI 2000*). The region is dominated by forests of western hemlock and Sitka spruce, where avian inhabitants such as the marbled murrelet (*Brachyramphus marmoratus*), northern goshawk (*Accipiter gentilis*), bald

[19] The birds of a particular region, habitat, or geological period.
[20] Procellariiform is an order of seabirds that includes albatrosses and petrels.
[21] An Order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.

eagle (*Haliaeetus leucocephalus*), Northern Saw-whet owl (*Aegolius acadicus*),chestnut-backed chickadee (*Poecile rufescens*), red-breasted sapsucker (*Sphyrapicus ruber*), and hermit warbler (*Setophaga occidentalis*) are supported (*USGS 2014*). The Copper and Stikine River deltas, as well as many pockets of estuarine and freshwater wetlands, provide critical breeding, wintering, and migration habitat for internationally significant populations of waterfowl and other wetland-dependent species, especially western sandpipers (*Calidris mauri*) and dunlins (*USGS 2014*). Nearshore marine areas and offshore islands support many breeding and wintering seabirds including important populations of murrelets, murres, and kittiwakes, as well as the rhinoceros auklet (*Cerorhinca monocerata*), tufted puffin (*Fratercula cirrhata*), western and glaucous-winged gull (*Larus occidentalis* and *Larus glaucescens*), Leach's storm-petrel (*Oceanodroma leucorhoa*), black oystercatchers (*Haematopus bachmani*), rock sandpipers (*Calidris ptilocnemis*), and black turnstones (*Arenaria melanocephala*) (*NABCI 2000*).

Northwestern Interior Forest

The Northwestern Interior Forest includes Southcentral and Interior Alaska and is composed of a boreal biome dominated by white spruce, black spruce, poplars, and paper birch (*USFWS 2012b*). Numerous river drainages, bogs, and lowland flats support a variety of migrating and breeding ducks, loons, geese, swans, and shorebirds (*NABCI 2000;USFWS 2015a*). The Yukon Flats support the highest breeding density of waterfowl in Alaska (*USFWS 2015a*). Common passerines inhabiting upland communities include the alder flycatcher (*Empidonax alnorum*); yellow-rumped warbler (*Setophaga coronata*); dark-eyed junco (*Junco hyemalis*); boreal chickadee (*Poecile hudsonicus*); Swainson's and gray-cheeked thrushes (*Catharus ustulatus* and *Catharus minimus*); American pipit (*Anthus rubescens*); white-crowned sparrow (*Zonotrichia leucophrys*), American tree sparrow (*Spizella arborea*), and fox sparrow (*Passerella iliaca*); and common redpoll (*Acanthis flammea*) (*NABCI 2000*). Due to the vast extent and geography of the Northwestern Interior Forest BCR, avian species found here can range from breeding shorebirds, such as greater and lesser yellowlegs (*Tringa melanoleuca* and *Tringa flavipes*), solitary and spotted sandpipers (*Tringa solitaria* and *Actitis macularius*), and sanderling (*Calidris alba*), to high elevation breeders such as the horned lark (*Eremophila alpestris*) and Lapland longspur (*NABCI 2000*).

Western Alaska

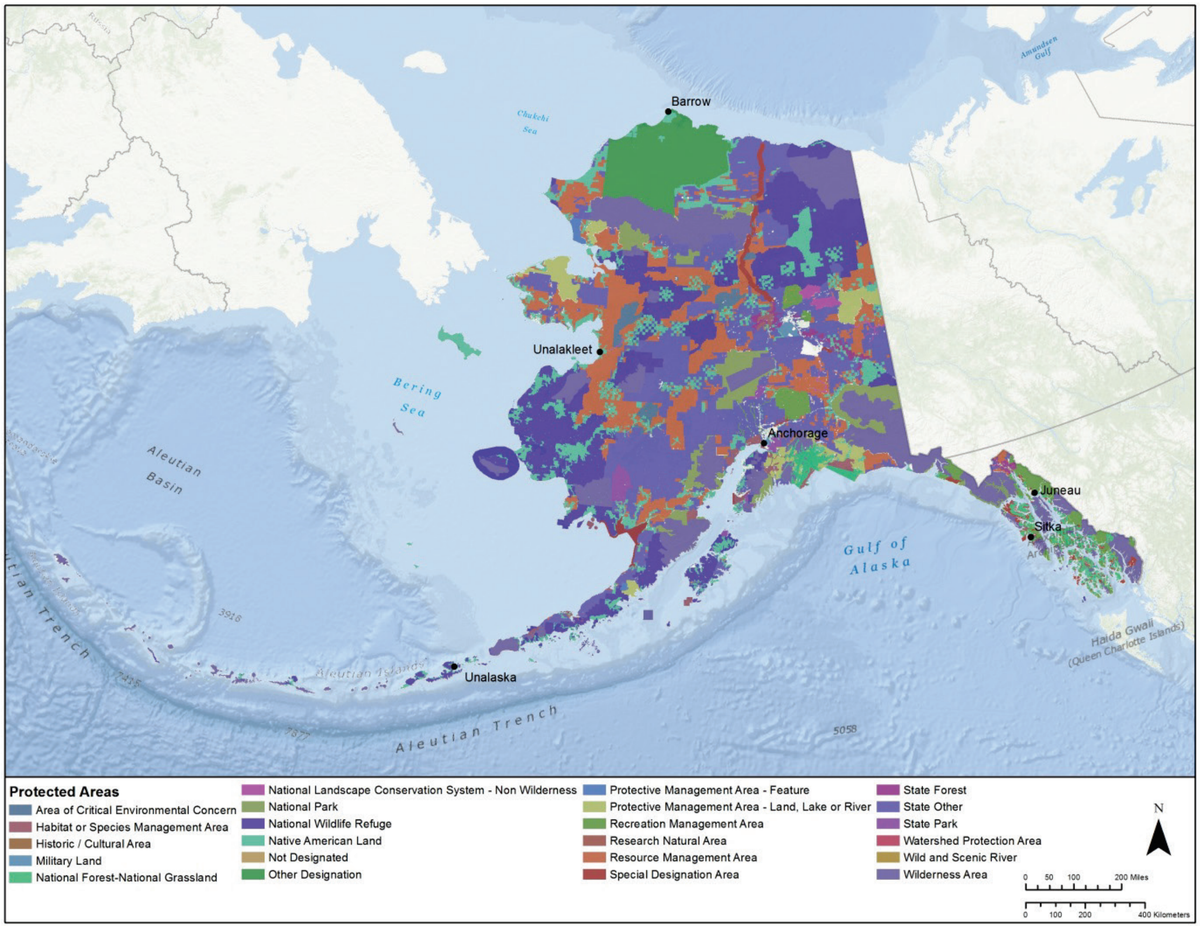
This region consists of the sub-Arctic coastal plain of western Alaska and the Alaska Peninsula Mountains. The coastal plain of Western Alaska is described as a wet community of lowland grasses and sedges with numerous ponds, lakes, and rivers (*NABCI 2000*). High densities of breeding waterfowl and shorebirds (e.g., dunlin, western sandpiper, red knot [*Calidris canutus*], and bar-tailed godwit [*Limosa lapponica*]) are found on the coastal plain of the Yukon and Kuskokwim rivers, along with intertidal areas and lagoons on the northern side of the Alaska Peninsula (*NABCI 2000*). Forests of spruce and hardwoods penetrate the region on the eastern edge, providing variable avian habitat. Wintering sea ducks, including Steller's eider (*Polysticta stelleri*), harlequin (*Histrionicus histrionicus*), long-tailed duck, surf scoter (*Melanitta perspicillata*), and black scoter (*Melanitta nigra*) have also been observed on the coast of the

Alaska Peninsula (*NABCI 2000*). According to the NABCI, songbird diversity is greatest in tall, riparian shrub habitats, where the Arctic warbler, gray-cheeked thrush, and blackpoll warbler (*Setophaga striata*) breed and nest. Raptors such as gyrfalcon and rough-legged hawks nest occupy regions along the riverine cliffs. Conversely, mainland sea cliffs are occupied by nesting colonies of black-legged kittiwake (*Rissa tridactyla*), common murre (*Uria aalge*), and Pelagic cormorant (*Phalacrocorax pelagicus*) (*NABCI 2000*).

Important Habitat Areas

Alaska's 16 federally owned National Wildlife Refuges consist of roughly 77 million acres of protected habitat (*USFWS 2015c*). Over 3.2 million acres of Alaska are state-owned game refuges, critical habitat areas, and wildlife sanctuaries (*ADFG 2015m*). Figure 3.1.6.4-7 shows locations of ADFG managed State Game Refuges, State Game Sanctuaries, and Critical Habitat Areas otherwise known as "Special Areas." Detailed information on Special Areas can be found at the ADFG website.[22] Of note is the Walrus Islands State Game Sanctuary in northern Bristol Bay, which protects one of the largest terrestrial haulout sites in North America for Pacific walrus (*ADFG 2015m*). The sanctuary also protects important habitats for several species of seabirds, Steller sea lions and other marine and terrestrial birds and mammals. In the Arctic, the Teshekpuk Lake Special Area is a key habitat site which includes important nesting, staging, and molting habitat for a large number of waterfowl and shorebirds and critical Teshekpuk Caribou Herd caribou calving, migration, and insect-relief habitat.

[22] http://www.adfg.alaska.gov/index.cfm?adfg=habitatregulations.main

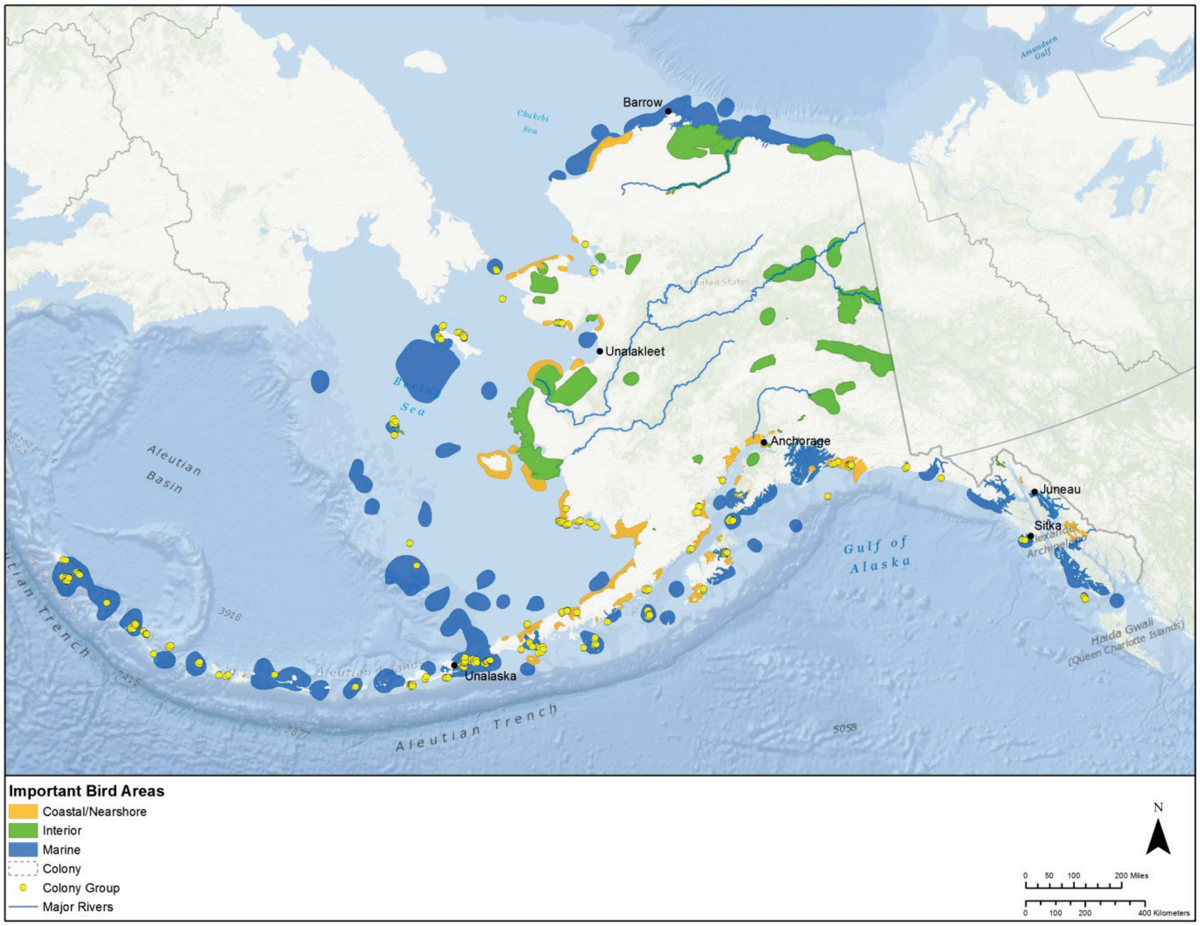


Source: USGS 2012

Figure 3.1.6.4-7: Protected Areas in Alaska

Audubon Alaska has identified 212 Important Bird Areas (IBAs) in the state, more than three-quarters of which are globally-significant (*National Audubon Society 2015c*). Figure 3.1.6.4-8 shows the IBA network within Alaska's marine, costal, and terrestrial areas. Site specific information on IBAs can be found at Audubon Alaska's website.[23] Of particular importance to nesting waterfowl in Alaska are the Yukon-Kuskokwim Delta, Bristol Bay Lowlands, Yukon Flats, and the Tanana/Kuskokwim Valley (*USFWS 2015d*).

[23] http://ak.audubon.org/important-bird-areas-4



Source: National Audubon Society 2015c

Figure 3.1.6.4-8: Important Bird Areas in Alaska

Threats and Stressors

Alaska's CWCS identified the primary threats and stressors to Alaska's wildlife including climate change and "human-effect" themed stressors (e.g., industrial and community development; increased human access, disturbance, motorized traffic; and introduced, non-indigenous, and invasive species) (*ADFG 2005*). The Association of Fish and Wildlife agencies summarized the Alaska CWCS findings of primary threats and challenges to wildlife (*Association of Fish and Wildlife Agencies 2015*):

> "While most of the state remains relatively undeveloped, without additional efforts Alaska may not have protected its most important lands during future development—though residents still have time to employ a science-based approach to protect biodiversity. In addition to human disturbance, threats to Alaska's ecosystems include increasing populations of invasive non-native species that are affecting both the aquatic and terrestrial environment. This is especially evident in the more populated regions where non-native weeds are spreading into native habitats.

> Climate change, however, may pose the greatest challenge. Alaska, as with other northern latitude regions, is experiencing a dramatic increase in temperature that will have a cascading effect in all ecosystems. Biomes are expected to shift north, affecting all biodiversity conservation efforts in the state. For example, along the Arctic Ocean coastline, the reduction in pack ice has increased coastal erosion rates, creating significant impacts on polar bears, their habitat, and the prey that support them.
>
> Climate change is affecting Alaska's weather, landforms, people, wildlife, and habitat, and this trend is expected to continue. As forests dry out, the state is experiencing an increase in forest insect outbreaks and the frequency and severity of wildfires. Drying or flooding of wetland and tundra areas may have profound effects on nesting success of many migratory birds and their predators. The ranges of species from more temperate regions, including nuisance species, will likely expand into higher latitudes and elevations, causing major shifts in types of plants and animals across Alaska. Scientists expect some species that depend on sea ice (e.g., polar bears, walrus and ice seals) to decline and possibly go extinct in the next century.
>
> Habitat fragmentation and loss occurs when land alteration (e.g., logging, wetland fill) and urbanization (expanding communities and transportation systems) break up large landscapes into smaller blocks. Adverse effects on wildlife can include altered migration routes, disrupted dispersal, and reduced reproduction; as an example, amphibian species that overwinter in forested areas must be able to reach their spring breeding grounds in order to survive. Newly opened corridors can act as conduits for invasive species, or make a secretive species more visible to its predators. Also, even in very small remote communities, food, trash, and habitat changes linked to human activities can boost numbers of predators like ravens, with serious effects for at-risk species like bristle-thighed curlew nesting nearby. Some of the greatest pressures on wildlife occur in riparian areas and coastal ecoregions, the primary focus of Alaska's growth in human population, development, and tourism. Habitat alteration can affect forest-dwelling animals like Sitka black-tailed deer, little brown bats, Northern flying squirrels, marbled murrelets, and songbirds like Townsend's warbler."

The primary threats to wildlife and their habitats in Alaska are human disturbance, invasive non-native species, climate change, habitat loss, fragmentation, and land alternation. Minimizing potential impacts on wildlife species and their habitats would help preserve productive wildlife areas within Alaska.

3.1.6.5. Fisheries and Aquatic Habitats

Introduction

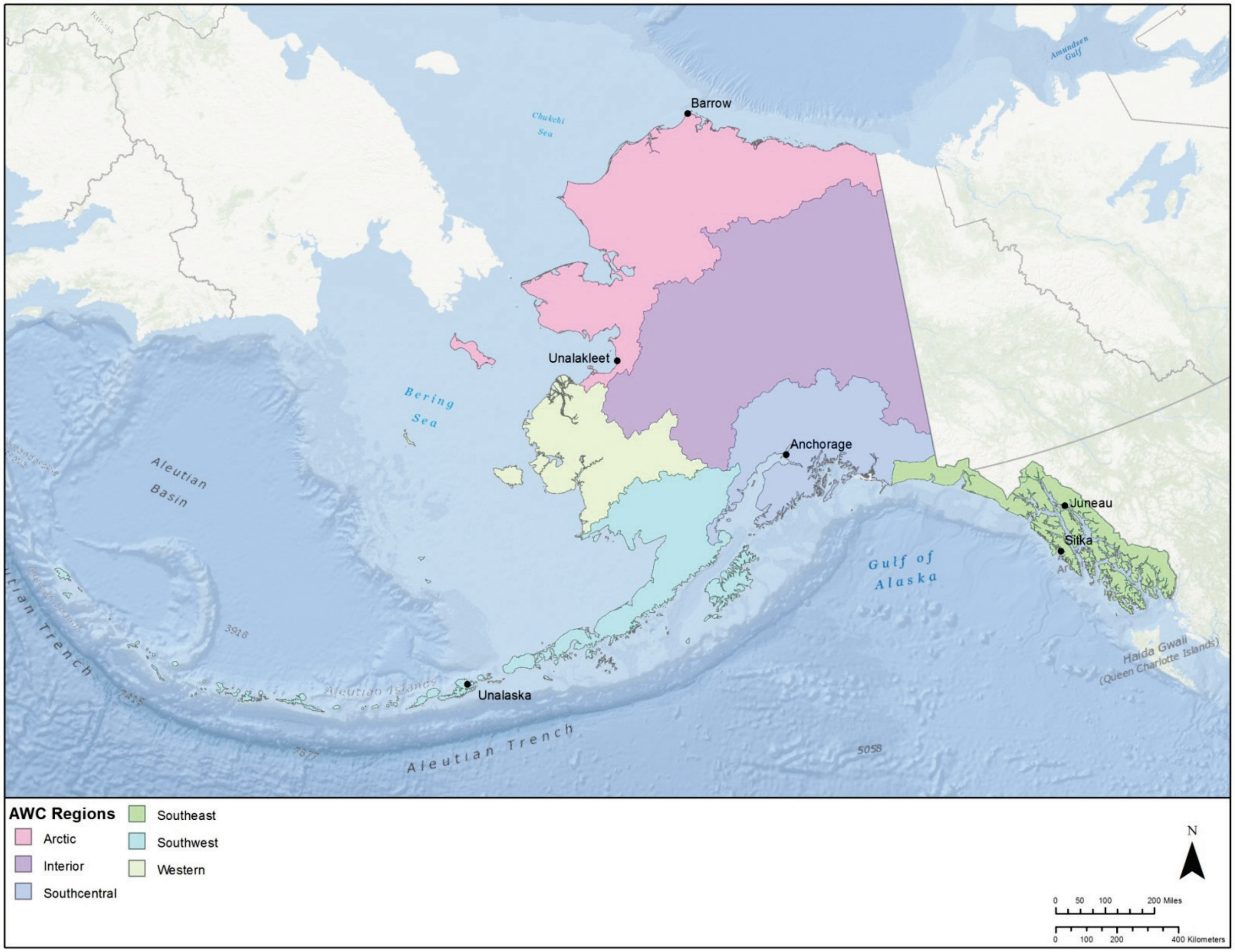
This section discusses fisheries resources in Alaska. Information is presented regarding fisheries features and characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action. Species included in this section include freshwater, anadromous,[1] and marine species of fish and shellfish occurring in Alaska and in Alaska's offshore environment. Anadromous fish species have a complex life history strategy where juvenile fish hatch and rear in freshwater, migrate to the marine environment where growth to reproductive maturity takes place, and return to freshwater for spawning. Fish species and habitat in Alaska are generally discussed in this section. For more information about water, see Section 3.1.4, Water Resources.

Fisheries are defined as the human activities involved in harvesting fish or shellfish, or a group of fish species that share the same habitat (*NOAA 2015a*). The types of fisheries in Alaska include commercial,[2] subsistence,[3] and recreational.[4] Recreational fisheries are then further divided into personal use[5] and sport.[6] For more information on subsistence use and threatened and endangered species of fish, see Section 3.1.9, Socioeconomics, and Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, respectively. Alaska is among three fisheries in the world considered sustainable and is managed under the principles of maximum sustainable yield (*ADFG 2009*). Fisheries in the other states and territories discussed in this Programmatic Environmental Impact Statement are widely considered more at-risk and are under much greater pressure than Alaska's (*NOAA 2014c*).

Specific Regulatory Considerations

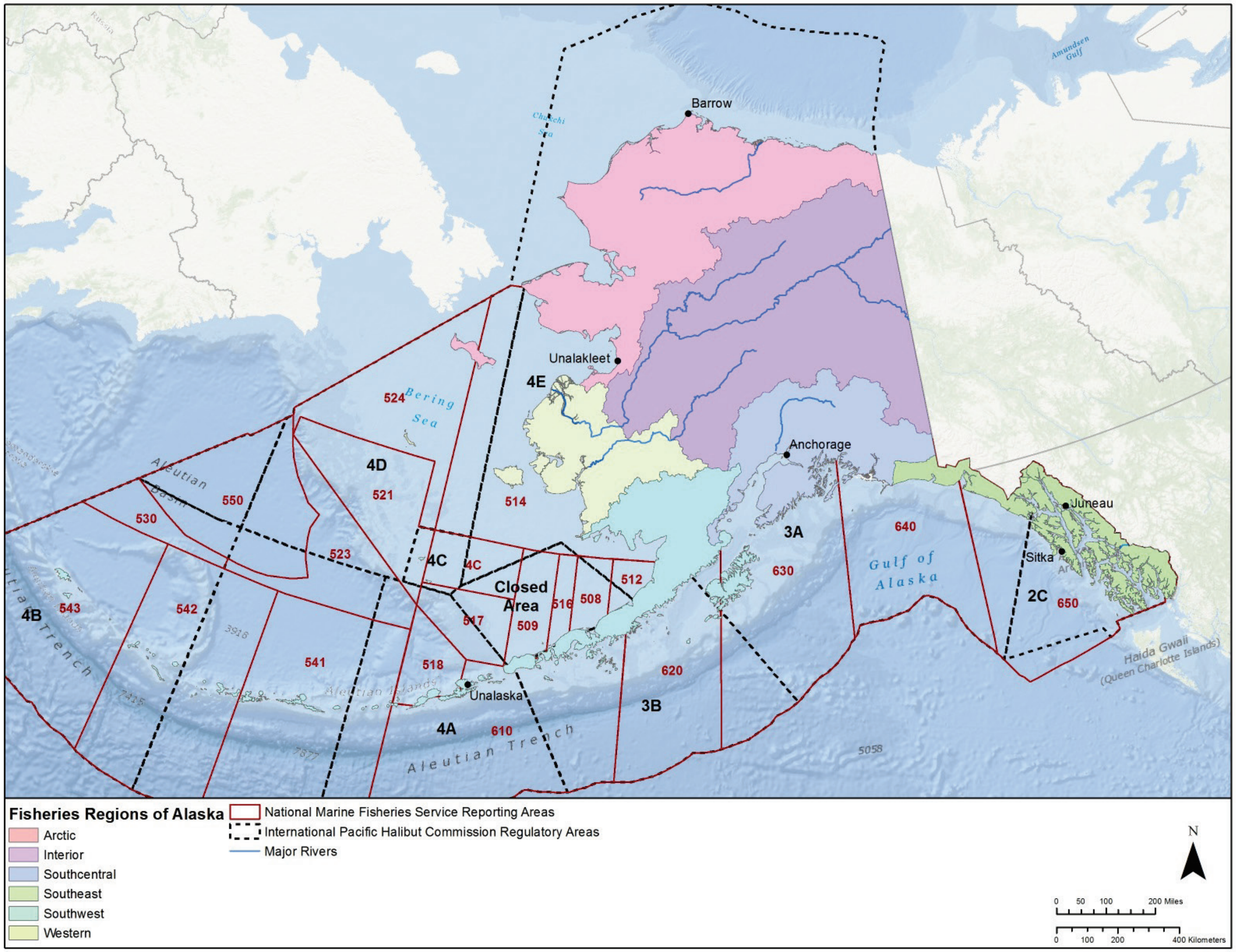
Alaska's watersheds and marine waters are divided into fishery units for the purpose of management, regulation, permitting and licensing. The National Oceanic and Atmospheric Administration (NOAA) is the primary regulatory agency responsible for marine fisheries in U.S. federal waters, and its management area covers 842,000 square nautical miles of Alaska's offshore marine environment. Pacific halibut (*Hippoglossus stenolepis*) fisheries are an exception; they are regulated cooperatively by the International Pacific Halibut Commission, North Pacific Fishery Management Council, NOAA National Marine Fisheries Service, and Alaska Department of Fish and Game (ADFG) (*ADFG 2015f*) (Figures 3.1.6.5-1 and 3.1.6.5-2). ADFG manages freshwater fisheries in the state of Alaska as well as recreational fishing in the marine environment (e.g., shrimp in Prince William Sound).

[1] Anadromous fish are born in freshwater, migrate to the ocean to grow as adults, and then return to freshwater to spawn.
[2] The whole process of catching and marketing fish and shellfish for sale (*NOAA 2015a*)
[3] The catch is shared and consumed directly by the families and kin of the fishermen, rather than being sold (*NOAA 2015a*).
[4] The catch is for personal use, pleasure, or competition (*NOAA 2015a*).
[5] The catch is used by the fishermen and their kin for their own consumptive use.
[6] The catch is for pleasure or competition, generally catch-and-release.



Source: ADFG 2015k

Figure 3.1.6.5-1: Spatial Distribution of Alaska Fisheries Regions



Source: NOAA Undated

Figure 3.1.6.5-2: Fisheries Regions of Alaska

The Anadromous Fish Act requires that a permit be obtained before altering or affecting a specified waterbody or stream that has been designated as anadromous fish habitat. These anadromous waterbodies are mapped by the state of Alaska and are updated annually by ADFG in the *Catalog of Waters Important for the Spawning Rearing or Migration of Anadromous Fishes*, also known as the *Anadromous Waters Catalog*. The Fish Passage Act requires that a permit be obtained for activities within or across a stream used by fish if the activity could impede the passage of fish in the stream. Commercial, subsistence, and recreational fishing in Alaska requires licenses and/or permits, which are distributed by either NOAA or ADFG depending on jurisdictional location. Guidance on compliance with Alaska government fisheries regulations can be found at the *ADFG*[7] (*2015i)* and *NOAA*[8] (*2015d)* websites.

Environmental Setting

Freshwater Environments

The interior is characterized by broad river valleys and interspersed with a complex of uplands and mountain ranges. The interior valleys contain many rivers that originate from different water sources including glaciers, springs, bogs, and mountain lakes. The Yukon River, the fifth largest drainage in North America, lies within this region (*ADFG 2015n*). Many lakes and streams in the interior mountains and uplands freeze severely in winter, often to the bottom. Consequently, habitat becomes extremely limited in winter, and fishes may become concentrated in small areas of rivers and at the bottom of lake basins. However, spring-fed systems provide ice free habitat for late-spawning salmon, grayling, and whitefish. Commercial and subsistence fisheries, as well as personal-use anglers, harvest salmon (particularly Chinook [*Oncorhynchus tshawytscha*], coho [*Oncorhynchus kisutch*], and chum [*Oncorhynchus keta*]) that are bound for major rivers of the interior, such as the Yukon River. Chum salmon are especially important to the Yukon River subsistence fishery (*ADFG 2015m*).

The Arctic region encompasses the North Slope of the Brooks Mountain Range and the Seward Peninsula freshwater environments. The North Slope of the Brooks Range subarea includes all waters north of the Brooks Range flowing into the Beaufort and Chukchi seas (*Scanlon 2015*). The Colville, Sagavanirktok, Canning, and Kuparuk rivers are the major drainages providing rearing, spawning, and wintering habitat for anadromous Dolly Varden (*Salvelinus malma*) and whitefish species (*Coregonus ssp.*) (*ADFG 2015h, Scanlon 2015*). Thousands of shallow, rectangular lakes cover up to 50 percent of the coastal plain along with the state's third largest lake, Teshekpuk Lake (*Scanlon 2015*). Although most lakes are too shallow to support fish populations, there are dozens of lakes and streams that contain lake trout (*Salvelinus namaycush*), Arctic char (*Salvelinus alpinus*), Arctic grayling (*Thymallus arcticus*), and burbot (*Lota lota*) (*ADFG 2015h*). Because fish grow and reproduce more slowly at high latitudes and elevations, this region can support only minimal harvests (*ADFG 2015h*). Sport anglers in this region commonly fish for Chinook (king) salmon, chum (dog) salmon, Arctic char,

[7] http://www.adfg.alaska.gov/index.cfm?adfg=regulations.main.
[8] http://alaskafisheries.noaa.gov/regs/summary.htm

Dolly Varden, lake trout, Arctic grayling, sheefish (inconnu) (*Stenodus leucichthys*), Northern pike (*Esox Lucius*), and burbot (*ADFG 2015h*). Major drainages in the Seward Peninsula subarea include the Chukchi Sea drainage to the north (Kotzebue Sound) and the Bering Sea drainage to the south (Norton Sound). In Kotzebue Sound, the Noatak and Kivalina rivers are the major drainages supporting Chum and Dolly Varden fisheries, respectively (*Scanlon 2015*). The Kobuk River contains the largest spawning population of sheefish in northwestern Alaska (*Scanlon 2015*). In Norton Sound, several large marshy areas including the Koyuk River Basin, Kuzitrin River lowlands, and the Imuruk Basin act as important habitat for juvenile salmonids. The Unalakleet River is the largest in the area supporting populations of anadromous Dolly Varden and salmonids as well as resident populations of Dolly Varden, Arctic grayling, and whitefish (*Scanlon 2015*). King crab is harvested near Nome in both commercial and subsistence fisheries (*ADFG 2015l*).

The western region is characterized by a massive delta area where the Kuskokwim and Yukon rivers flow into the Bering Sea. Subsistence fisheries for salmon, whitefish, and other freshwater resident species are important to community members of remote villages in western Alaska that can only be reached by boat or airplane. Salmon returns have been depressed for over 10 years, and fisheries have been severely restricted or closed (*Chythlook 2014*).

The southwest region includes both mainland areas of Alaska as well as the Aleutian Island chain. The mainland area includes Bristol Bay and its numerous freshwater nursery lakes and shallow estuaries, supporting the largest commercial sockeye salmon (*Oncorhynchus nerka*) producing region in the world (*ADFG 2015b*).

The southeast includes over 1,000 islands just offshore westward from the mainland. At the northern end of the region, the Situk River supports the largest run of steelhead (*Oncorhynchus mykiss*) as well as runs of all five species of Pacific Salmon, trout, and Dolly Varden (*ADFG 2015h*).

Seventy-five species of fish have been reported in Alaskan freshwaters, including anadromous and resident species (*ADFG 2015e*).

The adaptations of fish species to different systems or to different parts of the same system have sometimes caused complex migrations to overwintering, spawning, and feeding sites that overlap the various fishery regions (*Armstrong 1986*).

Marine Environments

Nearshore marine waters, including estuaries, provide a mosaic of habitat types that support an abundant and diverse array of fishes. Nearshore fish habitats commonly found in Alaska include soft bottom eelgrass meadows with eelgrass, cobble beaches with understory kelps, sand or gravel beaches with no rooted vegetation, mud flats, and steep bedrock outcrops with understory kelps (*Johnson et al. 2012*). The juvenile life stages of many commercially and ecologically important fishes use nearshore marine habitats (*Lellis-Dibble 2008*; *Johnson et al. 2012*). Marine invertebrates (e.g., mollusks) often have complex multi-stage life histories and may begin as planktonic larvae before using seafloor habitat as benthic[9] adults (e.g., chiton [*Chiton spp*.]).

The southeastern region of Alaska is representative of all nearshore habits found in Alaska, resulting in the highest diversity of fish species relative to other nearshore regions. There is also a high diversity of marine invertebrates off the shore of southeast Alaska including pinto abalone (*Haliotis kamtschatkana*) and geoduck clam (*Panopea generosa*) (*ADFG 2015o*). In the southwest, the Aleutian Islands consist of bedrock, kelp, and sand-gravel habitat types with the Bristol Bay area greatly influenced by mud flats (*Johnson et al. 2012*). In addition, the Aleutian Islands may harbor the highest diversity and abundance of cold-water corals in the world *(Heifetz et al. 2005)*. Both the Arctic and western regions are characteristic of sand-gravel habitat types (*Johnson et al. 2012*). Sand or gravel beaches are the predominant nearshore habitat type in the Arctic. However, in the nearshore Beaufort Sea, habitat complexity and species diversity are highest in rare, isolated offshore boulder patch community types where shallow boulders create habitat for large kelp, soft corals, sea anemones, algae, sponges and fish (*Martin and Gallaway 1994*).

A synthesis of marine surveys conducted from 1998 to 2011 reported 121 species from 29 families (*Johnson et al. 2012*).

Fisheries Characteristics

Commercial

The main categories of commercial fisheries in Alaska are salmon, groundfish, shellfish, herring, and dive fisheries (*ADFG 2015b*). Methods and vessels for commercial fishing in Alaska are variable. Some examples of fishing methods include gillnetting, trawling, purse seining, long lining, trolling, and crabbing (*ADFG 2009*).

Salmon produces the most revenue out of all the fisheries managed by ADFG. Commercial fisheries for salmon extend from northwest to southwest Alaska, as well into the interior of Alaska on the Yukon and Kuskokwim rivers. Salmon are harvested using a variety of fishing gear, and more Alaskans are employed in harvesting and processing salmon than in any other commercial fishery (*ADFG 2015b*).

Two primary groundfish management areas are regulated by NOAA: the Bering Sea/Aleutian Island (BSAI) and the Gulf of Alaska (GOA). Target fish species for BSAI and GOA are very similar and both include many species (e.g., walleye pollock [*Theragra chalcogramma*], Pacific cod [*Gadus microcephalus*], sablefish [*Anoplopoma fimbria*], sole [family Pleuronectidae], flounder [family Pleuronectidae], rockfish [*Sebastes ssp*.], Atka mackerel (*Pleurogrammus monopterygius*), skates [family Rajidae], sculpins (Cottus ssp.), sharks (*Lamna ditropis*), squid, and octopus) (*NOAA 2014a* and *NOAA 2014b*). Pollock is currently the principal fishery in the Eastern Bering Sea, while in the Aleutian Islands the primary target species has changed several times from Pacific ocean perch (*Sebastes alutus*), to Pacific cod, to Atka mackerel based on

[9] Anything associated with or occurring on the bottom of a body of water

prevailing ecological and environmental conditions, fishery technological characteristics (e.g., gear selection), and distribution of catch among fishing fleets (*NOAA 2014a* and *NOAA 2014b*). Pacific cod and walleye pollock are the principally harvested fish in the GOA groundfish fishery (*NOAA 2014b*).

Alaska's commercial fisheries produce large volumes of shellfish, including several types of crab and various shrimp. Commercial dive fisheries also harvest scallops, clams, sea urchins, sea cucumbers, octopus, and squid, and these species are defined as miscellaneous shellfish in state regulations. All commercial shellfish fisheries in state and federal waters of Alaska are managed by the ADFG. Shellfish is the second most valuable fishery in the state, occurring primarily in the Bering Sea and southeast Alaska (*ADFG 2015b*).

Pacific herring (*Clupea pallasii*) and their eggs (sac roe) are harvested in nearshore areas from the Bering Sea to southeast Alaska (*ADFG 2015b*) in state-managed fishing areas (e.g., Kodiak, Norton Sound, southeast).

Non-game Fish Species

Alaska has dozens of non-game fish species that play important freshwater ecosystem roles (e.g., longnose sucker [*Catostomus catostomus*], sculpin, ninespine and threespine stickleback [*Pungitius pungitius and Gasterosteus aculeatus*]) such as prey for other fish species, foragers and scavengers. Directed fisheries for marine forage fish (e.g., gunnel [family Pholidae], capelin [*Mallotus villosus*]) in Alaska are prohibited *(Nelson 2003)*. Forage fishes are a critical link between primary and secondary producers and marine ecosystems. Other non-game fish species such as river lamprey (*Lampetra ayresii*), Arctic lamprey (*Lampetra camtschatica*) and Pacific lamprey (*Lampetra tridentata*) are the target of subsistence fisheries where they are used for bait as well as human and dog food (*ADFG 2015h*). Alaska’s marine non-game species are vulnerable to commercial fishery bycatch.[10]

Subsistence

Subsistence uses of wild resources are defined as “noncommercial, customary and traditional uses” for a variety of purposes including “direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation, for the making and selling of handicraft articles out of nonedible by-products of fish and wildlife resources taken for personal or family consumption, and for the customary trade, barter, or sharing for personal or family consumption” (*Alaska Statute 16.05.940[32]*) (*ADFG 2015d*). The majority of Alaska is considered rural and classified as subsistence use areas with the exception of areas surrounding Anchorage, Fairbanks, Juneau, Ketchikan, and Valdez, which are considered nonsubsistence use areas where dependence upon subsistence (customary and traditional uses of fish) is not a principal characteristic of the economy, culture, and way of life (*ADFG 2015d*).

[10] Unintentional capture/injury/entanglement of unwanted species during commercial fishing (e.g., a shark captured in a seine net targeting salmon)

Subsistence fisheries of freshwater and anadromous species are divided into 13 areas regulated by the Alaska Board of Fisheries. Under Alaska's subsistence statute, the Alaska Board of Fisheries must identify fish stocks that support subsistence fisheries and, if there is a harvestable surplus of these stocks, adopt regulations that provide reasonable opportunities for these subsistence uses to take place. Whenever it is necessary to restrict harvests, subsistence fisheries have a preference over other uses of the stock (*Alaska Statute 16.05.258*) (*ADFG 2015d*).

Subsistence halibut fishing in Alaska is managed by NOAA and defined as halibut caught by rural resident or a member of an Alaska Native tribe for direct personal or family consumption as food, sharing for personal or family consumption as food, or customary trade (*NOAA 2015b*). The majority of subsistence halibut are harvested with setline (stationary) gear (i.e., longlines or skate), with hand-operated gear being the alternative method.

Of subsistence fisheries, salmon constitutes the majority of harvested species, followed by finfish and shellfish (*ADFG 2014*). Varieties of fish harvested for subsistence purposes include salmon, Pacific halibut, Pacific Herring, and whitefishes (*Fall 2014*).

Recreational

Alaska has been divided into three major regions for the purpose of managing recreational fisheries by ADFG (Division of Sport Fish): interior, southcentral, and southeast. Recreational fishing takes place in/on rivers or streams, lakes, the marine environment from vessels, or from/on beaches.

Sport fishing: In interior Alaska, the most often sport-fished species include sockeye salmon, sea-run coho salmon, Arctic grayling, rainbow trout, and Dolly Varden (*ADFG 2015a*). In the southcentral region, the most commonly caught species include sockeye salmon, sea-run coho salmon, rainbow trout, Pacific halibut, and Dolly Varden (*ADFG 2015a*). In the southeastern region, sea-run coho salmon, pink salmon, Pacific halibut, rockfish, and sea-run Chinook salmon are the most commonly caught sport fish species (*ADFG 2015a*). Chinook salmon and rainbow trout in the Kenai River are considered to be some of the most sought-after sport fish in Alaska.

Personal use fishing: The main personal use fisheries in interior Alaska include the Chitina Copper River salmon fishery, Tanana River salmon fishery, Chatanika Whitefish Spear fishery, and various other smaller fisheries (e.g., interior and northern salmon, shellfish, herring, suckers, and whitefish) (*ADFG 2015c*). Southcentral Alaska's personal use fisheries include Lower Kenai River salmon, Kasilof River salmon, Fish Creek salmon, China Poot Bay salmon, Kachemak Bay salmon gillnet, herring and hooligan, Prince William Sound shrimp, Cook Inlet and North Gulf Coast tanner crab (*Chionoecetes bairdi and C. opilio*), and Cook Inlet clams (*ADFG 2015c*). Southeast Alaska also has major fisheries for salmon, king crab (family Lithodidae), tanner crab, Dungeness crab (*Metacarcinus magister*), shrimp, herring, and scallops/clams/abalone (*ADFG 2015c*).

Areas of Importance

Essential fish habitat (EFH) is enforced by NOAA through the Magnuson-Stevens Fishery Conservation and Management Act. EFH are those waters and substrates necessary to fish for spawning, breeding, feeding, or growing to maturity (*NOAA 2015c*). EFH have been identified for many species throughout Alaska that are important contributors to Alaska's fisheries: Arctic cod, saffron cod (*Eleginus gracilis*), snow crab (*Chionoecetes opilio*), BSAI king and tanner crabs, BSAI and GOA groundfish species, scallop, and five salmon species (*NOAA 2015c*). EFH is pervasive throughout Alaska and includes all waters used by Pacific salmon as cataloged in the states' Anadromous Waters Catalog and Atlas. EFH delineations can be found at the *ADFG* (*2015j*) and *NOAA* (*2015e*) websites.

Johnson et al. (*2012*) describes specific areas of importance for Alaska's fisheries:

> "Due to factors such as high species abundance, diversity, and susceptibility to disturbance, two regions and one location deserve special consideration. First, the Arctic is an ecologically fragile area experiencing rapid changes in climate (warming) and loss of sea ice (*Moline et al. 2008*)… Second, the Aleutian Islands are noteworthy because of the extremely high abundance and frequency of Pacific sand lance in sand habitats. Nowhere else in Alaska did we witness such high and consistent catches of such an ecologically important species… Third, The Brothers Islands in [Southeast Alaska] is unique because of the abundance and diversity of commercially important and forage fish species. The most abundant species (walleye pollock, Pacific herring, Pacific sand lance, Pacific cod, chum salmon, and Pacific sandfish; *Thedinga et al. 2006*) are commercially important or forage fish species." (*Thedinga et al. 2006*)

Threats and Stressors

Although fisheries in Alaska are broadly considered pristine and sustainable, salmon fisheries are struggling. This has resulted in strict commercial and recreational fisheries management and closures. There is some debate whether the low returns are the result of overfishing, low marine survival, or limitations of freshwater spawning and rearing habitat.

Examples of major threats to fisheries include climate change, ocean acidification, habitat disturbance, overfishing, invasive species, and non-target species bycatch.

Fisheries in the Arctic are particularly susceptible to environmental variations due to climate change. Loss of sea ice and rising sea levels from climate change threatens marine life and habitat (e.g., beach erosion) and has the potential to open up formerly inaccessible areas to oil and gas development, vessel traffic, and commercial fishing (*Johnson et al. 2012*). Disturbance of the nearshore Arctic environment could have consequences for many species, particularly capelin that use the area for spawning and rearing (*George et al. 2009*).

Alaska is particularly susceptible to ocean acidification due to its relatively shallow marine environments, cold water, large amounts of primary level food production, and glacial melt (*AOOS 2015*). As the ocean becomes more acidic, the water becomes harmful to organisms with shells, such as plankton, oysters, clams and corals, and threatens their survival and reproduction (*AOOS 2015*). Commercial fishermen and subsistence users could be greatly impacted as the aquatic ecosystem changes (*AOOS 2015*).

Because many commercially important and forage fish species (e.g., Pacific herring and Pacific sand lance [*Ammodytes hexapterus*]) depend on the nearshore environment for shelter, food, and spawning habitat, disturbance of the nearshore from shoreline development, oil spills, or natural catastrophes (e.g., earthquake) are of great concern (*Johnson et al. 2012*).

Overfishing is when fish are harvested at a rate faster than they can reproduce, a potentially devastating problem for fisheries worldwide (*Monterey Bay Aquarium 2015*). The issue begins with fishermen targeting the largest fish in the population, for the greatest economic value. Then when the largest fish are depleted, they target the next size down, and so on. Additionally, the larger fish are generally the ones that reproduce; when the larger fish are gone, the population cannot sustain itself.

The invasive northern pike, which are native to Interior Alaska, are a threat to sought-after lake fish species in southcentral Alaska. Northern pike compete with trout and salmon species for food, prey on eggs and juveniles, and alter the balance of the aquatic ecosystem (*ADFG 2015e*).

Alaska's marine non-game species are vulnerable to commercial fishery bycatch (i.e., the unintentional capture/injury/entanglement of unwanted species during commercial fishing). NOAA (*2011*) describes the effects and importance of managing non-target species bycatch:

> "Bycatch costs fishermen time and money, harms endangered and threatened species, affects marine and coastal ecosystems, and makes it more difficult for scientists to measure the effect of fishing on the stock's population, and for managers to set sustainable levels for fishing. Preventing and reducing bycatch is an important part of ensuring sustainable living marine resources and coastal communities. The 2006 reauthorization of the Magnuson Stevens Act, the nation's principal law for living marine resources, made bycatch reduction a priority, leading NOAA to establish a bycatch reduction program to develop technological devices and other conservation engineering solutions."

3.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

Introduction

The threatened and endangered species analysis in this Draft Programmatic Environmental Impact Statement considers plant and animal species that are federally listed as threatened (likely to become endangered), endangered (at risk for extinction), candidate[1], proposed[2], or species of concern (species in need of conservation); and species listed by the United States (U.S.) Forest Service (Forest Service) and Bureau of Land Management (BLM) as sensitive; species that are state-listed as endangered. This analysis considers species that are known to occur in Alaska for all or part of their life cycle[3].

Specific Regulatory Considerations

Federal Regulations

Endangered Species Act

The Endangered Species Act (ESA) is administered by the U.S Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). With some exceptions, Section 9 of the ESA prohibits unauthorized take[4] of any fish or wildlife species listed as endangered or threatened under the ESA. Subject to specified terms and conditions, Section 10 of the ESA allows for the incidental take of listed species by non-federal entities otherwise prohibited by Section 9. Pursuant to Section 10, an Incidental Take Permit[5] is issued through adoption of an USFWS-approved Habitat Conservation Plan[6], which demonstrates that take has been avoided, minimized, and mitigated (reduced severity) to the maximum extent practicable.

Section 7(a)(2) of the ESA states that each federal agency shall ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of designated critical habitat. A federal action "means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies in the United States or upon the high seas" (*50 Code of Federal Regulations [CFR] 402.2*).

[1] Candidate species are plants and animals for which the USFWS has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.
[2] Proposed species are those that have been proposed in a *Federal Register* after the completion of a status review and consideration of other protective conservation measures.
[3] Life cycle is defined as the continuous sequence of development of an organism.
[4] Take is defined differently by various federal and state regulations, but the most commonly accepted definition is that of the U.S. Endangered Species Act. This act defines take as "to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct." The act further defines "harm" as "significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering," and "harass" as "actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering."
[5] An incidental take permit is issued under Section 10 of the Endangered Species Act to private parties undertaking otherwise lawful projects that might result in the take of an endangered or threatened species (*USFWS 2015a*).
[6] A plan that outlines mitigation measures to enhance, maintain, and protect habitats of a particular species. The plan is developed to help reduce impacts.

Actions of federal agencies that do not jeopardize the continued existence of listed species or result in destruction or adverse modification of their designated critical habitat, but that could result in a take, must be addressed by consulting with applicable resource agencies under Section 7. The Proposed Action is subject to the ESA because it is a proposed federal undertaking.

Forest Service and BLM Sensitive Species Requirements

The Forest Service Alaska Region (Region 10) contains two national forests that occur in southeast Alaska: the Chugach and Tongass national forests. Together, these forests encompass 24 million acres. The BLM manages over 72 million surface acres of federal public land throughout Alaska. The Forest Service and BLM each maintain lists of sensitive species that occur on their respective lands. Both agencies define sensitive species as non-listed wildlife, fish, and plants that require special management to maintain and improve their status on Forest Service and BLM lands to prevent a need for federal listing under the ESA. In addition, the BLM sensitive species list includes all federal candidate species, proposed species, and delisted species in the 5 years following delisting. The Forest Service – required under the National Forest Management Act (*36 CFR 219.19*) – and BLM – required under BLM Manual Direction 6840 – must manage sensitive species populations and consider the potential effects of proposed activities within Forest Service and BLM lands on these species to ensure that activities do not contribute to trends leading to the listing of these species under the ESA.

State Regulations

Article 3 Sections 16.20.180 through 16.20.210 of the Alaska Statutes (AS) establish the state's legal framework related to endangered species. Under *AS 16.20.190*, the Alaska Department of Fish and Game (ADFG) is responsible for determining and maintaining a list of endangered species in Alaska. Under this statute, a species or subspecies of fish or wildlife listed as endangered may not be harvested, captured, or propagated except under the terms of a special permit issued by the commissioner of ADFG for scientific or educational purposes, or for propagation in captivity for the purpose of preservation. Further, *AS 16.20.185* requires the commissioners of fish and game and natural resources to implement measures to preserve the natural habitat of fish and wildlife species that are listed as endangered. Currently, there are five state species listed as endangered, all of which are also federally listed under the ESA (*ADFG 2015a*).

ADFG no longer maintains a Species of Special Concern list but instead uses the Alaska Wildlife Action Plan (*ADFG 2005*) to assess the needs of species with conservation concerns and to prioritize conservation and other actions to maintain or restore populations of these species. This plan is currently being updated.

The Policy for the Management of Sustainable Salmon Fisheries (*Alaska Administrative Code 5 39.222, effective 2000, amended 2001*) directs the ADFG to provide the Alaska Board of Fisheries with reports on the status of salmon stocks and identify any salmon stock that present a concern. The ADFG assigns three levels of concern for certain fish stocks: 1) Yield Concern; 2) Management Concern; and 3) Conservation Concern, with yield being the lowest level of concern and conservation the highest level of concern. A designation of concern under this policy does not yield protected status for the species or trigger any regulatory requirements. Rather, it is used by ADFG as an indicator of population status and conservation need.

Species Overview

Federally and State-listed and Candidate Species

There are 39 federally listed species and 2 candidate species for federal listing in Alaska. Of the 39 federally listed species, 1 is a plant, 4 are birds, 15 are mammals (of which all but one are marine or live on the sea ice), 4 are marine reptiles (sea turtles), and 15 are fish. There are no Federal Species of Concern. The two federally listed candidate species are yellow-billed loon (*Gavia adamsii*) and Pacific walrus (*Odobenus rosmarus divergens*). Of the 39 federally listed species, 5 are also state-listed as endangered. Table 3.1.6.6-1 lists the federally and state-listed species and summarizes their habitat preferences, geographic distribution, population status, and occurrence in Alaska.

Forest Service and BLM Sensitive Species

There are 25 species on the Forest Service Region 10 Sensitive Species List, which was last updated in 2009 (*USFS 2009*). There are 59 species on the BLM Alaska Sensitive Species List, which was last updated in 2010 (*BLM 2010*). Appendix D, *Threatened and Endangered Species*, lists the Forest Service and BLM sensitive plant, fish, and wildlife species and summarizes their habitat preferences, geographic distribution, population status, and occurrence in Alaska.

Table 3.1.6.6-1: Federal- and State-listed Threatened and Endangered and Candidate Species Known to Occur in Alaska

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Plants (1)						
Aleutian shield fern *(Polystichum aleuticum)*	FE	Terrestrial	East-facing slopes characterized by steep cliffs and rock outcrops with overhangs and vegetated gullies and ledges	Occurs only on Adak Island in the central Aleutian Islands	Stable	Y
Birds (5)						
Short-tailed albatross (*Phoebastria albatrus)*	FE, SE	Marine and island habitats during non-breeding season	Non-breeding adults live on the open ocean and sometimes loaf or roost on islands.	Northern Pacific Ocean, with highest densities along shelf waters of the Pacific Rim and along the coasts of Japan. Winters After breeding moves to eastern Russia, the Aleutian Islands, and coastal Alaska for winter.	Increasing	W, M (primarily Aleutian Islands)
Eskimo curlew (*Numenius borealis)*	FE, SE	Terrestrial	Arctic tundra, grassland, burned prairie, meadow, and pasture. Nesting period is from May through July.	Winter: South America Summer: North America (Alaska and northern Canada)	Unknown, possibly extinct	B
Spectacled eider (*Somateria fischeri)* (CH)	FT	Terrestrial	Wet tundra. Nesting period is from May through August.	Arctic coasts of Alaska, Yukon-Kuskokwim Delta in Alaska, and Russia	Stable	Y

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Steller's eider *(Polysticta stelleri)* (CH)	FT	Terrestrial	Arctic coastal plain, forage in shallow water. Nesting period is from May to July.	Breed along the arctic coastal plain of northern Alaska (Yukon-Kuskokwim Delta and Arctic Coastal Plain near Barrow) and Russia. In the winter, most of the world's Steller's eiders are found in the Alaska Peninsula, the Aleutian Islands, Kodiak Island, and Kachemak Bay in Cook Inlet.	Declining	Y
Yellow-billed loon *(Gavia adamsii)*	FC	Terrestrial and freshwater	Tundra, freshwater lakes Nesting period is from May to August.	Freshwater lakes in the arctic tundra on the Arctic Coastal Plain	Declining	Y
Mammals (16)						
Blue whale (*Balaenoptera musculus)*	FE, SE	Marine	In the Northern Pacific Ocean, the species feeds on small, planktonic, shrimp-like krill (*Euphausia pacifica* and *Thysanoessa spinifera*) near the ocean's surface	Distributed widely in the North Pacific Ocean, from Kamchatka to southern Japan in the west, and from the Gulf of Alaska and California south to at least Costa Rica in the east. Found primarily south of the Aleutian Islands and the Bering Sea but occasionally north to the Chukchi Sea.	Unknown	M

Common and Scientific Name	**Listing Status[a]**	**Type of Habitat (Terrestrial, Marine, or Freshwater)**	**General Habitat Description**	**Geographic Range**	**Population Status (Stable, Declining, Increasing, Unknown)**	**Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)**
Humpback whale (*Megaptera novaeangliae)*	FE, SE	Marine	Breeds in tropical waters and migrates to temperate and subpolar waters for feeding	Summer range includes area from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk. Winter range includes western Baja California and Mexico, Hawaii, and islands south of Japan.	Increasing	M
Northern Pacific right whale *(Eubalaena japonica)* (CH)	FE, SE	Marine	Inhabits coastal or shelf waters year-round	Baja California to Bering Sea; most common in Bering Sea, Gulf of Alaska, Okhotsk Sea, Kuril Islands, and Kamchatka area	Unknown	M
Bowhead whale *(Balaena mysticetus)*	FE	Marine	Inhabits areas with ice pack in the Bering Sea	Bering, Chukchi, and Beaufort Seas	Increasing	Y
Cook Inlet Beluga whale (*Delphinapterus leucas)* (CH)	FE	Marine	Inhabits open ocean, continental shelf, coastal, estuary, and river waters where individuals are opportunistic feeders	Arctic and subarctic waters in the United States, Canada, Greenland, and Russia; Alaska: Cook Inlet, Bristol Bay, eastern Bering Sea, eastern Chukchi Sea, and Beaufort Sea.	Stable	M

Common and Scientific Name	**Listing Status[a]**	**Type of Habitat (Terrestrial, Marine, or Freshwater)**	**General Habitat Description**	**Geographic Range**	**Population Status (Stable, Declining, Increasing, Unknown)**	**Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)**
Fin whale (*Balaenoptera physalus)*	FE	Marine	Generally concentrated along frontal boundaries or mixing zones between coastal and oceanic waters near the 600-foot depth. Feeds on fish.	Worldwide (offshore and outside of temperate waters); near coastal waters in the northern Gulf of Alaska and southeastern Bering Sea from May to October, with some movement through the Aleutian passes into and out of the Bering Sea	Unknown	Y
Sei whale (*Balaenoptera borealis)*	FE	Marine	Distribution in open ocean highly variable and related to ocean currents. Strongly associated with ocean fronts and eddies; rare in semi-enclosed seas or gulfs. Feeds on copepods (small crustaceans) and euphausiids (shrimp-like crustaceans).	Offshore occurring in the North Atlantic, North Pacific and Southern Hemisphere, an occasional visitor to the Mediterranean Sea; Distributed throughout the temperate North Pacific north of 40°N latitude, but mainly south of the Aleutian archipelago	Unknown	M
Sperm whale (*Physeter microcephalus)*	FE	Marine	Occurs offshore in submarine canyons at the edge of the continental shelf or in waters deeper than 600 feet.	Worldwide; Alaska: 57°N in the Bering Sea south to Aleutian/Pribilof Islands	Unknown	M
Western Pacific Gray Whale (*Eschrichtius robustus)*	FE	Marine	Occurs mainly in shallow coastal waters in the North Pacific Ocean	Two isolated populations in the North Pacific Ocean: the eastern North Pacific stock (west coast of North America) and the Western North Pacific stock (coast of eastern Asia). Feeds in the northern Pacific Ocean, migrate to Baja California to breed.	Eastern North Pacific stock: 18,000 to 30,000 individuals Western North Pacific: <100 individuals	M

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Stellar sea lion (Western Distinct Population Segment) *(Eumetopias jubatus)* (CH)	FE	Terrestrial and marine	Breeds and loafs on rocky shores and feeds on fish and invertebrates in open marine waters.	Central California north along the west coast of North America, westward through the Gulf of Alaska, Aleutian Islands to the Kamchatka Peninsula, and from there south along the Kuril Islands to the Sea of Japan	Increasing	Y
Sea otter *(Enhydra lutris kenyoni)* (CH)	FT	Terrestrial and marine	Nearshore marine environments at depths of ≤90 feet rocky substrates with kelp beds and soft-sediment areas	Southern California, British Columbia (Vancouver) Canada, Gulf of Alaska, Aleutian Islands, Sea of Okot (Japan)	Decreasing	Y
Bearded seal (*Erignathus barbatus)*	FT	Marine	Arctic waters less than 600 feet in depth and commonly found on drifting sea ice	Northern hemisphere with a circumpolar distribution that doesn't extend further north than 80°N	Unknown	Y
Pacific walrus *(Odobenus rosmarus divergens)*	FC	Marine	Shallow arctic waters where they feed almost solely on benthic invertebrates; also commonly found on sea ice	Southern Bering Sea to the northern Chukchi Sea; Alaskan and Russian coasts	Unknown	Y
Polar bear *(Ursus maritimus)*	FT	Marine	Shallow nearshore waters or where currents or upwellings increase biological productivity near ice areas associated with open water	Ice-covered waters of the Arctic Ocean	Decreasing	M
Ringed seal *(Phoca [sym. Pusa] hispida)* (CH)	FT	Marine	Ice pack and adjacent open marine waters; opportunistic foragers that eat a variety of marine invertebrates, fish, and amphipods	Ice-covered waters of the Arctic Ocean	Unknown	Y

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Wood bison *(Bison bison athabascae)*	FT	Terrestrial	Meadows around lakes and rivers and in recent burns where there is young grass for forage	Northwestern Canada (free-ranging) and one captive herd in interior and southcentral Alaska	Unknown	Y
Reptile (4)						
Green sea turtle *(Chelonia mydas)*	FT	Marine	Coastal neritic areas rich in sea grass/marine algae	Circumglobal distribution, although rare visitors to coastal southeast Alaska (only 15 sightings in Alaska since 1960, and most of these occurrences were dead turtles)	Decreasing	M
Loggerhead sea turtle *(Caretta caretta)*	FT	Marine	Coastal neritic areas rich in sea grass/marine algae	Circumglobal distribution throughout temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans; rare in Alaska Gulf Coast waters (observed twice between 1960 and 2007)	Decreasing	M
Olive ridley sea turtle *(Lepidochelys olivácea)*	FT	Marine	Coastal neritic areas rich in sea grass/marine algae	Circumglobal distribution throughout temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans; rare in Alaska Gulf Coast waters (observed three times between 1960 and 2007)	Decreasing	M
Leatherback sea turtle *(Dermochelys coriácea)*	FE	Marine	Coastal neritic areas rich in sea grass/marine algae	Found from tropical to sub-polar oceans; uncommon to casual visitors to Alaska's Gulf Coast waters, with19 sightings between 1960 and 2007	Decreasing	M

Common and Scientific Name	**Listing Status[a]**	**Type of Habitat (Terrestrial, Marine, or Freshwater)**	**General Habitat Description**	**Geographic Range**	**Population Status (Stable, Declining, Increasing, Unknown)**	**Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)**
Fish (15)						
Upper Columbia River Spring Chinook Salmon *(Oncorhynchus tshawytscha)*	FE	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to tributaries of the Columbia River between the Rock Island Dam and Chief Joseph Dam (excluding the Okanogan River subbasin) in Washington.	Unknown	M
Snake River Sockeye Salmon *(Oncorhynchus nerka)*	FE	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Snake River Basin, Idaho.	Unknown	M
Upper Columbia River Steelhead (*Oncorhynchus mykiss)*	FE	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Columbia River basin upstream from the Yakima River, Washington, to the U.S.-Canada border.	Unknown	M

Common and Scientific Name	**Listing Status[a]**	**Type of Habitat (Terrestrial, Marine, or Freshwater)**	**General Habitat Description**	**Geographic Range**	**Population Status (Stable, Declining, Increasing, Unknown)**	**Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)**
Snake River Fall Chinook Salmon (*Oncorhynchus tshawytscha)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Snake River upriver to the Hagerman Valley and in lower portions of the Salmon and Clearwater Rivers in Idaho.	Unknown	M
Snake River Spring/Summer Chinook Salmon (*Oncorhynchus tshawytscha)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Snake River watershed in northwestern Idaho and southwestern Montana.	Unknown	M
Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the tributaries of Puget Sound in western Washington.	Increasing in Lower/North Fork/Middle Ford Nooksack, Cedar and White Rivers; decreasing in South Fork/Mainstem Stillaguamish River; unknown elsewhere	M

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Lower Columbia River Chinook Salmon (*Oncorhynchus tshawytscha)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Hood River and the White Salmon River watersheds, including the Sandy River and the Willamette River to Willamette Falls, Oregon.	Increasing in Sandy River; unknown elsewhere	M
Upper Willamette River Chinook Salmon (*Oncorhynchus tshawytscha)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Upper Willamette River watershed in northwest Oregon.	Unknown	M
Lower Columbia River Coho Salmon (*Oncorhynchus kisutch)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the lower Columbia River, up to and including the Big White Salmon and Hood Rivers in Washington.	Unknown	M

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Hood Canal Summer Run Chum Salmon (*Oncorhynchus keta)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Hood Canal and Strait of Juan de Fuca in Washington.	Increasing	M
Snake River Basin Steelhead (*Oncorhynchus mykiss)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the Grande Ronde River, Clearwater River, Hells Canyon, Imnaha, Lower Snake, and Salmon River in Washington, Oregon, and Idaho	Unknown	M
Lower Columbia River Steelhead (*Oncorhynchus mykiss)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the lower Columbia River Basin in southwest Washington and northwest Oregon.	Unknown	M

Common and Scientific Name	Listing Status[a]	Type of Habitat (Terrestrial, Marine, or Freshwater)	General Habitat Description	Geographic Range	Population Status (Stable, Declining, Increasing, Unknown)	Occurrence in Alaska (B=Breeding, Y=Year Round Resident, W=Wintering, M=Migratory)
Upper Willamette River Steelhead (*Oncorhynchus mykiss)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the upper Willamette River Basin in northwest Oregon.	Unknown	M
Middle Columbia River Steelhead (*Oncorhynchus mykiss)*	FT	Marine and freshwater	Nearshore marine waters throughout the northeastern Pacific Ocean, including Alaskan coastal waters	Non-breeding adults occur throughout the northern Pacific Ocean, reaching Alaskan waters as occasional migrants. Spawning and nursery habitat is confined to the middle Columbia River Basin in south-central Washington and north-central Oregon.	Increasing Deschutes River-westside, Umatilla, Naches, Satus, Toppenish, and Yakima Rivers upper mainstem; unknown elsewhere	M
Green sturgeon *(Acipenser medirostris)*	FT	Marine and freshwater	Nearshore marine (adulthood) and Freshwater (breeding)	Anadromous species from Mexico to Alaska	Stable	Y

Sources: USFWS 2015c; ADFW 2015a; ADFW 2015d; NMFS 2015; IUCN Red List 2015; and official species accounts or recovery plans published by USFWS and NMFS.

°N = degrees north; ≤ = greater than
[a] Listing Status: FE = Federally Endangered; FT = Federally Threatened; FC = Candidate for Federal Listing; SE = State Endangered. CH = Species has federally designated critical habitat in Alaska.

Fish Stocks of Concern

There are currently no stocks of Conservation Concern designated in Alaska, but the ADFG has assigned the following stocks to the Management Concern and Yield Concern categories (*ADFG 2015b*):

- Chuitna River Chinook;
- Theodore River Chinook;
- Lewis River Chinook;
- Alexander Creek Chinook;
- Goose Creek Chinook;
- Sheep Creek Chinook;
- Karluk River Chinook; and
- Swanson Lagoon Sockeye.

In addition, the following species are in the Yield Concern category:

- Susitna (Yentna) River Sockeye;
- Willow Creek Chinook;
- Yukon River Chinook;
- Norton Sound Sub-district 5 and 6 Chinook;
- Norton Sound Sub-district 2 and 3 Chum; and
- Norton Sound Sub-district 1 Chum.

Critical Habitat

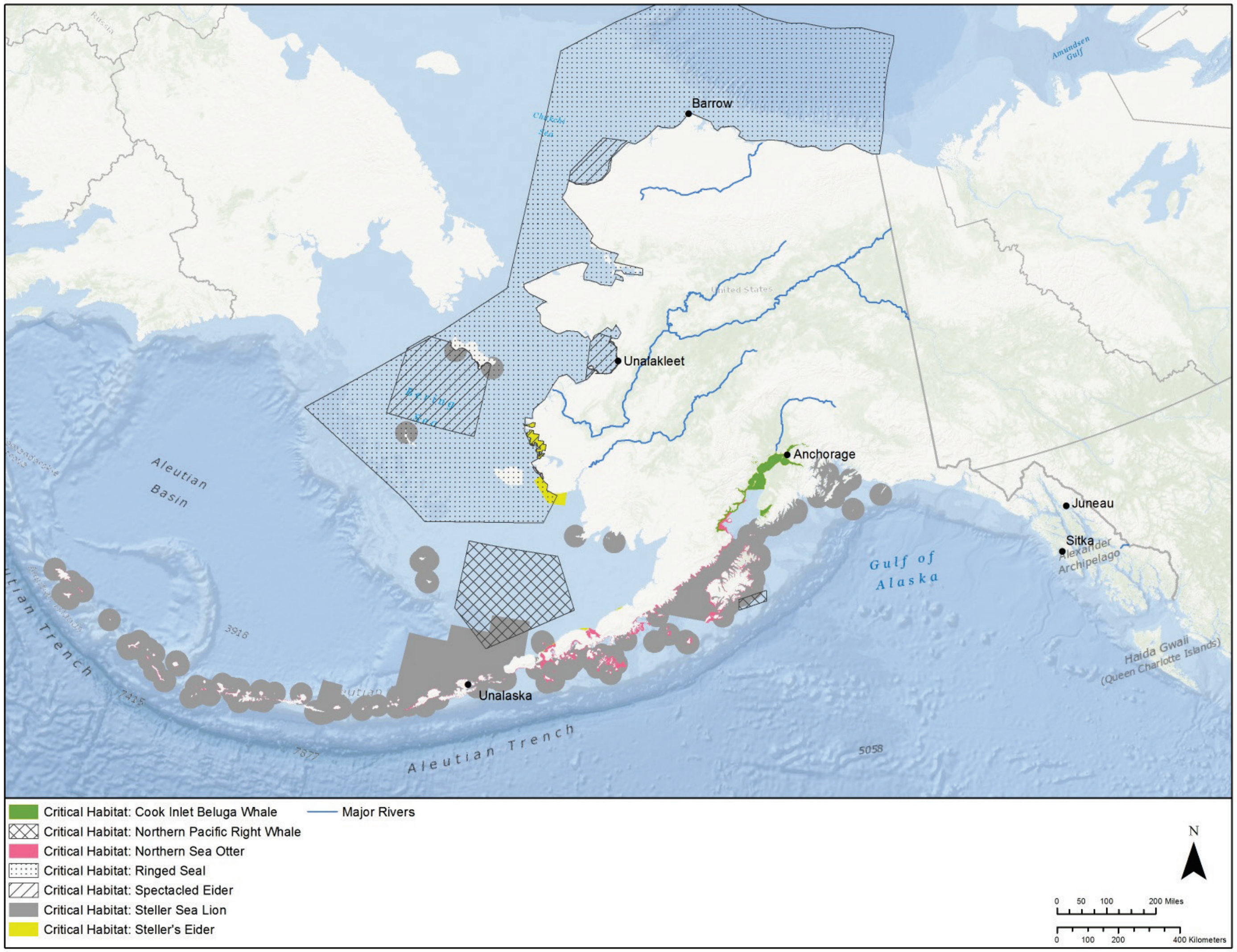
Several birds and marine mammals have critical habitat in Alaska that has been designated by the USFWS or NMFS (see Figure 3.1.6.6-1). These species (or subpopulations) and a brief description of the location of their critical habitat in Alaska are listed below by taxa (*USFWS 2015b*).

<u>Birds</u>

- Spectacled eider (*Somateria fischeri*) – Arctic coast of Alaska; and
- Steller's eider (*Polysticta stelleri*) (Alaska breeding population only) - arctic coastal plain of northern Alaska.

Marine Mammals

- Northern sea otter (*Enhydra lutris kenyoni*) (Southwest Alaska Distinct Population Segment only);
- Steller sea lion (*Eumetopias jubatus*) (Western Distinct Population Segment only) - Aleutian Islands and nearshore marine areas adjacent to the Aleutians, as well as scattered islands and promontories and adjacent marine areas in the Bering Sea;
- Cook Inlet beluga whale (*Delphinapterus leucas*) - Cook Inlet from Katchemak Bay to the Douglas River in the south to Knik Arm in the north;
- Northern pacific right whale (*Eubalaena japonica*) - Southern Bering Sea and a small portion of Gulf of Alaska; and
- Ringed seal (*Phoca (sym. Pusa) hispida*) - U.S.-controlled portions of the Bering, Chukchi, and Beaufort Seas.



Source: NMFS 2005; USFWS 1993; USFWS 2000a; USFWS 2000b; USFWS 2001; USFWS 2009; USFWS 2014

Figure 3.1.6.6-1: Designated Critical Habitats in Alaska

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3.1.7. Land Use, Airspace, and Recreation

3.1.7.1. Introduction

This section provides a broad overview of land use, airspace, and recreational facilities and activities in Alaska. This includes regulations, conditions, and activities that could potentially be affected by deployment and operation of the Proposed Action. The following summarizes major land uses, recreational venues, and airspace considerations, and characterizes existing, baseline conditions for use in evaluating the potential environmental consequences resulting from implementing the Proposed Action or Alternatives.

Land Use and Recreation

Land use is defined as "the arrangements, activities and inputs people undertake in a certain land cover type to produce, change, or maintain it" (*Di Gregorio and Jansen 1998*). A land use designation can include one or more pieces of land, and multiple land uses may occur on the same piece of land. Land use also includes the physical cover, observed on the ground or remote sensing and mapping, on the earth's surface; land cover includes vegetation and manmade development (*USGS 2012b*).

Recreational uses are activities in which residents and visitors participate. They include outdoor activities, such as hiking, fishing, boating, athletic events (e.g., golf and boating), and other attractions (e.g., historic monuments and cultural sites) or indoor activities, such as museums and historic sites. Recreational resources can include trails, beaches, caves, lakes, forests, beaches, recreational facilities, museums, historic sites, and other outdoor areas. Recreational resources are typically managed by state, county, or local governments.

Land uses are typically defined and managed by local governments, and the categories of land use can vary considerably from jurisdiction to jurisdiction. As a result, this Draft Programmatic Environmental Impact Statement refers to "land use/land cover," as defined in the National Land Cover Database (*USGS 2001*), a standardized set of 21 categories defined by the U.S. Geological Survey that incorporates both land use and land cover characteristics. Where appropriate, or important to convey local conditions, more general land use categories such as "forest," "agricultural," and "developed" are also used. Descriptions of land ownership are presented in four main categories: private, federal, state, and tribal, although other geographically-specific terms (such as "municipal") are used where appropriate. Descriptions of recreational opportunities are presented in a regional fashion, highlighting areas of recreational significance within 12 identified regions.

Airspace

Airspace is generally defined as the space lying above the earth, above a certain area of land or water, or above a nation and the territories that it controls, including territorial waters (*Merriam Webster Dictionary 2015*). Airspace is a finite resource that can be defined vertically and horizontally, as well as temporally, when discussing it in relation to aircraft activities. Airspace management addresses how and in what airspace aircraft fly. Air flight safety considers aircraft flight risks, such as aircraft mishaps and bird/animal-aircraft strikes. The Federal Aviation Administration (FAA) is charged with the safe and efficient use of the nation's airspace and has established criteria and limits to its use.

The FAA operates a network of airport towers, air route traffic control centers, and flight service stations. The FAA also develops air traffic rules, assigns use of airspace, and controls air traffic in U.S. airspace. "The Air Traffic Organization (ATO) is the operational arm of the FAA responsible for providing safe and efficient air navigation services to approximately 30.2 million square miles of airspace. This represents more than 17 percent of the world's airspace and includes all of the U.S. and large portions of the Atlantic and Pacific Oceans and the Gulf of Mexico" (*FAA 2014*). The ATO is comprised of Service Units (organizations) that support the operational requirements.

The FAA Air Traffic Services Unit (the Unit) manages the National Airspace System and international airspace assigned to U.S. control and is responsible for ensuring efficient use, security, and safety of the nation's airspace. FAA field and regional offices (e.g., Aircraft Certification Offices, Airports Regional Offices, Flight Standards District Offices, Regional Offices & Aeronautical Center, etc.) assist in regulating civil aviation to promote safety, and develop and carry out programs that control aircraft noise and other environmental effects (e.g., air pollutants) attributed from civil aviation (*FAA 2015a*). The FAA works with state aviation officials and airport planners, military airspace managers, and other organizations in deciding how best to use airspace.

3.1.7.2. Specific Regulatory Considerations

Land Use and Ownership

Land Use

Land use in Alaska is guided by several statutes of the Alaska Administrative Code (AAC), including Chapter 29.40, which provides municipal authority for planning, platting, and land use regulation. The AAC requires most larger cities and boroughs to provide for planning, platting, and land use regulation. Smaller cities outside of boroughs may exercise planning powers; however, they are not required to do so.[1]

For communities outside of boroughs that do not exercise planning powers, the Alaska Department of Natural Resources, Division of Mining, Land, and Water, acts as the platting authority. Depending on the form and classification of local government and whether a city is located either within a borough government or in the unorganized borough, the state statutes governing planning have different applications (*3 AAC 190.330* and *Alaska DCRA 2012*).

Local governments (cities and boroughs), determine specific land use categories, goals, policies, and implementation procedures through comprehensive plans and zoning ordinances. In Alaska,

[1] Alaska has two types of local government: cities and boroughs. Both "are a municipal corporation and political subdivision of the State of Alaska" (*Alaska DCCE 2015*). Boroughs are generally equivalent to counties in other states, although Anchorage—Alaska's largest municipality—is a borough rather than a city.

"communities must have an adopted comprehensive plan before they may adopt land use regulations such as a zoning ordinance" (*Alaska DCRA 2012*). Whereas general plans indicate the overall intent of the borough's land use policy, zoning codifies that intent with specific requirements such as a list of permitted land uses, maximum residential density (e.g., number of dwelling units per acre), and maximum building height. Zoning must be consistent with the comprehensive plan (*Alaska DCRA 2012*). Thus, for example, a city's zoning ordinance may not permit industrial development in an area designated as residential by that city's comprehensive plan.

In general, the zoning codes for Alaska's municipalities regulate the location, height, and other characteristics of telecommunications equipment (especially, but not necessarily exclusively, aboveground facilities such as transmission towers). On federal lands, such regulations may be contained in each facility's relevant establishing legislation or other adopted management policies.

Land Ownership

In 1867, the United States (U.S.) government purchased Alaska from Russia. When Alaska became a state in 1959, the federal government granted the new state government ownership of lands totaling approximately 105 million acres (28 percent of its total area). In 1971, Congress passed the Alaska Native Claims Settlement Act (ANSCA), which identified Alaska Native villages and corporations, and granted 44 million acres and 1 billion dollars to those entities (*Alaska DNR 2000*).

The federal Bureau of Land Management (BLM) oversees the Alaska Land Transfer Program, which involves the survey and conveyance of lands in Alaska under three statutes: the Native Allotment Act of 1906; the Alaska Statehood Act, and the ANCSA (*BLM 2015*). The Alaska National Interest Lands Conservation Act of 1980, which resulted from Section 17(d)2 of ANCSA, specifies that 80 million acres be placed in national parks, forests, wildlife refuges or wild and scenic river systems. These areas are divided into management units, which are subject to comprehensive conservation plans or other management plans (*Alaska DCRA 2012*).

Airspace

The FAA has jurisdiction over air traffic in the U.S., and must be contacted for proposed construction or alteration of objects within navigable airspace that meet the following criteria (*14 Code of Federal Regulations 77, commonly known as Part 77 regulations*):

- Any construction or alteration that is more than 200 feet above ground level at the structure's proposed location (including buildings, wind turbines, communications towers, etc.); or
- Construction or alteration that exceeds certain imaginary surfaces extending outward and upward from an airport, seaplane base, or heliport. Imaginary surfaces are three-dimensional shapes surrounding aviation facilities within which development is limited or prohibited in order to ensure safe aviation and minimize the potential effects of crashes.

FAA review of proposed construction or alteration within the spaces listed above could result in denial of permission for construction/alteration, or approval of construction/alteration with or without additional marking/or lighting (*FAA 2015b*). Section 3.1.8, Visual Resources, discusses FAA lighting regulations. Certain airspace in the U.S. reserved or intended for military use is managed jointly by the FAA and the Department of Defense. Military airspace in Alaska includes Military Operations Areas, Military Training Routes, and various types of restricted or prohibited airspace.

Recreation

Alaska contains a variety of federal, state, and local (city and borough) recreational lands, ranging from national forests, units of the National Park System and national wildlife refuges to municipal parks and other public lands where recreation is a permitted (or even encouraged) use. Each of these facilities is administered according to the applicable federal, state, or local law, along with management documents prepared for that facility. For example, for each of its units, the National Park Service prepares a General Management Plan (essentially equivalent to a municipal comprehensive plan) to provide broad discussion of management policies and major initiatives, as well as a Superintendent's Compendium document that enumerates specific restrictions, closures, permit requirements, and other regulations (*NPS 2015*).

3.1.7.3. Land Use and Ownership

Land Use/Land Cover

Land use/land cover refers to the use of land, as visible from the air (or satellites). Figure 3.1.7-1 and Table 3.1.7-1 show the distribution of land use/land cover in Alaska. As shown in Table 3.1.7-1, the Forest (deciduous, evergreen, and mixed), Dwarf Scrub, and Scrub/Shrub designations account for more than half of land cover statewide. As shown in Figure 3.1.7-1, forests tend to be found in the mountainous areas of central Alaska, while Scrub and Scrub/Shrub generally cover Alaska's northern and coastal areas. Developed land covers less than 1 percent of the state, while wetlands cover approximately 6 percent of the state.

Table 3.1.7-1: Land Use/Land Cover in Alaska

Land Use/Land Cover	Acres	Percent of Total[a]
Perennial Ice/Snow	17,878,512	4%
Developed, Open Space[b]	77,183	<1%
Developed, Low Intensity	231,818	<1%
Developed, Medium Intensity	30,590	<1%
Developed, High Intensity	11,424	<1%
Barren Land[c]	32,143,187	8%
Deciduous Forest	14,484,670	3%
Evergreen Forest	65,118,310	16%
Mixed Forest	14,577,139	3%
Dwarf Scrub	72,038,453	17%
Scrub/Shrub	89,138,190	21%
Grassland/Herbaceous[d,e]	3,402,505	1%
Sedge Herbaceous[e,f]	24,014,568	6%
Moss	129,610	<1%

Land Use/Land Cover	Acres	Percent of Total[a]
Pasture/Hay	11,595	<1%
Cultivated Crops	71,191	<1%
Wetlands	27,113,118	6%
Open Water[g]	59,575,567	14%
Total	**420,047,630**	**100%**

Source: USGS 2001

[a] Totals may not match due to rounding.
[b] "Areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses" (*MRLC 2014*).
[c] "Areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material" (*MRLC 2014*).
[d] These areas may be used for grazing, but are not subject to active management, such as tilling (*MRLC 2014*).
[e] Herbaceous plants do not have woody stems.
[f] "Alaska only areas dominated by sedges and forbs" (*MRLC 2014*).
[g] The U.S. Geological Survey 2001 dataset includes substantial offshore areas (i.e., much of Prince William Sound near Anchorage, waters surrounding the Aleutian Islands, and waters in southeast Alaska) as well as inland areas such as the Yukon River. Because offshore areas could not easily be segregated, the total acreages of "land" cover here may be higher than the land area of Alaska, as reported in other portions of this Draft Programmatic Environmental Impact Statement.

Land Ownership

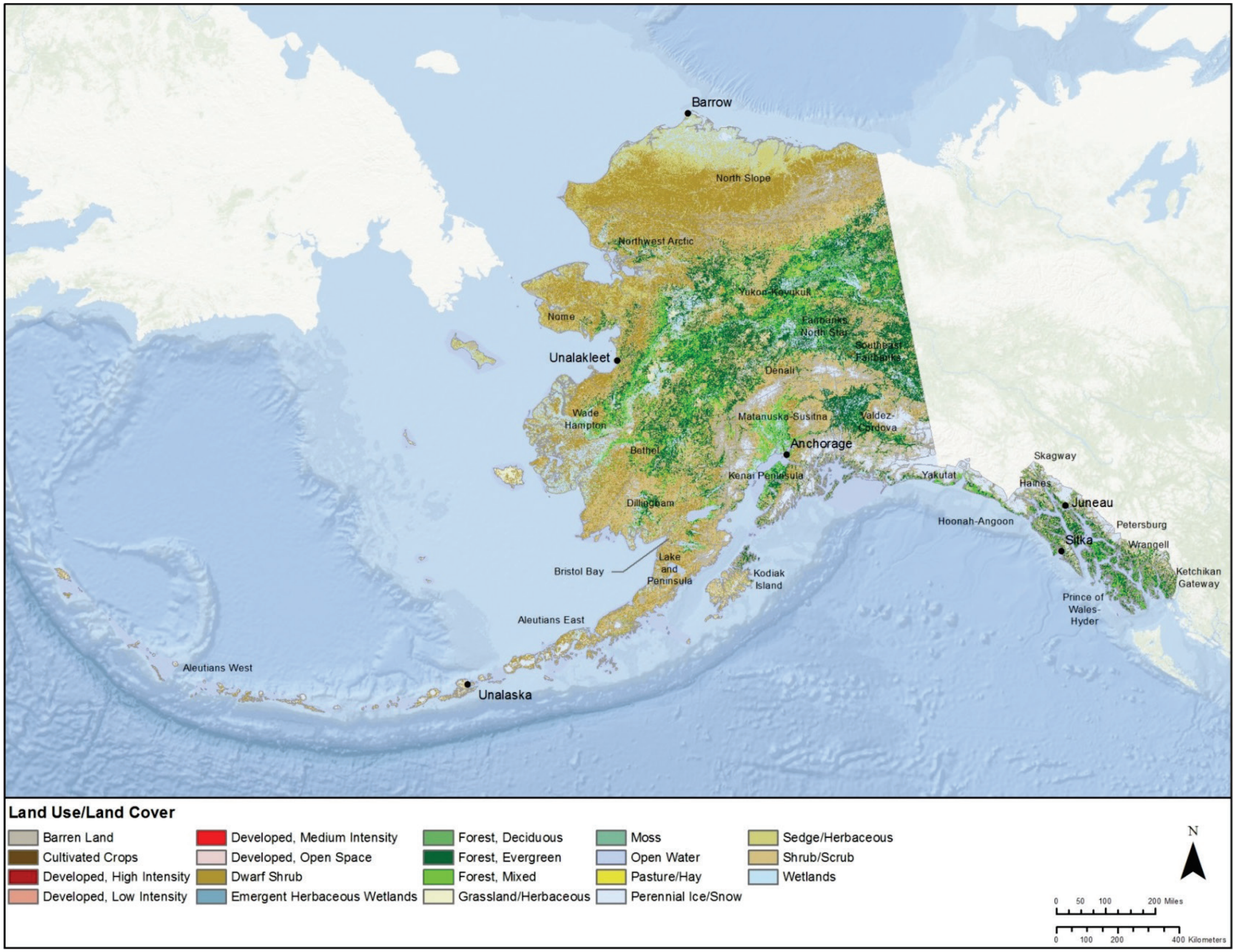
Table 3.1.7-2 lists major land owners in Alaska. The federal government owns and manages approximately 66 percent of land in the state, much of which is land managed in part or whole for forestry or recreation (see Section 3.1.7.5, Recreation). State government owns approximately 25 percent of land statewide, while Native Alaskan tribes and tribal corporations own approximately 8 percent of land in the state. Privately ownership accounts for approximately 1 percent of land in the state.

Table 3.1.7-2: Major Land Owners in Alaska

	Acres	Percent of Total[a]
Federal	242,330,000	66%
State Government	91,981,800	25%
Native Alaskan Tribe or Tribal Corporation	30,825,300	8%
Jointly Held by State and Native Alaskan Tribe or Tribal Corporation	339,618	<1%
Municipal (City or Borough)	1,175	<1%
Private/Other	2,331,138	1%
Total	**367,809,031**	100%

Source: USGS 2012a

[a] Please see footnote f in Table 3.1.7-1 for a discussion of the discrepancies between the acreage totals in these two tables. Totals may not match due to rounding.



Source: USGS 2001

Figure 3.1.7-1: Land Use/Land Cover in Alaska

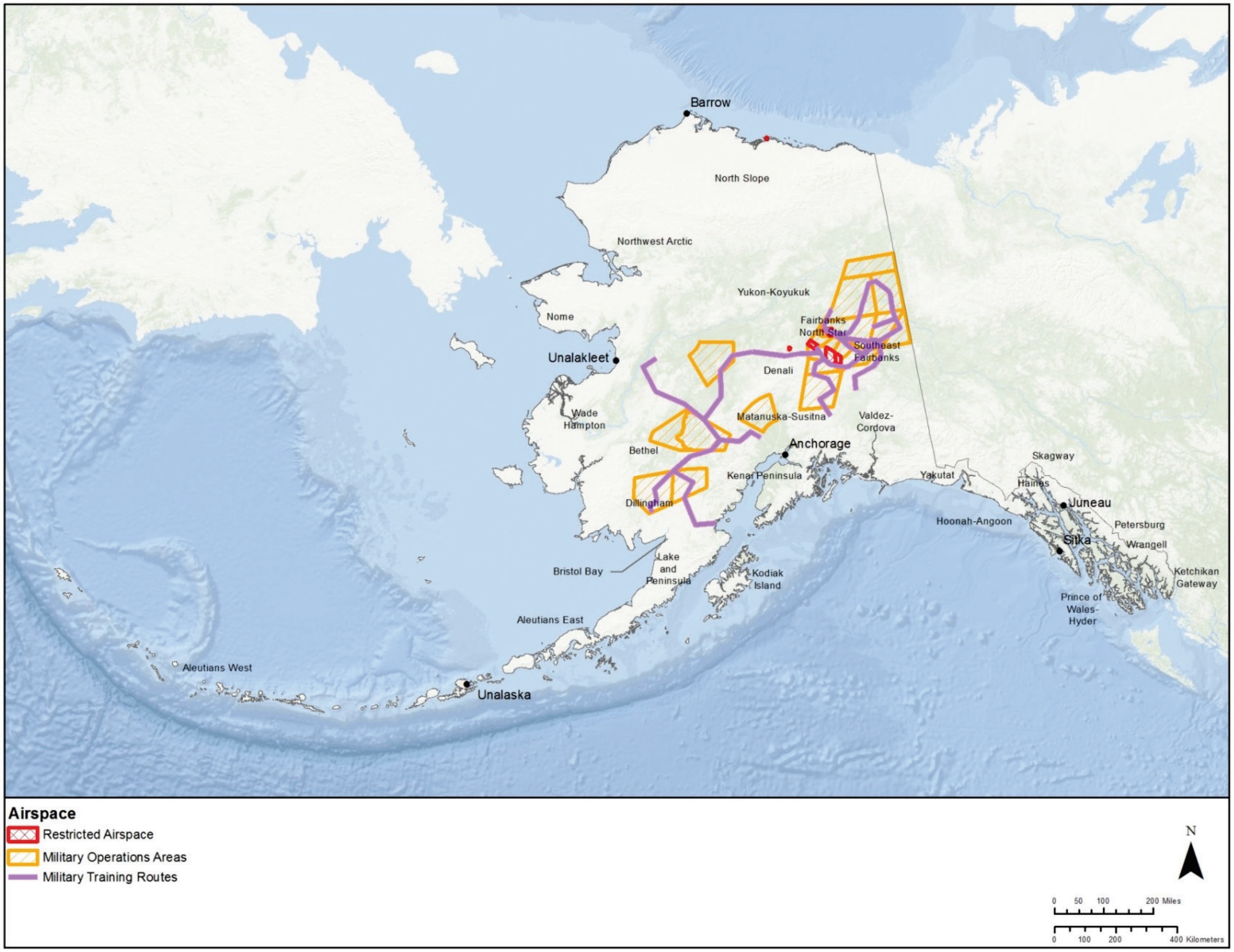
3.1.7.4. Airspace

Because of the remote and often isolated nature of Alaska's rural population, along with the large distances between communities in Alaska, aviation plays a more important role in everyday Alaskan life than is the case in other parts of the U.S. As of 2013, there were 721 FAA-registered airports in Alaska, including 129 seaplane bases and 42 heliports. Of that total, the state's Department of Transportation and Public Facilities owns 249 airports, while other state agencies and municipal governments own approximately 150 additional airports (*Alaska DOT 2013*). Airport facilities in Alaska range from three international airports (Anchorage, Fairbanks, and Juneau) to back-country airstrips. Not included in the totals provided above are back-country locations where seaplanes are capable of landing, but that are not specifically listed as seaplane bases. Of the 721 total airports in Alaska, 20 are military airfields. The largest are Eielson Air Force Base near Fairbanks and Joint Base Elmendorf-Richardson in Anchorage. Other smaller military airfields are scattered throughout the state (*Alaska DOT 2013*).

As described in Section 3.1.7.2, Specific Regulatory Considerations, airspace immediately surrounding airports is subject to Part 77 regulations, which generally govern the placement, height, and use of structures near airports and their runway approaches. In addition, there are six areas of restricted airspace in Alaska not associated with the Part 77 airspace around airports, as shown in Figure 3.1.7-2. Restricted airspace delineates areas that are off-limits for non-military pilots under most circumstances, but does not necessarily indicate restrictions on aboveground telecommunications facilities such as transmission towers As shown in Figure 3.1.7-2, restricted airspace in Alaska is generally south of Fairbanks, and covers more than 730,000 acres of land.

In addition to restricted airspace, there are numerous Military Operations Areas in Alaska, generally clustered in the state's east-central and southwestern areas. Military Operations Areas identify airspace designated for military training activities, but where civilian aviation is permitted—often with some restrictions or requirements for advanced notification (*FAA 2008*). Military Operations Areas in Alaska cover approximately 40 million acres of land.

In addition, as shown on Figure 3.1.7-2, Military Training Routes link these special airspace areas, traversing considerable portions of south-central Alaska. Military Training Routes are "are routes used by military aircraft to maintain proficiency in tactical flying," including some designated low-level (below 1,500 feet above sea level) activities (*FAA 2008*).



Source: FAA 2015c

Figure 3.1.7-2: Alaska Airspace

3.1.7.5. Recreation

Figure 3.1.7-3 shows federal, state, and locally owned or managed land in Alaska that is intended or generally available for public recreation. Such land generally includes public parks and recreation facilities (including large athletic fields at public schools), forests, wildlife refuges, and other lands the public might reasonably expect to be able to use for recreation.

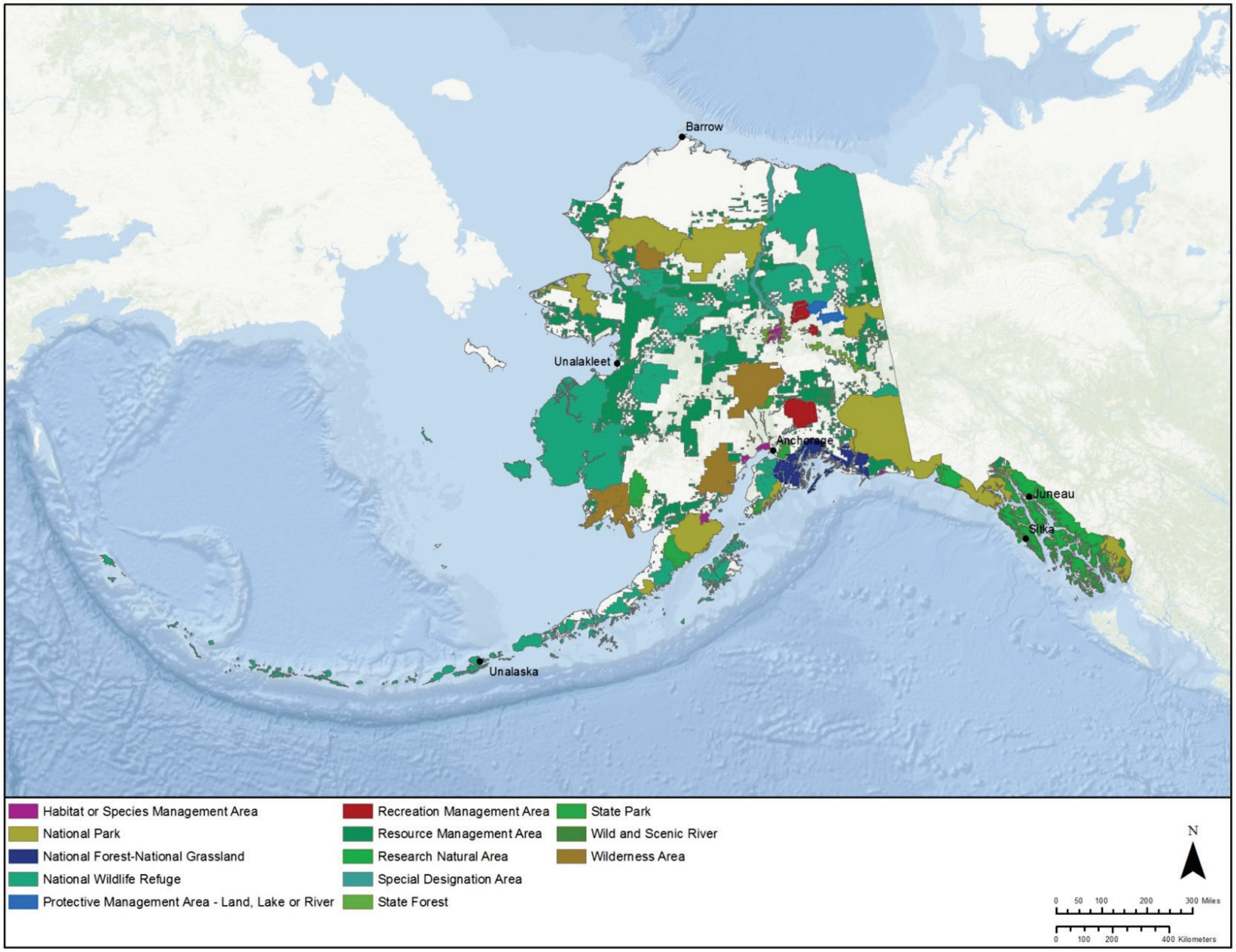
Table 3.1.7-3 summarizes the acreage of lands managed or available for recreation, by type. Federal lands include 23 national wildlife refuges, 14 national parks and preserves, 2 national forests, and a wide variety of other federal lands. As shown in Table 3.1.7-3, federal lands account for approximately 94 percent of these recreational lands in Alaska. National wildlife refuges alone comprise 37 percent of statewide recreational lands. State lands account for approximately 6 percent of recreational lands. In total, as shown in Table 3.1.7-3, recreational lands comprise approximately 62 percent of all land in Alaska.

Table 3.1.7-3: Acreage of Recreational Lands in Alaska, by Type

Recreational Land Type	Acres	Percent of Total[a]
National Forests	19,498,192	9%
National Park System	56,110,471	25%
BLM Public Lands[b]	55,325,709	24%
National Wildlife Refuges	84,640,486	37%
State Parks, Marine Parks, and Recreation Areas	4,534,773	2%
State Forests and Preserves	2,137,954	1%
State Game Lands	1,257,830	1%
Other State Lands	4,778,606	2%
Total	**228,284,021**	**100%**

Source: USGS 2012a

[a] Totals may not match due to rounding.
[b] Includes BLM lands, Steese National Conservation Area, White Mountains National Recreation Area, research natural areas, and land associated with National Wild and Scenic Rivers (except Alagnak Wild and Scenic River, which is managed by the National Park Service).



Source: USGS 2012a

Figure 3.1.7-3: Recreational Areas

3.1.8. Visual Resources

3.1.8.1. Introduction

Visual resources refer collectively to the natural and manmade features, landforms, structures, and other objects visible from a single location or a broader landscape. Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for National Environmental Policy Act and National Historic Preservation Act compliance. A general definition of visual resources used by the Bureau of Land Management is "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (*BLM 1984*). This section provides a broad overview of visual resources in Alaska. This includes regulations, conditions, and activities that could potentially be affected by deployment and operation of the Proposed Action.

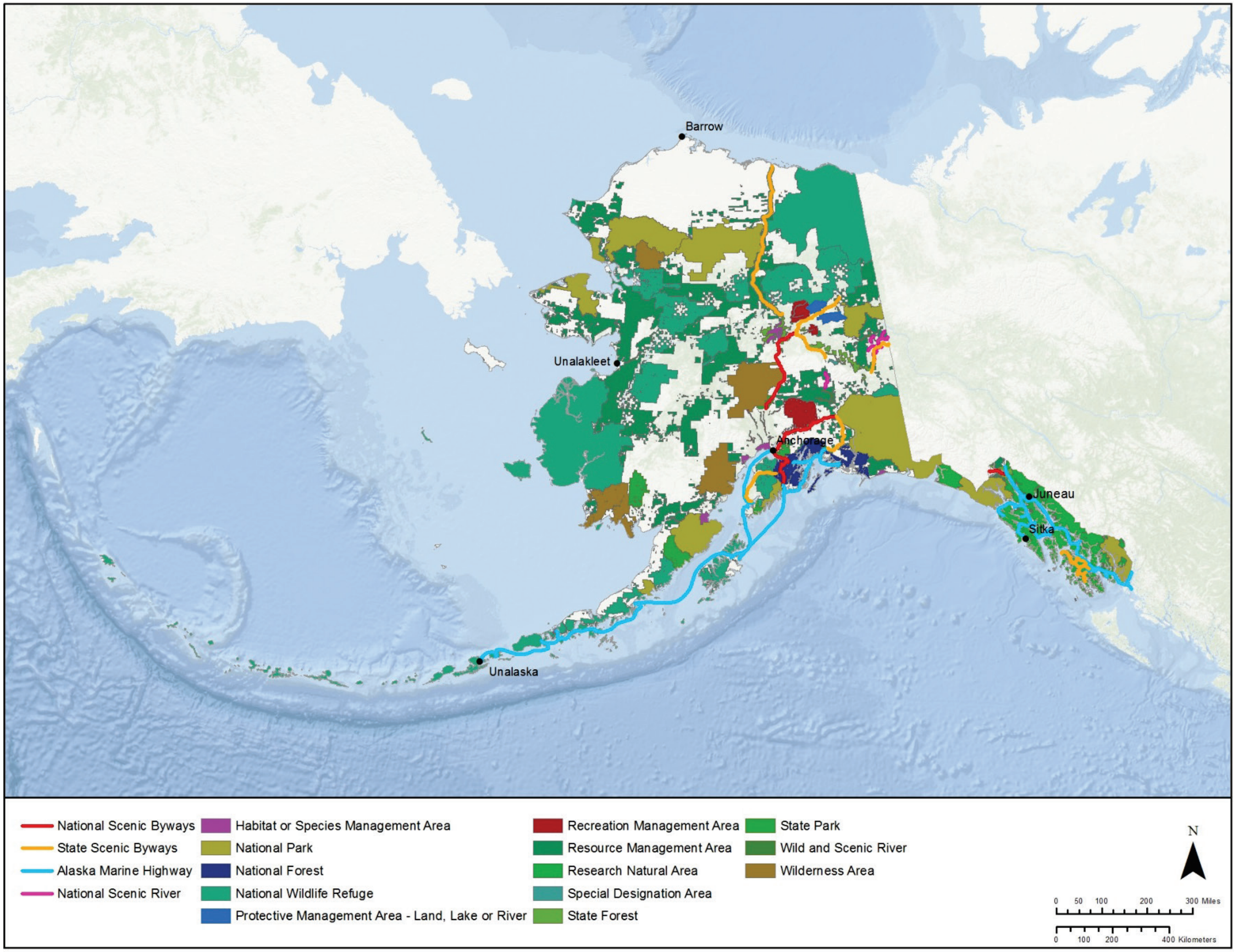
3.1.8.2. Specific Regulatory Considerations

Federal Lands

As described in Section 3.1.7, Land Use, Airspace, and Recreation, the major federal landholders in Alaska are the Department of Defense (DOD), Bureau of Land Management (BLM), Forest Service, National Park Service (NPS), and U.S. Fish and Wildlife Service (USFWS). DOD facilities are not evaluated here because any deployment on DOD lands will have to comply with DOD requirements associated with visual concerns. As DOD facilities are not open to the public, the likelihood of a visual impact beyond the perimeter of the facility is unlikely. Figure 3.1.8-1 shows federal and state lands (other than DOD lands) that are managed to address visual resources, while Section 3.1.7, Land Use, Airspace, and Recreation, describes them.

While agency-specific guidelines for complying with the National Environmental Policy Act typically require consideration of visual impacts, there is no overall federal regulation or methodology specifying how such impacts should be evaluated.

The most comprehensive federal agency visual impact methodologies are the Forest Service's Scenery Management System and the BLM's Visual Resource Management System. There are no agency-specific methodologies for evaluating visual impacts on NPS or USFWS lands, although relevant NPS guidance is described below.



Source: USGS 2012

Figure 3.1.8-1: Areas in Alaska Managed for Visual Resources

Forest Service Scenery Management System

The Forest Service Scenery Management System (SMS) is described in the 1995 publication, *Landscape Aesthetics: A Handbook for Scenery Management* (*USDA 1995*). As stated in the SMS publication

> "[t]he system is to be used in the context of ecosystem management to inventory and analyze scenery in a national forest, to assist in establishment of overall resource goals and objectives, to monitor the scenic resource, and to ensure high-quality scenery for future generations." *(USDA 1995*)

The SMS process "involves identifying scenery components as they relate to people, mapping these components, and developing a value unit for aesthetics from the data gathered" (*USDA 1995*). The scenery components identified in the SMS include:

- Scenic Attractiveness: the distinctiveness of the landscape in question;
- Landscape Visibility: the ability of observers to see the landscape in question;
- Constituent Analysis: the importance of landscape aesthetics to those who view the landscape in question; and
- Distance Zones: the relative sensitivity of the landscape in question based on the distance from a typical observer.

Within each forest, the Forest Service maps scenery component values (i.e., showing the portions of the forest that fall into each gradation of scenic attractiveness or landscape visibility, etc.), and then uses that data to determine which of the seven Scenic Classes in the SMS best describes each area of the forest.

> "Scenic classes measure the relative importance, or value, of discrete landscape areas having similar characteristics of scenic attractiveness and landscape visibility. Scenic classes are used during forest planning to compare the value of scenery with the value of other resources, such as timber, wildlife, old-growth, or minerals." (*USDA 1995*)

Scenic Classes are numbered from 1 to 7. "Generally Scenic Classes 1-2 have high public value, Classes 3-5 have moderate value, and Classes 6 and 7 have low value" (*USDA 1995*).

BLM Visual Resource Management System

The Visual Resource Management (VRM) system used by the BLM is similar to the SMS, in that it provides a framework for managing lands based on their scenic value. The VRM system consists of two major procedures, each of which is described in a separate BLM Handbook.

- Inventory, as described in BLM Handbook H-8410-1, Visual Resource Inventory (*BLM 1986a*) assigns BLM lands into one of four visual classes whose objectives range from preservation (Class I) to significant modification (Class IV); and

- Analysis, as described in BLM Handbook H-8431-1, Visual Resource Contrast Rating *(BLM 1986b*), which evaluates how a proposed change (new structure, different land management approach, etc.) would contrast with existing conditions.

As implied in the VRM analysis stage description above, the VRM is designed in part to assist BLM managers in conducting impact assessments as part of National Environmental Policy Act and/or revisions to the Resource Management Plan—the primary planning document for a BLM unit.

National Park Service

An NPS-authored guidance document for evaluating visual impacts associated with renewable energy projects (such as wind turbines) does provide an indication of the agency's approach to visual impact assessment. For NPS, visual impact assessment revolves primarily around the following concepts:

- Visual contrast: "the change in what is seen by the viewer" as a result of a new project such as a wind turbine (*Sullivan and Meyer 2014*); and
- Visual impact: "both the change to the visual qualities of the landscape resulting from the introduction of visual contrasts [i.e., a new wind turbine]…and the human response to that change" (*Sullivan and Meyer 2014*).

Visual impact assessments are incorporated into Environmental Impact Statements for units of the National Park System.

Federal Aviation Administration

Federal Aviation Administration (FAA) regulations in *14 Code of Federal Regulations 77* (commonly known as Part 77 regulations) require distinctive paint and lighting for structures with the potential to affect aerial navigation. Recommendations on marking and lighting structures may vary depending on terrain features, weather patterns, and geographic location. Guidance for implementing Part 77 regulations include (but are not limited to) the following (all citations from *FAA 2015*):

- Flashing or steady red lights (nighttime only) on structures up to 200 feet above ground level (AGL);
- Medium-intensity flashing white lights (daytime and twilight with automatically selected reduced intensity for nighttime) for structures greater than 200 feet AGL (other lighting and marking methods may be omitted for structures that do not exceed 700 feet AGL);
- Aviation orange and white paint for daytime marking on structures exceeding 700 feet AGL;
- High-intensity flashing white lights (daytime only with automatically selected reduced intensities for twilight and nighttime) for structures exceeding 700 feet AGL (other lighting and marking methods may be omitted if this system is used);
- Dual lighting including red lights for nighttime and high- or medium-intensity flashing white lights for daytime and twilight;

- Temporary high- or medium-intensity flashing white lights, as recommended in the determination, operated 24 hours a day during construction until all permanent lights are in operation;
- Red obstruction lights with painting or a medium-intensity dual system for structures 200 feet or more AGL in urban areas where there are numerous other white lights; and
- Steady red lighting for transmission wires (referred to in *FAA 2015* as "catenary wires" between transmission towers) near aviation facilities, canyons, and other areas.

In addition, USFWS has drafted revised guidelines related to communication towers, designed to protect migratory birds (*USFWS 2013*).[1] Regarding visual conditions, the USFWS guidelines recommend that, for new structures tall enough to require lighting under FAA Part 77 guidance

> "…the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA should be used. Unless otherwise required by the FAA, only white strobe or red strobe lights (red preferable), or red flashing incandescent lights should be used at night, and these should be the minimum number, minimum intensity,…and minimum number of flashes per minute (i.e., longest duration between flashes/"dark phase") allowable by the FAA. The use of solid (non-flashing) warning lights at night should be avoided." (*USFWS 2013*)

National Scenic Byways

Alaska has five National Scenic Byways, two of which are also designated All-American Roads (see Figure 3.1.8-1). These include:

- Alaska Marine Highway (All-American Road);
- George Parks Highway;
- Glenn Highway;
- Haines Highway – Valley of the Eagles; and
- Seward Highway (All-American Road).

National Scenic Byways and All-American Roads are nominated by each state's byway management agency

> "…based upon their scenic, historic, recreational, cultural, archeological, and/or natural intrinsic qualities. To be designated as a National Scenic Byway, a road must significantly meet criteria for at least one of the above six intrinsic qualities. For the All-American Roads designation, criteria must be met for multiple intrinsic qualities." (*60 Federal Register 96, Docket 95-15*)

[1] See Chapter 11, BMPs and Mitigation Measures, for additional information regarding USFWS and FAA guidelines.

National Scenic Byway or All-American Road designations, which are awarded by the U.S Secretary of Transportation, make a state eligible to receive federal funds for projects that conserve or enhance the road's intrinsic characteristics (as described above). This can include projects "not only for travelers' safety and comfort, but also for preserving the highest levels of visual integrity and attractiveness" (*60 Federal Register 96, Docket 95-15*). Projects must be consistent with (if not specifically listed in) each byway's Corridor Management Plan. The Corridor Management Plan for an All-American Road must address (and federal funding may be used to enhance) tourism, in addition to the six intrinsic qualities. Participation in the federal scenic byway program is voluntary; landowners in the area covered by the Corridor Management Plan cannot be compelled to preserve or alter their properties.

National Scenic Rivers

Portions of two Alaska rivers are designated as National Scenic Rivers:

- A 203-mile segment of the Fortymile River; and
- A 24-mile segment of the Delta River.

Both of these rivers are managed by the BLM.

National Scenic Rivers are part of the National Wild and Scenic Rivers System created by the National Wild and Scenic Rivers Act *(Public Law 90-542, 1968*). The goal of the system is to "preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Act is notable for safeguarding the special character of these rivers, while also recognizing the potential for their appropriate use and development." (*National Wild and Scenic Rivers System 2015*)

A river or segment of a river may be designated as wild, scenic, and/or recreational—the three designations are independent, although all may exist along the same reach.[2] A national scenic river is "free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads" (*National Wild and Scenic Rivers System 2015*).

Designation under the National Wild and Scenic Rivers System makes the river and surrounding lands eligible to receive federal funding for land acquisition for the purpose of preservation. It also enables federal review of proposed projects along the banks of the designated river segment to ensure that such projects would not compromise the river's wild, scenic, and/or recreational qualities.

State Lands

The Alaska Statutes—the state's compiled laws—do not include a general requirement for evaluation of visual or aesthetic impacts, nor do they contain general limitations on development

[2] Alaska has an additional 23 national wild and/or recreational rivers. Portions of the Fortymile and Delta rivers are also designated as wild and recreational.

to protect visual or aesthetic resources. Sections of the Alaska Statutes do address visual or aesthetic impacts for specific types of land, including (but not limited to) the following:

- For state game refuges, wildlife sanctuaries, and similar wildlife lands, aesthetics (among other resources) may be used as the basis for land preservation—see, for example, the McNeil River State Game Sanctuary (*Alaska Statutes §16.20.162*).
- The state must prepare a forest management plan prior to most timber sales in state forests. This plan must consider, among other things non-timber uses of the forest, such as recreation and tourism—both of which can be reasonably inferred to include visual resources (*Alaska Statutes §41.17.230*).
- Certain areas may be designated as unsuitable for coal mining based on aesthetic values, among other factors (*Alaska Statutes §27.21.260.c.2.B*).

None of these provisions includes discussion of the methodology to be used to evaluate visual or aesthetic impacts.

In addition to the federal scenic byways described above, Alaska has identified 11 other state scenic byways (see Figure 3.1.8-1). Designation as a state scenic byway makes the road and surrounding areas eligible for state funding to enhance the road's qualities. State designation in Alaska also makes the road eligible for federal designation. While the state government is responsible for maintaining the designated roads, participation by surrounding landowners is voluntary.

Local Regulations

Outside of federal lands, local land development (i.e., zoning) ordinances provide some regulation of visual resources in Alaska cities and boroughs. These ordinances typically govern the type, height, bulk (i.e., how much of the lot a building can occupy, along with setbacks from front, side, and rear property lines), and density/intensity (i.e., number of housing units per acre or non-residential floor area ratio) of development.

3.1.8.3. Existing Visual Resources

Taken as a whole, Alaska is almost universally regarded for its high scenic quality, particularly scenery associated with untouched or minimally developed areas such as forests, rivers, and other natural areas. Section 3.1.9, Socioeconomics, discusses the importance of tourism in Alaska, an industry that depends heavily on scenic resources, particularly those in more remote parts of the state. This section focuses on scenic resources that have been defined through the regulations and guidance described in Section 3.1.8.2, Specific Regulatory Considerations.

Federal Lands

Scenic resources on the federal lands in Alaska are identified and managed by the host agency (in this case, the Forest Service, BLM, NPS, or USFWS) and codified in each agency's management document. These include Forest Plans for Forest Service lands, Resource

Management Plans for BLM lands, and General Management Plans for units of the National Park System (e.g., national parks, national monuments, etc.).

While the planning documents and specific analytical requirements for evaluating visual resources on Forest Service, BLM, and NPS lands are different, the general approach is similar. Management plans typically divide each federal property into management zones, each of which has a defined purpose, along with a list of appropriate activities and management strategies. That list of activities and strategies is based on existing conditions and the potential visual impact assessments or analyses described in Section 3.1.8.2, Specific Regulatory Considerations.

National Wildlife Refuges and other USFWS lands are managed according to Land Conservation Plans, Land Protection Plans, Monument Management Plans (for marine national monuments), or similar documents. While these documents may consider visual resources, they typically do not contain a visual impact assessment or policies specifically related to visual resources.

State Lands

As described in Section 3.1.8.2, Specific Regulatory Considerations, individual management plans for state lands may identify areas to be managed for visual resources. In particular, Forest Land Use Plans typically provide a general discussion of visual or scenic resources and the visual impacts of proposed timber sales and harvests (*Alaska DNR 2015*).

Other Considerations

Alaska has not identified any specific high-value visual resources. Height restrictions are often the de facto method for protecting views. Application of height limits on communications antennas and structures vary across the state's cities and boroughs. For example, Anchorage has an antenna farm zoning district where heights are unlimited (except as provided by Part 77 federal regulations). This allows unlimited heights in some industrial zoning districts and allows antennas only as a conditional use (i.e., subject to project-specific review and approval) in other districts (*City of Anchorage 2015*). The municipal code for the North Slope Borough does not specify a maximum height for antennas anywhere within the borough, although such uses would be subject to planning and zoning review (*North Slope Borough 2015*).

Due to the state's northern location, residents and visitors in Alaska are frequently able to view the aurora borealis, a visually spectacular natural phenomenon that "is caused by collisions between fast-moving electrons from space with the oxygen and nitrogen in Earth's upper atmosphere" (*NASA Undated*). While federal, state, and local regulations do not specifically address the aurora borealis, the ability to view and appreciate this phenomenon is affected by the presence of artificial lights.

3.1.9. Socioeconomics

3.1.9.1. Introduction

The National Environmental Policy Act of 1969 (NEPA; see Section 1.8, Overview of Relevant Federal Laws and Executive Orders) requires consideration of socioeconomics in NEPA analysis. Specifically, Section 102(A) of NEPA requires federal agencies to ensure "the integrated use of the natural and social sciences…in planning and in decision making" (*42 U.S.C. 4332(A)*). Socioeconomics refers to a broad, social-science-based approach to understanding a region's social and economic conditions. It typically includes population, demographic descriptors, cultural conditions, economic activity indicators, housing characteristics, property values, and public revenues and expenditures. When applicable, it includes qualitative factors such as community cohesion. Socioeconomics provides important context for analysis of FirstNet projects that could affect a region's socioeconomic conditions.

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide a nationwide public safety broadband network (NPSBN) and interoperable emergency communications coverage. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, to give special attention to potential impacts on those populations per *Executive Order 12898* (see Section 1.8, Overview of Relevant Federal Laws and Executive Orders). Certain demographic information including race, ethnicity, age, income, and poverty status is also relevant to evaluating potential environmental justice issues, as discussed in the Environmental Justice sections 3.1.10 and 3.2.10 (in the Affected Environment and the Environmental Consequences sections, respectively). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use, airspace, and recreation (Section 3.1.7 and 3.2.7), infrastructure (Section 3.1.1 and 3.2.1), and visual resources (Section 3.1.8 and 3.2.8).

The financial arrangements for deployment and operation of the FirstNet network have socioeconomic implications. Section 1.1, Overview and Background, frames some of the public expenditure and public revenue considerations specific to FirstNet. This socioeconomics section provides some additional broad context, including data and discussion of state and local government revenue sources that FirstNet could affect.

Wherever possible, this section draws on nationwide datasets from federal sources such as the United States Census Bureau (U.S. Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geographical location at the time of writing. At the borough, state, region, and United States levels, the data is typically for 2013 or 2014. For smaller geographic areas, this section uses data from the U.S. Census Bureau's American Community Survey (ACS). The ACS is the U.S. Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that 5-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county or borough level. Where available, information is presented at the national, state, and borough level (boroughs in Alaska are equivalent to counties in most other states).

This section discusses existing socioeconomic conditions of Alaska that could potentially be affected by deployment and operation of the Proposed Action, including the following subjects: regulatory considerations specific to socioeconomics in the state, communities and populations, economic activity, housing, property values, and taxes.

3.1.9.2. Specific Regulatory Considerations

Subsistence

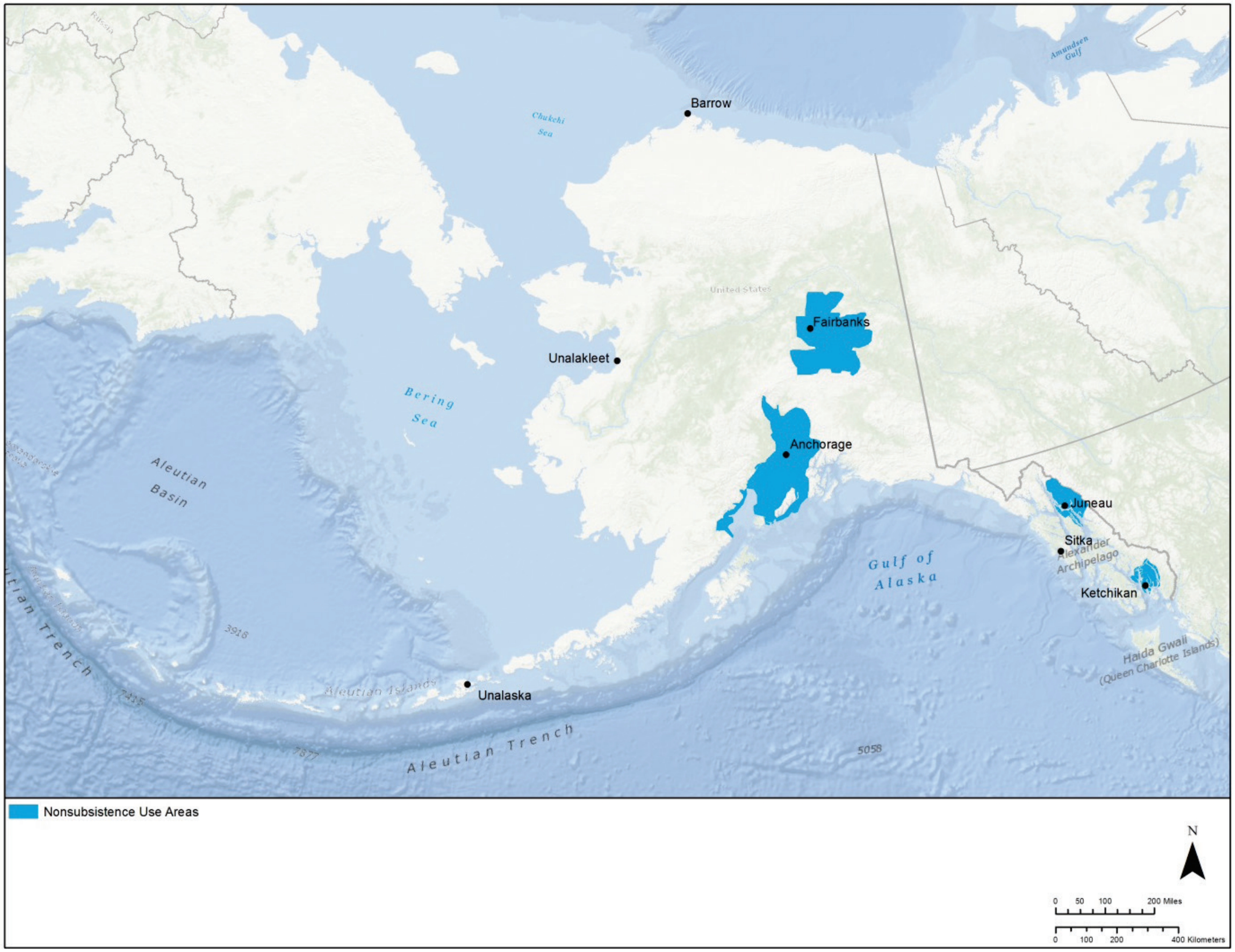
Title VIII of the federal Alaska National Interest Lands Conservation Act (Public Law 96-487) governs subsistence activity on federal lands and defines "subsistence use" for rural Alaska residents, regardless of identification as Native American, as:

> "…the customary and traditional uses by rural Alaska residents of wild renewable resources for direct, personal, or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of non-edible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade" (*16 U.S.C. §3113*).

Article 8 of the Alaska Constitution further guarantees equal access to fish, wildlife, and waters for all state residents (*State of Alaska 2015*), while the Alaska Department of Fish and Game states that "subsistence fishing and subsistence hunting are important for the economies and cultures of many families and communities in Alaska…[and] are especially important for most rural families, who depend on subsistence hunting and fishing as sources of nutrition and cultural practices" (*ADFG 2015a*).

Alaska recognizes the applicability of subsistence harvesting to all Alaska residents, whereas federal regulations restrict harvesting to those individuals who primarily reside in rural areas, and may restrict a particular harvest area to a specified community or group of communities (*ADFG 2015a*).

Subsistence is so intrinsic to Alaskan identity that state law requires the identification of *nonsubsistance* areas (emphasis added)—locations "where dependence upon subsistence (customary and traditional uses of fish and wildlife) is not a principal characteristic of the economy, culture, and way of life" (*ADFG 2015a*). Alaska nonsubsistence areas are shown in Figure 3.1.9-1, and include large areas around Fairbanks and Anchorage, smaller areas around Juneau and Ketchikan, and a small area surrounding Valdez.



Source: ADFG 2015a

Figure 3.1.9-1: Nonsubsistence Use Areas in Alaska

Other Socioeconomic Regulatory Considerations

Research for this section did not identify any other specific state, local, or tribal laws or regulations relevant to socioeconomics for this Draft Programmatic Environmental Impact Assessment.

3.1.9.3. Communities and Populations

Alaska consists of 19 organized boroughs and one unorganized borough, which is divided into 10 census areas. Significant population centers include the cities and surrounding areas of Anchorage, Juneau, Fairbanks, Sitka, and Ketchikan. Table 3.1.9-1 presents population information for the state and its boroughs (the equivalent of counties), while Figure 3.1.9-2 shows this population distribution, as well as the significant population centers listed above.

Population density is generally very low throughout the state. Only Anchorage, the largest city in the state, has a population density higher than the national average. Statewide, only Anchorage and Fairbanks—less than 1 percent of the state—can be characterized as urban,[1] as described by the U.S. Census Bureau (*U.S. Census Bureau 2015*). The Anchorage urban area extends beyond the Anchorage Municipality boundaries. Approximately 66 percent of the state's population lives in urban areas, compared to approximately 81 percent of the national population (*U.S. Census Bureau 2010a*). Table 3.1.9-1 provides select population, population density, and population growth rates at the state, borough, and census area levels, compared with national data.

As illustrated in Table 3.1.9-1, annual population growth in Alaska since 2000 has occurred at a slightly higher rate (1.1 percent) than in the nation as a whole (1 percent). Population change in Alaska boroughs varies considerably from location to location. Larger population centers (Anchorage, Fairbanks, the Kenai Peninsula, etc.) have generally grown at or above the state rate, while other more isolated areas have lost population.

Table 3.1.9-2 shows population projections for Alaska and the United States through 2040. Over this period of time, Alaska's population is projected to grow faster than the nation as a whole.

The analysis in Section 3.2.10, Environmental Justice, provides detailed race and ethnicity information for Alaska and its census block groups.

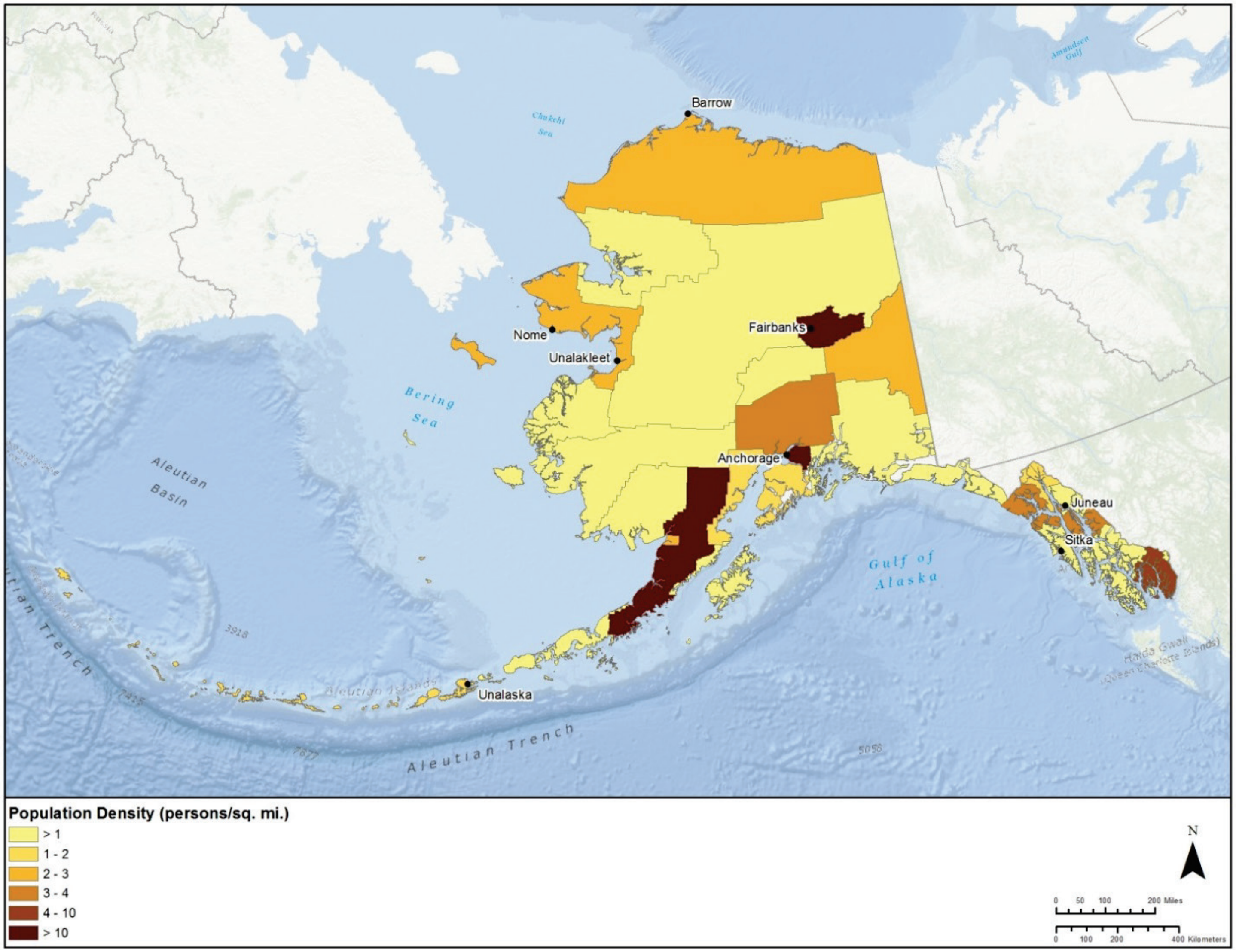
[1] Urban is defined as "densely developed residential, commercial, and other non-residential areas."

Table 3.1.9-1: National, State, and Borough Population, Population Density, and Growth Rates

	2000	2010	2014	2014 Population Density (persons/sq. mi.)	Annual Growth Rate, 2000-2014[a]
United States	281,421,906	308,745,538	318,857,056	90.3	1.0%
Alaska	626,932	710,231	736,732	1.1	1.3%
Aleutians East Borough	2,697	3,141	3,360	0.4	1.8%
Aleutians West Census Area	5,465	5,561	5,750	1.2	0.4%
Anchorage Municipality	260,283	291,826	301,010	152.7	1.1%
Bethel Census Area	16,006	17,013	17,868	0.4	0.8%
Bristol Bay Borough	1,258	997	957	2.5	-1.7%
Denali Borough	1,893	1,826	1,921	0.1	0.1%
Dillingham Census Area	4,922	4,847	4,988	0.3	0.1%
Fairbanks North Star Borough	82,840	97,581	99,357	11.3	1.4%
Haines Borough	2,392	2,508	2,566	1.0	0.5%
Hoonah-Angoon Census Area	1,432	2,149	2,082	0.2	3.2%
Juneau City and Borough	30,711	31,275	32,406	11.4	0.4%
Kenai Peninsula Borough	49,691	55,400	57,477	3.1	1.1%
Ketchikan Gateway Borough	14,070	13,477	13,787	2.9	-0.1%
Kodiak Island Borough	13,913	13,606	13,986	2.1	0.0%
Lake and Peninsula Borough	1,823	1,635	1,631	0.1	-0.8%
Matanuska-Susitna Borough	59,322	88,995	97,882	2.4	4.6%
Nome Census Area	9,196	9,492	9,817	0.4	0.5%
North Slope Borough	7,385	9,430	9,703	0.1	2.2%
Northwest Arctic Borough	7,208	7,523	7,717	0.2	0.5%
Petersburg Borough	3,224	3,207	3,160	1.0	-0.1%
Prince of Wales-Hyder Census Area	6,146	6,172	6,396	1.6	0.3%
Sitka City and Borough	8,835	8,881	8,900	3.1	0.1%
Skagway Municipality	2,004	968	1,036	7.6	-3.5%
Southeast Fairbanks Census Area	6,174	7,029	6,931	0.2	0.9%
Valdez-Cordova Census Area	10,195	9,636	9,488	0.3	-0.5%
Wade Hampton Census Area	7,028	7,459	8,010	0.4	1.0%
Wrangell City and Borough	3,460	2,365	2,364	2.6	-2.3%
Yakutat City and Borough	808	662	635	0.1	-1.5%
Yukon-Koyukuk Census Area	6,551	5,588	5,547	0.0	-1.1%

Source: U.S. Census Bureau 2000, 2010a, 2014

[a] Calculated as the total change, divided by the number of years between 2000 and 2014.



Source: U.S. Census Bureau 2013

Figure 3.1.9-2: Population Distribution and Density

Table 3.1.9-2: Population Projections

	2010	2020	2030	2040	Annual Growth Rate
United States	308,745,538	335,605,444	360,978,449	382,152,234	0.8%
Alaska	710,231	811,718	909,351	995,701	1.3%

Source: UVA 2015

3.1.9.4. Real Estate, Tax Revenues, Property Values, Local Economic Activity, and Subsistence

Economic Activity

Alaska's economy is driven largely by the oil and gas industry and the federal government (including the military), each of which provide (directly or indirectly) approximately one-third of all statewide jobs. Oil and gas activity also funds the state's Permanent Fund, which makes payments to all Alaska residents. Other important economic sectors include commercial fisheries, timber harvesting and wood products, mining, tourism, and air cargo (*Goldsmith 2008*).

Activities related to fish and wildlife are also important contributors to Alaska's economy. Commercial fisheries in Alaska generate an estimated $5.8 billion annually in revenue (*ADFG 2015b*), and are an important source of employment, as well as private and public taxable income (*NOAA 2015*). Recreational fishing allows access to fish resources for non-commercial vessels, while also providing economic opportunity. Communities generate revenue through building a robust visitor economy through charter fishing and guides, rentals, fishing stores, lodging, restaurants, and other amenities (*NOAA 2015*).

Hunters contribute significantly to the state economy, particularly in rural areas. For example, brown bear populations along much of the southwest provide an important economic resource via trophy hunting. On Kodiak Island, where 8 of the 10 largest bears harvested in North America were taken, hunters spent an estimated $5 million on Kodiak brown bear hunts in 2010 (*Van Daele and Barnes 2010*).

Table 3.1.9-3 summarizes selected economic indicators for Alaska and the United States Compared to the state average of 8.8 percent and the national average of 9.7 percent in 2013, borough-level unemployment rates range widely, from approximately 1.7 percent in the Aleutians East Borough to 28.1 percent in the Wade Hampton Census Area. Figure 3.1.9-3 shows the variation in median household income in Alaska, while Figure 3.1.9-4 shows the variation in unemployment rate.

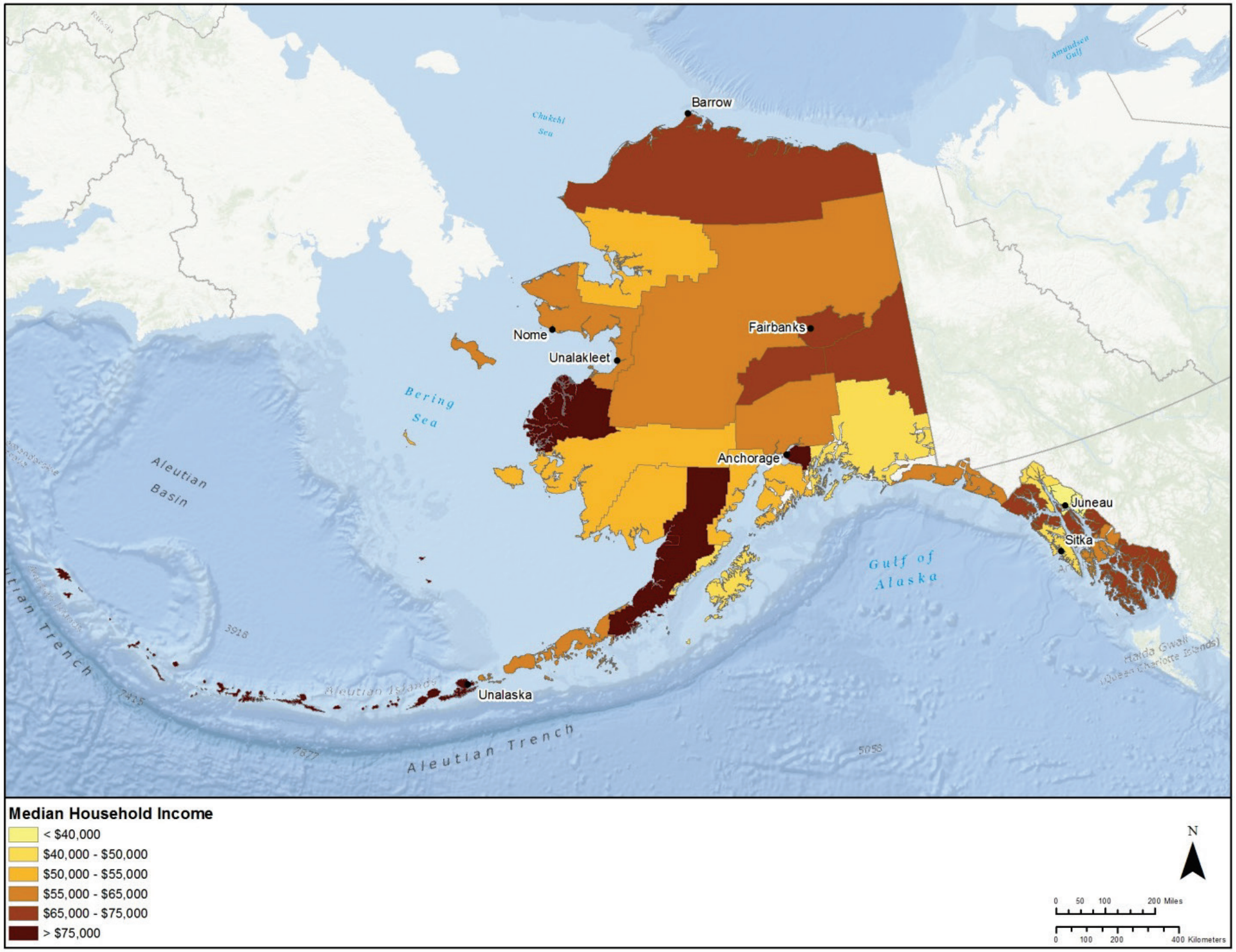
Median household income in Alaska is above the national average of $53,046. Borough incomes range from a high in the Aleutians West Census Area of $81,853 to a low of $34,710 in the Yukon-Koyukuk Census Area, while 22 of 29 borough incomes are above the national average. This above-average income at least partially reflects the high cost of living in Alaska: the City of Fairbank's cost of living index (a compilation of consumer prices intended to give a like-to-like comparison of common expenses in cities across the United States) was 137.4 in 2010 (the most recent year for which data were available), while Anchorage was 128.4. This indicates that

Fairbanks was approximately 37 percent more expensive and Anchorage approximately 28 percent more expensive to live in than the national average (*U.S. Census Bureau 2010b*).

Table 3.1.9-3: Select Economic Indicators

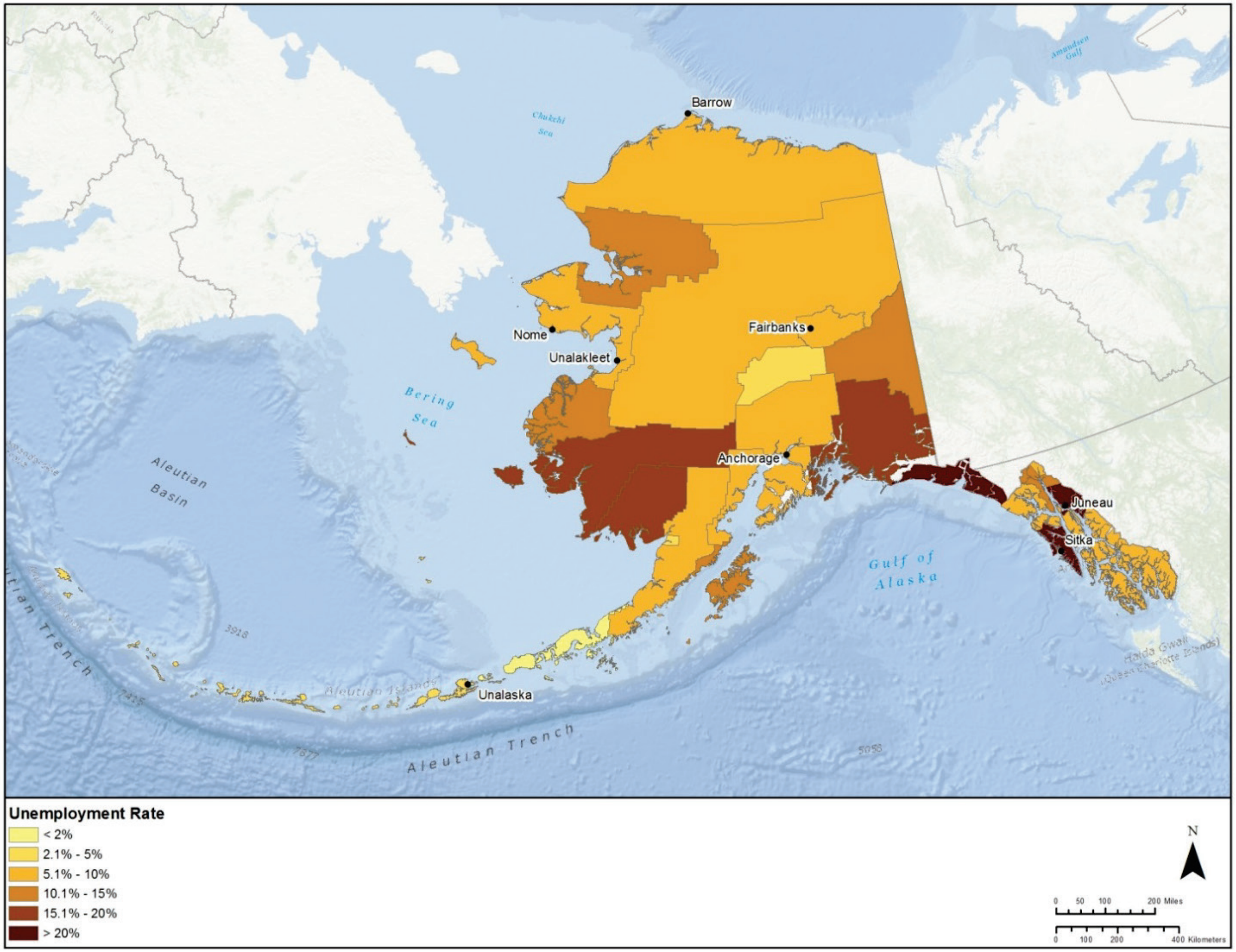
	Per Capita Personal Income (2013)	Median Household Income (2013)	Unemployment Rate (Annual Average, 2013)
United States	$28,155	$53,046	9.7%
State of Alaska	$32,651	$70,760	8.8%
Aleutians East Borough	$26,535	$61,250	1.7%
Aleutians West Census Area	$31,790	$81,853	4.0%
Anchorage Municipality	$36,214	$77,454	7.3%
Bethel Census Area	$18,497	$51,689	18.6%
Bristol Bay Borough	$37,024	$79,531	4.6%
Denali Borough	$35,295	$72,500	2.3%
Dillingham Census Area	$21,498	$54,150	16.1%
Fairbanks North Star Borough	$32,143	$69,223	7.9%
Haines Borough	$31,096	$52,866	8.3%
Hoonah-Angoon Census Area	$28,806	$49,545	13.9%
Juneau City and Borough	$37,558	$81,490	5.3%
Kenai Peninsula Borough	$31,256	$61,793	9.8%
Ketchikan Gateway Borough	$31,589	$62,519	8.7%
Kodiak Island Borough	$28,562	$68,718	6.9%
Lake and Peninsula Borough	$21,616	$51,786	10.9%
Matanuska-Susitna Borough	$29,534	$71,037	10.5%
Nome Census Area	$20,271	$49,974	17.9%
North Slope Borough	$46,457	$80,761	12.0%
Northwest Arctic Borough	$21,461	$61,607	26.2%
Petersburg Census Area	$34,183	$63,934	6.0%
Prince of Wales-Hyder Census Area	$24,581	$46,071	12.8%
Sitka City and Borough	$32,521	$69,405	5.3%
Skagway Municipality	$37,139	$71,667	7.8%
Southeast Fairbanks Census Area	$29,437	$56,801	9.2%
Valdez-Cordova Census Area	$32,579	$74,878	8.0%
Wade Hampton Census Area	$11,210	$40,176	28.1%
Wrangell City and Borough	$28,474	$45,841	8.0%
Yakutat City and Borough	$34,317	$72,500	6.2%
Yukon-Koyukuk Census Area	$19,729	$34,710	21.9%

Sources: U.S. Census Bureau 2013



Source: U.S. Census Bureau 2013

Figure 3.1.9-3: Median Household Income



Source: U.S. Census Bureau 2013

Figure 3.1.9-4: Unemployment

Housing

Table 3.1.9-4 provides information on housing units, occupancy, and tenure (owner versus renter), while Table 3.1.9-5 provides information on housing costs. Between 2010 and 2013, vacancy rates in Alaska increased by approximately 12 percent, faster than the nation as a whole, while home values decreased in both Alaska and the United States (likely reflecting the ongoing results of the 2007 to 2008 recession). The median value of a home in Alaska in 2013 was $241,800, ranging from $106,500 in Yukon-Koyukuk Census Area to $309,900 in Juneau City and Borough. Population centers such as Anchorage and Fairbanks generally had higher median home values than more remote parts of the state. Between 2010 and 2013, rental costs increased statewide, as was the case nationwide. Monthly rental costs varied across Alaska's boroughs, with the highest costs in the Aleutians West Census Area and in population centers (*U.S. Census Bureau 2010a, 2013*).

Property Values and Tax Revenues

Table 3.1.9-6 and Figure 3.1.9-5 illustrate the median value of owner-occupied, single family homes in 2013 as well as their distribution across a range of prices.

Changes in land value depend on factors such as the parcel size, proximity to public services, the parcel's current value and land use, and the value of nearby land parcels. Potential future buyers of land may also make decisions based on intended future use of land, as expressed in comprehensive land use plans or other local planning documents.

Table 3.1.9-7 lists the real estate taxes for owner-occupied housing units in Alaska and its boroughs. Landowners are responsible for property taxes levied against parcels based on the appraised value of their property.

Table 3.1.9-4: Housing Units, Occupancy, and Tenure

	2010				2013				Change, 2010-2013			
	United States		State of Alaska		United States		State of Alaska		United States		State of Alaska	
	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.	Number	Pct.
Total	131,704,730	100%	306,967	100%	132,057,804	1.00%	306,662	100%	353,074	0.30%	-305	-0.1%
Occupied	116,716,292	89%	258,058	84%	115,610,216	88%	251,889	82%	-1,106,076	-0.9%	-6,169	-2.4%
Owner occupied	75,986,074	58%	162,765	53%	75,075,700	57%	160,803	52%	-910,374	-1.2%	-1,962	-1.2%
Renter occupied	40,730,218	31%	95,293	31%	40,534,516	31%	91,096	30%	-195,702	-0.5%	-4,197	-4.4%
Vacant	14,988,438	11%	48,909	16%	16,447,588	13%	54,763	18%	1,459,150	9.7%	5,854	12.0%

Source: U.S. Census Bureau 2010b, 2013

Table 3.1.9-5: Housing Costs

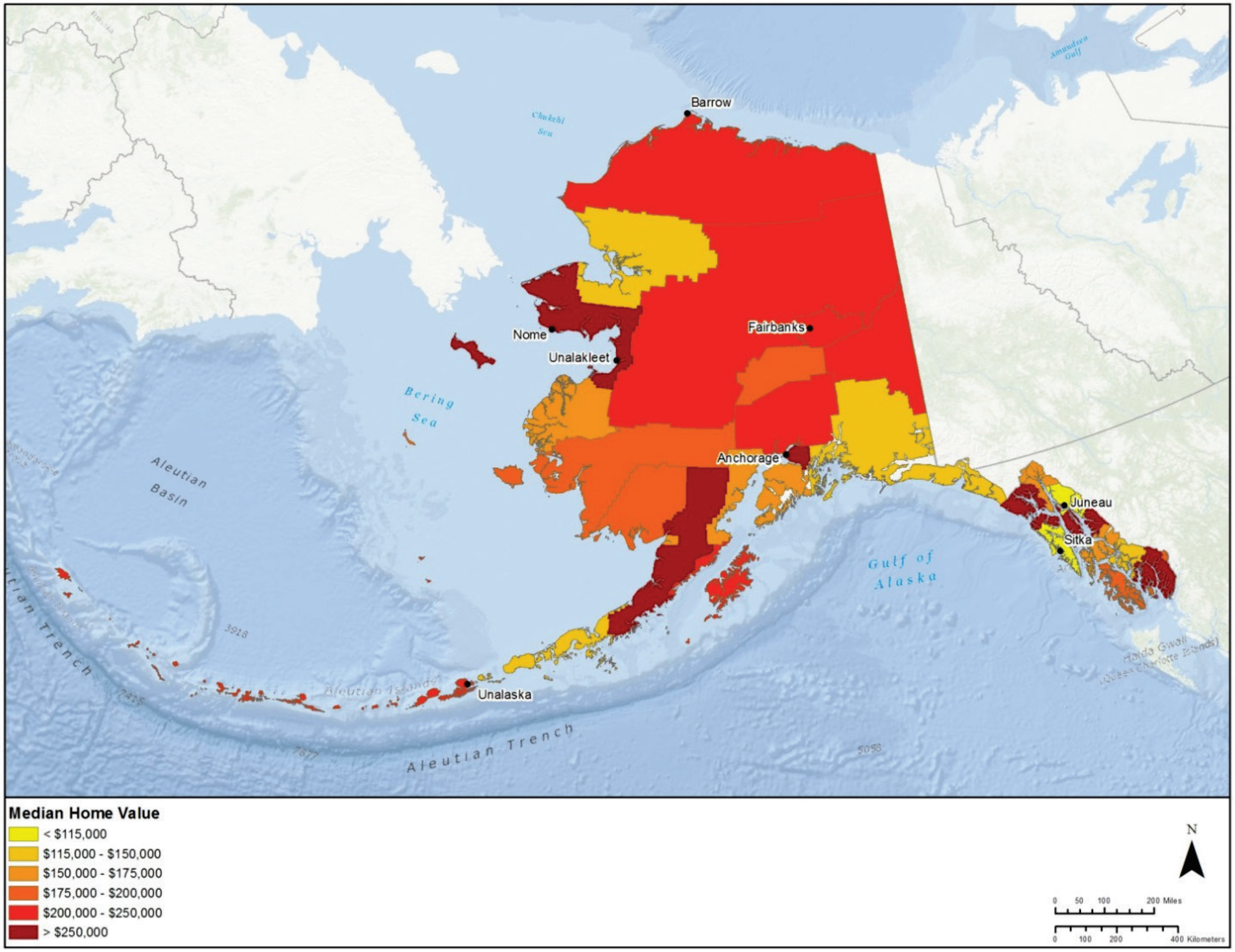
	Median home value (Owner-Occupied)			Median Monthly Contract Rent (Renter-Occupied)		
	2010	**2013**	**Change**	**2010**	**2013**	**Change**
United States	$179,900	$176,700	-$3,200	$713	$733	$20
State of Alaska	$255,700	$241,800	-$13,900	$904	$950	$46
Aleutians East Borough	$121,600	$118,500	-$3,100	$545	$888	$343
Aleutians West Census Area	$163,400	$218,400	$55,000	$1,024	$1,246	$222
Anchorage Municipality	$269,500	$282,800	$13,300	$939	$1,142	$203
Bethel Census Area	$153,400	$189,600	$36,200	$852	$1,177	$325
Bristol Bay Borough	$171,100	$175,000	$3,900	$775	$1,117	$342
Denali Borough	$174,000	$192,500	$18,500	$541	$837	$296
Dillingham Census Area	$199,100	$194,000	-$5,100	$850	$979	$129
Fairbanks North Star Borough	$206,800	$212,500	$5,700	$906	$1,179	$273
Haines Borough	$205,400	$171,900	-$33,500	$641	$828	$187
Hoonah-Angoon Census Area	$184,200	$200,500	$16,300	$614	$733	$119
Juneau City and Borough	$291,600	$309,900	$18,300	$976	$1,178	$202
Kenai Peninsula Borough	$193,000	$204,900	$11,900	$672	$917	$245
Ketchikan Gateway Borough	$242,500	$265,600	$23,100	$804	$1,022	$218
Kodiak Island Borough	$182,100	$224,500	$42,400	$881	$973	$92
Lake and Peninsula Borough	$156,400	$136,400	-$20,000	$406	$768	$362
Matanuska-Susitna Borough	$212,000	$218,900	$6,900	$795	$1,026	$231
Nome Census Area	$144,600	$142,800	-$1,800	$856	$1,127	$271
North Slope Borough	$135,800	$154,600	$18,800	$674	$1,025	$351
Northwest Arctic Borough	$129,000	$131,000	$2,000	$827	$1,121	$294
Petersburg Census Area	$195,300	$215,100	$19,800	$396	$847	$451
Prince of Wales-Hyder Census Area	$152,100	$162,500	$10,400	$509	$761	$252
Sitka City and Borough	$309,800	$323,200	$13,400	$878	$1,139	$261
Skagway Municipality	$253,700	$305,600	$51,900	$920	$1,057	$137
Southeast Fairbanks Census Area	$168,700	$175,000	$6,300	$818	$1,175	$357
Valdez-Cordova Census Area	$165,800	$177,700	$11,900	$721	$871	$150
Wade Hampton Census Area	$80,300	$109,300	$29,000	$335	$666	$331
Wrangell City and Borough	$163,700	$157,400	-$6,300	$655	$772	$117
Yakutat City and Borough	$151,900	$147,500	-$4,400	$636	$972	$336
Yukon-Koyukuk Census Area	$99,500	$106,500	$7,000	$309	$669	$360

Source: U.S. Census Bureau 2010b, 2013

Table 3.1.9-6: Median Value of Owner Occupied Single Family Homes, 2009 to 2013 American Community Survey

	Less than $50,000	$50,000 to $99,999	$100,000 to $149,999	$150,000 to $199,999	$200,000 to $299,999	$300,000 to $499,999	$500,000 or more
State of Alaska	6.1%	5.9%	8.7%	14.8%	32.9%	25.2%	6.3%
Aleutians East Borough	9.2%	26.5%	29.8%	16.4%	13.0%	4.2%	0.8%
Aleutians West	6.6%	22.3%	8.2%	9.0%	17.8%	31.1%	4.8%
Anchorage Municipality	4.8%	1.7%	5.1%	9.6%	35.0%	34.0%	9.7%
Bethel	15.6%	11.9%	14.2%	11.3%	27.5%	18.0%	1.5%
Bristol Bay Borough	5.0%	5.9%	23.6%	23.2%	27.3%	9.5%	5.5%
Denali Borough	7.9%	11.0%	16.2%	17.0%	31.2%	14.8%	1.8%
Dillingham	11.1%	8.9%	15.2%	16.1%	27.5%	19.6%	1.4%
Fairbanks North Star Borough	4.8%	7.7%	11.6%	20.6%	37.8%	14.7%	2.9%
Haines Borough	6.6%	11.4%	14.0%	28.5%	18.4%	18.0%	3.0%
Hoonah-Angoon	6.6%	10.5%	14.7%	18.0%	30.5%	14.7%	4.9%
Juneau City and Borough	5.4%	3.4%	3.9%	6.5%	28.4%	42.3%	10.2%
Kenai Peninsula Borough	5.6%	8.5%	12.9%	21.3%	29.3%	18.1%	4.3%
Ketchikan Gateway Borough	3.1%	8.1%	5.2%	11.6%	35.2%	30.7%	6.2%
Kodiak Island Borough	11.0%	8.1%	11.1%	14.5%	26.1%	23.8%	5.4%
Lake and Peninsula Borough	11.6%	25.7%	16.5%	9.8%	20.5%	12.5%	3.3%
Matanuska-Susitna Borough	4.7%	6.3%	9.4%	21.4%	37.0%	17.3%	3.9%
Nome	18.2%	15.8%	18.6%	14.7%	20.0%	11.1%	1.6%
North Slope Borough	10.8%	24.8%	10.9%	29.0%	17.0%	7.4%	0.0%
Northwest Arctic Borough	11.1%	21.7%	22.2%	22.0%	14.7%	7.3%	1.0%
Petersburg Census Area	11.2%	8.0%	13.6%	12.7%	33.3%	18.2%	3.0%
Pr. of Wales-Hyder Census Area	13.1%	18.8%	12.5%	17.6%	20.1%	13.1%	4.9%
Sitka City and Borough	7.2%	5.5%	2.2%	7.1%	21.3%	43.5%	13.2%
Skagway Municipality	0.0%	4.9%	8.6%	4.1%	30.7%	40.6%	11.0%
Southeast Fairbanks	9.8%	14.2%	15.3%	17.6%	23.4%	17.3%	2.5%
Valdez-Cordova	13.1%	9.2%	12.9%	20.0%	26.8%	15.3%	2.7%
Wade Hampton	21.6%	25.1%	12.0%	8.5%	19.0%	13.7%	0.1%
Wrangell City and Borough	18.8%	7.2%	19.3%	20.9%	26.1%	7.3%	0.5%
Yakutat City and Borough	4.8%	17.5%	28.6%	23.0%	19.0%	7.1%	0.0%
Yukon-Koyukuk	21.3%	24.8%	20.4%	14.0%	12.2%	6.6%	0.6%

Source: U.S. Census Bureau 2013



Source: U.S. Census Bureau 2013

Figure 3.1.9-5: Property Values

Table 3.1.9-7: Real Estate Taxes, Owner-Occupied Units with a Mortgage, 2013

	Less than $800	$800 to $1,499	$1,500 or More	No Real Estate Taxes Paid	Median (dollars)
United States	13.2%	18.4%	66.2%	2.2%	$2,382
State of Alaska	4.3%	9.1%	77.8%	8.8%	$3,174
Aleutians East Borough	0%	1%	1%	98%	1300
Aleutians West Census Area	0%	16%	56%	27%	$2,886
Anchorage Municipality	2%	5%	90%	3%	$3,796
Bethel Census Area	0%	3%	2%	95%	$1,471
Bristol Bay Borough	5%	7%	48%	40%	$1,952
Denali Borough	2%	0%	0%	98%	ND
Dillingham Census Area	4%	10%	44%	42%	$2,452
Fairbanks North Star Borough	4%	8%	80%	7%	$3,023
Haines Borough	21%	19%	57%	3%	$1,513
Hoonah-Angoon Census Area	2%	0%	20%	78%	$2,848
Juneau City and Borough	5%	6%	85%	4%	$2,912
Kenai Peninsula Borough	10%	30%	52%	8%	$1,642
Ketchikan Gateway Borough	8%	16%	73%	4%	$2,398
Kodiak Island Borough	6%	15%	73%	6%	$2,424
Lake and Peninsula Borough	0%	1%	0%	99%	$2,500
Matanuska-Susitna Borough	5%	10%	81%	4%	$2,738
Nome Census Area	12%	14%	24%	50%	$2,006
North Slope Borough	1%	4%	39%	56%	$2,369
Northwest Arctic Borough	0%	2%	5%	93%	$2,300
Petersburg Census Area	2%	16%	64%	18%	$2,178
Prince of Wales-Hyder Census Area	3%	13%	12%	71%	$1,322
Sitka City and Borough	9%	24%	56%	11%	$1,745
Skagway Municipality	4%	31%	64%	1%	$1,758
Southeast Fairbanks Census Area	0%	1%	4%	95%	$2,500
Valdez-Cordova Census Area	4%	9%	53%	33%	$2,350
Wade Hampton Census Area	7%	0%	3%	89%	ND
Wrangell City and Borough	15%	22%	45%	19%	$1,503
Yakutat City and Borough	16%	55%	14%	16%	$909
Yukon-Koyukuk Census Area	11%	7%	9%	72%	$900

Source: U.S. Census Bureau 2013

ND = no data

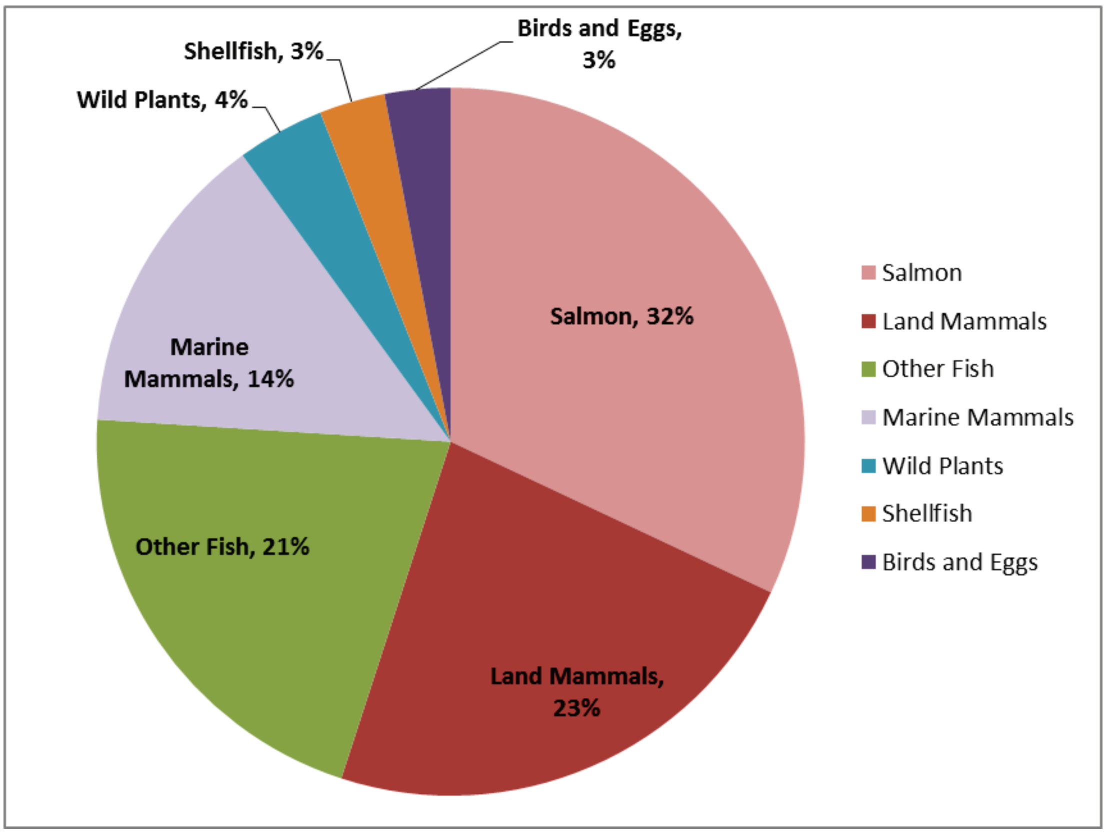
Subsistence

Statewide in 2012 (the most recent year for which data are available, "an estimated 36.9 million pounds of wild foods [were] harvested annually by rural subsistence users. Residents of more populated urban areas harvest about 13.4 million pounds of wild food under subsistence, personal use, and sport regulations" (*ADFG 2015b*). This equates to approximately 70 pounds of annual subsistence harvest per Alaska resident, regardless of location, and approximately 295 annual pounds per rural resident (*ADFG 2014*).

Subsistence hunters use their harvested animals as a source of food, and use the hides, bones, antlers, and organs for art, clothing, etc. Muskoxen are valued for the artwork made from their horns and for their soft underwool called qiviut (*ADFG 2015c*). Marine mammals are particularly important to coastal communities, while big game and fish are the main source of subsistence food for interior communities (*USFWS 2015*). Trapping for fur is also an important source of subsistence income, and is "particularly important in rural communities because it provides cash income during the winter when few jobs exist in most isolated villages. In the larger towns and villages, trapping income provides a supplement to salaries" (*Alaska Trappers Association 2015*).

Alaska Native communities rely heavily on subsistence resources such as fish as a source of sustenance and cultural identity, especially in remote communities that lack full-time employment opportunities (*NOAA 2015*). Walrus make up an important part of the diet of many coastal Alaska Natives. Tusks, bones, and hides are used to make authentic Alaska Native handicrafts, as well as many of the items necessary to continue a subsistence lifestyle (*USFWS 2015*).

Figure 3.1.9-6 shows the distribution of the total subsistence harvest by food type. Approximately 32 percent of the total subsistence harvest (by weight) was from salmon alone, while only 4 percent was from wild plants (*ADFG 2014*). The state estimates that the replacement value of this food (i.e., if purchased at a store) was between $200 and $400 million.



Source: ADFG 2014

Figure 3.1.9-6: Alaska Subsistence Harvest

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3.1.10. Environmental Justice

3.1.10.1. Introduction

This section presents select demographic data relevant to the assessment of environmental justice in Alaska. The United States (U.S.) Environmental Protection Agency (USEPA) defines environmental justice as "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" (*USEPA 2014*). Environmental justice issues arise when minority or low-income groups experience disproportionately adverse health or environmental effects. The Council on Environmental Quality's (CEQ) document titled *Environmental Justice: Guidance Under the National Environmental Policy Act* clarifies that environmental effects include ecological, cultural, human health, economic, and social impacts (*CEQ 1997*).

Potential environmental justice issues associated with the Proposed Action are most likely to occur within the confines of a particular place and at a local level. Therefore, the information in this section is presented at the U.S. Census block group level, the smallest geographic unit for which demographic data are readily available. The U.S. Census Bureau describes block groups as statistical divisions of census tracts, generally containing between 600 and 3,000 people, and typically covering a contiguous area. Block Groups do not cross state, county, or census tract boundaries, but may cross the boundaries of other geographic entities (*U.S. Census Bureau 2012*).

3.1.10.2. Specific Regulatory Considerations

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, is the basis for environmental justice analysis and is discussed in Section 1.8, Overview of Relevant Federal Laws and Executive Orders.

The analysis of the potential impacts of the Proposed Action on environmental justice issues follows guidelines described in the *Environmental Justice: Guidance Under the National Environmental Policy Act* (*CEQ 1997*). The analysis method has three steps: 1) describe the geographic distribution of low-income and minority populations in the affected area; 2) assess whether the potential impacts of construction and operation would produce impacts that are high and adverse; and, 3) if impacts are high and adverse, determine whether these impacts disproportionately affect minority and low income populations (*CEQ 1997*).

A description of the geographic distribution of minority and low-income groups in Alaska was based on U.S. Census Bureau demographic data. The following definitions provided by the *Environmental Justice: Guidance Under the National Environmental Policy Act* (*CEQ 1997*) were used to identify minority and low-income population groups:

- Minority populations consist of individuals who are members of the following population groups: American Indian or Alaska Native; Asian or Pacific Islander; Black, not of Hispanic origin; or, Hispanic; and
- Low-income populations consist of individuals living in poverty, as defined by the U.S. Census Bureau.

Since publication of the *Environmental Justice: Guidance under the National Environmental Policy Act* (*CEQ 1997*), the U.S. Census Bureau has changed how it defines race and ethnicity. Ethnicity (Hispanic or not Hispanic) is now counted separately from race. As a result, this Draft Programmatic Environmental Impact Statement (PEIS) considers both race and ethnicity separately for the purpose of evaluating minority status.

In 2014, the USEPA issued the *Policy on Environmental Justice for Working with Federally Recognized Tribes and Indigenous Peoples*, which establishes principles to ensure that achieving environmental justice is part of the USEPA's work with federally recognized tribes and Indigenous Peoples in all areas of the U.S. and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands, as well as others living in Indian country. The policy, which is based on Executive Order 12898 as well as USEPA strategic plan and policy documents, contains 17 principles pertaining to the policy's four focus areas. These four focus areas are:

- Direct implementation of federal environmental programs in Indian country and throughout the U.S.;
- Work with federally recognized tribes/tribal governments on environmental justice;
- Work with Indigenous Peoples (state recognized tribes, tribal members, etc.) on environmental justice; and
- Coordinate and collaborate with federal agencies and others on environmental justice issues of tribes, Indigenous Peoples, and others living in Indian country.

The policy includes accountability for the implementation of the policy, a definitions section, and an appendix that contains a list of implementation tools available.

Research for this section did not identify any Alaska-specific state, local, or tribal laws or regulations relevant to environmental justice for this Draft PEIS. However, the USEPA will implement the North Slope Communication Protocol for any proposed project that occurs in the North Slope of Alaska. The communication strategies in this protocol ensure that USEPA Region 10 practices culturally appropriate communications for each project by considering the cultural context of the North Slope communities and adapting communications to the values and practices of those communities (*USEPA 2009*).

3.1.10.3. Minority and Income Status

Table 3.1.10-1 shows the race and ethnicity of Alaska residents. Respondents to the U.S. Census may identify themselves as White, Black or African American, Asian, Native Hawaiian and Other Pacific Islander, American Indian or Alaska Native, some other race alone[1], or a combination of these primary races. In Alaska, 66.9 percent of residents identify themselves as white, and 3.5 percent identify themselves as Black or African American, compared to 74.0 percent and 12.6 percent, respectively, in the nation as a whole. Alaska Natives and American Indians comprise over 14 percent of Alaska's population, compared to less than 1 percent of the nation. Nearly 8 percent of Alaskans identify themselves as being of more than one race, compared to less than 3 percent of the national population *(U.S. Census Bureau 2013)*.

In the U.S. Census, ethnicity refers to being of Hispanic origin. Ethnicity is independent of race; Hispanic individuals may identify themselves as being of one or multiple races. As shown in Table 3.1.10-1, approximately 6 percent of Alaskans identify themselves as being Hispanic, compared to nearly 17 percent for the entire U.S.

Appendix E, *Environmental Justice Demographic Data*, provides demographic data characteristics for all block groups in Alaska, including race, ethnicity, poverty status, and income. These data form the basis for the analysis of environmental consequences in Section 3.2.10, Environmental Justice.

Table 3.1.10-1: Race and Ethnicity, Alaska

	Alaska		United States	
Race	**Number**	**Percent**	**Number**	**Percent**
White	481,638	66.9%	230,592,579	74.0%
Black/African American	25,033	3.5%	39,167,010	12.6%
American Indian/Alaska Native	101,273	14.1%	2,540,309	0.8%
Asian	39,200	5.4%	15,231,962	4.9%
Native Hawaiian/Pacific Islander	8,013	1.1%	526,347	0.2%
Some other race alone	8,402	1.2%	14,746,054	4.7%
Multiple Races	56,757	7.9%	8,732,333	2.8%
Ethnicity				
Hispanic or Latino	42,832	5.9%	51,786,591	16.6%
Not Hispanic or Latino	677,484	94.1%	259,750,003	83.4%
Total	**720,316**		**311,536,594**	

Source: U.S. Census Bureau 2013

[1] This definition includes all respondents who did not identify themselves as either White, Black or African American, American Indian or Alaska Native, Asian, or Native Hawaiian or Other Pacific Islander race categories, or as an individual of multiple races.

3.1.10.4. Identification of Potential for Environmental Justice Impacts

Environmental justice impacts of the Proposed Action would most likely occur at a local level. For example, if adverse impacts from dust and noise exposure from construction of a communication tower, changes in property values, or effects from operation of communications equipment occur disproportionately in a specific environmental justice community (or communities), then these could constitute an environmental justice impact. Therefore, the environmental justice screening analysis in this Draft PEIS uses the smallest geographic unit for which socioeconomic data are readily available, the Census Block Group. The U.S. Census Bureau defines this unit as follows:

> "Block groups are statistical divisions of census tracts, [and] are generally defined to contain between 600 and 3,000 people…A block group usually covers a contiguous area…block groups never cross state, county, or census tract boundaries but may cross the boundaries of any other geographic entity." (*U.S. Census Bureau 2012*)

In dense urban areas, a block group may only encompass a few city blocks. In rural areas, a block group may cover many square miles.

Because the specific location and deployment options of the Proposed Action have not been determined, this Draft PEIS identifies locations in Alaska where potential environmental justice impacts could be either more or less likely to occur. If the potential exists for environmental justice impacts from one or more aspects of the Proposed Action (such as noise, air quality, or visual impacts), additional analyses to identify environmental justice communities and assess specific impacts on those communities could be necessary as part of implementation. The remainder of this section describes the methodology for making that determination.

The CEQ provides some basic guidance on the choice of metrics for classifying minority populations (i.e., environmental justice communities):

> "Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50% or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." (*CEQ 1997*)

The CEQ also states that "low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the U.S. Census Bureau's Current Population Reports, Series P-60 on Income and Poverty" (*CEQ 1997*). Poverty thresholds are specific income levels that take into account factors such as family size. The federal government defines these levels annually for the nation. The U.S. Census Bureau defines a "poverty area" as an area (in this case, a block group) where more than 20 percent of the population is at or under the poverty level (*Bishaw 2014*).

Beyond this guidance, many aspects of environmental justice impacts are discretionary and are matters of precedent and best practice within particular agencies and among socioeconomic analysts. The CEQ also does not define “meaningfully greater,” nor does it define the “appropriate unit of geographic analysis” (per the quote above).

For the purpose of evaluating potential environmental justice impacts, the Draft PEIS uses the state of Alaska’s total population as the comparison group (the “general population or other appropriate unit” described in the quote above), hereafter called the reference population. The Draft PEIS also defines a low-income household as one whose income is less than or equal to two times the federal poverty level. This approach aligns with the USEPA’s approach to defining “low income” in its recently released EJSCREEN mapping tool (*USEPA 2015*).

The Draft PEIS evaluates the potential for environmental justice impacts along a spectrum, from low to high potential. The location along this spectrum is determined by the presence of one or more cases where the racial, ethnic, or low income characteristics of the block group’s population is “meaningfully greater” than the reference population’s characteristics. The Draft PEIS defines “meaningfully greater” as meeting or exceeding one or more of the following thresholds:

1. An overall racial (non-white) or ethnic (Hispanic or Latino) minority population whose share of the block group’s population is at least 20 percentage points greater than the reference population’s minority percentage. This is the U.S. Department of Housing and Urban Development’s definition of a “minority neighborhood” (*HUD Undated*).[2]
2. One or more individual racial or ethnic minority populations whose share of the block group’s population is at least 20 percentage points greater than the reference population’s comparable minority percentage.
3. An overall racial or ethnic minority population whose share of the block group’s population is at least 120 percent of the reference population’s minority population.
4. The share of low-income residents (those with a household income equal to or less than two times the federal poverty level) in the block group is at least 120 percent of the reference population’s low income level. For example, if 25 percent of the reference population is low income, the threshold applied to each block group is 30 percent.

Approximately 33 percent of Alaska’s population identifies itself as a racial minority (i.e., a race other than White or Caucasian). The same is true in a large proportion of Alaska’s block groups, although there are also a few block groups where more than 95 percent of the population identifies itself as a racial minority. While the state does not exceed the 50 percent threshold for racial and ethnic minorities recommended by CEQ guidelines, this threshold could nonetheless identify potential environmental justice impacts in block groups that are not necessarily “meaningfully” different from the rest of the state. As a result, the 50 percent threshold has not been applied to Alaska. Instead, the analysis of minority populations is based on the other thresholds described above.

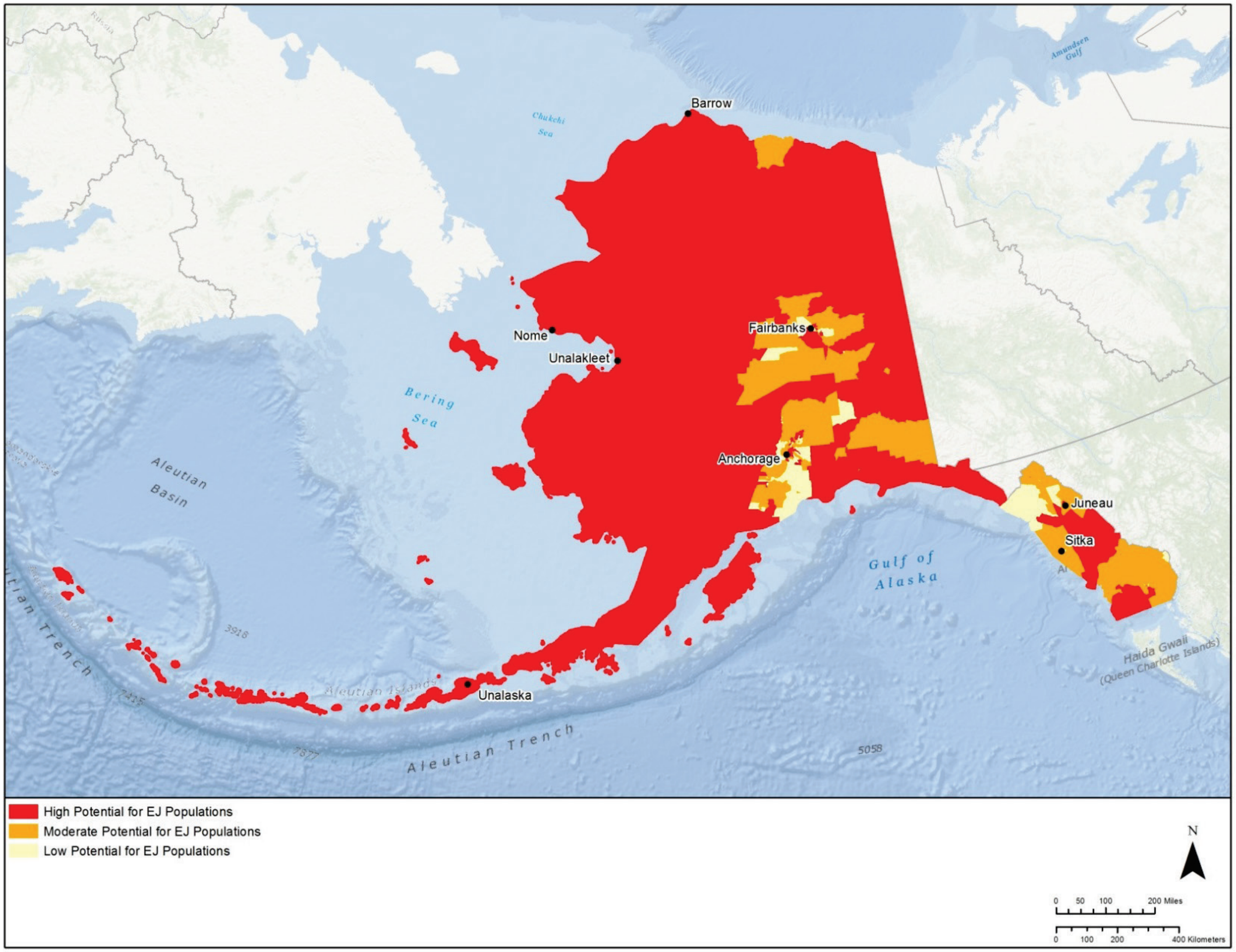
[2] Race (White, Black/African American, Asian, etc.) and ethnicity (Hispanic/Latino or not Hispanic/Latino) are separate categories, and are therefore considered separately.

The following combinations of the threshold characteristics listed above define three degrees of likelihood that a block group contains a potential environmental justice community:

- High Potential for Environmental Justice Communities
  - Greater than 20 percent of the block group's total population living in poverty; or
  - At least one minority population whose percentage of the block group's total population is at least 20 percentage points higher than that minority's share of the reference population; or
  - The combined minority share of the block group's overall population is at least 120 percent of the reference population's combined minority share.
- Moderate Potential for Environmental Justice Communities
  - Does not meet any of the above thresholds; and
  - At least one minority's share of the block group's overall population is at least 120 percent of that minority's share of the reference population; or
  - The low-income share of the block group's population is at least 120 percent below the 200 percent poverty level.
- Low Potential for Environmental Justice Communities
  - Does not meet any of the above thresholds

This Draft PEIS applies this methodology to all block groups in the state.

Figure 3.1.10-1 displays the results of the screening analysis, and shows the potential presence of environmental justice communities. A substantial portion of Alaska's block groups has a high potential for environmental justice communities, and therefore a high potential for impacts to those communities. These high-potential areas are found on all of Alaska's populated islands and cover a substantial portion of the mainland. Moderate-potential block groups are found near Fairbanks, Anchorage, Sitka, and Juneau. Moderate- and low-potential block groups appear to be clustered near major population centers such as Anchorage, Fairbanks, Juneau, and Sitka.



Source: U.S. Census Bureau 2013

Figure 3.1.10-1: Potential for Environmental Justice Populations

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3.1.11. Cultural Resources

3.1.11.1. Introduction

This section discusses cultural resources that are known to exist in Alaska. For the purposes of this Draft Programmatic Environmental Impact Statement (PEIS), cultural resources are defined as natural or manmade structures, objects, features, and locations with scientific, historic, and cultural value, including those with traditional religious or cultural importance, as well as any prehistoric or historic district, site, or building included in, or eligible for inclusion in, the National Register of Historic Places (NRHP).

This definition is consistent with how cultural resources are defined in:

- The statutory language and implementing regulations for Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), formerly *16 United States Code (USC) 470a(d)(6)(A)* (now *54 USC 306131(b)*) and *36 Code of Federal Regulations (CFR) 800.16(l)(1)*;
- The statutory language and implementing regulations for the Archaeological Resources Protection Act of 1979, *16 USC 470cc(c)* (now *54 USC 3203*) and *43 CFR 7.3(a)*;
- The statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act, *25 USC 3001(3)(D)* and *43 CFR 10.2(d)*; and
- National Park Service's guidance for evaluating and documenting traditional cultural properties (TCPs)[1] (*NPS 1998*).

Information is presented regarding cultural resources that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

3.1.11.2. Specific Regulatory Considerations

The Proposed Action is considered an undertaking as defined in *36 CFR 800*, the regulation implementing Section 106 of the NHPA. The intent of Section 106, as set forth in its attending regulations, is for federal agencies to take into account the effects of a proposed undertaking on historic properties,[2] which can include TCPs, and to consult with the Advisory Council on Historic Preservation, State Historic Preservation Offices, federally recognized American Indian tribes,[3] local governments, applicants for federal assistance, permits, licenses, and other

[1] TCPs are defined as a place "eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (*NPS 1998*).

[2] A historic property is defined as any "prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on the National Register [of Historic Places (NRHP)], including artifacts, records, and material remains relating to the district, site, building, structure, or object" (*54 USC 300308*).

[3] NHPA defines "Indian tribe" as "an Indian tribe, band, nation, or other organized group or community, including a Native village, Regional Corporation or Village Corporation (as those terms are defined in section 3 of the Alaska Native Claims Settlement Act (*43 USC 1602*), that is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians" (*54 USC 300309*).

approvals, as well as any other interested parties with a demonstrated interest in the proposed undertaking and its potential effects on historic properties.

The Alaska Office of History and Archaeology (OHA) and State Historic Preservation Office (SHPO) of the Department of Natural Resources is responsible for the preservation and protection of cultural resources and consultation with the Advisory Council on Historic Preservation, federal and state agencies, Alaska Natives tribes and organizations, and state residents regarding proposed undertakings under Section 106 and various other federal and state laws and regulations in Alaska.

In addition to Section 106 and the various federal laws and regulations discussed in Section 1.8, Overview of Relevant Federal Laws and Executive Orders, and Appendix C, *Environmental Laws and Regulations*, Alaska has adopted a state review process to preserve and protect cultural resources as part of any proposed federal or state projects.

The Alaska Historic Preservation Act (Alaska Statutes Chapter 41.35) establishes and implements a historic preservation program and procedures for other state agencies to consult with OHA and SHPO when considering their own projects, plans, and programs. Among other things, the law also established standards, permit programs, and review procedures and authority for cultural resources survey, excavation, and handling of human remains.

Based on the federal and state laws and regulations discussed above, the Proposed Action requires FirstNet to seek the review, consultation, and concurrence of the OHA and SHPO prior to deployment.

Federal agencies are required to consult with Alaska Native tribes and organizations as part of Section 106, but also as part of other federal historic preservation laws.[4] As stated in NHPA, the agency “shall make a reasonable and good faith effort to identify any [American] Indian tribes… that might attach religious and cultural significance to historic properties in the area of potential effects and invite them to be consulting parties” for the individual project (*36 CFR 800.3(f)(2)*).

In accordance with the Council on Environmental Quality’s guidance, entitled *NEPA and NHPA: A Handbook for Integrating NEPA and Section 106*, the NHPA Section 106 process is proceeding on a parallel path to the National Environmental Policy Act (NEPA) process. FirstNet has begun consultation with affected Alaska Native tribes and organizations as part of the NHPA and NEPA processes, and these consultations have informed the development of the cultural resources sections of this Draft PEIS.

[4] Consultation with American Indian tribes is specifically addressed in the Native American Graves Protection and Repatriation Act of 1990 and American Indian Religious Freedom Act of 1978. Additionally, Executive Memorandum Government-to-Government Relationship with Tribal Governments, Executive Order 13007 Indian Sacred Sites, Executive 13175 Consultation and Coordination with Indian Tribal Governments, and the Archaeological Resources Protection Act all direct, to the extent practicable, that most federal agencies consult with and involve federally recognized American Indian tribes.

3.1.11.3. Cultural Setting

As discussed above, cultural resources is a general term that can include a wide range of resources. Section 106 review commonly focuses on the identification of historic properties; however, historic properties are only a subset of cultural resources, and are but one aspect of the "human environment" defined by the NEPA regulations. The human environment, under NEPA, includes the natural and the physical (e.g., structures) environment, and the association of people to those environments. Therefore, a NEPA review must consider the cultural context in which the project effects would occur. The intent of this section is to describe the affected environment within this cultural context.

Cultural Context

Prehistoric Period

Due to Alaska's prominent location, vast size, and varying environments, Alaska's prehistory is complex. As a result, the following cultural context attempts to be concise as well as detailed enough to provide a context for the human environment and cultural resources. The following prehistoric cultural context does not follow one single cultural chronology for the state; instead, it has been divided into the Northern, Interior, and Southern Regions. Separating chronologies by region is an arbitrary division; as with regions and cultures, there is overlap inevitably. The historic context that follows the prehistoric overviews starts with Russian exploration in the 18th century and follows relatively chronologically, primarily focused on discussions concerning the major commercial or industrial themes in the state.

<u>Northern Region</u>

Paleoindian Period (ca. 11700 to 8000 BCE [Before Common Era])

Paleoindian sites are known in a variety of locations throughout northern and interior Alaska. The earliest sites in the northern Brooks Range and North Slope regions date to the terminal Pleistocene, a time period in which human population coexisted with and subsisted upon, now-extinct megafauna. The Mesa Site dates to between 11700 to 9700 BCE and is the best documented site of this period with 30 small hearths and associated stone tools (*Bever 2001*). Mesa complex sites exhibit classical traits of Paleoindian complexes elsewhere in North America, such as large, finely crafted lanceolate projectile points and other distinctive stone tools (*Kunz et al. 2003*).

American Paleoarctic Tradition (ca. 10,000 to 7000 BCE)

The American Paleoarctic Tradition appears in northern Alaska approximately 10000 BCE, overlapping with some Paleoindian sites but persisting some 1,000 years longer until approximately 7,000 years ago (*Anderson 1970; Dixon 1975; Reanier 2001*). The American Paleoarctic Tradition consists of a lithic core and blade technology characterized by wedge-shaped microblade cores, microblades, blades, burins, and ellipsoidal bifaces (*Anderson 1970*).

Lack of well-defined projectile points at American Paleoarctic sites indicate that projectile technology may have consisted of largely unpreserved bone or wood point styles (*Schoenberg 1995*).

Northern Archaic Tradition (ca. 6500 to 4000 BCE)

The Northern Archaic Tradition appears in northern Alaska approximately 6500 BCE, and is characterized by the appearance of side-notched projectile points. Some sites, such as the Tuktu site near Anaktuvuk Pass contain not only side-notched projectile points, but also have microblades and cores present, suggesting some level of continuity between the Paleoarctic and Northern Archaic (*Schoenberg 1995; Anderson 2008*).

Arctic Small Tool Tradition (ca. 4500 to 1200 BCE)

Evidence of the Arctic Small Tool Tradition appears in the archaeological record at approximately 4500 BCE. Sites of this tradition are somewhat common throughout the North Slope and Brooks Range (*Reanier and Kunz 2010*). Artifacts consist of exceptionally well made, tiny bifacial tools and projectile points. These artifacts are believed to represent the first material culture of the ancestral Iñupiat of northern and northwestern Alaska (*Kunz et al. 2003*). Additionally, such artifacts may indicate the introduction of bow and arrow technology to the arctic region (*Reanier and Kunz 2010*).

Prehistoric Eskimo/Thule (ca. 1500 CE [Common Era] to European Contact)

Thule, or Northern Maritime Tradition, represents the most immediate ancestors of modern Iñupiat peoples. The Thule Tradition is first seen in the archaeological record in north Alaska approximately 1500 CE. Northern Maritime Tradition sites are distinguished from earlier Ipiutak sites by distinctive artifact styles, and a technology that emphasized the extraction of marine resources including whales (*Kunz et al. 2003*).

Interior Region

Beringian Period (After 11500 BCE)

During the Beringian Period/Tradition, also referred to as the American Paleoarctic Tradition, North America and Asia were connected by a land bridge, allowing for the migration of animals and people between the two continents. Thus, the earliest sites found in interior Alaska relate to migrations from Asia into North America and the occupation of Beringia (*Edwards et al. 2002*). This is seen through the archaeological record where sites found in Siberia, Alaska, and the Canadian Yukon all possess the same types of artifacts and artifact styles, that is burins and microblades in early phase (*Holmes 2001*) and blade core technology but lacking microblades in later phases (*Powers and Hoffecker 1989; Pearson and Powers 2001; Goebel et al. 2003; West 1981*).

Transitional Period (ca. 11000 to 8500 BCE)

The Transitional Period was a time of an abruptly warming climate that saw the inundation of the land bridge between Asia and North America. It was during this time that regional cultural variation occurred in Alaska. Between 11000 and 8500 BCE most interior Alaska sites contained all the artifact types represented in the older sites; however, many of these sites also represented new tool technology found only in North America, such as the development of local variants of bifacial knife or point forms, and in distinctive microblade and burin technologies (*Holmes 2001*).

Taiga Period (ca. 8500 BCE to European Contact)

The Taiga Period is divided into early, middle, and late. The Early Taiga Period (8500 to 6000 BCE) is characterized by Northern Archaic sites, which are attributed to two behavioral patterns: 1) seasonal or long-term settlements, or 2) temporary hunting camps (*Esdale 2008; Wilson and Rasic 2008*). Northern Archaic tradition assemblages include notched projectile points, lanceolate points, scrapers, notched pebbles, burin technology, and microblade technology (*Esdale 2008*).

During the Middle Taiga Period (6000 to 3000 BCE) there was a continuing diversification of Northern Archaic lithic technologies, including the appearance of notched projectile points, notched pebbles, whetstones, abraders, burins, gravers, and polishing stones. *Esdale* (*2008*) suggests that during this time hunting strategies changed to include waterfowl, both small and large game, and possibly fish. In the Late Taiga Period (ca. 3000 to 250 BCE), a shift occurred toward the use of bone, antler, or copper. The shift away from lithic materials has been ascribed to changes in bow and arrow hunting technologies (*Holmes 2008*). The Athabaskan tradition emerged during the end of the late Taiga period.

Southern Region

Early Period (ca. 10000 to 6000 BCE)

Prior to 12000 BCE, glaciers blocked high altitude passes over the Alaska Range, and the waters of Cook Inlet encroached inland (*Reger 2003*). No evidence exists for Paleoindian or late Pleistocene occupation of the Susitna Valley and Broad Pass regions. However, recent research indicates use of the area as early as 10000 BCE (*Wygal and Goebel 2012*). Identified sites contain blade and core technology similar to the Denali Complex of interior Alaska, possibly indicating use of the area from 10000 to 8000 BCE. Lithic artifacts recovered from these sites include wedge-shaped cores, microblades, knives, and burins.

Middle Period (ca. 6000 to 3000 BCE)

The oldest known sites in Upper Cook Inlet, consistent with the Middle Period, indicate early use of the area by coastal Eskimo populations (*Schneider 2013*).

Late Period (ca. 3000 BCE to European Contact)

Early Dena'ina archaeological sites in the Cook Inlet region date as early as 1500 BCE. These sites typically contain large, multi-room, semi-subterranean houses, with earthen embankments and central hearths. Tools constructed out of wood and bone are common. Copper artifacts indicate trade with Ahtna groups along the Copper River as early as 1,000 years ago (*Reger 2003*).

Historic Overview (1741 to Present)

The historic period in Alaska is generally considered to have begun with Russian exploration of Alaska's Bering Strait and other coastal regions to the south and east in the early 18th century. This initial exploration precipitated boom in the fur trade and the subsequent Russian colonization of Alaska. Other economic pursuits soon followed, such as whaling, mining, trapping, and oil and gas extraction, continued exploration of Alaska by Euroamericans over the next two centuries. The following historic context is organized by major themes in Alaskan history.

<u>Euroamerican Exploration (1741 to 1867)</u>

Russian explorers trying to locate a northern passage ventured north along the western Alaskan coast, sighting the Diomede Islands and then the north Alaskan coast at Cape Prince of Wales (*Black 2004*). Captain Vitus Bering sailed into the straight that now bears his name, but it was not until Bering's voyages in 1741 to 1742 that the Russians discovered the sea otter in the Aleutian Islands. This discovery ushered in the fur trade in Alaska during the second half of the 18th century. Independent Russian fur traders gradually expanded their trade networks from the western Aleutians to Kodiak Island, the Cook Inlet, Prince William Sound, and southeast Alaska, while at the same time devastating Alaska Native populations (*Allan 2013*).

In the late 18th century, French, Spanish, and British explorers also visited Alaska. In 1778, British explorer Captain James Cook sailed through the Bering Strait and reached a point he named "Icy Cape", approximately 120 miles west of Barrow, while French explorers visited Alaska's southeast coasts and Spanish explorers sailed up the southeast coastline to Prince William Sound and eventually sailed to the Aleutians (*Allan 2013*).

The 19th century saw continued exploration of north Alaska. A Russian Expedition led by Otto von Kotzebue resulted in the naming of the Kotzebue Sound in 1816, and British expeditions through central Canada reached portions of the eastern Brooks Range and the Arctic coast of Canada in the 1820s. By the 1830s, Russian fur traders were pushing into the interior along the Yukon, Kuskokwim, and Koyukuk Rivers, and in 1850 British explorer John Simpson travelled up the Kobuk River and travelled through portions of the Brooks Range in 1850 (*Allan 2013*).

Following the purchase of Alaska in 1867 by the United States (U.S.), expeditions to the new territory by American prospectors, trappers, and government sponsored military and scientific explorers began. U.S. government sponsored expeditions were largely done with the aim to identify the resources of Alaska, and then to determine access routes to those resources (*Allan 2013*).

Historic Growth and Statehood (1867 to Present)

The major industries that followed American acquisition of Alaska included the fur trade, whaling, mining, and oil and gas development. All have seen highs and lows as initially abundant resources are identified, resources are extracted at a rapid pace, and the industry either moderates or goes away as a substantial industry (*Higgs and Proue 2010; Bockstoce 1978; Kurtak et al. 2002; Banet 1991*). Whereas the fur trade and whaling have seen the latter, mining and oil and gas development have been established for generations to come. However, what has been more significant for Alaska is how these industries have affected the populations of Alaska Natives and their subsistence practices (*Spencer 1984*), as well as, the booming populations that ultimately follow the resource booms. World War II also had a significant role in not only bringing an influx of people to the state, but also solidifying Alaska as an important and strategic part of the U.S. During this time, the U.S. government identified Alaska as a strategic military resource and invested heavily in developing and modernizing the state's infrastructure (e.g., airfield, roads, ports, and the communication system). Following the war and into the Cold War, Alaska's importance was realized, leading to statehood in 1959. Additional discoveries of significant resources of oil in 1968 have continued to increase populations, although, like in previous periods in Alaska's history, even the oil boom saw a bust in the 1980s. Although Alaska's populations have shifted throughout its modern history due to the resources that are within the state, Alaska's economy and, in turn, its populations are shaped by those very resources (*ADLWD 2013*).

Archaeological and Historic Resources

The above sections provide a basis for understanding the identification and evaluation of cultural resources as it relates to the cultural context of Alaska and the type of cultural resources that could exist within a project area of potential effect. Although site-specific information regarding cultural resources would need to be collected to define the affected environment of an individual project, the types of cultural resources that are currently listed on the NRHP across Alaska can provide an understanding of the types and range of potential archaeological and historic resources that should be considered and could be affected by the Proposed Action.

Table 3.1.11-1 provides a list of cultural resources that have been evaluated and designated significant to be listed on the NRHP. There are currently 494 cultural resources listed on the NRHP in Alaska. The cultural resources consist of archaeological sites and features; historic buildings, bridges, and railroads; military sites, features, and objects; cemeteries; historic districts; and cultural landscapes. Figure 3.1.11-1 shows the locations of the cultural resources listed in Table 3.1.11-1.

Table 3.1.11-1: Cultural Resources Listed on the NRHP

Property Name	Property Type	Borough	City
Adak Army Base and Adak Naval Operating Station	District	Aleutians West	Adak Station
St. Alexander Nevsky Chapel	Building	Aleutians West	Akutan
Attu Battlefield and U.S. Army and Navy Airfields on Attu	Site	Aleutians West	Aleutian Islands
Japanese Occupation Site, Kiska Island	Site	Aleutians West	Aleutian Islands
Temnac P-38G Lightning	Structure	Aleutians West	Aleutian Islands
Ananiuliak Island Archeological District	District	Aleutians West	Ananiuliak Island
Atka B-24D Liberator	Structure	Aleutians West	Atka
Holy Resurrection Church	Building	Aleutians West	Belkofski
Cape Field at Fort Glenn (Umnak Island)	District	Aleutians West	Fort Glenn
Anangula Archeological District	Site	Aleutians West	Nikolski
Chaluka Site	Site	Aleutians West	Nikolski
St. Nicholas Church	Building	Aleutians West	Nikolski
St. John the Theologian Church	Building	Aleutians West	Perryville
Port Moller Hot Springs Village Site	Site	Aleutians West	Port Moller
Seal Island Historic District	District	Aleutians West	Pribilof Islands
St. Nicholas Chapel	Building	Aleutians West	Sand Point
St. George the Great Martyr Orthodox Church	Building	Aleutians West	St. George Island
Sts. Peter and Paul Church	Building	Aleutians West	St. Paul Island
Church of the Holy Ascension	Building	Aleutians West	Unalaska
Dutch Harbor Naval Operating Base and Fort Mears, U.S. Army	District	Aleutians West	Unalaska
S.S. NORTHWESTERN Shipwreck Site	Structure	Aleutians West	Unalaska
Sitka Spruce Plantation	Site	Aleutians West	Unalaska
A. E. C. Cottage No. 23	Building	Anchorage	Anchorage
Alaska Engineering Commission Cottage No. 25	Building	Anchorage	Anchorage
Anchorage Cemetery	District	Anchorage	Anchorage
Anchorage City Hall	Building	Anchorage	Anchorage
Anchorage Depot	Building	Anchorage	Anchorage
Anchorage Hotel Annex	Building	Anchorage	Anchorage
Anderson, Oscar, House	Building	Anchorage	Anchorage
Beluga Point Site	Site	Anchorage	Anchorage
Bieri, Sam, House	Building	Anchorage	Anchorage
Campus Center	Building	Anchorage	Anchorage
Civil Works Residential Dwellings	Building	Anchorage	Anchorage
David, Leopold, House	Building	Anchorage	Anchorage
Eklutna Power Plant	Building	Anchorage	Anchorage
FAA DC-3 Aircraft N-99	Structure	Anchorage	Anchorage
Federal Building-U.S. Courthouse	Building	Anchorage	Anchorage
Fourth Avenue Theatre (AHRS Site No. ANC-284)	Building	Anchorage	Anchorage

Property Name	Property Type	Borough	City
Gill, Oscar, House	Building	Anchorage	Anchorage
KENI Radio Building	Building	Anchorage	Anchorage
Kimball's Store	Building	Anchorage	Anchorage
Lathrop Building	Building	Anchorage	Anchorage
Loussac-Sogn Building	Building	Anchorage	Anchorage
McKinley Tower Apartments	Building	Anchorage	Anchorage
Pioneer School House	Building	Anchorage	Anchorage
Potter Section House	Building	Anchorage	Anchorage
Site Summit	District	Anchorage	Anchorage
Wendler Building	Building	Anchorage	Anchorage
Wendler Building	Building	Anchorage	Anchorage
Spring Creek Lodge	Building	Anchorage	Chugiak
Alex, Mike, Cabin	Building	Anchorage	Eklutna
Old St. Nicholas Russian Orthodox Church	Building	Anchorage	Eklutna
Fort Richardson National Cemetery	District	Anchorage	Fort Richardson
Crow Creek Consolidated Gold Mining Company	Building	Anchorage	Girdwood
Mt. Alyeska Roundhouse	Building	Anchorage	Girdwood
Indian Valley Mine	District	Anchorage	Indian
Government Hill Federal Housing Historic District	District	Anchorage	Anchorage
First Mission House	Building	Bethel	Bethel
St. Sergius Chapel	Building	Bethel	Chuathbaluk
St. Nicholas Russian Orthodox Church	Building	Bethel	Kwethluk
Sts. Constantine and Helen Chapel	Building	Bethel	Lime Village
St. Seraphim Chapel	Building	Bethel	Lower Kalskag
St. Jacob's Church	Building	Bethel	Napaskiak
Kolmakov Redoubt Site	Site	Bethel	Sleetmute
DIL-161 Site	Site	Bristol Bay	Alagnak Wild River
Hull No. AK7258 (Bristol Bay Double Ender)	Structure	Bristol Bay	Dillingham
St. Nicholas Chapel	Building	Bristol Bay	Ekuk
Archeological Site 49 MK 10	Site	Bristol Bay	Kanatak
Fure's Cabin	Building	Bristol Bay	King Salmon
Brooks River Archeological District	District	Bristol Bay	Naknek
Old Savonoski Site	Site	Bristol Bay	Naknek
Savonoski River Archeological District	District	Bristol Bay	Naknek
Kijik Archeological District	District	Bristol Bay	Nondalton
Kijik Historic District	District	Bristol Bay	Nondalton
St. Nicholas Chapel	Building	Bristol Bay	Nondalton
Transfiguration of Our Lord Chapel	Building	Bristol Bay	Nushagak
St. Nicholas Chapel	Building	Bristol Bay	Pedro Bay
St. Nicholas Church	Building	Bristol Bay	Pilot Point
Elevation of Holy Cross Church	Building	Bristol Bay	South Naknek
Aniakchak Bay Historic Landscape District	District	Dillingham	Chignik

Property Name	Property Type	Borough	City
Fishermen's Co-op	Building	Dillingham	Dillingham
Pilgrim 100B Aircraft	Structure	Dillingham	Dillingham
St. Nicholas Chapel	Building	Dillingham	Igiugig
Archeological Site 49 AF 3	Site	Dillingham	Kanatak
Kaguyak Village Site	Site	Dillingham	Kanatak
Kukak Village Site	Site	Dillingham	Kanatak
Takli Island Archeological District	District	Dillingham	Kanatak
Amalik Bay Archeological District	District	Dillingham	King Salmon
Brooks Camp Boat House	Building	Dillingham	King Salmon
Brooks River Historic Ranger Station	Building	Dillingham	King Salmon
Chatanika Gold Camp	Building	Fairbanks North Star	Chatanika
Rainey's Cabin	Building	Fairbanks North Star	College
Ester Camp Historic District	District	Fairbanks North Star	Ester
Alaska House	Building	Fairbanks North Star	Fairbanks
Chena Pump House	Building	Fairbanks North Star	Fairbanks
City Hall, Old	Building	Fairbanks North Star	Fairbanks
Clay Street Cemetery (AHRS Site No. FAI-164)	Site	Fairbanks North Star	Fairbanks
Constitution Hall	Building	Fairbanks North Star	Fairbanks
Cripple Creek Site	Site	Fairbanks North Star	Fairbanks
Davis, Mary Lee, House	Building	Fairbanks North Star	Fairbanks
Discovery Claim on Pedro Creek	Site	Fairbanks North Star	Fairbanks
F. E. Company Housing	District	Fairbanks North Star	Fairbanks
F. E. Company Machine Shop	Building	Fairbanks North Star	Fairbanks
F. E. Company Manager's House	Building	Fairbanks North Star	Fairbanks
F.E. Company Dredge No. 2	Structure	Fairbanks North Star	Fairbanks
F.E. Company Gold Dredge No. 5	Structure	Fairbanks North Star	Fairbanks
Federal Building	Building	Fairbanks North Star	Fairbanks
Goldstream Dredge No. 8	District	Fairbanks North Star	Fairbanks
Harding Railroad Car	Structure	Fairbanks North Star	Fairbanks
Hinckley-Creamer Dairy	Building	Fairbanks North Star	Fairbanks
Illinois Street Historic District	District	Fairbanks North Star	Fairbanks
Immaculate Conception Church	Building	Fairbanks North Star	Fairbanks
Joslin, Falcon, House	Building	Fairbanks North Star	Fairbanks
Lacey Street Theatre	Building	Fairbanks North Star	Fairbanks
Ladd Field	District	Fairbanks North Star	Fairbanks
Main School	Building	Fairbanks North Star	Fairbanks
Masonic Temple	Building	Fairbanks North Star	Fairbanks
NENANA (steamer)	Structure	Fairbanks North Star	Fairbanks
Oddfellows House	Building	Fairbanks North Star	Fairbanks
Rose Building	Building	Fairbanks North Star	Fairbanks
Thomas, George C., Memorial Library	Building	Fairbanks North Star	Fairbanks
Wickersham House	Building	Fairbanks North Star	Fairbanks
Nabesna Gold Mine Historic District	District	Fairbanks North Star	Nabesna
Chugwater Site	Site	Fairbanks North Star	North Pole
Anway, Charlie, Cabin	Building	Haines	Haines
Eldred Rock Lighthouse	Structure	Haines	Haines

Property Name	Property Type	Borough	City
Fort William H. Seward	District	Haines	Haines
Government Indian School	Building	Haines	Haines
Pleasant Camp	Building	Haines	Haines
Pleasant Camp (Boundary Decrease)	Building	Haines	Haines
Porcupine District	District	Haines	Haines
Klawock Totem Park	District	Haines	Klawock
Dyea Site	Site	Haines	Skagway
Mayflower School	Building	Juneau	Douglas
Alaska Governor's Mansion	Building	Juneau	Juneau
Alaska Steam Laundry	Building	Juneau	Juneau
Alaskan Hotel	Building	Juneau	Juneau
Baranof Hotel	Building	Juneau	Juneau
Bergmann Hotel	Building	Juneau	Juneau
Chicken Ridge Historic District	District	Juneau	Juneau
Davis, J. M., House	Building	Juneau	Juneau
Frances House	Building	Juneau	Juneau
Fries Miners' Cabins	District	Juneau	Juneau
Gruening, Ernest, Cabin	Building	Juneau	Juneau
Holy Trinity Church	Building	Juneau	Juneau
Jualpa Mining Camp	District	Juneau	Juneau
Juneau Downtown Historic District	District	Juneau	Juneau
Juneau Memorial Library	Building	Juneau	Juneau
MacKinnon Apartments	Building	Juneau	Juneau
Point Retreat Light Station	District	Juneau	Juneau
Pribilof Aleut Internment Historic District	District	Juneau	Juneau
Sentinel Island Light Station	District	Juneau	Juneau
St. Nicholas Russian Orthodox Church	Building	Juneau	Juneau
Taku Lodge	Building	Juneau	Juneau
Thane-Holbrook House	Building	Juneau	Juneau
Twin Glacier Camp	District	Juneau	Juneau
Valentine Building	Building	Juneau	Juneau
Wickersham House	Building	Juneau	Juneau
Fort Durham Site	Site	Juneau	Taku Harbor
Rudy-Kodzoff House	Building	Juneau	Juneau
Cooper Landing Historic District	District	Kenai Peninsula	Cooper Landing
Cooper Landing Post Office	Building	Kenai Peninsula	Cooper Landing
Sts. Sergius and Herman of Valaam Church	Building	Kenai Peninsula	English Bay
Chugachik Island Site	Site	Kenai Peninsula	Homer
Cottonwood Creek Archeological Site	Site	Kenai Peninsula	Homer
Thorn-Stingley House	Building	Kenai Peninsula	Homer
Hirshey Mine	Site	Kenai Peninsula	Hope
Hope Historic District	District	Kenai Peninsula	Hope
Johnson, Harry A., Trapline Cabin	Building	Kenai Peninsula	Hope
Sunrise City Historic District	District	Kenai Peninsula	Hope
Holm, Victor, Homestead	District	Kenai Peninsula	Kasilof

Property Name	Property Type	Borough	City
Church of the Assumption of the Virgin Mary	Building	Kenai Peninsula	Kenai
Holm, Victor, Cabin	Building	Kenai Peninsula	Kenai
Alaska Nellie's Homestead	Building	Kenai Peninsula	Lawing
Lauritsen Cabin	Building	Kenai Peninsula	Moose Pass
Holy Transfiguration of Our Lord Chapel	Building	Kenai Peninsula	Ninilchik
Coal Village Site	Site	Kenai Peninsula	Port Graham
Selenie Lagoon Archeological Site	Site	Kenai Peninsula	Port Graham
St. Nicholas Chapel	Building	Kenai Peninsula	Seldovia
Alaska Central Railroad: Tunnel No. 1	Structure	Kenai Peninsula	Seward
Ballaine House	Building	Kenai Peninsula	Seward
Brown & Hawkins Store	Building	Kenai Peninsula	Seward
Diversion Tunnel	Structure	Kenai Peninsula	Seward
Government Cable Office	Building	Kenai Peninsula	Seward
Hoben Park	Site	Kenai Peninsula	Seward
Lee, Jesse, Home for Children	Building	Kenai Peninsula	Seward
Seward Depot	Building	Kenai Peninsula	Seward
St. Peter's Episcopal Church	Building	Kenai Peninsula	Seward
Swetman House	Building	Kenai Peninsula	Seward
Van Gilder Hotel	Building	Kenai Peninsula	Seward
Berg, Andrew, Cabin	Building	Kenai Peninsula	Soldotna
Soldotna Post Office	Building	Kenai Peninsula	Soldotna
Moose River Site	Site	Kenai Peninsula	Sterling
Yukon Island Main Site	Site	Kenai Peninsula	Yukon Island
Alaska Totems	Site	Ketchikan Gateway	Ketchikan
Ayson Hotel	Building	Ketchikan Gateway	Ketchikan
Burkhart-Dibrell House	Building	Ketchikan Gateway	Ketchikan
First Lutheran Church	Building	Ketchikan Gateway	Ketchikan
Gilmore Building	Building	Ketchikan Gateway	Ketchikan
Grant Street Trestle	Structure	Ketchikan Gateway	Ketchikan
Guard Island Lighthouse	District	Ketchikan Gateway	Ketchikan
Ketchikan Federal Building	Building	Ketchikan Gateway	Ketchikan
Ketchikan Ranger House	Building	Ketchikan Gateway	Ketchikan
McKay Marine Ways	Building	Ketchikan Gateway	Ketchikan
Stedman-Thomas Historic District	District	Ketchikan Gateway	Ketchikan
The Star	Building	Ketchikan Gateway	Ketchikan
Totem Bight State Historic Site	Building	Ketchikan Gateway	Ketchikan
Walker-Broderick House	Building	Ketchikan Gateway	Ketchikan
Ziegler House	Building	Ketchikan Gateway	Ketchikan
Clover Pass School	Building	Ketchikan Gateway	Knudson Cove
Chief Kashakes House	Building	Ketchikan Gateway	Saxman
Saxman Totem Park	District	Ketchikan Gateway	Saxman
Creek Street Historic District	District	Ketchikan Gateway	Ketchikan
Nativity of Holy Theotokos Church	Building	Kodiak Island	Afognak
Cape Alitak Petroglyphs District	District	Kodiak Island	Akhiok
Protection of the Theotokos Chapel	Building	Kodiak Island	Akhiok
Ascension of Our Lord Chapel	Building	Kodiak Island	Karluk

Property Name	Property Type	Borough	City
Agricultural Experiment Station Barn	Building	Kodiak Island	Kodiak
AHRS Site KOD-207	Site	Kodiak Island	Kodiak
American Cemetery	Site	Kodiak Island	Kodiak
Holy Resurrection Church	Building	Kodiak Island	Kodiak
Kad'yak	Site	Kodiak Island	Kodiak
Kodiak 011 Site	Site	Kodiak Island	Kodiak
Kodiak Naval Operating Base and Forts Greely and Abercrombie	Site	Kodiak Island	Kodiak
Russian-American Company Magazin	Building	Kodiak Island	Kodiak
Uganik Island Archeological District	District	Kodiak Island	Kodiak
Fort Abercrombie State Historic Site	Site	Kodiak Island	Kodiak Island
KOD-171 Site	Site	Kodiak Island	Larsen Bay
KOD-233 Site	Site	Kodiak Island	Larsen Bay
SS ALEUTIAN (Shipwreck)	Site	Kodiak Island	Larsen Bay
Three Saints Site	Site	Kodiak Island	Old Harbor
Nativity of Our Lord Chapel	Building	Kodiak Island	Ouzinkie
Sts. Sergius and Herman of Valaam Chapel	Building	Kodiak Island	Ouzinkie
Woody Island Historic Archeological District	District	Kodiak Island	Kodiak
Savonoski River Archeological District (Boundary Increase)	District	Lake and Peninsula	Brooks Camp
Kukak Cannery Archeological Historic District	District	Lake and Peninsula	Kukak Bay
Bly, Dr. Elmer, House	Building	Lake and Peninsula	Port Alsworth
Kasna Creek Mining District	District	Lake and Peninsula	Port Alsworth
LIBBY'S NO. 23 (Bristol Bay double ender)	Structure	Lake and Peninsula	Port Alsworth
Proenneke, Richard, Site	District	Lake and Peninsula	Port Alsworth
Wassillie Trefon Dena'ina Fish Cache	Structure	Lake and Peninsula	Port Alsworth
Long Lake Archeological Site	Site	Matanuska-Susitna	Glenn Highway
Tangle Lakes Archeological District (Boundary Decrease)	District	Matanuska-Susitna	Glennallen
Bailey Colony Farm	District	Matanuska-Susitna	Palmer
Berry House	Building	Matanuska-Susitna	Palmer
Campbell House	Building	Matanuska-Susitna	Palmer
Cunningham-Hall Pt-6,Nc-692W	Object	Matanuska-Susitna	Palmer
Herried House	Building	Matanuska-Susitna	Palmer
Hyland Hotel	Building	Matanuska-Susitna	Palmer
Independence Mines	Site	Matanuska-Susitna	Palmer
Matanuska Colony Community Center	District	Matanuska-Susitna	Palmer
Palmer Depot	Building	Matanuska-Susitna	Palmer
Patten Colony Farm	District	Matanuska-Susitna	Palmer
Puhl House	Building	Matanuska-Susitna	Palmer
Rebarchek, Raymond, Colony Farm	Building	Matanuska-Susitna	Palmer

Property Name	Property Type	Borough	City
St. Michael's Roman Catholic Church	Building	Matanuska-Susitna	Palmer
United Protestant Church	Building	Matanuska-Susitna	Palmer
Sutton Community Hall	Building	Matanuska-Susitna	Sutton
Curry Lookout	Building	Matanuska-Susitna	Talkeetna
Fairview Inn	Building	Matanuska-Susitna	Talkeetna
Kirsch's Place	Building	Matanuska-Susitna	Talkeetna
Talkeetna Airstrip	Structure	Matanuska-Susitna	Talkeetna
Talkeetna Historic District	District	Matanuska-Susitna	Talkeetna
Settlement and Economic Development of Alaska's Matanuska--Susitna Valley	Building	Matanuska-Susitna	Various
Knik Site	Building	Matanuska-Susitna	Wasilla
Teeland's Country Store	Building	Matanuska-Susitna	Wasilla
Tryck, Blanche and Oscar, House	Building	Matanuska-Susitna	Wasilla
Wasilla Community Hall	Building	Matanuska-Susitna	Wasilla
Wasilla Depot	Building	Matanuska-Susitna	Wasilla
Wasilla Elementary School	Building	Matanuska-Susitna	Wasilla
Whitney Section House	Building	Matanuska-Susitna	Wasilla
Teller Mission Orphanage	Building	Nome	Brevig Mission
Iyatayet Site	Site	Nome	Cape Denbigh Peninsula
Fairhaven Ditch	District	Nome	Deering
Trail Creek Caves Archeological Site	Site	Nome	Deering
Anvil Creek Gold Discovery Site	Site	Nome	Nome
Bear Rock Monument	Structure	Nome	Nome
Berger, Jacob, House	Building	Nome	Nome
Cape Nome Mining District Discovery Sites	District	Nome	Nome
Cape Nome Roadhouse	Building	Nome	Nome
Discovery Saloon	Building	Nome	Nome
Donaldson, LT. C. V.	Structure	Nome	Nome
Fort Davis Guardhouse	Building	Nome	Nome
Lindblom, Erik, Placer Claim	Site	Nome	Nome
McLain, Carrie, House	Building	Nome	Nome
Snow Creek Placer Claim No. 1	Site	Nome	Nome
St. Joseph's Catholic Church, Old	Building	Nome	Nome
Swanberg Dredge	Structure	Nome	Nome
Council City and Solomon River Railroad	District	Nome	Solomon
Solomon Roadhouse	Building	Nome	Solomon
Gambell Sites	Site	Nome	St. Lawrence Island
Fort St. Michael	Building	Nome	St. Michael
St. Michael Redoubt Site	Site	Nome	St. Michael
Norge Storage Site	Building	Nome	Teller
Pilgrim Hot Springs	Building	Nome	Teller
Bureau of Indian Affairs Unalakleet School	Building	Nome	Unalakleet
Wales Sites	District	Nome	Wales
Birnirk Site	Site	North Slope	Barrow
Point Barrow Refuge Station	Building	North Slope	Barrow
Rogers-Post Site	Site	North Slope	Barrow
Utkeagvik Church Manse	Building	North Slope	Barrow

Property Name	**Property Type**	**Borough**	**City**
Leffingwell Camp Site	Site	North Slope	Flaxman Island
Etivluk Lake Archeological District	District	North Slope	National Petroleum Reserve
Kinyiksukvik Lake Archeological District	District	North Slope	National Petroleum Reserve
Tukuto Lake Archeological District	District	North Slope	National Petroleum Reserve
Upper Colville Multiple Resource Archeological District	District	North Slope	National Petroleum Reserve
Ipiutak Archeological District	District	North Slope	Point Hope Peninsula
Ipiutak Site	Site	North Slope	Point Hope Peninsula
Prudhoe Bay Oil Field Discovery Well Site	Site	North Slope	Prudhoe Bay
Gallagher Flint Station Archeological Site	Site	North Slope	Sagwon
Aluakpak	Site	North Slope	Wainwright
Anaktuvuk	District	North Slope	Wainwright
Atanik	District	North Slope	Wainwright
Avalitkuk	Site	North Slope	Wainwright
Ivishaat	Site	North Slope	Wainwright
Kanitch	District	North Slope	Wainwright
Napanik	Site	North Slope	Wainwright
Negilik Site	Site	North Slope	Wainwright
Uyagaagruk	District	North Slope	Wainwright
Onion Portage Archeological District	District	Northwest Arctic	Kiana
Cape Krusenstern Archeological District National Monument	Site	Northwest Arctic	Kotzebue
Hydaburg Totem Park	District	Prince of Wales-Outer K.	Hydaburg
Storehouse No. 4	Building	Prince of Wales-Outer K.	Hyder
Chief Son-I-Hat's Whale House and Totems Historic District	District	Prince of Wales-Outer K.	Kasaan
Mary Island Light Station	Building	Prince of Wales-Outer K.	Ketchikan
Storehouse No. 3	Building	Prince of Wales-Outer K.	Ketchikan
Tree Point Lighthouse	District	Prince of Wales-Outer K.	Ketchikan
Duncan, Father William, House	Building	Prince of Wales-Outer K.	Metlakatla
Alaska Native Brotherhood Hall	Building	Sitka	Sitka
American Flag Raising Site	Site	Sitka	Sitka
Cable House and Station	Building	Sitka	Sitka
Emmons House	Building	Sitka	Sitka
Government School	Building	Sitka	Sitka
Hanlon-Osbakken House	Building	Sitka	Sitka
Lutheran Church of New Archangel Site	Site	Sitka	Sitka
Mills House	Building	Sitka	Sitka
Mills, W. P., House	Building	Sitka	Sitka
Murray Apartments and Cottages	District	Sitka	Sitka

Property Name	Property Type	Borough	City
Old Sitka Site	Site	Sitka	Sitka
Russian Bishop's House	Building	Sitka	Sitka
Russian-American Building No. 29	Building	Sitka	Sitka
See House	Building	Sitka	Sitka
Sheldon Jackson School	Building	Sitka	Sitka
Sitka National Cemetery	District	Sitka	Sitka
Sitka National Historical Park	District	Sitka	Sitka
Sitka Naval Operating Base and U.S. Army Coastal Defenses	District	Sitka	Sitka
Sitka Pioneers' Home	Building	Sitka	Sitka
Sitka US Post Office and Court House	Building	Sitka	Sitka
St. Michael's Cathedral	Building	Sitka	Sitka
St. Peter's Church	Building	Sitka	Sitka
U.S. Coast Guard and Geodetic Survey Seismological and Geomagnetic House	Building	Sitka	Sitka
Alexander Lake Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Beaver Lake Dam	Structure	Skagway-Hoonah-Angoon	Angoon
Big Shaheen Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Davidson Lake Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Distin Lake Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Hasselborg Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Hasselborg Lake East Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Hasselborg Lake North Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Hasselborg Lake South Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Lake Guerin East Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Lake Guerin West Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Mitchell Bay Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Mole Harbor Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
St. John the Baptist Church	Building	Skagway-Hoonah-Angoon	Angoon
Thayer Lake East Shelter Cabin	Site	Skagway-Hoonah-Angoon	Angoon
Thayer Lake North Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Thayer Lake South Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon

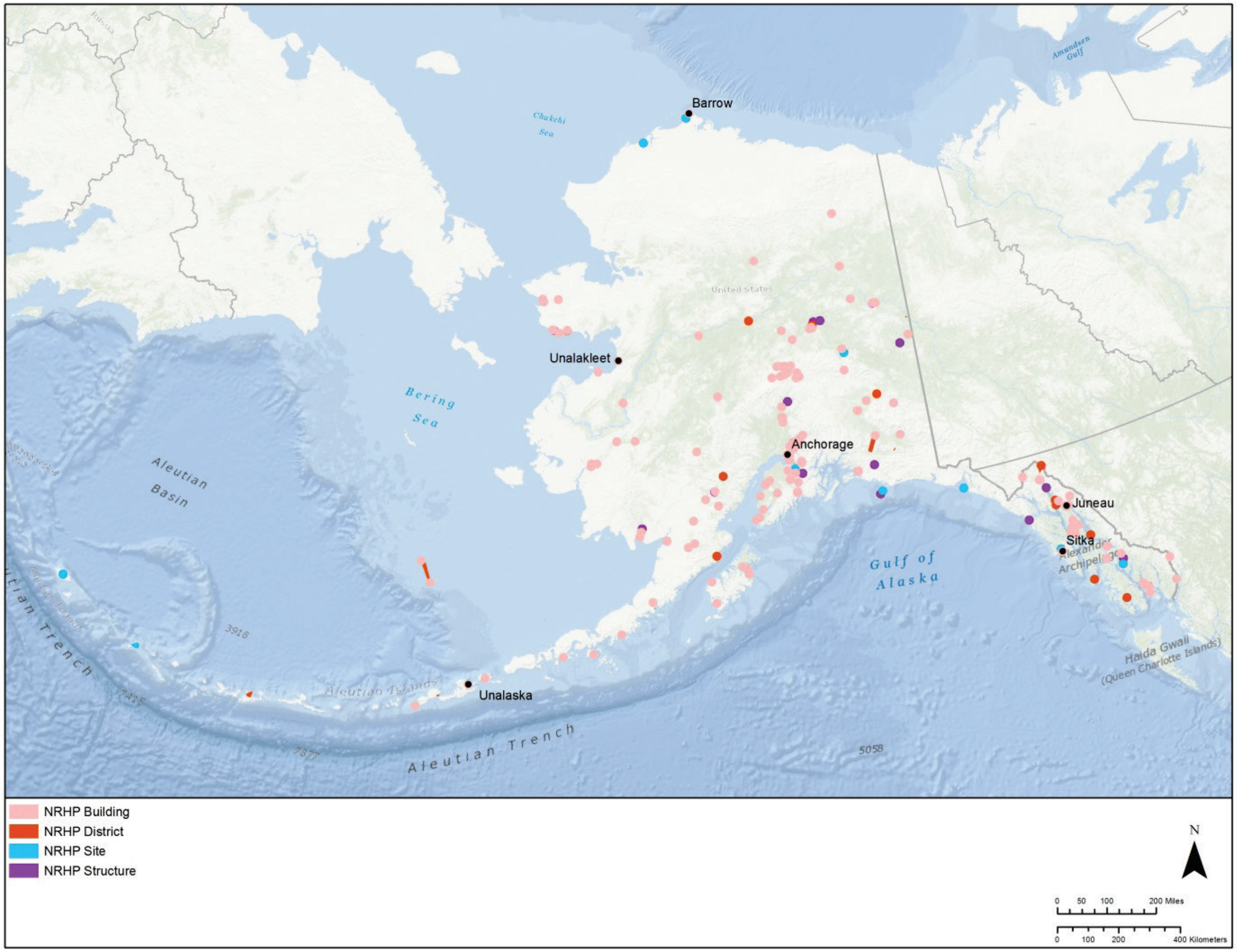
Property Name	Property Type	Borough	City
Windfall Harbor Shelter Cabin	Building	Skagway-Hoonah-Angoon	Angoon
Ground Hog Bay Archeological District	District	Skagway-Hoonah-Angoon	Hoonah
St. John the Baptist Chapel	Building	Skagway-Hoonah-Angoon	Naknek
Chilkoot Trail	District	Skagway-Hoonah-Angoon	Skagway
Klondike Gold Rush National Historical Park	District	Skagway-Hoonah-Angoon	Skagway
Skagway Historic District and White Pass	District	Skagway-Hoonah-Angoon	Skagway and
Cape Spencer Lighthouse	Structure	Skagway-Hoonah-Angoon	Yakutat
New Russia Site	Site	Skagway-Hoonah-Angoon	Yakutat
Yakutat and Southern Railway Company, Engine Number 2	Structure	Skagway-Hoonah-Angoon	Yakutat
Rika's Landing Roadhouse	Building	Southeast Fairbanks	Big Delta
Swan Point Archeological Site	Site	Southeast Fairbanks	Big Delta
F.E. Company Dredge No. 4	Structure	Southeast Fairbanks	Chicken
Haines, John, Homestead	District	Southeast Fairbanks	Delta
Rapids Roadhouse	Building	Southeast Fairbanks	Delta
Alaska-Canada Military Highway (Segment)	Structure	Southeast Fairbanks	Delta Junction
Big Delta Historic District	District	Southeast Fairbanks	Delta Junction
Sullivan Roadhouse	Site	Southeast Fairbanks	Delta Junction
Chicken Historic District	District	Southeast Fairbanks	Eagle
Eagle Historic District	District	Southeast Fairbanks	Eagle
Steele Creek Roadhouse	Building	Southeast Fairbanks	Eagle
Kink, The	Site	Southeast Fairbanks	Fairbanks
Chisana Historic Mining Landscape	District	Southeast Fairbanks	Northway
Slana Roadhouse	District	Southeast Fairbanks	Slana
Yukon River Lifeways	District/Site	Southeast Fairbanks	Yukon-Charley Rivers National Preserve
Chisana Historic District	District	Valdez-Cordova	Chisana
Bremner Historic Mining District	District	Valdez-Cordova	Chitina
Bremner Mining Camp Historic District	District	Valdez-Cordova	Chitina
Chitina Tin Shop	Building	Valdez-Cordova	Chitina
Copper River and Northwestern Railway	District	Valdez-Cordova	Chitina
Copper River and Northwestern Railway Bunkhouse and Messhouse	Building	Valdez-Cordova	Chitina
Dakah De'nin's Village Site	Site	Valdez-Cordova	Chitina
North Midas Mining Camp Historic District	District	Valdez-Cordova	Chitina
Bering River Train	Structure	Valdez-Cordova	Chugach National Forest
Valdez Trail-Copper Bluff Segment	Site	Valdez-Cordova	Copper City

Property Name	Property Type	Borough	City
Cape Hinchinbrook Light Station	District	Valdez-Cordova	Cordova
Cordova Post Office and Courthouse	Building	Valdez-Cordova	Cordova
Hegg's Photo Gallery	Building	Valdez-Cordova	Cordova
Million Dollar Bridge	Structure	Valdez-Cordova	Cordova
Palugvik Archeological District	Site	Valdez-Cordova	Cordova
Pioneer Igloo Hall Number 19	Building	Valdez-Cordova	Cordova
Reception Building	Building	Valdez-Cordova	Cordova
Red Dragon Historic District	District	Valdez-Cordova	Cordova
S.S. PORTLAND (Shipwreck)	Structure	Valdez-Cordova	Cordova
St. Michael the Archangel Church	Building	Valdez-Cordova	Cordova
Gakona Roadhouse	Building	Valdez-Cordova	Gakona
Chistochina Trading Post	Building	Valdez-Cordova	Gakona
Gakona Historic District	District	Valdez-Cordova	Gakona
Sourdough Lodge	Building	Valdez-Cordova	Gakona
Bering Expedition Landing Site	Site	Valdez-Cordova	Katalla
Cape St. Elias Lighthouse	Structure	Valdez-Cordova	Katalla
Chilkat Oil Company Refinery Site	Site	Valdez-Cordova	Katalla
Kennecott Mines	District	Valdez-Cordova	Kennecott
Green Butte Mining Camp Historic District	District	Valdez-Cordova	McCarthy
McCarthy General Store	Building	Valdez-Cordova	McCarthy
McCarthy Power Plant	Building	Valdez-Cordova	McCarthy
Paxson Lake BLM Archeological Site	Site	Valdez-Cordova	Paxson
Tangle Lakes Archeological District	District	Valdez-Cordova	Paxson
Kansky's	Building	Valdez-Cordova	Slana
Ahrens-Fox Continental Fire Engine	Object	Valdez-Cordova	Valdez
Mineral Development in Wrangell-St. Elias National Park and Preserve, Alaska	District/Building/Site	Valdez-Cordova	Wrangell-St. Elias National Park and Preserve
CCC Historic Properties in Alaska	Building/Structure/Site	Various	Various
Entrepreneurship and Exploitation along the Fairweather Coast and the Glacier Bay Vicinity	Structure/Site	Various	Various
European Exploration and Expansion in the Glacier Bay Region	Site	Various	Various
Homesteading and Related Settlement, Glacier Bay Region	Site/Structure/Building	Various	Various
Iditarod Trail	Structure	Various	Various
Light Stations of the United States	Structure/Site	Various	Various
Military Development and Infrastructure, Glacier Bay Region	Site/Structure	Various	Various

Property Name	Property Type	Borough	City
Rediscovery, Scientific Study, and Tourism within the Glacier Bay Region	Structure/Site	Various	Various
Russian Orthodox Church Buildings and Sites	Building/Site	Various	Various
Tourism and Early Park Development Resources of Katmai National Park and Preserve	Structure/Site	Various	Various
Valdez Trail	Structure	Various	Various
Kake Cannery	District	Wrangell-Petersburg	Kake
CHUGACH (Ranger Boat)	Structure	Wrangell-Petersburg	Petersburg
F/V CHARLES W (Schooner)	Structure	Wrangell-Petersburg	Petersburg
Five Finger Light Station	District	Wrangell-Petersburg	Petersburg
Sons of Norway Hall	Building	Wrangell-Petersburg	Petersburg
Cape Decision Light Station	District	Wrangell-Petersburg	Sitka
Chief Shakes Historic Site	Building	Wrangell-Petersburg	Wrangell
ETOLIN CANOE	Site	Wrangell-Petersburg	Wrangell
JUDITH ANN (Riverboat)	Structure	Wrangell-Petersburg	Wrangell
Lincoln Rock Lighthouse Site	Structure	Wrangell-Petersburg	Wrangell
Saint Philip's Episcopal Church	Building	Wrangell-Petersburg	Wrangell
Wrangell Public School	Building	Wrangell-Petersburg	Wrangell
Christ Church Mission	Building	Yukon-Koyukuk	Anvik
Mission Church	Building	Yukon-Koyukuk	Arctic Village
Bettles Lodge	Building	Yukon-Koyukuk	Bettles
Central House	Building	Yukon-Koyukuk	Central
Lost Chicken Mine	District	Yukon-Koyukuk	Chicken
Coal Creek Historic Mining District	District	Yukon-Koyukuk	Circle
Ewe Creek Ranger Cabin No. 8	Building	Yukon-Koyukuk	Denali National Park & Preserve
Igloo Creek Cabin No. 25	Building	Yukon-Koyukuk	Denali National Park & Preserve
Lower East Fork Ranger Cabin No. 9	Building	Yukon-Koyukuk	Denali National Park & Preserve
Lower Toklat River Ranger Cabin No. 18	Building	Yukon-Koyukuk	Denali National Park & Preserve
Lower Windy Creek Ranger Cabin No. 15	Building	Yukon-Koyukuk	Denali National Park & Preserve
Moose Creek Ranger Cabin No. 19	Building	Yukon-Koyukuk	Denali National Park & Preserve
Patrol Cabins, Mount McKinley National Park	Building	Yukon-Koyukuk	Denali National Park & Preserve
Riley Creek Ranger Cabin No. 20	Building	Yukon-Koyukuk	Denali National Park & Preserve
Sanctuary River Cabin No. 31	Building	Yukon-Koyukuk	Denali National Park & Preserve
Sushana River Ranger Cabin No. 17	Building	Yukon-Koyukuk	Denali National Park & Preserve
Toklat Ranger Station-Pearson Cabin No. 4	Building	Yukon-Koyukuk	Denali National Park & Preserve
Upper East Fork Cabin No. 29	Building	Yukon-Koyukuk	Denali National Park & Preserve

Property Name	Property Type	Borough	City
Upper Savage River Cabin No. 30	Building	Yukon-Koyukuk	Denali National Park & Preserve
Upper Toklat River Cabin No. 24	Building	Yukon-Koyukuk	Denali National Park & Preserve
Upper Windy Creek Ranger Cabin No. 7	Building	Yukon-Koyukuk	Denali National Park & Preserve
Mount McKinley National Park Headquarters District	District	Yukon-Koyukuk	Denali Park
Biederman, Ed, Fish Camp	Building	Yukon-Koyukuk	Eagle
McGregor, George, Cabin	Building	Yukon-Koyukuk	Eagle
New North Fork Washington-Alaska Military Cable and Telegraph System Relay Station	Building	Yukon-Koyukuk	Eagle
Slaven, Frank, Roadhouse	Building	Yukon-Koyukuk	Eagle
Taylor, James, Cabins	Building	Yukon-Koyukuk	Eagle
Woodchopper Roadhouse	Structure	Yukon-Koyukuk	Eagle
Miller House	Building	Yukon-Koyukuk	Fairbanks
Iditarod	District	Yukon-Koyukuk	Flat
Old Mission House	Building	Yukon-Koyukuk	Fort Yukon
Sourdough Inn	Building	Yukon-Koyukuk	Fort Yukon
Susitna River Bridge	Structure	Yukon-Koyukuk	Gold Creek
Mine Safety Car 5	Structure	Yukon-Koyukuk	Healy
Minchumina Archeological Site	Site	Yukon-Koyukuk	Lake Minchumina
Dry Creek Archeological Site	Site	Yukon-Koyukuk	Lignite
Minto Central Places and Cemeteries Historic District	Site	Yukon-Koyukuk	Minto
Nenana Depot	Building	Yukon-Koyukuk	Nenana
Tolovana Roadhouse	Building	Yukon-Koyukuk	Nenana
Presentation of Our Lord Chapel	Building	Yukon-Koyukuk	Nikolai
Ruby Roadhouse	Building	Yukon-Koyukuk	Ruby
Tanana Mission	District	Yukon-Koyukuk	Tanana
Teklanika Archeological District	District	Yukon-Koyukuk	Toklat

Source: Stutts 2014



Sources: Stutts 2014

Notes: Some of the cultural resources listed in Table 3.1.11-1 have sensitive locations (e.g., archaeological sites) and are not shown here.

Figure 3.1.11-1: Cultural Resources Listed on the NRHP

In addition to those listed on the NRHP, other known and unknown cultural resources exist across Alaska that have yet to be identified or evaluated for their significance. A cultural resources survey would need to be conducted to identify specific cultural resources of an individual project; however, through previous surveys and a general understanding of the cultural context, archaeological sites and historic resources are more typically found in certain locations given their size, type, and function.

Archaeological site potential is largely based on an area's habitation suitability, proximity to natural resources, and/or locational prominence/importance. For instance, habitation sites, both prehistoric and historic, are typically found in naturally protected, upland landforms close to a significant and consistent fresh water source and within proximity to food resources. However, habitation sites can vary based on seasonal considerations or be temporal based on their use as specific resource extraction locations, recognizing that environmental conditions may have changed over time. Proximity to resources can vary according to a combination of environmental conditions such as the size and nature of the water source (perennial versus intermittent) and/or extent and location of food sources. Topographic prominence is also often indicative of archaeological potential. Topographically prominent locations were likely desirable locations as they provided vantage points for observation, which would be useful for tracking wildlife or recognizing potential threats to the habitation site. The presence of an extractive resource can also raise the potential for archaeological sites in a given location. Large outcrops of preferred stone resources, for example, are often the location of quarry sites; in another example, wood or other structural building resources would be expected in heavily forested areas. Likewise, topographic prominence could be an important component of ceremonial or spiritual sites or cultural landscapes.

Traditional Cultural Properties and Cultural Resources of Traditional Religious or Cultural Importance

Traditional cultural properties and other cultural resources of traditional religious or cultural importance can include a wide range of tangible and intangible resources (e.g., archaeological sites and funerary objects, ceremonial places, traditional wildlife and plant gathering areas, and cultural landscapes). Section 106 consultation would provide the means of identifying the affected environment of these types of resources for an individual project (*NPS 1998*).

It is often difficult, if not impossible, to place strict boundaries on locations of traditional significance. Another complicating factor is that even when boundaries might be defined, members of cultural groups may not be willing to disclose such information to those outside of their communities for a number of reasons. Therefore, cultural sensitivity is needed to ensure protection of these important places (*ACHP 2008*). Types of traditional resources may include, but are not limited to, archaeological sites, burial sites, ceremonial sites, traditional hunting, fish ponds, plant gathering areas, trails, certain prominent geological features that may have spiritual significance (i.e., cultural landscapes), and viewsheds to and/or from sacred locations (*NPS 1998*).

Whereas traditional cultural properties are historic properties (they are eligible for listing in the NRHP), other cultural resources of traditional religious or cultural importance need to be considered as they are important to a community's practices and beliefs and are necessary for maintaining the community's cultural identity. FirstNet plans to work with the OHA and SHPO and Alaska Native tribes and organizations as part of the NHPA and NEPA processes, and these consultations will inform the development of the cultural resources sections of the Final PEIS. Although specific locations of traditional cultural properties and other cultural resources of traditional religious or cultural importance in Alaska are not currently known, FirstNet will maintain open, collaborative relationships with Alaska Native tribes and organizations throughout the NHPA consultation and NEPA public comment processes for all cultural groups.

3.1.11.4. Consultation

As discussed above, FirstNet has begun consultation with Alaska Native tribes and organizations as part of the NHPA and NEPA processes. FirstNet has engaged 227 Alaska Native tribes and organizations representing Alaska Native interests. These include:

- Agdaagux Tribe of King Cove
- Akiachak Native Community
- Akiak Native Community
- Alatna Village
- Algaaciq Native Village (St. Mary's)
- Allakaket Village
- Angoon Community Association
- Anvik Village
- Arctic Village
- Asa'carsarmiut Tribe
- Atqasuk Village (Atkasook)
- Beaver Village
- Birch Creek Tribe
- Central Council of the Tlingit & Haida Indian Tribes
- Chalkyitsik Village
- Cheesh-Na Tribe
- Chevak Native Village
- Chickaloon Native Village
- Chignik Bay Tribal Council
- Chignik Lake Village
- Chilkat Indian Village (Klukwan)
- Chilkoot Indian Association (Haines)
- Chinik Eskimo Community (Golovin)
- Chuloonawick Native Village
- Circle Native Community
- Craig Tribal Association
- Curyung Tribal Council
- Douglas Indian Association
- Egegik Village
- Eklutna Native Village
- Emmonak Village
- Evansville Village (aka Bettles Field)
- Galena Village (a.k.a., Louden Village)
- Gulkana Village
- Healy Lake Village
- Holy Cross Village
- Hoonah Indian Association
- Hughes Village
- Huslia Village

- Hydaburg Cooperative Association
- Igiugig Village
- Inupiat Community of the Arctic Slope
- Iqurmiut Traditional Council
- Ivanof Bay Village
- Kaguyak Village
- Kaktovik Village (aka Barter Island)
- Kasigluk Traditional Elders Council
- Kenaitze Indian Tribe
- Ketchikan Indian Corporation
- King Island Native Community
- King Salmon Tribe
- Klawock Cooperative Association
- Knik Tribe
- Kokhanok Village
- Koyukuk Native Village
- Levelock Village
- Lime Village
- Manley Hot Springs Village
- Manokotak Village
- McGrath Native Village
- Mentasta Traditional Council
- Naknek Native Village
- Native Village of Afognak
- Native Village of Akhiok
- Native Village of Akutan
- Native Village of Aleknagik
- Native Village of Ambler
- Native Village of Atka
- Native Village of Barrow Inupiat Traditional Government
- Native Village of Belkofski
- Native Village of Brevig Mission
- Native Village of Buckland
- Native Village of Cantwell
- Native Village of Chenega (aka Chanega)
- Native Village of Chignik Lagoon
- Native Village of Chitina
- Native Village of Chuathbaluk (Russian Mission, Kuskokwim)
- Native Village of Council
- Native Village of Deering
- Native Village of Diomede (aka Inalik)
- Native Village of Eagle
- Native Village of Eek
- Native Village of Ekuk
- Native Village of Ekwok
- Native Village of Elim
- Native Village of Eyak (Cordova)
- Native Village of False Pass
- Native Village of Fort Yukon
- Native Village of Gakona
- Native Village of Gambell
- Native Village of Georgetown
- Native Village of Goodnews Bay
- Native Village of Hamilton
- Native Village of Hooper Bay
- Native Village of Kanatak
- Native Village of Karluk
- Native Village of Kiana
- Native Village of Kipnuk

- Native Village of Kivalina
- Native Village of Kluti Kaah (aka Copper Center)
- Native Village of Kobuk
- Native Village of Kongiganak
- Native Village of Kotzebue
- Native Village of Koyuk
- Native Village of Kwigillingok
- Native Village of Kwinhagak (aka Quinhagak)
- Native Village of Larsen Bay
- Native Village of Marshall (aka Fortuna Ledge)
- Native Village of Mary's Igloo
- Native Village of Mekoryuk
- Native Village of Minto
- Native Village of Nanwalek (aka English Bay)
- Native Village of Napaimute
- Native Village of Napakiak
- Native Village of Napaskiak
- Native Village of Nelson Lagoon
- Native Village of Nightmute
- Native Village of Nikolski
- Native Village of Noatak
- Native Village of Nuiqsut (aka Nooiksut)
- Native Village of Nunam Iqua
- Native Village of Nunapitchuk
- Native Village of Old Harbor
- Native Village of Ouzinkie
- Native Village of Paimiut
- Native Village of Perryville
- Native Village of Pilot Point
- Native Village of Pitka's Point
- Native Village of Point Hope
- Native Village of Point Lay
- Native Village of Port Graham
- Native Village of Port Heiden
- Native Village of Port Lions
- Native Village of Ruby
- Native Village of Saint Michael
- Native Village of Savoonga
- Native Village of Scammon Bay
- Native Village of Selawik
- Native Village of Shaktoolik
- Native Village of Shishmaref
- Native Village of Shungnak
- Native Village of Stevens
- Native Village of Tanacross
- Native Village of Tanana
- Native Village of Tatitlek
- Native Village of Tazlina
- Native Village of Teller
- Native Village of Tetlin
- Native Village of Tuntutuliak
- Native Village of Tununak
- Native Village of Tyonek
- Native Village of Unalakleet
- Native Village of Unga
- Native Village of Venetie Tribal Government
- Native Village of Wales

- Native Village of White Mountain
- Nenana Native Association
- New Koliganek Village Council
- New Stuyahok Village
- Newhalen Village
- Newtok Village
- Nikolai Village
- Ninilchik Village
- Nome Eskimo Community
- Nondalton Village
- Noorvik Native Community
- Northway Village
- Nulato Village
- Nunakauyarmiut Tribe
- Organized Village of Grayling (aka Holikachuk)
- Organized Village of Kake
- Organized Village of Kasaan
- Organized Village of Kwethluk
- Organized Village of Saxman
- Orutsararmiut Traditional Native Council
- Oscarville Traditional Village
- Pauloff Harbor Village
- Pedro Bay Village
- Petersburg Indian Association
- Pilot Station Traditional Village
- Platinum Traditional Village
- Portage Creek Village (aka Ohgsenakale)
- Qagan Tayagungin Tribe of Sand Point Village
- Qawalangin Tribe of Unalaska
- Rampart Village
- Saint George Island (See Pribilof Islands Aleut Communities of St. Paul & St. George Island)
- Seldovia Village Tribe
- Shageluk Native Village
- Sitka Tribe of Alaska
- Skagway Village
- South Naknek Village
- Stebbins Community Association
- Sun'aq Tribe of Kodiak
- Takotna Village
- Tangirnaq Native Village (aka Woody Island)
- Telida Village
- Traditional Village of Togiak
- Tuluksak Native Community
- Twin Hills Village
- Ugashik Village
- Umkumiut Native Village
- Village of Alakanuk
- Village of Anaktuvuk Pass
- Village of Aniak
- Village of Atmautluak
- Village of Bill Moore's Slough
- Village of Chefornak
- Village of Clarks Point
- Village of Crooked Creek
- Village of Dot Lake
- Village of Iliamna
- Village of Kalskag

- Village of Kaltag
- Village of Kotlik
- Village of Lower Kalskag
- Village of Ohogamiut
- Village of Red Devil
- Village of Salamatof
- Village of Sleetmute
- Village of Solomon
- Village of Stony River
- Village of Venetie
- Village of Wainwright
- Wrangell Cooperative Association
- Yakutat Tlingit Tribe
- Yupiit of Andreafski

FirstNet has received a few responses from among the many Alaska Native tribes or organizations regarding their initial invitation to consult under NHPA, including the Nome Eskimo Community and the Yakutat Tlingit Tribe. Additionally, FirstNet has met with a representative from the Organized Village of Kake. Throughout the Environmental Impact States process, FirstNet will continue to maintain open and collaborative dialogue to inform the NHPA and NEPA processes.

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3.1.12. Air Quality

3.1.12.1. Introduction

This section discusses the existing air quality conditions in Alaska. Information is presented regarding air quality characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action. Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[1] of the area, and the prevailing weather and climate conditions. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[2] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time. The U.S. Environmental Protection Agency (USEPA) designates areas within the United States as attainment,[3] nonattainment,[4] maintenance,[5] or unclassifiable[6] depending on the concentration of air pollution relative to ambient air quality standards.

3.1.12.2. Specific Regulatory Considerations

Air quality and emissions of atmospheric pollutants are regulated under the Clean Air Act (CAA). The CAA establishes limits on how much air pollution can exist in an area at any given time, based on local climatological factors. These limits are known as the National Ambient Air Quality Standards (NAAQS). The USEPA has established NAAQS for six common pollutants, known as criteria pollutants. These include carbon monoxide (CO), lead, nitrogen dioxide, ozone, particulate matter (PM), and sulfur dioxide (*USEPA 2013c*). Local air quality protection and permitting in Alaska is primarily the responsibility of the Alaska Department of Environmental Conservation (DEC); the USEPA Region 10 is responsible for Native American lands and the outer continental shelf (*USEPA 2014c* and *USEPA 2014b*). Alaska DEC enforces the federal NAAQS as well as several State Ambient Air Quality Standards (SAAQS). In addition to the six criteria pollutants, the SAAQS also includes standards for ammonia and reduced sulfur dioxide, which are not criteria pollutants. For each pollutant, the most stringent standard in Alaska must be adhered to (throughout this section, the term AAQS [ambient air quality standards] is used to refer to the most stringent standard, inclusive of NAAQS and SAAQS). Table 3.1.12-1 below summarizes the NAAQS and SAAQS in Alaska.

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[1] The unique features and shapes of the land (e.g., valleys and mountains).

[2] Equivalent to 1 milligram per liter.

[3] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (*USEPA 2015d*).

[4] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (*USEPA 2015d*).

[5] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (*40 Code of Federal Regulations 93.152*).

[6] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (*USEPA 2015d*).

Table 3.1.12-1: Ambient Air Quality Standards in Alaska

Pollutant	Averaging Period	NAAQS (Primary Standard)[a]	NAAQS (Secondary Standard)[b]	SAAQS
Ammonia	8-hour	None	None	2.1 mg/m^3
Carbon monoxide	8-hour	9 ppm (10 mg/m^3)	None	Same as NAAQS
	1-hour	35 ppm (40 mg/m^3)	None	Same as NAAQS
Lead	3-month average	0.15 μg/m^3 (rolling 3-month)	Same as primary	Same as NAAQS
Nitrogen dioxide	Annual	0.053 ppm (100 μg/m^3)	Same as primary	Same as NAAQS
	1-hour	0.1 ppm (188 μg/m^3)	None	Same as NAAQS
Ozone	8-hour	0.075 ppm	Same as primary	Same as NAAQS
Particulate matter: PM_{10}	24-hour	150 μg/m^3	Same as primary	Same as NAAQS
Particulate matter: $PM_{2.5}$	Annual	12 μg/m^3	15 μg/m^3	15 μg/m^3
	24-hour	35 μg/m^3	Same as primary	Same as NAAQS
Sulfur dioxide	Annual	None (revoked)[c]	None	80 μg/m^3
	24-hour	None (revoked)[c]	None	365 μg/m^3
	3-hour	None	0.5 ppm (1,300 μg/m^3)	Same as NAAQS
	1-hour	0.075 ppm (196 μg/m^3)	None	Same as NAAQS
Sulfur dioxide (reduced)	30-min	None		50 μg/m^3

Source: USEPA 2014a and 18 Alaska Administrative Code (AAC) 50.010 Ambient Air Quality Standards

μg/m^3= microgram(s) per cubic meter ; mg/m^3 = milligram(s) per cubic meter; PM_{10} = particulate matter up to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; ppm = parts per million
[a] Primary standards are set to protect public health.
[b] Secondary standards are set to protect public welfare, including visibility and crops.
[c] Revoked means the previous pollutant standard has been retracted and is no longer valid.

States and territories must establish enforceable plans, known as State Implementation Plans (SIPs), to achieve their AAQS. Regions that are not in compliance with AAQS (i.e., exceed the AAQS limits) are known as nonattainment areas. Those that are in compliance are known as attainment areas. Those without sufficient data are designated unclassifiable and generally have the same obligations as attainment areas. Regions that have previously exceeded the AAQS and subsequently improved air quality to become in compliance are re-designated as maintenance areas. Regions can be classified as in attainment for some criteria pollutants and nonattainment for others. SIPs must describe how the state or territory will maintain compliance in attainment and maintenance areas and will improve air quality in nonattainment areas (*USEPA 2013c*).

In addition to regulating ambient air quality, the CAA also establishes limits on the level of air pollution that can be emitted from both stationary (e.g., manufacturing facility) and non-stationary (e.g., motor vehicle) emission sources. For stationary sources, states and territories may implement more stringent standards than those set by the USEPA. For mobile sources, states or territories must adopt standards set by either USEPA or California (*USEPA 2013c*).

The key permitting programs for major stationary sources are Prevention of Significant Deterioration (PSD) and Nonattainment New Source Review (NANSR). The PSD program ensures that clean air (in attainment, maintenance, and unclassifiable areas) is not degraded by new or modified major sources. To obtain a PSD permit, proposed sources must:

- Be designed with best available control technology giving consideration to cost and other factors;
- Show that the added emissions will not cause or contribute to an air pollution increase in excess of the allowable increment, any NAAQS, or any other applicable CAA emissions standard; and
- Show that the added emissions will not have an adverse impact on air-quality related values in a Class I area[7] such as a national park or wilderness area (*USEPA 2013c*).

The NANSR program ensures that proposed major stationary sources will not further degrade air quality in locations where AAQS are not being met (i.e., nonattainment areas). To obtain an NANSR permit, proposed sources must:

- Be designed for the lowest achievable emission rate; and
- Obtain emission offsets (certified reductions in air pollution from existing facilities in the region) to provide a net air quality benefit (*USEPA 2013c*).

Stationary sources may also be subject to federal air quality regulations under the New Source Performance Standards or National Emission Standards for Hazardous Air Pollutants.

Air pollution from mobile sources is managed primarily through vehicle and fuel standards. Vehicle standards set limits for fuel efficiency and are the basis for state vehicle emissions inspection programs. Fuel standards regulate the amount of sulfur in gasoline and diesel fuels.

Other regulatory programs that may potentially be involved with deployment and operation of the Proposed Action include visibility protection and conformity. Haze[8] is one of the most basic forms of air pollution and it degrades visibility in many U.S. cities and scenic areas (*USEPA 2015c*). National parks and scenic areas are protected from air pollution associated with both new and existing sources of air emissions due to visibility concerns from haze. Protection from new sources of air pollution occurs through the PSD program discussed above. Protection from existing sources occurs through the USEPA's 1999 Regional Haze Rule, which set goals of preventing future and remedying existing impairment in Class I Areas. States are required to adopt progress goals every 10 years, with the ultimate goal of achieving natural background conditions, or conditions which existed before manmade pollution, by 2064 (*USEPA 2010*).

[7] Class I areas are national parks and wilderness areas in attainment or unclassifiable areas that exceed 5,000 acres in size and were in existence on August 7, 1977.

[8] Haze is caused when sunlight encounters tiny pollution particles in the air. Some light is absorbed by particles; other light is scattered away before it reaches an observer. More pollutants mean more absorption and scattering of light, which reduce the clarity and color of what we see. Some types of particles, such as sulfates, scatter more light, particularly during humid conditions.

Federal departments and agencies are prohibited from taking actions in nonattainment and maintenance areas without first demonstrating that the actions would conform to the state or territory's SIP. The CAA conformity requirements ensure that federal activities will not: 1) cause or contribute to new air quality violations; 2) worsen existing violations; or 3) delay attainment of AAQS. The transportation conformity requirements apply to projects funded by or requiring approval from the Federal Highway Administration or those related to a project funded under the Federal Transit Act, and thus would not apply to the Proposed Action. The general conformity requirements apply to other federal actions and may apply to the Proposed Action (*18 Alaska Administrative Code [AAC] 50 Article 7* and *USEPA 2013c*).

3.1.12.3. Ambient Air Quality

One of the key indicators of current ambient air quality in a state or territory is the compliance status of each region compared to the AAQS (refer to Table 3.1.12-1 above). Compliance is typically evaluated by county or, in some cases, large cities. As mentioned above, Alaska is divided into boroughs and census zones rather than counties. The current nonattainment and maintenance areas within Alaska are listed in Table 3.1.12-2.

Table 3.1.12-2: Nonattainment and Maintenance Areas in Alaska

Pollutant (Standard)	Area	Nonattainment Classification	Nonattainment Date	Reclassification Date	2010 Population
Areas in Nonattainment Status					
Particulate Matter: $PM_{2.5}$ (2006)	Fairbanks North Star Borough	Moderate	Dec 2009	NA	87,456
Areas in Maintenance Status					
Carbon monoxide (1971)	Anchorage Area	Serious	Nov 1990	Jul 2004	286,227
	Fairbanks Area	Serious	Nov 1990	Sep 2004	46,211
Particulate Matter: PM_{10} (1987)	Anchorage; Eagle River	Moderate	Nov 1990	Sep 2010	219,193
	Juneau; Mendenhall Valley area	Moderate	Nov 1990	May 2009	14,030

Source: USEPA 2015a, USEPA 2015b.

$PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; NA = not available; PM_{10} = particulate matter up to 10 micrometers in diameter

A portion of the Fairbanks North Star Borough, including the City of Fairbanks and the City of North Pole, was designated as being a nonattainment area for particulate matter up to 2.5 micrometers in diameter ($PM_{2.5}$) in December 2009. These areas exceeded the health-based 24-hour exposure limit of 35 $\mu g/m^3$. The key contributors of PM in these areas are wood stoves, burning of distillate oil, industrial sources, and mobile emissions. Regarding exposure, $PM_{2.5}$ is primarily a concern during the winter months (October through March) when extremely strong temperature inversions are frequent and human-caused air pollution impacts increase. Summertime smoke from wild fires are also a health concern, but are addressed as natural, uncontrollable, exceptional events (*ADEC 2015*).

Emissions of particulate matter up to 10 micrometers in diameter (PM_{10}) and carbon monoxide are also of concern. Portions of Anchorage, Fairbanks, and Juneau have previously been in nonattainment with at least one of these pollutants. Additionally, rural areas of Alaska are considered at risk for PM_{10} and $PM_{2.5}$ air pollution. The primary programs that Alaska implements to maintain acceptable concentrations of PM is the Wood Smoke Control Program. Emissions of CO in Alaska are primarily a result of motor vehicles, with smaller contributions from aircrafts, wood burning, and natural gas space heating. The primary programs for managing CO are the Vehicle Inspection/Maintenance Program, the Share-A-Ride/Vanpool Program, and the block heater promotion program.

For proposed new or modified major stationary sources, Alaska follows the federal permitting programs referenced above, PSD and NANSR *(18 AAC Chapter 50; 40 Code of Federal Regulations [CFR] Part 52.21)*. Alaska also implements minor source construction and operating permit programs. The type of permit required in Alaska is primarily based on: 1) the location of the proposed stationary source (attainment/maintenance vs. nonattainment area); 2) the type of proposed stationary source; and 3) the potential amount of air pollutants that could be emitted per year from the proposed source. Emissions thresholds for new stationary sources are as follows: PSD triggered if facility-wide potential emissions of any criteria pollutant exceed 250 tons per year (tpy); NANSR triggered if facility-wide potential emissions of $PM_{2.5}$ exceed 100 tpy. For modified stationary sources, the PSD thresholds vary by pollutant; the NANSR threshold for $PM_{2.5}$ is 10 tpy (*40 CFR 51.166* and *18 AAC 50.306*). Minor source permitting thresholds also vary by pollutant.

Alaska has defined four air quality control regions (AQCRs) related to PSD standards: Cook Inlet Intrastate AQCR (AQCR 8), Northern Alaska Intrastate AQCR (AQCR 9), South Central Alaska Intrastate AQCR (AQCR 10), and Southeast Alaska Intrastate AQCR (AQCR 11) *(40 CFR Part 81, Appendix A; 18 AAC 50.015, Air quality designations, classifications, and control regions*).

In implementing the federal PSD program, Alaska DEC ensures that air quality throughout the state is not degraded by proposed major sources, specifically ensuring that a proposed major source would not cause ambient air concentrations to increase by more than the allowable thresholds listed in Table 3.1.12-3.

Table 3.1.12-3: PSD Allowable Increase Increments

Pollutant	Averaging Period	PSD Increment (µg/m³)	
		Class I Area[a]	Class II Area[b]
Nitrogen dioxide	Annual	2.5	25
Particulate matter: PM_{10}	Annual	4	17
	24-hour	8	30
Particulate matter: $PM_{2.5}$	Annual	1	4
	24-hour	2	9
Sulfur dioxide	Annual	2	20
	24-hour	5	91
	3-hour	25	512

Source: 40 CFR 51.166c and 18 AAC 50.020

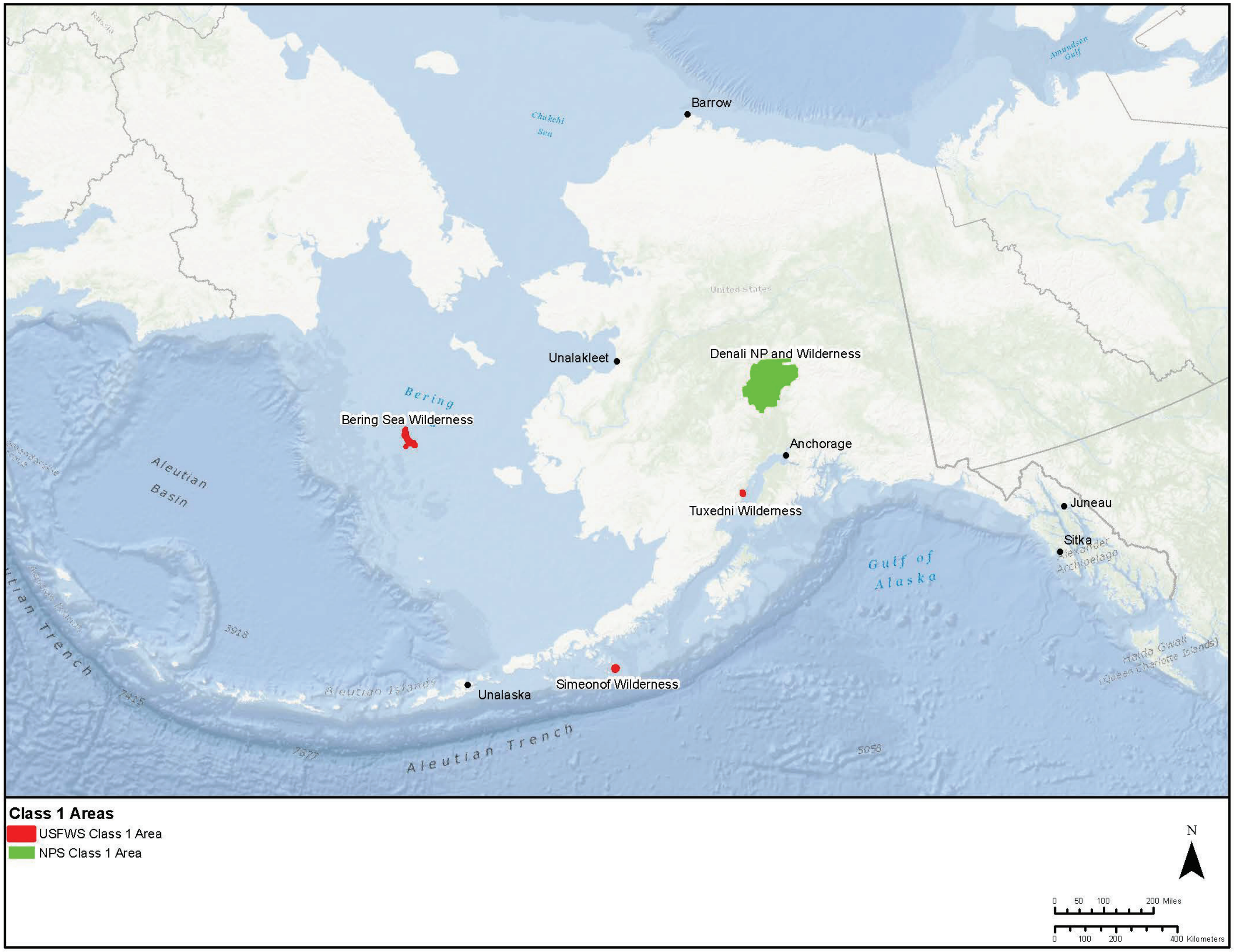
$\mu g/m^3$ = micrograms per cubic meter; PM_{10} = particulate matter up to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter
[a] Class I areas are national parks and wilderness areas in attainment or unclassifiable areas that exceed 5,000 acres in size and were in existence on August 7, 1977
[b] Class II areas are all other attainment or unclassifiable areas outside Class I areas

Note that thresholds are lower for Class I Areas, which receive greater protection. Also note that a stationary source could impact a Class I Area that is nearby; in other words, proposed sources must consider how much their emissions will travel and impact any nearby Class I Areas. Alaska's Class I Areas are shown below in Table 3.1.12-4 and Figure 3.1.12-1.

Table 3.1.12-4: Alaska Class I Areas

Class I Area	Size (acres)	Federal Land Manager
Bering Sea Wilderness Area	41,113	Fish and Wildlife Service
Denali National Park (formerly Mt. McKinley National Park)	1,949,493	National Park Service
Simeonof Wilderness Area	25,141	Fish and Wildlife Service
Tuxedni Wilderness Area	6,402	Fish and Wildlife Service

Source: USEPA 2012b



Source: USFWS 2006; NPS 2007

Figure 3.1.12-1: Alaska Class I Areas

Class I Areas are also protected through visibility protection programs, including the USEPA's 1999 Regional Haze Rule, which is discussed in Section 3.1.12.2, Specific Regulatory Considerations. Visibility is measured as the farthest distance a person can see in a given landscape. On a hazy day in Denali National Park, Alaska's largest Class I Area, average visibility is 130 miles; on a clear to mid-range day, average visibility in Denali National Park can range from 205 to 255 miles. Overall, Alaska's visibility is far better than visibility in the lower 48 states and is close to the long-term goal of natural background conditions (*ADEC 2002* and *ADEC 2001*).

While PSD and visibility programs are critical to air quality in attainment/unclassifiable and Class I Areas, respectively, conformity requirements are a key concern in nonattainment and maintenance areas. As discussed in Section 3.1.12.2, Specific Regulatory Considerations, general conformity (rather than transportation conformity) may apply to the Proposed Action.

The emissions thresholds for a general conformity demonstration in Alaska are summarized in Table 3.1.12-5. If annual source emissions are below specified threshold levels, no conformity determination is required. If the emissions exceed the threshold, a conformity determination must be undertaken to demonstrate how the action will conform to the SIP. However, notwithstanding these emission thresholds, certain federal actions are exempt from general conformity requirements. If applicable, the demonstration process includes public notification and response and may require extensive analysis. A map of the nonattainment and maintenance areas in Alaska are shown on Figure 3.1.12-2.

Table 3.1.12-5: General Conformity Emissions Thresholds in Alaska[a]

Pollutant	Region Status	Other Criteria	Emission Threshold (tpy)
Carbon monoxide	Maintenance	All maintenance areas	100
Particulate matter: PM_{10}	Maintenance	All maintenance areas	100
Particulate matter: $PM_{2.5}$	Nonattainment	Direct $PM_{2.5}$ emissions	100
		Sulfur dioxide precursor emissions	100
		NOx precursor emissions	100
		VOC or ammonia precursor emissions	100

Source: 18 AAC 50.725 and 40 CFR 93.153

tpy = tons per year; PM_{10} = particulate matter up to 10 micrometers in diameter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; NOx = nitrogen oxides; VOC = volatile organic compound

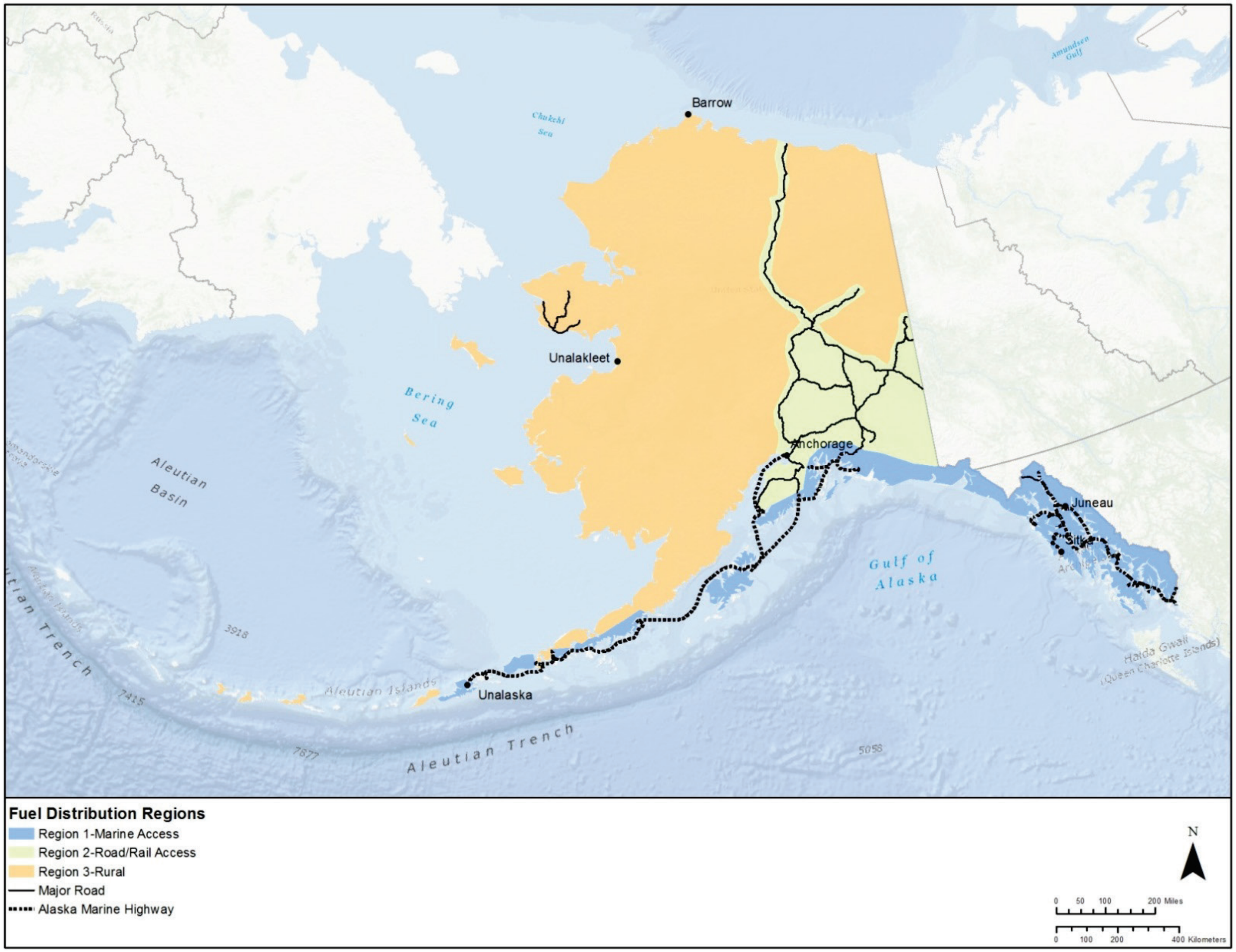
[a] Only those pollutant/attainment status combinations that are applicable to Alaska are shown in this table. Other emissions thresholds can be found at *40 CFR 93.153*.

Source: USEPA 2013a, USEPA 2013b

Figure 3.1.12-2: Nonattainment and Maintenance Areas in Alaska

Air pollution from mobile sources in Alaska is addressed by DEC's Air Non-Point and Mobile Sources group. In general, mobile source air pollution is managed primarily through vehicle maintenance and fuel standards. Vehicle maintenance standards in Alaska have relaxed during the past few years due to improvements in air quality. As mentioned above, the Vehicle Inspection/Maintenance Program was implemented in Anchorage and Fairbanks because those areas were previously in nonattainment for CO. As a result of improved CO concentrations in those areas, Alaska DEC has suspended the Vehicle Inspection/Maintenance Programs in Fairbanks North Star Borough and the Municipality of Anchorage as of January 2010 and March 2012, respectively (*ADEC 2015* and *Alaska DMV 2015*).

Fuel standards still apply throughout all regions in Alaska because the standards are driven by federal requirements and because PM emissions continue to be an air quality concern throughout the state. In both urban and rural areas of Alaska, all diesel-powered vehicles, including highway/on-road vehicles (e.g., trucks, vans), non-road/off-road equipment (e.g., graders, bulldozers), and locomotive and marine engines are required to use 15 ppm ultra-low sulfur diesel fuel. Figure 3.1.12-3 shows rural areas (areas not accessible by the Federal Aid Highway System and urban areas (*ADEC 2015*, *USEPA 2012a*, and *USEPA 2006*). Other off-road engines, including those used in certain aircraft, are also regulated by USEPA in order to protect air quality (*USEPA 2013b*).



Source: ADEC 2015

Figure 3.1.12-3: Alaska Fuel Distribution and Rural/Urban Transportation Areas

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3.1.13. Noise

3.1.13.1. Introduction

This section discusses noise conditions in Alaska. Information is presented regarding noise characteristics that would be potentially sensitive to impacts from deployment and operation of the Proposed Action.

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (*USEPA 2012*). Noise is one of the most common environmental issues that can interfere with normal human activities and otherwise diminish the quality of the human environment. Typical sources of noise that result in this type of interference in both urban and suburban surroundings include interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and
- Physiological effects such as hearing loss and anxiety.

3.1.13.2. Specific Regulatory Considerations

In 1974, the United States Environmental Protection Agency determined that an exterior day-night average sound level (L_{dn}) of 55 A-weighted decibels (dBA) would not adversely affect public health and welfare by interfering with speech or other activities (*USEPA 1974*).

Per the Occupational Safety and Health Act of 1970, the Alaska Department of Labor and Workforce Development requires that employees should not be exposed to more than 85 decibels (dB) for an 8-hour day, and if the noise level exceeds the 85 dB threshold, protective measures must be installed to reduce noise exposure (*Alaska DOLWD 2015; 29 Code of Federal Regulations 1910.95(c)(1)*).

The Anchorage Noise Control Ordinance, Anchorage Municipal Charter (AMC) 15.70 provides allowable noise levels for residential, commercial, and industrial activities (Table 3.1.13-1). Aside from Anchorage, the state and other municipalities in Alaska do not have numerical noise limits that pertain to the Proposed Action.

Table 3.1.13-1: Allowable Noise Levels by Receiving Land Use in Anchorage, Alaska

Affected Property	Time	Sound Level Limit (dBA)
Residential	7:00 a.m. – 10:00 p.m.	60
	10:00 p.m. – 7:00 p.m.	50
Commercial	7:00 a.m. – 10:00 p.m.	70
	10:00 p.m. – 7:00 p.m.	60
Industrial	At all times	80

Source: Municipality of Anchorage 2015

dBA = A-weighted decibel

3.1.13.3. Environmental Setting

Noise is generally defined as unwanted sound. Sound can be perceived as pleasant or annoying, and as loudness/intensity, in terms of dB. Sound measurement is refined by using a dBA scale that emphasizes the range between 1,000 and 8,000 cycles per second, which are the sound frequencies most audible to the human ear. The perceived increase in loudness of a sound does not correspond directly to numerical increase in dBA values. Typically, an increase of less than 3 dBA is barely noticeable, an increase of 5 dBA is noticeable, an increase of 10 dBA is perceived as a doubling in apparent loudness, and an increase of 20 dBA is perceived as a four-fold increase in apparent loudness. Table 3.1.13-2 shows typical noise levels generated by common indoor and outdoor activities, and provides possible human effects.

Table 3.1.13-2: Typical Noise Levels and Possible Human Effects

Common Noises[a]	**Noise Level (dBA)**	**Effect**
Rocket launching pad (no ear protection)	180	Irreversible hearing loss
Carrier deck jet operation	140	Painfully loud
Air raid siren		
Thunderclap	130	Painfully loud
Jet takeoff (200 feet)	120	Maximum vocal effort
Auto horn (3 feet)		
Pile driver	110	Extremely loud
Loud concert		
Garbage truck	100	Very loud
Firecrackers		
Heavy truck (50 feet)	90	Very Annoying
City traffic		Hearing damage (8 hours of exposure)
Alarm clock (2 feet)	80	Annoying
Hair dryer		
Noisy restaurant	70	Telephone use difficult
Freeway traffic		
Business office		
Air conditioning unit	60	Intrusive
Conversational speech		
Light auto traffic (100 feet)	50	Quiet
Living room	40	Quiet
Bedroom		
Quiet office		
Library/soft whisper (15 feet)	30	Very quiet
Broadcasting studio	20	Very quiet
Pin dropping	10	Just audible
Threshold of hearing	0	Hearing begins

Source: WSDOT 2015

dBA = A-weighted decibel
[a] No common 10 dBA source(s) was available, but expected noise effects for this decibel value were included.

In Alaska, just like in any state or territory, noise can be generated from a variety of sources such as industries, railway and roadway vehicle traffic, aircraft, hunting, construction activities, and public gatherings, to name just a few.

In the absence of measured data, typical outdoor sound level by land use category is presented in Table 3.1.13-3. In Alaska, forest, dwarf scrub, and scrub/shrub account for more than half of the land cover statewide while developed land (low, medium, and high intensity) covers less than 1 percent (see Section 3.1.7.3, Land Use and Ownership). Ambient day-night noise levels in major cities such as Anchorage, Fairbanks, and Juneau as well as areas with dense traffic or some commerce or industry are expected to range from 55 to 65 dBA. Ambient day-night noise levels in rural and suburban Alaskan towns (e.g., Galena, Fort Yukon, etc.) with infrequent traffic are expected to range from 40 to 45 dBA.

National Parks and National Wildlife Refuges comprise approximately 62 percent of all recreational land in Alaska (see Section 3.1.7.5, Recreation). Ambient day-night noise levels in the most sensitive areas in Alaska, such as the Denali National Park, are expected to be 35 dBA or less.

Table 3.1.13-3: Typical Outdoor Sound Levels by Land Use Category

Land Use Category	L_d (dBA)[a]	L_n (dBA)[b]	L_{dn} (dBA)[c]
Wilderness areas	35	25	35
Rural and outer suburban areas with negligible traffic	40	30	40
General suburban areas with infrequent traffic	45	35	45
General suburban areas with medium density traffic or suburban areas with some commerce or industry	50	40	50
Urban areas with dense traffic or some commerce or industry	55	45	55
City or commercial areas or residences bordering industrial areas or very dense traffic	60	50	60
Predominantly industrial areas or extremely dense traffic	65	55	65

Source: Cavanaugh and Tocci 1998; Bies and Hansen 2009

dBA = A-weighted decibel
[a] L_d, or daytime L_{eq}, is the average equivalent sound level for daytime (7 a.m. to 10 p.m.).
[b] L_n, or nighttime L_{eq}, is the average equivalent sound level for nighttime (10 p.m. to 7 a.m.).
[c] L_{dn}, or day-night average sound level, is the average equivalent A-weighted sound level during a 24-hour time period with a 10-dB weighting applied to equivalent sound level during the nighttime hours of 10 p.m. to 7 a.m.

$$L_{dn} = 10log_{10}(\frac{15}{24}10^{L_d/10} + \frac{9}{24}10^{(L_n+10)/10})$$

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3.1.14. Climate Change

3.1.14.1. Introduction

This section discusses the setting and context of global climate change effects in Alaska. Information is presented regarding the historical and existing climate parameters including temperature, precipitation, and severe weather.

Climate change, according to the Intergovernmental Panel on Climate Change (IPCC), is defined as "…a change in the state of the climate that can be identified (e.g., using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or human activity." (*IPCC 2007*)

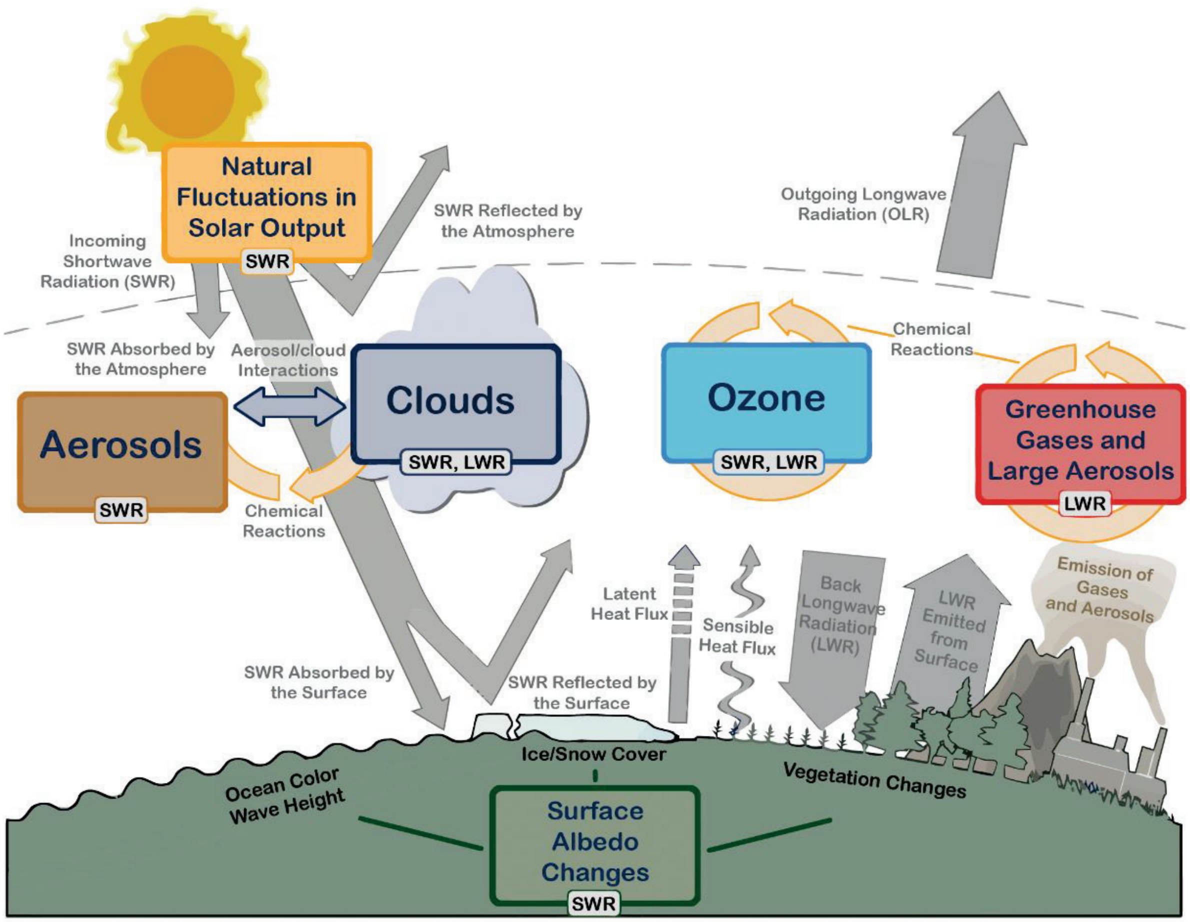
Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (*USEPA 2012*). The IPCC is now 95 percent certain that humans are the main cause of current global warming (*IPCC 2013a*). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (*IPCC 2007*). The common unit of measurement for GHGs is metric tons of CO_2-equivalent, which equalizes for the different global warming potential of each type of GHG.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" and that "atmospheric concentrations of CO_2 increased from 80 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005." (*IPCC 2007*) The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion to 1774 and 319 parts per billion, respectively, in 2005 (*IPCC 2007*). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (*IPCC 2007*).

Both the GHG emissions effects of the Proposed Action and Alternatives, as well as the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this Draft Programmatic Environmental Impact Statement (see Section 3.2, Environmental Consequences). Existing climate conditions in the Proposed Action area are described first by state/territory and sub-region, where appropriate, and then by future projected climate scenarios.

3.1.14.2. Context

Output from the sun powers the Earth's climate through solar radiation. The sun's energy in the form of light (including visible light or sunlight), which is electromagnetic radiation, and heat is reflected, transmitted or absorbed into the Earth's atmosphere. For the Earth's temperature and longer term climate to remain relatively constant, the incoming radiation from the sun must balance with outgoing radiation into space. Most of the outgoing radiation leaving the Earth's surface is longwave radiation, which is also referred to as infrared radiation (*IPCC 2013a*). Some of the infrared radiation that is emitted from the Earth's surface is absorbed by certain gases in the atmosphere, which also emit longwave radiation into all directions. The radiation downward back into the surface adds and traps heat into the earth's surface, creating the greenhouse gas effect. This effect is illustrated in Figure 3.1.14-1 below.



Source: IPCC 2013a

Figure 3.1.14-1: The Greenhouse Gas Effect

Gases including CO_2, CH_4, N_2O, water vapor, and ozone naturally occur in the atmosphere in addition to manufactured pollutants such as hydrofluorocarbons and chlorofluorocarbons. These gases have the ability to emit radiation and can trap outbound radiation within the Earth's atmosphere (*IPCC 2013a*). These gases are collectively called GHGs due to their ability to contribute to the greenhouse gas effect (*IPCC 2013a*). Some GHGs, such as CO_2, CH_4, N_2O, and water vapor, have been continuously released throughout Earth's geologic history through natural processes. Natural sinks[1] that absorb CO_2, such as vegetation and forests, counterbalance this cycle.

Since the industrial revolution, increasing GHG emissions from human activities (referred to as anthropogenic emissions and contrasting with emissions arising from natural processes) have increased the levels of GHGs in the atmosphere. Anthropogenic emissions enhance the greenhouse gas effect and result in a greater amount of heat that is trapped in the atmosphere (*IPCC 2013a*). Human activities that emit GHGs include the combustion of fossil fuel, industrial processes, land use changes, deforestation, and agricultural production.

The Fifth Assessment Report by the IPCC concludes that total radiative forcing, which is the difference between the visible light absorbed by Earth and the energy reflected back to space, is positive. This leads to an increase in energy in the climate system (*IPCC 2013b*). The largest contributor to radiative forcing is caused by the increase of CO_2 in the atmosphere since 1750 (*IPCC 2013b*). Furthermore, according to climate models, continued GHG emission will cause further warming and changes in the climate system (*IPCC 2013b*).

3.1.14.3. Specific Regulatory Considerations

In 2007, the United States (U.S.) Supreme Court in *Massachusetts v EPA, 549 U.S. 497 (2007)* ruled that GHGs are air pollutants and can be regulated under the Clean Air Act. Since this ruling, there have been state and federal programs and initiatives that have been proposed and implemented that address GHG emissions in the U.S. The programs that are relevant to the Proposed Action are described below.

Revised Draft CEQ Guidance

The Council on Environmental Quality (CEQ) published revised draft guidance for GHG emissions and climate change impacts in December 2014. This guidance is applicable to all federal agency actions and is meant to facilitate compliance within legal requirements of the National Environmental Policy Act. The CEQ guidance describes how federal agency actions should evaluate GHG and climate change effects in their National Environmental Policy Act reviews. CEQ defines GHGs to include CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, which is in accordance with section 19 (i) of Executive Order 13514. The CEQ guidance proposes that agencies should consider that a proposed action and its reasonable alternatives contribute, specifically, "(1) the potential effects of a proposed action on climate change as indicated by its GHG emissions; and (2) the implications of climate change for

[1] Carbon sinks occur when natural processes absorb more CO_2 than they release. Examples of natural processes that serve as carbon sinks include forests, soils, oceans, and vegetation.

the environmental effects of a proposed action." For GHG emissions, the guidance provides a reference point of 25,000 metric tons (tonnes) per year or more where a quantitative analysis would be warranted. CEQ recommends agencies evaluate project emissions and changes in carbon sequestration and storage, when appropriate, in assessing a proposed action's potential climate change impacts. The analysis should assess direct and indirect climate change effects of a proposed project including connected actions, the cumulative impacts of its proposed action, and reasonable alternatives. CEQ advises that climate change effects on the environmental consequences of a proposed action should be described based on available studies, observations, interpretive assessments, predictive modeling, scenarios, and other empirical evidence. The temporal bounds should be limited by the expected lifetime of the proposed project. Mitigation and adaptation measures should be considered in the analysis for effects that occur immediately and in the future.

State Regulations and Guidelines

There are no state regulations or guidelines on GHGs and climate change in the state of Alaska. However, in 2006, the Alaskan legislature in *Legislative Resolve 49 (House Concurrent Resolution 30)* established the Alaska Climate Impact Assessment Commission to assess the effects of climate change that could impact the citizens, economy, assets, and resources of Alaska. The commission concluded that climate change would present "unavoidable challenges to the citizens of Alaska" and provided a set of recommendations published in 2008 (*ADEC 2011*). The commission also concluded that continued identification of potential challenges would be needed in the future.

In 2007, a Climate Change Sub-Cabinet was created by *Administrative Order 238* to advise the Office of the Governor in preparing and implementing a climate change strategy for Alaska. The order directed the Sub-Cabinet to develop recommendations to assist communities in preparing for impacts of climate change effects (*ADEC 2010*). To assist in meeting its objectives, the Sub-Cabinet created several working groups, which have issued reports discussing results of the research and recommendations. Among the adaptation research and recommendations in the Adaptation Advisory Group final draft report was a recommendation to build resiliency into Alaska's public infrastructure (*ADEC 2010*).

3.1.14.4. Historical Climate

The Third National Climate Assessment published in 2014 concludes that Alaska has warmed more than twice as quickly as the rest of the United States in the last 60 years (*USGCRP 2014*). During this time period, the annual average temperature has increased by 3 degrees Fahrenheit (°F) while the average winter temperature has increased by 6°F (*USGCRP 2014*). Average annual precipitation has increased by 10 percent across the state from 1949 through 2005 with regional and seasonal variation (*Stewart et al. 2013*). Increasing warm, extreme temperatures in the spring and the decrease in frequency of cold extremes, particularly in the winter, has been observed (*Stewart et al. 2013*).

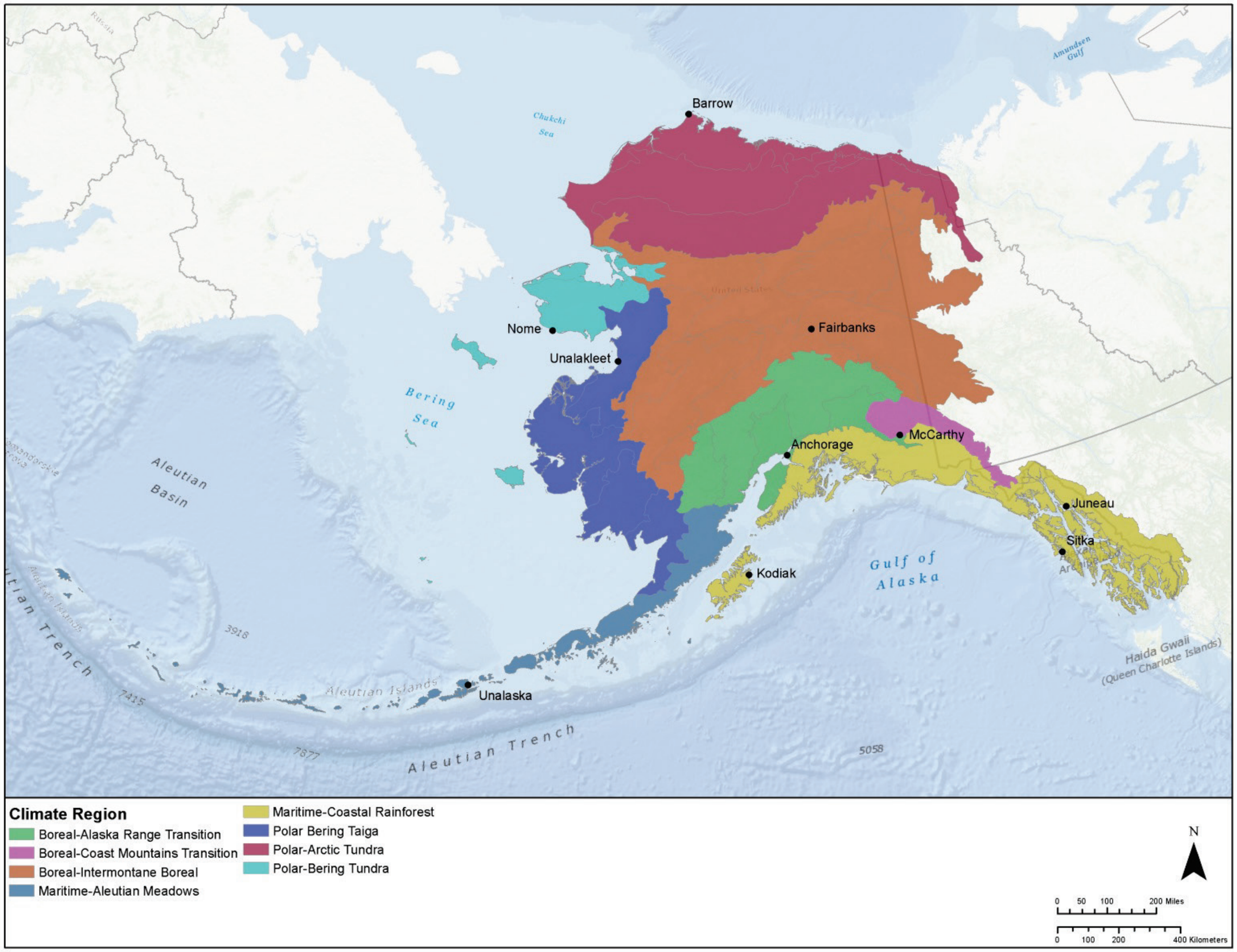
The north and northwestern coasts of Alaska have observed significant increases in the number of strong storms when protective ice cover is not present in the summer and fall months (*Stewart et al. 2013*). Other observed climate trends include earlier spring snowmelt, reduced sea ice, and warmer permafrost (*USGCRP 2014*).

Climate change projections in the National Climate Assessment use a baseline period of 1971 to 1999 for temperature and precipitation. The historical annual average temperature in Alaska during this time period is 26.2°F and precipitation is 36.2 inches (*NOAA 2015a*).

An increase in strong storms has been observed when protective ice is not present in the summer and fall months as a result of longer ice-free seasons (Stewart et al. 2013). Summers in the Arctic Ocean are dominated by low pressure systems that cause ice to diverge and spread out (NSIDC 2012). Loss of sea ice can result in local storms impacting the upper Arctic Ocean (Long and Perrie 2012). Additionally, as a result of increasing momentum of moisture and heat exchange between the atmosphere and the ocean, the loss of sea ice can result in increased strength and size of Arctic storms (Lang and Perrie 2012).

3.1.14.5. Existing Climate and Meteorology

Alaska has a landmass of 572,000 square miles; it spans 20 degrees of latitude (51 degrees north [°N] to 71°N) and 58 degrees of longitude (130°N to 172°N) (*ADEC 2012*). Alaska's topography is highly varied, with several mountain ranges, hills, coastal plains, lowlands, deserts, lakes, rivers, wetlands, glaciers, and fjords. The varying topography influences local and regional wind flow patterns. Turbulent wind patterns are created when the wind cannot pass over an object smoothly and an uneven or abrupt landscape increases the likelihood of turbulent winds (*ADEC 2012*). Due to Alaska's large landmass, the state is divided into eight climatic regions (see Figure 3.1.14-2). The typical meteorology, topography, and precipitation trends for each region are described in Table 3.1.14-1. Climate and air quality conditions are also commonly evaluated by borough or census zone, which are comparable to counties in other states. Therefore, the boroughs and census zones that are most closely aligned with each of the eight climatic zones are also listed in Table 3.1.14-1.



Source: ADEC 2012

Figure 3.1.14-2: Map of Climatic Regions in Alaska

Table 3.1.14-1: Climatic Regions of Alaska

Climatic Region	Boroughs/ Census Zones	Cities/Towns	Meteorology	Topography	Precipitation	
					Type	Amount per year (inches)
Maritime-Aleutian Meadows	Aleutians East; Aleutians West; Bristol Bay; Kodiak Island; Lake and Peninsula	Unalaska	Marine	Southwest extension of Aleutian Range, remote islands	Not Available	Not Available
Boreal-Intermontane Boreal	Denali; Fairbanks North Star; Southeast Fairbanks; Yukon-Koyukuk	Fairbanks	Blustery winds and dust from open riverbeds; winter weather; thunderstorms	Vast expanse of land north of the Alaska Range and south of the Brooks Range	Rain; Snow	<15
Polar-Arctic Tundra	North Slope	Barrow	Varying wind patterns	Arctic desert, extremely flat	Various	<10
Maritime-Coastal Rainforest	Haines; Hoonah-Angoon; Juneau; Ketchikan Gateway; Petersburg; Prince of Wales-Hyder; Sitka; Skagway; Wrangell	Juneau; Kodiak; Sitka	Temperate rainforest	Mountainous islands; marine waterways	Rain	>100
Polar-Bering Tundra	Nome; Northwest Artic	Nome	Wind (15-25 mph)	Barren hills	Rain	15-24
Boreal-Coast Mountains Transition	Valdez-Cordova; Yakutat	McCarthy	One of wettest regions in world	Rugged mountains and barren shoreline	Rain; Snow	>150 (Yakutat); >700 (Thompson Pass)
Boreal-Alaska Range Transition	Anchorage; Kenai Peninsula; Matanuska-Susitna	Anchorage	Temperate	Bounded by active volcanoes and glacial river plains	Rain	15 (Matanuska-Susitna Valley); 60 (Seward)
Polar-Bering Taiga	Bethel; Dillingham; Wade Hampton	Unalakleet	Windy (15-25 mph throughout the year); dust	Yukon-Kuskokwim River Delta, a wide low-lying area	Various	40-70

Source: ADEC 2012; Bonanza Creek LTER 2011

mph = miles per hour
Note: The highest temperatures in these boroughs occur June through August and the lowest temperatures occur November through January.

General meteorological conditions including temperature, precipitation, wind direction, and wind speed over a 30-year period are presented in Table 3.1.14-2 for three of the most populated boroughs in Alaska (Anchorage, Fairbanks, Juneau) and two wilderness/rural boroughs (Barrow and Kodiak). The data were extracted from historic climate information issued by the National Climatic Data Center (NCDC) Comparative Climatic Data for the United States through 2012.

Table 3.1.14-2: Annual Average Temperature, Humidity, Precipitation, and Wind Speed Data for Anchorage, Barrow, Fairbanks, Juneau, and Kodiak, Alaska

Parameter	Anchorage	Barrow	Fairbanks	Juneau	Kodiak
Temperature (°F)	37.1	11.8	27.7	42.1	40.9
Relative Humidity (%)	68	80	63	75	75.5
Precipitation: Rain (in)	16.5	4.5	10.8	62.2	40.9
Precipitation: snow/sleet (in)	72.8	31.9	66.1	99	80.3
Wind speed (mph)	15.9	26.8	11.9	18.1	24.4
Max (gust) wind speed (mph)	167.8	165.5	89.5	129.7	196.9
Wind direction	NE	SW	NNE	N	WNW

Source: NOAA Undated

°F = degree Fahrenheit, % = percent, in = inches, mph = miles per hour, NE = northeast, SW = southwest, NNE = north-northeast, N = north, WNW = west-northwest

Severe weather data recorded over the last 18 years (1996 to 2014) within Alaska include flooding, hail, lightning, thunderstorm (marine/wind/heavy rain), tornado/funnel cloud, and high wind (50-plus miles per hour [mph]). Severe weather data for each borough/census zone are listed in Table 3.1.14-3. High wind (greater than 50 mph) is the most common severe weather phenomenon within the state with 1,319 occurrences. Flooding is also a severe weather phenomenon in Alaska, primarily within the Kenai Peninsula/Mountains and in the Yukon-Koyukuk regions.

Table 3.1.14-3: Recorded Severe Weather Occurrences for Alaskan Boroughs/Census Zones (1996-2014)

Borough/Census Zone	Flooding[a]	Hail	Thunderstorm[b]	Tornado/ Funnel Cloud	High Wind (50+ mph)
Aleutians East	0	0	0	0	236
Aleutians West	0	0	0	1	211
Anchorage	5	1	2	1	139
Bethel	0	0	0	0	0
Bristol Bay	5	0	1	1	90
Denali	6	0	2	2	50
Dillingham	0	0	0	0	0
Fairbanks North Star	1	1	2	1	0
Haines	1	0	1	0	36
Hoonah-Angoon	0	0	1	0	0
Juneau	8	0	1	0	133
Kenai Peninsula/ Mountains	23	6	0	0	101
Ketchikan Gateway	2	0	1	1	0
Kodiak Island	2	0	3	0	93
Lake And Peninsula	0	0	0	0	0
Matanuska-Susitna	4	1	0	0	79

Borough/Census Zone	Flooding[a]	Hail	Thunderstorm[b]	Tornado/ Funnel Cloud	High Wind (50+ mph)
Nome (Seaward Peninsula)	3	0	3	1	48
North Slope	2	0	0	0	24
Northwest/Western Arctic	0	0	0	0	20
Petersburg	0	0	0	0	0
Prince of Wales-Hyder	0	0	0	0	0
Sitka	1	0	3	0	0
Skagway	0	0	0	0	0
Southeast Fairbanks	0	0	0	0	0
Valdez-Cordova	0	0	0	0	0
Wade Hampton	0	0	0	0	0
Wrangell	1	0	1	0	1
Yakutat	1	0	1	0	0
Yukon-Koyukuk	56	1	1	1	58
Total	**121**	**10**	**23**	**9**	**1,319**

Source: NOAA 2015b

mph = miles per hour
[a] Includes NCDC Event Type: Coastal Flood, Flash Flood, and Flood
[b] Includes NCDC Event Type: Marine Thunderstorm Wind, Thunderstorm Wind, Lightning, and Heavy Rain

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3.1.15. Human Health and Safety

3.1.15.1. Introduction

This section provides a health profile of the population of Alaska where potential worker and community health and safety effects related to the deployment and operation of the Proposed Action could occur. The health profile includes a summary of basic population health indicators and a discussion of any key community health and safety issues identified, with a focus on those health issues that may be potentially sensitive to impacts from the Proposed Action.

This health profile is based on a review of various secondary data sources, including the Centers for Disease Control and Prevention, the World Health Organization, and the United States (U.S.) Environmental Protection Agency (USEPA).

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the deployment, operation, and maintenance of towers, antennas, cables, utilities, and other equipment and infrastructure at existing and potential FirstNet telecommunication sites. There are two human populations of interest within the existing environment of health and safety, 1) telecommunication occupational workers and 2) the general public near telecommunication sites. Each of these populations could experience different degrees of exposure to hazards as a result of their relative access to FirstNet telecommunication sites and their function throughout the implementation of the FirstNet telecommunication network infrastructure.

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency radiation or vehicular traffic and transportation of hazardous materials and wastes. Radio frequency is evaluated in Section 2.4, Radio Frequency Emissions. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 3.1.1, Infrastructure.

3.1.15.2. Specific Regulatory Considerations

Alaska Occupational Safety and Health (AKOSH) has a state Occupational Safety and Health Plan whose purpose and intent is to implement the provisions of the federal Occupational Safety and Health Act of 1970. This Act sets and enforces protective standards to assure safe and healthful working conditions for workers. AKOSH is responsible for all private and public employers and employees in the state with the exception of some specific groups that are covered under the Occupational Safety and Health Administration (OSHA) (*ADOLWD Undated*).

AKOSH, in coordination with the OSHA, is the primary regulatory agency responsible for the enforcement of worker safety and health regulations; however, other regulations may play a role if project activities include handling of hazardous waste.

The following four laws are overseen by the USEPA and regulate aspects of worker health in conjunction with OSHA:

- The main objective of the Resource Conservation and Recovery Act of 1976 is to "protect human health and the environment from the potential hazards of waste disposal, to conserve energy and natural resources, to reduce the amount of waste generated, and to ensure that wastes are managed in an environmentally sound manner" (*USEPA 2013*);
- The Comprehensive Environmental Response, Compensation, and Liability Act or Superfund law was designed to help clean up hazardous waste sites and releases of pollutants or contaminants that may negatively affect public health (*USEPA 2015c*);
- The Toxic Substances Control Act regulates the introduction of new or existing chemicals that present a risk to human health or the environment (*USEPA 2015d*); and
- The Emergency Planning and Community Right-to-Know Act of 1986 was designed to assist communities in planning for emergencies related to hazardous waste. The law also requires industry to inform federal, state, and local governments on the storage use and releases of hazardous chemicals (*USEPA 2015a; USEPA 2015e*).

Other regulatory considerations that are applicable to worker and community health and safety are outlined in Section 2.4, Radio Frequency Emissions; Section 3.1.1, Infrastructure; Section 3.1.4, Water Resources; Section 3.1.10, Environmental Justice; Section 3.1.12, Air Quality; and Section 3.1.13, Noise.

3.1.15.3. Health Overview

Several measures of general health status, such as life expectancy (how long an individual from a certain population is expected to live), mortality rates, and disease prevalence are common indicators of the overall health status of a population. Table 3.1.15-1 summarizes some of the key health indicators for Alaska compared to the averages for the U.S.

Table 3.1.15-1: Key Health Indicators for Alaska

Health Outcome Indicator (data year)	Alaska	United States
Age-adjusted death rates, per 100,000 population (2013)	724.4	731.9
Life expectancy at birth (2010)	Male: 76.3 years Female: 80.4 years	Male: 76.2 years Female: 81.0 years
Leading causes of death, % of total deaths (2013)	25.4% - cancer 17.7% - heart disease 8.8% - accidents 4.9% - chronic lower respiratory diseases 4.7% - cerebrovascular disease	23.5% - heart disease 22.5% - cancer 5.7% - chronic lower respiratory diseases 5.0% - accidents 5.0 – cerebrovascular disease
Infant mortality rate, per 1,000 live births (2013)	5.59	5.96

Source: CDC 2010; CDC 2013b

Data indicate that Alaska has a comparable age-adjusted death rate and life expectancies to the contiguous U.S. While the percentage of deaths from heart disease is considerably lower in

Alaska relative to the overall U.S., deaths from cancer and accidents are higher. This rate of accident fatality includes a much higher rate of suicide deaths in Alaska (4.3 percent in 2013, compared with a 1.6 percent U.S. average). Alaska also has high rates of substance abuse compared with U.S. averages (*Alaska State Troopers 2014*).

3.1.15.4. Summary of Key Health and Safety Conditions for Alaska

The following summarizes key health and safety conditions in Alaska, with a focus on those conditions that could potentially be impacted by the activities and infrastructure associated with the Proposed Action, or potentially increase health risk to the Proposed Action workforce.

Accidents and injuries—Accidents resulting in death account for 8.8 percent of total deaths compared to 5 percent in the U.S. (*CDC 2013*b). Motor vehicle accidents account for a large number of these, with alcohol sometimes playing a factor (*CDC 2013*b). Data show that Alaska natives are disproportionately affected by unintentional injury death, including motor vehicle accidents (*Hull-Jilly et al. 2013*). While not a regular occurrence, wildlife attacks causing serious injury or death are a potential hazard in many areas of the Alaskan wilderness (*ADFG 2015*).

Substance abuse—Alaska has one of the highest per capita alcohol consumption rates in the U.S., and a 14.0 percent prevalence of alcohol dependence and alcohol abuse among its population, compared with 7.0 percent for the contiguous U.S. *(CDC 2013a).* Excessive alcohol use is a risk factor for many adverse health outcomes such as unintentional injuries (e.g., motor-vehicle accidents), violence, suicide, hypertension, and acute myocardial infarction (*CDC 2014*).

Alaska was also ranked as one of the top 10 states for rates of illicit drug use for a number of drug categories in 2010. Methamphetamines, cocaine, heroin, marijuana, and prescription drugs were identified by the Department of Public Safety as the drugs of focus for most of the Alaskan law enforcement effort. Heroin and other opiates and opiate-based prescriptions are especially of concern in urban areas, while alcohol and marijuana are the most commonly abused substances in rural Alaskan areas; however, seizures of methamphetamine, heroin, and prescription drugs have also been growing in rural communities (*Alaska State Troopers 2014*).

Mental health—Death from suicide is a major public health issue in Alaska, where it makes up 4.2 percent of deaths compared to 1.6 percent in the U.S. (*CDC 2013b*). A recent study found that suicide rates in Alaska native populations are twice that of the general population (*Hull-Jilly et al. 2013*). Additionally, the researchers found that suicide rates were higher among communities residing at higher latitudes, attributing it to longer winters and fewer daylight hours. Suicide is often linked with many other issues such as substance abuse, isolation, and access to mental health services (*CDC 2015*).

Chronic diseases affected by air pollution—Common mobile source air emissions of health concern include nitrogen dioxide and particulate matter up to 2.5 micrometers in diameter ($PM_{2.5}$). Fossil fuel combustion associated with traffic and the use of heavy machinery and generators is the primary source of $PM_{2.5}$ and nitrogen oxides that could be generated by the Proposed Action. Baseline levels of air pollutants in Alaska are addressed in Section 3.1.12, Air

Quality. The focus of this section is on vulnerable groups that may be particularly sensitive to even short-term increases in $PM_{2.5}$ or nitrogen oxides.

Research to date has not revealed the existence of "No Observed Adverse Effects Level" thresholds for $PM_{2.5}$ or nitrogen oxides below which no health effects would be expected for sensitive populations (*HEI 2010; USEPA 2009, 2013; Kelly and Fussell 2011; Levy et al. 2002; Nishimura et al. 2013; Patel and Miller 2009; O'Neill et al. 2005, 2007; Sarnat and Holguin 2007*). Sensitive populations for exposure to $PM_{2.5}$ and nitrogen dioxide are:

- Those with chronic respiratory diseases (asthma and chronic obstructive pulmonary disease), particularly children and the elderly;
- Those with acute respiratory infections, particularly children and the elderly;
- Those with chronic heart diseases; and
- Diabetics.

Table 3.1.15-2 below summarizes health indicators in Alaska and the U.S. for conditions that can be exacerbated by air pollution (respiratory illnesses and diabetes) and indicate lower rates of death from flu and pneumonia, chronic lower respiratory disease, and diabetes in Alaska relative to the U.S. as a whole. However, the data show that adult asthma prevalence in Alaska is comparable to the U.S. average.

Table 3.1.15-2: Health Conditions Affected by Air Pollution

Health Condition (data year)	Alaska	United States
Adult asthma prevalence [a]	9.3%	9.0%
Chronic lower respiratory diseases, percentage of all deaths (2013)	4.9%	5.6%
Influenza and pneumonia, percentage of all deaths (2013)	1.7%	2.2%
Heart disease, percentage of all deaths (2013)	17.7%	23.5%
Diabetes prevalence [b]	7.1%	9.8%

Source: CDC 2013a; CDC 2013b.

[a] Defined as ever having been told by a doctor that you currently have asthma.
[b] Defined as ever having been told by a doctor that you have diabetes.

Smoking is the primary behavioral health risk factor for illnesses that are affected by air pollution. In 2013, Alaska had a higher percentage of current smokers (an estimated 22.6 percent, according to the Center for Disease Control's Behavioral Risk Factor Survey) compared with the U.S. at 19.0 percent (*CDC 2013a*).

Hazardous waste/contaminated areas—Existing environmental contaminants in soil or water at a development site could potentially result in a worker or community health concern if such contaminants were not managed during development. Health effects from environmental contaminants can range from experiences of physical irritation/nuisance to acute illness to chronic disease outcomes. Existing areas of contamination can come from both existing industrial facilities and legacy contaminated sites.

Parts of Alaska are heavily industrialized, and the state ranks 15 out of 56 for the highest volume of toxic releases.[1] According to the USEPA's Toxic Release Inventory program, there were 34 registered facilities in 2013 that released 970,610,034 pounds of toxic chemicals. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The "releases" do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities).

There are six active Superfund sites in Alaska. These are summarized in Table 3.1.15-3.

Table 3.1.15-3: Alaska Active Superfund Sites

Site Name	City	Cleanup Type / Description of
Adak Naval Air Station	Adak	• Former Navy base • Site contains landfills, storage areas, drum disposal areas, spill sites, and pits for waste oil and fire-fighting training. • Contaminated with PCBs, lead, and silver in sediments, water, and soil
Eielson Air Force Base	Fairbanks North Star Borough	• Tactical support base to Alaskan Air Command • Contains closed and active unlined landfills, shallow trenches with buried weathered tank sludge, drum storage area, and spill areas. • Groundwater contamination with heavy metals and trans-1,2-dichloroethylene
Elmendorf Air Force Base	Greater Anchorage Borough	• Unlined and unbermed landfills with hazardous materials • Lead and a number of VOCs detected in wells
Fort Richardson (U.S. Army)	Anchorage	• Former ordnance testing area • Soil and shallow groundwater contaminated with VOCs
Fort Wainwright	Fairbanks North Star Borough	• Former army and equipment training center • Unlined, unbermed sanitary landfill with waste oil, fuel, and fuel tank sludge • Shallow water contamination with lead, chromium, tetrahydrofuran
Salt Chuck Mine	Thorne Bay	• Inactive former gold, silver, and copper mine containing large volumes of tailings • Contamination in surface water and sediments including copper, mercury, and PCBs

Source: USEPA 2015b

PCB = polychlorinated biphenyl; VOC = Volatile Organic Compound

[1] Ranking 1 represents the highest volume of releases.

Affected environment discussions for Radio Frequency, traffic, noise/vibration, and public safety services, all of which have the potential to influence community and worker health, are covered in Section 2.4, Radio Frequency Emissions; Section 3.1.1.3, Transportation; Section 3.1.13 Noise; and Section 3.1.1.4, Public Safety Services, respectively, in this Draft Programmatic Environmental Impact Statement.

3.2. Environmental Consequences

This section describes the potential direct and indirect environmental impacts that could be caused by the deployment, operation, and maintenance of the Proposed Action and discusses best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts. Cumulative environmental impacts of the Proposed Action and other past, present, and reasonably foreseeable projects are described separately in Chapter 10, Cumulative Effects. In each of the resource area-specific sections that follow, a table is presented outlining each of the potential types of effects that could impact the given resource.

The levels of impacts for each resource area are defined as follows:

- *Potentially significant,* where there is substantial evidence that an effect may be significant;
- *Less than significant with best management practices (BMPs) and mitigation measures incorporated,* where the use of mitigation measures reduce an effect from a *potentially significant* impact to a *less than significant* impact;
- *Less than significant,* where the activity creates impacts but no significant impacts; or
- *No impact,* which applies where a project does not create an impact.

Characteristics of each type of effect, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact for each type of project activity associated with the Proposed Action. Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to the resources are presented as a range of possible impacts. BMPs and mitigation measures are presented in Chapter 11.

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3.2.1. Infrastructure

3.2.1.1. Introduction

This section describes potential impacts to infrastructure in Alaska, including transportation, communications and other utilities, associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.1.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on infrastructure, which includes public safety telecommunications systems, transportation safety and capacity, utility services, access to emergency services, and commercial communications systems, were evaluated using the significance criteria presented in Table 3.2.1-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to infrastructure addressed in this section are presented as a range of possible impacts.

Table 3.2.1-1: Impact Significance Rating Criteria for Infrastructure

Type of Effect	**Effect Characteristics**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Transportation system capacity and safety	Magnitude or Intensity	Creation of substantial traffic congestion/delay and/or a substantial increase in transportation incidents (e.g., crashes, derailments)	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minimal change in traffic congestion/delay and/or transportation incidents (e.g., crashes, derailments)	No effect on traffic congestion or delay, or transportation incidents
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: persisting indefinitely		Short-term effects would be noticeable for up to the entire construction phase or a portion of the operational phase	NA
Strain on capacity of local health, public safety, and emergency response services	Magnitude or Intensity	Impacted individuals or communities cannot access health care and/or emergency health services or access is delayed due to the Proposed Action activities.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minor delays to access to care and emergency services that do not impact health outcomes	No impacts on access to care or emergency services
	Geographic Extent	Regional impacts observed (“regional” assumed to be at least a borough or borough - equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level	NA
	Duration or Frequency	Duration is constant during the construction and deployment phase.		Rare event during construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Modifies existing public safety response telecommunication practices, physical infrastructure, or level of service in a manner that directly affects public safety communication capabilities and response times	Magnitude or Intensity	Substantial adverse changes in public safety response times and the ability to communicate effectively with and between public safety entities	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minimal change in the ability to communicate with and between public safety entities	No perceptible change in existing response times or the ability to communicate with and between public safety entities
	Geographic Extent	Local/city, borough/region, or state/territory		Local/city, borough/ region, or state/territory	Local/city, borough/region, or state/territory
	Duration or Frequency	Permanent or perpetual change in emergency response times and level of service		Change in communication and/or the level of service is perceptible but reasonable to maintaining effectiveness and quality of service	NA
Effects to commercial telecommunication systems, communications, or level of service	Magnitude or Intensity	Substantial adverse changes in level of service and communications capabilities	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minor changes in level of service and communications while transitioning to the new system	No perceptible effect to level of service or communications while transitioning to the new system
	Geographic Extent	Local/city, borough/region, or state/territory		Local/city, borough/region, or state/territory	Local/city, borough/region, or state/territory
	Duration or Frequency	Persistent, long-term, or permanent effects to communications and level of service		Minimal effects to level of service or communications lasting no more than a short period (minutes to hours) during the construction and deployment phase	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to utilities, including electric power transmission facilities and water and sewer facilities	Magnitude or Intensity	Substantial disruptions in the delivery of electric power or to physical infrastructure that results in disruptions, including frequent power outages or drops in voltage in the electrical power supply system ("brownouts"); Disruption in water delivery or sewer capacity, or damage to or interference with physical plant facilities that impact delivery of water or sewer systems	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minor disruptions to the delivery of electric power, water, and sewer services or minor modifications to physical infrastructure that result in minor disruptions to delivery of power, water, and sewer services	There would be no perceptible impacts to delivery of other utilities and no service disruptions
	Geographic Extent	Local/city, borough/region, or state/territory		Local/city, borough/region, or state/territory	Local/city, borough/region, or state/territory
	Duration or Frequency	Effects to other utilities would be seen throughout the entire construction phase.		Effects to other utilities would be of short duration (minutes to hours) and would occur sporadically during the entire construction phase	NA

NA = not applicable

3.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

Deployment and operation of the Proposed Action could potentially impact transportation system safety and capacity in Alaska. The transport of heavy equipment required to support any clearance, drilling, and construction activities needed for network deployment could potentially have an impact on traffic congestion and transportation safety. Deployment activities including plowing, directional boring, and trenching necessary for the installation of fiber optic cable along the road and within the public road right-of-way (ROW) also have the potential to create temporary traffic congestion. The presence of deployable technologies such as Cell on Wheels, Cell on Light Truck, System on Wheels, and Deployable Aerial Communications Architecture could potentially impact air and land-based traffic congestion and safety. However, potential impacts would likely be lesser given that deployable technologies would typically be stationed in the more rural areas of Alaska where there is less transportation system infrastructure that would be disrupted and where less permanent fixed infrastructure is likely to be erected.

Submarine deployment activities have the potential to increase boat traffic and congestion on a short-term basis. Submarine deployment activities likely to create potential impacts include the installation of sealed cables in limited nearshore waters and inland waterbodies and the construction of landings and facilities onshore to accept cables.

Each of the potential impacts to transportation capacity and safety discussed above would likely be short term, would be regionally based around the ongoing phase of construction, and would return to normal conditions after a few months or less.

Strain on Capacity of Local Health, Public Safety, and Emergency Response Services

Deployment activities involving plowing, directional boring, or trenching along the road during the installation of fiber optic cable or construction of wireless towers or other structures could have the potential to temporarily create minor road blockages or cause radio interference during the transition to the new system. Deployable technologies with cellular base stations and generators that could require connection to utility power cables could have the potential to create temporary power outages or utility service interruptions. While the potential impacts are not certain, these potential impacts would be localized, short-term, and temporary, and the Proposed Action would likely improve overall access to health care and emergency health services during the operations phase. Deployable Technologies in particular would help to provide coverage in areas of Alaska where fixed infrastructure cannot be erected due to a variety of factors. In Alaska, communities are distributed widely amongst the vast landscape, and there is minimal infrastructure for public safety telecommunications, especially in rural areas (*Alaska NHTSATAT 2014*). With successful completion of the Proposed Action, FirstNet would have established a nationwide broadband network allowing public safety officers and emergency responders to communicate with each other across agencies and jurisdictions, thus improving current conditions for first responders and impacted individuals in emergency situations.

Public Safety Communication Capabilities and Response Times

Currently, the Alaska Land Mobile Radio (ALMR) is the primary public safety interoperable communications system for Alaska and provides federal, state, and local communications capabilities to emergency first responders. ALMR is not a statewide system but covers most roadways. A very large portion of the state lacks roadway infrastructure, and emergency medical service providers have expressed concern that ALMR coverage is incomplete. Other telecommunications systems are available in areas where ALMR coverage is not available. In the event of a disaster, all emergency medical service responders, whether traveling via air, land, or water, can be dispatched using such telecommunications systems as citizen band radio, hand held radios, ham radios, and satellite phones. Four communications trailers are strategically located throughout the state to provide redundant communications capabilities and support these telecommunications systems. There are still large areas of the state that do not have even rudimentary 911 call taking and dispatch services (*NHTSATAT 2014*). FirstNet expects to deliver greater coverage, capacity, connectivity, cybersecurity, redundancy, and resiliency than the current multiplicity of diverse public safety wireless systems. The FirstNet network would likely enhance and expand the state's ALMR system with a range of broadband public safety applications that could potentially aid state public safety organizations in providing faster, and potentially more cost-effective, emergency services (*Statewide Broadband Task Force 2013*). The Proposed Action is needed to address existing deficiencies in public safety communications interoperability, durability, and resiliency that have been highlighted in recent years for the ways in which they have hindered response activities in high profile natural and manmade disasters.

As stated in Chapter 2, Description of the Proposed Action and Alternatives, FirstNet proposes to implement a nationwide public safety broadband network (NPSBN) that would involve high-speed fourth generation Long Term Evolution technology (as defined in Section 2.1.1, Characteristics of the NPSBN), a core network, and a radio access network. A wide range of new telecommunications infrastructure and deployable technologies would likely be implemented as a part of the core network, including fiber optic cable, towers, data centers, microwave technology, and others. The radio access network is necessary for the connection of user devices and includes infrastructure related to the radio base station, such as communication towers, cell site equipment, antennas, deployable mobile hotspots, and backhaul equipment required to enable wireless communications with devices using the public safety broadband spectrum.

The NPSBN intends to provide a backbone to allow for improved communications by carrying high-speed data, location information, images, and, eventually, streaming video. This capability could increase situational awareness during an emergency, thereby improving the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively. The backhaul, or intermediate links that carry user traffic, including voice, data and video, and signaling from radio base stations to the core network, would likely be accomplished through fiber optic and microwave technology, with an emphasis on redundancy that is intended to allow the network to continue to function in events of extreme demand. The NPSBN would also include, by statute, a variety of characteristics, one of which being substantial rural coverage. Alaska is severely lacking in existing rural coverage, and implementation of the FirstNet public safety telecommunications infrastructure is intended to significantly improve public safety communications capabilities and response times in both urban and rural areas of Alaska during operations.

Effects to Commercial Telecommunication Systems, Communications, or Level of Service

The capacity of local health, public safety, and emergency response services would experience negligible impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of local health, public safety, and emergency response services through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders, local health officials, and public safety officials to communicate during emergency response situations. Based on the impact significance criteria presented in Table 3.2.1-1, such potential negative and positive impacts would be *less than significant*.

Effects to Utilities

Potential impacts to utilities, including electric power transmission facilities, could occur throughout the deployment/construction phase but would return to their original state during the operational phase. During deployment activities, to the extent practicable or feasible, FirstNet would work to implement wired projects using existing public road ROWs. These ROWs include existing utility corridors and other easements. As part of the Proposed Action, FirstNet could also install new fiber on existing poles in an effort to improve disaster resistance and resiliency. Pole replacement could be necessary as a part of project activities. Deployable technologies that contain generators could be connected to power utility cables, which could potentially result in temporary power outages. It is unlikely that these project activities would increase the load on the existing electrical utilities; however, the implementation of BMPs and mitigation measures (as discussed in Chapter 11, BMPs and Mitigation Measures) such as organizing scheduled coordination with other service providers while working within utility corridors and easements, would help avoid or minimize the potential for overloading or interrupting the service. Once deployment activities have terminated, if there was any change in service or added burden to the system, electrical utilities would likely return to their original state.

Deployment of new submarine cable would involve the installation of specially sealed cables in nearshore waters and inland waterbodies. However, it is not likely that these project activities would impact offshore utilities.

3.2.1.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to public safety telecommunications systems, commercial communications, transportation capacity and safety, and utilities, and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to public safety telecommunications infrastructure, commercial communications, transportation capacity and safety, access to emergency services, and utilities under the conditions described below:

- Wired Projects
  - Use of Existing Conduit–New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to infrastructure resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to telecommunications infrastructure as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of excavation, trenching, construction, or maintenance within public road

ROWs and utility corridors, collocation of network equipment on existing structures, transport or positioning of deployable technologies, construction of access roads, and installation of new fiber optic cables, poles, towers, or ancillary structures. Potential impacts that could possibly result due to the deployment activities of the Preferred Alternative could include increased traffic congestion, current telecommunication system interruption, increased emergency response times, and utility interruptions. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to telecommunications infrastructure, commercial communications systems, transportation capacity and safety, utilities, and access to emergency facilities include the following:

- Wired Projects
  - New Build–Buried Fiber Optic Plant: Deployment activities involving plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence,[1] huts, or other associated facilities or hand-holes along the utility corridor or within the public road ROW could potentially result in minor, temporary disruptions to some utility services. Construction along a utility corridor could require that certain utilities are shut down during construction. Temporary traffic congestion and limited access to emergency services could occur as a result of construction and the presence of heavy machinery and vehicles near public road ROWs. Public safety and commercial telecommunications systems could also be temporarily disturbed during construction due to potential short-term radio interference; however, during operation the buried fiber optic plant would likely improve coverage and telecommunications capabilities, as discussed below.
  - New Build–Aerial Fiber Optic Plant: Construction of new fiber optic cable involving installation of new poles and hanging cables on disturbed and undisturbed ROWs or easements could potentially impact some utility services. The presence of heavy equipment and vehicles during construction along ROWs could limit access to emergency services and result in increased traffic congestion. Depending on the availability of ROWs, the installation of new poles could involve the construction of access roads, which also has the potential to impact traffic flow. Temporary disruptions to public safety telecommunications systems and current commercial communications systems could also occur as a result of the installation of new poles and hanging cables. As a large portion of the state lacks roadway infrastructure, public safety and commercial communication systems are likely to improve during operations given the new source of coverage that the NPSBN intends to provide. These positive impacts are discussed below.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles, installation of new fiber on existing poles, and structural hardening could cause some disruptions to current telecommunications infrastructure. These activities also have the potential to temporarily disrupt current commercial communications systems. If construction is

[1] Points of presence are connections or access points between two different networks, or different components of one network.

required within utility corridors, current utility systems could be affected. The transport of heavy equipment use associated with these activities could result in increased traffic congestion and could potentially impact traffic safety conditions and limited access to emergency services. The collocation on existing aerial fiber optic plant would provide a new level of resiliency to current public safety telecommunications capabilities. Furthermore, pole replacement as a part of deployment activities could help to accommodate loads from new users. These positive impacts are discussed below.

  - New Build–Submarine Fiber Optic Plant: The installation of cables in limited nearshore or inland bodies of water would not impact land transportation systems, public safety telecommunications systems, commercial communications system, or land-based utility systems because there would be little to no terrestrial ground disturbance associated with this activity. Temporary impacts to telecommunications infrastructure could potentially occur as a result of the construction of landings and facilities on shore to accept submarine cables.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require minimal construction, there would likely be *no impact* to infrastructure because there would be no disturbance to existing infrastructure. Fiber installation activities could require additional installation of equipment to enhance the digital signals traveling through the fiber, which could interfere with the existing telecommunication services. Installation of transmission equipment such as small boxes or huts is typically installed in the ROW of the utility corridor. Construction activities involving excavation could potentially impact utility services. Depending on the availability of a public ROW, construction of a new access road could be necessary, which has the potential to impact transportation capacity and safety. However, these potential impacts are expected to be minor and temporary.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current public safety telecommunications systems, commercial communications systems, or utility service during installation or interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. Transport of heavy equipment during these activities, construction that occurs within the public road ROW, and construction of new access roads could result in temporary impacts to transportation capacity and safety and could limit access to emergency services.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, installation of power units, and structural hardening on existing towers and structures. These activities are not likely to impact transportation system capacity and safety or access to emergency services; however, there is a possibility that these activities could result in interruptions to the existing public safety telecommunications infrastructure, current communications systems, and electric power utilities. Collocation on existing wireless towers, structures, or buildings would improve disaster resistance and resiliency and increase the capacity of the system to accommodate the load from new users. These positive impacts are discussed below.

- Deployable Technologies
  - Deployable technologies including Cell on Wheels, Cell on Light Truck, and System on Wheels are comprised of cellular base stations (sometimes with expandable antenna masts) and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies would help to provide coverage in rural and urban areas of Alaska where permanent, fixed infrastructure cannot be erected due to a variety of factors such as harsh climatic conditions and rugged terrain (*Alaska NHTSATAT 2014*). Positive impacts associated with operation of the Proposed Action are discussed below.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology have the potential to temporarily interfere with existing public safety telecommunications systems and current commercial communications systems. Given that construction activities would occur on existing structures, transportation capacity and safety and access to emergency services would not be impacted.

In general, the abovementioned activities could potentially involve trenching or directional boring, construction of access roads, huts, and installation of equipment such as antennas or microwave dishes and specially sealed cables in nearshore waters and inland waterbodies, and heavy equipment movement. Potential impacts to telecommunications infrastructure associated with deployment of this infrastructure could include increased traffic congestion, interruptions to existing telecommunication systems, increased emergency response times, reductions in emergency levels of service, and utility interruptions. These potential impacts would generally be minor and temporary, and associated BMPs and mitigation measures to help avoid or reduce these impacts are described further in Chapter 11.

Potential Transportation System Capacity and Safety Impacts

Based on the analysis of the deployment activities described above, potential impacts to transportation system capacity and safety as a result of transport of heavy equipment, road blockages, and excavation activities are anticipated to be *less than significant* (see Table 3.2.1-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts to the Accessibility of Local Health, Public Safety, and Emergency Response Services

Based on the analysis of proposed activities described above, potential impacts to local health, public safety, and emergency response times are considered to be *less than significant* (see Table 3.2.1-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with infrastructure.

Potential Public Safety Telecommunication and Infrastructure Impacts

Based on the analysis of proposed activities described above, potential impacts to public safety telecommunications are considered to be *less than significant* (see Table 3.2.1-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Commercial Telecommunication System Level of Service Impacts

Based on the analysis of the proposed activities described above, potential impacts to the current commercial telecommunication system level of service are anticipated to be *less than significant* (see Table 3.2.1-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Utility Service Impacts

Based on the analysis of the proposed activities described above, potential impacts to utility services are anticipated to be *less than significant* (see Table 3.2.1-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no negative impacts to telecommunications infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads and utility ROWs used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could result as explained above, although these potential impacts would be expected to be minor and temporary.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service. Finally, the NPSBN would likely improve the much needed coverage in both rural and remote areas as well as the urban areas of Alaska.

3.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to public safety telecommunications infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[2]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to Alaska's infrastructure system as a result of implementation of this alternative could be as described below.

[2] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to telecommunications systems, commercial communications systems, and utilities if deployment occurs within public road and utility ROWs. Some staging or landing areas (depending on the type of technology) could require heavy equipment movement, excavation, or paving, which have the potential to impact transportation systems. The presence and transport of these mobile communication units could potentially increase traffic congestion and delays, increase transportation-related incidents, and limit access to emergency services. However, implementation of deployable technologies would result in positive impacts during operation, as discussed below.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no negative impacts to the existing telecommunications infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads and utility ROWs used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, *less than significant* impacts to transportation systems, utility services, emergency-level of service, emergency response times, and access to emergency facilities could occur.

As with operations associated with the Preferred Alternative, it is likely that the operation of the Deployable Technologies Alternative would result in improvements to public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in improvements in level of service and communications capabilities, but all these improvements would likely be temporary as opposed to the permanent beneficial impacts of the Preferred Alternative. Generally, these units would be deployed at times of an incident to the affected area for either planned or unplanned incidents or events. Many of the rural areas in Alaska are lacking public safety telecommunications infrastructure and coverage given the rugged terrain and vast landscape. As explained above, under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure, which would likely temporarily improve coverage throughout Alaska.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no negative impacts to telecommunications infrastructure as a result of construction and operation of the Proposed Action; however, none of the beneficial impacts associated with improved response times, redundancy, and resiliency of the system creating a more reliable emergency communication system would be realized. Environmental conditions would therefore be the same as those described in Section 3.1.1, Infrastructure.

3.2.2. Soils

3.2.2.1. Introduction

This section describes potential impacts to soil resources in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are discussed in Chapter 11, BMPs and Mitigation Measures.

3.2.2.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 3.2.2-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each potential impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to soil resources addressed in this section are presented as a range of possible impacts.

Table 3.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils; High likelihood of encountering prime or unique farmland	Effect that is *potentially significant*, but with mitigation is *less than significant*	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil suborders; low likelihood of encountering prime or unique farmland	No perceptible change in baseline conditions; *no impacts* to prime or unique farmland
	Geographic Extent	State or territory		Region or borough	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years		Isolated, temporary, or short-term erosion that that is reversed over few months or less	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers	Effect that is *potentially significant*, but with mitigation is *less than significant*	Minimal mixing of the topsoil and subsoil layers has occurred	No perceptible evidence that the topsoil and subsoil layers have been mixed
	Geographic Extent	State or territory		Region or borough	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline	Effect that is *potentially significant*, but with mitigation is *less than significant*	Perceptible compaction and rutting in comparison to baseline conditions	No perceptible change in baseline conditions
	Geographic Extent	State or territory		Region or borough	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less	No perceptible change in baseline conditions

NA = not applicable

3.2.2.3. Description of Environmental Concerns

Soil Erosion

One of the primary environmental concerns during construction activities is soil erosion and sedimentation. Increased sedimentation in waterways, for example, could alter natural sediment transport processes, which can impair water and habitat quality and potentially affect aquatic plants and animals. Potential impacts to soils from erosion could occur in areas where the slopes are steep and where the erosion potential is moderate to severe as indicated by soil characteristics. Soil suborders exist in Alaska that have steep slopes (i.e., greater than 20 percent) and where the erosion potential is moderate to severe, particularly in the Cryands, Orthents, Wassents, Cryepts, Gelepts, Umbrepts, Gelolls, and Cryods soil suborders (see Section 3.1.2, Soils).

The Proposed Action would result in *no impacts* to prime farmland in Alaska because, according to Natural Resources Conservation Service data, prime farmland does not exist in Alaska since soil temperatures do not meet the required threshold established by Congress[1]. To the extent practicable or feasible, FirstNet and/or their partners would work to avoid deployment/construction activities, as practicable or feasible, in areas with severe erosion potential and steep slopes (up to 110 percent). However, given that steep slopes are present throughout much of Alaska, some limited amount of infrastructure could be built or deployed in these areas, in which case BMPs and mitigation measures (see Chapter 11) could help avoid or minimize the potential impacts. In addition, it is anticipated that any soil erosion would likely be isolated within those locations and would be short-term with stability achieved after a few months or less.

Topsoil Mixing

The potential for the loss of topsoil (i.e., organic and mineral topsoil layers) by mixing would be present during construction of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Although there are no prime farmland soils identified in Alaska, topsoil mixing could result in the loss of soil productivity and fertility, as well as the loss of viable seeds and/or root mass present in surficial soil layers in non-prime farmland areas. It is possible that minimal topsoil mixing as a result of construction could potentially be perceptible at some buildout locations if BMPs and mitigation measures are not followed (see Chapter 11). However, it is anticipated that topsoil mixing would likely be minimal and isolated within those locations.

Soil Compaction and Rutting

The movement of heavy equipment required to support any clearance, drilling, and construction activities, as well as installation of equipment or modification of structures needed to support network deployment, could potentially impact soil resources by causing the compaction and rutting of susceptible soils. Soils suborders with the highest potential for compaction or rutting

[1] See Section 3.1.7, Land Use, Airspace, and Recreation, for additional information related to prime farmland.

resulting from heavy equipment passage were identified by using the STATSGO2 Database (see Section 3.1.2, Soils). Of the soil suborders identified in Alaska, poorly drained and hydric soils likely have the greatest potential for compaction and rutting. These soils may be found within the Aquands, Fluvents, Orthents, Wassents, Aquepts, Histels, Orthels, Turbels, Fibrists, Hemists, Saprists, and Aquods suborders. It is anticipated that soil compaction and rutting as a result of deployment of the Proposed Action would likely not be perceptible over a widespread area since poorly drained and hydric soils (with high potential for compaction) are present to varying degrees within only 12 of the 21 soil suborders present in Alaska, as mentioned above. In addition, compaction would not likely be widespread within those locations and deployment activities would likely be temporary.[2] Implementation of BMPs and mitigation measures would further decrease the potential for impacts.

3.2.2.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to soil resources and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to soil resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to soil resources because the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to soil resources because there would be no ground disturbance.

[2] Although deployable technologies could be in place for a period of several years, potential impacts are still expected to range from *no impact* (if placed on a previously paved surface) to *less than significant*. See below.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact soil resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact soil resources, it is anticipated that this activity would have *no impact* to soil resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to soil resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence[3], huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to soil resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of points of presence, huts, or other associated facilities or hand-holes to access fiber could result in soil erosion, topsoil mixing, soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the installation of new poles could result in soil erosion and topsoil mixing. The use of heavy equipment during the installation of new poles and hanging of cables could result in soil compaction and rutting.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.

[3] Points of presence are connections or access points between two different networks, or different components of one network.

  - New Build – Submarine Fiber Optic Plant: The installation of cables in limited near-shore or inland bodies of water would not impact soil resources because there would be no ground disturbance associated with this activity (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources). However, impacts to soil resources could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable. Soil erosion and topsoil mixing could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Soil compaction and rutting could potentially occur due to heavy equipment use during these activities.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to soils. If installation of transmission equipment required grading or other ground disturbance to install small boxes, hunts, or access roads, there could potentially be impacts to soils. Such ground disturbance could result in soil erosion and topsoil mixing. Heavy equipment use could result in soil compaction and rutting.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to soil resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in soil erosion or topsoil mixing, and heavy equipment use during these activities could result in soil compaction and rutting.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to soils because there would be no ground disturbance associated with this activity. The potential addition of power units, structural hardening, and physical security measures would not impact soil resources if this activity would not require ground disturbance. However, if structural hardening and physical security measures require ground disturbance, such as grading or excavation activities, impacts to soil resources could occur, including soul erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.

- Deployable Technologies
  - Where deployable technologies, both land-based and aerial, would be located on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, it is anticipated that there would be *no impacts* to soil resources because there would be no ground disturbance. However, implementation of deployable technologies could result in potential impacts to soil resources if deployment of land-based deployables occurs in unpaved areas, or if the implementation results in minor construction or paving of previously unpaved surfaces. In addition, potential impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging areas could require land/vegetation clearing, minor excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities could result in soil compaction and rutting. In addition, implementation of and activities associated with deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, and/or soil compaction and rutting. These potential impacts are described further below, and BMPs and mitigation measures to help avoid or reduce these potential impacts are discussed in Chapter 11.

Potential Soil Erosion Impacts

Based on the analysis of the deployment activities described above to soil resources, potential impacts as a result of erosion are anticipated to be *less than significant*. See Chapter 11 for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential soil erosion impacts.

Potential Topsoil Mixing Impacts

Based on the analysis of proposed activities described above, the minimal mixing of the topsoil with the subsoil layers could result in potentially *less than significant* impacts. See Chapter 11 for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts as a result of topsoil mixing.

Potential Soil Compaction and Rutting Impacts

Based on the analysis of the proposed activities described above to soil resources, potential impacts to soil resources as a result of soil compaction and rutting are anticipated to be *less than significant*. See Chapter 11 for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential soil compaction and rutting impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be *no impacts* to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, *less than significant* soil compaction and rutting impacts could potentially result as explained above.

3.2.2.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action alternative.[4]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile land-based and aerial communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Potential impacts to soil resources as a result of implementation of this alternative are described below.

Potential Deployment Impacts

As explained above, implementation of land-based deployable technologies could result in *less than significant* impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, potential impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging areas could require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities could result in soil compaction and rutting. In addition, implementation of and activities associated with deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas.

[4] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, *less than significant* soil compaction and rutting impacts could potentially result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion as it runs onto the soil below. However, it is anticipated that the soil erosion would not result in perceptible changes to baseline conditions.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.2, Soils.

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3.2.3. Geology

3.2.3.1. Introduction

This section describes potential impacts to geologic resources in Alaska associated with deployment and operation of the Proposed Action as well as the geologic hazards that could potentially affect the Proposed Action. Best management practices (BMPs) and mitigation measures that would help avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.3.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on geologic resources and the potential impacts to the Proposed Action from geologic hazards were evaluated using the significance criteria presented in Table 3.2.3-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to geologic resources addressed in this section are presented as a range of possible impacts.

Table 3.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Surface geology, bedrock, topography, physiography, and geomorphology impacts	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minor degradation or alteration of surface geology, bedrock, topography that does not result in measurable changes in physiographic characteristics or geomorphological processes	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes
	Geographic Extent	State or territory		State or territory	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes		Temporary degradation or alteration of resources that is limited to the construction and deployment phase	NA
Mineral and fossil fuel resource impacts	Magnitude or Intensity	Severe, widespread, observable impacts to mineral and/or fossil fuel resources	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Limited impacts to mineral and/or fossil resources	No perceptible change in mineral and/or fossil fuel resources
	Geographic Extent	Regions of mineral or fossil fuel extraction areas are highly prevalent within the state or territory.		Mineral or fossil fuel extraction areas occur within the state or territory, but may be avoidable.	Mineral or fossil fuel extraction areas do not occur within the state or territory.
	Duration or Frequency	Long-term or permanent degradation or depletion of mineral and fossil fuel resources		Temporary degradation or depletion of mineral and fossil fuel resources	NA
Paleontological resources impacts	Magnitude or Intensity	Severe, widespread, observable impacts to paleontological resources	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than*	Limited impacts to paleontological and/or fossil resources	No perceptible change in baseline conditions

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state or territory.		Areas with known paleontological resources occur within the state or territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state or territory.
	Duration or Frequency	NA		NA	NA
Seismic hazards	Magnitude or Intensity	High likelihood that a project activity could be located within a high-risk earthquake hazard zone or active fault	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Low likelihood that a project activity could be located within an earthquake hazard zone or active fault	No likelihood of a project activity being located in an earthquake hazard zone or active fault
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state or territory.		Earthquake hazard zones or active faults occur within the state or territory, but may be avoidable.	Earthquake hazard zones or active faults do not occur within the state or territory
	Duration or Frequency	NA		NA	NA
Volcanic activity	Magnitude or Intensity	High likelihood that a project activity could be located near a volcano lava or mud flow area of influence	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Low likelihood that a project activity could be located near a volcanic ash area of influence	No likelihood of a project activity located within a volcano hazard zone
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state or territory.		Volcano ash areas of influence occur within the state or territory, but may be avoidable.	Volcano hazard zones do not occur within the state or territory.
	Duration or Frequency	NA		NA	NA
Landslides	Magnitude or Intensity	High likelihood that a project activity could be located within a landslide area	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Low likelihood that a project activity could be located within a landslide area	No likelihood of a project activity located within a landslide hazard area
	Geographic Extent	Landslide areas are highly prevalent within the state or territory.		Landslide areas occur within the state or territory, but may be avoidable.	Landslide hazard areas do not occur within the state or territory.

Type of Effect	**Effect Characteristic**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	NA		NA	NA
Land subsidence	Magnitude or Intensity	High likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain, lava tubes, etc.)	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Low likelihood that a project activity could be located within an area with a hazard for subsidence (e.g., karst terrain, lava tubes, etc.)	Project activity located outside an area with a hazard for subsidence (e.g., karst terrain, lava tubes, etc.)
	Geographic Extent	Areas with a high hazard for subsidence (e.g., karst terrain, lava tubes, etc.) are highly prevalent within the state or territory.		Areas with a high hazard for subsidence (e.g., karst terrain, lava tubes, etc.) occur within the state or territory, but may be avoidable.	Areas with a high hazard for subsidence (e.g., karst terrain, lava tubes, etc.) do not occur within the state or territory.
	Duration or Frequency	NA		NA	NA

NA = not applicable

3.2.3.3. Description of Environmental Concerns

Terms and concepts discussed in this section are further discussed and defined in the Affected Environment section (Section 3.1.3, Geology).

Potential Effects from the Proposed Action

Potential Surface Geology, Bedrock, Topography, Physiography, and Geomorphology Impacts

The potential for impacts to surface geology, bedrock, topography, physiography, and geomorphology could be present during deployment or construction of the proposed facilities/infrastructure, particularly during trenching, grading, and/or foundation excavation activities. For example, as discussed in and shown graphically in Section 3.1.2, Soils, there are numerous areas in Alaska where shallow soils are present and bedrock is likely at or near the surface including, but not limited to, the Kodiak Archipelago, North Bearing Sea Islands, and Southern Alaska Peninsula and Coastal Mountains. Such shallow bedrock could be susceptible to potential impacts from rock ripping.[1] However, rock ripping would likely only occur in discrete locations where necessary and would not result in large-scale changes to Alaska's geologic, topographic, or physiographic characteristics. In addition, to the extent practicable or feasible FirstNet and/or their partners would work to avoid areas that commonly undergo significant geomorphological changes, such as active glacial valleys. Temporary degradation or alteration of surface geology, bedrock, topography, physiography, and geomorphology would primarily be limited to the construction/deployment phases and would be limited and localized in extent. Therefore, it is anticipated that potential impacts to surface geology, bedrock, topography, physiography, and geomorphology as a result of the anticipated project activities would be minor and would not result in measureable changes. Implementation of BMPs and mitigation measures would help further reduce potential impacts.[2]

Potential Mineral and Fossil Fuel Resource Impacts

In general, potential impacts to mineral and fossil fuel resources as a result of the Proposed Action would be more likely in states or territories with numerous extraction areas. Although Alaska ranked 5th among the 50 states in mineral production values in 2011 and 13th for total energy production in 2013, the state is by far the largest in the U.S. at about 21 percent of the size of the entire contiguous U.S. (*USGS 2015; EIA 2014).* In other words, the density of extraction areas is relatively low in comparison to the overall size of the state.[3] Because of this, very limited potential impacts to mineral and fossil fuel resources are anticipated as a result of the Proposed Action, if any at all. Any potential impacts are likely to be minor and temporary, and further reduced with implementation of BMPs and mitigation measures, as discussed in Chapter 11, BMPs and Mitigation Measures.

1 Rock ripping refers to the breakup and removal of rock material with heavy equipment such as an excavator.
2 See Chapter 11 for a discussion of specific required BMPs and mitigation measures.
3 See Section 3.1.3, Geology, for a map showing the primary mineral production areas and a discussion of mineral and fossil fuel resources.

Potential Paleontological Resources[4] Impacts

The potential for impacts to paleontological resources could be present during deployment or construction of the proposed facilities/infrastructure, particularly during trenching, grading, and/or foundation excavation activities. As discussed in detail in Section 3.1.3, Geology, some of the United States' most scientifically significant fossils have been discovered in Alaska, and its geographic location along with the former land bridge that connected Asia and North America make the state rich in paleontological resources. However, it is anticipated that potential impacts to specific areas with significant paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would likely be limited and localized. Implementation of the BMPs and mitigation measures as discussed in Chapter 11, BMPs and Mitigation Measures, would help further reduce potential impacts.

Potential Effects to the Proposed Action

Seismic Hazards

As discussed in Section 3.1.3, Geology, one of the most active plate boundaries in the world is located in Alaska and the state is susceptible to earthquakes, particularly in its southern portions where seismic hazards are the highest. The Proposed Action is unlikely to affect seismic activity, but rather seismic hazards could have the potential to impact the Proposed Action. As discussed in Chapter 1, Introduction, the FirstNet network would be "hardened" from the physical layer, user access, and cyber security perspectives to be more resilient to potential impacts than typical telecommunications infrastructure. However, some potential impacts to the Proposed Action infrastructure could occur during significant earthquake events, and it is recommended that FirstNet and/or their partners attempt, as practicable or feasible, to design the network to reasonably withstand the seismic activity typical in Alaska, thereby limiting potential impacts. In addition, implementation of the BMPs and mitigation measures as discussed in Chapter 11, BMPs and Mitigation Measures, would help further reduce potential impacts.

Volcanic Activity

As described and shown graphically in Section 3.1.3, Geology, most volcanoes in Alaska exist primarily just north of the Aleutian Trench in southern Alaska. As with seismic hazards, the Proposed Action is unlikely to affect volcanic activity, but rather volcanic activity could have the potential to impact the Proposed Action. It is recommended that FirstNet and/or their partners work to avoid developing and deploying fixed telecommunications infrastructure near active volcanoes unless absolutely necessary. Implementation of the BMPs and mitigation measures as discussed in Chapter 11, BMPs and Mitigation Measures, would help further reduce potential impacts.

[4] Paleontological resources, or fossils, are the physical remains of plants and animals that have mineralized into or left impressions in solid rock or sediment.

Landslides

In general, the Proposed Action is unlikely to affect landslide activity, but rather landslides in Alaska have the potential to impact the Proposed Action. As discussed in Section 3.1.3, Geology, excessive rainfall, seismic activity, and volcanic activity can trigger local landslides, especially near areas with steep slopes and loose or unconsolidated material. As discussed in Section 3.1.2, Soils, slopes in Alaska range from 0 to 110 percent, with steepest areas located in the mountainous regions including, but not limited to, the Ahklun Mountains, Aleutian Islands, Cook Inland Mountains, and the Interior Alaska Highlands.[5]

To the extent practicable or feasible, FirstNet and/or their partners would work to avoid developing and deploying telecommunications infrastructure in areas with steep slopes that are highly susceptible to landslides. Although some localized, limited potential impacts could occur as a result of landslides, widespread potential impacts are unlikely. Implementation of the BMPs and mitigation measures as discussed in Chapter 11, BMPs and Mitigation Measures, would help further reduce potential impacts.

Land Subsidence

As discussed in Section 3.1.3, Geology, the best developed and most well-known karst areas in Alaska exist in the temperate rainforests near the southeastern portion of the state. Outside of this area, land subsidence risk is likely much lower. To the extent practicable or feasible, FirstNet and/or their partners would work to avoid areas with a high hazard for subsidence during deployment and operation of the Proposed Action. Implementation of the BMPs and mitigation measures discussed in Chapter 11 would help avoid or further minimize potential impacts to the Proposed Action as a result of land subsidence.

3.2.3.4. Potential Impacts of and to the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities as well as potential geologic hazards to the Preferred Alternative.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to geologic resources and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions. Additionally, geologic hazards such as earthquakes, volcanic activity, landslides, and land subsidence that have the potential to impact the deployment of the Preferred Alternative are discussed below.

[5] See Section 3.1.2, Soils, for a map and descriptions of the physiographic characteristics of these areas.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to geologic resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to geologic resources because the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have *no impact* to geologic resources.

Activities and Geologic Hazards with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of ground disturbance activities including potential impacts to surface geology, bedrock, topography, physiography, and geomorphology; potential mineral and fossil fuel impacts; and potential paleontological impacts. In addition, geologic hazards including seismic activity, volcanoes, landslides, and land subsidence have the potential to impact deployment of the Preferred Alternative. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or potential impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence[6], huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources. Ground disturbance and heavy equipment use associated with plowing, trenching, directional boring, excavation activities, rock ripping, and landscape grading associated with construction of points of presence, huts, or other associated facilities or

[6] Points of presence are connections or access points between two different networks, or different components of one network.

hand-holes to access fiber could result in limited potential impacts to bedrock, topography, physiography, and geomorphology; potential mineral impacts; and potential paleontological impacts. Depending on its location, this development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence if it occurs in areas of high susceptibility.

- New Build – Aerial Fiber Optic Plant: Depending on its location and deployment methods used, excavation and excavated material placement, trenching, grading, and rock ripping during the installation of new poles or construction of points of presence, huts, or other facilities could result in potential limited and localized impacts to bedrock, topography, physiography, and geomorphology; potential mineral impacts; and potential paleontological impacts. This development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence, if it occurs in areas of high susceptibility.
- Collocation on Existing Aerial Fiber Optic Plant: Depending on its location, excavation, grading, and rock ripping during the replacement of poles and structural hardening could result in localized potential impacts to bedrock, topography, physiography, and geomorphology; potential mineral impacts; and potential paleontological impacts. This development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence, depending on deployment location and its susceptibility to those hazards.
- New Build – Submarine Fiber Optic Plant: The installation of cables in near-shore or inland bodies of water would not impact geologic resources. However, potential impacts to geologic resources could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable. Grading, foundation excavation, rock ripping, or other ground disturbance activities could result in limited potential impacts to bedrock, topography, physiography, and geomorphology; potential mineral impacts; and potential paleontological impacts. Deployment of this development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence if it occurs in areas of high susceptibility.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to geologic resources. If installation of transmission equipment required grading, foundation excavation or other ground disturbance activities including rock ripping to install small boxes, hunts, or access roads, there could potentially be temporary potential impacts to geologic resources. Deployment of this development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence if it occurs in areas of high susceptibility.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to geologic resources. Excavation activities, landscape grading, rock ripping, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in localized potential impacts to bedrock, topography, physiography, and geomorphology; potential mineral and fossil fuel impacts; and potential paleontological impacts. Deployment of this development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence if it occurs in areas of high susceptibility.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to geologic resources because there would be no ground disturbance associated with this activity. The potential addition of power units, structural hardening, and physical security measures would not impact geologic resources if this activity would not require ground disturbance. However, if structural hardening required ground disturbance, such as grading, excavation activities, or rock ripping, potential impacts to geological resources could occur. Deployment of this development scenario could also potentially be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence if it occurs in areas of high susceptibility.
- Deployable Technologies
  - Where deployable technologies (both land-based and aerial) would be located or deployed on existing paved surfaces, it is anticipated that there would be *no impacts* to geologic resources because there would be no new ground disturbance. However, implementation of deployable technologies could result in potential impacts to geologic resources. These potential impacts could occur if deployment of land-based or aerial deployables occurs in unpaved areas, or if the implementation results in minor construction, paving of previously unpaved surfaces, grading, excavation, or rock ripping (e.g., for staging or launching/landing areas).
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance nor any impact to the built or natural environment. However, where equipment is permanently installed in locations that are susceptible to specific geologic hazards, such as earthquakes, it is possible that they could be affected by that hazard.

In general, the abovementioned activities could potentially involve excavation, rock ripping, trenching or directional boring, and landscape grading. Potential impacts to geologic resources associated with deployment of this infrastructure could include localized and/or limited potential impacts to bedrock, topography, physiography, and geomorphology; mineral; and paleontological resources. Additionally, deployment of the abovementioned scenarios potentially could be impacted by geologic hazards including seismic activity, volcanoes, landslides, and/or land subsidence if it occurs in areas of high susceptibility. These potential impacts are described further below. BMPs and mitigation measures to help avoid or reduce these potential impacts are discussed in Chapter 11, BMPs and Mitigation Measures.

Potential Impacts from the Preferred Alternative

Potential Surface Geology, Bedrock, Topography, Physiography, and Geomorphology Impacts

Based on the analysis of the deployment activities described above to bedrock, topography, physiography, and geomorphology, potential impacts are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to these resources.

Potential Mineral and Fossil Fuel Resource Impacts

Based on the analysis of proposed activities described above to geologic resources, potential mineral and fossil fuel resource impacts could result in potentially *less than significant* impacts. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to mineral resources.

Potential Paleontological Resources Impacts

Based on the analysis of the proposed activities described above to geological resources, potential paleontological resources impacts are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to paleontological resources.

Potential Impacts to the Preferred Alternative

Potential Seismic Hazard Impacts

Based on the analysis of the proposed activities described above, potential impacts to the deployment of the Preferred Alternative as a result of seismic hazards are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with seismic hazards.

Potential Volcanic Activity Impacts

Based on the analysis of the proposed activities described above, potential impacts to the deployment of the Preferred Alternative as a result of volcanic activity are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with volcanic activity.

Potential Landslide Impacts

Based on the analysis of the proposed activities described above, potential impacts to the deployment of the Preferred Alternative as a result of landslides are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with landslide hazards.

Potential Land Subsidence Impacts

Based on the analysis of the proposed activities described above, potential impacts to the deployment of the Preferred Alternative as a result of land subsidence are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with land subsidence.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be *no impacts* to geologic resources associated with routine inspections of the Preferred Alternative.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be *less than significant*, and even further reduced if BMPs and mitigation measures discussed in Chapter 11, BMPs and Mitigation Measures, are implemented.

3.2.3.5. Alternatives Impact Assessment

The following section assesses potential impacts to geologic resources associated with the Deployable Technologies Alternative and the No Action alternative.[7]

[7] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile land-based and aerial communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Potential impacts to geologic resources as a result of implementation of this alternative are described below.

Potential Deployment Impacts

As explained above, if deployment occurs on unpaved areas and/or if implementation results in paving of unpaved surfaces or if grading, excavation, or rock ripping is required for staging or launching/landing areas, implementation of deployable technologies (i.e., System on Wheels, Cell on Wheels, Cell on Light Truck, Unmanned Aerial Vehicle) would likely result in *less than significant* impacts to geologic resources. It is anticipated that the same BMPs and mitigation measures discussed for the Preferred Alternative would apply to the Deployable Technologies Alternative, to the extent practicable or feasible.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* to geologic resources associated with routine inspections of the Deployable Technologies.

As with the Preferred Alternative, the operation of the Deployable Technologies Alternative could be affected due to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be *less than significant*, especially given the BMPs and mitigation measures discussed in Chapter 11, BMPs and Mitigation Measures. It is anticipated that the same BMPs and mitigation measures discussed for the Preferred Alternative would apply to the Deployable Technologies Alternative, to the extent practicable or feasible.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to geologic resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.3, Geology.

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3.2.4. Water Resources

3.2.4.1. Introduction

This section describes potential impacts to water resources in Alaska associated with deployment and operation of the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.4.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 3.2.4-1. As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant, less than significant with BMPs and mitigation measures incorporated, less than significant,* or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to water resources addressed in this section are presented as a range of possible impacts.

Table 3.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Water Quality (groundwater and surface water) - sedimentation, pollutants, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: Clean Water Act, Safe Drinking Water Act	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions	No changes to water quality, sedimentation, water temperature, or the presence of water pollutants
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level[a]	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons		The impact is temporary, lasting no more than 6 months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Floodplain degradation	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces or place structures that would impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. There is a low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		The impact is temporary, lasting no more than 1 season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		The impact is temporary, lasting no more than 6 months.	NA
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Minor or no consumptive use with negligible impact on discharge	Activities do not impact discharge or stage of waterbody.
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than 6 months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers
	Geographic Extent	Watershed level, and/or within multiple watersheds		Watershed or subwatershed level	NA
	Duration or Frequency	Impact is ongoing and permanent.		Potential impact is temporary, not lasting more than 6 months.	NA

Note: Because public safety infrastructure is considered a critical facility, Proposed Action activities should avoid the 500-year floodplain wherever practicable per the Executive Orders on Floodplain Management (*Executive Orders 11988 and 13690*).
NA = not applicable
[a] Definitions of U.S. Geological Survey (USGS) watershed and subwatershed: USGS watershed refers to the USGS 10 digit hydrologic unit code (HUC10), which averages approximately 230 square miles, depending on the region. USGS subwatershed refers to the USGS 12 digit hydrologic unit code (HUC12), which averages approximately 40 square miles, depending on the region. See *USGS and NRCS 2013* for an explanation of HUC codes.

3.2.4.3. Description of Environmental Concerns

Water Quality – Potential Impacts Associated with Sedimentation, Pollutants, or Water Temperature

One of the primary environmental concerns during deployment activities is minimizing potential impacts to water quality, particularly since 99.9 percent of Alaska's 700,000 miles of rivers and streams are currently considered unimpaired (*ADEC 2013*). Potential impacts to water quality could result from sedimentation or pollutants due to ground disturbance; disruption of streamside soils or vegetation; or spills of fluids from motorized equipment. Potential impacts to water quality due to deployment activities would be influenced by the timing of deployment, weather conditions, local topography, and the erosion and infiltration potential of soils.

Potential sedimentation impacts to streams or lakes, the near-shore ocean floor, or floodplains could be caused by ground-disturbing construction activities such as trenching, pole installation, or road work. Increased sedimentation in waterways could impair water and habitat quality and potentially affect aquatic plants and animals. Potential impacts to water quality from erosion and sedimentation are most likely in areas where:

- Ground disturbance occurs in or near waterbodies or floodplains;
- Riparian vegetation is cleared or disturbed; and/or
- Steep slopes with moderate to severe erosion potential are disturbed.

Soil suborders exist in Alaska that have steep slopes (i.e., greater than 20 percent) where the erosion potential is moderate to severe, particularly in the Cryands, Orthents, Wassents, Cryepts, Gelepts, Umbrepts, Gelolls, and Cryods soil suborders (see Section 3.1.2, Soils).

Other potential sources of sedimentation impacts include vehicle travel on dirt or gravel roads or off-road construction activity outside of periods of permafrost. During periods of permafrost, the amount of sediment introduced to streams during vehicular travel, ground disturbance, or road work would be similar to natural erosion processes because there would be little or no flowing water on road surfaces or across disturbed areas.

BMPs and mitigation measures could be implemented during deployment to adjust to local conditions and minimize soil erosion and storm water runoff.

Potential inputs of pollutants could occur if chemicals or petroleum products are spilled from equipment due to malfunction or refueling errors. Accidental spills of chemicals or petroleum products from motorized equipment during deployment could expose surface water resources to hazardous materials. Spills could also infiltrate the groundwater aquifer in areas with porous geology if the spills are not contained. Any spills from vehicles or machinery used during deployment tend to be associated with refueling activities, and as such, would likely be a few gallons or less in volume and could easily be contained and cleaned.

Most wood poles used for utility or telephone lines are treated with a preservative called pentachlorophenol (PCP) to lessen wood rot and extend the life of the poles. Once constructed, new treated poles could potentially impact surface water (or groundwater) by leaching PCP. Because of the demonstrated tendency for PCP to adsorb to soils, the moderately rapid degradation of the compound in the environment, and the localized nature of the compound, it is unlikely that surface water (or groundwater) contamination would result from installation of the new wood poles. In addition, concentrations of PCP released during placement or replacement of poles are not expected to exceed United States Environmental Protection Agency levels of concern for human health.

Water temperature could potentially be impacted by reduced stream shading in any areas where riparian vegetation is cleared.

To the extent practicable or feasible, FirstNet and/or their partners would work to avoid stream crossings, and crossings that are required could be limited to times of the year that they are dry or frozen. When crossing streams that are flowing is required, potential impacts could be reduced by scheduling stream crossings for the times of the year when stream flow is lowest. Further, to the extent practicable or feasible, limiting deployment in areas with severe erosion potential due to sensitivity and constructability limitations associated with steep slopes (up to 90 percent) could also reduce potential water quality impacts (see Section 3.2.2, Soils, and Section 3.2.3, Geology). However, because steep slopes are present throughout much of Alaska, some limited amount of infrastructure are likely to be built in these areas, in which case BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help avoid or minimize the potential impacts. If appropriate BMPs and mitigation measures are implemented, soil erosion could be isolated within those locations and could be short-term, with stability achieved after a few months or less.

Sedimentation, whether due to storm water runoff or other deployment activity, could return to current levels once deployment is complete and if vegetation is re-established in disturbed areas. Vegetation re-establishment, which is a BMP, would take longer in northern areas of Alaska with shorter growing seasons. Additionally, creation of turbidity from installation of submarine infrastructure deployed in near-shore or inland bodies of water would be temporary and would likely return to background levels after deployment activities subside.

Floodplain Degradation

Floodplains can be degraded by construction of additional impervious surfaces or reduced ability to store floodwaters due to floodplain fill. Additionally, construction of structures in floodplains that cannot withstand flooding can cause residual effects for downstream areas where flood debris is transported. Soil compaction and removal of vegetation in the floodplain could contribute to erosion within the floodplain, lessen dissipation of water energy during floods, and impede floodplain permeability. In areas that are not permanently disturbed, these potential impacts could be reduced if these areas are restored by establishing new vegetation.

To the extent practicable or feasible, FirstNet and/or their partners would work to avoid deployment activities in floodplains, particularly in the floodway. The employment of BMPs and mitigation measures as described in Chapter 11 could also help avoid or minimize potential impacts in floodplain areas.

Drainage Pattern Alteration

Drainage patterns could be altered if Proposed Action activities involved alteration of a stream or a river course. This could be due to changes in stream geomorphological conditions, and/or a substantial or measureable increase in the amount of surface water, or changes to the hydrologic regime of a surface waterbody. If in-stream construction activities such as trenching or road building were to involve rerouting of surface waters, this could result in drainage pattern alterations. Where surface disturbance associated with trenching and road building could be conducted when streams do not have flow, potential impacts are not anticipated to occur and surface waters would not need to be re-routed. When construction activities would cross perennial streams or during times that intermittent streams have flow, potential impacts to drainage patterns would be temporary and streams would be returned to their natural course after construction is complete.

Flow Alteration

Stream flow could be altered if Proposed Action activities involved withdrawal of surface water or diversion of surface water flows such that there is a measurable reduction in stream discharge. Withdrawal of surface water for water trucks (used in dust suppression for air quality mitigation) would be unlikely to result in a significant quantity of water being withdrawn and therefore would not be likely to impact stream flow patterns.

Changes in Groundwater or Aquifer Characteristics

Groundwater or aquifer characteristics could potentially be impacted if Proposed Action activities involved contamination of groundwater with petroleum, lubricants, or other fluids from heavy equipment. As discussed above, any concentrations of PCP released to groundwater during placement or replacement of poles are not expected to exceed United States Environmental Protection Agency levels of concern for human health, and are likewise not anticipated to impact wildlife. Trenching for installation of Proposed Action features and pole placement could be deep enough to interact with shallow groundwater, but would not impact groundwater quality or aquifer characteristics, and any accidental spills of chemicals would likely be contained before they would reach groundwater; therefore, impacts to groundwater are not anticipated.

3.2.4.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities could result in potential impacts to water resources and others would not. In addition, and as explained in this section, the various types of Proposed

Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to water resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to water resources because the activities that would be conducted at these small entry and exit points are likely to be located in areas away from waterbodies, and are not likely to produce perceptible surface disturbances.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.

Activities with the Potential to Have Impacts

Potential construction/deployment-related impacts to water resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of ground disturbance activities, including in-stream construction work, resulting primarily in sediments entering streams, but also potentially to near-shore or inland waters, as well as the potential for other impacts to water quality and floodplains. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs)[1], huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Ground disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in stream sedimentation, construction of impervious surfaces and structures in floodplains, stream channel alteration, and accidental spills of fuels or lubricants to waterbodies. New Build – Buried Fiber Optic Plant projects could present a higher risk to water resources because of their relatively high degree of soil disturbance compared to the other types of projects.

[1] POPs are connections or access points between two different networks, or different components of one network.

  - New Build – Aerial Fiber Optic Plant: Soil exposure from installation of new poles or construction of new roads, POPs, huts, or other facilities near waterbodies could result in ground disturbance, resulting in sediment deposition and increased turbidity in nearby waterbodies. The use of heavy equipment during the installation of new poles and cables could result in potential soil disturbance and the resulting potential sedimentation impacts to streams, disturbance of riparian vegetation, leaching of PCPs, and accidental spills of fuels or lubricants to waterbodies.
  - Collocation on Existing Aerial Fiber Optic Plant: Lighting up of dark fiber would have *no impacts* to water resources. If required, and if done in existing huts or on existing poles with no ground disturbance, installation of new associated equipment would have *no impacts* to water resources. Ground disturbance during the replacement of poles and structural hardening could result in potential soil erosion and sedimentation impacts to streams, particularly where this work would be done in proximity to waterbodies. Collocation on Existing Aerial Fiber Optic Plant projects could present a lower risk to water resources because of their relatively low degree of soil disturbance compared to the other types of projects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in near-shore and inland bodies of water would potentially impact water quality due to disruption of sediments on the floor of the waterbody. Impacts to water resources could also potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable. Sediments entering limited near-shore or inland waterbodies could potentially occur as result of grading, foundation excavation, or other ground disturbance activities. Construction of facilities in floodplains could potentially impact floodplain functionality and drainage patterns.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to water resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes, huts, or access roads, there could potentially be impacts to water resources. The extent of these potential impacts would depend upon the proximity of the disturbance to waterbodies and floodplains.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to water resources. Ground disturbance and vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads completed in or near streams could result in sediments entering streams and physical disturbance of streams if crossings are required. Additionally, use of heavy equipment around streams could result in the accidental spill of fuel or other liquids from equipment

that could potentially impact water quality. New Wireless Communication Tower projects could present a higher risk to water resources than some of the lower risk wired projects because of their relatively high degree of soil disturbance compared to the other projects.

- Co-location on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to water resources because there would be no ground disturbance or in-water construction associated with this activity. The potential addition of power units, structural hardening, and physical security measures would not impact water resources if this activity would not require ground disturbance or in-water construction. However, if the on-site delivery of additional power units, structural hardening, and physical security measures required travel through streams or ground disturbance, such as grading or excavation activities near streams, potential impacts to water resources could occur, including stream sedimentation and physical disturbance associated with heavy equipment use.

- Deployable Technologies
  - Where deployable technologies would be implemented on existing paved surfaces, away from streams, and outside of floodplains, it is anticipated that there would be *no impacts* to water resources because there would be no ground disturbance use of motorized equipment near streams. However, implementation of deployable technologies could result in potential impacts to water resources. These potential impacts could occur if deployment involves movement of equipment through streams, involves riparian or floodplain areas, or if the implementation results in minor construction, paving of previously unpaved surfaces in floodplains, or fuels leaking into surface or groundwater. Some staging or landing areas (depending on the type of technology) could require land/vegetation clearing, minor excavation, and paving. These activities could result in erosion and sedimentation into streams. Heavy equipment use associated with these activities could result in stream sedimentation and physical disturbance of waterbodies if the equipment is used in or near streams. In addition, implementation of deployable technologies themselves could result in ground disturbance and related sediments entering waterbodies deployed in unpaved areas near streams.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance, construction in floodplains, or use of motorized equipment near streams.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide, public safety broadband network (NPSBN); however, it may include equipment on satellites that are already being launched for other purposes.

As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have *no impact* to those resources.

In general, the abovementioned activities could potentially involve land/vegetation clearing, ground disturbance, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to water resources associated with deployment of this infrastructure could include soil erosion and the resulting sediments entering waterbodies; construction of structures and impervious surfaces near waterbodies and in floodplains; in-water construction related to trenching, road building, and construction of marine infrastructure; and spills of fuels, lubricants, or other materials from construction and maintenance equipment to waterbodies. These potential impacts and associated BMPs and mitigation measures to help mitigate or reduce these impacts are described in Chapter 11.

Potential Water Quality Impacts

Based on the analysis of the deployment activities described above to water resources, potential impacts to water quality are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts to water resources.

Potential Floodplain Degradation Impacts

Based on the analysis of proposed activities described above, the development of Proposed Action facilities in floodplains could result in potentially *less than significant* impacts (see Table 3.2.4-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts to water resources.

Potential Drainage Pattern Alteration Impacts

Based on the analysis of the proposed activities described above to water resources, potential impacts to water resources as a result of drainage pattern alteration are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts to water resources.

Potential Flow Alteration Impacts

Based on the analysis of the proposed activities described above, *no impacts* to water resources as a result of drainage pattern alteration would occur as a result of the Proposed Action because activities would not impact the discharge or stage of waterbodies.

Potential Groundwater or Aquifer Impacts

Based on the analysis of the proposed activities described above, potential impacts to water resources as a result of groundwater or aquifer impacts are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts to water resources.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned construction impacts. It is anticipated that there would be *no impacts* to water resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections, and assuming that all refueling and vehicle maintenance BMPs and mitigation measures are followed. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies.

3.2.4.5. Alternatives Impact Assessment

The following section assesses potential impacts to water resources associated with the Deployable Technologies Alternative and the No Action alternative.[2]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile and aerial communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to water resources as a result of implementation of this alternative could be as described below.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to water resources if deployment of ground-based equipment occurs

[2] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, potential impacts to water resources could occur if equipment maintenance and refueling standards are not followed, resulting in spills of petroleum products or other chemicals to surface waters. Some staging or landing areas (depending on the type of technology) could require land/vegetation clearing, minor excavation, and paving. These activities could result in soil erosion and related sediments entering streams, drainage pattern alteration through the creation of cleared or impervious surfaces, and/or floodplain degradation if these activities occur in floodplains. Deployment and heavy equipment use associated with these activities could result in ground disturbance and sedimentation.

Potential Operation Impacts

As explained above, operation activities would consist of implementation and running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* to water resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Site maintenance, including mowing or herbicides, may result in *less than significant* effects to water quality, depending on the location and amount of herbicides used. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies. It is anticipated that operation impacts on water quality would be *less than significant* due to the small scale of expected FirstNet activities in any one location.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.4, Water Resources.

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3.2.5. Wetlands

3.2.5.1. Introduction

This section describes potential impacts to wetland resources in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.5.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on wetland resources were evaluated using the significance criteria presented in Table 3.2.5-1. As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each potential impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

As discussed in Section 3.1.5, Wetlands, wetlands are recognized as important for maintenance of watershed and environmental health due to their potential to perform various ecological, hydrologic, biogeochemical, and social functions, although not all wetlands perform these functions equally. Typical wetland functions include bank stabilization, flood mitigation, maintenance of water quality, maintenance of fish and wildlife habitat, sediment retention, groundwater discharge and recharge, and maintenance of nutrient retention and export. Their capacity or degree to which they perform individual functions depends on the wetland characteristics including soil type, substrate, type and percent cover of vegetation, water source, landscape position, location within a watershed, and location relative to populated areas (*USGS 1997*).

As part of mitigation planning (to avoid, minimize, and/or compensate for unavoidable impacts to wetlands) associated with Clean Water Act (CWA) Section 404 permitting, a wetland functional assessment is typically used to categorize wetlands into one of three categories, as defined by United States (U.S.) Army Corps of Engineers (USACE) (*USACE 2014*). Category 1 wetlands are the highest quality or functioning wetlands (or rare/unique); Category 2 wetlands are moderate to high functioning (or rare/unique); and Category 3 wetlands are lesser quality or lower functioning (or less rare/unique). Although these categories are useful for determining the significance of project-specific impacts to wetlands, given the programmatic nature of this environmental analysis, the magnitude of potential wetland impacts are discussed more broadly as part of the significance criteria presented in Table 3.2.5-1.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wetland resources addressed in this section are presented as a range of possible impacts.

Table 3.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct wetland loss (fill or conversion to non-wetland)	Magnitude[a] or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); Violations of Section 404 of the Clean Water Act	Effect that is *potentially significant*, but with mitigation is *less than significant*	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No direct loss of wetlands
	Geographic Extent	USGS watershed level (e.g., HUC10),[d] and/or within multiple watersheds		USGS watershed (HUC10)[d] or subwatershed (HUC12)[d] level	NA
	Duration or Frequency	Long-term or permanent loss, degradation, or conversion to non-wetland		Periodic and/or temporary loss reversed over one to two growing seasons with or without active restoration	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of high-quality wetlands impacting salinity, pollutants, nutrients, biodiversity (diversity of species present), ecological condition, or water quality; Introduction and establishment of invasive plant or animal species to high-quality wetlands	Effect that is *potentially significant*, but with mitigation is *less than significant*	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity (diversity of species present), ecological condition, or water quality; Introduction and establishment of invasive plant or animal species to high-quality wetlands	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality
	Geographic Extent	USGS watershed level (e.g., HUC10),[d] and/or within multiple watersheds		USGS watershed (HUC10)[d] or subwatershed (HUC12)[d] level	NA
	Duration or Frequency	Long-term or permanent alteration that is not restored within two growing seasons, or ever		Periodic and/or temporary loss reversed over one to two growing seasons with or without active restoration	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect effects:[b] change in function(s);[c] change in wetland type	Magnitude or Intensity	Changes to the functions or type of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.)	Effect that is *potentially significant*, but with mitigation is *less than significant*	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity)	No changes in wetland function or type
	Geographic Extent	USGS watershed level (e.g., HUC10),[d] and/or within multiple watersheds		USGS watershed (HUC10)[d] or subwatershed (HUC12)[d] level	NA
	Duration or Frequency	Long-term or permanent change in function or type that is not restored within two growing seasons, or ever		Periodic and/or temporary loss reversed over one to two growing seasons with or without active restoration	NA

NA= not applicable
[a] Magnitude is defined based on the type of wetland impacted, high or low quality.
[b] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time.
[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, threatened and endangered species habitat, biodiversity, recreational/social value.
[d] Definitions of USGS watershed and subwatershed: *USGS Watershed* refers to the USGS 10 digit hydrologic unit code (HUC10), which averages approximately 230 square miles, depending on the region. For reference, the entire Eklutna River watershed near Anchorage, Alaska, is an example of a HUC10 watershed. *USGS Subwatershed* refers to the USGS 12 digit hydrologic unit code (HUC12), which averages approximately 40 square miles, depending on the region. See *USGS and NRCS (2013)* for an explanation of HUC codes.

3.2.5.3. Description of Environmental Concerns

Table 3.2.5-1 presents three types of potential effects to wetlands that were evaluated: direct wetland loss, other direct effects, and indirect effects. *Direct wetland loss* includes the actual loss of wetland habitat due to fill or conversion to a non-wetland habitat, such as a dryer habitat (upland area) or a wetter habitat (e.g., lake or stream). *Other direct effects* includes any direct effects that cause impacts such that the area remains a wetland and is not lost or converted, but the impacts cause a change in the type of wetland or a decrease in wetland function. *Indirect effects* are effects that occur secondarily as a result of direct effects and, like direct effects, cause a change in the type of wetland or a decrease in wetland function.

Wetland Loss

Wetland loss is the primary environmental concern for wetlands during construction. Direct wetland loss can be caused by the placement of fill into wetlands, thereby converting the wetland to a developed area. Wetlands can also be lost due to impacts to hydrology that cause a wetland to convert to a non-wetlands either by draining (converting a wetland to an upland area), or by inundation (converting a wetland to a waterbody such as a lake). Hydrologic changes can occur due to several activities, including draining or damming of a wetland, or placing fill outside of, but up or down flow of the wetland's primary hydrologic source (in turn causing drying or inundation of the wetland, respectively); replacing native soil with soil having different drainage rates; compacting or rutting soil; or increasing non-permeable surfaces. All of these activities can in turn alter wetland drainage patterns. Potential impacts to soils that could indirectly cause changes to hydrology are discussed in greater detail in Section 3.2.2, Soils. Potential impacts to water resources that could directly or indirectly impact wetland hydrology are discussed in Section 3.2.4, Water Resources.

To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high- and low-quality wetlands would be *less than significant* given the small amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations would be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures).

Other Direct Effects

For the purpose of this assessment, direct effects are defined as any effect that occurs in the same time and place as the impact, resulting from activities including vegetation clearing, ground disturbance, hydrologic alteration such as flooding or draining, changes to soils, or water quality degradation. Short of causing wetland loss, these construction and/or operation activities could potentially cause direct effects to wetlands, such as a change in the type of wetland (e.g., vegetation type), or a decrease or loss of one or all wetland functions performed by a given wetland. These activities can alter the wetland type by shifting vegetation structure, such as changing from a forested to a woody shrub or herbaceous vegetation type, due to vegetation clearing or changes in hydrology or soil drainage. Some or all wetland functions in a given wetland can be lost or decreased due to the activities described above.

Effects to high-quality wetlands would be *less than significant* given the small amount of land disturbance associated with the project locations (generally less than an acre), the short time-frame of deployment activities, and the application of federal, Commonwealth, or locally required wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures).

Indirect Effects

Indirect effects can result from the same activities that cause direct effects, but the effect occurs secondarily (e.g., in a different time or location) to the direct effects. In the same ways as direct effects, indirect effects can result in a change in wetland type or decrease in wetland function. In the case of wetlands, indirect effects can be the result of direct hydrologic alterations. For example, changes in hydrology caused by direct effects (e.g., fill placement) can result in a cascade of indirect effects, including changes in vegetation structure, changes in the type of wildlife habitat that is supported by the wetland, and changes to the functions that the wetland provides, including bank stability, filtering of pollutants for maintenance of water quality, and mitigation of flood flows. Indirect effects can also occur due to other activities such as vegetation clearing and ground disturbance, resulting in changes in wildlife habitat, weed infestation, and changes in wetland function, as described previously.

It is anticipated that indirect effects to high-quality wetlands will be *less than significant* due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, state, or locally required wetlands regulations. Implementation of BMPs and mitigation measures (see Chapter 11) could further reduce these potential impacts.

As with the direct effects category described above, the indirect effects category includes only effects that do not cause wetland loss or conversion to non-wetland, which are covered in the wetland loss category above.

3.2.5.4. Potential Impacts of the Preferred Alternative

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wetland resources. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to wetland resources under the conditions described below:[1]

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to wetlands resources because the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to wetlands resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact wetland resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands resources, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetland resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of project construction activities. The following types of infrastructure development or deployment activities could cause wetland loss, conversion of wetlands to non-wetlands, or direct or indirect effects to wetlands as a result of wetland fill, vegetation clearing, landscape grading, soil compaction, and other various ground disturbance activities. Potential wetland impacts associated with each infrastructure development type are discussed below.

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of points of presence,[2] huts, or other associated facilities or hand-holes to

[1] A determination of *no impact* from these activities assumes that no heavy construction equipment would be required for deployment, or if heavy construction equipment were required, it would be deployed on a paved or non-paved gravel surface.
[2] Points of presence are connections or access points between two different networks, or different components of one network.

access fiber could result in potential impacts to wetlands from both construction equipment and the activity itself.

- New Build – Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the installation of new poles could result in wetland loss, conversion, or direct or indirect effects. The use of heavy equipment during the installation of new poles and hanging of cables could result in direct or indirect effects to wetlands.
- Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in wetland fill, conversion, or direct or indirect effects to wetlands.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited near-shore or inland bodies of water could potentially impact wetland resources if the water body was a flooded wetland. In addition, potential wetland impacts could occur as a result of the construction of landings and/or facilities on shore to accept submarine cable.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be *no impacts* to wetlands. However, if installation of transmission equipment required vegetation clearing, grading, or other ground disturbance to install small boxes, hunts, or access roads, wetland loss, conversion, or direct or indirect effects to wetlands could potentially occur.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to wetland resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in wetland loss, conversion, or direct or indirect effects to wetlands.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower or structure, which would have *no impacts* to wetlands because there would be no ground disturbance associated with this activity. The potential addition of power units, structural hardening, and physical security measures would also have *no impacts* on wetland resources if this activity would not require ground disturbance. However, if the onsite delivery of additional power units, structural hardening, and physical security measures required ground disturbance, such as grading or excavation activities, direct or indirect effects to wetlands could occur.

- Deployable Technologies
  - Implementation of deployable aerial communications architecture (such as drones, balloons, or piloted aircraft) would not likely result in any potential impacts to wetlands, as there would not be any ground disturbance. Implementation of ground-based Cell on Wheels, Cell on Light Truck, and System on Wheels would not result in potential impacts to wetland resources if deployment occurs on paved or non-paved gravel surfaces. However, implementation of the three land-based deployable technologies (Cell on Wheels, Cell on Light Truck, and System on Wheels) could result in potential impacts to wetland resources. These potential impacts could occur if deployment occurs in undeveloped areas, requiring minor construction, grading, filling, or paving of a surface to place a deployable technology. Some staging or landing areas (depending on the type of technology) could require land/vegetation clearing, excavation, and paving.

Potential Wetland Impacts

Based on the analysis of the deployment activities described above to wetland resources, potential impacts as a result of Preferred Alternative activities are anticipated to be *less than significant* given the small amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts can be further reduced by implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures).

As discussed in Section 3.1.5, Wetlands, certain wetland types are more sensitive to disturbance, and/or are of higher quality, or are rarer, than other wetland types. In Alaska, wetlands that provide one or more of the following characteristics are typically considered high-quality wetlands: habitat for threatened, endangered, or other species of concern; high-quality general wildlife habitat; habitat or support for anadromous fish species (e.g., salmon) or resident fish important for sport or subsistence fishing; or are a unique wetland type based on relative abundance by area in a pre-defined region (see the Alaska Wetland Assessment Method [*Alaska DOT&PF 2010*] for an example of a wetland rating system for Alaska). In addition, in urban areas or areas near remote towns or villages, wetlands that support human health, safety, and quality of life are also highly valued, including wetlands that contribute to community water storage, flood mitigation, and/or coastal storm protection; maintenance of groundwater quality to protect drinking water resources; maintenance of surface water quality; and provide coastal or inland waterbody bank stabilization. Specific examples of high-quality wetlands in Alaska include palustrine emergent[3] and estuarine emergent[4] wetlands in northern Alaska that provide habitat for threatened Steller's or spectacled eiders; wetlands located along salmon streams; wetlands located within the floodplain of rivers and streams upstream of communities; and estuarine wetlands located adjacent to coastal communities. Further discussion of threatened and

[3] Palustrine emergent wetlands includes all nontidal wetlands dominated by persistent herbaceous plants, mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 parts per thousand.
[4] Estuarine emergent wetlands are coastal wetlands dominated by herbaceous vegetation where salt water from the sea mixes with rivers and streams.

endangered species habitat is presented in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Certain Alaska wetland types are also regionally rare or unique and would be considered high-quality based on this characteristic alone. For reference, *Hall et al. (1994)* presents a summary of the proportion of wetland types by broad region, as described in the Affected Environment section. Statewide, estuarine wetlands are the least abundant wetland type by area (*Hall et al. 1994)*, but are highly valued for several reasons including wildlife habitat, coastal storm protection, and coastal and delta area bank stabilization.

Other characteristics and/or wetland types other than those listed here can certainly be associated with high-quality wetlands. As described in Section 3.2.5.2, Impact Assessment Methodology and Significance Criteria, the quality or uniqueness of wetlands potentially impacted by deployment activities would require a formal assessment on a case-by-case basis as part of Proposed Action permitting.

To minimize potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. For example, loss of jurisdictional wetlands[5] resulting from the placement of dredged or fill material would require a CWA Section 404 permit, issued by the USACE and reviewed by the U.S. Environmental Protection Agency. It is important to recognize that Alaska has a far greater proportion of wetlands than any other state, and the impact significance would be evaluated accordingly on a case by case basis. In certain regions such as the Arctic Coastal Plain or the valley areas of Western Alaska, it would be difficult for deployment activities to avoid wetlands, and compensatory mitigation for unavoidable impacts could be the only mitigation option available.

See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with wetlands.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be *no impacts* to wetland resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If heavy equipment is used as part of routine maintenance, if inspections occur off of established access roads or corridors, or if routine maintenance and application of herbicides is used to control vegetation, potential wetland impacts could be *less than significant* as explained above.

[5] Jurisdictional wetlands are wetlands that are found to be "waters of the U.S." per definitions presented in the CWA, and are thus under the jurisdiction of the USACE.

3.2.5.5. Alternatives Impact Assessment

The following section assesses potential impacts to wetlands associated with the Deployable Technologies Alternative and the No Action alternative.[6]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of aerial and land-based mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas.

The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wetland resources as a result of implementation of this alternative could be as described below.

Potential Deployment Impacts

Implementation of the three land-based deployable technologies (Cell on Wheels, Cell on Light Truck, and System on Wheels) could result in *less than significant* impacts. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in wetland loss, conversion, or direct or indirect effects to wetlands. Heavy equipment use associated with these activities could result in soil compaction, resulting in direct or indirect potential impacts to wetlands. However, it is anticipated that impacts to wetlands would be *less than significant* due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, Commonwealth, or locally required wetlands regulations. Implementation of BMPs and mitigation measures (see Chapter 11) could further reduce these potential impacts.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there could be *less than significant* potential impacts to wetland resources associated with routine inspections and maintenance of the Preferred Alternative.

[6] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to wetland resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.5, Wetlands.

3.2.6. Biological Resources

3.2.6.1. Introduction

This section describes potential impacts to biological resources in Alaska associated with deployment and operation of the Proposed Action, and discusses best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts. These are the resources covered in this section:

- Terrestrial vegetation, including vegetation loss, fragmentation, and invasive species;
- Wildlife, including amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in both onshore and offshore environments;
- Fisheries and aquatic habitats, including both marine and freshwater species and habitats; and
- Threatened and endangered species and species of conservation concern, including federal-, state-, or agency-listed plant and animal species and designated critical habitat.

3.2.6.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on terrestrial vegetation, wildlife, and fisheries and aquatic habitat were evaluated using the significance criteria presented in Table 3.2.6.2-1 for direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; effects to migration or migratory patterns; reproductive effects; and invasive species effects. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*.

The potential impacts of the Proposed Action on threatened and endangered species and species of conservation concern were evaluated using the significance criteria presented in Table 3.2.6.6-1 in Section 3.2.6.6, Threatened and Endangered Species and Species of Conservation Concern. The categories of impacts are defined as: *may affect, likely to adversely affect; may affect, not likely to adversely affect;* and *no effect*. These impact categories are comparable to those defined in the *Endangered Species Consultation Handbook* (*USFWS and NMFS 1998*).

Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact. Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to biological resources addressed in this section are presented as a range of possible impacts.

Table 3.2.6.2-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, and Fisheries and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigations Measures Incorporated**	**Less than Significant**	**No Impact**
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population[a] injury/mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics[b] or concentrations during breeding or migratory periods. Violation of various regulations including: MMPA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant.*	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within each respective state or territory for at least one species. Anthropogenic[c] disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within 1 to 3 years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigations Measures Incorporated**	**Less than Significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of said species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia,[d] or cover from weather or predators. Violation of various regulations including: MMPA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with BMPs and mitigation is *less than significant.*	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from the Proposed Action would occur.
	Geographic Extent	Regional effects observed within each respective state or territory for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or subpopulation located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within 1 to 3 years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigations Measures Incorporated**	**Less than Significant**	**No Impact**
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation or the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with BMPs and mitigation is *less than significant*	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within each respective state or territory for at least one species; Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts,[e] resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within 1 to 3 years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigations Measures Incorporated**	**Less than Significant**	**No Impact**
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with BMPs and mitigation is *less than significant.*	Temporary loss of migratory rest stops due to anthropogenic activities takes place in important habitat that is widely distributed, and there are no cumulative effects from additional projects.	No alteration of migratory pathways and no stress or avoidance of migratory paths/patterns due to Proposed Action activities.
	Geographic Extent	Regional effects observed within each respective state or territory for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within 1 to 3 years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigations Measures Incorporated**	**Less than Significant**	**No Impact**
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MMPA, MBTA, and BGEPA.	Effect that is *potentially significant*, but with BMPs and mitigation is *less than significant.*	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within each respective state or territory for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning, or anthropogenic disturbances that lead to stress, abandonment, and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigations Measures Incorporated**	**Less than Significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is *potentially significant*, but with BMPs and mitigation is *less than significant.*	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to Proposed Action sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term changes not likely to be reversed over several years or seasons.		Periodic, temporary, or short-term changes that are reversed over one or two seasons.	NA

BMPs = best management practices; BGEPA = Bald and Golden Eagle Protection Act; MBTA = Migratory Bird Treaty Act; MMPA = Marine Mammal Protection Act; NA = not applicable; RF = Radio Frequency

[a] Interbreeding organisms occupying a certain space; the number of people or other living creatures in a designated area.

[b] Species that are only found in one area or region.

[c] Changes caused by humans.

[d] Areas of stable environmental conditions that protect wildlife and organisms from environmental change.

[e] Haulouts refers to periods are when seals and walrus come ashore (either land or ice) to rest, molt or breed.

3.2.6.3. Terrestrial Vegetation

Introduction

This section describes potential impacts to terrestrial vegetation resources in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are discussed in Chapter 11, BMPs and Mitigation Measures.

Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on terrestrial vegetation resources were evaluated using the significance criteria presented in Table 3.2.6.2-1 for vegetation and habitat loss, alteration, or fragmentation, and invasive species effects.[1] As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant, less than significant with BMPs and mitigation measures incorporated, less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation resources addressed in this section are presented as a range of possible impacts.

Description of Environmental Concerns

Terms and concepts discussed in this section are further discussed and defined in the Affected Environment section (Section 3.1.6.3, Terrestrial Vegetation).

Vegetation and Habitat Loss, Alteration, or Fragmentation[2]

With any construction project requiring ground disturbance, one of the main concerns during construction activities includes vegetation clearing. Not only could vegetation loss potentially result in wildlife habitat loss or fragmentation, as described in Section 3.2.6.4, Wildlife, it could also lead to accelerated erosion and increased sedimentation in waterways.[3] As explained in Section 3.2.2, Soils, soil erosion could alter natural sediment transport processes in streams and other surface waterbodies, which can impair water and habitat quality and potentially affect aquatic plants and animals. Soil suborders in the Alaska that have moderate to severe erosion

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[1] Although direct and indirect injury/mortality, effects to migration or migratory patterns, and reproductive effects are types of effects presented in Table 3.2.6.2-1 that are applicable to other biological resources, these effects do not apply to terrestrial vegetation and are therefore not included in this section. For discussions of Wildlife, Fisheries and Aquatic Habitats, and Threatened and Endangered Species and Species of Conservation Concern, see Sections 3.2.6.4, 3.2.6.5, and 3.2.6.6, respectively. A discussion of potential wetland impacts is included in Section 3.2.5, Wetlands.

[2] Vegetation and habitat loss, alteration, or fragmentation effects related to wildlife are presented in Section 3.2.6.4, Wildlife.

[3] Keeping soil vegetated is often the most effective way to prevent erosion.

potential include the Cryands, Orthents, Wassents, Cryepts, Gelepts, Umbrepts, Gelolls, and Cryods soil suborders (see Section 3.2.2, Soils, for descriptions of these soil types).

As described and shown graphically in Section 3.1.6.3, Terrestrial Vegetation, the central portion of Alaska has the highest percentage of forest and woodland cover, and the southern portion of the state consists primarily of nonvascular and sparse vascular[4] vegetation with some forest and woodland, shrubland, and grassland. Potential impacts to terrestrial vegetation in Alaska could occur in areas where construction activities require vegetation cutting, clearing, and/or removal. It is anticipated that for most types of facilities or infrastructure development scenarios, vegetation loss would likely be isolated within construction locations and/or would be short-term with stability achieved within several years, depending on the vegetation cover present in the area.[5] As discussed in Chapter 11, BMPs and mitigation measures would help avoid or minimize potential vegetation loss associated with ground disturbance activities.

Invasive Species Effects

Once a landscape has been cleared of vegetative cover and soil is disturbed, the re-establishment of native vegetation could be delayed or prevented if undesirable noxious weeds and/or invasive plants become established (*USFS Undated)*. As discussed in Section 3.1.6.3, Terrestrial Vegetation, some invasive plants in Alaska, such as the Canada thistle (*Cirsium arvense*), giant hogweed (*Heracleum mantegazzianum*), leafy spurge (*Euphoriba esula*), and others, thrive in disturbed soil environments (*Alaska DNR 2010*). Once established, these invasive plants can displace native plants preferred by native animals. In addition, construction equipment or vehicles traveling from areas infested with invasive or noxious plants to areas free of those plants could disperse them if proper care is not taken or if BMPs and mitigation measures are not followed if they are deemed not practicable or feasible (see Chapter 11, BMPs and Mitigation Measures).

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities could result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, various

[4] Vascular plants possess conducting tissues to transport nutrients and water throughout the plant. Nonvascular plants, such as mosses, liverworts, hornworts, and algae, do not have the same types of conducting tissues.

[5] Clearing of trees in forested and woodland areas (see Section 3.1.6.3, Terrestrial Vegetation, for an explanation of these and other vegetation types) could result in potential longer-term impacts given the length of time needed for these vegetation communities to mature to pre-disturbance conditions. Therefore, the duration of the potential impact would depend in part on the type of vegetation to be cleared. Grasses, for example, take less time to mature and become re-established than a stand of large trees.

types of Proposed Action infrastructure could result in a range of *no impact* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

<u>Activities Likely to Have No Impacts</u>

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to terrestrial vegetation resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to terrestrial vegetation resources because the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to terrestrial vegetation resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact terrestrial vegetation resources because those activities would not require ground disturbance or vegetation clearing.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact vegetation, it is anticipated that this activity would have *no impact* to terrestrial vegetation resources.

<u>Activities with the Potential to Have Impacts</u>

Potential deployment-related impacts to terrestrial vegetation resources in Alaska as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of ground disturbance activities, including vegetation and habitat loss, alteration, or fragmentation, and invasive species effects (including the establishment of invasive plants such as the Canada thistle, giant hogweed, leafy spurge, or others). The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation resources include the following activities:

- Wired Projects
  - New Build–Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence,[6] huts, or other associated facilities or hand-holes to access fiber would require ground disturbance that would likely result in vegetation loss.[7] In addition, ground disturbance and heavy equipment use associated with excavation activities and landscape grading for constructing points of presence, huts, or other associated facilities or hand-holes to access fiber could also result in vegetation clearing or loss. Furthermore, in some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs[8] and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.
  - New Build–Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the installation of new poles could result in ground disturbance and vegetation loss. Additionally, forested areas would likely need to be permanently converted to and maintained as shrub/grassland in the permanent right-of-way. In some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in *no impact* to terrestrial vegetation because there would be no ground disturbance or vegetation clearing associated with this activity. The potential addition of power units, structural hardening, and physical security measures would not impact vegetation if these activities would not require ground disturbance or vegetation clearing. However, topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening (should that be required) could result in ground disturbance and vegetation loss. However, it is anticipated that in most cases there would generally be less soil disturbance compared to a new build project. If that is the case, there would likely be correspondingly fewer potential impacts to terrestrial vegetation. In some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their

[6] Points of presence are connections or access points between two different networks, or different components of one network.
[7] See Section 2.1.2, Proposed Action Infrastructure, for a description of the types of infrastructure to be potentially implemented and explanations of specific techniques and terms.
[8] BMPs and mitigation measures to minimize potential impacts to terrestrial vegetation resources are listed in Chapter 11, BMPs and Mitigation Measures.

spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.

- New Build–Submarine Fiber Optic Plant: The installation of cables in limited near-shore or inland bodies of water would have *no impact* terrestrial vegetation because there would be no ground disturbance associated with this activity (see Section 3.2.6.5, Fisheries and Aquatic Habitats, for a discussion of potential impacts to aquatic habitat). However, potential impacts to vegetation could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable. Soil disturbance and vegetation loss could occur as a result of grading, foundation excavation, or other ground disturbance activities. Furthermore, in some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance or vegetation clearing, there would be *no impacts* to terrestrial vegetation. However, if installation of transmission equipment would require vegetation clearing, landscape grading, or other ground disturbance to install small boxes, huts, or access roads, there would be potential impacts to terrestrial vegetation. In some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to terrestrial vegetation resources. Excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads would likely result in vegetation loss. Furthermore, in some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to terrestrial vegetation. However, if

the onsite delivery of additional power units, structural hardening, and physical security measures required ground disturbance or resulted in vegetation loss, such as grading or excavation activities, potential impacts to vegetation resources would occur. It is anticipated that in most cases there would generally be less soil disturbance compared to a new build project. If that is the case, there would likely be correspondingly fewer potential impacts to terrestrial vegetation. Furthermore, in some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.

- Deployable Technologies
  - Where deployable technologies would be located on existing paved surfaces, it is anticipated that there would be *no impacts* to terrestrial vegetation resources because there would be no new ground disturbance or vegetation clearing required. However, implementation of deployable technologies could result in potential impacts to terrestrial vegetation if deployment of land-based or aerial deployables occurs in unpaved areas and results in vegetation loss. Some staging areas could require land clearing, excavation, and paving, which would result in vegetation loss. Furthermore, in some build-out locations, short-term and localized potential impacts to terrestrial vegetation could occur as a result of invasive or noxious weed establishment if local conditions and ground disturbance creates an environment conducive to their spreading. However, BMPs and mitigation measures to promptly and properly revegetate disturbed areas would help further reduce these potential impacts.

In general, the abovementioned activities could potentially involve land clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to terrestrial vegetation resources associated with deployment of this infrastructure could include vegetation loss and invasive species effects. These potential impacts are described further below, and BMPs and mitigation measures to help avoid or reduce these potential impacts are discussed in Chapter 11, BMPs and Mitigation Measures.

<u>Potential Vegetation Loss Impacts</u>

Based on the analysis of the deployment activities described above related to terrestrial vegetation resources, potential impacts as a result of vegetation loss are anticipated to be *less than significant* (see Table 3.2.6.2-1).[9] As mentioned previously, even if certain forested areas would be impacted that require more than several years to become re-established or would be permanently converted to a different cover type, the magnitude/intensity and geographic extent of the vegetation loss is anticipated to be *less than significant*, and further reduced with the

[9] Potential impacts to wildlife as a result of vegetation and habitat loss, alteration, or fragmentation as well as a listing of applicable BMPs and mitigation measures are discussed in Section 3.2.6.4, Wildlife, and Chapter 11, respectively.

implementation of BMPs and mitigation measures. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential vegetation loss impacts.

Potential Invasive Species Impacts

Based on the analysis of proposed activities described above, invasive species effects could result in potentially *less than significant* impacts since it is anticipated that the proposed activities would not lead to measureable increases in invasive species populations, would be localized to individual build-out locations, and would result in changes that could be reversed over one or two growing seasons or less (see Table 3.2.6.2-1). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential invasive species impacts.

Potential Operation Impacts

As explained above, implementation of land-based deployable technologies could result in *no impacts* if the deployment occurs on paved or previously disturbed surfaces and *less than significant* impacts to terrestrial vegetation resources if deployment occurs in unpaved areas and results in vegetation loss, or if the implementation results in paving of previously unpaved vegetated surfaces. Potential impacts to vegetation could also occur if ground disturbance of the deployable vehicle(s) creates an environment conducive to invasive plant species and they become established, however, those potential impacts, as explained above, would also be *less than significant*. In addition, some staging or landing areas (depending on the type of technology) could require land clearing, minimal excavation, and paving, which could result in *less than significant* vegetation loss. BMPs and mitigation measures could help to minimize the spread of noxious and invasive weeds.

Alternatives Impact Assessment

The following section assesses potential impacts to terrestrial vegetation associated with the Deployable Technologies Alternative and the No Action Alternative.[10]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile land-based and aerial communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies

[10] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Potential impacts to terrestrial vegetation resources as a result of implementation of this alternative are described below.

Potential Deployment Impacts

As explained above, implementation of land-based deployable technologies could result in *no impacts* if the deployment occurs on paved or previously disturbed surfaces and *less than significant* impacts to terrestrial vegetation resources if deployment occurs in unpaved areas and results in vegetation loss, or if the implementation results in paving of previously unpaved vegetated surfaces. Potential impacts to vegetation could also occur if ground disturbance of the deployable vehicle(s) creates an environment conducive to invasive plant species and they become established; however, those potential impacts, as explained above, would also be *less than significant*. In addition, some staging or landing areas (depending on the type of technology) could require land clearing, minimal excavation, and paving, which could result in *less than significant* vegetation loss. BMPs and mitigation measures could help to minimize the spread of noxious and invasive weeds. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential vegetation loss and/or invasive species impacts.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, there would be *no impacts* anticipated to terrestrial vegetation associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and results in ground disturbance or land clearing, vegetation loss and/or invasive species effects could result in *less than significant* impacts as previously explained above. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential vegetation loss and/or invasive species impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to terrestrial vegetation resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.6.3, Terrestrial Vegetation.

3.2.6.4. Wildlife

Introduction

This section describes potential impacts to wildlife resources in Alaska associated with deployment and operation of the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures. Potential impacts to amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates occurring in Alaska and Alaska's offshore environment are discussed in this section.

Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on wildlife resources were evaluated using the significance criteria presented in Table 3.2.6.2-1. As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to wildlife resources addressed in this section are presented as a range of possible impacts.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. In general, the most common direct injuries from development projects are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals, like walrus, from disturbance events. Direct injury/mortality environmental concerns pertaining to Alaska's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below.

<u>Amphibians and Reptiles</u>

The majority of Alaska's amphibian populations are concentrated in the Southeast region of Alaska, with the exception of the wood frog (*Rana sylvaticus*) found throughout Alaska (*MacDonald 2010*). Direct mortality to amphibians could occur in construction zones either by excavation activities or by vehicle strikes; however, these events are expected to be temporary and isolated, affecting only individual animals.

Only four species of reptiles (all marine turtles listed as threatened or endangered) occur in Alaska. Environmental consequences pertaining to these reptiles are discussed in Section 3.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in Alaska. Alaska's mammals are attracted to roads for a variety of reasons including use as a source of minerals, preferred vegetation along roadways, areas of insect relief, and ease of travel along road corridors (*ADFG 2015a, 2015b; Ballard et al. 2000; Dau and Cameron 1986; Grosman et al. 2009; Jacobson 2005; Laurian et al. 2008; Leblond et al. 2007*). Individual injury or mortality as a result of vehicle strikes associated with the Proposed Action could occur; however, these events are expected to be temporary and isolated, affecting only individual mammals.

Potential impacts of fences or other barriers on wildlife could be a source of mortality or injury to terrestrial mammals. Potential impacts include separation of moose (*Alces alces*) cow calf pairs. For example if a pair wanders into an enclosed area around a communication tower, one may exit the enclosure without the other realizing where the exit is located. Separation can result in stress and, if prolonged, mortality of the calf by starvation or abandonment. Fences or other barriers can also effectively corral wildlife on roadways where vehicular traffic increases strike mortality. Entanglement resulting from wildlife attempting to traverse under or over the barrier is also of concern, as animals can get legs or antlers caught. Potential impacts of fences or other barriers would likely be isolated, individual events.

Marine Mammals

Marine mammals swimming or hauled out on land, rock, or ice are visually and aurally sensitive to boats, aircraft, and human presence. Noises, smells, sounds, and sights may elicit a flight reaction. Trampling deaths associated with haulout[1] disturbance are among the largest known sources of natural mortality for walrus (*Odobenus rosmarus*) (*Loughrey 1959, Fay 1981*). It is possible that noise or visual disturbances to walrus from aerial deployable equipment could be a result of the Proposed Action; however, given the limited amount of near-shore deployment activities, it is unlikely this would result in population-level impacts and would be isolated, individual events. BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to minimize the potential impacts to walrus.

Underwater sound sources, if intense enough, could cause injury or death to marine mammals in the vicinity of the activity. However, given the limited amount of near-shore deployment activities, it is unlikely this would result in population-level impacts and would be isolated, individual events. BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to minimize potential impacts from underwater noise.

[1] Haulouts are areas of land or ice where seals and walrus come ashore to rest, molt, or breed.

Direct mortality and injury to marine mammals as a result of vessel strikes could occur but are not likely to be widespread or affect populations of species as a whole. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further reduce potential impacts. Mitigation measures that are the result of consultations with the National Marine Fisheries Service would be followed, as required.

Birds

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species, with some species covered under the Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA). Generally, collision events occur to “poor” fliers (such as ducks), heavy birds (such as swans and cranes), and birds that fly in flocks. Species susceptible to electrocution are birds of prey, ravens (*Corvus corax*), and thermal soarers[2] like golden eagles (*Aquila chrysaetos*) that typically have large wing spans. Avian mortalities or injuries can also result from vehicle strikes, although they typically occur as isolated events.

Direct mortality and injury to birds of Alaska are not likely to be widespread or affect populations of species as a whole and could be further reduced by implementing BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures). Mitigation measures that are a result of consultations with the U.S. Fish and Wildlife Service (USFWS) regarding potential impacts to migratory birds will be implemented, as required.

Terrestrial Invertebrates

The terrestrial invertebrate populations of Alaska are so widely distributed that injury/mortality events are not expected to affect populations of species as a whole.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Potential habitat impacts are primarily physical perturbations that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the potential impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates. The majority of Alaska is in a relatively unfragmented state.

Additionally, habitat loss can occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause isolated, temporary exclusion effects only in very special circumstances.

[2] Soarers are birds that fly to a considerable altitude and maintain elevation without moving their wings by using ascending air currents. This is done because soaring is much more energy efficient than flapping their wings; soarers generally hunt from the air and so spend a lot of time waiting for prey.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for Alaska's wildlife species below.

Amphibians and Reptiles

Important habitats for Alaska's amphibians typically consist of wetlands and, in some cases as with the wood frog, the surrounding upland forest. Filling or draining of wetland breeding habitat and alterations to ground or surface water flow associated with the Proposed Action could also have effects to Alaska's amphibian populations, although the Proposed Action is likely to only affect a small number of the overall population. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to minimize the potential impacts.

The activities associated with the Proposed Action (see below) would cause disturbance and result in temporary displacement of amphibians and reptiles. Some limited amount of infrastructure may be built in these sensitive areas that could permanently displace small numbers of amphibians. Implementation of BMPs and mitigation measures could further help minimize potential impacts.

Terrestrial Mammals

Small mammals occupy a wide range of habitats throughout Alaska and could experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation could potentially impact large mammals (e.g., moose, bear [*Ursus americanus, Ursus arctos, and Ursus maritimus*], caribou [*Rangifer tarandus*], and sheep [*Ovis dalli*]) by decreasing the availability of forest as cover from predators and foraging. Loss of cover could increase predation on both breeding adults as well as their young.

Alaska's large terrestrial mammals have more specialized habitat requirements, including specific winter and summer habitats in the case of moose and caribou. Summer ranges for caribou are areas important for calving, replenishing resources lost during winter, and insect relief (*Skoog 1968; Ferguson and Elkie 2004*). Winter ranges typically provide energy-rich forages such as lichen (*Joly et al. 2003; Skoog 1968; Leopold et al. 1953; Scotter 1967*). Denning habitat for bear is also very specialized (*Durner et al. 2006; Goldstein et al. 2010; Smith et al. 1994; Reynolds et al. 1976*). Loss of habitat or exclusions from these areas would likely be temporary and/or isolated. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further reduce potential impacts.

Marine Mammals

Ringed seals (*Phoca hispida*) use sea ice haulouts to construct lairs under snow/ice, which they use for resting, nursing, and protection from predation. Lairs are especially important for ringed seal pups to use to dry off and warm up after emerging from water (*75 Federal Register [FR] 77476, 2010*). Seal haulout locations are selected because of their proximity to feeding areas. A lactating female bearded seal (*Erignathus barbatus*) spends more than 90 percent of her time in the water foraging for herself and her pup (*Holsvik 1998; Krafft et al. 2000*; both cited in

Cameron et al. 2010); energy costs increase the farther a seal must travel to feed and the deeper it must dive to find food. This, in turn, causes physiological stress and depletes energy reserves. If a disturbance such as noise from boats or aerial deployables excluded seals from a preferred sea ice haulout, for example, the seals would need to find a new haulout, likely at a less favorable location. However, potential effects on seals from exclusion from resources would be low in magnitude and temporary in duration.

Whales may be temporarily excluded from a resource if they avoid it due to the increased noise associated with human activity. Depending on the duration of the activity, beluga whales (*Delphinapterus leucas*) could be excluded from their environment temporarily or could abandon the habitat entirely (*Loughrey 1959, Fay 1981*). Native hunters near Kotzebue Sound reported that belugas abandoned areas where fishing vessels were common (*NMFS 2008*). Greater human activity of longer duration would increase the likelihood that belugas would avoid the area, possibly being excluded from essential resources. However, the degree to which habitat exclusion affects beluga whales depends on many factors. Beluga are mobile and use open water habitat; therefore, it is expected that sea-based activities from the Proposed Action, which would be limited to small boats in near-shore and inland waters, would not affect the ability of beluga whales to access important resources.

If walrus are excluded from a particular haulout location for an extended period of time, they may abandon it all together (*Wilson and Evans 2009*). Haulouts are critical for walrus because a walrus cannot remain in the water for extreme periods of time; they require haulout locations to rest or they will drown or starve. Additionally, haulout locations are selected because of their proximity to feeding areas. Walrus foraging trips can last as long as several days and cover distances of 100 kilometers (60 miles) (*76 FR 7634, 2011*), but the farther a walrus must travel to feed and the deeper it must dive to find food, the more energy costs increase. These increases cause physiological stress and deplete energy reserves, a high-magnitude effect that can be temporary or long-term. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of walruses. Potential impacts to walruses could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Birds

The USFWS (*2009*) has published recommendations for time periods to avoid vegetation clearing. These recommendations are provided to help avoid vegetation removal during the breeding season. The removal and loss of vegetation can affect avian species directly by loss of nesting, foraging, and cover habitat. Displacement of migratory birds from feeding areas is of particular concern in the Arctic region because feeding habitats are limited. For example, the Western Arctic population of snow geese (*Chen caerulescens*) depends on access to the entire staging area on the Arctic National Wildlife Refuge. This regional requirement ensures that the population can locate suitable feeding habitat in all years (*Hupp et al. 2002*).

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration could increase the likelihood that birds would avoid the area, possibly being excluded from essential resources.

The degree to which habitat exclusion affects birds depends on many factors. The potential impact to passerine[3] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have potential impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of birds. Potential impacts to birds could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state (*ADFG 2005*). Proposed Action activities that could affect terrestrial invertebrates are expected to be temporary and isolated, affecting only small numbers of terrestrial invertebrates. Potential impacts could be further reduced by the implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (*40 Code of Federal Regulations 1508.8[b]*). Indirect injury/mortality can include stress related to disturbance and disruption of life history patterns (such as migration and breeding) important for survival. A short-term stress response to an acute, temporary stressor initiates a "fight or flight" response that diverts energy (which would otherwise be used for reproduction and growth) to the immediate survival of the animal (*Reeder and Kramer 2005*). Most organisms are well adapted and recover quickly from these types of stressors. A chronic stress response to a persistent stressor; however, can be detrimental to the organism and result in cell death, compromised immune system, muscle wasting, reproductive suppression, and memory impairment (*Reeder and Kramer 2005*). Potential indirect injury/mortality impacts vary depending on the species, time of year, and duration of deployment. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

[3] Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.

Amphibians and Reptiles

In general, amphibian species utilize aquatic habitats for some part of their life cycle. Amphibian species have a complex life cycle (i.e., having both larval and adult stages) and require aquatic habitats, such as bogs, vernal pools,[4] temporary ponds, and even streams for mating, laying eggs, and larval growth. Aquatic habitats are naturally dynamic, often filling and drying on an annual basis. Amphibians associated with these habitat types are specifically adapted to such processes. Changes in water quality and quantity and loss of wetlands and vernal pools, especially during the breeding seasons, reduce the number and density of breeding sites, leading to lower productivity and diminishing the capacity to maintain local and regional species populations (*Semlitsch 2000*). However, changes in water quality or quantity are expected to be temporary and isolated, affecting only a limited number of amphibians.

Terrestrial Mammals

Response of caribou to disturbances such as aircraft (overflights, nearby landings) varies depending on the season, degree of habituation, type of aircraft, altitude, airspeed, weather conditions, frequency of overflights, and the sex and age composition of caribou groups. Caribou have been shown to react most strongly to small fixed-wing and helicopter overflights during calving (late May to early June), post-calving (early June to late June) and winter (*Calef et al. 1976*).

Caribou can and do respond negatively to human activities that include vehicles, aircraft, roads, and industrial development infrastructures. Manifested behavioral responses can result in elevated energy requirements for individuals and movement of animals. Cows during calving season, and larger groups of individuals (greater than 10), are most susceptible to disturbance effects. The behavioral effect is positively correlated to the novelty, intensity, and spatial extent of the disturbance (*Wolfe et al. 2000*).

Stress from repeated disturbances during critical time periods (e.g., calving and mating) can reduce the overall fitness and productivity of terrestrial mammals by reducing calf survival and increasing daily activity and energy requirements. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of caribou. Potential impacts to caribou could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Marine Mammals

Haulout sites utilized by seals and walrus that are in close proximity to human boat activity can be particularly vulnerable to disturbance, because of their coastal nature (*Waters 1992*). Harbor seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) increased their movements between the sea and their haulout site at Miquelon after a disturbance by humans (*Renouf et al. 1981*). Normal haulout pattern of harbor seals has been observed interrupted by disturbance from boats,

[4] Vernal pools are seasonal depressional wetlands that are ponded only during the wetter part of the year, also known as ephemeral pools (*USEPA 2015*)

pedestrians, dogs, and aircraft (*Allen et al. 1984*). However, deployment activities would only take place in near-shore environments and are expected to be temporary and isolated, likely affecting only individual marine mammals.

Foraging is a significant activity for walrus using the coastal haulouts in the Bristol Bay region. Haulouts are frequently localized where animals can forage most efficiently. Repeated disturbance that results in the abandonment of preferred haulout locations could displace animals from preferred feeding areas or impose greater travel distances between feeding and haulout locations, thereby increase the energetic cost to each individual. The potential for long-term disturbance can lead to the permanent abandonment of a haulout (*Wilson and Evan 2009*).

Disturbance from underwater acoustic sources can potentially impact marine mammals in several ways, including masking, changes to dive patterns and direction as well as avoidance, *Richardson et al.* (*1995*) reviewed reactions of marine mammals to ships and boats in general. *Schevill* (*1968*) indicated that it is not the mere presence of the boat, but its noise evoking the reaction.

Repeated disturbance, especially near haulouts and in areas of aquatic concentrations (food resources), can cause stress to individuals resulting in lower fitness and productivity. However, deployment activities will only take place in near-shore environments and are expected to be temporary and isolated, likely affecting only individual marine mammals.

Birds

Nest abandonment and increased predation are two consequences resulting from human-induced disturbance during the breeding/nesting season. Disturbance during migration has been shown to negatively affect grazing geese, shorebirds and lowland and upland waders (*Hockin et al. 1992*). Most waterfowl and shorebirds take to flight when disturbed displacing them from preferred feeding or roosting areas (*Tuite et al., 1983; Bell and Austin, 1985; Cryer et al. 1987; Belanger and Bedard, 1989*) or leading them to abandon areas completely (*Bell and Austin 1985; Korschgen et al. 1985; Burger 1986*). A shift from preferred to less preferred feeding areas is likely to affect feeding efficiency (*Burger 1988*).

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of birds. Potential impacts to birds could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Terrestrial Invertebrates

Invasive species have both potential ecological and genetic impacts on the invertebrate communities that they invade. Ecological interactions between native invertebrates and invasive species can be direct (e.g., predation, herbivory, parasitism, competition, mutualism) or indirect (e.g., habitat alteration, apparent predation, cascading trophic interactions) and result in changes in the population biology (births, death, migration) of the native invertebrate species. Significant genetic and evolutionary changes in both the native invertebrate and invasive species may also occur. Rapid evolution in the invading species can be the result of both genetic drift and natural selection (from biotic interactions and abiotic factors in the new environment). As a consequence, native invertebrate species could also undergo rapid evolutionary changes in response to the invading species. In the extreme, hybridization and introgression between invading species and native invertebrate species may result in extinction of the native invertebrate species (*Levin et al. 1996; Rhymer & Simberloff 1996; Perry et al. 2001*). However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of terrestrial invertebrates. Impacts could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Potential effects to migration patterns of Alaska's amphibians and reptiles, terrestrial mammals, marine mammals, birds, and terrestrial invertebrates are described below.

<u>Amphibians and Reptiles</u>

Wood frogs use diverse vegetation types from grassy meadows to open forests, muskeg,[5] and tundra.[6] They hibernate under the snow in depressions in forest litter (*MacDonald 2010*). After they emerge from dormancy, wood frogs migrate up 900 feet to breeding pools, where they breed rapidly in early spring in permanent or ephemeral water (*Homan et al. 2010*). However, *Berven and Grudzien* (*1990*) found that a small percentage of juvenile wood frogs can migrate over 1.5 miles from natal ponds, suggesting juveniles may be capable of migrating relatively long distances. The population size and trends in Alaska are unknown, but is considered to be stable to slightly declining. However, numerous reports from the Kenai Peninsula, Anchorage Bowl, and Talkeetna indicate wood frogs are no longer present at historical breeding sites (*ADFG Undated*) .

Species that use streams as dispersal or migratory corridors could potentially be impacted if these waterways are restricted or altered. Restrictions or alterations of waterways are not expected to affect widely distributed populations as a whole, as deployment activities would likely be limited and temporary. It is likely that any potential impacts would only affect individual amphibians, rather than entire populations. BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to avoid or minimize potential impacts.

<u>Terrestrial Mammals</u>

Large game animals including moose, caribou, and bison (*Bison bison*) have well-defined migratory routes. Route knowledge is passed on from one generation to the next and includes important feeding and calving areas (*Sweanor and Sandegren 1989; Box and Gibson 1999*).

[5] North American swamp or bog consisting of a mixture of water and partly dead vegetation, frequently covered by a layer of sphagnum or other mosses.
[6] A vast, flat, treeless Arctic region of Europe, Asia, and North America in which the subsoil is permanently frozen.

Migration corridors are important to the survival of many Alaskan species. Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert large migratory mammals from well-defined migratory routes. Potential impacts can vary depending on the species, time of year of construction/operation, and duration; however, deployment activities are expected to be temporary and isolated. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to avoid or minimize potential impacts. It is likely that the limited number of permanent structures such as towers or access roads would also have a minimal impact on migratory patterns.

Many shorebird species are long distance migrants, and fly more than 7,000 miles between Alaskan breeding and Australian non-breeding areas. Only a few shorebird species, including rock sandpipers (Calidris ptilocnemis) in Alaska, are considered short-distance migrants and travel just a few hundred miles between breeding and nonbreeding habitats.

Marine Mammals

Noise associated with the installation of cables in the near/offshore waters of coastal Alaska could potentially impact marine mammal migration patterns, though potential impacts are likely to be short-term provided the noise sources are not wide ranging and below Level A and B sound exposure thresholds.[7] It is clear that behavioral responses are strongly affected by the context of exposure and by the animal's experience, motivation, and conditioning. Additionally, as marine mammals have the capacity to divert from sound sources during migration, it is unlikely the Proposed Action would result in migratory impacts. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to avoid or minimize potential impacts.

Birds

Because many bird species have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over vast distances often involving many different countries. For example, many shorebird species (e.g., Pacific golden-plovers [*Pluvialis fulva*], bar-tailed godwits [*Limosa lapponica*], and ruddy turnstones [*Arenaria interpres*]) are long distance migrants, and fly more than 7,000 miles between Alaskan breeding and Australian non-breeding areas. Only a few shorebird species, including rock sandpipers (*Calidris ptilocnemis*) in Alaska, are considered

[7] Level A (minimum exposure criterion for injury at the level at which a single exposure is estimated to cause onset of permanent hearing loss): 190 decibels (dB) referenced to 1 micro Pascal (μPa) (root mean square [rms]) for seals and 180 dB referenced to 1 μPa (rms) for whales, dolphins, and porpoises. Level B (defined as the onset of significant behavioral disturbance is proposed to occur at the lowest level of noise exposure that has a measurable transient effect on hearing): 160 dB referenced to 1 μPa (rms) (*Southall et al. 2007*).

short-distance migrants and travel just a few hundred miles between breeding and nonbreeding habitats(*Brown et al. 2001*). Many migratory routes are passed from one generation to the next. Potential impacts can vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration. It is unlikely that the limited amount of infrastructure and the temporary nature of the deployment activities would result in impacts to large populations of migratory birds, but more likely that individual birds could be impacted. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to avoid or minimize potential impacts to migratory pathways.

Terrestrial Invertebrates

Very little is known about migratory behavior in Alaskan terrestrial invertebrates. It is expected that the majority of terrestrial invertebrates are localized in their movements during their short life spans and as a result, no effects to migratory patterns of Alaska's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which can affect the overall population of individuals.

Amphibians and Reptiles

Reproductive effects to sub-populations of amphibians could occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools. It is unlikely that the limited amount of infrastructure and the temporary nature of the deployment activities would result in impacts to large populations of nesting amphibians or reptiles, but more likely that individuals could be impacted. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further help to avoid or minimize potential impacts to nesting amphibians and reptiles.

Terrestrial Mammals

Restricted access to important calving grounds has the potential to negatively affect body condition and reproductive success of many large mammals in Alaska. For example, the displacement of female caribou from preferred calving habitats may reduce fitness and survival of calves potentially affecting overall herd productivity (*Griffith et al. 2002*). Additionally, moose use certain types of habitats that allow for more effective defense of their calves from predators (*Bowyer et al. 1999*).

Disturbance could also result in the abandonment of offspring leading to reduced survival. It is, however, unlikely that the limited amount of infrastructure and the temporary nature of the deployment activities would impact the life phases of large numbers terrestrial mammals. It is more likely that individuals could be affected. Additionally, the implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further reduce potential impacts.

Marine Mammals

Restricted access to important calving and nursing grounds has the potential to negatively affect body condition and reproductive success of many marine mammals in Alaska. For example, the displacement of female seals from preferred pupping habitats may reduce fitness and survival of pups potentially affecting overall productivity. However, as deployment activities are expected to take place only in limited near-shore environments and for a short duration, it is unlikely that marine mammals would experience reproductive impacts. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further reduce any reproductive impacts.

Birds

Potential impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. Avian tolerance levels to disturbance can be species-specific (e.g., golden eagles exhibit lower tolerance to disturbance compared to bald eagles [*Haliaeetus leucocephalus*]) (*Pagel et al. 2010*). Disturbance to golden eagles is likely if they are nesting within line-of-sight of activities related to the Proposed Action or if the areas under active construction are preferred foraging areas. Under the BGEPA, the term "disturb" is 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 Code of Federal Regulations 22.3*). However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of birds. Potential impacts to birds could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

Terrestrial Invertebrates

Alaskan terrestrial invertebrate species are highly diverse and prevalent. Currently, little is known on the status of species populations. It is expected that the majority of terrestrial invertebrates are widespread in the state of Alaska and as a result, no population-level reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

The introduction of non-native species is often the result of human activity. Invasive (non-native) species can have a dramatic effect on natural resources and native populations. For the most part, Alaska has been minimally affected by invasive species as a result of such factors that include isolation, localized rather than widespread development, a colder climate, and restrictive species import/transport regulations.

Non-native species that are introduced into an ecosystem in which they did not evolve often increase rapidly in number. Native species evolve together as a community and function within an ecosystem governed by many checks and balances. Balance evolves within the system that limits the population growth of any one species; for example predators, herbivores, diseases, parasites, and other organisms compete for the same resources under limiting environmental factors. A non-native species, when introduced into an ecosystem in which it did not evolve naturally, is often times not bound by those limits; its numbers can sometimes dramatically increase and have potential severe impacts on the native community and ecosystem. Invasive species are often times very capable of out-competing native species for food and habitats and sometimes may even be attributed to the extinction of native species or potentially impact the species richness in an ecosystem (*USFWS 2012*).

Potential invasive species effects to Alaska's wildlife are described below.

<u>Amphibians and Reptiles</u>

The Alaska Herpetological Society considers many amphibians highly dangerous to Alaska's native species; the bullfrog (*Rana catesbeiana*) is of particular concern. This predatory species is highly invasive in many parts of North America and it is very well adapted to cold climates. Adults and tadpoles of this species are large and aggressive. Documented prey species for bullfrogs includes smaller frog species, fish, small mammals, birds, snakes, turtles, field mice, and even smaller bullfrogs. Bullfrogs are capable of depleting local food resources and can potentially impact productivity of other smaller native amphibians; this invasive is also known to carry diseases which can spread rapidly to other frogs (*AHS 2015*).

As the limited deployment of infrastructure and the short duration of construction activities are unlikely to result in bullfrogs being released, it is unlikely that the Proposed Action would impact amphibians or reptiles through the introduction or further exacerbation of invasive species. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further reduce potential impacts.

<u>Terrestrial Mammals</u>

Murid rodent species, specifically the Norway rat (*Rattus norvegicus*), are likely the most destructive invasive fauna species in Alaska. Murids are attributed with an estimated 50 to 81 percent of native mammal extinctions on the Aleutian Islands (*Ceballos and Brown 1995*). Rat-caused species extinctions occur not only via direct predation, but also by murids outcompeting for and eliminating common prey species used by other native animals. For example, in addition to consuming seeds and small vertebrates, rats also prey heavily on insects. Native insectivore species are heavily impacted by invasive rat species, and as a result their numbers are often reduced or eliminated from the populations (*Fritts 2007*).

Invasive species can have a role in changing the terrestrial large mammal food web as well. Invasive scrub and small trees have displaced native grassland, resulting in reduction in forage for native grazing mammals. As the limited deployment of infrastructure and the short duration of construction activities are unlikely to result in any of the above named species being introduced or further exacerbated, it is unlikely that the Proposed Action would impact terrestrial mammals through the introduction of invasive species. Invasive species effects to terrestrial mammals could be further minimized following the BMPs and mitigation measures described in Chapter 11, BMPs and Mitigation Measures.

Marine Mammals

Invasive species are detrimental to native communities and ecosystem in that they compete for the same natural resources and life requirements (food, space, and shelter) as native species effectively displacing native fauna and flora communities. Displacement radically alters the nature of the habitats, resulting in the degradation of local ecologies, disrupting food chains, and finally causing the extinction of native species (*USFWS 2012*). Disruptions of food chains can potentially impact higher trophic (i.e., feeding) level species like marine mammals that are specialized feeders. However, the short duration of construction activities in limited near-shore locations are unlikely to result in the introduction or further exacerbation of invasive species to marine environments. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures) could further reduce the likelihood of effects to the marine ecosystem from invasive species.

Birds

Seabird populations are particularly susceptible to rat and other invasive mammalian predators because of their unique life histories. Seabirds are long-lived and many species do not typically reproduce until attaining at least 2 to 3 years of age. Clutch sizes are typically small and young undergo long fledgling periods. These life history variables manifest in low annual productivity. Seabirds typically nest on the ground or in burrows or crevices and are absent for long periods on forage bouts (e.g., puffins, auklets, and storm-petrels). Absence for long periods leaves the eggs and young vulnerable to predation (*Moors and Atkinson 1984; Major et al. 2006*). Rats are also believed to kill and cache the adults of smaller seabird species like as auklets (*Major et al. 2006*). As the Proposed Action only involves temporary limited near-shore deployment activities, it is unlikely invasive species would be released by the construction activities that could threaten seabird populations. Additionally, due to the temporary and limited nature of terrestrial deployment activities, it is also unlikely that invasive species would be introduced or further exacerbated as a result of construction of the Proposed Action. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures), would further reduce potential impacts associated with invasive species.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that could change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation. As the Proposed Action involves temporary and limited deployment actions, it is unlikely that construction activities would result in population-level impacts as a result of the introduction or further exacerbation of invasive species. Implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures), would further reduce potential impacts associated with invasive species.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology,[8] and the nature and extent of the habitats affected.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have *no impacts* to wildlife resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to wildlife because the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes. Additionally noise generated to install fiber would be infrequent and of short duration and unlikely to produce measureable changes in wildlife behavior.

[8] Phenology is the seasonal changes in plant and animal life cycles, such as emergence of insects or migration of birds.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have *no impact* to those resources.

<u>Activities with the Potential to Have Impacts</u>

Potential construction/deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of points of presence (POPs),[9] huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g., small mammals and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

[9] POPs are connections or access points between two different networks, or different components of one network.

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public right-of-ways (ROWs) or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Potential impacts could vary depending on the number or individual poles installed, but could include direct injury/mortality as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited near-shore or inland bodies of water and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact wildlife, marine mammals in particular (see Section 3.2.4, Water Resources, for a discussion of potential impacts to water resources and Section 3.2.6.6, Threatened and Endangered Species and Species of Conservation Concern, for potential impacts to listed wildlife[10]). Effects could include direct injury/mortality; habitat loss, alteration, or fragmentation. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/ mortality could occur. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be *no impacts* to wildlife because no new infrastructure would be created and no disturbance to wildlife would incur. However, if installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory

[10] Listed wildlife is any animal listed as threatened or endangered by federal or state agencies.

patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife if no additional disturbance is required to install the hardware on the tower. The potential addition of power units, structural hardening, tower replacement, and physical security measures such as lighting could potentially impact wildlife resources resulting in direct injury/mortality from disturbance activities that could occur during the installation of new equipment. However, deployment activities are expected to be temporary and isolated, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures). Refer to Section 2.4, Radio Frequency Emissions, for information on radio frequency concerns.
- Deployable Technologies
  - In general, some limited construction could be associated with the implementation of deployable technologies such as land clearing or paving for parking or staging areas. This could lead to vegetation and habitat loss, alteration, or fragmentation. Implementation of deployable technologies themselves, including Cell on Wheels, Cell on Light Truck, or System on Wheels, could result in direct injury/mortalities to wildlife on roadways as well as bird strike hazards to low flying species. If off-road deployment is required, the action would potentially impact habitat and result in indirect injury/mortality. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. Refer to Section 2.4, Radio Frequency Emissions, for information on radio frequency concerns. Although unlikely, deployment of drones, balloons, blimps, or piloted aircraft could potentially impact wildlife by direct or indirect

injury/mortality from entanglement, collision, or ingestion and potential effects to migratory patterns and reproductive effects from disturbance and/or displacement. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary, likely affecting only a small number of wildlife. Potential impacts to wildlife could be further reduced by implementation of BMPs and mitigation measures (described in Chapter 11, BMPs and Mitigation Measures).

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers and poles; installation of underwater cables in limited near-shore or inland bodies of water; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. These potential impacts and are described further below.

Given the scope of the Proposed Action, while geographically enormous (in all 50 states, 5 territories, and the District of Columbia), the actual deployment in any one location is unlikely to be extensive and would likely involve a variety of deployment options (including an emphasis on collocations on existing facilities). The specific deployment activity and location would be determined based on location-specific conditions and the results of site-specific environmental reviews. These potential impacts associated with the Preferred Alternative, based on the deployment activity and the limited duration of construction activities, are described further below. BMPs and mitigation measures to help mitigate or reduce these potential impacts are described in Chapter 11, BMPs and Mitigation Measures.

Potential Impacts to Amphibians and Reptiles

Based on the analysis of the deployment activities described above to wildlife resources, potential impacts to Alaskan amphibians and reptiles are anticipated to be *less than significant* due to the localized and short-term nature of the deployment activity. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with wildlife.

Potential Impacts to Terrestrial Mammals

Based on the analysis of proposed activities described above to wildlife resources, potential impacts to Alaska's terrestrial mammals are anticipated to be *less than significant* as deployment activities would be temporary and short in duration. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with wildlife.

Potential Impacts to Marine Mammals

Based on the analysis of proposed activities described above to wildlife resources, potential impacts to Alaska's marine mammals are anticipated to be *less than significant* as deployment activities would be temporary, short in duration, take place in near-shore and inland waters and not the open ocean, and avoid important haulout areas. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with wildlife.

Potential Impacts to Birds

Based on the analysis of proposed activities described above to wildlife resources, potential impacts to Alaska's birds are anticipated to be *less than significant* as deployment activities would be temporary and short in duration. BMPs and mitigation measures could be required, as practicable or feasible, to further reduce potential impacts to migratory birds. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with wildlife.

Potential Impacts to Terrestrial Invertebrates

Potential impacts to Alaska's terrestrial invertebrates are expected to be *less than significant*. Some limited and localized impacts could result from Preferred Alternative effects such as habitat loss or invasive species. However, deployment activities are expected to be temporary, likely affecting only a small number of wildlife. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential impacts associated with wildlife.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be *less than significant* impacts to wildlife resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance would be infrequent, including mowing or the limited use of herbicides. This could result in *less than significant* effects to wildlife including direct injury/mortality to less mobile wildlife, or exposure to contaminants from accidental spills from maintenance equipment or release of pesticides.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts.

Wildlife resources could be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas. As stated above, these impacts would likely result in potential impacts to individuals rather than population-level impacts.

In addition, the presence of new access roads and transmission line ROWs could increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely result in potential impacts to individuals rather than population-level impacts.

While these impacts could occur, they are expected to be limited in magnitude and extent, primarily affecting individuals in isolated occurrences. As such, potential operational impacts to Alaska's wildlife resources are expected to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with wildlife.

Alternatives Impact Assessment

The following section assesses potential impacts to wildlife resources associated with the Deployable Technologies Alternative and the No Action Alternative.[11]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to wildlife resources as a result of implementation of this alternative could be as described below.

[11] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Potential Deployment Impacts

Activities associated with the set up and operation of deployable technologies for short time periods could result in *less than significant* impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Similar to potential impacts from the deployable elements of the Preferred Alternative, potential impacts under the Deployable Technologies Alternative could include potential noise or visual disturbances from aerial deployable equipment as well as bird strike hazards to low flying species; potential direct injury/mortalities to wildlife on roadways; potential habitat impacts and indirect injury/mortality from off-road deployment; and potential impacts to migratory wildlife patterns due to noise from external generators. Greater frequency and duration of deployments could change the magnitude of potential impacts depending on species, life history, and region of the state. However, deployment activities are expected to be temporary, likely affecting only a small number of wildlife. Potential impacts associated with the Deployable Technologies Alternative could be further reduced if the BMPs and mitigation measures described in Chapter 11 are implemented.

Potential Operational Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *less than significant* impacts to wildlife resources associated with routine operations, management, and monitoring. To further reduce potential impacts, the BMPs and mitigation measures described in Chapter 11 could be implemented. The potential impacts can vary greatly among species and geographic region and depend on the length and type of operation; potential impacts could result in indirect injury mortality or reproductive effects.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.6.4, Wildlife.

3.2.6.5. Fisheries and Aquatic Habitats

Introduction

This section describes potential impacts to fisheries resources in Alaska associated with deployment and operation of the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on fisheries resources were evaluated using the significance criteria presented in Table 3.2.6-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to fisheries resources addressed in this section are presented as a range of possible impacts.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism that could result from interactions associated with the Proposed Action. The most common direct injuries from equipment deployment and operation events are entanglement, habitat degradation, accidental ingestion of marine debris, and disturbance incurred by sensitive fishes like salmonids. However, given that the Proposed Action is only envisioned to be deployed in limited near-shore and inland waters, it is unlikely to impact large populations of fish and any potential impacts would likely be localized, isolated, short-term, and limited to individual or small numbers of fish.

Indirect injury/mortality environmental concerns pertaining to Alaska's fisheries are described below.

Vegetation and Habitat Loss, Alteration, or Fragmentation

The clearing of vegetation presents environmental concerns to fish and other aquatic species, including the condition of waterbodies, by the reduction of habitat availability, increased erosion, and changes in nutrient concentrations. Vegetation actively participates in stream enrichment by aiding aquatic organisms with temperature-dependent stages of egg development, stabilization of stream banks by tree roots, and providing organic debris that decompose into valuable nutrients used by these aquatic systems (*Post 2008, ADFG 2015a*). It is anticipated that for most types of facilities or infrastructure development scenarios, loss of terrestrial vegetation would likely be isolated within construction locations and/or would be short-term with stability achieved within several years, depending on the vegetation cover present in the area. In addition, since the proposed deployment activities are only envisioned to be performed in limited near-shore and inland waters, it is unlikely that deployment will result in impacts to aquatic habitats. Implementation of BMPS and mitigation measures could further reduce potential impacts. In addition, habitat loss can occur through exclusion by directly or indirectly preventing fish or shellfish from accessing an optimal habitat (e.g., breeding, spawning, feeding, or cover), either by physically preventing them from using a habitat or by causing fish to avoid a habitat, either temporarily or long-term (*ADFG 2015b*). However, as the Proposed Action is only envisioned to be deployed in limited near-shore and inland waters, it is unlikely to impact large populations of fish and any potential impacts would likely be limited to individual or small numbers of fish.

Alterations in streamflow can decrease dissolved oxygen concentrations and stress organisms. Oxygen enters streams from the atmosphere and groundwater discharge. For instance, the contribution of oxygen from groundwater discharge is significant in areas of Alaska with glacial deposits into the stream channel. A reduction in flow rate can lead to eutrophication, an oxygen-deficient condition that causes mortality resulting in the loss of fish (*Edmundson 2002*). As mentioned above, since the Proposed Action is only envisioned to be deployed in limited near-shore and inland waters, it is unlikely to impact large populations of fish and any potential impacts would likely be limited to individual or small numbers of fish.

Wetlands serve as important breeding grounds and habitat for fish. Wetlands including tundra, permafrost areas, marshes, and bogs help maintain water quality by filtering excess nutrients, sediments, and pollutants before water seeps into rivers, streams, and underground aquifers (*ADEC 2014*). Actions that degrade wetlands and decrease their quality as fish habitat include the draining and filling of wetlands with dirt, pilings, or concrete. The draining and filling of wetlands can block fish passage and exclude them from resources such as food, cover, and spawning and rearing areas (*Shields and Dupuis 2015*). However, to the extent practicable or feasible, FirstNet and/or their partners would work to avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands.[1] Implementation of buffer zones and other BMPs and mitigation measures to avoid wetland degradation during equipment placement and operation are addressed in Chapter 11, BMPs and Mitigation Measures.

Disturbance to sea floor habitats could cause fishery related stresses such as direct injury or mortality, loss of refuge or cover habitat, increase of suspended sediment, and disturbance or mortality of fish prey (e.g., algae, invertebrates). If fragmentation or other habitat disturbance from construction and development were to occur, concerns related to fish could include the loss of resident fish species, range reduction, and a decrease of habitat productivity. A decrease in habitat productivity could result from degradation of pools and riffles necessary for salmon

[1] See Section 3.2.5, Wetlands, section for more information related to potential impacts to wetlands.

spawning (*ADFG 2015c*). These potential impacts could also extend to many invertebrate and fish assemblages associated with habitat. However, as the Proposed Action is only envisioned to be deployed in limited near-shore and inland waters, it is unlikely to impact large populations of fish and potential impacts would likely be limited to individual or small numbers of fish. Sediment and erosion control would be implemented in accordance with federal, state, or local regulations. BMPS and mitigation measures would be required, as practicable or feasible, to further reduce potential sedimentation and turbidity (see Chapter 11, BMPs and Mitigation Measures).

Indirect Injury/Mortality

Indirect injury to aquatic habitat (e.g., reefs and seagrasses) that inadvertently affect fisheries includes changes in water quality, pH, and increased water turbidity (*USGS 2014*). Indirect injuries to individuals could be caused by underwater sound, poor water quality or changes in food availability. Underwater sound, such as noise caused by motor boats laying cable or heavy equipment near the shoreline, depending on magnitude and frequency during operation and deployment of equipment, can physically damage aquatic organisms or disrupt movement and migration patterns (*USDOT 2011*). BMPs and mitigation measures to reduce the effects of underwater noise are addressed in Chapter 11, BMPs and Mitigation Measures. Indirect mortality and exclusion from resources could also result from degraded water quality or perturbation of physical habitat features. However, as deployment activities would likely be temporary and of short duration, it is anticipated that any impacts would be limited to individual fish and aquatic organisms.

Potential indirect fisheries impacts associated with construction noise, installation, and increased human activity could include abandoned reproductive efforts, displacement, and avoidance of work areas, though these potential impacts would likely be temporary. Both direct and indirect potential impacts on fish and other marine life are expected to be short in duration and infrequent (limited to the period of activities). Mortality and injury of individual fish and aquatic organisms directly or indirectly linked to Proposed Action activities would likely be infrequent and could be further minimized by maintaining access to habitats and avoiding critical, species-specific time periods (e.g., spawning and migration).

Effects to Migration or Migratory Patterns

In marine systems, highly migratory species are characterized as having vast geographical distributions with single stocks utilizing both national and international waters for feeding or reproduction (*Pacific Fishery Management Council 2015*). Highly migratory species identified in the Magnuson-Stevens Act include tuna species, marlin (*Tetrapturus* spp. and *Makaira* spp.), oceanic sharks, sailfish (*Istiophorus* spp.), and swordfish (*Xiphias gladius*) (*NOAA 2007b*). Many statutes and regulations have been implemented in Alaska to minimize project activities on specific anadromous[2] fish-bearing waterbodies and are discussed in Affected Environment

[2] Anadromous fish are born in freshwater, migrate to the ocean to grow as adults, and then return to freshwater to spawn (*NOAA 2006*).

Section 3.1.6.3 (*Johnson and Blanche 2012*). Productive riparian, wetland, and coastal habitats are typically important for the migratory patterns used by anadromous fish. It is possible that the Proposed Action could potentially impact migration or migratory patterns as a result of construction and operation if BMPs and mitigation measures are not followed. However, it is anticipated that any interruption of migratory patterns would be minimal, or not likely to occur within the Project area. Areas used by migratory fish tend to be isolated within migration pathways, spawning grounds, rearing sites, and nursery areas of resident and anadromous fish.

Proposed Action related noise could mask communications by aquatic species and displace them entirely. Researchers have found that when fish are exposed to high noise levels, communication and auditory sensitivity decline (*Ladich 2013, Codarin et al. 2009*). If continuous high levels of ambient noise persist in an area (e.g., from existing pedestrian traffic, highway noise, and other human activities in the area), the additional noise from installation, deployment, and operation could be negligible and species could acclimate. Otherwise, some species could consequently become temporarily or permanently displaced due to noise. Physical noise displacement from the Proposed Action could cause fish and marine organisms to use an excess expenditure of energy to avoid the noise source or search for more suitable habitat. This, in turn, depletes energy reserves normally used for growth, migration, and/or reproduction. It is possible that the Proposed Action could potentially impact migratory patterns due to noise, but it is likely that such impacts would be very localized (associated with limited near-shore and inland water deployment) and of a short duration. Therefore, it is anticipated that migratory patterns would be subject to minimal noise disturbance during construction and operation. Additionally, to further reduce potential impacts, suitable habitat availability in the vicinity of the Proposed Action could be considered to accommodate these species to the extent practicable. For specific noise BMPs and mitigation measures, see Chapter 11, BMPs and Mitigation Measures.

> *Fish produce sounds through three ways: drumming of the swim bladder with the sonic muscle, striking or rubbing together teeth or skeletal parts, and hydrodynamic sound production when fish quickly change speed and direction. The majority of sounds produced by fishes are of low frequency, typically less than 1000 Hz.*

Reproductive Effects

The Magnuson-Stevens Fishery Conservation and Management Act (*16 USC 1801 et seq*.) established a management system for fishery resources in the United States. Identification of essential fish habitat (EFH) includes “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity” (*NOAA 2007a*).

The Proposed Action could potentially impact reproduction of aquatic resources, particularly in EFH areas if BMPs, mitigation measures, and regulatory guidelines pertaining to Alaska's fisheries are not followed (*NOAA 2000*). Reproductive effects to fish and shellfish species could occur through the direct loss of spawning habitat, slow recovery rates of habitat features, and the mortality of eggs and juveniles. In addition, disruption of fish passage could also influence reproductive timing, larval traits, and oceanographic features that act together, greatly reducing reproductive dispersal success between populations (*National Fish Habitat Partnership 2015*). One example of temporary or long-term barriers is the underwater housing of cables that could potentially prevent the success of fish egg fertilization or invertebrate passage during construction or operation, although unlikely due to the small size of underwater conduit that contain telecommunication cable. Reproductive effects to fish and shellfish species are most prevalent through the direct loss of spawning habitat, slow recovery rates of habitat features, and the mortality of eggs and juveniles. However, the Proposed Action anticipates only minor disruption of the reproduction of fisheries and disturbance of their resources as individual projects will be small scale (generally less than an acre of disturbance) and deployment will be short term. During construction, activities such as minor removal of aquatic and terrestrial vegetation, in-stream trenching, trench dewatering, and equipment installation could potentially result in the modification of aquatic habitats and thereby adversely affect fish reproduction. Additionally, vegetation clearing and soil compaction could potentially increase runoff to active reproductive coastal habitats (*Thrush et. al 2004*). Potential impacts could include increased sedimentation and turbidity (see Section 3.2.2, Soils), increased temperature, decreased dissolved oxygen concentrations, releases of existing chemical and nutrient pollutants from disturbed sediments, and introduction of chemical contaminants, such as fuel and lubricants, due to spills (see Section 3.2.4, Water Resources).

However, due to the scale of the individual projects (generally less than an acre of disturbance) and the short duration of deployment activities (in some cases, as little as a few hours at one location) it is unlikely that deployment activities will result in more than minor impacts to fish from removal of vegetation or increased sedimentation. Additionally all federal, state, and local regulatory requirements will be adhered to regarding erosion and sediment control. BMPs and mitigation measures could be implemented to further prevent sedimentation and other discussed hazards from reaching nearby surface waters (see Chapter 11, BMPs and Mitigation Measures). Measures such as time or area restrictions, avoidance of certain habitats, and mitigation could minimize adverse effects on reproductive habitat.

Invasive Species Effects

The introduction of nonnative species affects the structure and function of aquatic systems relied upon by fish. Invasive species can diminish the health of native fish communities through predation, disease introduction, habitat alteration, and competition for resources (e.g., food and space) (*ADFG 2015d*). For example, waterweed (*Elodea* ssp.) is an emerging issue for aquatic invasive species management in Alaska. Waterweed is an underwater perennial plant that can reproduce by stem fragmentation carried by float planes, boats, and trailers. It degrades fish habitat by decreasing water flow and increasing sedimentation (*Alaska DNR 2015*). It is, however, unlikely that the Proposed Action would result in dispersal of waterweed. To prevent, control, and eradicate aquatic invasive species, the Alaska Department of Fish and Game has prepared the Alaska Aquatic Nuisance Species Management Plan (*ADFG 2015d*).

It is possible that the Proposed Action could potentially impact native species if previously deployed equipment is not cleaned and sterilized to prevent the spread of invasive algae, fish species, or other aquatic organisms. However, it is anticipated that the small scale of the individual projects (generally less than an acre) and the short duration of deployment activities would be unlikely to result in the spread of invasive species. Additionally, implementation of BMPs and mitigation measures (and recommended sanitation procedures) could further prevent the spread of invasive species and the alteration of fishery habitat.

Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative would result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries resources and others would not. In addition, and as explained in this section, the various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

<u>Activities Likely to Have No Impacts</u>

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to fisheries resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit–New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to fisheries resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes and are likely not located in fish habitat. Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fishery resources because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries resources because those activities would not require ground or water disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries resources, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Potential construction/deployment-related impacts to fisheries resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of ground or water disturbing activities, including plowing, trenching, boring, and filling in fish habitat. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries resources include the following:

- Wired Projects
  - New Build–Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, excavating, filling, directional boring and the construction of points of presence,[3] including huts or other associated facilities or hand-holes to access fiber, could result in potential impacts to fisheries and fish habitat. Although potential impacts are usually temporary, buried fiber optic installation methods could potentially result in high-risk situations to fisheries resources by sedimentation from on-shore activities. Furthermore, these risks include the removal of productive habitat, blocked passage of streams used by anadromous fish during reproduction periods, and the introduction of excess sediment and turbidity into waterways during construction/deployment. Ground and water disturbance associated with vibratory plowing and excavation activities could also result in fish habitat loss and mortality of individuals due to ground-born sound transmissions. Sound pressure waves pass through various media (soil, water, air) and can propagate long distances with little attenuation, especially when travelling through water (*Dahl et al. 2007*). Aquatic organisms' sensitivity to sound and vibrations varies greatly by species, with sharks and bony fish being particularly sensitive (*University of Maryland 2000*), thus sound and pressure waves can change fish behavior (*Popper and Hastings 2009*). Egg viability and embryoic development of aquatic species can be affected when exposed to low frequency vibrations (*VanDerwalker 1964; Vandenberg et al. 2012*). It is

[3] Points of presence are connections or access points between two different networks, or different components of one network.

anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, state, or locally required sediment and erosion control mechanisms.

- New Build–Aerial Fiber Optic Plant: Ground and water disturbance and heavy equipment use associated with construction activities, including land/vegetation clearing and excavation activities associated with pole construction, could result in fish habitat loss if activities occur near/in lakes, streams, rivers, coastlines, or wetlands. Noise and sedimentation associated with construction activities could stress fish, therefore potentially impacting their longevity and/or migratory patterns. It is anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, state, or locally required sediment and erosion control mechanisms.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of cables using existing poles and structural hardening or reinforcement of equipment to improve disaster resistance and resiliency would have few potential impacts on fisheries habitat compared to new build construction, although some fish habitat loss could occur if activities were near/in lakes, streams, rivers, coastlines, or wetlands. It is anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, state, or locally required sediment and erosion control mechanisms. Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.
- New Build–Submarine Fiber Optic Plant: The installation and construction of sealed cables in limited near-shore or inland bodies of water and the construction of landings/facilities on the shore to accept a cable buried close to the shoreline could potentially impact fisheries resources. Although sensitive or vulnerable areas vary along Alaska's shores, changes to aquatic communities that occupy the shoreline could disrupt fish development, sessile[4] invertebrates, alter community structure, and potentially change the fishery dynamics within the aquatic habitat (*NOAA 2008*). It is anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, state, or locally required sediment and erosion control mechanisms. Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.

[4] Unable to move; attached to the substrate (*NOAA 2006*).

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground or water disturbance, there would be *no impacts* to fisheries. Ground and water disturbance during the installation of equipment to enhance the signals traveling through the fiber may involve the installation of concrete pads and potential construction of an access road, potentially leading to runoff, erosion, and sediment reaching nearby fishery habitats. These construction activities, which may include land/vegetation clearing and excavation, could potentially result in the loss of fishery habitat. If an access road is constructed, additional potential impacts to fish habitat resulting from stream crossing methods, culvert installations, and road runoff should be considered. It is anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre), the short duration of those activities, and the application of federal, state, or locally required sediment and erosion control mechanisms. Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads constructed near aquatic habitats could potentially result in potential impacts to fish habitat and other fisheries resources (i.e., construction noise disturbance, light pollution, and spills from generator fluids). It is anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre) and the short duration of those activities. Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would result in less potential impact to fisheries than the construction of new wireless communication towers. However, if the onsite delivery of additional power units, structural hardening, and physical security measures were required, potential impacts and disturbance to fishery habitat could potentially lead to species deterrence and loss of suitable habitat.
- Deployable Technologies
  - Where deployable technologies (i.e., Cell on Wheels, Cell on Light Truck, System on Wheels, or aerial deployables such as piloted aircraft, balloons, or drones) would be implemented on existing paved and unpaved road surfaces, it is anticipated that there would be no impacts to fisheries resources because there would be no new ground or water disturbance. However, implementation of deployable technologies could result in potential impacts to fisheries resources if deployment occurs in off-road areas. Some construction of staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Although unlikely, these

activities could result in loss of fish habitat (e.g., wetlands, streams, or vegetation used as cover in these areas). In addition, while likely to only impact individual fish, implementation of aerial deployable technologies could result in direct injury or death to fish or damage to fish habitat if a piece of equipment were to fall into an aquatic habitat. To retrieve a fallen piece of equipment, additional fish habitat damage could occur. It is anticipated that these potential impacts will be minimal due to the small footprint of deployment activities (generally less than an acre) and the short duration of those activities (as short as a few hours in some cases). Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.

In general, the abovementioned activities could potentially involve ground, water, and near-shore sea floor disturbance by heavy equipment use associated with the construction activities, land/vegetation clearing, and excavation activities associated with construction. Potential impacts to fisheries resources associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and introduction of invasive species.

Given the scope of the project, while geographically enormous (50 states, 5 territories, and the District of Columbia), the actual deployment in any one location is unlikely to be extensive (generally less than an acre) and will likely involve a variety of deployment options (including an emphasis on collocations on existing facilities). The specific deployment activity, and where the deployment will take place, will be determined based on location-specific conditions and the results of site-specific environmental reviews. These potential impacts associated with the Proposed Action, based on the deployment activity and the limited duration of construction activities, are described further below. BMPs and mitigation measures to help mitigate or reduce these potential impacts are described in Chapter 11, BMPs and Mitigation Measures.

<u>Potential Direct Injury/Mortality Impacts</u>

Based on the analysis of the deployment activities described above to fisheries resources, potential impacts as a result of direct injury/mortality are anticipated to be *less than significant* since the proposed activities are only envisioned to be deployed in limited near-shore and inland waters, are unlikely to impact large populations of fish, and any potential impacts would likely be localized, isolated, short-term, and limited to individual or small numbers of fish. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with fisheries and aquatic habitats.

Potential Habitat Loss Impacts

Based on the analysis of the potential deployment effects to fisheries resources described above, potential impacts as a result of habitat loss are anticipated to be *less than significant*. It is anticipated that for most types of facilities or infrastructure development scenarios, loss of terrestrial vegetation would likely be isolated within construction locations and/or would be short-term with stability achieved within several years, depending on the vegetation cover present in the area. In addition, since the proposed deployment activities are only envisioned to be performed in limited near-shore and inland waters, it is unlikely that deployment will result in impacts to aquatic habitats. Implementation of BMPS and mitigation measures could further reduce potential impacts. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with fisheries and aquatic habitats.

Potential Indirect Injury/Mortality Impacts

Based on the analysis of the potential deployment effects to fisheries resources described above, potential impacts as a result of indirect injury/mortality are anticipated to be *less than significant* since deployment activities would likely be temporary, of short duration, and any impacts would likely be limited to individual fish and aquatic organisms. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with fisheries and aquatic habitats.

Potential Migration Impacts

Based on the analysis of the deployment activities described above to fisheries resources, potential migration impacts are anticipated to be *less than significant* since such impacts are anticipated to be localized, short term, and limited to near-shore and inland environments. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with fisheries and aquatic habitats.

Potential Reproductive Effects Impacts

Based on the analysis of the deployment activities described above to fisheries resources, potential impacts as a result of reproductive effects are anticipated to be *less than significant*. It is anticipated that project activities would result in only minor disruption to fisheries reproduction at the individual level, not the population level. Potential impacts to reproduction would also likely be short term and localized. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with fisheries and aquatic habitats.

Potential Invasive Species Impacts

Based on the analysis of the deployment activities described above to fisheries resources, potential invasive species impacts are anticipated to be *less than significant*. It is anticipated that the small scale of the individual projects (generally less than an acre) and the short duration of deployment activities would be unlikely to result in the spread of invasive species. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with fisheries and aquatic habitats.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would likely result in potential impacts similar to the abovementioned potential deployment/construction impacts. It is anticipated that there would be few potential impacts to fisheries resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Although unlikely, limited use of herbicides and the potential release of other contaminants by runoff could present potential impacts to fish and their habitats. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, additional potential fish impacts could occur (e.g., stream bank erosion, sedimentation of streams). However, these impacts would likely be localized, limited to individual species, and unlikely to cause population-level impacts.

Alternatives Impact Assessment

The following section assesses potential impacts to fisheries associated with the Deployable Technologies Alternative and the No Action Alternative.[5]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries resources as a result of implementation of this alternative could be as described below.

[5] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Potential Deployment Impacts

The implementation of deployable technologies is not anticipated to cause significant potential impacts to fisheries resources. Deployment and operation of cellular masts and antenna-generated signals are anticipated to have minimal disturbance to fish. However, greater frequency and duration of deployments could change the magnitude of potential impacts depending on species, life history, and region of the state.

The main potential impact on fisheries would be the placement of deployable infrastructure near waterbodies. Generator stations that power this infrastructure are designed to be self-contained within a trailer. This would require fuel storage to be kept onsite with associated protection plans to prevent spills and contamination to fishery dependent waterways.

Tidal regimes, which may differ between the north and south coasts, should be taken into account when deploying equipment near coastal locations. This would help prevent loss of equipment and marine debris in nearby coastal fish habitat.

Routine maintenance checks of equipment operation sites could prevent potential impacts by equipment weathering, such as corrosion of metal, rust, and growth removal to reduce potential impacts on water quality and prevent coastal source pollution. Stability in the construction of equipment to withstand natural environmental factors, (e.g., storms, hurricanes, and typhoons) could prevent the irritation or damage to the digestive systems of fish (*NOAA 2011*).

Potential Operation Impacts

As explained above, operation activities would consist of running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *no impacts* to fisheries resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If routine maintenance or inspections occur off of established access roads or corridors, or if the acceptable load capacity of the roads is exceeded, sediment laden runoff and increased stream bank erosion could occur. The utilization of buffer zones, temporary or permanent native seeding on disturbed ground, ground cover, plastic sheeting and matting would minimize sedimentation of aquatic systems. In addition, Stormwater Pollution Prevention Plans are required at construction sites where more than 1 acre of ground would be disturbed (*USEPA 2007*).

Coastal development can cause potential impacts to aquatic organisms from underwater sound, poor water quality, or changes in food availability. Underwater sound during equipment operation, depending on magnitude and frequency, can physically damage fish or disrupt movement and migration patterns (*Popper and Hastings 2009*, *USDOT 2011*).

To minimize disturbance for the duration of operation, which could potentially last up to 2 years, it is recommended that deployment activities avoid productive habitats, such as coastal wetlands, inland waterways, EFH, anadromous fish spawning areas, and reefs to the extent practicable. Adverse effects on these productive habitats could include many potential direct and indirect impacts in the form of physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, individuals, fisheries, benthic organisms, prey species, and their habitat, and many other ecosystem components (*NOAA 2007a*). However, it is anticipated that these potential impacts would be minimal due to the small footprint of deployment activities (generally less than an acre) and the short duration of those activities (as short as a few hours in some cases). Implementing BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce these potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to fisheries resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.2.6.5, Fisheries and Aquatic Habitats.

3.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

Introduction

This section describes potential impacts to federal-, state-, or agency-listed plant and animal species[1] (hereafter collectively referred to as listed species) and designated critical habitat associated with deployment and operation of the Proposed Action and alternatives, and discusses best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts.

Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on listed species were evaluated using the significance criteria presented in Table 3.2.6.6-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as: *may affect, likely to adversely affect; may affect, not likely to adversely affect;* and *no effect*. These impact categories are comparable to those defined in the *Endangered Species Consultation Handbook* and are described in general terms below (*USFWS and NMFS 1998*):

- "*No effect*" means that no listed resources would be exposed to the action and its environmental consequences.
- "*May affect, not likely to adversely affect*" means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur.
- "*May affect, likely to adversely affect*" means that listed resources are likely to be exposed to the action or its environmental consequences and would respond in a negative manner to the exposure.

Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

[1] Includes terrestrial, freshwater, and marine plant and animal species that are federally listed as threatened, endangered, candidate, proposed, or species of concern; species listed by the Forest Service and Bureau of Land Management as sensitive; species that are state-listed as endangered; and/or species that receive specific protection defined in federal or state legislation.

Table 3.2.6.6-1: Impact Significance Rating Criteria for Listed Species and Critical Habitats

Type of Effect	Effect Characteristic	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Direct and Indirect Injury/Mortality of a Listed Species	Magnitude or Intensity	According to the U.S. Endangered Species Act, this impact threshold applies at the individual level so therefore applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under *likely to adversely affect* category); Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect; Includes permitted take	No measurable effects on listed species
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect; Typically applies to one or very few locations	No measurable effects on listed species
	Duration or Frequency	Any duration or frequency that could result in take of a listed species	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect; Typically applies to infrequent, temporary, and short-term effects	No measurable effects on listed species
Indirect Effects from Disturbance or Displacement Resulting in Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success or survivorship of offspring of a listed species	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success or survivorship of offspring	No measurable effects on listed species
	Geographic Extent	Reduced breeding success or survivorship of offspring of a listed species at any geographic extent	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success or survivorship of offspring of listed species; Typically applies to one or very few locations	No measurable effects on listed species
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success or survivorship of offspring of a listed species	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success or survivorship of offspring of a listed species within a breeding season	No measurable effects on listed species

Type of Effect	**Effect Characteristic**	**Impact Level**		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Indirect Effects From Disturbance or Displacement Resulting in Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species	Minor behavioral changes that would not result in take of a listed species	No measurable effects on listed species
	Geographic Extent	Any geographic extent that could result in take of a listed species	Changes in behavior at any geographic scale that are not expected to result in take of a listed species; Typically applies to one or very few locations	No measurable effects on listed species
	Duration or Frequency	Any duration or frequency that could result in take of a listed species	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species	No measurable effects on listed species
Direct or indirect effects on habitats (including designated critical habitats) that affect population size and long-term viability for listed species	Magnitude or Intensity	Effects to any of the essential features of listed species habitat that would diminish the value of the habitat for the survival and recovery of the listed species	Effects to listed species habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated	No measurable effects on listed species habitat
	Geographic Extent	Effects to listed species habitat at any geographic extent that would diminish the value of the habitat for listed species; Note that the *likely to adversely affect* threshold for geographic extent depends on the nature of the effect; Some effects could occur at a large scale but still not appreciably diminish the habitat function or value for a listed species; Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for the listed species; Typically applies to one or few locations within a habitat known to be used by listed species	No measurable effects on listed species habitat
	Duration or Frequency	Any duration or frequency that could result in reduction in habitat function or value for a listed species	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated; Typically applies to Infrequent, temporary, or short-term changes	No measurable effects on listed species habitat

As discussed in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, there are many listed species that occur in Alaska. Listed species are protected under federal and state regulations and, in most cases, a permit or other authorization is required for take[2] of a listed species. There are 39 federally listed species and 2 candidate species for federal listing in Alaska (*USFWS 2015a; NMFS 2015*). These species are under the jurisdiction of the United States (U.S.) Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service (NMFS). Of the 39 federally listed species, 5 are also state-listed as endangered by Alaska Department of Fish and Game (*ADFG 2015*). Federally designated critical habitat has been established for 7 species in Alaska (*USFWS 2015b*). All of the designated critical habitats occur within marine and coastal environments. Another 84 species are designated by the U.S. Forest Service (Forest Service) (*USFS 2009*) and Bureau of Land Management (BLM) (*BLM 2010*) in Alaska as sensitive. Table 3.2.6.6-2 provides key information about the federal and state-listed species and designated critical habitats, summarized by taxonomic group.[3]

As summarized in Table 3.2.6.6-2, most of the federally and state-listed species fall under the threatened[4] category (22 of 41). All but one of the species in the highest listing category (endangered[5]) occur in marine, coastal, or other aquatic environments and several of these species have federally designated critical habitat in Alaska. The species listed by Forest Service and BLM as sensitive are mostly associated with forest or tundra habitats on Forest Service and BLM lands in Alaska.

[2] Take is defined differently by various federal and state regulations but the most commonly accepted definition is that of the U.S. Endangered Species Act (ESA). This act defines take as “to harass, harm, pursue, hunt, shoot, wound, trap, capture, collect or attempt to engage in any such conduct.” The act further defines “harm” as “significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering”, and “harass” as “actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering.”

[3] A taxonomic group is a group of biological organisms that have shared characteristics.

[4] According to the ESA, the term “threatened species” means any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

[5] According to the ESA, the term “endangered species” means any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary of the Interior to constitute a pest whose protection under the provisions of the ESA would present an overwhelming and overriding risk to man.

Table 3.2.6.6-2: Summary of Information on Federally and State-Listed Species[a] and Critical Habitats

Taxonomic Group	Listing Status and Number of Species				
	Endangered	**Threatened**	**Candidate**	**Designated Critical Habitat**	**Key Habitat/Distribution Information**
Marine Mammals	10	4	1	5[b]	Marine, coastal, sea ice
Terrestrial Mammals	0	1	0	0	Forest—occurring as an experimental population in one location in southeast Alaska
Birds	2	2	1	2[c]	Lakes, wet tundra, and marine habitats
Marine Reptiles	1	3	0	0	Marine (all occurrence of marine turtles in Alaska are extremely rare)
Fish	3	12	0	0	Marine, estuarine, freshwater
Plants	1	0	0	0	The one listed plant species is known from one location on Adak Island on cliff face
TOTAL	**17**	**22**	**2**	**7**	

Sources: USFWS 2015a and b; ADFG 2015.

[a] The five state-listed species are also federally-listed species so they are not summarized separately in this table (see Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern).
[b] Federally designated critical habitat has been established for five marine mammal species in the following locations:

- Northern sea otter (*Enhydra lutris kenyoni*, Southwest Alaska Distinct Population Segment only)—southwest Alaska coast
- Steller sea lion (*Eumetopias jubatus*, Western Distinct Population Segment only)—Aleutian Islands and nearshore marine areas adjacent to the Aleutians, as well as scattered islands and promontories and adjacent marine areas in the Bering Sea
- Cook Inlet beluga whale (*Delphinapterus leucas*)—Cook Inlet from Kachemak Bay to the Douglas River in the south to Knik Arm in the north
- Northern pacific right whale (*Eubalaena japonica*)—Southern Bering Sea and a small portion of Gulf of Alaska
- Ringed seal (*Phoca hispida*)—U.S.-controlled portions of the Bering, Chukchi, and Beaufort Seas

[c] Federally-designated critical habitat has been established for two bird species along the Arctic coast of Alaska: spectacled eider (*Somateria fischeri*) and Steller's eider *(Polysticta stelleri*).

Listed species would be subject to the same potential impacts described for vegetation, wildlife, and fish (Section 3.2.6.3, Terrestrial Vegetation, Section 3.2.6.4, Wildlife, and Section 3.2.6.5, Fisheries and Aquatic Habitats). However, the magnitude of such impacts on listed species and critical habitats have the potential to be greater because of the reduced population size and/or limited geographic distribution of listed species and the importance of designated critical habitats for the maintenance of listed species populations. Potential impacts to endangered species would be more significant in terms of magnitude than impacts to species in the threatened or sensitive categories.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to listed species and critical habitats discussed in this section are presented as a range of possible impacts to the major taxonomic groups that encompass the listed species in Alaska (i.e., terrestrial mammals, marine mammals, marine reptiles, birds, fish, and plants).

Description of Environmental Concerns

The following types of direct and indirect effects were considered in evaluating the potential impact of the Proposed Action and alternatives on listed species (see Table 3.2.6.6-1 for further details):

- Direct injury or mortality—includes the taking (removal or loss) of a listed species (individual or population) due to physical injuries, extreme stress, or death of an individual from interactions associated with the Proposed Action;
- Indirect effects from disturbance or displacement—includes changes in an individual or population's habitat use or life history pattern due to disturbance from increased noise and vibration, human activity, visual disturbance, and associated transportation activity; increased competition for resources or habitat due to displacement of individuals from the affected area into the territory of other animals; or other indirect effects that ultimately cause mortality, decreased fitness, or reduced breeding in the future population; and
- Direct or indirect effects on habitats for listed species (including designated critical habitats) that affect population size and long-term viability for listed species—direct habitat effects are primarily physical disturbances that result in alterations in the amount or quality of a habitat. Indirect habitat loss can occur through preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term.

Any of the listed species with individuals, populations, or habitat in the vicinity of activities related to the Proposed Action could be subject to one or more of the above potential impacts from the Proposed Action; however, implementation of BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would completely avoid potential impacts on some species and reduce potential impacts on others. The nature and extent of potential impacts to listed species would vary depending on many factors, including but not limited to, the species, the location and extent of the Proposed Action activity, the time of year, and the duration of deployment.

The following sections define and describe each of these potential impacts according to the taxonomic groups encompassing the listed species in Alaska.

Terrestrial Mammals

The only threatened or endangered terrestrial mammal species in Alaska is the wood bison (*Bison bison athabascae*), which is federally listed as threatened (*USFWS 2015a*). This is a highly mobile species that would be expected to move away from activities associated with the

Proposed Action. As such, potential impacts to this species from the Proposed Action would likely be limited to disturbance, displacement, and/or habitat loss. However, this species occurs in Alaska as a captive herd (experimental population) (*ADFG 2015*), so potential impacts from the Proposed Action on this species would be avoidable through informed siting of Proposed Action features.[6]

Numerous other terrestrial mammal species are listed by the Forest Service and/or BLM as sensitive (*USFS 2009; BLM 2010*). Potential impacts of the Proposed Action on Forest Service or BLM sensitive species could involve mortality or injury of individuals, disturbance of individuals or their habitat, displacement of individuals, and/or habitat loss. Any activities associated with the Proposed Action that would occur on Forest Service or BLM lands would be conducted under consultation with the Forest Service or BLM to minimize potential impacts to sensitive species or their habitats.

Marine Mammals

Fifteen species of marine mammals listed as candidate, threatened, or endangered occur in Alaska (*USFWS 2015a; NMFS 2015*). These species are restricted to marine waters, coastal habitats, or the sea ice. Nine of the species are whales, which are generally restricted to offshore marine habitats. FirstNet is unlikely to impact whales because deployment activities would only take place in nearshore or inland waters. Such activities would be conducted using small- to medium-sized vessels that are highly maneuverable and could, therefore, easily avoid interactions with any whales that could incidentally occur in nearshore waters. The other species include seals, walrus, otter, and polar bear, all of which are associated with marine waters and the sea ice.

A potential impact to listed whale species is disturbance from underwater noise. Noise associated with the installation of cables in the near/offshore waters of coastal Alaska could potentially impact whale behavior or migration patterns; however, the marine activities related to the Proposed Action are very limited in nature, so risks to listed marine species from marine noise are expected to be low. Whales could be temporarily excluded from a resource if they avoid it due to the increased presence of boats and associated noise. Beluga whales are particularly sensitive to disturbance and depending on the duration of disturbing activities, belugas could be excluded from their environment temporarily or could abandon the affected habitat entirely (*Norman 2011*). Native hunters near Kotzebue Sound reported that belugas abandoned areas where fishing vessels were common (*NMFS 2008*). Greater human activity of longer duration would increase the likelihood that belugas or other listed whale species would avoid affected areas, possibly being excluded from essential resources. The degree to which habitat exclusion could affect any of the listed whale species depends on many factors, including the context and duration of the noise exposure and the individual's experience, life stage, and conditioning. However, as stated above, the potential impacts associated with the Proposed Action are unlikely to impact whales; the likelihood of impacts could be further reduced with

[6] In this section, informed siting of Proposed Action features refers to the act of locating activities or features in areas that do not support listed species or their known habitats.

implementation of appropriate BMPs and mitigation measures if deemed necessary and defined in consultation with the appropriate resource agency. Potential impacts from the Proposed Action would likely be short-term, not wide ranging, and below sound exposure impact thresholds[7] and thus would not adversely affect listed whale species.

Potential impacts to the other non-whale listed marine mammal species (seals, otter, and walrus) from the Proposed Action include direct injury or mortality from vessel strike, although the risk of this is low due to the very limited nature of the Proposed Action's marine activities, and disturbance/displacement from preferred habitats such as haulout areas,[8] pupping grounds, or feeding grounds. Seals, otter, and walrus species that are swimming or hauled out on land, rock, or ice are sensitive to passing boats, aircraft overflights, and human presence. Unexpected or abnormal noises, smells, sounds, and sights could elicit a flight reaction from individuals, particularly at haulout sites where many animals congregate. Trampling deaths associated with haulout disturbance are among the largest known sources of natural mortality for walrus (*Cooper et al. 2006*). Aerial disturbances could occur in relation to the Proposed Action, which could cause flight reactions at haulout sites. If a disturbance such as noise, human activity, or vessel traffic excluded marine mammals from a preferred sea ice haulout, the individuals would need to find a new haulout site, possibly at a less favorable location, requiring expenditure of vital energy reserves, creating physiological stress, and possibly resulting in reduced reproductive success. Implementation of BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would avoid or minimize the potential disturbance impacts to listed marine mammal species. Underwater sound sources, if intense enough, could cause injury to non-whale listed marine mammals in the vicinity of the activity. Implementation of BMPs and mitigation measures for underwater noise reduction, as defined through consultation with the appropriate resource agency, would help avoid or minimize the potential impacts from underwater noise.

Critical habitat has been designated for five marine mammal species in Alaska, all within coastal and marine environments (*USFWS 2015b*). Proposed Action activities that occur in areas designated as critical habitat for marine mammals could result in degradation of these habitats and thereby adversely affect listed species for which the critical habitat was designated. Installation of new equipment on existing infrastructure could disturb or harass individuals within the critical habitat, degrading the value of the critical habitat without causing any physical change to it. Examples of these types of potential impacts would include auditory or vibrational disturbance of marine mammals due to underwater noise and vehicles driving on beaches used as haulouts. These potential impacts would be most significant if they occurred during seasonally important migrations or breeding periods within the affected habitat units. Siting Proposed Action activities outside designated critical habitats would avoid potential impacts to these areas.

[7] Sound exposure impact thresholds developed by Southall et al. (*2007*) define specific sound levels above which measurable transient effects (Level B) or permanent effects (Level A) could occur on the hearing of marine mammal species. Level A and B thresholds have been established for seals (all species considered as one group) and for whales, dolphins, and porpoises (all species considered as one group) (*Southall et al. 2007*).

[8] Haulout areas are sites on the sea ice or shoreline that are used by pinnipeds (seals and walrus) for resting, predator avoidance, and social interaction.

If activities within designated critical habitats are unavoidable, consultation with NMFS and/or the USFWS would identify strategies for avoiding or minimizing potential impacts on critical habitats and the species for which they were designated.

FirstNet does not expect to increase the disturbance to marine mammals associated with deployment over or on the marine environment. As such, potential impacts to marine mammals as a result of the Proposed Action would be highly unlikely.

Marine Reptiles

The four species of reptiles that occur in Alaska are all marine turtles and each is federally listed as threatened (three species) or endangered (one species). Marine turtles occur very irregularly in Alaska and only as transients so they do not nest or reside there for long periods (*ADFG 2015*). This, combined with the very limited nature of marine activities associated with the Proposed Action make potential impacts to marine turtles as a result of the Proposed Action highly unlikely.

Birds

There are five species of candidate, threatened, endangered bird species in Alaska, all of which are associated with marine, coastal, lake, or tundra habitats. Critical habitat has been designated along the Alaska coast for two of these species. The most significant potential direct impacts to listed bird species from the Proposed Action would be injury or death of individuals from deployment of equipment. Such potential impacts would be unlikely given that birds are highly mobile and would disperse from Proposed Action activities. Young birds or eggs would be most susceptible to direct or indirect mortality due to their immobility or limited mobility, but BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would significantly reduce the likelihood such potential impacts.

Mortality or injury from collisions or electrocutions with manmade cables and wires are of concern for avian species. Birds that are at greatest risk of collision events include those that are not highly maneuverable (such as ducks), heavy birds (such as swans and cranes), and birds that fly in flocks (*APLIC 2012*). Certain bird species and species groups are more susceptible to electrocution than others based on their size and behavior that increases their risk of exposure to energized and/or grounded hardware. For example, the large wingspans of raptors such as bald eagles, red-tailed hawks (*Buteo jamaicensis*), osprey (*Pandion haliaetus*), and great horned owls (*Bubo virginianus*) enable them to simultaneously touch energized and/or grounded hardware parts. Tall birds such as herons and egrets are also at risk of electrocution where vertical spacing between lines is less than their height (*APLIC 2012; Brown et al. 1987*).

With the exception of the Eskimo curlew (*Numenius borealis*), all of the listed bird species could be susceptible to collision or electrocution with Proposed Action features because the species are not highly maneuverable and/or are large bodied. Implementation of BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would significantly reduce the likelihood of collision or electrocution by listed species.

The more likely direct and indirect effects of the Proposed Action on listed birds would include habitat loss; and disturbance and stress caused by noise, human activity, and habitat degradation. The most significant of these potential impacts on listed bird species would be habitat disturbance/degradation or exclusion from breeding sites resulting in reduced reproductive success.

Direct or indirect habitat loss could affect listed bird species, particularly through loss of nesting habitat. The five species of candidate, threatened, or endangered birds in Alaska each have very specific nesting requirements. As such, loss of nesting habitat could be avoided through implementation of informed siting of Proposed Action features to avoid such habitats.

The five species of candidate, threatened, or endangered bird species in Alaska are all highly susceptible to human disturbance and habitat alteration particularly during the summer breeding season. Disturbance from human activity, noise, vibration, and habitat degradation could cause abandonment of nesting sites, resulting in adverse reproductive effects. If the disturbance occurs late in the breeding season, individuals may not reattempt to nest following disturbance, resulting in the loss of a full breeding year for the affected species in a given area. If the disturbance occurs early in the breeding season, individuals could reattempt to nest if suitable habitat exists and it is not already occupied by other individuals. If the new habitat is suboptimal, reduced adult and immature bird survivorship, reduced reproductive rates, or reduced offspring survivorship could occur. Single disturbance events would have lower potential impacts on listed birds than repeated disturbances that are unpredictable in terms of the timing, type, or magnitude of the disturbance. Greater human activity of longer duration would increase the likelihood that birds would avoid the affected area, possibly resulting in permanent displacement or exclusion from essential resources. Implementation of BMPs and mitigation measures related to siting and timing of activities, as defined through consultation with the appropriate resource agency, would avoid or significantly reduce disturbance-related potential impacts to listed bird species.

Numerous other bird species are listed by the Forest Service and/or BLM as sensitive (*USFS 2009; BLM 2010*). Potential impacts to these species could be similar to those described above. However, any activities associated with the Proposed Action that would occur on Forest Service or BLM lands would be conducted under consultation with the Forest Service or BLM to minimize potential impacts to sensitive species or their habitats.

Fish

The most significant potential direct impacts to listed fish species from the Proposed Action would be injury or death from deployment of equipment. Other direct and indirect effects could include stress caused by noise or vibration, habitat degradation, and general disturbance or harassment. The most significant potential indirect impact on listed fish species would be reduced reproductive potential due to habitat degradation.

All of the listed fish species in Alaska are anadromous[9] and with the exception of green sturgeon (*Acipenser medirostris*), all are salmonids. While in the marine environment, the primary risks to salmonids and green sturgeon associated with the Proposed Action would be collision with vessels engaged in deployment of equipment and general disturbance of benthic[10] habitat associated with installation of cables or other communications equipment. Green sturgeon would be more susceptible to these potential impacts than salmonids because they are comparatively slow moving, highly bottom oriented, and feed almost exclusively on immobile benthic organisms. They are much less likely to actively avoid vessels and equipment operating near the bottom than salmonids. Conversely, sub-adult and adult salmonids are active swimmers, which makes them comparatively unlikely to be injured by boats or marine construction equipment. Neither salmonids nor sturgeon have been shown to be particularly sensitive to marine noise; however, percussive sound (such as the sound of pile drivers or other potential impact-driven machinery) at close range could impair internal ear structures or lateral line function, or cause injury to internal organs of exposed individuals.

Anadromous salmonids are particularly sensitive to land disturbances in riparian zones (i.e., the area that borders rivers and streams) because their most sensitive life stages (spawning adults, eggs, larvae, and smolts[11]) occur in freshwater streams and rivers. However, none of the listed salmonid Distinct Population Segments spawn in Alaska; they only occur in Alaska as marine migrants. As such, potential impacts on sensitive life stages of these Distinct Population Segments from the Proposed Action would not occur.

Green sturgeon also spawn in freshwaters including Alaskan rivers, but are the most marine oriented of all the sturgeon in North America (*NMFS 2014*), and unlike many of the salmonids that are geographically restricted and have narrow physical habitat requirements for spawning and feeding, green sturgeon have a comparatively wide geographical range, can spawn over a variety of substrates, and are capable of extracting prey from fine sediments (*NMFS 2014*). Therefore, they would be less susceptible to sedimentation, turbidity,[12] and other temporary potential water quality impacts from disturbance of freshwater riparian zones. Targeted BMPs and mitigation measures to avoid disturbance of sensitive riparian habitats, especially in known spawning areas and/or spawning seasons, as defined through consultation with the appropriate resource agency, would reduce the potential for adverse impacts on green sturgeon.

Plants

The only threatened or endangered plant species in Alaska is the Aleutian shield fern (*Polystichum aleuticum*), which is federally listed as endangered. Potential impacts to this species from the Proposed Action could include direct injury or mortality of individuals or habitat loss; however, the species is restricted to steep cliffs and rock outcrops on Adak Island in

[9] Anadromous fish are born in freshwater, migrate to the ocean to grow as adults, and then return to freshwater to spawn.
[10] Anything associated with or occurring on the bottom of a body of water.
[11] A smolt is a young fish that is undergoing its first migration from freshwater to the ocean.
[12] Turbidity is a measure of the clarity of a liquid, in this case water. When many fine particles are suspended in water, the turbidity is high.

the central Aleutian Islands (*USFWS 2015a*) so potential impacts from the Proposed Action on this species would be highly unlikely and avoidable through informed siting of any Proposed Action features.

Numerous other plant species are listed by the Forest Service and/or BLM as sensitive. Any activities associated with the Proposed Action that would occur on Forest Service or BLM lands would be conducted under consultation with the Forest Service or BLM to minimize potential impacts to sensitive species or their habitats.

Potential Impacts of the Preferred Alternative

This section assesses potential impacts associated with implementation of the Preferred Alternative, including construction/deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities could result in potential impacts to listed species and critical habitats and others would not. These potential impacts would vary considerably by species and would be significantly influenced by deployment scenario, potential impact area, species presence, and site-specific conditions. The species that would be affected would depend on the potential impact area, the species' phenology,[13] and the nature and extent of the habitats affected. As explained in this section, various types of Proposed Action infrastructure could result in a range of *no effect* to *may affect, but not likely to adversely affect* depending on the deployment scenario or site-specific conditions.

<u>Activities Likely to Have No Effect</u>

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no effect* to listed species under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.

[13] Phenology is the seasonal change in plant and animal life cycles, such as insect emergence or bird migrations.

  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no effect* to listed species because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened and endangered species because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would not result in ground or human disturbance in listed species habitats, it is anticipated that this activity would have *no effect* on these resources.

The above activities are expected to have *no effect* to listed species because they involve collocation or shared use of existing facilities or do not require new ground disturbance or substantial construction activity. Should the above defined conditions not be met and activities require land disturbance, substantial construction activity, or implementation of physical security measures such as lighting, potential impacts to listed species would be similar to those described for new build activities below, although they would likely be lesser in magnitude due to the smaller scale of the activities required for collocation compared to new build scenarios.

Activities with the Potential to Affect

The infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and *may affect, but not likely to adversely affect* listed species include: 1) New Build Scenarios (Buried Fiber Optic Plant, Aerial Fiber Optic Plant, Submarine Fiber Optic Plant, or Installation of Optical Transmission or Centralized Transmission Equipment); 2) New Wireless Communication Towers, Collocation on Existing Aerial Fiber Optic Plant, or Collocation on Existing Wireless Tower, Structure, or Building; and 3) Deployable Technologies.

The actions related to these components that could cause potential impacts to listed species include: 1) land/vegetation clearing; 2) excavation and trenching; 3) construction of access roads; 4) installation or restructuring of towers, poles, or underwater cables; 5) installation of security/safety lighting and fencing; and 6) deployment of aerial platforms. Potential impacts to listed species associated with deployment of this infrastructure and related actions are further described below and in the previous taxa-specific descriptions (see Description of Environmental Concerns section above).

- Wired Projects
  - New Build–Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of points of presence (POPs) ,[14] huts, or other associated facilities or hand-holes to access fiber could result in direct injury/mortality to species that are not mobile enough to avoid construction activities (e.g., slow moving species and young), that utilize burrows or haulout sites (e.g., polar bear [*Ursus maritimus*], seals, and walrus), or that are defending nest sites (e.g., nesting mammals or birds). If new construction or deployment activities block stream or river channels or cause excessive sedimentation or turbidity, potential impacts on listed fish could occur. Disturbance and habitat degradation from noise and human activity associated with the above activities could result in displacement of individuals, changes in use of important migration pathways or breeding/rearing sites, indirect injury/mortality, and reproductive effects. In-water activities, although such activities would be minimal and limited to nearshore and inland waters, could cause vessel strike and/or auditory and potential disturbance impacts on listed fish and/or marine mammals.
  - New Build–Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to listed species. Potential impacts would vary depending on the number and location of individual poles or other facilities installed, but would primarily occur to terrestrial species as a result of habitat loss or degradation and/or disturbance from construction noise and human activity. Loss of fish habitat or stress on listed fish species could occur if new equipment were installed near or in streams, rivers, coastlines, or wetlands, though freshwater and marine activities related to the Proposed Action are very limited in nature, so risks to listed species are expected to be low.
  - Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
  - New Build–Submarine Fiber Optic Plant: The installation of cables in limited nearshore marine or inland freshwater environments and construction of landings and/or facilities on the shore to accept submarine cables could potentially impact listed species, particularly fish and marine mammals. Effects could include direct or indirect injury/mortality; habitat loss or alteration; and disturbance/displacement from underwater noise and vibration. If activities occurred during critical time periods, effects to migratory patterns or reproduction could occur. However, the marine activities related to

[14] POPs are connections or access points between two different networks, or different components of one network.

the Proposed Action are very limited in nature so risks to listed freshwater and marine species are expected to be low.

  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment occurs in existing boxes or huts, there would be *no effect* to listed species because there would be no ground disturbance and very limited human activity. However, if installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential impacts to terrestrial listed species. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory or habitat use patterns. Security lighting could diminish habitat quality for listed species, particularly birds.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower or structure which would not result in impacts to threatened and endangered species. However, if replacement towers or structural hardening are required, impacts would be similar to new wireless construction. Hazards related security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions and potential impacts, refer to Chapter 2.4, Radio Frequency Emissions.
- Deployable Technologies
  - Implementation of deployable technologies including Cell on Wheels, Cell on Light Truck, or System on Wheels could result in direct injury/mortalities to terrestrial listed species on roadways. Construction of staging areas could cause potential aquatic habitat impacts if they were constructed near or in lakes, streams, rivers, coastlines, or wetlands. Implementation of Deployable Airborne Communications Architecture is not anticipated to impact threatened and endangered species or their habitat.

<u>Potential Impacts to Listed Species</u>

FirstNet is committed to avoidance of impacts to listed species, their known habitats, and any designated critical habitats to the maximum extent practicable. The key time to implement avoidance actions is during siting and deployment, prior to and during Preferred Alternative activities. To facilitate this commitment to impact avoidance, pre-siting or pre-deployment desktop reviews and expert and/or agency consultation to gather information on the location and distribution of listed species and their habitats in the vicinity of Proposed Action activities would be conducted for all proposed activities to ensure that informed siting and/or timing of Preferred Alternative activities would enable avoidance of impacts to listed species and their habitats to the maximum extent practicable.

For activities that could potentially affect listed species, FirstNet would enter into informal or formal consultation, as appropriate, with USFWS and/or NMFS. These consultations would identify measures to be implemented to ensure potential impacts to listed species would not rise to the level of take or, should take be unavoidable, that it would be fully authorized through receipt of an Incidental Take Permit from USFWS or NMFS and fully mitigated. If activities occur within Forest Service or BLM lands, FirstNet would consult with the Forest Service or BLM to ensure that all Proposed Action activities are in conformance with applicable agency regulations. FirstNet is committed to perform all required monitoring or mitigation activities associated with any federally or territorially-listed species.

In summary, with effective implementation of BMPs and mitigation measures, as needed and defined through consultation with the appropriate resource agency, the Preferred Alternative *may affect, but not likely to adversely affect* listed species. *No effects* would occur to listed plants and terrestrial mammals because of their extremely limited distribution, which makes full avoidance of potential impacts on these species feasible. Minor potential impacts could occur to listed marine mammals, birds, and fish but these *may affect, but not likely to adversely affect* listed species or designated critical habitats with the implementation of BMPs and mitigation measures, as defined through consultation with the appropriate resource agency. Additional BMPs and mitigation measures, as defined in Chapter 11, may be implemented as appropriate to further minimize potential impacts. Site-specific analysis would likely be required to determine the potential impacts on listed species at specific proposed activity locations, once those locations are determined. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to these resources.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement conducted as part of ongoing system maintenance would result in potential impacts that are similar to the abovementioned deployment impacts. The species that would be affected and the nature and magnitude of potential impacts would depend on many factors, including but not limited to the impact location related to listed species use areas, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that potential impacts to listed species *may affect, but not likely to adversely affect* with BMPs and mitigation measures (as defined through consultation with the appropriate resource agency) to listed species associated with routine inspections of the Preferred

Alternative, assuming that the same access routes used for deployment are also used for inspections. This is because routine inspections would be short-term in nature, would not involve any new potential habitat impacts, and would not result in significant disturbance or displacement. Site maintenance activities, including mowing and application of herbicides *may affect, but not likely to adversely affect* listed species, as the activity would be infrequent and done in compliance with BMPS and mitigation measures (as defined through consultation with the appropriate resource agency).

During operations, direct injury/mortality of listed bird species could occur from collisions and/or entanglements with communication lines, towers, and aerial platforms. In addition, the presence of new access roads and communication line rights-of-way could increase human use of the surrounding areas, which could increase disturbance to or hunting or fishing of listed species or degradation of listed species habitats. If external generators were used, noise disturbance could potentially impact habitat use patterns or displacement of terrestrial listed species.

Deployable Aerial Communications Architecture, including deployment of drones, balloons, blimps, and piloted aircraft could potentially impact listed bird and bat species by direct or indirect injury/mortality and disturbance and/or displacement. Seals, walrus, and birds would be the most likely of the listed species to be affected by deployable aerial communications equipment because they are the species most likely to interact with such equipment based on their habitat and behavior. The magnitude of these effects depends on the timing, location, and frequency of deployments. Aerial equipment could fall, resulting in injury or death of a listed species individual and/or habitat disturbance. If aerial equipment were to fly at low levels over marine mammal haulout sites or seabird nest locations, mass flight response could occur resulting in trampling death of individuals and/or abandonment of haulout or nest sites.

Such potential impacts *may affect, but not likely to adversely affect* listed species provided that any necessary federal and/or state authorizations regarding listed species are obtained. Implementation, as practicable or feasible, of the operational BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would further reduce the potential for impacts on listed species.

Table 3.2.6.6-3 summarizes the impact significance determinations for each taxonomic group as a result of deployment and operation of the Preferred Alternative. Potential impacts to listed species were considered significant (i.e., adverse effect) if listed species or their habitats could be adversely affected over relatively large areas; a large proportion of a listed species' population within a region could be adversely affected; or if disturbances related to the Preferred Alternative could cause significant reductions in population size or distribution of a listed species. The duration of a potential impact also affected its significance level: temporary impacts (e.g., noise associated with construction) were considered less significant than permanent impacts (e.g., land conversion). The impact ratings assume full and successful implementation of BMPs and mitigation measures, as defined through consultation with the appropriate resource agency. Additional BMPs and mitigation measures, as defined in Chapter 11, may be implemented as appropriate to further minimize potential impacts.

Table 3.2.6.6-3: Determination of Impact Significance for Listed Species as a Result of the Preferred Alternative

Taxa	Impact Determination	Rationale for Determination
Marine mammals	*May affect, not likely to adversely affect*	The marine-based activities of the Preferred Alternative are not extensive and they are limited to nearshore and inland waters. They would be of short duration and spatial extent and would avoid key listed species habitats and activity periods.
Terrestrial mammals	*No effect*	The one listed terrestrial mammal species has extremely limited distribution so full avoidance of potential impacts on these species is feasible.
Birds	*May affect, not likely to adversely affect*	The five listed bird species have extremely limited distribution in aquatic and tundra habitats. The time period of greatest potential impact to listed birds is during the breeding season. Each of the listed species has very specific nesting requirements so avoidance of breeding habitat is feasible, which makes it unlikely for significant adverse impacts from the Preferred Alternative on listed bird species.
Reptiles	*No effect*	The marine-based activities of the Preferred Alternative are not extensive. Further, the occurrence of sea turtles in Alaska is exceedingly rare, making interaction between turtles and Preferred Alternative activities extremely unlikely.
Fish	*May affect, not likely to adversely affect*	The marine- and freshwater-based activities of the Preferred Alternative are not extensive. BMPs and mitigation measures to minimize underwater noise or vibration, habitat degradation, and disturbance or harassment of listed fish species, as defined through consultation with the appropriate resource agency, would ensure that the species are not significantly impacted at the population level.
Plants	*No effect*	The one listed plant species has extremely limited distribution on steep cliffside habitat so full avoidance of potential impacts on this species is feasible.

Alternatives Impact Assessment

The following section assesses potential impacts to listed species associated with the Deployable Technologies Alternative and the No Action Alternative.[15]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies

[15] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Alternative (including land based and aerial technologies) would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. These increases could increase the magnitude of potential impacts to listed species compared with the Preferred Alternative, as further described below.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could result in minor potential impacts from direct and indirect injury or mortality events, habitat loss, disturbance, or displacement. Greater frequency and duration of deployments could increase the magnitude of these potential impacts depending on the location of the deployments in relation to listed species use areas. However, even with the increased impact magnitude, potential impacts *may affect, but not likely to adversely affect* listed species or designated critical habitats if BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 11, may be implemented as appropriate to further minimize potential impacts.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, potential impacts associated with routine operations, management, and monitoring would vary among species, season, and geographic region but *may affect, but not likely to adversely affect* any listed species or designated critical habitat with implementation of BMPs and mitigation measures, as defined through consultation with the appropriate resource agency. Such consultation would facilitate avoidance of known listed species use areas and critical habitats to the maximum extent possible. If complete avoidance of listed species use areas would be impossible, consultation with USFWS, NMFS, and state natural resource agencies, as applicable, would identify appropriate impact minimization and mitigation actions that would reduce the potential impacts. As such, the Deployable Technologies Alternative *may affect, but is not likely to adversely affect* listed species.

The same BMPs and mitigation measures implemented for deployment and operation of the deployable technologies component of the Preferred Alternative would be applied to this alternative.

Table 3.2.6.6-4 summarizes the impact significance determinations for each taxonomic group under the Deployable Technologies Alternative. Deployment and operation of the Deployable Technologies Alternative *may affect, but not likely to adversely affect* any listed species with implementation of any BMPs and mitigation measures, as defined through consultation with the appropriate resource agency. Additional BMPs and mitigation measures, as defined in Chapter 11, may be implemented as appropriate to further minimize potential impacts. *No effects* would occur to listed plants and terrestrial mammals because of their extremely limited distribution, which makes full avoidance of potential impacts on these species feasible. Minor potential impacts could occur to listed birds but these would not be expected to adversely affect any listed bird species with implementation of any BMPs and mitigation measures, as defined through consultation with the appropriate resource agency. Additional BMPs and mitigation measures, as defined in Chapter 11, may be implemented as appropriate to further minimize potential impacts. *No effects* would occur to marine mammals, marine reptiles, or fish because of the lack of activities within the aquatic habitats of these species.

Table 3.2.6.6-4: Determination of Impact Significance for Listed Species and Critical Habitats as a Result of the Deployable Technologies Alternative

Taxa	Impact Determination	Rationale for Determination
Marine mammals	*No effect*	Deployment and operation of deployable technologies would not occur in marine waters or coastal habitats and thus would have no effect on listed marine mammal species.
Terrestrial mammals	*No effect*	The one listed terrestrial mammal species has extremely limited distribution so full avoidance of potential impacts on these species is feasible.
Birds	*May affect, not likely to adversely affect*	The five listed bird species have extremely limited distribution in aquatic and tundra habitats. The time period of greatest potential impact to listed birds is during the breeding season. Each of the listed species has very specific nesting requirements so avoidance of breeding habitat is feasible, which makes it unlikely for significant adverse impacts from the Deployable Technologies Alternative on listed bird species.
Reptiles	*No effect*	Deployment and operation of the Deployable Technologies Alternative would not occur in marine waters or coastal habitats and thus would have no effect on listed marine turtle species.
Fish	*No effect*	Deployment and operation of the Deployable Technologies Alternative would involve no or very minimal potential impacts on aquatic habitats. As such, this alternative would have no effect on listed fish species.
Plants	*No effect*	The one listed plant species has extremely limited distribution on steep cliffside habitat so full avoidance of potential impacts on this species is feasible.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no effects* to listed species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

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3.2.7. Land Use, Airspace, and Recreation

3.2.7.1. Introduction

This section describes potential impacts to land use, airspace, and recreation in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.7.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on land use, airspace, and recreation were evaluated using the significance criteria presented in Table 3.2.7-1. As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to land use, airspace, and recreation addressed in this section are presented as a range of possible impacts.

Table 3.2.7-1: Impact Significance Rating Criteria for Land Use, Airspace, and Recreation

Type of Effect	**Effect Characteristic**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Direct land use change (site of FirstNet facility installation or deployable base)	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Change in existing land use that is within permitted (by-right) uses	No change in land use
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one location.	No measurable effects
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire deployment phase or a portion of the operations phase.	No measurable effect
Indirect land use change (site of FirstNet facility installation or deployable base)	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Adverse effect that is *potentially* significant, but with BMPs and mitigation measures is *less than significant*	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses	No measurable effects
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one location.	No measurable effects
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire deployment phase or a portion of the operations phase.	No measurable effect

Type of Effect	**Effect Characteristic**	**Impact Level**			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Use of airspace (at and near site of FirstNet facility installation or deployable base)	Magnitude or Intensity	Complete change in flight patterns and/or use of airspace	Effect that is *potentially* significant, but with BMPs and mitigation measures is *less than significant*	Alteration to air space usage is minimal	No measurable effects
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one location.	No measurable effects
	Duration or Frequency	Permanent: Airspace altered indefinitely		Short-Term: Airspace altered for as long as the entire deployment phase or a portion of the operations phase.	No measurable effect
Loss of access to public or private recreation land	Magnitude or Intensity	Total loss of access to recreation land	Effect that is *potentially* significant, but with BMPs and mitigation measures is *less than significant*	Minor restricted access to recreation land	No measurable effects
	Geographic Extent	Most or all recreational land/sites in a state or territory		One (or a small number of) recreational site	No measurable effects
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire deployment phase or a portion of the operations phase	No measurable effect
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment, resulting in avoidance of activity at one or more sites	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Small reductions in visitation or duration of recreational activity	No measurable effects
	Geographic Extent	Most or all recreational land/sites in a state or territory		One (or a small number of) recreational site	No measurable effects
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire deployment phase or a portion of the operations phase	No measurable effect

3.2.7.3. Description of Environmental Concerns

Direct and Indirect Land Use Change

Deployment and operation of new aboveground facilities associated with the Proposed Action, such as new towers, antennas, or other structures, could result in direct changes to land use where such deployment occurs on land not already used for telecommunications, industrial, or public utility activity. In Alaska, where less than 1 percent of state land is developed, such direct changes are likely.

As discussed in Section 3.2.9, Socioeconomics, the presence of permanent aboveground facilities could lead to reduced property values due to diminishment of aesthetic characteristics and the potential for perceived health impacts. Purchases of land for FirstNet buildout (as also discussed in Section 3.2.9) could also affect localized real estate market values. Such potential real estate impacts could indirectly impact the intensity or type of land use in residential or commercial neighborhoods near new FirstNet aboveground facilities.

The location of new telecommunications equipment, particularly larger aboveground facilities such as antennas or towers with aerial fiber optic plant, would be affected by statutes of the Alaska Admin Code, the Alaska Department of Natural Resources, or city and borough zoning regulations, as discussed in Section 3.1.7.2, Specific Regulatory Considerations. FirstNet and/or their partners will consider existing zoning, likely giving preference to areas where appropriate zoning already exists to facilitate deployment. FirstNet and/or their partners may need to obtain zoning variances or other special permits to construct such facilities in some areas.

Use of Airspace

Deployment and operation of new aboveground facilities associated with the Proposed Action, particularly taller structures such as new towers and antennas, could add new obstructions to existing airspace. Use of Deployable Airborne Communications Architecture (DACA) could add the presence of new air traffic and/or aerial navigation hazards. These could be a concern in Alaska, where aviation plays an important role in day-to-day transportation (Alaska *DOT&PF 2013*), even given the sparse nature of development in Alaska. Given the requirements of Federal Aviation Administration (FAA) Part 77 regulations (see Section 3.1.7.2, Specific Regulatory Considerations), such taller structures are unlikely to be built near one of Alaska's more than 700 FAA-registered airports. Restricted airspace comprises more than 730,000 acres of land predominantly south of Fairbanks, limiting areas where such structures may be placed.

Access to and Enjoyment of Recreation Land

Deployment of the Proposed Action could temporarily block or hinder access to recreation lands in Alaska in cases where deployment activity occurs in the vicinity of the entrances to parks or other such lands. Access could also be affected in cases where construction vehicles must use or cross the access roads for recreation lands. Operation of the Proposed Action would not involve any routine or frequent closures of roads or trails; therefore, the Proposed Action is unlikely to prevent or hinder access to recreation lands.

As discussed above under Direct and Indirect Land Use Change and in Section 3.2.8, Visual Resources, the presence of new aboveground facilities or deployment activity could be perceived as a negative visual impact, particularly in Alaska where land is valued for its pristine, relatively undeveloped characteristic. Such negative perceptions are more likely to be experienced near areas in Alaska that are managed for recreational uses and/or visual resources and/or preservation of natural environmental conditions, (see Section 3.1.7.5, Recreation, and Figure 3.1.7-3). Placement of new aboveground facilities within sight of such lands could create a perceived diminution of those aesthetic and environmental values in the eyes of Alaska residents and visitors, thus reducing the enjoyment they derive from living near or visiting recreation lands and facilities.

3.2.7.4. Potential Impacts of the Preferred Alternative

The following section assesses potential land use, airspace, and recreation impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. As explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts, depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

The following types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative are likely to have *no impacts* to land use, airspace, or recreation in Alaska:

- Wired Projects
  - Use of Existing Conduit–New Buried Fiber Optic Plant: Installation of a new buried fiber optic plant within an existing conduit would have *no impact* on the use of airspace and would have no direct effects on land use or land ownership in Alaska. Visible evidence of deployment is unlikely to affect land use or ownership decisions. In general, such effects would be temporary, with blockages of recreation access lasting only as long as deployment. If the deployment activities take place on non-paved roads, the visual evidence of deployment would diminish as affected areas revegetate.
  - Collocation on Existing Aerial Fiber Optic Plant: This activity would involve no new towers or other structures, and thus would not directly affect land use, land ownership, or use of airspace in Alaska. While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible, and thus would not affect land uses or the enjoyment of recreation lands. While deployment (specifically, the stringing of new aerial fiber optic plant) could cause temporary blockage of recreation lands'

access roads or trails, such activity would likely be so spread out and of such a short duration as to be imperceptible to the vast majority of potential users.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: The use of existing fiber optic plant would involve no new aboveground facilities and no substantial new trenching. As a result, there would be no perceptible change in land use, land ownership, or use of airspace in Alaska from this option. While deployment activity (particularly if a small amount of new buried fiber optic plant must be installed) could be visible, and could theoretically cause temporary blockage of recreation lands' access roads or trails, such activity would likely be so spread out and of such a short duration as to be imperceptible. If deployment activities take place on non-paved surfaces, the visual evidence of deployment would be temporary and diminish as affected areas revegetate.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: This activity would involve no new towers or other structures, and thus would not directly affect land use, land ownership, or use of airspace in Alaska. While the addition of new satellite-enabled equipment to existing towers, structures, or buildings would likely be visible, the change associated with this option would be so small as to be essentially imperceptible, and thus would not affect land uses or the enjoyment of recreation lands. Deployment is unlikely to cause blockage of access routes for recreation lands due to the lack of substantial construction activity.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact land use, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use, airspace, and recreation include the following:

- Wired Projects
  - New Build-Buried Fiber Optic Plant: Installation of a new buried fiber optic plant (i.e., new underground conduit) would have *no impact* on the use of airspace in Alaska. Depending on the specific location, minor construction could be visible from existing residences, businesses, or recreation areas until revegetation was complete. Deployment could also temporarily block access to recreation areas. As discussed in Section 3.2.7.3, Description of Environmental Concerns, visible evidence of deployment could indirectly affect land use or ownership decisions because the visible presence of infrastructure may be unappealing to home owners and buyers; however, once the area over the buried conduit has revegetated, there would likely be little visual evidence remaining. Similarly, the visible presence of infrastructure may diminish the enjoyment of recreation facilities

and activities during deployment until revegetation has occurred—particularly in more rural recreation sites where the evidence of human activity is expected to be minimal. In general, such effects would be temporary, with blockages of recreation access lasting only as long as deployment; the visual evidence of deployment would diminish as affected areas revegetate. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could further reduce the potential impact of this scenario.

- New Build–Aerial Fiber Optic Plant: The installation of a new aerial fiber optic plant (i.e., new wires on existing or new poles) could involve the permanent placement of new poles. New-Build-Aerial Fiber Optic Plan would have *no impact* on airspace as utility poles are in average 40 feet in height and do not intrude into useable airspace. Depending on the existing ownership and land use, this scenario could constitute a potential permanent impact on land use and ownership (if an easement is required for new pole placement). In addition, new poles could potentially constitute a discernable change in visual conditions (see Section 3.2.8, Visual Resources), and thus could indirectly affect land use, land ownership, and/or enjoyment of recreation (as described under the New Build–Buried Fiber Optic Plant option). As discussed for other scenarios, deployment of this scenario could result in temporary blockages of access routes to recreational lands. As it is likely that deployment of new wires on either new or existing poles would take place in established rights of way, and it is unlikely this activity would be noticeable beyond the short time it would take to install the new poles or place the new wire on existing poles. BMPs and mitigation measures (see Chapter 11) could help to further avoid or minimize potential impacts.
- New Build–Submarine Fiber Optic Plant: Installation of a new submarine fiber optic plant in nearshore or inland waters would have *no impact* on the use of airspace. Depending on the existing ownership and use of affected land (including land required for and immediately adjacent to the submarine plant's onshore landing site), this scenario could constitute a small but potentially permanent impact on land use and ownership. While onshore landing sites would be visible (see Section 3.2.8, Visual Resources), it is unlikely that they would constitute a change in visual conditions sufficient to indirectly affect use or ownership of land not directly affected by this scenario. Depending on the specific location of these landing sites, the change in visual conditions caused by the presence of onshore landing sites could decrease the enjoyment of nearby recreational facilities—particularly if new submarine cables and onshore landing sites are installed near one of Alaska's many scenic beaches or shorelines. Offshore deployment of this scenario could limit access to nearshore recreation areas in the immediate vicinity of a new submarine fiber optic plant. Such effects would be more noticeable in near-shore areas or inland bodies of water designated or managed for recreational activity. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of new transmission equipment would have *no impact* on the use of airspace in Alaska. Depending on their specific location, access roads associated with deployment of this

scenario could temporarily affect land use or access to recreation, in cases where access roads cross private property. The presence of deployment activity near recreational lands could temporarily diminish the enjoyment of recreation activities; however, as the deployment would be short-term (lasting several hours to several weeks), it is unlikely to cause any permanent impact. BMPs and mitigation measures (see Chapter 11) could further help to avoid or minimize potential impacts. While new transmission equipment in this scenario could be visible from private property and recreation areas in Alaska, it is unlikely that their presence would noticeably affect land use or the enjoyment of recreational lands.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless communication towers would involve the permanent placement of new structures. Depending on the existing ownership and use of affected land (including land immediately adjacent to the towers), this scenario could constitute a potential permanent impact on land use and ownership. In addition, new structures could potentially constitute a discernable change in visual conditions (see Section 3.2.8, Visual Resources), and thus could indirectly affect land use, land ownership, and/or enjoyment of recreation. Depending on their specific height and proximity to one of Alaska's airports, new structures could constitute a new obstruction to be managed by aviators. As discussed for other scenarios, deployment could result in temporary blockages of access routes to recreational lands. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize potential impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: There would be *no impacts* to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses. Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation. Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structural hardening, and physical security measures could result in impacts if located near airports.
- Deployable Technologies (all options)
  - The deployment of land-based deployable technologies (e.g., mobilizing vehicles) would have no direct effect on land use or ownership, and would have no permanent effects on the use of airspace or access to or enjoyment of recreation lands and activities in Alaska. Implementation of DACA could result in temporary and intermittent potential impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near airports. Potential impacts to airspace (such as special use airspace and military training routes) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required

to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

Potential Direct and Indirect Land Use and Land Ownership Impacts

Potential direct land use and land ownership impacts for the New Build–Aerial Fiber Optic Plant and Construction of New Wireless Communication Towers option would be *less than significant*. These options would require permanent dedication of land to new towers or other aboveground structures; however, new aboveground facilities would likely be constructed in locations where such structures are consistent with local land use regulations. Additionally, once deployment locations are known, the location would be subject to an environmental review to help ensure environmental concerns are identified. New communication tower projects would also be required to comply with all relevant federal, state, and local regulations.

Potential indirect land use and land ownership impacts associated with these two scenarios, along with for the New Build–Buried Fiber Optic Plant, New Build–Submarine Fiber Optic Plant, Installation of Optical Transmission or Centralized Transmission Equipment, and Deployable Technologies options would generally be *less than significant*. These options would result in temporary disruption associated with deployment, as well as the potential indirect land use and land ownership impacts associated with changing visual conditions (see Section 3.2.7.3, Description of Environmental Concerns); however, these activities would generally be consistent with local land use regulations and would not result in widespread changes in land use or land ownership patterns.

See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential impacts associated with land use and land ownership.

Potential Airspace Impacts

The Construction of New Wireless Communication Towers could permanently affect the use of airspace by potentially creating new aerial navigation hazards, although restricted airspace would likely be avoided. New towers would be required to comply with all relevant federal, Commonwealth, and local regulations regarding siting, lighting, and engineering. The DACA option would add the presence of new manned and unmanned air traffic and/or aerial navigation hazards (in the case of tethered balloons) in Alaska; however, it is likely that only the piloted aircraft option would enter controlled airspace. Because DACA would primarily be used to address wide scale loss of coverage after a major catastrophic event, such disruptions could be long-term in nature (up to 2 years depending on the emergency).

These effects would be *less than significant,* although BMPs and mitigation measures (see Chapter 11) could further minimize their potential impacts.

To minimize these effects, FirstNet and/or their partners would likely give preference to development options that do not involve new towers or other tall aboveground structures. For cases where new towers or tall aboveground structures are the preferred option, FirstNet and/or their partners would require, as practicable or feasible, implementation of BMPs and mitigation measures (see Chapter 11).

Other build options would have no airspace impacts because they would not involve aboveground facilities that would intrude into airspace.

Potential Recreational Access and Enjoyment Impacts

None of the FirstNet scenarios would permanently affect access to recreational lands. Deployment of the New Build–Buried Fiber Optic Plant, New Build–Aerial Fiber Optic Plant, New Build–Submarine Fiber Optic Plant, Installation of Optical Transmission or Centralized Transmission Equipment, and New Wireless Communication Towers options could result in temporary blockages of access routes to recreational lands. These blockages would not continue beyond deployment activity. Due to the temporary nature of these deployment scenarios, potential impacts would be *less than significant*, although BMPs and mitigation measures (see Chapter 11) could further minimize their potential impacts.

Potential impacts during deployment of the New Build–Aerial Fiber Optic Plant and New Wireless Communication Towers options could permanently change visual conditions in the vicinity of Alaska's recreation lands. Because such changes could be perceived as adverse, and because adverse perceptions could affect the ability to enjoy recreational activities, deployment of these options could therefore have to some degree a permanent negative effect on the enjoyment of recreational lands. However, it is anticipated that only minimal or small reductions in visitation or duration of recreational activities would result (as opposed to total loss of enjoyment), if any at all. In addition, the geographic extent of this potential impact would likely be limited to a small number of recreational sites. For these reasons, potential impacts during deployment would be *less than significant.*

All the development scenarios listed in this subsection, as well as Deployable Technologies, could cause temporary changes to the visual environment, due to the presence of vehicles, deployment activities, and construction "scars" where subsurface infrastructure is deployed. Such potential impacts would occur during deployment and until vegetation is able to reclaim affected areas. Accordingly, due to the temporary nature of the deployment activities, these effects would be *less than significant* and further reduced by implementation of BMPs and mitigation measures.

See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with recreation.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. There would be *no impacts* to land use, land ownership, use of airspace, access to recreation, or enjoyment of recreation lands associated with routine inspections of the Wired or Wireless options within the Preferred Alternative. However, as discussed above, there would be *less than significant* impacts for wireless projects that deployed new towers or aboveground structures. These impacts could be further minimized by implementation of the BMPs and mitigation measures detailed in Chapter 11.

Operation of the Deployable Technologies options of the Preferred Alternative could result in the temporary presence of deployable vehicles and equipment (including airborne equipment), potentially for up to 2 years in some cases. The degree of change in the visual environment (see Section 3.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. Nighttime lighting in isolated rural areas or if sited near a national park would be *less than significant with BMPs and mitigation measures incorporated* during operations. Additionally, FirstNet would work closely with the National Park Service to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a National Park Service unit. The use of DACA could temporarily add new air traffic or aerial navigation hazards, as discussed above. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. However, as operation of all of the Deployable Technology options are to address emergency situations on a temporary basis, the potential impacts are *less than significant.* BMPs and mitigation measures (see Chapter 11) could further help to avoid or minimize potential impacts.

3.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, airspace, and recreation associated with the Deployable Technologies Alternative and the No Action Alternative.[1]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, airspace, and recreation as a result of implementation of this alternative could be as described below.

[1] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* impacts to land use if deployment occurs in areas with compatible land uses. While a single deployable technology may have an imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected. Also, implementation of deployable technologies could result in *less than significant* impacts to airspace if deployment does trigger any obstruction criterion or result in changes to flight patterns and airspace restrictions.

Potential Operation Impacts

Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in Alaska—all of which would potentially affect a larger number of properties and/or areas of airspace. It is anticipated that there would be *no impacts* to land use, recreational resources, or airspace associated with routine inspections assuming the same access roads used for deployment are also used for inspections. Overall these potential impacts would be *less than significant* due to the minimal footprint associated with the land-based deployable (generally the size of a utility truck). Aerial deployables (piloted aircraft, balloons, and drones) would likely use existing airports and facilities for launching and recovery. To further minimize these effects, FirstNet and/or their partners would require, as practicable or feasible, implementation of BMPs and mitigation measures similar to those described for the Preferred Alternative (see Chapter 11).

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to land use, airspace, and recreation as a result of deployment and operation of the Proposed Action. Land use, airspace, and recreation conditions would therefore be the same as those described in Section 3.1.7, Land Use, Airspace, and Recreation.

3.2.8. Visual Resources

3.2.8.1. Introduction

This section describes potential impacts to visual resources in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize potential negative impacts, and/or that would preserve or enhance potential positive impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.8.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 3.2.8-1. As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each potential impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to visual resources addressed in this section are presented as a range of possible impacts.

Table 3.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Intermittently noticeable negative change in aesthetic character	No visible effects
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or several locations, but not widespread.	NA
	Duration or Frequency	Persisting more than 1 year		Persisting 1 month or less	NA
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions.	Adverse effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Lighting alters night-sky conditions to a degree that is noticeable.	Lighting does not noticeably alter night-sky conditions.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or several locations, but not widespread.	NA
	Duration or Frequency	Persisting more than 1 year		Persisting 1 month or less	NA

NA = not applicable

3.2.8.3. Description of Environmental Concerns

Opinions of and reactions to changes in visual resources are inherently subjective, and are based on each observer's personal feelings about what they are seeing. This Draft Programmatic Environmental Impact Statement focuses on cases where changes in the aesthetic environment would occur in or affect lands in Alaska where visual or scenic resources are the subject of adopted regulations or places where observers are likely to expect higher scenic quality. These lands are discussed in Section 3.1.8, Visual Resources.

Aesthetic Character

Construction and operation of new aboveground facilities, such as new towers, antennae, or other structures, could add new permanent elements to the visual landscape (what observers can readily see from a given vantage point), while construction of options other than aboveground facilities could create temporary changes to the landscape—such as construction scars or the presence of construction equipment.

Applicable federal and state policies and regulations would affect the type and location of new Proposed Action facilities on lands where visual resources are managed through specific policies (such as National Forests and units of the National Park System) or laws (such as zoning ordinances). Observers are more likely to perceive Proposed Action facilities adversely in or near areas managed for public recreational or cultural activities, such as local, state or national parks; state or national forest areas; waterways that are used for subsistence fishing or for recreational purposes including sports fishing or wildlife viewing; Native Alaskan villages or communities of historic character; and coastlines. While such preferences are not necessarily codified in law or regulation, observers (especially in a state like Alaska with a reputation for scenic quality and pristine, undeveloped terrestrial and marine spaces) tend to prefer or demand higher levels of scenic quality and an absence of human-built structures in such areas.

Proposed Action facilities (especially new towers) that extend above the horizon are also likely to be perceived more negatively than options that remain at or near ground level. In addition, as discussed in Section 3.1.8.2, Specific Regulatory Considerations, the Federal Aviation Administration (FAA) may require certain aboveground structures to be painted white and orange, and in some cases to include daytime lighting (*FAA 2015*). Even for structures that do not extend above the horizon, this paint scheme is likely to contrast with the predominant background, and could thus be perceived as a negative effect.

Areas in Alaska where aesthetic character is highly valued and to which changes may be most noted include national parks and forests and state lands that are managed for recreation (see Section 3.1.7, Land Use, Airspace, and Recreation), as well as lands and features specifically managed for visual resources (as described in Section 3.1.8, Visual Resources): national and state scenic byways and national scenic rivers.

Finally, as discussed in Section 3.2.9.3, Description of Environmental Concerns, potential real estate purchasers (individuals who wish to purchase a home or property, investors, developers, etc.) and renters could see the presence of aboveground facilities as a negative aesthetic element—a perception that could affect property values. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing (looking at the impact of external factors effecting price), or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (*Bond et al. 2013*). Essentially, analysts compare the value of multiple properties while statistically controlling differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (*Bond et al. 2013*). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately 2 percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Nighttime Lighting

As discussed in Section 3.1.8.2, Specific Regulatory Considerations, the FAA requires lighting for a wide variety of aboveground structures, including communication towers over 199 feet above ground level (*FAA 2015*). Additionally, structures and facilities associated with the Proposed Action could include ground-level security and safety lighting, although such lighting is not specifically required by the FAA regulations. Although likely minimal, such lighting would not only constitute a new light source, but could also increase the overall diffusion of artificial light into the sky (commonly referred to as sky glow).

Aside from federal and state lands where visual resources are managed according to established policies or laws, new nighttime light sources are most likely to be perceived negatively in less developed areas of Alaska (areas away from major cities such as Anchorage). In such cases, the new light source may not be able to blend with existing light sources, and would thus potentially be perceived as more distinct. Increased artificial nighttime lighting could affect tourists traveling to Alaska for the purpose of observing displays of *aurora borealis* (see Section 3.1.8.3, Existing Visual Resources), as well as residents accustomed to appreciating this natural phenomena under existing nighttime conditions.

Nighttime sky glow depends on topography and weather conditions, as well as the number, type, and location of artificial lights. In general, sky glow is associated with larger concentrations of artificial lights (such as a city or neighborhood), rather than a single light source.

3.2.8.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. Potential visual impacts of each of the Preferred Alternative options are discussed as a statewide system—i.e., the potential collective visual impact of a series of new fiber optic towers, or the potential collective visual impact of a statewide system of new wireless receivers installed on existing structures, etc. While this approach could overestimate potential impacts, this is preferable to underestimating potential impacts, as could be the case if the options were evaluated on a structure-by-structure basis.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. As explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant with BMPs and mitigation measures incorporated*, depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

The following types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative are likely to have *no impacts* to visual resources:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of a new buried fiber optic plant within an existing conduit would create visible evidence of construction limited to minor “scars” in the earth at the entry and exit points of the existing conduit, and the presence of construction equipment. These impacts would be minor, temporary, and last only until the area was revegetated. This option would involve no new nighttime lighting.
  - Collocation on Existing Aerial Fiber Optic Plant: While the addition of new aerial fiber optic plant to an existing aerial fiber optic transmission system would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting, and pole replacement would be limited.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would not have any impacts to visual resources because there would be no ground disturbance. This option would involve no new nighttime lighting.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: While new satellite-compatible infrastructure on existing towers, structures, or buildings (where antennae are already placed) would likely be visible, the change associated with this option is so small as to be essentially imperceptible. This option would involve no new nighttime lighting.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact visual resources, it is anticipated that this activity would have *no impact* on those resources.

Activities with the Potential to Have Impacts

Given the scope of the Proposed Action, while geographically enormous (in all 50 states, 5 territories, and the District of Columbia), the actual deployment in any one location is unlikely to be extensive and would likely involve a variety of deployment options (including an emphasis on collocations on existing facilities). The specific deployment activity, and where the deployment would take place, would be determined based on location-specific conditions and the results of site-specific environmental reviews.

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would generally consist of the presence of new aboveground structures (where appropriate), as well as visual evidence of construction and the presence of construction equipment. Potential impacts associated with the Preferred Alternative, based on the deployment activity and the limited duration of construction activities, are described further below. The remainder of this section provides summary impact discussions for each development scenario or deployment activity.

The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects:
  - New Build – Buried Fiber Optic Plant: Installation of a new buried fiber optic plant (i.e., new underground conduit) would create visible evidence of construction, including a "scar" in the earth where the new fiber optic plant was installed, and the presence of construction equipment used for this installation. These "scars" would likely be temporary and last only until the area was revegetated. BMPs and mitigation measures could help to avoid or minimize the potential impacts. This option would involve no new nighttime lighting.
  - New Build – Aerial Fiber Optic Plant: The installation of a new aerial fiber optic plant (i.e., new wires on existing and/or new poles) could have a discernable change on aesthetic conditions. This option could add new elements (poles) to the visual environment, and would result in the temporary visible evidence of construction activity and equipment. As it is likely that any new pole placement would take place in established rights-of-way, any potential visual impacts associated with this activity would be temporary and generally unnoticed. BMPs and mitigation measures could further help to avoid or minimize potential impacts.
  - New Build – Submarine Fiber Optic Plant: Installation of a new submarine fiber optic plant in nearshore or inland waters would affect visual resources in the vicinity of the onshore landings and any equipment boxes or huts associated with such a cable. Such facilities would represent a change in the visual condition of the shoreline, would create a temporary construction "scar" for the onshore portion of the fiber optic plant, and would involve the presence of construction equipment used for installation. The construction-related aspects of this activity would be temporary while any equipment boxes or huts

would be permanent, although generally small in size. BMPs and mitigation measures could help to further avoid or minimize the potential impacts. This option would involve no new nighttime lighting.

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of new transmission equipment could add a new element to the visual environment, in the form of a small box or hut. The construction aspects of this activity would be temporary and localized while the new boxes or huts would be permanent, although generally small in size. BMPs and mitigation measures could help to further avoid or minimize the potential impacts. This option would likely involve no new nighttime lighting.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless communication towers would have a discernable change on aesthetic conditions. This option would add new elements (towers) to the visual environment and would result in visible evidence of construction activity and equipment. Depending on specific design, the FAA could require high-visibility paint schemes and/or lighting on the new towers required for this option. BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: While new wireless elements added to existing towers, structures, or buildings (where antennae are already placed) would likely be visible, the change associated with this option is so small as to be essentially imperceptible. However, if the on-site delivery of additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- Deployable Technologies (all options)
  - Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, or results in vegetation removal, areas of surface disturbance, or additional nighttime lighting.

Potential Aesthetic Character Impacts

Potential visual impacts for the Construction of New Wireless Communication Towers and other build options are expected to be *less than significant*. FirstNet and/or their partners would require, as practicable or feasible, implementation of the BMPs and mitigation measures listed in Chapter 11 to further minimize potential visual impacts. BMPs and mitigation measures are particularly important if these project types are implemented in more than a few locations—and/or in locations that affect lands where visual resources are regulated—because these options would permanently change views for a variety of observers. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with visual resources.

Potential Nighttime Lighting Impacts

Depending on specific design, Construction of New Wireless Communication Towers or Installation of Optical Transmission or Centralized Transmission Equipment options could introduce new artificial lighting, due to FAA regulations or other security concerns. New lighting associated with FirstNet structures could contribute incrementally to sky glow. As a result of the temporary nature of deployment, these effects would be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with visual resources.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. Wired or wireless options within the Preferred Alternative would have *no impacts* to visual resources beyond those discussed under Potential Deployment Impacts, above. Nighttime lighting in isolated rural areas or if sited near a national park would be *less than significant with BMPs and mitigation measures incorporated* during operations. Additionally, FirstNet would work closely with the National Park Service to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a National Park Service unit.

Operation of the Deployable Technologies option of the Preferred Alternative would create no permanent changes to the aesthetic environment. Use of these technologies would result in the temporary presence of deployable vehicles and equipment, which would represent a change in existing conditions. The degree of change in the visual environment would be highly dependent on the specific vehicle parking location. Although the FAA would not likely require nighttime lighting for ground-based deployable technologies, some ground-based deployable technologies could include their own safety lighting, which would be visible in the vicinity of the deployable unit. The FAA would likely require nighttime lighting for airborne deployable technologies, such as balloons, blimps, drones, and piloted aircraft.

3.2.8.5. Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomic resources associated with the Deployable Technologies Alternative and the No Action Alternative.[1]

[1] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to visual resources as a result of implementation of this alternative could be as described below. To minimize these effects, FirstNet and/or their partners would implement, as practicable or feasible, the BMPs and mitigation measures for the Proposed Action described in Chapter 11.

Potential Deployment Impacts

Deployment (i.e., purchase, staffing, and mobilization) of deployable technologies would generally result in *less than significant* impacts to visual resources—including aesthetic conditions and nighttime lighting due to the temporary nature of deployment.

Potential Operation Impacts

The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be *less than significant.* These potential impacts would be similar to the potential impacts described for the Deployable Technologies option of the Preferred Alternative, above, only likely with greater numbers of deployable units.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to visual resources due to deployment and operation of the Proposed Action. Visual conditions would therefore be the same as those described in Section 3.1.8, Visual Resources.

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3.2.9. Socioeconomics

3.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize potential negative impacts, and/or would preserve or enhance potential positive impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.9.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on socioeconomic resources were evaluated using the significance criteria presented in Table 3.2.9-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to socioeconomic resources addressed in this section are presented as a range of possible impacts.

Table 3.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristic	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Impacts to real estate	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift	Effect that is *potentially significant*, but with mitigation is *less than significant*	Indiscernible impact to property values and/or rental fees	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one location	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Economic benefits or adverse impacts related to changes in tax revenues, wages, or direct spending (could be positive or negative)	Magnitude or Intensity	Economic change that constitutes a market shift	Adverse effect that is *potentially significant*, but with mitigation is *less than significant*	Discernible but not substantial economic change	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized in one city or town	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA
Employment	Magnitude or Intensity	High level of job loss or creation	Effect that is *potentially significant*, but with mitigation is *less than significant*	Low level of job creation	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized in one city or town	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	No perceptible change in baseline conditions

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased pressure on existing public services	Magnitude or Intensity	Access to or quality of public services severely constrained, potentially threatening public safety	Effect that is *potentially significant*, but with mitigation is *less than significant*	Access to or quality of public services constrained to a minimally perceptible degree	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one location	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	No perceptible change in baseline conditions
Diminished social cohesion/disruption related to influx	Magnitude or Intensity	Impacted individuals and communities cannot adapt to social disruption/ diminished social cohesion, or are not able to adapt fully, even with additional support	Effect that is *potentially significant*, but with mitigation is *less than significant*	Impacted individuals and communities are able to adapt to social disruption and/or diminished social cohesion without support	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one location	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	No perceptible change in baseline conditions

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Reduced opportunities for subsistence practices	Magnitude or Intensity	Impacted individuals and communities cannot adapt to reduced subsistence opportunities, or are not able to adapt fully, even with additional support	Effect that is *potentially significant*, but with mitigation is *less than significant*	Impacted individuals and communities are able to adapt to reduced subsistence opportunities without support	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one location	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	No perceptible change in baseline conditions

NA = not applicable

3.2.9.3. Description of Environmental Concerns

Real Estate

Construction and operation of new aboveground facilities, such as new towers, antennae, or other structures, could affect real estate values. Potential real estate purchasers (individuals who wish to purchase a home or property, investors, developers, etc.) and renters could see the presence of aboveground facilities as a negative aesthetic element, especially in a highly scenic state such as Alaska (potential impacts are discussed in Section 3.2.8, Visual Resources). Purchasers and renters may also believe (regardless of factual information) that the presence of wireless facilities is a negative health impact (potential health impacts are discussed in Section 3.2.15, Human Health and Safety). Such negative perceptions of the Proposed Action could cause purchasers and renters offer lower payments for affected properties than might otherwise be expected.

Should new land be required for FirstNet buildout (as opposed to installing additional equipment at existing telecommunications sites), such purchases could affect overall real estate markets by reducing the supply of available land. The low population density and sheer geographic size in Alaska (see Section 3.1.9, Socioeconomics), indicates that such effects could be less pronounced than in more land-constrained parts of the nation.

The new presence of telecommunications coverage serving first responders could result in increased property value due to that increased connectivity given the relative sparseness of the state's public service infrastructure, including telecommunications. That finding notwithstanding, the overall effects would be limited to areas near FirstNet new-build projects.

Economic Effects (Positive and Negative)

FirstNet deployment and operation could affect the state's economy through changes in tax revenue, wages, and spending associated with FirstNet. Such effects could be direct, indirect, or induced. Direct effects could include (but are not limited to) taxes generated by FirstNet facilities, wages paid directly to FirstNet employees (deployment or operations), and FirstNet spending on raw materials. Indirect effects could include, for example, wages paid and materials purchased by FirstNet contractors and subcontractors. Induced effects are those that are not directly related to FirstNet, but that would not occur "but for" FirstNet, such as increased spending at restaurants near construction sites.

New projects such as FirstNet are typically associated with potential positive economic impacts. Potential negative impacts could occur if the presence of the Proposed Action were to prevent or diminish other existing or likely future economic activity, resulting in reduced taxes, wages, or spending. The same potential visual impacts that could affect real estate (see above) in Alaska, could also negatively affect tourist activity in Alaska, which is based at least in part on the state's visual characteristics.

Employment

FirstNet deployment and operations could create direct, indirect, and induced employment, through new jobs associated with FirstNet (direct), its contractors and subcontractors (indirect), and other businesses that serve FirstNet employees, contractors, or subcontractors (induced). As is the case for economic effects (discussed above), such potential impacts are typically positive, but could potentially be negative if FirstNet deployment or operation results in negative economic impacts.

The use of Alaska-resident employees for projects in Alaska is an important consideration. Residents are more likely to spend their wages in the state, driving economic activity (discussed above) while reducing potential negative impacts on social cohesion (see below).

Increased Pressure on Public Services

The use of public services, such as first responders (police, fire, etc.), public utilities, and public schools, is typically tied to Proposed Action-related changes in residential population and employment. Increased population and/or employment typically results in increased demand for services. Increased demand for services could be offset by increased tax revenue (see Economic Effects subsection, above, as well as Section 3.2.1, Infrastructure).

Diminished Social Cohesion and/or Disruption due to Influx

Construction projects such as FirstNet could result in the influx of construction and operations workers into the Proposed Action area. Social tension between existing residents and newly arrived workers could result from a variety of sources, such as dissatisfaction among existing residents who did not receive Proposed Action-related jobs, cultural differences between existing residents and new workers, and inappropriate or illegal behavior by incoming workers (e.g., alcohol and drug abuse, or solicitation of prostitution), many of whom are men without families, or whose families have not relocated with them. Alaska's distance from the mainland United States reduces, but does not eliminate, the possibility of such influx.

Reduced Opportunities for Subsistence Practices

FirstNet's physical footprint and deployment activities could reduce the land available for subsistence activities, and/or could diminish the availability of subsistence species, either through diminishment of habitat or through the interruption of migratory pathways. The cultural aspects of subsistence practices in Alaska are discussed in Section 3.1.11, Cultural Resources.

3.2.9.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. As explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts, depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following is likely to have *no impacts* to socioeconomics:

- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact socioeconomic resources, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to socioeconomic resources as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of new employment and/or economic activity, as well as potential effects on real estate, public services, subsistence, and social cohesion. The remainder of this section provides summary potential impact discussions for each development scenario or deployment activity.

The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to socioeconomics include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Installation of a new buried fiber optic plant (i.e., new underground conduit) would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety). There could be potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but would be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts.
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of a new buried fiber optic plant within an existing conduit would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety). There could be potentially discernable benefits to the economy (increased property, income, and sales tax

revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but would be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize potential impacts. The effects described above would be similar to but less than the New Build – Buried Fiber Optic Plant option, because the Use of Existing Conduit – New Buried Fiber Optic Plant option would involve less ground disturbance, and therefore less labor and use of equipment.

- New Build – Aerial Fiber Optic Plant: The installation of a new aerial fiber optic plant (i.e., new wires on elevated structures) could potentially have a discernable change for factors that affect perceived property values (aesthetics, health, and safety). To the degree that such changes reduce property values, these effects could also reduce tax revenues, a negative economic effect. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts. There could be potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but would be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts.
- Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant with existing fiber optic plant would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety) or subsistence resources. There could be potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: The use of existing fiber optic plant would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety) or subsistence resources. There could be some potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts. The effects described above would be similar to but less than those described for the Collocation on Existing Aerial Fiber Optic Plant option, and substantially less than the new build options.
- New Build – Submarine Fiber Optic Plant: Installation of a new submarine fiber optic plant in limited near-shore or inland waters would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety). There could be potentially discernable benefits to the economy (increased property, income, and sales tax

revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of new transmission equipment could potentially have a discernable change in factors that affect perceived property values—particularly aesthetics due to new access roads. To the degree that such changes reduce property values, these effects could also reduce tax revenues, a negative economic effect. There could be potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts. The effects described above would be similar to but less than those described for the New Build – Buried Fiber Optic Plant, because the Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable option would involve less ground disturbance, and therefore less labor and use of equipment.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless communication towers could potentially have a discernable change for factors that affect perceived property values (aesthetics, health, and safety). To the degree that such changes reduce property values, these effects could also reduce tax revenues, a negative economic effect. There could be potentially discernable benefits to the economy (income and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. In addition, and depending on location, installation of new wireless communication towers could affect terrestrial subsistence resources given FirstNet's physical footprint and deployment activities, either through diminishment of habitat or through the interruption of migratory pathways. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize these potential impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: The collocation of new wireless facilities on existing facilities would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety) or subsistence resources. There could be some potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts. The effects described above would be similar to but less than those described for the Collocation on Existing Aerial Fiber Optic Plant option, and substantially less than the new build options.

- Deployable Technologies (all options)
  - The use of deployable technologies, including some limited construction associated with implementation, such as land clearing or paving for parking or staging areas, would create no permanent changes to factors that affect perceived property values (aesthetics, health, and safety). There could be potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts.
- Satellites and Other Technologies
  - Satellite-Enables Devices and Equipment: The installation of new satellite-compatible infrastructure would create no permanent change in factors affecting perceived property values (aesthetics, health, and safety) or subsistence resources. There could be potentially discernable benefits to the economy (increased property, income, and sales tax revenues) and employment. The influx of new workers could affect the social cohesion of a given area, but could be dependent on whether the workers are Alaska residents or not. The effects described above would be similar to but less than those described for the Collocation on Existing Aerial Fiber Optic Plant option, and substantially less than the new build options. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to further minimize potential impacts. The use of satellite-compatible devices (e.g., mobile phones) absent the installation of new equipment would have *no impacts*.

Potential Real Estate Impacts

Potential real estate impacts for the New Build – Aerial Fiber Optic Plant and Construction of New Wireless Communication Towers option and the Installation of Optical Transmission or Centralized Transmission Equipment option would be *less than significant*. These options could permanently change views from private property and/or introduce new wireless infrastructure that property buyers or renters could perceive as having impacts; however, these potential impacts would be temporary and only as long as the construction period lasted. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing (looking at the impact of external factors effecting price), or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (*Bond et al. 2013)*. Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as, proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (*Bond et al. 2013*). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential real estate impacts.

Potential Economic Impacts

To the degree that the New Build – Aerial Fiber Optic Plant and Construction of New Wireless Communication Towers or Installation of Optical Transmission or Centralized Transmission Equipment options reduce property values and, although anticipated to be minor, these options could also reduce tax revenues. Other options would not reduce property values, and would therefore not affect tax revenues. Additionally, construction activity associated with FirstNet deployment would create additional wages, spending, and/or tax revenues. To further minimize these effects, FirstNet and/or their partners would require, as practicable or feasible, implementation of the BMPs and mitigation measures described in Chapter 11, BMPs and Mitigation Measures.

Overall, the potential economic impacts from Preferred Alternative development options would be positive and *less than significant*. BMPs and mitigation measures described in Chapter 11 could maintain or enhance these positive economic impacts.

Potential Employment Impacts

The potential employment impacts from Preferred Alternative development options would be positive and *less than significant*. Construction activity associated with FirstNet deployment could create additional jobs (through new jobs directly associated with FirstNet, its contractors and subcontractors, and other business that serve FirstNet employees, contractors, or subcontractors). See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to enhance these benefits.

Potential Public Services Impacts

Potential impacts on demand for public services would be *less than significant*. As mentioned above, the use of public services is typically tied to changes in residential population and employment. Increases in population and/or employment typically results in increased demand for services, however, this demand is anticipated to be minimal. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further minimize potential public services impacts.

Potential Social Cohesion Impacts

Potential social cohesion impacts, due to the potential influx of workers into the project areas, are anticipated to be *less than significant* for Preferred Alternative development options primarily due to the limited amount of construction activities in any one area. To further minimize potential social cohesion impacts, FirstNet and/or their partners would, as practicable or feasible, likely give preference to hiring workers who are residents of Alaska, and ideally of the locality where construction activities would take place (see Chapter 11, BMP and Mitigation Measures).

Potential Subsistence Impacts

As described in Section 3.1.9, Socioeconomics, subsistence harvesting is an important part of Alaskan identity. FirstNet's physical footprint and deployment activities could reduce the land available for subsistence activities, and/or could diminish the availability of subsistence species, either through diminishment of habitat or through the interruption of migratory pathways. The New Wireless Communication Towers project type would likely disturb the greatest amount of land or ecosystems, and would therefore have the greatest potential impact to subsistence activities in Alaska. There could be a potential to cause minor damage, remove access to, or cause the relocation of plant and animal species important for subsistence activities. However, given the limited amount of construction anticipated in any one area, it is anticipated that this potential impact would be minimal. Therefore, potential subsistence impacts are anticipated to be *less than significant* for the Preferred Alternative.

These minimal potential impacts could be further reduced by implementing the BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential impacts to subsistence harvesting (see Chapter 11, BMPs and Mitigation Measures).

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. There would be *less than significant* impacts to real estate, public services, social cohesion, and subsistence resources, and minimal, positive, *less than significant* impacts to economic activity and employment associated with routine inspections of the Preferred Alternative.

3.2.9.5. Alternatives Impact Assessment

The following section assesses potential impacts to socioeconomic resources associated with the Deployable Technologies Alternative and the No Action alternative.[1]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to socioeconomic resources as a result of implementation of this alternative could be as described below.

Potential Deployment Impacts

Deployment (i.e., purchase and staffing) of deployable technologies would result in *no impacts* to real estate, public services, social cohesion, and subsistence, as well as *less than significant* positive impacts on economic activity and employment due to the employees who operate deployable equipment, the wages paid to them, and the expenditures on equipment, fuel, and other items.

Potential Operation Impacts

Operation of deployable technologies would result in *no impacts* to public services or social cohesion, and *less than significant* impacts to real estate and subsistence resources if deployment locations are in areas where subsistence resources are present, and if the same deployment locations are used repeatedly and frequently. Implementation of deployable technologies could have *less than significant* positive impacts on economic activity and employment due to the employees who operate deployable equipment, the wages paid to them, and the expenditures on equipment, fuel, and other items.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to socioeconomic resources as a result of construction and operation of the Proposed Action. Socioeconomic conditions would therefore be the same as those described in Section 3.1.9, Socioeconomics.

[1] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

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3.2.10. Environmental Justice

3.2.10.1. Introduction

This section describes the potential impacts to environmental justice in Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would help avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.10.2. Impact Assessment Methodology and Significance Criteria

Construction and operation of the Proposed Action in Alaska could generate a potential environmental justice impact if high and adverse health and/or environmental impacts resulting from any phase of the Proposed Action's deployment or operation were to disproportionately affect a minority or low-income group (see below). If the impacts on the general population are not significant (in other words, are not high and adverse), there can be no disproportionate impacts on minority and low-income populations. For impacts determined to be significant, disproportionality would be determined based on the minority and low-income status of the population in the affected area. The significance of potential impacts of the Proposed Action on environmental justice was evaluated using the significance criteria presented in Table 3.2.10-1. As described in Section 3.2, Environmental Consequences, the categories of potential impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various areas, the potential impacts to environmental justice addressed in this section are presented as a range of possible impacts.

Table 3.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Effects associated with other resource areas (e.g., cultural resources) that have environmental justice implications due to the affected parties (as defined by EO 12898)	Magnitude or Intensity	Direct and disproportionate effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated	Effect that is *potentially significant*, but with mitigation is *less than significant*	Direct effects on environmental justice communities (as defined by EO 12898) that do not require mitigation	No perceptible change in baseline conditions
	Geographic Extent	Regional impacts observed throughout the state or territory		Effects realized at one location	NA
	Duration or Frequency	Persists during or beyond the life of the Proposed Action		Persists for as long as the entire construction phase or a portion of the operations phase	NA

EO = Executive Order; NA = not applicable

3.2.10.3. Description of Environmental Concerns

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the location of the facility/infrastructure and the specific deployment requirements, some activities could result in potential impacts to environmental justice communities and others would not. As explained in this section, various types of Proposed Action infrastructure could result in impacts ranging from *no impact* to *less than significant*, depending on the deployment scenario or site-specific conditions.[1] Section 3.1.10.4, Identification of Potential for Environmental Justice Impacts, shows areas in Alaska with high, moderate, and low potential for environmental justice impacts.

3.2.10.4. Potential Impacts of Preferred Alternative

The following section assesses potential environmental justice impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

The determination of potential environmental justice impacts is dependent on both the specific location of deployment and operation as well as the magnitude of impacts to other resources and the types of resources affected. Environmental justice impacts are more likely to occur as a result of significant impacts to soils, water resources, land use, visual resources, socioeconomics, cultural resources, air quality, noise, and human health and safety, to the extent those impacts occur.

Activities Likely to Have No Impacts

The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and that are likely to have *no impact* on environmental justice include the following:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be *no impacts* to environmental justice communities because the activities that would be conducted at these small entry and exit points are not likely to produce perceptible surface disturbances. Additionally, installation of a new buried fiber optic plant within an existing conduit could lead to minor positive economic and employment benefits.

[1] Since potential environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would be required to determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: The use of existing fiber optic plant would involve minimal aboveground activity in Alaska. While some socioeconomic impacts could occur (see Section 3.2.9, Socioeconomics), it is unlikely that any of these impacts would rise to the level of "high and adverse" necessary to create environmental justice effects.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of new satellite-compatible infrastructure could lead to economic benefits, and would create no permanent negative changes in factors that affect environmental justice (such as income, economic conditions, population distribution, and subsistence, among others). The use of satellite-compatible devices (e.g., mobile phones) absent the installation of new equipment would have *no impacts*. BMPs and mitigation measures could help to avoid or minimize the potential impacts.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice resources, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Given the scope of the project, while geographically enormous (in total 50 states, 5 territories, and the District of Columbia), the actual deployment in any one location is unlikely to be extensive and will likely involve a variety of deployment options (including an emphasis on collocations on existing facilities). The specific deployment activity and where the deployment will take place will be determined based on location-specific conditions and the results of site-specific environmental reviews.

Except for the four infrastructure development activities described above, all development scenarios and deployment activities have at least some potential to create environmental justice impacts. Taking into account the limited duration of construction activities, the types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential environmental justice impacts are discussed below. In general, as described in Section 3.2.10.2, Impact Assessment Methodology and Significance Criteria, environmental justice impacts could occur as a result of other impacts (such as to air, water, or socioeconomics, etc.); the potential for environmental justice impacts shown in Figure 3.1.10-1 (in the Affected Environment section) indicates the degree to which such resource-specific impacts could disproportionately and adversely affect environmental justice communities. These potential impacts associated with the Proposed Action, based on the deployment activity and the limited duration of construction activities, are described further below.

- Wired Projects:
  - New Build – Buried Fiber Optic Plant: Installation of a new buried fiber optic plant (i.e., new underground conduit) could lead to economic and employment benefits, but could have adverse effects on land, air, water, community cohesion (due to worker influx), and other resources. BMPs and mitigation measures would help to avoid or minimize these potential impacts.
  - New Build – Aerial Fiber Optic Plant: The installation of a new aerial fiber optic plant (i.e., new wires on elevated structures) could lead to economic and employment benefits, but could have adverse effects on land, air, community cohesion (due to worker influx), and other resources. BMPs and mitigation measures would help to avoid or minimize these potential impacts.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant with existing fiber optic plant could lead to economic and employment benefits, although these would be less than the New Build – Aerial Fiber Optic Plant option. While this option could affect land air, and water resources, such potential impacts are less likely than under the New Build – Aerial Fiber Optic Plant option because the Use of Existing Aerial Fiber Optic Plant option would involve less ground disturbance. BMPs and mitigation measures would help to further avoid or minimize these potential impacts.
  - New Build – Submarine Fiber Optic Plant: Installation of a new submarine fiber optic cable in limited near-shore or inland bodies of water could lead to economic and employment benefits, but could have adverse effects on land, air, water, community cohesion (due to worker influx), and other resources. BMPs and mitigation measures would help to avoid or minimize these potential impacts.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of new transmission equipment could lead to economic and employment benefits, but could have adverse effects on land, air, water, community cohesion (due to worker influx), and other resources, due in part to the need to create access roads. BMPs and mitigation measures would help to avoid or minimize the potential impacts. The effects described above would be similar to but less than those described for the New Build – Buried Fiber Optic Plant, because the Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable option would involve less ground disturbance, and therefore less labor and use of equipment.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless communication towers could lead to economic and employment benefits, but could have adverse effects on land, air, water, community cohesion (due to worker influx), and other resources. In addition, and depending on location, installation of new wireless communication towers could result in limited and isolated impacts to some terrestrial subsistence resources, either through diminishment of habitat or through the interruption of migratory pathways. However, given the relatively small footprint of this project type, potential impacts, if

any, would likely be localized (not widespread) and only persist during the construction phase, or a limited portion of the operations phase. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) would help to avoid or minimize these potential impacts.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Deployable Technologies (all options)
  - Deployable Technologies: Cell on Wheels, Cell on Light Truck, System on Wheels, and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

As described in this Draft Programmatic Environmental Impact Statement, none of the development scenarios or deployment activities would result in significant impacts after mitigation. As a result, there would likely be no disproportionately high and adverse effects to environmental justice communities in Alaska from any development scenario or deployment activity and even less potential impacts if BMPs and mitigation measures are followed.

Potential Environmental Justice Impacts

Potential environmental justice impacts from all development scenarios and activities (except for the Use of Existing Conduit – New Buried Fiber Optic Plant, Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable, Satellite Enabled Devices and Equipment, or Deployment of Satellites options, which would have *no impacts*) would be *less than significant*. In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly for new towers. Since environmental justice impacts occur at the site-specific level, analyses of individual proposed projects would help determine potential impacts to specific environmental justice communities. BMPs and mitigation measures may be required to address potential impacts to environmental justice communities at the site-specific level. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with environmental justice.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative, which would consist of routine maintenance and inspection of the facilities, are anticipated to have *less than significant* impacts if the same roads are used to perform inspections and maintenance activities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the deployment impacts described above.

3.2.10.5. Alternatives Impact Assessment

This section discusses potential environmental justice impacts associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. In general, some limited construction could be associated with the implementation of deployable technologies such as land clearing or paving for parking or staging areas. However, these construction activities would be minimal in comparison to the combination of project types associated with the Preferred Alternative as described above. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative, but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration.

The potential for environmental justice impacts shown in Figure 3.1.10-1 is applicable to this alternative.

Potential Deployment Impacts

As explained above, deployable technologies such as Cell on Wheels, Cell on Light Truck, and System on Wheels, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise and dust could be generated temporarily, and traffic could be disrupted. These impacts are expected to be *less than significant*. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

Potential Operation Impacts

Operation of deployable technologies would result in effects similar in type to, but more frequent than, those described for the Preferred Alternative. As a result, this alternative would result in *less than significant* disproportionate impacts to environmental justice communities due to the impacts to air, water, land, and subsistence resources associated with the operation of deployable vehicles for up to 2 years at a time. The BMPs and mitigation measures described for the

Preferred Alternative would help to minimize these impacts. Implementation of deployable technologies could have *less than significant* positive impacts on environmental justice communities due to the employees who operate deployable equipment, the wages paid to them, and the expenditures on equipment, fuel, and other items (see Section 3.2.9, Socioeconomics).

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be *no impacts* associated with construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. There would be no environmental justice impacts associated with the No Action Alternative.

3.2.11. Cultural Resources

3.2.11.1. Introduction

This section describes potential impacts to cultural resources in Alaska associated with deployment and operation of the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would help avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.11.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 3.2.11-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as an *adverse effect; mitigated adverse effect; effect, but not adverse;* and *no effect*. These impact categories are comparable to those defined in *36 Code of Federal Regulations (CFR) 800*, Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation (*NPS 1983*), and the United States (U.S.) National Park Service's *National Register Bulletin: How to Apply the National Register Criteria for Evaluation* (*NPS 2002*). Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to cultural resources addressed in this section are presented as a range of possible impacts.

Table 3.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristic	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect**[a]	**Effect, but not Adverse**	**No Effect**
Direct effects to historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
	Geographic Extent	Direct effects APE		Direct effects APE	Direct effects APE
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties		Permanent direct effects to a non-contributing portion of a single or many historic properties	No direct effects to historic properties
Indirect effects to historic properties (i.e., visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process	Effects to a contributing or non-contributing portion of a single or many historic properties	No indirect effects to historic properties
	Geographic Extent	Indirect effects APE		Indirect effects APE	Indirect effects APE
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties		Infrequent, temporary, or short-term, indirect effects to a single or many historic properties	No indirect effects to historic properties
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties	*Adverse effect* that has been procedurally mitigated through Section 106 process	Effects to a non-contributing portion of a single or many historic properties	No segregation or loss of access to historic properties
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties	No segregation or loss of access to historic properties
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties		Infrequent, temporary, or short-term changes in access to a single or many historic properties	No segregation or loss of access to historic properties

APE = Area of Potential Effect

Notes:
[a] Whereas BMPs and mitigation measures for other resources discussed in this Draft Programmatic Environmental Impact Statement may be developed to achieve an impact that is *less than significant with BMPs and mitigation measures incorporated*, historic properties are considered to be "non-renewable resources" given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the National Historic Preservation Act (as codified in *Title 36 of the CFR Parts 800.6*), would require FirstNet to consult with the State Historic Preservation Office/Tribal Historic Preservation Office and other consulting parties, including American Indian tribes and Native Hawaiian organizations, to develop appropriate BMPs and mitigation measures.
[b] Per the National Historic Preservation Act, a historic property is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the National Register of Historic Places (NRHP). Cultural resources present within an individual project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian tribes and other consulting parties that, in consultation with the respective party or parties, may or may not be eligible for listing in the NRHP. These sites may also be considered traditional cultural property (TCP). Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term "historic property" is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

Specific Regulatory Considerations

As discussed in Section 3.1.11, Cultural Resources, the Proposed Action is considered an undertaking as defined in *36 CFR 800*, the regulation implementing Section 106 of the National Historic Preservation Act. The intent of Section 106, as set forth in its attending regulations, is for federal agencies to take into account the effects of a proposed undertaking on historic properties, which can include traditional cultural properties (TCPs), and to consult with the Advisory Council on Historic Preservation (ACHP); State Historic Preservation Offices (SHPOs); federally recognized American Indian tribes and Alaska Native tribes and organizations; local governments; applicants for federal assistance, permits, licenses, and other approvals; and any other interested parties with a demonstrated interest in the proposed undertaking and its potential effects on historic properties.

Section 106 establishes a process for the following:

- Identifying historic properties that may be affected by a proposed undertaking;
- Assessing the undertaking's effects on those resources; and
- Engaging in consultation that seeks ways to avoid, minimize, or mitigate adverse effects on properties that are either listed on, or considered eligible for listing on, the National Register of Historic Places (NRHP).

The area in which effects on resources are evaluated is known as the Area of Potential Effect (APE). The APE is defined as, "… the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of the undertaking and may be different for different kinds of effects caused by the undertaking" (*36 CFR § 800.16(d)*).

The APE would include potential effects areas for both direct and indirect effects. Direct effects physically alter the historic property in some way, and indirect effects are further removed in time or space and diminish some aspect of the historic property, but may not physically alter it. Direct and indirect effects are discussed in further detail below. Although an APE has not been identified for the Proposed Action due to the nature of this programmatic evaluation, an APE would need to be established to evaluate the potential site-specific effects to cultural resources for any individual project.

To be eligible for listing in the NRHP, a cultural resource must meet at least one of the four criteria for eligibility. The major criteria (*36 CFR 60.4(a–d)*) used to evaluate the significance of a cultural resource are as follows:

a) It is associated with events that have made a significant contribution to the broad patterns of history;

b) It is associated with the lives of past significant persons;

c) It embodies the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d) It has yielded or may be likely to yield information important in history or prehistory.

Properties also need to exhibit integrity of location, materials, setting, design, association, workmanship, and feeling and commonly be at least 50 years old. However, under Criteria Consideration G, a property achieving significance within the past 50 years is eligible if it is of exceptional importance.

As discussed in Section 3.1.11, Cultural Resources, historic properties can also include properties of traditional religious and cultural significance to various populations; these properties are commonly referred to as TCPs. TCP is defined in National Register Bulletin 38 as a place "eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (*NPS 1998*). Because the cultural practices or beliefs that give a TCP its significance are typically still observed in some form at the time the property is evaluated, it is sometimes perceived that the intangible practices or beliefs themselves, not the tangible property, constitute the subject of evaluation. There is naturally a dynamic relationship between tangible and intangible. The beliefs or practices associated with a TCP are of central importance in defining its significance. However, it should be clearly recognized at the outset that the NRHP does not include intangible resources themselves. The entity evaluated must be a tangible property—i.e., a district, site, building, structure, or object. Notably, a property must meet several preconditions in order to meet the federal definition of TCP as articulated in National Register Bulletin 38. These conditions include the ongoing use of a property in spiritual practice or other traditional activities (*NPS 1998*). It is difficult to identify properties of traditional cultural significance because they are often kept secret due to sensitivity around use and location by the effected communities, and the National Register discourages nominations of purely natural features "without sound documentation of their historical or cultural significance" (*NPS 1998*). It is through consultation with affected groups themselves that historic properties of religious and cultural significance can be properly identified and evaluated (*ACHP 2008*).

Local, state, tribal, and federal agencies would be consulted as appropriate in findings and determinations made during the Section 106 process, as specified in *36 CFR 800*. This includes any SHPO/Tribal Historic Preservation Office whose state would physically include any portion of the APE. In addition to the SHPO, the lead federal agencies have an obligation, as appropriate, to work with state and local governments as well as private organizations, applicants, or individuals with a demonstrated interest from initiation to completion of the review under Section 106 of the National Historic Preservation Act. Once the lead federal agency has identified the appropriate SHPO, *36 CFR 800.3(f)(2)* requires the federal agencies to identify American Indian tribes or Alaska Native tribes and organizations that may attach religious and cultural significance to historic properties within the APE and invite them to be consulting parties.

In consultation with the SHPO and other effected parties, FirstNet would apply the criteria of adverse effects to historic properties within the APE to evaluate the potential effect of the Proposed Action on the identified historic properties, as codified in *36 CFR 800.5*.

An *adverse effect* is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the NRHP in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association, as discussed above. Adverse effects may include reasonably foreseeable indirect effects that occur later in time, are farther removed, or are cumulative.

FirstNet would confer with consulting parties to determine the undertaking's effects on historic properties, to resolve adverse effects, and to develop BMPs and mitigation measures as necessary. As presented in Table 3.2.11-1, effects determinations have the following three possible outcomes:

1. Finding of *no effect* to historic properties – The Proposed Action does not have the potential to cause effects on historic properties that may be present.
2. Finding of *effect, but not adverse* – The historic property would be affected; however, the effects of an undertaking do not meet the criteria of adverse effect, or measures have been taken to avoid or minimize adverse effects.
3. Finding of *adverse effect/mitigated adverse effect* – The undertaking may affect the integrity, which would alter, directly or indirectly, any of the characteristics of a historic property that qualify it for inclusion in the NRHP. If an *adverse effect* is found, the federal lead agency shall consult further to resolve the adverse effect.

Except as described later, if an historic property could be affected, FirstNet would follow the provisions of *36 CFR 800.5* to determine whether the effects were adverse. If an effect were adverse, FirstNet would consult with the parties identified above to identify practicable and feasible ways to avoid, minimize, or mitigate any potential effects of the Proposed Action pursuant to *36 CFR 800.6*. Additionally, the ACHP would be notified of the adverse effects and invited to participate in the resolution of adverse effects process. If adverse effects are unavoidable, then the following are potential BMPs and mitigation measures that could be taken to resolve adverse effects:

- Minimization, which would reduce the effects on the resource through partial avoidance, but would not completely eliminate the effects; and
- Mitigation, which would offset that effect through some of the following means:
  - Protection of a similar resource nearby;
  - Detailed documentation of the resource through data recovery (e.g., excavations, in the case of archaeological sites, or Historic American Buildings Survey/Historic American Engineering Record documentation, in the case of historic structures);
  - Contributions to the preservation of cultural heritage in the affected community;

- Interpretative exhibits highlighting information gained about cultural resources through the Proposed Action; or
- Some combination of these strategies.

If adverse effects are unavoidable, FirstNet would be required to develop appropriate BMPs and mitigation measures, in consultation with some combination of the ACHP, SHPO, a Tribal Historic Preservation Office, and other interested parties, and execute a Memorandum of Agreement (MOA) or Programmatic Agreement (PA), depending on the size and length of the individual project or program and the number of parties involved.

The MOA or PA would establish a process for ongoing consultation, review, and compliance with federal and state historic preservation laws, and describe the actions that would be taken by the parties to meet their cultural resources compliance responsibilities. The MOA or PA would ensure the resolution of adverse effects and that consultation and BMPs and mitigation procedures are followed. The MOA or PA would also include an Unanticipated Discovery Plan, which would detail the procedures taken if unanticipated cultural materials or human remains were encountered during the deployment phase of the Proposed Action. The MOA or PA would be used as a tool to ensure that Section 106 and other applicable state and federal cultural resource laws and regulations, such as the Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act, and American Indian Religious Freedom Act, are complied with and implemented accordingly.

Additionally, FirstNet is permitted under a 2015 Program Comment approved by the ACHP—that renewed and amended an existing 2009 Program Comment—to use its alternative procedures to comply with Section 106 for any potential effects resulting from any proposed construction and modification undertakings that would be subject to review by the Federal Communications Commission under either an existing 2001 or 2004 nationwide PA for telecommunications and collocations. This permits FirstNet to avoid duplicative reviews and complying separately with Section 106 in evaluating any proposed undertaking, when it has already undergone or will undergo, or is exempt from, a review by the Federal Communications Commission under either the 2001 or 2004 PA (*ACHP 2015*).

3.2.11.3. Description of Environmental Concerns

Direct Effects to Historic Properties

The primary cultural resource concern during deployment and operation activities is physical damage to and/or destruction of historic properties. Direct effects typically occur to historic properties located within or in close proximity to deployment areas. Impacts caused by deployment or operation are restricted to any historic properties, known or unidentified, within the area of physical disturbance.

Any deployment-related ground disturbing activities, such as grading, excavation, vegetation clearing, or even merely driving equipment off-road has the potential to damage, disturb, or remove known or previously unidentified cultural resources, particularly archaeological sites. Since archaeological sites and the scientific data that can be gathered from them are based on their undisturbed context, the integrity and undisturbed nature of an archaeological site is of utmost importance. Ground-disturbing activities are likely to occur during deployment of Proposed Action facilities and associated infrastructure, both on land and in water, and in the future during operation phase maintenance that could involve unanticipated find events.

An influx of non-local workers into an area could subject known historic properties to an increase in visitors who may not be aware of a resource's local, regional, or national cultural value. Resources could be damaged due to intentional or unintentional looting or vandalism. If previously unidentified cultural resources are identified during deployment or operation, individual project-related personnel collecting artifacts as souvenirs could also impact resources.

Based on the impact significance criteria presented in Table 3.2.11-1, physical damage to and/or destruction of historic properties could be adverse if FirstNet's deployment locations or activities would cause permanent direct effects to a contributing portion of a single or multiple historic properties. As discussed in the affected environment Section 3.1.11, Cultural Resources, known and unidentified cultural resources can occur throughout Alaska. Although parts of the state have been systematically surveyed, not all areas or cultural resources have been evaluated for their eligibility, and historic properties have been listed on the National Register of Historic Places, there is the potential for unidentified cultural resources to exist and/or known historic properties to be adversely effected by the Proposed Action. Because prehistoric sites in Alaska are known to occur near coastal areas where populated areas and infrastructure are prevalent, historic properties such as prehistoric period archaeological sites and near-shore shipwrecks would be most susceptible to near-coastal adverse effects. Additionally, many prehistoric and historic period archaeological sites and historic structures are commonly located in more level, inland areas where individual project activities could occur. Topographically prominent locations suited for telecommunication infrastructure could also be located near or on sites of religious and/or cultural significance or within cultural landscapes.

Prior to deployment, FirstNet would identify and evaluate cultural resources through systematic survey and apply the criteria of adverse effects to historic properties within the individual project APE to determine the potential effect of the Proposed Action on any identified historic properties. To the extent practicable, FirstNet does not expect to raze any historic structures or adversely affect any known historic properties as part of siting the Proposed Action. If the proposed deployment activities would have the potential to adversely affect historic properties, FirstNet would apply BMPs and mitigation measures and/or consult with appropriate federal, state, tribal, and other interested parties to apply appropriate mitigation measures to resolve adverse effects. If after initial surveys unanticipated cultural resources were identified during deployment or operation, procedures established within the MOA or PA would be followed to appropriately consult, evaluate, and resolve potential adverse effects to any historic properties. If unmarked human burial remains are encountered, then work in the area of the find must cease immediately and the Office of History and Archaeology and SHPO must be contacted before further ground-disturbing activity could occur at the discovery site.

Indirect Effects to Historic Properties

Indirect effects to historic properties could include changes to the views to and from a resource (viewshed impacts); increased noise levels at a resource; vibration; and/or visual or atmospheric effects due to dust, emissions, or pollutants. These types of indirect effects may not only affect a historic property's sense of setting, feeling, or association, but could also indirectly affect the physical characteristics of a historic property.

Indirect effects are typically caused by spatially removed activities due to visual, auditory, vibratory, or atmospheric impacts that occur beyond the physical area of disturbance, but are typically restricted to the immediate area around the emitting source, especially in the case of noise, vibration, dust, or emissions. The size of the area impacted by the indirect effects is determined by a combination of variables including the frequency, duration, intensity, and magnitude of the impacts.

Proposed Action activities that could result in these types of impacts include deployment-related ground disturbance; vegetation clearance; increased noise, vibration, dust, pollutants, and emissions associated with vehicle traffic; and placement of individual project components within viewsheds. The accumulation of dust due to vehicular traffic or deployment activities on historic properties could impact their cultural value to a site user, although they would tend to be minor or limited in extent. The accumulation of other pollutants could have a similar effect as dust and could contribute to physical damage to historic properties from chemical reactions between pollutant and resource materials, although the effects would generally be required to be long-term to cause significant damage.

Historic structures and prehistoric ruins or sensitive features are prone to vibration-related impacts. Vibrations are measured in terms of peak particle velocity. The Swiss Association of Standardization Vibration Damage Criteria states that structures highly sensitive to vibration will sustain damage if continuous vibration activities generate peak particle velocity in the underlying soil of 3.048 millimeters per second (mm/s) or higher (*Jones & Stokes 2004*). A British Museum study found that continuous vibrations of 2.5 mm/s or 5.0 mm/s from intermittent vibrations will damage historic buildings (*Higgitt 2010*). The use of heavy equipment during deployment and increased vehicular traffic along established or new access roads during deployment and operation-phase activities could generate localized vibrations sufficient to damage historic properties. The Proposed Action, however, would likely not possess the amount or frequency of vehicular traffic needed to cause significant effects.

Based on the impact significance criteria presented in Table 3.2.11-1, indirect effects to historic properties could be adverse if FirstNet's deployment or operation activities would cause permanent indirect effects to a contributing portion of a single or many historic properties. As discussed in the affected environment Section 3.1.11, Cultural Resources, known and previously unidentified cultural resources can occur throughout Alaska. Although parts of the state have been systematically surveyed, cultural resources have been evaluated for their eligibility, and historic properties have been listed on the National Register of Historic Places, the potential remains for unidentified cultural resources to exist and/or known historic properties to be adversely effected by the Proposed Action. Additionally, in the case of TCPs and cultural resources of religious and/or cultural significance, sites may be difficult to identify, boundaries may not be able to be defined, and the affected cultural groups may not be willing to share information about the sites. Historic properties such as those related to natural features, such as many of the beach sites, cemeteries, or even traditional hunting, fishing, or plant gathering sites, could be adversely affected by effects from views, noise, or emissions. Topographically prominent locations suited for telecommunication infrastructure could also be located within the viewshed of TCPs or other sites of religious and/or cultural significance. Historic properties containing structural components (i.e., Kake Cannery or Skagway Historic District) or sensitive or fragile features, such as the Cape Alitak Petroglyphs District, could be susceptible to damage due to vibrations.

As discussed above, FirstNet would identify, evaluate, and apply the criteria of adverse effects to historic properties within the individual project APE to determine the potential effect of the Proposed Action on any identified historic properties. To the extent practicable, FirstNet does not expect to adversely affect any known historic properties as part of siting the Proposed Action. If the proposed deployment activities would have the potential to adversely affect historic properties, FirstNet would apply BMPs and mitigation measures and/or consult with appropriate federal, state, tribal, and other interested parties to apply appropriate mitigation measures to resolve adverse effects.

Loss of Access to Historic Properties

The goal of historic preservation is not only to preserve and protect historic properties, but also to provide access to cultural resources, especially to those who value them. This is fundamental to all historic properties, primarily to historic properties that are considered TCPs and other sites of religious and/or cultural significance (*NPS 1998*). Effects would be considered adverse if long-term or permanent segregation or loss of access was caused by individual project activities to a single or many historic properties.

Historic resources, especially TCPs, hunting, fishing, or plant gathering sites, graves or cemeteries, and areas of particular religious or traditional importance, can lose their integrity, and, thus, their potential eligibility for the NRHP when they become degraded as a result of natural or human disturbance processes. Additionally, loss of integrity can occur when the groups, such as Alaska Native tribes and organizations, who value these places, can no longer access them, thus, losing their ability to use the sites in a traditional way and the cultural connection to the site or place over time.

The cause of the loss of access can be direct or indirect. A historic property such as a cemetery or religious place—St. George the Great Martyr Orthodox Church, for example—could be physically segregated, excluding public use of the place. However, limitations on access could also be indirect, whereas the use associated with the cultural landscape or traditional gathering area is affected be visual or audible effects long-term or permanently so as practitioners cannot perform traditional uses. Many TCPs are used for practical purposes by those who value them, and the resources gathered are vital to continuing cultural and traditional practices.

As discussed above, FirstNet would consult with the appropriate state agencies and interested Alaska Native tribes and organizations to identify, evaluate, and apply the criteria of adverse effects to historic properties within the individual project APE to determine the potential effect of the Proposed Action on any identified historic properties. To the extent practicable, FirstNet does not expect to adversely affect access to any known historic properties as part of siting the Proposed Action. If the proposed deployment or operation activities would have the potential to adversely affect historic properties, FirstNet would apply BMPs and mitigation measures and/or consult with appropriate federal, state, tribal, and other interested parties to apply appropriate mitigation measures to resolve adverse effects.

3.2.11.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to cultural resources and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Effects

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no effects* to cultural resources under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no direct or indirect effects to cultural resources because the activities that would be conducted at these small entry and exit points are within previously disturbed areas and any indirect effect or effects to access would be short-term.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no effects* to cultural resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of new satellite-compatible infrastructure on existing towers, structures, or buildings (where antennae are already

placed) would likely be visible. It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact cultural resources because those activities would not require ground disturbance or create new perceptible visual effects. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize potential impacts.

- Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle is very unlikely to impact cultural resources, it is anticipated that this activity would have *no effect* on cultural resources.

Activities with the Potential to Have Effects

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of effects that could occur as a result of ground disturbance activities, vehicular traffic, the presence of new aboveground structures or components, visual evidence of construction, and the presence of construction equipment. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential effects to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence,[1] huts, or other associated facilities or hand-holes to access fiber could result in potential direct and indirect effects or access effects to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of points of presence, huts, or other associated facilities or hand-holes to access fiber could result in direct and indirect effects or access effects to cultural resources. Installation of a new buried fiber optic plant would create visible evidence of construction, including a narrow, impermanent "scar" in the earth where the new fiber optic plant was installed, and the presence of construction equipment used for this installation. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize the potential impacts.
  - New Build – Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the installation of new poles could result in potential direct and indirect effects or access effects to cultural resources. The use of heavy equipment during the installation of new poles and hanging of cables could also result in potential direct and indirect effects to cultural resources or access effects to cultural resources. The installation of a new aerial fiber optic plant (i.e., new wires on new transmission towers) would have a

[1] Points of presence are connections or access points between two different networks, or different components of one network.

discernable change on visual conditions. Except if replacing existing infrastructure, this option would add new elements (towers) to a viewshed, and would result in visible evidence of construction activity and equipment. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize potential impacts.

- Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.
- New Build – Submarine Fiber Optic Plant: The installation of cables in bodies of water could have direct and indirect impacts to submerged cultural resources. Direct and indirect effects as well as access effects to cultural resources could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable or the impact of cable placement on submerged resources. Direct and indirect effects to terrestrial cultural resources could potentially occur as result of grading, foundation excavation, or other ground disturbance activities as well as heavy equipment use during these activities. Installation of new associated huts or equipment, however, would create aboveground features and the presence of construction equipment and create visible aboveground components. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize the potential impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance (collocations), there would be *no effects* to cultural resources. However, if installation of transmission equipment required grading or other ground disturbance to install small boxes, hunts, or access roads, there could potentially be direct and indirect impacts to cultural resources, although access effects would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources. Installation of new transmission equipment would add a new element to the viewshed, in the form of a small box or hut. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize the potential impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in direct and indirect effects or access effects to cultural resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads and heavy equipment use could result in direct and indirect effects. Installation of new wireless communication towers would add new elements (towers) to the viewshed and

would result in visible evidence of construction activity and equipment. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize potential impacts.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. Although the change associated with this option is small, it could cause cumulative visual effects to historic properties within its viewshed. If the onsite delivery of additional power units, structural hardening, and physical security measures required ground disturbance, such as grading or excavation activities, direct and indirect effects to cultural resources could occur, although access effects would be short-term. The use of heavy equipment could also have direct and indirect effects. BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) could help to avoid or minimize potential impacts.

- Deployable Technologies
  - Implementation of deployable technologies could result in potential direct and indirect effects to cultural resources if deployment of land-based deployables occurs in unpaved areas, or if the implementation results in minor construction or paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) could require land/vegetation clearing, minor excavation, and paving. These activities could result in direct and indirect effect to cultural resources, although access effects would be unlikely. Heavy equipment use associated with these activities and implementation of deployable technologies themselves could result in direct and indirect effects if deployed in unpaved areas. It is anticipated that there would be *no effects* to access or the viewshed during deployment of the deployable technologies.

In general, the abovementioned activities could potentially involve land/vegetation clearing, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, heavy equipment movement, and installation of aboveground components. Potential effects to cultural resources associated with deployment of this infrastructure could include direct and indirect effects or access effects to cultural resources. These effects and associated BMPs and mitigation measures to help mitigate or reduce these impacts are described further below.

Direct Effects to Historic Properties

Based on the analysis of the deployment activities described above to cultural resources, impacts as a result of direct effects are anticipated to be *effect, but not adverse*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to these resources.

FirstNet is committed to avoidance of direct effects to historic properties to the maximum extent practicable. The key time to implement avoidance actions is during siting and deployment, prior to and during Preferred Alternative activities. To facilitate this commitment to effect avoidance, pre-siting or pre-deployment surveys for cultural resources would be conducted for all proposed activities not covered by the Program Comment to ensure that informed siting of Preferred Alternative activities would enable avoidance of adverse effects to historic properties to the maximum extent practicable.

Further, the establishment of an unanticipated discovery plan during deployment and operation would be implemented to ensure that procedures are followed if unanticipated cultural materials or human remains were encountered during the deployment and operation of the Preferred Alternative, and that BMPs and mitigation measures are fully and effectively implemented and unanticipated effects to historic properties are not occurring. For activities that could adversely affect historic properties, FirstNet would enter into formal consultation with federal, state, tribal, and other interested parties to execute a MOA or PA to establish a process for ongoing consultation, review, and compliance with federal and state historic preservation laws, and describe the actions that would be taken by the parties in order to meet their cultural resources compliance responsibilities. The MOA or PA would ensure the resolution of adverse effects and that consultation and mitigation procedures are followed. The MOA or PA would be used as a tool to ensure that Section 106 and other applicable state and federal cultural resource laws and regulations, such as the Archaeological Resources Protection Act, Native American Graves Protection and Repatriation Act, American Indian Religious Freedom Act, and state laws, are complied with and implemented accordingly.

Potential Indirect Effects to Historic Properties

Based on the analysis of the deployment activities described above to cultural resources, indirect effects are anticipated to be *effect, but not adverse*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to these resources.

Potential Loss of Access to Historic Properties

Based on the analysis of the deployment activities described above to cultural resources, impacts as a result of effects to access are anticipated to be *effect, but not adverse*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential impacts to these resources.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be *no effects* to historic properties associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections and the activities are infrequent and temporary. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, direct and indirect effects or temporary access effects could result as explained above.

3.2.11.5. Alternatives Impact Assessment

The following section assesses potential impacts to historic properties associated with the Deployable Technologies Alternative and the No Action Alternative.[2]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of land-based and aerial mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Potential effects to historic properties as a result of implementation of this alternative are described below.

Deployment Impacts

As explained above, implementation of land-based deployable technologies could result in *effects, but not adverse* to historic properties if deployment of land-based deployables occurs in unpaved areas or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) could require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect effect to cultural resources, although access effects would be unlikely. Heavy equipment use associated with these activities and implementation of deployable technologies themselves could result in direct and indirect effects if deployed in unpaved areas. It is anticipated that there would be *no effects* to access or the viewshed during deployment of the deployable technologies.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be *effects, but not adverse* to historic properties associated with implementation/running of the deployable technology because effects to access or the viewshed could occur, depending on the length of deployment. Assuming that the same access roads used for deployment are also used for inspections, it is anticipated that there would be *no effects* to historic properties due to inspections. If usage of heavy equipment as part of

[2] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

routine maintenance or inspections occurs off of established access roads or corridors, *effects, but not adverse* to historic properties could result as previously explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated deployment or operation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no effects* to historic properties as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.11, Cultural Resources.

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3.2.12. Air Quality

3.2.12.1. Introduction

This section describes potential impacts to air quality in Alaska associated with deployment and operation of the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are discussed in Chapter 11, BMPs and Mitigation Measures.

3.2.12.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on air quality were evaluated using the significance criteria presented in Table 3.2.12-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of the potential air quality impact, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to air quality addressed in this section are presented as a range of possible impacts.

Table 3.2.12-1: Impact Significance Rating Criteria for Air Quality

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased air emissions	Magnitude or Intensity	Emissions would prevent progress toward meeting one or more NAAQS in nonattainment areas. Emissions in attainment or maintenance areas would cause an exceedance for any NAAQS. Emissions exceed one or more major source permitting thresholds. Projects do not conform to SIP.	Effect that is *potentially significant*, but with mitigation is *less than significant*	Negligible emissions would occur for any pollutant within an attainment area, but would not cause a NAAQS exceedance and would not trigger major source permitting.	Emission increases would be infrequent or absent, mostly immeasurable. Projects conform to SIP.
	Geographic Extent	NA		NA	NA
	Duration or Frequency	Permanent or long-term		Short-term	Temporary

NAAQS = National Ambient Air Quality Standards; NA = not applicable; SIP = State Implementation Plan

3.2.12.3. Description of Environmental Concerns

Increased air emissions could result in potentially negative impacts to human health, wildlife, vegetation, and visibility. Emissions could result from stationary or mobile equipment that is powered by fossil fuels such as excavators, backhoes, frontend loaders, graders, pavers, dump trucks, etc. required to support any clearance, drilling, and construction activities associated with network deployment. In addition, the use of power generators, first responder on-road vehicles (large towable trailers, commercial trucks, standard sport utility vehicles), and aerial platforms (unmanned aircraft such as drones and piloted aircraft such as airplanes, balloons, and blimps) associated with the implementation of deployable technologies could also increase air emissions, both from fossil fuel combustion and, in some cases, from stirring up dust on unpaved roads. Helicopters, if needed, would likely only be used during deployment of one of the above technologies to potentially move people or equipment to remote areas. As the use of helicopters would be infrequent, if at all, potential impacts associated with the use of helicopters are not evaluated here.

Potential impacts from increased air emissions could occur in any location; however, the most affected areas are nonattainment areas (where air quality is not meeting local standards), maintenance areas (where air quality has improved but historically did not meet local standards), and designated Class I Areas (areas of special national or cultural significance including certain national parks, wilderness areas, and national monuments). Nonattainment and maintenance areas are sensitive to increased air pollution because of their existing air quality concerns; Class I Areas are sensitive because of the expectation for pristine air quality and visibility in these areas (see Section 3.1.12, Air Quality).

Because there are four Class I Areas (Bering Sea Wilderness Area, Denali National Park, Simeonof Wilderness Area, and Tuxedni Wilderness Area) in Alaska, and certain areas of the state are designated as nonattainment or maintenance status (Fairbanks, Anchorage, and Juneau-Mendenhall Valley) and because infrastructure could be deployed in these areas, BMPs and mitigation measures (see Chapter 11) would help avoid or minimize potential air quality impacts. In addition, it is anticipated that any air pollution increase due to deployment would likely be short-term with pre-existing air quality levels generally achieved after some months (typically less than a year, and could be as short as a few hours or days for some activities such as pole construction).

3.2.12.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. Estimated emissions associated with the Proposed Action are compared to the permitting thresholds for new major stationary sources in order to evaluate the significance of potential air quality impacts. Because the air emissions associated with most of the construction/deployment activities (excluding use of mobile power generators for deployment technologies if on-site for 12 consecutive months or more) are solely from mobile construction equipment/vehicles, these non-stationary sources or activities would not be subject to state air quality requirements that would require consultation or permitting actions. Emissions from the non-stationary sources (and sources not covered by a New Source Review permit) are subject to the general conformity requirements, if such emissions are generated in areas designated as nonattainment or maintenance for any criteria pollutant or its pre-cursor. The major stationary source permitting thresholds are lower for modifications (rather than new sources); however, these thresholds are based on an increase in emissions compared to the existing source. It is anticipated that any modifications associated with the Proposed Action (e.g., replacement of an existing diesel generator) would involve equipment of the same size with emissions performance equal to or better than the existing equipment. Therefore, only new emission sources are quantitatively evaluated to determine significance. Additionally, lead emissions were not quantified in the following assessment because all fuels are anticipated to be unleaded and no measurable amount of lead emissions are expected as a result of the Proposed Action.

Alaska also enforces State Ambient Air Quality Standards for ammonia and reduced sulfur oxides. The major sources of ammonia emissions are from agricultural fertilizer use and livestock operations. The Proposed Action does not include these types of sources. Internal combustion engines equipped with ammonia control devices such as Selective Catalytic Reduction[1] systems could also result in ammonia emissions in the form of ammonia slip[2] (*USEPA 2004*). However, the types of diesel engines expected to be used for the Proposed Action are not usually equipped with ammonia-based emissions control devices and therefore produce minimal ammonia emissions Because fuel sulfur content is the main source of reduced sulfur oxides, the use of ultra-low sulfur diesel[3] in on-road and non-road engines would further result in minimal emissions of reduced sulfur oxides. Therefore, emissions of ammonia and reduced sulfur oxides were not quantified.

As noted in Section 3.1.12, Air Quality, one area of Alaska (Fairbanks North Star Borough) is designated as a moderate nonattainment area for particulate matter with a diameter of 2.5 micrometers or less ($PM_{2.5}$); the applicable threshold is 100 tons per year (tpy) for direct $PM_{2.5}$ and its precursors (sulfur dioxides [SO_2] and nitrogen dioxides [NOx]), and 250 tpy for each of the other criteria pollutants. Additionally, two areas of Alaska (Anchorage and Fairbanks) are designated as maintenance areas for carbon monoxide (CO), and two areas (Anchorage–Eagle River; and Juneau–Mendenhall Valley) are designated as maintenance areas for particulate matter with a diameter of 10 micrometers or less (PM_{10}). Although the major source permitting threshold for each of these pollutants is still 250 tpy, the threshold for triggering general conformity requirements for each of these pollutants is 100 tpy (see Section 3.1.12.3, Ambient Air Quality). Therefore, emissions of carbon monoxide and PM_{10} estimated below are evaluated relative to the 100-tpy threshold. However, as also mentioned in

[1] Selective Catalytic Reduction is add-on nitrogen dioxides control placed in the exhaust stream following the engine and involves injecting ammonia into the flue gas. The ammonia reacts with the nitrogen dioxides in the presence of a catalyst to form water and nitrogen.
[2] Ammonia slip is an industry term for ammonia passing through the Selective Catalytic Reduction system un-reacted. This occurs when ammonia is over-injected into gas stream, temperatures are too low for ammonia to react, or catalyst has degraded.
[3] Urban and rural areas of Alaska are required to use 15 parts per million sulfur standard diesel fuel (ultra-low sulfur diesel) for all diesel powered highway/on-road vehicles, non-road/off-road equipment, and locomotive and marine engines (*ADEC Undated*).

Section 3.1.12, Air Quality, NOx and SO_2 are also pollutants of particular concern relative to Prevention of Significant Deterioration increments[4] in Alaska.

Furthermore, within the United States and its territories, there are no air quality permitting programs, and thus no thresholds, for mobile sources such as construction equipment/activities, motor vehicles, small boats, airplanes, and drones.[5] As noted in Section 3.1.12, Air Quality, emissions from each of these mobile sources are regulated through fuel standards and inspection/maintenance programs. The proposed BMPs and mitigation measures (see Chapter 11) would help avoid or minimize potential air quality impacts associated with these mobile emission sources. Nonetheless, to provide additional context, emissions from construction equipment/activities and motor vehicles are estimated below and compared to the 250- and 100-tpy major source permitting and general conformity thresholds, although these thresholds would not apply to such emissions for permitting purposes.

Finally, the following analyses consider pollutant emission rates only. Changes to ambient air pollutant concentrations through air dispersion modeling (which accounts for emission rates, source parameters, meteorological conditions, building wake effects, and terrain effects) and associated potential impacts relative to local ambient air quality standards, are not evaluated. More detailed Proposed Action information would be needed to model potential air emission impacts relative to local ambient air quality standards.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of potential impacts (*no impacts* to *less than significant*) depending on the deployment scenario or site-specific conditions.

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[4] Prevention of Significant Deterioration increment is the maximum allowable increase in pollutant concentration that is allowed to occur above a baseline concentration for a pollutant. These allowable increases in pollutant concentrations are determined through air dispersion modeling. Significant deterioration occurs if the amount of new pollution would exceed the applicable Prevention of Significant Deterioration increment.

[5] The Clean Air Act (CAA), as amended through the 1990 Clean Air Act Amendments, defines "stationary source" in Title III, *General Provisions, Section 302*, *Definitions,* paragraph (z) [*CAA §302(z)*] such that any source of air emissions resulting directly from a non-road engine is not regulated as a stationary source under the CAA and are therefore, exempt from federal stationary source permitting requirements. The definition of a non-road engine in *Title II, Emission Standards for Moving Sources, Section 216*, *Definitions* of the CAA is codified in *40 CFR Part 89.2 and 40 CFR Part 90.3*. As defined in these parts, internal combustion engines that are mobile (i.e., portable or transportable) engines are considered non-road engines. Therefore, internal combustion engines such as portable generators, air compressors, welders, etc. that do not stay at any single site at a building, structure, facility, or installation for 12 consecutive months or more, are considered non-road engines.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to air quality under the conditions described below:

- Wired Projects
  - Use of Existing Conduit–New Buried Fiber Optic Plant: Although existing conduits would be used, these projects could involve construction equipment for cable pulling and blowing. However due to the temporary and intermittent need for such machinery, there would be no perceptible increase in air emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would have *no impacts* to air quality because it would not create any sources of airborne emissions. It is expected that no heavy equipment would be used and that transportation activities would be temporary, producing a negligible quantity of air pollution.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact air quality resources, unless this decision changes, it is anticipated that this activity would have *no impact*.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to air quality as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur as a result of fossil fuel combustion associated with on-road and off-road engines, and as a result of motor vehicles or heavy equipment stirring up dust on unpaved roads. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following activities.

<u>Wired Projects</u>

For buried wired projects, construction activities could include plowing (including vibratory plowing), trenching, or directional boring, depending on the nature of the terrain, geology, and environmental conditions. These activities could result in potential impacts to air quality as a result of associated fuel-burning equipment (combustion emissions) and ground disturbance (fugitive dust). This section excludes air emissions associated with trenching and horizontal boring activities as these are expected to be lower or similar to plowing activities (i.e., only one of the three options would likely occur at a particular location depending on the nature of the terrain, geology, and environmental conditions). For aerial wired projects, construction activities could include new wiring and poles that require use of auger trucks, boom trucks, and bucket lifts, as well as excavation and grading for new or modified rights-of-way or easements.

Additional activities associated with installation of new, or modifications to existing, wired systems (buried and aerial) and the construction of points of presence,[6] huts, or other associated facilities could result in air emissions from cable blowing, pulling, and vault placement. In other cases, new structures could be required without the need for new or modified wired systems. The deployment of marine vessels to lay submarine cable is unlikely; however, small work boats (with engines similar to recreational vehicle engines) may be required to transport and lay small wired cable in limited near-shore or inland bodies of water, but emissions from these small marine sources are expected to be negligible and were not quantified. Associated combustion emissions estimates for the anticipated fuel-burning equipment are presented in Table 3.2.12-2 through Table 3.2.12-4.

Furthermore, deployment of wired projects could potentially impact air quality as a result of associated excavation/filling and grading/earth moving activities. Associated fugitive dust emissions estimates are presented in Table 3.2.12-5.

Table 3.2.12-2: Combustion Emission Estimates (Monthly) from New Buried Wired Project Deployment[a]

Emission Source[b,c]	Estimated Emissions (tons/month)[d,e,f]					
	NOx	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
Vibratory Plow	0.329	0.110	0.015	0.002	0.001	0.0004
Backhoe	0.328	0.108	0.015	0.001	0.001	0.0004
Dozer	0.330	0.114	0.015	0.002	0.002	0.0004
Flat-bed Truck	0.333	0.124	0.016	0.002	0.002	0.0004
Pick-up Truck	0.333	0.124	0.016	0.002	0.002	0.0004
Trench Roller	0.330	0.112	0.015	0.002	0.002	0.0004
Air Compressor	0.329	0.110	0.015	0.002	0.001	0.0004
Cable Puller/Blower	0.327	0.103	0.015	0.001	0.001	0.0004
Concrete Mixer	0.328	0.105	0.015	0.001	0.001	0.0004
Grader	0.330	0.115	0.015	0.002	0.002	0.0004
Roller	0.330	0.112	0.015	0.002	0.002	0.0004
Total	**3.63**	**1.24**	**0.166**	**0.018**	**0.017**	**0.004**

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound

[a] Deployment activities are assumed to include plowing, wire installation, and construction of points of presence and fiber huts.

[b] Emissions are based on one unit of typical equipment. If additional equipment is required, equipment-specific emission estimates should be multiplied by the number of equipment units.

[c] Each equipment is assumed to have a maximum rated capacity of 300 horsepower and to be 10 years old (equipment age). If new equipment is used, emissions would be lower.

[d] Emissions are estimated using methodology from *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition*, Equations 1 to 7, NR-009d, July 2010 (*USEPA 2010a*). Typical equation values were obtained from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*, EPA-420-R-10-016, NR-005d, July 2010 (*USEPA 2010b*).

[e] Emissions (tons) per month assume 240 hours (24 days, 10 hours/day) of construction activity per month. If construction lasts for 4 months, estimated air pollutant emissions would be expected to be four times as large as the values listed here.

[f] Fuel is assumed to be ultra-low sulfur diesel with a maximum sulfur content of 15 parts per million.

[6] Points of presence are connections or access points between two different networks, or different components of one network.

Table 3.2.12-3: Combustion Emission Estimates (Monthly) from New Aerial Wired Project Deployment[a]

Emission Source[b,c]	Estimated Emissions (tons/month)[d,e,f]					
	NOx	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
Grader	0.330	0.115	0.015	0.002	0.002	0.0004
Suction Excavator	0.331	0.117	0.015	0.002	0.002	0.0004
Auger Truck	0.328	0.107	0.015	0.001	0.001	0.0004
Boom Truck	0.330	0.112	0.015	0.002	0.002	0.0004
Cable Puller/ Blower	0.327	0.103	0.015	0.001	0.001	0.0004
Bucket Lift	0.327	0.104	0.015	0.001	0.001	0.0004
Flat-bed Truck	0.333	0.124	0.016	0.002	0.002	0.0004
Total	**2.31**	**0.781**	**0.106**	**0.011**	**0.011**	**0.003**

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound
[a] Deployment activities are assumed to include excavation, grading, and pole delivery and installation.
[b] Emissions are based on one unit of typical equipment. If additional equipment is required, equipment-specific emission estimates should be multiplied by the number of equipment units.
[c] Each equipment is assumed to have a maximum rated capacity of 300 horsepower and to be 10 years old (equipment age). If new equipment is used, emissions would be lower.
[d] Emissions are estimated using methodology from *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition*, Equations 1 to 7, NR-009d, July 2010 (*USEPA 2010a*). Typical equation values were obtained from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*, EPA-420-R-10-016, NR-005d, July 2010 (*USEPA 2010b*).
[e] Emissions (tons) per month assume 240 hours (24 days, 10 hours/day) of construction activity per month. If construction lasts for 4 months, estimated air pollutant emissions would be expected to be four times as large as the values listed here.
[f] Fuel is assumed to be ultra-low sulfur diesel with a maximum sulfur content of 15 parts per million.

Table 3.2.12-4: Combustion Emission Estimates (Monthly) from Tower, Structure, and Transmission Equipment Delivery and Installation

Emission Source[a,b]	Estimated Emissions (tons/month)[c,d,e]					
	NOx	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
Concrete Mixer	0.328	0.105	0.015	0.001	0.001	0.0004
Flat-bed Truck	0.333	0.124	0.016	0.002	0.002	0.0004
Grader	0.330	0.115	0.015	0.002	0.002	0.0004
Paver	0.330	0.113	0.015	0.002	0.002	0.0004
Roller	0.330	0.112	0.015	0.002	0.002	0.0004
Truck-mounted Crane	0.330	0.112	0.015	0.002	0.002	0.0004
Total	**1.98**	**0.681**	**0.091**	**0.010**	**0.010**	**0.002**

CO = carbon monoxide; NOx = nitrogen oxides; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; SO_2 = sulfur dioxide; VOC = volatile organic compound
[a] Emissions are based on one unit of typical equipment. If additional equipment is required, equipment-specific emission estimates should be multiplied by the number of equipment units.
[b] Each equipment is assumed to have a maximum rated capacity of 300 horsepower and to be 10 years old (equipment age). If new equipment is used, emissions would be lower.
[c] Emissions are estimated using methodology from *Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, Equations 1 to 7, NR-009d, July 2010* (*USEPA 2010a*). Typical equation values were obtained from *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling, EPA-420-R-10-016, NR-005d, July 2010* (*USEPA 2010b*).
[d] Emissions (tons) per month assume 240 hours (24 days, 10 hours/day) of construction activity per month. If construction lasts for 4 months, estimated air pollutant emissions would be expected to be four times as large as the values listed here.
[e] Fuel is assumed to be ultra-low sulfur diesel with a maximum sulfur content of 15 parts per million.

Table 3.2.12-5: Dust Emission Estimates (Monthly) from Excavation/Filling and Grading/Earth Moving Activities

Emission Source	Estimated Level of Activity	Estimated Emissions (tons/month)[a,b,c]		
		PM	PM_{10}	$PM_{2.5}$
Excavation and Filling	100,000 tons of material transferred [d]	0.192	0.091	0.014
Grading and Earth Moving	1,200 vehicle miles traveled per month [e]	1.34	0.459	0.042
Total		**1.53**	**0.550**	**0.055**

PM = particulate matter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter

[a] Emissions are estimated using methodology from *AP-42*, *Compilation of Air Pollutant Emission Factors (USEPA 1998* and *USEPA 2006)*.

[b] Excavation and filling emissions are based on Section 13.2.4, Aggregate Handling and Storage Piles - Equation (1) (*USEPA 2006*). Mean wind speed is assumed to be 7.0 meters per second (15.7 miles per hour) based on National Oceanic and Atmospheric Administration data for Anchorage, Fairbanks, and Juneau Alaska (refer to Chapter 3.1.14). Moisture content is assumed to be the median value (2.525%) listed in AP-42. Control efficiency is assumed to be zero (worst-case scenario).

[c] Grading and earth moving emissions are based on Section 11.9, Western Surface Coal Mining - Table 11.9-1 (*USEPA 1998*). Mean speed for construction vehicles is assumed to be 5 miles per hour. Emissions (tons) per month assume 240 hours (24 days, 10 hours/day) of construction activity per month. Emission estimates could be scaled proportionally based on the number of months required for grading and earth moving activities.

[d] Excavation and filling emissions assume 100,000 tons of material transferred per month. Emissions estimates could be scaled proportionally based on actual monthly estimates for material transfer (e.g., if monthly material transfer is to be 200,000 tons, associated PM emissions would be 0.480 tons).

[e] Vehicle miles traveled is based on average speed (5 miles per hour) and operating time per month (240 hours) (see note c above). Emission estimates cannot be directly scaled based on an increase/decrease in vehicle miles traveled – refer to equations in AP-42, Table 11.9-1 (*USEPA 1998*).

Wired project deployment would also involve other on-road vehicle use, including employee transportation to and from work sites. However, these ancillary activities would be temporary and would produce a negligible quantity of air pollution. Therefore, emissions associated with these ancillary activities were not quantified.

Potential air quality impacts associated with each type of wired project are discussed below:

- New Build–Buried Fiber Optic Plant: These projects could involve plowing (including vibratory plowing), trenching, or directional boring (depending on the nature of the terrain, geology, and environmental conditions), as well as the construction of points of presence, huts, or other associated facilities or hand-holes to access fiber. The associated fuel-burning emissions are estimated in Table 3.2.12-2; the associated dust emissions are estimated in Table 3.2.12-5. For example, monthly NOx emissions are the highest of all criteria pollutant emissions, at approximately 3.6 tons (based on the assumptions noted in each table); annual NOx emissions, if construction lasted for at least 1 year, would be approximately 44 tons. Annual emissions of SO_2 would be expected to be approximately 0.05 tons. The annual estimate for each criteria pollutant is less than the major source permitting threshold of 250 tons. Additionally, emissions of CO, PM_{10}, and $PM_{2.5}$ would be expected to be approximately 14.9, 6.8, and 0.86 tpy, respectively, each less than the 100-tpy general conformity threshold. Even if additional equipment, beyond the equipment assumed in these calculations, was needed, it is still unlikely that emissions would reach the major source or general conformity thresholds.

- New Build–Aerial Fiber Optic Plant: These projects would not require plowing, trenching, or directional boring. However, they could require construction of new wiring and poles, as well as excavation and grading for new or modified right-of-ways or easements. The associated fuel-burning emissions are estimated in Table 3.2.12-3; the associated dust emissions are estimated in Table 3.2.12-5. These emissions are smaller in magnitude than the total emissions associated with New Build–Buried Fiber Optic Plant projects. Even if additional equipment, beyond the equipment assumed in these calculations, was needed, it is still unlikely that emissions would reach the major source or general conformity thresholds.
- Collocation on Existing Aerial Fiber Optic Plant: These projects could require replacement of existing wiring and poles. These emissions are expected to be smaller in magnitude than the total emissions associated with New Build–Aerial Fiber Optic Plant projects.
- New Build–Submarine Fiber Optic Plant: The deployment of large marine vessels to lay submarine cable is unlikely; however, small work boats (with engines similar to recreational vehicle engines) may be required to transport and lay small wired cable in limited near-shore or inland bodies of water, but emissions from these small marine sources would be negligible.
- Installation of Optical Transmission or Centralized Transmission Equipment: These projects could involve installation of boxes, huts, or other structures. Equipment delivery could require large trucks/trailers and installation could require cranes or skylifts. These projects could also require excavation and grading for new equipment and/or access roads. Therefore, emissions could include the sum of the emission estimates in Tables 3.2.12-4 and 3.2.12-5. Assuming at least 1 year of activity, these emissions are also below the 250- and 100-tpy thresholds.

Wireless Projects

Wireless projects would involve similar, but fewer, air emission sources than the previously discussed wired projects. Emissions associated with installation of towers and other structures are comparable to the estimates in Table 3.2.12-4. Potential air quality impacts associated with each type of wireless project are discussed below:

- New Wireless Communication Towers: These projects could involve installation of new wireless towers and associated structures (backup power generator and equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads). Installation emissions are expected to correspond to those listed in Table 3.2.12-4 (emissions associated with backup power generators are discussed in the Potential Operation Impacts section below). For example, monthly NOx emissions are the highest of all criteria pollutant emissions, at approximately 1.98 tons (based on the assumptions noted in Table 3.2.12-4); total NOx emissions for one tower, if construction lasted for a maximum of four months, would be approximately 8 tons. The annual estimate for each criteria pollutant is less than the major source permitting threshold of 250 tons. Additionally, emissions of CO, PM_{10}, and $PM_{2.5}$ would be expected to be approximately 2.7, 0.04, and 0.04 tons, respectively, each less than the 100-tpy general conformity threshold. Based on the assumptions stated in

Table 3.2.12-4, at least 32 such simultaneous tower installations would be needed for any criteria pollutant (based on the worst-case pollutant, NOx) to trigger the major source permitting threshold of 250 tpy. Similarly, at least 13 such simultaneous tower installations would be needed for any criteria pollutant (based on the worst-case pollutant, NOx) to trigger the general conformity threshold of 100 tpy. Even if additional equipment, beyond the equipment assumed in these calculations, was needed, it is still unlikely that emissions would reach the major source permitting threshold or general conformity threshold. As noted in Section 3.2.12.4, Potential Impacts of the Preferred Alternative, the mobile sources (non-road engines) are not subject to major source permitting requirements; only general conformity requirements could apply during deployment, and only if a project is located in a nonattainment or maintenance area in Alaska.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. Delivery and installation of equipment could require trucks and cranes that would generate air emissions. Additionally, these projects could require some work on structure foundations and thus concrete mixing equipment. Because these projects would not involve installation of new wireless towers and associated structures, air emissions are expected to be smaller in magnitude than the total emissions associated with New Wireless Communication Towers projects.

Deployable Technologies

Deployable technologies could potentially impact air quality because of their use of fuel-burning equipment, including first responder on-road vehicles, mobile power generators (diesel power generators are assumed as most likely fossil fuel technology; although gasoline-fueled and hydrogen-fueled generators could be an option), and aerial vehicles such as drones, airplanes, and blimps. In addition, some limited construction could be associated with the implementation of deployable technologies such as land clearing or paving for parking or staging areas.

During deployment, on-road vehicles could include light-duty trucks for Cell on Light Truck projects or heavy-duty trucks for Cell on Wheels and System on Wheels projects. Vehicle emissions are estimated in Tables 3.2.12-6 and 3.2.12-7; diesel generator emissions are discussed in the Potential Operation Impacts section. This deployment phase is expected to occur over a few days. Potential air quality impacts of the long-term implementation of the deployment technologies at deployment locations (some months to a year or more) are discussed in the Potential Operation Impacts section. Potential air quality impacts associated with each type of deployable technology project are discussed below.

Table 3.2.12-6: Combustion Emission Estimates from Heavy-Duty Vehicles

Pollutant	Emission Factor[a,b]	Estimated Emissions[c]	
	g/hp-hr	lb/day	tons/year
NOx[b]	2.28	22.1	0.022
CO	15.5	150	0.150
PM/PM_{10}/$PM_{2.5}$	0.1	0.97	0.001
VOC[b]	0.12	1.16	0.001

CO = carbon monoxide; g/hp-hr = grams per horsepower-hour; lb/day = pounds per day; NOx = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; VOC = volatile organic compound

[a] Emission factors taken from *40 Code of Federal Regulations 86.004-11(a)(1)* (*Emission Standards for 2004 and Later Model Year Diesel Heavy-Duty Engines and Vehicle*). Emission factors for PM, PM_{10}, and $PM_{2.5}$ were assumed to be the same. SO_2 emission factors were not provided for heavy-duty trucks but these are expected to be negligible due to the likely use of fuels with low sulfur content.

[b] NMHC/NOx (non-methane hydrocarbon compounds/nitrogen oxides) emission factor was split 5%/95% for VOC (assumed equal to NMHC) and NOx, respectively (based on California guidance [*CARB 2008*]).

[c] Emissions are estimated assuming one vehicle operates 8 hours per day, 2 days per year (one day for driving to location, one day for departing from location). Vehicle engine size was assumed to be 550 horsepower (typical tractor trailer engine specifications [*Caterpillar 2006*]). Driving emissions are larger than idling emissions; therefore, all operation was assumed to be driving at full capacity.

Table 3.2.12-7: Combustion Emission Estimates from Light-Duty Trucks

Pollutant	Emission Factor[a]	Estimated Emissions[b]	
	g/mi	lb/day	tons/year
NOx	0.9	0.794	0.001
CO	7.3	6.44	0.006
PM/PM_{10}/$PM_{2.5}$	0.12	0.106	0.0001
VOC[c]	0.28	0.247	0.0002

CO = carbon monoxide; g/mi = grams per mile; lb/day = pounds per day; NOx = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; VOC = volatile organic compound

[a] Emission factors taken from *40 Code of Federal Regulations 86.1811-04*, Table S04-1 (*Emission Standards for Light-Duty Vehicles, Light-Duty Trucks and Medium-Duty Passenger Vehicles*); emission limits were used as worst-case emission factors. Bin 11 vehicles were selected as worst-case scenario. Emission factors for PM, PM_{10}, and $PM_{2.5}$ were assume to be the same. SO_2 emission factors were not provided for light-duty trucks but these are expected to be negligible due to the likely use of fuels with low sulfur content.

[b] Emissions are estimated assuming one vehicle operates 8 hours per day, 2 days per year (one day for driving to location, one day for departing from location). Driving emissions are larger than idling emissions; therefore, all operation was assumed to be driving, with an average speed of 50 miles per hour.

[c] VOC emission factor assumed equal to non-methane organic compounds emission factor.

- Cell on Wheels: These projects could include a heavy-duty vehicle (large trailer) and mobile diesel generator. During deployment, the vehicle engines would power the vehicle while in motion on roadways (the diesel power generators are assumed to be off while the vehicle is in motion). Associated combustion emission estimates during the short-term deployment period (i.e., a few days) are presented in Table 3.2.12-6. If deployment (i.e., mobilization, setting up, and demobilization) lasted for 2 days per year (assume 8 hours per day), NOx emissions (as the worst-case pollutant) from a single Cell on Wheels/ heavy-duty vehicle would be approximately 0.022 ton. Additionally, annual CO, PM_{10}, and $PM_{2.5}$ emissions per unit of heavy-duty vehicle would be approximately 0.15, 0.001, and 0.001 ton, respectively. Based on the assumptions stated in Table 3.2.12-6, the project would need to involve over 11,300 Cell on Wheels systems deploying for 2 days per year, for NOx emissions to exceed the 250-tpy major source permitting threshold. At least 665 such systems would be needed to trigger general conformity requirements for CO, more than 103,000 such systems would be needed to trigger general conformity for PM_{10} or $PM_{2.5}$, and more than 4,520 such systems would be needed to trigger general conformity for NOx ($PM_{2.5}$ pre-cursor). Emissions of sulfur oxides (SOx), a $PM_{2.5}$ pre-cursor, were not quantified but are expected to be negligible due to the likely use of fuels with low sulfur content. Should these amounts of equipment be required during deployment (which is very unlikely), emissions could exceed the regulatory thresholds. As noted in Section 3.2.12.4, Potential Impacts of the Preferred Alternative, the mobile heavy-duty vehicles are not subject to major source permitting requirements. Therefore, only general conformity requirements could apply during deployment and only if a project is located in a nonattainment or maintenance area in Alaska.

- Cell on Light Truck: These projects could include a light-duty truck and diesel power generator. Associated combustion emission estimates during the short-term deployment period (i.e., a few days) are presented in Table 3.2.12-7. If deployment (i.e., mobilization, setting up, and demobilization) lasted for 2 days per year (assume 8 hours per day), NOx emissions (as the worst-case pollutant) would be less than 0.001 ton from the mobile light-duty vehicle. Annual CO, PM_{10}, and $PM_{2.5}$ emissions would be approximately 0.006, 0.0001, and 0.0001 ton, respectively. Based on the assumptions stated in Table 3.2.12-7, the project would need to involve approximately 315,000 Cell on Light Truck systems deploying for 2 days per year for NOx emissions to exceed the 250-tpy major source permitting threshold. At least 15,534 such systems would be needed to trigger general conformity requirements for CO; approximately 945,000 such systems would be needed to trigger general conformity for PM_{10} or $PM_{2.5}$, and approximately 126,000 such systems would be needed to trigger general conformity for NOx ($PM_{2.5}$ pre-cursor). SOx emissions (a $PM_{2.5}$ pre-cursor) were not quantified, but are expected to be negligible due to the likely use of fuels with low sulfur content. Should these amounts of equipment be required during deployment (which is very unlikely), emissions could exceed the regulatory thresholds. As noted in Section 3.2.12.4, Potential Impacts of the Preferred Alternative, the mobile light-duty vehicles are not subject to major source permitting requirements; only general conformity requirements could apply during deployment and only if a project is located in a nonattainment or maintenance area in Alaska.
- System on Wheels: These projects could include a heavy-duty vehicle (large trailer) and diesel power generator. Therefore, potential air quality impacts are expected to be similar to those for Cell on Wheels projects.
- Deployable Aerial Communications Architecture: These projects could involve mobilizing and demobilizing aerial vehicles including, but not limited to, unmanned aircraft such as drones and piloted aircraft such as airplanes, balloons, and blimps. As indicated above, the deployment phase is only expected to occur over a few days. Potential air quality impacts of the long-term implementation of the Deployable Aerial Communications Architecture at the deployment location (some months to a year or more) are discussed in the Potential Operation Impacts section. These projects could involve fossil fuel combustion (e.g., drone, airplane, and blimp engines), but the associated combustion emissions would not be

comparable to stationary source permitting thresholds. More detailed project information would be needed to model potential air emission impacts relative to local ambient air quality standards. However, most of the aerial vehicle emissions would occur at or above a few thousand feet above ground and are expected to dissipate before reaching ground level.

Satellites and Other Technologies

- Satellite-Enabled Devices and Equipment: Although it is expected that existing structures would be used, these projects could involve delivery and installation of equipment. The associated emissions can be estimated from the values in Table 3.2.12-4, although less equipment would likely be required, so emission estimates would likely be less than those values.

In general, the abovementioned activities could potentially involve fuel-burning construction equipment, dust from unpaved roads, first responder on-road vehicles, aerial platforms, and fossil fuel power generators. Increased air emissions associated with deployment of this infrastructure could potentially impact the surrounding community. However, increases in air emissions are not expected to exceed applicable major source permitting thresholds for the projects and potential air quality impacts are expected to be *less than significant* and could be further minimized with BMPs and mitigation measures incorporated. In addition, it is anticipated that any air pollution increase due to deployment would likely be short-term with pre-existing air quality levels generally achieved after some months (typically less than a year and could be as short as a few hours or days for some activities). BMPs and mitigation measures to help reduce these potential deployment-related impacts are described in Chapter 11.

Potential Impacts for Increased Air Emissions

Based on the analysis of the deployment activities described above, potential impacts as a result of increased air emissions are anticipated to be *less than significant* and can be further minimized with BMPs and mitigation measures incorporated for the deployment scenarios. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize the potential air quality impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be *less than significant* impacts to air quality associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections (i.e., air emissions would be infrequent and/or immeasurable). If use of heavy equipment or vehicles, outside of established access roads or corridors, occurs as part of routine maintenance or inspections, potential air quality impacts could result as explained above.

Operation activities associated with the Preferred Alternative could also involve the short-term (e.g., few weeks per year) operation of a fossil fuel-powered backup generator for wireless projects (e.g., to power a deployed antenna during upset conditions when commercial power is interrupted and during normal routine maintenance) as well as long-term (e.g., some months up to a year or more) operation of power generators (embedded in on-road vehicles) for land-based deployable technologies while stationed on-site. The types of infrastructure operation scenarios or activities that could be part of the Preferred Alternative and result in potential impacts to air quality include the following activities.

Wireless Projects

- New Wireless Communication Towers: Operation of these projects could involve the use of backup power generators, including those that operate by burning fossil fuels. Diesel-fueled backup power generators were assumed for this analysis; however, gasoline and hydrogen-fueled generators could be an option. The backup power generators would only operate during upset conditions when commercial power is interrupted and during normal routine maintenance (assumed a maximum of 500 hours per year for both upset conditions and normal routine maintenance). The diesel-fueled backup power generator emissions are provided in Table 3.2.12-8. Based on the assumptions stated in the table, these projects would need to involve at least 480 diesel generators rated at 67 horsepower and running 500 hours per year, for any pollutant emissions (NOx) to exceed the 250-tpy major source permitting threshold. At least 909 such generators would be needed to trigger general conformity requirements for CO; more than 2,700 such systems would be needed to trigger general conformity for PM_{10} or $PM_{2.5}$, more than 2,940 such systems would be needed to trigger general conformity for SO_2 ($PM_{2.5}$ pre-cursor), and more than 192 such systems would be needed to trigger general conformity for NOx ($PM_{2.5}$ pre-cursor). Should these amounts of equipment be required (which is very unlikely), emissions could exceed the corresponding regulatory thresholds for major source permitting or general conformity.
- Collocation on Existing Wireless Tower, Structure, or Building: Operation of these projects would likely not involve the use of additional backup power generators during operations unless the existing backup generator power rating is not large enough for the collocation project. If additional backup power generator is required at the existing site, the potential operation impacts for these projects are expected to be similar to those associated with the New Wireless Communication Towers project (see Table 3.2.12-8).

Table 3.2.12-8: Combustion Emission Estimates from Diesel Backup Power Generators at Wireless Communication Towers

Pollutant	Emission Factor[a]	Estimated Emissions[b]	
	lb/hp-hr	lb/year	tons/year
NOx	0.031	1,039	0.52
CO	0.00668	224	0.11
SOx	0.00205	68.7	0.034
$PM/PM_{10}/PM_{2.5}$	0.00220	73.7	0.037
VOC[c]	0.00251	84.2	0.042

CO = carbon monoxide; lb/hp-hr = pounds per horsepower-hour; lb/year = pounds per day; NOx = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; SOx = sulfur oxides; VOC = volatile organic compound

[a] Emission factors taken from AP-42, *Compilation of Air Pollutant Emission Factors*, Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1 (diesel engines) (*USEPA 1996*). Emission factors for PM, PM_{10}, and $PM_{2.5}$ were assume to be the same.

[b] Emissions are estimated assuming one, 67-horsepower diesel engine operates for 500 hours per year when commercial power is interrupted and during normal routine maintenance. Estimates can be directly scaled based on actual equipment size and operating schedule.

[c] VOC emissions are assumed equal to total organic compound emissions.

Deployable Technologies

Operation of land-based deployable technologies while stationed on-site could involve the use of power generators embedded on heavy-duty vehicles (Cell on Wheels and System on Wheels) and/or light-duty trucks (Cell on Light Truck). During operations, the generators would power the cell unit while the vehicle is on-site and stationary (vehicle engines would likely be turned off on-site). Associated combustion emission estimates during the long-term operation period (i.e., some months up to a year or more) are presented in Table 3.2.12-9. If operation of the land-based deployment technologies lasted for 363 days per year (assumes 24-hour continuous operation excluding 2 days a year for mobilization, setting up, and demobilization as discussed in the Potential Deployment Impacts section), NOx emissions (as the worst-case pollutant) from a single power generator embedded in each land-based deployment technology (Cell on Wheels, Cell on Light Truck, or System on Wheels) would be approximately 4.32 tons. Additionally, annual SOx, CO, PM_{10}, and $PM_{2.5}$ emissions per unit of heavy-duty vehicle would be approximately 0.29, 0.93, 0.31, and 0.31 ton, respectively. The Proposed Action would need to involve at least 58 land-based deployable technology systems operating continuously and simultaneously for 363 days per year for NOx emissions to exceed the 250-tpy major source permitting threshold. At least 107 such systems would be needed to trigger general conformity requirements for CO, approximately 323 such systems would be needed to trigger general conformity for PM_{10} or $PM_{2.5}$, approximately 345 such systems would be needed to trigger general conformity for SOx ($PM_{2.5}$ pre-cursor), and more than 23 such systems would be needed to trigger general conformity for NOx ($PM_{2.5}$ pre-cursor). Should these amounts of equipment be required during operations (which is very unlikely), emissions could exceed the regulatory thresholds.

Table 3.2.12-9: Combustion Emission Estimates from Diesel Generators on On-Road Vehicles Stationed On-Site

Pollutant	Emission Factor[a]	Estimated Emissions[b]	
	lb/hp-hr	lb/day	tons/year
NOx	0.031	23.8	4.32
CO	0.00668	5.1	0.93
SOx	0.00205	1.6	0.29
PM/PM_{10}/$PM_{2.5}$	0.00220	1.7	0.31
VOC[c]	0.00251	1.9	0.35

CO = carbon monoxide; lb/day = pounds per day; lb/hp-hr = pounds per horsepower-hour; NOx = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter up to 2.5 micrometers in diameter; PM_{10} = particulate matter up to 10 micrometers in diameter; SOx = sulfur oxides; VOC = volatile organic compound

[a] Emission factors taken from AP-42, *Compilation of Air Pollutant Emission Factors,* Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1 (diesel engines) (*USEPA 1996*). Emission factors for PM, PM_{10}, and $PM_{2.5}$ were assumed to be the same.

[b] Emissions are estimated assuming one, 32-horsepower diesel engine operates continuously (24 hours per day), 363 days per year (all year except for two travel days–see previous two tables). Estimates can be directly scaled based on actual equipment size and operating schedule.

[c] VOC emissions are assumed equal to total organic compound emissions.

Operation of aerial vehicles such as drones, airplanes, balloons, and blimps could involve fossil fuel combustion (e.g., from their engines), but the associated combustion emissions would not be comparable to stationary source permitting thresholds. Helicopters are not expected to be used for operations activities. More detailed information on the Proposed Action would be needed to model potential air emission impacts relative to local ambient air quality standards. However, most of the aerial vehicle emissions would occur at or above a few thousand feet above ground and are expected to dissipate before reaching ground level.

In general, the abovementioned activities could potentially involve dust from unpaved roads and combustion emissions from first responder on-road vehicles, aerial platforms, and fossil fuel power generators. Increased air emissions associated with operation of this infrastructure could potentially impact the surrounding community. However, increases in air emissions are not expected to exceed applicable major source permitting thresholds for most deployment scenarios and potential air quality impacts are expected to be *less than significant* and can be further minimized with BMPs and mitigation measures incorporated.

Based on the analysis of the operation activities described above, potential impacts as a result of increased air emissions are anticipated to be *less than significant* and can be further minimized with BMPs and mitigation measures incorporated. To minimize the effects of the Preferred Alternative on air quality, FirstNet and/or their partners would require, as practicable or feasible, implementation of the same BMPs and mitigation measures as those required for potential deployment impacts (see Chapter 11).

3.2.12.5. Alternatives Impact Assessment

The following section assesses potential impacts to air quality associated with the Deployable Technologies Alternative and the No Action Alternative.[7]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to air quality as a result of implementation of this alternative could be as described below.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil fuel-powered generators, first responder on-road vehicles, and/or aerial platforms. Some staging or landing areas (depending on the type of technology) could require excavation and grading. In the event that a limited number of equipment units are needed (consistent with the assumptions described above for the potential deployment impacts), these projects are expected to be *less than significant* and can be further minimized with BMPs and mitigation measures incorporated. However, should greater numbers of equipment or larger equipment be needed, potential impacts could become significant. These impacts would still be reduced through implementation of the BMPs and mitigation measures described in Chapter 11.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be *less than significant* impacts to air quality associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections; use of fossil fuel-powered generators would result in *less than significant* impacts and can be further minimized with BMPs and mitigation measures incorporated. If greater numbers of equipment or larger equipment are needed, potential impacts could become significant. Potential impacts could be reduced through implementation of BMPs and mitigation measures described in Chapter 11. If use of heavy equipment or vehicles outside of established access roads or corridors occurs as part of routine maintenance or inspections, additional potential air quality impacts could result as explained

[7] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

above. This alternative could also involve deploying aerial vehicles including, but not limited to, drones, blimps, and piloted aircraft, which could involve fossil fuel combustion. More information would be required regarding the number, type, and flight duration of the vehicles deployed to determine emissions from these technologies. However, most of the aerial vehicle emissions would occur at or above a few thousand feet above ground and are expected to dissipate before reaching ground level.

No Action Alternative

Under the No Action Alternative, the nationwide public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to air quality because there would be no deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.12, Air Quality.

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3.2.13. Noise

3.2.13.1. Introduction

This section describes potential impacts from noise in Alaska associated with deployment and operation of the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures. Unless otherwise stated, all references to noise in this section are airborne noise, specifically potential airborne noise impacts on humans. Potential airborne noise impacts on wildlife and underwater noise impacts on marine mammals and fish are discussed in Section 3.2.6, Biological Resources.

3.2.13.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on noise were evaluated using the significance criteria presented in Table 3.2.13-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of the potential noise impact, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to noise addressed in this section are presented as a range of possible impacts.

Table 3.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state/ territory noise limits. Noise levels plus baseline noise levels would exceed 10 dBA increase from baseline noise levels (i.e., louder).	Effect that is *potentially significant*, but with mitigation and/or BMPs is *less than significant*	Noise levels resulting from project activities would exceed natural sounds but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent	Borough or local		Borough or local	Borough or local
	Duration or Frequency	Permanent or long-term		Short-term	Temporary

dBA = A-weighted decibel(s)

3.2.13.3. Description of Environmental Concerns

Potential impacts to the community from increased noise levels could occur in a range of areas:

- Wilderness areas or pristine environments (including wildlife refuges, historic sites, ecological preserve areas, etc.) where natural quiet is expected;
- Rural and outer suburban areas with negligible traffic;
- General suburban areas with infrequent traffic, general suburban areas with medium density traffic; and
- Suburban areas with some commerce or industry.

These areas are most sensitive to increased noise levels because of their low to medium baseline day-night average noise levels, which typically range from 35 to 50 A-weighted decibels (dBA) (see Table 3.1.13-1). Urban areas are less susceptible to increased noise levels because of their higher average ambient noise levels.

Increased noise levels could result in community annoyance by interfering with speech and other human-related activities. Noise emissions associated with network deployment could potentially impact sensitive receptors (residences, hotels/motels/inns, hospitals, places of worship, schools, and recreational areas). The use of the following land-based and aerial deployable technologies could potentially impact such sensitive receptors:

- Wired and wireless technologies using heavy equipment such as excavators, backhoes, trenchers, graders, pavers, rollers, dump trucks, cranes, etc. required to support any construction/deployment activities;
- Land-based deployable technologies using power generators and first responder on-road vehicles (heavy-duty and light-duty trucks or vans); and
- Aerial deployable technologies, such as unmanned aircraft (e.g., drones) and piloted aircraft (e.g., airplanes, balloons, and blimps). Helicopters, if needed, would likely only be used during deployment to potentially move people or equipment to remote areas. As the use of helicopters would be infrequent, if at all, potential impacts associated with the use of helicopters are not evaluated here.

Over 50 percent of the wilderness areas in the United States are in Alaska. Some of the largest wilderness areas in Alaska (over a million acres) include, but are not limited to, Aleutian Islands, Andreafsky, Denali, Gates of the Arctic, Glacier Bay, Innoko, Katmai, Kenai, Lake Clarke, Misty Fjords National Monument, Mollie Beattie, Noatak, Togiak, and Wrangell-Saint Elias. Because sensitive areas such as wilderness and pristine environments, rural areas, and suburban areas are present in the Alaska, infrastructure may be built near these areas, in which case BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) would help avoid or minimize the potential impacts. In addition, it is anticipated that any potential noise increase due to deployment would likely be isolated within those locations and would be short-term, with pre-existing noise levels generally achieved after some months (typically less than a year and could be as short as a few hours or days for some activities such as pole construction).

3.2.13.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to noise and others would not. In addition, and as explained in this section, various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to noise under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Although existing conduits would be used, these projects could involve equipment used for cable pulling and blowing. Noise associated with this equipment would be infrequent and of a short duration and is not expected to produce perceptible impacts.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to noise. It is expected that no heavy equipment would be used and no new structure would be installed or erected as most activities would be conducted in existing huts.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact noise resources, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to noise as a result of implementation of the Preferred Alternative would encompass a range of potential impacts that could occur from on-road and off-road engines of heavy equipment during ground disturbance and installation activities. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to noise include the following:

Wired Projects

For buried wired projects, construction activities could include plowing (including vibratory plowing), trenching, or directional boring, depending on the nature of the terrain, geology, and environmental conditions. These activities could result in potential impacts to noise as a result of heavy equipment use during earth-work and material handling activities. Additional activities associated with buried wired projects include the installation of new or modified wired systems and the construction points of presence[1], huts, or other associated facilities could result in noise increases. Limiting distances for maximum noise levels associated with these buried wired project-related activities under hard[2] and soft[3] ground conditions are presented in Table 3.2.13-2.

For aerial wired projects, construction activities could include new wiring and poles that require use of auger trucks, boom trucks, and bucket lifts, as well as excavation and grading for new or modified right-of-ways or easements. Similar to buried wired projects, additional activities associated with aerial wired projects include the installation of new or modifications to existing wired systems and the construction points of presence, huts, or other associated facilities could result in noise increases. Limiting distances for maximum noise levels associated with these aerial wired project-related activities under hard and soft ground conditions are presented in Table 3.2.13-3.

In other cases, new buildings or structures could be required without the need for new or modified wired systems. In such cases, construction activities associated with the installation of transmission equipment would be required. Limiting distances[4] for maximum noise levels associated with transmission equipment installation under hard and soft ground conditions are presented in Table 3.2.13-4.

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[1] Points of presence are connections or access points between two different networks, or different components of one network.

[2] A hard site exists where noise travels away from the source over a generally flat, hard surface such as water, concrete, hard-packed soil, or other ground surfaces having a low porosity. These are examples of reflective ground, where the ground does not provide any attenuation. The standard attenuation rate for hard site conditions is 6 dBA per doubling of distance for point source noise (e.g., power generators, most construction activities, etc.) and 3 dBA per doubling of distance for line sources (e.g., highway traffic, conveyor belt, etc.) (*WSDOT 2015*).

[3] A soft site exist where noise travels away from the source over porous ground or normal unpacked earth capable of absorbing noise energy such as grass, trees, or other ground surfaces suitable for the growth of vegetation, such as farmland. An absorptive ground results in an additional 1.5 dBA reduction per doubling of distance at it spreads from the source. Added to the standard reduction rate for soft site conditions, point source noise attenuates at a rate of 7.5 dBA per doubling of distance, and line source noise decreases at a rate of 4.5 dBA per doubling of distance (*WSDOT 2015*).

[4] Limiting distances are distances beyond which an adverse effect would not occur.

Table 3.2.13-2: Limiting Distances for Maximum Noise Levels Associated with New Buried Wired Activities such as Plowing, Wire Installation, and Construction of Points of Presence and Fiber Huts

Noise Source[a,b]	Actual Measured Average Lmax at 50 Feet (dBA)[a]	Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[c]	Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[c]
Vibratory Plow[d]	80.0	889	500
Backhoe	78.0	706	416
Dozer	82.0	1,119	601
Flat-bed Truck	74.0	446	288
Pick-up Truck	75.0	500	315
Trench Roller[e]	80.0	889	500
Air Compressor	78.0	706	416
Cable Puller/Blower[f]	80.0	889	500
Concrete Mixer	79.0	792	456
Grader	89.0	2,506	1,145
Roller	80.0	889	500
Warning Horn	83.0	1,256	659
Total	**92.6**	**3,788**	**1,594**

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel
[a] Source: *WSDOT 2015*
[b] Maximum noise levels are based on operating one unit of typical equipment. It is not likely that more than one piece of each equipment type would be used at the same time. It is also unlikely that individual units of each equipment type listed in the table would be used concurrently; therefore, maximum noise levels and associated limiting distances presented in the table are conservative.
[c] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in WSDOT 2015. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.
[d] Lmax data for slurry trenching machine were assumed for vibratory plow.
[e] Lmax data for roller were assumed for trench roller.
[f] Lmax data for ventilation fan were assumed for cable puller/blower.

Table 3.2.13-3: Limiting Distances for Maximum Noise Levels Associated with New Aerial Wired Activities such as Excavation, Grading, and Pole Delivery and Installation

Noise Source[a,b]	**Actual Measured Average Lmax at 50 Feet (dBA)[a]**	**Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[c]**	**Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[c]**
Grader	89.0	2,506	1,145
Suction Excavator	81.0	998	548
Auger Truck[d]	84.0	1,409	723
Boom Truck[e]	81.0	998	548
Cable Puller/Blower[f]	80.0	889	500
Bucket Lift[e]	81.0	998	548
Flat-bed Truck	74.0	446	288
Warning Horn	83.0	1,256	659
Total	**92.4**	**3,717**	**1,570**

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel
[a] Source: *WSDOT 2015*
[b] Maximum noise levels are based on operating one unit of typical equipment. It is not likely that more than one piece of each equipment type would be used at the same time. It is also unlikely that individual units of each equipment type listed in the table would be used concurrently; therefore, maximum noise levels and associated limiting distances presented in the table are conservative.
[c] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in *WSDOT 2015*. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.
[d] Lmax data for auger drill rig were assumed for auger truck.
[e] Lmax data for truck mounted crane were assumed for boom truck and bucket lift.
[f] Lmax data for ventilation fan were assumed for cable blower.

Table 3.2.13-4: Limiting Distances for Maximum Noise Levels Associated with Tower, Structure, and Transmission Equipment Delivery and Installation

Noise Source[a,b]	**Actual Measured Average Lmax at 50 Feet (dBA)[a]**	**Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[c]**	**Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[c]**
Concrete Mixer	79.0	792	456
Flat-bed Truck	74.0	446	288
Grader	89.0	2,506	1,145
Paver	77.0	629	379
Roller	80.0	889	500
Truck Mounted Crane	81.0	998	548
Warning Horn	83.0	1,256	659
Total	**91.4**	**3,296**	**1,426**

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel
[a] Source: *WSDOT 2015*
[b] Maximum noise levels are based on operating one unit of typical equipment. It is not likely that more than one piece of each equipment type would be used at the same time. It is also unlikely that individual units of each equipment type listed in the table would be used concurrently; therefore, maximum noise levels and associated limiting distances presented in the table are conservative.
[c] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in *WSDOT 2015*. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.

Wired project deployment would also involve other on-road vehicle use, including worker transportation to and from work sites. However, these ancillary activities would be temporary and would produce negligible noise pollution. Potential noise impacts associated with each type of wired project are discussed below:

- New Build – Buried Fiber Optic Plant: These projects could result in increased noise levels due to use of heavy equipment for plowing (including vibratory plowing), trenching, or directional boring, as well as the construction of points of presence, huts, or other associated facilities or hand-holes to access fiber. The limiting distances for maximum noise levels associated with new buried wired activities are presented in Table 3.2.13-2. The table excludes noise associated with trenching and horizontal boring activities as these are expected to be lower or similar to plowing activities (i.e., only one of the three options could occur at a particular location depending on the nature of the terrain, geology, and environmental conditions). As indicated in Table 3.2.13-2, a maximum noise level of 93 dBA at 50 feet could be expected from New Build – Buried Fiber Optic Plant projects and residences or other sensitive receptors within 3,788 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 1,594 feet of these sources could be exposed to noise in excess of the 55 dBA criterion. Without BMPs and mitigation measures and/or if a wired project is situated in an area with low background sound levels such as wilderness area, pristine environments, rural areas, or suburban areas with infrequent traffic (see Table 3.1.13-1), the predicted maximum noise levels could substantially increase above background levels (i.e., 10 dBA or more above background levels) and residences and other sensitive receptors within these limiting distances could experience potential negative noise impacts. To minimize the potential short-term noise impacts to residences and other sensitive receptors within these limiting distances, BMPs and mitigation measures should be implemented for New Build – Buried Fiber Optic Plant projects and other similar wired projects.
- New Build – Aerial Fiber Optic Plant: These projects would not require plowing, trenching, or directional boring. However, they could require construction of new wiring and poles, as well as excavation and grading for new or modified right-of-ways or easements. The limiting distances for maximum noise levels associated with new buried wired activities are presented in Table 3.2.13-3. As indicated in the table, a maximum noise level of 92 dBA at 50 feet could be expected from New Build – Aerial Fiber Optic Plant projects and residences or other sensitive receptors within 3,717 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 1,570 feet of these sources could be exposed to noise in excess of the 55 dBA criterion. These noise increases are similar but slightly smaller in magnitude than those associated with the New Build - Buried Fiber Optic Plant projects.

- Collocation on Existing Aerial Fiber Optic Plant: These projects would not require plowing, trenching, or directional boring. However, they could require replacement of existing wiring and poles (i.e., equipment installation). The maximum noise increases for these projects would be smaller in magnitude than those associated with the New Build - Aerial Fiber Optic Plant projects.
- New Build – Submarine Fiber Optic Plant: The installation of cables in limited near-shore or inland bodies of water could potentially impact aquatic and/marine resources (fish and marine mammals) due to increased underwater noise from small marine vessels (similar to recreational vessels). Potential impacts to airborne noise could potentially occur as a result of the construction of landings and/or facilities on shore to accept submarine cable. Increased airborne and underwater noise is expected to result in similar potential noise impacts to the other New Build projects. Additional information on potential underwater noise impacts on marine mammals and fish is discussed in Section 3.2.6, Biological Resources.
- Installation of Optical Transmission or Centralized Transmission Equipment: These projects could involve installation of boxes, huts, or other structures. Equipment delivery could require large trucks/trailers and installation could require cranes or skylifts. These projects could also require excavation and grading for new equipment and/or access roads. The limiting distances for maximum noise levels associated with installation of transmission equipment are presented in Table 3.2.13-4. As indicated in the table, a maximum noise level of 92 dBA at 50 feet could be expected from these projects and residences or other sensitive receptors within 3,656 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 1,549 feet of these sources could be exposed to noise in excess of the 55 dBA criterion. These noise increases are similar to those for the New Build – Aerial Fiber Optic Plant projects.

Wireless Projects

Wireless projects would involve similar, but fewer, noise sources than the previously discussed wired projects. Noise increases associated with installation of towers and other structures are comparable to the estimates in Table 3.2.13-4. Potential noise impacts associated with each type of wireless project are discussed below:

- New Wireless Communication Towers: These projects could involve installation of new wireless towers and associated structures (power generator and equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads). Installation noise levels are expected to correspond to those listed in Table 3.2.13-4. Therefore, a maximum noise level of 91 dBA at 50 feet could be expected from these projects and residences or other sensitive receptors within 3,296 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 1,426 feet of these sources could be exposed to noise in excess of the 55 dBA criterion.

Without BMPs and mitigation measures and/or if a wireless project is situated in an area with low background sound levels such as wilderness areas, pristine environments, rural areas, or suburban areas with infrequent traffic (see Table 3.1.13-1), the predicted maximum noise levels could substantially increase above background levels (i.e., 10 dBA or more above background levels) and residences and other sensitive receptors within these limiting distances could experience potential negative noise impacts. BMPs and mitigation measures could be implemented for New Wireless Communication Towers projects and other similar wireless projects to further reduce potential impacts.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. Delivery and installation of equipment could require trucks and cranes that would generate noise. Additionally, these projects could require some work on structure foundations and thus concrete mixing equipment. Because these projects would not involve installation of new wireless towers and associated structures, expected maximum noise increases and limiting distances to the 55 dBA criterion would be smaller in magnitude than those for the New Wireless Communication Towers project. Table 3.2.13-5 shows that a maximum noise level of 86 dBA at 50 feet could be expected from these projects, and residences or other sensitive receptors within 1,844 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 896 feet of these sources could be exposed to noise in excess of the 55 dBA criterion.

Table 3.2.13-5: Limiting Distances for Maximum Noise Levels Associated with Collocation on Existing Wireless Tower, Structure, or Building

Noise Source[a,b]	Actual Measured Average Lmax at 50 Feet (dBA)[a]	Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[c]	Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[c]
Concrete Mixer	79.0	792	456
Flat-bed Truck	74.0	446	288
Truck Mounted Crane	81.0	998	548
Warning Horn	83.0	1,256	659
Total	**86.3**	**1,844**	**896**

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel
[a] Source: *WSDOT 2015*
[b] Maximum noise levels are based on operating one unit of typical equipment. It is not likely than more than one piece of each equipment type would be used at the same time. It is also unlikely that all individual units of each equipment type listed in the table would be used concurrently; therefore, maximum noise levels and associated limiting distances presented in the table are conservative.
[c] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in WSDOT 2015. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.

<u>Deployable Technologies</u>

Implementation of deployable technologies could result in potential impacts to noise from use of power generators and first responder on-road vehicles and aerial platforms. On-road vehicles could include light-duty trucks for Cell on Light Truck projects or heavy-duty trucks for Cell on Wheels and System on Wheels projects. Aerial platforms could include drones, airplanes, balloons, and blimps. In addition, some limited construction could be associated with the implementation of deployable technologies such as land clearing or paving for parking or staging areas. Noise levels associated with deployable technologies during deployment (including mobilization to the destination site, setting up, and demobilization) are estimated in Table 3.2.13-6.

Table 3.2.13-6: Limiting Distances for Maximum Noise Levels Associated with Deployable Technologies Implementation—Short-Term

Noise Source[a,b,c]	Actual Measured Average Lmax at 50 Feet (dBA)[a,b]	Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[d]	Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[d]
Cell on Wheels or System on Wheels			
Heavy-duty Vehicle or Large Trailer (1 Unit)[e]	76.0	561	346
Heavy-duty Vehicle or Large Trailer (2 Units)[e]	79.0	793	456
Heavy-duty Vehicle or Large Trailer (3 Units)[e]	80.8	792	537
Heavy-duty Vehicle or Large Trailer (4 Units)[e]	82.0	1,122	602
Heavy-duty Vehicle or Large Trailer (5 Units)[e]	83.0	1,254	659
Cell on Light Truck			
Light-duty Truck (1 Unit)[f]	75.0	500	315
Light-duty Truck (2 Units)[f]	78.0	707	416
Light-duty Truck (3 Units)[f]	79.8	866	490
Light-duty Truck (4 Units)[f]	81.0	1,000	549
Light-duty Truck (5 Units)[f]	82.0	1,118	601
Deployable Aerial Communication Architecture			
Unmanned Aircraft - Drone Takeoff or Landing (1 Unit)[g, h]	82.0	1,125	603
Unmanned Aircraft - Drone Take-off or Landing (2 Units)[g, h]	85.1	1,591	796
Unmanned Aircraft - Drone Take-off or Landing (3 Units)[g, h]	86.8	1,948	936
Unmanned Aircraft - Drone Take-off or Landing (4 Units)[g, h]	88.1	2,249	1,051
Unmanned Aircraft - Drone Take-off or Landing (5 Units)[g, h]	89.0	2,515	1,149
Piloted Aircraft - Plane Flyover (1 Unit)[i]	114.0	44,668	11,476
Piloted Aircraft - Plane Flyover (2 Units)[i]	117.0	63,171	15,143

Noise Source[a,b,c]	Actual Measured Average Lmax at 50 Feet (dBA)[a,b]	Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[d]	Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[d]
Piloted Aircraft - Plane Flyover (3 Units)[i]	118.8	77,368	17,809
Piloted Aircraft - Plane Flyover (4 Units)[i]	120.0	89,337	19,981
Piloted Aircraft - Plane Flyover (5 Units)[i]	121.0	99,881	21,847
Piloted Aircraft - Blimps (1 Unit)[j]	85.6	1,687	835
Piloted Aircraft - Blimps (2 Units)[j]	88.6	2,386	1,101
Piloted Aircraft - Blimps (3 Units)[j]	90.3	2,922	1,295
Piloted Aircraft - Blimps (4 Units)[j]	91.6	3,374	1,453
Piloted Aircraft - Blimps (5 Units)[j]	92.6	3,772	1,589

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel; NA = not applicable
[a] Source of Lmax data for Cell on Wheels, Cell on Light Truck, and System on Wheels: *WSDOT 2015*
[b] Source of Lmax data for Deployable Aerial Communication Architecture: *Hodgson et al 2013* and *WSDOT 2015*
[c] Maximum noise levels for deployable technologies are based on operating one to five units of vehicle type, depending on the size of the coverage area.
[d] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in *WSDOT 2015*. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.
[e] Lmax data for dump truck were assumed for heavy-duty vehicle (large trailer).
[f] Lmax data for pick-up truck were assumed for light-duty truck.
[g] Lmax data for drone take-off were based on noise levels of a ScanEagle Unmanned Aerial Vehicle (85 to 90 dBA) at 6 meters (20 feet) (*Hodgson et al. 2013*). The 90 dBA maximum level at 20 feet was assumed for this analysis. The noise level at 20 feet was converted using typical logarithmic equations to reference noise levels at 50 feet.
[h] Lmax data for drone landing were assumed to equal to that for drone take-off.
[i] Lmax data for airplane flyover (120 dBA) at 1,000 feet were taken from *Purdue University 2015*. The noise level at 1,000 feet was converted using typical logarithmic equations to reference noise levels at 50 feet.
[j] Lmax data for blimps were based on noise levels of a Goodyear blimp with two 210-horsepower engines with a total of 110 dBA just outside of a gondola (assume 3 feet away) (*Goodyear Blimp 2015*). A gondola is a passenger compartment suspended beneath a balloon or airship. The 110 dBA maximum level at 3 feet was assumed for this analysis. The noise level at 3 feet was converted using typical logarithmic equations to reference noise levels at 50 feet.

This deployment phase is expected to occur over a few days. Potential noise impacts of the long-term implementation of this technology at the deployment location (some months to a year or more) are discussed in the operation impact section. Potential noise impacts associated with each type of deployable technology project are discussed below.

- Cell on Wheels: These projects could include noise sources such as a heavy-duty vehicle (with large trailer) and power generators. During deployment, the vehicle engines would power the vehicle while in motion on roadways (the power generators are assumed to be off while the vehicle is in motion). The limiting distances for maximum noise levels associated with Cell on Wheels projects during the short-term deployment period (i.e., a few days) are presented in Table 3.2.13-6. As indicated in the table, a maximum noise level of 76 dBA at 50 feet could be expected per unit of heavy-duty vehicle and residences or other sensitive receptors within 561 feet of each heavy-duty vehicle could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 346 feet of each heavy-duty vehicle could be exposed to noise in excess of the 55 dBA criterion. Without BMPs and mitigation measures and/or if a deployable technologies project is situated in an area with low background sound levels such as wilderness area, pristine environments, rural areas, or suburban areas with infrequent traffic (see Table 3.1.13-3), the predicted maximum noise levels could substantially increase above background levels (i.e., 10 dBA or more above background levels) and residences and other sensitive receptors within these limiting distances could experience potential negative noise impacts. The expected maximum noise levels and limiting distances to the 55 dBA criterion during the short-term deployment period (i.e., a few days) is dependent on the type of deployed technology and the number of deployed units per affected area. For example, if Cell on Wheels technology were to be deployed in a rural area such as Galena Town (approximately 24 square miles) in Alaska and assuming the Cell on Wheel technology can provide 10-mile diameter coverage, it would require only one heavy-duty vehicle or large trailer to cover the entire town. The maximum noise level associated with this land-based deployment technology (i.e., one heavy-duty vehicle) in Galena Town would be approximately 76 dBA at 50 feet. Given the extent of permafrost and/ or the large portion of the year in which the ground is frozen (i.e., hard ground conditions), Galena residences or other sensitive receptors within 561 feet of the single heavy-duty vehicle could be exposed to noise in excess of the 55 dBA criterion. To minimize the potential noise impacts to residences and other sensitive receptors within these limiting distances, BMPs and mitigation measures could be implemented for Cell on Wheels projects and other similar deployable technology projects.

- Cell on Light Truck: These projects could include a light-duty truck and power generator. As indicated above, generator noise is discussed in the operation impact section. The expected maximum noise levels and limiting distances to the 55 dBA criterion during the short-term deployment period (i.e., a few days) is dependent on the type of deployed technology and the number of deployed units per affected area (Table 3.2.13-6). For example, if Cell on Light Truck technology were to be deployed in a rural area such as Galena Town (approximately 24 square miles) in Alaska and assuming the Cell on Light Truck technology can provide 2-mile diameter coverage, it would require approximately three light-duty trucks to cover the entire town. The maximum noise level associated with this land-based deployment technology (i.e., 3 light-duty trucks) in Galena Town is approximately 80 dBA at 50 feet. Given the extent of permafrost and/ or the large portion of the year in which the ground is frozen (i.e., hard ground conditions), Galena residences or other sensitive receptors within 866 feet of the light-duty trucks could be exposed to noise in excess of the 55 dBA criterion.
- System on Wheels: These projects could include a heavy-duty vehicle (large trailer) and power generator (i.e., same noise sources as Cell on Wheels technology). As indicated above, the generator noise is discussed in the operation impact section. Therefore, expected maximum noise levels and limiting distances to the 55 dBA criterion would be similar to those for the Cell on Wheels projects (Table 3.2.13-6).
- Deployable Aerial Communications Architecture: These projects could involve mobilizing and demobilizing aerial vehicles, including, but not limited to, drones, airplanes, balloons, and blimps. As indicated above, the deployment phase is only expected to occur over a few days. Potential noise impacts of the long-term implementation of the Deployable Aerial

Communications Architecture at the deployment location are discussed in the operation impact section. The aerial vehicles typically generate loud noises during take-off and landing operations. During the short-term deployment period (i.e., a few days), the maximum noise levels for a single aerial vehicle take-off or landing are expected to range from 82 dBA at 50 feet for a drone to 114 dBA at 50 feet for an airplane. As such, residences or other sensitive receptors within 1,125 to 44,668 feet (0.21 to 8.5 miles) of these aerial vehicles could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 603 to 11,476 feet (0.11 to 2.2 miles) of these aerial vehicles could be exposed to noise in excess of the 55 dBA criterion (Table 3.2.13-6). It is unlikely that take-off or landing of aerial vehicles would occur concurrently at the same location; however, if this were to occur, total noise increases and limiting distances to the 55 dBA criterion would increase as well (Table 3.2.13-6). For overflight operations, most of the noise would occur at a few thousand feet above ground level and could be perceived by sensitive receptors on the ground but for a short-term/intermittent period.

The short-term and intermittent noise increases associated with the aerial vehicles take-off and landings would be higher than those for the Cell on Wheels, Cell on Light Truck, and System on Wheels projects. The expected maximum noise levels and limiting distances for the 55 dBA criterion during the short-term deployment period (i.e., few days) is dependent on the type of deployed aerial technology and the number of deployed units per affected area. For example, if an unmanned aircraft such as a drone were to be deployed in or near Denali National Park (approximately 3,045 square miles) and assuming the drone can provide 15-mile diameter coverage, it would require approximately four to five drones to cover the entire national park.

The maximum noise level associated with this Deployable Aerial Communication Architecture (i.e., the four to five drones taking off or landing) in or near Denali National Park would range from 88 to 89 dBA at 50 feet. Because the ground conditions at national parks and wilderness areas in Alaska are typically hard (due to permafrost and/or frozen ground most of the year) sensitive receptors within 2,249 and 2,515 feet of the drone take-offs and landings could be exposed to noise in excess of the 55 dBA criterion. If piloted aircraft are used, the corresponding noise levels would be higher and sensitive receptors at larger distances from the source (piloted aircraft) would be exposed to noise above 55 dBA. For example, if a piloted aircraft such as a two-engine airplane were to be deployed in or near Denali National Park (3,045 square miles) and assuming the two-engine airplane can also provide 15-mile diameter coverage, it would require four to five two-engine airplanes to cover the entire park. The maximum noise level associated with this Deployable Aerial Communication Architecture (i.e., the four to five two-engine airplanes taking off or landing) in or near Denali National Park would range from approximately 120 to 121 dBA at 50 feet. Because the ground conditions at national parks and wilderness areas in Alaska are typically hard (due to permafrost and/or frozen ground most of the year), sensitive receptors within 89,337 to 99,881 feet (16.9 to 18.9 miles) of the four to five two-engine airplane take-offs or landings could be exposed to noise in excess of the 55 dBA criterion.

<u>Satellites and Other Technologies</u>

- Satellite-Enabled Devices and Equipment: Although it is expected that existing structures would be used, these projects could involve delivery and installation of equipment. The associated noise increases can be estimated from the values in Table 3.2.13-4 above, although less equipment would likely be required, so noise increases and limiting distances to the 55 dBA criterion under hard and soft ground conditions would likely be less than those values.

Increased Noise Levels during Deployment

In general, the abovementioned activities could potentially involve heavy equipment movement associated with ground disturbance, equipment delivery, and installation, as well as operation of power generators, and first responder on-road vehicles, and aerial platforms. Increased noise levels associated with deployment of this infrastructure could potentially impact the surrounding community. BMPs and mitigation measures could help reduce these potential impacts during deployment activities. Based on the analysis of the deployment activities described above, potential impacts as a result of increased noise levels are anticipated to be *less than significant* since these potential impacts would generally be temporary and limited to areas near deployment locations. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential noise impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be minimal potential impacts to noise associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections (i.e., noise from pick-up truck driven by inspector would be infrequent and/or immeasurable). If use of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, potential noise impacts could result as explained above.

Operation activities associated with the Preferred Alternative could also involve prolonged operation of a fossil fuel-powered generator (e.g., to power a deployed antenna), aerial vehicles (drones, airplanes, balloons, and blimps), and other support equipment such as ventilation fans associated with heating, ventilation, and air cooling at fiber huts or central offices. Helicopters are not expected to be used for operations activities. Such operation would result in increased noise levels over extended periods. The types of infrastructure operation scenarios or activities that could be part of the Preferred Alternative and result in potential impacts to noise include the following:

Wireless Projects

- New Wireless Communication Towers: Operation of these projects could involve the use of power generators and ventilation fans at fiber huts or central offices. Table 3.2.13-7 indicates a maximum noise level of 83 dBA at 50 feet could be expected from extended use of power generators and ventilation fans and as such, residences or other sensitive receptors within 1,274 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 667 feet of these sources could be exposed to noise in excess of the 55 dBA criterion. Without BMPs and mitigation measures and/or if a wireless project is situated in an area with low background sound levels such as wilderness area, pristine environments, rural areas, or suburban areas with minimum traffic (see Table 3.1.13-3), the predicted maximum noise levels could substantially increase above background levels (i.e., 10 dBA or more above background levels) and residences and other sensitive receptors within these limiting distances could experience potential negative noise impacts. To minimize the potential long-term noise impacts to residences and other sensitive receptors within these limiting distances, BMPs and mitigation measures should be implemented, as practicable or feasible, for New Wireless Communication Towers projects and other similar wireless projects.
- Collocation on Existing Wireless Tower, Structure, or Building: In the event that additional onsite backup power is required, for reasons of FirstNet's requirements for resiliency and redundancy, operation of these projects could involve the use of power generators (Table 3.2.13-7). If additional power generators are required, the potential operation impacts for these projects are expected to be similar but slightly less than those associated with the New Wireless Communication Towers project. If additional power generators are not required, the potential operation noise impact for these projects would be negligible.

Table 3.2.13-7: Limiting Distances for Maximum Noise Levels Associated with Power Generators and Ventilation Fans at Fiber Huts or Central Offices

Noise Source[a,b]	Actual Measured Average Lmax at 50 Feet (dBA)[a]	Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[c]	Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[c]
Power Generator	81.0	998	548
Ventilation Fan	79.0	792	456
Total	**83.1**	**1,274**	**667**

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel
[a] Source: *WSDOT 2015*
[b] Maximum noise levels are based on operating one unit of typical equipment. It is not likely that more than one piece of each equipment type would be used at the same time. It is also unlikely that individual units of each equipment type listed in the table would be used concurrently; therefore, maximum noise levels and associated limiting distances presented in the table are conservative.
[c] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in *WSDOT 2015*. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.

Deployable Technologies

Operation of land-based deployable technologies while stationed on-site could involve the use of power generators embedded on heavy-duty vehicles (Cell on Wheels and System on Wheels) and/or light-duty trucks (Cell on Light Truck) (Table 3.2.13-8). As indicated in the table, a maximum noise level of approximately 61 dBA at 50 feet could be expected per unit of power generator, and residences or other sensitive receptors within 103 feet of these sources could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 89 feet of each power generator could be exposed to noise in excess of the 55 dBA criterion.

The expected maximum noise levels and limiting distances to the 55 dBA criterion during the long-term deployment period (i.e., some months to a year or more) is dependent on the type of deployed land-based technology and the number of deployed units per affected area. For example, if Cell on Wheels technology were to be deployed in a rural area such as Galena Town (approximately 24 square miles) in Alaska and assuming the Cell on Wheel technology can provide 10-mile diameter coverage, it would require only one power generator (embedded in a heavy-duty vehicle or large trailer) to cover the entire town. The maximum noise level associated with this land-based deployment technology (i.e., one power generator) in Galena Town would be approximately 61 dBA at 50 feet. Given the extent of permafrost and/or the large portion of the year in which the ground is frozen (i.e., hard ground conditions), Galena residences or other sensitive receptors within 103 feet of the power generator could be exposed to noise in excess of the 55 dBA criterion.

These projects could involve aerial vehicles, including, but not limited to, drones, airplanes, balloons, and blimps. Aerial vehicle take-off and landing operations typically generate loud noises. The magnitude of noise generated by these aerial vehicles would be similar to those described in the short-term deployment phase but would occur over a longer period (i.e., some months to a year or more). During the long-term deployment period, the maximum noise level is expected to range from approximately 82 dBA at 50 feet for a drone take-off or landing to 114 dBA at 50 feet for an airplane. As such, residences or other sensitive receptors within 1,125 and 44,668 feet (0.21 to 8.5 miles) of each aerial vehicle take-off or landing could be exposed to noise in excess of the 55 dBA criterion under hard ground conditions. Similarly, under soft ground conditions, residences or other sensitive receptors within 603 to 11,476 feet (0.11 to 2.2 miles) of each aerial vehicle operation could be exposed to noise in excess of the 55 dBA criterion (Table 3.2.13-8). It is unlikely that take-off and landing of aerial vehicles would occur concurrently at the same location; however, if this were to occur, total noise increases and limiting distances to the 55 dBA criterion would increase as well (Table 3.2.13-8). For overflight operations, most of the aerial vehicle noise would occur at a few thousand feet above ground level and could be perceived by sensitive receptors on the ground but for a short-term/intermittent period. The short-term and intermittent noise increases associated with the aerial vehicle take-off and landing would be higher than those for the land-based deployment technologies.

Table 3.2.13-8: Limiting Distances for Maximum Noise Levels Associated with Deployable Technologies Implementation – Long-Term

Noise Source[a,b,c]	Actual Measured Average Lmax at 50 Feet (dBA)[a,b]	Threshold Distance to 55 dBA Noise Criterion Under Hard Ground Conditions (Feet)[d]	Threshold Distance to 55 dBA Noise Criterion Under Soft Ground Conditions (Feet)[d]
Cell on Wheels, Cell on Light Truck, or System on Wheels			
Power Generator (1 Unit)	61.3	103	89
Power Generator (2 Units)	64.3	145	117
Power Generator (3 Units)	66.0	178	138
Power Generator (4 Units)	67.3	205	155
Power Generator (5 Units)	68.2	230	169
Deployable Aerial Communication Architecture			
Unmanned Aircraft - Drone Takeoff or Landing (1 Unit)[e,f]	82.0	1,125	603
Unmanned Aircraft - Drone Takeoff or Landing (2 Units)[e,f]	85.1	1,591	796
Unmanned Aircraft - Drone Takeoff or Landing (3 Units)[e,f]	86.8	1,948	936
Unmanned Aircraft - Drone Takeoff or Landing (4 Units)[e,f]	88.1	2,249	1,051
Unmanned Aircraft - Drone Takeoff or Landing (5 Units)[e,f]	89.0	2,515	1,149
Piloted Aircraft - Plane Flyover (1 Unit)[g]	114.0	44,668	11,476
Piloted Aircraft - Plane Flyover (2 Units)[g]	117.0	63,171	15,143
Piloted Aircraft - Plane Flyover (3 Units)[g]	118.8	77,368	17,809
Piloted Aircraft - Plane Flyover (4 Units)[g]	120.0	89,337	19,981
Piloted Aircraft - Plane Flyover (5 Units)[g]	121.0	99,881	21,847
Piloted Aircraft - Blimps (1 Unit)[h]	85.6	1,687	835
Piloted Aircraft - Blimps (2 Units)[h]	88.6	2,386	1,101
Piloted Aircraft - Blimps (3 Units)[h]	90.3	2,922	1,295
Piloted Aircraft - Blimps (4 Units)[h]	91.6	3,374	1,453
Piloted Aircraft - Blimps (5 Units)[h]	92.6	3,772	1,589

Lmax = maximum value of a noise level that occurs during a single event; dBA = A-weighted decibel; NA = not applicable
[a] Source of Lmax data for Cell on Wheels, Cell on Light Truck, and System on Wheels: *WSDOT 2015*
[b] Source of Lmax data for Deployable Aerial Communication Architecture: *Hodgson et al 2013* and *WSDOT 2015*
[c] Maximum noise levels for deployable technologies are based on operating one to five units of vehicle type, depending on the size of the coverage area.
[d] Threshold distances to 55 dBA noise criterion were calculated in accordance with the equation and methodology (accounting for hard and soft ground conditions) described in WSDOT 2015. The calculations do not include the effects, if any, of atmospheric absorption, screening obstacles/barriers (e.g., earthen berm, buildings), or foliage that could reduce sound levels and limiting distances further.
[e] Lmax data for drone take-off were based on noise levels of a ScanEagle Unmanned Aerial Vehicle (85 to 90 dBA) at 6 meters (20 feet) (*Hodgson et al. 2013*). The 90 dBA maximum level at 20 feet was assumed for this analysis. The noise level at 20 feet was converted using typical logarithmic equations to reference noise levels at 50 feet.
[f] Lmax data for drone landing were assumed to equal to that for drone take-off.
[g] Lmax data for airplane flyover (120 dBA) at 1,000 feet were taken from *Purdue University 2015*. The noise level at 1,000 feet was converted using typical logarithmic equations to reference noise levels at 50 feet.
[h] Lmax data for blimps were based on noise levels of a Goodyear blimp with two 210-horsepower engines with a total of 110 dBA just outside of a gondola (assume 3 feet away) (*Goodyear Blimp 2015*). A gondola is a passenger compartment suspended beneath a balloon or airship. The 110 dBA maximum level at 3 feet was assumed for this analysis. The noise level at 3 feet was converted using typical logarithmic equations to reference noise levels at 50 feet.

The expected maximum noise levels and limiting distances to the 55 dBA criterion during the long-term deployment period (i.e., some months to a year or more) is dependent on the type of deployed aerial technology and the number of deployed units per affected area. For example, if an unmanned aircraft such as a drone were to be deployed in or near Denali National Park (approximately 3,045 square miles) and assuming the drone can provide 15-mile diameter coverage, it would require approximately four to five drones to cover the entire national park. The maximum noise level associated with this Deployable Aerial Communication Architecture (i.e., the four to five drones taking off or landing) in or near Denali National Park would range from 88 to 89 dBA at 50 feet. Because the ground conditions at national parks and wilderness areas in Alaska are typically hard (due to permafrost and/or frozen ground conditions most of the year), sensitive receptors within 2,249 and 2,515 feet (0.43 to 0.48 mile) of these drones could be exposed to noise in excess of the 55 dBA criterion. If piloted aircraft are used, the corresponding noise levels would be higher and sensitive receptors at larger distances from the source (piloted aircraft) would be exposed to noise above 55 dBA. For example, if a piloted aircraft such as a two-engine airplane were to be deployed in or near Denali National Park (3,045 square miles) and assuming the two-engine airplane can also provide 15-mile diameter coverage, it would require only four to five two-engine airplanes to cover the entire park. The maximum noise level associated with this Deployable Aerial Communication Architecture (i.e., the four to five two-engine airplanes taking off or landing) in or near Denali National Park would be approximately 120 to 121 dBA at 50 feet. Because the ground conditions at national parks and wilderness areas in Alaska are typically hard (due to permafrost and/or frozen ground conditions most of the year), sensitive receptors within 89,337 and 99,881 feet (16.9 to 18.9 miles) of the four to five two-engine airplane take-offs or landings could be exposed to noise in excess of the 55 dBA criterion.

Increased Noise Levels during Operations

In general, the abovementioned activities could potentially generate noise from extended use of power generators, and aerial vehicles. Increased noise levels associated with operation of this infrastructure could potentially impact the surrounding community. BMPs and mitigation measures could help reduce these potential impacts during operation activities.

Based on the analysis of the operation activities described above, potential impacts as a result of increased noise levels are anticipated to be *less than significant*. To minimize the effects of the Preferred Alternative on noise during operation activities, FirstNet and/or their partners would require, as practicable or feasible, implementation of BMPs and mitigation measures described in Chapter 11.

3.2.13.5. Alternatives Impact Assessment

The following section assesses potential impacts to noise associated with the Deployable Technologies Alternative and the No Action alternative.[5]

[5] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts from noise as a result of implementation of this alternative could be as described below.

Potential Deployment Impacts

As explained above, implementation of deployable technologies could result in *less than significant* potential impacts to noise if deployment requires use of heavy equipment, power generators, first responder on-road vehicles, and/or aerial platforms. Some staging or landing areas (depending on the type of technology) could require land/vegetation clearing, minimal excavation, and paving. In comparison to the Deployable Technologies Alternative implemented as part of the Preferred Alternative (Table 3.2.13-6), these activities would likely be implemented in greater number over a larger geographic extent, and used in greater frequency and duration. Therefore, the maximum noise increases and limiting distances to sensitive receptors for this alternative are expected to be greater in magnitude than those listed in Table 3.2.13-6. These activities would result in increased noise levels as well, but again these potential impacts are expected to be *less than significant*.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that potential noise impacts associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections, and the use of power generators, aerial vehicles, and ventilation fans on fiber huts or central offices are expected to be *less than significant*. If use of heavy equipment or vehicles outside of established access roads or corridors occurs as part of routine maintenance or inspections, potential noise impact could result as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to noise as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 3.1.13, Noise.

3.2.14. Climate Change

3.2.14.1. Introduction

This section presents future climate change projections for temperature, precipitation, sea-level rise (SLR), permafrost, and sea ice loss. It also describes potential greenhouse gas (GHG) emissions arising from deployment and operation of the Proposed Action and alternatives, the effects of climate change in Alaska on the Proposed Action and alternatives. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.14.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of climate change on the Proposed Action were evaluated using the significance criteria presented in Table 3.2.14-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of the potential climate change effects, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts of climate change on the Proposed Action and the potential GHG emissions arising from the Proposed Action are addressed in this section as a range of possible impacts.

Table 3.2.14-1: Impact Significance Rating Criteria for Climate Change

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000[a] metric tons of CO_2e/year, and global level effects observed.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Only slight change observed.	There would be no increase in GHG emissions or related changes to the climate as a result of the Proposed Action activities.
	Geographic Extent	NA		NA	NA
	Duration or Frequency	NA		NA	NA
Effect of climate change on Proposed Action-related impacts	Magnitude or Intensity	Local impacts from global climate change effects are observed in air temperature rise, precipitation increases (severe storm events), and/or sea level.	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	Only slight change observed.	There would be no measurable changes in global average temperature, precipitation events including severe storms, or sea-level rise.
	Geographic Extent	Local impacts from global climate change effects are observed.		Local impacts from global climate change effects are observed.	NA
	Duration or Frequency	Long-term changes; changes cannot be reversed in a short term		Long-term changes; changes cannot be reversed in a short term	NA

GHG = greenhouse gas; CO_2e = carbon dioxide equivalents; NA = not applicable

[a] Twenty-five thousand (25,000) metric tons per annum is the threshold set by Draft Council on Environmental Quality Guidance for a quantitative analysis.

3.2.14.3. Global Climate Change

Global climate change due to increasing GHG emissions is projected to produce a range of effects, including changes in temperature and precipitation on a seasonal and annual basis and in sea level compared to historical trends. Additional effects could include intensity and frequency of weather events such as storms, tornados, and droughts. Climate change projections are developed by simulating different future emission scenarios with a variety of models that are calibrated using historical trends plus the influence of a varying radiative forcing[1] index due to increase in concentration of GHG in the atmosphere. Global circulation models are frequently used to make global high level projections of temperature, precipitation, and other parameters. These models can be downscaled to produce regional climate models. Downscaling refers to disaggregating and refining future predictions from global to regional levels.

As part of this Draft Programmatic Environmental Impact Statement, an analysis was conducted to evaluate potential overall effects of climate change in Alaska. The potential climate change impacts on the effects of the Proposed Action are evaluated in Section 3.2.14.6, Potential Impacts of the Preferred Alternative. The analysis identified relevant and credible sources for climate change projections in the region potentially affected by the Proposed Action. The projections analyzed were downscaled from global general circulation models. Due to the broad geography of the Proposed Action, three studies were reviewed as part of this analysis:

- *Fifth Assessment Report, International Panel on Climate Change*: the fifth assessment report provides global and regional climate change projections and sector-specific climate risks.
- *Third National Climate Assessment, United States Global Change Research Program*: The third National Climate Assessment (NCA) provides downscaled climate change projections and impacts covering the U.S. and its territories.
- *Regional Climate Trends and Scenarios for the U.S. National Climate Assessment Part 7 – Climate of Alaska, National Oceanic and Atmospheric Administration*: The regional climate trends report for Alaska is a key input into the NCA. It provides climate change projections for temperature, precipitation, sea ice loss, and permafrost for Alaska using 15 coupled atmosphere-ocean general circulation models. These models were downscaled to a resolution of approximately190 miles latitude and 60 to110 miles longitude for multi-model mean maps (*Stewart et al. 2013*). Downscaled Coupled Model Intercomparison Project phase 3 models for temperature, precipitation, and growing season lengths at a 1.2-mile (2-kilometer) resolution were used to simulate season temperature, precipitation, and sea level pressure (*Stewart et al. 2013*).

Further information on the models used in this Draft Programmatic Environmental Impact Statement can be found in Appendix F, *Climate Change Sources and Models*.

The projections prepared and presented in the NCA are the most recent and relevant to the U.S. and its territories. Since the Proposed Action has an undetermined timeline, outputs have been provided for three time periods: 2021 to 2050, 2041 to 2070, and 2070 to 2099. The NCA

[1] Radiative forcing is the difference between the radiation absorbed by Earth and the energy reflected back to space.

provides climate projections using A2 (high emissions) and B1 (low emissions) scenarios, which cover a significant range of potential future human impacts on the climate system. Additionally, many available literature sources use these two scenarios to evaluate potential impacts as well as mitigation and adaptation measures.

3.2.14.4. Global and Regional Climate Change Projections

Temperature and Precipitation

The average annual temperature in Alaska is expected to increase across all models and scenarios. By the end of the century, annual average temperatures are expected to increase by 10 degrees Fahrenheit (°F) to 12°F in the North Alaska, 8°F to 10°F in the interior, and 6°F to 8°F in the rest of the state in the A2 scenario above the baseline of 1971 to 1999 (*USGCRP 2014*). Table 3.2.14-2 below illustrates the simulated annual temperature increases for 2021 to 2050, 2041 to 2070, and 2070 to 2099 in Alaska (*Stewart et al. 2013*) for both high (A2) and low (B1) emission scenarios. Northwest Alaska is expected to see the greatest amount of warming in both emission scenarios (*Stewart et al. 2013*). Seasonal mean temperatures are expected to also increase with winters expected to see the greatest temperature increases throughout the century in the high emission scenario (*Stewart et al. 2013*).

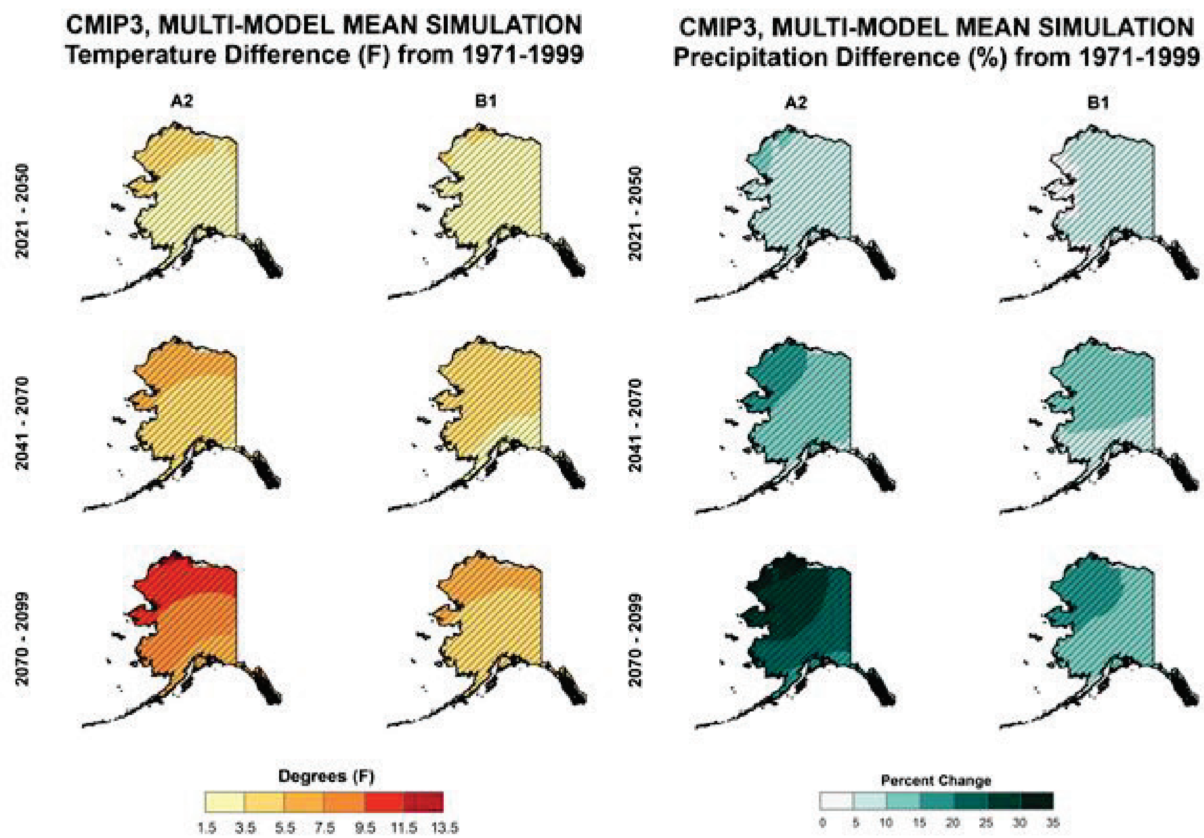
Table 3.2.14-2: Projected Temperature and Precipitation Changes

Scenario	Timeline	Temperature (°F)	Precipitation (% change)
	Baseline (1971-1999)[a]	26.2	36.2[b]
A2	2021-2050	2.8	8
	2041-2070	4.7	12
	2070-2099	8.3	25
B1	2021-2050	2.9	7
	2041-2070	4.1	10
	2070-2099	4.8	14

Source: Stewart et al. 2013

°F = degrees Fahrenheit
[a] Temperature from *NOAA 2015*
[b] Precipitation for baseline time period is presented in inches.

Average annual precipitation is also expected to increase in Alaska in all emission scenarios and across all time periods. Precipitation will increase 8 percent in the 2021 to 2050 period, 12 percent for 2041 to 2070, and 25 percent for 2070 to 2099 (*Stewart et al. 2013*). Seasonal mean precipitation will also increase in all seasons with the months of December, January, and February expected to have the largest increase. However, increases in precipitation do not necessarily result in increased rain or water availability (*USGCRP 2014*). Water availability is expected to decline as a result of a longer growing season and increased evaporation (*Stewart et al. 2013*). Increased precipitation will also lead to a delayed freeze date (*Stewart et al. 2013*). Temperature and precipitation projections in Alaska will vary greatly across the state's geography due to its topographic features as illustrated in Figure 3.2.14-1 below.



Source: Stewart et al. 2013

Figure 3.2.14-1: Projected Temperature and Precipitation Changes for Alaska

Global Sea Level Rise

Global sea level is expected to rise throughout the century. The National Oceanic and Atmospheric Administration's report on global sea level scenarios supporting the NCA concludes with high confidence (greater than 9 in 10 chance) that the global mean sea level will rise at least 8 inches and no more than 6.6 feet by 2100 (*Parris et al. 2012*). SLR is primarily attributed to ocean thermal expansion and ice sheet loss. However, recent studies by The National Research Council based on satellite measurements indicate that the ice sheet loss has greater contribution to global sea level rise than thermal expansion in the period from 1993 to 2008 (*Parris et al. 2012*). Global sea level rise projections use four scenarios:

- High, which should be considered for situations with low tolerance for risk;
- Intermediate high, which is based on an average of the high-end global SLR projections;
- Intermediate low, which is based on the upper global SLR projections using B1 emissions scenarios from Intergovernmental Panel on Climate Change's Fourth Assessment Report; and

- Lowest scenarios, which are based on linear extrapolation of historical SLR from tide gauge records since1900. This scenario should be considered where there is great tolerance for risk (*Parris et al. 2012*).

Global SLR projections are highly uncertain. Projected global SLR can result in emerging of land from the ocean at a slower rate than today (*Markon et al. 2012*). However, for most of Alaska, projected global SLR could result in submergence of land (*Markon et al. 2012*). Table 3.2.14-3 below illustrates projected global sea level rise using the four scenarios relative to mean sea level in 1992.

Table 3.2.14-3: Projected Global Sea Level Rise Relative to 1992

Scenario	**Sea Level Rise (SLR) by 2100 (feet)[a]**
Highest	6.6
Intermediate high	3.9
Intermediate low	1.6
Lowest	0.7

Source: Parris et al. 2012

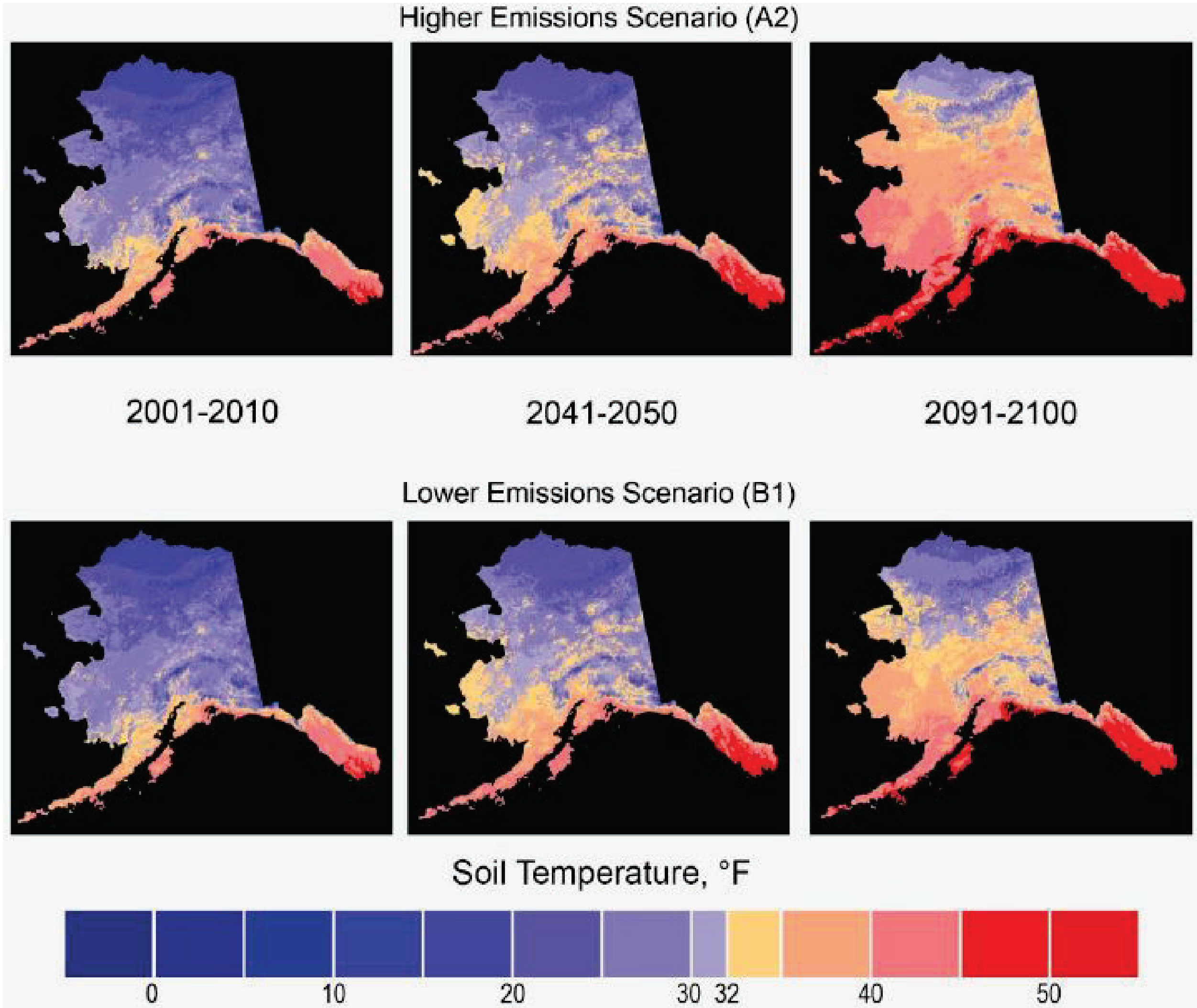
[a] Relative to mean sea level in 1992

Permafrost, Sea Ice, and Extreme Weather Events

Approximately 80 percent of the land in Alaska is permafrost (*USGCRP 2014*). The permafrost in Alaska is expected to continue to thaw through the end of the century. Some models predict that some near-surface permafrost will be completely thawed by the end of the century (*Stewart et al. 2013*).

Figure 3.2.14-2 below shows annual mean ground temperature at a 1 meter (3.28 feet) depth for both high and low emission scenarios (*Stewart et al. 2013*). Stable permafrost occurs when temperatures at a depth of 1 meter are below 32°F (0°C); temperatures above 32°F (0°C) are indicative of permafrost that is degrading or declining (*Stewart et al. 2013*).

Sea ice changes in the Bering and Chukchi seas have been observed in the last decade, particularly in the late summer and early fall (*Stewart et al. 2013*). According to a study conducted by *Meier et al. 2007,* which examined the seasonal changes in the Arctic Sea ice extent, the Bering Sea ice decreased by 39 to 43 percent in July and August from 1979 to 2006 while sea ice extent decreased by 24 to 47 percent in the Chukchi Sea in the same time period (*Stewart et al. 2013*). This trend can be attributed to increasing air and ocean temperatures (*Stewart et al. 2013*). Climate models project that sea ice extent will continue to decline throughout the century (*USGCRP 2014*). Some models indicate that summer sea ice in the Chukchi Sea will disappear between 2030 and 2050 and that winter sea ice in both the Bering and Chukchi seas will decrease by more than 50 percent (*Stewart et al. 2013*).



Source: Stewart et al. 2013

Note: ground temperatures shown at depth of 1 meter (3.28 feet)

Figure 3.2.14-2: Projected Annual Mean Ground Temperatures at 1-Meter Depth for High (A2) and Low (B1) Scenarios

3.2.14.5. Description of Environmental Concerns

Greenhouse Gas Emissions

Since the industrial revolution, increasing GHG emissions from human activities (referred to as anthropogenic emissions and contrasting with emissions arising from natural processes) have increased the levels of GHGs in the atmosphere. Anthropogenic emissions enhance the greenhouse gas effect and result in a greater amount of heat that is trapped in the atmosphere (*IPCC 2013*). Human activities that emit GHGs include the combustion of fossil fuel, industrial processes, land use changes, deforestation, and agricultural production GHG emissions cumulatively contribute to climate change globally. There is no causal connection between GHG emissions arising from the deployment of the Proposed Action and the potential local impacts from global climate change.

Climate Change

Climate changes due to increasing global GHG emissions are projected to produce a range of effects, including changes in temperature, precipitation, and sea level as well as changes in frequency and intensity of weather events when compared to historical trends. These climate change effects can exacerbate, lessen, or have a positive effect on the potential impacts on environmental resources from operations associated with the Proposed Action, as identified in Section 3.2, Environmental Consequences.

Climate change projections have been presented for the A2 (high emission) and B1 (low emission) scenarios. However, this analysis took a precautionary approach by using and discussing the worst case scenario (high emission A2) to ensure future potential impacts and outcomes are not underestimated. In an A2 scenario, temperature in Alaska is expected to increase by 8.3°F by the end of the century compared to a baseline of 1971 to 2000, precipitation in Alaska is also projected to increase 25 percent by 2099 compared to this baseline.

As a result of these climate changes, thawing permafrost may accelerate erosion of shorelines and riverbanks and will alter the terrestrial hydrologic cycle of Alaska's North Slope (*Markon, 2012*). Thawing of permafrost will also likely impact infrastructure, particularly foundations and structures including buildings, roads, and pipelines resulting from potential hazards caused by uneven ground (*Markon et al. 2012)*.

Seasonal hydrology in Alaska is impacted by changes in glacial cover. As glaciers become smaller, average river flow is decreased. Loss of glaciers reduces water storage and increases extreme flood events (*Markon et al. 2012*). Loss of sea ice and increases in temperature may impact biological ecosystems, particularly fisheries; as a result, some studies indicate that fish species may migrate toward the poles (*Markon et al. 2012*). Additionally, changes in ocean conditions (surface temperature, circulation, chemistry, nutrients) may impact the population, mortality, growth, and interactions among these processes of marine fish (*Markon et al. 2012*). Climate change effects will also impact terrestrial landscapes likely leading to increased potential for fires and insect outbreaks, lengthening of growing season, shifts in species distributions, and introduction of novel species (*Markon et al. 2012*).

An increase in temperature could increase stress in vegetation and wildlife species potentially impacted by the Proposed Action operations (*Markon et al. 2012*). Changes in precipitation and increases in extreme weather events could potentially exacerbate impacts due to soil erosion and top soil mixing. Foundations for infrastructure and infrastructure near coastal areas could be particularly vulnerable to increased soil erosion (*Markon et al. 2012*). Additionally, increases in precipitation, particularly in storm events, could potentially exacerbate impacts from flooding, especially infrastructure near coastal areas and in flood zones (*Markon et al. 2012*). Furthermore, changes in temperature and precipitation and increases in extreme weather could increase stress on wetlands and biodiversity (*Markon et al. 2012)*.

3.2.14.6. Potential Impacts of the Preferred Alternative

The following sections assess potential impacts associated with implementation of the Preferred Alternative, including deployment and operational activities. Potential climate change impacts associated with the Proposed Action include potential impacts from the Proposed Action on climate change, in terms of an increase in GHG emissions, as well as the opposite: climate change effects on the Proposed Action.

GHG emissions would arise from combustion of fossil fuel in stationary or mobile equipment, clearing of vegetation, use of generators, and changes in land use during construction and operation. The types of stationary and mobile equipment that would be used include excavators, backhoes, frontend loaders, graders, pavers, and dump trucks. Additionally, combustion of fuel used in power generators, first responder on-road vehicles, and aerial platforms such as drones and piloted aircraft would contribute to GHG emissions. GHGs are characterized in terms of their GWP. The GWP is a measure of how much energy the emission of 1 tonne[2] of gas will absorb over a period of time, relative to the emission of 1 tonne of carbon dioxide (CO_2). This metric is normalized in terms of carbon dioxide equivalents (CO_2e) and expressed with a time horizon. The most commonly used time horizon is 100 years, where 1 unit of CO_2 will have a 100-year GWP of 1; an equivalent amount of methane will have a 100-year GWP of 25, and an equivalent amount of nitrous oxide will have a 100-year GWP of 298. GHG emissions would be emitted locally but have a global effect as explained in Section 3.1.14.2, Context. The GWP values are revised from time to time and should be updated accordingly based on the Intergovernmental Panel on Climate Change Assessment Reports. Current values derive from the Forth Assessment Report (*IPCC 2007*).

GHG emissions associated with the Proposed Action are estimated and compared against a threshold limit of 25,000 metric tons per year as defined by Council on Environmental Quality (CEQ) Revised Draft GHG and Climate Change Guidance (*CEQ 2014*). GHG emissions arise from combustion of fossil fuel in stationary or mobile equipment, use of generators, clearing of vegetation and changes in land use during construction and operation. GHG emissions from loss of vegetation and soil disturbance are expected to be minimal and therefore will not be estimated in this analysis.[3] As described in Section 4.1.14.3, Specific Regulatory Considerations, the Revised Draft CEQ Guidance requires that projects provide a quantitative analysis for emissions greater than 25,000 metric tons of CO_2e annually.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the facility infrastructure and specific deployment requirements, climate change effects would result in potential impacts from some activities in the Preferred Alternative in

[2] One tonne is a unit of measure in the International System of Units that is equivalent to 1 metric ton and equivalent to 1.1023 U.S. tons, which are also known as short tons.
[3] Emissions from vegetation loss are not significant in the evaluation of the Proposed Action. The greatest source of GHG emissions comes from loss of forest. Approximately 230 hectares of forest would need to be cleared to generate 25,000 metric tons.

terms of GHG emissions. Climate change effects from deployment of the Preferred Alternative could range from *less than significant* to *no impacts* depending on the project types deployed.

In addition to potential effects from the Proposed Action on climate change, potential climate change effects on the Proposed Action were assessed. If deployment activities occur in the next 10 years, as is anticipated, climate conditions in that period would not differ much from current conditions even in the worst case emission scenario. Therefore, climate change effects on the various deployment activities would likely be minimal and are expected to have *no impacts*.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, climate change effects are likely to have *no impacts* to the following facilities under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Existing conduits would be used in the installation of new fiber optic cable, which could require construction equipment for cable blowing or pulling. The emissions associated with the use of existing conduit would arise from use of similar equipment as those listed in Table 3.2.14-4 below. The short duration and intermittent use of heavy equipment would not produce perceptible changes to climate change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: These projects involve lighting up dark fiber and installation of new equipment in existing huts. The use of heavy construction equipment is not expected and movement of equipment by light truck or cars would produce a minimal amount of GHGs in the context of this Proposed Action. Therefore, no significant GHG emissions are expected to arise from these activities. As mentioned above, GHG emissions from ground disturbance and vegetation loss are expected to be minimal.

Table 3.2.14-4: GHG Emission Estimates from Buried Wired Project Deployment[a]

Emission Source[b,c]	Estimated Emissions[d,e,f]	
	CO_2e (tons/year)	CO_2e (metric tons/year)
Vibratory Plow, Backhoe, Dozer, Flat-bed Truck, Pick-up Truck, Trench Roller, Air Compressor, Cable Blower, Concrete Mixer, Grader, Roller	1,403	1,273

CO_2e = carbon dioxide equivalent

[a] Deployment activities are assumed to include excavation, grading, and pole delivery and installation.
[b] Emissions are based on one unit of typical equipment. One unit consists of one each of the equipment listed in the table, operating simultaneously. If additional equipment is required, equipment-specific emission estimates should be multiplied by the number of equipment units.
[c] Each equipment is assumed to have a maximum rated capacity of 300 horsepower and to be 10 years old (equipment age). If new equipment is used, emissions would be lower.
[d] Emissions are estimated using methodology from *USEPA 2010a*. Typical equation values were obtained from *USEPA 2010b*.
[e] Emissions (tons) assume 240 hours (24 days, 10 hours/day) of construction activity per month. Construction was assumed to last for 3 months in a year. If construction lasts for more than 3 months, emissions would be greater than the values listed here.
[f] Fuel is assumed to be ultra-low sulfur diesel.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: These projects would include installing permanent equipment on existing structures. GHG emissions would arise from fuel combustion from delivery and installation of equipment, however the use of satellite enabled devices and equipment would not create any perceptible changes in GHG emissions.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. Therefore it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Activities with the Potential to Have Impacts

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Land use emissions occur as a result of soil disturbance and loss of vegetation. GHG emissions from loss of vegetation and soil disturbance are expected to be minimal and therefore are not estimated. The types of deployment activities that would create GHG emissions are discussed below.

<u>Wired Projects</u>

GHG emissions would arise from combustion of fuel from the equipment used for plowing, trenching (including vibratory plowing), or directional boring during construction for buried wired projects. The worst-case emissions are expected to result from plowing techniques. For aerial wired projects, construction activities could include new wiring and poles that require use of auger trucks, boom truck, and bucket lifts, as well as excavation and grading equipment that use fossil fuels. Other activities associated with installation of new or modification of existing wired systems and associated infrastructure, including points of presence[4] (POPs) and huts, could result in GHG emissions during cable blowing, pulling, and vault placement. For some deployment activities, new structures could be required without the need for new or modified wired systems. GHG emissions from fuel combustion due to construction of deployment of wired projects have been estimated and are presented in Tables 3.2.14-4 and 3.2.14-5. Emission calculations assume that all construction equipment use diesel fuel and would have the same emissions. Therefore, each table shows a summation of the estimated emissions for the construction equipment required for each deployment activity.

[4] Points of presence are connections or access points between two different networks, or different components of one network.

Table 3.2.14-5: GHG Emission Estimates from New Aerial Wired Project Deployment[a]

Emission Source[b,c]	Estimated Emissions[c,d,e,f]	
	CO_2e (tons/year)	CO_2e (metric tons/year)
Grader, Suction Excavator, Auger Truck, Boom Truck, Cable Blower, Bucket Lift, Flat-bed Truck	893	810

CO2e = carbon dioxide equivalent

[a] Deployment activities are assumed to include excavation, grading, and pole delivery and installation.
[b] Emissions are based on one unit of typical equipment. One unit consists of one each of the equipment listed in the table, operating simultaneously. If additional equipment is required, equipment-specific emission estimates should be multiplied by the number of equipment units.
[c] Each equipment is assumed to have a maximum rated capacity of 300 horsepower and to be 10 years old (equipment age). If new equipment is used, emissions would be lower.
[d] Emissions are estimated using methodology from *USEPA 2010a*. Typical equation values were obtained from *USEPA 2010b*.
[e] Emissions (tons) assume 240 hours (24 days, 10 hours/day) of construction activity per month. Construction was assumed to last for 3 months in a year. If construction lasts for more than 3 months, emissions would be greater than the values listed here.
[f] Fuel is assumed to be ultra-low sulfur diesel.

Potential GHG impacts associated with each type of wired project are discussed below:

- New Build – Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. The emissions associated from fuel use from these activities are estimated in Table 3.2.14-4. These annual CO_2e emissions resulting from deployment of buried fiber for one unit of equipment, operating for a total of 3 months within a given year, are equivalent to 1,403 tons (1,273 metric tons), which is less than the 25,000 metric ton threshold. It would require 20 or more buried fiber optic cable projects to be deployed simultaneously for 1 year or more for the threshold to be met and/or exceeded, which is unlikely.
- New Build – Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. The GHG emissions from burning fuel for one unit of equipment, operating for a total of 3 months within a given year, are estimated in Table 3.2.14-5. The total emissions are estimated at 893 tons (810 metric tons) per year, which is less than the 25,000 metric ton threshold. It would require 31 or more aerial fiber optic plant projects to be deployed simultaneously for 1 year or more to meet and/or exceed the threshold for quantification, which is unlikely.
- Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of less equipment than those listed in Table 3.2.14-5. As a result, these emissions have not been estimated separately but are expected to be fewer than the total emissions from New Build Aerial Fiber Optic Plant projects analyzed above.

- New Build – Submarine Fiber Optic Plant: The deployment of marine vessels that are capable of laying underwater cables that would be required for these types of projects is unlikely. However, small work boats (with engines similar to recreational vehicle engines) may be required to transport and lay small wired cable. The emissions from these small marine sources would be negligible.
- Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment and additional cranes or sky lifts for installation. GHG emissions for one unit of equipment, operating for a total of 3 months within a given year, correspond to those emissions from Table 3.2.14-6. These emissions are estimated at 766 tons (695 metric tons). For the threshold for quantification to be met and/or exceeded, it would require 36 or more optical transmission or transmission equipment projects to be deployed simultaneously for 1 year or more, which is unlikely.

Table 3.2.14-6: GHG Emissions Estimates from Tower, Structure, and Transmission Equipment Delivery and Installation[a]

Emission Source[b,c]	Estimated Emissions (tons/month)[c,d,e]	
	CO_2e (tons/year)	CO_2e (metric tons/year)
Concrete Mixer, Flat-bed Truck, Grader, Paver, Roller, Truck-mounted Crane	766	695

CO_2e = carbon dioxide equivalent

[a] Emissions are based on one unit of typical equipment. One unit consists of one each of the equipment listed in the table, operating simultaneously. If additional equipment is required, equipment-specific emission estimates should be multiplied by the number of equipment units.
[b] Equipment is assumed to have a maximum rated capacity of 300 horsepower and to be 10 years old (equipment age). If new equipment is used, emissions would be lower.
[c] Emissions are estimated using methodology from Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, Equations 1 to 7, NR-009d, July 2010 (*USEPA 2010a)*. Typical equation values were obtained from *USEPA 2010b*.
[d] Emissions (tons) assume 240 hours (24 days, 10 hours/day) of construction activity per month. Construction was assumed to last for 3 months in a year. If construction lasts for more than 3 months, emissions would be greater than the values listed here.
[e] Fuel is assumed to be ultra-low sulfur diesel.

Wireless Projects

Wireless projects would involve similar but fewer GHG emissions than wired projects. Emissions associated with installation of structures are similar to those found in Table 3.2.14-6 above. GHG emissions associated with each type of wireless project are discussed below:

- New Wireless Communication Towers: These projects would involve installation of new towers as well as associated structure including generators, equipment sheds, fencing, security lighting, aviation lights, and electrical feeds. Emissions from installation of new towers are estimated in Table 3.2.14-6. The annual emissions from these tower structure delivery and installation projects, assuming one unit of equipment operating for a total of 3 months within a given year, are estimated at 766 (695 metric tons) per year. For the threshold for quantification to be met and/or exceeded, 36 or more new towers deployed simultaneously would be required, which is unlikely.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would require mounting and installation of equipment on an existing tower. GHG emissions could arise from combustion of fuel from trucks required for the delivery and installation of equipment and from the equipment used for excavation and grading. GHG emissions for these projects are expected to be fewer than the total emissions associated with New Wireless Communication Towers projects (which are estimated in Table 3.2.14-6) because there would be no new towers.

Deployable Technologies

GHG emissions would arise from use of Deployable Technologies from combustion of fuel from on-road vehicles and mobile power generators. It is assumed that diesel generators are the most likely fuel technology although gasoline and hydrogen-fueled generators could be an option. On-road vehicles could include light-duty trucks for Cell on Light Truck projects or heavy-duty trucks for Cell on Wheels and System on Wheels. Emissions from diesel-power generators are estimated in Table 3.2.14-7.

Table 3.2.14-7: GHG Emissions Estimates from Heavy and Light Duty Vehicles[a]

Vehicle Type	Emission Factors[b,c]			Emissions	
	CO_2	**CH_4**	**N_2O**	**Ton CO_2e/year**	**Metric tons CO_2e/year**
	kg/gal	**g/mi**	**g/mi**		
Light Truck	10.21	0.0009	0.0014	1.80	1.63
Heavy Duty Vehicles	10.21	0.0051	0.0048	1.80	1.63

CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; kg/gal = kilograms per gallon; g/mi = grams per mile

[a] Emissions are estimated assuming one vehicle operates 8 hours per day, 2 days per year (one day for driving to location, one day for departing from location). Driving emissions are larger than idling emissions; therefore, all operation was assumed to be driving, with an average speed of 50 miles per hour
[b] Emission factors taken from *Climate Registry 2015*, *Default Emission Factors 2014* Table 13.1 and 13.4.
[c] Fuel efficiency for light and heavy trucks taken from *Understanding Tractor-Trailer Performance* (*Caterpillar 2006*).

GHG emissions associated with each type of deployable technology are discussed below:

- Cell on Wheels: These projects consist of a cellular base station on a trailer, which is a heavy-duty vehicle. The generators would power the cell unit while the vehicle is on-site and stationary and the vehicle engines would power the vehicle when it is traveling to and from the site. The GHG emissions from the use of heavy-duty vehicles are presented in Table 3.2.14-7. This estimation assumed that one vehicle operates for 2 days a year twice a year, traveling to and from the site for deployment (operating emissions are calculated separately, below). In order for the threshold for quantification to be met and/or exceeded, 15,338 trucks or more would have to be deployed within a given year, an unlikely event.
- Cell on Light Truck: GHG emissions would arise from the combustion of fuel from light-duty truck and diesel generator for powering the cellular base station. Similar to Cell on Wheels, the generators would power the cell unit while the vehicle is onsite and stationary; however, the vehicle engines would power the vehicle while traveling to the site. The GHG emissions from use of a light-duty truck are presented in Table 3.2.14-7. This estimation assumed that one vehicle operates for 2 days a year twice a year, traveling to and from the

site for deployment (operating emissions are calculated separately, below). In order for the threshold for quantification to be met and/or exceeded, 15,338 trucks or more would have to be deployed simultaneously, which is an unlikely event.

- System on Wheels: These projects include a full base station and controller on a large towable trailer or truck. These trailers or trucks are similar to the heavy duty vehicle and diesel-power generator associated with the Cell on Wheels technology. As such, GHG emissions from these projects are expected to be similar to those for Cell on Wheels and are listed in Table 3.2.14-7. This estimation assumed that one vehicle operates for 2 days a year twice a year, again for deployment only. In order for the threshold for quantification to be met and/or exceeded, 15,338 trucks or more would have to be deployed simultaneously, which is an unlikely event.
- Deployable Aerial Communication Architecture: These projects consist of deploying, but not operating, aerial vehicles such as drones, balloons, blimps, and piloted aircraft to staging areas. GHG emissions would arise from fuel combustion from this staging activity. These emissions have not been estimated but would likely be less than those used in installation and delivery of tower, structure, and transmission equipment (which are estimated in Table 3.2.14-6).

It is likely that the Preferred Alternative would use one or more or a combination of the above mentioned activities. Although each individual project might not meet the GHG emissions threshold for quantification in accordance to CEQ, it is possible that a combination of these activities could result in emissions that meet or exceed the requirement for a qualitative assessment. For example, if a combination of new build buried fiber optic plant, new build aerial fiber optic, new build submarine fiber optic, and the installation of optical transmission equipment occurred simultaneously, the threshold for quantification would be exceeded if nine sets of these operating units were deployed in a given year. The use of BMPs and mitigation measures help reduce these emissions. Operational emissions are described further below.

GHG Emissions during Deployment

Based on the analysis of deployment activities described above, GHG emissions are anticipated to be *less than significant* based on a reasonable assumption that the number of simultaneously deployed units would be less than the number required to reach the quantification threshold of 25,000 metric tons per project. It is unlikely that more units would be used or that a combination of projects would be deployed in sufficient numbers to exceed the threshold. In addition, BMPs and mitigation measures presented in Chapter 11, BMPs and Mitigation Measures, would further reduce potential GHG impacts.

Potential Operation Impacts

GHG Emissions

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in similar potential impacts to the abovementioned potential deployment impacts. There would be GHG emissions from combustion of trucks and other equipment used for routine inspection of the Preferred Alternative. However, these emissions would be far fewer than those associated with deployment activities. It is anticipated that there would be no GHG emissions associated with soil disturbance and vegetation loss from routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are used for inspection.

Operational activities associated with the Preferred Alternative could involve operation of fossil fuel power generators in Wireless Projects and Deployable Technologies. This analysis assumed that these power generators would use diesel fuel; however, gasoline- and hydrogen-fueled generators could be other options. Power generators would be used as backup generators and operated while onsite for wireless projects during upset conditions where commercial power is interrupted and during routine maintenance; as a result, they would be expected to operate for only a short period of time. For deployable technologies, power generators would be utilized as the primary power source. The deployable technologies would operate on site for as long as needed. The types of deployment activities that GHG emissions would arise from include the following:

- Wireless Projects
  - New Wireless Communication Towers: GHG emissions would arise from use of power generators including those that operate by combustion of fossil fuels. Backup power generators would only operate for a short period of time during upset conditions when commercial power supply has been interrupted or during routine maintenance. This analysis assumed a maximum of 500 hours per year for both upset conditions and routine maintenance. These emissions have been estimated and are presented in Table 3.2.14-8 below. The annual emissions for backup power generators are 19.3 tons (17.5 metric tons) of CO_2e for one unit, which is less than the 25,000 metric tons threshold. For the threshold to be met and/or exceeded, 1,429 or more units of the above mentioned equipment, operating simultaneously, would be needed, which is unlikely.
  - Collocation on Existing Wireless Tower, Structure or Building: These projects could involve the use of backup power generators such as diesel-power generators. The emissions from combustion of fuel for power generators are comparable to New Wireless Communication towers and are presented in Table 3.2.14-8 below.

Table 3.2.14-8: GHG Emissions from Back-up Diesel Power Generators for Wireless Projects

Emission Source	Estimated Emissions[a,b]	
	CO_2e (tons/year)	CO_2e (metric tons/year)
Diesel Generators	19.3	17.5

CO_2e = carbon dioxide equivalent

[a] Emission factors taken from AP-42, Compilation of Air Pollutant Emission Factors, Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1 (diesel engines) (*USEPA 1996*)
[b] Emissions are estimated assuming one, 67-horsepower diesel engine operates for 500 hours per year when commercial power is interrupted and during normal routine maintenance. Estimates can be directly scaled based on actual equipment size and operating schedule.

- Deployable Technologies
  - Operation of land-based deployable technologies would involve use of power generators such as diesel-power generators to power the cell unit. This analysis assumed power generators operating continuously for 24 hours a day and for 363 days a year (deployment to and from the site would require 2 additional days, as discussed above). The emissions from combustion of fuel for power generators are presented in Table 3.2.14-9 below. The annual emissions for power generators for deployable technologies are 160 tons (145 metric tons) of CO_2e for one unit, which is less than the 25,000 metric tons threshold. It would require 173 or more units of the above mentioned equipment operating simultaneously for the threshold to be met and/or exceeded, which is unlikely. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. These emissions would not be similar to any of the other technologies presented here. More information would be required regarding the number, type, and flight duration of the vehicles deployed to determine emissions from these technologies.

Table 3.2.14-9: GHG Emissions from Power Generators for Deployable Technologies

Emission Source	Estimated Emissions[a,b]	
	CO_2e (tons/year)	CO_2e (metric tons/year)
Diesel Generators	160	145

CO_2e = carbon dioxide equivalent

[a] Emission factors taken from AP-42, *Compilation of Air Pollutant Emission Factors, Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1* (diesel engines) (*USEPA 1996*).
[b] Emissions are estimated assuming one, 32-horsepower diesel engine operates continuously (24 hours per day), 363 days per year (all year except for two travel days – see Tables 3.2.14-7 and 3.2.14-8). Estimates can be directly scaled based on actual equipment size and operating schedule.

Based on the analysis of operations activities described above, GHG emissions are anticipated to be *less than significant*. It is likely that emissions could be *potentially significant* only if 1,429 or more backup generators for wireless projects or 173 or more deployable units are used at the same time, an unlikely event. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to avoid or minimize potential impacts associated with GHG emissions.

Potential Climate Change Impacts on the Preferred Alternative

Climate change effects such as changes in temperature, precipitation, and sea-level rise during operations could potentially impact the infrastructure of the Preferred Alternative. Section 3.2.14.4, Global and Regional Climate Change Projections, presents climate change effects projected for Alaska through the end of the 21st century. The potential impacts on the Preferred Alternative from climate change effects include the following:

- Projections indicate increasing average annual temperatures through the end of the century. These increases could lead to potential impacts associated with heat stress and wildfire risk, particularly for aboveground infrastructure. These would include towers, antennas, POPs, huts, poles, and microwave dishes.
- Precipitation is also expected to increase throughout Alaska. These increases could result in increased periods of soil saturation. Additionally, any heavy precipitation events could result in flooding, increased runoff, and erosion. These effects could potentially impact the stability of aboveground infrastructure such as towers, antennas, POPs, huts, poles, and microwave dishes.
- Projections indicate that the global mean sea level would rise through the end of the century. Sea level rise increases the likelihood for coastal flooding and erosion. Sea level rise, soil and coastal erosion, and flooding could pose potential significant impacts to infrastructure near or on the coast such as huts for buried aerial fiber optic or submarine fiber optic. Additionally, other aboveground infrastructure such as antennas, POPs, and poles could potentially be impacted during extreme events.
- Projections indicate that sea ice will continue to decline throughout the century with some models projecting that summer ice will disappear by mid-century. Loss of sea ice could pose potential significant impacts and/or damage infrastructure that is located near or on sea ice.

Adaptation to Climate Change Effects during Operation

Based on the analysis of the operational activities described above, climate change effects on the Preferred Alternative could be *potentially significant* to *less than significant with BMPs and mitigation measures incorporated* because climate change effects such as changes in temperature, precipitation, and sea-level rise during operations could potentially impact the infrastructure of the Preferred Alternative. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting from the Project, while adaptation refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to minimize climate change effects on the Preferred Alternative.

3.2.14.7. Alternatives Impact Assessment

The following section assesses potential impacts of climate change on the Deployable Technologies Alternative and the No Action Alternative.[5]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts of climate change on the implementation of this alternative are described below. As with the Preferred Alternative, the effects of this alternative on climate change (in terms of GHG emissions) were examined as well as the other way around, in other words, the effects of climate change on the alternative.

Potential Deployment Impacts

The potential impacts on climate change from this alternative were assessed in terms of its potential to generate GHG emissions. As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be *less than significant* if 15,338 units or fewer of either light trucks or heavy duty trucks were deployed, or if a combination of the light and heavy duty trucks amounting to 15,338 units or fewer were deployed simultaneously, which is unlikely; these potential impacts would be further reduced by implementation of BMP and mitigation measures. In addition, GHG emissions would arise from fuel combustion from staging of aerial vehicles. These emissions have not been estimated; more information would be required regarding the number, type, and staging locations of the vehicles deployed to determine emissions from these technologies.

In addition to potential impacts on climate change from this alternative, the potential impacts from climate change on this alternative were assessed. Climate change effects on this alternative during deployment would be similar to such effects on the Preferred Alternative. If deployment activities occur in the next 10 years, as is anticipated, climate conditions in that period would not differ much from current conditions even in the worst case emission scenario. Therefore, climate change effects on the various deployment activities would likely have little to *no impact*. See the section below for more discussion on potential climate change effects during operation.

[5] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be few GHG emissions associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Emissions would arise from use of power generators as the main power source. Emissions from the use of one fossil-fuel-powered generator would not be significant. It would require more than 173 power generators working simultaneously for GHG emissions to be *potentially significant*. These potential impacts could still be reduced through implementation of BMPs and mitigation measures. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. These emissions would not be similar to any of the other technologies presented here. More information would be required regarding the number, type, and flight duration of the vehicles deployed to determine emissions from these technologies.

Climate change effects on this alternative would have the most noticeable impacts over a long period of time. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to *no impact* on the deployed technology if the technologies are deployed within a short period of time (less than a decade). If there are no permanent structures, particularly near coastal areas, there would be little to *no impacts* as a result of sea-level rise. However, if these technologies are deployed continuously (at the required location) for a time period greater than a decade, climate change effects on infrastructure could be similar to the Proposed Action, as explained above.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no GHG impacts from the No Action Alternative. However, GHG emissions would be emitted from the current technologies used in Alaska for first responders. Climate change effects such as changes in temperature and precipitation, extreme weather and sea-level rise would still occur globally and regionally but have *no impact* in the No Action alternative since there would be no associated infrastructure.

3.2.15. Human Health and Safety

3.2.15.1. Introduction

This section describes potential impacts to human health and safety in the State of Alaska associated with deployment and operation of the Proposed Action. Best management practices (BMPs) and mitigation measures that would avoid or minimize those potential impacts are addressed in Chapter 11, BMPs and Mitigation Measures.

3.2.15.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 3.2.15-1. As described in Section 3.2, Environmental Consequences, the categories of impacts are defined as *potentially significant*, *less than significant with BMPs and mitigation measures incorporated*, *less than significant*, or *no impact*. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various geographic and social settings, the potential impacts to health and safety addressed in this section are presented as a range of possible impacts. Potential impacts to human health and safety are assessed for both the workers and/or the general public, where applicable.

Environmental Consequences assessments for traffic, noise, water quality, and air quality, all of which have the potential to influence community and worker health, are covered in this Programmatic Environmental Impact Statement (see Section 3.2.1, Infrastructure; Section 3.2.13, Noise; Section 3.2.4, Water Resources; and Section 3.2.12, Air Quality, respectively). Applicable information from those assessments is referenced in this section if the potential impacts to those resources could result in impacts to community and/or worker health.

Other areas that directly or indirectly relate to health and safety but are not included in this section given the discussion in the respective resource sections include: radio frequency emissions (see Section 2.4, Radio Frequency Emissions); access to health and emergency services (see Section 3.2.1, Infrastructure); environmental justice issues that could result in decreased health (see Section 3.2.10, Environmental Justice); community cohesion and sense of safety (see Section 3.2.9, Socioeconomics).

Table 3.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	**Less than significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Decrease in human health and safety (resulting from potential exposure to hazardous materials [including emissions, spills, and potential exposures via disturbance of historical contaminated sites]; accidents and injuries; exposure to noise; unsafe working conditions, and other recognized workplace safety hazards; and transmission of infectious diseases)	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public; A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity; and probable regulatory violations; Site contamination conditions could preclude development of sites for the proposed use; exposure to recognized workplace safety hazards. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA	Effect that is *potentially significant*, but with BMPs and mitigation measures is *less than significant*	No exposure to chemicals above health-protective screening levels; Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks; No exposure to unsafe working conditions or other workplace safety hazards	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a borough or borough-equivalent geographical extent, could extend to state)		Impacts only at a local/neighborhood level	NA
	Duration or Frequency	Occasional frequency during the life of the Proposed Action		Rare event	NA

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; EPCRA = Emergency Planning and Community Right-to-Know Act; NA = not applicable; OSHA = Occupational Safety and Health Administration; RCRA = Resource Conservation and Recovery Act; TSCA = Toxic Substances Control Act

3.2.15.3. Description of Environmental Concerns

Exposure to Hazardous Materials

Health effects from human exposure to contaminants can range from experiences of physical irritation/nuisance to acute illness, to chronic disease outcomes, depending on the type of contaminant and level of exposure. The following are potential pathways for human exposure to contaminants in Alaska associated with the Proposed Action.

Existing Contaminants in Soil or Water

The construction of the proposed facilities/infrastructure, trenching, and/or foundation excavation could expose soil containing contaminants from either existing industrial facilities or from legacy industrial activities. The disturbed soil could pose a health risk to workers and communities if there is direct contact with the soil or surface water runoff containing soil chemicals from the construction site. As outlined in the Affected Environment Health and Safety Section 3.1.15, Alaska has six active Superfund sites that have ongoing cleanup action to address soil and ground water contamination, including volatile organic compounds, polychlorinated biphenyls, and heavy metals. The implementation, as practicable or feasible, of water quality and soil erosion BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures) would help ensure contaminated soil and water are safely and adequately managed in accordance with all applicable regulations and policies, and exposure risks are minimized.

Potential Spills of Pollutants into Surface Water

Section 3.2.4.3, Description of Environmental Concerns, discusses the potential for water quality impacts that could occur from petroleum products accidentally spilled during refueling, or from potential pentachlorophenol associated with treated utility poles leaching into surface water, although concentrations of pentachlorophenol released during placement or replacement of poles are not expected to exceed United States (U.S.) Environmental Protection Agency levels of concern for human health (see Section 3.2.4.3, Description of Environmental Concerns). Health risks posed to workers and community members who could potentially come into contact with these chemicals range from acute to chronic illnesses, including increased risk of cancer (*USEPA 2000*).

In Alaska, water used for human consumption is sourced from groundwater and surface water sources (*USEPA 2015*). Therefore, surface water contamination could potentially impact catchment potable water systems. FirstNet will attempt, to the extent that is practicable or feasible, to avoid buildout/deployment locations in or adjacent to waterbodies or that involve in-stream construction. In the event of a larger spill that goes unnoticed, shallow groundwater wells used for potable water could also potentially be impacted. The implementation of spill management BMPs and mitigation measures outlined in Section 11.4, Water Resources, could help to further ensure contaminated soil and water are safely and adequately managed in accordance with all applicable regulations and policies, and exposure risks are minimized.

Air Emissions from Mobile Sources

Section 3.2.12, Air Quality, discusses the potential impacts to air quality associated with the Proposed Action, which include emissions from stationary and mobile sources during deployment. Emissions could result from stationary or mobile equipment that is powered by fossil fuels, such as excavators or backhoes, required to support any clearance, drilling, and construction activities associated with network deployment. In addition, the use of power generators, first responder on-road vehicles (large towable trailers, commercial trucks, standard sport utility vehicles), and aerial platforms (aircraft such as drones and piloted aircraft) associated with the implementation of deployable technologies could also increase air emissions, both from fossil fuel combustion and, in some cases, from stirring up dust on unpaved roads. The emissions of health concern to both workers and communities are primarily particulate matter up to 2.5 micrometers in diameter ($PM_{2.5}$) and nitrogen dioxide (NO_2), both of which are produced by fossil fuel combustion associated with vehicle and heavy machinery and generator use.

There is a substantial body of scientific literature linking both short-term and long-term adverse health impacts to various types of air pollution (*HEI 2010; Sarnat and Holguin 2007; Nishimura et al. 2013; Patel and Miller 2009; USEPA 2009; Levy et al. 2002*). NO_2 has been linked to short-term respiratory and cardiovascular effects (*USEPA 2008*). $PM_{2.5}$ has been linked to both short-term and long-term health effects. Specific health effects for $PM_{2.5}$ exposures include adverse cardiovascular effects, increase in cardiovascular and respiratory mortality, and adverse respiratory effects, including lung cancer (*USEPA 2009*).

Research to date has not revealed the existence of concentration thresholds for $PM_{2.5}$ and nitrogen oxides below which no health effects would be expected for sensitive populations.[1] Because a no-effect level has not been defined, the increase in emissions from deployment activities could potentially increase the risk of short-term and long-term effects to sensitive populations within the workforce or nearby communities (*HEI 2010; USEPA 2009, 2013; Kelly and Fussell 2011; Levy et al. 2002; Nishimura et al. 2013; Patel and Miller 2009; O'Neill et al. 2005, 2007; Sarnat and Holguin 2007*). Sensitive populations for exposure to $PM_{2.5}$ and NO_2 are listed below:

- Those with chronic respiratory diseases (asthma and chronic obstructive pulmonary disease), particularly children and the elderly;
- Those with acute respiratory infections, particularly children and the elderly;
- Those with chronic heart diseases; and
- Diabetics.

Regarding sensitive populations in Alaska, the prevalence of asthma is comparable but slightly higher than the national rate, while rates of death from chronic lower respiratory diseases and acute respiratory diseases are lower than at the national level. In addition, prevalence of diabetes and deaths from heart disease are lower in Alaska than in the United States as a whole (*CDC*

[1] If health-based air quality standards are being met, the health of the general population is unlikely to be adversely affected.

2013a; CDC 2013b). Overall, the percentage of the Alaskan population that could be considered sensitive is likely smaller than the national percentage.

It is important to note that there are multiple causes of the diseases associated with particulate exposures. Although it is possible that some cases of cardiovascular problems, respiratory problems, and lung cancer could be related to, result from, or be worsened by $PM_{2.5}$, most cases of these health problems are associated with other causes, such as smoking (*American Lung Association 2015; Heart and Stroke Foundation 2015*).

According to Section 3.2.12, Air Quality, potential impacts to air quality associated with the Preferred Alternative activities could range from *no impacts* to *less than significant,* depending on the deployment or operation scenario, or the site-specific conditions. It is anticipated that any air pollution increase due to deployment would likely be short-term with pre-existing air quality levels generally achieved after some months (typically less than a year). Because certain areas of the state are designated as nonattainment or maintenance status (Fairbanks, Anchorage, and Juneau-Mendenhall Valley) and some amount of infrastructure may be built in these areas, air quality BMPs and mitigation measures outlined in Section 11.12, Air Quality would further help reduce human exposure to air contaminants and minimize the potential risk of health effects.

Accidents and Injuries

Workplace and Construction Site Accidents and Injuries

The Preferred Alternative construction activities, including excavation, drilling, buried or aerial installations, and transportation to and from work sites could increase the risk of accidents and injuries to both workers and communities. For communities, inadequate safety signage at construction and other work sites, as well as poor public awareness regarding construction risks, can increase the risk of injuries and accidents for community members living or working in proximity to those sites. For the workforce, workplace hazards such as work at heights and work involving the use of heavy machinery increase the risk of slips, trips, falls, and other accidents. The U.S. Occupational Safety and Health Administration (OSHA) maintains authority over all federal and private sector workplaces in Alaska; therefore, although accidents and injuries are considered an employee workplace hazard, FirstNet and/or their partners could implement appropriate measures, such as Job Hazard Analyses, to assure a safe and healthful workplace in compliance with OSHA standards.

Road Traffic Accidents and Injuries

In addition to worksite accidents and injuries, temporary traffic congestion on public roads as discussed in Section 3.2.1, Infrastructure, during deployment could increase the risk of road traffic-related accidents and injuries for both workers and community members.

Those most at risk for traffic-related accidents are often local citizens whose daily activities occur at the same time or in the same vicinity as the Proposed Action activities. The degree of health risk to the local communities and workers relates to the forms of local community traffic that exist on the same roads used by the Proposed Action (e.g., mixed-use traffic involving pedestrians, motorcycles, etc.), the integrity of local road infrastructure, and driver behavior. In

Alaska, key road traffic accident risk factors that should be taken into consideration and mitigated in the deployment and operation phases of the Proposed Action include alcohol-impaired driving, speeding, and not making use of occupant restraints (seat belts) in vehicles. In addition, the state has identified four specific highway segments that have a higher than average incidence of fatal and major injury crashes (Seward, Parks, Knik/Goose Bay, and Sterling Highways); these are known to be at or near traffic volume capacity and are the target of interventions by the Department of Public Safety to reduce severe crashes (*Alaska Highway Safety Office 2012*).

Adherence to OSHA workplace standards, the implementation of the appropriate traffic congestion BMPs and mitigation measures in Section 11.1, Infrastructure and the implementation of human health and safety BMPs and mitigation measures outlined in Section 11.15 could reduce the risk of road traffic-related accidents and injuries to both communities and workers.

Accidents and Injuries from Biological and Climatic Hazards

Conducting construction activities in Alaska's largely remote and undeveloped landscape is associated with a range of unique health and safety risks. This includes attacks from wildlife such as bears and moose, as well as hazards from extremely cold temperatures. A range of mitigation measures and BMPs could help minimize these risks to worker health and safety.

Potential Noise-Related Health Impacts

Noise is measured in A-weighted decibels (dBA). Human exposure to long-term noise levels above 80 dBA is associated with an increased risk of hearing loss, and lower levels of noise exposure may be associated with non-auditory health effects, including sleep disturbance, increase in blood pressure, and increase in stress (*Evans et al. 2001; Babisch 2011; WHO 1999*). Sources of noise during deployment above ambient background noise and threshold distances are discussed in Section 3.2.13, Noise.

Worker health effects managed by OSHA are designed to prevent hearing impairment. If worker noise exposure is equal to or greater than 85 dBA for an 8 hour exposure, a hearing conservation program must be implemented (*OSHA 2015*). During deployment, construction activities that involve the use of heavy machinery could exceed 85 dBA (refer to Section 3.2.13, Noise).

For communities, a 5 dBA increase in noise above the ambient background is used to assess whether an impact is considered to be potentially significant (*IFC 2007; USDOT 2005; WHO 1999*). "Significant" in this context means the level of sound that a community is likely to perceive as an annoyance (*USDOT 2005*). The minimum increase in sound levels that most people can perceive is 3 dBA (*Bies and Hansen 1996*), which equates to a doubling of the sound power (sound is measured on a logarithmic scale). Use of a 5 dBA increase to assess whether a community might perceive a noise annoyance may not be accurate if noise levels in the community are already relatively high (e.g., above 65 dBA) (*USDOT 2005)*. In general, the "noisier" existing conditions are, the less additional noise is tolerated by the community (*USDOT 2006*). Higher noise levels and larger increases above existing noise levels are associated with increasing levels of stress responses. Noise-related disturbance and stress are subjective factors, and therefore there is no defined threshold at which a noise disturbance is considered to result in stress levels representing a measurable health effect. Best practice guidance suggests assessment of community noise based on perception rather than measured health outcomes (*USDOT 2005*), and on examining increases above baseline conditions (*IFC 2007*).

Providing further complication, the potential impacts of increased sound depend not just on the numerical increase in sound levels, but also on the intensity of the sound, the duration of the sound, and the sound setting (*WHO 1999*). Unexpected, short duration, high intensity sounds can have a worse effect than relatively steady sounds. Research suggests that humans appear to have capacity for adaptive response to typical sound levels in their environment; once adaptation has occurred, sleep patterns are not affected (*Stansfeld and Matheson 2003*).

Adherence to OSHA workplace standards, the implementation of the appropriate noise and human health and Safety BMPs and mitigation measures outlined in Chapter 11 could minimize the risk of human exposure to noise levels above health-protective levels.

Communicable Diseases

Communicable, or infectious, diseases are illnesses that result typically from the infection of biologic agents (most commonly viruses, bacteria, and parasites) in a human or animal host. Given the small size of the workforce, and the assumption that workers would be provided safe and hygienic housing and working environments in line with OSHA standards, it is not expected that the Proposed Action would increase risk for these diseases in worker populations or local communities.

3.2.15.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities.

Potential Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to human health and safety and others would not. In addition, and as explained in this section, the various types of Proposed Action infrastructure could result in a range of *no impacts* to *less than significant* impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have *no impacts* to human health and safety under the condition described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: The pulling or blowing of fiber optic cable would be performed through existing conduit. Use of mechanical equipment would be limited to pulley systems and blowers. Hazardous materials needed for this work would include fiber optic cable lubricants or mechanical oil/grease, although these materials are expected to be used infrequently and in small quantities. These activities are not likely to result in serious injury, chemical exposure, or surface disturbances since work would be limited to existing entry and exist points, would be temporary, and intermittent. It is anticipated there would be *no impacts* to human health and safety.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have *no impacts* to health resources because there would be no ground disturbance or heavy equipment used to accomplish the task.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the nationwide public safety broadband network (NPSBN); however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact health and safety, it is anticipated that this activity would have *no impact* to those resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of the Preferred Alternative implementation would encompass a range of potential impacts that could occur as a result of exposure to hazardous materials in the air, water, or soil; potential workplace or road traffic accidents that result in injury; and potential health effects from exposure to noise. The remainder of this section provides summary impact discussions for each development scenario or deployment activity.

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Installation of a new buried fiber optic plant (i.e., new underground conduit) would include plowing, trenching, or directional boring and the construction of points of presence,[2] huts, or other associated facilities or hand-holes to access fiber could result in disturbed soil and the potential for exposure to legacy contaminants in the ground, and the possibility for spills and soil and water contamination that could affect human health. Additionally, the use of heavy machinery and other vehicles around the construction area and on access roads would potentially impact human health through increases in air emissions and noise, as well as increased risk of workplace and road traffic accidents. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.

[2] Points of presence are connections or access points between two different networks, or different components of one network.

  - New Build – Aerial Fiber Optic Plant: The build of an aerial fiber optic plant would require less soil disturbance and therefore the potential for exposure to legacy contaminants would be less than for a buried fiber optic plant. The use of heavy machinery still presents the possibility for spills and soil and water contamination, and air and noise emissions that could potentially impact human health, as well as possible workplace and road traffic accidents that could result in injury. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of an existing aerial fiber optic plant is not expected to cause a sufficient level of soil disturbance that would result in the potential for exposure to legacy contaminants in the ground. The use of heavy machinery, while expected to be less than for new build, still presents the possibility for spills, soil and water contamination, and air and noise emissions that could potentially impact human health, as well as possible workplace and road traffic accidents that could result in injury. BMPs and mitigation measures (see Chapter 11) could help avoid or minimize the potential impacts.
  - New Build – Submarine Fiber Optic Plant: The build of a submarine fiber optic plant would require less soil disturbance and therefore the potential for exposure to legacy contaminants would be less than for a buried fiber optic plant. The use of heavy machinery still presents the possibility for spills and soil and water contamination, and air and noise emissions that could potentially impact human health, as well as possible workplace and road traffic accidents that could result in injury. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes, hunts, or access roads, there could be soil disturbance and the potential for exposure to legacy contaminants in the ground, and the possibility for spills and soil and water contamination that could affect human health. Additionally, the use of heavy machinery and other vehicles around the construction area and on access roads would potentially impact human health through increases in air emissions and noise, as well an increased short-term risk of workplace and road traffic accidents. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in soil disturbance and potential for exposure to legacy contaminants in the ground. The use of heavy machinery and generators presents the possibility for spills and soil and water contamination, and air and noise emissions that could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic

accidents that could result in injury. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in soil disturbance; however the use of heavy machinery and generators presents the possibility for spills and soil and water contamination, and air and noise emissions that could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.

- Deployable Technologies
  - Cell on Wheels, Cell on Light Truck, System on Wheels, Deployable Aerial Communications Architecture: The use of deployable technologies could result in soil disturbance if land-based deployables occur in unpaved areas, or if the implementation results in minor construction or paving of previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and air and noise emissions that could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment, and when not in use, the aerial vehicles could require preventive maintenance. Workers responsible for these activities may handle hazardous materials not limited to fuel, solvents, and adhesives. BMPs and mitigation measures (see Chapter 11) could help to avoid or minimize the potential impacts.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would have *no impact* on impact soil, water, air or noise resources (refer to Sections 3.2.2 Soils, 3.2.4 Water Resources, 3.2.12 Air Quality, and 3.2.13 Noise), therefore the only potential human health and safety impacts considered are those associated with worksite or traffic-related congestion, which are anticipated to be minor and insignificant. Any use of satellite-enabled devices and equipment would be within current regulated ranges/standards. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

In general, the abovementioned activities could potentially involve trenching and/or foundation excavation, which could expose soil containing contaminants either from existing industrial facilities or from legacy industrial activities and could potentially affect human health. In addition, the possibility for spills that result in soil and water contamination exists and could also potentially affect human health. The use of heavy machinery and other vehicles around construction areas and on access roads could potentially impact human health through increases in air emissions and noise, as well as increased risk of workplace and road traffic accidents that could result in injury. Potential human health and safety impacts are described further below, and BMPs and mitigation measures to help avoid or reduce these potential impacts are discussed in Chapter 11.

Potential Exposure to Hazardous Materials Impacts

Based on the analysis of deployment activities, and assuming the adherence to OSHA workplace standards, potential health effects as a result of exposure to environmental hazardous materials are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential human health and safety impacts.

Potential Accident and Injury Impacts

Based on the analysis of deployment activities, and assuming the adherence to OSHA workplace health and safety standards, the risk of construction site, road, and other accidents and injuries to workers and communities is considered *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential human health and safety impacts.

Potential Noise-Related Health Impacts

Based on the analysis of deployment activities, and assuming the adherence to OSHA workplace health and safety standards, potential health effects as a result of exposure to noise are anticipated to be *less than significant*. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential human health and safety impacts.

Potential Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned potential deployment impacts. It is anticipated that there would be *less than significant* impacts associated with human exposure to environmental hazardous materials, impacts to human health and safety associated with the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission. See Chapter 11, BMPs and Mitigation Measures, for a listing of BMPs and mitigation measures that FirstNet and/or their partners would require, as practicable or feasible, to further avoid or minimize potential human health and safety impacts.

3.2.15.5. Alternatives Impact Assessment

The following section assesses potential impacts to soils associated with the Deployable Technologies Alternative and the No Action alternative.[3]

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile land-based and aerial communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and no new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Potential impacts to health and safety resources as a result of implementation of this alternative are described below.

Potential Deployment Impacts

As explained above, implementation of land-based deployable technologies could result in *less than significant* impacts to health and safety resources if deployment occurs within public roads and some staging and land/vegetation clearing, excavation, or paving are required. These activities could result in the potential of on-site or road traffic related accidents involving workers and community members; disturbed soil and the potential for exposure to legacy contaminants in the ground; and air and noise emissions that could potentially impact human health; however, it is anticipated that the activities associated with the Deployables Alternative would have *less than significant* potential impacts because they would not result in exposure to chemicals, including hazardous or toxic materials, above health screening levels and those materials would be handled and disposed of in accordance with prevailing laws and regulations.

Potential Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology, and routine maintenance and inspections. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise, and risk of infectious disease transmission would be *less than significant* because of the small scale of likely FirstNet activities. These potential impacts could be further reduced by implementation, as practicable or feasible, of BMPs and mitigation measures (see Chapter 11, BMPs and Mitigation Measures).

[3] As mentioned above and in Section 2.1.2, Proposed Action Infrastructure, the Preferred Alternative includes implementation of deployable technologies.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be *no impacts* to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in the Affected Environment Section 3.1.15, Human Health and Safety.

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3.3. References

3.3.1. Introduction

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