3.0 Affected Environment

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3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter describes the environmental conditions of the potential NMD deployment sites and their regions of influence (ROIs). The information provided serves as a baseline from which to identify and evaluate environmental changes resulting from the construction and operation of an NMD system. The affected environment is discussed in terms of 15 resource areas: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste management, health and safety, land use and aesthetics, noise, socioeconomics, transportation, utilities, water resources, and environmental justice. In addition, subsistence resources are discussed for potential Alaska sites. Each resource area is discussed at each location unless the proposed activities at that location would not foreseeably result in an impact. The data presented are commensurate with the importance of the potential impacts in order to provide the proper context for evaluating impacts.

For those resources included in the affected environment, an ROI will be defined for each affected resource and will determine the geographical area to be addressed as the environmental setting.

Provided below is a brief description of the location, history, and current status of each potential NMD deployment location.

3.1.1 ALASKA INSTALLATIONS

Clear AFS

Clear AFS is about 126 kilometers (78 miles) southwest of Fairbanks in the Denali Borough near the community of Anderson. The site currently consists of approximately 4,760 hectares (11,542 acres). The Clear AFS area was first used by the Army shortly after World War II, when an airstrip was built for B-36 bombers. Construction of the existing Ballistic Missile Early Warning System radar began in 1958, and the radar has been in operation since 1961. The current radar system will be replaced by a phased array radar by the end of 2000, independent of NMD. The role of Clear AFS is to detect and provide early warning and assessment of a ballistic missile attack and to provide space surveillance tracking for satellites and space objects. (Clear Air Station, 1993—Comprehensive Planning Framework)

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Eareckson AS

Eareckson AS (formerly known as Shemya AFB) is on Shemya Island about 2,414 kilometers (1,500 miles) from Anchorage, Alaska, and is part of the Near Islands group at the tip of the Aleutian Island chain. Shemya Island occupies approximately 1,425 hectares (3,520 acres) and is part of the Alaska Maritime National Wildlife Refuge admistered by the USFWS. The island was first occupied by the military on May 28, 1943, to retake nearby Attu Island from the Japanese. The island has been developed by the military and continues to operate as an early warning radar site whose principal purpose involves monitoring space and missile activities. The base is under control of the Eareckson AS Program Management Office, part of the 611th Air Support Group at Elmendorf AFB.

Eielson AFB

Eielson AFB is located approximately 37 kilometers (23 miles) southeast of Fairbanks, and about 14 kilometers (9 miles) southeast of the city of North Pole within the Fairbanks North Star Borough. The main base consists of approximately 8,021 hectares (19,820 acres). (Gori, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft EIS). It also manages an additional 15,098 hectares (37,309 acres) at four other locations. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

Mile 26 (now Eielson AFB) was originally constructed in 1943 as a satellite location for Ladd Field (now Fort Wainwright). In 1946, military planners decided that because of the Cold War, a strategic bomber base was needed in Interior Alaska. Eielson AFB was eventually chosen. The two runways at Mile 26 were increased to 4,420 meters (14,500 feet), and buildings were constructed to house the planes. On February 4, 1948, the Air Force changed the name of Mile 26 to Eielson AFB. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

The current mission of Eielson AFB and the 354th Fighter Wing is to "Prepare, provide, and support combat ready forces...any time, any place." The primary mission has evolved from one of support of both rotating and assigned strategic air assets to one of supporting permanently-assigned fighter aircraft for close air support, air interdiction, and support of ground forces; as well as hosting the Air Force's premier tactical training exercises, COPE THUNDER. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

Fort Greely

Fort Greely is approximately 172 kilometers (107 miles) southeast of Fairbanks and just south of the community of Delta Junction in an

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unincorporated borough. Fort Greely is about 267,519 hectares (661,051 acres), most of which was withdrawn from the Bureau of Land Management. Fort Greely consists of the Main Post, two large training areas—Fort Greely West Training Area and Fort Greely East Training Area—and three outlying sites in the area—Gerstle River Test Site, Black River Training Site, and Whistler Creek Climbing Area. (U.S. Army Alaska, 1997—Draft Integrated Natural Resources Management Plan 1997–2001)

Fort Greely originated as Station 17, Alaskan Wing, Air Transport Command, later known as the Allen Army Airfield. The first Army units set up camp in 1942. It served as a rest and refueling stop for pilots en route to Ladd Army Field during World War II. Several name changes occurred until it finally became Fort Greely on August 6, 1955. Fort Greely's lands are used for testing and evaluation of weapons and equipment under conditions of extreme cold, training forces for action in Arctic and subarctic regions in the event of war, and for infantry training by the U.S. Army Alaska. (U.S. Army Alaska, 1997—Draft Integrated Natural Resources Management Plan 1997–2001)

Approximately 741 hectares (1,830 acres) of Fort Greely will be excessed in 2001. This area contains most buildings on the base. (Gori, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft DEIS)

Yukon Training Area (Fort Wainwright)

The Yukon Training Area is a part of Fort Wainwright and is about 24 kilometers (15 miles) southeast of the main post. The Yukon Training Area is located in the Fairbanks North Star Borough about 40 kilometers (25 miles) southeast of Fairbanks. All branches of the armed forces utilize this 100,362-hectare (248,000-acre) site (U.S. Army Corps of Engineers, 1987—Master Plan Report, Fort Wainwright, Alaska). The Yukon Training Area is roughly broken down into three parcels. One area is the Stuart Creek Impact Area, which is roughly a 10-kilometer (6-mile) square tract into which the Army and Air Force fire munitions. Because of the extensive use of this area, it is restricted from public use. Another area, the Air Force Technical Applications Center site that lies immediately east of Transmitter Road in the northwest section of the Yukon Training Area, consists of about 8,802 hectares (21,750 acres). It is jointly utilized by the Army and the Air Force Technical Applications Center. Within this large parcel, 971 hectares (2,400 acres) of land are used exclusively by the Air Force Technical Applications Center (Department of the Army, 1989—Permit of Usage of Air Force Technical Applications Center Site, Fort Wainwright Maneuver Area, Alaska). The remainder of the Yukon Training Area is designated as training areas used for various mortar, artillery, and maneuver exercises. (U.S. Department

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of the Interior and U.S. Department of Defense, 1994—Fort Wainwright Yukon Maneuver Area, Proposed Resource Management Plan, Final EIS)

3.1.2 NORTH DAKOTA INSTALLATIONS

Cavalier AFS

Cavalier AFS is approximately 23 kilometers (14 miles) west of the town of Cavalier in Pembina County. The 113-hectare (278-acre) site was leased from the U.S. Army by the U.S. Air Force in 1977 and named the Cavalier AFS. The site is in use as part of the Spacetrack Missile Warning system and has no missile fields associated with it. The original purpose of the radar at Cavalier AFS was to detect missiles launched at the United States from the north. Some of the site's buildings were hardened against nuclear effects and had the ability to operate autonomously while "buttoned-up" against a nuclear blast. The site currently consists of the main radar and numerous support facilities and residential units.

Grand Forks AFB

Grand Forks AFB is on 1,954 hectares (4,830 acres) in eastern North Dakota about 23 kilometers (14 miles) west of Grand Forks in Grand Forks County. Grand Forks was chosen in 1954 as the site for an Air Defense Command Base. Construction began in 1956, with initial operations commencing in 1960. The 319th Air Force Refueling Wing is the major organization currently at Grand Forks AFB (Grand Forks AFB, 1995—Management Action Plan).

As the first core air refueling wing in the Air Mobility Command, the 319th Air Refueling Wing "Warrior of the North" guarantees global engagement by providing extended range in the air. The 319th Air Refueling Wing regularly supports deployments and multinational operations from bases in England, France, Italy, Turkey, and the Arabian Gulf region as well as counter-drug operations in Panama (Grand Forks AFB, 1996—Global Reach for America, Installation Guide).

Since activated in 1942 as the 321st Bombardment Group, the mission of the 321st Missile Group has evolved from flying a variety of medium and heavy bomber aircraft to nuclear deterrence with the Minuteman III intercontinental ballistic missile system. The 321st Missile Group controlled 150 Minuteman missiles spread out over 19,425 square kilometers (7,500 square miles) of prairie in eastern North Dakota (U.S. Department of the Air Force, 1997—Grand Forks AFB General Plan). On July 1, 1995, the Base Realignment and Closure (BRAC) Commission announced a recommendation to inactivate the 321st Missile Group. All rocket motors, reentry systems, and missile guidance systems have been removed.

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Missile Site Radar

The 175-hectare (432-acre) Missile Site Radar is adjacent to Nekoma in Cavalier County, approximately 21 kilometers (13 miles) from Langdon. Construction of the Missile Site Radar was completed in October 1974. The complex reached initial operational capability in April 1975 and full operational capability in September 1975. The site originally consisted of a radar and missile field of 30 launchers for Spartan long-range, nuclear-warhead missiles, and 16 launchers for Sprint short-range, nuclear missiles. The Missile Site Radar had a dual purpose: to acquire targets and to control launch and guidance of interceptors to their targets. Buildings in the Tactical Area portion of the site were hardened against nuclear attack. Between December 1975 and 1977, all missiles were removed from the Missile Site Radar, the silos were sealed, and some tactical buildings were salvaged. The site is currently inactive.

Remote Sprint Launch Site 1

Remote Sprint Launch Site 1 is in northern Ramsey County, 5 kilometers (3 miles) east of Hampden. The site occupies approximately 17 hectares (41 acres) and is composed of a sentry station, heat sink, waste stabilization ponds, a Sprint missile launch area containing 12 launch stations, and a Remote Launch Operations Building. Construction of Remote Sprint Launch Site 1 was completed in October 1974. The complex reached initial operational capability in April 1975 and full operational capability in September 1975. By 1977, all missiles had been removed from the silo launchers, the silos were sealed, and buildings were salvaged and sealed. The site is currently inactive.

Remote Sprint Launch Site 2

Remote Sprint Launch Site 2 is in Cavalier County, 13 kilometers (8 miles) northwest of Langdon. The site occupies approximately 15 hectares (36 acres). The layout and operational dates for Remote Sprint Launch Site 2 are similar to Remote Sprint Launch Site 1. The site is currently inactive.

Remote Sprint Launch Site 4

Remote Sprint Launch Site 4 is approximately 3 kilometers (2 miles) southwest of Fairdale, in Walsh County, approximately 135 kilometers (84 miles) from Grand Forks AFB. The site occupies approximately 20 hectares (50 acres). The layout and operational dates for Remote Sprint Launch Site 4 are similar to Remote Sprint Launch Site 1. The site is currently inactive.

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3.2 AIR QUALITY

Air quality in a given area is a function of the area itself (size and topography), the prevailing weather patterns (meteorology and climate), and the pollutants released (specific pollutant, rate and frequency of release, and location of release). Air quality is described in terms of the concentrations of various pollutants in a given area of the atmosphere. This is generally expressed in terms of parts per million (ppm), milligrams per cubic meter, or micrograms per cubic meter. The lower the overall concentration of a specific pollutant (whether from natural sources or man-made), the better the air quality in that area. The significance of a pollutant concentration is determined by comparison to Federal, state, and/or local air quality standards. The significance of pollutant concentrations for pollutants with no applicable ambient air quality standard (AAQS) is determined by comparison with health-based guidelines.

The ROI for air quality includes the geographic airshed in which the emissions would occur. This broad area encompasses both direct, immediate impacts due to criteria pollutants and hazardous air pollutants that generally disperse within a few miles of the emissions source, and indirect, delayed impacts due to precursor actions (primarily ozone precursors) that can delay impacts for several hours.

Climate and Meteorology

Climatic and meteorological data for the air quality analysis include wind direction and speed, precipitation levels, temperature and relative humidity, occurrence of severe storms, and atmospheric turbulence. Wind direction and speed have a direct impact on the path and dispersion rate of airborne pollutants. Precipitation tends to wash pollutants out of the atmosphere. Temperature and humidity indirectly influence the dispersion of pollutants through their influence on the physical aspects of the atmosphere (temperature inversions and atmospheric stability being prime examples).

Federal Regulatory Framework

Air quality is regulated under Title 40 CFR 50-99. The National Ambient Air Quality Standards (NAAQS) (40 CFR 50) have been promulgated to protect public health and welfare and represent maximum ambient concentrations that are allowable in a given area. Ambient air in these regulations is defined as “that portion of the atmosphere, external to buildings, to which the general public has access” (40 CFR 50.1). The NAAQS address seven pollutants, termed criteria pollutants. These criteria pollutants are: carbon monoxide, lead, oxides of nitrogen (nitrogen dioxide), ozone, particulate matter with a mean aerodynamic diameter less than or equal to a nominal 10 micrometers (PM-10), particulate matter with a mean aerodynamic diameter less than or equal to a nominal 2.5 micrometers (PM-2.5), and sulfur dioxide.

Areas that violate the NAAQS are designated as “nonattainment” areas for the relevant pollutant(s). Areas that meet the NAAQS are designated as “attainment” areas. Those areas for which measurements were not made are termed “unclassifiable” and are assumed to be in attainment. Nonattainment areas that attain the NAAQS and are redesignated as being in attainment are required to be addressed in the State Implementation Plan to provide for monitoring of the air quality and maintenance of the attainment status for at least 10 years. These areas are described as "maintenance" areas.

Federal actions are required to conform to any applicable State Implementation Plan (approved or promulgated under Section 110 of the Clean Air Act). If the action is to take place in a non-attainment or maintenance area, it is subject to a General Conformity determination as indicated in 40 CFR 51. This determination can take one of three forms. If the action meets certain criteria, it may be specifically exempted. Most exemptions cover administrative-type actions; however, recurring activities, emergencies, and certain research and development activities are also exempted. If the action is determined to emit pollutants below specified *de minimis* thresholds and the potential emission levels are not regionally significant (less than 10 percent of the region’s emissions for a particular pollutant), the action can be assumed to conform to the State Implementation Plan. For actions that do not fall under either of these two categories, a complete conformity determination must be made. Specifics of this process are listed in 40 CFR 51 Subpart W.

In addition to those pollutants addressed by the NAAQS, Federal regulations address emissions of hazardous air pollutants (Clean Air Act, Section 112(b)). Under Federal law, hazardous air pollutants are those air pollutants to which no AAQS is applicable and that were established by Congress in the list in Section 112 of the Clean Air Act. There are currently 188 hazardous air pollutants listed, including, but not limited to, the pollutants controlled by the National Emissions Standards for Hazardous Air Pollutants (NESHAP) program (40 CFR 61 and 63).

Title V of the Clean Air Act Amendments of 1990 requires all major stationary sources to file an operating permit application. The resultant operating permit (Title V Air Permit) incorporates all applicable Federal requirements under the Clean Air Act affecting the respective source. A source is defined as a major source if it has the potential to emit any of the following:

- 91 metric tons (100 tons) per year of any regulated pollutant in an area in attainment for that pollutant

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- 9.1 metric tons (10 tons) per year of any one of the 188 hazardous air pollutants
- 23 metric tons (25 tons) per year of total hazardous air pollutants

In non-attainment areas, these thresholds are lower for specific pollutants. For example, the major source threshold for volatile organic compounds in an area classified as being in "serious ozone non-attainment" is 45 metric tons (50 tons) per year rather than 91 metric tons (100 tons) per year.

New or modified major sources in attainment areas would also be subject to Prevention of Significant Deterioration (PSD) review as presented in 40 CFR 51.166 in order to ensure the continued maintenance of a high air quality baseline standard. For the purpose of determining whether a source is subject to a PSD review, "new or modified major source" means:

(1) Any of the stationary sources of air pollutants listed in 40 CFR 51.166(b)(1)(I)(a) which emits, or has the potential to emit, 91 metric tons (100 tons) per year or more of any pollutant subject to regulation under the Clean Air Act

(2) Any stationary source which emits, or has the potential to emit, 227 metric tons (250 tons) per year or more of any air pollutant subject to regulation under the Clean Air Act

(3) Any physical change that would occur at a non-major stationary source if the change would constitute a major source in and of itself

Emissions from new or modified major sources are controlled using Best Available Control Technology. Geographical areas are ranked into three categories for purposes of PSD review. Class I areas are those areas where any appreciable deterioration of air quality would be considered significant. These areas include certain national parks and wilderness areas. Class II is the default classification. Class II areas can allow for moderate, well-controlled industrial growth. Under certain circumstances, states may reclassify areas as Class III. These areas allow for greater industrial development. The overall air quality impacts due to the source in question in combination with other sources in the area subject to PSD review must not exceed the area's allowable incremental increases identified in table 3.2-1.

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Table 3.2-1: Permissible PSD Incremental Increase (by Area Classification)

Pollutant	Averaging Time	Maximum Allowable Increase (micrograms per cubic meter)		
		Class I	Class II	Class III
Nitrogen Dioxide	Annual	2.5	25	50
Sulfur Dioxide	Annual	2	20	40
	24-hour	5	91	182
	3-hour	25	512	700
PM-10	Annual	4	17	34
	24-hour	8	30	60

Source: 40 CFR 51.166, revised as of July 1, 1995.

Note: PM-10 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers

3.2.1 ALASKA INSTALLATIONS

State Regulatory Framework

Alaska has established state AAQS. Emissions of air pollutants from operations in Alaska are limited to the more restrictive standard (Federal or state). Table 3.2-2 compares the NAAQS and the Alaska state AAQS.

Climate and Meteorology

Interior Alaska has a continental or subarctic climate characterized by long cold winters, short mild summers, and significant changes in the daily pattern throughout the year. Temperature averages in the Alaskan interior range from approximately 16° Celsius (C) (60° Fahrenheit [F]) in July to approximately -24° C (-12° F) in January. However, temperature extremes can vary from a low of approximately -51°C (-60°F) in the winter to a high of nearly 38°C (100°F) in the summer. Mean annual precipitation is approximately 33 centimeters (13 inches), with the majority occurring in the July through September timeframe. (U.S. Department of the Air Force, 1997—EA for Radar Upgrade Clear AFS, Alaska). Early summer is often dry with an increased hazard of fires. Prevailing winds in the vicinity west of Fairbanks are from the south–southeast and normally range from 0 to 21 kilometers (0 to 13 miles) per hour (U.S. Department of the Air Force, 1997—EA for Radar Upgrade Clear AFS, Alaska). However, in the area east of Fairbanks, there is much less wind, and it normally occurs from the north, except during June and July when it is from the southwest. In this area, winds average approximately 8 kilometers (5 miles) per hour. (U.S. Army Corps of Engineers, 1990—The Use and Environmental Impacts of Airboats on the Tanana Flats, Fort Wainwright, Alaska)

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Table 3.2-2: Federal and Alaska State Ambient Air Quality Standards

Pollutant	Averaging Time	Alaska State Standard	National Primary Standard	National Secondary Standard
Carbon Monoxide	8-hour	10 mg/m³ (9 ppm)	10 mg/m³ (9 ppm)	None
	1-hour	40 mg/m³ (35 ppm)	40 mg/m³ (35 ppm)	None
Lead	Quarterly(1)	1.5 µg/m³	1.5 µg/m³	Same as Primary
Nitrogen Dioxide	Annual(1)	100 µg/m³ (0.053 ppm)	100 µg/m³ (0.053 ppm)	Same as Primary
Ozone	8-hour(2)	None	164 µg/m³ (0.084 ppm)	Same as Primary
	1-hour	235 µg/m³ (0.12 ppm)	235 µg/m³ (0.12 ppm)	Same as Primary
PM-2.5	Annual(3)	None	15 µg/m³	Same as Primary
	24-hour(4)	None	65 µg/m³	Same as Primary
PM-10	Annual	50 µg/m³	50 µg/m³	Same as Primary
	24-hour(5)	150 µg/m³	150 µg/m³	Same as Primary
Sulfur Oxides(6)	Annual(1)	80 µg/m³ (0.03 ppm)	80 µg/m³ (0.03 ppm)	None
	24-hour	365 µg/m³ (0.14 ppm)	365 µg/m³ (0.14 ppm)	None
	3-hour	1,300 µg/m³ (0.5 ppm)	None	1,300 µg/m³ (0.5 ppm)
Reduced Sulfur(6)	30-minute	50 µg/m³ (0.02 ppm)	None	None
Ammonia	8-hour	2.1 mg/m³ (3.0 ppm)	None	None

Sources: 40 CFR 50.9; 18 AAC 50; U.S. Environmental Protection Agency, 1998—EPA's Updated Air Quality Standards for Smog and Particulate Matter.

(1)Calculated as the arithmetic mean

(2)Calculated as the 3-year average of the fourth highest daily maximum 8-hour ozone concentration

(3)Calculated as the 3-year average of annual arithmetic means

(4)Calculated as the 98th percentile of 24-hour PM-2.5 concentrations in a year (averaged over 3 years) at the population-oriented monitoring site with the highest measured values in the area.

(5)Calculated as the 99th percentile of 24-hour PM-10 concentrations in a year (averaged over 3 years)

(6) Measured as Sulfur Dioxide

Note: mg/m³ = milligrams per cubic meter, µg/m³ = micrograms per cubic meter, PM-10 = particulate matter with a mean aerodynamic diameter equal to not less than a nominal 10 micrometers, ppm = parts per million

The initial dispersion of pollutants generally occurs in the near-ground atmospheric mixing layer. The depth of this mixing layer is known as the mixing height and varies substantially depending upon atmospheric conditions. Turbulence caused by heat from the sun is a prime source of atmospheric instability. As such, the mixing height is generally highest during afternoon hours and lowest in the evening or early morning. However, temperature inversions (a common winter occurrence) may cause extended periods of low mixing heights. Low mixing heights may adversely affect regional air quality until the inversion is lifted. Average mixing heights near Fairbanks range from a low of approximately 198 meters (650 feet) on winter mornings to a high of approximately 604 meters (1,980 feet) on summer afternoons. However, actual mixing heights on any given day can vary widely from these values. As an example, in 1991, morning inversions in the area near Fairbanks ranged

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from 5 meters (16 feet) to more than 1,980 meters (6,500 feet) and afternoon inversions from 8 meters (26 feet) to higher than 3,690 meters (12,110 feet). Multiple inversion layers are common occurrences in the winter, and resultant mixing occurs primarily in a horizontal plane with only minimal vertical mixing. (U.S. Department of the Air Force, 1995—EIS, Alaska Military Operations Areas)

The climate and meteorology of coastal Alaska and the Aleutian Island chain differs significantly from that described above. The climate and meteorology of these sites are described in the appropriate section.

Regional Air Quality

Air quality in Alaska is generally very good, with the notable exception of two carbon monoxide nonattainment areas in and around urban areas of Anchorage and Fairbanks. The Fairbanks nonattainment area includes a small area in North Pole that is separated geographically from the Fairbanks nonattainment area, and specifically does not include Eielson AFB.

Several emissions sources in the vicinity of Fairbanks account for much of the regional background levels of nitrogen oxides and sulfur dioxide.

The excessively high carbon monoxide levels have been attributed mainly to motor vehicle use. Temperature inversions, low winter mixing heights, and decreased motor efficiency associated with the cold weather are all factors that contribute to higher pollutant concentrations for longer periods of time. Vehicle inspection and maintenance programs have been instituted and have been partially successful in reducing the incidence of exceedances in Alaska.

Alaska has four PSD Class I areas. Only one of these, Denali National Park and Preserve, is in the ROI for the Proposed Action. All other areas in Alaska are Class II for purposes of PSD review. Denali National Park and Preserve is located approximately 180 kilometers (110 miles) southwest of Eielson AFB.

3.2.1.1 Clear AFS—Air Quality

This section describes the air quality in the vicinity of Clear AFS. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further defined in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and state regulations are described in section 3.2.1. The climate and meteorology presented in section 3.2.1 apply to Clear AFS and its immediate environment. Clear AFS is in attainment for all NAAQS and state AAQS and should be evaluated as a PSD Class II area.

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Denali National Park is a Class I PSD area located approximately 40 kilometers (25 miles) south of Clear AFS. It would be within the base's air quality ROI. All other areas within the ROI are Class II for PSD determination purposes.

Existing Emissions Sources

Clear AFS operates under a permit shield while the Title V Air Permit application is under review. Clear AFS generates its own energy through a series of coal-fired steam turbine generators, which is also used for heating a portion of the base. Smaller fuel-oil furnaces are used in those areas not heated by the power plant's steam. Emergency power is provided through a series of diesel-fuel generators. There is also an emergency water pump to maintain the availability of water on Clear AFS. The cafeteria operates a solid waste incinerator to dispose of dry waste generated from cafeteria operations packaging. Various shops and operational sites on-station generate a variety of hazardous air pollutants and volatile organic compounds, which may act as ozone precursors. Clear AFS is a major source of hazardous air pollutants. Table 3.2-3 summarizes the 1997 air emissions inventory for Clear AFS. (Air Force Space Command, 1998—1997 Air Emissions Inventory, Clear AS, Alaska)

3.2.1.2 Eareckson AS—Air Quality

This section describes the air quality in the vicinity of Eareckson AS, which effectively encompasses the entire island of Shemya, Alaska. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further described in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and state regulations are described in section 3.2.1.

Climate and Meteorology

Shemya Island has a maritime climate, characterized by long, moderately cold winters and short, cool summers. Winter winds average approximately 35 kilometers per hour (22 miles per hour) and have been known to reach 182 kilometers per hour (113 miles per hour). Summer winds are comparatively mild, generally ranging between 21 to 24 kilometers per hour (13 to 15 miles per hour). Temperatures range from approximately -4 to +2°C (25 to 35°F) in the winter up to approximately 6 to 12°C (44 to 54°F) in the summer. Shemya Island receives some form of precipitation nearly every day of the year and averages approximately 76 centimeters (30 inches) annually. Winter precipitation is generally in the form of snow, ice, or a mixture of the two. In the summer, misty rain, light drizzle, and heavy fog are common. (U.S. Department of the Air Force, 1997—Final Installation–Wide Environmental Baseline Survey, Eareckson AS, Alaska)

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Table 3.2-3: 1997 Air Emissions Inventory—Clear AFS

Emission Source	Emissions (Metric Tons [Tons] per Year)					
	Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	PM-10	VOC	HAP
Power Plant Boilers	177.22 (195.35)	485.58 (535.26)	236.01 (260.16)	57.06 (62.90)	1.78 (1.96)	48.26 (53.20)
Diesel Generators	0.14 (0.16)	0.57 (0.63)	0.06 (0.07)	0.02 (0.02)	0.03 (0.03)	< 0.01 (< 0.01)
Emergency Water Pump	< 0.01 (< 0.01)	0.03 (0.03)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	< 0.01 (< 0.01)
Furnaces	0.21 (0.23)	0.84 (0.93)	2.43 (2.68)	0.05 (0.05)	0.02 (0.02)	< 0.01 (< 0.01)
Cafeteria Incinerator	0.13 (0.14)	0.05 (0.06)	0.10 (0.09)	0.05 (0.06)	0.04 (0.04)	< 0.01 (< 0.01)
Vehicle Fueling	--	--	--	--	0.06 (0.07)	0.03 (0.03)
Storage Tanks	--	--	--	--	0.06 (0.07)	0.01 (0.01)
Coal Handling	--	--	--	0.04 (0.04)	--	< 0.01 (< 0.01)
Landfill	--	--	--	--	0.68 (0.75)	0.15 (0.16)
Fire Training	0.18 (0.20)	< 0.01 (< 0.01)	--	--	0.03 (0.03)	--
Shop Chemical Usage	--	--	--	--	1.59 (1.75)	0.20 (0.22)
Total	177.89 (196.09)	487.09 (536.92)	238.60 (263.01)	57.23 (63.09)	4.29 (4.73)	48.64 (53.62)

Source: Air Force Space Command, 1998—1997 Air Emissions Inventory, Clear AS, Alaska.

Note: HAP = hazardous air pollutant, PM-10 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers, VOC = volatile organic compound

Regional Air Quality

The only significant source of emissions in the vicinity of Shemya Island is Eareckson AS, which operates within the restrictions of its Title V Air Permit. As such, the area is assumed to be in attainment for the NAAQS and state AAQS. The U.S. EPA has classified Shemya Island (and the vicinity of Eareckson AS) as Class II for PSD review purposes. There are no Class I areas within the ROI.

Existing Emissions Sources

Eareckson AS is classified as a major emissions source and maintains a Title V Air Permit issued by the Alaska Department of Environmental

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Conservation. An air emissions inventory was conducted before the conversion of Eareckson AS from an active base to caretaker status. Table 3.2-4 summarizes the estimated maximum annual emissions anticipated at Eareckson AS while in caretaker status. Eareckson AS is not a major source of hazardous air pollutants.

Table 3.2-4: Air Emissions Inventory—Eareckson AS

Emission Source	Emissions (Metric Tons [Tons] per Year)					
	Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	PM-10	VOC	HAP
Boilers, Generators, and Furnaces	91.16 (100.49)	349.09 (384.81)	27.81 (30.65)	5.72 (6.30)	11.26 (12.41)	0.19 (0.21)
Fuel Storage and Handling	--	--	--	--	3.63 (4.00)	0.38 (0.42)
Miscellaneous Sources	--	--	--	3.57 (3.93)	--	0
Total	91.16 (100.49)	349.09 (384.81)	27.81 (30.65)	9.29 (10.23)	14.89 (16.41)	0.57 (0.63)

Source: U.S. Department of the Air Force, 1995—Eareckson AS 1993/1994 Emissions Survey Final Report.

Note: The values presented here are based on caretaker status and the use of Diesel Fuel-8 as the sole fuel source.

PM-10 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers, VOC = volatile organic compound, HAP = hazardous air pollutant

3.2.1.3 Eielson AFB—Air Quality

This section describes the air quality in the vicinity of Eielson AFB. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further defined in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and state regulations are described in section 3.2.1. The climate and meteorology presented in section 3.2.1 apply to Eielson AFB and its immediate environment. The regional air quality is described in section 3.2. Eielson AFB is in attainment for all NAAQS and state AAQS and should be evaluated as a PSD Class II area.

Existing Emissions Sources

Eielson AFB is classified as a major emissions source and is in the process of obtaining a Title V Air Permit through the Alaska Department of Environmental Conservation. Table 3.2-5 summarizes the 1997 emissions summary for Eielson AFB. Eielson AFB is a major source of hazardous air pollutants.

Table 3.2-5: 1997 Air Emission Inventory—Eielson AFB

Emission Source	Emissions (Metric Tons [Tons] per year)					
	Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	Particulate Matter	VOC	HAP
Coal Boilers	412.1 (454.3)	1,129.0 (1,244.5)	783.9 (864.1)	300.7 (331.5)	4.1 (4.5)	121.12 (133.51)
Oil Boilers	0.5 (0.5)	1.9 (2.1)	6.7 (7.4)	0.1 (0.1)	0.05 (0.06)	0
Large Engines (>450 kilowatts)	3.6 (4.0)	16.5 (18.2)	0.5 (0.6)	0.3 (0.3)	0.5 (0.5)	0.02 (0.02)
Small Engines (<450 kilowatts)	0.3 (0.3)	1.3 (1.4)	0.1 (0.1)	0.1 (0.1)	0	0
Waste Incinerator	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	0	<0.01 (<0.01)
Hush House	3.6 (4.00)	3.8 (4.2)	0.2 (0.2)	0.1 (0.1)	0.8 (0.9)	0.19 (0.21)
Commercial Gas Stations	0	0	0	0	22.1 (24.4)	1.31 (1.44)
Base-wide Evaporative Emissions	0	0	0	0	3.1 (3.4)	3.05 (3.36)
Radio Direction Finding (RDF) Machine	0	0	0	0.5 (0.5)	0	0
Wastewater Treatment Plant	0	0	0	0	1.6 (1.8)	0
Unpaved Roads	0	0	0	6.9 (7.6)	0	0
Ozone Depleting Chemicals	0	0	0	0	13.3 (14.7)	13.36 (14.73)
Gravel Quarries	0	0	0	0.03 (0.03)	0	0
Fuel Handling: Other Gasoline	0	0	0	0	2.4 (2.7)	0.15 (0.16)
Fuel Handling: Diesel	0	0	0	0	0.3 (0.3)	0
Fuel Handling: JP-8	0	0	0	0	0.7 (0.8)	0.22 (0.24)
Fuel Handling: JP-4	0	0	0	0	0.6 (0.7)	0
Insignificant Boilers	0.21 (0.23)	0.82 (0.90)	0.87 (0.96)	0.08 (0.09)	0.03 (0.03)	<0.01 (<0.01)
Insignificant Generators	0.02 (0.02)	0.06 (0.07)	<0.01 (<0.01)	0.01 (0.01)	<0.01 (<0.01)	0

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Table 3.2-5: 1997 Air Emission Inventory—Eielson AFB (Continued)

Emission Source	Emissions (Metric Tons [Tons] per year)					
	Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	Particulate Matter	VOC	HAP
Wood Shop Cyclones	0	0	0	<0.01 (<0.01)	0	0
Smart Ash Burners	<0.01 (0.01)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	0	0
Ethylene Glycol (De-icer)	0	0	0	0	0.03 (0.03)	0.05 (0.06)
Wastewater Treatment Plant Flare	0.15 (0.16)	0.03 (0.03)	0	0.02 (0.02)	0.05 (0.06)	0
Coal Handling	0	0	0	0.3 (0.3)	0	0
Miscellaneous Exempt Emissions Units	0.18 (2.0)	0.9 (1.0)	0.9 (1.0)	1.8 (2.0)	0.9 (1.0)	0.91 (1.00)
Totals	422.29 (465.5)	1,154.3 (1,272.4)	793.2 (874.3)	310.80 (342.6)	50.9 (56.1)	140.38 (154.74)

Source: U.S. Department of the Air Force, 1998—Draft Emissions Inventory Report for Calendar Year 1998, Eielson AFB.

Note: HAP = hazardous air pollutant, VOC = volatile organic compound

Although the base itself is located in an attainment area, the Fairbanks North Star Borough is in nonattainment for carbon monoxide. During episodes of cold winter weather, atmospheric inversions may trap contaminants and cause exceedances of the NAAQS or state AAQS. According to Fairbanks North Star Borough studies, approximately 90 percent of all carbon monoxide produced within the borough is from vehicles. (U.S. Department of the Air Force, 1992—EA, Upgrade Eielson Sewage Treatment Plant, Eielson AFB) Denali National Park, a Class I PSD area, is approximately 180 kilometers (110 miles) from Eielson AFB, and would be within the base's ROI.

The base recently conducted a PSD review and obtained a PSD Operating Permit that addresses emissions of nitrogen oxides. This application restricts oil-fired boilers installed after 1981 to an overall average 50-percent utility and restricts diesel engines installed since 1981 (other than the 25-megawatt power plant generator) to an overall average of 500 hours of operation per year. These two operating limitations avoid triggering the PSD applicability threshold for sulfur dioxide and reduce the potential-to-emit level for nitrogen oxides from engines installed since 1981. (U.S. Department of the Air Force, 1999—PSD Operating Permit, Eielson AFB)

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3.2.1.4 Fort Greely—Air Quality

This section describes the air quality in the vicinity of Fort Greely. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further defined in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and state regulations are described in section 3.2.1. The climate and meteorology presented in section 3.2.1 are generally representative of the Fort Greely area, though wind speeds are higher here, averaging approximately 18 kilometers (11 miles) per hour and are generally southerly along the Delta River in the summer. (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely)

Regional Air Quality

Fort Greely is approximately 172 kilometers (107 miles) southeast of Fairbanks, Alaska. As such, it is removed from many of the sources that disrupt air quality in the Fairbanks region. Principal sources of air pollution in the Fort Greely area are vehicles and the burning of various fuels for heat and/or power. Air quality parameters, primarily particulate levels, tend to deteriorate during the summer months due to wildfire smoke and high winds blowing dust. Ice fog, frozen vapor from internal combustion engines, affects air quality and visibility when air temperatures are below -34°C (-30°F). The overall air quality is good, and the area is in attainment (or unclassifiable) for all NAAQS and state AAQS (U.S. Army Center for Health Promotion and Preventive Medicine, 1996—Air Pollution Emission Statement No. 43-21-5681-96). The Fort Greely area is considered a PSD Class II area.

Existing Emissions Sources

Fort Greely is a major emissions source and has submitted an application for a Title V Air Permit to the Alaska Department of Environmental Conservation. Fort Greely is not a major source of hazardous air pollutants. Table 3.2-6 summarizes the assessable emissions as of December 7, 1997.

3.2.1.5 Yukon Training Area (Fort Wainwright)—Air Quality

This section describes the air quality in the vicinity of the Yukon Training Area. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further defined in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and state regulations are described in section 3.2.1.

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Table 3.2-6: Fort Greely Assessable Emissions Summary—1997

		Emissions (Metric Tons [Tons] per Year)					
Emission Source		Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	PM-10	VOC	HAP
1	2-Industrial Boilers, 57.9 × 106 BTU/hour	2.77 (3.05)	11.07 (12.20)	6.29 (6.93)	0.56 (0.62)	0.11 (0.12)	--
2	Industrial Boilers, 67.3 × 106 BTU/hour	1.39 (1.53)	5.53 (6.10)	3.15 (3.47)	0.28 (0.31)	0.05 (0.06)	--
3-5	(3) Generators, 1,000-kilowatt	1.52 (1.68)	5.69 (6.27)	0.16 (0.18)	0.11 (0.12)	0.16 (0.18)	--
6-7	(2) Generators, 1,250-kilowatt	1.25 (1.38)	4.74 (5.22)	0.13 (0.14)	0.09 (0.10)	0.13 (0.14)	--
8	3-Generators, 125-kilowatt	3.12 (3.44)	14.46 (15.94)	0.95 (1.05)	1.02 (1.12)	1.18 (1.30)	--
9	Open Burn Pit	91.04 (100.35)	6.42 (7.08)	1.07 (1.18)	17.14 (18.89)	32.13 (35.42)	--
10	Aboveground Storage Tank–Diesel–76,000-liter (20,000-gallon)	0	0	0	0	< 0.01 (< 0.01)	--
11	2-Underground Storage Tanks–Diesel–130,000-liter (35,000-gallon)	0	0	0	0	0.02 (0.02)	
12	Underground Storage Tank–Diesel–110,000-liter (30,000-gallon)	0	0	0	0	< 0.01 (< 0.01)	--
13	Underground Storage Tank–Diesel–57,000-liter (15,000-gallon)	0	0	0	0	< 0.01 (< 0.01)	--
14	Underground Storage Tank–JP-4–76,000-liter (20,000-gallon)	0	0	0	0	0.45 (0.50)	--
15	Aboveground Storage Tank–Diesel–2,390,000-liter (630,000-gallon)	0	0	0	0	0.05 (0.06)	--
16	Prescribed Burning/Firefighter Training	3,225.22 (3,555.20)	72.57 (80.00)	--	299.01 (329.60)	--	--
17	Ozone Depleting Chemicals	0	0	0	0	0	0.27 (0.30)
18	Fugitive Dust	0	0	0	1.42 (1.56)	0	--
19	Municipal Landfill	0	0	0	0	0.36 (0.40)	--
--	Miscellaneous Insignificant Sources	0.84 (0.93)	3.32 (3.66)	1.36 (1.50)	0.57 (0.63)	2.66 (2.93)	--
Total		3,327.15 (3,667.56)	123.80 (136.47)	13.11 (14.45)	320.19 (352.95)	37.34 (41.16)	0.27 (0.30)

Source: U.S. Army Center for Health Promotion and Preventive Medicine, 1997—Title V Permit Application Fort Greely, Alaska

Note: PM-10 = Particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers, VOC = volatile organic compound, HAP = hazardous air pollutant, BTU = British Thermal Unit

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The Yukon Training Area is to the east of Eielson AFB. The climate and meteorology presented in section 3.2.1 provide an accurate description of the Yukon Training Area. The area is in attainment for all NAAQS and state AAQS and is physically removed from the Fairbanks carbon monoxide non-attainment area. The Yukon Training area is considered a PSD Class II area.

Existing Emissions Sources

The Yukon Training Area is an undeveloped area currently used for a variety of military exercise and training activities. These activities include heavy machinery movements, low-level overflights by aircraft or helicopters, and troop movements. The primary emissions sources in the area are vehicles, aircraft, and occasional portable power generators. No emissions inventory has been identified for this site.

3.2.2 NORTH DAKOTA INSTALLATIONS

State Regulatory Framework

The North Dakota Department of Health has established state AAQS designed to maintain public health and welfare. These standards are either equivalent to or stricter than the NAAQS. In addition to the pollutants covered by the NAAQS, the North Dakota state AAQS include hydrogen sulfide. Table 3.2-7 compares the NAAQS and the North Dakota state AAQS.

Climate and Meteorology

The normal average annual temperature in North Dakota ranges from approximately 3°C (37°F) in the northeast to 6°C (43°F) along the southern border. It ranges from approximately –17°C (2°F) in January to approximately 19°C (67°F) in July. Winter temperatures in northeast North Dakota are among the coldest in the contiguous United States, and the normal winter temperatures in the southwestern portion still compare with temperatures found in northern Iowa or upstate New York. Summer temperatures above 32°C (90°F) occur in northeast North Dakota, on average, only 8 days annually. (Jensen, undated—Climate of North Dakota)

Average snowfall in North Dakota ranges from less than 66 centimeters (26 inches) to approximately 97 centimeters (38 inches). The northeast portion of the state generally receives amounts in the high end of this range. However, the average maximum snow depth during the winter season is only 23 to 38 centimeters (9 to 15 inches). This level varies substantially from year to year. (Jensen, undated—Climate of North Dakota)

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Table 3.2-7: Federal and North Dakota State Ambient Air Quality Standards

Pollutant	Averaging Time	North Dakota Standard	National Primary Standard	National Secondary Standard
Carbon Monoxide	8-hour	10 mg/m^3 (9 ppm)	10 mg/m^3 (9 ppm)	None
	1-hour	40 mg/m^3 (35 ppm)	40 mg/m^3 (35 ppm)	None
Hydrogen Sulfide	3-month[(1)]	28 μg/m^3 (0.02 ppm)	None	None
	24-hour	140 μg/m^3 (0.10 ppm)	None	None
	1-hour	280 μg/m^3 (0.20 ppm)	None	None
	Instantaneous[(2)]	14 mg/m^3 (10 ppm)	None	None
Lead	Quarterly[(1)]	1.5 μg/m^3	1.5 μg/m^3	Same as Primary
Nitrogen Dioxide	Annual[(1)]	100 μg/m^3 (0.053 ppm)	100 μg/m^3 (0.053 ppm)	Same as Primary
Ozone	8-hour[(3)]	None	164 μg/m^3 (0.084 ppm)	Same as Primary
	1-hour	235 μg/m^3 (0.12 ppm)	235 μg/m^3 (0.12 ppm)	Same as Primary
PM-2.5	Annual[(4)]	None	15 μg/m^3	Same as Primary
	24-hour[(5)]	None	65 μg/m^3	Same as Primary
PM-10	Annual	50 μg/m^3	50 μg/m^3	Same as Primary
	24-hour[(6)]	150 μg/m^3	150 μg/m^3	Same as Primary
Sulfur Oxides[(7)]	Annual[(1)]	60 μg/m^3 (0.023 ppm)	80 μg/m^3 (0.03 ppm)	None
	24-hour	260 μg/m^3 (0.099 ppm)	365 μg/m^3 (0.14 ppm)	None
	1-hour	715 μg/m^3 (0.273 ppm)	None	None
	3-hour	None	None	1,300 μg/m^3 (0.5 ppm)

Sources: 40 CFR 50.9; NDACP 33-15-02; U.S. Environmental Protection Agency, 1998—EPA's Updated Air Quality Standards for Smog and Particulate Matter.

[(1)]Calculated as the arithmetic mean

[(2)]Ceiling level, not to be exceeded at any point in time.

[(3)]Calculated as the 3-year average of the fourth highest daily maximum 8-hour ozone concentration

[(4)]Calculated as the 3-year average of annual arithmetic means

[(5)]Calculated as the 98th percentile of 24-hour PM-2.5 concentrations in a year (averaged over 3 years) at the population-oriented monitoring site with the highest measured values in the area.

[(6)]Calculated as the 99th percentile of 24-hour PM-10 concentrations in a year (averaged over 3 years)

[(7)] Measured as sulfur dioxide

Note: mg/m^3 = milligrams per cubic meter, μg/m^3 = micrograms per cubic meter, PM-10 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers, PM-2.5 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 2.5 micrometers, ppm = parts per million

Average annual precipitation in North Dakota ranges from approximately 33 centimeters (13 inches) to more than 51 centimeters (20 inches), with northeast North Dakota again being in the high end of that average. The majority of the rain falls in the summer. June is generally the wettest month with an average of approximately 8 centimeters (3 inches) of precipitation. (Jensen, undated—Climate of North Dakota)

Relative humidity is one of the primary indicators of atmospheric turbulence. It ranges from approximately 51 to 74 percent in North Dakota, with the northeast generally at the lower end of the scale. (Jensen, undated—Climate of North Dakota)

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Wind in North Dakota generally originates from the northwest and averages approximately 16 kilometers (10 miles) per hour.

The initial dispersion of pollutants generally occurs in the near-ground atmospheric mixing layer. The depth of this mixing layer is known as the mixing height and varies substantially depending upon atmospheric conditions. Turbulence caused by heat from the sun is a prime source of atmospheric instability. As such, the mixing height is generally highest during afternoon hours and lowest in the evening or early morning. However, temperature inversions (generally a winter occurrence) may cause extended periods of low mixing heights. Low mixing heights may adversely affect regional air quality until the inversion is lifted. The mixing heights in northeast North Dakota range from an average of approximately 280 meters (900 feet) on winter mornings to approximately 1,900 meters (6,200 feet) on summer afternoons. (U.S. EPA, 1972—Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States)

Regional Air Quality

The *1997 Air Quality Monitoring Report* (North Dakota Health Department, 1999) indicates that all regions in North Dakota are in attainment or unclassifiable for all NAAQS. The state monitored air quality at 13 locations, and industry maintained another 10 pollutant-specific monitors. No exceedances of NAAQS or state AAQS were recorded in the ROIs. All areas within the ROIs are designated by the U.S. Environmental Protection Agency (U.S. EPA) as Class II for PSD purposes. There are no Class I areas within the ROIs.

3.2.2.1 Cavalier AFS—Air Quality

This section describes the air quality in the vicinity of Cavalier AFS. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further defined in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and North Dakota state regulations are described in section 3.2.2. The climate of North Dakota varies little throughout the state and is described in section 3.2.2. The Cavalier AFS region is considered a PSD Class II area.

Existing Emissions Sources

Cavalier AFS is classified as a major emissions source and maintains a Title V Air Pollution Control Permit issued by the North Dakota Department of Health. Table 3.2-8 summarizes the emissions from the significant emissions sources regulated by the permit. It does not include those units or activities classified as insignificant by the North Dakota Department of Health. Non-permitted sources and activities at Cavalier AFS that are covered by the Title V Air Permit as insignificant emissions sources include maintenance equipment and activities, construction

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equipment, and fueling operations (North Dakota Department of Health, 1997—Air Pollution Control Title V Permit to Operate, Cavalier AS). No reportable levels of hazardous air pollutants were identified in the emissions summary for Cavalier AFS (Department of the Air Force, 1998—1997 Annual Emissions Inventory Report, Cavalier AS). Cavalier AFS is not considered a major source of hazardous air pollutants.

Table 3.2-8: 1997 Air Emissions Inventory—Cavalier AFS

Emission Source	Emissions (Metric Tons [Tons] per Year)					
	Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	PM-10	VOC	HAP[1]
Dual-fuel Boiler 11.64×106 BTU/hour	0.28 (0.31)	1.14 (1.26)	0.05 (0.05)	0.04 (0.04)	0.02 (0.02)	--
5 Dual-fuel Generators, 3 Megawatts each	47.06 (51.88)	184.68 (203.57)	2.98 (3.28)	2.96 (3.26)	35.74 (39.40)	--
Emergency Generators	0.01 (0.01)	0.04 (0.04)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	--
Air Compressor 200 Horsepower	<0.01 (<0.01)	0.03 (0.03)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	--
Fire Water Pump (2 each)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	<0.01 (<0.01)	--
Total	47.36 (52.21)	185.88 (204.90)	3.03 (3.34)	3.00 (3.31)	35.77 (39.43)	--

Source: Department of the Air Force, 1998—Annual Emissions Inventory Report, Cavalier AS.

[1] There were no reportable HAPs emissions listed in the Title V Emissions Survey for Cavalier AFS.

Note: BTU = British Thermal Unit, PM-10 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers, VOC = volatile organic compound, HAP = hazardous air pollutant

3.2.2.2 Grand Forks AFB—Air Quality

This section describes the air quality in the vicinity of Grand Forks AFB. The ROI for air quality includes the geographic airshed in which the emissions would occur and is further defined in section 3.2. Federal regulations applicable to air quality are described in section 3.2, and North Dakota state regulations are described in section 3.2.2. The climate of North Dakota varies little throughout the state and is described in section 3.2.2. The vicinity of Grand Forks AFB is in attainment for all NAAQS and state AAQS and is considered a PSD Class II area.

Existing Emissions Sources

Grand Forks AFB has several stationary pollutant emissions sources and is classified as a major emissions source as defined in section 3.2. The Title V Air Permit issued to Grand Forks AFB by the North Dakota state

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Department of Health in October 1997 restricts permissible emissions on the base. This permit delineates the permissible emissions from each potentially significant stationary emission source. It specifies air pollution control measures required, record keeping measures, and annual reporting requirements. This permit also addresses insignificant emissions units and activities. Table 3.2-9 summarizes the results reported in the 1997 emissions inventory. Grand Forks AFB is not considered a major source of hazardous air pollutants. (Department of the Air Force, 1998—Annual Emissions Inventory Report, Grand Forks AFB)

Table 3.2-9: 1997 Air Emissions Inventory—Grand Forks AFB

Emission Source	Emissions (Metric Tons [Tons] per Year)					
	Carbon Monoxide	Oxides of Nitrogen	Oxides of Sulfur	PM-10	VOC	HAP
2 Jet Kerosene Storage Tank	--	--	--	--	0.02 (0.02)	--
3 Dual-fuel Boilers–42 ×106 BTU/hour each	0.72 (0.79)	8.78 (9.68)	0.64 (0.71)	0.12 (0.13)	0.03 (0.03)	--
7 Dual-fuel Boilers–18.75 ×106 BTU/hour each	8.35 (9.20)	112.28 (123.77)	1.57 (1.73)	1.11 (1.23)	0.35 (0.39)	--
Oil-fired Boiler – 10.5 ×106 BTU/hour	0.02 (0.02)	0.07 (0.08)	0.10 (0.11)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	--
Incinerator	0.01 (0.01)	0.18 (0.20)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	--
Natural Gas Boiler–5.021 ×106 BTU/hour	< 0.01 (< 0.01)	0.05 (0.06)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	--
Natural Gas Boiler–1.15 ×106 BTU/hour	< 0.01 (< 0.01)	0.05 (0.06)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	< 0.01 (< 0.01)	--
Emergency Generators	2.29 (2.52)	10.51 (11.59)	1.96 (2.16)	0.42 (0.46)	0.61 (0.67)	--
Fire Training	--	--	--	--	--	0.57 (0.63)(1)
Paint Booth	--	--	--	--	--	0.62 (0.68)(2)
Medical Waste Incinerator	--	--	--	--	--	0.09 (0.10)(3)
Total	11.39 (12.55)	131.94 (145.44)	4.28 (4.72)	1.66 (1.83)	10.17 (11.21)	1.28 (1.41)

Source: Department of the Air Force, 1998—Annual Emissions Inventory Report, Grand Forks AFB.

Note: BTU = British Thermal Unit, HAP = hazardous air pollutant, PM-10 = particulate matter with a mean aerodynamic diameter equal to or less than a nominal 10 micrometers, VOC = volatile organic compound

(1) Formaldehyde

(2) Methyl ethyl ketone

(3) Hydrogen chloride

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3.2.2.3 Missile Site Radar—Air Quality

This section describes the air quality in the vicinity of the Missile Site Radar. The ROI for air quality includes the geographic airshed in which the emissions would occur. This broad area encompasses both direct, immediate impacts due to criteria pollutants and hazardous air pollutants that generally disperse within a few miles of the emissions source, and indirect, delayed impacts due to precursor actions (primarily ozone precursors) that can delay impacts for several hours. Federal regulations applicable to air quality are described in section 3.2, and state regulations are described in section 3.2.2. The climate of North Dakota varies little throughout the state and is described in section 3.2.2. The area is in attainment for all NAAQS and state AAQS and is considered a PSD Class II area.

Existing Emissions Sources

The Missile Site Radar is currently in caretaker status. As such, emissions are minimal and are limited to groundskeeping, security activities, and minimal maintenance of used buildings.

3.2.2.4 Remote Sprint Launch Site 1—Air Quality

The air quality and emission sources at Remote Sprint Launch Site 1 are similar to those described for the Missile Site Radar.

3.2.2.5 Remote Sprint Launch Site 2—Air Quality

The air quality and emission sources at Remote Sprint Launch Site 2 are similar to those described for the Missile Site Radar.

3.2.2.6 Remote Sprint Launch Site 4—Air Quality

The air quality and emission sources at Remote Sprint Launch Site 4 are similar to those described for the Missile Site Radar.

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3.3 AIRSPACE

Airspace, or that space which lies above a nation and comes under its jurisdiction, is generally viewed as being unlimited. However, it is a finite resource that can be defined vertically and horizontally, as well as temporally, when describing its use for aviation purposes. The scheduling, or time dimension, is a very important factor in airspace management and air traffic control.

Under Public Law 85-725, the FAA is charged with the safe and efficient use of the nation's airspace and has established certain criteria and limits to its use. The method used to provide this service is the National Airspace System. This system is "...a common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information and manpower and material" (Aeronautical Information Manual, 1998—FAR/AIM 98).

Airspace for this EIS only covers those installations where an XBR could be deployed as part of the NMD program. Since there would be no change in airspace as a result of GBI or BMC2 deployment, those installations where these elements could be deployed are not addressed in the airspace resource area.

Types of Airspace

Controlled and Uncontrolled Airspace. Controlled and uncontrolled airspace is divided into six classes, dependent upon location, use, and degree of control. Figure 3.3-1 depicts the various classes of controlled airspace. Class A airspace, which is not specifically charted, is generally, that airspace from 5,486 meters (18,000 feet) mean sea level up to and including flight level 600 (18,288 meters or 60,000 feet). Unless otherwise authorized, all aircraft must be operated under instrument flight rules. Class B airspace is, generally, that airspace from the surface to 3,048 meters (10,000 feet) mean sea level surrounding the nation's busiest airports in terms of instrument flight rules operations or passenger enplanements. An air traffic control clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. Class C airspace is, generally, that airspace from the surface to 1,219 meters (4,000 feet) above the airport elevation surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of instrument flight rules operations or passenger enplanements. Class D airspace is, generally, that airspace from the surface to 762 meters (2,500 feet) above the airport elevation surrounding those airports that have an operational control tower. Class E airspace is controlled airspace that is not Class, A, Class B, Class C, or Class D airspace.

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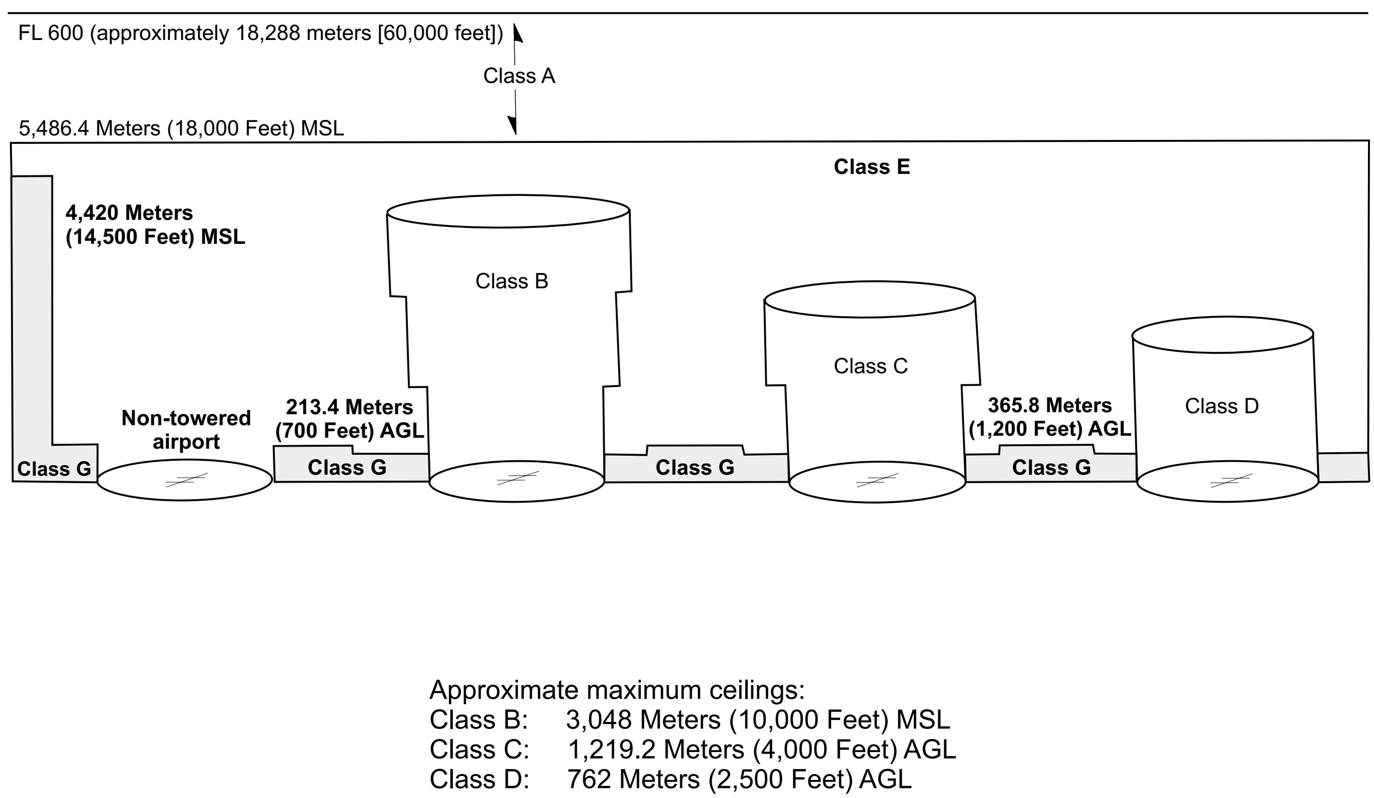

EXPLANATION

AGL = Above Ground Level
FL = Flight Level
MSL = Above Mean Sea Level

The Six Classes of Non-Military Airspace

Figure 3.3-1

Not to Scale

dp_as_01

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Uncontrolled airspace, or Class G airspace, has no specific definition but generally refers to airspace not otherwise designated. No air traffic control service to aircraft operating under either instrument or visual flight rules is provided other than possible traffic advisories when the air traffic control workload permits and radio communications can be established (Illman, 1993—The Pilot's Air Traffic Control Handbook).

Special Use Airspace. Complementing the classes of controlled and uncontrolled airspace described above are several types of special use airspace used by the military to meet its particular needs. Special use airspace consists of that airspace wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of these activities, or both. Except for Controlled Firing Areas, special use airspace areas are depicted on aeronautical charts, which also include hours of operation, altitudes, and the controlling agency. Only the kinds of special use airspace found in the ROI are described. These include:

- Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Activities within these areas must be confined, because of their nature, or limitations imposed upon aircraft operations that are not a part of these activities, or both. Restricted Areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Restricted Areas are published in the Federal Register and constitute Federal Aviation Regulation (FAR) Part 73. (Aeronautical Information Manual, 1998—FAR/AIM 98)
- Military Operations Areas consist of airspace of defined vertical and lateral limits established for the purpose of separating certain non-hazardous military training activities from instrument flight rules traffic and to identify for visual flight rules traffic where these activities are conducted. Whenever a military operations area is being used, non-participating instrument flight rules traffic may be cleared through a military operations area if instrument flight rules separation can be provided by Air Traffic Control. Otherwise, Air Traffic Control will reroute or restrict non-participating instrument flight rules traffic (Aeronautical Information Manual, 1998—FAR/AIM 98).

Other Airspace Areas. Other types of airspace include airport advisory areas, military training routes, temporary flight restrictions areas, flight limitations/prohibitions areas, parachute jump aircraft operations areas, published visual flight rules routes, and terminal radar service areas (Aeronautical Information Manual, 1998 FAR/AIM 98). Of these, military training routes are described below:

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- Military Training Routes, a joint venture by the FAA and the DOD, are mutually developed for use by the military for the purpose of conducting low-altitude, high speed training. The routes above 457 meters (1,500 feet) above ground level are developed to be flown, to the maximum extent possible, under instrument flight rules. The routes at 457 meters (1,500 feet) above ground level and below are generally developed to be flown under visual flight rules. Generally, military training routes are established below 3,048 meters (10,000 feet) mean sea level for operations at speeds in excess of 463 kilometers per hour (250 knots). However, route segments may be defined at higher altitudes for purposes of route continuity (Aeronautical Information Manual, 1996—FAR/AIM 98). In addition to the instrument and visual flight rules routes, there are slow speed low altitude routes used for military air operations at or below 457 meters (1,500 feet) at airspeeds of 463 kilometers per hour (250 knots) or less (National Imagery and Mapping Agency, 1998—DOD Flight Information Publication).

3.3.1 ALASKA INSTALLATIONS

3.3.1.1 Eareckson AS—Airspace

The ROI is defined as that area that could be affected by either the ongoing No-action Alternative activities or that could potentially be affected by the Proposed Action. For the purposes of this document it is that airspace within approximately 185 kilometers (100 nautical miles) of the proposed XBR on Shemya Island, in the western Aleutian Islands, Alaska. A description of the airspace resource is given in section 3.3.

The affected airspace use environment in the western Aleutian Islands airspace ROI is described below in terms of its principal attributes, namely: controlled and uncontrolled airspace; special use airspace, military training routes, en route airways and jet routes, airports and airfields, air navigation facilities, and air traffic control.

Controlled and Uncontrolled Airspace

The ROI is composed of Class A airspace from 5,486 meters (18,000 feet) mean sea level up to and including flight level 600 (18,288 meters or 60,000 feet). Below 5,486 meters (18,000 feet), the ROI is composed largely of Class G (uncontrolled) airspace, except for the area around Eareckson AS which is Class E airspace. The Class E airspace extends upward from 213 meters (700 feet) above the surface within a 13-kilometer (6.9-nautical-mile) radius of Eareckson AS, and includes that airspace extending upward from 366 meters (1,200 feet) above the surface within a 48.5-kilometer (26.2-nautical-mile) radius of Eareckson AS, excluding that airspace more than 22 kilometers (12 nautical miles)

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from the shoreline. There is no Class B airspace, which usually surrounds the busiest airports, Class C or Class D airspace in the ROI.

Special Use Airspace

There is no special use airspace in the Western Aleutian Islands airspace ROI.

Military Training Routes

Although there are no Military Training Routes in the ROI, there is a Military Instrument Flight Rules route (route 604) from St. Paul Island to Eareckson AS. Military Instrument Flight Rule routes are a military backup to the civilian (FAA) system and are used by military aircraft.

En route Airways and Jet Routes

There is one en route low altitude airway, G8, connecting Shemya with Adak Island to the east, in the ROI. Located on the great circle route from North America to the Far East, there are many en route high altitude jet routes that cross the Western Aleutian Islands airspace ROI (figure 3.3-2).

As an alternative to aircraft flying above 8,839 meters (29,000 feet) following the published, preferred instrument flight rules routes (shown in figure 3.3-2), the FAA is gradually permitting aircraft to select their own routes as alternatives. This “Free Flight” program is an innovative concept designed to enhance the safety and efficiency of the National Airspace System. The concept moves the National Airspace System from a centralized command-and-control system between pilots and air traffic controllers to a distributed system that allows pilots, whenever practical, to choose their own route and file a flight plan that follows the most efficient and economical route. (Federal Aviation Administration, 1997—Free Flight)

Free Flight is already underway, and the plan for full implementation will occur as procedures are modified and technologies become available and are acquired by users and service providers. This incremental approach balances the needs of the aviation community and the expected resources of both the FAA and the users. The Central Pacific Oceanic Program is one of two current Free Flight programs underway. In the airspace over the Central Pacific, advanced satellite voice and data communications are being used to provide faster and more reliable transmission to enable reductions in vertical, lateral, and longitudinal separation, more direct flights and tracks, and faster altitude clearances. (Federal Aviation Administration, 1997—Free Flight). With the full implementation of this program, the amount of airspace in the ROI that is likely to be clear of traffic, will decrease as pilots, whenever practical, choose their own route and file a flight plan that follows the most efficient and economical route, rather than following the published

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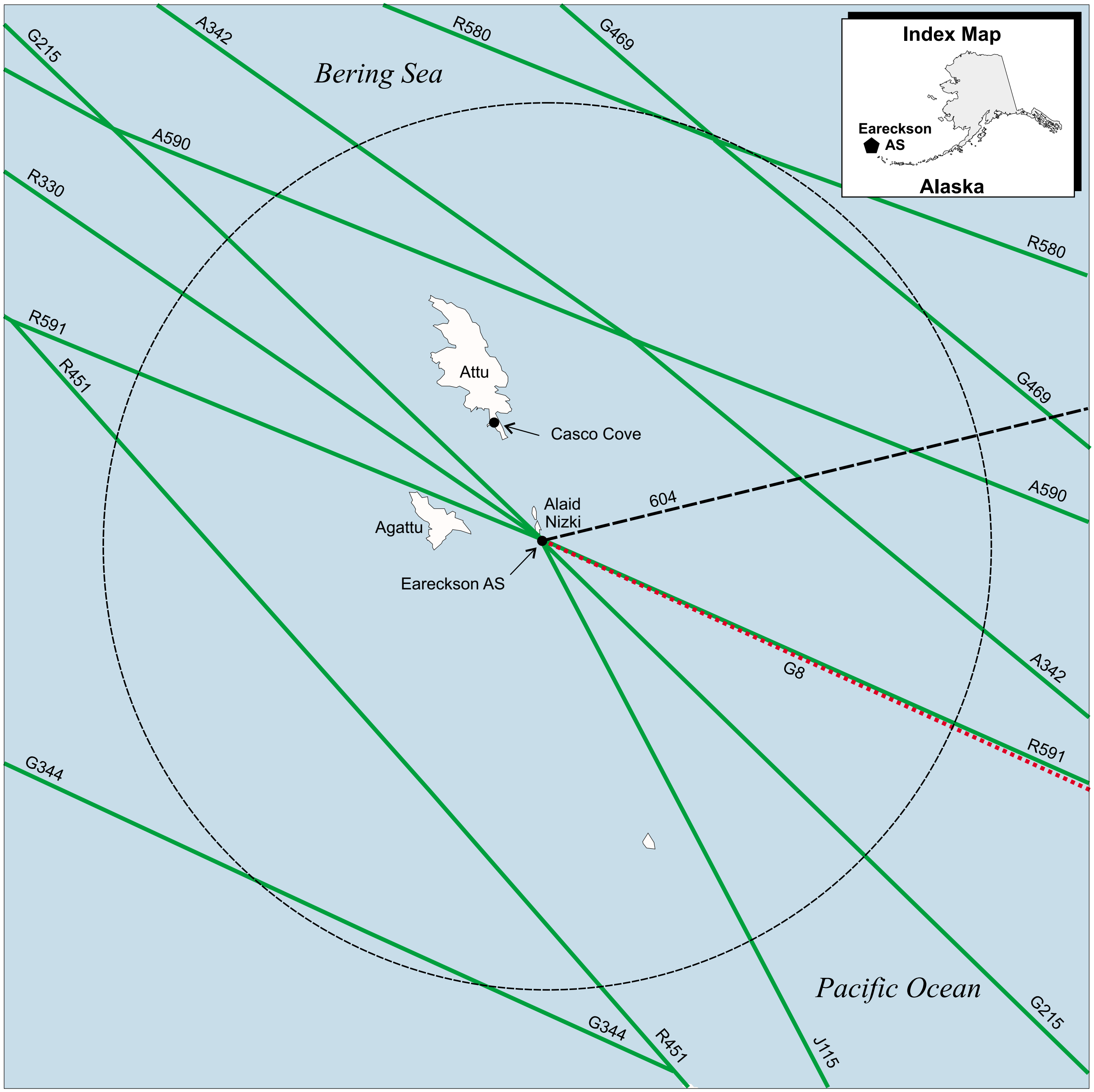

EXPLANATION

185 Kilometer (100 Nautical Mile) Region of Influence

High Altitude Airways

Low Altitude Airways(G8)

Military Instrument Flight Rule Route

Airport

NORTH

Scale 1:2,500,000

0 20 40 Miles

0 32 64 Kilometers

Low and High Altitude En Route Airways and Jet Routes, Western Aleutians

Alaska

Figure 3.3-2

as_shemya_001

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preferred instrument flight rules routes across the Pacific Ocean shown in figure 3.3-2.

Airports/Airfields

There are two military airports/airfields in the Western Aleutian Islands airspace ROI: Eareckson AS on Shemya Island, and Casco Cove Coast Guard Station on Attu Island approximately 61 kilometers (33 nautical miles) west of Eareckson AS (figure 3.3-2). The instrument approach and standard instrument departure tracks into and out of Eareckson AS are to the east, southeast, west, and southwest (National Ocean Service, 1998—U.S. Terminal Procedures, Alaska). There are no public airports or private airfields/airstrips in the ROI.

Air Navigation and Communications Facilities

Both Eareckson AS and Casco Cove Coast Guard Station are the sites of non-directional radiobeacons. In addition, Eareckson AS is the site of a Very High Frequency (VHF) Omni-Directional Range/Tactical Air Navigation facility, an airport surveillance radar (AN/GPN-20), and an instrument landing system. Non-directional radiobeacons are low or medium frequency radio beacons that transmit non-directional signals whereby the pilot of an aircraft properly equipped can determine bearings and “home” on the station. These non-directional radiobeacon facilities normally operate in the frequency band of 190 to 535 kilohertz and transmit a continuous carrier with either 400 or 1,020 hertz modulation (Aeronautical Information Manual, 1998—FAR/AIM 98). The AN/GPN-20 airport surveillance radar operates in the 2,750 to 2,850 megahertz frequency band (Joint Spectrum Center, undated—The Aleutian Island of Shemya). The instrument landing system is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway. The ground equipment consists of two highly directional transmitting systems known as the localizer and glideslope. The localizer operates in a frequency range of 108.10 to 111.95 megahertz, and the glideslope operates from 329.15 to 335 megahertz.

The VHF omni-directional range/tactical air navigation facility consists of two components, a VHF Omni-Directional Range air navigation radio aid operating within the 108.0 to 117.95 megahertz frequency band, and a Tactical Air Navigation azimuth and distance system, operating in the ultra high frequency (UHF) band of frequencies, located at one site as a unified navigational aid (Aeronautical Information Manual, 1998-FAR/AIM 98).

One of the four FAA Long Range Navigation radio transmitters in the North Pacific Chain, which operate at the 100 kilohertz frequency, is located on Attu Island. The other three transmitters are well outside the ROI in Saint Paul, Kodiak, and Port Clarence, Alaska (Aeronautical Information Manual, 1998—FAR/AIM 98). There are no other air

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navigation or communications facilities, including air route surveillance radars, which track aircraft en route and operate in the L-Band (1 to 2 gigahertz) in the Western Aleutian Islands airspace ROI.

Air Traffic Control

The Western Aleutian Islands airspace ROI lies within the Anchorage Oceanic Control Area/Flight Information Region (CTA/FIR) and within the U.S. Alaskan Air Defense Identification Zone. In the Class A (positive control areas) airspace from 5,486 to 18,288 meters (18,000 to 60,000 feet) all operations are conducted under instrument flight rules procedures and are subject to air traffic control clearances and instructions. Aircraft separation and safety advisories are provided by air traffic control, the Anchorage Air Route Traffic Control Center. In Class E airspace (general controlled airspace), below 5,486 meters (18,000 feet), operations may be either under instrument flight rules or visual flight rules: separation service is provided to aircraft operating under instrument flight rules only, and to the extent practicable, traffic advisories to aircraft operating under visual flight rules, by the Anchorage Air Route Traffic Control Centers. For Class G airspace (uncontrolled airspace), operations may be either under instrument or visual flight rules, but no air traffic control service is available.

The airspace beyond the 22-kilometer (12-nautical-mile) limit is in international airspace. In this airspace outside U.S. territory, FAA air traffic service is provided in accordance with Article 12 and Annex 11 of the International Civil Aviation Organization (ICAO) Convention. Because it is in international airspace, the procedures of the ICAO, outlined in ICAO Document 444, Rules of the Air and Air Traffic Services, are followed (ICAO, 1985—Procedures for Air Navigation Services; 1994—Amendment No. 5 to the Procedures for Air Navigation Services). ICAO Document 444 is the equivalent air traffic control manual to FAA Handbook 7110.65, Air Traffic Control. The FAA acts as the United States agent for aeronautical information to the ICAO, and air traffic in the ROI is managed by the Anchorage Air Route Traffic Control Centers.

3.3.2 NORTH DAKOTA INSTALLATIONS

3.3.2.1 Cavalier AFS—Airspace

The ROI is defined as that area that could be affected by either the ongoing No-action Alternative activities or that could potentially be affected by the Proposed Action. For the purposes of this document, it is that airspace within approximately 185 kilometers (100 nautical miles) of the proposed XBR sites in North Dakota.

The affected airspace use environment in the North Dakota airspace ROI is described below in terms of its principal attributes, namely: controlled and uncontrolled airspace, special use airspace, military training routes,

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en route airways and jet routes, airports and airfields, air navigation facilities, and air traffic control.

Controlled and Uncontrolled Airspace

The ROI is composed of Class A airspace from 5,486 meters (18,000 feet) mean sea level up to and including flight level 600 (18,288 meters or 60,000 feet). Below 5,486 meters (18,000 feet), the ROI is composed largely of Class E airspace with a floor of 366 meters (1,200 feet) or greater above the surface, except for the areas around Grand Forks International, Fargo, Jamestown and the larger municipal airports, and Grand Forks AFB where the floor is 213 meters (700 feet) above the surface. There is no Class B airspace, which usually surrounds the busiest airports, or Class C airspace in the ROI. Grand Forks International, Grand Forks AFB, and Fargo airports are surrounded by Class D airspace with ceilings of 1,006 and 1,036 meters (3,300 and 3,400 feet), respectively. In Canada, Winnipeg International and Southport airports are also surrounded by Class D airspace.

The ROI has some large areas of uncontrolled, or Class G, airspace immediately above and to the west, south, southwest, and northwest of the proposed radar sites.

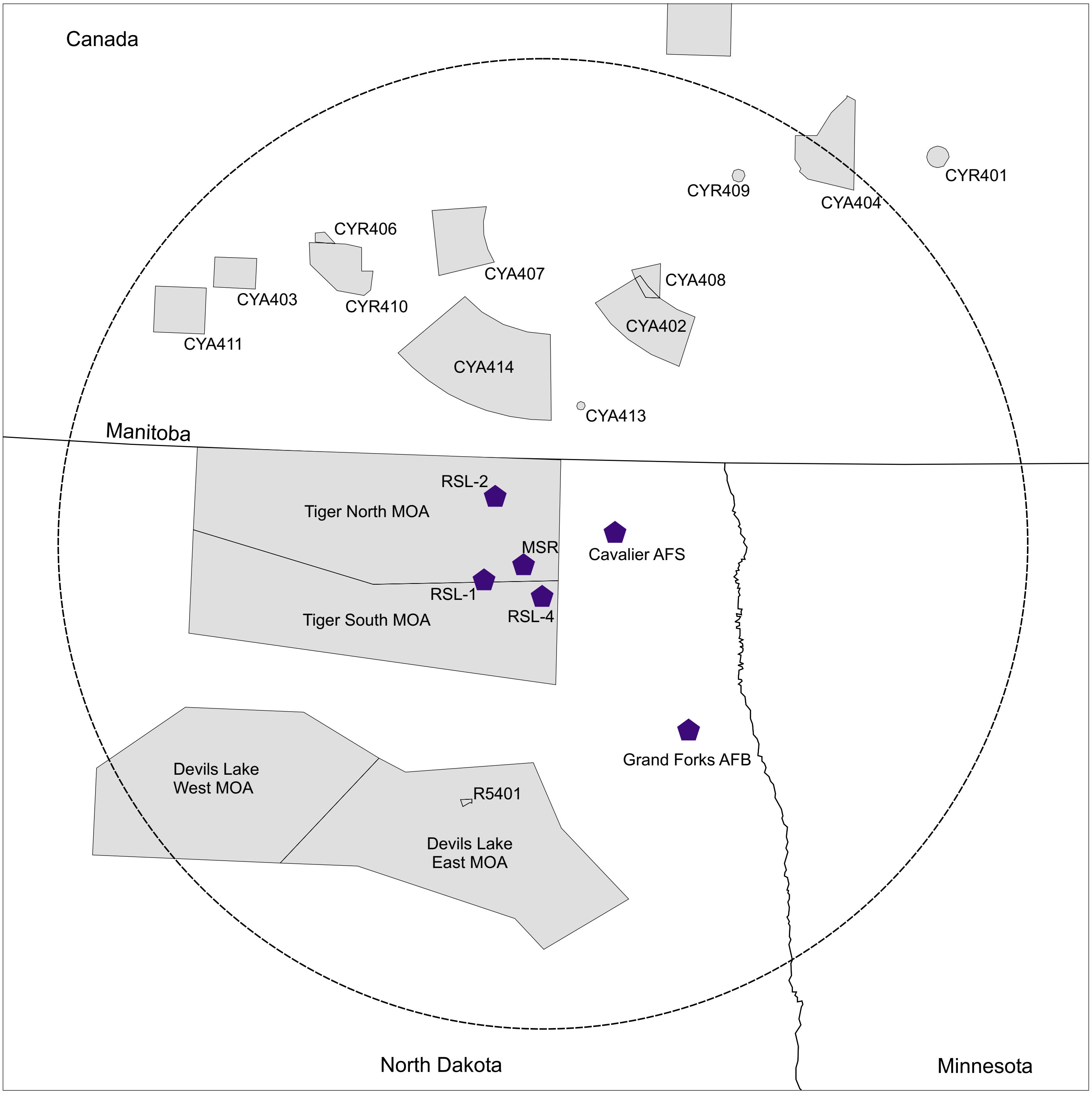
Special Use Airspace

The special use airspace in the ROI consists of the R-5401 Restricted Area southeast of Devils Lake in the Devils Lake East Military Operations Area, the Tiger North and Tiger South Military Operations Area, and the Devils Lake East and Devils Lake West Military Operations Area in the United States. Restricted areas in Canada include the Canadian Restricted Area CYR-406 and CYR-410 areas just southeast of Brandon, and the Canadian Restricted Area CYR-409 area north of Winnipeg (figure 3.3-3). The Canadian airspace portion of the ROI also has a number of Advisory Areas.

Table 3.3-1 provides a listing of the special use airspace and their effective altitudes, times used, and their manager/scheduler. There are no Prohibited, Alert, or Controlled Firing Areas special use airspace areas in the ROI.

Military Training Routes

There are four instrument flight rules Military Training Routes in the ROI (figure 3.3-4). All four routes are designated such that the military assumes responsibility for separation of aircraft operations established by coordinated scheduling. There are no visual flight rules Military Training Routes or Slow Speed Low Altitude Training Routes in the ROI. (National Imagery and Mapping Agency, 1998—DOD Flight Information Publication)



EXPLANATION

185 Kilometer (100 Nautical Mile) Region of Influence

Special Use Airspace

Potential NMD Sites

Scale 1:2,500,000

0 20 40 Miles

0 32 64 Kilometers

NORTH

as_nd_001

Special Use Airspace

North Dakota

Figure 3.3-3

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Table 3.3-1: Special Use Airspace in the North Dakota Airspace Use ROI

Number	Effective Altitude in meters (feet)	Times Used		Controlling Agency
		Days	Hours	
R-5401	To 1,524 (5,000)	By NOTAM	By NOTAM	Minneapolis CNTR/FSS
CYR 406	To 1,219 (4,000)	Continuous[1]	Continuous[1]	No A/G[2]
CYR 409	To 396 (1,300)	Continuous[1]	Continuous[1]	Winnipeg CZWG
CYR 410	To 8,534 (28,000)	Continuous[1]	Continuous[1]	No A/G[2]
	To 10,668 (35,000)	By NOTAM	By NOTAM	No A/G[2]
CYA 403(T)	To 1,829 (6,000)	Continuous[3]	Continuous[3]	Winnipeg CZWG
CYA 411(A)	1,067 to 3,048 (3,500 to 10,000)	Continuous[3]	Continuous[3]	Winnipeg CZWG
CYA 402(M)	1,524 to 3,810 (5,000 to 12,500)	Mon-Fri	1400-2200[4]	Winnipeg CZWG
CYA 404(T)	To 1,219 (4,000)	Continuous[3]	Continuous[3]	Winnipeg CZWG
CYA 407(T)	To 2,438 (8,000)	Mon-Fri	1400-2300[5]	Winnipeg CZWG
CYA 408(S)	To below 914 (3,000)	Continuous[3]	Continuous[3]	Winnipeg CZWG
CYA 413(P)	To 1,524 (5,000)[6]	Continuous[3]	Continuous[3]	Winnipeg CZWG
CYA 414(T)	1,524 to 3,810 (5,000 to 12,500)	Intermittent	By NOTAM	Winnipeg CZWG
CYA 420(T)	To 1,829 (6,000)	Continuous[3]	Continuous[3]	Winnipeg CZWG
Tiger North Military Operations Area	91 (300) AGL[7]	Intermittent	By NOTAM	Minneapolis CNTR/FSS
Tiger South Military Operations Area	1,829 (6,000)[7]	Intermittent	By NOTAM	Minneapolis CNTR/FSS
Devils Lake East Military Operations Area	1,067 (3,500)[7]	Intermittent	By NOTAM	Minneapolis CNTR/FSS
Devils Lake West Military Operations Area	1,219 (4,000)[7]	Intermittent	By NOTAM	Minneapolis CNTR/FSS

Source: National Ocean Service, 1998—L-10 IFR Enroute Low Altitude Aeronautical Chart; Department of Natural Resources (Canada), 1998—LO 4 Enroute Low Altitude Chart.

[1] Continuous = 24 hours a day and/or 7 days a week
[2] No A/G = No air/ground communications
[3] Continuous = Daylight hours
[4] 1300 to 2100 during daylight savings time
[5] 1300 to 2200 during daylight savings time
[6] April through October 31, to 12,000 by NOTAM
[7] To but not including 5,486 meters (18,000 feet)

AGL = Above Ground Level
CNTR = Center
CYA = Canadian Advisory Area (Activity Code A = Acrobatic, M = Military Operations, P = Parachuting, S = Soaring, T = Training)
CYR = Canadian Restricted Area
CZWG = Winnipeg-Area Control Center Call Number
FSS = Flight Service Station
NOTAM = Notice to Airmen
R = Restricted

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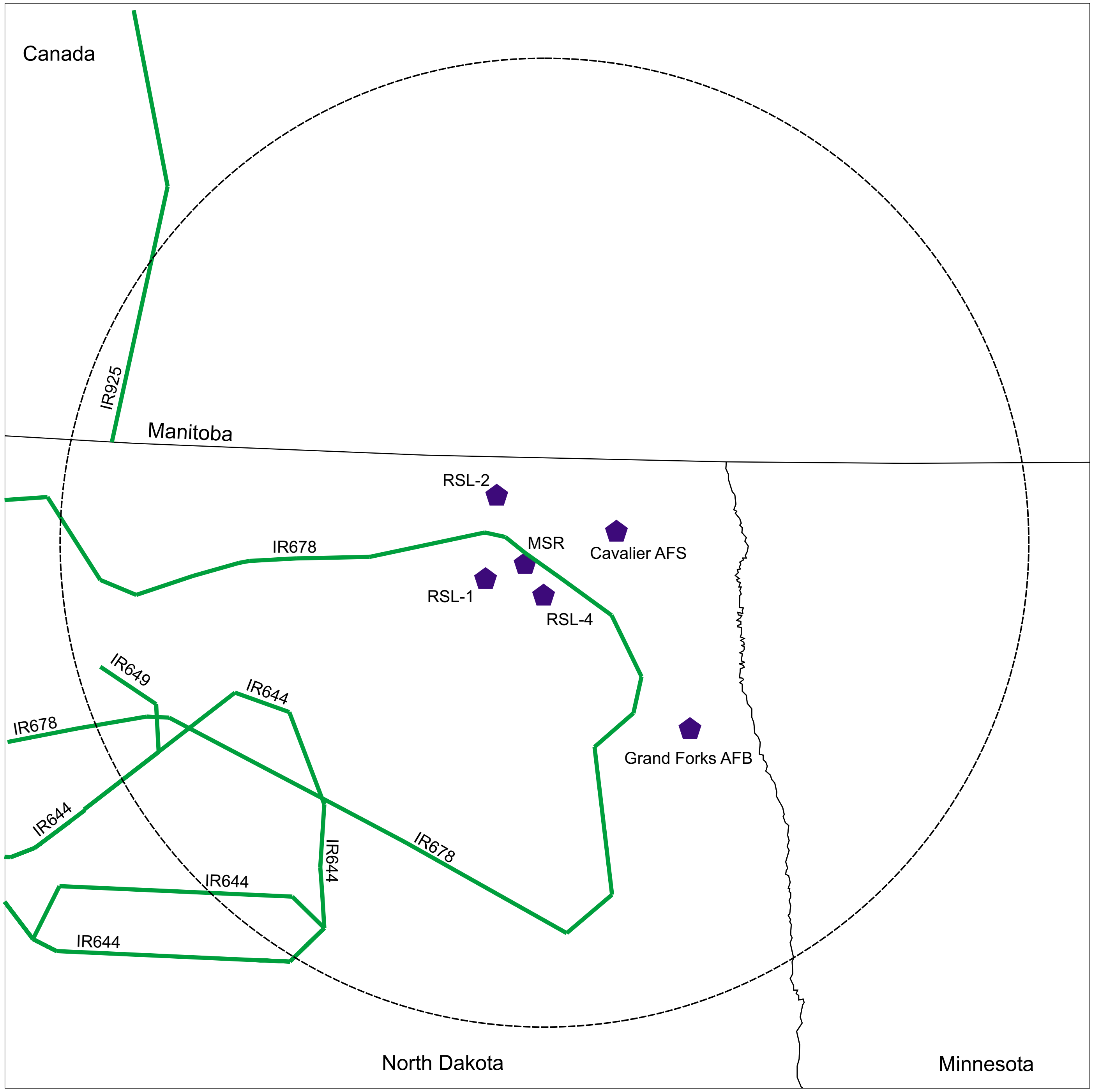

EXPLANATION

185 Kilometer (100 Nautical Mile) Region of Influence

Military Training Routes

Potential NMD Sites

Military Training Routes

North Dakota

NORTH

Scale 1:2,500,000

0 20 40 Miles

0 32 64 Kilometers

Figure 3.3-4

as_nd_002

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En Route Airways and Jet Routes

The airspace use ROI has a number of instrument flight rules en route low altitude airways used by commercial air traffic that pass through the ROI (figure 3.3-5). An accounting of the number of flights using each airway is not maintained. Although relatively remote from the majority of high altitude jet routes that crisscross the country, the ROI has a number of them, which are shown in figure 3.3-6.

Airports/Airfields

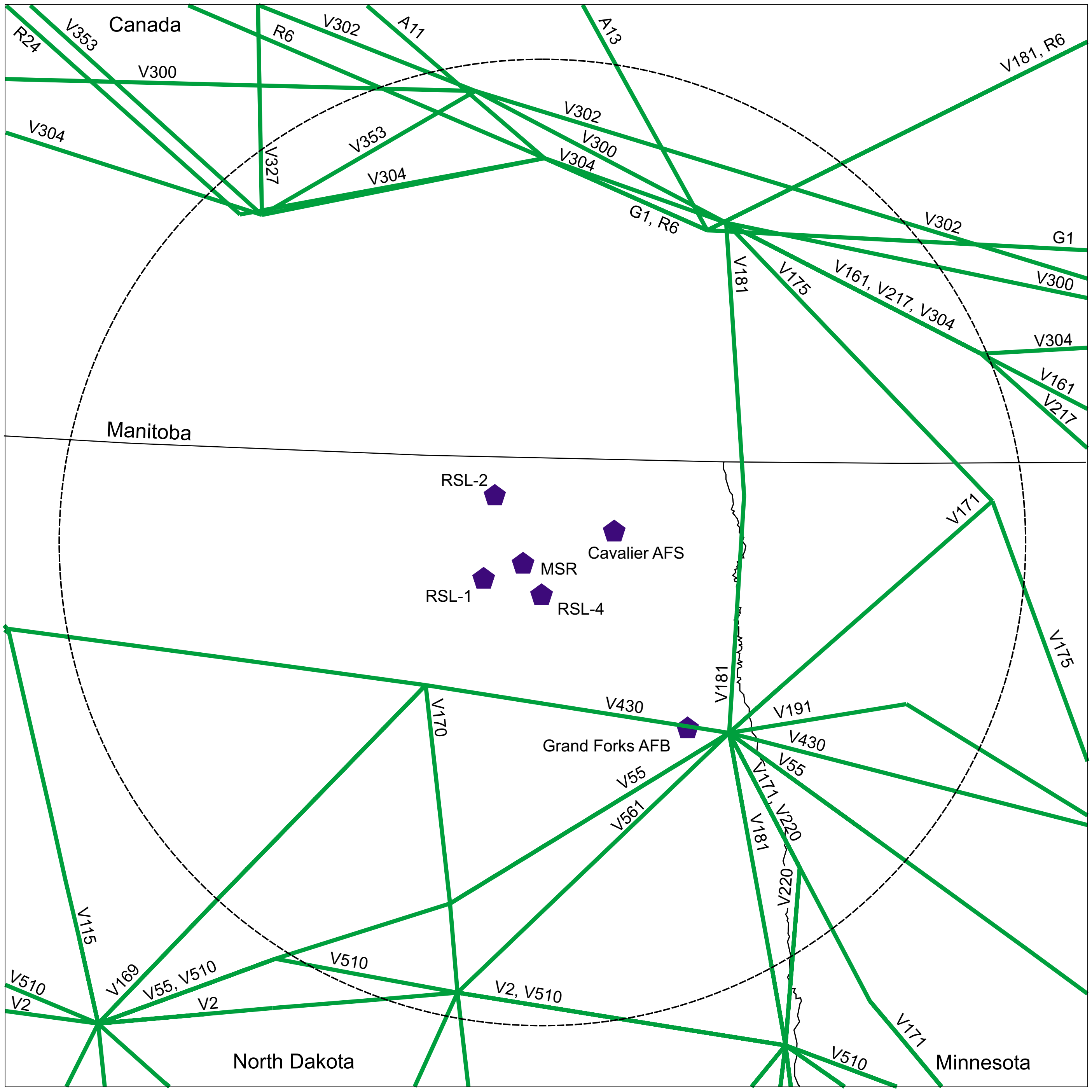
There is one Commercial Service I (General Transport) FAA classification airport in the ROI: Grand Forks International to the southeast, and one major Canadian airport, Winnipeg International, to the northeast. Commercial Service I airports provide scheduled passenger services by transport aircraft and qualify for Federal primary airport improvement funding. Grand Forks International had 318,000 airport operations in 1995, with 450,000 projected for 2000. (North Dakota Aeronautics Commission, undated—North Dakota Aviation System Plan Executive Report). Winnipeg International Airport in Manitoba, with close to 3 million passenger arrivals/departures in 1997, is the sixth busiest airport in Canada (Winnipeg Airport Authority, 1998—Winnipeg International Airport).

There are two Commercial Service II (Basic Transport) airports that provide scheduled passenger service by commuter aircraft in the ROI: Devils Lake, to the southwest of the proposed radar sites, and Jamestown, to the south. Devils Lake had 22,000 operations in 1995 with 24,000 projected for 2000, and Jamestown had 39,000 operations in 1995 with 44,000 projected for 2000 (North Dakota Aeronautics Commission, undated—North Dakota Aviation System Plan Executive Report). Thief River Falls airport, in Minnesota, is also a commercial service airport. In addition to these commercial service airports, there are a number of general aviation airports and private airstrips in the ROI (figure 3.3-7).

In addition to the airports and airfields identified above, the ROI has one Air Force base, Grand Forks AFB. Grand Forks AFB is home to the 319th Air Refueling Wing and the 321st Missile Group. Minot AFB, just outside of the ROI to the west, is home to the 5th Bomb and the 91st Space Wing.

Air Navigation and Communications Facilities

A number of air navigation facilities are distributed throughout the ROI, including: non-directional radiobeacons and non-directional radiobeacons-distance measuring equipment facilities, and VHF Omni-Directional Range/Tactical Air Navigation facilities.



EXPLANATION

185 Kilometer (100 Nautical Mile) Region of Influence

Low Altitude Airways

Potential NMD Sites

Scale 1:2,500,000

0 20 40 Miles

0 32 64 Kilometers

NORTH

Low Altitude Airways

North Dakota

Figure 3.3-5

as_nd_005

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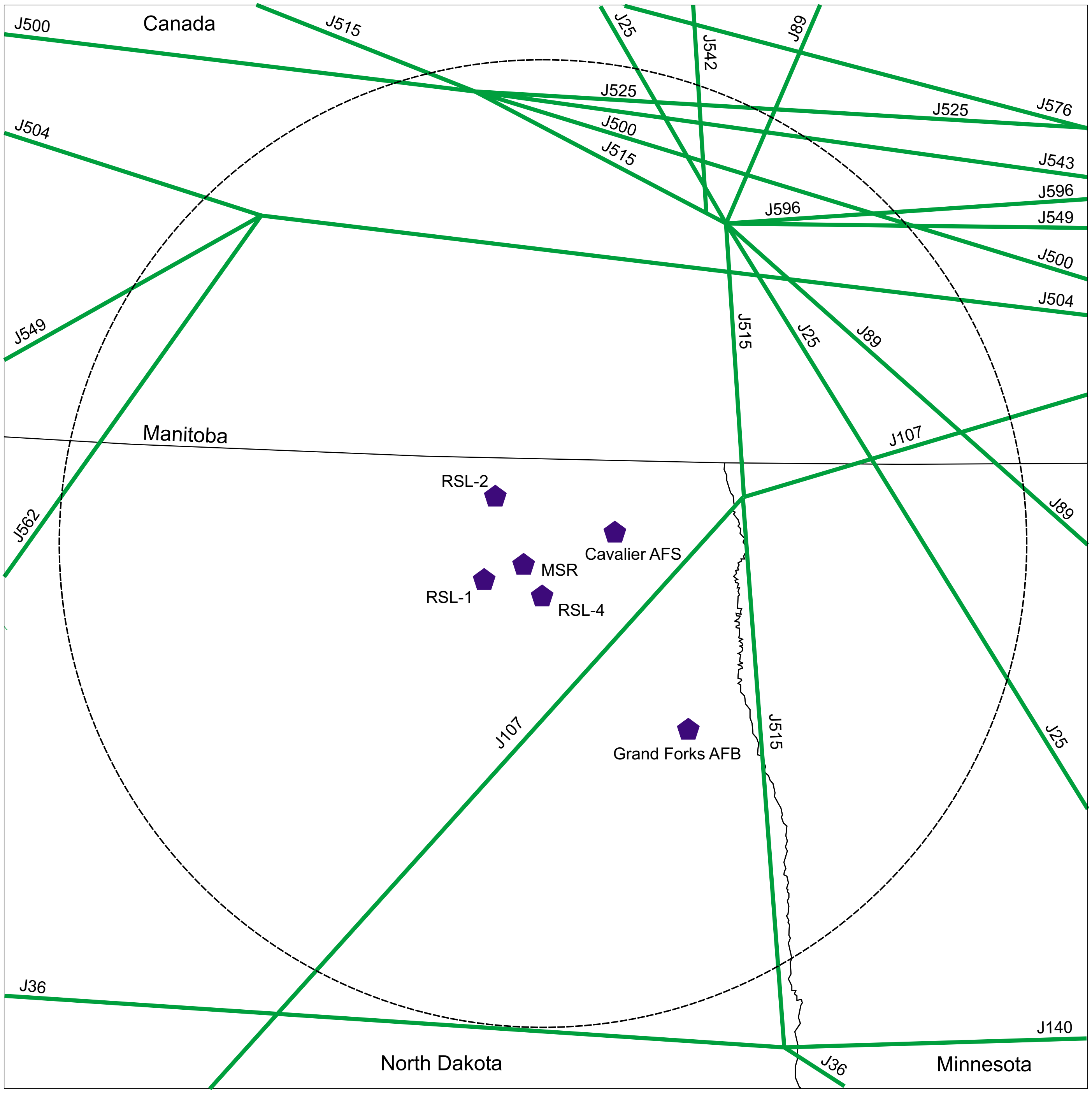


EXPLANATION

185 Kilometer (100 Nautical Mile) Region of Influence

High Altitude Airways

Potential NMD Sites

Scale 1:2,500,000

0 20 40 Miles

0 32 64 Kilometers

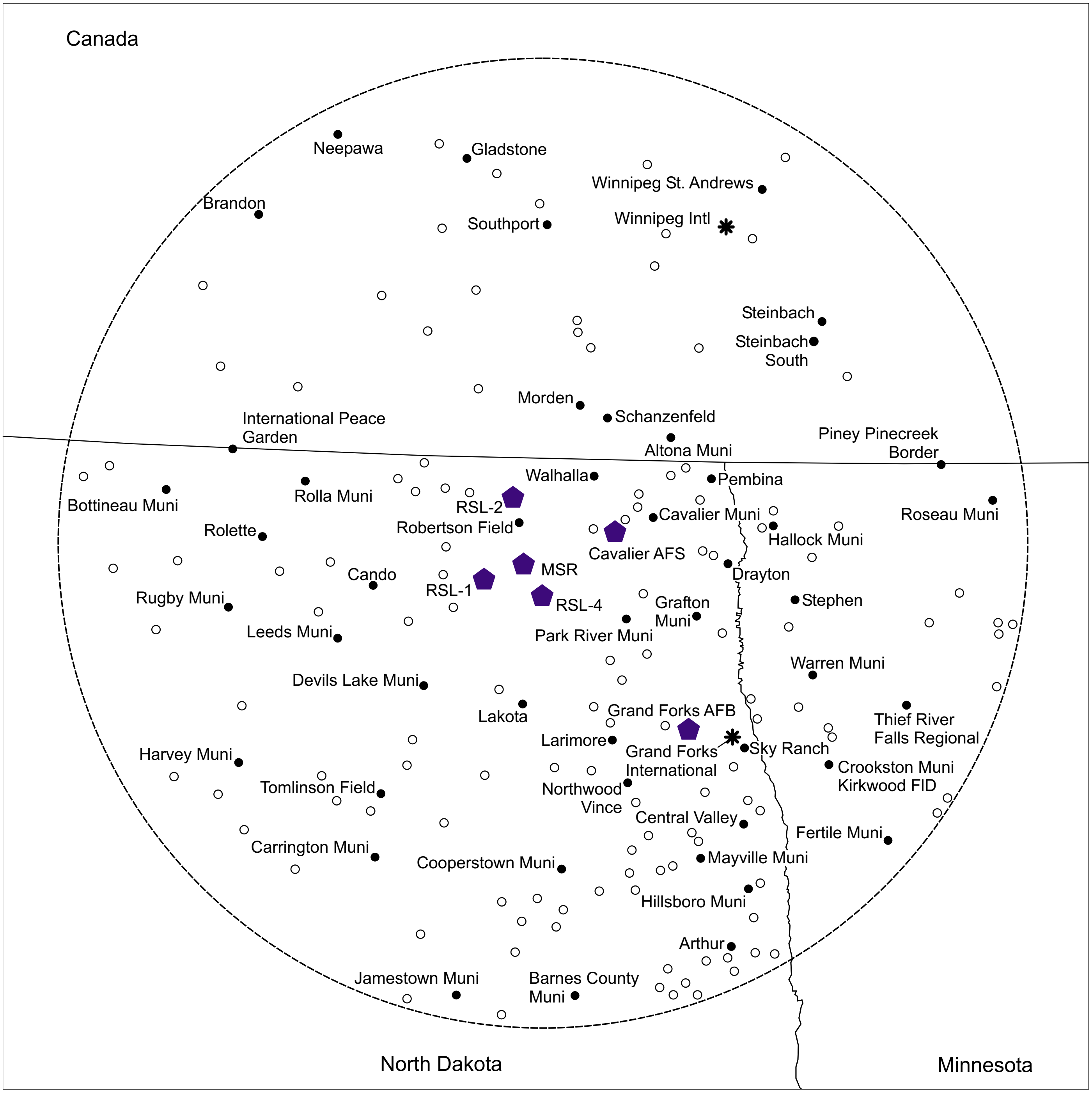
NORTH

as_nd_004

High Altitude Jet Routes

North Dakota

Figure 3.3-6



EXPLANATION

- - - - - 185 Kilometer (100 Nautical Mile) Region of Influence

Potential NMD Sites

Major International Airports

Municipal Airports

Private Airfields

Scale 1:2,500,000

0 20 40 Miles

0 32 64 Kilometers

NORTH

Airports/Airfields

North Dakota

Figure 3.3-7

as_nd_003

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Non-directional radiobeacons are low or medium frequency radio beacons that transmit non-directional signals whereby the pilot of an aircraft properly equipped can determine bearings and “home” on the station. These facilities normally operate in the frequency band of 190 to 535 kilohertz and transmit a continuous carrier with either 400 or 1,020 hertz modulation. Distance measuring equipment is airborne and ground equipment used to measure, in nautical miles, the slant range distance of an aircraft from the distance measuring equipment navigational aid. Distance measuring equipment operates on frequencies in the UHF spectrum between 962 and 1,213 megahertz (Aeronautical Information Manual, 1998—FAR/AIM 98).

The VHF Omni-Directional Range/Tactical Air Navigation facilities consist of two components, a VHF Omni-Directional Range air navigation radio aid operating within the 108.0 to 117.95 megahertz frequency band, and a Tactical Air Navigation azimuth and distance system, operating in the UHF band of frequencies, located at one site as a unified navigational aid (Aeronautical Information Manual, 1998—FAR/AIM 98).

There is only one airport surveillance radar (Grand Forks AFB), which operates in the S-Band (2 to 4 gigahertz), and no air route surveillance radars, which track aircraft en route and operate in the L-Band (1 to 2 gigahertz), in the North Dakota airspace ROI (National Ocean Service, 1998—L-10 IFR Enroute Low Altitude Aeronautical Chart). Both Cavalier and Langdon airports in North Dakota will be implementing global positioning system approach operations in the near future. The four FAA Long Range Navigation radio transmitters in the North Central U.S. Chain, which operate at the 100 kilohertz frequency, are located well outside the ROI in Baudette, Minnesota; Gillette, Wyoming; Havre, Montana; and Williams Lake, British Columbia, Canada (Aeronautical Information Manual, 1998—FAR/AIM 98). The Very Low Frequency band OMEGA transmitting station in Lamoure, North Dakota, well outside the airspace ROI, is no longer operational (U.S. Coast Guard, 1998—Navigation Center).

Air Traffic Control

In the Class A (positive control areas) airspace from 5,486 to 18,288 meters (18,000 to 60,000 feet), all operations are conducted under instrument flight rules and are subject to air traffic control clearances and instructions. Aircraft separation and safety advisories are provided by air traffic control, the Minneapolis Air Route Traffic Control Center in the United States, and the Winnipeg Air Route Traffic Control Center in Canada. In Class E airspace (general controlled airspace), below 5,486 meters (18,000 feet), operations may be either instrument or visual flight rules: separation service is provided to aircraft operating under instrument flight rules only, and to the extent practicable, traffic advisories to aircraft operating under visual flight rules, by the

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Minneapolis and Winnipeg Air Route Traffic Control Centers. For the Class G airspace (uncontrolled airspace), operations may be under either instrument or visual flight rules, but no air traffic control service is available.

In the Class D airspace surrounding the Commercial Service I (General Transport) airports of Grand Forks International and Fargo airports, and Grand Forks AFB in the United States, and Winnipeg and Southport airports in Canada, operations may be under either instrument or visual flight rules, with all aircraft subject to air traffic control clearances and instructions. Air traffic control separation service is provided to aircraft under instrument flight rules only, but all aircraft are given traffic advisories and, on request, conflict resolution instructions.

Airspace in the R-5401 Restricted Area, the Tiger North, Tiger South Military Operating Areas, and the Devils Lake East and Devils Lake West Military Operating Areas is controlled by the Minneapolis Air Route Traffic Control Center. The special use airspace in the Canadian portion of the airspace ROI is controlled by Winnipeg Area Control Center.

3.3.2.2 Missile Site Radar—Airspace

The airspace ROI is identical to the ROI described for Cavalier AFS in section 3.3.2.1.

3.3.2.3 Remote Sprint Launch Site 1—Airspace

The airspace ROI is identical to the ROI described for Cavalier AFS in section 3.3.2.1.

3.3.2.4 Remote Sprint Launch Site 2—Airspace

The airspace ROI is identical to the ROI described for Cavalier AFS in section 3.3.2.1.

3.3.2.5 Remote Sprint Launch Site 4—Airspace

The airspace ROI is identical to the ROI described for Cavalier AFS in section 3.3.2.1.

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3.4 BIOLOGICAL RESOURCES

Native or naturalized vegetation, wildlife, and the habitats in which they occur are collectively referred to as biological resources. Existing information on plant and animal species and habitat types in the vicinity of the proposed sites was reviewed with special emphasis on the presence of any species listed as rare, threatened, or endangered by Federal or state agencies to assess their sensitivity to the effects of the Proposed Action. Biological studies consisted of literature review, field reconnaissance, agency consultation, and map documentation. Site visits to the Alaska and North Dakota project areas were also conducted in June and July 1998. For the purpose of discussion, biological resources have been divided into the areas of vegetation, wildlife, threatened and endangered species, and sensitive habitats.

3.4.1 ALASKA INSTALLATIONS

The following sections describe biological resources for the NMD alternatives in Alaska and their surrounding areas. Clear AFS, Eareckson AS, Eielson AFB, Fort Greely, the Yukon Training Area, and the ocean around the Aleutian Islands for the fiber optic cable line are potential alternatives for the NMD program.

3.4.1.1 Clear AFS—Biological Resources

This section describes biological resources at Clear AFS, located southwest of Fairbanks in Interior Alaska. The ROI includes areas that may potentially be affected by construction activities and deployment of the GBI (approximately 243 hectares [600 acres]) and dormitories. The ROI includes Clear AFS and surrounding areas. Existing facilities within the main base cantonment area may also be used. A site visit to the project area was conducted in July 1998.

Vegetation

The predominant vegetative cover on proposed Site A is tall aspen forest that shows evidence of fire. Small areas of gravel barren are also present along the southern edge of this site. Vegetation at Site B consists mainly of aspen-black spruce forest, black spruce forest and woodland, and aspen-birch forest. Figure 3.4-1 indicates the location of plant cover types within the proposed project area. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

Gravel barren communities are not common in central Alaska but are present in much of the western portion of Clear AFS (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS, Alaska). Gravel

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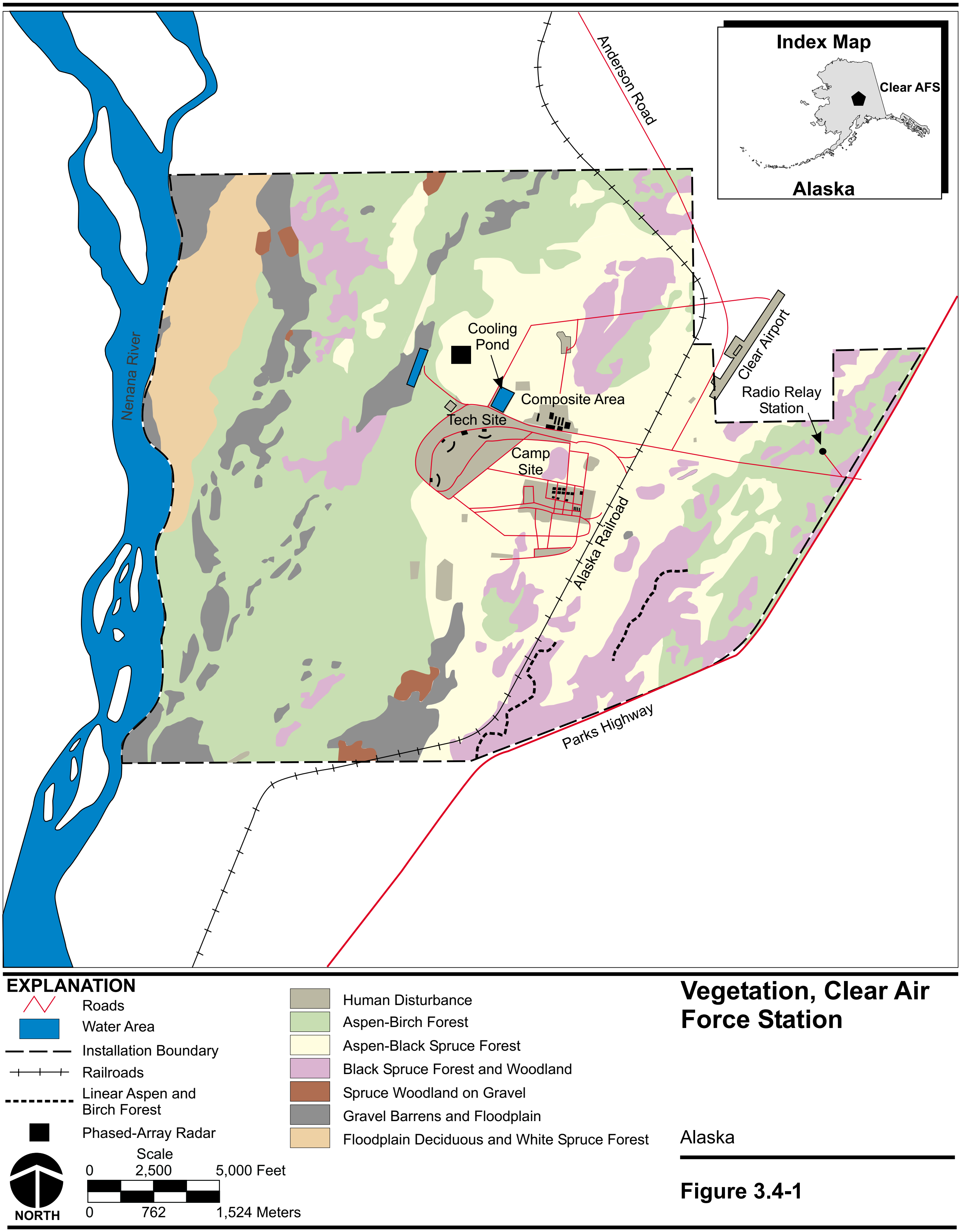

Vegetation, Clear Air Force Station

Alaska

Figure 3.4-1

br_clas_001_color

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barrens, characterized by dry meadows and dwarf woodlands, tend to occur where the fine soil cap is nearly absent. The community supports a variety of lichens and mosses at ground level and scattered black spruce (*Picea mariana*) and white spruce (*Picea glauca*). (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

Soil type and natural disturbance affect the vegetative community diversity at Clear AFS. The two dominant disturbance factors are fire in upland areas and flooding along the Nenana River. A wildfire swept the area in 1956 just before initial construction of Clear AFS (U.S. Department of the Air Force, 1997—Supplemental EA for Radar Upgrade, Clear AS, Alaska). Appendix F, table F-1, lists species of vegetation identified at Clear AFS during a biodiversity study conducted in 1995. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

Aspen (*Populus* species [spp.]) forests are found in locations with a thin layer of sandy loam. Aspen occurs on permafrost-free soils for several decades after a fire and is gradually invaded by a black spruce understory that encourages permafrost or a persistent seasonal frost. A cooler soil condition combined with a slowed decomposition rate of forest litter and resulting low nutrient availability is gradually removing the aspen. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

The majority of the vegetation in the cantonment and construction camp areas has been cleared, landscaped, or otherwise disturbed. Black spruce and aspen forest showing evidence of fire remains in isolated pockets throughout both areas of human activity and disturbance. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

Several plant species considered uncommon by the State of Alaska were identified at Clear AFS during a recent biodiversity survey. These species, primarily found along the Nenana River, are Williams' milkvetch (*Astragalus williamsii*), Setchell's willow (*Salix setchelliana*), sandbar willow (*Salix interior*), and Williams' campion (*Silene menziesii* ssp. *williamsii*). (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

Wildlife

The glacially fed Nenana River, which runs the entire length of the western border of Clear AFS, is a designated anadromous fish stream (Alaska Department of Fish and Game, 1999—Comments received by EDAW, Inc. regarding the Draft EIS). It serves as a migratory route and spawning area for some anadromous fish species, such as chinook, chum, and coho salmon, but it is not part of the installation.

The wildlife at Clear AFS is typical of the fairly undisturbed nature of the station and its vicinity. Appendix F, table F-2, lists species of wildlife potentially occurring at the station. Mammals commonly observed

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throughout the area include red fox (*Vulpes vulpes*), coyote (*Canis latrans*), black bear (*Ursus americanus*), brown/grizzly bear (*Ursus arctos*), snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), porcupine (*Erethizon dorsatum*), mink (*Mustela vision*), marten (*Martes americana*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), and moose (*Alces alces*). (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS, Alaska) No suitable habitat for caribou (*Rangifer tarandus*) exists at the station. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

Clear AFS provides foraging, migrating, and nesting habitat for a variety of bird species (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS). Birds commonly observed include ruffed grouse (*Bonasa umbellus*), Canada goose (*Branta canadensis*), mallard (*Anas platyrhyncos*), cliff swallow (*Hirundo pyrrhonota*), American robin (*Turdus migratorius*), yellow-rumped warbler (*Dendroica petechia*), and dark-eyed junco (*Junco hyemalis*). (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

The Nenana River valley, which lies within the Tanana River Basin, is an important migratory route for waterfowl and other birds. Species observed during migration include sandhill crane (*Grus canadensis*), Canada goose, belted kingfisher (*Ceryle alcyon*), numerous swallows and warblers, red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverious*), great horned owl (*Bubo virginianus*), spotted sandpiper (*Actitis macularia*), and green-winged teal (*Anas crecca*). (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS, Alaska)

During a survey conducted in 1996, blackpoll warbler (*Dendroica striata*) and gray-cheeked thrush (*Catharus minimus*) were observed. The Alaska Department of Fish and Game lists these two bird species as species of special concern (Argonne National Laboratory, 1999—Abstract–Biodiversity Survey of Clear Air Station, Alaska). Neither species was found within the proposed project sites (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska). Two other state species of special concern are the olive-sided flycatcher (*Contopus borealis*) and Townsend's warbler (*Dendroica townsendi*) have been observed on Clear AFS. (U.S. Department of the Interior, 1999—Comments received on the Draft EIS)

Hunting and trapping are currently permitted throughout the proposed project site for base personnel and their families only. (Clear Air Force Station, 1993—Comprehensive Planning Framework)

As the majority of the vegetation in the cantonment and construction camp areas has been cleared, landscaped, or otherwise disturbed, very little wildlife habitat remains.

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Threatened and Endangered Species

No federally listed threatened, endangered, or candidate species of vegetation or wildlife are found at Clear AFS (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS, Alaska). No critical habitat has been identified on Clear AFS (Alaska Department of Fish and Game, 1999—State of Alaska Refuges, Critical Habitat Areas and Sanctuaries).

The range of the recently delisted American peregrine falcon (*Falco peregrinus anatum*) includes Clear AFS, but none have been observed near the proposed site or on Clear AFS (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska).

Sensitive Habitat

Sensitive habitat usually includes wetlands, plant communities that are unusual or of limited distribution, and important wildlife seasonal use areas, such as migration routes and breeding areas.

Wetlands are defined by the U.S. Army Corps of Engineers as "those areas that are inundated or saturated by surface or ground water 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. Wetlands generally include swamps, marshes, bogs, and similar areas." Wetlands (figure 3.4-2) cover approximately 9.5 percent of Clear AFS. Most of these wetlands are classified as riverine wetlands and occur along the channel of the Nenana River. The remaining wetlands include palustrine (non-flowing water) wetlands. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

A small area (2.7 hectares [6.6 acres]) of palustrine scrub/shrub, broad-leaved deciduous, PSS1, wetlands is located within the area proposed for the location of Site A. Proposed Site B is located within an area where PSS1/4B palustrine scrub/shrub, broad-leaved deciduous/needle-leaved evergreen, saturated wetlands are more prevalent, approximately 55 hectares (135 acres). Wetlands are also located within the 0.4-hectare (1-acre) area proposed for housing and administrative facilities. (U.S. Fish and Wildlife Service, undated—National Wetlands Inventory)

The gravel barrens located on Clear AFS may be considered as unusual communities since they do not normally occur in central Alaska. While possessing unique plants, there is no evidence that gravel barrens provide critical habitat for wildlife. (Clear AS, 1996—Biodiversity Survey of Clear AS, Alaska)

As described above in the discussion of wildlife at Clear AFS, the Nenana River valley is an important migratory route for waterfowl and other birds (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS, Alaska).

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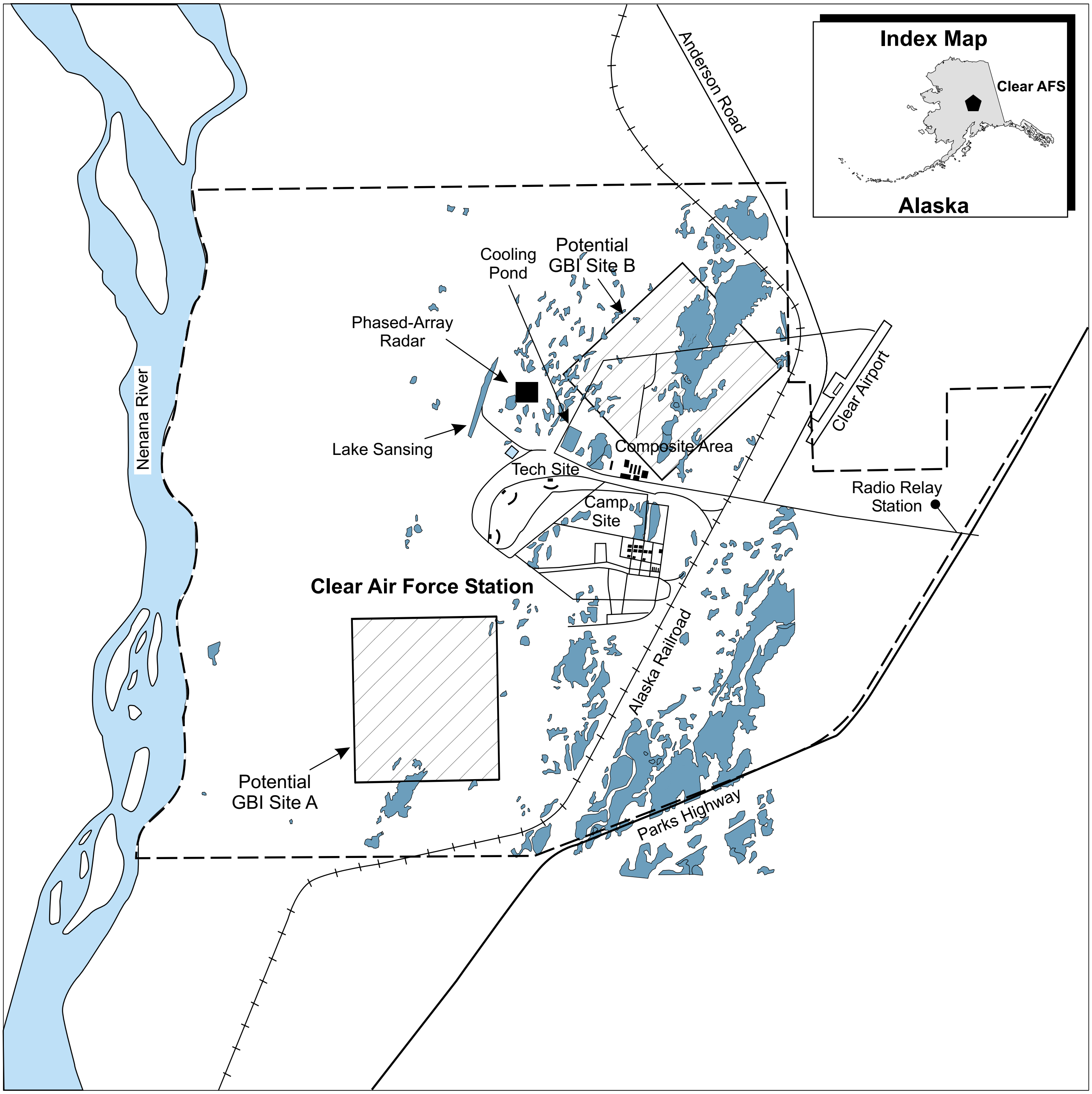

EXPLANATION

Roads

Water Area

Wetlands*

Installation Boundary

Railroads

* Note: This figure only depicts wetlands within or adjacent to potential GBI sites and is not inclusive of all wetlands on Clear AFS.

Scale
0 2,500 5,000 Feet
0 762 1,524 Meters

NORTH

Wetlands, Clear Air Force Station

Alaska

Figure 3.4-2

br_clas_003

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3.4.1.2 Eareckson AS—Biological Resources

This section describes biological resources at Eareckson AS, located on Shemya Island, Alaska. The ROI includes the entire island, including the area that may potentially be affected by construction activities and deployment or operation of the XBR (approximately 12 hectares [30 acres]). This ROI includes the wildlife that may use the area around the island. Existing facilities within the main base cantonment area may also be used. A site visit to the project area was conducted in April 1998.

Vegetation

The predominant vegetative cover on Shemya Island consists of beach grass (*Elymus arenarius*) grasslands that tend to colonize disturbed areas and remnants of crowberry tundra. The tundra is composed mainly of grasses, sedges, heath, and composite families. An almost continuous mat of mosses and lichens characterizes the tundra. Cottongrass (*Eriophorom russeoium*) may predominate in poorly drained areas.

Dwarf shrubs such as crowberry (*Empetrum nigrum*), cloudberry (*Rubus chamaemorus*), lapland cornel (*Cornus suecica*), and blueberry (*Vaccinium* species [spp.]) are located at higher elevations with better drainage. Forbs such as bistort (*Polygonum viviparum*), buttercup (*Ranunculus* spp.), lousewort (*Pedicularis chamissonis*), monkshood (*Aconitium maximum*), and violet (*Viola langsdorffii*) are scattered throughout the area. There are no large native trees. Only a few Sitka spruce (*Picea sitchensis*), introduced by the Russians in 1805, exist on the island today. Other trees introduced by Americans during World War II have resulted in small groves on the island. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

Beach grass dominates the beach community that inhabits shorelines within bays, inlets, and coves of the island. Other plants inhabiting this area are beach pea (*Lathyrus japonica*), seabeach sandwort (*Honckenya peploides*), cow parsnip (*Heracleum lanatum*), cinquefoil (*Potentilla* spp.), and species of sedge (*Carex* spp.). Grasslands are often more than 1 meter (3 feet) high during the summer and are very dense near sea level. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

Kelp and eelgrass (*Zostera marina*) beds occur in coastal waters of Shemya Island. Eelgrass beds are confined to lagoons and estuaries and are an important food source for waterfowl and invertebrates. Eelgrass beds also provide food and rearing habitat for juvenile groundfish and salmon. Pondweed (*Potamogeton alpinus*), water milfoil (*Myriophyllum spicatum*), and mare's tail (*Hippuris vulgaris*) are the primary freshwater vegetation. Large mosses and leafy liverworts are located in freshwater streams. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

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Figure 3.4-3 indicates the location of plant cover types within the proposed project area. Appendix F, table F-3, lists additional vegetative species observed at Eareckson AS.

Wildlife

Anadromous fish of the Near Islands include pink, chum, sockeye, and coho salmon. Shemya Island, however, has no salmon runs (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS).

There are no indigenous terrestrial mammals on Shemya Island. The blue phase arctic fox (*Alopex lagopus*) is the largest mammal on the island and was introduced in 1911. The foxes are found in areas on the island where garbage or other food sources are available. The other terrestrial mammals are introduced rodents. No native rodents or insects are known to occur on the island. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS; U.S. Air Force, undated—EA for Construction of a Composite Environmental Waste Facility)

Shemya Island is along the migratory route of many North American shorebirds and waterfowl. Its rocky cliffs provide ideal habitat for seabird colonies and roosting sites for the Peale’s peregrine falcon (*Falco peregrinus peali*). Pelagic cormorants (*Phalacrocorax pelagicus*), red-faced cormorants (*Phalacrocorax urile*), and tufted puffins (*Fratercula cirrhata*) nest offshore on islets located on the north side of Shemya Island, but seabirds have been mainly extirpated from the main island by introduced foxes and rats. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

Waterfowl use the lakes of Shemya Island as feeding and resting places during migration. Large numbers of gulls rest on the runways in the fall after their young fledge from offshore colonies. The emperor goose (*Chen canagica*), a species on the decline, primarily uses the northern shore intertidal areas, but can be found around the entire perimeter of the island. Harlequin ducks (*Histronicus histronicus*) and common eiders (*Somateria mollissima*) are often seen in salt water surrounding the island. The north shore bluffs provide important resting habitat for migrating Asiatic songbirds. Appendix F, table F-4, lists some of the bird species commonly seen on Shemya Island. Appendix F, table F-5, lists fish species found on and around the island. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

Several marine mammals are located along the rocky coast of the island and offshore. The sea otter (*Enhydra lutris*) uses the southwest coastal kelp beds of Shemya Island for feeding, pupping (March through May), and as haulout grounds. Populations began increasing when all sea otter hunting was prohibited after 1960. Harbor seals (*Phoca vitulina*), which are typically found on the surface, can be found as deep as 55 meters

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EXPLANATION

- Roads
- Water Area
- Beach Grass
- Grasses, Sedges, Heath, and Dwarf Shrubs

Scale
0 1,738 3,475 Feet
0 530 1,059 Meters

NORTH

br_eas_002_color

Vegetation, Eareckson Air Station

Alaska

Figure 3.4-3

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(180 feet) while feeding. They are adaptable to a wide range of conditions, with water clarity ranging from highly turbid to very clear. They are scarce, in general in the Near Islands area, and tend to be concentrated from the South Alaska Peninsula to Unimak Island. Harbor seals have been observed along the northwest coastline of Shemya Island (U.S. Air Force, 1995—Draft Management Action Plan, Eareckson AS). Other marine mammals located near Shemya Island are discussed in the threatened and endangered section below. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

Threatened and Endangered Species

Species with Federal or state status that potentially occur in the area of Eareckson AS are listed in table 3.4-1. The Steller sea lion (*Eumetopias jubatus*) is the most abundant marine mammal species found in the area. Haul out occurs on offshore islands northeast of Shemya Island. Two haul out grounds have been located on the north and northwest ends of the island. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

The blue whale (*Balaena musculus*), bowhead whale (*Balaena mysticetus*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), northern right whale (*Eubalaena glacialis*), and sperm whale (*Physeter macrocephalus*) are seasonal visitors to the waters surrounding Shemya Island. Bowhead and humpback whales may be observed passing by the shore during migration in May and October (Augustine, 2000—Personal communication with 611 CES/CEVP regarding natural resources at Eareckson AS). Northern right and sperm whales can be observed in the area from April to September. The blue and fin whales may be observed feeding in the area during the summer. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

The Aleutian Canada goose (*Branta canadensis leucopareia*), is currently a threatened species. However, the goose is in the final steps of being delisted, which is expected by the end of July 2000 (Boone, 2000—Personal communication with the USFWS regarding the Aleutian Canada goose). A 3-year study on the threatened Aleutian Canada goose on Eareckson AS is ongoing to determine the population during spring (mid April through mid June) and fall migrations (mid August through mid October) when the species is found on Shemya Island. The study will determine island populations and prime feeding areas. As of fall of 1999, the exact feeding locations on the island have not been determined, but will be determined once future vegetation studies are conducted in 2000. The goose is found on the island from mid April through mid June and mid August through Mid October. At any one time 700 Aleutian Canada geese use Shemya Island for non-breeding activities, such as staging,

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Table 3.4-1: Sensitive Species with Federal or State Status Under the Endangered Species Act Potentially Occurring in Project Areas

Scientific Name	Common Name	Status State	Status Federal	Habitat and Distribution
Birds				
Branta canadensis leocopareia	Aleutian Canada goose	--	T	Visitor to Shemya Island from May–June and August–October to feed and for other non-breeding activities
Phoebastria albatrus	Short-tailed albatross	E	E	Unlikely visitor to Shemya Island; observed during the summer months in the Aleutian Islands, Bering Sea, and Gulf of Alaska
Somateria fischeri	Spectacled eider	--	T	Observed during the winter months off the shore of Shemya Island where water depth is approximately 30 meters (99 feet)
Polysticta stelleri	Steller's eider	--	T(1)	Occasional visitor to intertidal waters of Shemya Island during the winter months
Mammals				
Balaena mysticetus	Bowhead whale	E	E	Seasonal visitor to the waters surrounding Shemya Island, usually observed during migration in May and October
Balaenoptera musculus	Blue whale	--	E	Seasonal visitor to the waters surrounding Shemya Island during the summer months
Balaenoptera physalus	Fin whale	E	E	Seasonal visitor to the waters surrounding Shemya Island during the summer months
Megaptera novaeangliae	Humpback whale	E	E	Seasonal visitor to the waters surrounding Shemya Island, usually observed during migration in May and October
Eubalaena glacialis	Northern right whale	E	E	Seasonal visitor to the waters surrounding Shemya Island, usually observed from April to September
Physeter macrocephalus	Sperm whale	E	E	Seasonal visitor to the waters surrounding Shemya Island, usually observed from April to September
Eumetopias jubatue	Steller sea lion	E	T	Haul out grounds on offshore islands northeast of Shemya Island and on the north and northwest ends of the island

Source: U.S. Fish and Wildlife Service, 1996—Alaska Region, The Great Land; Alaska Department of Fish and Game, 1997—State of Alaska Endangered Species List.

(1) Only the North American breeding population is considered threatened.

– = Not listed
E = Endangered
T = Threatened

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resting, and feeding during migration. The location of the goose's preferred feeding areas is directly associated with the availability of the preferred food. They feed on upland and wetland vegetation, including grass sprouts in the spring and crowberries (*Empetrum nigrum*) in the fall. Feeding occurs over the entire island primarily during daylight hours. The geese return to neighboring predator-free islands for the night. The geese do not nest on Shemya Island, and the island is not suitable for nesting recovery efforts due to the presence of humans, rodents, and blue phase arctic fox. (Augustine, 2000—Personal communication with 611 CES/CEVP regarding natural resources at Eareckson AS)

The short-tailed albatross *(Diomedea albatrus*) is a very large seabird with narrow 2-meter- (7-foot-) long wings. Most summer sightings of this albatross are in the Aleutian Islands, Bering Sea, and Gulf of Alaska. Its presence on Shemya Island is considered unlikely. The short-tailed albatross is officially listed as a proposed candidate species in Alaska (endangered only on the high seas and in Japan and Russia). This species has been proposed for listing for the near-shore areas, 5 kilometers (3 miles) out from U.S. shores, to correct an administrative oversight. The preferred habitat of the short-tailed albatross is offshore marine waters. This species has been identified pelagically; however, its presence on Shemya Island is unlikely. This species, however, occurs within 5 kilometers (3 miles) of Shemya Island. There are no land management requirements or issues associated with this species. (Augustine, 2000—Personal communication with 611 CES/CEVP regarding natural resources at Eareckson AS)

The spectacled eider (*Somateria fischeri*), a threatened large-bodied, marine, diving duck may be observed offshore during the winter. (U.S. Fish and Wildlife Service, 1993—Final Rule to List Spectacled Eider; U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

The Steller's eider (*Polysticta stelleri*), a marine, diving duck, is the smallest of four eider species (U.S. Fish and Wildlife Service, 1996—Steller's Eider). The only known regularly occupied nesting area of the Steller's eider in Alaska is now near Barrow (U.S. Fish and Wildlife Service, 1996—Steller's Eider). This eider species may occur in intertidal waters of Shemya Island during the winter (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS).

Sensitive Habitat

A U.S. Army Corps of Engineers wetland delineation was completed in 1986. A substantial portion of Eareckson AS (80 percent) falls within a wetlands classification under criteria applied by the U.S. Army Corps of Engineers (figure 3.4-4). Beaches, cliffs, lakes, disturbed areas west of the abandoned Runway B, areas around Runway 10-28 and slopes south

EXPLANATION

- Roads
- Land Area
- Water Area
- Wetlands

Scale

0 1,738 3,475 Feet

0 530 1,059 Meters

NORTH

br_eas_001

Wetlands, Eareckson Air Station

Alaska

Figure 3.4-4

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of this runway, and other areas altered by construction of roads, building pads, and structures are the only areas excluded from wetlands classification. (U.S. Air Force, undated—EA for Construction of Composite Environmental Waste Facility; U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

The USFWS has indicated the Upper, Middle, and Lower Lake system is of interest for its ability to support migratory birds and provide a resting place. Asian birds, not seen elsewhere in the United States, are often blown off course during migration by storms and appear to be attracted by the airfield lights located in the vicinity of the lakes at Eareckson AS. (U.S. Air Force, 1995—Natural Resources Plan Eareckson AS)

Shemya Island is part of the Alaska Maritime National Wildlife Refuge administered by the USFWS, and as such, the Department of the Interior exercises real property jurisdiction over Shemya Island. The purposes of the refuge include (1) conserving wildlife habitats in their natural diversity, (2) fulfilling international treaty obligations of the United States with respect to fish and wildlife, (3) providing for a subsistence opportunity by local residents, (4) providing a national and international program of scientific research on marine resources, and (5) ensuring water quality and quantity within the refuge. The U.S. Air Force operates Eareckson AS under the authority of the original 1913 executive order withdrawing Shemya Island for refuge purposes. The U.S. Air Force exercises real property jurisdiction, custody, and control over Shemya Island. Consequently, the Department of the Interior and the Air Force have overlapping real property jurisdiction on Shemya Island. The refuge consists of 1.8 million hectares (4.5 million acres) and is used by about 75 percent of Alaska's marine birds. (U.S. Fish and Wildlife Service, 1997—Alaska Maritime National Wildlife Refuge)

3.4.1.3 Eielson AFB—Biological Resources

Eielson AFB is in the Tanana River Valley between the Alaska Range and the Yukon-Tanana Uplands. The base is located along the northern bank of the Tanana River on a flat floodplain terrace (U.S. Air Force, 1997—EA, Gravel Borrow Pit in the North Area of Eielson AFB). The base is surrounded by undeveloped military land on the north, east, and west (Eielson AFB, 1998—Integrated Natural Resources Management Plan).

The ROI includes existing facilities within the main base cantonment area (figure 2.4.1-3). Additional facilities within the cantonment area may also be constructed. A site visit to the proposed project area was conducted in July 1998.

Vegetation

The vegetation of Eielson AFB, as with the Tanana River Valley and the lowlands of Interior Alaska in general, is composed of boreal (or taiga)

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forest. Evergreen forests of black and white spruce dominate this habitat. There are also extensive stands of deciduous forests of paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and balsam poplar (*Populus balsamifera*). The presence of black spruce and bogs usually indicates an area underlain by permafrost. Paper birch, quaking aspen, and white spruce generally develop on permafrost-free soils. Figure 3.4-5 indicates the location of vegetation types within the proposed project area. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

The majority of Eielson AFB has experienced very little human disturbance or alteration. Much of the forested area is old-growth forest ranging in age from 85 to 115 years. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

The project area is composed primarily of land categorized as improved ground (intensive maintenance), semi-improved ground (periodic maintenance), or land under facilities (such as buildings, structures, roads, or pavement). Appendix F, table F-6, lists species of vegetation observed at Eielson AFB. Improved ground includes mowed fields usually adjacent to housing, administrative buildings, or associated facilities within the cantonment area. These fields are generally composed of Kentucky bluegrass (*Poa protensis*), common dandelion (*Taraxacum officinale*), alsike clover (*Trifolium hybridum*), and assorted weedy species. Ornamental trees are commonly chokecherry (*Prunus virginiana*), lodgepole pine (*Pinus contorta*), scotch pine (*Pinus sylvestris*), white spruce, and paper birch. Common shrubs are cotoneaster (*Cotoneaster* spp.), lilac (*Syringa* spp.), and shrubby cinquefoil (*Potentilla fruiticosa*). (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

Semi-improved ground is generally not well organized into specific plant communities. The areas include unpaved ground within and around the airfield, tank farms, and similar facilities. Most semi-improved ground is maintained in an early stage of succession due to annual mowing and brush control measures. Vegetation varies with soil conditions, amount of disturbance or fill material, and presence of ditches or other wet areas. The dominant cover commonly consists of tickle grass (*Agrostis scabra*), foxtail barley (*Hordeum jubatum*), Kentucky bluegrass, alsike clover, Canada goldenrod (*Solidago canadensis*), and yarrow (*Achillea millefolium*). Along the runway, common fireweed (*Epilobium angustifolium*) and alpine sweet-vetch (*Hedysarum alpinum*) are abundant. Patches of smooth brome (*Bromus inermis*) are also common in open, seeded areas. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

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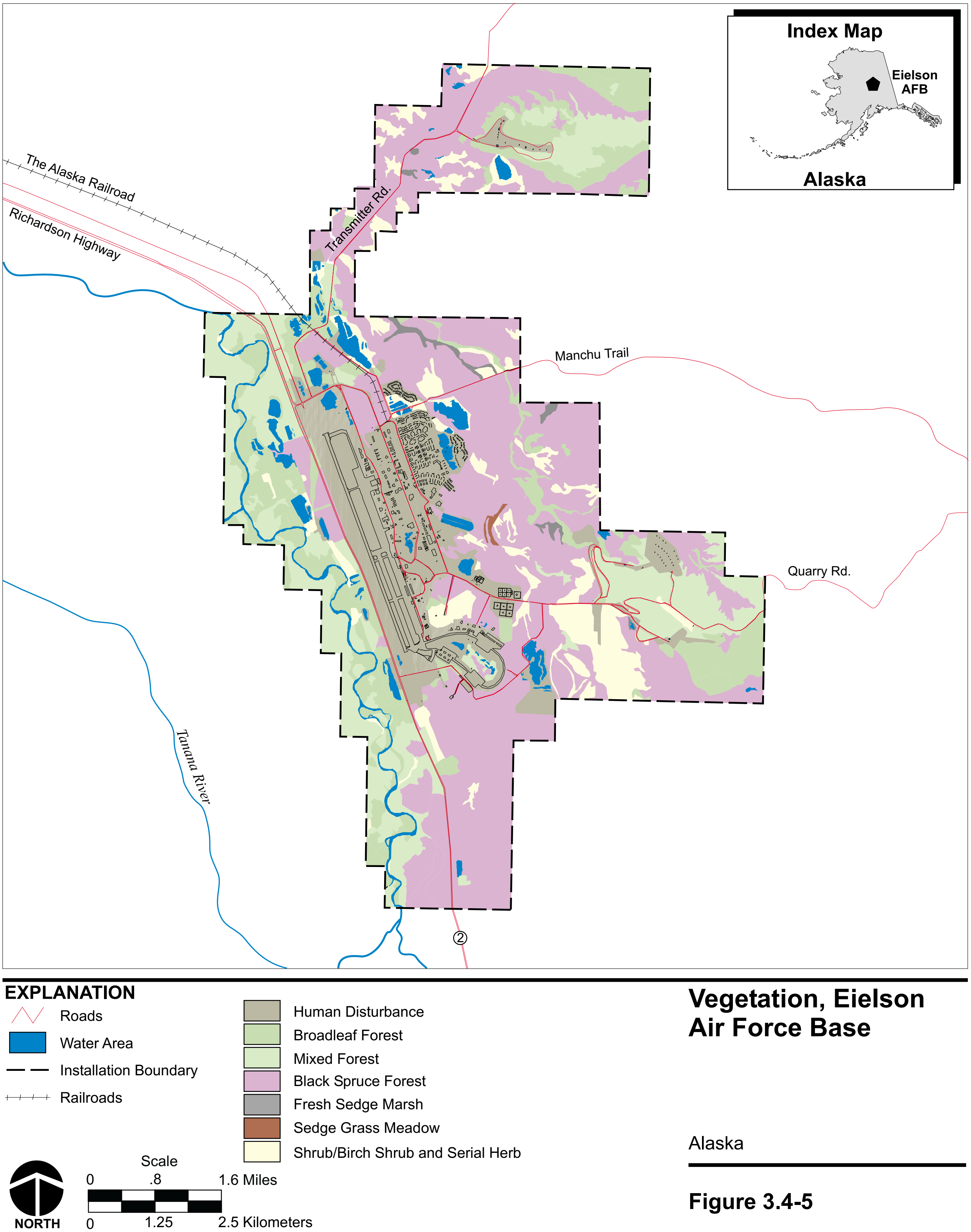

Vegetation, Eielson Air Force Base

Alaska

Figure 3.4-5

br_eafb_001_color

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Surveys for two plant species considered rare by the State of Alaska have been conducted (U.S. Department of the Air Force, 1994 Biological Surveys, Final Report). These species, glaucus goosefoot (*Chenopodium glaucus*) and Alaskan paintbrush (*Castelleja annua*), are known to occur in the Fairbanks area. No population of either species was located during field surveys. Neither species is expected to occur within the proposed project area.

Wildlife

Eielson AFB supports habitat for most of the indigenous wildlife found in Interior Alaska, primarily in the areas undisturbed by human intervention or military operations. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

The Tanana Valley provides summer breeding habitat for a variety of migratory birds, in addition to the many year-round residents. Some of the most common species include spruce grouse (*Dendragapus canadensis*), ruffed grouse, great horned owl, red-tailed hawk, sharp-shinned hawk (*Accipiter striatus*), American kestrel, willow ptarmigan (*Lagopus lagopus*), northern goshawk (*Accipeter gentilis*), rock ptarmigan (*Lagopus mutus*), and a wide variety of waterfowl. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

A key role in the ecosystems of Eielson AFB and the surrounding areas is played by 32 species of mammals common to the vicinity. Some of the more important or abundant species include moose, black bear, brown/grizzly bear, snowshoe hare, marten, meadow vole (*Microtus pennsylvanicus*), red-back vole (*Clethrionomys rutilus*), meadow jumping mice (*Zapus hudsonius*), red squirrel, beaver, muskrat, and mink. North American lynx (*Felis lynx canadensis*) are occasionally trapped on Eielson AFB, and the population estimates for the area vary between 3 and 36 individuals. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

Small game hunting and trapping are allowed on Eielson AFB. Moose hunting by bow and arrow is also allowed. A permit is required for both base personnel and the public. No hunting is allowed within the cantonment area. (Eielson AFB, 1998—Integrated Natural Resources Management Plan)

No habitat for the majority of wildlife species found at Eielson AFB occurs within the project area. Sporadic areas of black spruce and old field habitat border the runway and cantonment area. This habitat can support coyote, red fox, red squirrel, common raven (*Corvus corax*), ruffed grouse, and a variety of waterfowl in the open water areas. Appendix F, table F-7, lists wildlife species observed at Eielson AFB.

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Anadromous fish in French Creek and Piledriver Slough on Eielson AFB include king and chum salmon (Eielson AFB, 1998—Integrated Natural Resources Management Plan).

Threatened and Endangered Species

No threatened or endangered species have been identified on lands managed by Eielson AFB (Eielson AFB, 1998—Integrated Natural Resources Management Plan). The recently delisted American peregrine falcon and arctic peregrine falcon (*Falco peregrinus tundrius*) are known to occasionally pass through the base. (U.S. Department of the Air Force, 1998—EA for Test Drop and Recovery of Two Simulated B61-11 Units on Stuart Creek Impact Area)

Sensitive Habitat

Approximately 51 percent of Eielson AFB is composed of wetlands (figure 3.4-6). The most common type of vegetated wetlands is black spruce wetlands. Most of the wetlands on base have wet soils due to poor drainage caused by permafrost. No wetlands, however, are located in the area proposed for use by the NMD program. (Eielson Air Force Base, 1998—Integrated Natural Resources Management Plan)

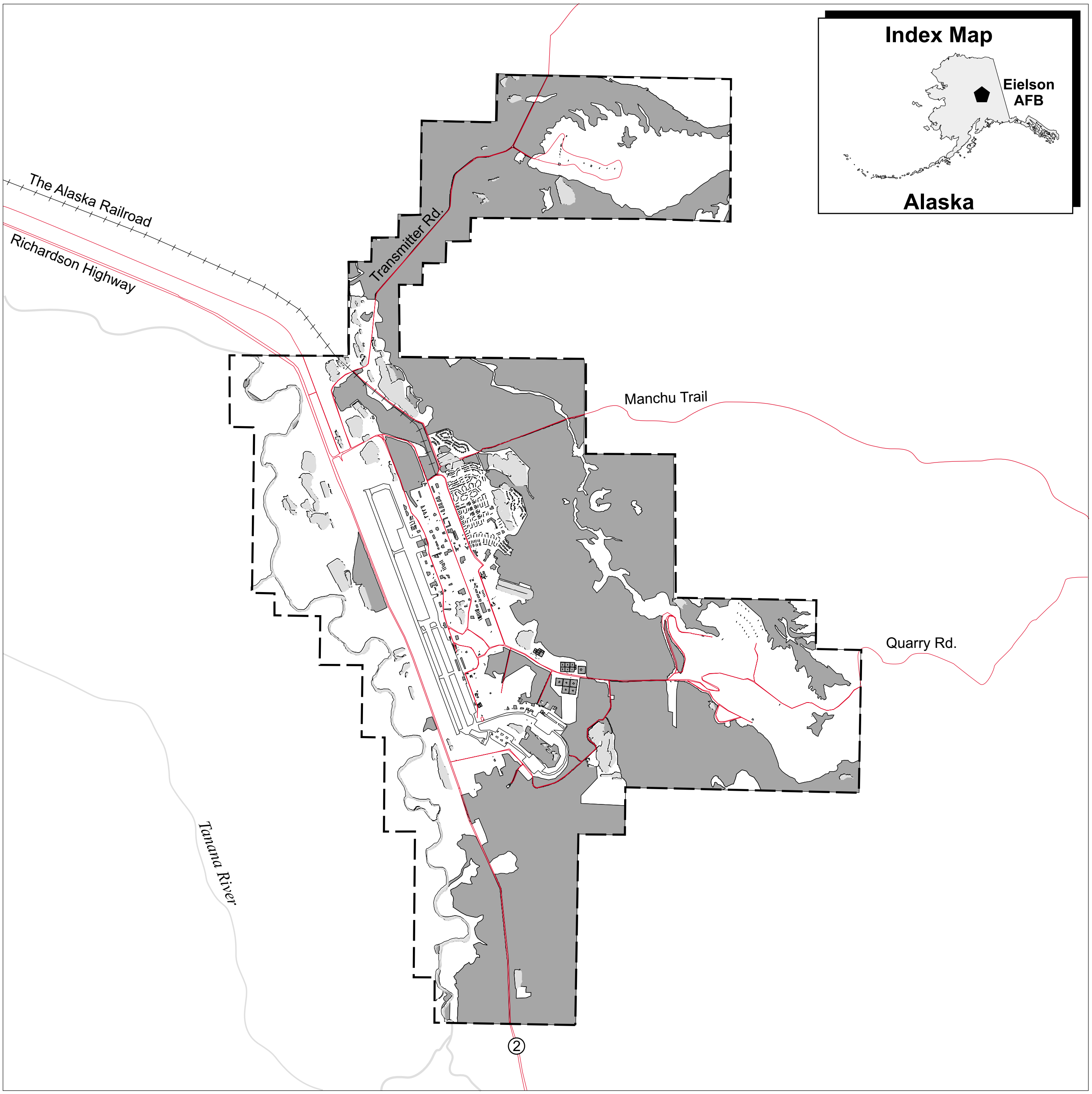
3.4.1.4 Fort Greely—Biological Resources

Fort Greely is located southeast of Fairbanks within the Tanana River valley. The Fort Greely region is mostly flat, sloping gently northwest toward the Tanana River. The base lies completely within the Tanana River valley and is bordered on the south by the Alaska Range. (U.S. Army Alaska, 1998—Oil Discharge Prevention and Contingency Plan)

The ROI includes areas that may potentially be affected by construction activities and deployment or operation of the GBI (approximately 243 hectares [600 acres]). This ROI includes Fort Greely and the surrounding areas. A site visit to the project area was conducted in July 1998.

Vegetation

Provided below is a description of the vegetation at the proposed NMD site at Fort Greely and surrounding area based on a 1998 site visit. However, in June 1999, a wildfire burned through the area, and as a result, all vegetation within the site was burned.



EXPLANATION

Roads
Water Area
Railroads
Installation Boundary
Uplands
Vegetated Wetlands

NORTH

Scale
0 .8 1.6 Miles
0 1.25 2.5 Kilometers

br_eafb_002

Wetlands, Eielson Air Force Base

Alaska

Figure 3.4-6

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The predominant vegetation at the proposed site is low growing spruce forest, which is common throughout Interior Alaska (U.S. Department of the Army, 1997—EA, Construct Munitions Storage Facility, Cold Regions Test Center, Bolio Lake). Figure 3.4-7 indicates the location of vegetation types within the proposed project area. Dominant tree species are black spruce and balsam poplar. The understory and groundcover consist of *Vaccinium* spp., marsh laborador tea (*Ledum palustris*), crowberry, and a variety of mosses and lichens.

Appendix F, table F-8, lists species of vegetation observed at Fort Greely.

Black spruce communities generally occur on poorly drained lowland and permafrost sites. At Fort Greely, approximately one-third of the base is lowland black spruce interspersed with about 40 percent heath bog communities. (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely)

Environmental factors influencing vegetative cover in the region are long, cold winters, a shortened growing season, and wildfires (U.S. Department of the Army, 1997—EA, Construct Munitions Storage Facility, Cold Regions Test Center, Bolio Lake). Much of the land at Fort Greely has been burned over the years (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely).

Native vegetation was removed from the majority of the cantonment area during the 1950s. The area has been landscaped and maintained by mowing. A few isolated pockets of forest do remain, particularly north of the airfield. (U.S. Department of the Army, 1997—Preliminary Draft EA for the Disposal and Reuse of Surplus Property at Fort Greely, Alaska)

Wildlife

Numerous lakes and ponds and four glacially fed major streams, Little Delta River, Delta Creek, Delta River, and Jarvis Creek, are located on Fort Greely. The major streams flow north to the Tanana River. However, there is relatively little quality habitat for fish streams. These streams are silt laden and do not provide a fishery on the installation, although Arctic grayling migrate through them. Coho salmon occur in the mouth of the Delta River occasionally, and it is an important area for spawning runs of fall chum salmon (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely). No important spawning streams are located on the installation. (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Greely, Proposed Resource Management Plan, Final EIS)

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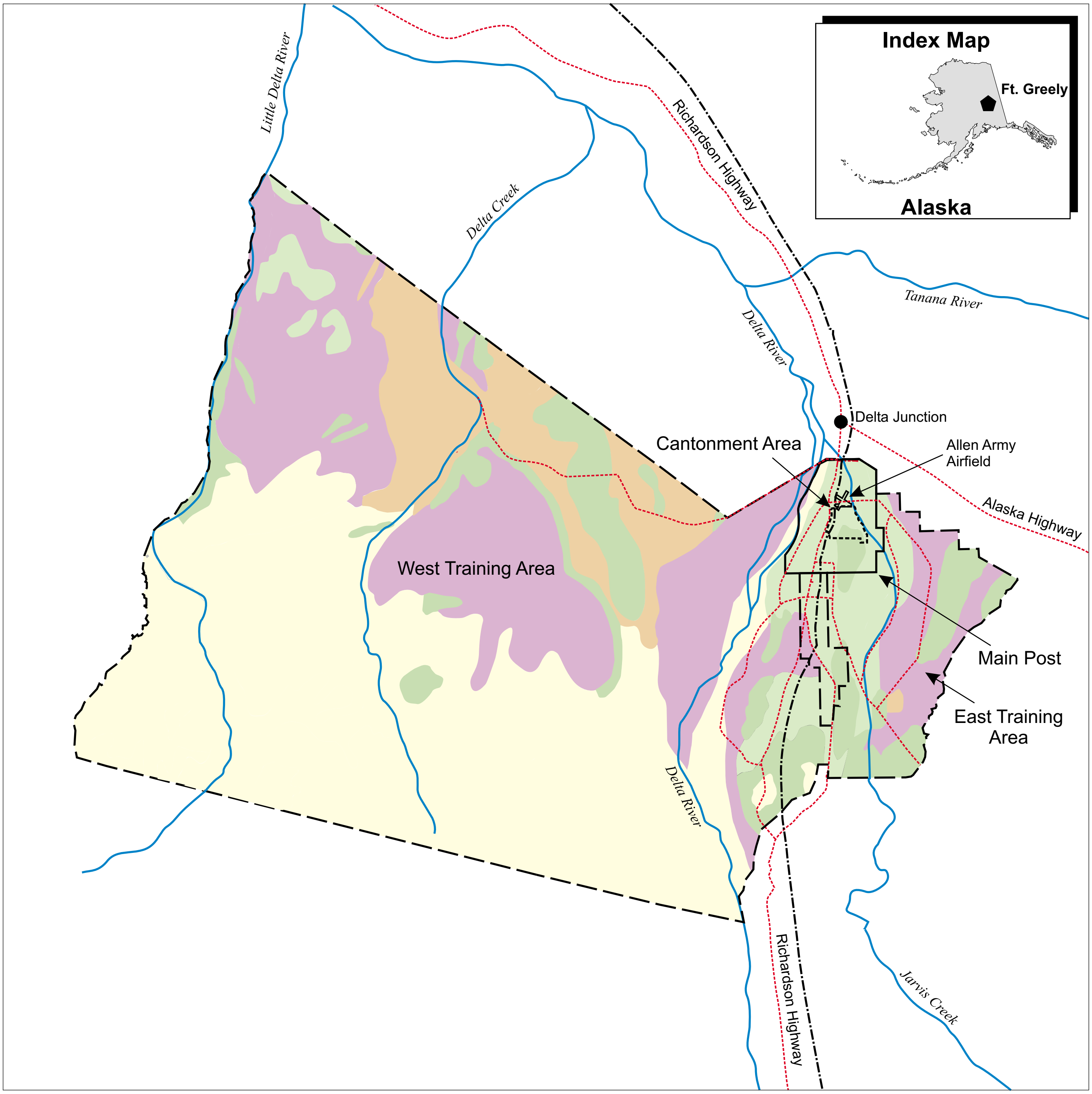
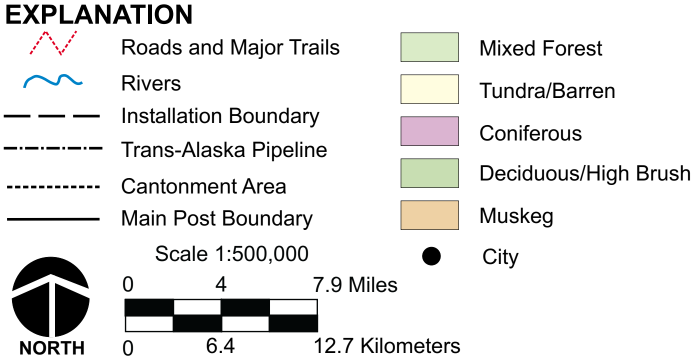


EXPLANATION



Vegetation, Fort Greely

Alaska

Figure 3.4-7

br_fge_001_color

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Fort Greely supports the largest number of game species found at any military installation within the United States. Due to factors such as an unobtrusive military mission and a diversity of habitats, most of the indigenous species of wildlife found in Interior Alaska are represented at Fort Greely. The majority of research and management has been focused on big game species. (U.S. Army Alaska, 1997—Draft Integrated Natural Resources Management Plan)

No wildlife studies or population inventories have been conducted at Fort Greely. The most common big game species within the project area include moose, bison (*Bison bison*), and barren ground caribou. The moose, Delta bison herd, and Delta caribou herd are considered the most valuable species at Fort Greely. (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely)

Commonly occurring predators in the project area include grizzly bear, black bear, gray wolf (*Canis lupus*), red fox, marten, coyote, and wolverine (*Gulo luscus*). Additional species trapped for fur at Fort Greely are mink, muskrat, snowshoe hare, beaver, and red squirrel. Avian species occurring within the project area are the common raven, willow ptarmigan (*Lagopus lagopus*), rock ptarmigan (*Lagopus mutus*), spruce grouse (*Dendragopus canadensis*), and ruffed grouse. (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely)

Fort Greely has been recognized for its quality moose and grouse hunting programs. In addition, it offers one of the only opportunities in the world to hunt bison. Hunting is open to both post personnel and the public by permit only. Bag limits, open hunting seasons, and open hunting areas are carefully managed by species, and are adjusted yearly. (U.S. Army Alaska, 1997—Draft Integrated Natural Resources Management Plan)

The cantonment area at Fort Greely does not provide quality wildlife habitat compared to the surrounding undeveloped areas. Resident wildlife is limited to small rodents and bats, such as the little brown bat (*Myotis lucifugus*). A variety of songbirds may feed in developed areas during daylight hours. (U.S. Department of the Army, 1980—EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Greely)

Three of the most common species observed at Fort Greely in many different ecosystems are the coyote, red fox, and raven (U.S. Department of the Army, 1997—Preliminary Draft EA for the Disposal and Reuse of Surplus Property at Fort Greely, Alaska).

Appendix F, table F-9, lists wildlife species observed at Fort Greely.

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Threatened and Endangered Species

No federally listed threatened, endangered, or candidate species of vegetation are found in Interior Alaska (U.S. Army Alaska, 1997—Draft Integrated Natural Resources Management Plan).

There are no known threatened or endangered wildlife species occurring on Fort Greely (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Greely, Proposed Resource Management Plan, Final EIS). However, the recently delisted American peregrine falcon and arctic peregrine falcon migrate through Fort Greely during the spring and fall migration periods (U.S. Army Alaska, 1998—Oil Discharge Prevention and Contingency Plan). The nearest known nests are along the Tanana River, and no nest sites have been identified at Fort Greely. There have been no confirmed sightings of either species within 16 kilometers (10 miles) of Fort Greely (U.S. Department of the Army, 1997—Preliminary Draft EA for the Disposal and Reuse of Surplus Property at Fort Greely, Alaska).

Sensitive Habitat

As shown in figure 3.4-8, there are no wetlands within the proposed GBI site. The nearest wetland is approximately 563 meters (1,848 feet) from the southeastern corner of the proposed site. This wetland consists of a palustrine shrub wetland and was assessed as having a low value. The wetland does not contribute significantly to the local diversity of fish but does provide habitat for wildlife. This wetland does not contribute substantially to abiotic resources such as flood control, groundwater recharge, or sediment or toxicant retention (U.S. Army Corps of Engineers, 1999—Wetland Delineation and Site Characterization for Military Sites, Alaska, Area 6—Fort Greely).

3.4.1.5 Yukon Training Area (Fort Wainwright)—Biological Resources

This section describes biological resources at the Yukon Training Area, located southeast of Fairbanks. The ROI includes areas that may potentially be affected by construction activities and deployment of the GBI (approximately 243 hectares [600 acres]). This ROI also includes the Yukon Training Area surrounding the potential GBI site. A site visit to the project area was conducted in July 1998.

Vegetation

The forested areas of the Yukon Training Area are a part of Alaska's taiga, which is defined as subarctic and subalpine forested areas adjacent to areas of treeless tundra. The predominant vegetation at the proposed site is deciduous forest, characterized by birch, quaking aspen, and balsam poplar on south-facing slopes. In low areas where the soils drain

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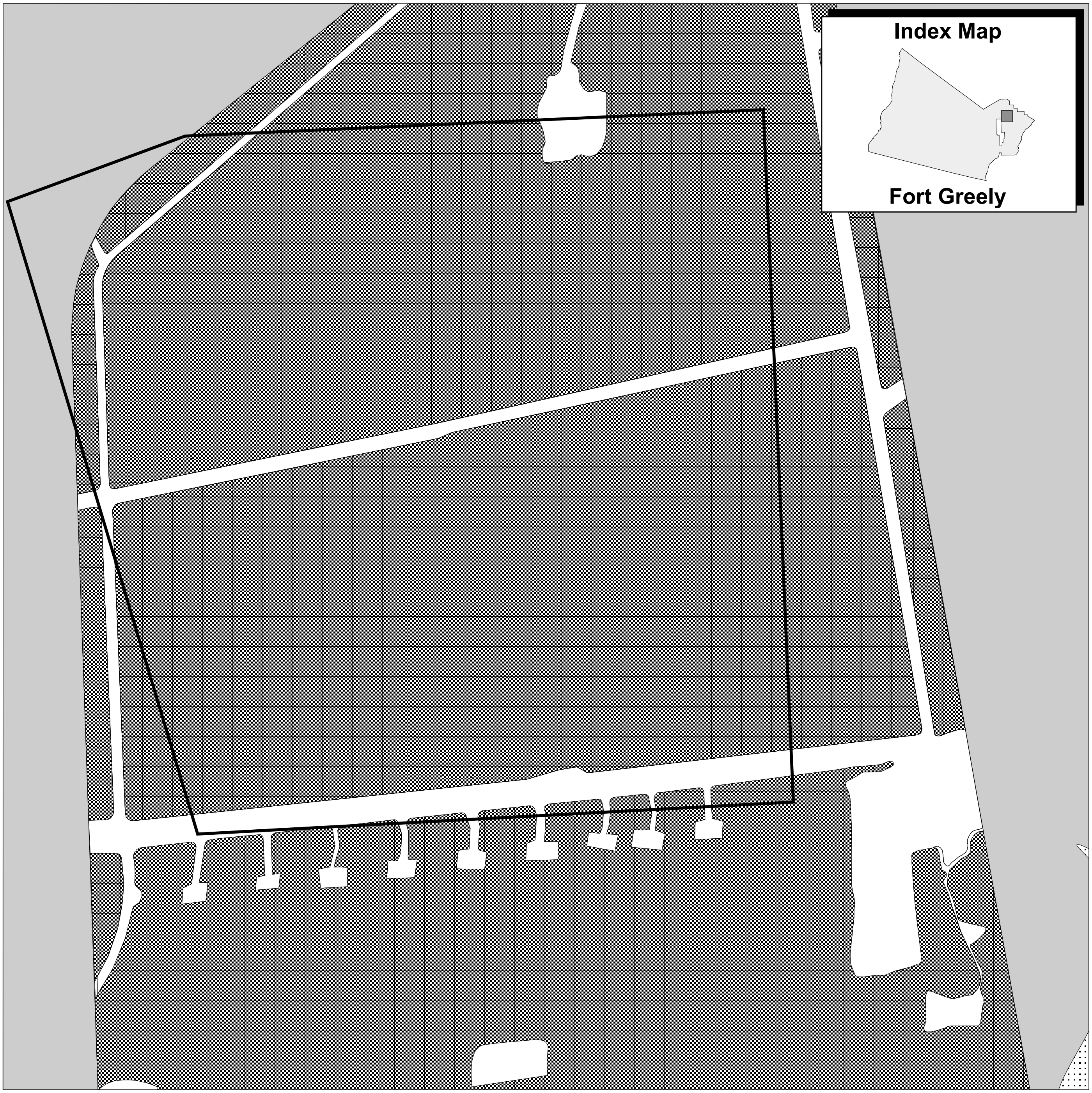

EXPLANATION

- Ground-Based Interceptor Site Boundary
- Fort Greely
- Upland
- Developed/Disturbed, Upland
- Wetland (Palustrine, Scrub-Shrub, Broad-Leaved Deciduous)

br_fge_002

Wetlands, Potential GBI Site, Fort Greely

Alaska

Figure 3.4-8

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more slowly, white spruce and black spruce are found mixed with the hardwoods. (U.S. Department of the Army, 1997—EA BRAC 95 Realignment of Personnel and Military Functions to Fort Wainwright, Alaska)

Taiga forest communities typically support a low species diversity of four to five tree species and a more developed understory and groundcover layer. These layers commonly contain buffaloberry (*Shepherdia canadensis*), American red currant (*Ribes triste*), high-bush cranberry (*Viburnum opulus*), bunchberry (*Cornus canadensis*), bearberry (*Arctostaphylos uva-ursa*), Labrador tea (*Ledum groenlandicum*), bush cinquefoil, twinflower (*Linnaea borealis*), horsetail (*Equisetum arvense*), tall bluebell (*Mertensia paniculata*), and wintergreen (*Pyrola asarifolia*) in deciduous forests. (U.S. Department of the Army, 1979—Draft EIS concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Wainwright)

Figure 3.4-9 depicts the location of vegetation types within the proposed project area. Appendix F, table F-10, lists species of vegetation observed at the Yukon Training Area.

Wildlife

Aquatic habitat in the Yukon Training Area is limited; Moose Creek is the closest water body to the area proposed for use (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Wainwright Yukon Maneuver Area, Proposed Resource Management Plan Final EIS). No data is available that indicates salmon spawning within the installation (U.S. Department of the Army, 1979—Draft EIS Concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Wainwright). Wildlife species common to the proposed project area within the Yukon Training Area are essentially forest-dwellers, as this is the predominant habitat type. Species common to all habitats at the Yukon Training Area are the coyote, red fox, and common raven. Mammals found in the deciduous forest include deer mouse (*Peromyscus maniculatus*), pygmy shrew (*Microsorex hoyi*), arctic shrew (*Sorex arcticus*), ermine (*Mustela erminea*), porcupine (*Erethizon dorsatum*), red squirrel, marten, black bear, brown/grizzly bear, moose, and lynx. Bird species observed include great horned owl, red-tailed hawk, gray jay (*Perisoreus canadensis*), spruce grouse (*Dendragapus canadensis*), ruffed grouse, hairy woodpecker (*Dendrocopos villosus*), hermit thrush (*Hylocichla guttata*), varied thrush (*Ixoreus naevius*), Swainson's thrush (*Catharus ustulata*), and black-capped chickadee (*Parus atricapillus*). (U.S. Department of the Army, 1997—EA BRAC 95 Realignment of Personnel and Military Functions to Fort Wainwright, Alaska) The olive-sided flycatcher (*Contopus borealis*), gray-checked thrush (*Catharus*

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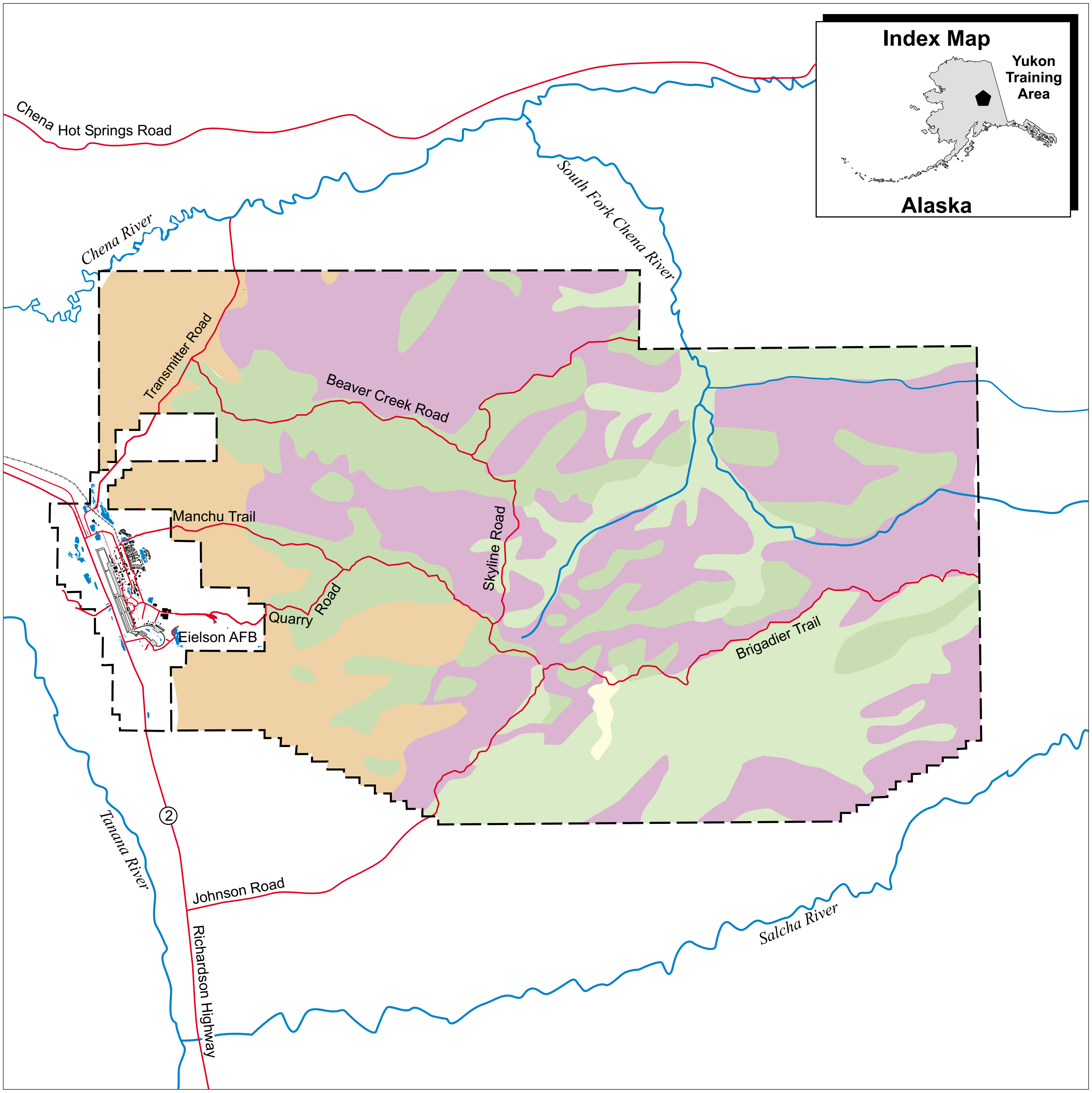

EXPLANATION

Roads
Rivers
Installation Boundary
Water Area
Mixed Forest
Tundra/Barren
Coniferous
Deciduous/High Brush
Muskeg

NORTH

Scale 1:300,000
0 2.4 4.7 Miles
0 3.8 7.6 Kilometers

Vegetation, Yukon Training Area

Alaska

Figure 3.4-9

br_yukon_001_color

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minimus), Townsend's warbler (*Dendroica townsendi*), and blackpoll warbler (*Dendroica striata*), all state species of concern, have been observed on the Yukon Training Area (U.S. Department of the Interior, 1999—comments received on the Draft EIS).

Mature forests generally provide poor habitat for moose, as there is little preferred browse. However, the Winter Camp provides some habitat for moose. (U.S. Department of the Army, 1979—Draft EIS concerning Proposed Land Withdrawal for the 172nd Infantry Brigade (Alaska) at Fort Wainwright)

Migratory birds observed in the vicinity of the proposed sites include a variety of swallows, thrushes, sparrows, and warblers (Department of the Army, 1996—Environmental Stewardship/Environmental Protection).

The Yukon Training Area is in the same region as Fort Greely and is within the same hunting district. The major difference is the absence of bison habitat in the area. Hunting is open both to post personnel and the public by permit only. Bag limits, open hunting seasons, and open hunting areas are carefully managed by species and are adjusted yearly.

Appendix F, table F-11, lists wildlife species observed at the Yukon Training Area.

Threatened and Endangered Species

No federally-listed threatened, endangered, or candidate species have been found within the Yukon Training Area (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Wainwright Yukon Maneuver Area, Proposed Resource Management Plan Final EIS). However, the recently delisted American peregrine falcon may travel through the area or nest in the vicinity of the Salcha River bluffs (Department of the Army, 1998—EA, Beddown of a Chemical Company and Utilization of M3A4 Smoke Generators at Fort Wainwright, Alaska).

Sensitive Habitat

The functions and values of wetlands and other waters in the Yukon Training Area at the proposed GBI site (figure 3.4-10) were evaluated in accordance with the rapid assessment methodology. The Rapid Assessment of Wetland Functions and Values evaluates the physical, biological, and human resource values of various landform and vegetation classes. Each type of wetland present in the area was evaluated with respect to the assessment criteria, such as groundwater recharge and discharge, water quality, and fish and wildlife habitat. Those types with a greater abundance of critical indicators were ranked higher; a general lack of indicators was scored lower. Each type was then given a ranking of High, Moderate, or Low for each of the 11 assessment criteria. (U.S.

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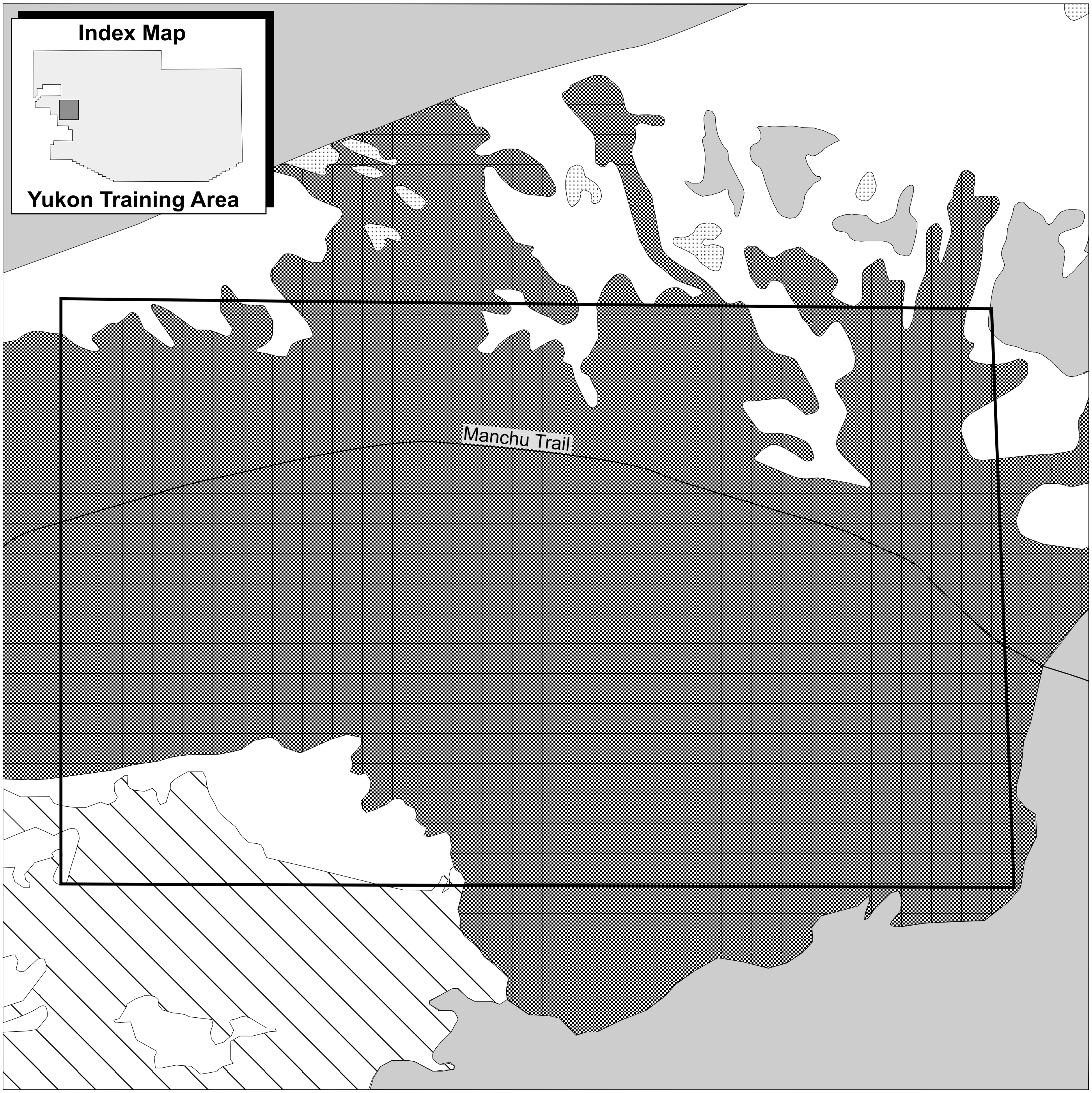

EXPLANATION

- Roads
- Ground-Based Interceptor Site Boundary
- Yukon Training Area
- Upland
- Wetland Disturbed (Palustrine, Scrub-Shrub, Broad-Leaved Deciduous)
- Wetland (Palustrine, Scrub-Shrub, Broad-Leaved Deciduous)
- Wetland (Palustrine, Scrub-Shrub, Broad-Leaved Deciduous/Needle-Leaved Evergreen)

NORTH

Scale 1:15,000

0 621 1,242 Feet

0 190 379 Meters

br_yukon_002

Wetlands, Potential GBI Site, Yukon Training Area

Alaska

Figure 3.4-10

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Army Corps of Engineers, 1999—Wetland Delineation and Site Characterization for Military Sites, Alaska, Area 4—Fort Wainwright)

Palustrine, scrub-shrub, broad-leaved deciduous (PSS1) wetlands are abundant throughout the site (12 hectares [29 acres]). Dominant vegetation consists of grasses, willow, resin birch, cranberry, and moss. Soils consist of a shallow organic layer underlain by sandy loam. Water is found approximately 15 to 30 centimeters (6 to 12 inches) below the surface. (U.S. Army Corps of Engineers, 1999—Wetland Delineation and Site Characterization for Military Sites, Alaska, Area 4—Fort Wainwright)

Palustrine, scrub-shrub, broad-leaved deciduous/needle-leaved evergreen (PSS1/4) wetlands are also abundant throughout the vicinity of the site (34 hectares [84 acres]). Dominant vegetation consists of grasses, willow, cranberry, black spruce, and moss. Soils consist of a shallow layer underlain by sandy loam. Although in many areas no water was found beneath the immediate surface, the soil was thoroughly saturated during the U.S. Army Corps of Engineers study. (U.S. Army Corps of Engineers, 1999—Wetland Delineation and Site Characterization for Military Sites, Alaska, Area 4—Fort Wainwright)

The site consists of an elevated ridge vegetated by uplands. On either side of the ridge is a series of expansive PSS1 and PSS1/4 wetlands. These wetlands likely provide habitat for moose and water-associated birds. Overall, the PSS1 and PSS1/4 wetland types were assessed as having a low value. These wetlands do not contribute significantly to the local diversity of fish but do provide habitat for wildlife. Neither wetland contributes substantially to abiotic resources such as flood control, groundwater recharge, or sediment or toxicant retention. (U.S. Army Corps of Engineers, 1999—Wetland Delineation and Site Characterization for Military Sites, Alaska, Area 4—Fort Wainwright)

3.4.1.6 Alaska—Fiber Optic Cable Line—Biological Resources

3.4.1.6.1 Plankton, Algae, and Invertebrates

Marine phytoplankton are single celled oceanic plants. They are found for at least part of their lives in the water column (pelagic), although a few species live on the sea floor (benthic). Phytoplankton provide the majority of primary production in the food webs of ocean environments. Primary production in the water column is the net increase in plant matter produced by the phytoplankton.

Zooplankton are single and multi-celled animals that live passively or semi-passively in the water column. Most species of marine animals spend a portion of their lives in plankton waters (U.S. Department of the Interior, 1977—Draft EIS, Proposed Outer Continental Shelf Oil and Gas Lease Sale). Zooplankton are extremely important to the diet of marine mammals and young fishes.

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Marine algae normally include those species that spend their adult lives attached to a substrate. They are generally large enough to see with the naked eye. There are three basic groups of marine algae: the green algae (chlorophyta), the brown algae or kelps (phaeophyta) and the red algae (rhodophyta).

Prince William Sound

Plankton. Primary production reported for the nearby Gulf of Alaska (U.S. Department of the Interior, 1974—The Western Gulf of Alaska) ranges from 18 to 408 milligrams carbon per square meter per day (0.0005 to 0.012 ounces carbon per square yard per day). These are integrated values for the entire photic zone in June and July. Values from Motoda and Minoda (1974) are 229 milligrams carbon per square meter per day (0.007 ounces per square yard per day) in March and 290 milligrams carbon per square meter per day (0.0086 ounces carbon per square yard per day) in early summer in the western Gulf of Alaska. Winter values are much lower, as much less light is available. Motoda and Minoda (1974) provide one mid-winter value for the North Pacific, 71 milligrams carbon per square meter per day (0.002 ounces carbon per square yard per day). The range measures at the surface south of Unimak Pass was 0.15 to 1.95 milligrams carbon per square meter per hour (0.000004 to 0.00005 ounces carbon per square yard per hour), while values from the continental shelf near Kodiak Island ranged from 0.39 to 2.80 milligrams carbon per square meter per hour (0.00001 to 0.00007 ounces carbon per square yard per hour).

Phytoplankton found in Prince William Sound are similar to those found in the Gulf of Alaska (U.S. Department of the Interior, 1974—The Western Gulf of Alaska). They include over 80 species of diatoms. Dominant genera include *Chaetoceros* and *Thalassiosira*. There are also about 20 species of dinoflagellates, predominately *Ceratium*, *Dinophysis*, and *Peridinium* spp.

The dominant species of zooplankton in Prince William Sound include jellyfish, chaetognaths, annelid worms, numerous amphipods, copepods and molluscs.

Algae. Marine algae fix carbon as food for many other species—directly as live food or indirectly as detritus. They are an important component of the habitat for many species of invertebrates and fishes. Algae are found covering most intertidal and shallow subtidal rocky habitats, and fill a basic role in the food webs of these habitats. The only algae that are found in the deeper waters are drift that is moving downward from the shallows and surface areas. The lack of light penetration limits algal growth to less than 30 meters (100 feet) below the sea's surface; and under the best conditions, little algal growth occurs below 18 to 21 meters (60 to 70 feet) below the sea's surface.

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The most common intertidal alga found in Prince William Sound is rockweed, *Fucus gardneri* (*F. distichus*). Bull kelp (*Nereocystis leutkeana*), a highly visible kelp species that grows to the surface forming a dense canopy, is also found in Prince William Sound. (U.S. Department of the Interior, 1974—The Western Gulf of Alaska)

Invertebrates. Intertidal benthic invertebrates are numerous along the shorelines of Prince William Sound. Habitats for these species range from fine silts and clay to solid rock outcrops. Included in the identified groupings are protozoans, poriferans (sponges), coelenterates (corals, anemones, and hydroids), molluscs (snails and clams), annelid worms, crustaceans (crabs and shrimps), echinoderms (seastars and urchins), and several minor phyla (U.S. Department of the Interior, 1974—The Western Gulf of Alaska). The largest group by species is the molluscs. Limpets, clams, mussels, chitons, and snails are all found in the intertidal zone. Also common are annelid worms, crustaceans, and echinoderms (sea stars, urchins, and sea cucumbers).

Subtidal benthic marine invertebrates are found in great numbers throughout Prince William Sound. They encompass both sessile (attached to the bottom) and motile (mobile) species. They are found both on hard and soft substrates. Commonly represented forms include sponges, coelenterates, worms, crustaceans, molluscs, and echinoderms.

Gulf of Alaska

Plankton. Primary phytoplankton production reported for the Gulf of Alaska (U.S. Department of the Interior, 1974—The Western Gulf of Alaska) ranges from 18 to 408 milligrams carbon per square meter per day (0.0005 to 0.012 ounces carbon per square foot per day). These are integrated values for the photic zone at a station south of Unimak Pass in June and July. Values from Motoda and Minoda (1974) were 747 milligrams per square meter per day (0.022 ounces per square foot per day) in March and 290 milligrams per square meter per day (0.009 ounces per square foot per day) in early summer. Winter values are much lower since there is considerably less sunlight. Motoda and Minoda (1974) reported one mid-winter value for the North Pacific of 71 milligrams per square meter per day (0.002 ounces per square foot per day). The range of surface phytoplankton production south of Unimak Pass was 0.15 to 1.95 milligrams carbon per cubic meter per hour (0.000004 to 0.00005 ounces carbon per cubic foot per hour), whereas production values from the Continental Shelf south of Kodiak Island ranged from 0.39 to 2.80 milligrams carbon per cubic meter per hour (0.0005 to 0.012 ounces carbon per cubic foot per hour).

Phytoplankton in the Gulf of Alaska include 86 species of diatoms (U.S. Department of the Interior, 1974—The Western Gulf of Alaska). The dominant species are *Chaetoceros* (21 spp.) and *Thalassiosira* (8 spp.).

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Also, in the Gulf of Alaska there are 21 species of the less common dinoflagellates, predominately *Ceratium* spp. (5 spp.), *Dinophysis* (7 spp.) and *Peridinium* (6 spp.). Around Unimak Island, the most common species were the temperate, near-surface, open-ocean diatoms, including *Asterionella japonica, Thalassiosira nordenskioldii, Chaetoceros debilis,* and *Buddulphia aurita.*

The dominant species of zooplankton in the Gulf of Alaska (U.S. Department of the Interior, 1974—The Western Gulf of Alaska) include one species of jellyfish, one chaetognath, one annelid worm, numerous amphipods, nine species of copepods, and three molluscs. A common method for reporting zooplankton density is biomass volume in the water column. Values are presented as cubic centimeters of zooplankton biomass per 1,000 cubic meters of water (cubic inches of zooplankton biomass per 1,000 cubic yards of water). Density ranges from less than 50 to over 400 cubic centimeters per 1,000 cubic meters (0.09 to 0.72 cubic inches of zooplankton biomass per 1,000 cubic yards of water). The highest volumes of zooplankton were found in the coastal inshore waters. Levels below 50 cubic centimeters per 1,000 cubic meters (0.09 cubic inch per 1,000 cubic feet) were mostly offshore above the abyssal plain. Copepods form 85 percent of zooplankton by number. Densities decrease with distance offshore.

Algae. For the Gulf of Alaska, the U.S. Department of the Interior (1974) lists five species of green algae (*chlorophyta*), 31 species of brown algae (*phaeophyta*), and 11 species of red algae (*rhodophyta*). Fewer of these species are found in Prince William Sound and in the Bering Sea. The most common intertidal alga found in the Gulf of Alaska is rockweed. Bull kelp is a highly visible kelp species growing to the surface and forming a dense canopy that has been reported as far west in the Gulf of Alaska as Unimak Island. Less visible from the surface, but common in the shallow subtidal areas, are several large-bladed kelps (seven *Laminaria* spp. and six *Alaria* spp.) and several coralline red algae. Eelgrass (*Zostera marina*) is found in protected silty or sandy intertidal and shallow subtidal habitats. (U.S. Department of the Interior, 1974—The Western Gulf of Alaska)

In the western area of the Gulf of Alaska, 14 species of green algae, 28 species of brown algae, and 74 species of red algae have been identified (Lebednik and Palmisano, 1977—Ecology of Marine Algae). Green algae are found mostly in the upper intertidal area; *Fucus gardneri*, a brown alga, is the dominant species found in the midlevel of the intertidal area; and *Alaria* spp. and *Laminaria spp*. are primarily found in the subtidal region. Both the *Alaria* and *Laminaria* species are brown algae and are commonly called kelps. Several species of *porphyra* and coralline red algae are also common in the intertidal areas. The *porphyra* species are fleshy red algae, and the corallines are encrusting or articulate. The coralline red algae are also found to depths of greater than 30 meters

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(100 feet). The bull kelp was found at Amchitka only as drift. Presumably, the western limit for growth is to the east, possibly as far as the tip of the Alaska Peninsula. The geographic distributions of the algae found include 23 percent from the Atlantic-arctic area, 49 percent from the western North Pacific, 39 percent from the eastern Pacific, and 10 percent are endemic to the Aleutian Chain.

Invertebrates. Intertidal benthic invertebrates are numerous along the shorelines of the Gulf of Alaska. Habitats for these species range from fine silts and clay to solid rock outcrops. Included in the identified groupings are protozoans, poriferans, coelenterates, molluscs, annelid worms, crustaceans, echinoderms, and several minor phyla (U.S. Department of the Interior, 1974—The Western Gulf of Alaska). The largest group by species is the molluscs with 42 species of limpets, clams, mussels, chitons, and snails. Also common are annelid worms that are represented by 21 species; arthropods, with 20 species of crabs, hermit crabs, and barnacles; and echinoderms, with 15 species of sea stars, urchins, and sea cucumbers.

Subtidal benthic marine invertebrates are found in great numbers throughout the Gulf of Alaska. They encompass both attached and mobile species. They are found both on hard and soft substrates. Commonly represented forms include sponges, coelenterates, worms, crustaceans, molluscs, and echinoderms. Species identified from soft substrate areas of the Kodiak Island region include 45 species of molluscs, 37 polychaete worms, 14 species of crustaceans, and 23 echinoderms. Additional groupings listed include five species of sipunculid worms and three brachiopods.

Shellfishes, particularly crabs, form a major biological component in the Gulf of Alaska and the Bering Sea. Commercially important crustaceans include red king crab (*Paralithodes camschatica*), blue king crab (*P. platypus*), brown king crab (*Lithodes aquespina*), scarlet king crab (*L. couesi*), Tanner (Snow) crabs (*Chionoecetes bairdi, C. opilio, C. tanneri, C. angulatus*), Dungeness crab (*Cancer magister*), and Korean hair crab (*Erimacrus isembeckii*). The shrimps include four species of pandalids; they are pink shrimp (*Pandalus borealis*), humpy shrimp (*P. goniurus*), sidestripe shrimp (*P. dispar*), and coonstripe shrimp (*P. hypsinotus*).

King crabs are found across the Gulf of Alaska and the eastern Bering Sea. They are typically found at depths from 100 to 550 meters (330 to 1,800 feet). They spawn in shallow water in the spring, and then move offshore to feed during the summer. Juveniles are released to the inshore plankton, where they stay for approximately 10 weeks. They then settle in the shallow coastal waters to live for several years. At times, juveniles form “pods” in the shallow waters; these pods may contain several thousand individuals. The longest of these snake-like pods to be measured was 7.3 meters (24 feet) long (U.S. Department of

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the Interior, 1984—Final EIS, Proposed Gulf of Alaska/Cook Inlet Lease Sale 88). They eat plankton as larvae, then switch to diatoms, algae, protozoans, ostracods, echinoderms, small molluscs, hydroids, and sponges as juveniles. Food for adults consists of bivalves, snails, brittle stars, polychaete worms, Tanner crabs, and probably decaying fish and marine mammals.

Tanner and king crabs are found in similar habitats. The Tanner crabs exhibit spawning behavior that is similar to that exhibited by the king crabs, although slightly later in the year. During the spring, the Tanner crabs move inshore where the females release the egg masses that they had been carrying for 11 months. They then move back to deeper waters to feed for the rest of the year. Larvae stay in the nearshore water column for 60 to 90 days and then settle to the bottom. Pelagic larvae feed on phyto- and zooplankton. On the sea floor, they switch to a diet of benthic diatoms, macroalgae, hydroids, and detritus. Adult Tanner crabs feed on dead and decaying invertebrates and fishes on the sea floor, as well as on clams, hermit crabs, and brittle stars (U.S. Department of the Interior, 1985—Final EIS, Proposed St. George Basin Lease Sale 89).

Dungeness crabs are found in the Gulf of Alaska and were formerly found throughout Prince William Sound. This is a coastal species, found in bays, inlets, and other nearshore waters. They are found from the intertidal region to a depth of 90 meters (300 feet). Release of larvae occurs in the spring. The larvae spend 3 to 4 months in the plankton before settling to the bottom. Larvae consume phytoplankton and small zooplankton. After settling to the sea bottom, they consume shrimps, smaller crabs, barnacles, clams, and polychaetes (U.S. Department of the Interior, 1984—Final EIS, Proposed Gulf of Alaska/Cook Inlet Lease Sale 88).

As noted above, there are four commercially important species of shrimps in the Gulf of Alaska. Of these four, pink shrimp provide for the majority of the catch. Shrimp species spend their days on the bottom, and move up into the water column at night to feed on larval crabs and other zooplankton. They can be found during the night from near surface to a depth of at least 460 meters (1,500 feet). Location and depth depend on species, substrate, and oceanographic conditions.

Other commercially important benthic invertebrates include scallops and clams. *Patinopecten caurinus*, the weathervane scallop, is the only one of eight species found in the Gulf of Alaska sufficiently large and in sufficient numbers that they are fished. They are found in dense, discrete beds on the continental shelf in the Gulf of Alaska. Greatest densities are found at depths of 55 to 130 meters (180 to 425 feet). Spawning occurs in June and July. They are filter feeders, consuming phytoplankton, small zooplankton, and detritus. Fertilized eggs settle to the bottom. After 2 to 3 days, larvae hatch and enter the plankton for 2

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to 3 weeks. They then settle to the bottom, transforming into juveniles. Scallops are found in areas with mud, clay, sand, or gravel substrate. Rocky substrates are not fished due to high gear losses in these areas. Because of this, it is not known whether scallops are also found in high densities on rocky substrates. (U.S. Department of the Interior, 1974—The Western Gulf of Alaska; 1984—Final EIS, Proposed Gulf of Alaska/Cook Inlet Lease Sale 88)

Bering Sea

Plankton. Primary production measurements in the Bering Sea water column range from near zero—due to the winter ice pack—to 2,400 milligrams per square meter per day (0.07 ounces per square yard per day) (McAlister and Favorite, 1977—Oceanography). Values along the north side of the Aleutian Chain range from 38 at Amchitka Island in February to 686 milligrams per square meter per day (0.001 to 0.02 ounces per square yard per day) off Adak Island in late spring-summer. Further offshore in the Bering Sea, phytoplankton production values range from 133 milligrams per square meter per day (0.004 ounces per square yard per day) in February to 327 milligrams per square meter per day (1,068 ounces per square foot per day) in June. These variations, especially nearshore, reflect the annual seasonal climatic changes that these areas undergo. Summer hourly rates at the surface range from 1 to 5 milligrams per cubic meter per hour (0.00003 to 0.0001 ounces per cubic yard per hour). Most values, however, fall below 2 milligrams per cubic meter per hour (0.00005 ounces per cubic yard per hour) (Motoda and Minoda, 1974—Plankton of the Bering Sea).

There are 74 species of diatoms listed for the Bering Sea (Motoda and Minoda, 1974—Plankton of the Bering Sea). The dominant species include nine species of *Chaetoceros* and three species of *Nitzschia*. Sixteen species of dinoflagellates exist in the Bering Sea—nine of these are in the genus *Peridinium*, six are *Ceratium* spp., and one is a species of *Dinophysis*.

Zooplankton in the Bering Sea include foraminiferans, radiolarians, tintinnoides, siphonophores, scyphomedusae, pteropods, polychaetes, chaetognaths, copepods, amphipods, mysids, euphausids, and appendicularians. By volume, the dominant groups include 29 species of calenoid copepods in 18 genera, 19 species of euphausids (*malacostraca*), and 3 species of Chaetognaths. By volume, copepods comprise 85.2 percent, chaetognaths 5.2 percent, and amphipods 2.4 percent of a typical trawl. Of the zooplankton, copepods have received the most study due to their importance as forage for fishes and because they are the most prevalent species. Many of the species of zooplankton listed are the same as those that are found in the Gulf. Volume density reported (U.S. Department of the Interior, 1974—The Western Gulf of Alaska) is over 800 cubic centimeters per 1,000 cubic meters (1.4 cubic

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inches per 1,000 cubic feet). The highest density of zooplankton in the Bering Sea is found along the western Alaskan shoreline. Moderate densities, generally below 200 cubic centimeters per 1,000 cubic meters (0.35 cubic inch per 1,000 cubic feet), are found in the water column over the deeper areas of the abyssal plain of the southern Bering Sea.

Algae. Types of algae found in the Bering Sea are similar to those discussed above under the Gulf of Alaska. The same species of algae are found in the southern Bering Sea along the Aleutian Chain. The areas further north contain much less intertidal and subtidal macroalgae.

Invertebrates. Subtidal benthic marine invertebrates are found in great numbers throughout the Bering Sea. They encompass both attached and mobile species. They are found both on hard and soft substrates. Commonly represented forms include sponges, coelenterates, worms, crustaceans, molluscs, and echinoderms (U.S. Department of the Interior, 1985—Final EIS Proposed Northern Aleutian Basin Lease Sale 92). Species identified from soft substrate areas of the southern Bering Sea region include 130 species of molluscs, 143 polychaete worms, 76 species of crustaceans, and 28 echinoderms.

Shellfishes, particularly crabs, form a major biological component in the Bering Sea. Commercially important crustaceans are similar to those discussed above under the Gulf of Alaska.

King crabs and Tanner crabs are found across the eastern Bering Sea. They are typically found at depths from 100 to 550 meters (330 to 1,800 feet) and are discussed above under the Gulf of Alaska.

Only limited information is available for the Korean hair crab that is found along the Aleutian Chain and in shallow areas throughout the Bering Sea. Larvae are released into the plankton in the spring, where they stay for about 5 months (U.S. Department of the Interior, 1985—Final EIS, Proposed St. George Basin Lease Sale 89).

Shrimp species spend their days on the bottom, and move up into the water column at night to feed on larval crabs and other zooplankton. They can be found during the night from near surface to a depth of at least 460 meters (1,500 feet). Location and depth depend on species, substrate, and oceanographic conditions.

Other commercially important benthic invertebrates including scallops and clams are discussed above under the Gulf of Alaska.

Clam resources in the Bering Sea include six species. The primary species of commercial interest is the surf clam (*Spisula polynyma*). The surf clam is widely distributed from the intertidal region to the edge of the continental shelf. Species of less interest include razor (*Siliqua patula*), butter (*Saxidomus gigantea*), softshell (*Mya sp*.), littleneck

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(*Protothaca staminea*) and Macoma clams (*Macoma spp*.). All clams broadcast pelagic sperm and eggs into the water column, where fertilization occurs. The larval stage lasts several months before they settle to soft substrate of the sea floor as juveniles.

3.4.1.6.2 Fishes

Prince William Sound

The fish communities and many of the species discussed below are found throughout Prince William Sound, the Gulf of Alaska, and the Bering Sea. Studies in the western Gulf of Alaska identified 96 species of fishes (Simenstad, Isakson and Nakatani, 1977—Marine Fish Communities). Included were 2 species of sharks, 3 rays, 6 salmonids, 3 cods, 7 rockfishes, 18 sculpins, and 6 flatfishes. Most of the rest of the fishes identified are small demersal species, bottom dwellers that generally lack swim bladders.

The fish communities were separated into seven fairly distinct habitats. These are the epipelagic, mesopelagic, offshore demersal (rock/sponge), offshore demersal (sand/gravel), inshore (sand/gravel), inshore (rock/algae), and littoral (intertidal) communities. The epipelagic community consists of 11 species, living offshore in less than 200 meters (650 feet) of water. The salmon species are dominant among these.

The mesopelagic community has 18 species that typically live between 200 to 1,000 meters (650 and 3,300 feet) deep. Most of these are deep ocean species, typically with bioluminescent organs for communication, and often unique feeding appendages. Occurrence is closely related to presence of the shrimps they prey upon.

The dominant features of the offshore demersal (rock/sponge) community are rocky substrate covered by sessile (attached to the bottom) invertebrates, such as sponges, cold water corals, and tunicates. Water depths are typically 55 to 180 meters (180 to 600 feet), but may include much shallower and deeper water on shoals and in canyons. Eight species dominate this environment, with many more found there at times. The dominants include sculpins, pollock, and the rockfishes. Difficulties caused by entanglement of gear with the rocky bottom make this a poorly sampled region, resulting in difficulties identifying the species present.

The offshore demersal (sand/gravel) community also typically encompasses depths from 55 to 180 meters (180 to 600 feet). There is little stabilized benthic growth, leaving a fairly uniform substrate. The fish community is dominated by Pacific cod and Pacific halibut. Other flatfishes and small demersal fishes are common. The inshore (sand/gravel) habitat is similar to the offshore sand/gravel habitat, in that most of the substrate is uniform. It is found mostly in protected areas, such as bays. Pacific cod, pollock, and Pacific halibut dominate during

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the summer. Other flatfishes and small demersal fishes were also found. Time spent in this habitat during the rest of the year is not known, as conditions make sampling very difficult during the winter.

The inshore (rock/algae) is found from the low tide line out to about 100 meters (330 feet). It is composed of rocky ridges, canyons, cliffs, exposed rock outcrops, and flat rock benches. Attached algae and invertebrates cover the substrate and add additional variations to an already diverse environment. Included are kelp forests, which increase habitat to include the water column. Most of the fishes found here are demersal. They include greenlings, sculpins, rockfishes, and a wide variety of other species. High variability among species present at different sites makes this a loose aggregation more than a consistent community. Few fishes are found here during the winter, when wave activity increases dramatically.

The littoral (intertidal) community consists of the species found in tide pools and nearshore surge channels. It provides a nursery for a wide variety of juvenile fishes, as well as for adults of several species. Six species of sculpins and other small demersals dominate the tidepools. Species typically found in subtidal areas move up into the littoral zone to feed during high tides. Reductions in algal cover and food sources during the winter, combined with severe physical conditions, push many of these fishes down into subtidal areas to overwinter.

Gulf of Alaska

The fish communities found throughout the Gulf of Alaska are the same as those discussed above under Prince William Sound.

Bering Sea

The fish communities found throughout the Bering Sea are similar to those discussed above under Prince William Sound.

Identifications of about 300 species have been made for the Bering Sea (Wilimovsky, 1974—Fishes of the Bering Sea). Of these, most are considered to be boreal species, rather than primarily from the arctic. The nearshore fishes of the Aleutian Chain and the Alaska Peninsula are predominantly from the eastern Pacific. The southern Bering Sea, around Bower's Ridge, has a unique community of fishes, many of which are not found elsewhere.

The dominant groups throughout the Bering Sea are the sculpins and other small demersal fishes. Sculpins account for 22 percent (66 species) of the 300 species found, while 4 other families of demersal fishes account for 34 percent (102 species). These are the liparids, stichaeds, zoarcids, and the agonids. Flatfishes account for 8 percent (24 species), rockfishes for 5 percent (15 species), and salmonids for 4

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percent (12 species). These totals include the species found at all depths throughout the Bering Sea in all seasons. (Wilimovsky, 1974—Fishes of the Bering Sea)

3.4.1.6.3 Fisheries

The route for the proposed fiber optic cable line traverses some of the world’s richest marine fishing grounds. Harvesting of shellfish and finfish is a year round activity in the Gulf of Alaska and Bering Sea/Aleutian Islands regions. Vessels range from small skiffs that fish in more protected coastal waters to longliners, trawler vessels, and factory trawlers over 60 meters (200 feet) long that harvest crab and groundfish from offshore waters. During summer, thousands of salmon fishing vessels, including small skiffs and medium sized purse seine and gillnet vessels, fish coastal waters for five species of salmon. During winter months, trawl and crab pot vessels fish the nearshore and offshore Gulf of Alaska and the Bering Sea for groundfish and crab.

In 1997, Dutch Harbor received the largest commercial fishery landings of any port in the United States with 2 million kilograms (4.4 million pounds) of product landed (U.S. Department of Commerce, 1998—Fisheries of the United States). Dutch Harbor’s landings also were the nation’s most valuable at $122.6 million. Landings in Kodiak were sixth in quantity at 125.8 million kilograms (277.5 million pounds) and third in value in 1997 ($88.6 million) (U.S. Department of Commerce, 1998—Fishes of the United States). The total annual processed value of fishery products harvested from offshore waters in Alaska’s Exclusive Economic Zone is $1.1 to 1.4 billion (U.S. Department of Commerce, 1998—Fisheries of the United States). The study area encompasses nearly all of the fisheries that generate this value. Statistics on catch levels by fishery, effort expended in fishery categories, and economic values of these fisheries can be reviewed in North Pacific Fisheries Management Council documents (North Pacific Fisheries Management Council, 1998—Stock Assessments of the Gulf of Alaska, and Bering Sea and Aleutian Islands Regions).

The North Pacific Fisheries Management Council and National Marine Fisheries Service (NMFS) are currently evaluating areas in the Gulf of Alaska and Bering Sea/Aleutian Islands for consideration as Essential Fish Habitat. The Magnuson-Stevens Fishery Conservation and Management Act reauthorization requires this effort. Essential Fish Habitat includes all life history stages of each managed species and includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The purpose of assessing Essential Fish Habitat for species managed by these agencies is so that Councils and NMFS, when setting annual fishing quotas and regulations, will consider fish habitat concerns along with socioeconomic and other concerns. Considerable amounts of descriptive background material on what may constitute

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Essential Fish Habitat for various species of shellfish and finfish harvested in marine waters of Alaska's state waters and Exclusive Economic Zone is provided in North Pacific Fisheries Management Council documents (North Pacific Fisheries Management Council, 1998—Draft EA for Amendments to the Fishery Management Plan; Essential Fish Habitat Assessment Report for the Gulf of Alaska, and the Bering Sea and Aleutian Islands Regions).

The State of Alaska manages all fisheries that occur within 5 kilometers (3 miles) of the Alaskan coast, and also several shellfish fisheries further offshore. Fisheries in Federal waters (the Exclusive Economic Zone), beyond 5 kilometers (3 miles), are managed by the Federal government. Following are descriptions of shellfish and finfish fisheries that occur in the project area.

Prince William Sound

All fisheries in Prince William Sound are under the direction of the Alaska Department of Fish and Game.

Shellfish. The only shellfish fishery open in the project east of Kodiak Island in Prince William Sound is for sidestripe shrimp (*Pandalus dispar*). It is a trawl fishery, with few vessels participating. The fishery occurs primarily in the northwest part of the Sound, with some effort west of Knight Island (Trowbridge, 1998—Personal communication).

Finfish. Finfish fisheries that may be affected by the proposed project include herring, salmon, and groundfish. Herring are fished commercially, but only in the northeast part of the sound, well away from the project area. Five species of salmon are harvested in the sound by gill net or purse seine. These fisheries are conducted in inshore coastal areas. These fisheries occur from May through August.

A limited pollock (*Theragra chalcogramma*) fishery occurs in southwestern Prince William Sound. The harvest in this area is around 2 million kilograms (4.4 million pounds) annually. There is also a fishery in the region outside Resurrection Bay to Day Harbor. This fishery takes approximately 4 million kilograms (9 million pounds) annually (Trowbridge, 1998—Personal communication). The pollock fishery in the Sound is open only in January.

Pacific cod (*Gadus macrocephalus*) are fished with longlines and pots. Some jig fishing occurs in shallow, inshore waters. Jig gear generally does not contact the sea floor. Gear limits per vessel are 60 pots or 5 jigs (Trowbridge, 1998—Personal communication).

The first Pacific cod fishing season in state waters is January to March, concurrent with the season in Federal waters. A week later, the fishery in state waters reopens and continues through the remainder of the year.

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With gear limitations currently in effect, the catch for this fishery continues well below its potential (Trowbridge, 1998—Personal communication).

Fishing generally occurs in waters less than 110 meters (60 fathoms) deep. The primary Prince William Sound fishing area is in deep waters of the central Sound. The catch of Pacific cod from Prince William Sound is approximately 0.6 to 0.9 million kilograms (1.3 to 2.0 million pounds) (Trowbridge, 1998—Personal communication).

Sablefish (*Anoplopoma fimbria*) fisheries in Prince William Sound are under a limited entry system, and approximately 65 vessels participate. This fishery is under Individual Transferable Quota regulations, with each fisherman allowed a percentage of the allowable catch based on past history with the fishery (Trowbridge, 1998—Personal communication).

The Sound fishery opens May 1 and continues for 1 or 2 days. This derby fishery occurs in deeper waters of the Sound, including the east side of Lone Island and Knight Island Pass. The Cook Inlet fishery opens March 15 (Trowbridge, 1998—Personal communication). Very little effort is expended by commercial fishermen on rockfish in this area.

Gulf of Alaska

Shellfish. Commercial shellfish fishing in the Gulf of Alaska includes king crab (three principal spp.), Tanner crab (four spp.), Dungeness crab, and scallops. Several minor fisheries occur for other species of crab, snails, shrimp, clams, octopus, sea cucumbers, and sea urchins (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

King crab traditionally provided one of the largest and richest fisheries in Alaska. Red king crab in most areas of Alaska are at low population levels, and no fishing occurs at present. Brown, or golden, king crab were historically harvested from the Kodiak Island area. The fishery for this species is presently limited, and there are no commercial openings in the Gulf of Alaska.

King crabs are fished using heavy mesh-covered pots attached to surface buoys. Red and blue king crab fisheries use 4-square-meter (43-square-foot) pots fished from single lines. Brown and scarlet king crab are harvested by smaller pots set on longlines (North Pacific Fisheries Management Council, 1998—Essential Fish Habitat Assessment Report for the Bering Sea and Aleutian Islands King and Tanner Crabs).

There is a limited Tanner crab fishery in the Gulf of Alaska west of Kodiak Island. Tanner crabs were historically abundant in state waters, but harvests are limited at present, with most of the state closed due to low stocks. Tanner crabs are harvested with 4-square-meter (43-square-

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foot) mesh-covered pots fished with single lines attached to surface buoys. (Alaska Department of Fish and Game, 1998—Commercial Shellfish Fishing Regulations, 1998–1999)

Dungeness crab are fished in shallow waters. Around Kodiak District and the Alaska Peninsula the season runs from May or June until January. The harvest in 1996 was 349,266 kilograms (770,000 pounds). The principal gear type used is the Dungeness pot. They are fished as individual buoyed pots. (Alaska Department of Fish and Game, 1998—Commercial Shellfish Fishing Regulations, 1998–1999)

The Alaskan fisheries for weathervane scallops primarily occur in waters 73 to 110 meters (40 to 60 fathoms) in depth (Alaska Department of Fish and Game, 1998) on the Continental Shelf. Most vessels are specialized for pulling dredges across the sea floor. Weathervane scallops are fished around Kodiak Island and along the Alaska Peninsula (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

A very small fishery occurred for pink scallops in the Dutch Harbor in 1991 and 1992. These catch data are confidential (North Pacific Fisheries Management Council, 1997—Stock Assessment and Fishery Evaluation Report for the Scallop Fisheries off Alaska).

A variety of other species are harvested to a limited extent under commercial shellfish regulations established by the state. Shrimp fishing in Kodiak Island bays is conducted for spot shrimp using pots, but landings are very small. (Alaska Department of Fish and Game, 1998— Annual Management Report for the Shellfish Fisheries of the Westward Region)

Sea cucumbers (*Parastichopus californicus*) and sea urchins, primarily the green urchin, *Strongylocentrotus droebachiensis*, are harvested in small numbers by divers or with rakes from shallow waters around Kodiak Island.

Octopus (*Octopus dofleini*) is harvested incidental to Pacific cod trawl and pot fisheries in the Kodiak and Alaska Peninsula Districts. Octopus is utilized for bait and a food product (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

Two species of squid are harvested around the Aleutian Islands, *Berryteuthis magister* and *Onychoteuthis borealijanpoicus*. Squid are taken as bycatch in other trawl fisheries, primarily the pollock fishery (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Islands).

Other fisheries in the study area have included snails (*Neptunea* sp.), razor clams (*Siliqua* sp.), and the crab *Paralomis multispina*. Of these, only snails are harvested at present. Pots are the fishing gear permitted

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for harvesting snails (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

Finfish. Pacific herring are harvested by purse seine and gill net from coastal waters in portions of the study area. Herring fisheries occur around Kodiak Island and the Alaska Peninsula. These fisheries occur in April and early May.

Five species of salmon are harvested in this region from May through August by gill net or purse seine. These fisheries are conducted in inshore coastal areas.

Groundfish include all species of cod, pollock, flatfish, rockfish, and other species harvested by trawl, pot, or jig. No on-bottom trawl gear is permitted in state waters of the Gulf of Alaska. Fishing is by pelagic trawls, pot gear, or jigs (Trowbridge, 1998—Personal communication). In Federal waters bottom trawls are used extensively.

Walleye pollock are the most abundant species of groundfish targeted in the commercial fisheries of the North Pacific Ocean. Fisheries for pollock occur throughout the Gulf of Alaska and the Aleutian Islands.

Pollock occur along the outer Continental Shelf and Slope during winter. They migrate into shallower waters and aggregate for spawning in late winter and spring. Vessels fishing for pollock mostly use bottom trawls that fish on or near the bottom. A limited quantity of pollock is landed from longline gear. In the Gulf of Alaska about 100 trawl vessels participate in the pollock fishery, while in the Aleutian Islands and Bering Sea area about 160 vessels participate (Kinoshita et al. 1997—Economic Status of the Groundfish Fisheries off Alaska).

Harvest from state waters has increased in recent years to over 30 percent of the combined state/Federal quota (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K96-50). Approximately 14 million kilograms (31 million pounds) of pollock were harvested from the state waters in the Gulf of Alaska in 1995 (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K96-50).

In the Gulf of Alaska, the 1997 pollock season opened on January 20 and closed between late January and early March, depending on the area. Short openings also occurred in June and September in specific areas (DiCosimo, 1998—Groundfish of the Gulf of Alaska).

The state cod fishery in 1997 occurred in three areas: around Kodiak, the Chignik Area, and the south side of the Alaska Peninsula area. The Kodiak fishery opened April 4 with closures as quota allocated to various gear types were reached; 3.4 million kilograms (7.5 million pounds) were

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harvested by pot and jig gear. In the Chignik Area, the fishery opened April 15, and limited interest by pot and jig vessels resulted in a total harvest of 0.5 million kilograms (1.1 million pounds). The south Alaska Peninsula fishery opened April 4 with both pot and jig vessels participating and was closed December 22; harvest was nearly 4.3 million kilograms (9.4 million pounds) (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K98-2).

Pacific cod are harvested offshore in the Gulf of Alaska and Aleutian Islands by longline, trawl, pot, and jig gear. Cod fishing in the Gulf of Alaska occurs in the central and western gulf (North Pacific Fishery Management Council, 1998—Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Gulf of Alaska). Cod are fished from January to March. Additional openings occur in late summer and fall, depending on area (DiCosimo, 1998—Groundfish of the Gulf of Alaska). Fishing vessels participating in the offshore Pacific cod fishery in the Gulf include approximately 125 trawl vessels, 350 longline vessels, and 150 pot vessels (Kinoshita et al., 1997—Economic Status of the Groundfish Fisheries off Alaska).

Rockfish fisheries are generally managed by species groups that have similar values, abundance, or habitat use patterns. Some species are pelagic and live in the water column, while others are demersal and inhabit the benthic zone. Among the demersal assemblages, some are shallow water species, others inhabit deeper waters.

Several species of rockfish are harvested in state waters. They are grouped according to their habitat preferences. The most abundant species harvested in state waters is the black rockfish (*Sebastes melanops*), which is part of the assemblage of midwater schooling fishes. This fishery started in the early 1990s with small vessels fishing with jig gear. Effort has increased and expanded from a few areas around Kodiak to a larger area westward along the Alaska Peninsula (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K96-50). The season for pelagic shelf rockfish in state waters is open year round.

Pacific ocean perch (*Sebastes aleutus*) and related demersal species inhabit the outer Continental Shelf and Slope. They are long-lived species that may live up to 90 years (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Islands Area). The fishery is conducted by trawling vessels.

The offshore pelagic shelf rockfish complex is managed as a group in the Gulf of Alaska, and consists of species that typically are midwater. The Dusky rockfish (*Sebastes ciliatus*) is the predominant species in the complex (DiCosimo, 1998—Groundfish of the Gulf of Alaska). The

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fishery is conducted by both shore-based trawlers and larger catcher-processors.

The thornyhead rockfish assemblage includes the shortspine (*Sebastolobus alaskanus*) and longspine (*S. altivalis*) rockfish. These species inhabit deep waters along the Continental Shelf edge and slope; shortspine thornyheads are the most abundant (DiCosimo, 1998—Groundfish of the Gulf of Alaska). They are taken primarily as bycatch in bottom trawl and longline fisheries for other species. A large exploitable biomass is available, but little is harvested.

There is a complex of other species managed as an assemblage that includes at least 30 species of *Sebastes* (DiCosimo, 1998—Groundfish of the Gulf of Alaska). Little is known about the biology of this group. A fairly small percentage of the available harvestable biomass is taken each year. In the Bering Sea/Aleutian Islands, this group includes *Sebastolobus* and *Sebastes* rockfish not included with the Pacific ocean perch complex.

The Pacific halibut (*Hippoglossus stenolepis*) is a large flatfish harvested on the Continental Shelf throughout the North Pacific Ocean, primarily in the Gulf of Alaska (International Pacific Halibut Commission, 1987—The Pacific Halibut: Biology, Fishery, and Management). This species is managed internationally by the International Pacific Halibut Commission and the North Pacific Fisheries Management Council. The largest fisheries occur in Alaskan waters of the Gulf of Alaska, with smaller fisheries in the Bering Sea and offshore from British Columbia and Washington/Oregon. Halibut are harvested by longline gear only, and the fishery is conducted as an Individual Transferable Quota fishery in Alaska. The season is from March 15 through November 15 in Alaska.

The halibut commercial harvest throughout its range was 21.5 million kilograms (47.3 million pounds) in 1996 (International Pacific Halibut Commission, 1997—Annual Report, 1996) and 29 million kilograms (63.9 million pounds) in 1997 (Gilroy, 1998—Personal communication). Preliminary catch data for the 1998 fishery indicate a commercial catch of 30.5 million kilograms (67.3 million pounds), with the majority of the catch from the central Gulf of Alaska (Gilroy, 1998—Personal communication).

Flatfish, with the exception of halibut, are managed as groups of species according to abundance levels, value, and habitat use patterns. They are harvested by trawl. In state waters, shallow water flatfish harvested include sole, flounder, and plaice. Harvest of shallow water flatfish in 1995 was approximately 0.8 million kilograms (1.7 million pounds) from the Central Gulf of Alaska, and 5,443 kilograms (12,000 pounds) from the western gulf. (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K96-50)

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Flatfish harvested offshore in the Gulf of Alaska include several species of flounder, sole, sand dabs, plaice, and turbot. A large biomass of these species exists, but most are exploited at a low level.

Sablefish, or black cod (*Anoplopoma fimbria*), are managed as a directed fishery in the Gulf of Alaska. They are long lived, and occur along the outer Continental Shelf and Slope in waters deeper than 900 meters (3,000 feet). They are harvested primarily by longline, and are under an Individual Transferable Quota program in all Federal waters. Some are harvested as trawl bycatch or by pot gear. The fishery occurs from March 15 to November 15, concurrent with the halibut Individual Fisheries Quota fishery. Qualified individual fishermen are allocated a percentage of the annual allowable harvest level and can fish for sablefish until their individual quota is caught.

Atka mackerel (*Pleurogrammus monopterygius*) is a schooling, semi-demersal species found primarily around the Aleutian Islands. The fishery is conducted primarily by larger factory trawlers (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Islands Area). Due to low stock abundance in the Gulf of Alaska, Atka mackerel was a bycatch only fishery in 1997 (DiCosimo, 1998—Groundfish of the Gulf of Alaska).

Bering Sea

Shellfish. Shellfish in the Bering Sea include king crab (three principal spp.), Tanner crab (four spp.), Dungeness crab (*Cancer magister*) and scallops. Several minor fisheries occur for other species of crab, snails, shrimp, clams, octopus, sea cucumbers, and sea urchins (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

King crab fisheries are discussed above under the Gulf of Alaska. Brown king crab, also called golden king crab, was historically harvested from the Kodiak Island area. The fishery for this species is presently limited to the Aleutian Islands, with 2.6 million kilograms (5.8 million pounds) harvested in 1996. The fishery occurs in fall and winter. Scarlet king crab is found in the Bering Sea and around the Aleutian Islands. Little is known of this species, and limited fisheries occur under special permit from the state.

Several species of Tanner crab are harvested in the Bering Sea. Tanner crabs were historically abundant, but harvests are limited at present, with most of the state closed due to low stocks. Snow crabs (*Chionoecetes opilio*), are harvested primarily in the Bering Sea. The 1997 fishery occurred from January to March, with 227 vessels taking approximately 53 million kilograms (117 million pounds) of crab. Limited fisheries also occur in the Bering Sea for the grooved and triangle Tanner crab (*Chionoecetes tanneri* and *C. angulatus*). Fisheries for these two species

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are by special permit only, and in 1997 no vessels registered to participate. (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region)

Tanner and snow crabs are harvested with 2-square-meter (7- or 8-square-foot) mesh-covered pots fished with single lines attached to surface buoys. Grooved and triangular Tanner crabs are harvested with smaller pots attached to longlines (Alaska Department of Fish and Game, 1998—Commercial Shellfish Fishing Regulation, 1998–1999).

Dungeness crabs are fished in shallow waters. In the Aleutian Islands and Bering Sea, Dungeness crabs are harvested in very limited numbers (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region). The principal gear type used is the Dungeness pot. They are fished as individual buoyed pots. (Alaska Department of Fish and Game, 1998—Commercial Shellfish Fishing Regulation, 1998–1999).

The Bering Sea fishery for scallops primarily occurs in waters 73 to 110 meters (40 to 60 fathoms) in depth over the Continental Shelf (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region). Most vessels are specialized for pulling dredges across the sea floor. The primary target is the weathervane scallop (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region). A very small fishery occurred for pink scallops near Adak in 1991 and 1992. These catch data are confidential (North Pacific Fisheries Management Council, 1997—Stock Assessment and Fishery Evaluation Report for the Scallop Fisheries off Alaska).

A variety of other species are harvested to a limited extent under commercial shellfish regulations established by the state. Two vessels registered to fish for shrimp using pots in the Aleutian Islands Area in 1997, but no harvests were reported (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

Sea urchins, primarily the green urchin *Strongylocentrotus droebachiensis*, are harvested by divers and rakes from shallow waters around Unalaska Bay.

Other fisheries in the study area have included snails (*Neptunea* sp.), razor clams (*Siliqua* sp.), and the crab *Paralomis multispina*. Of these, only snails are harvested at present. Pots are the fishing gear permitted for harvesting snails (Alaska Department of Fish and Game, 1998—Annual Management Report for the Shellfish Fisheries of the Westward Region).

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Finfish. Pacific herring are harvested by purse seine and gill net from coastal waters in portions of the study area. This fishery is by seine, with a few boats participating. In the western part of the project area, herring fisheries occur around the Alaska Peninsula. They occur in April and early May.

Five species of salmon are harvested in the Bering Sea by gill net or purse seine. These fisheries are conducted in inshore coastal areas. These fisheries occur from May through August.

Groundfish include Pacific cod, walleye pollock, rockfish, flatfish, sablefish, and Atka mackerel. Walleye pollock are the most abundant species of groundfish targeted in the commercial fisheries of the North Pacific Ocean. Fisheries for pollock occur throughout the Gulf of Alaska, the Aleutian Islands, and the eastern Bering Sea. The pollock trawl fishery in the Bering Sea (1.2 to 1.4 million metric tons [1.3 to 1.5 million tons] annual catch) is one of the largest finfish fisheries in the world.

Pollock in the study area occur along the outer Continental Shelf and Slope during winter. They migrate into shallower waters and aggregate for spawning in late winter and spring months. Vessels fishing for pollock mostly use bottom trawls that fish on or near the bottom. A limited quantity of pollock is landed from longline gear. In the Bering Sea/Aleutian Islands area, approximately 160 trawl vessels participate in the pollock fishery (Kinoshita et al., 1997—Economic Status of the Groundfish Fisheries off Alaska).

The pollock fishery in the Bering Sea/Aleutian Islands occurs in two seasons. An early season targets roe pollock north of the Aleutian Islands from Unimak Island to the Pribilof Islands. A later season targets non-roe pollock north and west of the Pribilof Islands. Fishing occurs during the months of mid January to early March for the early season. The later season runs from mid August through late September (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Island Area).

Pacific cod, or gray cod (*Gadus macrocephalus*), are harvested in the Bering Sea/Aleutian Islands by longline, trawl, pot, and jig gear. The season in the Bering Sea/Aleutian Islands is March through April for trawling, January through early May for hook and line, and March through October for jigging and pots. Most trawling and pot fishing grounds are located north and west of Unimak Island. Longline fishing areas are further offshore along the Continental Slope north and west of the Pribilof Islands (DiCosimo, 1998—Groundfish of the Gulf of Alaska). In the Bering Sea/Aleutians, 150 trawl vessels, 90 longline vessels, and 100 pot vessels fish for Pacific cod (Kinoshita et al., 1997—Economic Status of the Groundfish Fisheries off Alaska).

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The Pacific halibut is a large flatfish harvested on the Continental Shelf throughout the North Pacific Ocean, primarily in the Gulf of Alaska (International Pacific Halibut Commission, 1987—The Pacific Halibut Biology, Fishery and Management). The largest fisheries occur in Alaskan waters of the Gulf of Alaska, with a smaller fishery in the Bering Sea. Halibut are harvested by longline gear only, and the fishery is conducted as an Individual Transferable Quota fishery in Alaska. The season is from March 15 through November 15 in Alaska.

Other species of flatfish harvested in the Bering Sea include several species of flounder, sole, sand dabs, plaice, and turbot. A large biomass of these species exists, but most are exploited at a low level.

Sablefish are a deeper water species harvested primarily by longline. They are long lived, and occur along the outer Continental Shelf and Slope in waters deeper than 900 meters (3,000 feet). They are managed as a directed fishery in the Bering Sea/Aleutian Islands areas. They are harvested under an Individual Transferable Quota program in all Federal waters. The rest are harvested as trawl bycatch or by pot gear. The state fishery is very limited, due to the limited deep water near shore. A harvest quota for the fishery around the Aleutian Islands is established annually. The 1996 season ran from March 15 to July 26 when the quota of 122,470 kilograms (270,000 pounds) was attained (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K96-50).

Rockfish fisheries are generally managed by species groups that have similar values, abundance, or habitat use patterns. Some species are pelagic and live in the water column, while others are demersal and inhabit the benthic zone. Among the demersal assemblages, some are shallow water species, others inhabit deeper waters.

Several species of rockfish are harvested in state waters. They are grouped according to their habitat preferences. The most abundant species harvested in state waters is the black rockfish (*Sebastes melanops*), which is part of the assemblage of midwater schooling fishes. This fishery started in the early 1990s with small vessels fishing with jig gear. Effort has increased and expanded from a few areas around Kodiak to a larger area westward along the Alaska Peninsula (Jackson and Urban, 1998—Westward Region Report on 1997 State Managed Pacific Cod Fishery, No. 4K96-50). The season for pelagic shelf rockfish in state waters is open year round.

Pacific ocean perch and related demersal species inhabit the outer Continental Shelf and Slope. They are long-lived species that may live up to 90 years (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Islands Area). The fishery is conducted by trawling vessels.

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There is a complex of other species managed as an assemblage that includes at least 30 species of *Sebastes* (DiCosimo, 1998—Groundfish of the Gulf of Alaska). Little is known about the biology of this group. A fairly small percentage of the available harvestable biomass is taken each year. In the Bering Sea/Aleutian Islands, this group includes *Sebastolobus* and *Sebastes* rockfish not included with the Pacific ocean perch complex.

The Atka mackerel fisheries occur in both the Gulf of Alaska and the Bering Sea/Aleutian Islands management areas. The fishery is conducted primarily by larger factory trawlers (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Islands Area). Due to low stock abundance in the Gulf of Alaska, Atka mackerel was a bycatch only fishery in 1997 (DiCosimo, 1998—Groundfish of the Gulf of Alaska).

The other species category in the Bering Sea/Aleutian Islands management area includes species that have minimal economic value such as skates, sculpins, smelts, sharks, and octopus. These fishes are taken as bycatch in other fisheries. Most are discarded, although some skate are marketed and some species are processed into fishmeal (Witherell, 1996—Groundfish of the Bering Sea and Aleutian Island Area).

3.4.1.6.4 Terrestrial Habitats

The description of affected environments for terrestrial biota differ slightly from the marine species. Divisions for the terrestrial habitats are made into regions as closely aligned with the oceanic masses they contact. Whittier and Seward are grouped together as similar habitats. Kodiak Island and the Alaska Peninsula front the Gulf of Alaska, and the Aleutian Chain divides the Bering Sea from the Gulf of Alaska.

Prince William Sound/Seward

Vegetation. The onshore sites at Whittier and Seward are both highly modified by human activities and contain little vegetation.

Anadromous Fishes. Anadromous fish species known to migrate in streams near Whittier and Seward include six species of Pacific salmon: king (*Oncorhynchus tschawytscha*), silver (O*. kisutch*), chum (*O. keta*), red (*O. nerka*), pink (*O. gorbuscha*), and steelhead (*O. mykiss*) (previously rainbow trout). Whittier Creek, a pink salmon migration waterway, discharges into Passage Canal next to the boat harbor. Additionally, the Alaska Department of Fish and Game has been releasing silver salmon smolts into Whittier Creek since 1978.

The area surrounding Seward contains a vast number of waterways important for anadromous fish, including Salmon Creek, Resurrection River, and numerous unnamed creeks and streams. Over a dozen of these streams and creeks discharge into Resurrection Bay within 3.2

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kilometers (2 miles) of Seward. These streams provide salmon spawning, rearing, and migration habitat for all six species.

Terrestrial Wildlife. The areas surrounding Whittier and Seward are among the richest in Alaska for abundance and variety of wildlife. Terrestrial mammals found in the Seward area include black bear, brown/grizzly bear (*Ursus arctos horribilis*), moose, Dall sheep (*Ovis dalli*), mountain goat (*Oreamnos americanus*), Sitka black-tailed deer (*Odocoileus hemionus*), wolf, coyote, lynx, red fox, marten, wolverine, mink, weasel (*Mustela erminea* and *M. rixosa*), marmot (*Marmota caligata*), porcupine, beaver, land otter (*Lutra canadensis*), muskrat, snowshoe hare (*Lepus americanus*), red squirrel, ground squirrel (*Spermophilus parryii*), mice and voles (*Microtus spp.*), pika (*Ochotona collaris*), and lemmings (*Lemmus sibiricus*) (Alaska Department of Fish and Game, 1989—Wildlife Note Book Series; Jarrell and MacDonald, 1989—Checklist of the Mammals of Alaska; Exxon Valdez Oil Spill Council, 1994—Final EIS—Proposed IMS Infrastructure Improvements Project). However, few of these species live in the specific area of the proposed project, due to its urban setting.

Whittier is in a major migratory flyway for ducks traveling between Cook Inlet and Prince William Sound (City of Whittier, 1989—Whittier Coastal Management Plan). Twelve common species of ducks, one goose species, and two swan species are found in the Whittier/Portage Pass area (U.S. Fish and Wildlife Service, 1977—Portage Flats Environmental Analysis Report). The coves and bays of Passage Canal are an important area for migration, nesting, rearing, and wintering for sea ducks (Alaska Department of Transportation and Public Facilities, 1995—Whittier Access Project Revised Draft EIS; City of Whittier, 1989—Whittier Coastal Management Plan). Ptarmigan, grouse, bald eagles, swans, songbirds, and possibly peregrine falcons are also found in the area (U.S. Fish and Wildlife Service, 1977—Portage Flats Environmental Analysis Report).

Seward provides wintering habitat for birds and waterfowl including ducks, scoters, and mergansers. The Steller’s eider winters in small numbers in Resurrection Bay. Bald eagles are the most abundant raptor species present in Seward. As many as 70 eagles winter in the vicinity, although only a few actually nest there (Exxon Valdez Oil Spill Trustee Council, 1994—Final EIS, Proposed IMS Infrastructure Improvement Project).

Kodiak Island

Vegetation. The onshore area of the proposed landing site at Monashka Bay is a wet low elevation area that may be classified as a wetland.

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Anadromous Fishes. The three nearest creeks on Kodiak Island containing anadromous fish are several miles away from the landing site, and would not be affected by the project.

Terrestrial Wildlife. Six species of land mammals occur naturally on Kodiak Island. They include one large mammal, the brown/grizzly bear, three furbearers, and two small mammals. These species are common throughout Kodiak Island in suitable habitats. Several large terrestrial mammal species, such as cattle, elk, and deer have been introduced to Kodiak Island, but few if any would be encountered by project activities (U.S. Fish and Wildlife Service, 1985—Kodiak National Wildlife Refuge, Draft Comprehensive Conservation Plan).

The approximately 1,287 kilometers (800 miles) of coastline, plus a variety of interior areas, provide abundant habitat for a large variety of birds on Kodiak. Over 80 species of birds nest on Kodiak Island, and it is a wintering area for over 1.5 million pelagic seabirds and sea ducks (U.S. Fish and Wildlife Service, 1985—Kodiak National Wildlife Refuge, Draft Comprehensive Conservation Plan). Shorebird species nesting on Kodiak include plovers, yellowlegs, sandpipers, dowitchers, and phalaropes. (U.S. Fish and Wildlife Service, 1985—Kodiak National Wildlife Refuge, Draft Comprehensive Conservation Plan).

Thirteen raptor species occur on Kodiak Island. The bald eagle is the most abundant, with fewer numbers of hawks and owls (U.S. Fish and Wildlife Service, 1985—Kodiak National Wildlife Refuge, Draft Comprehensive Conservation Plan).

Forty-three songbirds have been identified on Kodiak Island. They include ravens, magpies, crows, and many smaller species (U.S. Fish and Wildlife Service, 1985—Kodiak National Wildlife Refuge, Draft Comprehensive Conservation Plan).

Aleutian Islands

Vegetation. The vegetation of the Aleutian Islands is classed as a terrestrial-maritime tundra ecosystem (U.S. Fish and Wildlife Service; 1994—EA for the Removal of Introduced Caribou from Adak Island, Alaska). The vegetation in the Aleutians is characterized as heath, dominated by *Empetrum nigrum*. The chain is essentially treeless except for a few introduced spruce trees.

Three vegetative zones were described for Umnak Island during an intensive forage survey conducted by the Alaska Agricultural Experiment Station and Extension Service (1956). The Seashore and Low Plateau Zone varies in width from a few feet of shore to several miles wide. Sedge marshes frequently occur behind the shoreline, with grass extending inland. The Low Hills and Upland Plateau Zone mainly consists

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of grass prairie and pumice rock ridges. The final zone described is the Alpine Zone of Ridges and Upland Meadows. The proposed terrestrial cable route and landing sites are primarily in the Seashore and Low Plateau Zone, and the Low Hills and Upland Plateau Zone. Lowland tundra, which is generally a "wet meadow" with sedges, lichens, grass, and subshrubs, would be crossed in both of these zones (Batten and Murray, 1982—A Literature Survey of the Wetland Vegetation of Alaska).

Anadromous Fishes. Anadromous fish species known to spawn in streams of the Aleutians include red, pink, and silver salmon, and Dolly Varden char (Alaska Department of Fish and Game, 1985—Alaska Habitat Management Guide, Southwest Region; 1996—An Atlas to the Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes).

Red, pink, and silver salmon use the streams of Adak for reproduction. There are several red and pink salmon streams scattered around the island. Silver salmon are found in NavFac Creek (west of Zeto Point) and have been reported to occur in several additional streams. (Alaska Department of Fish and Game, 1985—Alaska Habitat Management Guide, Southwest Region)

On Umnak Island, small numbers of red salmon were located in Nikolski Bay and Sandy Beach. Most of the pink salmon streams were located in the southern half of the island. Silver salmon were found in streams of Nikolski Bay, Sandy Beach, and other streams. (Alaska Department of Fish and Game, 1985—Alaska Habitat Management Guide, Southwest Region)

A large commercial red salmon run occurs at Kashega Lakes on Unalaska Island. Numerous pink salmon streams are found on Unalaska. The major runs of the island are in Unalaska Bay, which is the only area that produces many pink salmon during odd-numbered years. A few chum and silver salmon were observed in a variety of locations on Unalaska Island. (Alaska Department of Fish and Game, 1985—Alaska Habitat Management Guide, Southwest Region)

Terrestrial Wildlife. Almost all terrestrial mammals of the Aleutian Chain, west of Unimak Island, have been introduced by man. Only the fox is thought to be indigenous, and then only to the Fox Islands (easternmost group of the Aleutians) (U.S. Bureau of Sport Fisheries and Wildlife, 1974—Draft Environmental Statement, Proposed Aleutian Islands Wilderness).

The USFWS conducted a survey in August 1993 of the caribou introduced to Adak in the late 1950s and found the population to be between 650 and 700.

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Farmers introduced domestic cattle to seven of the Aleutian Islands, beginning in the 1890s. However, herds of feral cattle presently roam freely on only four islands, including Umnak and Unalaska (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan). Sheep were introduced to Umnak and Unalaska Islands. Ranches have been reported to carry over 12,000 sheep at various times; however numbers are much lower now (Soil Conservation Service, 1978—Soils and Range Sites of the Umnak-Unalaska Area; University of Alaska, 1956—Forage Plants, Soils, and General Grazing Conditions on Umnak, Kodiak and Other Areas in Southern Alaska).

Foxes are considered an introduced species in most of the Aleutian Islands. However, red foxes are native to the Fox Island Group of the Aleutians (easternmost group including Umnak and Unalaska) (U.S. Bureau of Sport Fisheries and Wildlife, 1973—Preliminary Draft Aleutian Islands National Wildlife Refuge Wilderness Study Report). Damage to native bird populations has prompted a plan for fox management to allow native bird species to return and/or recover. (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan)

Several introduced species of small mammals are found on islands in the chain. Fox farmers introduced several of these to islands where there were no rodents to increase the available food supply for the fox (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan; U.S. Bureau of Sport Fisheries and Wildlife, 1974—Draft Environmental Statement, Proposed Aleutian Islands Wilderness). The others were accidental introductions.

Many groups of birds are found on the Aleutian Islands, but in contrast with seabirds, only a few species breed on the islands. However, during the fall and spring migration, the Aleutians host an extraordinary diversity of birds from both America and Asia, due to their proximity to both continents. (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan)

The lowland lakes, streams, and adjacent marine waters of the Aleutians support up to 250,000 nesting and feeding waterfowl. The Aleutians also represent the major breeding grounds of the threatened Aleutian Canada goose. Steller's eiders and ducks are common year-round residents. Harlequin ducks are found throughout the year in the Aleutians, but are most common in winter and spring. They are not known to breed on the Aleutian Chain. (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan)

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Wintering waterfowl populations in the Aleutians include several species of sea ducks (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan). Many goose species are generally distributed in wet lowland areas throughout the Alaska Peninsula and Aleutian Chain. Nearly the entire world population of emperor geese winter along Aleutian shorelines from December to April (U.S. Bureau of Sport Fisheries and Wildlife, 1974—Draft Environmental Statement, Proposed Aleutian Islands Wilderness; U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan). Loons and grebes occur throughout the Aleutians. Sandhill cranes are migratory visitors. (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan)

Each spring, thousands of migrating shorebirds from Asia and the western hemisphere frequent the Aleutian Islands. Beach and mudflat habitats for migrating shorebirds are widely scattered, offering many small pieces of habitat, which host an unusually large number of species, and which are critical for a few. (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan)

Peregrine falcons are the most widely distributed raptor throughout the entire Aleutian Chain. Breeding peregrines are cliff-nesters that typically feed on medium-sized seabirds (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan). Bald eagles are the next most widespread raptor. Eagles nest on bushes or on the ground in the Aleutians from Buldir Island east, with high numbers nesting on Adak and Umnak (U.S. Bureau of Sport Fisheries and Wildlife, 1974—Draft Environmental Statement, Proposed Aleutian Islands Wilderness; U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan, 1994—EA for the Removal of Introduced Caribou from Adak Island, Alaska). Other raptors nesting in the Aleutians include several species of eagles, falcons, hawks, and owls (U.S. Bureau of Sport Fisheries and Wildlife, 1974—Draft Environmental Statement, Proposed Aleutian Islands Wilderness; U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan).

The most common terrestrial bird that nests throughout the Aleutian Chain is the Lapland longspur. Buntings, sparrows, finches, wrens, and ravens are also common (U.S. Bureau of Sport Fisheries and Wildlife, 1974—Draft Environmental Statement, Proposed Aleutian Islands Wilderness).

Shemya Island's Significance for Migrating Birds. Shemya Island and the other Near Islands in the Western Aleutians support a diversity of birds not seen on the other Aleutian Islands further to the east. The Western Aleutians appear especially important for migrating songbirds, which

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require landfall during storms, and even in calm weather. At Shemya, protected bays on the north shore, along with dense tall grassy meadows, provide refuge for the migrants, especially during intense storms.

3.4.1.6.5 Marine Mammals

The Federal Marine Mammal Protection Act of 1972 protects all marine mammals in U.S. waters, and some marine mammals are listed under the U.S. Endangered Species Act of 1973. Table 3.4-2 lists the marine mammals that might be encountered near the Aleutian Islands and in the western Gulf of Alaska. Whales migrate into the Gulf of Alaska, Prince William Sound, and the Bering Sea to feed during the summer. Most of the whales, however, are commonly found offshore along the Continental Shelf in areas of high marine productivity. Most of the pinniped species and sea otters are found from Prince William Sound through the Aleutian Islands.

Table 3.4-2: Marine Mammals Potentially Occurring in the Project Area

Scientific Name	Species	Status
Balaena glacialis	Northern Right Whale	Endangered
Balaenoptera acutorostrata	Minke Whale	Not Listed
Balaenoptera borealis	Sei Whale	Endangered
Balaenoptera musculus	Blue Whale	Endangered
Balaenoptera physalus	Fin Whale	Endangered
Berardius bairdii	Baird's Beaked Whale	Not Listed
Callorhinus ursinus	Northern Fur Seal	Depleted
Delphinapterus leucas	Beluga Whale	Not Listed
Enhydra lutris	Sea Otter	Not Listed
Eschrichtius robustus	Gray Whale	Not Listed
Eumetopias jubatas	Steller Sea Lion	Endangered
Lagenorhynchus obliquidens	Pacific White-Sided Dolphin	Not Listed
Megaptera novaeangliae	Humpback Whale	Endangered
Mesoplodon stejnegeri	Stejneger's Beaked Whale	Not Listed
Odobenus rosmarus	Walrus	Not Listed
Orcinus orca	Killer Whale	Not Listed
Phoca vitulina richardii	Harbor Seal	Not Listed
Phocoena phocoena	Harbor Porpoise	Not Listed
Phocoenoides dalli	Dall's Porpoise	Not Listed
Physeter macrocephalus	Sperm Whale	Endangered
Ziphius cavirostrius	Cuvier's Beaked Whale	Not Listed

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Affected Species. Any of the marine mammals listed in table 3.4-2 might be encountered along the route of the project. The most likely marine mammal species to be encountered are the Steller sea lions, beluga whales, northern fur seals, sea otters, and harbor seals. Steller sea lions are common throughout the waters surrounding the Aleutian Islands, and they are also found in the Gulf of Alaska.

The sensitivity of Steller sea lions to human presence on or near rookeries and haulouts is variable. Adult sea lions seem to be less disturbed by human presence at rookeries during the breeding season (June), and are generally more sensitive to human presence after the breeding season (Johnson, et al., 1989—Synthesis of Information on the Effects of Noise). Typically during a significant disturbance event, non-breeding or sub-adult animals will leave the rookery or haulout first, followed by adults and females with pups.

Steller sea lion haulouts in British Columbia are located adjacent to high traffic shipping lanes. Steller sea lions are often seen around and follow vessels actively engaged in fishing or fish processing (Johnson, et al., 1989—Synthesis of Information on the Effects of Noise). They also "raft" in the major shipping lanes near British Columbia. There is no trend in the estimated abundance of Steller sea lions at rookeries and major haulouts in British Columbia (National Marine Fisheries Service, 1992—Recovery Plan for the Steller Sea Lion).

Beluga whales are found in Cook Inlet during the summer and are distributed throughout Prince William Sound and the Gulf of Alaska during the winter. Northern fur seals migrate through and forage in the waters around the Aleutian Islands and in the Gulf of Alaska. Sea otters and harbor seals inhabit the nearshore waters of the Gulf of Alaska, the Alaska Peninsula, and the Aleutian Islands; they are likely to be encountered in the nearshore areas where the fiber optic cable line makes landfall.

The marine domains of the northern Gulf of Alaska, the Bering Sea, and Prince William Sound could be impacted. Domains are defined as large marine ecosystems: they are units of the marine environment based on distinct hydrographic boundaries, bottom topography, and trophic dependencies of interacting populations.

Prince William Sound

Presently, there are no active Steller sea lion rookeries or major haulouts within Prince William Sound (National Marine Fisheries Service, 1992—Recovery Plan for the Steller Sea Lion). Steller sea lions, however, are frequently seen. During the winter, beluga whales are found within Prince William Sound, although their winter migratory pattern is largely unknown (Hill, et al., 1997—Alaska Marine Mammal Stock Assessment). Northern fur seals are unlikely to be found. The sea otter population in

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Prince William Sound was estimated to be approximately 14,352 animals in 1994 (U.S. Fish and Wildlife Service, 1998—Sea Otter Program). Fin, minke, and humpback whales are regular summer migrants (Wynne, 1992—Guide to Marine Mammals of Alaska). Killer whales and Dall's and harbor porpoises inhabit Prince William Sound year round.

Gulf of Alaska

Steller sea lion rookeries are located on the following islands in the region of proposed activity in the Gulf of Alaska: Outer, Sugarloaf, Marmot, Chirikof, Chowiet, Atkins, Chernabura, Pinnacle Rock, Clubbing Rocks, Ugamak, and Ogchul (National Marine Fisheries Service, 1992—Recovery Plan for the Steller Sea Lion). Beluga whales are found during the winter in the northern Gulf of Alaska; their winter distribution, however, is largely unknown (Hill, et al., 1997—Alaska Marine Mammal Stock Assessment). In the spring, fall, and winter, northern fur seals migrate through the Gulf of Alaska (National Marine Fisheries Service, 1993—Conservation Plan for the Northern Fur Seal). In the late 1980s and early 1990s, the number of sea otters in the Gulf of Alaska (northern Gulf of Alaska, Kodiak Island, Kenai Peninsula, south Alaska Peninsula) was estimated to be approximately 42,203 animals (U.S. Fish and Wildlife Service, 1998—Sea Otter Program). During the summer, fin, blue, sei, gray, minke, and humpback whales are found regularly in the Gulf (Wynne, 1992—Guide to Marine Mammals of Alaska). Pacific white-sided dolphins, northern right, Cuvier's beaked, Stejneger's beaked, and Baird's beaked whales are found in the Gulf of Alaska (Wynne, 1992—Guide to Marine Mammals of Alaska). Killer whales and Dall's and harbor porpoises inhabit the Gulf of Alaska year round (Wynne, 1992—Guide to Marine Mammals of Alaska).

Bering Sea

Steller sea lion rookeries are located on the following islands in the Bering Sea along the proposed fiber optic cable line route: Adugak, Seguam, Agligadak, Kasatochi, Tag, Semisopochnoi, Ayugadak, and Buldir. During the winter, beluga whales from the western Alaska coastal stocks are widely distributed in the Bering Sea; their winter distribution, however, is largely unknown (Hill, et al., 1997—Alaska Marine Mammal Stock Assessments). Northern fur seals forage primarily in the Bering Sea from June through November (National Marine Fisheries Service, 1993—Conservation Plan for the Northern Fur Seal). There is a northern fur seal rookery on Bogoslof Island (National Marine Fisheries Service, 1993—Conservation Plan for the Northern Fur Seal). Northern fur seals forage along the Continental Shelf and Slope to the north of Bogoslof Island (Robson, 1996—Personal communication). The number of sea otters in the Bering Sea–Aleutian Islands (including southern Bristol Bay) is estimated at approximately 32,194 animals (U.S. Fish and Wildlife Service, 1998—Sea Otter Program). Fin, blue, sei, gray, northern right,

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minke, humpback, Cuvier's beaked, and Stejneger's beaked whales are all found in the Bering Sea and waters around the Aleutian Islands (Wynne, 1992—Guide to Marine Mammals of Alaska; Hill, et al., 1997—Alaska Marine Mammal Stock Assessment). Baird's beaked whale is a winter migrant and the Pacific white-sided dolphin is a summer migrant in the Bering Sea and waters around the Aleutian Islands (Wynne, 1992—Guide to Marine Mammals of Alaska). Killer whales, Dall's porpoise, and harbor porpoises inhabit the Bering Sea year round (Wynne, 1992—Guide to Marine Mammals of Alaska).

3.4.1.6.6 Marine Birds

A detailed description of the cable route and construction techniques is given elsewhere in this document, but a brief summary of the route provides a context for the discussion of marine birds. The fiber optic cable line will be laid offshore on the Continental Shelf, the Continental Slope, or the Abyssal Plain along most of its route and will be buried where possible. The cable will come ashore at a limited number of sites to connect to various other existing communication facilities. The cable will originate at either Whittier or Seward. Landfalls could be made at Kodiak, Umnak Island at Nikolski, and finally on Shemya Island. The island crossing at Nikolski will be overland for approximately 10 kilometers (6 miles) from the Gulf of Alaska to the Bering Sea. The landings at Whittier or Seward and on Kodiak Island would utilize existing charted cable corridors. The landings on Umnak Island and Shemya would be new, and cable corridors would need to be surveyed.

Over 15 million marine birds of over 35 species or species groups are present at colonies in Alaskan waters during the summer breeding period (U.S. Fish and Wildlife Service, 1998—Beringian Seabird Colony Catalog). A very large proportion of these birds is present in Prince William Sound, the Gulf of Alaska, and the Aleutian Chain. An additional 10 million non-breeding marine birds of over a dozen additional species migrate from the southern hemisphere to feed in the rich waters of the Gulf of Alaska and the Bering Sea. The greatest abundance of marine birds occurs during the May through July breeding season when they aggregate at nesting colonies along the coast. Another major peak in marine bird abundance is during the spring (May through June) migration period of short-tailed and sooty shearwaters. The marine birds traverse the Gulf of Alaska (including Prince William Sound) and the Aleutians (mainly through Unimak Pass) to reach their feeding grounds in the Bering Sea. The return migration to nesting areas in the southern hemisphere occurs in the fall (August through September).

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As described above, the proposed route of the fiber optic cable line passes through Prince William Sound, the Gulf of Alaska, and the Bering Sea. The discussion of marine bird distribution and abundance along the currently proposed cable route is broken down into these three broad geographic regions. As shown in tables 3.4-3, 3.4-4, and 3.4-5, the numbers of birds associated with marine bird colonies in the Aleutians exceeds those in Prince William Sound by a factor of 100 and those in the Gulf of Alaska by a factor of 10. A very large proportion of the millions of southern hemisphere migrants heading to and from the Bering Sea aggregate in the Unimak Pass area of the Aleutian Islands during spring and fall. It is clear that the Aleutian Islands segment of the proposed cable route supports the largest number of marine birds.

Table 3.4-3: Summary of 10 Largest Marine Bird Colonies Adjacent to Proposed Fiber Optic Cable Line Route Through Prince William Sound, Alaska

Colony Name	Location	Estimated Total Number of Birds	Total Number of Species	Most Abundant Species	Total Number of Species Likely Breeding
Barwell Island	Entrance to Resurrection Bay	21,620	7	Common Murre	7
Beehive Island	Chiswell Islands Group	15,710	7	Tufted Puffin	7
Wooded Islands	E Montague Island	14,857	13	Tufted Puffin	13
Passage Canal	Near Whittier	8,228	3	Black-legged Kittiwake	2
Matushka Island	Chiswell Islands Group	5,620	14	Rhinoceros Auklet	14
Chiswell Island	Chiswell Islands Group	5,557	11	Black-legged Kittiwake	11
Blackstone Glacier	Blackstone Bay, near Whittier	4,874	3	Black-legged Kittiwake	2
North Icy Bay	Near Chenega Island	3,758	2	Black-legged Kittiwake	2
Northland Glacier	Blackstone Bay, near Whittier	3,512	2	Black-legged Kittiwake	2
Chiswell Bay	Chiswell Islands Group	2,758	8	Tufted Puffin	8

Source: U.S. Fish and Wildlife Service, 1998—Beringian Seabird Colony Catalog.

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Table 3.4-4: Summary of 10 Largest Marine Bird Colonies Adjacent to Proposed Fiber Optic Cable Line Route Through the Gulf of Alaska

Colony Name	Location	Estimated Total Number of Birds	Total Number of Species	Most Abundant Species	Total Number of Species Likely Breeding
Suklik Island	Semidi Islands	611,286	16	Horned Puffin	16
Aghiyuk Island	Semidi Islands	517,558	14	Murres	14
Amagat Island	South of Unimak Island	451,140	11	Horned Puffin	11
Chowiet Island	Semidi Islands	384,210	14	Murres	14
Castle Rock	North of Shumagin Islands	271,242	16	Tufted Puffin	15
Karpa Island	Southwest of Stepovak Bay, Alaska Pen.	247,319	8	Common Murre	8
Kateekuk Island	Semidi Islands	225,032	15	Murres	15
Aliksemit Island	Semidi Islands	206,162	15	Murres	15
Aghik Island	Semidi Islands	184,574	14	Horned Puffin	14
High Island	Sandman Reefs, South of Deer Island	135,316	12	Leach's Storm-Petrel	12

Source: U.S. Fish and Wildlife Service, 1998—Beringian Seabird Colony Catalog.

Table 3.4-5: Summary of 10 Largest Marine Bird Colonies Adjacent to Proposed Fiber Optic Cable Line Route Along the Aleutian Islands and Through the Bering Sea

Colony Name	Location	Estimated Total Number of Birds	Total Number of Species	Most Abundant Species	Total Number of Species Likely Breeding
Chagulak Island	Islands of the Four Mountains	1,695,186	18	Northern Fulmar	18
Kiska Island (Sirius Pt.)	Rat Islands	1,496,126	5	Least Auklet	5
Gareloi Island (Southeast side)	West of Tanaga Island	641,078	12	Least Auklet	4
Segula Island	Rat Islands	524,339	8	Least Auklet	8
Egg Island	East of Unalaska Island	442,716	12	Fork-tailed Storm-Petrel	9
Koniuji Island	North of Atka Island	288,007	14	Fork-tailed Storm-Petrel	14
Emerald Island	West of Unalaska Island	162,593	8	Leach's Storm-Petrel	8
Aiktak Island	Unimak Pass	146,561	15	Tufted Puffin	12
Kaligagan Island	Unimak Pass	128,078	10	Tufted Puffin	10

Source: U.S. Fish and Wildlife Service, 1998—Beringian Seabird Colony Catalog.

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Prince William Sound

According to the Beringian Seabird Colony Catalogue maintained by the USFWS, there are approximately 224 known marine bird colonies in the general area of the proposed fiber optic cable line route through Prince William Sound. Although all of these colonies are not immediately adjacent to the proposed route, seabirds are known to fly long distances to areas where prey are abundant, and birds from any one of the colonies could be present along the cable route. Table 3.4-3 summarizes important information regarding the 10 largest marine bird colonies in the area of the proposed cable route through Prince William Sound. The largest colony in the vicinity of Whittier is in Passage Canal where a colony of over 8,000 glaucous-winged gulls exists (over 4,000 nests). The largest colony along the cable route outside the Whittier area is on the Wooded Islands on the east side of Montague Island. This site supports over 9,500 tufted puffins, over 2,000 black-legged kittiwakes, and over 2,000 fork-tailed storm-petrels. The largest colony in the vicinity of Seward is on Barwell Island at the mouth of Resurrection Bay, where a colony of over 17,500 common murres and over 2,800 black-legged kittiwakes exists.

Gulf of Alaska

According to the Beringian Seabird Colony Catalogue maintained by the USFWS maps 22, 25-29, 31-34, and 50, there are approximately 240 known marine bird colonies in the general area of the proposed fiber optic cable line route through the Gulf of Alaska. Although all of these colonies are not immediately adjacent to the proposed route, seabirds are known to fly long distances to areas where prey are abundant, and birds from any one of the colonies could be present along the cable route. Table 3.4-4 summarizes important information regarding the 10 largest marine bird colonies in the area of the proposed cable route through the Gulf of Alaska. The largest colony in the vicinity of where the cable comes ashore at Kodiak is on Kulichikof Island, which has a colony of about 1,700 mainly black-legged kittiwakes. The largest marine bird colony along this entire Gulf of Alaska section of the cable route is on Suklik Island, in the Semidi Island group. This site supports over 611,000 marine birds, of which over 250,000 are tufted puffins.

Aleutian Islands

According to the Beringian Seabird Colony Catalogue maintained by the USFWS maps 13-24, there are approximately 272 known marine bird colonies in the general area of the proposed fiber optic cable line route along the Aleutian Islands. Although all of these colonies are not immediately adjacent to the proposed route, seabirds are known to fly long distances to areas where prey are abundant, and birds from any one of the colonies could be present along the cable route. Table 3.4-5 summarizes important information regarding the 10 largest marine bird colonies in the area of the proposed cable along the Aleutian Islands.

The largest colony in the immediate vicinity of where the cable would come ashore on the south side of Umnak Island in Driftwood Bay is on East Cliff at Cape Udak, which has a colony of about 2,000 tufted puffins. The largest colony in the immediate vicinity of where the cable would leave Umnak Island in Nikolski Bay is in Nikolski Bay itself, which has a colony of about 40 Aleutian terns.

The largest colony along the cable route away from the Adak and Dutch Harbor areas is on Buldir Island. This island supports over 3.5 million marine birds, of which 1.7 million are Leach's storm-petrels, 1.3 million are fork-tailed storm-petrels, and over 500,000 are crested auklets and least auklets. The largest colony in the immediate vicinity of where the fiber optic cable line would come ashore at Shemya is on the Hammerhead Islets, where a colony of nearly 2,000 glaucous-winged gulls and tufted puffins exists.

3.4.1.6.7 Endangered, Threatened, and Special Concern Species

Steller Sea Lion (*Eumetopias jubatas*)

In 1997 the western stock of Steller sea lions was listed as an endangered species under the Endangered Species Act of 1973, as amended. All Steller sea lion rookeries in the western stock are located in the general project area except those on Walrus, Attu, and Agattu Islands. The fiber optic cable line route, however, falls within the critical aquatic habitat in the vicinity of Bogoslof Island (50 CFR 227.12). The designated critical aquatic habitats are designed to protect the important foraging areas of the Steller sea lions.

Beluga Whale (*Delphinapterus leucas*)

There are five stocks of beluga whales in Alaska. Of these, four are western Bering Sea stocks and one is the Cook Inlet stock. The Cook Inlet stock is distributed throughout upper Cook Inlet in the spring and summer and is thought to be distributed in lower Cook Inlet and the northern Gulf of Alaska during the fall and winter.

The Cook Inlet beluga whale stock is presently listed as a candidate species under the Endangered Species Act. On March 3, 1999, NMFS was petitioned under the Endangered Species Act to list the Cook Inlet beluga whale stock as endangered. NMFS will issue an Endangered Species Act determination by April 2000. On October 19, 1999, NMFS proposed to designate the Cook Inlet beluga whale stock as depleted under the Marine Mammal Protection Act. The four beluga whale stocks

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in the Bering Sea are neither listed under the Endangered Species Act nor being reviewed to be designated as a depleted, threatened, or endangered species.

Northern Fur Seal (*Callorhinus ursinus*)

The Eastern Pacific stock of northern fur seals is listed as a depleted species under the Marine Mammal Protection Act. The habitat for this species includes rookeries and haulouts on the Pribilof Islands and Bogoslof Island. The population on Bogoslof Island only has recently (1980) comprised breeding individuals. Each summer, female fur seals arrive (peak arrival around mid-July) on the breeding grounds on the Pribilof Islands and only recently on Bogoslof Island to give birth, breed, and nurse their pups. Fur seals from this stock migrate through the Aleutian Islands in the spring (May through June) and fall (November through December) to winter in the North Pacific Ocean. However, some fur seals (primarily adult males) may stay in the Bering Sea throughout the winter (National Marine Fisheries Service, 1993—Conservation Plan for the Northern Fur Seal).

Endangered Whales

The endangered bowhead whale (*Balaena mysticetus*), blue whale (*Balaenoptera musculus*), Sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), northern right whale (*Balaena glacialis*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*) are present in the general project area at some times of the year (generally in the summer). All of these species range widely in the North Pacific Ocean. They transit through the passes in the Aleutian Islands, and may forage in the highly productive offshore areas.

Short-tailed Albatross (*Phoebastria albutrus*)

The short-tailed albatross is currently listed as endangered by Alaska and Federally endangered only on the high seas and in Japan and Russia. This species has been proposed for listing for the near shore, 5 kilometers (3 miles), to correct an administrative oversight (Augustine, 2000—Personal communication with 611 CES/CEVP regarding natural resources on Eareckson AS). Feather hunters killed an estimated 5 million short-tailed albatrosses during the late 1800s and early 1900s, and volcanic eruptions in the 1930s destroyed potential nesting habitat. The short-tailed albatross is a large (2-meter [7-foot] wingspan) pelagic seabird that breeds mainly on Torishima (500 individuals) in the Izu Islands group in Japan. Other small colonies occur at Minami-kojima (75 individuals), Japan, and at Midway Atoll (1 to 3 individuals) near the Hawaiian Islands. Although this species does not breed in Alaska, its distribution at sea includes the Gulf of Alaska and Bering Sea. Sightings in Alaskan waters have become

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more common in recent years as the population has increased from about 50 in the late 1940s to approximately 1,000 in 1999, and several sitings near Kodiak Island have been documented (U.S. Fish and Wildlife Service, 1998—Kodiak National Wildlife Refuge and Kodiak Island Archipelago—Birds). Population increases are largely due to habitat protection and restoration and protection from hunting (Cochrane, 1998—Short-tailed Albatross).

Current threats to this species include accidental mortality associated with the high seas long-line and drift-net fisheries (United Nations, 1998—Food and Agriculture Organization-Committee on Fisheries) and the potential for another volcanic eruption on Torishima to destroy nesting habitat (Cochrane, 1998—Short-tailed Albatross).

Aleutian Canada Goose (*Branta canadensis leucopareia*)

The Aleutian Canada goose is currently listed as a Species of Special Concern by the State of Alaska and is currently (since 1990) considered threatened by the U.S. Government (Alaska Department of Fish and Game, 1998—Species of Special Concern; U.S. Fish and Wildlife Service, 1998—Endangered and Threatened Wildlife) and is in the final steps of being delisted, which is expected by the end of July (Boone, 2000—Personal communication with the USFWS regarding the Aleutian Canada goose). If survey data after delisting indicate a reversal in recovery, the Aleutian Canada goose could be emergency listed at any time. Aleutian Canada geese declined in the early part of the twentieth century as a result of the introduction of arctic foxes for fur farming to most of their nesting islands in the Aleutian Islands and the Commander and Kuril Islands in the North Pacific. It was listed as endangered by the U.S. Government in 1967.

The Aleutian Canada goose is one of several small subspecies of Canada goose found in Alaska. It is distinguished by small size, an obvious ring of white feathers around the neck, and a short bill and abrupt forehead. Since the initiation of the recovery program in the mid-1970s, the population has rebounded from about 800 geese nesting on only 3 islands where foxes were not introduced, to over 20,000 geese on the original 3 islands and on several additional islands where foxes were exterminated. In addition, sport hunting for all Canada geese was curtailed in areas in California and Oregon where this subspecies was known to overwinter and to stage during migration. Aleutian Canada geese apparently make a 3,220-kilometer (2,000-mile) migration across the Gulf of Alaska during spring and fall migration, and they may spend considerable time roosting on the ocean. Large numbers feed on Shemya Island during mid April to mid June at the conclusion of spring migration and during mid August to mid October at the beginning of fall migration (Augustine, 2000—Personal communication with 611 CES/CEVP

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regarding natural resources at Eareckson AS). Aleutian Canada geese currently nest on the Semidi Islands in the Gulf of Alaska and on several other islands in the Aleutian Chain, including Buldir Island, Agattu Island, Alaid/Nizki Islands, Chagulak Island, and the Rat Islands (U.S. Fish and Wildlife Service, 1998—Status of Aleutian Canada Geese).

Spectacled Eider (*Somateria fischeri*)

The spectacled eider is currently listed as a Species of Special Concern by the State of Alaska and as threatened by the U.S. Government (Alaska Department of Fish and Game, 1998—Species of Special Concern; U.S. Fish and Wildlife Service, 1998—Endangered and Threatened Wildlife). The breeding population in Alaska has declined markedly since the 1960s. Where an estimated 47,700 to 70,000 pairs of spectacled eiders had nested in the Yukon-Kuskokwim Delta in the early 1970s, the nesting population had declined to about 1,700 to 3,000 pairs by 1990-1992 (U.S. Fish and Wildlife Service, 1993—Final Rule to List Spectacled Eider as Threatened). Similar declines have been noted on the north slope of Alaska. The cause(s) of the decline of this species are unknown but may include reduced food supplies, pollution, overharvest, increased predation, lead poisoning, and other causes (U.S. Fish and Wildlife Service, 1993—Final Rule to List Spectacled Eider as Threatened). They were listed in the United States as a threatened species in 1993.

Spectacled eiders are large diving ducks that nest in wetland complexes near ponds in Arctic Alaska and Russia and in the Yukon–Kuskokwim Delta in Alaska. They feed on marine and freshwater molluscs, crustaceans, and plant material. They build their nests on shorelines, islands, and meadows in wet coastal arctic and subarctic tundra, usually within 15 kilometers (9.3 miles) of the coast (Dau and Kistchinski, 1977—Seasonal Movements and Distribution of the Spectacled Eider). Most of the world population overwinters in the northern Bering Sea south of St. Lawrence Island. The birds molt and stage at a number of locations, including areas in the Bering, Beaufort, and Chukchi Seas. Staging also occurs in waters off eastern St. Lawrence Island and just off the island's southern shore. In the waters around Kodiak Island, individual spectacled eiders have been reported in spring and winter, but they are considered rare or accidental in this area (U.S. Fish and Wildlife Service, 1998—Kodiak National Wildlife Refuge and Kodiak Island Archipelago—Birds).

Steller's Eider (*Polysticta stelleri*)

The Steller's eider is currently listed as a Species of Special Concern by the State of Alaska and the Northern American breeding population as threatened by the U.S. Government (Alaska Department of Fish and Game, 1998—Species of Special Concern; U.S. Fish and Wildlife Service,

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1998—Endangered and Threatened Wildlife). The cause(s) of the decline of this species are unknown, but the current world population (150,000 to 200,000 birds) is thought to have declined by up to 50 percent during the 20-year period between the 1960s and the 1980s. They were listed in the United States as a threatened species in 1997. The breeding population in Alaska may be fewer than 1,000 birds (Alaska Department of Fish and Game, 1998—Species of Special Concern). Little is known about this species, but studies are in-progress to determine the causes of the decline.

Steller's eiders are diving ducks that feed on marine invertebrates during winter and on freshwater invertebrates during the breeding season in spring and summer. Their breeding range currently includes the Arctic Coastal Plain of northwest Alaska and northern coastal areas of Russia. Most of the world population overwinters throughout the Alaska Peninsula and in the eastern Aleutian Islands. In the waters around Kodiak Island, Steller's eiders are commonly seen in spring and winter, are uncommon in fall, and are rare in summer (U.S. Fish and Wildlife Service, 1998—Kodiak National Wildlife Refuge and Kodiak Island Archipelago—Birds).

3.4.2 NORTH DAKOTA INSTALLATIONS

The following sections describe biological resources for the NMD alternatives in North Dakota and their surrounding areas when applicable. Cavalier AFS, Grand Forks AFB, the Missile Site Radar and Remote Sprint Launch Sites (facilities of the SRMSC), and areas between some of these facilities, for fiber optic cable lines, are alternative locations for the NMD program.

Northeastern and north central North Dakota lie within the Northern Great Plains. The area's natural vegetation consisted of northern mixed prairie containing tall grass, mid-grass, and short grass species. Extensive cultivation has resulted in only remnants of natural prairie remaining today. Prairie potholes in the region provide important habitat for migrating birds. (Minot AFB, 1995—Integrated Natural Resources Management Plan)

3.4.2.1 Cavalier AFS—Biological Resources

Cavalier AFS is located in west central Pembina County, North Dakota. The ROI for biological resources includes Cavalier AFS property (approximately 4 hectares [10 acres]) that could be affected by the construction of an XBR, as well as surrounding areas that could potentially be affected by the deployment or operation of this component. A site visit to the project area was conducted in June 1998.

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Vegetation

Cavalier AFS lies within the rolling western region of the Red River Valley in a vegetational transition area. A recent biological survey (Cavalier AS, 1996—Biological Survey) describes the vegetation of the Gunlogson Nature Preserve, approximately 16 kilometers (10 miles) from the station, as a composite of eastern deciduous woodlands, boreal forests, and mid-continental grasslands. Wooded areas of the Nature Preserve are characterized by mixed hardwood dominated by bur oak (*Quercus macrocarpa*), basswood (*Tilia americana*), and elm (*Ulmus americana*). The understory is primarily hazel (*Corylus cornuta* and *C. americana*) with juneberry (*Amelanchier alnifolia*) and chokecherry (*Prunus virginiana*). Grasslands near the station have been described as high prairie with dominant grasses such as needle and thread (*Stipa comata*), porcupine grass (*S. spartea*), little bluestem (*Andropogon scoparius*), Junegrass (*Koeleria pyramida*), and prairie sandreed (*Calamovilfa longifolia*). (Cavalier AS, 1996—Biological Survey; National Park Service, 1998—Grasses of the Mixed Prairie)

The site is landscaped with non-native trees and shrubs and is regularly mowed, particularly in the areas immediately surrounding the buildings (figure 3.4-11). There is evidence that the area was cultivated before the construction of Cavalier AFS and reseeded with non-native grasses. The dominant species are smooth brome (*Bromus inermis*) and Kentucky bluegrass *(Poa pratense*) (appendix F, table F-12). The remainder of the vegetation within the ROI consists of a variety of scattered weedy species, approximately half of which are non-native. (Cavalier AS, 1996—Biological Survey)

Wildlife

The lack of habitat for wildlife nesting and foraging at Cavalier AFS results in a relatively low diversity in species observed. The great blue heron (*Ardea herodias*), horned lark (*Eremophila alpestris*), and eastern mourning dove (*Zenaida macroura*) are examples of bird species observed in recent surveys at the site. Moose, deer mice (*Peromyscus maniculatus*), and Richardson ground squirrel (*Spermophilus richardsonii*) are some of the mammals that have been observed. No reptiles were observed during the recent 2-year biological survey performed for Cavalier AFS. One amphibian, a northern leopard frog (*Rana pipens*) was seen in the drainage ditch near the northern boundary fence. Appendix F, table F-13, lists the species sighted during the recent survey of the site (Cavalier AS, 1996—Biological Survey)

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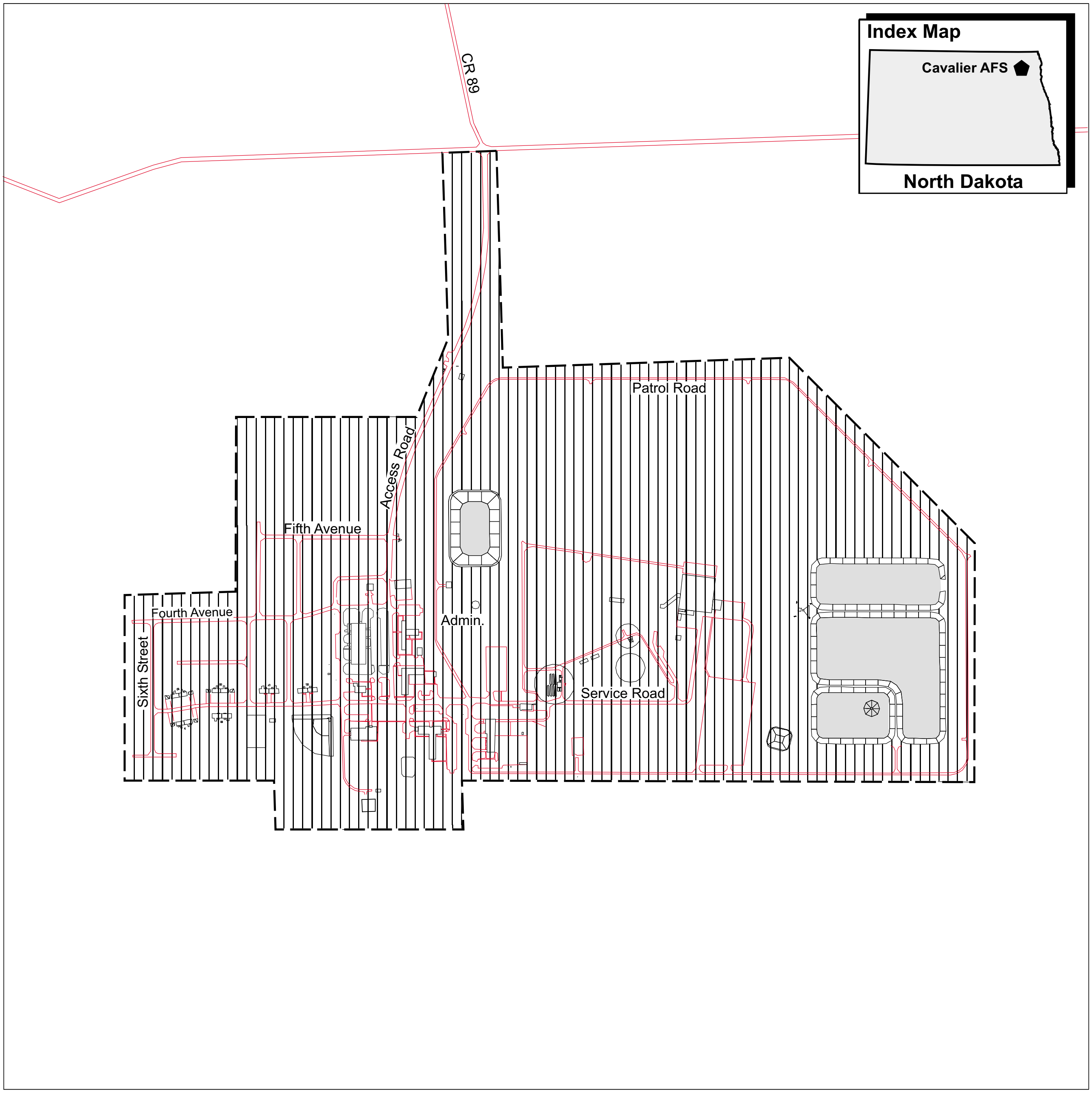

EXPLANATION

- Installation Boundary
- Human Influenced Upland Grassland/Maintained
- Standing Water

CR = County Road

Scale 1:11,000

0 459 917 Feet

0 140 280 Meters

NORTH

Vegetation, Cavalier Air Force Station

North Dakota

Figure 3.4-11

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Threatened and Endangered Species

No species listed as threatened or endangered either by the state or the USFWS have been identified at Cavalier AFS; however, species such as the bald eagle (recommended for delisting), whooping crane, and recently delisted peregrine falcon may fly over the site during migration (Cavalier AS, 1996—Biological Survey).

Sensitive Habitats

There are no wetlands or other sensitive habitat on Cavalier AFS (Cavalier AS, 1996—Biological Survey).

3.4.2.2 Grand Forks AFB—Biological Resources

Grand Forks AFB is located in Grand Forks County, North Dakota. The ROI for biological resources includes the base and adjacent properties that could be affected by the construction and deployment or operation of a GBI or BMC2 at Grand Forks AFB. The ROI also includes the area encompassed by the installation of the utility corridor. A site visit to the project area was conducted in June 1998.

Vegetation

The land surrounding Grand Forks AFB is predominantly agricultural, with small grain crops and sunflowers. An area west of the base is maintained as a wildlife research area. A natural area of lowland prairie and marshes that is part of the Kelly's Slough National Wildlife Refuge is located to the east and northeast of the base. (Grand Forks AFB, 1994—Biological Survey)

Grand Forks AFB is located within the bluestem prairie region, an area dominated by tallgrass and mixed grass prairie communities. Bluestem prairies are dominated by big bluestem (*Andropogon gerardii*), wand panic grass (*Panicum virgatum*), and yellow Indian grass (*Sorghastrum nutans*). Fire suppression has encouraged the invasion of shrubs and trees into the remaining prairie remnants. There are no known prairie remnants on Grand Forks AFB (figure 3.4-12). Some prairie index species, however, are found in unimproved and semi-improved areas on base. (U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan)

Two introduced grass species, smooth bromegrass and Kentucky bluegrass, are predominant throughout the base. Hay and alfalfa are actively cultivated on base. Grass within semi-improved areas is maintained at a height of 18 to 36 centimeters (7 to 14 inches). (U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan)

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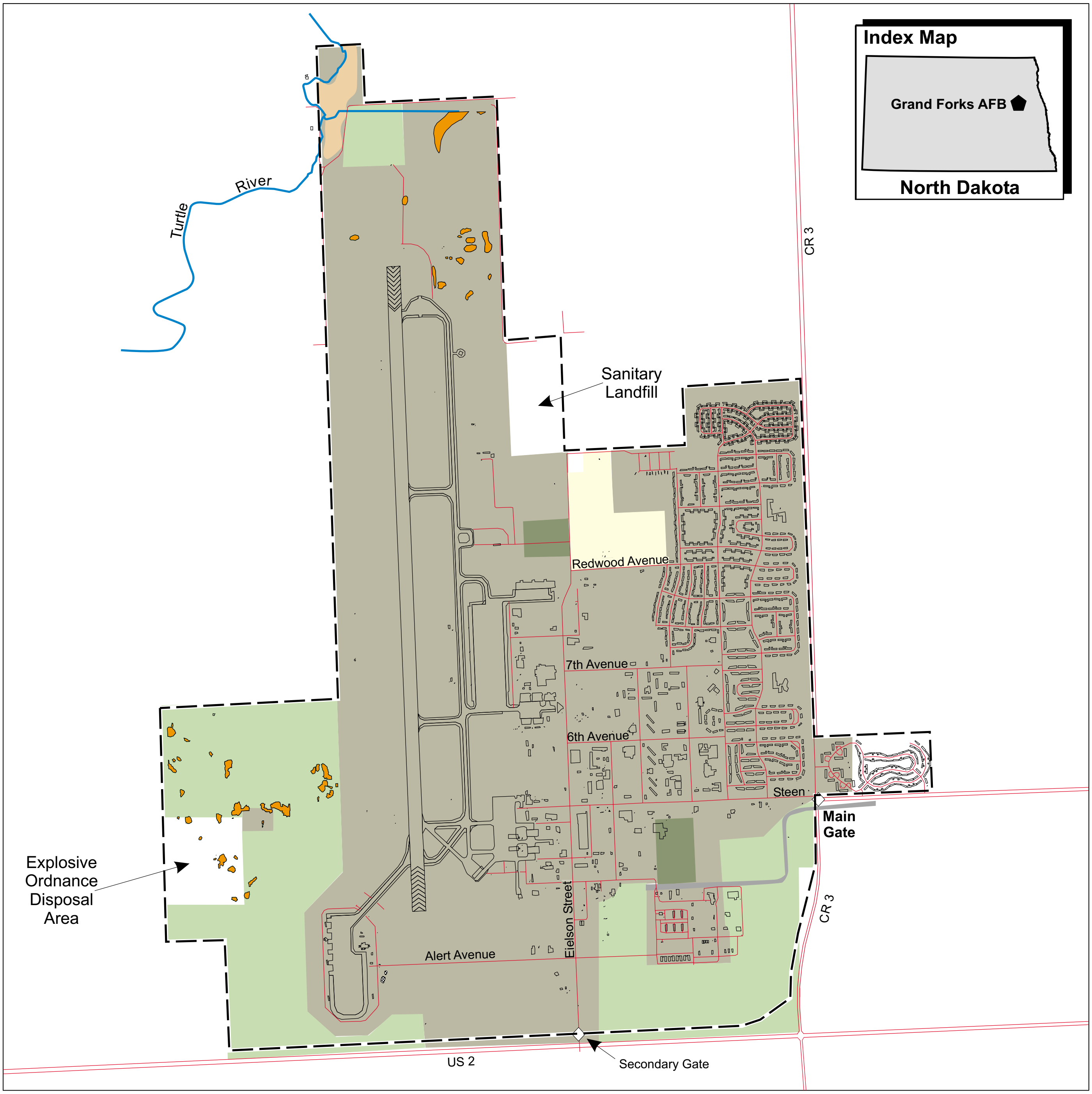

EXPLANATION

- Roads
- Water Area
- Installation Boundary
- Gate
- CR = County Road
- Seeded Grassland
- Wet Meadow (seeded)
- Alfalfa Field
- Wetlands
- Naturalized Grassland
- Oak Woodland

Scale 1:40,000

0 1,667 3,333 Feet

0 508 1,016 Meters

NORTH

Vegetation and Wetlands, Grand Forks Air Force Base

North Dakota

Figure 3.4-12

br_gfafb_001_color

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Ten natural vegetative communities have been identified in Grand Forks County, but only one, the Lowland Woodland community, has been identified as occurring on Grand Forks AFB. Dominant trees include elm (*Ulmus americana*), cottonwood (*Populus deltoides*), and green ash (*Fraxinus pennsylvanica*). Chokecherry and woodrose (*Rosa woodsii*) are common understory plants. Bur oak, green ash, and basswood are common trees in upland areas on base. Meadow anemone (*Anemone canadensis*), downy yellow violet (*Viola pubescens*), and burdock (*Arctium minus*) are common forbs in the upland areas. Appendix F, table F-14, lists vegetation observed on Grand Forks AFB. (U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan)

Wildlife

Terrestrial and aquatic habitats are very limited on base due to extensive development. White-tailed deer (*Odocoeilus virginianus*), eastern cottontail (*Sylvilagus floridanus*), white-tailed jackrabbits (*Lepus townsendi*), and Richardson's ground squirrel are common mammals on the base. Cliff swallows and sea gulls (*Larus* spp.) are the most frequent birds involved in low altitude bird strikes on and near the Grand Forks AFB airfield. Canada geese (*Branta canadensis*) and ducks are attracted to small prairie potholes and open water wetlands such as Kellys Slough in the vicinity of the base. Appendix F, table F-15, lists wildlife common to Grand Forks AFB. (U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan; U.S. Department of the Air Force, 1999—Final EIS, Minuteman III Missile System Dismantlement)

Threatened and Endangered Species

An inventory of protected and rare plants, completed in 1994, did not identify any rare plants on Grand Forks AFB. Threatened, endangered, and special interest species that have the potential to be located on base are listed in table 3.4-6. Protected birds may migrate through the area. (Grand Forks AFB, 1994—Biological Survey; U.S. Department of the Air Force, 1999—Final EIS, Minuteman III Missile System Dismantlement)

Sensitive Habitats. Kelly's Slough Wildlife Management Area is located approximately 3 kilometers (2 miles) east of the base. This 656-hectare (1,620-acre) wetland area, managed by the USFWS, is a stopover for migratory waterfowl. Wetlands occur in drainageways, low-lying areas, and potholes. Approximately 10 hectares (24 acres) of wetlands were recently identified within the boundary of Grand Forks AFB (Grand Forks AFB, 1999—Draft Wetland Identification and Delineation). An additional 73 hectares (180 acres) are located east of the main base and are associated with four sewage lagoons. Several small prairie potholes on Grand Forks AFB support nonforested wetlands. (U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan)

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Table 3.4-6: Sensitive Species at Grand Forks Air Force Base

Scientific Name	Common Name	Status		Habitat and Distribution
		Federal	State	
Wildlife				
Charadrius melodus	Piping plover	T	S2	Nests on sand bars of Missouri and Yellowstone Rivers, along shorelines of saline wetlands, no nests known at or near any of the missile facilities
Charadrius montanus	Mountain plover	C	SX	Short grass prairie, considered extirpated in North Dakota
Falco peregrinus [(1)] *anatum*	American peregrine falcon	--	S1	Migrates spring and fall along major river courses
Falco peregrinus [(1)]*tundrius*	Arctic peregrine falcon	--	--	Migrates spring and fall along major river courses
Grus americana	Whooping crane	E	SX	Migrates through west and central counties during spring and fall; roosts on wetlands and stockdams
Haliaeetus leucocephalus	Bald eagle	T	S1	Migrates spring and fall along major river courses; concentrated along Missouri River
Numenius borealis	Eskimo curlew	E	--	Variety of grassland habitat; not likely to occur in project area
Sterna antillarum	Least tern	E	S1	Along Missouri River; barren or sparsely vegetated sandbars
Vulpes velox hebes	Swift fox	C	--	Prairie grasslands
Plants				
Platanthera praeclara	Western prairie fringed orchid	T	SH	Moist tall grass prairie swales

Source: U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan; U.S. Department of the Air Force, 1999—Final EIS, Minuteman III Missile System Dismantlement.
[(1)] Recently delisted, will be monitored for the next decade

E Endangered
T Threatened
C Candidate
R Rare
-- Not listed
S1 Critically imperiled in state (5 or fewer occurrences)
S2 Imperiled in state (6 to 20 occurrences)
S3 Rare in state
SA Accidental in state
SH Of historical occurrence in state
SU Possibly in peril in the state
SX Apparently extirpated from the state

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3.4.2.3 Missile Site Radar—Biological Resources

The Missile Site Radar is located in Cavalier County, North Dakota. The ROI for biological resources includes the areas on and surrounding the Missile Site Radar that could be affected by construction and deployment or operation of a GBI element or an XBR. A site visit to the project area was conducted in June 1998.

Vegetation

Northeastern North Dakota was historically vegetated by tall grass prairie. Little of the natural prairie remains today due to extensive cultivation in the region. Vegetation on the Missile Site Radar (figure 3.4-13) (appendix F, table F-16) consists of four general upland habitat types: natural unmowed grassland, human-influenced grassland, maintained lawn, and upland grassland and thicket. All four of these habitat types are generally dominated by smooth bromegrass, Kentucky bluegrass, and yellow sweet clover (*Melilotus officinalis*). Most of the central portion of the site is covered with human-influenced upland grasslands that are mowed periodically. The western half and the southeastern corner of the site are vegetated by prairie grasses that provide habitat for a variety of wildlife species. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Wildlife

The most important habitats for wildlife on Missile Site Radar are the wetlands associated with Roaring Nancy Creek, the storm water swales, and waste stabilization ponds. These wetland and upland habitats provide nesting cover for a variety of birds and refuge and security to regional deer and small mammals such as Richardson ground squirrels and northern pocket gophers (*Thomomys talpoides*). Security fencing on the site imposes a barrier to use of wildlife habitat by larger mammals, although deer have been observed near the waste stabilization ponds. Appendix F, table F-17, lists wildlife observed at the site. (U.S. Army Strategic Defense Command, 1993—Winter 1992 Biological Survey)

Threatened and Endangered Species

No Federal or state threatened or endangered species have been observed at Missile Site Radar. However, the bald eagle, recently delisted peregrine falcon, and whooping crane could fly over the site during migration.

Sensitive Habitats

The natural wetland on Missile Site Radar is a wetland system associated with Roaring Nancy Creek, located in the western portion of the site. Vegetation in this wetland is dominated by broad-leaved cattails (*Typha*

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Figure 3.4-13: Vegetation and Wetlands, Missile Site Radar, North Dakota

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latifolia), soft rush (*Juncus effusus*), and pussy willow (*Salix discolor*). The waste stabilization lagoons provide some of the functions of created wetland systems, such as wildlife habitat and flood storage. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

3.4.2.4 Remote Sprint Launch Site 1—Biological Resources

Remote Sprint Launch Site 1 is located in the northwest corner of Ramsey County, North Dakota. The ROI for biological resources encompasses approximately 17 hectares (41 acres) of disturbed land entirely within the current launch site that could be affected by the construction of an XBR at Remote Sprint Launch Site 1, and the surrounding area that could potentially be affected by operation of the XBR. A site visit to the project area was conducted in June 1998.

Vegetation

Remote Sprint Launch Site 1 is a small, flat site surrounded by tilled agricultural fields. The site is periodically mowed and has been seeded (figure 3.4-14) with non-native or human-influenced grasses. There is a small parcel (0.7 hectare [1.7 acres]) of natural upland grassland. Appendix F, table F-18, lists vegetation that has been observed on the site. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Wildlife

Wildlife on the site is limited due to the size of the site and the fencing surrounding it. Appendix F, table F-19, lists wildlife, such as the white-tailed jackrabbit (*Lepus townsendii*), thirteen-lined ground squirrel, and northern pocket gopher, that have been observed on the site. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Threatened and Endangered Species

No Federal or state threatened or endangered species have been observed at Remote Sprint Launch Site 1. However, the bald eagle, recently delisted peregrine falcon, and whooping crane could fly over the site during migration.

Sensitive Habitats

Two small sewage lagoons (figure 3.4-14) provide relatively good habitat for a variety of reptiles, amphibians, and small mammals. The vegetation is dominated by soft rush, reed canary grass (*Phalarus arundinacea*), and broad-leaved cattail. (U.S. Army Strategic Defense Command, 1992—

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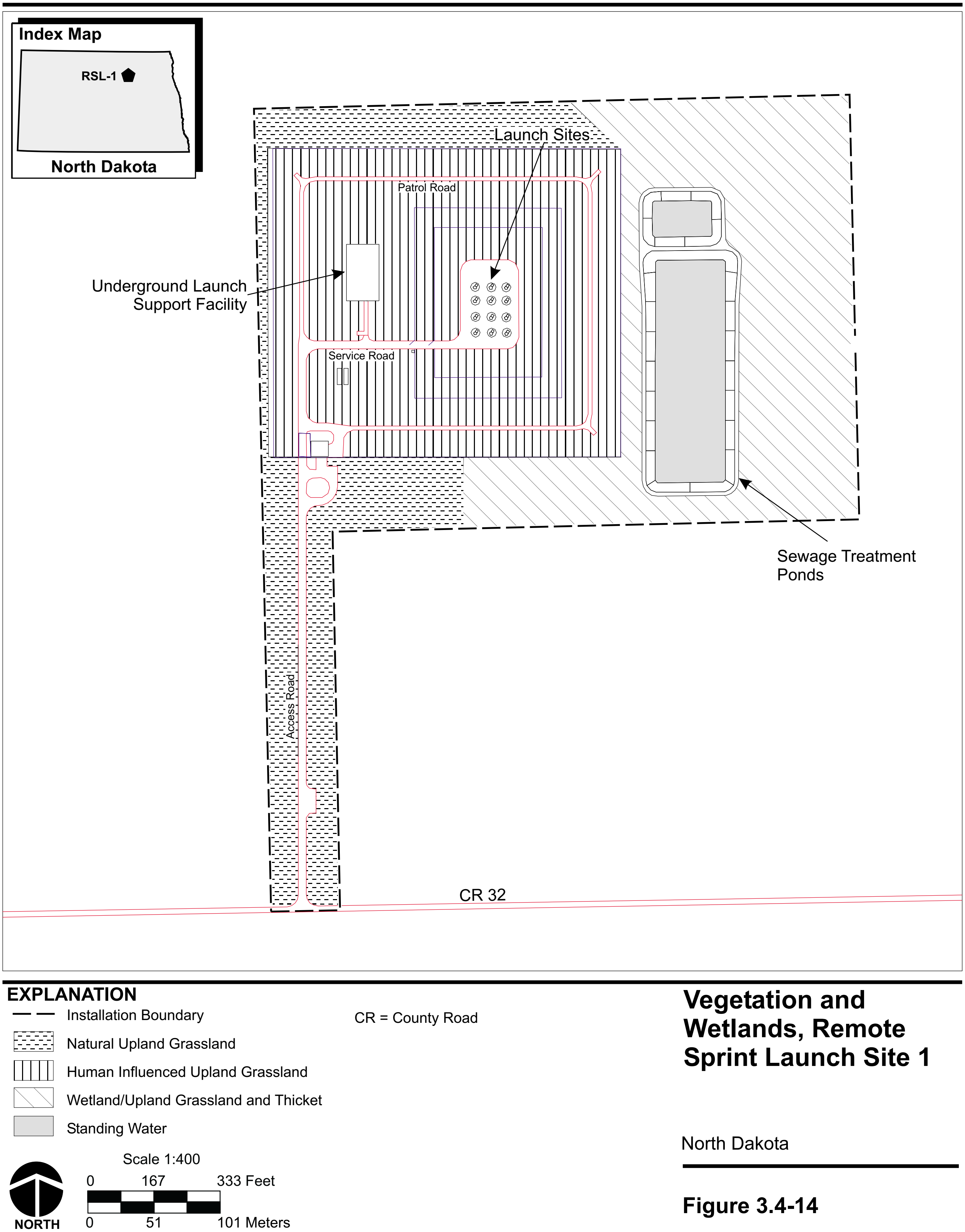

Vegetation and Wetlands, Remote Sprint Launch Site 1

North Dakota

Figure 3.4-14

br_rsl1_001

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Natural Resources Management Plan; Summer 1992 Biological Survey) Although the lagoons contain vegetation normally associated with jurisdictional wetlands, it has been determined that they are not subject to Section 404 regulations as long as they continue to function as wastewater containment facilities (U.S. Army Corps of Engineers, 1992—Final Section 404 Clean Water Act Jurisdictional Determination)

3.4.2.5 Remote Sprint Launch Site 2—Biological Resources

Remote Sprint Launch Site 2 is located in north central Cavalier County, North Dakota. The ROI for biological resources encompasses approximately 15 hectares (36 acres) of disturbed land entirely within the current launch site that could be affected by the construction of an XBR, and the area that could potentially be affected by deployment or operation of the XBR. A site visit to the project area was conducted in June 1998.

Vegetation

Remote Sprint Launch Site 2 is a small, flat site surrounded by tilled agricultural fields. The site is periodically mowed and has been seeded (figure 3.4-15) with non-native or human-influenced grasses. There is a small parcel (0.7 hectare [1.7 acres]) of natural upland grassland. Appendix F, table F-20, lists vegetation that has been observed on the site. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Wildlife

Wildlife on the site is limited due to the size of the site and the fencing surrounding it. Appendix F, table F-21, lists wildlife, such as the white-tailed jackrabbit, northern pocket gopher, and red fox that have been observed on the site. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Threatened and Endangered Species

No Federal or state threatened or endangered species have been observed at Remote Sprint Launch Site 2. However, the bald eagle, recently delisted peregrine falcon, and whooping crane could fly over the site during migration.

Sensitive Habitats

Two small sewage lagoons (figure 3.4-15) provide good habitat for waterfowl. The vegetation is dominated by dense scrub-shrub habitat. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey) Although the lagoons contain vegetation normally associated with jurisdictional

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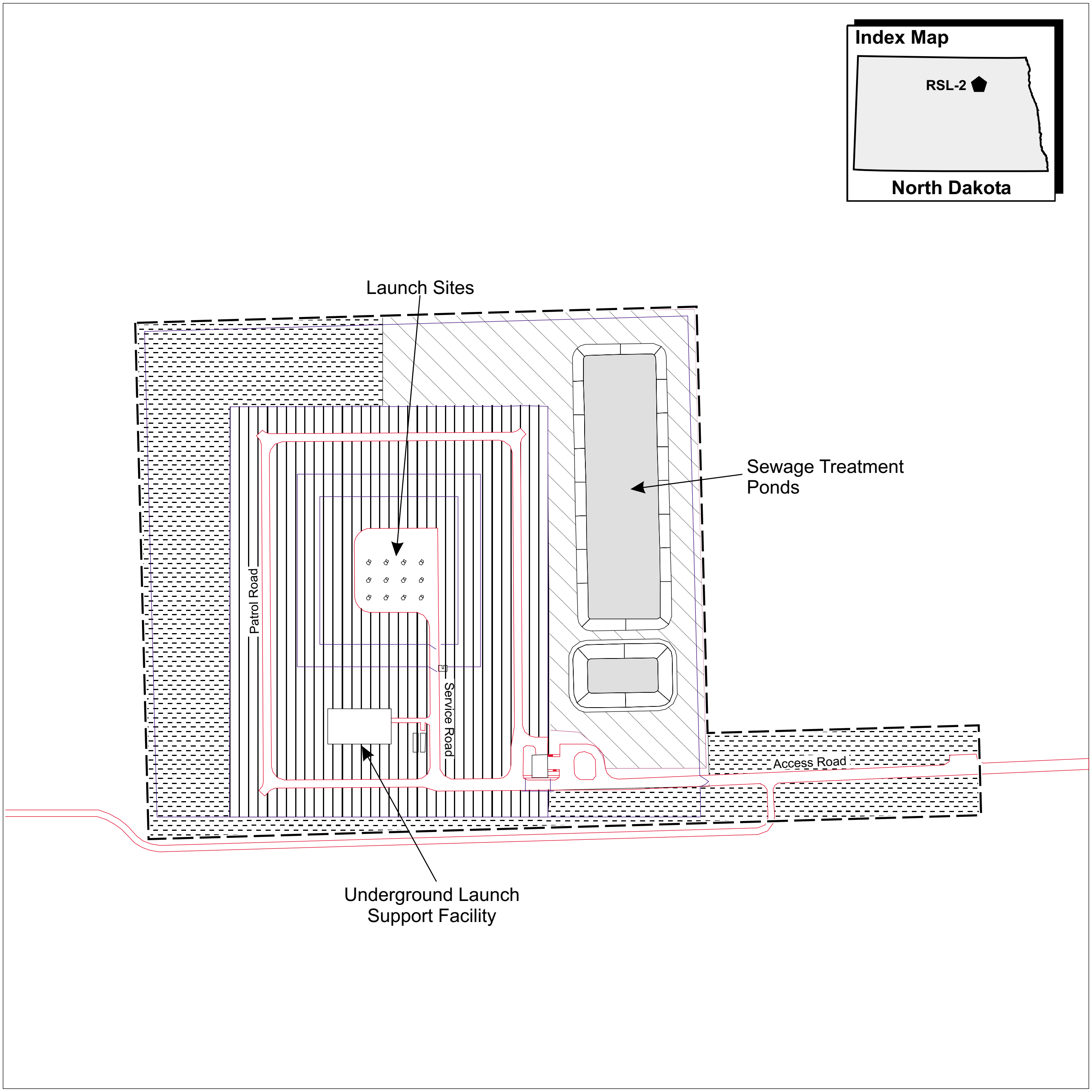

EXPLANATION

- Installation Boundary
- Natural Upland Grassland
- Human Influenced Upland Grassland
- Wetland/Upland Grassland and Thicket
- Standing Water

Scale 1:4,000

0 167 333 Feet

0 51 101 Meters

NORTH

Vegetation and Wetlands, Remote Sprint Launch Site 2

North Dakota

Figure 3.4-15

br_rsl2_001

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wetlands, it has been determined that they are not subject to Section 404 regulations as long as they continue to function as wastewater containment facilities (U.S. Army Corps of Engineers, 1992—Final Section 404 Clean Water Act Jurisdictional Determination)

3.4.2.6 Remote Sprint Launch Site 4—Biological Resources

Remote Sprint Launch Site 4 is located in northwestern Walsh County, North Dakota. The ROI for biological resources encompasses approximately 20 hectares (50 acres) of disturbed land entirely within the current launch site that could be affected by the construction of an XBR, and the area that could potentially be affected by deployment or operation of the XBR. A site visit to the project area was conducted in June 1998.

Vegetation

Remote Sprint Launch Site 4 is a small, flat site surrounded by tilled agricultural fields. The site is periodically mowed and has been seeded (figure 3.4-16) with non-native or human-influenced grasses. There is a small parcel (5.8 hectares [14.3 acres]) of natural upland grassland. This vegetation is typical of disturbed and undisturbed grasslands and provides habitat for small rodents and ground nesting birds.

Appendix F, table F-22, lists vegetation that has been observed on the site. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Wildlife

Wildlife on the site is limited due to the size of the site and the fencing surrounding it. Appendix F, table F-23, lists wildlife, such as the white-tailed jackrabbit, northern pocket gopher, and red fox, that have been observed on the site. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey)

Threatened and Endangered Species

No Federal or state threatened or endangered species have been observed at Remote Sprint Launch Site 4. However, the bald eagle, recently delisted peregrine falcon, and whooping crane could fly over the site during migration.

Sensitive Habitats

Two small sewage lagoons are located at Remote Sprint Launch Site 4 (figure 3.4-16), the smaller of which provides good waterfowl habitat. The larger lagoon is a palustrine emergent wetland dominated by broad-leaved cattail. The smaller lagoon supports both emergent and scrub-

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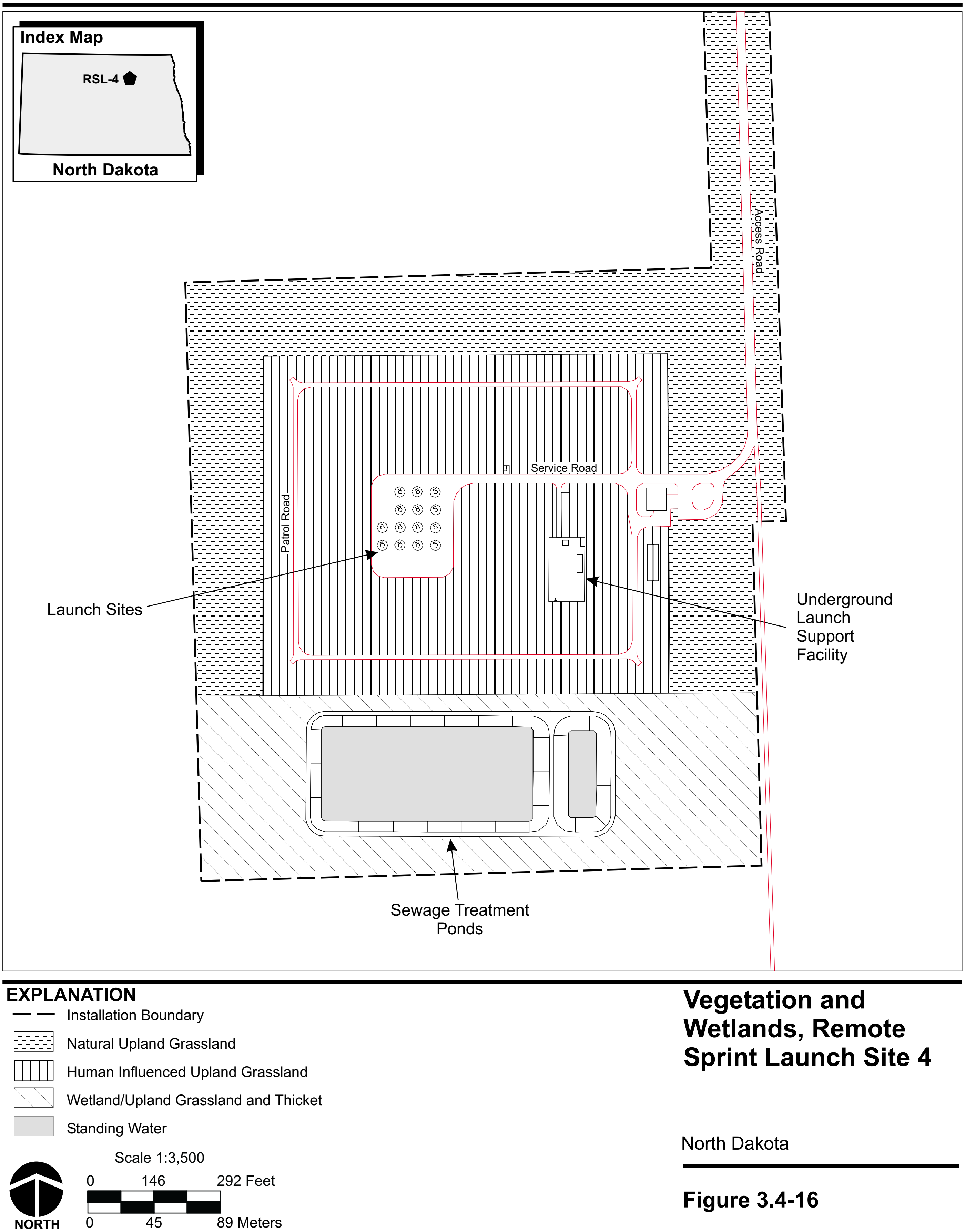

Vegetation and Wetlands, Remote Sprint Launch Site 4

North Dakota

Figure 3.4-16

br_rsl4_001

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shrub vegetation. (U.S. Army Strategic Defense Command, 1992—Natural Resources Management Plan; Summer 1992 Biological Survey) Although the lagoons contain vegetation normally associated with jurisdictional wetlands, it has been determined that they are not subject to Section 404 regulations as long as they continue to function as wastewater containment facilities. (U.S. Army Corps of Engineers, 1992—Final Section 404 Clean Water Act Jurisdictional Determination)

3.4.2.7 North Dakota—Fiber Optic Cable Line—Biological Resources

This section describes biological resources for the area along the fiber optic cable line route. It is expected that the fiber optic cable line would be laid in the area around the proposed NMD element locations described above. The cable alignment would be along existing roadways and utility corridors. The width of the ROI would encompass approximately 8 meters (25 feet) on each side of the roadway along the indicated route.

Vegetation

Construction and motor vehicle use frequently disturb the sides of the roadway. Vegetation within the ROI is indicative of disturbed areas and consists primarily of grasses and weedy species. However, there are some small areas of vegetation along the roadways that provide highly productive wildlife habitat (U.S. Department of the Interior, 1999—comments received on the Draft EIS). The remainder of the area in the fiber optic cable line ROI is used for agricultural purposes.

Wildlife

Wildlife is sparse within the ROI along the roadway corridor, as there is little overall habitat for nesting and foraging. However, there are pockets of habitat that make up a small fraction of the area along the roadways. Researchers have found these areas are highly productive nesting sites for more than 40 kinds of birds and animals that nest on the ground or in low vegetation. This is particularly the case in northeastern North Dakota (U.S. Department of the Interior, 1999—comments received on the Draft EIS). The types of wildlife would be similar to that described above for the North Dakota installations.

Threatened and Endangered Species

Potential threatened and endangered species in fiber optic cable line alignment area would be similar to those described above for the North Dakota installations. Additional species not listed above that could be found in the area include the endangered gray wolf (*Canis lupus*), the endangered black-footed ferret (*Mustela nigripes*), and the endangered pallid sturgeon (*Scaphirhynchus albus*). The gray wolf is an occasional visitor in North Dakota, with most habitat found in forested areas in the north central part of the state in the Turtle Mountains. The black-footed

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ferret is typically found in the southwestern part of North Dakota. The decline in the ferret has been linked to eradication of the prairie dog due to farming and grazing. The pallid sturgeon is not known to exist within the ROI for the fiber optic cable line alignment (U.S. Department of the Air Force, 1999—Final EIS, Minuteman III Missile System Dismantlement).

Sensitive Habitats

Although it is anticipated that the fiber optic cable line would be installed along existing roadways and utility corridors, there is the potential to affect sensitive habitat. The sensitive habitat would mainly consist of wetlands and prairie potholes that can be found along some of the roadways in North Dakota. This habitat provides nesting for migrating waterfowl and shorebirds.

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3.5 CULTURAL RESOURCES

Cultural resources include prehistoric and historic sites, structures, districts, artifacts, or any other physical evidence of human activity considered important to a culture, subculture, or community for scientific, traditional, religious, or any other reason. For ease of discussion, cultural resources have been divided into archaeological resources (prehistoric and historic), historic buildings and structures, native populations/ traditional resources (e.g., Native American sacred or ceremonial sites), and paleontological resources.

Prehistoric and historic archaeological resources are the physical remnants of human activity. They include archaeological sites, features, ruins, artifacts, and other evidence of prehistoric or historic human behavior.

Historic buildings and structures (i.e., architectural features) consist of above ground, standing properties postdating the advent of written records (e.g., homesteads, ranchsteads, World War II buildings, Cold War structures).

Traditional resources may be prehistoric sites and artifacts, historic areas of occupation and events, historic and contemporary sacred areas, materials used to produce implements and sacred objects, hunting and gathering areas, and other botanical, biological, and geological resources of importance to contemporary culture groups. Of primary concern are Native American sacred spaces, because a fundamental feature of Native American cultures is the belief in the sacred character of physical spaces (e.g., mountain peaks, springs, and burial sites). In addition, traditional rituals often prescribe the use of a particular native plant, animal, or mineral; therefore, activities that may affect sacred sites, their accessibility, or the availability of materials used in traditional practices may be of concern.

Paleontological resources include the fossil evidence of past plant and animal life. This includes both fossil traces left in stone, and also remains such as coalized or petrified wood or bone preserved in sediment, or insects and plants preserved in sediment or amber.

Numerous laws and regulations require that possible effects to cultural resources be considered during the planning and execution of Federal undertakings. These laws and regulations stipulate a process of compliance, define the responsibilities of the Federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., State Historic Preservation Officer [SHPO], the Advisory Council on Historic Preservation [ACHP]). In addition to the NEPA, the primary laws that pertain to the treatment of cultural resources during environmental analysis are the National Historic Preservation Act (NHPA) (especially

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Sections 106 and 11O), the Archaeological Resources Protection Act, the Antiquities Act of 1906, the American Indian Religious Freedom Act, and the Native American Graves Protection and Repatriation Act (NAGPRA).

Only those cultural resources determined to be potentially significant under the above-cited legislation are subject to protection from adverse impacts resulting from an undertaking. To be considered significant, a cultural resource must meet one or more of the criteria established by the National Park Service that would make that resource eligible for inclusion in the National Register of Historic Places (NRHP). The term "eligible for inclusion in the NRHP" includes all properties that meet the NRHP listing criteria, which are specified in the Department of the Interior regulations Title 36 CFR 60.4 and NRHP Bulletin 15. Therefore, sites not yet evaluated may be considered potentially eligible for inclusion in the NRHP and, as such, are afforded the same regulatory consideration as nominated properties. Whether prehistoric, historic, or traditional, significant cultural resources are referred to as "historic properties."

Note: On June 17, 1999, the revised regulations implementing Section 106 of the NHPA (36 CFR 800) were officially put into effect. The new regulation significantly modifies the review process, introducing new streamlining while incorporating statutory changes mandated by the 1992 amendments to the NHPA. Substantial information relating to the changes in 36 CFR 800 can be found at the ACHP internet web site.

To relieve the burden on agencies to revise documents already in an "advanced" state of review at the time of the regulation change, the ACHP suggests completion of those "in progress" documents under the old (pre-June 1999) regulations. Because of the complexity of this EIS and the length of time the document has been under preparation and review, guidance under the old regulation has been maintained.

Region of Influence

For the purposes of this analysis, the term ROI is synonymous with the "area of potential effect" as defined under cultural resources legislation. In general, the ROI for cultural resources at each location encompasses areas requiring ground disturbance (e.g., areas of new facility/utility construction) and all buildings or structures requiring modification, renovation, demolition, or abandonment. Specific cultural resources ROIs for each installation and alternative will be provided within each subsection.

3.5.1 ALASKA INSTALLATIONS

Following is a brief prehistory and history encompassing the Alaska NMD ROIs. The description is divided into two parts: Interior Alaska (which encompasses the areas associated with Clear AFS, Eielson AFB, Fort

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Greely, and the Yukon Training Area) and the Aleutian Islands (which encompasses the area associated with Eareckson AS). Together, these discussions provide a general context for the types of cultural resources known to exist, or that have the potential to occur, within the two Alaska ROIs. Detailed information can be found in the numerous reports cited within this section and listed in the reference list. Installation-specific information is found within each subsection.

Interior Alaska

Because Interior Alaska was ice-free during the Wisconsin glaciation, prehistoric and historic archaeological sites have been recorded within the Interior that span the time period from the late Pleistocene to the present (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS). Some of these sites are among the oldest and most well-documented archaeological sites in North America (approximately 12,000 years before the present [B.P.]) and are characterized by microblades, bifaces, a burin technology, core bifaces, and bifacially-flaked projectile points (U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Lands in Alaska; U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

There are four divisions for the prehistory of Interior Alaska (discussed below). Euroamerican historical accounts began in the latter part of the 19th century, resulting in a relatively short Interior Alaska Historic Period (A.D. 1875 to the present).

Nenana and Denali Complexes (12,000 to 7,000 B.P.). The earliest known inhabitants of Interior Alaska were likely adapted to exploitation of late glacial tundra or steppe-tundra environments. Trees were generally absent from the landscape, warm and dry conditions prevailed, and populations of herd animals (e.g., bison, caribou) are believed to have been plentiful. The remains of these inhabitants are represented by Nenana Complex archaeological sites, which are characterized by teardrop-shaped knife forms and triangular, bifacially-flaked projectile points. Noteworthy archaeological sites representing this complex include Components 1 of the Dry Creek, Moose Creek, and Walker Road sites (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

The Denali Complex spans the Pleistocene-Holocene boundary and appears to date to between 10,690 and approximately 7,000 B.P. Characteristic artifacts of this archaeological culture include wedge-shaped microblade cores, microblades, burins, leaf-shaped biface knives, and scrapers. Inhabitants of this period appear to have been more adapted to tundra environments. Noteworthy archaeological sites representing this complex include Dry Creek (Component II), Dragonfly Creek, and several sites in the Alaska Range drainage. Early Denali

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materials are also documented from the Healy Lake and Chugwater sites (near Eielson AFB) (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

Northern Archaic Tradition (6,000 to 2,000 B.P.). About 6,000 years ago, the Northern Archaic tradition appeared in Interior Alaska. This culture is generally associated with a boreal forest adaptation to climate and vegetation changes and is believed to coincide with the expansion of white spruce. Hallmarks of this tradition include side-notched projectile points (which may relate to either hunting or wood-working); large, irregular knives; steep-angled end scrapers; cobble choppers; and crescent to oval-shaped bifaces (U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Lands in Alaska; U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS). Key archaeological sites representing this complex include the Tok Terrace site, Healy Lake, the Chugwater site, and several other sites in the Fairbanks area.

Late Denali Complex (3,500 to 1,500 B.P.). The artifacts ascribed to the Late Denali Complex are similar in many respects to the early Denali Complex, even though the ages of the two differ by several thousand years. Microblades and notched points are most typically found; however, cores, burins, and endscrapers are also seen. Sites of the Late Denali Complex are found throughout the middle Tanana Valley, the Goldstream area, and areas just north and east of Fairbanks (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

Athapaskan Tradition (2,000 B.P. to the Present). Sites derived from the Athapaskan Tradition encompass roughly the last two millennia; however, they are comparatively rare in numbers. This rarity is believed to represent high mobility and seasonal human movements, cremation practices, and an apparent tendency towards settlements along major waterways. The prehistoric Athapaskan period is represented by several well-documented sites. Two of these include the Nenana River Gorge site (near Moody), the components of which were deposited between A.D. 1500 and 1685 and the Porcupine River site (in the Yukon), which may have the longest continuum of any site of this age (from 1,200 to 100 years B.P.). Artifacts associated with these sites include copper tools, wood and bone tools, crude pottery, fire-cracked rock, pecked and ground-stone tools, and unmodified flakes (U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Lands in Alaska; U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

Historic Period (A.D. 1875 to Present). Indirect contact between the Alaska Natives and Euroamerican immigrants in Interior Alaska began in the 1830s and 1840s, when trading posts were established at Nulato and Fort Yukon; British traders established a post at Fort Yukon in 1847.

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During the 1860s, non-native prospectors, traders, and explorers (primarily British and Russian) immigrated to Interior Alaska and began directly trading with the local native groups (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

In 1867, the Territory of Alaska was purchased from Russia, but even at that point, very little was known about the area and, in particular, Interior Alaska. Several expeditions were made between 1885 and the turn of the century to map the Copper, Tanana, Yukon, and Kyoukuk rivers (Fairbanks Convention and Visitors Bureau, 1998—Fairbanks Alaska Visitors Guide), but it was not until 1902, when gold was discovered in Fairbanks, that large numbers of non-native immigrants settled in Interior Alaska. With the influx of gold seekers, roadhouses and way stations were constructed along many of the existing Alaska Native trails. The roadhouses and way stations assisted the horse and dog teams that traversed the wilderness (Northern Land Use Research, Inc., 1996—Archaeological Survey) and served the local native groups, as well as subsistence hunters and trappers, prospectors, miners, market meat hunters, and mail delivery men. Numerous existing trails were improved into roads, including the Bonnifield Trail, which was a good winter road from Fairbanks to Gold King Creek; the Kobi-Bonnifield Trail, which ran from the Bonnifield mining district (in the Wood River area) to just south of present-day Clear AFS; and the Valdez-Fairbanks Trail (later called the Richardson Highway), which was an essential overland trail between the Pacific Ocean and Interior Alaska (Northern Land Use Research, Inc., 1996—Archaeological Survey, Eielson AFB).

Increased mining and trading in Alaska led the Army to improve communications systems in the region and construct the Washington–Alaska Military Cable Telegraph System. Completed between 1899 and 1906, the Washington–Alaska Military Cable Telegraph System connected areas such as Fort Liscum (in Valdez) and Fort Egbert (in Eagle), across the "fortymile" region east of Fort Greely and down the Tanana River to Fort Gibson, at the village of Tanana (Northern Land Use Research, Inc., 1996—Archaeological Survey, Eielson AFB; Office of History and Archaeology, 1998—Draft Integrated Cultural Resources Management Plan). Part of this system included the construction of small cabins spaced at intervals of about 64 kilometers (40 miles).

In 1904, the town of Fairbanks was incorporated and named after Charles W. Fairbanks, a senator from Indiana (later to become Vice President under Theodore Roosevelt) (Fairbanks Convention and Visitors Bureau 1998—Fairbanks Alaska Visitors Guide). That same year, the U.S. Army Signal Corps established the McCarthy Telegraph Station adjacent to the Fairbanks–Valdez Trail, and Delta Junction was established as a road construction camp and telegraph station. In 1914, the Alaska Railroad was authorized by Congress and constructed between Fairbanks and Seward (completed between 1915 and 1923)

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(the line runs adjacent to Clear AFS). Many of the town names now in usage along the railroad route evolved from construction camps established to build the railroad; Nenana and Anchorage were the largest of the railroad towns (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

Between 1920 and 1927, the new Richardson Highway was constructed east of the old Valdez Trail to link Fairbanks with the seaport of Valdez, and the Steese Road was built to connect Fairbanks to Circle City on the Yukon River. The Alaska Highway connecting Alaska and the lower 48 United States was constructed during World War II. Taking only 8 months to construct, the road was built by the 97th Army Corps of Engineers (University of Alaska Museum 1996—Guide to the University of Alaska Museum).

In 1968, oil was discovered at Prudhoe Bay and, shortly thereafter, the construction of the Trans-Alaska Pipeline began. Extending from Prudhoe Bay to Valdez, the pipeline is one of the largest pipeline systems in the world. Passing through Fairbanks and Delta Junction, the pipeline transports 20 percent of the U.S. oil production.

Native Populations/Traditional Resources. The native peoples of Interior Alaska (i.e., Athapaskans) have survived as a recognizable group in Alaska for more than 10,000 years. At the time of Euroamerican contact, the areas of Interior Alaska encompassing the NMD ROI were traditionally used by the Tanana Athapaskans. These groups primarily utilized the Nenana, Tanana, Wood, and Chena River drainages, but ranged southward into the foothills of the Alaska Range. Native bands traditionally had permanent, seasonally-used camps (which sometimes shifted) that were used for hunting and salmon fishing and, later, for trapping (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS). Their economy was based on subsistence hunting, fishing, and trapping of such animals as moose, caribou, black and brown/grizzly bear, salmon, and muskrat and was supplemented by the gathering of edible plants, especially berries. Paper birch was used to make baskets, canoes, and assorted household utensils. Trade goods (beads and other Western items) entered Interior Alaska through aboriginal trade routes well before the arrival of Euroamerican explorers and fur traders (University of Alaska Museum 1996—Guide to the University of Alaska Museum).

Before 1870, the Tanana Athapaskans cremated their dead, marking pyre sites with forked sticks and with a crosspiece between them. After Euroamerican contact, prepared graves became a standard practice that continues to the present (Northern Land Use Research, Inc. 1996—Archaeological Survey).

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Paleontological Resources. Interior Alaska is dominated by boreal forest environments, where white and black spruce, birch, aspen, and willow dominate the landscape. North facing slopes and valley bottoms generally have permafrost soil, sediment, and rock that remain frozen all year long. Because of this, many areas of Interior Alaska have the potential for paleontological remains (University of Alaska Museum 1996—Guide to the University of Alaska Museum). This is largely attributed to the fact that arctic and subarctic frozen soils (i.e., permafrost) preserve very old organic remains in excellent condition. Vertebrate remains are most often preserved in glacial age eolian and fluvial sediments; alluvium and colluvium have good potential for bone preservation; and invertebrate and plant fossils are likely to occur in association with the Tertiary-aged coal-bearing layers (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

In addition to a variety of plant and invertebrate life forms, 31 species of Ice Age mammal once roamed the grassland of Interior Alaska, including the woolly mammoth, the muskox, the American lion, the American horse, and the bison. Abundant evidence of the so-called "mega" fauna was exhumed during 1920s and 1930s placer mining in the Tanana Valley (Northern Land Use Research, 1996—Archaeological Survey). Paleontological remains that have been recorded within Interior Alaska include fossil plants and impressions; mammoth teeth, tusks, and bones; bison horns and bones; petrified wood; beaver and badger skulls; casts of the giant sloth; and freshwater clams (U.S. Department of the Interior, 1997—Northern Intertie Project, Draft EIS).

Aleutian Islands

The earliest evidence for settlement of the Aleutian Islands has been recorded in the eastern part of the chain on Anangula (within the Fox Islands), where a core and blade technology has been radiocarbon-dated to about 8,000 years B.P. The Anangula Industry (which spans approximately 10,000 to 4,500 years B.P.) appears to represent a variant of some of the oldest known archaeological remains in Alaska. By about 5,000 years ago, a distinctive Aleutian tradition (5,000 years B.P. to the present) is recognized in the Fox Islands at sites such as the Chaluk midden (on Umnak Island). The tradition is characterized by stemmed points and knives, stone lamps, diagnostic barbed harpoon and lance points, and polished slate ulus. Sites are represented by deep middens containing the remains of sea mammals, fish, shellfish, and sea urchins and traces of semi-subterranean houses (Drummond, 1983—Alaska and the Northwest Coast).

At Amchitka in the Rat Islands, the stone and bone artifacts are similar to those from Chaluka and include the remains of sea mammals, birds, fish, and invertebrates. A house dated to about 1500 A.D. was elliptical and

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apparently entered through a hole in the roof. Associated tools included polished stone ulus (Drummond, 1983—Alaska and the Northwest Coast).

Farther west, collections from the Near Islands are stylistically the most variant of all those in the Aleutian Chain. Chipped stone artifacts include a very high proportion of elliptical to leaf-shaped bifaces similar to some found at Umnak (Drummond, 1983—Alaska and the Northwest Coast).

Although some changes occur in artifact style and dwelling form, the material culture of the prehistoric Aleuts remained fundamentally unchanged throughout prehistory—a phenomenon that likely suggests their isolation from other peoples of the northern Pacific (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan).

Beginning in the 18th century, Russian sailors and fur traders began to explore the Aleutians. The first recorded contact occurred in 1741, when a Russian ship anchored off what is believed to be Adak Island. Exploration and exploitation of the islands and their resources (particularly whale, sea otter, and seal) continued until 1867 when the United States purchased the entire Alaskan territory. The purchase set off a new wave of hunting and trapping in the islands that ultimately led to overhunting and a drastic decline in the number of otters and seals. By that time, violence between the native Aleuts and the Russians, disease, and an overall disruption of the Aleut society had caused the population of the Aleutians to decline by as much as 80 percent (Engineering Field Activity Northwest, 1996—HARP Plan for the Adak Naval Complex).

In the early 20th century, international treaties and Federal laws limited hunting and designated most of the archipelago as a national wildlife refuge. At about the same time, the United States was expanding into the Pacific, and U.S. military planners began to realize the strategic importance of Alaska and the Aleutian Islands. It was not until World War II, however, that the importance of the Aleutians became critical when, after the attack on Pearl Harbor, the western Aleutians were occupied by the Japanese. Soon after the occupation, the U.S. Army landed on Adak Island and rapidly built an air base. The Navy soon followed and established a seaplane base and a port. For the next several months, Adak was the forwardmost base of the U.S. military in the Aleutians and proved instrumental in U.S. efforts during the Aleutian Campaign. After the war, most of the various bases in the Aleutians were deactivated; however, both Adak and Shemya were retained (Engineering Field Activity Northwest, 1996—HARP Plan for the Adak Naval Complex).

Native Populations/Traditional Resources. Archaeological investigations indicate that the native peoples of the Aleutian Archipelago have survived as a recognizable group in Alaska for at least 8,000 years. At the time of Euroamerican contact, the area encompassing the NMD ROI was

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traditionally used by the Aleut. The Aleut, or Unangan, as they call themselves, have relied almost exclusively on the sea. Historically, terrestrial animals have been virtually absent from the islands. Settlements have been clustered by the coast near sources of fresh water, large inter-tidal zones with sources of food, and areas offering some protection from the nearly constant storms. Settlement patterns also indicate that the Aleuts may have considered defense an important factor.

The Aleuts usually dwelled in large, communal, semi-subterranean structures of grass and earth over a driftwood or whale bone frame; smaller structures served as storage facilities and summer dwellings. The Aleuts depended on the seal for the majority of their food, and hunted whales, seals, otters, and especially sea lions, with harpoons and darts. The Aleuts used skin-covered kayaks to hunt on the open waters and supplemented their marine diets with birds, bird eggs, plants, and a variety of berries. Each village would generally have a recognized leader, but beyond the village (or small island) there was no particular organization. Leadership was frequently hereditary, and leaders were often whaling captains as well as the heads of the strongest family in the village.

Lifeways of the Aleut remain essentially unchanged today, with the communities in the Aleutian Archipelago almost entirely dependent on subsistence (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan).

Paleontological Resources. The Aleutian Islands are composed almost entirely of Tertiary and Quaternary volcanic and volcaniclastic rock. Water, wind, and ice erode the landscape, and there is considerable earthquake activity, as a result of tectonic plate movements along the Aleutian arc; a type of maritime tundra covers most of the area (University of Alaska Museum, 1996—Guide to the University of Alaska Museum). The older rocks of the Aleutians date back to the Paleozoic with the region being underlain by Cenozoic lava flows; volcanic ash, pumice, cinders, glacial till, outwash, and alluvium cover the bedrock. It is unlikely that permafrost occurs in the Aleutian Islands, but glacial erosional processes are active because of the cold, wet climate (U.S. Fish and Wildlife Service, 1988—Alaska Maritime National Wildlife Refuge, Final Comprehensive Conservation Plan).

There are no reports of paleontological sites within the Aleutian Islands; however, given the physiographic setting, fossils are possible.

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3.5.1.1 Clear AFS—Cultural Resources

Prehistoric and Historic Archaeological Resources

For general archaeological information about Interior Alaska, see section 3.5.1.

Archaeological evidence indicates that the region around Clear AFS has been occupied for about 12,000 years. Although no specific sites have been found within the boundary of the installation, sites in nearby locations have been dated to that time frame. Sites characterized by projectile points, cores, and tools for preparing animal skins and food have been identified in areas around the installation.

Before 1991, no cultural resources surveys of Clear AFS had been undertaken. That year, the Oak Ridge National Laboratory initiated surveys to locate prehistoric and historic resources and to reconnoiter the station for potential future discovery of cultural resources. The 1991 survey identified no prehistoric archaeological sites and recorded two historic archaeological sites (a railroad camp and a portion of the Alaska Railroad bed), both of which have been determined to be potentially eligible for inclusion in the NRHP (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan).

In 1994, Northern Land Use Research, Inc. conducted additional survey (covering over 800 hectares [2,000 acres]) of the installation to build upon the previous survey and provide a basis for a Cultural Resources Management Plan. No prehistoric archaeological sites were identified (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan).

Results of the two surveys indicate that there are no areas within the boundary of Clear AFS with high potential for prehistoric archaeological resources. Based on geomorphic indicators and the amount of ground disturbance in some areas, the ancient Healy Terrace and the Nenana River margin have moderate potential for prehistoric use, and the central portion of the installation has low potential for preserved sites and requires no further survey (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan).

The currently defined NMD ROI (see figure 2.4.1-1) has not been surveyed for prehistoric or historic archaeological resources. However, neither of the historic sites is within the ROI, and the entire ROI is situated within the area determined by Northern Land Use Research to be of low archaeological potential (and requiring no further studies); the Alaska SHPO has concurred (Novak, 1998—Personal communication).

Detailed information about the 1991 and 1994 surveys can be found in the *Cultural Resources Survey and Management Plan of the Clear Air*

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Force Station (1991) and *Cultural Resources Literature Search and Inventory Plan for Clear Air Force Station* (Northern Land Use Research, Inc. 1994).

Historic Buildings and Structures

The earliest non-indigenous use of the Clear AFS area was by the U.S. military, shortly after World War II (1949), when an airstrip was constructed. At that time, the installation was named Clear Air Force Air Auxiliary Field (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS). By 1950, the area of Clear AFS had become the Master Ground Control Intercept of the Air Force's Alaskan Interim Air Defense System. Between 1950 and 1960, Clear AFS became part of the White Alice Communications System and provided communications to the continental United States along the southeastern coast of Alaska. During the height of the Cold War, this installation provided 15-minute warning in the event of a Soviet-launched ICBM towards the United States, thereby allowing the United States time for interception of incoming missiles (Clear AFS, 1993—Comprehensive Planning Framework). In 1959, construction of the Ballistic Missile Early Warning System radar and support facilities (a faster early warning system) began, with operational capability being achieved in 1961 (Clear AFS, 1993—Comprehensive Planning Framework; U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS). The detection radars, tracking radar, and associated buildings for the Ballistic Missile Early Warning System sites were the primary missile tracking and early warning systems of the Cold War era.

Currently, the installation's mission is to detect and provide early warning of a ballistic missile attack and to detect and monitor the behavior of satellites and space objects (Clear AFS, 1993—Comprehensive Planning Framework).

In 1995, the Argonne National Laboratory conducted an inventory and evaluation of Cold War-era properties at 21st Space Wing installations (Argonne National Laboratory, 1995—Historic Properties of the Cold War Era). Eight Ballistic Missile Early Warning System buildings/structures at Clear AFS (Buildings 101, 102, 104, 105, 106 and Structures 735, 736, and 737) were identified as potentially eligible for listing in the NRHP, and the Alaska SHPO has concurred (State of Alaska, Department of Natural Resources, 1997—Letter from the State Historic Preservation Officer). The Clear AFS Ballistic Missile Early Warning System is the only remaining mechanical radar warning system in the United States (Clear AS, 1998—Visitors Briefing). In 1996, the Ballistic Missile Early Warning System was considered for demolition; consultation with the Alaska SHPO has identified the need for a Memorandum of Agreement and Historic American Engineering Record documentation for this undertaking (Department of the Air Force, 1996—Memorandum from Peterson AFB).

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In addition, the Clear AFS White Alice Communications System site has been included in a historic inventory of statewide White Alice Communications System sites; a determination of eligibility for the site has not been finalized.

Plans to modify or demolish existing facilities to support NMD activities (see section 2.4.1.1) will not involve any of the Ballistic Missile Early Warning System or White Alice Communications System buildings or structures; however, new facilities would be constructed near some of these potential properties.

Native Populations/Traditional Resources

Clear AFS is located within the traditional territory of the Nenana–Toklat band of the Lower Tanana Athapaskan Indians. The area was used by Athapaskan bands for hunting moose and small game animals as they moved across the land seasonally (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan).

No Alaska Native traditional cultural properties have been identified within the NMD ROI or the boundary of Clear AFS. Local Alaska Native groups with which Clear AFS typically consults include the Tanana Chief's Conference and the Toghotthele Corporation (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan).

Paleontological Resources

Most of Clear AFS is situated within a broad glaciofluvial outwash plain composed of sandy gravel (Clear AFS, 1993—Comprehensive Planning Framework); portions of the ROI may be underlain by permafrost.

Although no paleontological remains have been recorded within the NMD ROI or the boundary of the installation, evidence of several forms of extinct animals has been found in the vicinity. Evidence of mammoth (radiocarbon dated to about 13,500 years) has been found in the Teklanika River drainage (west of the station), and remains of elk (from approximately 11,120 years ago) and steppe bison (from approximately 10,690 years ago) have been found near Healy (U.S. Department of the Air Force, 1997—EA for Radar Upgrade, Clear AS).

3.5.1.2 Eareckson AS—Cultural Resources

Prehistoric and Historic Archaeological Resources

For general archaeological information about the Aleutian Archipelago, see section 3.5.1.

The prehistory of the Near Islands (which includes Shemya Island) has been only sporadically studied due to their relative inaccessibility.

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Syntheses of Aleutian prehistory, which address this westernmost group of Aleutian Islands, indicate that they were settled much later than the central and eastern island groups (U.S. Department of the Air Force, undated—EA Shemya Borrow Pit and Rock Quarry Plan).

It is assumed that the Aleutian Islands were first settled in the Umnak Island area and that inhabitants then spread east and west until the entire chain became occupied. One dated archaeological assemblage in the Near Islands (on Krugloii Point on Aggatu Island) has been dated to 2,600 years ago. Based on the presence of some artifact classes there, as well as on Shemya and Attu, and their absence elsewhere, it has been hypothesized that the Near Islands inhabitants lived in relative geographic isolation from the rest of the archipelago. Of all the assemblages in the Aleutians, the Near Islands are the least typical stylistically. Near Islands assemblages appear distinctive from 2,600 years ago until about 400 years ago, when similarities to other assemblages farther east became more apparent (U.S. Department of the Air Force, undated—EA Shemya Borrow Pit and Rock Quarry Plan). Diagnostic artifact types include barbless fishhooks, flaked semi-lunar knives, and stylistic patterns (including circle and dot decoration of bone and serration of stone points). Art objects also exhibit unusual features such as ivory figurines with ovoid trunks and pegged-on appendages that bear a similarity to some northeast Asian cultures.

It is uncertain whether Shemya Island was inhabited when first sighted by the Russians in 1741. However, Russian records reveal that, when they arrived, practically every island was inhabited—Agattu alone had 31 villages. The first recorded contact between Europeans and the native people of the Near Islands was in 1745, when Russian hunters landed on Agattu and Attu in search of sea otters. It has been estimated that at that time the Near Islands had a population of approximately 1,000 Aleuts—Shemya island was apparently occupied by approximately 100 people.

By the end of the 1760s, the Aleut population of the Near Islands had declined to about 100 and Shemya Island was abandoned as a permanent settlement. Shemya remained essentially unpopulated until around 1922, when trapper's cabins were built on both Attu and Shemya Island for the trapping of the introduced arctic fox. In 1940, there were approximately 40 inhabitants of Attu, who used the cabins on Shemya for trapping—there were no permanent inhabitants of Shemya Island at that time.

Although archaeological investigations of the Near Islands began as early as the late 1800s (on Attu and Agattu), no professional surveys of Shemya Island were conducted until after World War II. In 1948, the locations of four prehistoric sites were plotted on the basis of an aerial reconnaissance. In the early 1960s, a student from the University of

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Alaska located seven sites (including the four previously plotted). The information from this investigation represents the only record of several of these sites, which have since been destroyed. In 1985 and 1988, additional surveys were conducted to document claims made by the Aleut Corporation (under the Alaska Native Claims Settlement Act); however, only one site (ATU-003) was located during these surveys. Between 1990 and 1994, additional sites were located and samples taken for radiocarbon dates and paleobiological analyses.

A total of nine prehistoric archaeological sites have been recorded on Shemya Island. Three of the sites have been destroyed by previous construction, and the remaining six have been disturbed by construction and/or vandalism. In addition to the nine, two other locations have apparently yielded isolated artifacts, but have thus far failed to provide evidence of sites.

All of the prehistoric sites recorded on Shemya Island are located along the shoreline and represent middens occupied by prehistoric Aleuts. The sites consist primarily of sea urchin remains, organic-rich sediments, large quantities of bone and shell, and artifacts of stone and bone. Traces of semi-subterranean houses appear to be present at some sites, and at least one burial has been reported (site ATU-061). There have been no reported sites from the higher elevations of the island (Hoeffecker, 1998—Letter regarding archaeological survey).

The currently defined NMD ROI for Eareckson AS includes the 16-hectare (40-acre) XBR construction site and any other areas where ground disturbance could occur (e.g., utility corridors). In 1998, the proposed area for the NMD XBR was surveyed by Hoeffecker (1998); no prehistoric or historic sites were identified. The Alaska SHPO has reviewed the survey information and concurred that there are no historic properties within the NMD XBR ROI (State of Alaska, Department of Natural Resources 1998—Letter from Bittner, J., August 17).

Historic Buildings and Structures

World War II had an enormous impact on the population, economy, and culture of the Aleutian Islands. The western Aleutians possessed strategic military importance to the United States because of their relative proximity to northern Japan, and Shemya Island was especially suitable for long runways and the operation of large bombers.

In June 1942, carrier-based planes attacked U.S. Army and Navy forces at Dutch Harbor and Japanese troops landed on Attu and Kiska, but Shemya remained unoccupied. Occupation of these American islands was of limited strategic significance to the Japanese, but it represented enormous psychological and propaganda value. As a counter-offensive, the United States established new bases on Adak and other islands and began air

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attacks of Kiska and Attu in May 1943. Kiska was isolated at this time and subsequently abandoned by the Japanese; however, the Japanese garrison on Attu was destroyed by the American strike in the second most costly battle of the World War II Pacific Theater. Towards the last days of this battle (May 11–30), U.S. Army units landed on Shemya Island to begin construction of an airfield and, by the end of 1943, the United States had established bases on both Attu and Shemya.

In addition to the runway, between 1943 and 1944 the Army erected Quonset huts, numerous permanent buildings such as a large hospital (now demolished), warehouses, a recreation hall, four massive birchwood hangars, and defensive fortification, such as concrete bunkers and gun emplacements. At the end of 1943, the Aleutians ceased to be a combat theater and the Japanese made no further attempt to contest U.S. control of the island chain; the final bombing raid from the Aleutians was launched from Shemya in August 1945.

Between 1945 and the early 1950s, Shemya Island had only limited military importance, and activities and personnel at the base were reduced. No new facilities were constructed on the island during that time, and its mission was primarily as a refueling stop for support and supply aircraft on the Great Circle Route between the Far East and North America. At that time the base was assigned to the Alaskan Air Command and operated by the 5021st Air Base Squadron. In 1954, following the Korean Armistice, the base at Shemya was deactivated and its facilities turned over to the Civil Aeronautics Authority. Subsequently, the facilities were leased to Northwest Orient Airlines, which used them for refueling commercial aircraft until 1961. The airlines constructed some additional facilities during that time, including 12 small dormitories, one of which remains (Building 527).

In 1958, Shemya Island was reactivated as an Air Force installation and assigned to the 5040th Air Base Squadron. Between 1958 and 1972, many additional Cold War military facilities were constructed, including a large dormitory, a mess hall, a chapel, maintenance shops, a radar, and three antennas. White Alice Communications System facilities were constructed on both Shemya and Adak in the 1960s; however, the Shemya facility was demolished in the late 1970s and replaced by a phased array radar (designated COBRA DANE), which became operational in 1977.

In 1993, Shemya Air Force Base was redesignated Eareckson Air Force Station. In 1994, as a result of downsizing, the Air Force Station was further redesignated an Air Station.

An inventory of historic buildings and structures was conducted by Argonne National Laboratory in 1996. Although numerous World War II and Cold War features are extant, the only facility from these periods at

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Eareckson AS determined to be significant is the COBRA DANE radar. Plans to modify existing facilities to support NMD activities (section 2.4.4.1) do not include modification of the COBRA DANE radar; however, construction of the new XBR would be in the vicinity of this property.

Native Populations/Traditional Resources

Eareckson AS is located within the traditional territory of the Aleut. Nine archaeological sites have been recorded on Shemya Island; however, none have been determined to be Alaska Native traditional cultural properties.

The regional Alaska Native group with which Eareckson AS typically consults is the Aleut Corporation.

Paleontological Resources

The surface of Shemya Island is typical of hummocky glaciated terrain and tundra regions. A veneer of past or mid-Wisconsin (10,000 to 25,000 years ago) unconsolidated sediments cover the raised wave-cut platform of the island, and a thin layer of outwash sand and ground moraine till are observed in low areas. Active and stable sand dunes are along the entire south shore of the island with accumulation of up to 15 meters (50 feet) (U.S. Department of the Air Force, undated—EA Shemya Borrow Pit and Rock Quarry Plan). Knee-high tundra grass covers most of the island (Morrisette, 1988—Shemya).

There have been no paleontological sites reported on Shemya Island; however, given the physiographic setting, fossils are possible.

3.5.1.3 Eielson AFB—Cultural Resources

Prehistoric and Historic Archaeological Resources

For general archaeological information about Interior Alaska, see section 3.5.1.

Archaeological evidence indicates that the Eielson AFB area has been occupied for at least 9,000 years, and likely (based on sites dated in the Nenana and Upper Tanana Valleys) for 12,000 years. Despite this antiquity, the density of archaeological sites within this region is very low. This is possibly a function of limited subsistence resources in the area and/or a historically low density population (Northern Land Use Research, Inc. 1996—Archaeological Survey Eielson AFB).

Between May and August of 1996, a systematic cultural resources survey of three large areas (designated survey areas A through C) was conducted at Eielson AFB. The three areas were based on a predictive

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model developed for the installation in 1994 (Northern Land Use Research, Inc., 1994—Predictive Model for Discovery of Cultural Resources). One hundred percent visual survey accompanied by soil probes and shovel tests covered the three areas (approximately 5,459 acres). Although archaeological sites have been recorded from adjacent lands on Fort Wainwright, no significant prehistoric or historic sites were discovered within any of the survey areas on Eielson AFB, and no further studies are recommended. If significant resources are present, it is believed that their discovery will be inadvertent through erosion and/or exposure of deeply buried sites through construction projects (Northern Land Use Research Inc., 1996—Archaeological Survey Eielson AFB, Management Summary). One paleontological site was investigated and is described below.

A number of cultural features associated with recent military activities, trapping, and hunting were identified during the survey. Ten features and 54 isolated objects were identified within Survey area A (e.g., a hunting stand and can scatter); 16 features and 96 isolated objects were identified within Survey area B (e.g., a collapsed cabin, can dumps, and a wooden sign); and 28 features and 77 isolated objects were identified within Survey area C (e.g., bunkers, foxholes, lean-tos, and collapsed cabins). All of the features or isolates noted during the survey were determined to be of little or no significance, and most (e.g., the cabins) retained no integrity. Detailed information about the survey and the predictive model can be found in the reports prepared by Northern Land Use Research, Inc. (1994—Predictive Model for the Discovery of Cultural Resources; 1996—Archaeological Survey Eielson AFB; Management Summary).

The NMD ROI for Eielson AFB is currently unspecified. Ground disturbance associated with construction of facilities or utilities could occur anywhere within the boundary of the installation.

Historic Buildings and Structures

The area now known as Eielson AFB lies adjacent to two transportation and communication routes significant to the development of Alaska—the Washington–Alaska Military Cable Telegraph System and the historic trail connecting Valdez and Fairbanks (see section 3.5.1). Thus, Euroamerican use of the area in both historic and recent times is likely. Features associated with this usage would include cabins, fur-bearer traps, wood-cutting lots, dog yards/pens, garden plots, etc. (Northern Land Use Research, Inc., 1996—Archaeological Survey Eielson AFB).

In June 1943, the Western Defense Command authorized construction of an airfield at Mile 16 on the Richardson Highway. Named "26 Mile Field," the new airfield was a satellite to Ladd Field (now Fort Wainwright) to receive excess Soviet Lend-Lease aircraft. Consisting of a

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2,019-meter (6,625-foot) runway and a birchwood hangar, the field was underutilized between 1943 and 1944 and was placed in caretaker status in June 1945 (U.S. Army Corps of Engineers, 1995—Historic Building Survey).

In 1946, military planners decided that a strategic bomber base was needed in Interior Alaska, and "26 Mile Field" was reactivated. The runway was extended to 4,426 meters (14,520 feet), and buildings were constructed to house the planes on a rotational basis. In 1947, the 59th Reconnaissance Squadron was placed at the installation for a variety of missions, including weather reconnaissance. By 1948, the installation had been renamed Eielson AFB in honor of famed Arctic aviation pioneer Carl Ben Eielson and, throughout the 1950s, supported rotational Strategic Air Command forward-based bombers and tankers. There was also a major base expansion during this period with the construction of several new permanent facilities, including the central heat plant, ammunition storage igloos, taxiways, hydrant fueling systems, roads, and a hangar (Building 1140).

In 1961, Eielson AFB assumed all Interior Alaska Air Force duties with the transfer of Ladd AFB to the Army. During the 1970s, 0-2A forward air control aircraft were assigned to the installation to support Army missions. These aircraft departed in 1981 to allow for the arrival of the first A10s, and during that time additional construction was initiated. F-16s were assigned to the base in 1991, and the Pacific Air Force premier flying training exercises (COPE THUNDER) relocated to Eielson from Clark Air Base in the Philippines in 1992.

Currently, the 354th Fighter Wing flies F-16C and D Falcons and A-10 and OA-10 Thunderbolt I's and operates COPE THUNDER and three ranges. The 168th Air Refueling Wing utilizes KC-135Rs.

No historic buildings/structures have been identified on Eielson AFB; however, several have been identified as possibly historic during the ongoing Historic Building Inventory being worked with the SHPO. The Alaska SHPO has indicated that Buildings 500 (FAI-608) and 1185 (FAI-609) may be eligible for listing in the NRHP. Building 500 was the home of the Atomic Energy Detection System from 1954 to 1977, and Building 1185 is a nose hangar constructed in 1946 for small- and medium-sized aircraft. Building 500 will be demolished in 1999, and Building 1185 was demolished in 1998 under a Memorandum of Agreement among the Council, the SHPO, and the base. The Alaska SHPO has also indicated interest in a cluster of eight buildings within the Eielson AFB cantonment that may represent a Cold War historic district (Buildings 1221, 1230, 3425, 4112, 4113, 4365, 3409, and 3411) (State of Alaska, Department of Natural Resources, 1998—Letter from Bittner, J., January 30). A final determination on the eligibility of these buildings has not yet been made.

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Building 1120 (Nose Dock); Building 1140 (SAC hangar); Building 1306 (Intelligence Operations); and the WB-29 aircraft (Serial Number 44-62214), known as Lady in the Lake, are also under consideration.

Plans to modify existing facilities at Eielson AFB to support NMD activities are described in section 2.4.1.3. The Alaska SHPO has expressed interest in Building 3425 (a warehouse) as an element of a potential Cold War historic district; however, a formal determination on the eligibility of this building has not yet been made.

Native Populations/Traditional Resources

No Alaska Native traditional cultural properties have been formally identified within the Eielson AFB NMD ROI. Alaska Native villages situated at the mouths of the Chena and Salcha rivers probably included this area in their subsistence areas; however, no archaeological sites or traditional cultural properties have been recorded (Northern Land Use Research, Inc., 1996—Archaeological Survey Eielson AFB; 1996—Archaeological Survey Eielson AFB, Management Summary).

The Alaska Native group with which Eielson AFB typically consults is the Tanana Chief's Conference (Northern Land Use Research, Inc., 1996—Archaeological Survey Eielson AFB; 1996 Archaeological Survey Eielson AFB, Management Summary).

Paleontological Resources

Several paleontological sites have been discovered within the boundary of Eielson AFB. Most of the finds have been located in pits during the quarrying of gravel and include bones and teeth of moose, bison, and Woolly Mammoth. The remains of several unidentified species have also been located.

In addition, one known site was investigated during the 1996 archaeological survey conducted by Northern Land Use Research, Inc. (Northern Land Use Research, Inc., 1996—Archaeological Survey Eielson AFB; 1996—Archaeological Survey Eielson AFB, Management Summary). Located in the vicinity of Quarry Hill (within an Alyeska Pipeline Service roadcut), this site has an assigned a number from the State Office of History and Archaeology (XBD-164) and contains the remains of a mammoth. Stratigraphic samples taken during the 1996 survey indicate that the base of the site dates to greater than 51,000 radiocarbon years ago (Northern Land Use Research, 1996—Archaeological Survey Eielson AFB).

Although site XBD-164 was the only paleontological site noted during the 1996 cultural resources survey of Eielson AFB, fossil remains of Ice-Age mammals such as horse, bison, or mammoth may be located in a variety of locales on the base (e.g., along the lower slopes and valley bottoms).

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These areas hold potential for paleontological finds, which tend to be distributed randomly in organic rich and ice-rich sedimentary deposits (Northern Land Use Research 1996—Archaeological Survey Eielson AFB; 1996—Archaeological Survey Eielson AFB, Management Summary).

3.5.1.4 Fort Greely—Cultural Resources

Resources Prehistoric and Historic Archaeological Resources

For general archaeological information about Interior Alaska, see section 3.5.1.

Archaeological evidence indicates that the Fort Greely area has been occupied for between 10,000 and 12,000 years. Sites associated with the prehistoric era contain materials typical of those recorded from other sites within Interior Alaska (e.g., projectile points, cores, and tools for preparing animal skins and food).

Nine archaeological investigations have been conducted at Fort Greely. Six of the surveys were small clearance surveys within the cantonment; three were extensive investigations scattered throughout the training ranges. From these investigations, 84 prehistoric archaeological sites have been identified, all of which are located in one of three types of physiographic settings: on a high ridge, hill, or knoll; on a bluff or terrace overlooking a major river or site drainage; or on a lake margin. Sites are found in every vegetative community and predominantly west of the Delta River. Most of the sites are surface flake scatters, isolated artifacts, or are found in a disturbed context and contain insufficient information to determine site function, affiliation, or age. The remainder are largely associated with the Northern Archaic Tradition, although materials from earlier time periods have also been identified.

Fifteen of the identified archaeological sites have been found to be eligible for inclusion in the NRHP, including three individual sites and an archaeological district containing twelve sites (the Donnelly Ridge Archaeological District, located approximately 32 kilometers [20 miles] southeast of the NMD ROI) (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Greely Proposed Resource Management Plan, Final EIS). Thirty-four sites have been determined to be not eligible for inclusion in the NRHP; the remaining sites on the installation require additional evaluation (U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Army Lands in Alaska).

In 1997, a survey of the BRAC cantonment area (including the runway area) was conducted by the Bureau of Land Management and the Corps of Engineers, Alaska District (Reynolds, 1998—Archaeological Site Report, Fort Greely Cantonment Area). Due to a lack of subsurface artifacts, the area was cleared of cultural resources concerns.

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Detailed information about the prehistoric and historic sites at Fort Greely can be found in the *Historic Preservation Plan for U.S. Army Lands in Alaska* (U.S. Army Corps of Engineers, 1986), as well as the numerous survey reports cited within.

The currently defined NMD ROI for Fort Greely includes the 243-hectare (600-acre) GBI construction site and any other areas where ground disturbance could occur (e.g., utility corridors, roads, or runway modifications). This area is a large, essentially flat parcel, heavily disturbed in portions from past and present training missions. It is situated just south of the cantonment and approximately 1.6 kilometers (1 mile) from the nearest surface water. A review of the Alaska SHPO's archaeological database (conducted through the Fort Richardson data set) indicates that there are no recorded sites within the ROI; and that because of the degree of disturbance to the area and the physiographic setting within which the GBI ROI occurs, the potential for archaeological materials is considered low. However, to confirm this assumption, consultation with the SHPO determined that additional survey would be required. As such, an archaeological survey of the Fort Greely ROI was undertaken in August 1999. Results indicate that despite an extensive and intensive level of survey coverage and the use of subsurface archaeological testing methods considered appropriate and reasonable, evidence of prehistoric or non-military historic land use by Athapaskans or Euro-Americans was not found (Northern Land Use Research, Inc., 1999—Draft Cultural Resource Survey: Fort Greely and Yukon Training Area). Recent use sites (i.e., less than 50 years in age) are associated with contemporary hunters, trappers, and the military. None of these display sufficient significance or integrity to be considered eligible for listing in the NRHP. SHPO concurrence is pending.

Historic Buildings and Structures

Fort Greely originated as Station 17, Alaskan Wing, Air Transport Command in 1942. During World War II, the installation served as a rest and refueling stop for American pilots on their way to Ladd Army Airfield (now Fort Wainwright) to transport air freight and Lend-Lease planes to Russia (U.S. Army Alaska, 1997—Draft Integrated Natural Resource Management Plan).

In 1945, the installation was put on inactive status, but by 1948 had been reactivated for "Exercise Yukon," one of the first post-war cold weather maneuvers. in 1949, the installation became the site of the Arctic Training Center, because of its combination of extreme winter conditions and varied terrain (rivers, lakes, swamps, open plains) (U.S. Army Alaska, 1997—Draft Integrated Natural Resource Management Plan).

The Army Chemical Corps Arctic Test Team was established in 1950, and the post was renamed the Army Arctic Center in 1952. Construction began on permanent buildings to support cold weather testing and training (in the area now known as the Main Post) in 1953, and the installation had been renamed Fort Greely by 1955. Facilities constructed during that period included new housing, warehouses, and the military's first nuclear power plant (Office of History and Archaeology, 1998—Draft Integrated Cultural Resources Management Plan, Fort Wainwright).

In 1957, the Soviet Union successfully tested its first intercontinental ballistic missile. Antiaircraft defenses could not defend against such a weapon, and identifying and tracking missiles became a major component of the Air Force's mission. In 1959, a Missile Identification, Detection, and Alarm System was constructed at Donnelly Flats on Fort Greely. However, after 2 years of operation, the system was replaced by the Ballistic Missile Early Warning System station south of Fairbanks (Clear AFS), and the Missile Identification, Detection, and Alarm System was dismantled (Office of History and Archaeology, 1998—Draft Integrated Cultural Resources Management Plan, Fort Wainwright).

In 1963, elements of the Arctic Training Center were redesignated as the Northern Warfare Training Center with the mission of training units in the conduct of warfare in northern areas of operation. This center also became involved in emergency rescues and investigations across Alaska (e.g., climbing and aircraft accidents) (Charles M. Mobley & Associates, 1998—Historic Overview and Architectural Inventory of Fort Greely).

When the U.S. Army, Alaska, was restructured in 1974, Fort Greely became part of the 172nd Infantry Brigade, which was in turn replaced by the reactivated 6th Infantry Division (Light) in 1986. The 6th Infantry Division, which was deactivated in Korea following distinguished service in two world wars, was recalled as a specialized Arctic/mountain light contingency force under U.S. Army Pacific, with headquarters at Fort Richardson, where it remained until transferred to Fort Wainwright in 1990. In 1994, the 1st Infantry Brigade, 6th Infantry Division (Light), Headquarters, U.S. Army, Alaska became the active Army component at Fort Richardson.

As a result of archaeological investigations, three historic sites and a historic trail have been identified at Fort Greely—all are west of the Delta River. Sullivan Roadhouse on the Delta Creek (at the western edge of the Oklahoma Impact Area) is listed on the NRHP and a cabin, which dates from a molybdenum mining operation begun in 1914, is eligible. Gordon's Roadhouse, which is situated between Delta River and Delta Creek, is in ruins—it and the Sullivan Roadhouse were on the Washburn-Donnely winter sled trail, an alternate part of the Valdez–Fairbanks route established in the 1910s (U.S. Department of the Interior and U.S.

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Department of Defense, 1994—Fort Greely Proposed Resource Management Plan, Final EIS).

In addition, a Historical Overview and Architectural Inventory of Fort Greely was completed in 1998 (Charles M. Mobley & Associates, 1998—Historic Overview and Architectural Inventory of Fort Greely). The study considered numerous buildings at Fort Greely associated with the World War II and Cold War historic contexts. Review of the study by the Alaska SHPO and subsequent consultation between the Army and the SHPO indicates that there are 26 buildings and structures eligible for listing in the National Register. Forming a National Register District, the buildings are: Buildings 501, 503, 504, 601, 602, 603, 605, 606, 608, 609, 610, 612, 614, 615, 650, 652, 653, 655, 656, 658, 659, 660, 661, 662, 663, and 675. A Memorandum of Agreement between the Army and the Alaska SHPO regarding these buildings has been drafted. The Memorandum of Agreement stipulates that all of the buildings within the district "may be altered, demolished, leased with no restrictions, or transferred out of federal ownership with no restrictions" following completion of Historic American Buildings Survey (HABS) Level 1 recordation. In accordance with the Memorandum of Agreement, completion of draft recordation documents (i.e., photographs, narrative, drawings) is scheduled for December 31, 2000.

The currently defined Fort Greely NMD ROI includes the area of the runway modification and a large open parcel south of the cantonment, which is heavily disturbed from past and present training missions and a number of buildings that require modification. Twenty of the buildings requiring modification have been determined eligible for listing in the National Register. These are: Buildings 503, 504, 601, 605, 608, 609, 610, 612, 615, 650, 652, 653, 655, 656, 659, 660, 661, 662, 663, and 675.

Native Populations/Traditional Resources

Fort Greely encompasses lands historically and prehistorically occupied by the Tanana Indians. Salcha Natives used the Delta River and Delta Creek for subsistence hunting in historic times; however, this generally ceased by the 1920s. By 1945, the natives had virtually abandoned Salcha, and by 1962, there were no native settlements in the Tanana Valley between Healy Lake and Nenana (U.S. Army Alaska, 1997—Draft Integrated Natural Resource Management Plan).

No Alaska Native traditional cultural properties have been formally identified within the NMD ROI. In addition, there are no Alaska Native reservations or villages in the immediate vicinity of Fort Greely. Tanana is the closest Alaska Native village, approximately 130 kilometers (80 miles) east of Fort Greely.

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The Alaska Native group with which Fort Greely typically consults is the Tanana Chief's Conference (Johnson, 1998—Personal communication, August).

Paleontological Resources

The NMD ROI at Fort Greely is situated within an alluvial fan, characterized by glacial till; portions of the ROI are also underlain by permafrost. Although the bones of Ice Age mammals have been found elsewhere on the installation (bison bones associated with site XMH-297), no paleontological remains have been encountered within the NMD ROI.

3.5.1.5 Yukon Training Area (Fort Wainwright)—Cultural Resources

Prehistoric and Historic Archaeological Resources

For general archaeological information about Interior Alaska, see section 3.5.1.

Since 1973, there have been eight archaeological investigations conducted for Fort Wainwright and a total of 67 prehistoric and historic sites recorded; most of the prehistoric artifacts consist of lithic debris and bone fragments—most of the historic sites consist of buildings or groups of buildings (U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Army Lands in Alaska). Of the 8 surveys, 1 extensive survey was focused on the Yukon Training Area where 10 prehistoric archaeological sites were identified (Holmes, 1979—Report of Archaeological Reconnaissance; U.S. Army Corps of Engineers, 1997—EA BRAC 95 Realignment of Personnel and Military Functions to Fort Wainwright). Seven of the sites consist of isolates or a small number of artifacts in a disturbed context and require no further assessment. Three sites merit additional work, including Site FAI 157, which is near the NMD ROI. In addition, a large-scale survey was also conducted by the University of Alaska–Fairbanks in 1980; this survey resulted in the preparation of maps indicating low, medium, and high potential areas for both prehistoric and historic sites (U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Army Lands in Alaska).

Holmes' survey of the Yukon Training Area encompassed the NMD ROI. Records indicate that no sites were located within the ROI; however, consultation with the SHPO determined that additional survey would be required to ensure that no archaeological sites are impacted by NMD activities. As such, an archaeological survey of the Yukon Training Area ROI was undertaken concurrent with the survey performed at Fort Greely in August 1999. Results indicate that despite an extensive and intensive level of survey coverage and the use of subsurface archaeological testing methods considered appropriate and reasonable, evidence of prehistoric or non-military historic land use by Athapaskans or Euro-Americans was not found (Northern Land Use Research, Inc., 1999—Draft Cultural

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Resource Survey: Fort Greely and Yukon Training Area). Recent use sites (i.e., less than 50 years in age) are associated with contemporary hunters, trappers, and the military. None of these display sufficient significance or integrity to be considered eligible for listing in the NRHP. SHPO concurrence is pending.

In addition, one site is located approximately 262 meters (860 feet) west of the westernmost boundary of the ROI. At the time of recordation, the site (site FAI 157) contained one coarse grained beige chert flake and the medial segment of an obsidian microblade. Additional studies to determine the extent of the site have not been undertaken; however, Holmes recommended that follow-on studies be conducted if future activities in the area posed a potential threat to the site (Holmes, 1979—Report of Archaeological Reconnaissance; U.S. Army Corps of Engineers, 1986—Historic Preservation Plan for U.S. Army Land in Alaska).

Historic Buildings and Structures

The currently defined NMD ROI is a large parcel within Yukon Training Area 2 and approximately 0.8 kilometer (0.5 mile) east of the Small Arms Impact Area (see section 2.4.1.3). With the exception of a few recent use log features (Northern Land Use Research, Inc., 1999—Draft Cultural Resource Survey: Fort Greely and Yukon Training Area), the entirety of the ROI is heavily wooded and devoid of standing buildings and structures. Plans to modify existing facilities to support this location would likely involve buildings or structures located on Eielson AFB (see section 3.5.1.3).

Native Populations/Traditional Resources

No Alaska Native traditional cultural properties have been formally identified within the Fort Wainwright NMD ROI. Alaska Native villages situated at the mouths of the Chena and Salcha rivers probably included the Yukon Training Area in their subsistence areas; however, only 10 archaeological sites have been recorded within this area, none of which have been determined to be traditional cultural properties (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Greely Proposed Resource Management Plan, Final EIS; U.S. Army Corps of Engineers, 1997—EA BRAC 95 Realignment of Personnel and Military Functions to Fort Wainwright).

The Alaska Native group with which Fort Wainwright typically consults is the Tanana Chief's Conference (Office of History and Archaeology, 1998—Draft Integrated Cultural Resource Management Plan; Johnson, 1998—Personal communication, August).

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Paleontological Resources

Although there is reason to believe that paleontological resources may exist within the Yukon Training Area (most likely buried in creek bottoms), none have been found (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Greely Proposed Resource Management Plan, Final EIS). Paleontological resources have been recorded within the adjacent lands of Eielson AFB (see section 3.5.1.3).

3.5.1.6 Alaska—Fiber Optic Cable Line—Cultural Resources

Prehistoric and Historic Archaeological Resources

For general archaeological information about the Aleutian Archipelago, see section 3.5.1.

Whittier/Seward ROI

The fiber optic cable line would begin from a terminal building in either Whittier or Seward. The cable would be routed along existing commercial fiber optic corridor; however, the exact route has not, as yet, been determined, and the presence or absence of archaeological sites is not currently known.

Kodiak ROI

The fiber optic cable line would make landfall on Kodiak Island, north of the town of Monashka Bay. A 457-meter (1,500-foot) length of cable would tie to the existing utility corridor; however, the exact route has not, as yet, been determined, and the presence or absence of archaeological sites is not currently known.

Umnak ROI (Cable Line and Terminal Structure)

The fiber optic cable line would cross Umnak Island from south to north. The route of the cable would be along an existing dirt track. In addition, a small terminal structure would be constructed on Umnak. The exact route of the cable and the location of the terminal structure has not, as yet, been determined, and the presence or absence of archaeological sites is not currently known.

Shemya ROI

The fiber optic cable line will make landfall near the southeast end of Shemya Island. There is one archaeological site within this area (SH-5). The site was that of a midden; however, it has been completely destroyed by extensive construction and operational use on the island.

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Historic Buildings and Structures

The fiber optic cable line will be constructed within an underground/underwater utility corridor; construction is not expected to affect any existing buildings or structures.

Native Populations/Traditional Resources

Information related to the native populations and traditional resources within the region traversed by the fiber optic cable line route would be as described in section 3.5.1 and 3.5.1.2.

Paleontological Resources

Information related to the paleontology in the region traversed by the fiber optic cable line route would be as described in section 3.5.1.

3.5.2 NORTH DAKOTA INSTALLATIONS

A brief culture history is included here to provide a context for the types of cultural resources known to exist or that have the potential to occur within any ROI for cultural resources in North Dakota.

Paleoindian (9,500 to 5,500 B.C.)

People lived in northwestern North Dakota before the end of the last Ice Age. People of the Paleoindian period are associated with long fluted points that were mounted on the ends of spears. Paleoindian finds are rare in eastern North Dakota. They are less rare in parts of the state where intact early Holocene land surfaces lie closer to the surface, such as the Unglaciated Missouri Plateau. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

Plains Archaic (5,500 to 400 B.C.)

The Early Archaic is not well understood in North America, largely due to a paucity of sites. The Archaic in North Dakota seems to be characterized by regionalization of projectile point styles, and less apparent interaction between populations in different archaeological areas. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

Woodland Period (400 B.C. to A.D. 1600)

The advent of the Woodland Period in North Dakota is marked by the appearance of ceramics and mound burials. The advent of pottery in North America is generally correlated with increased processing of plant foods, and often accompanies the use of domesticated plants. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

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Plains Village Period (A.D. 1000 to 1780)

Plains Village people were semi-sedentary, and constructed permanent dwellings in villages. The Plains village tradition was a combination hunter-gatherer-gardener subsistence practice. Bison hunting, maize horticulture, and wild plant collection all complemented each other during the appropriate production times of the year. The production of a surplus of maize is considered to have allowed for the establishment of more permanent communities by these groups in earthlodge villages. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

Equestrian (A.D. 1600 to 1860)

The Equestrian Period marks the introduction of the horse and the gun to the Northern Plains in the protohistoric and early historic times. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

The first trading post in North Dakota was established on the Knife River between the Native American Mandan and Hidatsa villages by Rene Jusseaume in 1794. Other trading posts were established near Pembina and on the Turtle River. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

North Dakota became a part of the United States after the Louisiana Purchase in 1803, and was visited by Lewis and Clark the same year. North Dakota was a part of a succession of different territories until 1861 when the Dakota territory was established, encompassing what is now North and South Dakota, Montana, and Wyoming. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

In 1812, an agricultural colony of Scots and Irish at the confluence of the Red and Assiniboine Rivers was founded. Insufficient provisions the first winter forced the colonists south to Pembina, where vast herds of buffalo could ensure their survival. Although many people returned north in the spring, Pembina became an important alternative settlement for both whites and Metis, the children of white fathers and Indian mothers. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

The Metis at Pembina had long built sturdy wooden carts, with wheels wrapped in buffalo rawhide. Transportation in these Red River carts was much less expensive than moving goods by water through Hudson's Bay. Each spring long trains of these carts left Pembina for the journey to St. Paul, carrying valuable furs and other goods that meant wealth for St. Paul businessmen. This form of transportation grew in importance and lasted until the late 1860s and 1870s, when it was superseded by river steamboats and the railroad. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

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A network of forts was established across the territory during the 1850s, 60s, and 70s. These forts were designed to protect trading posts from attacks by Native American groups, and succeeded in drawing more white settlers to the region. However, tensions between these two groups erupted into a series of wars in 1862, ending when Sitting Bull surrendered in 1881. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

Agricultural Expansion and the Cold War (A.D. 1860 to 1989)

The prairies and climate of North Dakota were ideal for the production of cereal crops, including oats, barley, rye, and wheat. The land was immensely productive and has remained so to the present. The wide prairies and sparse population encouraged military planners to regard the region as ideal for a new purpose (U.S. Army Space and Strategic Defense Command, 1995—Draft, SRMSC Historic Preservation Plan).

In 1954, as Cold War tension between the United States and the Soviet Union escalated, the DOD announced plans to build-up, or newly construct, six military installations within the uppermost northern tier of the middle United States. All of the installations were designed to support an alert fighter-interceptor squadron and a complement of support personnel and facilities. (Grand Forks AFB, 1997—Cultural Resources Management Plan)

In 1962 North Dakota was chosen as a deployment area for nuclear weapons systems, and by 1965 Minuteman intercontinental ballistic missiles had been installed. In 1975 the SRMSC was completed to safeguard the existing Minuteman missiles.

Native Populations/Traditional Resources

The five Native American groups that may have an association with traditional resources which may be located within the North Dakota ROI include: the three affiliated tribes of the Mandan, Hidatsa, and Arikara, The Spirit Lake Tribe, The Trenton Indian Service Area, The Turtle Mountain Band of Chippewa Indians, and the Standing Rock Sioux Tribe (North Dakota Indian Affairs Commission, 1998—Statewide Indian Program Directory).

Paleontological Resources

The surface geology of northeastern North Dakota consists primarily of relatively recent sediments associated with Wisconsin Glaciation (80,000 to 205,000 years B.P.) (Eardley, 1962—Structural Geology of North America; Thornsbury, 1965—Regional Geomorphology of the United States). These sediments include silts and gravels of late Tertiary age, which are generally not associated with the older deposits located in western North Dakota that commonly yield paleontological resources

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(Eardley, 1962—Structural Geology of North America; Thornsbury, 1965—Regional Geomorphology of the United States).

3.5.2.1 Cavalier AFS—Cultural Resources

This section describes the cultural resources for the affected base property at Cavalier AFS. The ROI for cultural resources includes the Perimeter Acquisition Radar building and the complex of associated Cold War-era buildings as well as the 4 hectares (10 acres) at the site that could be affected by XBR construction activities.

Prehistoric and Historic Archaeological Resources

General background of archaeological resources in northeast North Dakota is provided in section 3.5.2. A cultural resources survey of Cavalier AFS was prepared for the U.S. Air Force Space Command in 1991. Neither the literature search conducted before the survey nor the actual field reconnaissance located any archaeological sites within the ROI or within the boundaries of Cavalier AFS (HQ SPACECOM, 1991—Draft Cultural Resource Survey of the Cavalier AFS). Therefore, no potentially eligible, eligible, or listed archaeological resources are located within the ROI for Cavalier AFS. The North Dakota SHPO has concurred with these findings (Peterson AFB, 1992—Draft EA of the Transition of Cavalier AFS to the Army).

Historic Buildings and Structures

The SRMSC was designed to protect the Minuteman ICBM fields against a Sino–Soviet ballistic missile attack (U.S. Army Space and Strategic Defense Command, 1992—Historic Context for Properties Located on the SRMSC). Completed in 1975, the various components of the SRMSC are located at five of the proposed NMD deployment locations in North Dakota. These components include Cavalier AFS, the Missile Site Radar, and Remote Sprint Launch Sites 1, 2, and 4.

Operation of the SRMSC was terminated after the ratification of the Strategic Arms Limitation Treaty of 1976 (U.S. Army Space and Strategic Defense Command, 1995—Draft SRMSC Historic Preservation Plan). Much of the SRMSC is considered eligible for listing in the NRHP because it was instrumental in obtaining Soviet agreement to the Anti Ballistic Missile Treaty and as a part of the United States' heritage as a unique and highly technical Cold War facility (Greenwood, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft DEIS). The U.S. Army Space and Missile Defense Command has completed a Historic American Engineering Record (HAER) of all SRMSC facilities that are NRHP-eligible. HAER documentation includes a photographic, architectural, and historical recordation preserved in an archival form and typically serves as a mitigation for unavoidable impacts to historic buildings and structures. The National

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Park Service has approved the SRMSC HAER documentation (Greenwood, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft DEIS).

The facilities that compose the Cavalier AFS were constructed as a single component of the SRMSC. The function of the Cavalier AFS was to detect and track incoming ballistic missiles and transfer the acquisition information to the Missile Site Radar when the incoming missile was within a range and altitude suitable for an intercept attempt (U.S. Army Space and Strategic Defense Command, 1992—Historical Context for Properties Located on the SRMSC). While the SRMSC became inactive in 1975, the Perimeter Acquisition Radar has remained operational. The Perimeter Acquisition Radar and some of its associated support structures and infrastructure are eligible as part of the SRMSC.

Native Populations/Traditional Resources

See section 3.5.2 for a discussion of the traditional resources within the Cavalier AFS ROI.

Paleontological Resources

See section 3.5.2 for a discussion of the paleontological resources within the Cavalier AFS ROI.

3.5.2.2 Grand Forks AFB—Cultural Resources

This section describes the cultural resources for the affected base property at Grand Forks. The ROI for cultural resources includes the areas encompassed by the two proposed GBI sites within Grand Forks AFB, the area encompassed by the construction of the BMC2, and the corridor encompassed by the installation of the utility corridor.

Prehistoric and Historic Archaeological Resources

General background of archaeological resources in northeast North Dakota is provided in section 3.5.2. Two archaeological surveys have been conducted on Grand Forks AFB. The first of these surveys was conducted in 1989 and encompassed a 147-hectare (364-acre) portion of the base for the proposed Peace Keeper Rail Garrison Program. The second included a literature search and intensive survey of 299 hectares (740) acres. The latter survey was conducted for the purpose of identifying any archaeological resources located on the entire base. This survey established high, medium, and low probability zones for archaeological resources. Neither of these surveys located any archaeological sites that were considered potentially eligible for listing on the NRHP (Grand Forks AFB, 1997—Cultural Resources Management Plan). Therefore, no potentially eligible, eligible, or listed archaeological resources are located within the ROI for Grand Forks AFB.

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Historic Buildings and Structures

Discussions with the North Dakota SHPO continues on all Cold War facilities in light of emerging Air Force guidance and increased DOD personnel and SHPO cognizance. However, the Air Force has prepared an Inventory of Cold War Properties for Grand Forks AFB (U.S. Air Force, 1996—Grand Forks AFB, Inventory of Cold War Properties). These inventoried Cold War-era resources are historically associated with both Air Defense Command/Tactical Air Command and Strategic Air Command missions. Twenty-seven buildings and structures located at Grand Forks AFB were inventoried. Most of the inventoried Cold War-era buildings and structures at Grand Forks AFB have been substantially altered and were determined to be ineligible for listing on the NRHP. Only building 714, a missile system surveillance and inspection facility, is considered potentially eligible for listing on the NRHP under criteria consideration G as a structure less than 50 years in age of exceptional significance. However, SHPO concurrence on the Cold War evaluation at Grand Forks AFB is pending.

Native Populations/Traditional Resources

See section 3.5.2 for a discussion of the traditional resources within the Grand Forks AFB ROI.

Paleontological Resources

See section 3.5.2 for a discussion of the paleontological resources within the Grand Forks AFB ROI.

3.5.2.3 Missile Site Radar—Cultural Resources

This section describes the cultural resources for the affected base property at Missile Site Radar. The ROI for cultural resources includes the area encompassed by the proposed GBI site within the Missile Site Radar complex; the area encompassed by the construction of the BMC2; the site that could be affected by the XBR construction activities; as well as the actual Missile Site Radar and the complex of associated Cold War-era structures.

Prehistoric and Historic Archaeological Resources

General background of archaeological resource in northeast North Dakota is provided in section 3.5.2. No archaeological survey has been undertaken at the Missile Site Radar. The Missile Site Radar is not within an area viewed as a high-density zone for archaeological resources, such as areas adjacent to streambanks, river terraces, or vertical changes in topography. Because the area within the facility security fence and right-of-way areas have been extensively disturbed and modified over the years, the likelihood of intact archaeological resources in the immediate

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area is negligible (U.S. Department of the Air Force, 1999—Final EIS Minuteman III Missile System Dismantlement).

Historic Resources and Structures

The facilities which compose the Missile Site Radar were constructed as a single component of the SRMSC. See section 3.5.2.1 for a discussion of the SRMSC. The function of the Missile Site Radar was to locate and track incoming ballistic missiles, providing intercept trajectories, and launching and guiding Sprint and Spartan intercept missiles (U.S. Army Space and Strategic Defense Command, 1992—Historic Context for Properties Located on the SRMSC). The tactical areas of the Missile Site Radar have been determined to be eligible for listing in the NRHP (Greenwood, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft DEIS).

Native Populations/Traditional Resources

See section 3.5.2 for a discussion of the traditional resources within the Missile Site Radar ROI.

Paleontological Resources

See section 3.5.2 for a discussion of the paleontological resources within the Missile Site Radar ROI.

3.5.2.4 Remote Sprint Launch Site 1—Cultural Resources

This section describes cultural resources for the base property and the surrounding areas of Remote Sprint Launch Site 1. The ROI for cultural resources encompasses approximately 17 hectares (41 acres) of disturbed land entirely within the current launch site that could be affected by the construction and deployment of XBR at Remote Sprint Launch Site 1.

Prehistoric and Historic Archaeological Resources

General background of archaeological resource in northeast North Dakota is provided in section 3.5.2. No archaeological survey has been undertaken at the Remote Sprint Launch Site 1. This site is not within an area viewed as a high-density zone for archaeological resources, such as areas adjacent to streambanks, river terraces, or vertical changes in topography. Because the area within the facility security fence and right-of-way areas have been extensively disturbed and modified over the years, the likelihood of intact archaeological resources in the immediate area is negligible (U.S. Department of the Air Force, 1999—Final EIS Minuteman III Missile System Dismantlement).

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Historic Buildings and Structures

See section 3.5.2.1 for an overview of the SRMSC, including Remote Sprint Launch Site 1. Four Remote Sprint Launch Sites were originally constructed as part of the SRMSC. All of these sites and associated support structures and infrastructure have been determined to be eligible for listing in the NRHP (Greenwood, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft DEIS). However, in accordance with a programmatic agreement with the North Dakota SHPO, only Remote Sprint Launch Site 3, the only Remote Sprint Launch site not located within the ROI, will be managed as a historic property (Greenwood, 1999—Comments received by EDAW, Inc., regarding the NMD Deployment Coordinating Draft DEIS).

Native Populations/Traditional Resources

See section 3.5.2 for a discussion of the traditional resources within the Remote Sprint Launch Site 1 ROI.

Paleontological Resources

See section 3.5.2 for a discussion of the paleontological resources within the Remote Sprint Launch Site 1 ROI.

3.5.2.5 Remote Sprint Launch Site 2—Cultural Resources

The ROI for cultural resources encompasses approximately 15 hectares (36 acres) of disturbed land entirely within the current launch site that could be affected by the construction and deployment of XBR at Remote Sprint Launch Site 2. The affected environment for cultural resources at this location is similar to that described for Remote Sprint Launch Site 1.

3.5.2.6 Remote Sprint Launch Site 4—Cultural Resources

This section describes cultural resources for the base property and the surrounding areas of Remote Sprint Launch Site 4. The ROI for cultural resources encompasses approximately 20 hectares (50 acres) of disturbed land entirely within the current launch site that could be affected by the construction and deployment of XBR at Remote Sprint Launch Site 4. The affected environment for this location is similar to that described for Remote Sprint Launch Site 1.

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3.5.2.7 North Dakota—Fiber Optic Cable Line—Cultural Resources

The fiber optic cable line in North Dakota would follow existing road and utility alignments. The cultural complexity of the area would be the same as described above for the North Dakota region. Most of the cable route should be in areas that have been previously disturbed; however, the exact route of the cable and has not, as yet, been determined, and the presence or absence of archaeological sites is not currently known. Areas considered high-density zones for archaeological resources include streambanks, river terraces, or vertical changes in topography (U.S. Department of the Air Force, 1999—Final EIS Minuteman III Missile System Dismantlement).

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3.6 GEOLOGY AND SOILS

Geology and soils include those aspects of the natural environment related to the earth, which may affect or be affected by the proposed NMD program. These features include physiography, geologic units and their structure, the presence/availability of mineral resources and related natural resources, soil condition and capabilities, and the potential for natural hazards. A natural hazard or geologic hazard is a phenomenon that presents a risk or potential danger to life and property, either naturally or by man-made means.

3.6.1 ALASKA INSTALLATIONS

3.6.1.1 Clear AFS—Geology and Soils

The ROI is the approximately 243-hectare (600-acre) GBI deployment area, associated support facilities, and adjacent area on Clear AFS. The GBI field and support structures may require the use of the Clear AFS infrastructure and existing facilities. Some of the NMD facilities could be located in the base construction camp. There are two proposed GBI alternatives at Clear AFS, one in the southern portion of the installation and the other in the northeast corner.

Physiography

Clear AFS is located in the Yukon Region of Interior Alaska on the southern margin of the Tanana–Kuskokwin Lowlands physiographic province, adjacent to the Northern Foothills province of the Alaska Range (U.S. Department of the Interior, 1997—Northern Inertie Project Draft EIS). The Lowlands can be characterized as a broad, relatively flat, sediment-filled depression formed by glacial meltwater outwash. Several rivers and streams originating in the Alaska Range and Northern Foothills flow northerly across the Lowlands to the Tanana River. These include the Nenana River, Totatlanika River, Tatlanika Creek, Wood River and their numerous tributaries (U.S. Department of the Interior, 1997—Northern Inertie Project Draft EIS). The Nenana River floodplain flanks the western edge of Clear AFS. A branch of the Nenana River (Lost Slough) forks near the west central border of Clear AFS and trends northeasterly across the northwest corner of the installation. Clear AFS is covered with many interlaced channels, terraces, and banks. Local topographic relief of these features generally ranges between 0.5 to 2.0 meters (2 to 7 feet) (Clear AS, 1996—Biodiversity Survey). Surface elevations are greatest at the southern Clear AFS boundary at approximately 198 meters (650 feet); however, the regional surface gradient is relatively mild at about 5 meters per kilometer (25 feet per mile) to the north (U.S. Geological Survey, 1950—Fairbanks, 15 Minute Quadrangle).

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Geology

Much of the Fairbanks region is located within a large geologic province known as the Yukon–Tanana terrane. This a region of deformed and faulted metamorphic and igneous rocks of Precambrian to Mesozoic age (800 to 66 million years B.P.), overlain by younger sedimentary formations of Tertiary and Quaternary age (65 million years to present). The Yukon–Tanana terrane underlies much of Interior Alaska and encompasses three major physiographic provinces (Yukon–Tanana Upland, Tanana–Kuskokwin Lowland, and the Northern Foothills). For many years, the older metamorphic and igneous rocks in Interior Alaska were known collectively as the Birch Creek Schist. The Yukon–Tanana terrane is now recognized as a complex assemblage of many rock types with a very complicated geologic history. The area is cut by northeast-trending, high angle faults (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS).

The geology of Clear AFS has been influenced by the mountain building and glacial history of the Alaska Range to the south. The Alaska Range was uplifted during the late Pliocene (about 5 million years B.P.) and partially glaciated during the Late Pleistocene Epoch. Traces of six to eight glacial expansions have been noted before the last Glacial, which is dated to the late Wisconsin (25,000 to 9,500 years B.P.). Glacial advances ceased abruptly at the present escarpment of the Northern Foothills of the Alaskan Range (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan). The uplift of the Northern foothills, advance and retreat of the glaciers, and subsequent erosion by major drainages originating in the Alaska Range and foothills provided the source for major sedimentary deposition in the Tanana River Valley.

The sediments underlying the Clear AFS are derived from several sources: alluvial fans developed upon the Nenana gravel pediment (a gently sloping bedrock with low-relief covered with gravel and sand) at the mountain front; Pleistocene glacial outwash (cobbles, sand, and silt debris); Holocene alluvial sediments (mostly silt and sand) from the Nenana River; wind transported silt (loess) reworked from channel bars onto terraces; and Modern colluvium from water reworked loess (Northern Land Use Research, Inc., 1995—Cultural Resources Management Plan). The sedimentary wedge is heterogeneous but primarily composed of sandy gravel. The sandy gravel is poorly stratified with well to poorly graded course sand. The exact thickness is unknown but is estimated to exceed several hundred feet (Clear AS, 1998—Draft Solid Waste Management Plan).

Soils

Generally, soils at Clear AFS are predominately well drained sands and gravels overlain by a thin layer of silt. Silty soils generally occur in areas

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dominated by deciduous forests. These soils vary from 0.9 meter (3 feet) to 1.8 meters (6 feet) deep and then a sandy gravel horizon varying from the 1.8-meter (6-foot) level to below 9 meters (30 feet). Areas dominated by spruce are generally covered by a peat layer 0.3 meter (1 foot) thick over a silt horizon that varies from 0.9 to 1.5 meters (3 to 5 feet) in depth. Under this horizon are horizons of sand, silt, and gravel combinations (Clear AS, 1996—Biodiversity Survey).

Silty soils of the station are generally well drained, although the drainage may be impeded in some areas by intermittent pockets of permafrost. Areas covered by the peat are more susceptible to permafrost, and drainage is poor. Permafrost may extend below 8 meters (25 feet) in these areas. The occurrence of permafrost at Clear AFS is discontinuous and comparable to Fairbanks and other areas in the Tanana Valley (Clear AS, 1996—Biodiversity Survey). Churn drill holes drilled in 1947 to depths of 12 to 15 meters (40 to 50 feet) show the presence of some permafrost; however, the permafrost is sporadic, and locations free of permafrost can be outlined by drilling (Clear AS, 1998—Draft Solid Waste Management Plan). Soils of the station have low erodibility. Erosion is minimized by vegetation and low annual precipitation (Clear AS, 1996—Biodiversity Survey).

Mineral Resources

Several former and potentially active gravel pits do exist on, or in close proximity to, Clear AFS. The quality, extent, and economic potential of the aggregate resources are unknown.

Geologic Hazards

Interior Alaska is periodically shaken by severe shocks. Several faults in the vicinity of Clear AFS are considered active, including the east-west trending Hines Creek and McKinley faults, which occur in the foothills to the south. Both are strands of the Denali Fault, one of the largest crustal breaks in Alaska (Bureau of Land Management, 1997—Northern Inertie Project Draft EIS). The Clear AFS lies in seismic zone 3 (Bureau of Land Management, 1997—Northern Inertie Project Draft EIS). Since 1904, there have been 12 earthquakes of magnitude 6.0 or higher within a 161-kilometer (100-mile) radius of Clear AFS (U.S. Geological Survey, 1993—Fact Sheet from the Largest Earthquakes in the United States) including a 1947 event, reported to be an 8+ on the Mercalli Scale, which was centered at Clear AFS (Bureau of Land Management, 1997—Northern Inertie Project Draft EIS). Recurrence of earthquakes of similar intensity is probable (Bureau of Land Management, 1997—Northern Inertie Project Draft EIS).

Clear AFS facilities might be subject to liquefaction conditions during a major earthquake. Wet sandy soils associated with alluvium of the

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Nenana floodplain and its tributaries may be transformed to a liquefied state under extreme ground motion.

Permafrost, perennially frozen ground, is common throughout the region. The distribution of permafrost is sporadic and varies in occurrence, depth, and thickness depending on slope orientation, vegetation, landform, drainage, and soil type (Bureau of Land Management, 1997—Northern Inertie Project Draft EIS). Permafrost can also be a hazard when underlying proposed new facilities. New building structures can cause differential thawing of subsoils, resulting in loss of soil strength. Permafrost in fine-grained soils, such as loess, can be more troublesome, with subsidence and thermokarsts appearing more frequently than in other soil types. Thermokarsts appear when the permafrost thaws, shrinks, and the ground subsides, usually in uneven patterns. (Bureau of Land Management, 1997—Northern Inertie Project Draft EIS)

Site soils might also be susceptible to frost heave, or the upward movement of facility foundations due to freezing of the surrounding soil. The condition is particularly severe in fine-grained, high moisture content soils.

3.6.1.2 Eareckson AS—Geology and Soils

Planned NMD construction at Eareckson AS would consist of an approximately 12-hectare (30-acre) XBR in the northeast portion of the island. New construction of a power plant, fuel storage areas, and connecting infrastructure for electrical lines, and sewer lines, will affect both the north and south sides of the island. Since the island is relatively small, and new construction traverses much of the island, the ROI will be considered to be the entire island of Shemya.

Physiography

Shemya Island is near the eastern end of the Aleutian archipelago (arc or chain), that forms an arcuate string of islands that stretches from the southwest corner of mainland Alaska to within 161 kilometers (100 miles) of the Kamchatka Peninsula of Russia, a distance of over 2,414 kilometers (1,500 miles). Shemya is part of the Near Islands group, the westernmost group of islands in the Aleutian Chain consisting of Attu, Agattu, Shemya, Alaid, and Nizki. (U.S. Air Force, 1995—Draft Management Action Plan, Eareckson AS)

Shemya Island is a flat topped seamount approximately 2.4 kilometers (1.5 miles) in width and 5.7 kilometers (3.5 miles) in length on a west-east axis. The island's relief ranges from 6 to 8 meters (20 to 25) feet above sea level on the Pacific side to a maximum height of 73 meters (240 feet) on the northern Bering Sea side. Slopes exceeding 10 percent are found where the bluffs rise above the Bering Sea coast on the northern coast. The island is rimmed with small sandy/gravely beaches

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and rugged bedrock crags. A small raised wave-cut platform nearly encircles Shemya island and suggests previous ocean level changes. (U.S. Department of the Air Force, 1997—Final Installation-Wide Environmental Baseline Survey, Eareckson AS) The surface is typical of hummocky glaciated terrain and tundra regions. Surface and subsurface drainage flows in a south-southwest direction. The construction of the existing 3,048-meter (10,000-foot) runway has greatly modified the natural surface drainage of the island. (U.S. Air Force, 1995—Natural Resources Plan, Eareckson AS)

Geology

Regionally, Shemya Island is part of the Aleutian volcanic arc of the North Pacific Ocean. The bedrock geology of the island consists of intrusive and extrusive igneous complexes, sedimentary and weakly metamorphosed deposits primarily Tertiary and Quaternary in age (30 million years to present). Bedrock on the western half of the island consists of a basement complex of fine-banded argillites, limey argillites, siltstone, graywackes, and conglomerates. On the north side of the island (Alcan Cove) silicified and pyritized lavas outcrop. Submarine pyroclasts and volcanic intrusives cover the eastern half of the island. These rocks overlie the sedimentary basement complex of the western half of the island. Intrusives composed of feldspar and horneblende porphyry outcrop along the northeast and southeast shores and locally inland. (U.S. Air Force, 1995—Draft Management Action Plan, Eareckson AS)

Unconsolidated surface materials on Shemya Island are generally of three types: sand, gravel, and peat deposited by marine, alluvial, and eolian processes. A thin layer of remnant glacial outwash sand and ground moraine covers most of the island. Sands, gravels, and discontinuous lenses of till are found in low areas directly overlying the southwest sloping bedrock. A thin veneer of unconsolidated sand mantles much of the wave cut terrace along the west and south facing slopes. Deposits of peat occur over much of the island, and it is the predominant surface material found over the east-northeast portion of the island. The western one-third of the island and part of the south side of the island are covered by active and stable sand dunes. The sand dunes on the southern side of the island are known to have accumulations up to 15 meters (50 feet). (U.S. Air Force, 1995—Draft Management Action Plan, Eareckson AS)

Soils

A matted accumulation of tundra peat is the predominant surficial soil on the island. The highly saturated material is typical of tundra regions. This layer varies in thickness, but is usually 1 to 2 meters (2 to 5 feet) deep overlaying loamy sands and gravel in the substrata. Depth to bedrock varies from zero to over 8 meters (25 feet). Sand soils over bedrock tend to dominate the south shore beach areas. Most of the

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surficial materials on Shemya Island can retain and transmit water. Shemya Island has no permafrost.

Mineral Resources

Known mineral resources on Shemya are restricted to sand and gravel for construction purposes (Morrisette, 1988—Shemya). The U.S. Air Force has proposed to develop a borrow pit and quarry plan for controlled removal of available aggregate resources to support future construction and maintenance at Eareckson AS. Sand and gravel resource material on the island is limited. (U.S. Department of the Air Force, undated—EA, Shemya Borrow Pit and Rock Quarry Plan)

Geologic Hazards

Tectonic plate and volcanic activities along the Aleutian arc are frequent and often violent. The convergence of the Pacific and North American crustal plates creates one of the world's most active seismic zones. Over 100 earthquakes of magnitude 7 or larger have occurred along this boundary since the turn of the century. Shemya Island falls within seismic zone 4, which reflects the highest hazard potential for earthquakes and severe ground shaking. (U.S. Department of the Air Force, 1997—Final Installation-Wide Environmental Baseline Survey) Recent regional seismic zonation maps compiled by the U.S. Geological Survey (USGS) for the Building Seismic Safety Council and Federal Emergency Management Agency indicate the maximum considered earthquake ground motion at Shemya could exceed 1g. (U.S. Geological Survey, 1997—National Earthquake Hazards Reduction Program)

Eareckson AS is susceptible to tsunamis (tidal waves) resulting from earthquake ground displacements and earthquake triggered submarine landslides. In 1965, an 8.7 magnitude earthquake in the Rat Islands, Alaska, generated an 11-meter (36-foot) tsunami at Shemya. (U.S. Geological Survey, 1993—Fact Sheet from Largest Earthquakes in the United States) A tsunami line has been established at the 30-meter (100-foot) line for new construction (U.S. Department of the Air Force, 1997—Final Installation-Wide Environmental Baseline Survey, Eareckson AS).

3.6.1.3 Eielson AFB—Geology and Soils

The ROI is anticipated to be the cantonment area of Eielson AFB. Eielson AFB would be used to provide power and support logistics for the Yukon Training Area.

Physiography

Eielson AFB lies predominantly in the eastern portion of the Tanana–Kuskokwim Lowland physiographic province, with the eastern edge of the base encompassing the Yukon–Tanana Uplands. The Tanana–Kuskokwim

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Lowland is characterized by flat lowlands and gently rolling hills, with elevations ranging from 107 to 290 meters (350 to 950 feet) above mean sea level. The Tanana River and tributaries marks the northeastern edge of the lowlands and western base boundary. Surface drainage at Eielson AFB is generally north–northwest, parallel to the Tanana River. Five streams flow through the base and discharge into the Tanana River via Piledriver Slough. (Pacific Air Forces, 1998—Draft General Plan, Eielson AFB) About 89 percent of the base is situated on flat alluvial floodplain with elevations ranging from 158 to 168 meters (520 to 550 feet). The remaining 11 percent of the base occurs in steeply rising hills to the east. The highest elevation is achieved in the southeast corner of the base at Quarry Hill, with an elevation of 343 meters (1,125 feet). (Eielson AFB, 1998—Integrated Natural Resources Management Action Plan)

Geology

Eielson AFB is located within a large geologic province known as the Yukon–Tanana terrane. This a region of deformed and faulted metamorphic and igneous rocks of Precambrian to Mesozoic age (800 to 66 million years B.P.), overlain by younger sedimentary formations of Tertiary and Quaternary age (65 million years to present). The Yukon–Tanana terrane underlines much of Interior Alaska and encompasses three major physiographic provinces (Yukon–Tanana Upland, Tanana–Kuskokwin Lowland, and the Northern Foothills). For many years, the older metamorphic and igneous rocks in Interior Alaska were known collectively as the Birch Creek Schist. The Yukon–Tanana terrane is now recognized as a complex assemblage of many rock types with a very complicated geologic history. The area is cut by northeast-trending, high angle faults. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

During the Quaternary period, alluvial fans were deposited along the southern margin of the Tanana River Valley due to rapid uplift of the Alaska Range and northern foothills and the occurrence of at least four major glacial advances. Aggradation of the river plain built up a thick, layered sequence of unconsolidated silts, sands, and gravels in the lowlands. Unconsolidated deposits are approximately 61 to 91 meters (200 to 300 feet) beneath Eielson AFB but have been estimated to be as great as 229 meters (750 feet) just south of Fairbanks. (Eielson AFB, 1998—Integrated Natural Resources Management Action Plan) The glacial sediments have also been the source for wind blown silts that have been transported northward and been deposited as loess mantles on the crystalline upland areas and at lower elevations in organic muck deposits (Eielson AFB, 1998—Integrated Natural Resources Management Action Plan). Most of the base has been constructed on artificial fill material. (U.S. Air Force, 1995—Final Environmental Restoration Program, Eielson AFB)

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Soils

Soils in the Tanana Valley consist of unconsolidated silt sands and gravels, organic silts, sandy silts, and clays. Floodplain soils nearest the active channel are sandy with a thin silt loam layer on the surface. On higher terraces, the soils are predominantly silt belonging to the Salchaket series. (Pacific Air Forces, 1998—Draft General Plan, Eielson AFB) On older river terraces, silt loam soils of the Goldstream series dominate and often have a significant organic component. These soils tend to be cold and wet and are generally underlain by permafrost. Clays, sandy silts, and sandy gravelly loams may be found in upland areas of the Tanana River Valley. (Pacific Air Forces, 1998—Draft General Plan, Eielson AFB)

Mineral Resources

Mining activities in and around Eielson are primarily for sand and gravel extraction. Sand and gravel have been used for the construction of the Richardson Highway, Eielson AFB, and the Trans-Alaska Pipeline.

Bedrock outcrops in the hills to the northeast of the base have been related to precious metal deposits near Eielson AFB and elsewhere in the Fairbanks region (Pacific Air Forces, 1998—Draft General Plan, Eielson AFB). These units consist of Precambrian and Paleozoic-age schists, micaceous quartzites, subordinate phyllite and marble, which have been locally intruded by a series of Cretaceous to lower Tertiary plutons of granodiorite and quartz monzonite.

Geologic Hazards

Eielson AFB is within the Fairbanks seismic zone, a northeast-trending band of seismic activity. An average of five or six earthquakes a year are actually felt in this zone. In June 1967, a series of three earthquakes of about magnitude 6 had epicenters to the west of Eielson AFB. Two other moderate earthquakes (magnitude 4.0 to 4.6) occurred in this zone in 1977. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS) In 1937, a magnitude 7.3 earthquake occurred with an epicenter at Salcha Bluff, about 21 kilometers (13 miles) southeast of Eielson AFB (U.S. Department of the Air Force, 1998—Draft 1997 Sitewide Monitoring Program Report).

Other potential geotechnical hazards resulting from severe ground shaking, and frozen ground, are described in section 3.6.1.1.

3.6.1.4 Fort Greely—Geology and Soils

The ROI is anticipated to encompass a 243-hectare (600-acre) missile field with support structures and the land adjacent to this site. The ROI could also include the BMC2 element. The GBI field and support structures may require the use of the Fort Greely infrastructure and

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existing facilities within the main cantonment area. The airfield may also require upgrading for NMD. Additional facilities could be constructed within the base area.

Physiography

Fort Greely encompasses portions of both the Northern Foothills of the Alaska Range and the Tanana–Kuskokwim Lowlands physiographic provinces. The Northern Foothills Physiographic province area can be characterized by flat-topped, east-trending ridges 610 to 1,219 meters (2,000 to 4,000 feet) in elevation, 5 to 11 kilometers (3 to 7 miles) wide, and 8 to 32 kilometers (5 to 20 miles) long. These foothills are separated by rolling lowlands 213 to 457 meters (700 to 1,500 feet) in elevation and 3 to 16 kilometers (2 to 10 miles) wide. The proposed site is situated in a transition area on the northern flanks of the Foothill province. Landforms in the area include coalescing alluvial fans, moraines, and river floodplains. Streams flowing through the foothills generally originate in the Alaska Range and flow north in rugged V-shaped canyons and across the broad terraced valleys of the Tanana–Kuskokwim Lowland. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS) The site and the Fort Greely cantonment area are situated between two significant drainages originating in the foothills—the Delta River to the west and Jarvis Creek to the east. The terrain at the site is mildly undulating with elevations ranging from approximately 411 to 442 meters (1,350 to 1,450 feet). The site vicinity has a northeast surface gradient of about 18 meters (60 feet) per mile.

Geology

The Fort Greely area is underlain by altered sedimentary and volcanic rocks of Paleozoic age that were later intruded by granitic plutons. These rocks were subsequently overlain by Tertiary-age sediments of continental origin. The oldest of the Tertiary sediments contains coal. As the Alaska Range rose to the south, the exposed Tertiary sediments were eroded, then covered by massive gravel deposits known as the Nenana gravel. Glaciers flowed northward from the Alaska Range during the Quaternary Period, depositing moraine and outwash material in the site area. Deposits of loess were laid down between glacial periods. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS) To the north of the cantonment area, between the Delta River and the Clearwater Lake, depth to bedrock has been estimated to exceed 762 meters (2,500 feet). (U.S. Army Corps of Engineers, 1996—Postwide Site Investigation, Fort Greely)

The proposed GBI site, like the cantonment area, is located on a low alluvial terrace that has a gently undulating surface. The terrace is composed of glacial outwash deposits that are underlain by till, which in turn is underlain by stratified gravel. The glaciofluvial (glacial meltwater

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streams) sediments consist primarily of fine to coarse gravel with sand, and lenses of sand and silt are also found. Moraine features to the east and south of the cantonment are characterized by kame and kettle topography and are composed of coarse, unstratified, unsorted till ranging from silty gravel with sand to sandy silt with gravel. (U.S. Army Corps of Engineers 1996—Postwide Site Investigation, Fort Greely)

Wind blown loess of glacial origin forms a mantle over much of the Fort Greely area, ranging from several centimeters thick to greater than 1.5 meters (5 feet) thick. Discontinuous permafrost occurs throughout the region. The permafrost ranges [from the surface] to as much as 66 meters (217 feet) below ground surface. (U.S. Army Corps of Engineers 1996—Postwide Site Investigation, Fort Greely)

Soils

No detailed soil surveys have been completed for the site area. Shallow, well-drained silt loams with sandy to gravelly underlying material occupy most of the rolling uplands on the surface of the glacial moraines and alluvium east of the Delta River (U.S. Department of the Interior and U.S. Department of Defense, 1994—Fort Greely Proposed Resource Management Plan, Final EIS). The exact thickness and areal extent of these soils at the site are unknown.

Soils have generally been derived from glacial action, influenced by the presence of streams and intermittent permafrost. Glacial loess (windblown silt and dust) and outwash account for the presence of silty loams. Deep gravel deposits with shallow silt or sand cover are associated with alluvial plains in the area.

Mineral Resources

Select geologic units at Fort Greely could have potential locatable mineral resources. The geology of the area could be favorable for sulfide mineralization, copper-molybdenum porphyry, lode gold and placer deposits (includes gold, silver, lead, zinc, copper, tungsten, molybdenum, and tin). Lode mineral deposits are most likely to be found in the Paleozoic and Mesozoic-age rocks exposed in the southwest and northwest part of the West Training Area. In the southwest, the granite intrusive contains the Ptarmigan Creek molybdenum prospect, which was discovered in 1914. Molybdenum is associated with quartz veins in the granite, at the contact between granite and black slate. Ore samples from the prospect reportedly contained up to 2.7 percent molybdenum. Traces of gold were also reported. About 32 claims were located along Ptarmigan Creek before the withdrawals. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

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Localized placer deposits may also occur in streams draining the granites and Tertiary-age gravel benches. Some small placer mines, concentrated in the Tertiary gravels, are located in the Jarvis-Ober Creek area. No production records are available. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

The U.S. Department of the Interior and DOD considered Fort Greely to have low to moderate potential for leasable minerals. The Nenana coal basin trends across the southern half of the Fort Greely West Training Area. The Middle Tanana basin contains coal to the west of Fort Greely, but no coal has been documented on the installation. A few hundred tons of coal were produced from one small mine in the Jarvis Creek field in 1958. This mine also provided all coal required at Fort Wainwright and Eielson AFB for at least one year, and was active from 1966 to 1972. (U.S. Army Alaska, 1997—Draft Integrated Natural Resource Management Plan) The potential of finding economic deposits of Tertiary coal on Fort Greely is unknown due to poor outcrops, a lack of subsurface information, extensive erosion of Tertiary sediments, and structural deformation of the bedrock. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Coal and organics within the Tertiary sediments could generate and trap gas under suitable geologic conditions. The Nenana Basin, with its known coal deposits, has moderate potential for producing gas. Geologic conditions are not favorable for oil. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Throughout the northern and central portion of Fort Greely there are extensive sand and gravel deposits associated with glacial moraines, glacial outwash, stream beds, and river floodplains. Readily accessible sand and gravel occur along the drainages and floodplains of Jarvis Creek, Granite Creek, and the Delta River. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS) Eight mineral material sites, all of which are now closed or inactive, have been located at Fort Greely. Other gravel pits are located near Fort Greely along the Richardson Highway and the Trans-Alaska Pipeline System. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Geologic Hazards

Fort Greely lies within a seismic zone extending from Fairbanks southward through the Kenai Peninsula. Earthquake epicenters are scattered throughout Fort Greely and surrounding areas. From past studies there appears to be no concentration of seismic events in the area, and serious damage has not been reported. Fort Greely does lie in seismic Zone 3, where major earthquake damage has a 10 percent

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probability of occurring at least once in 50 years. (U.S. Department of the Interior, 1997—Northern Intertie Project Draft EIS)

Severe ground shaking is described in section 3.6.1.1. In 1999 geotechnical studies were conducted at the proposed GBI site on Fort Greely. Permafrost was not encountered within the test borings, nor did ground penetrating radar indicate any ice lenses or other permafrost features.

3.6.1.5 Yukon Training Area (Fort Wainwright)—Geology and Soils

The ROI is anticipated to be an approximately 243-hectare (600-acre) missile field with support structures located on the western edge of the range and the area adjacent to the site. The GBI site could include a BMC2. The GBI field may require the use of Eielson AFB infrastructure and existing facilities.

Physiography

The Yukon Training Area encompasses portions of two physiographic provinces: the Tanana–Kuskokwim Lowlands, and the Yukon–Tanana Uplands. The lowlands region is characterized by flat lowlands and gently rolling hills, with elevations ranging from 107 to 290 meters (350 feet to 950 feet) above mean sea level. Bottom land, forest, and wetlands are typical. The uplands are characterized by rolling hills with elevations typically between 152 to 1,006 meters (500 and 3,300 feet) above mean sea level. The Chena River flows from east to west through the main cantonment area and drains into the Tanana River west of Fairbanks, Alaska (Alaskan Air Command, 1990—Installation Restoration Program, Site 3). The proposed site is located on a subdued east–west trending ridgeline on the west flanks of the uplands area. Maximum elevation is approximately 290 meters (950 feet). Surface slopes range from a mild 3 percent down the ridgeline to 10 to 20 percent on the north and south side slopes, respectively.

Geology

The Yukon Training Area is located within a large geologic province known as the Yukon–Tanana terrane. This a region of deformed and faulted metamorphic and igneous rocks of Precambrian to Mesozoic age (800 to 66 million years B.P.), overlain by younger sedimentary formations of Tertiary and Quaternary age. The Yukon–Tanana terrane underlines much of Interior Alaska and encompasses three major physiographic provinces (Yukon–Tanana Upland, Tanana–Kuskokwin Lowland, and the Northern Foothills). For many years, the older metamorphic and igneous rocks in Interior Alaska were known collectively as the Birch Creek Schist. The Yukon–Tanana terrane is now recognized as a complex assemblage of many rock types with a very complicated geologic history. The area is cut by northeast-trending, high angle faults. No glaciers exist within the

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uplands. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Yukon Training Area cantonment area is underlain by several hundred feet of Quaternary fluvioglacial sediments deposited by the Tanana and Chena rivers. Bedrock is generally near the surface in the upland site area. However, it is largely obscured by extensive deposits of wind-blown sand and loess, locally as great as 46 meters (150 feet) thick. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Soils

Windblown silts and fine-grained sands form a mantle on much of the rolling upland area that varies in average thickness between 0.3 to 5 meters (1 to 15 feet). These soils are generally described as Alfic Cryochrepts in association with Histic Pergelic Cryaquepts. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS) Approximately 35 percent of these soil types occur as well-drained silt loams on slopes other than north facing. Approximately 20 percent occurs as poorly drained silt loams on foot slopes and in valley bottoms, with corresponding peat layer and shallow permafrost conditions. Moderately drained silt loams occupy foot slopes over 15 percent of the area, and well drained shallow silt loam over bedrock occupies slopes over 10 percent of the area. The remainder of the area is occupied by poorly drained shallow silt loam underlain by permafrost in north facing slopes. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

The Yukon Training Area is underlain by discontinuous permafrost of generally low ice content in non-organic soils. The ice is typically restricted to pore spaces and to thin ice seams in silts and clays. The depth to permafrost, when present, ranges from 0.6 to 12 meters (2 to 40 feet) below ground surface. Regionally, the thickness of the permafrost intervals varies from about 1.5 to 84 meters (5 to 275) feet. The seasonal frost layer (or active layer) varies between 0.6 to 4 meters (2 to 12 feet) thick (Alaskan Air Command, 1990—Installation Restoration Program, Site 3).

Permafrost is generally thickest in valley bottoms and on lower slopes and can extend to the summit of north-facing slopes. Sediments beneath the floodplain of the Tanana and Chena Rivers are perennially frozen as deep as 81 meters (265 feet). (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS) Permafrost is generally absent on hilltops and moderate to steep south facing slopes. River channels, lakes, wetlands, and other low-lying areas covered by water are also permafrost free. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

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Geotechnical studies of the proposed GBI site indicated the presence of permafrost on north-facing slopes.

Mineral Resources

The Yukon Training Area has been closed to mineral location since the 1950s. There are no valid mining claims nor leases (for leasable minerals) on withdrawn lands. Little active mineral exploration or development occurred before the withdrawal of the lands because the area is largely obscured by floodplain deposits, loess, and heavy vegetation, and there has been no compelling evidence of major mineralization trends (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS). That said, Interior Alaska is one of the state's most important regions for mineral production. The Fairbanks Mining District, which encompasses the Yukon Training Area, Eielson AFB, and a portion of Fort Greeley West Training Area, is the largest historic gold producer in the state. The Fairbanks District has experienced a resurgence in activity with the development of the Fort Knox gold mine in 1997. In addition to gold, other potentially economic mineralization has been identified in the Fairbanks Mining District, including silver, bismuth, antimony, tungsten, tin, and lead. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

The area does encompass abundant surficial deposits of sand and gravel for construction, as well as silt and peat for agricultural use. Although sand and gravel have been extracted by the military and other agencies for construction purposes, they have not been extracted commercially. Near North Pole, Alaska, basalt has been quarried commercially for several years, providing high quality decorative stone and riprap for local projects. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Geologic Hazards

Moderate seismic activity occurs throughout the region. The earthquakes, however, have not been linked to movement along known faults, but rather, block rotation between Tintina and Denali faults resulting from the collision of the Pacific and North American plates. (U.S. Department of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

The western part of the Yukon Training Area is within the Fairbanks seismic zone, a northeast-trending band of activity. An average of five or six earthquakes a year are actually felt in this zone. In June 1967, a series of three earthquakes of about magnitude 6 had epicenters to the west of the withdrawal land. Two other moderate earthquakes (magnitude 4.0 to 4.6) occurred in this zone in 1977. (U.S. Department

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of the Army, 1999—Alaska Army Lands Withdrawal Renewal Final Legislative EIS)

Geotechnical hazards resulting from severe ground shaking, and frozen ground, are discussed in section 3.6.1.1.

3.6.1.6 Fiber Optic Cable Line—Geology and Soils

To provide a communication link between system elements that could be located in Alaska, fiber optic cable lines would be required out to Eareckson AS (Shemya Island). To meet NMD reliability requirements, two redundant lines may be needed. One preliminary route along the Aleutian Islands from Whittier or Seward to Eareckson AS has been identified. The second route could be north of the Aleutian Islands or connect to existing fiber optic cable in the central Pacific or along the northwestern United States. The exact alignment of this second cable has not been identified. Provided below is a description of the known route. The route would run from Whittier or Seward on the Kenai Peninsula to Eareckson AS in the western Aleutian Islands, a distance of approximately 3,592 kilometers (2,232 miles). Virtually all of the route would be offshore, with shore landings at Kodiak Island (north of the town of Monashka Bay), Island of Umnak, and terminating at Shemya Island. Since the exact location of the cable route would be predicated on a sea floor survey, this section only describes general conditions along the preliminary corridor alignment. The fiber optic cable line route would traverse a wide variety of offshore geologic conditions. For purposes of discussion, the geologic environment is characterized by conditions revealed in the islands that skirt the southern coasts of both the Kenai and Alaska Peninsula, and the Aleutian Island chain. Unless otherwise noted, this entire section references the Comprehensive Conservation Plan and EIS for the Alaska Maritime National Wildlife Refuge.

Physiography

The cable route predominantly traverses broad expanses of submarine terrain on the continental shelf (less than 200 meters (nominal 600 feet), transition and deep ocean areas (regarded as greater than 2,000 meters (6,560 feet). The continental shelf break generally lies 3 to 30 kilometers (2 to 20 miles) offshore in parts of the Aleutians, but 70 to 480 kilometers (45 to 300 miles) from land in parts of the Bering Sea. Cable depths can be very deep. From Whittier or Seward through Prince William Sound, cable depths would achieve estimated depths of 3,550 meters (11,640 feet) at Knight Island Passage. Entering the Gulf of Alaska to the Kodiak Loop, depths to seafloor are more shallow, generally ranging between 115 to 300 meters (380 to 966 feet). South of Kodiak and for the remainder of the cable reach, depths generally range from just over 900 to almost 4,000 meters (3,000 to 13,000 feet).

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Land segments of the cable route would be relatively short and would generally occupy previously disturbed cable and utility corridors. Seward and Whittier are situated near the base of deeply incised glacial fjords in the Kenai Mountains. Surface relief is mildly sloping toward the bay. Adjacent mountain elevations can achieve 1,303 meters (4,274 feet) at Seward and 1,100 meters (3,609 feet) at Whittier.

The fiber optic cable line would land at Kodiak Island at Monashka Bay. The cable would traverse southerly across 457 meters (1,500 feet) of beach land before intersecting an existing utility corridor. The terrain along the cable alignment generally would not exceed 76 meters (250 feet) in ground elevation.

The longest land segment would occur at Nikolski, Umnak Island. The fiber optic cable line would come ashore at Driftwood Bay, passing westerly across low-lying terrain to Nikolski Bay, a distance of 10 kilometers (6 miles).

The land terminus of the fiber optic cable line would be at Shemya Island. The fiber optic cable line would make landfall near the southeast end of the island, near Fox Beach. Once on-island, the cable would follow existing utility corridors. The exact on-island route has not been determined at this juncture. The island is nearly encircled by a wave cut platform or terrace. Elevations on the southern side of the island are generally 6.0 to 8.0 meters (20 to 25 feet) above mean sea level.

Geology

The composition and thickness of sea floor sediments along the proposed alignment are unknown, as is the geology structure, and possible geologic hazards. The underlying geology can be surmised from the general geology of the islands.

The western Kenai Peninsula is underlain by Cretaceous graywacke, slate, conglomerates, and volcanic rock containing mafic and ultramafic bodies. Continental sedimentary rock and basaltic andesite outcrop on many island shores. Much of region is blanketed by surficial deposits of superglacial till, glacial outwash, alluvium, colluvium, and littoral deposits consisting of sand and lesser gravel.

Geologically, the Kodiak–Afognak Island areas are thought to be an appendage of the Kenai Peninsula; they share the same rocks and structures and are only 64 kilometers (40 miles) apart. The islands in the western part of the region are “accreted” continental parts. That is, they are successive wedges of marine sediments that accumulated in and near the trench at a convergent plate margin and were subsequently scraped off onto the continental margin and deformed as the oceanic plate was subducted.

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Long faults, some thrust and others steep with predominantly vertical movement, extend the length of the western region and travel northeast from Kodiak Island to the Kenai Peninsula.

The islands and offshore area of the Alaska Peninsula are composed of deformed strata of continental origin that has been detached from the Alaska Peninsula by faulting and volcanism. The islands are situated on the Shumagin–Kodiak Shelf and are part of the slate and graywacke belt of southern Alaska. This belt of sedimentary rock is highly deformed and displays local and complex folding and faulting. The boundary between rock of the Alaska Peninsula and rock of the slate and graywacke belt probably represents a major fault. Portions of the area are covered by Tertiary and/or Quaternary volcanic rocks that prevent identification of the underlying terranes.

The sedimentary belt is composed of a thick sequence of Tertiary graywacke sandstone, black argillite, marl, shale, clay, and conglomerate. This sequence is intruded by mid-Tertiary quartz-diorite. The Shumagin Islands and islands nearby are underlain chiefly by sedimentary and volcanic rocks that are intruded by felsic and intermediate plutons.

Bedrock deposits are overlain by unconsolidated glacial deposits of varying thickness, as well as alluvium, colluvium, and inactive and active sand dunes. At Simeonof Island, deposits of beach and wind-blown sand can exceed 10 meters (30 feet) in thickness.

The Aleutian Islands are composed almost entirely of Tertiary and Quaternary volcanic and volcaniclastic rocks. Rock types are predominantly basalt and andesite lava flows. The major active volcanoes are strato volcanoes. The Aleutian Islands are actually the crests of an arc of submarine volcanoes. An arcuate line of 57 volcanoes, 27 of these active, rises 610 to 2,743 meters (2,000 to 9,000 feet) above sea level along the north side of the islands. Older volcanoes of the Aleutians include both shield volcanoes and strato volcanoes. There are also a large number of calderas or craters of volcanoes that have collapsed.

The bedrock is overlain by a wide variety of unconsolidated deposits including volcanic ash, pumice, cinders, glacial till, outwash, and alluvium deposited by glacial ice, running water, lake water, mass wasting, and wind.

Soils

Detailed soil information is not available for the cable land crossings. In general, steeper rock areas will consist of gravelly loam to silty volcanic ash layers. Hilly terrains will generally yield a thicker mantle of silty

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volcanic ash, and low valley bottoms and moraine hills will contain deep fibrous or partially decomposed peat soils with lenses of volcanic ash.

Mineral Resources

There is evidence of mineralization throughout the Gulf of Alaska. Most relevant to the land crossings, there are stone and gravel pits near the town of Kodiak on Kodiak Island. On the northwest portion of Kodiak Island there is also gold, silver, and lead prospect as well as a past-producing placer gold deposit on the beach. Gold has been reported near Womens Bay, but not in economically feasible amounts. None of the other land crossings should encounter potentially recoverable mineral resources.

Petroleum prospects are favorable along the Gulf of Alaska Outer Continental Shelf Planning Area; however, for the most part, oil and gas resources of offshore Alaska occur in accumulations too small to warrant commercial exploitation in the foreseeable future. Only about 15 percent of the geologic oil endowment of offshore Alaska occurs in accumulations sufficiently large to be economic. Most of the undiscovered economically recoverable oil resources occur beneath the Beaufort Shelf and Chukchi Shelf in the Arctic area. The rest of the undiscovered, economically recoverable oil resources of the Alaska Federal offshore occur in Cook Inlet. (U.S. Department of Interior, Mineral Management Service, 1995—Assessment Data for Oil and Gas Potential of Alaska Federal Offshore)

Geologic Hazards

The Gulf of Alaska and Aleutian Island chain is one of the most seismically active areas in the world, responsible for 10 of the 13 largest earthquake events ever recorded in the United States. Most significant among these quakes was the magnitude 9.2 Prince William Sound Earthquake, or Great Alaska Earthquake, which was centered north of Middleton Island in the northern Gulf of Alaska in 1964. Most of the great earthquakes in this region generate tsunamis that impact coastal towns on the Gulf of Alaska as well as distant locations in the Pacific Basin. Notable events include the Andreanof Islands Earthquake of 1957. This magnitude 8.8 earthquake destroyed two bridges on Adak Island, destroyed part of a dock on Umnak Island, and Mount Vsevidof erupted after being dormant for 200 years. (U.S. Geological Survey, 1993—Fact Sheet from the Largest Earthquakes in the United States) The 1965 Rat Island Earthquake, magnitude 8.7, generated a tsunami reported to be about 10.7 meters (35.1 feet) high at Shemya Island.

Active volcanoes are prevalent along the Aleutian arc. Over 40 volcanoes have been active in historic time, responsible for approximately 256 eruptions. The volcanoes can generate earthquakes, submarine

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volcanism, and volcanic ash, which could potentially disrupt cable continuity or operation if undiscovered.

3.6.2 NORTH DAKOTA INSTALLATIONS

3.6.2.1 Cavalier AFS—Geology and Soils

The ROI is anticipated to be the area adjacent to the existing Perimeter Acquisition Radar facility. Some power plant and road improvements would be required within the existing boundaries of Cavalier AFS to support the XBR.

Physiography

Cavalier AFS lies in the Central Lowlands province and is situated in the Red River Valley district. Cavalier AFS is located east of the Pembina Escarpment (ridge running approximately north to south through central North Dakota). The valley area is a result of a glacial lake created during the last glacial melting, approximately 12,000 years ago. Features of the ROI include nearshore deposits, beaches, and delta plains from the ancestral glacial lake (Lake Agassiz). Cavalier AFS and the ROI are situated in a relatively flat, large lake plain area. Elevations in the Cavalier AFS area range from 244 to 366 meters (800 to 1,200 feet) above mean sea level. The regional gradient is to the northeast, away from the Pembina Escarpment (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties).

Geology

In eastern North Dakota, Paleozoic and Mesozoic sedimentary rocks ranging in thickness from about 61 to 640 meters (200 to 2,100 feet) overlie Precambrian crystalline rocks. Paleozoic rocks are all of Ordovician age; they include shale, sandstone, and limestone of the Winnipeg Group and limestone of the Red River and Stony Mountain formations. Mesozoic rocks are composed of sandstones, limestones, siltstones, and shales of the Dakota Group and shales and marlstone of the Colorado and Montana Groups. The Mesozoic sequence contains 13 formations, which range in age from Jurassic to Cretaceous. Three of these formations, the Carlile, Niobrara, and Pierre formations, are exposed at the surface along the Pembina escarpment. All three formations are primarily composed of shale of differing structure and hardness, some of which weathers heavily on exposure due to its bentonitic composition. (North Dakota Geology Survey, 1975—Geology of Cavalier and Pembina Counties) The thickness of these formations ranges from 91 meters (300 feet) to greater than 396 meters (1,300 feet).

Surficial deposits at Cavalier AFS consist of four categories based on origin; glacial, lacustrine, fluvial, and eolian. Lithologically, the glacial and fluvial deposits are primarily sand and gravel, reflecting the

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heterogeneous mix of sediment in the original glacial outwash. Lacustrine, or lake deposits from ancestral Lake Agassiz, may range from coarse to fine grained sediments based on the energy environment in which they were deposited in the lake. Eolian deposits are primarily fine, well sorted sand. (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties) Unconsolidated deposits for the Cavalier AFS range in thickness from 4 to 19 meters (13 to 63 feet).

Soils

The soils of the Cavalier AFS area consist of six major associations. The six soil associations range from poorly to well drained and include clays, silts, fine to coarse sands, and gravels (table 3.6-1).

Table 3.6-1: Soils at Cavalier AFS

Soils	Drainage	Texture	Erosion	Salinity
Binford Loam	Moderate to well	Moderate	Minimal	None
Vang Loam	Moderate to well	Fine to coarse	High	None
Brantford Loam	Poor	Very fine to fine	Minimal	None
Rollete Loam	Moderate to poor	Very fine to fine	Minimal	None
Rauville Loam	Poor	Very fine	Minimal	None
Clayey Breaks	Poor	Fine to moderate	Minimal	None

Source: U.S. Army Space and Strategic Defense Command, 1994—Engineering Report, SRMSC.

Mineral Resources

Sand and gravel suitable for concrete aggregate are found around Cavalier AFS and the ROI. The sand and gravel deposits are largely limited to beach deposits of Lake Agassiz. The major gravel pits are found in an old spit west of Cavalier AFS and on top of the Pembina Delta, south of Walhalla. Sand, especially in the delta area, is relatively clean. (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties)

The Carlisle shale has been commercially used in the past for the manufacture of bricks; however, the high sulfur content makes it questionably suitable except for lower grade applications. (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties)

The Pierre Formation is rich in Fuller's earth, which has been used as a clarifying agent for oils, as in bleaching clay, drilling mud, and filler. The lack of abundance and quality of the Fuller's earth does not make commercial extraction feasible except for possible lower quality applications. (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties)

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The Niobrara formation and Red River formation have been investigated as possible sources of Portland Cement. Neither source appears economically feasible at this time. (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties)

Geologic Hazards

There are no known geologic hazards within the Cavalier AFS and ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

3.6.2.2 Grand Forks AFB—Geology and Soils

The ROI is anticipated to be Grand Forks AFB and adjacent land. The GBI field and support structures may require the use of the Grand Forks infrastructure and existing facilities.

Physiography

Grand Forks is situated in the Red River Valley District of the Central Lowlands Physiographic Region. The Central Lowlands region is a result of the last glacial melting, approximately 12,000 years ago. Physiographic features in the ROI include lake plains, beaches, inter-beach areas, and delta plains in the Red River Valley district. Narrow ridges of sand and gravel follow a northwest-southeast trend in Grand Forks County. Grand Forks AFB is situated in a relatively flat, large lake plain area. Elevation in the region ranges from 243 to 353 meters (800 to 1,160 feet) above mean sea level. Relief in the deployment area varies from 1 to 8 meters (3 to 25 feet) per mile (U.S. Department of the Air Force, 1997—Integrated Natural Resource Management Plan, Grand Forks AFB).

Geology

The geologic history and setting is similar to the sequence described in section 3.6.2.1. The Fall River and Lakota formations of the Dakota Group are the predominant bedrock formations underlying Grand Forks AFB. These formations are composed of sandstone, siltstone, and shale and lie at depths generally ranging from 61 to 701 meters (200 to 2,300 feet) below ground surface. These units are overlain by a thick unconsolidated sequence of glacial, fluvial, lacustrine, and eolian deposits. (U.S. Department of the Air Force, 1997—Integrated Natural Resource Management Plan, Grand Forks AFB)

Soils

The soils of the Grand Forks AFB consist of six major soil associations. The soil associations range from poorly to well drained, from fine to coarse textured, and from no saline content to high saline content in their characteristics (table 3.6-2).

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Table 3.6-2: Soils at Grand Forks AFB

Soils	Drainage	Texture	Erosion	Salinity
Antler–Gilby-Svea Loam	Poor to well	Medium	Minimal	None
Bearden–Antler	Poor	Fine to moderate	Minimal	Yes
Glyndon–Gardena	Poor to well	Medium	Minimal	None
LaDelle-Cashel	Poor to moderate	Fine to medium	Minimal	None
Ojata	Poor	Fine to moderate	Minimal	Yes
Wyndmere–Tiffany–Arvenson	Poor	Moderate to coarse	Minimal	None

Source: U.S. Department of the Air Force, 1997—Integrated Natural Resources Management Plan, Grand Forks AFB.

Mineral Resources

There are no mineral resources of economic value on Grand Forks (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota). The main sand and gravel suppliers are located near the Grand Forks area. Most of the suppliers have local resources or could obtain additional supplies by rail from sources outside of North Dakota.

Geologic Hazards

There are no known geologic hazards in the Grand Forks AFB area and ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

3.6.2.3 Missile Site Radar—Geology and Soils

The ROI is anticipated to be all the area proposed for new construction within the existing Missile Site Radar boundary and the land adjacent to the site. This would include a GBI missile field in the east-central portion of the Missile Site Radar, and a BMC2, helicopter pad, and housing in the western half of the existing cantonment area.

Physiography

The Missile Site Radar and the ROI lie in the Central Lowlands physiographic area in the Drift Prairie province. The Drift Prairie is bordered on the east by the Pembina Escarpment (a ridge running approximately north to south through eastern North Dakota) and on the west by the Missouri Escarpment (a ridge running approximately north to south through western North Dakota). Features of the ROI include undulating delta plains, moraines, drumlins, and occasional meltwater channels. The Missile Site Radar and ROI are situated in a relatively flat, large lake delta plain area. Elevations in the plain district range between 491 to 506 meters (1,610 to 1,660 feet) above mean sea level and average approximately 497 meters (1,630 feet) above mean sea level.

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Relief is approximately 15 meters (50 feet) for the entire region (U.S. Army Space and Strategic Defense Command, 1994). Average elevation at the site is approximately 494 meters (1,620 feet).

Geology

The geologic setting is similar to that described in section 3.6.2.1. Surficial geology of the Missile Site Radar and ROI consists of clays, silts, sands, sand lenses, glacial till, and occasional cobblestones. Unconsolidated deposits are to a depth of approximately 5 meters (15 feet) in the Missile Site Radar area and ROI. Unconsolidated deposits are underlain by light to dark gray blocky shales. The shales range in depth from 91 meters (300 feet) to a maximum of 700 meters (2,300 feet) (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties).

Soils

The soils of the Missile Site Radar and ROI consist of 19 major soil associations. The soil associations range from poorly to well drained and from fine to coarse textured in their characteristics (table 3.6-3).

Table 3.6-3: Soils at Missile Site Radar

Soils	Drainage	Texture	Erosion	Salinity
Valler–Hamerly Loam	Poor	Fine to medium	Minimal	Yes
Parnell Silty Clay Loam	Poor	Fine	Moderate	No
Svea–Barnes Loam	Moderately well	Fine	Minimal	No
Cresbard–Svea Loam	Well	Fine to medium	Moderate	No
Barnes Loam	Moderately well	Fine	Minimal	No
Hamerly–Tonka Loam	Moderate to well	Fine to moderate	Moderate	No
Svea–Base Loam	Poor to well	Medium	Minimal	No
Barnes–Buse Loam	Poor to well	Fine to medium	Minimal	No
Hamerly–Svea Loam	Poor to well	Fine to medium	Minimal	No
Vang Loam	Very well	Fine to coarse	High	No
Lamoure Complex	Poor	Fine	Minimal	No
Wyard–Hamerly Loam	Poor	Fine to medium	Minimal	No
Vallers–Parnell Complex	Poor	Fine to medium	Moderate	Yes
Binford Loam	Well	Medium	Minimal	No
Hamerly–Cresbard Loam	Moderate	Very fine to fine	Minimal	No
Brantford Loam	Poor	Fine to medium	Minimal	No
Rollete Loam	Poor to moderate	Fine	Minimal	No
Rauville Loam	Poor	Fine	Minimal	No
Clayey Breaks	Poor	Fine to moderate	Minimal	No

Source: U.S. Army Space and Strategic Defense Command, 1994—Engineering Report, SRMSC.

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Mineral Resources

Sand and gravel suitable for concrete aggregate are found in the vicinity of the Missile Site Radar. The highest grade deposits are largely limited to beach deposits of Lake Agassiz. The major gravel pits are found in beach gravels on top of the Pembina Delta, south of Walhalla. Sand, especially in the delta area, is relatively clean (North Dakota Geological Survey, 1975—Geology of Cavalier and Pembina Counties). Sources of sand and gravel derived from river deposited outwash may be extractable locally. A gravel pit exists 8 kilometers (5 miles) to the southwest of the Missile Site Radar.

Geologic Hazards

There are no known geologic hazards in the Missile Site Radar area of the ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

3.6.2.4 Remote Sprint Launch Site 1—Geology and Soils

This section describes the physiography, geology, mineral resources, soils, and geologic hazards for the Remote Sprint Launch Site 1 property and ROI. The geologic ROI is defined as the physical geography, natural features, and land forms in the area of Remote Sprint Launch Site 1 and the adjacent properties that could be affected by construction or operations of an XBR. The physiography, geology, and mineral resources for this site are similar to that described for the Missile Site Radar. The soils of the Remote Sprint Launch Site 1 and ROI consist of four major soil associations. The soil associations range from poorly to well drained and from fine to medium textured in their characteristics (table 3.6-4). There are no known geologic hazards in the Remote Sprint Launch Site 1 ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

Table 3.6-4: Soils at Remote Sprint Launch Site 1

Soils	Drainage	Texture	Erosion	Frost Heave	Salinity
Valler–Hamerly Loam	Poor	Fine to medium	Minimal	Yes	Yes
Svea–Buse Loam	Poor to well	Medium	Minimal	None	No
Barnes–Buse Loam	Poor to well	Fine to medium	Minimal	None	No
Hamerly–Svea Loam	Poor to well	Medium to fine	Minimal	None	No

Source: U.S. Army Space and Strategic Defense Command, 1994—Engineering Report, SRMSC.

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3.6.2.5 Remote Sprint Launch Site 2—Geology and Soils

This section describes the physiography, geology, mineral resources, soils, and geologic hazards for the Remote Sprint Launch Site 2 property and ROI. The geologic ROI is defined as the physical geography, natural features, and land forms in the area of the Remote Sprint Launch Site 2 and the adjacent properties that could be affected by construction or operations of an XBR. The physiography, geology, and mineral resources for this site are similar to that described for the Missile Site Radar. The soils of the Remote Sprint Launch Site 2 and ROI consist of four major soil associations. The soil associations range from poorly to well drained and from fine to medium textured in their characteristics (table 3.6-5). There are no known geologic hazards in the Remote Sprint Launch Site 2 ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

Table 3.6-5: Soils at Remote Sprint Launch Site 2

Soils	Drainage	Texture	Erosion	Frost Heave	Salinity	Regions
Svea–Barnes Loam	Moderately well	Fine	Minimal	None	No	Central, southcentral
Cresbard–Svea Loam	Well	Fine to medium	Moderate	None	No	Southeast
Hamerly–Tonka Loam	Moderate to well	Fine to moderate	Moderate	None	No	North, southwest, southeast
Svea–Buse Loam	Poor to well	Medium	Minimal	None	No	Southwest, northeast

Source: U.S. Army Space and Strategic Defense Command, 1994—Engineering Report, SRMSC.

3.6.2.6 Remote Sprint Launch Site 4—Geology and Soils

This section describes the physiography, geology, mineral resources, soils, and geologic hazards for the Remote Sprint Launch Site 4 property and ROI. The geologic ROI is defined as the physical geography, natural features, and land forms in the area of the Remote Sprint Launch Site 4 and the adjacent properties that could be affected by construction or operations of an XBR. The physiography, geology, and mineral resources for this site are similar to that described for the Missile Site Radar. The soils of the Remote Sprint Launch Site 4 and ROI consist of five major soil associations. The soil associations range from poorly to well drained and from fine to medium textured in their characteristics (table 3.6-6). There are no known geologic hazards in the Remote Sprint Launch Site 4 ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

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Table 3.6-6: Soils at Remote Sprint Launch Site 4

Soils	Drainage	Texture	Erosion	Frost Heave	Salinity	Regions
Valler–Hamerly Loam	Poor	Fine to medium	Minimal	Yes	Yes	Plains
Parnell Silty Clay Loam	Poor	Fine	Moderate	None	No	Northwest
Svea–Barnes Loam	Moderately well	Fine to moderate	Minimal	None	No	Southeast, central, northwest
Cresbard–Svea Loam	Well	Fine to medium	Moderate	None	No	East, south, southwest
Barnes Loam	Moderately well	Fine to moderate	Minimal	None	No	North, northeast

Source: U.S. Army Space and Strategic Defense Command, 1994—Engineering Report, SRMSC.

3.6.2.7 North Dakota—Fiber Optic Cable Line—Geology and Soils

Fiber optic cable line would be required to link all system elements in the North Dakota region. Cable would be buried 2 to 3 meters (6 to 10 feet) below ground surface along existing rights of way. At this juncture, the exact routing has not been defined. This section is therefore described in general terms.

Physiography

The fiber optic cable line would traverse portions of the Red River Valley (Cavalier AFS) and Glaciated Plains sections (all remaining site areas) of the Central Lowland physiographic province. Landforms in this region include lake plains, beaches, inter-beach areas, and delta plains. The terrain is relatively flat over large areas of the Red River Valley section, shifting to undulating and rolling terrain on the glacial plain. Drainage is poorly developed, creating many lakes and sloughs on the glacial plain. Elevations in the area range between 366 meters (1,200 feet) to 518 meters (1,700 feet) above mean sea level and average approximately 497 meters (1,630 feet) above mean sea level. The most significant physiographic feature to be negotiated by the cable routing will be the Pembina Escarpment, a significant (but relatively subtle) topographic feature that marks the boundary between the two physiographic sections.

Geology

The rolling terrain is underlain by Quaternary glacial deposits of variable thickness, ranging from a few feet to several hundred feet in buried valleys. Shale of the Cretaceous Pierre Formation, Niobrara or Carlile formations directly underlies the Quaternary sediments over the cable route. Depending on the route, these formations may be encountered

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during excavation. All three formations are primarily composed of shale of differing structure and hardness, some of which weathers heavily on exposure due to its bentonitic composition (North Dakota Geological Survey, 1975–Geology of Cavalier and Pembina Counties).

The glacial surficial materials will exhibit a wide range of compositions, from clay and sand deposits to gravelly and cobbly glacial tills.

Soils

The soils of the fiber optic cable line area would be varied based upon the regions that it would pass through from site to site. The soil associations in the Central Lowlands physiographic area range from poorly to well drained, from fine to coarse texture, and from no saline content to high saline content in their characteristics. The soils would be similar to those previously described for the other North Dakota sites.

Mineral Resources

Construction quality sand and gravel are found primarily in deposits similar to those in the fiber optic cable line area. The USGS does not consider the sands and gravel in the area to be of a high enough quality for a potential economic source (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).

Geologic Hazards

There are no known geologic hazards in the fiber optic cable line ROI (North Dakota Geological Survey, 1973—Mineral and Water Resources of North Dakota).