DEPARTMENT OF THE ARMY
U.S. ARMY GARRISON ALASKA

PERMAFROST TUNNEL RESEARCH FACILITY
SAFETY, SUSTAINMENT, AND PROTECTION
DRAFT FINDING OF NO SIGNIFICANT IMPACT AND ENVIRONMENTAL ASSESSMENT

U.S. ARMY

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ENVIRONMENTAL ASSESSMENT

U.S. ARMY GARRISON, ALASKA
PERMAFROST TUNNEL RESEARCH FACILITY SAFETY, SUSTAINMENT, AND PROTECTION

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DRAFT FINDING OF NO SIGNIFICANT IMPACT

PERMAFROST TUNNEL RESEARCH FACILITY SAFETY, SUSTAINMENT, AND PROTECTION

The National Environmental Policy Act of 1969 (NEPA) requires federal agencies to consider potential environmental impacts prior to undertaking a course of action. Within the Department of the Army, NEPA is implemented through regulations promulgated by the Council on Environmental Quality (CEQ) (Parts 1500–1508 of Title 40 of the Code of Federal Regulations [40 CFR Parts 1500–1508]), with supplemental guidance provided by Army NEPA regulations (32 CFR Part 651). In accordance with NEPA, U.S. Army Garrison (USAG) Alaska prepared an Environmental Assessment (EA) to consider the environmental consequences of the proposed action and alternatives for Permafrost Tunnel Research Facility (PTRF) Safety, Sustainment, and Protection.

Description of Action: USAG Alaska seeks a real estate solution that improves the safety, protection, and sustainability of the PTRF by: (1) mitigating the risk of encroachment, and (2) enabling the prerequisite conditions for several other potential actions that would be subject to separate environmental review if considered in the future. These actions could include installation of erosion control features, continued research in the watershed, and expansion of the tunnel beyond the current property boundaries. The decision is whether to implement Alternative 1, purchase 338 acres (six parcels) from the Alaska Mental Health Trust Association (MHTA) and purchase 67 acres (two parcels) from the State of Alaska Department of Natural Resources (DNR) (proposed action); Alternative 2, purchase 338 acres (six parcels) from MHTA and lease 67 acres (two parcels) from DNR; or Alternative 3, no action. The eight parcels owned by MHTA and DNR are in the watershed directly upslope of the PTRF. Land disturbance in these parcels modifies the surface flow through the PTRF property, potentially damages the permafrost, and threatens the sustainability of the PTRF.

Procedure: Analysis of potential environmental impacts associated with each alternative action is set forth in the USAG Alaska *Permafrost Tunnel Research Facility Safety, Sustainment, and Protection Environmental Assessment*. The findings of this EA are incorporated into this decision document. Potential issues were determined relevant if they fell within the scope of the proposed action or if they influenced the decision on the proposed action. The EA therefore evaluates the potential environmental consequences of implementing the proposed action and alternatives with regard to biological resources, water resources, and geological resources. USAG Alaska and agency stakeholders were informed of the proposed action, and their comments were solicited. Solutions responsive to public concerns and questions are integrated into elements of the proposed action.

Anticipated Environmental Impacts for Permafrost Tunnel Research Facility Safety, Sustainment, and Protection: Under Alternative 1 (the proposed action), the parcels in the watershed upstream of the PTRF, whose hydrological regime directly influences the condition of permafrost resources within and above the existing PTRF property, can be managed in alignment with the continued, effective operation of the PTRF. Alternative 1 would not change existing conditions for biological, water, or geological resources, but would effectively mitigate the adverse impacts of encroachment on biological, water, and geological resources. Cumulative impacts under Alternative 1, related to future potential maintenance, research, and facilities management for the PTRF enabled by the purchase of the eight parcels from MHTA and DNR, would have neutral-to-beneficial impacts on the resources analyzed. Under Alternative 2, the PTRF would gain a measure of protection from upstream land development; however,

uncertainty would remain as to future actions, access, and conditions related to the leased DNR parcels, which contain the lower reach of a stream channel upstream of the PTRF. Alternative 2 would not change existing conditions for biological, water, or geological resources, but would effectively mitigate the adverse impacts of encroachment on those resources on the MHTA properties. Benefits to resources related to cumulative impacts from foreseeable future PTRF management actions would be limited to the MHTA parcels under Alternative 2. Under Alternative 3 (no-action alternative), MHTA and DNR would continue to own and manage the properties in the watershed upstream of the PTRF, unless and until either landowner chooses to lease or sell any of these properties to another entity. Alternative 3 would have no direct impact on biological, water, or geological resources; however, the cumulative impacts of the no-action alternative in combination with the anticipated future lease or sale of parcels for land development include adverse impacts to resources analyzed. After consideration of potential environmental impacts, community concerns, and USAG Alaska mission requirements, Alternative 1, Purchase 338 acres (six parcels) from the MHTA and Purchase 67 acres (two parcels) from the DNR, was found to offer the best course of action.

Mitigation Measures: The proposed action ensures that parcels adjacent to the PTRF will not be developed for land uses incompatible with the sustainability of the PTRF, which requires that the properties remain undeveloped. Relative to the other alternatives, this outcome yields benefits for biological resources, water resources, and geological resources in the watershed. Therefore, no mitigation measures are proposed.

Conclusion: Based on a review of the information contained in this EA, USAG Alaska determined that the acquisition of eight parcels owned by MHTA and DNR, as set forth in Alternative 1, is not a major federal action that would significantly affect the quality of the environment within the meaning of Section 102(2)(C) of NEPA. Accordingly, the preparation of an Environmental Impact Statement for this proposed action is not required.

Point of Contact: Requests for Further Information should be directed to Melanie Roed, NEPA Program Manager, (907) 361-6323, melanie.s.roed.civ@army.mil, or by mail:

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ACRONYMS AND ABBREVIATIONS

°F	Degrees Fahrenheit
AR	Army Regulation
Army	U.S. Army
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CRREL	Cold Regions Research and Engineering Laboratory
CWA	Clean Water Act
DNR	State of Alaska Department of Natural Resources
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ERDC	Engineering Research and Development Center
ESA	Endangered Species Act
FNSI	Finding of No Significant Impact
ICRMP	Integrated Cultural Resources Management Plan
IPaC	Information for Planning and Consultation
MBTA	Migratory Bird Treaty Act
MHTA	Mental Health Trust Authority
MHTA	State of Alaska Mental Health Trust Association
NEPA	National Environmental Policy Act
$PM_{2.5}$	Particulate matter with a diameter less than 2.5 micrometers
PTRF	Permafrost Tunnel Research Facility
SHPO	State Historic Preservation Office
USACE	U.S. Army Corps of Engineers
USAG	U.S. Army Garrison
USC	United States Code
USGCRP	U.S. Global Change Research Program
USFWS	U.S. Fish and Wildlife Service

1. PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

1.1.1 Description of the Permafrost Tunnel Research Facility

Situated on a 16-acre parcel in Fox, Alaska, near the confluence of Goldstream and Glenn creeks, the Permafrost Tunnel Research Facility (PTRF)—owned by the U.S. Army (Army) and managed by the U.S. Army Corps of Engineers (USACE) Cold Regions Research and Engineering Laboratory (CRREL)—permafrost tunnel complex is a 650-meter-long research facility dug into a large block of continuous permafrost. The PTRF is unique, unlike any other permafrost research facility in the world. The 1963 tunnel project initiated a U.S. and international effort to better understand permafrost, which has lasted six decades. The tunnel intersects a wide range of permafrost features including ice wedges, segregated ice, thermokarst cave ice, frozen silts, gravels, and organic material. It also provides an unprecedented continuous 100-meter exposure of permafrost extending in time from the present to approximately 45,000 years in the past, with unusually complete sequences of paleo-environments (including mega-fauna bones) preserved intact. The permafrost in the tunnel represents syngenetic, ice-rich, high-organic carbon soils. The facilities at the PTRF consist of the old (north) portal and tunnel, the new (south) portal and tunnel, the visitor cabin, the safety building, three storage units, and refrigeration units. A trail heading above the tunnel provides access to undeveloped lands with modern surface vegetation and permafrost.

The tunnel has been used to study civil engineering and geotechnical aspects of permafrost, geology, geocryology, cryospheric science, microbial life in extreme environments, permafrost biogeochemistry, paleontology, paleoclimatology, and mining and construction techniques specific to permafrost environments. More than 70 technical papers have been based on research conducted at the PTRF. The site also provides a unique opportunity for research, outreach, and education; thousands of people visit the facility annually to learn about permafrost and see features firsthand. U.S. presidents, members of Congress, cabinet members, ambassadors, state and federal agency heads, numerous researchers, and thousands of teachers, students, and administrators have studied and learned about permafrost firsthand in the tunnel. In 2022, CRREL renewed a Cooperative Research and Development Agreement that facilitates contributions from the University of Alaska Fairbanks to CRREL's management of the tunnel for research and education purposes.

Department of Defense and Army strategies for climate resilience and Arctic operations are closely aligned with CRREL permafrost and related research objectives. The Army owns the land where the tunnel is located and has strategic interest in the research enabled by the continued operation of the PTRF. Climate change and its impact on permafrost have implications for military infrastructure and forces in the Arctic. Lands surrounding the PTRF are experiencing altered surface hydrology and shifting vegetation regimes due to unprecedented warming. These changes present both an opportunity for critical research and a threat to the sustainability of the PTRF.

1.1.2 History of the Permafrost Tunnel Research Facility

The permafrost tunnel was constructed to test the potential benefits of permafrost for military applications. Located at the eastern edge of early twentieth century mining operations in the Goldstream Valley, 10 miles north of Fairbanks, Alaska, the purpose of the PTRF was to explore the military

applications of permafrost and, specifically, the construction of emergency shelters or storage facilities in case of a nuclear attack or Soviet invasion.

The original tunnel—including the north adit (or horizontal passage), winze (vertical or inclined passage), and gravel room—was excavated from 1963 to 1969 for the study of permafrost, geology, ice science, and mining and construction techniques specific to permafrost environments. Excavated into an escarpment left over from the area's historical gold mining, the tunnel was also used to evaluate underground excavation techniques for mining applications. It was during the excavation process that the scientific and engineering research value of the previously undisturbed permafrost and associated resources within the tunnel became clear.

To expand knowledge and understanding of scope, scale, and three-dimensional properties of permafrost, a new, south tunnel was begun approximately 200 feet to the southwest of the original, north tunnel in 2011. The south tunnel was again expanded in 2013, 2018, 2019, and 2020. The south tunnel now connects to the north tunnel with three crosscuts, creating a single tunnel complex totaling approximately 650 meters in length.

Expansion of the permafrost tunnel was essential to support vital research limited by the previous tunnel configuration. Expansion of the permafrost tunnel has resulted in a three-dimensional test bed for use in advancing capabilities in geophysical and remote sensing standoff detection, predictions of thaw degradation based on similar historical warm periods evident in the tunnel, and improved engineering to account for the anticipated future changes to permafrost. The additional permafrost exposed by new excavations provides access to more ice features, bones, vegetation, and soils, which allows for a more holistic view of the formation history and anticipated changes to permafrost in interior Alaska. Environmental changes, attributed in part to Alaska's warming climate, are apparent at the PTRF, where ongoing changes to surface hydrology threaten the integrity of the permafrost to which the tunnels provide access.

1.1.3 Ongoing Actions

In recent years, CRREL has begun to consider expanding the tunnel beyond current property boundaries into (i.e., below) adjacent property currently owned by Alaska Mental Health Trust Authority (MHTA). Tunnel expansion, which would facilitate further permafrost research and help the PTRF adapt to climate change, is only a potential future prospect that would be subject to a separate environmental review process and is not being considered under the proposed action.

In 2019, CRREL submitted a permit application to MHTA to preclude incompatible development, construct erosion control structures, and continue existing USACE Engineering Research and Development Center (ERDC) research projects on the adjoining MHTA property. During the permit application process, MHTA informed CRREL of preliminary plans to extend a subdivision down towards the PTRF property. MHTA also explained that only a lease or purchase would preclude them from issuing permits for mining development on the property.

Concurrent with the MHTA permit, CRREL requested support from USACE Alaska District's Real Estate Division to seek an appropriate real estate instrument to acquire or lease the property. During discussions with USACE Alaska's District, CRREL also inquired about the potential to tunnel under the property. USACE Alaska's District determined that purchase was the only viable acquisition option since a tunnel would be considered a permanent improvement.

1.2 Purpose and Need

1.2.1 Purpose of the Proposed Action

The purpose of the proposed action is to protect the safety and sustainability of the PTRF by: (1) precluding incompatible development on the adjoining properties that threaten the tunnel and (2) enabling the implementation of erosion control measures on adjoining properties where changing drainage patterns threaten the facility. Additional benefits include enabling PTRF operations and strategic upgrades, otherwise hindered by the existing property boundaries; namely (3) continued deployment of long-term research equipment already on the adjoining property and (4) future expansion of the tunnel further into the hillside below the adjoining property.

1.2.2 Need for the Proposed Action

Potential development and changing drainage patterns on the adjoining properties (currently owned by MHTA and State of Alaska Department of Natural Resources [DNR]) threaten the safety and sustainability of the PTRF. Historical mining activity (limited to artisanal practices that ended over a century ago) combined with the changing climate have contributed to unstable drainage conditions in the watershed upslope of the PTRF. Development of properties in the watershed above the tunnel (whether commercial, industrial, residential, or other development), would exacerbate the existing drainage and erosion problem and could result in the total loss of the PTRF, a national treasure unique in the world. Since 2011, the Army has invested over $20 million in PTRF expansion, and upgrading and supporting facilities that are at increasing risk. Congressional support and funding are available to continue to upgrade the PTRF facilities, purchase properties above the PTRF to protect the tunnel, and expand the tunnel. However, tunnel expansion is not within the scope of this Environmental Assessment (EA).

Hydrology and Climate Change: Rapidly changing drainage patterns threaten the PTRF. The hydrology on the hillside above the tunnel property is changing quickly due to climate change, historical alterations to stream channels, and ongoing recreational use of informal trails throughout the property by all-terrain vehicles and snowmobiles. Modified drainage patterns and recreational use on the MHTA and DNR properties above and upslope of the tunnel, are channeling water onto the PTRF property directly above the tunnel complex, threatening the tunnel's integrity. Historical mining activity until the early twentieth century modified the profiles of Glenn Creek and Swindle Creek, destabilizing the creek channels. The local substrate of glacial silt and gravel has not enabled the creeks to stabilize over time. The creek channels are unnaturally steep and show signs of headcutting and downcutting (i.e., the lengthening and deepening of an eroding streambed, respectively). Unstable conditions have also led to lateral migration of the creek channels. Due to recent and future projected climate warming in the Fairbanks area, the incidence of extreme rainfall events and erosion across the hillside above the tunnel are increasing. It is critical that U.S. Army Garrison (USAG) Alaska and CRREL have permanent access and control over this land to put in place permanent drainage and erosion control structures and allow CRREL to install protective measures if and where needed.

Encroachment: Mining and subdivision expansion threaten the PTRF. There are currently no limitations on the type of activities that MHTA could permit on its properties (including development and mining), which could exacerbate existing drainage problems and threaten the PTRF. MHTA has notified CRREL of a potential plan to expand an existing subdivision into the watershed above the tunnel facility. Mining companies have been acquiring leases for former mining properties in the PTRF area and have announced plans to open new mines on these properties.

Tunnel Expansion: Land acquisition is required for permanent modifications. Future plans for the tunnel call for excavation eastward into lands currently held by MHTA. Excavating into lands held by lease would not be permitted. Incompatible development on leased lands would threaten the long-term viability of the tunnel expansion. Fairbanks has multiple ongoing mine and exploration projects near the tunnel property. If USAG Alaska purchased the lands uphill of the tunnel, surface or subsurface mining claims would be prevented from affecting the management of and access to those lands. It is critical that CRREL have permanent access and control over this land to prevent surface and subsurface mining or property development.

Ongoing Research in the Watershed at Risk: CRREL currently has small-scale meteorological stations and other mobile research equipment in the watershed upslope of the tunnel on MHTA and DNR properties. This research equipment and the long-term experiments that depend on the equipment are at risk because the permit has not been renewed. A major aspect of permafrost research and engineering is the vegetation/ecotype above the permafrost. Currently, CRREL has permanent access only to the spruce forest ecotype immediately above and surrounding the tunnel, but the properties east of the tunnel provide access to mixed birch and tussock tundra ecotypes. Permanent meteorological stations and other equipment need to be installed on the adjoining property.

1.3 Scope and Content of the Environmental Assessment

Per the updated National Environmental Policy Act (NEPA) regulations by the Council on Environmental Quality (CEQ) that went into effect May 2022, this EA considers the potential impacts of the proposed action and alternatives on the potentially affected environment and the degree of the effects or impacts of the action. Effects or impacts are changes to the human environment from the proposed action or alternatives that are reasonably foreseeable and include the following 2022 updated NEPA regulations:

1. Direct effects are caused by the action and occur at the same time and place.

2. Indirect effects are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable.

3. Cumulative effects are effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (federal or non-federal) or person undertakes such other actions Part 1508.1 (g)(1)-(3) Title 40 of the Code of Federal Regulations (40 CFR 1508.1 (g)(1)-(3)). The analysis is based on impacts to environmental resource areas. Specific environmental resource areas analyzed in detail within this EA include biological resources, water resources, and geological resources, and cumulative impacts.

The analysis uses existing survey data and describes existing environmental conditions and impacts to resource areas. The analysis then presents how proposed land acquisition may potentially impact resource areas. For example, how the proposed purchase of properties in the watershed upslope of the PTRF may affect soils, hydrology, and habitats differently than other land uses that one of the current property owners may enable by selling the land to mining or residential development interests. The decision by USAG Alaska is whether or not to implement the proposed action or the alternatives. USAG Alaska would issue a Finding of No Significant Impact (FNSI) if the selected alternative would result in no significant impact to human or environmental health. If the selected alternative results in a significant impact, USAG Alaska would prepare an Environmental Impact Statement.

1.4 Decision To Be Made

The Army is the landholder of the PTRF property and as such is the proponent for the proposed action. If no significant environmental impacts are determined based on the evaluation of impacts in this EA, a FNSI will be signed by the USAG Alaska - Fort Wainwright Garrison Commander. If it is determined that the proposed action would have significant environmental impacts, the action would be modified and mitigated to the level of no significant impact. If the impact cannot be reduced to less than significant, a Notice of Intent to prepare an Environmental Impact Statement would be published.

1.5 Public Participation

To facilitate the analysis and the decision-making process, USAG Alaska maintains a policy of open communication with interested parties and invites public participation. USAG Alaska urges federal and state agencies, public and private organizations, and members of the public that have a potential interest in the proposed action, including minority, low-income, disadvantaged, and Alaska Native groups to participate in the Army's NEPA and decision-making processes, as guided by CEQ regulations at 40 CFR Parts 1500-1508 and Army Regulation (AR) at 32 CFR Part 651. The EA and Draft FNSI are available to federal, state, and local agencies, Native American tribes, and the public for review and comment for a 30-day period upon signature of the EA. USAG Alaska published a Notice of Availability for the EA and Draft FNSI in the Fairbanks Daily News-Miner concurrent with the start of the 30-day public comment period.

USAG Alaska has also made the EA and Draft FNSI available for online viewing at https://home.army.mil/wainwright/about/garrison/public-works/environmental/national-environmental-policy-act-nepa.

Following the 30-day review period, USAG Alaska will address all relevant comments received.

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

USAG Alaska, on behalf of CRREL, is seeking authorization to enter into an appropriate real estate instrument (easement, lease, or purchase) for 338 acres of MHTA property and 67 acres of DNR property. USAG Alaska seeks a real estate solution that improves the safety, protection, and sustainability of the PTRF by:

1. Mitigating the risk of encroachment, and
2. Enabling the prerequisite conditions for several other potential actions that would be subject to separate environmental review if considered in the future, including installation of erosion control features, continued research in the watershed, and expansion of the tunnel beyond the current property boundaries.

All parcels identified (338 acres MHTA plus 67 acres DNR) are in the watershed directly upslope of the PTRF. Land disturbance in these parcels modifies the surface flow through the PTRF property, potentially damages the permafrost, and threatens the sustainability of the PTRF.

The PTRF property is currently owned by the Army. The real estate instrument would be processed through the USACE Alaska District's Real Estate Division on behalf of USAG Alaska - Fort Wainwright. If purchased, the properties would be added to Fort Wainwright real property.

2.2 Alternatives Considered

2.2.1 Alternative 1 (Proposed Action)

Alternative 1 provides the greatest level of protection for the safety and sustainability of the PTRF. Under this alternative, USAG Alaska would purchase up to 338 acres (six parcels) of MHTA property and up to 67 acres (two parcels) of DNR property adjoining and in the watershed upslope of the PTRF (Figure 1). Alternative 1 would, therefore, bestow CRREL with permanent access to and long-term management of the lands with direct hydrological influence on the permafrost and other natural resources critical to the PTRF. The properties to be purchased from MHTA cover the entire main channel of Glenn Creek and the uppermost reach of Swindle Creek's main channel. The DNR properties to be purchased cover the lower reach of the Swindle Creek main channel. DNR owns an additional 200-acre parcel of which the northeast corner covers less than approximately 800 linear feet of Swindle Creek's main channel. The purchase of this parcel is not within the scope of this EA; however, the likelihood that this property will be leased, sold, or developed by DNR is extremely low.

Purchase of the MHTA and DNR properties effectively mitigates the risk of encroachment by land uses incompatible with the safety and security of the PTRF (e.g., mining, residential development). Ownership of the land containing the watershed's major drainage channels (i.e., Glenn Creek and Swindle Creek) enables CRREL to effectively manage erosion as part of long-term water resources and climate change risk management, potentially through the installation of erosion control structures. (The evaluation of design alternatives for erosion control measures is outside the scope of this EA.) Under this alternative, CRREL would be able to continue and expand PTRF research in the watershed for the foreseeable future, and future expansion of the tunnel beyond existing PTRF property boundaries will be feasible due to

certainty and control over the surface land use above the potential new tunnel expansion. (The evaluation of research interventions or tunnel expansion alternatives is outside the scope of this EA.)

2.2.2 Alternative 2

Alternative 2 confers a partial or intermediate measure of safety and sustainability to the PTRF. Under this alternative, up to 338 acres (six parcels) of MHTA property would be purchased and up to 67 acres (two parcels) of DNR property would be leased. Alternative 2 would, therefore, grant CRREL long-term management control over only a portion of the watershed (i.e., the MHTA parcels) and its drainage channels. Over the term of the lease for the DNR properties, the PTRF may benefit from temporary exclusion of incompatible land uses that threaten permafrost integrity and temporarily be able to continue ongoing research on these parcels. The installation of erosion control features may potentially be negotiated with DNR and maintained over the term of the lease; however, long-term management of erosion and hydrological threats to permafrost will not be secured. The expansion of the PTRF with a new tunnel beneath lands purchased from MHTA would be possible under this alternative.

Alternative 2 represents a meaningful divergence from Alternative 1 in terms of real property investment. The cost of leasing properties is understood to be less than the cost of property acquisition, in the short-to-medium term, at least. However, substantial historical and ongoing investment in the PTRF remains vulnerable under Alternative 2. Although DNR is not expected to sell its parcels with a result of incompatible land use, future development of leased land (whether for mining or residential development) poses an existential threat to permafrost and other natural resources critical to the safety and sustainability of the PTRF. For this reason, a purchase/lease combination alternative in which the MHTA parcels are leased and the DNR parcels are purchased was not considered, as such an alternative would not meet the project purpose and need.

2.2.3 Alternative 3 (No-Action Alternative)

The no-action alternative represents a range of potential outcomes relevant to the safety and sustainability of the PTRF, given the lack of control CRREL will have over the access, use, or development of the MHTA and DNR properties adjoining the PTRF. Under Alternative 3, CRREL would not obtain the properties through any real estate instrument, including easement, lease, or purchase. This alternative may, therefore, represent a continuation of current land access and research permitting arrangements between CRREL and the owners of the adjoining properties. However, MHTA has indicated that its properties will likely be sold or leased in the future. The undeveloped parcels could be developed for the expansion of an existing residential subdivision southeast of the PTRF or converted for industrial mining operations. Disturbance of lands in the watershed, including modifications to surface hydrology, represents an existential threat to permafrost within and surrounding the PTRF. The properties owned by DNR are not likely to be sold or developed.

The no-action alternative provides a basis for comparison but is not a selectable alternative because it does not meet the purpose and need for safety and sustainability of the PTRF.

2.3 Alternatives Eliminated from Further Consideration

2.3.1 Screening Criteria

Alternatives that are neither practicable nor reasonable have been eliminated from further consideration. Action alternatives that do not meet the purpose and need for the proposed action have also been eliminated from further consideration.

2.3.2 Close the Tunnel

Closing the permafrost tunnel would result in the loss of a nationally and internationally important research facility that continues to enable advances in fields including cold regions geology, engineering, paleontology, and climate science. This alternative was considered but eliminated from further study because the loss of this unique asset constitutes an unreasonable outcome given the scientific research utility of the PTRF for USACE and its technical partners.

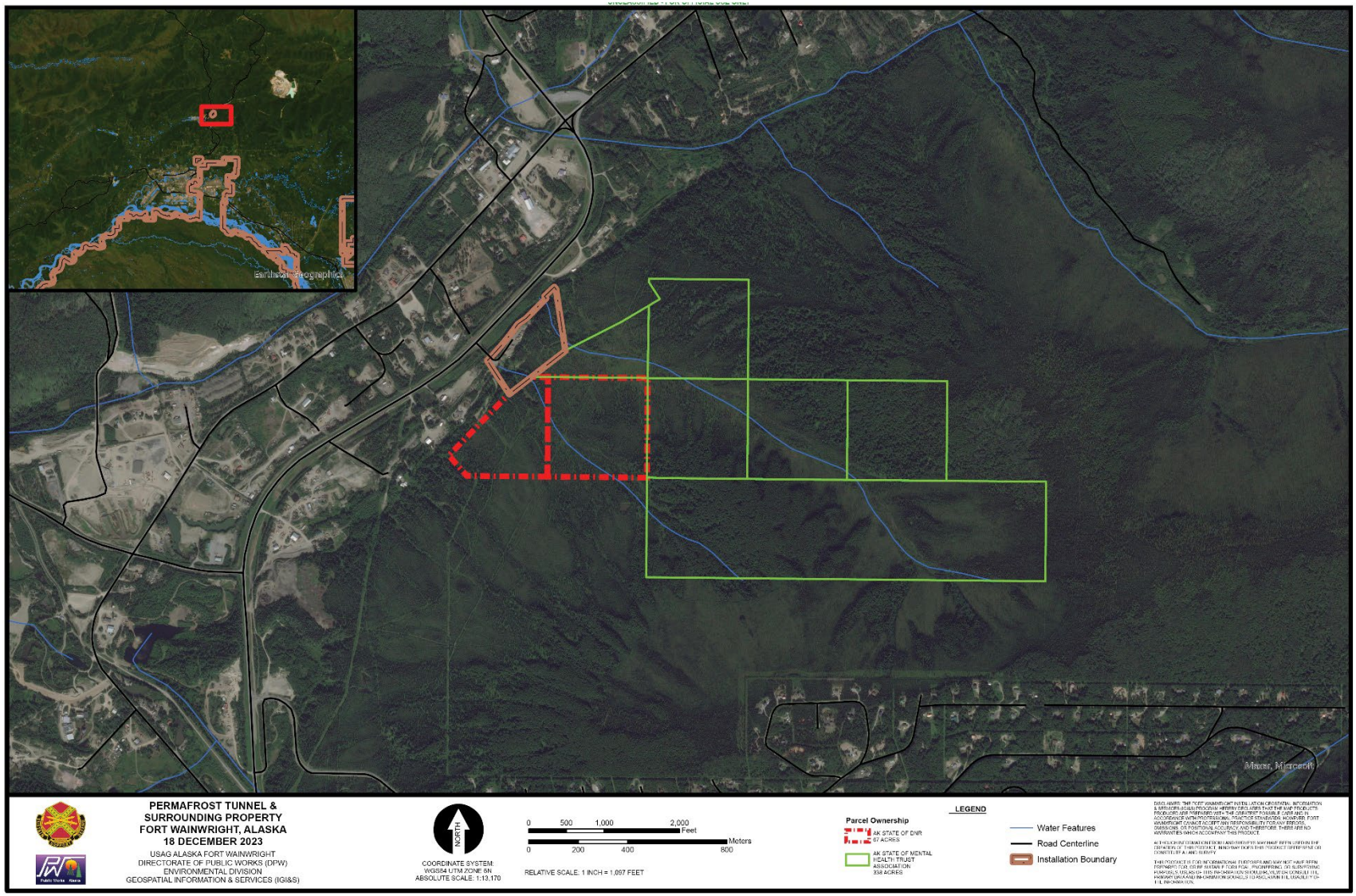
2.3.3 Construct a New Tunnel

Constructing a new PTRF in another location would not be logistically or financially practicable. This alternative was considered but eliminated from further study because the effort and expense to relocate the PTRF and its operations—even if a logistically suitable new location was available—would be unreasonably high relative to Alternatives 1, 2, or 3. In addition, the construction of a new tunnel would interrupt 60 years of research in the existing PTRF. Ending the long-term study of permafrost and related resources that relies on the 60-year record of conditions in the existing PTRF, would eliminate the opportunity to continue decades of continuous research and therefore not meet the purpose and need of the proposed action.

2.3.4 Lease MHTA Parcels and Lease (or Purchase) DNR Parcels

An alternative under which the MHTA parcels are leased would not meet the purpose and need for the proposed action, regardless of whether the DNR parcels are leased or purchased. Potential future expansion of the tunnel complex would not be possible beneath lands leased from MHTA. Leasing the MHTA parcels exposes the PTRF to potentially adverse impacts of incompatible land development after the period of the lease ends. On the other hand, leasing the MHTA parcels in perpetuity would be cost ineffective, especially relative to the cost of purchasing the parcels. In addition, leasing the MHTA parcels under favorable terms (i.e., terms that would prevent MHTA from leasing the parcels to multiple tenants, and that would grant USAG Alaska right of first refusal to purchase the parcels) would be unreasonably expensive.

Figure 1. Properties Adjacent to the PTRF Owned by MHTA and DNR



3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the affected environment (existing conditions) and the environmental consequences for the proposed action and alternatives for PTRF safety, sustainment, and protection.

3.1 Scope of the Analysis

3.1.1 Issues Analyzed

The scope of this EA includes potential environmental impacts of the proposed action and alternatives. Resource categories analyzed for the proposed action and alternatives include water resources, biological/natural resources, and geological resources. These resource categories are expected to experience predictable impacts that would differ depending on the alternative selected, and therefore an analysis of impacts is possible for these resource categories. The discussion includes the environmental impacts of the alternatives; environmental impacts (adverse or beneficial) should the proposed action be implemented including direct, indirect, long-term, and short-term impacts; any irreversible or irretrievable commitments of resources; and cumulative impacts.

3.1.2 Issues Considered and Eliminated from Analysis

The following issues would either not be affected by the proposed action and alternatives, or there is inadequate certainty regarding the outcome of the no-action alternative (Alternative 3) to enable a comparative impact analysis. The potential impacts to the following resource categories could vary widely depending on whether the parcels are sold or leased for other land uses under the no-action alternative and, if so, the extent and type of land development resulting from said lease or sale. Due to this uncertainty, or because the proposed action would have no impact, the following resource categories were considered but eliminated from further analysis:

- **Environmental Health and Safety Risks for Children**

  Executive Order 13045 (1994), Protection of Children from Environmental Health Risks and Safety Risks, requires identification and assessment of environmental health and safety risks that may disproportionately affect children. The proposed action would not involve dangerous or hazardous activities, nor are schools or childcare facilities located near the proposed action area.

- **Environmental Justice**

  Executive Order 12898 (1994), Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, directs each federal agency to identify and address any disproportionately high and adverse environmental effects of its programs, policies, and activities on minority populations and low-income populations. The proposed action area is in Fairbanks North Star Borough, which has a low-income population of 21 percent and a minority population of 32 percent (U.S. Environmental Protection Agency [EPA] 2023). Six U.S. Census block groups are located in the vicinity of the project (i.e., a portion of each block group falls within approximately 1 mile of the proposed action area). Of these six block groups, three block groups contain populations with a low-income or minority population that is proportionally greater than in the reference population (i.e., Fairbanks North Star Borough). Although this environmental justice screening reveals the potential presence of vulnerable communities in the region, there are

no foreseeable impacts to human health, wellbeing, or environmental equity resulting from the proposed action.

- **Socioeconomics**

  Socioeconomics is an umbrella term used to describe aspects of a project that are either social or economic in nature, or a combination of the two. A socioeconomic analysis evaluates how elements of the human environment, such as population, employment, housing, and public services, might be affected by the proposed action and alternatives. The CEQ regulations for implementing NEPA (40 CFR Parts 1500–1508) direct economic analyses of federal actions that will affect local or regional economies. The development (under the no-action alternative) of any number of the eight parcels considered under the proposed action, whether for residential, mining, or other land uses, could be expected to have a minor socioeconomic impact on the region. However, without any certainty regarding the nature of potential land development under the no-action alternative, it is not possible to reasonably estimate socioeconomic impacts. The proposed action (Alternative 1) and Alternative 2 represent no change or disturbance to land uses and therefore no change to local socioeconomics.

- **Hazardous Materials**

  The proposed action area comprises only undeveloped land and there are no records of hazardous materials or waste disposal in the proposed action area. Neither the proposed action nor its alternatives would change hazardous material risks.

- **Floodplains**

  Floodplains are low-lying areas adjacent to rivers, stream channels, or coastal waters. Areas within a floodplain are subject to periodic or infrequent inundation. No floodplains are present on the MHTA or DNR properties.

- **Noise**

  Neither the proposed action nor its alternatives would change environmental noise conditions. Short-term noise associated with the potential development of lands under Alternative 1 would likely be confined to the general site areas, primarily in the immediate vicinity of construction or forestry equipment.

- **Air Quality**

  Neither the proposed action nor its alternatives would change air quality conditions. Short-term, construction-related emissions associated with the potential development of lands under Alternative 1 would likely be confined to the general site areas, primarily in the immediate vicinity of construction or forestry equipment. The proposed action (Alternative 1) may represent a potential net benefit in terms of avoided greenhouse gas emissions. Permafrost stores more than 50 percent of global terrestrial carbon (U.S. National Park Service 2017); therefore, the preservation of existing, undisturbed land uses under the proposed action represents a prevention of greenhouse gas emissions that would potentially occur if the land were disturbed and developed under the other alternatives. However, the potential for changes to air quality, including greenhouse gas emissions, due to the proposed action and alternatives remains negligible. In December 2009, a portion of the Fairbanks North Star Borough, including the City

of Fairbanks and the City of North Pole, was designated as a Nonattainment Area for particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$). These areas exceed the health-based, 24-hour $PM_{2.5}$ (2006) National Ambient Air Quality Standard of 35 micrograms per cubic meter. The proposed action would have no impact on ambient $PM_{2.5}$ air concentration.

- **Cultural Resources**

  The National Historic Preservation Act (54 United States Code [USC] §§ 300101 et seq.) is comprehensive federal preservation legislation intended to protect cultural resources. Section 106 of the National Historic Preservation Act (54 USC § 306108), as implemented in 36 CFR Part 800, requires federal agencies to consider the effects of undertakings on historic properties, should any such properties exist. Historic property is defined in 54 USC § 300308 and 36 CFR § 800.16(l)(1) as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register. This term includes artifacts, records, and remains that are related to and located within such properties. It also includes properties of traditional religious and cultural importance to an Indian tribe and those that meet the National Register criteria. The USAG Alaska Integrated Cultural Resources Management Plan (ICRMP) meets the requirements for ICRMPs set forth in Department of Defense Instruction 4715.16, Cultural Resources Program, and AR 200-1, Environmental Protection and Enhancement. In accordance with the USAG Alaska ICRMP and related regulations, the Fort Wainwright Cultural Resources Management staff have determined that the proposed action and alternatives qualify as an undertaking, and after consultation with the Alaska State Historical Preservation Officer and federally recognized Alaska native tribes, has determined that the undertaking has no potential to affect historic properties.

3.2 Summary of Environmental Consequences

Table 1 contains a summary matrix of the alternatives comparing their environmental consequences for the specific resource categories. The table describes the range of environmental consequences (including cumulative impacts) of the proposed action and alternatives discussed in Chapter 3. The qualitative terms used in the matrix are generally defined as:

- None – No measurable impacts are expected to occur.
- Minor – Short term but measurable adverse impacts are expected. Impacts may have slight impact to resource.
- Moderate – Noticeable adverse impacts that would have a measurable effect on resource and are not short term.
- Severe – Adverse impacts would be obvious short and long term and would have serious consequences to resource.
- Beneficial – Impacts would benefit resource.

Analysis of cumulative impacts is required for NEPA documents. Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions. Cumulative effects can also result from individually minor but (over time) collectively impactful actions taking place locally or regionally. Chapter 3 of this EA discusses cumulative impacts associated with the proposed action and its alternatives.

Activities resulting in cumulative impacts under Alternative 1 and Alternative 2 include the potential installation of erosion control features on lands upstream from the PTRF, the potential continuation of research activities in the watershed upstream of the PTRF, and potential future expansion of the tunnel beyond the current property boundaries. Such potential future actions considered by USAG Alaska or CRREL would be subject to additional environmental review under NEPA. Additional reasonably foreseeable future actions (under Alternative 3) include the lease and sale of parcels in the watershed that are not owned by USAG Alaska; potentially for land uses that are incompatible with the protection and sustainability of the PTRF, such as residential development or mining. The regions of influence for cumulative impacts are not expected to extend beyond the PTRF boundary or its upstream watershed.

Table 1. Summary of Environmental Consequences under Each Alternative

Resource Category	Alternative 1	Alternative 2	Alternative 3
Biological Resources	Beneficial (up to eight parcels)	Beneficial (up to six parcels)	None to Severe
Water Resources	Beneficial (up to eight parcels)	Beneficial (up to six parcels)	None to Severe
Geological Resources	Beneficial (up to eight parcels), or Moderate (up to one parcel)	Beneficial (up to six parcels), or Moderate (up to one parcel)	None to Severe

3.3 Biological Resources

3.3.1 Affected Environment

3.3.1.1 Definition of the Resource

Biological resources include vegetation, wildlife, and threatened and endangered species. Specific concerns relating to biological resources consist of declines in species diversity, degradation of wildlife habitat, and impacts to threatened and endangered species.

Federal protection as a threatened or endangered species is derived from the Endangered Species Act of 1973 (ESA). Under ESA, species may be listed as federally endangered or federally threatened depending on the likelihood of the species becoming extinct throughout all or a significant portion of its range (U.S. Fish and Wildlife Service [USFWS] 2023a). Species designated as ESA candidates receive no statutory protection under ESA, but USFWS encourages conservation efforts for these species because they may warrant future protection under ESA (USFWS 2023a). Section 7(a)(2) of ESA requires federal agencies to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. Federal agencies are required to consult with USFWS if an action may affect a listed species. In addition to federal protection, certain species are given protection under state law. Species may be designated as state threatened or endangered and not federally protected. The State of Alaska and the U.S. government maintain a list of potentially vulnerable species, which are protected by regulatory provisions or other conservation measures, to conserve populations and prevent species extinctions from occurring (Alaska Department of Fish and Game 2023).

The Migratory Bird Treaty Act of 1918 (MBTA) established federal responsibilities for protecting nearly all migratory species of birds, eggs, and nests. Bird migration is defined as the periodic seasonal movement of birds from one geographic region to another, typically coinciding with available food supplies or breeding seasons. More than 1,000 species are protected under the MBTA. USFWS is responsible for administering the provisions of the act and maintaining a list of bird species protected under the MBTA.

3.3.1.2 Existing Conditions

The MHTA and DNR properties are located in the taiga, or boreal forest, of interior Alaska, which is characterized by coniferous trees such as the black spruce (*Picea mariana*). The boreal forest/taiga supports a relatively small variety of fauna due to the cold, harsh climate of high northern latitudes. A review of biological resources is provided below.

Vegetation: Primary species in the boreal forest/taiga of Alaska are broad-leaved deciduous trees, needle-leaved evergreens, and needle-leaved deciduous trees (Bonanza Creek Long-Term Ecological Research 2023). The predominant coniferous tree species is black spruce. Predominant deciduous tree species include quaking aspen (*Populus tremuloides*), balsam poplar (*Populus balsamifera*), and paper birch (*Betula neoalaskana*). Predominant shrubs include alder (*Alnus* spp.) and willow (*Salix* spp.). The boreal forest has a rich community of mosses and lichens.

Wildlife: The boreal forest of Alaska supports a relatively low diversity of wildlife, dominated by migratory birds, waterfowl, and mammals including moose (*Alces alces*), black bear (*Ursus americanus*), brown bear (*Ursus arctos*), caribou (*Rangifer tarandus granti*), wolverine (*Gulo gulo*), wolf (*Canus lupus*), vole (*Microtus* spp.), red squirrel (*Tamiasciurus hudsonicus*), northern flying squirrel (*Glaucomys sabrinus yukonensis*), North American porcupine (*Erethizon dorsatum*), American mink (*Neovison vison*), American marten (*Martes americana*), lynx (*Lynx canadensis*), snowshoe hare (*Lepus americanus*), red fox (*Vulpes vulpes*), ermine (*Mustela erminea*), coyote (*Canis latrans*), and little brown bat (*Myotis lucifugus*). Amphibians present in the boreal forest include the wood frog (*Rana sylvatica*).

Protected Species: USFWS Information for Planning and Consultation (IPaC) was consulted to gain an understanding of threatened and endangered species in the project area. There are not any federally listed threatened or endangered terrestrial biota in the project area (USFWS 2023b). Additionally, there are no potentially vulnerable species in the area listed by the State of Alaska. There are, however, birds classified as "migratory" that are protected under MBTA (16 USC 703-712). IPaC lists several species that are listed as a Bird of Conservation Concern as well as species that are protected by the Bald and Golden Eagle Protection Act, which are shown in Appendix A. To gain an understanding of the MBTA-protected species likely present, the Cornell Lab of Ornithology's eBird data mapping tool was reviewed. According to this resource, 212 species have been observed in the region (i.e., Fairbanks North Star Borough) since this reference's data record began in 1986 (eBird 2023). Appendix A lists the migratory birds that have been documented by eBird in the Fairbanks North Star Borough.

3.3.1.3 Environmental Trends and Planned Actions

Alaska is warming at a rate of two to three times the rate of the global average. The average annual temperature in the Fairbanks area has increased by 3.2 degrees Fahrenheit (°F) since 1971 (U.S. Department of Agriculture 2023). The main impacts of a rapidly warming climate in interior Alaska are thawing permafrost and larger, more intense wildfires. Thawing permafrost is rapidly altering hydrology and habitat in the boreal forest, which has already been seen on MHTA and DNR properties, as evidenced by land caving in the forest floor, consequently knocking down trees and creating more streams. As permafrost thaws, it turns into a mud slurry that cannot support the weight of the soil and vegetation above it (U.S. Global Change Research Program [USGCRP] 2017). The loss of permafrost can irreversibly degrade existing habitat, permanently altering the boreal ecosystem.

3.3.2 Environmental Consequences

3.3.2.1 Impacts of Alternative 1 on Biological Resources

Under Alternative 1, there would be a beneficial impact to biological resources on MHTA and DNR properties. Purchasing the parcels precludes land development that would have adverse impacts on habitats and species using the parcels. Indirect impacts under Alternative 1 include the proactive management and conservation of watershed habitats for the protection of PTRF safety and sustainability, enabled solely by land acquisition (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 1: Under the proposed action, foreseeable future actions include the potential for installation of erosion control features on lands upstream from the PTRF, the potential continuation of research activities in the watershed upstream of the PTRF, and potential future expansion of the tunnel beyond the current property boundaries. Erosion control features to be considered in the future include nature-based solutions that would be designed to enhance ecological resilience in the watershed while protecting permafrost resources currently within the PTRF property boundary. Stream channel and land disturbance would be temporary and short term during construction of the erosion control features. The long-term cumulative impact of this potential future action would be neutral, if not beneficial, to biological resources in the watershed. Future research activities conducted by CRREL and its partners in the watershed would involve minimal land disturbance, likely limited to foot traffic and instrument installation and maintenance. The long-term cumulative impact of research activities on biological resources would be negligible. The potential expansion of the PTRF with a new adit would not involve any disturbance to surface biological resources, including vegetation or habitat, on MHTA or DNR parcels. Therefore, no long-term cumulative impact associated with tunnel expansion is anticipated for biological resources.

3.3.2.2 Impacts of Alternative 2 on Biological Resources

Under Alternative 2, up to 338 acres (six parcels) of MHTA property would be purchased and up to 67 acres (two parcels) of DNR property would be leased, which would grant CRREL long-term management control over a portion of the land (i.e., the MHTA parcels). Under Alternative 2, there would be beneficial impact to biological resources on the MHTA properties, where land development would be precluded for the long term. Indirect impacts under Alternative 2 include the proactive management and conservation of watershed habitats (in the MHTA parcels only) for the protection of PTRF safety and sustainability, enabled solely by land acquisition (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 2: Under Alternative 2, foreseeable future actions and corresponding cumulative impacts are the same as under Alternative 1; however, actions taking place on the DNR parcels would be subject to a lease agreement and potentially limited to the short-term timeframe. Erosion control structures may be more feasible to implement on Glenn Creek, which runs through the MHTA parcels, than on Swindle Creek, whose lower reach runs through the DNR parcels. Future research activities in the DNR parcels will likely not be limited relative to Alternative 1; however, the terms of a lease agreement will apply. Potential tunnel expansion under Alternative 2 will be viable as under Alternative 1, as the candidate parcel where expansion would potentially occur is currently owned by MHTA. Because DNR lands are not expected to be leased or sold for land uses incompatible with PTRF protection and sustainability, reasonably foreseeable future actions under Alternative 2 do not include land development that would result in cumulative impacts to biological resources.

3.3.2.3 Impacts of Alternative 3 on Biological Resources

Under the no-action alternative, there would be no direct impact to biological resources on the MHTA and DNR properties. Existing conditions would continue in the short term; however, indirect impacts to conditions of biological resources in the long term are uncertain (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 3: Under the no-action alternative, foreseeable future actions include the lease or sale of any of the eight DNR and MHTA parcels to other interests, which would likely lead to development of the land for commercial or industrial uses. Whether the land is developed under Alternative 3 for the construction of a residential subdivision, the creation of a mining operation, or another potentially lucrative endeavor, the no-action alternative could result in cumulative impacts to biological resources. Conversion of existing boreal forest habitat for new land uses would have a long-term impact on the extent and quality of existing vegetation and habitat available for wildlife, including migratory birds.

3.4 Water Resources

3.4.1 Affected Environment

3.4.1.1 Description of Resource

Water resources include groundwater, surface water, and wetlands. Surface water includes lakes, rivers, and streams that may be used as sources of potable water, provide habitat for aquatic and amphibious species, support commerce via navigation, and offer recreational opportunities.

Groundwater includes the subsurface hydrologic resources of the physical environment and is described in terms of depth to aquifer or water table, quality, and surrounding geologic consumption.

The nation's waters are protected under the statutes of the Clean Water Act (CWA). The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's water to support "the protection and propagation of fish, shellfish, wildlife, and recreation in and on the water." Under Section 402 of the CWA, it is illegal to discharge any point and/or nonpoint pollution sources (including sediment) into any surface water without a National Pollutant Discharge Elimination System permit. EPA is charged with administering the National Pollutant Discharge Elimination System permit program; however, the State of Alaska has legal authority to implement and enforce the provisions of the CWA, while EPA retains oversight responsibilities. Stormwater runoff is generated when precipitation from rain

and snowmelt events, flows over land or impervious surfaces and does not percolate into the ground. This water flows either directly into surface waterways or storm sewers or can pond and cause flooding in some areas depending on the soil type and topography of the area.

Wetlands are considered sensitive habitats and are subject to federal regulatory authority under Section 404 of the CWA, Section 10 of the Rivers and Harbors Act of 1899, and Executive Order 11990, *Protection of Wetlands*. Jurisdictional wetlands are defined by USACE as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Experimental Laboratory 1987). Wetlands generally include swamps, marshes, bogs, and similar areas. Wetland functions include water quality improvement, groundwater recharge and discharge, filtering of pollutants, nutrient cycling, and erosion protection. In accordance with Executive Order 11990, which extends to non-jurisdictional wetlands as well, construction within wetlands is to be avoided, where practicable. Actions that include construction in a wetland require a Finding of No Practicable Alternative to be prepared and approved by Headquarters, Army Materiel Command. All appropriate permits must be obtained from applicable regulatory agencies to address impacts on wetland areas and determine potential mitigation, if required. Alternatively, if there are no actions that result in a net loss of wetlands, a FNSI is completed.

3.4.1.2 Existing Conditions

Two stream channels run through the MHTA and DNR properties. Glenn Creek runs through the MHTA parcels, and Swindle Creek's lower reach runs through the DNR parcels. Both Glenn Creek and Swindle Creek are ephemeral, meaning they have flow only after precipitation events or after snowmelt.

Depth of groundwater in the area is generally shallow, and ranges between 5 and 15 feet below ground surface. Of the 405 acres (eight parcels) owned by MHTA and DNR, more than half of this area is classified as palustrine wetlands in the USFWS National Wetlands Inventory database. These wetlands are dominated by black spruce, a wetland species indicator (USACE 2020).

3.4.1.3 Environmental Trends and Planned Actions

As the climate continues to warm, average annual temperatures in Alaska are projected to increase an additional 2 to 4°F by the middle of this century (USGCRP 2014). The impacts of this warming trend are thawing permafrost and increased precipitation during all seasons. These impacts will create more streams and will cause existing streams to become wider and potentially cause erosion. Permafrost thaw has already caused land caving in the forest floor on the MHTA and DNR properties, which has altered the course of Glenn Creek and Swindle Creek. Changes in the courses of these streams will cause permafrost to thaw quicker underneath, thoroughly altering the boreal forest wetlands in the area.

3.4.2 Environmental Consequences

3.4.2.1 Impacts of Alternative 1 on Water Resources

Under Alternative 1, there would be beneficial impacts to water resources on the MHTA and DNR properties. Purchasing the parcels precludes incompatible development that would degrade water resources. Indirect impacts under Alternative 1 include the proactive management and conservation of watershed habitats for the protection of PTRF safety and sustainability, enabled solely by land acquisition (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 1: Under the proposed action, foreseeable future actions include the potential installation of erosion control features on lands upstream from the PTRF, the potential continuation of research activities in the watershed upstream of the PTRF, and potential future expansion of the tunnel beyond the current property boundaries. Erosion control features to be considered in the future include nature-based solutions that would be designed to enhance ecological resilience in the watershed while protecting permafrost resources currently within the PTRF property boundary. Stream channel and land disturbance would be temporary and short-term during construction of the erosion control features. The long-term cumulative impact of this potential future action would be neutral, if not beneficial, to water resources. Future research activities conducted by CRREL and its partners in the watershed would involve minimal land disturbance, likely limited to foot traffic and instrument installation and maintenance. The long-term cumulative impact of research activities on water resources would be negligible. The potential expansion of the PTRF with a new adit would not involve any disturbance to water resources, including streams or groundwater, on the MHTA or DNR parcels. Therefore, no long-term cumulative impact associated with tunnel expansion is anticipated for water resources.

3.4.2.2 Impacts of Alternative 2 on Water Resources

Under Alternative 2, up to 338 acres (six parcels) of MHTA property would be purchased and up to 67 acres (two parcels) of DNR property would be leased, which would grant CRREL long-term management control over a portion of the land (i.e., the MHTA parcels). Under Alternative 2, there would be beneficial impact to water resources on the MHTA properties, where land development would be precluded. Indirect impacts under Alternative 2 include the proactive management and conservation of watershed habitats (in the MHTA parcels only) for the protection of PTRF safety and sustainability, enabled solely by land acquisition (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 2: Under Alternative 2, foreseeable future actions and corresponding cumulative impacts are the same as under Alternative 1; however, actions taking place on the DNR parcels would be subject to a lease agreement and potentially limited to the short-term timeframe. Erosion control structures may be more feasible to implement on Glenn Creek, which runs through the MHTA parcels, than on Swindle Creek, whose lower reach runs through the DNR parcels. Future research activities in the DNR parcels will likely not be limited relative to Alternative 1; however, the terms of a lease agreement will apply. Potential tunnel expansion under Alternative 2 will be viable as under Alternative 1, as the candidate parcel where expansion would potentially occur is currently owned by MHTA. Because DNR lands are not expected to be leased or sold for land uses incompatible with PTRF protection and sustainability, reasonably foreseeable future actions under Alternative 2 do not include land development that would result in cumulative impacts to water resources.

3.4.2.3 Impacts of Alternative 3 on Water Resources

Under the no-action alternative, there would be no direct impact to water resources on the MHTA and DNR properties. Existing conditions would continue in the short term; however, indirect impacts to conditions of water resources in the long term are uncertain (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 3: Under the no-action alternative, foreseeable future actions include the lease or sale of any of the eight DNR and MHTA parcels to other interests, which could lead to development of the land for commercial or industrial uses. Whether the land is developed under

Alternative 3 for the construction of a residential subdivision, the creation of a mining operation, or another potentially lucrative endeavor, the no-action alternative could result in severe cumulative impacts to water resources. Conversion of the boreal forest for new land uses would have a long-term impact on the extent and quality of surface hydrology, permafrost resources, wetlands, and other water resources.

3.5 Geological Resources

3.5.1 Affected Environment

3.5.1.1 Description of Resource

Geological resources include the geology, topography, and soils (including permafrost) located within the project area. Topography describes the physical surface characteristics of land such as slope, elevation, and general surface features. Long-term geological, erosional, and depositional processes typically influence topographic relief of an area. The geology of an area includes bedrock materials and mineral deposits. The principal geologic factors influencing the stability of structures are soil stability, bedrock depth, and seismic properties. Soil refers to unconsolidated earthen materials overlying bedrock or other parent material. Soil structure, elasticity, strength, shrink-swell potential, liquefaction potential, and its potential to erode, all determine the ability of the ground to support structures and facilities.

3.5.1.2 Existing Conditions

Compared to other regions in North America, Alaska's geology is relatively recent. Alaska began forming hundreds of millions of years ago as the Pacific tectonic plate slowly moved northward. Much of Alaska's bedrock is metamorphic rock.

The Fairbanks North Star Borough is located at the border between the Yukon-Tanana Uplands and Tanana-Kuskokwin Lowlands ecoregions. The Tanana-Kuskokwin Lowlands are characterized as an alluvial plain that slopes gently northward from the Alaska Range, while the Yukon-Tanana Uplands are characterized as broad, rounded mountains of moderate heights (Nowacki et al. 2001). These regions share a climate characterized by short, warm summers and long, cold winters.

Geology and Soils: Soil types in the ecoregion vary; however, both ecoregions have discontinuous permafrost. The Tanana-Kuskokwin Lowlands consist of undifferentiated sediments of fluvial and glaciofluvial origin, which are capped by varying thicknesses of eolian silts and soils (Nowacki et al. 2001). Soils are wet and organic due to the impermeable permafrost. The Yukon-Tanana Uplands is a composite of transported crust blocks that include former volcanic island arcs and continental shelf deposits (Nowacki et al. 2001). Most surfaces are comprised of bedrock and coarse rubble on ridges, colluvium on lower slopes, and alluvium in the narrow valleys.

Topography: The local topography has rolling hills with generally flat areas in the valleys.

3.5.1.3 Environmental Trends and Planned Actions

With Alaska at the frontline of climate change, permafrost degradation is causing irreversible effects. Permafrost is structurally important to soil in northern regions; therefore, permafrost thaw creates unstable soils which can lead to erosion, landslides, and sinkholes, among other things. The MHTA and DNR properties already have large land caves in the forest floor from permafrost thaw. Thawing

permafrost can greatly alter the soil environment, by changing soil temperature, microbes, and soil organic carbon, with carry-on impacts to the boreal ecosystem.

3.5.2 Environmental Consequences

3.5.2.1 Impacts of Alternative 1 on Geological Resources

Under Alternative 1, there would be beneficial impact to geological resources on the MHTA and DNR properties. Purchasing the parcels precludes land development that would have adverse impacts on geological resources. Indirect impacts under Alternative 1 include the proactive management and conservation of watershed habitats for the protection of PTRF safety and sustainability, enabled solely by land acquisition (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 1: Under the proposed action, foreseeable future actions include the potential installation of erosion control features on lands upstream from the PTRF, the potential continuation of research activities in the watershed upstream of the PTRF, and potential future expansion of the tunnel beyond the current property boundaries. Erosion control features to be considered in the future include nature-based solutions that would be designed to enhance ecological resilience in the watershed while protecting permafrost resources currently within the PTRF property boundary. Stream channel and land disturbance would be temporary and short-term during construction of the erosion control features. The long-term cumulative impact of this potential future action would be neutral, if not beneficial, to geological resources in the watershed. Future research activities conducted by CRREL and its partners in the watershed would involve minimal land disturbance, likely limited to foot traffic and instrument installation and maintenance. The long-term cumulative impact of research activities on geological resources would be negligible. The potential expansion of the PTRF with a new adit would require excavation of geological resources in one of the MHTA parcels. Excavated material would be disposed of offsite in accordance with local, state, and Army regulations. Therefore, there is potential for cumulative impact associated with tunnel expansion on geological resources.

3.5.2.2 Impacts of Alternative 2 on Geological Resources

Under Alternative 2, up to 338 acres (six parcels) of MHTA property would be purchased and up to 67 acres (two parcels) of DNR property would be leased, which would grant CRREL long-term management control over a portion of the land (i.e., the MHTA parcels). Under Alternative 2, there would be beneficial impact to geological resources on the MHTA properties, where land development would be precluded for the long term. Indirect impacts under Alternative 2 include the proactive management and conservation of watershed habitats (in the MHTA parcels only) for the protection of PTRF safety and sustainability, enabled solely by land acquisition (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 2: Under Alternative 2, foreseeable future actions and corresponding cumulative impacts are the same as under Alternative 1; however, actions taking place on the DNR parcels would be subject to a lease agreement and potentially limited to the short-term timeframe. Erosion control structures may be more feasible to implement on Glenn Creek, which runs through the MHTA parcels, than on Swindle Creek, because the lower reach runs through the DNR parcels. Future research activities in the DNR parcels will likely not be limited relative to Alternative 1; however, the terms of a lease agreement will apply. Potential tunnel expansion under Alternative 2 will be viable as under Alternative 1, as the candidate parcel where expansion would potentially occur is currently owned by MHTA. Therefore, the potential for earth excavation as part of potential tunnel

expansion is possible. As under Alternative 1, this would result in moderate cumulative impacts to geological resources on that parcel. Because DNR lands are not expected to be leased or sold for land uses incompatible with PTRF protection and sustainability, reasonably foreseeable future actions under Alternative 2 do not include land development that would result in cumulative impacts to geological resources.

3.5.2.3 Impacts of Alternative 3 on Geological Resources

Under the no-action alternative, there would be no direct impact to geological resources on the MHTA and DNR properties. Existing conditions would continue in the short term; however, indirect impacts to conditions of geological resources in the long term are uncertain (see the discussion of cumulative impacts that follows).

Cumulative Impacts under Alternative 3: Under the no-action alternative, foreseeable future actions include the lease or sale of any of the eight DNR and MHTA parcels to other interests, which could lead to development of the land for commercial or industrial uses. Whether the land is developed under Alternative 3 for the construction of a residential subdivision, the creation of a mining operation, or another potentially lucrative endeavor, the no-action alternative could result in cumulative impacts to geological resources. Conversion of the boreal forest for the new land use or land uses, would have a long-term impact on the extent and quality of geological resources.

4. AGENCY AND TRIBAL COORDINATION

Interagency consultation with multiple federal and state agencies and government-to-government coordination with seven Alaska native tribes took place during the environmental analysis of potential impacts to biological resources and cultural resources.

On 22 May 2023, USAG Alaska initiated consultation with the State Historic Preservation Office (SHPO) under Section 106 of the National Historic Preservation Act of 1966. Following review of the documentation provided regarding the undertaking, SHPO concurred on 20 June 2023 with the finding of No Historic Properties Affected. In accordance with 36 CFR 800.3(c), the following Alaska native tribes were contacted concurrently with the letter sent to SHPO on 22 May 2023:

- Native Village of Tetlin
- Native Village of Tanacross
- Northway Village
- Healy Lake Village
- Nenana Native Association
- Village of Dot Lake
- Native Village of Minto

USAG Alaska contacted the Northern Alaska Fish & Wildlife Field Office, USFWS, to request informal consultation under Section 7 of the ESA. Due to the absence of threatened, endangered, or candidate species or critical habitat in the proposed action area, as conveyed in the IPaC report (USFWS 2023b), USAG Alaska sought USFWS concurrence that the proposed action would have "no effect" on federally listed species or on critical habitat.

USAG Alaska has invited federal, state, and local agencies, along with tribal governments and non-governmental organizations to participate in the 30-day scoping period. These agencies were sent a letter summarizing the Proposed Action and a map of the project area. The following agencies were contacted:

Federal Agencies

- U.S. Army Corps of Engineers, Regulatory Division
- U.S. Fish and Wildlife Service, Northern Alaska Fish and Wildlife Field Office

State Agencies

- Alaska State Historic Preservation Office
- Alaska Department of Natural Resources

Tribal Governments

- Native Village of Tetlin
- Native Village of Tanacross

- Northway Village
- Healy Lake Village
- Nenana Native Association
- Village of Dot Lake
- Native Village of Minto

Non-Governmental Agencies

- Tanana Chiefs Conference, Realty Branch

Local Officials and Agencies

- Fairbanks North Star Borough, Community Planning Department
- State Representative for District 34, Frank Tomaszewski

5. REFERENCES

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APPENDIX A: MIGRATORY BIRDS DOCUMENTED IN FAIRBANKS NORTH STAR BOROUGH

Common Name	Scientific Name	Listing
American golden-plover	*Pluvialis dominica*	MBTA, BCC
Bristle-thighed curlew	*Numenius tahitiensis*	MBTA, BCC
Hudsonian godwit	*Limosa haemastica*	MBTA, BCC
Rock sandpiper	*Calidris ptilocnemis*	MBTA, BCC
Short-billed dowitcher	*Limnodromus griseus*	MBTA, BCC
Solitary sandpiper (Western)	*Tringa solitaria*	MBTA, BCC
Wandering tattler	*Tringa incana*	MBTA, BCC
Lesser yellowlegs	*Tringa flavipes*	MBTA, BCC
Marbled murrelet (Alaska)	*Brachyramphus marmoratus*	MBTA, BCC
Aleutian tern	*Onychoprion aleuticus*	MBTA, BCC
Short-eared owl	*Asio flammeus*	MBTA, BCC
Olive-sided flycatcher	*Contopus cooperi*	MBTA, BCC
Gray-headed chickadee	*Poecile cinctus*	MBTA, BCC
Red-necked grebe	*Podiceps grisegena*	MBTA
Lesser Canada goose	*Branta canadensis parvipes*	MBTA
Greater scaup	*Aythya marila nearctica*	MBTA
Violet-green swallow	*Tachycineta thalassina*	MBTA
Bank swallow	*Riparia riparia*	MBTA
Orange-crowned warbler	*Oreothlypis celata*	MBTA
Blackpoll warbler	*Setophaga striata*	MBTA
Horned grebe	*Podiceps auratus*	MBTA
Eared grebe	*Podiceps nigricollis*	MBTA
Yellow-billed cuckoo	*Coccyzus americanus*	MBTA
Sora	*Porzana Carolina*	MBTA
American coot	*Fulica americana*	MBTA
Sandhill crane	*Antigone canadensis*	MBTA
Herring gull	*Larus argentatus*	MBTA
Glaucous-winged gull	*Larus glaucescens*	MBTA
Iceland gull	*Larus glaucoides*	MBTA
White-winged tern	*Chlidonias leucopterus*	MBTA
Arctic tern	*Sterna paradisaea*	MBTA
Red-throated loon	*Gavia stellata*	MBTA
Pacific loon	*Gavia pacifica*	MBTA
Common loon	*Gavia immer*	MBTA
Yellow-billed loon	*Gavia adamsii*	MBTA
Double-crested cormorant	*Nannopterum auritum*	MBTA
Great egret	*Ardea alba*	MBTA
Great blue heron	*Ardea herodias*	MBTA
Turkey vulture	*Cathartes aura*	MBTA
Osprey	*Pandion haliaetus*	MBTA
Golden eagle	*Aquila chrysaetos*	MBTA, BGEPA
Northern harrier	*Circus hudsonius*	MBTA
Sharp-shinned hawk	*Accipiter striatus*	MBTA

Common Name	Scientific Name	Listing
Bald eagle	*Haliaeetus leucocephalus*	MBTA, BGEPA
Swainson's hawk	*Buteo swainsoni*	MBTA
Red-tailed hawk	*Buteo jamaicensis*	MBTA
Tree swallow	*Tachycineta bicolor*	MBTA
Purple martin	*Progne subis*	MBTA
Barn swallow	*Hirundo rustica*	MBTA
Cliff swallow	*Petrochelidon pyrrhonota*	MBTA
Arctic warbler	*Phylloscopus borealis*	MBTA
Ruby-crowned kinglet	*Corthylio calendula*	MBTA
Golden-crowned kinglet	*Regulus satrapa*	MBTA
Red-breasted nuthatch	*Sitta canadensis*	MBTA
Brown creeper	*Certhia americana*	MBTA
American dipper	*Cinclus mexicanus*	MBTA
Brown thrasher	*Toxostoma rufum*	MBTA
Mountain bluebird	*Sialia currucoides*	MBTA
Townsend's solitaire	*Myadestes townsendi*	MBTA
Varied thrush	*Ixoreus naevius*	MBTA
Gray-cheeked thrush	*Catharus minimus*	MBTA
Swainson's thrush	*Catharus ustulatus*	MBTA
Hermit thrush	*Catharus guttatus*	MBTA
American robin	*Turdus migratorius*	MBTA
Wilson's warbler	*Cardellina pusilla*	MBTA
Snow goose	*Anser caerulescens*	MBTA
Ross's goose	*Anser rossii*	MBTA
Greater white-fronted goose	*Anser albifrons*	MBTA
Brant	*Branta bernicla*	MBTA
Cackling goose	*Branta hutchinsii*	MBTA
Trumpeter swan	*Cygnus buccinator*	MBTA
Tundra swan	*Cygnus columbianus*	MBTA
Blue-winged teal	*Spatula discors*	MBTA
Cinnamon teal	*Spatula cyanoptera*	MBTA
Northern shoveler	*Spatula clypeata*	MBTA
Gadwall	*Mareca strepera*	MBTA
Eurasian wigeon	*Mareca penelope*	MBTA
American wigeon	*Mareca americana*	MBTA
Mallard	*Anas platyrhynchos*	MBTA
American black duck	*Anas rubripes*	MBTA
Northern pintail	*Anas acuta*	MBTA
Green-winged teal	*Anas crecca*	MBTA
Common crane	*Grus grus*	MBTA
Black-bellied plover	*Pluvialis squatarola*	MBTA
Killdeer	*Charadrius vociferus*	MBTA
Semipalmated plover	*Charadrius semipalmatus*	MBTA

Common Name	Scientific Name	Listing
Upland sandpiper	*Bartramia longicauda*	MBTA
Whimbrel	*Numenius phaeopus*	MBTA
Marbled godwit	*Limosa fedoa*	MBTA
Long-billed dowitcher	*Limnodromus scolopaceus*	MBTA
Wilson's snipe	*Gallinago delicata*	MBTA
Wilson's phalarope	*Phalaropus tricolor*	MBTA
Red phalarope	*Phalaropus fulicarius*	MBTA
Red-necked phalarope	*Phalaropus lobatus*	MBTA
Spotted sandpiper	*Actitis macularius*	MBTA
Greater yellowlegs	*Tringa melanoleuca*	MBTA
Ruddy turnstone	*Arenaria interpres*	MBTA
Rough-legged hawk	*Buteo lagopus*	MBTA
Snowy owl	*Bubo scandiacus*	MBTA
Great horned owl	*Bubo virginianus*	MBTA
Northern hawk owl	*Surnia ulula*	MBTA
Great gray owl	*Strix nebulosa*	MBTA
Boreal owl	*Aegolius funereus*	MBTA
Northern saw-whet owl	*Aegolius acadicus*	MBTA
Belted kingfisher	*Megaceryle alcyon*	MBTA
Yellow-bellied sapsucker	*Sphyrapicus varius*	MBTA
American three-toed	*Picoides dorsalis*	MBTA
Black-backed woodpecker	*Picoides arcticus*	MBTA
Downy woodpecker	*Dryobates pubescens*	MBTA
Hairy woodpecker	*Dryobates villosus*	MBTA
Northern flicker	*Colaptes auratus*	MBTA
American kestrel	*Falco sparverius*	MBTA
Merlin	*Falco columbarius*	MBTA
Gyrfalcon	*Falco rusticolus*	MBTA
Peregrine falcon	*Falco peregrinus*	MBTA
Northern wheatear	*Oenanthe oenanthe*	MBTA
Bohemian waxwing	*Bombycilla garrulus*	MBTA
Cedar waxwing	*Bombycilla cedrorum*	MBTA
American pipit	*Anthus rubescens*	MBTA
Pine grosbeak	*Pinicola enucleator*	MBTA
Eurasian bullfinch	*Pyrrhula pyrrhula*	MBTA
Gray-crowned rosy finch	*Leucosticte tephrocotis*	MBTA
Purple finch	*Haemorhous purpureus*	MBTA
Common redpoll	*Acanthis flammea*	MBTA
Hoary redpoll	*Acanthis hornemanni*	MBTA
Red crossbill	*Loxia curvirostra*	MBTA
White-winged crossbill	*Loxia leucoptera*	MBTA
Pine siskin	*Spinus pinus*	MBTA
Lapland longspur	*Calcarius lapponicus*	MBTA

Common Name	Scientific Name	Listing
Snow bunting	*Plectrophenax nivalis*	MBTA
Little bunting	*Emberiza pusilla*	MBTA
Rustic bunting	*Emberiza rustica*	MBTA
Canvasback	*Aythya valisineria*	MBTA
Redhead	*Aythya americana*	MBTA
Ring-necked duck	*Aythya collaris*	MBTA
Tufted duck	*Aythya fuligula*	MBTA
Lesser scaup	*Aythya affinis*	MBTA
Steller's eider(a)	*Polysticta stelleri*	MBTA, Federally Threatened
Harlequin duck	*Histrionicus histrionicus*	MBTA
Surf scoter	*Melanitta perspicillata*	MBTA
White-winged scoter	*Melanitta deglandi*	MBTA
Black scoter	*Melanitta americana*	MBTA
Long-tailed duck	*Clangula hyemalis*	MBTA
Bufflehead	*Bucephala albeola*	MBTA
Common goldeneye	*Bucephala clangula*	MBTA
Barrow's goldeneye	*Bucephala islandica*	MBTA
Hooded merganser	*Lophodytes cucullatus*	MBTA
Common merganser	*Mergus merganser*	MBTA
Red-breasted merganser	*Mergus serrator*	MBTA
Ruddy duck	*Oxyura jamaicensis*	MBTA
Red knot	*Calidris canutus*	MBTA
Surfbird	*Calidris virgata*	MBTA
Stilt sandpiper	*Calidris himantopus*	MBTA
Red-necked stint	*Calidris ruficollis*	MBTA
Buff-breasted sandpiper	*Calidris subruficollis*	MBTA
Sanderling	*Calidris alba*	MBTA
Dunlin	*Calidris alpina*	MBTA
Baird's sandpiper	*Calidris bairdii*	MBTA
White-rumped sandpiper	*Calidris fuscicollis*	MBTA
Least sandpiper	*Calidris minutilla*	MBTA
Pectoral sandpiper	*Calidris melanotos*	MBTA
Western sandpiper	*Calidris mauri*	MBTA
Semipalmated sandpiper	*Calidris pusilla*	MBTA
Long-tailed jaeger	*Stercorarius longicaudus*	MBTA
Pomarine jaeger	*Stercorarius pomarinus*	MBTA
Sabine's gull	*Xema sabini*	MBTA
Bonaparte's gull	*Chroicocephalus philadelphia*	MBTA
Franklin's gull	*Leucophaeus pipixcan*	MBTA
Short-billed gull	*Larus brachyrhynchus*	MBTA
Ring-billed gull	*Larus delawarensis*	MBTA
Glaucous gull	*Larus hyperboreus*	MBTA
Western wood-pewee	*Contopus sordidulus*	MBTA

Common Name	Scientific Name	Listing
Yellow-bellied flycatcher	*Empidonax flaviventris*	MBTA
Alder flycatcher	*Empidonax alnorum*	MBTA
Least flycatcher	*Empidonax minimus*	MBTA
Hammond's flycatcher	*Empidonax hammondii*	MBTA
Say's phoebe	*Sayornis saya*	MBTA
Northern shrike	*Lanius borealis*	MBTA
Canada jay	*Perisoreus canadensis*	MBTA
Black-billed magpie	*Pica hudsonia*	MBTA
Clark's nutcracker	*Nucifraga columbiana*	MBTA
Common raven	*Corvus corax*	MBTA
Black-capped chickadee	*Poecile atricapillus*	MBTA
Boreal chickadee	*Poecile hudsonicus*	MBTA
Horned lark	*Eremophila alpestris*	MBTA
Chipping sparrow	*Spizella passerine*	MBTA
American tree sparrow	*Spizelloides arborea*	MBTA
Fox sparrow	*Passerella iliaca*	MBTA
Dark-eyed junco	*Junco hyemalis*	MBTA
White-crowned sparrow	*Zonotrichia leucophrys*	MBTA
Golden-crowned sparrow	*Zonotrichia atricapilla*	MBTA
White-throated sparrow	*Zonotrichia albicollis*	MBTA
Savannah sparrow	*Passerculus sandwichensis*	MBTA
Lincoln's sparrow	*Melospiza lincolnii*	MBTA
Red-winged blackbird	*Agelaius phoeniceus*	MBTA
Brown-headed cowbird	*Molothrus ater*	MBTA
Rusty blackbird	*Euphagus carolinus*	MBTA
Common grackle	*Quiscalus quiscula*	MBTA
Northern waterthrush	*Parkesia noveboracensis*	MBTA
Tennessee warbler	*Leiothlypis peregrina*	MBTA
Lucy's warbler	*Leiothlypis luciae*	MBTA
Nashville warbler	*Leiothlypis ruficapilla*	MBTA
Common yellowthroat	*Geothlypis trichas*	MBTA
Yellow warbler	*Setophaga petechia*	MBTA
Palm warbler	*Setophaga palmarum*	MBTA
Yellow-rumped warbler	*Setophaga coronate*	MBTA
Townsend's warbler	*Setophaga townsendi*	MBTA

Notes:
BCC = Bird of Conservation Concern
BGEPA = Bald and Golden Eagle Protection Act
MBTA = Migratory Bird Treaty Act
Steller's eider is federally threatened; however, this species is unlikely to occur in the Fairbanks North Star Borough. There has been only one documented occurrence of this species in the region, in 2002.
Source: eBird (2023)