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Draft Environmental Impact Statement

STB Finance Docket No. 34658

Alaska Railroad Corporation Construction and Operation of a Rail Line between North Pole and Delta Junction, Alaska

Volume II




Lead Agency:
Surface Transportation Board

Information Contacts:
Victoria J. Rutson, Chief
David Navecky, Environmental Protection Specialist

Cooperating Agencies:
U.S. Department of Defense Alaskan Command
Bureau of Land Management
Federal Transit Administration
Federal Railroad Administration
U.S. Air Force 354th Fighter Wing Command from Eielson AFB
U.S. Army Corps of Engineers
U.S. Coast Guard
Alaska Department of Natural Resources

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Appendix A –
Acronyms and Abbreviations

A. ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
AADT	Annual Average Daily Traffic
AAR	Association of American Railroads
ACHP	Advisory Council on Historic Preservation
ADCED	Alaska Department of Community & Economic Development
ADEC	Alaska Department of Environmental Conservation
ADEC/EH	Alaska Department of Environmental Conservation, Division of Environmental Health
ADEC/SPAR	Alaska Department of Environmental Conservation, Division of Spill Prevention and Response
ADEC/WQ	Alaska Department of Environmental Conservation, Division of Water Quality
ADF&G	Alaska Department of Fish and Game
ADL	Alaska Division of Lands
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AFB	Air Force Base
AFN	Alaska Federation of Natives
AGIA	Alaska Gasline Inducement Act
AGPPT	Alaska Gas Producers Pipeline Team
AIRFA	American Indian Religious Freedom Act of 1978
ALCAN	Alaskan-Canadian
ALCOM	U.S. Department of Defense Alaska Command
ANCSA	Alaska Native Claims Settlement Act
ANGTS	Alaska Natural Gas Transportation System
ANHP	Alaska Natural Heritage Program
ANILCA	Alaska National Interest Lands Conservation Act
APE	Area of Potential Effect
APSC	Alyeska Pipeline Service Company
AR	Army Regulation
ArcGIS	Arc Geographic Information System
AREMA	American Railway Engineering Maintenance-of-Way Association
ARPA	Archaeological Resource Protection Act of 1979
ARRC	Alaska Railroad Corporation
AS	Alaska Statute
ASLRRA	American Short Line and Regional Railroad Association
BAX	Battle Area Complex at Donnelly Training Area
BCR4	Alaska's Bird Conservation Region 4
BLM	Bureau of Land Management
BMEWS	Ballistic Missile Early Warning System

BMLW	Bureau of Mining, Land, and Water
BMP	Best Management Practice
BNSF	Burlington Northern Santa Fe
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CAA	Clean Air Act of 1970
CAAA	Clean Air Act Amendments of 1990
CACTF	Combined Arms Collective Training Facility
CADNA	Computer Aided Noise Abatement program
CEMML	Center for Environmental Management of Military Lands
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CHPP	Central Heat and Power Plant
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COMDTINST	U.S. Coast Guard Commandant Instruction
CONUS	Continental United States
CORRACTS	Corrective Action Report
CRLFCP	Chena River Lakes Flood Control Project
CSP	Contaminated Sites Program
CSU	Colorado State University
CWA	Clean Water Act of 1977
CXST	CXS Transportation
dBA	A-weighted Decibels
DCED	Department of Commerce, Community and Economic Development
DCMPS	Delta Creek Material Processing Site Location
DM	Department Manual
DMA	Duane Miller Associates
DMU	Diesel Motorized Unit
DNL	Day-Night Average Noise Level
DoD	Department of Defense
DOLWD	Alaska Department of Labor and Workforce Development
DRO	Diesel Range Organics
DSMOA	Defense State Memorandum of Agreement in 1991
EA	Environmental Assessment
EDR	Environmental Data Resources, Inc.
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement

EO	Executive Order
EPA	Environmental Protection Agency
EPRCA	Summary of the Emergency Planning & Community Right-to-Know Act of 1986
ESA	Endangered Species Act of 1973
FARLR	Fairbanks Area Rail Line Relocation
FBX	Fairbanks Intermodal Facility and Depot
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FFA	Eielson Air Force Base Federal Facilities Agreement of 1990
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act of 1996
FLPMA	Federal Land Policy and Management Act of 1976
FMATS	Fairbanks Metropolitan Area Transportation System Plan
FNSB	Fairbanks North Star Borough
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FR	Federal Register
FRA	Federal Railroad Administration
FRPA	Alaska Forest Resources Practice Act, Alaska Statute 41.17
FRSA	Federal Railroad Safety Act of 1970
FTA	Federal Transit Administration
FUDS	Formerly Used Defense Sites
FWCA	Fish and Wildlife Coordination Act
GIS	Geographic Information System
GMU	Game Management Unit
GPS	Global Positioning System
GRO	Gasoline Range Organics
HABS/HAER	Historic American Buildings Survey/ Historic American Engineering Record
HFP	U.S. Army Haines-Fairbanks Pipeline
HSA	Highway Safety Act
HW	Hazardous Waste
I/M	Inspection & Maintenance
IC	Institutional Control
IPCC	Intergovernmental Panel on Climate Change
IPP	Industry Preparedness Program
KOP	Key Observation Point
LOS	Level of Service
LQG	Large Quantity Generator
LUST	Leaking Underground Storage Tank
mg/L	Milligrams per Liter
mg/m^3	Micrograms per Cubic Meter

MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MT	Microwave Tower
mton/yr	Metric Tons per Year
N/A	Not Available
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act of 1990
NEPA	National Environmental Policy Act of 1969
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act of 1966
NIP	Nonnative Invasive Plant
NLUR	Northern Land Use Research, Inc.
NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Oceanic & Atmospheric Administration
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRE	Northern Rail Extension
NRHP	National Register of Historic Places
O_3	Ozone
ºF	Degrees Fahrenheit
ORV	Off-Road Vehicles
OSHA	Occupational Safety and Health Administration
PA	Programmatic Agreement
PADS	Polychlorinated Biphenyls Activity Database System
Pb	Lead
PCAPS	Personal Computer Accident Prediction System
pH	Potential of Hydrogen
PHMSA	Pipeline and Hazardous Materials Safety Administration
PM	Particulate Matter
PM_{10}	Particulate Matter less than 10 microns
$PM_{2.5}$	Particulate Matter less than 2.5 microns
POL	Petroleum, Oils, Lubricants
ppb	Parts per Billion
ppm	Parts per Million
PPV	Peak Particle Velocity
PSD	Prevention of Significant Deterioration Program
RAATS	RCRA Administrative Action Tracking System
RAP	Recreation Access Permit
RCRA	Resource Conservation and Recovery Act of 1976
ROD	Record of Decision
ROW	Right-of-Way

RSPA	Research and Special Programs Administration
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act
SEA	Section of Environmental Analysis
SERC	Alaska State Emergency Response Commission
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SPCC	Spill Prevention, Control, and Countermeasure Plan
SRB&A	Stephen R. Braund and Associates
STB	Surface Transportation Board
SWPPP	Stormwater Pollution Prevention Plan
TA	Training Area
TAPS	Trans Alaska Pipeline System
TCC	Tanana Chiefs Conference
TD-2	Type Designation-2
TDD	Telecommunications Device for the Deaf
TRB	Transportation Research Board
TSCA	Toxic Substances Control Act of 1976
USACE	U.S. Army Corps of Engineers
USAG-AK	U.S. Army Garrison Alaska
USARAK	U.S. Army Alaska
U.S.C.	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USDOI	United States Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USTs	Underground Storage Tanks
VdB	Root-Mean-Square Velocity
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
VRM	Visual Resource Management
WAMCATS	Washington-Alaska Military Cable and Telegraph System
WRCC	Western Regional Climate Center

Appendix B – Correspondence with Agencies

B. CORRESPONDENCE WITH AGENCIES

This appendix contains a selection of the Section of Environmental Analysis's (SEA's) written correspondence with Federal, state, and local agencies. The first letter, sent to the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries Service) on June 6, 2005, is representative of 18 others sent to agencies requesting comments and assistance during the scoping period. The sixth letter, sent to the U.S. Coast Guard (USCG) on October 12, 2005, is representative of seven others sent to a smaller set of agencies inviting them to participate in the EIS (Environmental Impact Statement) process as cooperating agencies. The Alaska Department of Natural Resources (ADNR) was invited to participate in the EIS process as a cooperating agency at a later date, and its invitation letter is included separately.

Table B-1 lists all of the agencies with which SEA has corresponded. Copies of correspondence between SEA and the agencies on the dates listed in Table B-1 are included.

Table B-1
Agencies Consulted and Dates of Correspondence

Agency	Dates of Correspondence
Federal Agencies	
National Oceanic and Atmospheric Administration, National Marine Fisheries Service	6/6/2005; 1/12/2006
U.S. Coast Guard	6/6/2005; 10/12/2005
U.S. Department of Defense, Air Force- 354th Fighter Wing	10/12/2005
U.S. Department of Defense, Army Corps of Engineers	6/6/2005; 10/12/2005; 12/6/2005; 9/27/2007
U.S. Department of Defense, U.S. Army Garrison – Alaska Command	10/12/2005
U.S. Department of Defense, Alaska Command	10/12/2005; 4/17/2006
U.S. Department of the Interior, Bureau of Land Management	6/6/2005; 10/12/2005; 9/27/2007
U.S. Department of Transportation, Federal Railroad Administration	10/12/2005; 10/9/2007
U.S. Department of the Interior, U.S. Fish and Wildlife Service	6/6/2005; 1/13/2006
U.S. Environmental Protection Agency	6/6/2005; 1/13/2006
State Agencies	
Alaska Department of Commerce, Division of Community Advocacy	6/9/2005
Alaska Department of Environmental Conservation	6/6/2005
Alaska Department of Fish & Game, Division of Subsistence	6/6/2005
Alaska Department of Fish & Game, Sport Fish Division	6/6/2005
Alaska Department of Fish & Game, Wildlife Conservation	6/6/2005
Alaska Department of Natural Resources, Office of Habitat Management and Permitting	6/6/2005
Alaska Department of Natural Resources, Office of History and Archaeology, State Historic Preservation Officer	6/6/2005; 4/5/2006; 5/9/2006; 8/18/2006; 9/5/2006; 9/24/2007
Alaska Department of Natural Resources, Office of Mining, Land and Water	6/6/2005
Alaska Department of Natural Resources, Office of Project Management/Permitting	1/13/2006; 9/17/2007

Table B-1
Agencies Consulted and Dates of Correspondence (continued)

Agency	Dates of Correspondence
Alaska Department of Transportation & Public Facilities, Right-of-Way Office	6/6/2005
Local Agencies	
City of Fairbanks	6/6/2005
City of Delta Junction	6/6/2005
City of North Pole	6/6/2005
Fairbanks North Star Borough	6/6/2005

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

June 6, 2005

Larry Peltz
National Marine Fisheries Service
Protected Resources Division
and Habitat Conservation Division
222 West 7th Ave, Box 43
Anchorage, AK 99513

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Dear Mr. Peltz:

The Alaska Railroad Corporation intends to file a petition with the Surface Transportation Board (Board), pursuant to 49 U.S.C. 10502, requesting authority to construct and operate a new rail line from Eielson Air Force Base to Fort Greely, Alaska. The Board would be the Federal agency responsible for granting authority for the construction and operation of the proposed new rail line. The Section of Environmental Analysis (SEA) is the office within the Board responsible for preparing the appropriate National Environmental Policy Act (NEPA) documentation for railroad construction and operation cases that come before the Board.

While SEA plans to initiate the scoping process for the preparation of an Environmental Impact Statement later this summer or fall, we would like to meet with representatives of interested Federal, state and local agencies as early as possible. At these meetings, Mr. David Navecky, the Project Manager for SEA for this environmental review, would like to discuss the project in general terms and provide an overview of SEA's forthcoming environmental review process. We are hoping that you are available sometime during mid June to meet with Mr. Navecky and his team. The team includes ICF Consulting, which is serving as the independent third-party consultant to assist SEA with the NEPA review process. A member of ICF's team will contact you to determine whether your agency has an interest in meeting during that time. I have provided some information about the project below.

<u>Project Description</u>

The proposed Northern Rail Extension Project would involve the construction of approximately 80 miles of new rail line connecting the existing rail line near Eielson Air Force Base near North Pole, Alaska to Fort Greely and the Donnelly Training Area near Delta Junction, Alaska (see attached map). The proposed rail line would cross the Tanana River, possibly near Flag Hill, allowing the U.S. Army year-round access to the Tanana Flats and Donnelly training areas. The proposed project would include the construction of a 15-mile spur line from the vicinity of Flag Hill to the Blair Lakes Military Training Area. Construction of the proposed rail line would also provide all the major military installations in Alaska with rail access to the Port of Anchorage.

If you have any questions please do not hesitate to contact Alan Summerville, ICF Consulting Project Manager, at (703) 934-3616 or Dave Navecky, SEA Project Manager, at (202) 565-1593.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Attachment

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

January 12, 2006

David Navecky
Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Subject: STB Finance Docket No. 34658

Dear Mr. Navecky:

The National Marine Fisheries Service (NMFS) has reviewed the proposed Northern Rail Extension Environmental Impact Statement (EIS) Process. Your agency has requested NMFS comments on potential environmental impacts. The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires Federal agencies to consult with NMFS on all actions, or proposed action, authorized, funded, or undertaken by the agency, that may adversely affect essential fish habitat (EFH). EFH for this project is all streams where salmon are present.

The Northern Railroad Extension corridor contains numerous streams that serve as EFH for Chinook, chum and coho salmon. The stream crossings and wetland fills associated with this project have the potential to cause negative impacts to salmon EFH. Thorough planning as well as project design and implementation can help to avoid and minimize negative impacts.

The EIS should contain a detailed EFH Assessment. Examples of EFH Assessments and other guidance for EFH consultations can be found on the NMFS web site: http://www.nmfs.noaa.gov/habitat/habitatprotection/efh/consultation6.htm.
The EFH Assessment can be an appendix to the EIS, and can contain references to the main body of the EIS to avoid repeating project details and other information. NMFS is available to assist with development of the EFH Assessment. Please contact Larry Peltz in our Anchorage office (907-271-1332) or lawrence.peltz@noaa.gov with any questions.

Sincerely,

Robert D. Mecum
Acting Administrator, Alaska Region

ALASKA REGION - www.fakr.noaa.gov

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Fairbanks Fish and Wildlife Field Office
101 12th Avenue, Room 110
Fairbanks, Alaska 99701
January 13, 2006

Surface Transportation Board
Case Control Unit
Attn: David Navecky
Environmental Filing
1925 K Street, NW
Washington, D.C. 20423-0001

Re: STB Finance Docket No. 34658
Draft Scope of Study for EIS

Dear Mr. Navecky:

The U.S. Fish and Wildlife Service has reviewed the referenced draft Scope of Study for the Alaska Railroad Corporation's (ARRC) Northern Rail Extension Project. ARRC proposes to construct and operate a new rail line between Eielson Air Force Base and the Delta Junction/Fort Greely area. The project would include about 80 miles of new mainline track, and could include a rail spur (about 15 miles) to the U.S. Air Force's Blair Lakes training area. The Service has provided verbal comments concerning this project at previous meetings. We appreciate this opportunity to summarize our comments as they relate to the draft Scope of Study and the potential environmental effects of the project.

Reasonable and Feasible Alternatives – Proposed Alignments: The Service encourages the development and selection of an alternative that both meets the objectives of the project and minimizes impacts to fish and wildlife resources, particularly the loss of wetlands and other important habitats. Currently, the Service has been working with landowners along Piledriver and Twentythree-Mile Sloughs west of Eielson Air Force Base to improve fish habitat. All three of the proposed alignments pass through at least a portion of this area. Since alignment N3 crosses the Richardson Highway between Miles 10-11 and then back between Miles 22-23, the Service would like to have considered an additional alignment (say N3a) that crosses the highway near Mile 0 instead of between Miles 10-11. This additional alignment could then either pass through Eielson Air Fore Base using the existing alignment, or pass immediately west of the airfield between the airfield and the highway before reconnecting to the N3 alignment between Miles 10-11. This alignment would bypass Piledriver and Twentythree-Mile Sloughs altogether.

Land Use: The aerial photos provided in the *Preliminary Alignments Map Set* (Rev. 2) are very helpful for project planning. The Service recommends that aerial photos also be included for the Blair Lakes Spur (Maps 6-7).

Biological Resources: The Service has little biological information upon which to base a rational evaluation for much of the proposed alignments. We therefore recommend that:

- Raptor nests be surveyed within a quarter-mile of the proposed alignments for at least two nesting seasons.

- Plant communities be delineated and classified within a quarter-mile of each proposed alignment. The Service recognizes that certain plant communities have higher habitat value than others, so the classification should include at least the following higher-value habitats: freshwater fens, riparian corridors, tall (≥ 5 ft) shrub habitats, open-water wetlands with emergent/submergent vegetation, Interior Alaska mixed forested wetlands, non-riparian low to medium (< 5 ft) shrub, open-water oxbows and sloughs, and wet meadows.

- Wetlands be delineated and classified within a quarter-mile of each proposed alignment. Portions of the alignments have previously been mapped by the National Wetlands Inventory (http://wetlands.fws.gov/). We recommend that the unmapped areas be delineated and classified using NWI standards.

- The biological impacts from other project-related activities in addition to the rail line alignments are considered, such as material and disposal sites, and work camps.

The Service also recommends a timing window for land-clearing, excavation and fill to prevent the destruction of migratory bird nests, eggs or nestlings during the spring and summer breeding season. The Migratory Bird Treaty Act prohibits the willful killing or harassment of migratory birds, so we recommend that clearing, excavation and fill activities be completed prior to May 1 or after July 15 in Interior Alaska to avoid impacts to breeding migratory birds. If this is not possible, then other measures to avoid impacts to breeding migratory birds should be initiated.

Water Resources: Construction through wetlands, streams, and rivers should be designed to minimize the short-term (e.g., temporary construction activities) and the long-term (e.g., railbed) footprint. Alignments through high-value wetlands should be minimized. Bridges should be used where practicable across the full width of the floodplain, rather than restricting the floodplain with culverts and embankments, which tend to promote channel incision from increased flow velocity and channel narrowing by accretion. Small drainage patterns should be maintained and their flow allowed to pass freely without impounding water or directing the flow through a few, larger culverts. Both impounding water behind structures and diverting the natural flow can adversely impact wetland and riparian plant communities.

Cumulative Impacts: The cumulative impacts should evaluate the potential impacts of other projects that may become feasible with the completion of the rail extension, such as increased development of the Tanana Flats resulting from improved access provided by the new rail line.

We look forward to working with the ARRC and the Surface Transportation Board on the Draft Environmental Impact Statement (EIS) for this project, and we appreciate this opportunity for early comment. Please contact Bob Henszey at 907-456-0323 should you have any questions concerning these comments.

Sincerely,

Larry K. Bright
Branch Chief, Project Planning

rjh/rjh

cc: Christy Everett, USACE, Fairbanks
Bernardo Hernandez, Director of Community Planning, Fairbanks NSB
Robert McLean, ADNR-OHMP, Fairbanks
Mark Jen, EPA, Anchorage

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, WA 98101

January 13, 2006

E1 - 1854

Reply To
Attn Of: ETPA-088

Ref: 05-063-STB

Mr. David Navecky
Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, DC 20423-0001

Dear Mr. Navecky:

The U.S. Environmental Protection Agency (EPA) Region 10, has reviewed the October 26, 2005, Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) and Notice of Availability (NOA) of the Draft Scope of Study for the proposed Northern Rail Extension Project between Eielson Air Force Base (North Pole, Alaska) and Fort Greeley (Delta Junction, Alaska). Our review of the NOI and NOA was conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Clean Air Act §309, and the Clean Water Act.

EPA appreciates the opportunity for early involvement in the planning process by providing scoping comments on the proposed Northern Rail Extension Project. The enclosed comments are provided to inform the Surface Transportation Board (STB) of issues that warrant consideration during the planning process for the EIS.

Although EPA is not a formal cooperating agency, we would appreciate the continued early coordination and involvement with your office throughout the development of this EIS. We would be available to work with your agency to review and comment on preliminary sections of the document. If you have any questions regarding our comments, please do not hesitate to contact Mark Jen of my staff in the Alaska Operations Office in Anchorage by phone at (907) 271-3411 or by email at jen.mark@epa.gov. We look forward to continued involvement in this important project.

Sincerely,

Christine B. Reichgott, Manager
NEPA Review Unit

Enclosure

cc: Brett Flint, Alaska Railroad Corporation

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EPA REGION 10
SCOPING COMMENTS
ON THE NORTHERN RAIL EXTENSION PROJECT

SCOPING SUMMARY REPORT

As indicated in the NOI, at the conclusion of the scoping and comment period, a Final Scope of Study for the EIS will be issued. We support the development of such a document and recommend that it include a summary that identifies the types of comments raised during scoping, and demonstrates how these comments will be addressed in the EIS.

DEFINING THE PROJECT AREA

The EIS should clearly identify and delineate the project area to be analyzed for the Northern Rail Extension Project. The project area should be broad in scope to allow full consideration of the direct, indirect, and cumulative impacts resulting from this proposed project. The project area should not be restricted to a narrow corridor of the proposed rail line Right-of-Way (ROW). The project area for EIS analysis should include the proposed military training sites, such as the Tanana Flats/Blair Lakes and Donnelly training areas. The project area should encompass the communities within the rail corridor (e.g. North Pole, Salcha, Big Delta, Delta Junction) and potentially affected communities outside the rail corridor (e.g. Fairbanks, Anchorage, Seward, and Whittier). Furthermore, we recommend that the EIS include a discussion of how the project area was identified for the analysis in the EIS.

PURPOSE AND NEED

The EIS should include a clear and concise statement of the underlying purpose and need for the proposed action; consistent with the NEPA implementing regulations (see 40 CFR 1502.13). In presenting the purpose and need for this project, the EIS should reflect not only that of the Surface Transportation Board and the project proponent, but also that of the broader public interest and need. The purpose and need statement should be broad enough so that it would not preclude consideration and evaluation of the full range of reasonable and feasible alternatives and not unduly constrain the range of reasonable alternatives. The purpose and need statement should clearly reflect the construction and operation of the northern rail line extension to support all known public, private, and government interests. In particular, a rail line extension would provide for military training and access to military training areas, as well as enhance other military actions.

ALTERNATIVES ANALYSIS

Alternatives Criteria Development. The EIS should identify specific criteria that would be used to (1) develop a range of reasonable alternatives, (2) eliminate alternatives considered, and (3) select the agency preferred alternative. These criteria should be based on factors such as conservation of important aquatic and terrestrial habitats, maintaining wildlife and fish passage, economics, and public safety. The alternatives criteria should also incorporate substantive issues identified during the public scoping process and tribal consultation. The EIS should discuss the rationale and basis for how these criteria were developed.

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Range of Reasonable Alternatives. The proposed alternatives to be evaluated in the EIS should represent the full spectrum of actions that could fulfill the purpose and need for this project. The range of reasonable alternatives should not only evaluate different rail alignments and right-of-ways (ROWs). We recommend that the EIS include reasonable alternatives and would request that the following be considered:

- A rail line extension ROW along the North side of the Tanana River and parallel to the Richardson Highway;
- A surface highway along the South side of the Tanana River

Alternatives that were considered but rejected from further evaluation should also be discussed in the EIS. The basis and rationale for why such alternatives were rejected should be included and based on the alternatives criteria.

Early involvement and continued coordination on the proposed range of reasonable alternatives is an effective way to capture and address ideas and concerns of interested parties. Such an approach allows for project refinements and adjustments which could minimize project delays later in the process. For example, we encourage STB to provide the range of reasonable alternatives to Tribes, agencies, and the public for review and comment prior to selection of the preferred alternative and release of the Draft EIS.

RESOURCES OF CONCERN

Aquatic Resources. Project construction, operation, and maintenance will likely affect aquatic resources: water quality, open water habitats, wetlands, stream channels, and riparian areas. These resources will experience varying degrees of encroachment and alteration of their hydrologic functions, and project encroachment may degrade the habitat for fish and other aquatic biota. For any impacts that cannot be avoided through siting and design, the EIS should describe the types, location, and estimated effectiveness of best management practices (BMPs) applied to minimize and mitigate impacts to aquatic resources.

The EIS should describe aquatic habitats in the affected environment (e.g., habitat type, plant and animal species, functional values, and integrity) and the environmental consequences of the proposed alternatives on these resources. Impacts to aquatic resources should be evaluated in terms of the aerial (acreage) or linear extent to be impacted and by the functions they perform.

The proposed activities would require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (ACOE). For wetlands and other special aquatic sites, the Section 404(b)(1) guidelines establish a presumption that upland alternatives are available for non-water dependent activities. The 404(b)(1) guidelines require avoidance, minimization, and compensation for unavoidable wetland impacts. The EIS should discuss in detail how planning efforts (and alternative selection) conform with Section 404(b)(1) guidelines sequencing and criteria. The EIS should discuss alternatives that would avoid wetlands and aquatic resource impacts from fill placement, construction, and other activities before proceeding to minimization/mitigation measures.

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To meet the requirements of the Clean Water Act, the EIS should identify all water bodies and aquatic resources likely to be impacted by the project, the nature of the potential impacts, and the specific pollutants likely to impact those waters.

Ecological Connectivity. The proposed 80-mile long rail line could potentially contribute to fragmentation and direct loss of terrestrial and aquatic habitat. We have concerns that the rail extension may create a barrier to free migration and movement of terrestrial and aquatic species in the Tanana Flats/River Valley. In addition, there may be potential effects on the ecological processes, such as hydrology, movement of nutrients and sediment. The EIS should evaluate and discuss the potential adverse impacts to the ecological connectivity and ecological processes of the project area. The EIS should identify the critical areas of terrestrial wildlife movement and stream crossings, and measures and opportunities for maintaining existing wildlife crossings and corridors for resident species. Furthermore, there is a potential for collisions between locomotives and terrestrial wildlife crossing the rail line. Measures should be included to avoid and minimize such conflicts. Mitigation measures should be provided in the EIS to ensure safe movement of wildlife within the project area. The rail line should be designed to maintain the integrity of natural ecological processes, particularly hydrological processes and connectivity.

Invasive Species. Ground disturbing activities provide an opportunity for establishment of non-native invasive species. In compliance with NEPA and with the Executive Order 13112, the EIS should evaluate the potential impacts resulting from the introduction of non-native invasive species. This evaluation should identify the types of invasive species and discuss the potential pathways for introduction of such species during construction and operation of this project. During construction activities, we recommend that disturbed areas be revegetated using native species and that there be ongoing maintenance (wholly or primarily non-chemical means) to prevent establishment of invasive species in areas disturbed by project activities.

ENVIRONMENTAL CONSEQUENCES

The EIS should provide a detailed environmental baseline within the project area and the environmental consequences (e.g., direct, indirect, and cumulative impacts) associated with each proposed action alternative, including the no action alternative.

Direct Effects. The direct effects should include those caused by the construction, operation and maintenance of the Northern Rail Line Extension. If the purpose and need for this action is to provide access for military training, then the direct effects of the military training on the environmental resources should be evaluated. Military training sites, such as the Tanana Flats/Blair Lakes and Donnelly areas cover over one million acres of the project area. The potential effects from military training and maneuvers on these resource areas should be analyzed and discussed in the EIS. The types of military training, equipment used, and frequency of training should be considered in the evaluation of direct effects to the resource areas.

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Indirect (Induced) Effects. There may be potential adverse indirect (induced) effects resulting from this project. We recommend that the EIS thoroughly evaluate and discuss the indirect (induced) effects resulting from the construction and operation of the Northern Rail Extension project. This evaluation should include both short-term and long-term effects. The following development activities and actions should be addressed in the EIS:

- Urbanization – residential, commercial, industrial
- Economic Development
- Transportation – highways, rail lines (Alaska to Canada Rail Link), airstrips, ports/harbors, and other infrastructure
- Energy – electric power lines/grids, natural gas pipeline
- Resource Extraction – hard rock, coal, coal bed methane, oil and natural gas
- Tourism and recreation – fishing, hunting, trapping, snow machining,
- Subsistence – fishing, hunting, trapping, berry picking
- Agriculture – timber harvesting, farming, livestock
- Military – National Missile Defense (NMD)

Land Use Planning. Indirect (induced) effects include potential for long-term unplanned and unmitigated development resulting from this project, which could be a concern. Presently, there is minimal development within the Tanana River Valley. This area supports extensive wetlands and aquatic resources, wildlife habitat, and important fish bearing streams. We recommend that the EIS analyze and disclose the indirect (induced) effects of unplanned and unmitigated future development within the project area in the absence of any comprehensive land use plan. The analysis should discuss the environmental, social, and economic consequences. EPA recommends that a commitment be made to work collaboratively with local, state, and federal governments, private property owners, and interested parties to develop a comprehensive land use plan for the Tanana River Valley to guide future indirect (induced) growth and development in the project area.

Cumulative Effects Analysis

This EIS should describe in detail the assumptions, methodology, and framework for developing the cumulative effects analysis (CEA) that is consistent with CEQ's guidance for *Considering Cumulative Effects under the National Environmental Policy Act*. The EIS should establish the geographic scope and timeframe for the CEA.

Reasonably Foreseeable Future Actions. As part of the CEA, the EIS should evaluate the past, present, and reasonably foreseeable future actions associated with this project. The reasonably foreseeable future actions should include those actions that may occur in areas within and adjacent to the project area. Examples of reasonably foreseeable future actions that should be considered in the EIS include the following:

- Alaska-Canada Rail Link
- Natural Gas Pipeline
- Fairbanks Intermodal Transportation Center (FIC)

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When identifying reasonably foreseeable future actions to be addressed in the CEA, criteria should be developed to systematically separate those actions which are "reasonably foreseeable future actions" versus those that are considered "speculative or distant actions." Criteria to identify the reasonably foreseeable future actions could be based on the geographic scope and timeframe identified for this cumulative effects analysis.

Regional Climate Change. There is growing scientific evidence to support the concern that continued increases in greenhouse gas emissions resulting from human activities will contribute to climate change. Climate change should be considered a reasonably foreseeable future impact and should be evaluated through the NEPA process. This EIS should consider how changing conditions due to climate change could potentially influence STB's proposed actions and should also consider how the proposed actions, alternatives, goals and objectives may influence the emissions and sinks of greenhouse gases, contributing to or reducing impacts to climate change.

Public Participation and Environmental Justice

The EIS should describe what efforts will be taken to ensure effective and meaningful participation by Tribes and the public. We recommend that Tribal and Public Participation Plans be developed and implemented for this project. These plans should outline and describe the process for engaging Tribes and the public in the development of the EIS so that there is a commitment and understanding of the participation process.

The proposed action may result in disproportionately high and adverse human health or environmental effects to minorities and/or low income populations within the project area. The EIS should include an Environmental Justice (EJ) analysis which would include all possible measures to identify community issues, as part of the scoping or an ongoing process, and how the information was used. The EIS should discuss how the affected communities have had meaningful input on the decisions making process for this project. The EIS should describe what was done to inform the EJ communities about the project and the potential impacts it would have on their communities. As a recommendation, the EJ analysis for this EIS should include the following level of information:

- Description of the efforts that have/will be taken to inform the communities about the impacts of the project and to ensure "meaningful public participation" by the potentially impacted communities/individuals;
- Identify low income and people of color (minority) communities in the impact area(s) of the project;
- Detail in the EIS, what was heard from the community about the project during the public participation sessions by detailing the impacts identified by you and the communities (perceived and real);
- Address whether these impacts are likely to occur and to whom and evaluate all impacts for their potential to disproportionately impact low income and/or people of color (minority) communities;

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- Describe how what was heard from the public was/will be incorporated into the decisions that were made about the project (such as the development of alternatives or choice of alternatives).

- Propose off-setting mitigation for the impacts that will or are likely to occur.

TRIBAL CONSULTATION

Based on our experience working with Tribes in Alaska, a Tribal Government-to-Government Consultation plan is often used in outline the process for working effectively with Tribal Governments. EPA does not consider public meetings to fulfill the requirement for Tribal Government-to-Government consultation. A Tribe does not have to be formally designated a Cooperating Agency for this project in order for Government-to-Government consultation to occur. Consultation and coordination with Tribal Governments should continue well after the scoping process by maintaining regular meetings. Whether these meetings occur face to face in local communities, telephone conference calls, or statewide tribal conferences, continuous engagement with Tribes is an important element in meaningful Tribal involvement in the NEPA process.

Traditional Ecological Knowledge. The Tribal Government-to-Government consultation process is an opportunity to gather traditional ecological knowledge (TEK) about local subsistence resources, usual and accustomed use areas, and cultural resources. Traditional Ecological Knowledge, in addition to strong scientific data, should be used to develop alternatives, evaluate the environmental consequences of project alternatives, and identify appropriate mitigation measures. Furthermore, we recommend that the EIS integrate TEK into the NEPA planning process and use TEK to assist the STB in making a decision regarding this project.

COST-BENEFIT ANALYSIS

The EIS should provide an overall cost-benefit analysis for this project. This cost estimate should include an itemized breakdown of the proposed costs for construction and operation of each proposed action alternative, as well as the benefits associated with each. In addition, the EIS should include a discussion of the underlying methodology, assumptions, and framework for this analysis. This analysis is important to compare the relative costs and benefits associated with each action alternative and to provide for better public understanding of how economic factors are considered in the agency decision-making process. Furthermore, during the Clean Water Act Section 404 permit application review, the cost-benefit analysis would be used to determine the "practicability" of the agency preferred alternative.

ACCIDENTAL SPILLS

Characterization and Evaluation of Risk. The proposed Northern Rail Extension project would be constructed and operated between North Pole and Fort Greeley (80 miles) for the movement of military personnel, equipment, supplies, weaponry, civilians and commercial freight. The proposed rail line would be constructed adjacent to the Tanana River, and would eventually cross the Tanana River and the Delta River. With additional access to remote areas and movement of freight and military equipment/supplies, there is an increased risk of potential

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spills of materials into waters of the United States, including wetlands. To address the concern of the potential for accidental spills associated with this project, we recommend that the EIS include a characterization of the type of accidental spills, and evaluation of the risks associated with accidental spills from materials being transported along the Northern Rail Extension during frozen and unfrozen conditions. This evaluation should include an inventory of the different types of materials (hazardous, non-hazardous, etc.) that may potentially be transported via this new rail line, and an assessment of their environmental and public health effects. The EIS should also include a discussion of the volumes and frequency for which this material may be transported along the rail line.

Spill Response Planning. The EIS should discuss the potential spill response planning for this project in the event of an accidental spill in both frozen and unfrozen conditions. Our concern is that in more remote areas of Alaska, the response time to the site would be extended. The EIS should describe the spill response planning process and measures that would be taken to respond to accidental spills in the project area.

MITIGATION MEASURES

Mitigation measures should be included in the EIS to avoid, minimize, rectify, reduce, and compensate for project impacts. The EIS should describe the mitigation measures that would be implemented for this project. Mitigation measures identified during scoping, tribal consultation, public and agency coordination should be reflected in the development of the range of reasonable alternatives.

EIELSON BRANCH REALIGNMENT

It is our understanding that the project proponent, ARRC, is pursuing the Eielson Branch Realignment project concurrent with the Northern Rail Extension project in the Fairbanks/North Pole area. The Eielson Branch Realignment project proposes to reconstruct 16 miles of existing track between Fort Wainwright and Eielson Air Force Base. The Federal Railroad Administration (FRA) and the Federal Transit Administration (FTA) are the Federal co-lead agencies which are planning to prepare an Environmental Assessment for the Eielson Branch Realignment.

NEPA allows for integration of processes into early planning and combining environmental documents with other documents to reduce delay and duplication of effort. The Northern Rail Extension project appears to be dependent upon the Eielson Branch Realignment project as a connected action and may best be evaluated in one NEPA document.

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STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES
OFFICE OF PROJECT MANAGEMENT/PERMITTING

FRANK H MURKOWSKI, GOVERNOR

SOUTHCENTRAL REGIONAL OFFICE
ANCHORAGE, ALASKA 99501
PH: (907) 269-7470 / FAX: (907) 269-3981

January 13, 2006

Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001
Attention: David Navecky
Environmental Filing

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Contruct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction). Alaska

The State of Alaska has reviewed the November 1, 2005 Notice of Intent from the U.S. Surface Transportation Board (STB) to prepare an Environmental Impact Statement (EIS) for the proposed Alaska Railroad Corporation (ARRC) Northern Rail Extension, in which the ARRC proposes to construct and operate approximately 80 miles of new railroad line between North Pole and Delta Junction, with an approximately 15-mile spur to the Blair Lakes Military Training Area. The following comments represent the consolidated views of the State's resource agencies.

DRAFT SCOPE OF STUDY

The Notice of Intent requests comments on the included Draft Scope of Study for the EIS. In general, the State supports the scope as presented.

Potential interactions between permafrost changes (4. Geology and Soils) and surface water and ground water (3. Water Resources) need to be explicitly addressed in an appropriate section because of the high biological resources values of many of these waters in the project area. Similarly, project effects associated with potential changes in river, side channel, and stream ice formation, development, and break-up need to be addressed. Proposed material sources and sites need to be identified and included in the impacts analysis of an appropriate section. The cumulative training effects analysis should include effects of increased training intensity, duration, and seasons of use.

BIOLOGICAL RESOURCES

Wildlife

The Tanana River riparian corridor provides high value habitat for a variety of wildlife species (including big game, furbearers, and raptors) although there are currently few

site-specific data available at a scale appropriate for identification of potential project effects.

The EIS should address the wide range of bird species using the project area. This includes raptor nesting (cliffs along the Tanana River are well-known peregrine falcon nesting locations, and bald eagle nests are present adjacent to the river), winter and nesting season use of the Tanana Flats south of the river by hawk-owls and great gray owls, trumpeter swan nesting areas, lesser sandhill crane nesting and staging areas, and potential habitat for nesting rusty blackbirds. The latter is a species in major decline throughout their North American range, and is believed to nest in the project area. The project area has one of the highest moose densities in the state, and the Alaska Department of Fish & Game (ADF&G) is under legislative direction to provide high densities and high harvest levels. As such, potential alterations to moose habitat, calving and concentration areas and travel corridors will need to be addressed, and moose strike by trains is perhaps the greatest wildlife concern of the proposed action. To adequately address these issues, the Office of Habitat Management and Permitting (OHMP) recommends that surveys be conducted to identify and quantify concentration areas, travel corridors, and use patterns during the snow period.

As currently proposed, the ARRC Northern Rail Extension is not expected to directly affect the Delta Junction Bison Range. However, an increase training activities associated with increase access or mobility in the area west of Fort Greely has the potential to affect the Delta Bison Herd. We recommend that the EIS address potential effects of increased training activities on both sides of the Delta River to the herd.

For management purposes, the project area lies within ADF&G Game Management Unit 20: Fairbanks – Central Tanana. That portion south of the north bank of the Tanana River is within Subunit 20A, that portion north of the north bank of the Tanana River is within Subunit 20B, and that portion east of the west bank of the Delta River is within Subunit 20D.

Potential mitigation measures to reduce project effects on wildlife include keeping the alignment as far away from the Tanana River floodplain as possible, avoiding cliffs with raptor habitat, crossing the Tanana River as far upstream as possible, avoiding the moose calving area on the south side of the Tanana River southwest of Eielson Air Force Base, and reducing vegetation alterations and minimizing clearing limits to reduce the attraction of moose to the track corridor. Proposed protocols for monitoring and reporting moose strikes and kills (by location, fate, sex, and age) would also be appropriately addressed.

Fish

Fish habitat in and near the project area (including associated sheet, discrete surface, hyporheic, oxygenated groundwater, and deep groundwater sources and flows it depends on) is diverse, productive, and complex. Potential project effects on fish resources include alterations of surface and subsurface hydrologies from roadbed placement, grade

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cuts and fills, potential changes (more, less) in permafrost and active layer depths beneath fill material, type and locations of crossings, and accommodation of ice formation and passage at crossing structures. Proposed crossings of the Tanana River, Little Delta River, Delta Creek, and the Delta River will need to address not only fish passage but also downstream passage of debris, torrential flows, and ice formation from the glacial systems that feed them.

ADF&G typically conducts aerial surveys in November documenting spawning activity from Benchmark 735 Slough (near S2a MP 7-10) to the Delta River. Upwelling water systems remain open late into the winter, sometimes all winter. However, there are numerous channels and small systems along the south bank that are not surveyed because they are not accessible. Some surveys for juvenile fish on the south bank indicated presence of rearing coho and Chinook salmon in these areas. The lower 2 miles of the Delta River is one of the largest visible sources of upwelling water and the lower ¾ mile is protected under an Interagency Land Management Assignment for the conservation of critical fall chum salmon spawning habitat. Table 1 provides a listing of water bodies currently specified as anadromous.

TABLE 1. Water bodies crossed by or adjacent to the ARRC Northern Rail Extension potential alignments, that have been specified by the Deputy Commissioner as being important for the migration, spawning, or rearing of anadromous fishes in accordance with AS 41.14.870(a). Names in quotation marks are local names; others follow USGS maps. Anadromous water bodies and many others in the project area also provide spawning and rearing habitat for a variety of resident fish species including Arctic grayling, burbot, Dolly Varden, northern pike, and whitefish species.

Water Body	Fish Species*	Stream Number
Tanana River	CH, CO, K	334-40-11000-2490
Salchaket Slough	CH, K	334-40-11000-2490-3290
Piledriver Slough	CH	334-40-11000-2490-3315
Twentythree Mile Slough	CH	334-40-11000-2490-3315-4010
Little Salcha River	CH	334-40-11000-2490-3325
Salcha River	CH, K	334-40-11000-2490-3329
"Fivemile Clearwater River"	CO	334-40-11000-2490-3338
unnamed clearwater tributary to Tanana River	CO	334-40-11000-2490-3356
unnamed clearwater tributary to Tanana River	CO	334-40-11000-2490-3362
Clear Creek ("Richardson Clearwater River")	CH, CO	334-40-11000-2490-3370
"Providence Creek"	CO	334-40-11000-2490-3376
"North Creek"	CO	334-40-11000-2490-3378
"Whitestone Creek"	CO	334-40-11000-2490-3382
Delta River	CH, CO	334-40-11000-2490-3390

*Fish Species: CH = chum salmon, CO = coho salmon, K = chinook salmon

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The Tanana River is an important migratory route for anadromous salmon returning to their natal streams. The Chena, Salcha, and Goodpaster Rivers on the north bank of the Tanana River produce the majority of the Chinook and summer chum salmon while numerous major and minor tributaries entering the Tanana River floodplain on the south bank such as the Delta, Delta Clearwater, and Richardson Clearwater rivers are large producers of fall chum and coho salmon. Fall chum salmon are known to target specific upwelling groundwater spring habitat adjacent to and within the Tanana River floodplain. This habitat type is concentrated along the south bank of the Tanana River from Benchmark 735 Slough (adjacent to the Silver Fox Lodge) upstream to near the mouth of the Gerstle River.

Economically and socially, Chinook salmon are the most valuable stock to the people of the Yukon River drainage. These salmon are important for both commercial markets and provide for one of the largest subsistence fisheries within the state. Within the Tanana River drainage Chinook salmon are also harvested in personal use and sport fisheries. On average, based on genetic stock analysis, nearly 25% of the annual Yukon River commercial Chinook salmon harvest is composed of Tanana River drainage stocks. Juvenile Chinook salmon utilize rearing habitat on both the north and south banks of the Tanana River and remain in these freshwater habitats for 1-2 years before outmigrating to the Bering Sea.

Summer chum salmon are usually the most abundant salmon species within the Yukon River drainage. Summer chum salmon are an important subsistence resource, particularly for residents of the lower Yukon River. The Tanana River has produced large numbers of summer chum salmon and is the upper extension of this species' range. Few summer chum salmon migrate above the Tanana River's confluence with the Yukon River. The average (1995-2005) Yukon River total summer chum run size is estimated to be 1.4 million fish, of which the Tanana River stocks may contribute nearly 30%. The Yukon River summer chum run has ranged from less than 500 thousand fish during the recent crash (2000-2001) to 4 million fish (1995). Juvenile chum salmon do not rear in fresh water, instead they outmigrate to the sea soon after they emerge from the gravel.

Fall chum salmon are an important subsistence resource for the Yukon River people including many living in the communities along the Tanana River. Commercial markets are primarily available at the mouth of the Yukon River for ocean bright products taken from mixed stocks and on the Tanana River for value added products. Fall chum salmon are less abundant than summer chum salmon since their habitat requirements are much more restrictive. Preferred spawning areas for fall chum salmon are limited to upwelling ground water. This ground water has a consistent temperature (typically 4-6°C) higher than that of river water, and provides for accelerated maturation time since fall chum spawn much later in the season (October-November) than do summer chum (August-September). This accelerated maturation enables the later spawning fall chum salmon to emerge and outmigrate with the earlier spawned summer chum salmon during high flows in the spring. On average in recent years (2000 – 2004) the Tanana River has produced 37% of the total Yukon River fall chum salmon run.

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Yukon River coho salmon are similarly a small stock but the majority of the fish are believed to be bound for the Tanana River drainage. Large concentrations of coho salmon are found in the Delta Clearwater River, the only system with an escapement goal. Coho salmon are harvested incidentally to fall chum salmon in both the Yukon River subsistence and commercial fisheries. Additionally, coho salmon support a popular sport fishery within the Tanana River drainage. Similar to Chinook salmon, juvenile coho salmon remain in fresh water for 1-2 years before outmigrating to the sea. Tanana River coho salmon primarily use systems on the south bank of the Tanana River as rearing habitat although some rearing occurs in north bank systems such as Shaw Creek and the Goodpaster River.

We have little fish data for the glacial Little Delta River, Delta Creek, and Jarvis Creek other than seasonal use by resident fish species including Arctic grayling and other species such as whitefish for migratory corridors between overwintering habitat in the Tanana River and spawning and rearing habitats in their upper basins. The mouth of Delta Creek is partially tied into the mouth of the Richardson Clearwater River, a major coho and grayling stream with high human use. Each of these streams have clearwater tributaries in their upper reaches that are believed to provide resident fish spawning, rearing, and perhaps overwintering habitats.

The Delta River is similar to the other glacial tributaries, except for its lower mile or so. In this lower reach, the Delta River provides spawning habitat for fall chum salmon. The Delta River Interagency Land Management Assignment between the Alaska Department of Fish and Game and the Alaska Department of Natural Resources provides for management of approximately 547 acres in the lower ¾ mile of the Delta River for fall chum salmon spawning habitat. The area covered by this agreement typically provides a significant proportion of the total Tanana River basin fall chum spawning area. There are a myriad of clearwater streams and tributaries along the whole southside floodplain and benchlands of the Tanana River in this area, many of which provide important spawning and rearing habitat for anadromous and resident fish species. As specific crossing locations are designated, the EIS needs to identify all fish species and life stage using those locations.

For management purposes, the project area lies within the ADF&G Division of Commercial Fish Yukon River District 6, ADF&G Division of Sport Fish Lower Tanana and ADF&G Division of Sport Fish Upper Tanana Management Areas.

The greatest potential mitigation measure to reduce project effects on fish populations is to avoid the Tanana River floodplain because of its multiple highwater and clear runoff channels, spawning and rearing habitat, and tributaries systems. By staying well back from the Tanana, near to or up on the terrace break on the south side, many of the wetlands, surface and subsurface flow, and fishbearing waters issues with previous conceptual alignments may be avoided. The exception to this is the Piledriver Slough/Twentythree Mile Slough area. Although this area is highly productive, OHMP and ADF&G area willing to work with the applicant to develop alignments that could

reduce flood flows and provide habitat stability. Additional areas of concern include the Fivemile Clearwater and upper Richardson Clearwater rivers.

SUBSISTENCE

Although the proposed railroad extension corridor lies within the Fairbanks Nonsubsistence Area, approximately 26 rural communities not including Fairbanks annually participate in subsistence fisheries on stocks originating in the Tanana River. Subsistence and personal use mixed stock fisheries on the Tanana River and Yukon River systems downstream from the project site (excluding the Koyukuk River) annually harvested 36,000 Chinook salmon, 85,000 summer chum salmon, 45,000 fall chum salmon, and 22,000 coho salmon on average between 1994 and 2003.

We encourage consultation with Tanana Chiefs Conference, Inc. during preparation of the draft EIS.

RECREATION and ACCESS

The potential for the project to affect the passage of boats, including airboats, is also a significant concern for the entire Tanana River corridor, and the clearwater side channels and tributaries such as the Fivemile Clearwater River. Water craft used range from outboard jetboats to inboard jets with cabins to some airboats. Therefore, any crossing structure would need to clear the height of an airboat with CB antenna to assure continuance of existing waterborne access.

In addition to water craft passage, the project has the potential to restrict public surface access to and from the Tanana River. Surface access to the Tanana Flats for off road vehicles (ORV) and foot travel is extremely limited and the public has requested additional opportunities for surface access.

The impact to future access for Salcha, Delta Junction and other communities along the proposed expansion should be evaluated. A railroad route through or around a community can create access limitations to existing and future transportation infrastructure (highways, airports, river access) and adjacent lands. The EIS should identify alternatives with the least impact to the existing transportation systems and identify mitigation for unavoidable transportation impacts.

The EIS should also consider the impact of new road/railroad crossings created by the proposed project. The State of Alaska Department of Transportation and Public Facilities has worked with the ARRC to construct separated grade crossings at numerous locations on the national highway system (NHS). Available funding for these improvements is limited. The costs of constructing additional separated grade intersections on the NHS and on other high volume routes should be considered as part of the project and the EIS should consider alternatives to reduce the number of road crossings, where practicable.

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Finally, impacts to traffic levels on the Richardson Highway should be evaluated. Changes to traffic volume and type, particularly increases in volume, can have a significant impact on the maintenance of the Richardson Highway and the need for additional capital projects to improve capacity. Limited funds are available for highway maintenance and construction.

Thank you for the opportunity to provide comments on this action. We remain available to discuss these comments and look forward to working with the STB and ARRC as the EIS is developed.

Sincerely,

Don Perrin
Project Management and Permit Coordinator

cc: Randy Bates, DNR/OPMP
Don Young, ADF&G
Fronty Parker, ADF&G
Mac McLean, DNR/OHMP
Jim Durst, DNR/OHMP
Kerry Walsh, DNR/DMLW
Judy Bittner, DNR/DPOR/SHPO
Christy Miller, DCED
Jeff Roach, DOT&PF
Sue Slifer, DOT&PF
Ethan Birkholz, DOT&PF
Jerry Rafson, DOT&PF
Jim Powell, DEC
Brett Flint, ARRC
Michael Nagey, ENTRIX
Mark Dalton, HDR Alaska

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SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

October 12, 2005

Mr. James Helfinstine
Waterways and Navigation Branch (OAN-3)
Seventeenth Coast Guard District
P.O. Box 25517
Juneau, Alaska 99802-5517

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Dear Mr. Helfinstine:

I am writing to invite you to be a cooperating agency in the preparation of an environmental review described below:

The Alaska Railroad Corporation (ARRC) intends to file a petition with the Surface Transportation Board (Board), pursuant to 49 U.S.C. 10502, requesting authority to construct and operate a new rail line from Eielson Air Force Base to Fort Greely, Alaska. The proposed project would involve the construction of approximately 80 miles of new rail line connecting the existing rail line near Eielson Air Force Base near North Pole, Alaska to a point near Fort Greely and the Donnelly Training Area near Delta Junction, Alaska. The proposed rail line would cross the Tanana River, possibly near Flag Hill, allowing the U.S. Army year-round access to the Tanana Flats and Donnelly training areas. The proposed project could also include the construction of a 15-mile spur line from the vicinity of Flag Hill to the Blair Lakes Military Training Area. Construction of the proposed rail line would provide all the major military installations in Alaska with rail access to the Port of Anchorage. ARRC also intends to provide passenger rail service between Fairbanks and Delta Junction, and as a common carrier, ARRC would be obligated to provide freight rail service upon request to any future shippers on the proposed line.

The construction and operation of this project has the potential to result in significant environmental impacts. Therefore, the Board's Section on Environmental Analysis (SEA) has determined that the preparation of an Environmental Impact Statement (EIS) is appropriate. SEA intends to issue the Notice of Intent to Prepare an Environmental Impact Statement and

Draft Scope of Study in the near future. SEA will also hold public scoping meetings as part of the EIS process.

Based on preliminary agency consultations that have been conducted by SEA and its third-party contractor (ICF Consulting, Inc.) for this proposed project, SEA believes that the project could impact properties under the jurisdiction of or use by a number of several Federal agencies including yours. Therefore, consistent with 40 CFR 1501.6, we are inviting the following agencies to be cooperating agencies in the preparation of this EIS on the basis of their special expertise or jurisdiction by law:

- U.S. Department of Defense, Alaskan Command,
- U.S. Department of Defense, U.S. Army Garrison – Alaska Command,
- U.S. Department of Defense, 354th Fighter Wing Command,
- U.S. Army Corps of Engineers – Alaska District,
- U.S. Department of Interior, Bureau of Land Management – Alaska State Office,
- U.S. Coast Guard, Seventeenth Coast Guard District,
- U.S. Department of Transportation, Federal Railroad Administration, and
- U.S. Department of Transportation, Federal Transit Administration – Region 10

If you have any questions, please feel free to contact Dave Navecky of my staff at 202-565-1593 (e-mail address: naveckd@stb.dot.gov), or Alan Summerville, ICF Consulting project manager, at 703-934-3616 (e-mail address: ASummerville@icfconsulting.com). I would appreciate your response by November 18, 2005. We look forward to working with you in the near future.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

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EI - 1842

U.S. Department of Transportation

Federal Railroad Administration

1120 Vermont Ave., N.W.
Washington, D.C. 20590

RECEIVED NOV 15 2005

NOV 10 2005

Victoria Rutson
Chief, Section of Environmental Analysis
Surface Transportation Board
Office of Economics, Environmental Analysis, and Administration
Washington, DC 20423

Re: **STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base and Fort Greely, Alaska**

Dear Ms. Rutson:

I am writing in response to your letter of October 12, 2005, inviting the Federal Railroad Administration (FRA) to be a cooperating agency in the environmental review of the proposed Alaska Railroad Corporation rail line extension from Eielson Air Force Base to Fort Greely, Alaska. Your letter indicates that, given the extent of the environmental impacts, the review will consist of an Environmental Impact Statement (EIS).

As the agency charged with regulatory oversight over the finished rail line as well as administration of the grant funds that may be used to build the line, FRA has a special interest in this project. Therefore, FRA accepts your invitation and would like to act as a cooperating agency in the preparation of the EIS. Thank you for the opportunity to participate and we look forward to working with the Surface Transportation Board and the other cooperating agencies on the EIS.

Sincerely,

Mark E. Yachmetz
Associate Administrator for
Railroad Development

Rec'd 12/22/05

E1 - 1849

DEPARTMENT OF THE AIR FORCE
PACIFIC AIR FORCES

DEC 5 2005

Brigadier General Marke F. Gibson
354 FW/CC
354 Broadway St Unit 19A
Eielson AFB AK 99702-1899

Ms. Victoria Rutson
Chief, Section of Environmental Analysis
Surface Transportation Board
Washington DC 20423

Dear Ms. Rutson

I accept your invitation for the 354th Fighter Wing at Eielson AFB to be a cooperating agency in the preparation of an Environmental Impact Statement (EIS) for the extension of the Alaska Railroad to Fort Greely, Alaska. The project you describe will impact this installation and community. I concur that Eielson's participation in the EIS process is necessary and appropriate for a full and open engagement on project issues important to this base.

My point of contact is Mr. Mike Lee, 354th Mission Support Group Deputy, (907-377-3433, michael.lee@eielson.af.mil). When communicating with Eielson AFB on environmental specifics, please include Mr. Jim Nolke, Environmental Planning Manager, (907-377-3365, 354 CES/CEVP, james.nolke@eielson.af.mil).

Sincerely

MARKE F. GIBSON
Brigadier General, USAF
Commander

Rec'd 12/12/05

E1 - 1847

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, ALASKA
P.O. BOX 6898
ELMENDORF AFB, ALASKA 99506-0898

REPLY TO ATTENTION OF:

DECEMBER 0 6 2005

Regulatory Branch
North Section

Ms. Victoria Rutson
Chief, Section of Environmental Analysis
Office of Environmental Analysis and Administration
Surface Transportation Board
Washington, DC 20423

Dear Ms. Rutson:

Thank you for your October 12, 2005, letter inviting us to be a cooperating agency in the preparation of an Environmental Impact Statement (EIS) for the Alaska Railroad Corporation's proposed new rail line between Eielson Air Force Base and Fort Greeley, Alaska. We agree that portions of the proposed project could affect waters of the United States under our regulatory jurisdiction, and thus would require Department of Army (DA) authorization pursuant to Section 404 of the Clean Water Act and/or Section 10 of the Rivers and Harbors Act of 1899.

We are willing to be a cooperating agency in the preparation of the EIS, provided a Memorandum of Agreement (MOA) is jointly prepared and scrupulously followed that clearly documents our respective expectations, roles, and responsibilities, with the emphasis placed on producing a quality document, rather than meeting an estimated and inflexible schedule. One of our expectations would be that the final EIS contain sufficient information for us to make a permit decision, particularly the information required to determine compliance with the Section 404(b)(1) Guidelines (40 Code of Federal Regulations Part 230) and our public interest review (33 Code of Federal Regulations Part 320). The goal would be to ensure that our review process is integrated and concurrent with the EIS to the fullest extent possible in accordance with 40 Code of Federal Regulations Part 1502.25.

We look forward to working with you on the preparation of the MOA. Our point of contact in this effort will be Ms. Christy Everett. You may contact her by email at christy.a.everett@poa02.usace.army.mil, by phone at (907) 474-2166, by FAX at (907) 474-2164, or by mail at 3437 Airport Way, Suite 206, Fairbanks, Alaska, 99709-4777.

Sincerely,

Steve Meyers
Chief, North Section

Rec'd 12/9/05

El - 1846

HEADQUARTERS
ALASKAN COMMAND (ALCOM)
ELMENDORF AIR FORCE BASE, ALASKA 99506

28 NOV 2005

Lieutenant General Douglas M. Fraser
Commander, Alaskan Command
9480 Pease Avenue, Suite 101
Elmendorf AFB AK 99506-2100

Ms. Victoria Rutson
Chief, Environmental Analysis
Surface Transportation Board
1925 K Street, N.W
Washington DC 20423-0001

Dear Ms. Rutson

We accept your invitation to be a cooperating agency in the environmental review of the Alaska Railroad Corporation petition for operation and construction of a rail line from Eielson Air Force Base to Fort Greely, Alaska. I think it is important for Alaskan Command to participate in the environmental planning process. My point of contact is Colonel Paul Curtis, ALCOM/J4, 9480 Pease Avenue, Suite 216, Elmendorf Air Force Base, Alaska 99506-2100. You may contact him by phone at (907) 552-7013 or via email at paul.curtis@elmendorf.af.mil.

If you have not already done so, in addition to those listed on your letter, I recommend you also invite the Commander, U.S. Army Garrison – Fort Greely and the Director, Ground-Based Midcourse Defense Operations Support Group Alaska to participate. As the federal property manager or federal agency this project may affect, they too have an interest in the rail project and their involvement at this early stage will further enhance your environmental planning effort.

Again, thank you for your invitation. We look forward to working with you and the Surface Transportation Board on matters of mutual interest.

Sincerely

Douglas M. Fraser

DOUGLAS M. FRASER
Lieutenant General, USAF
Commander

Guardian of the North

Rec'd 1/17/06

El - 1856

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Alaska State Office
222 West Seventh Avenue, #13
Anchorage, Alaska 99513-7599
http://www.ak.blm.gov

TAKE PRIDE IN AMERICA

1793 (AK-932)

DEC 20 2005

Ms. Victoria Rutson, Chief
Section of Environmental Analysis
Office of Economics, Environmental Analysis, and Administration
Surface Transportation Board
Washington, D.C. 20423

Re: STB Finance Docket Number 34658, The Alaska Railroad Corporation-Petition for Exemption to Construct and Operate a Rail Line Between Eielson AFB and Fort Greely, Alaska.

Dear Ms. Rutson:

This responds to your letter of October 12, 2005, on behalf of the Surface Transportation Board to Gary Foreman inviting the Bureau of Land Management (BLM) to be a cooperating agency on the Environmental Impact Statement for a new rail line from Eilson Air Force Base, Alaska to Fort Greely, Alaska. The BLM is interested in becoming a cooperating agency in the Environmental Impact Statement process for the State of Alaska's proposed railroad construction. Cooperation may expedite agency NEPA compliance for the project.

The BLM has not received a right of way application from the State of Alaska. However, a right of way grant from the BLM under Title V of the Federal Land Management Policy Act is required for this project. A minimum of 5 to 6 miles of the proposed railway alignment involves land managed by the BLM.

The BLM wishes to enter into a Memorandum of Understanding (MOU) with your agency since the Surface Transportation Board intends to lead the environmental review. The MOU should name agency contacts, and identify the lead and cooperating agency responsibilities as required in 40 CFR 1501.6 (a) and (b). The MOU will also identify special resource needs, data requirements, and issues to be addressed in the analysis.

Project coordination will be the responsibility of the BLM Fairbanks District Office, Fairbanks, Alaska. Please feel free to contact Mr. Gary Foreman, Planner and Environmental Specialist, at (907) 474-2339.

Sincerely,

Acting Henri R. Bisson
State Director

EO-303

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

April 5, 2006

Judith Bittner
State Historic Preservation Officer
Alaska Office of History and Archaeology
550 West 7th Ave., Suite 1310
Anchorage, AK 99501-3565

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Dear Ms. Bittner:

I am writing to ask for your approval of a site location model and survey strategy described in detail below and enclosed. I have also provided some background information about the proposed project, which I understand you are acquainted with, as well as an explanation of how we anticipate implementing the model and survey, subject to your review and approval.

Background

The Alaska Railroad Corporation intends to file a petition with the Surface Transportation Board (Board), pursuant to 49 U.S.C. 10502, requesting authority to construct and operate a new rail line from North Pole to Delta Junction, Alaska. The Board would be the Federal agency responsible for granting authority for the construction and operation of the proposed new rail line. The Section of Environmental Analysis (SEA) is the office within the Board responsible for preparing the appropriate National Environmental Policy Act (NEPA) documentation for railroad construction and operation cases that come before the Board.

As previously communicated to you, SEA is preparing an Environmental Impact Statement (EIS) to evaluate the potential environmental impacts of the Northern Rail Extension Project, including consideration of cultural resources. ICF Consulting is serving as the independent third-party consultant to assist SEA with the EIS. Northern Land Use Research, Inc. (NLUR) is the cultural resources subcontractor to ICF Consulting.

Description of the Site Location Model and Survey Strategy

Following consultation with your office, NLUR has prepared the enclosed site location model and survey strategy in order to provide the SHPO and other regulatory agencies with the data and information necessary to permit a cultural resource survey of the proposed railroad alignments. The site location model -- developed within a Geographic Information System (GIS) framework – is used to demarcate high-moderate and low probability areas for the location of cultural materials within the project area. Using the site location model, we believe that we will be able to maximize the discovery of cultural resources and to optimize survey strategies (level of intensity and efficiency of different survey types).

Based on our research, high-moderate probability areas for site location would be ground surveyed (119.7 linear km, 28% of total proposed alignments), and low probability areas would be surveyed through low-altitude, low-speed helicopter overflight and spot ground testing (304.7 km, the remaining 72% of the total proposed alignments). Verification measures for the model have been built in by incorporating these alternative field survey strategies. Since all of the alignments will be surveyed to some level, a more refined model can be constructed on the basis of data gathered during the course of the proposed 2006 fieldwork.

The results of the 2006 field survey will be incorporated into the EIS. The ground survey is defined as the minimum level of effort to meet Level II (Evaluation Phase) survey requirements by the SHPO (i.e., gathering sufficient data for a determination of eligibility to the National Register of Historic Places). Future cultural resource work will depend on the evaluations (and SHPO concurrence) and predicted adverse impacts due to the Northern Rail Extension Project.

We request your approval of this site location model and associated survey strategy for the proposed Northern Rail Extension Project.

If you have any questions about the project please do not hesitate to contact Dave Navecky, SEA Project Manager, at 202-565-1593 or Alan Summerville, ICF Consulting Project Manager, at 703-934-3616.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Enclosure

E1-2469

FRANK H. MURKOWSKI, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION
OFFICE OF HISTORY AND ARCHAEOLOGY

550 W 7th Ave, SUITE 1310
ANCHORAGE, ALASKA 99501-3565
PHONE: (907) 269-8721
FAX: (907) 269-8908

May 9, 2006

File No.: 3130-1R Surface Transportation Board

SUBJECT: Construct and operate rail line between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Victoria Rutson
Surface Transportation Board
Office of Economics, Environmental Analysis and Administration
Washington, DC 20423

Dear Ms. Rutson,

The State Historic Preservation Office received on April 6, 2006, your letter regarding the referenced project and the attached report titled *Site location model and survey strategy for cultural resources in the Alaska Railroad Northern Rail Extension Project area* by Northern Land Use Research, Inc. (December 2005). We also met/teleconferenced with Dave Navecky (SEA Project Manager), Alan Summerville (ICF Consulting), Bob King (BLM) and Peter Bowers and Ben Potter (NLUR) on April 19, 2006 regarding this project. Based on the meeting and our review of the report, we find the proposed site location model and survey strategy acceptable.

Please contact Stefanie Ludwig at 269-8720 if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner
State Historic Preservation Officer

JEB:sll

Cc: Alan Summerville, ICF Consulting Service, LLC

EO-403

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

August 18, 2006

Judith Bittner
State Historic Preservation Officer
Alaska Office of History and Archaeology
550 West 7th Ave., Suite 1310
Anchorage, AK 99501-3565

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska

Dear Ms. Bittner:

This letter serves to formally delineate the minor deviations from the originally submitted and agreed-upon survey strategy (Potter 2005), and to formalize the verbal agreements reached in the July 28, 2006 meeting and teleconference attended by representatives of your office, the Board's Section of Environmental Analysis (SEA), and SEA's third-party contractor team, including ICF International and Northern Land Use Research, Inc. (NLUR).

NLUR is now working from the "Revision 4" version of alignment alternatives and associated ancillary facilities information provided by the Alaska Railroad Corporation (ARRC) in July 2006, which supersedes the previously reported Revision 3a alignment alternates series. With the addition of about 54 miles of alignment (by Revision 4 as compared to Revision 3a), NLUR has altered the survey strategy somewhat. Here are the specific changes in the survey strategy:

- All ancillary facilities are being analyzed with respect to the predictive model (Potter 2005), rather than being ground surveyed 100 percent. Most of these ancillary facilities are in areas with relatively low site potential, and are being surveyed through Type A surveys (helicopter-based surveys with localized areas of testing). Others are in higher potential locations and are being surveyed though Type B surveys (ground-based transects and localized areas of testing).

- A full Phase 2 (Evaluation Phase) level-of-effort was described in the survey strategy/predictive model document (Potter 2005). NLUR is testing discovered sites to obtain necessary information to complete a Determination of Eligibility (DOE) to the National Register of Historic Places. However, given the number of sites and the fact that most of them were discovered in subsurface contexts, NLUR is analyzing the sites in a less intensive manner, as agreed in principle during the July 28, 2005 meeting. Enough information is being gathered to assess context, integrity, stratigraphic position, age (if possible), diagnostics, and overall technology. Site extent (identifying the borders of located sites) is not being addressed in our field effort, given the limited helicopter availability, limited field season, and depth/complexity of the buried sites.

All other aspects of the survey are following the Predictive Model and Survey Plan document (Potter 2005). If you have any questions or comments please do not hesitate to contact Dave Navecky, SEA Project Manager, at 202-565-1593 or Alan Summerville, ICF Consulting Project Manager, at 703-934-3616.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

REFERENCES CITED:

Potter, Ben A. 2005. *Site Location Model and Survey Strategy for Cultural Resources in the Alaska Railroad Northern Rail Extension Project Area.* Prepared for ICF Consulting Services, LLC, by Northern Land Use Research, Inc., Fairbanks.

2

EI-2704

FRANK H. MURKOWSKI, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION
OFFICE OF HISTORY AND ARCHAEOLOGY

550 W 7th Ave. SUITE 1310
ANCHORAGE, ALASKA 99501-3565
PHONE: (907) 269-8721
FAX: (907) 269-8908

September 5, 2006

File No.: 3130-1R Surface Transportation Board

SUBJECT: Construct and operate rail line between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Victoria Rutson
Surface Transportation Board
Office of Economics, Environmental Analysis and Administration
Washington, DC 20423

Dear Ms. Rutson,

The State Historic Preservation Office (SHPO) received on August 18, 2006, your letter regarding the referenced project. We have reviewed your revised survey and testing strategy in accordance with Section 106 of the National Historic Preservation Act.

We agree with the following:

- The type of survey employed in investigating the ancillary facilitates will be guided by the predictive model: (A) helicopter based survey and localized testing in low potential areas; and (B) ground based survey and localized testing in high potential areas.
- All newly reported archaeological sites will continue to be evaluated for eligibility for the National Register of Historic Places. Site boundaries however, do not need to be delineated for this phase of the project. Once the final alternative has been selected, site boundaries must be established of all eligible sites within the area of potential effect. Only then will the SHPO be able to concur on an assessment of effect of this project.

Please contact Stefanie Ludwig at 269-8720 if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner
State Historic Preservation Officer

JEB:sll

Cc: Alan Summerville, ICF Consulting Service, LLC

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

August 22, 2007

Judith Bittner
State Historic Preservation Officer
Alaska Office of History and Archaeology
550 West 7th Ave., Suite 1310
Anchorage, Alaska 99501-3565

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska

Dear Ms. Bittner:

Please find enclosed the 2006 cultural resources survey and evaluation for the above-referenced project for your review pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C § 470f). This report was prepared for the Board's Section of Environmental Analysis (SEA) by our third-party contracting team including ICF International and Northern Land Use Research, Inc. (NLUR). The *Results of the 2006 Cultural Resource Survey of Proposed Alaska Railroad Northern Rail Extension Routes and Ancillary Facilities, Alaska*, in 2 volumes, includes all cultural resource survey results, site forms, and determination of eligibility recommendations for the above undertaking for 2006. This report meets the stipulations under State of Alaska Field Archaeology Permit 2006-08 (as well as BLM Fieldwork Authorization/USDOI Cultural Resource Use Permit AA86535).

Please note that the enclosed report does not include the results from the 2007 cultural resources investigation. The 2007 field work was recently completed and a separate report is currently being prepared and will be provided to you as soon as it's available.

If you have any questions about the project please do not hesitate to contact Dave Navecky, SEA Project Manager, at (202) 245-0294 or Alan Summerville, ICF Project Manager, at (703) 934-3616. Specific technical questions may be directed to our cultural resources third-party subcontractor (NLUR), Peter Bowers or Dr. Ben Potter at (907) 474-9684.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Enclosure
cc: Bob King, BLM

SARAH PALIN, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION

OFFICE OF HISTORY AND ARCHAEOLOGY

550 W. 7TH AVENUE, SUITE 1310
ANCHORAGE, ALASKA 99501-3565
PHONE: (907) 269-8721
FAX: (907) 269-8908

September 24, 2007

File No.: 3130-1R Surface Transportation Board

SUBJECT: Northern Rail Extension, Eielson Air Force Base (North Pole) to Fort Greely (Delta Junction), Alaska; State of Alaska Field Archaeology Permit 2006-08

Victoria Rutson
Chief, Section of Environmental Analysis
Surface Transportation Board
Office of Economics, Environmental Analysis and Administration
Washington, DC 20423

Dear Ms. Rutson,

The State Historic Preservation Office (SHPO) received your letter and the attached report titled *Results of the 2006 Cultural Resource Survey of Proposed Alaska Railroad Northern Rail Extension Routes and Ancillary Facilities, Alaska, Volumes I and II* by Northern land Use Research, Inc. (December 2006) on August 23, 2006. We have reviewed the report and find that it meets the requirements of the State of Alaska Field Archaeology Permit.

We also reviewed the report in accordance with Section 106 of the National Historic Preservation Act and offer the following comments in regard to identifying historic properties in the area of potential effect:

1. We agree that the prehistoric sites are eligible for the National Register under criterion D.
2. We need more information on the cabins and other historic features before we can concur that they are not eligible for the National Register. They should be evaluated under their historic context (for example, 20th century trapping in interior Alaska). If a cabin has lost historic integrity due to recent modifications, then these changes should be described. Also, keep in mind that a collapsed cabin may still be eligible under criterion D.
3. Be sure to evaluate properties that may be indirectly affected by this project. Examples include the agricultural landscape near Delta Junction and Eielson Air Force Base as well as the Trans Alaska Pipeline System. Both features are in close proximity to the rail corridor and must be evaluated for eligibility prior to an assessment of effects.
4. The photographs in the report appear to be black and white photo copies and are difficult to decipher. Future report submissions should have higher quality figure reproductions.

Northern Rail Extension 9/24/2007 Page 1

Please consider these comments when requesting our concurrence on the Surface Transportation Board's findings of eligibility and effect *(36 CFR 800.4 and 800.5)*. You may contact Stefanie Ludwig (269-8720) or Doug Gasek (269-8726) if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner
State Historic Preservation Officer

JEB:sll

Northern Rail Extension 9/24/2007 Page 2

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

September 17, 2007

Mr. Donald Perrin
Office of Project Management/Permitting
Southcentral Regional Office
Alaska Department of Natural Resources
Anchorage, Alaska 99501

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska

Dear Mr. Perrin:

I am writing to invite the Alaska Department of Natural Resources (ADNR) to be a cooperating agency in the preparation of the environmental review described below:

On July 6, 2007, the Alaska Railroad Corporation (ARRC) filed a petition with the Surface Transportation Board (Board), pursuant to 49 U.S.C. 10502, requesting authority to construct and operate a new rail line between North Pole and Delta Junction, Alaska. The proposed project would involve the construction of approximately 80 miles of new rail line connecting the existing rail line near North Pole, Alaska to a point near Delta Junction, Alaska. Construction of the proposed rail line would provide all the major military installations in Alaska with rail access to the Port of Anchorage. ARRC also intends to provide passenger rail service between Fairbanks and Delta Junction, and as a common carrier, ARRC would be obligated to provide freight rail service upon request to any future shippers on the proposed line.

The construction and operation of this project has the potential to result in significant environmental impacts. Therefore, the Board's Section on Environmental Analysis (SEA) determined that the preparation of an Environmental Impact Statement (EIS) is appropriate. SEA issued a Notice of Intent to Prepare an Environmental Impact Statement and Draft Scope of Study on November 1, 2005, and held public scoping meetings in December 2005 as part of the EIS process.

Based on agency consultations conducted by SEA and its third-party contractor (ICF International) for this proposed project, SEA determined that the project could impact properties under the jurisdiction of or use by a number of Federal agencies. Therefore, consistent with 40 CFR 1501.6, SEA previously invited the following Federal agencies to be cooperating agencies in the preparation of this EIS on the basis of their special expertise or jurisdiction by law:

- U.S. Department of Defense, Alaskan Command,
- U.S. Department of Defense, 354th Fighter Wing Command,
- U.S. Army Corps of Engineers – Alaska District,
- U.S. Department of Interior, Bureau of Land Management – Alaska State Office,
- U.S. Coast Guard, Seventeenth Coast Guard District,
- U.S. Department of Transportation, Federal Railroad Administration, and
- U.S. Department of Transportation, Federal Transit Administration – Region 10

Based on recently enacted state legislation (i.e., Alaska Stat. § 42.40.460 [2005]), SEA would now like to extend an invitation to ADNR to be a cooperating agency in the preparation of this EIS based on your agency's jurisdiction by law.

If you have any questions, please feel free to contact Dave Navecky of my staff at 202-245-0294 (e-mail address: naveckyd@stb.dot.gov), or Alan Summerville, ICF Consulting project manager, at 703-934-3616 (e-mail address: ASummerville@icfconsulting.com). I would appreciate your response by October 19, 2007. We look forward to working with you in the near future.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

2

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF PARKS AND OUTDOOR RECREATION

OFFICE OF HISTORY AND ARCHAEOLOGY

SARAH PALIN, GOVERNOR

550 W. 7TH AVENUE, SUITE 1310
ANCHORAGE, ALASKA 99501-3565
PHONE: (907) 269-8721
FAX: (907) 269-8908

July 16, 2008

File No.: 3130-1R Surface Transportation Board

SUBJECT: Northern Rail Extension, Eielson Air Force Base (North Pole) to Fort Greely (Delta Junction), Alaska

Victoria Rutson
Chief, Section of Environmental Analysis
Surface Transportation Board
Office of Economics, Environmental Analysis and Administration
Washington, DC 20423

Dear Ms. Rutson,

The State Historic Preservation Office (SHPO) received your letter and the attached report titled *Results of the 2007 Cultural Resource Survey of Proposed Alaska Railroad Northern Rail Extension Routes, Alaska* by Northern land Use Research, Inc. (November 2007) on January 17, 2008. We have reviewed the report in accordance with Section 106 of the National Historic Preservation Act. The excavation results of XBD-298 (Chapter 5) are impressive and confirm the potential for very deeply buried and very early, multi-component archaeological sites in the project area.

We informally agree with the recommendations regarding eligibility for the National Register of Historic Places listed in Appendix B of the report. To formally concur however, we need to know whether the Surface Transportation Board, as the lead Federal agency, agrees with the findings in the report (as with the sites reported in 2006). As your are aware, *36 CFR 800.2(a)(3)* allows Federal agencies to use the services of consultants to prepare information, analysis and recommendations, however the Federal official remains responsible for all findings of eligibility and effect.

We have also reviewed the report in accordance with *Alaska Statutes 41.35.080* and find that it meets the requirements of the State of Alaska Field Archaeology Permit issued to the contractor.

We look forward to continued consultation with you regarding this undertaking. Please contact Stefanie Ludwig (269-8720) if you have any questions or if we can be of further assistance.

Sincerely,

Judith E. Bittner
State Historic Preservation Officer

JEB:sll

Cc: Peter Bowers, Northern Land Use Research, Inc.

Appendix C –
Tribal and Government-to-Government Consultation

C. TRIBAL AND GOVERNMENT-TO-GOVERNMENT CONSULTATION

This appendix contains the Section of Environmental Analysis's (SEA's) written correspondence with federally recognized tribes, tribal groups, and Alaska Native Regional Corporations. The first letter is a sample letter sent to the Healy Lake Tribal Council on September 28, 2005, which is representative of 12 others sent to tribal entities introducing them to the project. The second letter is a sample scoping letter, sent to Dot Lake Village Council on November 7, 2005, and is representative of 12 others informing tribal entities of the issuance of the Notice of Intent and of upcoming public scoping meetings. The third letter is a sample joint introduction and scoping letter sent to the Alaska Federation of Natives on November 23, 2005, and it is representative of eight others sent to tribal entities that did not receive the initial letter of introduction. The fourth sample letter, sent to Ahtna, Inc**.,** on June 28, 2006, is representative of 22 others sent to tribal entities initiating formal government-to-government consultation. It includes a sample blank questionnaire that was sent to all 23 recipients of this letter.

Table C-1 lists all of the tribal entities with which SEA has corresponded and their dates of correspondence. Copies of correspondence between SEA and the tribal entities on the dates listed in the Table C-1 follow the table.

Table C-1
Dates of Correspondence with Tribal Entities Consulted

Tribal Entity	Dates of Correspondence
Federally Recognized Tribes	
Circle Native Community	11/23/2005; 6/28/2006
Dot Lake Village Council	9/28/2005; 11/7/2005; 6/28/2006; 7/5/2006
Healy Lake Village (Tribal Council)	9/28/2005; 11/7/2005; 6/28/2006
Manley Hot Springs Village	11/23/2005; 6/28/2006; 8/7/2006
Mentasta Traditional Council Office	9/28/2005; 11/7/2005; 6/28/2006
Native Village of Cantwell	11/23/2005; 6/28/2006
Native Village of Chistochina	11/23/2005; 6/28/2006; 8/8/2006
Native Village of Eagle	11/23/2005; 7/14/2006; 6/28/2006
Native Village of Minto	11/23/2005; 6/28/2006; 9/27/2006
Native Village of Stevens	11/23/2005; 6/28/2006
Nenana Native Association (Nenana Native Council)	9/28/2005; 11/7/2005; 6/28/2006; 7/21/2006
Northway Village (Northway Tribal Council)	9/28/2005; 11/7/2005; 6/28/2006
Native Village of Tanacross (Tanacross Village Council)	9/28/2005; 11/7/2005; 6/28/2006
Native Village of Tanana	6/28/2006
Native Village of Tetlin (Tetlin Village Council)	9/28/2005; 11/7/2005; 6/28/2006
Rampart Village	11/23/2005; 6/28/2006
Tribal Groups	
Alaska Federation of Natives	11/23/2005; 6/28/2006
Council of Athabascan Tribal Governments	9/28/2005; 11/7/2005; 6/28/2006
Tanana Chiefs Conference	9/28/2005; 11/7/2005; 2/2/2006; 6/28/2006; 8/18/2006
Tok Native Association	9/28/2005; 11/7/2005; 6/28/2006
Yukon River Inter-Tribal Watershed Council	9/28/2005; 11/7/2005; 6/28/2006
Alaska Native Regional Corporations	
Ahtna, Inc.	9/28/2005; 11/7/2005; 6/28/2006; 7/26/2006
Doyon Limited	9/28/2005; 11/7/2005; 6/28/2006; 7/20/2006

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

September 28, 2005

Ben Saylor, First Chief
Healy Lake Tribal Council
P.O. Box 60300
Fairbanks, AK 99706

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Dear Mr. Saylor:

The Alaska Railroad Corporation intends to file a petition with the Surface Transportation Board (Board), pursuant to 49 U.S.C. 10502, requesting authority to construct and operate a new rail line from Eielson Air Force Base to Fort Greely, Alaska. The Board would be the Federal agency responsible for granting authority for the construction and operation of the proposed new rail line. The Section of Environmental Analysis (SEA) is the office within the Board responsible for preparing the appropriate National Environmental Policy Act (NEPA) documentation for railroad construction and operation cases that come before the Board, and for conducting government-to-government consultations with Federally recognized tribes under NEPA, Section 106 of the National Historic Preservation Act and other Federal laws.

While SEA plans to initiate the scoping and consultation process for the preparation of an Environmental Impact Statement later this year, we would like to inform you of the project at this early stage and introduce Mr. David Navecky, the Project Manager for SEA for this environmental review. Mr. Navecky is being assisted by ICF Consulting, which is serving as the independent third-party consultant to assist SEA with the NEPA review process. I have provided some information about the project below.

Project Description

The proposed Northern Rail Extension Project would involve the construction of approximately 80 miles of new rail line connecting the existing rail line near Eielson Air Force Base near North Pole, Alaska to Fort Greely and the Donnelly Training Area near Delta Junction, Alaska (see attached map). The proposed rail line would cross the Tanana River, possibly near Flag Hill, allowing the U.S. Army year-round access to the Tanana Flats and Donnelly training areas. The proposed project would include the construction of a 15-mile spur line from the vicinity of Flag Hill to the Blair Lakes Military Training Area. Construction of the proposed rail line would also provide all the major military installations in Alaska with rail access to the Port of Anchorage.

If you have any questions or would like to arrange a meeting to discuss the project please do not hesitate to contact Dave Navecky, SEA Project Manager, at (202) 565-1593 or Alan Summerville, ICF Consulting Project Manager, at (703) 934-3616.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Attachment

- **Wednesday, December 7, 2005, 4-8 pm at Jarvis West Building, Mile 1420.5 Alaska Highway, Delta Junction, Alaska**

- **Thursday, December 8, 2005, 4-8 pm at Lousaac Library Public Conference Room, 3600 Denali Street, Anchorage, Alaska**

We are also accepting written comments on the all aspects of the proposal and the potential environmental impacts outlined in the draft Scope of Study. If you cannot attend the meetings, or even if you offered oral comments at the meetings, please feel free to submit comments in writing. We are accepting written comments on the Scope of Study and potential environmental effects of the project through January 13, 2006.

If you have any questions, or would like us to arrange a meeting with your tribe to discuss the project, please do not hesitate to contact Dave Navecky, SEA Project Manager, at 202-565-1593 or Alan Summerville, ICF Consulting Project Manager, at 703-934-3616. Thank you for your interest and we look forward to hearing your views during the government-to-government consultation process.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Enclosure

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

November 23, 2005

Julie Kitka, President
Alaska Federation of Natives
1577 C St., Suite 300
Anchorage, AK 99503

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Dear Ms. Kitka:

The Alaska Railroad Corporation intends to file a petition with the Surface Transportation Board (Board), pursuant to 49 U.S.C. 10502, requesting authority to construct and operate a new rail line from Eielson Air Force Base to Fort Greely, Alaska. The Board would be the Federal agency responsible for granting authority for the construction and operation of the proposed new rail line. The Section of Environmental Analysis (SEA) is the office within the Board responsible for preparing the appropriate National Environmental Policy Act (NEPA) documentation for railroad construction and operation cases that come before the Board, and for conducting government-to-government consultations with Federally recognized tribes.

I am writing to you at this early stage in the environmental review process to provide you with information about Alaska Railroad's proposed rail line construction project and to introduce you to Mr. David Navecky, the Project Manager for this environmental review. Assisting Mr. Navecky is ICF Consulting, which is serving as the independent third-party consultant to the Federal agency responsible for conducting the environmental review process for this proposal.

Project Description

The proposed Northern Rail Extension Project would involve the construction of approximately 80 miles of new rail line connecting the existing rail line near Eielson Air Force Base near North Pole, Alaska to Fort Greely and the Donnelly Training Area near Delta Junction, Alaska (please see attached map). The proposed rail line would cross the Tanana River, possibly near Flag Hill, allowing the U.S. Army year-round access to the Tanana Flats and Donnelly training areas. The proposed project could also include the construction of a 15-mile spur line from the vicinity of Flag Hill to the Blair Lakes Military Training Area. Construction of the proposed rail line would also provide all the major military installations in Alaska with rail access to the Port of Anchorage.

Scoping Process

On November 1, 2005, the Board published a Notice of Intent to Prepare an Environmental Impact Statement (EIS). A copy of the Notice of Intent is enclosed, along with a map showing the Alaska Railroad Corporation's proposed alignments. The purpose of the Notice of Intent is to notify all interested parties, including individuals and agencies interested in or affected by the proposed project, of the Board's decision to prepare an EIS. The Notice of Intent also included a draft Scope of Study for the EIS, notice of public scoping meetings, and a request for comments.

The Board will be holding the following scoping meetings as part of the EIS process. You are cordially invited to attend any of these meetings. The public scoping meetings will be held on:

- **Tuesday, December 6, 2005, 4-8 pm at the City Council Chambers, 125 Snowman Lane, North Pole, Alaska**
- **Wednesday, December 7, 2005, 4-8 pm at Jarvis West Building, Mile 1420.5 Alaska Highway, Delta Junction, Alaska**
- **Thursday, December 8, 2005, 4-8 pm at Loussac Library Public Conference Room, 3600 Denali Street, Anchorage, Alaska**

We are also accepting written comments on all aspects of the proposal and the potential environmental impacts outlined in the draft Scope of Study. If you cannot attend the meetings please feel free to submit comments in writing. We are accepting written comments on the Scope of Study and potential environmental effects of the project through January 13, 2006.

We are committed to conducting government-to-government consultations with Federally recognized tribes and will formally initiate government-to-government consultation in the near future. We look forward to listening to your thoughts and views on this proposal and the potential environmental effects.

If you have any questions or would like to arrange a meeting to discuss the project please do not hesitate to contact Dave Navecky, SEA Project Manager, at (202) 565-1593 or Alan Summerville, ICF Consulting Project Manager, at (703) 934-3616. Thank you for your interest and we look forward to hearing your views during the government-to-government consultation process.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Attachment

EI-2831

Tanana Chiefs Conference

Chief Peter John Tribal Building
122 First Avenue, Suite 600
Fairbanks, Alaska 99701-4897
(907) 452-8251 Fax: (907) 459-3850

SUBREGIONS

UPPER KUSKOKWIM
McGrath
Medfra
Nikolai
Takotna
Telida

LOWER YUKON
Anvik
Grayling
Holy Cross
Shageluk

UPPER TANANA
Dot Lake
Eagle
Healy Lake
Northway
Tanacross
Tetlin
Tok

YUKON FLATS
Arctic Village
Beaver
Birch Creek
Canyon Village
Chalkyitsik
Circle
Fort Yukon
Venetie

YUKON KOYUKUK
Galena
Huslia
Kaltag
Koyukuk
Nulato
Ruby

YUKON TANANA
Alatna
Allakaket
Evansville
Fairbanks
Hughes
Lake Minchumina
Manley Hot Springs
Minto
Nenana
Rampart
Stevens Village
Tanana

February 2, 2006

David C. Navecky
Environmental Protection Specialist
Surface Transportation Board
1925 K Street, NW, Suite 500
Washington, DC 20423

Dear Mr. Navecky,

Thank you for visiting Tanana Chiefs Conference (TCC) in November to share information about the proposed extension of the Alaska Railroad from Fairbanks to Delta Junction. We understand that relevant environmental studies were initiated a couple of years ago and will intensify through this winter to meet a proposed 2007 deadline for issuing a draft environmental review document. I appreciate the outreach you've conducted thus far and for the opportunity to meet in person at our offices.

In our meeting, we discussed areas in the environmental review where TCC has legal jurisdiction and special expertise that are relevant to the project, especially land issues on restricted Indian lands, or Native allotments, that may be affected by the project. As I explained, TCC manages a trust services program with the Bureau of Indian Affairs and acts as a trustee for Native allotment owners. In this case, there are two Native allotments located near Salcha that are potentially affected by the railroad project. These parcels of land are located along the Salcha River in the vicinity of Munson's Slough and the former Salchaket Indian Village. In your presentation and that of your contractor for cultural resources (Northern Land Use Research), we understand that the railroad alignment transects the east boundary of the allotments. I've included a figure that illustrates the location of the two allotments in question and the black, bold vertical line on the east side of the colored land parcels depict the proposed railroad corridor.

The original applicants for each allotment are deceased and the ownership rights have been passed on to multiple heirs. The Barnabus allotment is named after Murphus Barnabus who applied for the land as an allotment in 1933 (see attached figure). This allotment now has four owners and their addresses are listed on the attachment. The second allotment was applied for by Thomas Willock in 1961 and his application for allotment went through a convoluted adjudication process for years that culminated in a decision that validated the application in 2004. Throughout that period, his land interests were passed on to several heirs through Bureau of Indian Affairs probate proceedings. The attached list is our most updated version of heirs to whom you can send information about the railroad project.

Tanana Chiefs Conference is a unified voice advancing Tribal governments, economic and social development, promoting physical and mental wellness, educational opportunities and protecting language, traditional and cultural values.

As we discussed, please add these heirs to both allotments to your mailing list and provide them an update about the project. Also, please send us a copy of that correspondence that we will file in our master trust land records on the two Native allotments. These can then become a formal record of your consultation process with Native Alaskan restricted land owners on the railroad extension process.

TCC has other interests in the project that include fish and wildlife studies and monitoring, geographic information system data layers, employment and training, Tribal consultation and other compliance issues. I apologize about the delay in getting you this information, but it took some time to review the files, figure out the current status of the Willock allotment and compile the addresses.

Should you have further questions, or if we can be of additional assistance, please contact me at 907-452-8251, ext 3343 (rsattler@tananachiefs.org) or Paul Mayo at ext. 3261 (paul.mayo@tananachiefs.org)

Sincerely,

Robert A. Sattler
Senior Archaeologist/Environmental Quality Analyst

Cc: Paul Mayo, Acting Director, Natural and Cultural Resources
Mike Nagy, Senior Project Scientist, Entrix Environmental Consultants
Heirs on attachments to the Mumphus Barnabus and Thomas Willock allotments

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Office of Economics, Environmental Analysis and Administration

June 28, 2006

Ahtna, Inc.
Ken Johns, President/CEO
P. O. Box 649
Glenallen, AK. 99588

Re: STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between Eielson Air Force Base (North Pole) and Fort Greely (Delta Junction), Alaska

Dear Mr. Johns:

The purpose of this letter is initiate formal government-to-government consultation regarding the referenced project.

The Surface Transportation Board's (Board) previous letters of September 28, 2005 and November 1, 2005 informed you of the proposed project and of our responsibility for preparing the appropriate National Environmental Policy Act (NEPA) documentation for railroad construction and operation cases that come before the Board, and for conducting government-to-government consultations with Federally recognized tribes under NEPA and other Federal laws.

The Board is interested in your views regarding the projects potential effects to tribal lands, rights, resources, religious and cultural sites and subsistence activities. At your request, we can meet with you to hear your views and provide additional information regarding the Environmental Impact Statement process.

Your timely response will greatly assist us in incorporating your concerns into project development. For that purpose, we respectfully request that you complete the enclosed Project Consultation Options form and return it to us at your earliest convenience.

If you have any questions or would like to discuss the project please do not hesitate to contact Dave Navecky of my staff, at (202) 565-1593 or Alan Summerville of ICF Consulting, our independent third-party contractor, at (703) 934-3616.

Sincerely,

Victoria Rutson
Chief
Section of Environmental Analysis

Enclosures:

ARRC Northern Rail Extension Project Description
Environmental Review Process Description
Consultation Questionnaire

CONSULTATION QUESTIONNAIRE

Ahtna, Inc.

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

____ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

_____ Meeting with the Board and Cooperating Agencies at a tribal facility.

_____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

____ We want to continue to receive project information by mail and participate in the public involvement process.

Name of Ahtna, Inc. designated contact for this proposed project:

______________________________ Phone: ______________
Please print email: ______________

Signed: ______________________________ Date: ______________

Please mail to:

Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

CONSULTATION QUESTIONNAIRE

Dot Lake Village Council

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

____ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

____ Meeting with the Board and Cooperating Agencies at a tribal facility.

____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

X We want to continue to receive project information by mail and participate in the public involvement process.

Name of Dot Lake Village Council designated contact for this proposed project:

William Miller Phone: 907-882-2695
Please print email: n/a

Signed: [signature] Date: 7-5-06

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

CONSULTATION QUESTIONNAIRE

Native Village of Eagle (IRA)

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

____ We have no interests associated with this proposed project and further consultation is not required.

✓ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

____ Meeting with the Board and Cooperating Agencies at a tribal facility.

✓ Communication with the Board and Cooperating Agencies by scheduled teleconference.

✓ We want to continue to receive project information by mail and participate in the public involvement process.

Name of Native Village of Eagle (IRA) designated contact for this proposed project:

Isaac A. Juneby Phone: (907) 547-2271
Please print email:
Chief

Signed: [signature] Date: 7/14/06

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

CONSULTATION QUESTIONNAIRE

Nenana Native Council

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

____ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

_____ Meeting with the Board and Cooperating Agencies at a tribal facility.

_____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

X We want to continue to receive project information by mail and participate in the public involvement process.

Name of Nenana Native Council designated contact for this proposed project:

EDNA HANCOCK Phone (907) 832-5461
Please print email: ____________

Signed: Edna Hancock Date: 7/21/06

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

Rec'd 8/4/06
EI-2479

CONSULTATION QUESTIONNAIRE

Ahtna, Inc.

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

____ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

_____ Meeting with the Board and Cooperating Agencies at a tribal facility.

_____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

✓ We want to continue to receive project information by mail and participate in the public involvement process.

Name of Ahtna, Inc. designated contact for this proposed project:

Kathryn Martin Phone: 822-3476
Please print email: kmartin@ahtna-inc.com

Signed: [signature] Date: 7/26/06

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

8-18-06; 2:56PM; ;565 9000 # 7/ 7

AUG 16 2006 RECEIVED

CONSULTATION QUESTIONNAIRE

Manley Hot Springs Village

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

X We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

_____ Meeting with the Board and Cooperating Agencies at a tribal facility.

_____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

X We want to continue to receive project information by mail and participate in the public involvement process.

Since it not in our area, we feel that we don't need to meet but do support the rail line extension.

Name of Manley Hot Springs Village designated contact for this proposed project:

Elizabeth M Woods, TA Phone: 672-3177
Please print email: 672-3200

Signed: [signature] Date: 8/7/05

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

8-18-06; 2:56PM; ;565 9000 # 6/ 7

AUG 16 2006 RECEIVED

CONSULTATION QUESTIONNAIRE

Native Village of Chistochina

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

✓ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

_____ Meeting with the Board and Cooperating Agencies at a tribal facility.

_____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

✓ We want to continue to receive project information by mail and participate in the public involvement process.

Name of Native Village of Chistochina designated contact for this proposed project:

Elaine Sinyon Phone: 907-822-3503
Please print email: esinyon@chistochina.com

Signed: [signature] Date: 8-8-06

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

8-29-06; 1:24PM; ;565 9000 # 2/ 2

CONSULTATION QUESTIONNAIRE

Tanana Chiefs Conference

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

____ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

  _X_ Meeting with the Board and Cooperating Agencies at a tribal facility. (AT SOME POINT IN FUTURE AFTER)

  _X_ Communication with the Board and Cooperating Agencies by scheduled teleconference.

_X_ We want to continue to receive project information by mail and participate in the public involvement process.

Name of Tanana Chiefs Conference designated contact for this proposed project:

ROBERT SATTLER Phone: 907 452-8251, ext. 3343
Please print email: rsattler@tananachiefs.org

Signed: [signature] Date: 8/18/06

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

EI-2705

CONSULTATION QUESTIONNAIRE

Native Village of Minto (IRA)

Project Name: Northern Rail Extension Project Environmental Impact Statement

STB Finance Docket No. 34658, The Alaska Railroad Corporation – Petition for Exemption to Construct and Operate a Rail Line Between North Pole and Delta Junction, Alaska.

Please check the appropriate response(s) from the list below and use the back of this form or additional sheets if you wish to make comments:

_X_ We have no interests associated with this proposed project and further consultation is not required.

____ There are or may be issues of concern associated with this proposed project and we request further consultation. We prefer:

  ____ Meeting with the Board and Cooperating Agencies at a tribal facility.

  ____ Communication with the Board and Cooperating Agencies by scheduled teleconference.

____ We want to continue to receive project information by mail and participate in the public involvement process.

Name of Native Village of Minto (IRA) designated contact for this proposed project:

Patrick Smith Phone (907) 798-7112
Please print email: minto village council@hotmail.com

Signed: [signature] Date: Sept. 27, 2006

Please mail to: Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Attention: David Navecky
Environmental Filing
STB Finance Docket No. 34658

Doyon, Limited

1 Doyon Place, Suite 300
Fairbanks, Alaska 99701-2941
(907) 459-2000
info@doyon.com

JUL 26 2006
RECEIVED

July 20, 2006

Surface Transportation Board
Case Control Unit
1925 K Street, NW
Washington, D.C. 20423-0001

Att: David Navecky, Environmental Filing

RE: STB Finance Docket No. 34658

Ladies and Gentlemen:

Doyon, Limited would like to continue to receive information on this project by mail. There are no cemetery and historic sites in this area. Doyon, Limited also doesn't own any lands that will be affected by the project. However, we are interested in the impacts to subsistence resources. There are three Alaska Native village corporations that you should contact regarding subsistence:

Dot Lake Native Corporation
P.O. Box 2271
Dot Lake, Alaska 99737
(907) 882-2697

Mendas Chaag Native Corporation (Healy Lake)
c/o 457 Cindy Drive
Fairbanks, Alaska 99701
(907) 452-3094 (Gary Lee – President)

Tanacross, Inc.
P.O. Box 76029
Tanacross, Alaska 99776
(907) 883-4130

Sincerely,

Jamie Nollner
Lands Technician

Appendix D – Alternatives Development and Elimination

D. Alternatives Development and Elimination

Chapter 2 provides an overview and summary of the alternatives development process for the proposed Northern Rail Extension (NRE). Chapter 2 also summarizes the alternatives eliminated from detailed analysis. This appendix provides more detailed information about these two processes, specifically how Alaska Railroad Corporation (ARRC or the Applicant) developed alternatives and how the Surface Transportation Board (STB or the Board) Section of Environmental Analysis (SEA) identified alternatives for detailed analysis and eliminated alternatives from further environmental review.

D.1 Development of Alternatives

The alignment development process for the project, according to ARRC's 2006 Alternatives Analysis Study (ARRC, 2006), started with a risk assessment and management process, which ARRC implemented as part of its early planning process for the proposed NRE. The alignment development process continued until ARRC filed with the STB in July 2007 (ARRC, 2007a). ARRC's process, as described in its Alternatives Analysis Study, followed recent guidelines from the Federal Transit Administration for managing risk and reducing the potential for significant cost overruns on large transportation projects. ARRC sponsored risk workshops in April and July 2005 to identify potential project risks and estimate their probability of occurrence and impact if the risk occurred.

ARRC used existing topographic and other data were used in the early phases of alignment generation and analysis. Some of the data were generated for previous studies of potential ARRC extensions in the same general project area. Because some of the data were outdated, ARRC generated new aerial photography of the project area initiated field studies. ARRC's alignment generation and refinement process occurred in three general phases, as described in Sections D.1.1, D.1.2, and D.1.3.

D.1.1 Phase 1 – Study Area Identification

According to ARRC's 2006 Alternatives Analysis Study, the goals of Phase 1 were to define the general study area within which the rail line extension could be developed, identify potential Tanana River crossing locations within that study area, and identify a number of representative route corridors (ARRC, 2006). Key considerations in identifying the study area included natural barriers such as topographic features (*e.g.*, steep slopes, hills), significant surface-water resources and stream crossings, potential conflicts with military lands, and the need to minimize the curvature, grade, and overall length of the rail line. ARRC defined the study area by developing two alignments with common start and end points (North Pole and Delta Junction, respectively) consistent with the intended purpose of providing access to the Tanana Flats and Donnelly West Training Areas (TAs) and extending rail freight and passenger service to Delta Junction. One alignment was developed as far to the west as practicable and the other was developed as far to the east as practicable, with the location of the western alignment limited by military TAs and the eastern alignment limited by Eielson Air Force Base (AFB) in the north and hilly topography. The area between and including these alignments was considered to be the initial study area.

Delineation of this initial study area permitted ARRC to begin collecting data and to define the area to be flown for aerial photography and mapping.

D.1.2 Phase 2 – Corridor Development

The 2006 Alternatives Analysis Study describes Phase 2 as including a preliminary screening of the representative routes and Tanana River crossing locations identified in Phase 1 to eliminate any alignment with fatal flaws before continuing with corridor development (ARRC, 2006). This phase began after the initial study area was defined and continued until ARRC's March 2007 Preferred Route Alternative Report (ARRC, 2007b). The remaining corridors were further developed in Phase 2 based primarily on technical and practical considerations, including the following:

- Natural barriers to rail construction, such as topography, rivers, river crossings, and other features.
- Track geometry and design objectives. To support proposed passenger services and reduce long-term maintenance costs, ARRC is using geometric design criteria that would allow Federal Railroad Administration (FRA) Class 5 track standards to be easily maintained. Geometric design goals include grades limited to 1 percent and curvature limited to 1 degree 30 minutes (a 3,820-foot radius).
- Best practice engineering judgment based on providing a relatively shorter, flatter, and cost-effective route; routes that were comparatively longer, even though technically viable, were not included.
- Cost-effective and efficient crossings of major rivers and streams. The lengths of the individual crossings were considered to be an indicator of both overall cost and potential environmental impact (*i.e.*, size of footprint).
- Geological and geotechnical considerations. Although information on subsurface conditions (soil and rock type and quality) in the area is limited, the geologic history of the area and geologic formations that potentially present poor soil conditions for rail construction were taken into account.
- General land use patterns and preliminary information ARRC received from the State of Alaska and Federal resource agencies, potential shippers, and other project stakeholders. To support the corridor development effort, ARRC conducted preliminary field work to supplement the existing environmental and engineering data assembled from previous related studies and publications. Data assembled and supplemented included the topographic, geologic and geotechnical, and environmental aspects of the project area.

ARRC reviewed additional information on land use and ownership and archaeological resources, and used relevant information to further refine the preliminary alignment corridors. ARRC used parcel boundary information and general land ownership in the initial refinement, and refined and verified specific land use and ownership data. Other items ARRC considered in this stage included location and type of potential road-railroad crossings, the approximate numbers and types of drainage structures required in addition to major bridges, flood zones and water resources, and proximity to and needs of potential users of freight and passenger services.

Based on all of the data collected and analyzed and input from various project stakeholders, ARRC generated and refined corridors, and identified new corridors to address specific issues. ARRC broke individual alignments into segments based on common start, end, or intersection points that would allow the portions to be compared directly or combined and compared as full or partial alignment alternatives.

D.1.3 Phase 3 – Corridor Analysis

This phase involved a comparison of alignment corridors. The 2006 Alternatives Analysis Study states that a quantitative analysis was originally considered for evaluation of alignment corridors and/or corridor segments (ARRC, 2006), but such an analysis was determined not to be useful at this conceptual engineering stage. For example, comparison of the corridors regarding total length, total curvature, number of curves greater than 1 degree, and grade ratio revealed relatively minor variations between the corridors. Therefore, these quantifiable considerations were not useful criteria for differentiating among the corridors.

Similarly, efforts were made to develop preliminary estimates of the linear feet of frost-susceptible soils crossed, habitat affected, and the number of stream crossings associated with each alignment corridor segment. However, ARRC's margin of error in these estimates was high at this stage of corridor development; therefore, these estimates also were not a reliable means of differentiating between the corridors.

Thus, the corridor analysis phase involved a qualitative comparison of the relative advantages and disadvantages of various alignment corridors. The evaluation of each corridor's relative merits was based primarily on engineering and environmental considerations, including issues raised by regulatory or resource agencies or the public during ARRC's agency coordination and public outreach efforts. The key engineering considerations included geotechnical and hydraulic constraints and maintainability. The key environmental considerations included potential impacts to prime moose habitat and calving areas, wetlands, potential impacts to private property, and potential impacts to military property. Many of the preliminary alignment corridors identified originally were eliminated or combined with other similar alignments because they presented no clear advantages over adjacent alignments or they had more disadvantages than other alternatives.

D.2 Alternatives SEA Eliminated from Detailed Study

Alternatives Nomenclature in the EIS

To distinguish the alternatives analyzed in detail from alignments the Applicant proposed in the Preferred Route Alternative Report (ARRC, 2007b), SEA adopted a new nomenclature that retained the project area names, such as Eielson and Salcha, but removed the relative location adjectives. SEA replaced the location adjectives with numbers.

Based on the process described above, ARRC developed the initial sets of alignments and provided them to SEA for consideration as alternatives. Since 2005, ARRC has presented SEA with several versions of the alignments. ARRC identified the latest alignment versions and its preferred alignments in two key sources; ARRC's Preferred Route Alternative Report published in March 2007 (ARRC 2007b) and ARRC's filing of its preferred route with the Board on July 6, 2007 (ARRC 2007a). SEA and the cooperating agencies identified alignments and segments proposed to be carried forward for more detailed study, and others proposed to be eliminated from further consideration. Chapter 2 describes the alternative segments SEA and the cooperating agencies retained for detailed analysis. Sections D.2.1 through D.2.8 describe several alignments and alternatives for segments that were initially considered but eliminated from detailed study, and the reasons they were eliminated. Figure D-1 shows the general area of each of these alignments.

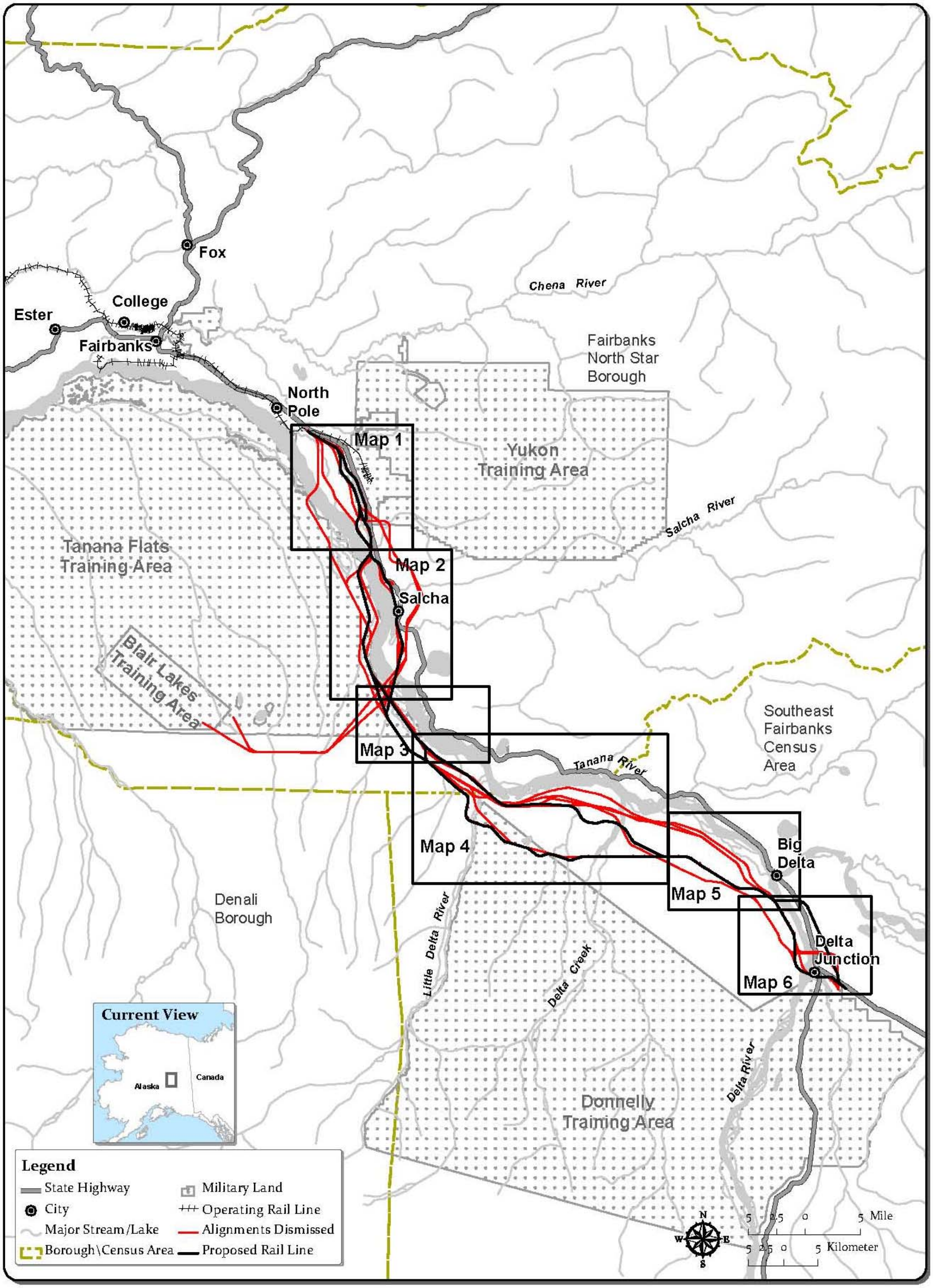

Figure D-1 – Map Key for Alignments Eliminated from Detailed Study along the Proposed NRE

D.2.1 Eielson Area Alignments

ARRC-proposed Alignments

During the scoping period for the EIS, ARRC initially presented three alignments (formerly called N1, N2, and N3) that would cross the Eielson Farm Community. Table D-1 summarizes the status of these three alignments.

Table D-1
Evolution of Eielson Alignments

Original Alignment Name	Relationship to other Alignments	Current Status
N1	None	No longer being considered
N2	Southern portion is part of Eielson Alternative Segment 1	No longer being considered
N3	Portions of a revision to the initial location retained as part of Eielson Alternative Segment 3	Original route no longer being considered

Because of impacts to private property, members of the Eielson Farm Community strongly opposed the N1 and N2 alignments, which were closer to the Tanana River (see Figure D-2). The N1 alignment, as initially proposed by ARRC in November 2005, would cross the Tanana River from the Eielson Farm Community into the Tanana Flats TA. The alignment then would continue south through the TA on the western side of the Tanana River. During scoping, U.S. Department of Defense Alaska Command expressed concern about the amount of encroachment this alignment would have on the TA. Other commenters raised strong concerns about the alignment passing through a prime moose calving area. After the scoping comment period, ARRC developed two other feasible and reasonable alignments, now Eielson Alternative Segments 1 and 2, and eliminated the N1 alignment through the Tanana Flats TA.

Because there were few design differences through the Eielson Farm Community among the Eielson alignments ARRC proposed in 2005, ARRC eliminated the first half of the N1 and N2 alignments, the two alignments that would intrude more on private property. ARRC instead retained one (formerly called N3 and Eielson West) of the three alignments presented in November 2005 and, after the scoping comment period, offered a new alignment (formerly called Eielson East) to the east of the Eielson Farm Community and closer to the Eielson AFB fenced boundary. In the interim between the end of the scoping comment period and ARRC's Preferred Route Alternative Report, ARRC developed a crossover alignment between Eielson East and West.

SEA agreed with elmininating the N1 and N2 alignments through the Eielson Farm Community and decided to retain the Eielson East and West alignments, renamed Eielson 1 and 2, including the crossover alignment, for detailed analysis in the EIS as the Eielson alternative segments.

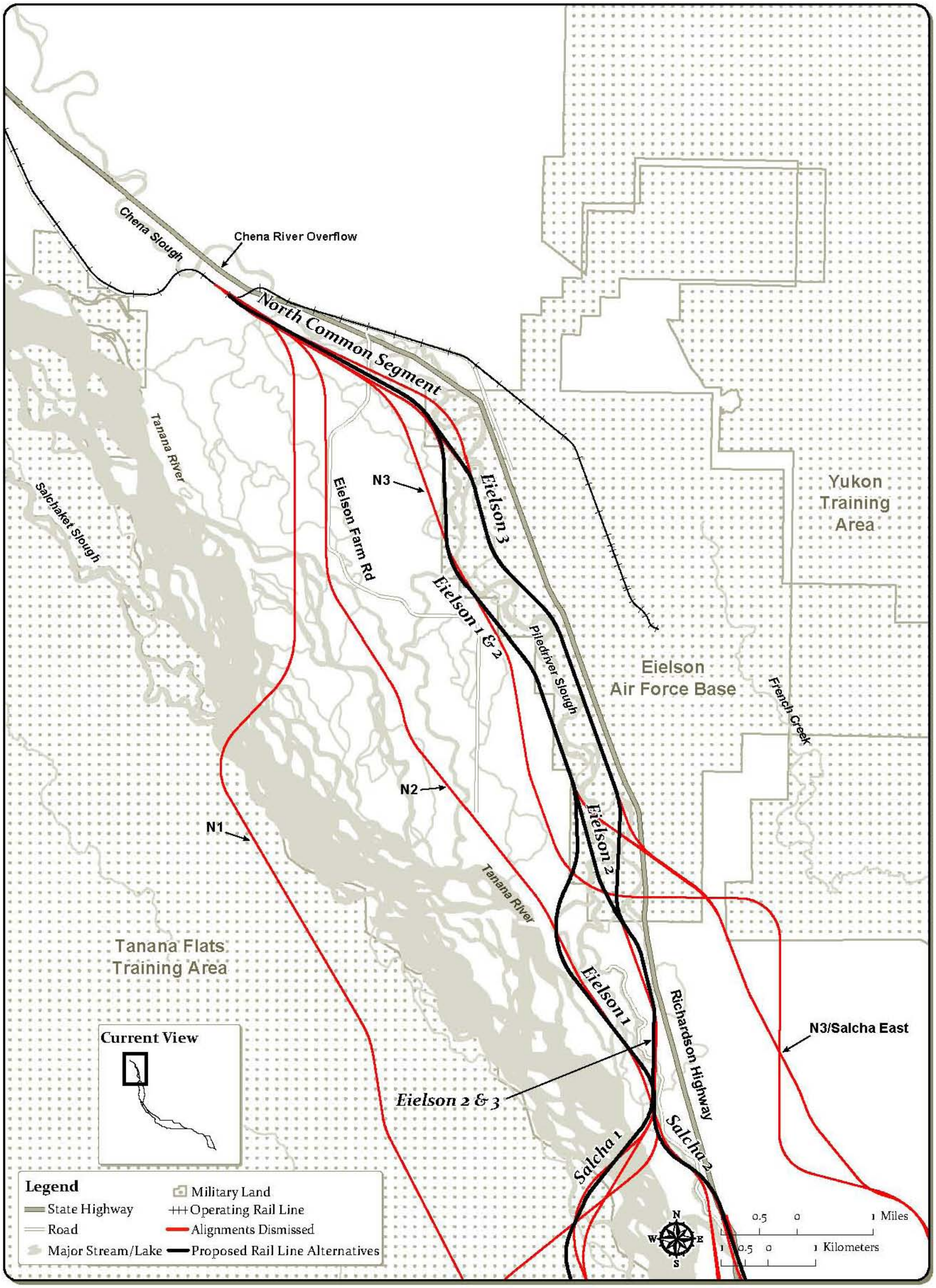

Figure D-2 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 1

Alignments Proposed in Scoping Comments

In response to scoping comments SEA received and posted on the STB web site, ARRC considered alignments that would cross the Tanana River shortly before or after the Chena River overflow; thereby bypassing the Eielson Farm Community. These alignments, however, would create further intrusion into the Tanana Flats TA and affect important moose habitat. Therefore, ARRC did not propose these alignments to SEA in the ARRC Preferred Route Alternative Report in March 2007.

Commenters also recommended an alignment that would cross Richardson Highway at Milepost 0 of the proposed NRE. The recommended alignment would either continue through Eielson AFB using the existing track or go around the AFB to the east. According to ARRC, during its initial corridor analysis, it considered using an additional portion of the existing Eielson Branch and routing the proposed rail line extension to the east of Eielson AFB. ARRC determined that this route would not be reasonable or practicable because of the existing grade crossing of Richardson Highway, steep topography, and potential impacts to private property. The portion of the existing Eielson Branch on Eielson AFB is government owned; ARRC ownership stops at the gate to the base. In conjunction with this ownership limitation, use of the existing rail line through Eielson AFB was deemed unacceptable because the existing line runs through the base housing area and rail traffic through the middle of the base would create security and operational concerns. For these reasons, ARRC determined that alignments east of Richardson Highway from the start of the proposed NRE (approximately Milepost G20 on the Eielson Branch) to the south end of the AFB runway would not be practicable or feasible.

Commenters also recommended an alignment through Eielson AFB along the east side of Richardson Highway. Such an alignment would avoid Piledriver Slough and private property in the Eielson Farm Community. ARRC reviewed the feasibility of alignments in this area. Based on information obtained from the military, ARRC determined that alignments east of the highway in proximity to the AFB would not be feasible due to encroachment on the operating and runway/taxi areas.

D.2.2 Salcha Area Alignments

In addition to ARRC's proposed Salcha area alignments, during public scoping commenters suggested other alignments. The following paragraphs describe both sets of alignment recommendations.

Alignments Proposed by ARRC

Before SEA's EIS scoping period began, ARRC proposed four alignments through the Salcha area, including two on the western side of the Tanana River south of ARRC's proposed Salcha Crossing. These alignments paralleled each other until merging in the Flag Hill area. One alignment (formerly called N5 and subsequently the Salcha West alignment) closely followed the bank of the Tanana River, intruding less into the Tanana Flats TA than the N1 alignment while having potentially higher impacts on fish habitat and higher construction costs. The second alignment (formerly called N1) would encroach more on military property, but would avoid the bank of the Tanana River and some of the fishery concerns. Because of the greater potential conflict with military use, ARRC retained the route closer to the Tanana River for further examination and dropped alignment N1. SEA retained an alignment closer to the Tanana River, Salcha Alternative Segment 1, for detailed analysis (see Figure D-3).

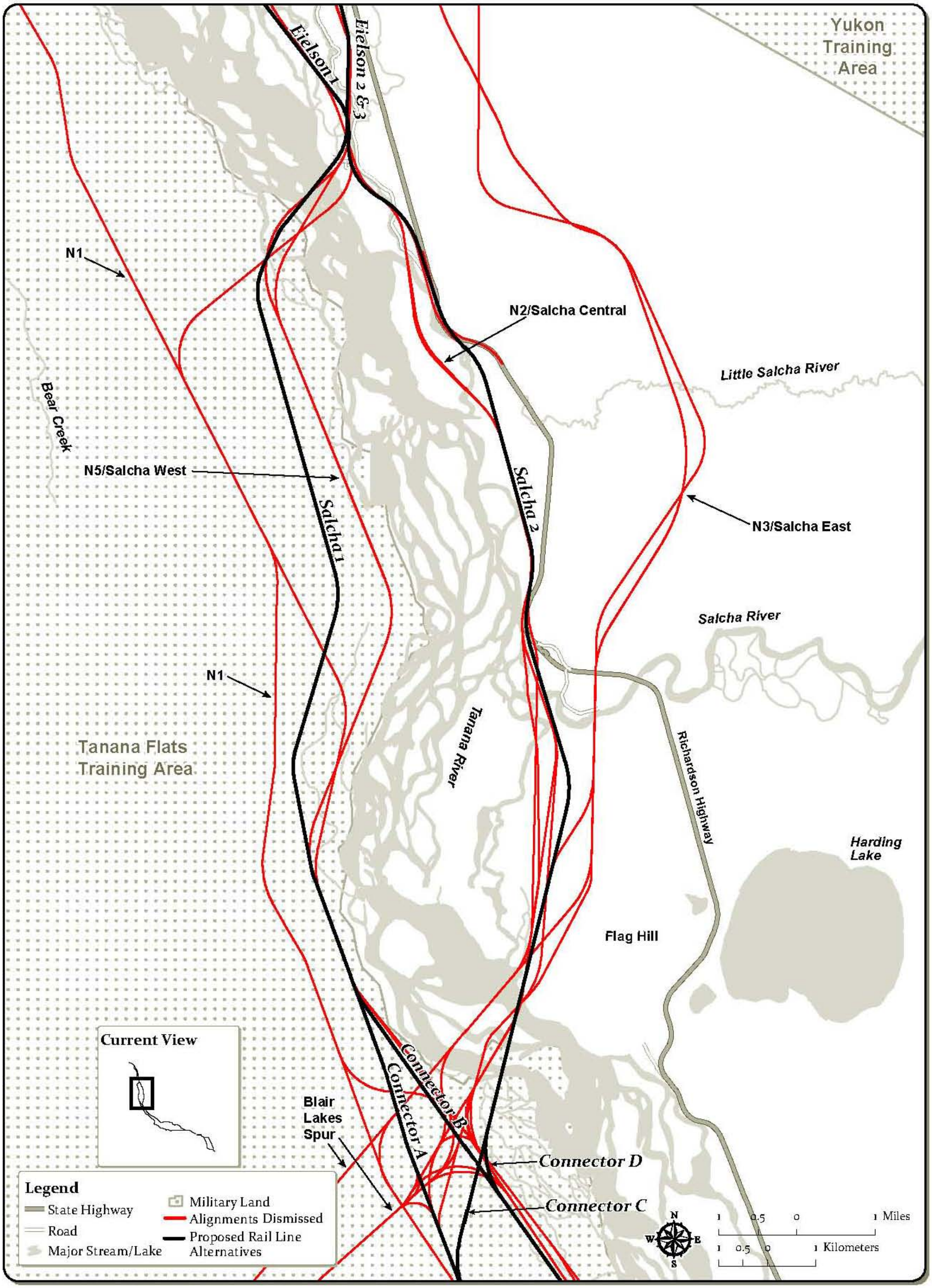

Figure D-3 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 2

ARRC also proposed two alignments on the east side of the Tanana River. One Salcha area alignment (formerly known as the N3 and subsequently the Salcha East alignment), retained in ARRC's March 2007 Preferred Route Alternative Report (ARRC, 2007b), would travel east of Richardson Highway and south of Eielson AFB. Although the alignment would meet the purpose and need for the proposed NRE, SEA did not retain this alignment for detailed analysis because it would affect significantly greater wetland acreage than the two Salcha alternative segments retained for detailed study. The N3 or Salcha East alignment would affect approximately 304 acres of wetlands, compared to 103 acres for the Salcha Central alignment, and 53 acres for the Salcha West alignment. This segment would also more directly affect cultural resources such as remains of the historic Salchaket Village. SEA retained the other alignment (formerly known as the N2 and subsequently the Salcha Central alignment, now called Salcha Alternative Segment 2) on the east side of the Tanana River for detailed analysis.

Tanana River Crossing on Salcha Alternative Segment 2

The Tanana River at the proposed Salcha Alternative Segment 2 crossing location is a semi-braided river with multiple channels and subchannels. Initial crossing concepts developed by ARRC attempted to address multiple channels with a series of bridge structures connected by embankments over the islands between the channels. Based on additional geotechnical investigations and analysis of river hydrology and morphology, ARRC has concluded more recently that distribution of the river's flow among the channels near Flag Hill could shift substantially over time. As a result, the use of separate bridges would make it necessary to either regulate the flow in each of the channels or size each bridge to handle the design flow of the entire river.

Although in-stream regulation of flow with dimensional channels or structures is frequently used, ARRC found that it would be impractical at this location due to the deep, highly permeable gravel riverbed that would make such structures unstable during high flow events. In addition, ARRC found that erosion would threaten the long-term stability of the islands that would be used to construct embankments between multiple bridges. ARRC also found that sizing multiple bridges to handle the entire flow of the river would not be a practical approach when compared to a single bridge over the entire channel (see Figure D-4).

However, ARRC also found that a single bridge to span all the primary channels would be cost-prohibitive, approximately $80 to $100 million more than the Salcha Alternative Segment 1 crossing. Thus, SEA did not retain the single-bridge concept shown in Figure D-4 for detailed analysis in the EIS. As an alternative approach, ARRC developed a crossing concept that involves the use of channel plugs, rock revetments, and fill to force the river flow toward the channel closest to Flag Hill to allow the use of a shorter bridge (see Figure D-5). When the cooperating agencies reviewed an initial layout for this approach, ADNR stated that it was not a viable alternative for analysis due to potential impacts on anadromous fish and habitat; radio tagging data indicate spawning in the upstream of the south channel across from Flag Hill. As a result, SEA did not retain the design shown in Figure D-5 for detailed analysis in the EIS. At SEA's request, ARRC developed a revised plan for inclusion in the EIS analysis (see Chapter 2).

Alignments Proposed in Scoping Comments

The east bank of the Tanana River, particularly through Salcha, remains transient and unstable as the river continues to migrate east. Richardson Highway along Salcha Bluff is on a narrow shelf between the steep bluff and the main channel of the Tanana River. In response to scoping

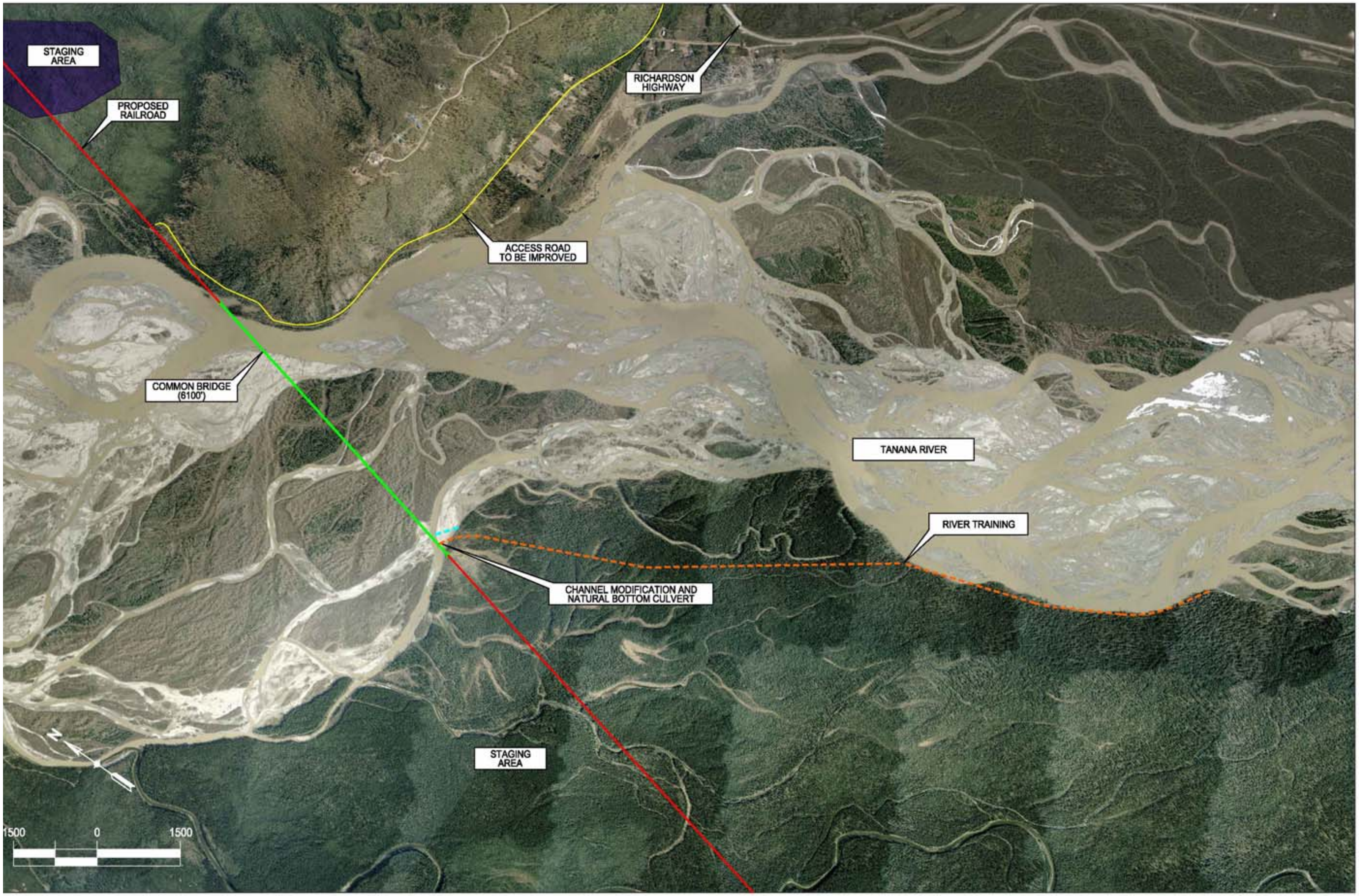

Figure D-4 – Single Bridge Crossing Concept for the Entire Tanana River for Salcha Alternative Segment 2

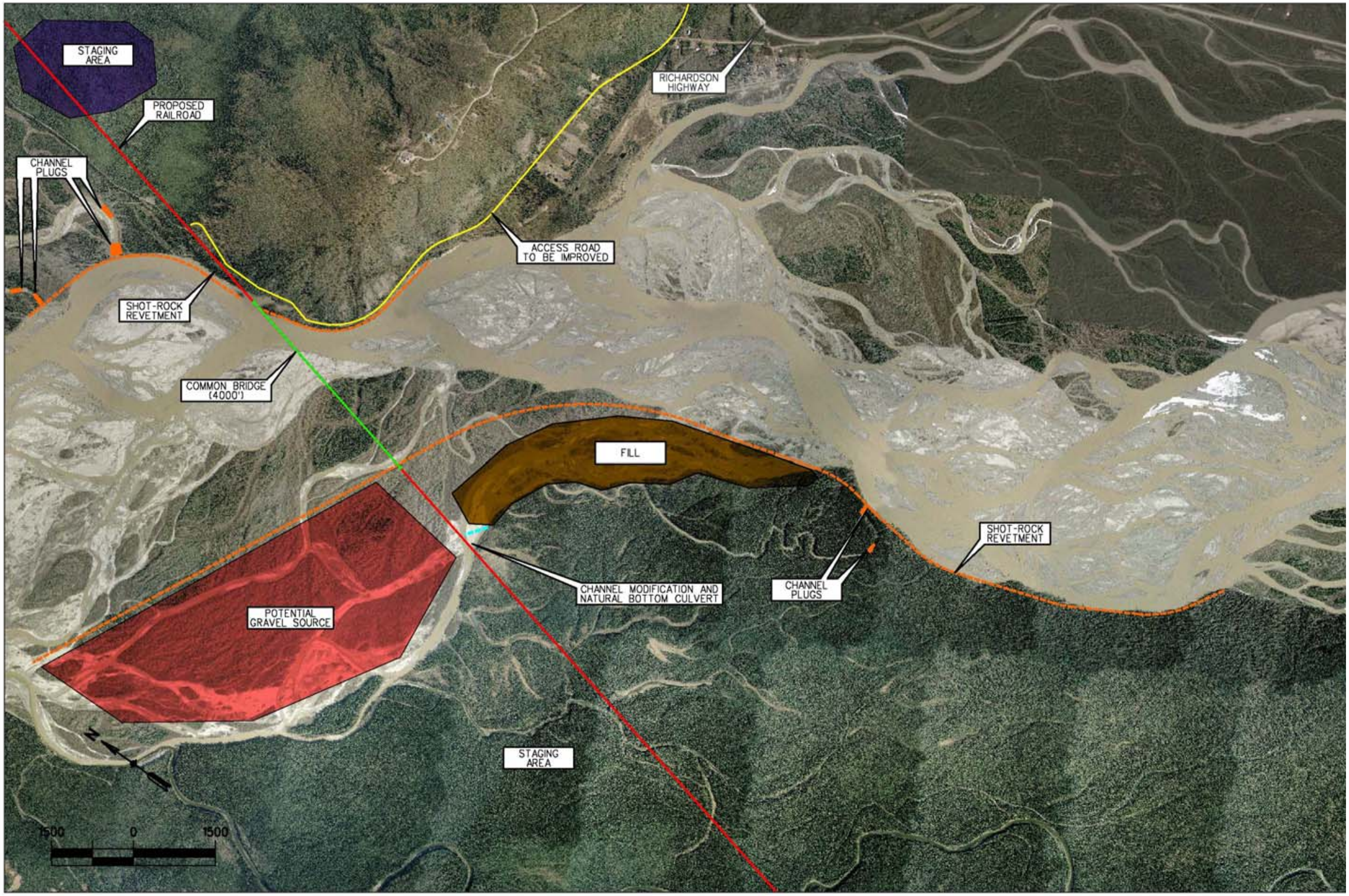

Figure D-5 – Initial Restricted Channel Crossing Concept for the Salcha Alternative Segment 2 River Crossing

comments, ARRC considered an alignment that would cross the eastern-most main channel to a pair of islands. This alignment would continue south of the bluff and traverse the islands before crossing back to the east bank of the Tanana River. However, after further examination of the river hydraulics, the stability of the islands in this area, and long-term serviceability, ARRC proposed to drop this alignment. SEA did not retain this alignment as an alternative in the EIS.

D.2.3 Richardson Highway

Comments received during SEA's EIS scoping period recommended a rail alternative that would parallel Richardson Highway all the way to Delta Junction. AT SEA's request, ARRC considered an alignment that would follow Richardson Highway, but determined such an alignment would not be reasonable or feasible. The hilly topography on the east side of the Tanana River is considerably less favorable for rail line construction south of Flag Hill. There are also a large number of private land holdings along the highway, requiring potentially significant mitigation for continued vehicle access and potentially causing large impacts to private property. In addition, such an alignment would not achieve one of the purposes of the proposed NRE—providing enhanced access to military training ranges. SEA did not retain this alignment as an alternative in the EIS.

D.2.4 Blair Lakes Spur

Before the start of scoping in 2005, ARRC proposed a spur to the Blair Lakes Range and/or other facilities to support military operations, including sidings, offloading facilities, and end-of-track facilities. However, the spur would only be constructed if requested by the military. At this time, the military has not request the spur and has indicated to SEA that such a spur could interfere with training activities at the Blair Lakes Range. Therefore, the Blair Lakes Spur is not analyzed in the EIS (see Figure D-6).

D.2.5 Tanana Area Alignments

All Tanana area alignments have been retained for detailed analysis in the EIS. These alignments have been renamed as the Central alternative segments (see Figure D-6).

D.2.6 Donnelly Area Alignments

During SEA's scoping process, ARRC presented two alignments through the Donnelly area. One alignment (formerly named S2 and subsequently Donnelly East alignment) would hug the west side of the Tanana River; the second alignment (formerly named S1 and subsequently Donnelly Central alignment) would initially follow the Tanana River before heading farther south and west near the Little Delta River (see Figures D-7 and D-8). In response to comments from agencies, ARRC shifted an early version of S2/Donnelly East farther inland from the Tanana River due to fish habitat concerns. In ARRC's March 2007 Preferred Route Alternative Report (2007b), both of these alignments were retained. In addition, ARRC included a third alignment called the Donnelly West alignment, which ARRC developed after SEA's scoping period.

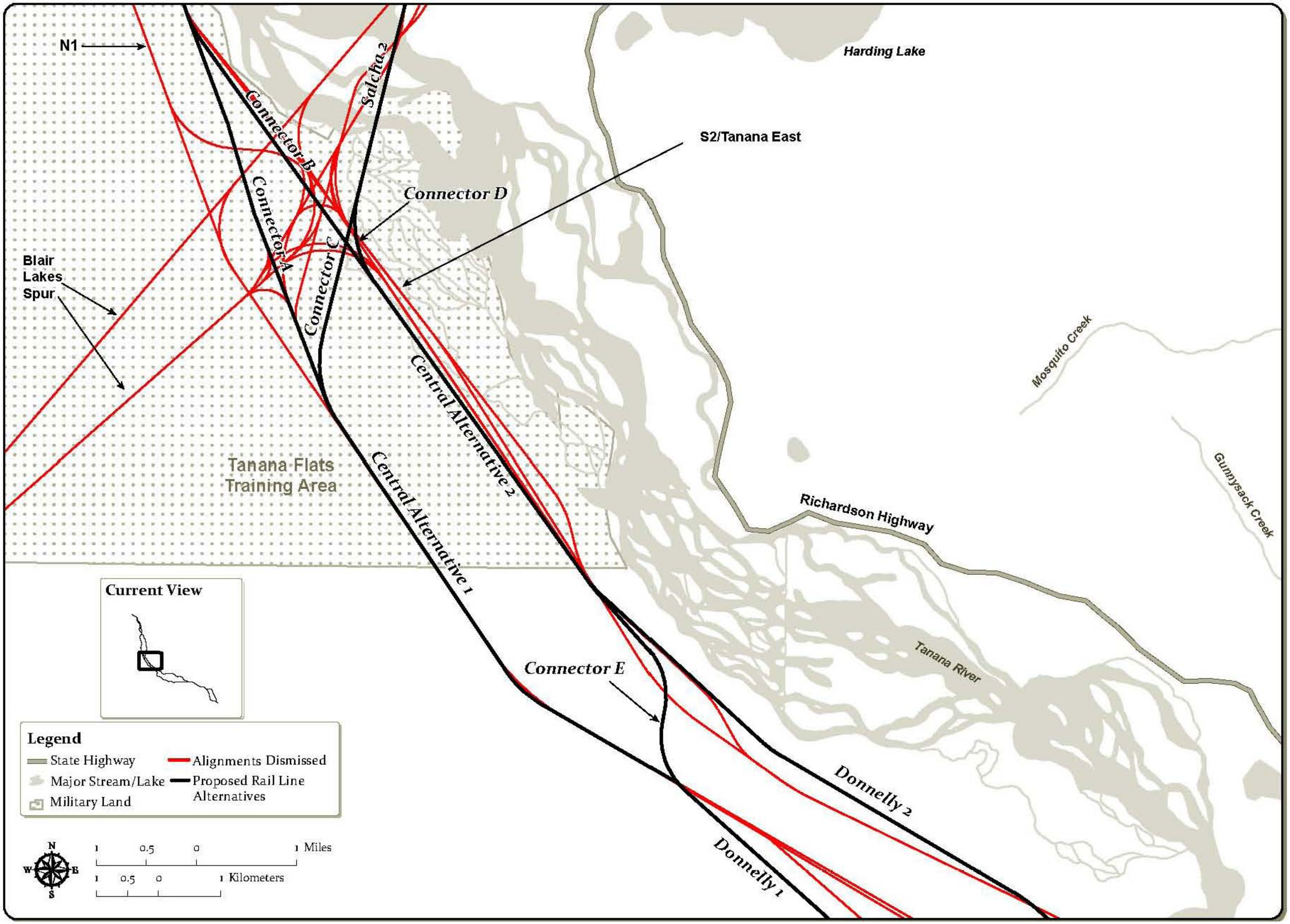

Figure D-6 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 3

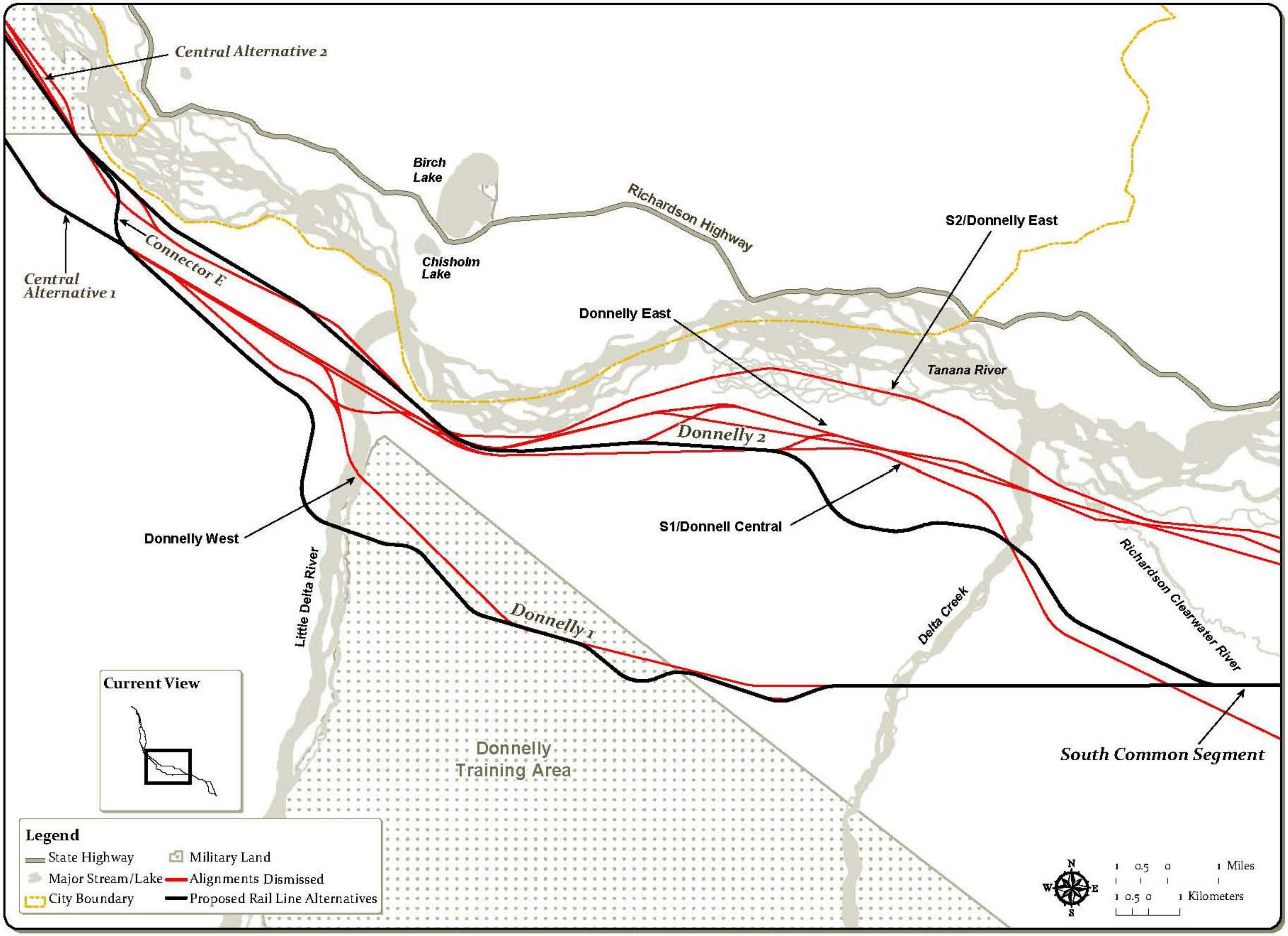

Figure D-7 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 4

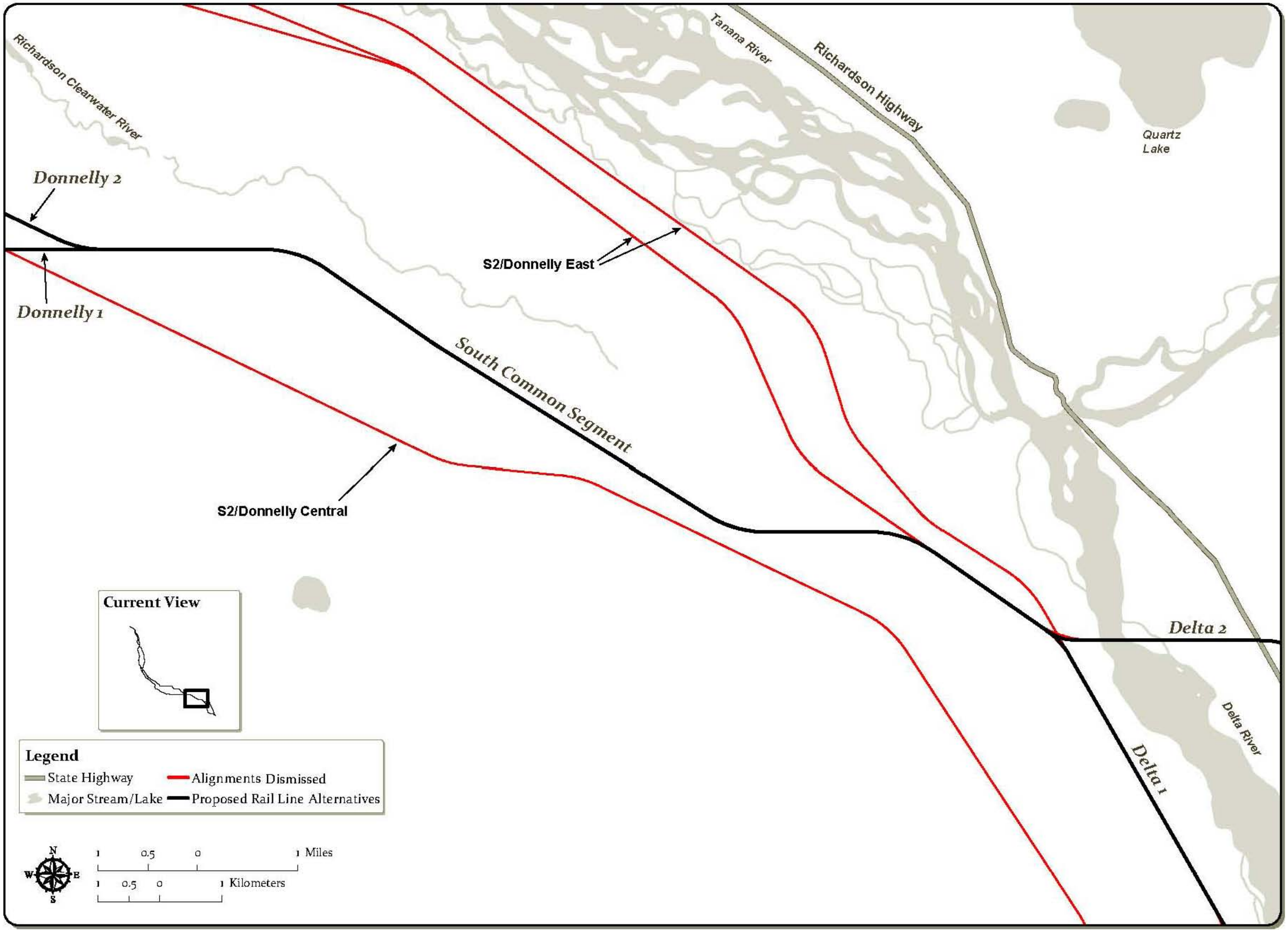

Figure D-8 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 5

Although ARRC had shifted the alignment to minimize potential impacts, SEA decided to not retain the Donnelly East alignment for detailed analysis in the EIS. The Donnelly East alignment would affect approximately 363 acres of wetlands, compared to 196 acres for Donnelly Central and 366 acres for Donnelly West. In addition, it would create adverse impacts through the displacement of summer homes and vacation cabins that the other two alignments would avoid. The Donnelly East alignment would also cross sensitive wildlife habitat contained in clear backwater channels and springs that serve as prime spawning and rearing habitat for salmon. ARRC has also indicated that this alignment would traverse steep hills with potential icing problems and areas that exhibit groundwater upwelling and quicksand-type conditions. SEA retained Donnelly Alternative Segments 1 (formerly Donnelly West) and 2 (formerly Donnelly Central) for detailed analysis in the EIS. SEA did not retain Donnelly East because it did not appear to offer any environmental advantages compared to the other two alternatives and would have greater potential impacts on fisheries.

D.2.7 Delta Area Alignments

During scoping, ARRC presented two alignments (formerly named S1 and S2, subsequently Delta Central and South, respectively) in the Delta Junction area that would cross the Delta River from the Donnelly alignments and continue to the rail terminus on the south side of Delta Junction (see Figure D-9). In the interim between scoping and the March 2007 Preferred Route Alternative Analysis Report, ARRC developed a third alignment (formerly named the S5 and subsequently Delta North alignment) that would cross the Delta River north of Delta Junction and continue south along the east side of Richardson Highway to the rail terminus.

SEA decided not to retain the Delta Central alignment for detailed analysis because it would involve greater adverse impacts to residential and commercial property in Delta Junction than the other alignments. In addition, the Delta Central alignment would involve adverse impacts to a larger amount of wetlands (approximately 83 acres) than the two alternative segments being retained for detailed analysis (36 acres for the Delta North segment and 58 acres for the Delta South segment). SEA retained Delta Alternative Segments 1 and 2 for detailed analysis in the EIS.

D.2.8 Alignment along the Alaska Range

In its October 2006 review of the range of reasonable alternatives, the U.S. Army Corps of Engineers recommended that the EIS include analysis of an alternative connecting to the ARRC mainline in the vicinity of Healy and running along the foothills of the Alaska Range to the military TAs on the west side of the Tanana River, and that the EIS evaluate transportation alternatives other than rail. SEA did not include these alternatives in the EIS analysis because they would not meet one of the purposes of the proposed NRE—to provide passenger train service between Fairbanks and Delta Junction and to provide common carrier rail service to Delta Junction.

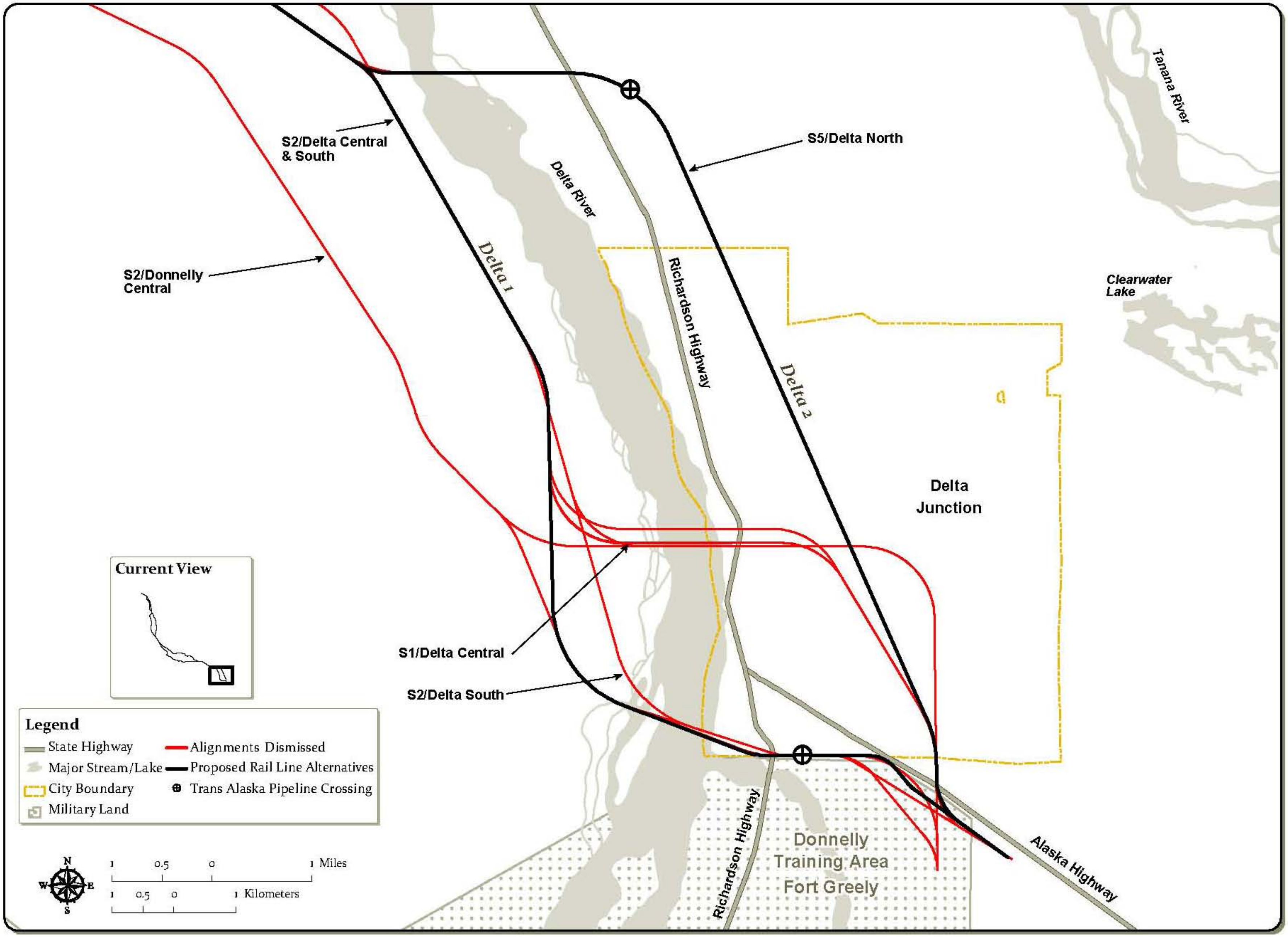

Figure D-9 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 6

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Appendix E - Water Resources

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E. WATER RESOURCES

This appendix provides background data and analysis related to water resources, including surface water, groundwater, water quality, wetlands, and floodplains. The information in this appendix supports findings presented in Chapter 4 of this document.

E.1 Background

Numerous factors contribute to the characteristics and future of water resources. The following presents an overview of these factors as they relate to the project area.

E.1.1 Climatic Factors

Climate in the interior Tanana River Valley is characterized by long, cold winters, relatively short summers, and transitional periods during the spring and fall months (Magoun and Dean, 2000). Annual temperatures vary considerably between the summer and winter months and are generally cooler higher up in the valley towards Delta Junction. Mean January and July temperatures at Big Delta were −2.6 degrees Fahrenheit (°F) and 60.8°F between 1971 and 2000, with temperature extremes ranging from −63°F (−53 degrees Celsius [°C]) in the winter to 92°F (33°C) in the summer. Average annual rainfall at Big Delta is 11.3 inches (28.7 centimeters), with almost 70 percent of this total falling from June through September. The maximum monthly precipitation was 5.98 inches (15.2 centimeters) in July 1984. Snowfall occurs typically from mid-September to mid-April, averaging about 44.3 inches (112.5 centimeters) at Big Delta (NCDC, 2001). These climatic factors influence the physical processes of glaciation, seasonal ice breakup, seasonal flooding, and groundwater movement that affect the water resources of the region.

The Tanana River Valley is located entirely within the discontinuous permafrost zone (Yarie et al., 1998), suggesting that permafrost may not be located beneath or near large river channels. Permafrost is likely present on poorer draining soils, in flat-lying areas along river terraces that are sometimes adjacent to smaller water courses.

E.1.2 Discharge Regimes

Stream flow, including flooding and base flow, within the Tanana River Basin is influenced annually by glaciers, rainfall, spring breakup, and groundwater sources. Each of these discharge processes vary depending on the time of year and affect the magnitude of changes instream flow. Some streams are dominated primarily by one of these processes while others exhibit seasonal and annual flow characteristics of more than one discharge regime. The form of each stream's hydrograph[1] reflects the predominant nature of these various discharge regimes. The different discharge regimes are described below.

Glacially Dominated

Glaciated portions of the Alaska Range are the principal sources of water and sediment for the Tanana River, the Delta River, Delta Creek, and the Little Delta River. In early summer, glacier ice and snow at lower relative elevations begin to melt, causing river flows to increase. The peak

[1] A graph for a given point on a stream showing the discharge, stage (depth), velocity, or other property of water flow with respect to time.

melt and flow season occurs typically during July and August, and then declines through September until surface temperatures remain below freezing. Although no stream flow records exist for the Delta River, Delta Creek, and the Little Delta River, peak summer flows are typically 8 to 10 times higher than winter base flows, based on U.S. Geological Survey (USGS) flow data for the Tanana River at Tanacross, Big Delta, and Fairbanks (USGS, 2007). The Tanana River, however, is also fed by a substantial groundwater component (during the low-water period—fall through pre-breakup) that is not evident in the other three rivers, except near their junctions with the Tanana. So it is likely that peak summer flows on these three rivers are much greater (possibly two orders of magnitude) than winter base flows. Due to the high sediment loads produced during the annual meltwater periods, these rivers have formed braided channels, which are wide and shallow and covered by networks of interlacing small channels.

Breakup-Dominated

Breakup processes occur with almost all streams in the study area, but there is a large portion of streams in the region that are dominated by seasonally heightened discharge patterns due to the late spring breakup period. Thus, the hydrograph of these streams displays a large seasonal peak that is characterized by diurnal variations typically during late April to early May, and then followed by a steady decline through summer. In breakup-dominated streams, the breakup peak is substantially higher than subsequent stage increases due to summer rain storms, and in some cases these streams may become intermittent prior to freeze-up.

Over the winter months, snowfall and low stream velocity conditions coupled with cold temperatures combine to freeze the margins and surface of the streams. Once a frozen surface layer develops across the entire channel, the frozen layer thickens throughout the winter, and in many cases for small streams, freezes to the channel bottom. The thickness of the frozen layer depends on, for example, channel geometry (primarily depth of water column), flow, and winter temperatures, and can range from a few centimeters to more than 1 meter.

When warmer temperatures during springtime begin to melt the snow and ice in the channel, water begins to flow on top of or below the ice depending on the size of the river and whether the ice was frozen to the channel. Eventually flows overwhelm and lift, crack, and break up the ice, forming rafts of ice blocks moving downstream. While moving downstream, the blocks can become lodged together and trapped in narrow or shallow reaches, creating ice jams, which can redirect or block flows from continuing downstream. If this occurs, flows downstream of this point decrease and flooding occurs upstream. Once the ice jam breaks up, the dammed water behind the jam could be released rapidly downstream in a flood wave, resulting in flows occurring as irregular waves. These types of floods are usually isolated at specific locations and do not impact the entire river corridor. Ice jam-related flooding has been observed on the Tanana and Salcha rivers, while breakup-related flooding is less severe on the Delta and Little Delta rivers and Delta Creek. In general, breakup processes have not been recorded and/or observed on many of the smaller streams in the study area. Breakup is typically inconsequential in the groundwater-dominated streams due to the more or less steady discharge of springs or groundwater seepage.

Rainfall-Dominated

Rainfall-dominated flow events can occur at any time during the spring to fall months. The response of instream flows to rainfall can either be rapid (forming sharp or peaky hydrographs) or slow (forming rounded or smooth hydrographs) depending on rainfall intensity; duration; drainage basin characteristics, such as lithology; and drainage density (i.e., the length of streams per unit area of the basin). Permafrost, impermeable bedrock, or fine sediment (silt and clay) inhibit the infiltration of rain or other precipitation, leading to direct surface runoff to the stream channel. In conjunction with this, areas that have moderate to steep gradients convey the water quickly across the ground surface. Runoff is then rapidly transported in gullies or shallow channels. In these cases, stream flows return to pre-rainfall conditions soon after the storm passes. During spring or fall, rainfall on snow can magnify the rainfall runoff effect, potentially causing extensive flooding when large quantities of snow or ice are rapidly melted. The Salcha River, the Little Salcha River, and Kiana Creek provide good examples of rainfall-dominated hydrographs.

Maximum riverbank erosion occurs during the summer months following large rainstorms (Mason and Beget, 1991). During this time, the banks are more susceptible to erosion because they are no longer frozen and the sands and gravels are more easily eroded.

Slower rises instream flows occur when the majority of rain infiltrates into shallow, permeable soils or deeper through porous media into the ground, where it recharges groundwater aquifers. Groundwater discharge to the stream slowly increases as the water table in perched zones or aquifers rises (Knighton, 1989). In comparison to direct surface runoff, this process is slower, allowing the river to rise and fall gently, and fluctuations in the overall stream flow are not as extreme, reducing the frequency and potential for flooding.

Groundwater/Spring-Dominated

Groundwater in the Tanana River Basin occurs primarily in permafrost free, unconsolidated, sandy to gravelly alluvium in the valleys at the base of moderate to high slopes and ridges. Groundwater-fed springs and seeps are common along the lower slopes and foothills where impermeable metamorphic bedrock or permafrost transitions to permeable sands and gravels (Anderson, 1970). Most commonly, flowing artesian springs emanate from hillsides where the water table is higher than the ground surface. These conditions are especially manifest along the southern side of the Tanana River, where Richardson Clearwater, Fivemile Clearwater, and other smaller streams are located (see Chapter 4 for visual representations of this area). North of the Tanana River, springs are less common due to the undifferentiated alluvial and colluvial material that have poor permeability and infiltration.

Spring-dominated streams typically flow year round, regardless of the air temperature because the groundwater remains slightly warmer than outside conditions and does not freeze at the source. In addition, spring-dominated streams typically exhibit near-steady seasonal to annual flow rates depending on the relative contributions by other sources of water.

E.2 Effects Assessment Methodology

The following describes the methods for assessing the surface water and groundwater regime that could be affected by the construction and use of the proposed rail line (including access roads, bridges and culverts) and associated facilities (e.g., camps, staging areas and borrow areas).

The analysis of impacts is understood best by evaluating the range of effects that can be expected within the six physiographic sub-regions described below and in Chapter 4 of this document. This is because the distinct set of hydrologic and hydrogeologic characteristics of each physiographic sub-region yield similar effects when stressed by similar types of activities (e.g., constructing access roads, excavating borrow areas, building bridges, etc.). The primary and secondary attributes of each physiographic region are described herein. Then, in the effects analysis, impacts common to all alternatives and physiographic sub-regions are described in Chapter 4 of this document. This is followed by a discussion of the unique or unusual set of impacts associated with each segment or alternative rail line.

E.2.2 Physiographic Regions

Yukon-Tanana Uplands

The Yukon-Tanana Uplands encompass the lower foothill area of the much larger Yukon-Tanana Uplands major physiographic region as defined by Wahrhaftig (1965). The Uplands are comprised of round-topped ridges that trend in a northwestern to eastern direction that form the major drainage divide separating the Tanana River Basin from the Yukon River basin. Within the Tanana River drainage basin, streams flow toward the south and the valleys are generally flat and wide and filled with alluvial deposits (Brabets et al., 2000). There is no documented glacial record within this region; however, discontinuous permafrost is located throughout this area (Brabets et al., 2000). Thus, stream flow within this area is dominated by groundwater and rainfall sources and other micro-climatic influences such as permafrost and aspect. The Salcha (2,170 square miles) and Little Salcha (66 square miles) watersheds have the only two streams that drain from the Yukon-Tanana region. Although the proposed Salcha Alternative Segment 2 crosses through much of the Yukon-Tanana region, the segment crosses these two rivers within less than a mile from the Tanana River within the Tanana River Valley region.

Variable topographic gradients distinctly identify this area where gradients range from less than 1 percent up to 5 percent locally, while sediments with instream channels are dominated by sand and silt sized material (Anderson, 1970).

Streams affected by rainfall events (and sometimes rain on snow events) can occur at any time during the spring to fall months. During the winter, precipitation falls as snow and remains frozen on the ground surface until spring. The response in stream flows due to rainfall events varies based on duration, size, and intensity of events, as well as the time of year (rain or snow).

In the Salcha watershed, permafrost terrain causes rapid rises in stream flow due to the relative impermeable ground surface; that is, it inhibits the infiltration of rain and snowmelt, leading to direct surface runoff to the stream channel. As soon as the rain event passes or snowmelt period has ended, stream flows return to pre-rainfall conditions. Maximum river bank erosion occurs during the summer months following large rain storm events. During this time, the banks are more susceptible to erosion because they are no longer frozen and the sands and gravels are more easily eroded (Mason and Beget, 1991). In the non-permafrost portions of the Salcha watershed, groundwater recharge is more dominant and stream flow rises and falls are slower. Therefore, the potential for flooding and subsequent erosion is reduced.

Tanana Lowlands

The Tanana Lowlands, as defined by Wahrhaftig (1965), encompasses the area between the Tanana River and the drainage divide along the southern boundary (i.e., the Alaska Range and the Wrangell Mountains). The higher elevations of these mountain areas are dominated by glaciated valleys 6,000 to 9,000 feet, and small to extensive ice fields at elevations above 9,000 feet. Large valley glaciers emanate from this region and feed large braided river systems, such as the Delta River, the Little Delta River and Delta Creek. The headwaters of the Tanana River are fed by the Nabesna and Chisana rivers which are fed by large valley glaciers that originate in the Wrangell Mountains. Below the glaciated uplands lie the Lower Foothills of the Alaska

Range and extensive lowland areas of the broad Tanana River Valley. The project area is located within these lowland areas. The lowlands are comprised of extensive glaciofluvial sedimentary deposits and large alluvial fans along the west side of the Tanana River (Anderson, 1970). The valley floor is wide (3 to 7 miles wide) with rolling hills and elevations ranging from 700 to 1,200 feet (Brabets et al., 2000). Drainage within this area flows north towards the Tanana River.

The Tanana Lowland region is sub-divided into five smaller physiographic areas which have unique sets of stream types, water types, hydrogeologic conditions and hydrologic regimes. The five physiographic areas include: Eielson Flats, Lower Foothills, Delta Moraine Wetlands, Tanana Valley Flats and the Tanana River Valley (including the valleys of the major tributaries).

Eielson Flats

Eielson Flats is located north of the Tanana River near Eielson Air Force Base (AFB), and extends northward to the Chena Floodway and southward to the Little Salcha River watershed. All of the North Common Segment and all of the Eielson alternative segments are located within this area. The substrate is comprised of sandy alluvium and floodplain deposits likely originating from the Tanana River, which results in low topographic gradients (typically less than 1 percent) and a general flat appearance throughout. Due to relatively low elevations and proximity to the Tanana River, a shallow water table occurs throughout the area and results in numerous small, groundwater-fed floodplain sloughs, streams, ponds and wetland flow-ways. Surface drainage within Eielson Flats is generally slow and to the west or north towards the Tanana River.

Most of the streams or sloughs are groundwater or spring dominated. Groundwater in the Tanana River Basin occurs primarily in unconsolidated alluvium in the valleys where the loose sediment allows infiltration of surface water and groundwater movement through aquifers. Groundwater-fed streams are comprised of clear water that does not have high concentrations of glacial flour characteristic of glacial fed streams or tea-colored water characteristic of humic streams (see Table E-2, Water Type Definitions). The larger streams in this area (i.e. Piledriver Slough, Twentythreemile Slough) likely do not freeze to the bottom during winter due to substantial and constant groundwater sources. Groundwater levels are highest following spring break and during high flows on the Tanana River (July), and tend to decline through August, September and October. Flow from the groundwater sources usually flows at a constant rate with minor annual fluctuations.

Some of the sloughs or streams also receive overbanking flows during peak flows on the Tanana River. This creates additional flows to the channel, and also changes the stream water color to a mixture of clear and glacial water.

Tanana River Valley and Major Tributaries

This region includes the active floodplains and channels of the Tanana River and its major tributaries (i.e., Delta River, Little Delta River, Delta Creek and Salcha River) with characteristic overbank channels and floodplain sloughs that are frequently inundated by flood flows. All the major river crossings (of the Tanana, Salcha, Delta and Little Delta rivers and Delta Creek) occur within this region. Numerous smaller bridge or culvert crossings over side channels, sloughs and wetlands are also proposed. Except for the major river crossings, alternative rail lines located within this region include portions of the Salcha alternative segments 1 and 2, Central Alternative Segment 1, Connector Segments B, C, D and E, and Donnelly Alternative Segment 2. This area is dominated by glacial outwash processes which include a wide, flat, braided or ananstomosing (branched) river system which carries a high silt and sand-sized fraction, as well as large loads of gravels, cobbles and boulders during higher flows. Small streams, overflow channels, floodplain sloughs, and wetland flow-ways are common throughout this area due to the shallow groundwater table, frequent overbanking events and seasonal fluctuations in the Tanana River water levels. The high sediment loads and steep headwater gradients create a wide and shallow channel with numerous smaller channels separated by small mid-channel bars. The result is a braided or anastomosed channel.

Glacially dominated stream flow is a result of the seasonal melting of mountain glaciers located in the Alaska Range and Wrangell Mountains. The snow and ice trapped in the glaciers is released downstream annually when warmer surface temperatures melt the toe of the glaciers. Warmer surface temperatures in spring begin to melt the ice, releasing water downstream that continues through the fall months until surface temperatures drop below freezing. Typically, flows are at their highest during July and August due to sustained warmer temperatures (that reach further up the glacier). At this time, flows in the Tanana River are 8 to 10 times higher than baseline flows during winter months, which are sustained primarily by groundwater.

Glacially dominated stream flows are visually discernable by their milky white to grey colored water. The coarser material trapped beneath the glacier and along the margins is ground down through friction over time, resulting in glacial flour. The color is a result of the high amount of fine material being transported as suspended sediment. Glacial till or moraines, which consist of coarser sands, gravels and cobbles, are also abundant along the margins and bottom of the channel and materials from these sources are transported downstream during peak meltwater season when stream flows are high.

A second seasonally dominated discharge pattern of this subregion occurs in the early spring (late April to early May) during ice-breakup. Over the winter months, cold temperatures, snow fall and low velocity conditions freeze the surface layers of the Tanana River and its many sloughs and overbank channels. This ice can range from a few inches to a few feet in depth depending upon the depth of the water column. When warmer temperatures begin to melt the snow and ice in the channel, flow initiates below the ice cover and then when hydrostatic pressures get high enough, the ice breaks into small and large size blocks which then move downstream. While the blocks of ice are moving downstream, they can become lodged together creating an ice jam, and can redirect or block flows from continuing downstream. If this occurs, flows downstream of this point decrease and flooding occurs upstream. Once the ice jam breaks up, the high flows behind the jam would proceed downstream like a flood wave, resulting in flows occurring as irregular waves. These type of floods are usually isolated at specific locations and do not impact the entire river corridor. At this time, many of the side channels may transport water when the main channel is blocked by debris or during ice jams.

Also during spring break-up, some of the smaller local streams that are fed by substantial groundwater sources (e.g., Richardson Clearwater) flow over the top of the ice of the Tanana River until the main river breaks up.

Tanana Valley Flats

The Tanana Valley Flats is a broad area of low relief adjacent to and slightly above the Tanana River Valley sub-physiographic region. Alternative rail lines though this sub-physiographic region include all of Central Alternative Segment 1 and Delta Alternative Segment 2, and portions of Salcha Alternative Segment 1, Connector Segments A, C and E, Donnelly alternative segments 1 and 2, and Delta Alternative Segment 1. Much of the Tanana Valley Flats' geomorphic (or landscape) character of long, sinuous to meandering sloughs, paleochannels and wetland flow-ways interspersed with islands of permafrost-free white spruce or black spruce-dominated forests is due to ancient positions of the Tanana River.

The substrate consists of silty to sandy alluvial and floodplain deposits that originated from the Tanana River. The combination of fine and coarse sediment allows for some movement of groundwater through this area, but ponding or seeps are also likely. As a result, this area contains streams, wetland flow-ways, seeps and natural lakes. The spring-fed Richardson Clearwater and Fivemile Clearwater rivers occupy former Tanana River Sloughs within this area.

Stream flows within this area are dominated by groundwater spring flow, or breakup processes where groundwater sources are not substantial.

Lower Foothills

This region is located south of the Tanana Valley Flats and southward up to the base of the Alaska Range. It is crossed by the three large braided rivers (e.g., Delta River, Little Delta River and Delta Creek) that drain the glaciated Alaska Range, as well as several smaller streams (e.g. Kiana Creek) that have headwaters within the foothills. These smaller streams have very different characteristics than the large braided rivers. Sections of Donnelly Alternative Segments 1 and 2 are located within the Lower Foothills.

Gradients throughout this area are variable and range from 3 to 5 percent further upslope trending down to 1 percent near the Tanana River. The substrate is comprised primarily of river alluvium and glacial outwash with windows (isolated hillsides) of metamorphic basement rock (especially along the northern boundary between the Little Delta River and Delta Creek). Due to varying geologic source, the grain sizes of banks and channels are variable and range from silt to gravels.

A high groundwater table or springs are common along the lower slopes and foothills where impermeable metamorphic bedrock or permafrost transitions to permeable sands and gravels (Anderson, 1970). Most commonly, flowing artesian springs emanate from hillsides. These springs primarily occur along the border of the Tanana Valley Flats and the Lower Foothills. As a result of the varying hydrologic processes, stream flows within the Lower Foothills can be influenced by groundwater springs, rainfall, and glacier meltwater.

Delta Moraine Wetlands

The Delta Moraine Wetlands Region occurs south of the Tanana River between the Delta River and Delta Creek and is an extensive hummocky flat-lying terrain interspersed with many small lakes and ponds, and exhibits a high groundwater table and poor surface drainage. Alternative rail lines within this area include short sections of Donnelly Alternative Segments 1 and 2, South Common Segment, and Delta Alternative Segment 1. The poor surface drainage is a result of the substrate, which is comprised of glacial and riverine deposits consisting of fine silts and clays.

The substrate and geomorphic character is largely due to rapid downwasting of the mid Pleistocene glacier that once occupied the Delta River Valley. Surface water in this area is dominated by the lack of stream flows, numerous small springs and a high groundwater table. As a result, the primary surface water features include clear water wetland flow-ways and small streams.

E.3 Data Collection Strategy and Summary

E.3.1 Surface Water

In early 2005, a preliminary list of alternative rail lines was developed by the Alaska Railroad Corporation (ARRC). During the 2005 summer field season, a plan for investigating potential stream crossings by alternative segments was developed so that representative sites for each alignment could be evaluated with respect to hydrologic, geomorphic and biologic (primarily fish habitat) characteristics and then assessed for potential impacts. The plan entailed categorizing all potential crossings with regard to accessibility, land ownership, stream size, apparent water quality type based on color (e.g., milky gray of glacial origin, humic or tea-colored from lowland or upland bedrock sources, clear from groundwater fed sources, etc.), geomorphic conditions (e.g., planform type - river, stream, slough, pond, etc.) and seasonal flow patterns (i.e., perennial, intermittent, ephemeral). A total 116 field sites were visited by SEA during the 2005 field season.

In 2006 and 2007, ARRC continued to refine the locations of the potential rail lines based on maximizing economic and engineering feasibility as well as minimizing environmental liability. These adjustments meant that additional crossing locations would need to be evaluated, while some rail lines and, therefore, crossing locations that had previously been investigated would not be part of an alternative (in the Environmental Impact Statement [EIS]). In 2006, an additional 22 hydrologic field stations were visited by SEA, and then in 2007 another 27 stations were assessed. As a result, over the three-year period, a total of 165 potential crossings were visited within the project area, of which, approximately 45 percent are located along proposed alternative segments being discussed in this document.

Because potential crossing sites were not equally accessible, accessibility was first evaluated based on public or private ownership and whether it was accessible by car/truck or helicopter. Almost all the crossings on public lands and accessible by car/truck were evaluated in the field. The remaining helicopter-accessible crossings on public lands were characterized using the general crossing classifications described above.

Once all of the potential crossings were initially characterized, the crossings were grouped into similar groups for field site analysis. An approximately similar number of streams within each grouping were to be sampled throughout the study area. In addition, when time allotted, sites along larger rivers, near springs, and at known or possible anadromous fish locations were preferred.

Potential staging areas and borrow areas were also visually inspected either on the ground if accessible by car/truck, or visually observed by the air. Locations were assessed for proximity to water bodies, presence or likelihood of permafrost, the presence and proximity to groundwater springs, and any other features that could be affected by or would affect construction within the area.

The definitions of stream types developed and used by SEA's 2005-2007 field crews differed somewhat from the definitions used by ARRC (Table E-1). Thus, an assessment of the coverage (or representation) of crossing sites varies when comparing ARRC's field site numbers to SEA's 2005-2007 field crew classifications. Water type definitions are presented in Table E-2.

Data collection at surface water crossing sites was conducted either on the ground when possible, or by visual observation from the air (helicopter). In some cases, sites were not accessible because there were no helicopter landing zones located nearby. In other cases, the site did not warrant a ground visit because upon aerial reconnaissance a stream crossing was not found (e.g., usually just a wetland flow-way area in a relict or paleochannel). Field data sheets were developed for the ground and aerial surveys to maintain consistency with the information collected.

Table E-1
Stream Type Definitions

Stream Types	2007 Alaska Railroad Corporations (ARRC) Working Definitions	SEA's 2005 to 2007 Field Definitions
Stream	Flowing water feature with a definable drainage basin that receives the dominate portion of its flow from an upland drainage basin, or groundwater sources. These water bodies may or may not receive flood flows from an adjacent major river (Tanana, Delta Creek, Little Delta, Salcha).	Flowing watercourse that has discernable channel banks and is supported with a constant source of water (i.e., from upstream headwater tributaries, glacier, or groundwater spring) but is not an overflow channel from a larger watercourse.
Slough or Floodplain Slough	Normally persistently wet side channel of a major river that can reasonably be expected to receive large flows from the main channel during flood flow events. There is a continuum between directly connected sloughs off the Tanana normally filled with glacial water and indirectly connected sloughs that are primarily filled with groundwater but may carry backed up or over bank floodwaters. Some of the latter are classified as streams.	Side channel of a major river that regularly receives flow from the main channel. The side channel may also have an additional groundwater source to maintain flows when not supplied from the main channel.
Overflow Channel	Normally dry side channels of major rivers that can reasonably be expected to fill with large flows from the main channel during flood flow events. These channels also represent a continuum between recently active flood channels, identified by active sediment transport, and inactive, nearly cutoff and refilled channels with thick vegetation re-growth.	Side channel of major rivers that periodically fills with flood flows from the main river. Not supported by a constant groundwater source.
Wetland Flow-way	Not all wetland crossings are included; only those that appear from aerial photo analysis to have a linear transport function. Most of these are abandoned and refilled overflow channels in the Tanana floodplain, but also includes some upland sites on the south side of the Tanana where there is considerable groundwater migration from upland basins.	Area appears to be saturated with an apparent flow direction, but no defined channel or drainage way was observed. Recognized by presence of grassy and/or boggy areas and lack of trees. These wetland flow-ways may or may not coincide with the areas of wetlands as described by the National Wetland Inventory (NWI) Codes, as defined by Classification of Wetlands and Deepwater Habitats in Cowardin et al. (1979), and used in Section 4.5.
Stream-Wetland Flow-way	No classification by ARRC.	Wetland type channel that has a combination of boggy land and open water. Stream flow appears to be minimal, if any.
Paleo Channel or Paleo Wetland Flow-way	No classification by ARRC.	Was once a channel or branch of a large river (i.e., normally the Tanana River), but is no longer active and does not receive flows from the main channel. A dry channel that appears more as a scar on the landscape. May convey spring runoff flows or become saturated during a high groundwater conditions.
Relic-Wetland or Relic-Overflow	No classification by ARRC.	This channel still has water in the channel (at least part of the year), but is no longer connected upstream to the main river, except for extreme flow events.

Table E-1
Stream Type Definitions (continued)

Stream Types	2007 Alaska Railroad Corporations (ARRC) Working Definitions	SEA's 2005 to 2007 Field Definitions
Overflow-Wetland/ Overflow-Stream	No classification by ARRC.	A combination of the two stream types. The location may receive high flows from a surrounding larger river, but appears to be supported by a minimal groundwater source, at least part of the year.
Seep	Small steeply sloping persistent drainage features with or without definable drainage basins that receive most of their base flow from groundwater springs. Conveyances for these crossings are sized primarily for dealing with winter icing conditions.	No classification– considered by character of crossing and not necessarily water source.
Drainage Way	A few select crossing sites with or without a definable drainage basin and drainage pathway identified by topography or vegetation features but lacking a definable water course or linear wetland feature.	No classification
Pond	No classification by ARRC.	Open body of water that is not in an existing or former channel.
Other	No classification by ARRC.	A potential crossing site initially identified by ARRC but upon subsequent field inspection turned out to have no water crossing characteristics.

Table E-2
Water Type Definitions

Stream Color	
Clear	Clear water stream. Source of water from seeps or groundwater.
Mixed	Multiple sources of water and can change seasonally depending upon the location. Mixed flows can be any combination or clear, glacial, or humic.
Glacial	Glacial draining streams, usually consists of a milky gray color from the glacial flour.
Humic	Dark brown or tea-colored water as a result of acids (tannic and humic) leaching from plants and other organic matter from the surrounding area.
Dry or Unknown	Water was not present or was not determined at the sampling time.

The information collected during the ground assessments included a description of the general stream environment and parameters, channel and floodplain dimensions, channel and bank substrate, surrounding vegetation types, bank stability, and stream channel classifications (e.g. modified Rosgen and U.S. Forest Service (USFS) classifications – see Table E-3 for definitions). Photographs of the crossing were taken from the air and the ground, and cataloged for future reference. When feasible, channel and floodplain measurements were taken with a tape measure. When the channel could not be waded, a laser range finder was used to estimate channel and floodplain dimensions. Bank angles were visually estimated using a hand-held clinometer. Channel and bank material were also estimated and noted on the field sheets. Discharge and field water quality measurements were also conducted where feasible.

The aerial assessment consisted of broader information due to limited site access. The information included a description of the general stream and floodplain environment, estimates on channel and floodplain dimensions, vegetation present and channel stability. Aerial photos of the crossings were also taken.

Tables E-4 to E-9 summarize the final distribution and coverage of crossing sites based on stream type (Tables E-4 and E-5), water type (Table E-6), crossing type (Table E-7), permafrost terrain (Table E-8) and stream classifications (Table E-9). In general, the final distribution of field stations within each sub-physiographic regions as described above is generally representative of the number of actual crossings being considered in that region.

Table E-3
Stream Classification Definitions

Modified Rosgen Stream Classification (not all Rosgen types are shown)

Rosgen Type	***Modified Sub-Types Used During Field Assessment***	***General Description***
C	No sub-types were used.	Meandering stream with pools and riffles and a defined floodplain. Can occur in glacial outwash locations where materials are abundant. Typically have high width/depth ratios.
D	No sub-types were used.	Wide braided river channel with numerous longitudinal and traverse bars. Eroding banks are also common.
DA	DA-S - single backwater or floodplain slough developed in former anastamosed branch; narrow entrenched channels on broad low-gradient wetland floodplains DA-B - single side branch of larger anastamosed system; banks are not necessarily stable; planform is entrenched and moderately stable DA-O - single overflow side branch of larger anastamosed or braided system; planform is aggrading and relatively stable DA-R - relic channel of overflow side branch of former anastamosed system; aggraded and planform poorly defined.	Anastomosing channel, similar to a D channel, but has stable mid-channel bars with vegetation.
E	E-W - low gradient riffle-pool-run meandering stream, high width:depth ratio; emergent vegetation, not confined E-M - low gradient shallowly incised riffle-pool-run meandering stream; moderate to high width:depth ratios; stable and unstable banks. E - stream is similar to E-W or E-M, but classification is not a good overall match	Meandering stream with some riffles and pools and have high width/depth ratios. Channel banks can be stabilized by dense bank vegetation.
F	F-P - small entrenched very low-gradient sinuous stream (pond-pool like without riffles) with low width:depth ratios and unstable banks F-N - small to moderate sized entrenched low-gradient meandering stream with pools and riffles, low width:depth ratios and unstable banks F- M - small to moderate sized open marshy very low-gradient meandering stream with pools, high width:depth ratios and poorly defined banks.	Confined or entrenched channel, with variable sinuosities. Eroding banks are common.
NA	A reasonable Rosgen stream classification was not found for the observed stream channel.	Not applicable.

Table E-3
Stream Classification Definitions (continued)

Modified U.S. Forest Service (USFS) Alaska Stream Classifications (not all USFS Alaska classes shown)

USFS Groups	***Modified Sub-Groups Used During Field Assessment***	***General Description***
PA: Palustrine Process Group	PA1 = Narrow Placid Flow Channel PA2 = Moderate Width Placid Flow Channel PA3 = Shallow Groundwater Fed Slough PA4 = Floodplain Backwater Slough PA5 = Beaver Dam/Pond Channel PA6 = Wide Placid Boggy Stream PA7 = Narrow Placid Boggy Stream	Very low gradient (<1%) streams associated with low relief landforms and wetland drainage networks; water movement is slow and sediment transport low; channels act as traps and storage areas for fine organic and inorganic sediments.
LM: Low Gradient Contained Process Group	LM1 = shallowly incised low gradient meandering stream LM2 = moderately incised low gradient meandering stream LM3 = deeply incised low gradient meandering stream	Low to moderate gradient (1-3%) channels are moderately incised with good low containment; stream flow is well contained by adjacent landforms; larger valley or the long-term potential of an area to be able to support animals.
GO: Glacial Outwash Group	GO1 = Glacial Outwash Floodplain Side Channel GO2 = Large Meandering Glacial Outwash Channel GO3 = Large Braided Glacial Outwash Channel GO4 = Moderate Width Glacial Channel	Mountain glacier meltwater is a source of runoff to these streams; streams carry extremely high sediment loads and turbid water; gradients usually <3%.
FP: Floodplain Process Group	FP1 = Uplifted Beach Channel FP2 = Foreland Uplifted Estuarine Channel FP3 = Narrow Low Gradient Floodplain Channel FP4 = Low Gradient Floodplain Channel FP5 = Wide Low Gradient Floodplain Channel	Generally lowland and valley bottom streams and rivers; high stream flows not commonly contained within the active channel banks and some degree of floodplain development evident; usually low gradient (<2%) channels where alluvial deposition is prevalent.

Table E-4a
Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type

				Wetlands				
	Stream	**Floodplain Slough**	**Overflow Channel**	**Wetland Flow-way**	**Stream-Wetland**	**Paleo-Channel/ Paleo-Wetland**	**Relic-Wetland/ Overflow**	**Overflow-Wetland/ Stream**
ARRC Site Crossings	43	21	28	64	-	-	-	-
All 2005-2007 SEA Field Crews Sites Sampled	63	3	13	14	17	13	10	15
2005-2007 SEA Field Crews EIS Alts Sites[1]	21	1	4	4	8	6	3	9
Physiographic Regions								
Eielson Flats								
ARRC	2	10	12	14	-	-	-	-
2005-2007 Field Crews -EIS Alts[1]	5	1	-	-	-	1	-	-
2005-2007 Field Crews -Off EIS Alts[2]	7	2	2	-	-	1	4	1

Table E-4a
Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type (continued)

	Stream	Floodplain Slough	Overflow Channel	Wetlands				
				Wetland Flow-way	Stream-Wetland	Paleo-Channel/ Paleo-Wetland	Relic-Wetland/ Overflow	Overflow-Wetland/ Stream
Tanana River Valley and Major Tributaries								
ARRC	20	11	14	13	-	-	-	-
2005-2007 Field Crews -EIS Alts[1]	5	-	2	2	5	1	1	6
2005-2007 Field Crews -Off EIS Alts[2]	12	-	4	2	7	6	1	3
Yukon-Tanana Uplands								
ARRC	-	-	-	-	-	-	-	-
2005-2007 Field Crews -EIS Alts[1]	-	-	-	-	-	-	-	-
2005-2007 Field Crews -Off EIS Alts[2]	-	-	-	-	-	-	-	-
Tanana Valley Flats								
ARRC	6	-	-	10	-	-	-	-
2005-2007 Field Crews -EIS Alts[1]	5	-	-	-	3	2	-	-
2005-2007 Field Crews -Off EIS Alts[2]	16	-	1	2	1	-	2	2
Delta Moraine Wetlands								
ARRC	5	-	-	12	-	-	-	-
2005-2007 Field Crews -EIS Alts[1]	2	-	-	1	-	-	-	-
2005-2007 Field Crews -Off EIS Alts[2]	-	-	-	5	-	-	-	-
Lower Foothills								
ARRC	10	-	2	15	-	-	-	-
2005-2007 Field Crews -EIS Alts[1]	4	-	2	1	1	2	2	-
2005-2007 Field Crews -Off EIS Alts[2]	5	-	2	1	1	-	-	-

1 Field sites in proximity to an EIS alternative: field sites located along watercourse within 500 to 1000 feet of proposed crossing location that are considered representative of crossing location; in some cases two or more sites may have been characterized for one crossing, so that the total number of sites would not necessarily be the same as the total number of crossings
2 Field sites located along watercourse more than 1000 feet of a potential crossing location. While not located at a crossing location, field sites were used as representative sites for the area in which they were sampled.

Table E-4b
Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type

	Seeps	Drainageway	Pond	Other	Total Number	Total Field Stations
ARRC Site Crossings	29	43	-	-	228	
All 2005-2007 SEA Field Crews Sites Sampled	-	-	2	15	169	**169**
2005-2007 SEA Field Crews EIS Alts Sites[1]	-	-	1	5	62	
Physiographic Regions						
Eielson Flats						
ARRC	-	1	-	-	39	
2005-2007 Field Crews -EIS Alts[1]	-	-	-	2	9	**45**
2005-2007 Field Crews -Off EISAlts[2]	-	-	1	-	18	
Tanana River Valley and Major Tributaries						
ARRC	3	6	-	-	58	
2005-2007 Field Crews -EIS Alts[1]	-	-	1	-	22	**59**
2005-2007 Field Crews -Off EISAlts[2]	-	-	-	2	37	
Yukon-Tanana Uplands						
ARRC	-	-	-	-	0	
2005-2007 Field Crews -EIS Alts[1]	-	-	-	-	0	**2**
2005-2007 Field Crews -Off EIS Alts[2]	-	-	-	-	2	
Tanana Valley Flats						
ARRC	13	5	-	-	28	
2005-2007 Field Crews -EIS Alts[1]	-	-	-	1	8	**38**
2005-2007 Field Crews -Off EIS Alts[2]	-	-	-	6	30	
Delta Moraine Wetlands						
ARRC	-	11	-	-	29	
2005-2007 Field Crews -EIS Alts[1]	-	-	-	-	4	**9**
2005-2007 Field Crews -Off EIS Alts[2]	-	-	-	-	5	
Lower Foothills						
ARRC	13	20	-	-	60	
2005-2007 Field Crews -EIS Alts[1]	-	-	-	2	15	**16**
2005-2007 Field Crews -Off EIS Alts[2]	-	-	-	2	11	

1 Field sites in proximity to an EIS alternative: field sites located along watercourse within 500 to 1000 feet of proposed crossing location that are considered representative of crossing location; in some cases two or more sites may have been characterized for one crossing, so that the total number of sites would not necessarily be the same as the total number of crossings

2 Field sites located along watercourses more than 1000 feet of a potential crossing location. While not located at a crossing location, field sites were used as representative sites for the area in which they were sampled.

Table E-5a
Detailed Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type

	Stream	Floodplain Slough	Overflow Channel	Wetlands				
				Wetland Flow-way	Stream-Wetland	Paleo-Channel/ Paleo-Wetland	Relic-Wetland/ Overflow	Overflow-Wetland/ Stream
Physiographic Regions								
Eielson Flats								
ARRC	**2**	**10**	**12**	**14**	**-**	**-**	**-**	**-**
North Common	1	1	-	-	-	-	-	-
Eielson 1	-	-	4	4	-	-	-	-
Eielson 1, Eielson 2	-	1	2	3	-	-	-	-
Eielson 2	1	1	2	-	-	-	-	-
Eielson 2, Eielson 3	-	1	--	2	-	-	-	-
Eielson 3	-	6	2	5	-	-	-	-
Salcha 2	-	-	2	-	-	-	-	-
SEA's 2005-2007 Field Crews	**5**	**1**	**-**	**-**	**-**	**1**	**-**	**-**
North Common	1	1	-	-	-	-	-	-
Eielson 1	-	-	-	-	-	-	-	-
Eielson 1, Eielson 2	1	-	-	-	-	1	-	-
Eielson 2	1	-	-	-	-	-	-	-
Eielson 2, Eielson 3	-	-	-	-	-	-	-	-
Eielson 3	2	-	-	-	-	-	-	-
Salcha 2	-	-	-	-	-	-	-	-
Tanana River Valley and Major Tributaries								
ARRC	**22**	**11**	**14**	**12**	**-**	**-**	**-**	**-**
Salcha 1	2	1	-	1	-	-	-	-
Salcha 2	5	8	1	2	-	-	-	-
Connector A	-	-	-	-	-	-	-	-
Connector B	1	1	-	-	-	-	-	-
Connector C	3	1	1	-	-	-	-	-
Connector D	4	-	-	-	-	-	-	-
Connector E	1	-	-	4	-	-	-	-
Central Alternative 2	-	-	9	2	-	-	-	-
Donnelly 1	2	-	1	-	-	-	-	-
Donnelly 2	2	-	2	3	-	-	-	-
Delta 1	1	-	-	-	-			
Delta 2	1	-	-	-	-	-	-	-

Table E-5a
Detailed Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type (continued)

	Stream	Floodplain Slough	Overflow Channel	Wetlands				
SEA's 2005-2007 Field Crews	**5**	**-**	**2**	**2**	**5**	**1**	**1**	**6**
Salcha 1	1	-	-	-	-	-	-	2
Salcha 2	2	-	1	-	-	1	1	-
Connector A	-	-	-	-	1	-	-	-
Connector B	1	-	1	-	-	-	-	1
Connector C	-	-	-	-	-	-	-	1
Connector D	-	-	-	-	-	-	-	-
Central Alternative 2	1	-	-	1	1	-	-	2
Donnelly 1	-	-	-	-	-	-	-	-
Donnelly 2	-	-	-	1	3	-	-	-
Delta 1	-	-	-	-	-	-	-	-
Delta 2	-	-	-	-	-	-	-	-
Yukon-Tanana Uplands								
ARRC	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Salcha 2	-	-	-	-	-	-	-	-
SEA's 2005-2007 Field Crews	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Salcha 2	-	-	-	-	-	-	-	-
Tanana Valley Flats								
ARRC	**6**	**-**	**-**	**12**	**-**	**-**	**-**	**-**
Salcha 1	-	-	-	5	-	-	-	-
Central Alternative 1	2	-	-	4	-	-	-	-
Connector A	1	-	-	2	-	-	-	-
Connector C	1	-	-	1	-	-	-	-
Connector E	-	-	-	-	-	-	-	-
Donnelly 1	-	-	-	-	-	-	-	-
Donnelly 2	2	-	-	-	-	-	-	-
SEA's 2005-2007 Field Crews	**5**	**-**	**-**	**-**	**3**	**2**	**-**	**-**
Salcha 1	-	-	-	-	-	-	-	-
Central Alternative 1	1	-	-	-	-	-	-	-
Connector A	1	-	-	-	-	-	-	-
Connector C	2	-	-	-	1	-	-	-
Connector E	-	-	-	-	-	1	-	-
Donnelly 1	-	-	-	-	-	-	-	-
Donnelly 2	1	-	-	-	-	1	-	-

Table E-5a
Detailed Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type (continued)

	Stream	Floodplain Slough	Overflow Channel	Wetlands				
Delta Moraine Wetlands								
ARRC	**5**	**-**	**-**	**12**	**-**	**-**	**-**	**-**
Donnelly 1	-	-	-	3	-	-	-	-
Donnelly 2	2	-	-	-	-	-	-	-
Delta 1	-	-	-	-	-	-	-	-
South Common	3	-	-	9	-	-	-	-
SEA's 2005-2007 Field Crews	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**
Donnelly 1	-	-	-	-	-	-	-	-
Donnelly 2	-	-	-	-	-	-	-	-
South Common	2	-	-	1	-	-	-	-
Delta 1	-	-	-	-	-	-	-	-
Lower Foothills								
ARRC	**10**	**-**	**2**	**15**	**-**	**-**	**-**	**-**
Donnelly 1	6	-	-	11	-	-	-	-
Donnelly 2	4	-	2	4	-	-	-	-
Delta 1	-	-	-	-	-	-	-	-
Delta 2	-	-	-	-	-	-	-	-
SEA's 2005-2007 Field Crews	**4**	**-**	**2**	**1**	**1**	**2**	**2**	**-**
Donnelly 1	3	-	2	1	2	1	2	-
Donnelly 2	1	-	-	-	-	1	-	-
Delta 1	-	-	-	-	-	-	-	-
Delta 2	-	-	-	-	-	-	-	-

Table E-5b
Detailed Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type

	Seeps	Drainageway	Pond	Other	Total Number	Total Field Stations
Physiographic Regions						
Eielson Flats						
ARRC	**-**	**1**	**-**	**-**		
North Common	-	-	-	-	2	
Eielson 1	-	-	-	-	8	
Eielson 1, Eielson 2	-	-	-	-	6	
Eielson 2	-	-	-	-	4	
Eielson 2, Eielson 3	-	-	-	-	3	
Eielson 3	-	1	-	-	14	
Salcha 2	-	-	-	-	2	**38**
SEA's 2005-2007 Field Crews	**-**	**-**	**-**	**2**		
North Common	-	-	-	-	2	
Eielson 1	-	-	-	-	0	
Eielson 1, Eielson 2	-	-	-	-	2	
Eielson 2	-	-	-	-	1	
Eielson 2, Eielson 3	-	-	-	-	0	
Eielson 3	-	-	-	2	4	
Salcha 2	-	-	-	-	0	**9**
Tanana River Valley and Major Tributaries						
ARRC	**-**	**4**	**-**	**-**		
Salcha 1	-	2	-	-	6	
Salcha 2	-	-	-	-	16	
Connector A	-	1	-	-	1	
Connector B	-	1	-	-	3	
Connector C	-	-	-	-	5	
Connector D	-	-	-	-	4	
Connector E	-	-	-	-	5	
Central Alternative 2	-	-	-	-	11	
Donnelly 1	-	-	-	-	3	
Donnelly 2	-	-	-	-	7	
Delta 1	-	-	-	-	1	
Delta 2	-	-	-	-	1	**63**
SEA's 2005-2007 Field Crews	**-**	**-**	**1**	**-**		
Salcha 1	-	-	-	-	3	
Salcha 2	-	-	-	-	5	

Table E-5b
Detailed Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type (continued)

	Seeps	Drainageway	Pond	Other	Total Number	Total Field Stations
Connector A	-	-	-	-	1	
Connector B	-	-	-	-	3	
Connector C	-	-	-	-	1	
Connector D	-	-	-	-	5	
Central Alternative 2	-	-	-	-	-	
Donnelly 1	-	-	-	-	-	
Donnelly 2	-	-	-	-	4	
Delta 1	-	-	-	-	-	
Delta 2	-	-	-	-	-	**22**
Yukon-Tanana Uplands						
ARRC	**-**	**-**	**-**	**-**		
Salcha 2	-	-	-	-	-	**0**
SEA's 2005-2007 Field Crews	**-**	**-**	**-**	**-**		
Salcha 2	-	-	-	-	-	**0**
Tanana Valley Flats						
ARRC	**13**	**4**	**-**	**-**		
Salcha 1	-	2	-	-	7	
Central Alternative 1	3	1	-	-	10	
Connector A	-	-	-	-	3	
Connector C	-	-	-	-	2	
Connector E	-	1	-	-	1	
Donnelly 1	-	-	-	-	-	
Donnelly 2	-	-	-	-	2	**25**
SEA's 2005-2007 Field Crews	**-**	**-**	**-**	**1**		
Salcha 1	-	-	-	-	-	
Central Alternative 1	-	-	-	-	1	
Connector A	-	-	-	-	1	
Connector C	-	-	-	-	3	
Connector E	-	-	-	-	1	
Donnelly 1	-	-	-	-	-	
Donnelly 2	-	-	-	-	2	**8**
Delta Moraine Wetlands						
ARRC	**-**	**11**	**-**	**-**		
Donnelly 1	-	5	-	-	8	
Donnelly 2	-	3	-	-	5	
Delta 1	-	1	-	-	1	
South Common	-	2	-	-	14	**28**

Table E-5b
Detailed Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Stream Type (continued)

	Seeps	Drainageway	Pond	Other	Total Number	Total Field Stations
SEA's 2005-2007 Field Crews	**-**	**-**	**-**	**-**		
Donnelly 1	-	-	-	-	-	
Donnelly 2	-	-	-	-	-	
South Common	-	-	-	1	4	
Delta 1	-	-	-	-	-	**4**
Lower Foothills						
ARRC	**13**	**20**	**-**	**-**		
Donnelly 1	-	9	-	-	26	
Donnelly 2	13	11	-	-	34	
Delta 1	-	-	-	-	-	
Delta 2	-	-	-	-	-	**60**
SEA's 2005-2007 Field Crews	**-**	**-**	**-**	**2**		
Donnelly 1	-	-	-	-	11	
Donnelly 2	-	-	-	2	4	
Delta 1	-	-	-	-	-	
Delta 2	-	-	-	-	-	**15**

Table E-6
Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Water Type

Physiographic Regions		Clear	Mixed	Glacial	Humic	Dry or Unknown	Total Number	
Eielson Flats								
ARRC	North Common	2	-	-	-	-	2	
	Eielson 1	-	7	1	-	-	8	
	Eielson 1, Eielson 2		2	2	-	2	6	
	Eielson 2	-	4	-	-	-	4	
	Eielson 2, Eielson 3	-	1	-	-	2	3	
	Eielson 3	1	7	-	-	6	14	
	Salcha 2	-	1	1	-	-	2	**39**
SEA's 2005-2007 Field Crews	North Common	2	-	-	-	-	2	
	Eielson 1	-	-	-	-	-	-	
	Eielson 1, Eielson 2	1	-	-	-	1	2	
	Eielson 2	-	1	-	-	-	1	
	Eielson 2, Eielson 3	-	-	-	-	-	-	
	Eielson 3	4	-	-	-	-	4	
	Salcha 2	-	-	-	-	-	-	
	Off Proposed Alts[1]	12	1	2	2	1	18	**27**
Tanana River Valley and Major Tributaries								
ARRC	Salcha 1	-	1	4	-	1	6	
	Salcha 2	2	5	6	1	2	16	
	Connector A					1	1	
	Connector B	1	1	-	-	1	3	
	Connector C	5	-	-	-	-	5	
	Connector D	4	-	-	-	-	4	
	Connector E	1	-	-	-	4	5	
	Central Alternative 2	5	1	5	-	-	11	
	Donnelly 1	1	-	2	-	-	3	
	Donnelly 2	-	-	4	-	3	7	
	Delta 1	-	-	1	-	-	1	
	Delta 2	-	-	1	-	-	1	**63**
SEA's 2005-2007 Field Crews	Salcha 1	-	-	1	1	1	3	
	Salcha 2	2	-	3	-	-	5	
	Connector A	1	-	-	-	-	1	
	Connector B	1	1	-	-	1	3	
	Connector C	1	-	-	-	-	1	
	Connector D	5	-	-	-	-	5	
	Central Alternative 2	-	-	-	-	-	-	
	Donnelly 1		-	-	-	-	-	

Table E-6
Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Water Type (continued)

Physiographic Regions		Clear	Mixed	Glacial	Humic	Dry or Unknown	Total Number	
	Donnelly 2	2	-	-	-	2	4	
	Delta 1		-	-	-	-	-	
	Delta 2		-	-	-	-	-	
	Off Proposed Alts[1]	15	-	11	4	9	39	**61**
Yukon-Tanana Uplands								
ARRC	Salcha 2	-	-	-	-	-	-	**0**
SEA's 2005-2007 Field Crews	Salcha 2	-	-	-	-	-	-	
	Off Proposed Alts[1]	-	-	-	-	-	-	**0**
Tanana Valley Flats								
ARRC	Salcha 1	-	-	-	-	7	7	
	Central Alternative 1	5	-	-	-	5	10	
	Connector A	1	-	-	-	2	3	
	Connector C	1	-	-	-	1	2	
	Connector E	-	-	-	-	1	1	
	Donnelly 1	-	-	-	-	-	-	
	Donnelly 2	2	-	-	-	-	2	**25**
SEA's 2005-2007 Field Crews	Salcha 1	-	-	-	-	-	-	
	Central Alternative 1	-	-	-	1	-	1	
	Connector A	1	-	-	-	-	1	
	Connector C	1	2	-	-	-	3	
	Connector E	-	-	-	-	1	1	
	Donnelly 1	-	-	-	-	1	-	
	Donnelly 2	-	1	-	-	1	2	
	Off Proposed Alts[1]	17	4	3	3	3	30	**38**
Delta Moraine Wetlands								
ARRC	Donnelly 1	1	-	-	-	7	8	
	Donnelly 2	2	-	-	-	3	5	
	Delta 1	-	-	-	-	1	1	
	South Common	3	-	-	-	11	14	**28**
SEA's 2005-2007 Field Crews	Donnelly 1	-	-	-	-	-	-	
	Donnelly 2	-	-	-	-	-	-	
	Delta 1	-	-	-	-	-	-	
	South Common	3	-	-	-	1	4	
	Off Proposed Alts[1]	1	-	-	-	4	5	**9**
Lower Foothills (Alaksa Range)								
ARRC	Donnelly 1	11	-	-	-	15	26	
	Donnelly 2	17	-	2	-	15	34	

Table E-6
Summary of Alaska Railroad Corporation (ARRC) Crossings and SEA's 2005-2007 Field Crews Field Stations by Water Type (continued)

Physiographic Regions		Clear	Mixed	Glacial	Humic	Dry or Unknown	Total Number	
	Delta 1	-	-	-	-	-	-	
	Delta 2	-	-	-	-	-	-	**60**
SEA's 2005-2007 Field Crews	Donnelly 1	-	-	-	3	8	11	
	Donnelly 2	2	1	-	-	1	4	
	Delta 1	-	-	-	-	-	-	
	Off Proposed Alts[1]	2	2	3	1	3	11	**26**

1 Field sites located along watercourses more than 1000 feet of a potential crossing location. While not located at a crossing location, field sites were used as representative sites for the area in which they were sampled.

Table E-7
Summary of ARRC Crossing Stations by Crossing Type

Physiographic Regions	Culvert	Small Bridge	Large Bridge	Total Crossings
Eielson Flats	**33**	**6**	**-**	**39**
North Common	1	1	-	2
Eielson 1	8	-	-	8
Eielson 1, Eielson 2	5	1	-	6
Eielson 2	3	1	-	4
Eielson 2, Eielson 3	2	1	-	3
Eielson 3	12	2	-	14
Salcha 2	2	-		2
Tanana River Valley	**41**	**14**	**8**	**63**
Salcha 1	5	-	1	6
Salcha 2	11	4	1	16
Connector A	1	-	-	1
Connector B	2	1	-	3
Connector C	3	2	-	5
Connector D	1	3	-	4
Connector E	4	1	-	5
Central Alternative 2	9	2	-	11
Donnelly 1	-	1	2	3
Donnelly 2	5	-	2	7
Delta 1	-	-	1	1
Delta 2	-	-	1	1
Yukon-Tanana Uplands	**-**	**-**	**-**	**0**
Salcha 2	**-**	**-**	-	-
Tanana Valley Flats	**22**	**5**	**-**	**27**
Salcha 1	7	-	-	7
Central Alternative 1	9	1	-	10
Connector A	2	1	-	3
Connector C	1	1	-	2
Connector E	1	-	-	1
Donnelly 1	-	-	-	-
Donnelly 2	1	1	-	2
Delta Moraine Wetlands	**25**	**3**	**-**	**28**
Donnelly 1	8	-	-	8
Donnelly 2	5	-	-	5
Delta 1	1	-	-	1
South Common	11	3	-	14
Lower Foothills (Alaska Range)	**36**	**3**	**6**	**60**
Donnelly 1	24	2	-	26
Donnelly 2	33	1	2	34
Delta 1	-	-	-	-
Delta 2	-	-	-	-

Table E-8
Summary of 2005-2007 Field Crews Field Stations Associated with Permafrost

Physiographic Regions	Yes	No	Disc	Unknown	Total Crossings
Eielson Flats	2	10	12	3	27
North Common	-	-	2	-	2
Eielson 1	-	-	-	-	-
Eielson 1, Eielson 2	-	1	-	1	2
Eielson 2	-	1	-	-	1
Eielson 2, Eielson 3	-	-	-	-	-
Eielson 3	-	2	-	2	4
Salcha 2	-	-	-	-	-
Off Proposed Alts[1]	2	6	10	-	18
Tanana River Valley and Major Tributaries	9	36	5	11	61
Salcha 1	-	2	-	1	3
Salcha 2	-	5	-	-	5
Connector A	-	-	-	-	1
Connector B	2	1	-	-	3
Connector C	1	-	-	-	1
Connector D	-	1	-	4	5
Central Alternative 2	-	-	-	-	-
Donnelly 1	-	-	-	-	-
Donnelly 2	-	2	1	1	4
Delta 1	-	-	-	-	-
Delta 2	-	-	-	-	-
Off Proposed Alts[1]	6	25	4	4	39
Yukon-Tanana Uplands	-	-	-	-	-
Salcha 2	-	-	-	-	-
Off Proposed Alts[1]	-	-	-	-	-
Tanana Valley Flats	6	16	9	7	38
Salcha 1	-	-	-	-	-
Central Alternative 1	-	1	-	-	1
Connector A	-	1	-	-	1
Connector C	-	1	2	-	3
Connector E	-	-	1	-	1
Donnelly 1	-	-	-	-	-
Donnelly 2	-	1	1	-	2
Off Proposed Alts[1]	6	12	5	7	30
Delta Moraine Wetlands	7	-	-	2	9
Donnelly 1	-	-	-	-	-
Donnelly 2	-	-	-	-	-
South Common	2	-	-	2	4
Off Proposed Alts[1]	5	-	-	-	5
Lower Foothills (Alaska Range)	2	13	4	7	26
Donnelly 1	1	5	2	3	11
Donnelly 2	-	2	-	2	4
Delta 1	-	-	-	-	-
Off Proposed Alts[1]	1	6	2	2	11

1 Field sites located along watercourses more than 1000 feet of a potential crossing location. While not located at a crossing location, field sites were used as representative sites for the area in which they were sampled.

Table E-9a
Summary of 2005-2007 Field Crews Field Stations by Stream Classification

Rosgen Stream Types							
Physiographic Regions	**C**	**D**	**DA**	**E**	**F**	**NA**	**Total Crossings**
Eielson Flats	**-**	**-**	**4**	**4**	**12**	**7**	**27**
North Common	-	-	-	-	2	-	2
Eielson 1	-	-	-	-	-	-	-
Eielson 1, Eielson 2	-	-	2	-	-	-	2
Eielson 2	-	-	-	-	1	-	1
Eielson 2, Eielson 3	-	-	-	-	-	-	-
Eielson 3	-	-	-	-	2	2	4
Salcha 2	-	-	-	-	-	-	-
Off Proposed Alts[1]	-	-	2	4	7	5	18
Tanana River Valley and Major Tributaries	**1**	**1**	**27**	**2**	**19**	**11**	**61**
Salcha 1	-	-	2	-	1	-	3
Salcha 2	-	-	4	-	-	1	5
Connector A	-	-	1	-	-	-	1
Connector B	-	-	2	-	1	-	3
Connector C	-	-	-	-	1	-	1
Connector D	-	-	5	-	-	-	5
Central Alternative 2	-	-	-	-	-	-	-
Donnelly 1	-	-	-	-	-	-	-
Donnelly 2	-	-	-	-	4	1	4
Delta 1	-	-	-	-	-	-	-
Detla 2	-	-	-	-	-	-	-
Off Proposed Alts[1]	1	1	13	2	12	10	39
Yukon-Tanana Uplands	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Salcha 2	-	-	-	-	-	-	-
Off Proposed Alts[1]	-	-	-	-	-	-	-
Tanana Valley Flats	**-**	**1**	**2**	**7**	**16**	**12**	**38**
Salcha 1	-	-	-	-	-	-	-
Central Alternative 1	-	-	-	-	1	-	1
Connector A	-	-	-	-	1	-	1
Connector C	-	-	1	-	2	-	3
Connector E	-	-	-	-		1	1
Donnelly 1	-	-	-	-	-	-	-
Donnelly 2	-	-	-	-	1	1	2
Off Proposed Alts[1]	-	1	1	7	11	10	30
Delta Moraine Wetlands	**-**	**-**	**-**	**-**	**1**	**8**	**9**
Donnelly 1	-	-	-	-	-	-	-
Donnelly 2	-	-	-	-	-	-	-
South Common	-	-	-	-	1	3	4
Off Proposed Alts[1]	-	-	-	-	-	5	5
Lower Foothills (Alaska Range)	**-**	**5**	**-**	**1**	**8**	**12**	**26**
Donnelly 1	-	1	-	-	5	5	11
Donnelly 2	-	-	-	-	1	3	4
Delta 1	-	-	-	-	-	-	-
Off Proposed Alts[1]	-	4	-	1	2	4	11

1 Field sites located along watercourses more than 1000 feet of a potential crossing location. While not located at a crossing location, field sites were used as representative sites for the area in which they were sampled.

Table E-9b
Summary of 2005-2007 Field Crews Field Stations by Stream Classification

USFS Stream Types Physiographic Regions	PA	LM	GO	FP	NA	Total Crossings
Eielson Flats	**21**	**-**	**2**	**-**	**4**	**27**
North Common	2	-	-	-	-	2
Eielson 1	-	-	-	-	-	-
Eielson 1, Eielson 2	1	-	-	-	1	2
Eielson 2	1	-	-	-	-	1
Eielson 2, Eielson 3	-	-	-	-	-	-
Eielson 3	4	-	-	-	-	4
Salcha 2	-	-	-	-	-	-
Off Proposed Alts[1]	13	-	2	-	3	18
Tanana River Valley and Major Tributaries	**25**	**2**	**23**	**-**	**11**	**61**
Salcha 1	1	-	1	-	1	3
Salcha 2	2	-	3	-	-	5
Connector A	-	-	1	-	-	1
Connector B	1	-	2	-	-	3
Connector C	1	-	-	-	-	1
Connector D	-	-	5	-	-	5
Central Alternative 2	-	-	-	-	-	-
Donnelly 1	-	-	-	-	-	-
Donnelly 2	4	-	-	-	-	4
Delta 1	-	-	-	-	-	-
Delta 2	-	-	-	-	-	-
Off Proposed Alts[1]	16	2	11	-	10	39
Yukon-Tanana Uplands	**-**	**-**	**-**	**-**	**-**	**-**
Salcha 2	-	-	-	-	-	-
Off Proposed Alts[1]	-	-	-	-	-	-
Tanana Valley Flats	**18**	**6**	**7**	**-**	**7**	**38**
Salcha 1	-	-	-	-	-	-
Central Alternative 1	1	-	-	-	-	1
Connector A	1	-	-	-	-	1
Connector C	2	1	-	-	-	3
Connector E	-	-	-	-	1	1
Donnelly 1	-	-	-	-	-	-
Donnelly 2	1	-	-	-	1	2
Off Proposed Alts[1]	13	5	7	-	5	30
Delta Moraine Wetlands	**2**	**-**	**-**	**-**	**7**	**9**
Donnelly 1	-	-	-	-	-	-
Donnelly 2	-	-	-	-	-	-
South Common	2	-	-	-	2	4
Off Proposed Alts[1]	-	-	-	-	5	5
Lower Foothills (Alaska Range)	**4**	**5**	**6**	**-**	**8**	**26**
Donnelly 1	3	2	1	1	4	11
Donnelly 2	1	2	-	-	1	4
Delta 1	-	-	-	-		-
Off Proposed Alts[1]	1	2	5	-	3	11

Groundwater and Surface Water Quality

Historical Data

The chemical composition of the surface water within the project area, specifically the Tanana River Basin, is influenced by natural features such as geology, soils, and climate. Studies by Anderson (1970) indicate that most surface water samples in the area contain less than 200 parts per million (ppm) of dissolved solids. Within this, the primary constituents include calcium, magnesium, sodium, potassium, sulfate, and bicarbonate. Minor trace amounts of iron, silica, fluoride, and nitrate are present in the watershed, with some reports of elevated iron. Chloride and fluoride concentrations are low in all reported samples. The chemical composition of the surface water is influenced by surface runoff, where dissolved solids decrease following periods of high surface runoff and dissolved solids increase during low-flow periods when groundwater flow dominates (Anderson, 1970).

Anderson (1970) summarized information regarding groundwater and known aquifer locations within the project area. The USGS also has published information regarding aquifers and known locations of groundwater in the Ground Water Atlas of the United Stated (Miller and Whitehead, 1999). Williams (1970) describes general characteristics of groundwater in permafrost regions of the Tanana Valley area.

Anderson (1970) also compiled water quality data for some of the major rivers and streams and also groundwater wells in the Tanana Valley area. A summary of relevant sites from Anderson (1970) is provided in Tables E-10 and Table E-11. The USGS collected surface water quality samples of several rivers and creeks within and around the project area. Table E-12 below lists the sampling locations and the years of sample collection. Some of these sites coincide with the ones reported by Anderson. Samples were not collected at regular intervals and varied from one sample per year to one sample per month. The parameters collected also varied during the sampling periods, but at most locations potential of hydrogen (pH), turbidity, temperature, suspended sediment concentrations and discharge were collected.

In 1983, a water quality study was conducted by the State of Alaska along Richardson Clearwater Creek and surrounding areas (Mauer, 1999). Water quality was measured at ten locations throughout this area and included stream flow, temperature, pH, specific conductance, dissolved oxygen, and alkalinity. Grab samples were also collected for additional laboratory analysis of various inorganic and organic constituents. In summary, Mauer (1999) concluded that stream flow fluctuated within a very narrow range at each site, and that the flow water quality data reflected the spring-dominated character of the streams. Water temperatures ranged from 0.1°C in October to 12.4°C in July, while mainstem water temperatures were generally similar among sites. The pH ranged from near neutral to basic (6.9 to 8.2 s.u.), while specific conductance ranged from 193 to 285 micro-siemens per centimeters (µS/cm). Dissolved oxygen concentrations were moderate to high (66 percent of samples greater than 10.0 milligrams per liter [mg/L], and 89 percent of samples greater than 8.0 mg/L), while alkalinity ranged from 97 to 152 mg/L displaying good acid-neutralizing capacity (Table E-13).

Table E-10
Summary of Historical Surface Water Quality Data in Study Area Compiled by Anderson (1970)

Station	Date of Collection	Location	Mean Discharge (cfs)	SiO_2	Fe	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	TDS	$CaCO_3$ - C	$CaCO_3$ - NC	SC	pH	Color
S-6	2/17/1953	Tanana River near Tok Junction	1,600	17	0.03	49	10	6.8	2.2	182	24	2	0	1.5	202	164	15	316	7.2	5
S-9	6/21-30/57	Tanana River near Tanacross	23,700	12	0	29	4.1	5.6	1.3	102	17	2.5	0.2	0.9	123	89	6	202	7.8	10
S-10	5/25-31/64	Tanana River near Tanacross	7,710	12	0	36	7.8	5.5	1.2	127	22	2.5	0.1	0.6	151	122	18	266	6.9	10
S-11	4/9/1959	Tanana River near Tanacross	1,960	17	0.02	46	10	5.5	2	168	26	3	0.1	0.6	193	156	18	322	6.6	0
S-18	1/5/1958	Delta River near rapids	~	5.7	0.02	39	12	5.3	2.5	121	55	3	0	0.6	183	147	48	308	7.5	0
S-19	12/11-20/50	Tanana River near Big Delta	6,160	9.2	0.03	44	9.3	4.9	0.8	154	30	1.5	~	0.6	187	148	22	305	7.4	5
S-21	12/9/1952	Salcha River near Salchaket	360	10	~	20	5.6	2.2	1.2	67	25	0.2	0.1	1.5	98	74	18	156	6.5	5
S-22	10/3/1948	Salcha River near Salchaket	1,880	4.9	0.12	19	5.7	1.8	1.8	66	18	1	0	1.5	90	71	17	141	~	~
S-23	5/10/1950	Salcha River near Salchaket	8,800			7.6	2.7	0.8	0.8	28	7	0.2	~	1.4	60	30	7	66	~	~

Legend: Silica=SiO_2, Iron=Fe, Calcium=Ca, Magnesium= Mg, Sodium=Na, Potassium=K, Bicarbonate=HCO_3, Sulfate=SO_4, Chloride=Cl, Fluoride=F, Nitrate=NO_3, Dissolves Solids (residue on evaporation)= TDS, Hardness as $CaCO_3$ Carbonated=$CaCO_3$-C, Hardness as Ca CO_3- Non Carbonate=$CaCO_3$-NC, Specific Conductance (micromhos at 25°C)=SC, Cubic Feet Per Second= CFS

Note: All values are ppm or mg/l unless otherwise noted; Color is measured in mg Pt/L (milligrams Platinum/Liter).

Table E-11
Summary of Historical Groundwater Quality Data in Study Area Compiled by Anderson (1970)

Station	Date of Collection	Owner or User	Major Aquifer	Depth of Well (feet)	SiO_2	Fe	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	NO_3	TDS	$CaCO_3$ - C	$CaCO_3$ - NC	SC	pH	Color
G-12	9/29/1948	Fort Greely	sandy-gravel	198	10	0.04	46	10	4.4	4.4	146	36	2.8	0.1	4.8	186	156	36	313	~	~
G-13	7/26/1951	Bert-Mary's Road House	bedrock	230	13	~	31	9.4	7.4	7.4	112	33	3.5	~	0.9	153	116	~	248	7.1	5
G-14	9/7/1965	Eielson AFB	gravel	115	28	7.11	38	9.7	7.5	0.8	166	15	4.6	0.1	0	135	135	0	290	7.5	15

Legend: Silica=SiO_2, Iron=Fe, Calcium=Ca, Magnesium= Mg, Sodium=Na, Potassium=K, Bicarbonate=HCO_3, Sulfate=SO_4, Chloride=Cl, Fluoride=F, Nitrate=NO_3, Dissolves Solids ((residue on evaporation at 180°C))= TDS, Hardness as $CaCO_3$ Carbonated=$CaCO_3$-C, Hardness as Ca CO_3- Non Carbonate=$CaCO_3$-NC, Specific Conductance (micromhos at 25°C)=SC
Note: All values are ppm or mg/l unless otherwise noted; Color is measured in mg Pt/L (milligrams Platinum/Liter).

Table E-12
Summary of Water Quality Data Collection Conducted by the U. S. Geological Survey (USGS) for Study Area

USGS ID	Station Name	Collection Dates
15478000	Tanana River at Big Delta	1949-1952, 1955-1958, 1971, 1975, 1978, 1979
642905146402400	Salcha River 6.5 miles above gauge near Salchaket	1976
642857146412500	Salcha River 5 miles above gauge near Salchaket	1976
640125145432500	Jarvis Creek near Delta Junction	1949, 1953-1956, 1974, 1975, 1978, 1979
15481000	Tanana River near Harding Lake	1971
15484000	Salcha River near Salchaket	1948-1958, 1967, 1968, 1970-1972, 1974-1976
640735145500000	Delta River near Big Delta	1955-1958, 1966, 1975, 1978, 1979

Table E-13
Stream flow and Water Quality Data for Richardson Clearwater Creek (RCC) Compiled by Mauer (1999)

Site Number	Site	Date	Flow	Water Temperature	pH	Specific Conductance	Dissolved Oxygen	Alkalinity
			(cfs)	°C	*standard units*	*µS/cm at 25 °C*	*mg/L*	*mg/L as $CaCO_3$*
1	**RCC near Vanderbilt's Cabin**	5/12/1983		6.8	IM	238	12.6	
		5/19/1983	415					
		6/22/1983	434	7	7.9	228	11.3	102
		7/6/1983	429	6.8	7.9	213	12.3	107
		7/27/1983	431	8.8	7.9	201	IM	97
		9/1/1983	442	3.4	7.6	262	13.4	110
		10/27/1983		-0.1	7.6	IM	13.9	110
2	**Trib number 2 above confluence with RCC**	5/12/1983	78					
		6/22/1983	77	5.7	7.4	230	8.6	101
		7/6/1983	72	6.7	7.5	225	10	109
		7/26/1983	75	7.7	7.9	231	EM	105
		9/1/1983	77	3	7.4	268	12	108
		10/27/1983	76	0.9	7.3	273	13	98
3a	**RCC below Tributary number 2**	5/12/1983		5.1	IM	249	10.2	
3	**RCC above Tributary number 2**	5/12/1983	218					
		6/22/1983	256	7.2	8.1	242	10	107
		7/6/1983	259	6.6	7.9	227	10.8	121
		7/26/1983	244	7.5	8	193	IM	102
		9/1/1983	237	3.5	7.7	268	12.8	121
		10/27/1983	238	0.8	7.6	276	13.2	111
4	**Tributary number 2 near headwaters**	6/22/1983	42	8.7	7.7	253	9.2	104
		7/6/1983	43	8.9	8	241	10.7	116
		7/25/1983	42	7	8	210	IM	113
		9/1/1983	43	3.6	7.7	269	12.8	112
		10/27/1983	43	1	7.6	274	13	102

Table E-13
Stream flow and Water Quality Data for Richardson Clearwater Creek (RCC) Compiled by Mauer (1999) (continued)

Site Number	Site	Date	Flow	Water Temperature	pH	Specific Conductance	Dissolved Oxygen	Alkalinity
5	Tributary number 1 near headwaters	5/12/1983	12	5.1	7.6	268	7.4	
		6/22/1983	17	8.7	7.7	264	6.2	123
		7/6/1983	21	9.8	7.7	249	7.8	136
		7/25/1983	23	8.3	7.9	209	IM	125
		9/1/1983	19	4	7.7	276	9.8	134
		10/27/1983	22	1.4	7.5	285	9.1	
6	RCC above Tributary number 1	5/12/1983		5.3	IM	267	8.3	
		6/22/1983	79	7.4	7.4	260	8.5	112
		7/6/1983	81	7.9	7.9	231	9.5	124
		7/26/1983	82	4.3	7.8	239	IM	117
		9/1/1983	84	3.3	7.9	279	12.1	125
		10/28/1983	82	1.3	7.7	266	12.1	152
7	Tanana River Tributary	6/22/1983	61	11.3	8.2	264	9.7	105
		7/6/1983	66	12.4	8	257	10.9	121
		7/25/1983	84	8.9	8	241	IM	116
		9/1/1983	72	4.2	7.9	268	13.8	119
		10/28/1983	59	0.1	7.9	274	15.2	117
8	Delta Creek Tributary	6/22/1983	3.7	7.2	7.7	280	9.4	102
		7/6/1983	4.8	12.4	7.7	257	10	109
		7/25/1983	7.8	8.2	7.8	248	10.7	107
		9/1/1983	8.3	4.9	7.6	278	13.4	110
		10/28/1983	4.3	-0.1	7.3	269	14.3	108
9	Red-Stain Spring along RCC	7/27/1983		2.3	6.9	227	2.8	
10	Big Spring at headwaters	7/25/1983	12	1.9	7.5	212	IM	

Legend: Cubic Feet Per Second=cfs, °C= Degrees Celsius, Potential of Hydrogen= pH, micro-siemens per centimeters =μS/cm, milligrams per liter=mg/L, Calcium=Ca, Carbon=C, Oxygen= O

2005-2007 Field Studies

Surface water quality data was collected by SEA, where possible (at 68 of the 165 field sites), during the 2005, 2006 and 2007 field site locations using a hand held Quanta® water quality meter. Water quality parameters included dissolved oxygen (DO) in mg/L, temperature in °C, turbidity in nephalometric turbidity units (NTUs), pH in standard units, and specific conductance in µS/cm. These in-situ measurements were used to identify trends or similarities associated with the physiographic sub-regions described above and for various stream classifications and water types and are summarized in Table E-14.

The data show some interesting trends, namely that turbidity values and DO concentrations were lowest in the Eielson Flats region, while DO was relatively high in the Tanana River and Tanana Valley Flats streams with moderately high turbidities. Although pH was fairly uniform and tending to slightly basic in most streams, pH was lowest in the Lower Foothills. Because the data was collected in June, July, September and October, the temperature data showed high standard deviations, so there may be no significance to high average temperature in the Lower Foothills and the lower average temperature in the Tanana Valley Flats.

Table E-14
Summary of Water Quality Data Collected by SEA's 2005-2007 Field Crews[1]

Physiographic Province	Number of Samples	Dissolved Oxygen		Temperature		Turbidity		pH		Conductivity	
		mg/L		°C		NTUs		s.u.		µs/cm	
		average	*stdev*	*average*	*stdev*	*average*	*stdev*	*average*	*stdev*	*average*	*stdev*
Delta Wetlands	0	N/A		N/A		N/A		N/A		N/A	
Eielson Flats	17	8.6	2.7	9.8	4.9	163	199	7.62	0.75	0.325	0.073
Lower Foothills	10	9.4	1.8	11.0	2.5	331	495	7.07	0.90	0.160	0.103
Tanana River	18	10.1	2.0	7.6	5.1	665	378	7.69	0.39	0.503	0.677
Tanana Valley Flats	21	10.4	2.8	6.4	3.7	519	370	7.71	0.43	0.301	0.130
Yukon Tanana Uplands	2	11.6	0.4	6.4	1.1	860	156	7.60	0.00	0.175	0.064

[1] Data collected during September 2005, July 2006, October 2006 and June 2007
Legend: °C= Degrees Celsius, Potential of Hydrogen= pH, micro-siemens per centimeters =µS/cm, milligrams per liter=mg/L, nephalometric turbidity units =NTU, Standard Deviation=stdev

E.4 Stream Crossing Inventory

This section provides two sets of tables for each alternative segment. The first table of each set is an inventory of the proposed stream and waterbody crossings and provides a summary of general characteristics that were used in the impacts analysis described in Chapter 4.2 of this document. The second table of each set presents a summary of impacts associated with various water resource elements for that alternative segment.

Table E-15
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for North Common Segment

Crossing Number	Stream Name	Water body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Proposed Conveyance Type	Proposed Conveyance Size (feet)
1	Piledriver Slough	Slough	Clear	-140	Boat	Flow/Nav	Bridge	100
105	un-named	Slough	Clear	-360	None	Flow	Culvert	2x10

*+=upstream of site, -=downstream of site, no value= no field site

Table E-16a
Summary of Impacts for North Common Segment –Construction (Short-Term)
Physiographic Region – Eielson Flats

Type of Waterbody	**Stream**	**Floodplain Slough**	**Adjacent to Streams and Floodplain Sloughs within Riparian Area**				
Name of large waterbody (if applicable)	***Piledriver Slough***						
Activity/Structure	**Bridge**	**Culvert**	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams							
Blockages or Changes in Channel Planform	1	2	1	1	NI	1	1
Disturbances to Permafrost – Thermal Erosion of Streambanks	1	2	1	1	NI	2	1
Altered Flood Hydraulics	1	3	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	3	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	2	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	NI	1	2
Lakes and Ponds							
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI
Water Quality							
Increased Turbidity and Sediment Loads	1	2	1	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	NI	2	1
Groundwater							
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	2	NI	2	1
Dewatering of Aquifers	1	1	1	1	NI	1	1
Floodplains							
Increased Potential for Flooding	1	1	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-16b
Summary of Impacts for North Common Segment –Operation (Long-Term)

Activity/Structure	*Bridge*	*Culvert*	*Use of Gravel Roads*	*Presence of Borrow - Gravel Pits*
Rivers and Streams				
Blockages or Changes in Channel Planform	1	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	1
Altered Flood Hydraulics	1	3	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	2	1	1
Stresses on Natural Water Balances	1	1	1	1
Lakes and Ponds				
Stresses on Natural Water Balances	1	1	1	1
Water Quality				
Increased Turbidity and Sediment Loads	1	1	1	1
Chemically Contaminate Waters	1	1	1	1
Groundwater				
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1
Dewatering of Aquifers	1	1	1	1
Floodplains				
Increased Potential for Flooding	1	1	1	1
Reduced Floodplain Area	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-17
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Eielson Alternative Segment 1

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
Crossings Unique to the Eielson Alternative Segment 1								
6	un-named	Wetland Flow-way	Mixed		None	Wetland Continuity	Culvert	4
7	un-named	Wetland Flow-way	Mixed		None	Wetland Continuity	Culvert	4
8	un-named	Wetland Flow-way	Mixed	+960	None	Wetland Continuity	Culvert	10
9	un-named	Wetland Flow-way	Mixed	+200	None	Wetland Continuity	Culvert	10
10	Piledriver Slough	Slough	Mixed		None	Flow/Fish	Culvert	3x10
11	un-named	Overflow	Mixed	-130	None	Flow	Culvert	3x10
12	un-named	Overflow	Mixed	+50	None	Flow	Culvert	3x10
317	un-named	Overflow	Glacial		None	Flow	Culvert	2x10
Crossings Common with the Eielson Alternative Segment 2								
2	un-named	Wetland Flow-way	Mixed		None	Wetland Continuity	Culvert	10
3	Twentythreemile Slough	Slough	Mixed	-215	Boat	Flow	Bridge	100
189	un-named	Wetland Flow-way	N/A	+1000	None	Wetland Continuity	Culvert	10
190	un-named	Overflow	Glacial		None	Flow	Culvert	10
191	un-named	Overflow	Glacial		None	Flow	Culvert	10
271	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-18
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Eielson Alternative Segment 2

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
Crossings Common with the Eielson Alternative Segment 1								
2	un-named	Wetland Flow-way	Mixed		None	Wetland Continuity	Culvert	10
3	Twentythreemile Slough	Slough	Mixed	-215	Boat	Flow	Bridge	100
189	un-named	Wetland Flow-way	N/A	+1000	None	Wetland Continuity	Culvert	10
190	un-named	Overflow	Glacial		None	Flow	Culvert	10
191	un-named	Overflow	Glacial		None	Flow	Culvert	10
271	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
Crossings Unique to the Eielson Alternative Segment 2								
313	un-named	Stream	Mixed		None	Flow	Culvert	4
314	Piledriver Slough	Slough	Mixed	+1850	Boat	Flow/Fish	Bridge	330
315	un-named	Overflow	Mixed		None	Flow	Culvert	4x10
316	un-named	Overflow	Mixed		None	Flow	Culvert	4
Crossings Common with the Eielson Alternative Segment 3								
13	un-named	Slough	Mixed	+5000	Boat	Flow	Bridge	60
194	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	2x4
304	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-19
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Eielson Alternative Segment 3

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
Crossings Unique to the Eielson Alternative Segment 3								
5	un-named	Slough	Mixed	onsite	None	Flow	Bridge	130
110	un-named	Slough	Mixed	+42	None	Flow	Culvert	3x10
111	un-named	Slough	Clear	+87	None	Flow	Culvert	3x10
112	un-named	Overflow	Mixed		None	Flow	Culvert	2x10
113	Piledriver Slough	Slough	Mixed	-200	Boat	Flow	Bridge	300
127	un-named	Overflow	Mixed		None	Flow	Culvert	10
129	un-named	Slough	Mixed	+1200	None	Flow	Culvert	3x10
131	un-named	Slough	Mixed	+2300	None	Flow	Culvert	3x10
192	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
193	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
305	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
306	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
307	un-named	Drain-way	N/A		None	Flow	Culvert	4
308	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
Crossings Unique to the Eielson Alternative Segment 2								
13	un-named	Slough	Mixed	+5000	Boat	Flow	Bridge	60
194	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	2x4
304	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-20a
Summary of Impacts for Eielson Alternative Segment 1 – Short-Term Construction
Physiographic Region – Eielson Flats

This table incorporates that portion of Eielson Alternative Segment 2 common with Eielson Alternative Segment 1.

Type of Waterbody	Overflow Channel	Wetland Flow-way	Adjacent to Overflow Channel and Wetlands within Riparian Area				
Activity/Structure	**Culvert**	**Culvert**	***Gravel Roads***	***Borrow/ Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams							
Blockages or Changes in Channel Planform	2	1	1	1	NI	NI	NI
Disturbances to Permafrost - Thermal Erosion Of Streambanks	2	1	1	1	NI	NI	NI
Altered Flood Hydraulics	2	1	1	1	NI	NI	NI
Increased Potential for Overbank Flooding And/Or Ice/Debris Jams	3	1	1	1	NI	NI	NI
Increased Scour, Bank Erosion And/Or Channel Aggradation	3	1	1	1	NI	NI	NI
Stresses on Natural Water Balances	1	1	1	1	NI	NI	NI
Lakes and Ponds							
Stresses on Natural Water Balances	NI	NI	NI	NI	NI	NI	NI
Water Quality							
Increased Turbidity and Sediment Loads	2	2	1	2	NI	NI	NI
Chemically Contaminate Waters	1	1	1	1	NI	NI	NI
Groundwater							
Removal of Surface Soils - Changes In Recharge Potential	1	1	1	2	NI	NI	NI
Dewatering of Aquifers	1	1	1	1	NI	NI	NI
Floodplains							
Increased Potential for Flooding	2	2	1	1	NI	NI	NI
Reduced Floodplain Area	1	1	1	1	NI	NI	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-20b
Summary of Impacts for Eielson Alternative Segment 1 – Long-Term Operation

	Overflow Channel	Wetland Flow-way	Adjacent to Overflow Channel and Wetlands within Riparian Area	
Activity/Structure	***Culvert***	***Culvert***	***Use of Gravel Roads***	***Presence of Burrow/ Gravel Pits***
Rivers and Streams				
Blockages or Changes in Channel Planform	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	1	1	1
Altered Flood Hydraulics	3	1	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	3	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	3	1	1	1
Stresses on Natural Water Balances	1	1	1	1
Lakes and Ponds				
Stresses on Natural Water Balances	1	1	1	1
Water Quality				
Increased Turbidity and Sediment Loads	1	1	1	1
Chemically Contaminate Waters	1	1	1	1
Groundwater				
Removal of Surface Soils – Changes In Recharge Potential	1	1	1	2
Dewatering of Aquifers	1	1	1	1
Floodplains				
Increased Potential for Flooding	1	1	1	1
Reduced Floodplain Area	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-21a
Summary of Impacts for Eielson Alternative Segment 2 - Short-Term Construction
Physiographic Region - Eielson Flats

Type of Waterbody	Stream	Floodplain Slough	Wetland Flow-way	Overflow Channel	Stream
Name of large waterbody (if applicable)	*Piledriver Slough*	*Twentythreemile Slough*			
Activity/Structure	**Bridge**	**Bridge**	**Culvert**	**Culvert**	**Culvert**
Rivers and Streams					
Blockages or Changes in Channel Planform	1	2	1	2	3
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	2	2
Altered Flood Hydraulics	2	2	2	2	3
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	1	3	2
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1	3	2
Stresses on Natural Water Balances	1	1	1	1	1
Lakes and Ponds					
Stresses on Natural Water Balances	NI	NI	NI	NI	NI
Water Quality					
Increased Turbidity and Sediment Loads	1	1	2	2	2
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of Surface Soils – Changes in Recharge Potential	1	1	1	1	1
Dewatering of Aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	1	1	2	2	2
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-21b
Summary of Impacts for Eielson Alternative Segment 2 – Short-Term Construction

Physiographic Region - Eielson Flats					
Type of Waterbody / ***Name of large waterbody (if applicable)***	**Adjacent to Floodplain Slough, Overflow Channel and Wetlands within Riparian Area**				
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	1	NI	1	NI
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	NI	1	NI
Altered Flood Hydraulics	1	1	NI	1	NI
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	NI	1	NI
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	NI	1	NI
Stresses on Natural Water Balances	1	1	NI	1	NI
Lakes and Ponds					
Stresses on Natural Water Balances	NI	NI	NI	NI	NI
Water Quality					
Increased Turbidity and Sediment Loads	1	2	NI	1	NI
Chemically Contaminate Waters	1	1	NI	1	NI
Groundwater					
Removal of Surface Soils - Changes in Recharge Potential	1	2	NI	1	NI
Dewatering of Aquifers	1	1	NI	1	NI
Floodplains					
Increased Potential for Flooding	1	1	NI	1	NI
Reduced Floodplain Area	1	1	NI	1	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-21c
Summary of Impacts for Eielson Alternative Segment 2 – Long Term Operation
Physiographic Region - Eielson Flats

Activity/Structure	*Bridge*	*Bridge*	*Culvert*	*Culvert*	*Culvert*	*Use of Gravel Roads*	*Presence of Borrow - Gravel Pits*
Rivers and Streams							
Blockages or Changes in Channel Planform	1	1	2	2	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	2	2	2	1	1
Altered Flood Hydraulics	2	2	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	2	3	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	2	3	2	1	1
Stresses on Natural Water Balances	1	1	1	1	1	1	1
Lakes and Ponds							
Stresses on Natural Water Balances	1	1	1	1	1	1	1
Water Quality							
Increased Turbidity and Sediment Loads	1	1	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1
Groundwater							
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1	1	1	2
Dewatering of Aquifers	1	1	1	1	1	1	1
Floodplains							
Increased Potential for Flooding	2	2	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-22a
Summary of Impacts for Eielson Alternative Segment 3 – Short-Term Construction
Physiographic Region - Eielson Flats

This table incorporates that portion of Eielson Alternative Segment 2 common with Eielson Alternative Segment 3.

Type of WaterBody	Stream	Floodplain Slough		Floodplain Slough	Drainageway	Overflow Channel	Wetland Flow-way
Name of large waterbody (if applicable)	*Piledriver Slough*						
Activity/Structure	**Bridge**	**Bridge**	**Bridge**	**Culvert**	**Culvert**	**Culvert**	**Culvert**
Rivers and Streams							
Blockages or Changes in Channel Planform	1	1	1	2	2	2	2
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	2	2	2	2
Altered Flood Hydraulics	1	2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	2	2	3	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	2	2	2	2	3	1
Stresses on Natural Water Balances	1	1	1	1	1	1	1
Lakes and Ponds							
Stresses on Natural Water Balances	1	1	1	1	1	1	1
Water Quality							
Increased Turbidity and Sediment Loads	1	1	2	2	2	2	2
Chemically Contaminate Waters	1	1	1	1	1	1	1
Groundwater							
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1	1	1	1
Dewatering of Aquifers	1	1	1	1	1	1	1
Floodplains							
Increased Potential for Flooding	1	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-22b
Summary of Impacts for Eielson Alternative Segment 3 – Short-Term Construction
Physiographic Region - Eielson Flats

This table incorporates that portion of Eielson Alternative Segment 2 common with Eielson Alternative Segment 3.

Type of WaterBody	Adjacent to Streams, Floodplain Sloughs, Overflow Channels and Wetlands within Riparian Area				
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	1	NI	1	NI
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	NI	1	NI
Altered Flood Hydraulics	1	1	NI	1	NI
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	NI	1	NI
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	NI	1	NI
Stresses on Natural Water Balances	1	1	NI	1	NI
Lakes and Ponds					
Stresses on Natural Water Balances	1	1	NI	1	NI
Water Quality					
Increased Turbidity and Sediment Loads	1	2	NI	1	NI
Chemically Contaminate Waters	1	1	NI	1	NI
Groundwater					
Removal of Surface Soils - Changes in Recharge Potential	1	2	NI	1	NI
Dewatering of Aquifers	1	1	NI	1	NI
Floodplains					
Increased Potential for Flooding	1	1	NI	1	NI
Reduced Floodplain Area	1	1	NI	1	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-22c
Summary of Impacts for Eielson Alternative Segment 3 – Long-Term Operation

Activity/Structure	*Bridge*	*Bridge*	*Culvert*	*Culvert*	*Culvert*	*Culvert*	*Use of Gravel Roads*	*Presence of Borrow - Gravel Pits*
Rivers and Streams								
Blockages or Changes in Channel Planform	1	1	2	2	2	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	2	2	2	2	1	1
Altered Flood Hydraulics	1	1	2	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	2	2	3	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	2	1	1	3	1	1
Stresses on natural Water Balances	1	1	1	1	1	1	1	1
Lakes and Ponds								
Stresses On Natural Water Balances	1	1	1	1	1	1	1	1
Water Quality								
Increased Turbidity and Sediment Loads	1	1	1	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1	1
Groundwater								
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1	1	1	1	2
Dewatering of Aquifers	1	1	1	1	1	1	1	1
Floodplains								
Increased Potential for Flooding	1	1	2	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-23
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Salcha Alternative Segment 1

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)[a]	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (ft)
	Tanana River	Stream	Glacial	onsite	Boat	Flow	Bridge	3,600
89	un-named	Slough	Glacial	+460	Boat	Flow	Culvert	3x10[b]
195	un-named	Wetland Flow-way	N/A	+25	None	Wetland Continuity	Culvert	10
295	un-named	Stream	mixed	-1025	None	Flow/Fish	Culvert	125
296	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
297	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
298	un-named	Drainageway	N/A		None	Flow	Culvert	4
299	un-named	Drainageway	N/A		None	Flow	Culvert	4
300	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
301	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
310	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
302	un-named	Drainageway	Glacial		None	Flow	Culvert	4
303	un-named	Drainageway	Glacial		None	Flow	Culvert	4

[a]+=upstream of site, -=downstream of site, no value= no field site
[b]The conveyance size is an estimate by SEA based on proposed lengths of similar crossings. The final conveyance would be determined during final design.

Table E-24
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Salcha Alternative Segment 2

Crossing Number	Stream Name	Water body Type	Water Type	Distance to Surveyed Site (feet)[a]	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
	Tanana River	Stream	Glacial	onsite	Boat	Flow	Bridge	4000
	Salcha River	Stream	Humic	onsite	Boat	Flow	Bridge	2,500
14	un-named	Overflow	Glacial	-260	None	Flow	Culvert	2x10
15	un-named	Overflow	Mixed	+95	None	Flow	Culvert	2x10
16	Little Salcha River	Stream	Mixed	-930	Boat	Flow	Bridge	160
17	un-named	Overflow	Mixed		None	Flow/Fish	Culvert	3x10
18	Un-named	Slough	Glacial	140	Boat	Flow	Bridge	390
22	un-named	Slough	Glacial	onsite	Boat	Flow	Bridge	4000
23	un-named	Slough	Glacial	onsite	None	Flow	Culvert	3x10[b]
124	un-named	Slough	Glacial		Boat	Flow	Bridge	4000
133	un-named	Slough	Mixed		None	Flow	Culvert	3x10
134	un-named	Slough	Mixed		None	Flow	Culvert	10
430	un-named	Slough	Mixed		None	Flow	Culvert	10
188	un-named	Slough	Mixed		None	Flow	Culvert	10
339	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
340	un-named	Stream	Clear		None	Flow/Fish	Culvert	10
341	un-named	Stream	Clear		None	Flow/Fish	Culvert	2x10
428	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

[a]+=upstream of site, -=downstream of site, no value= no field site
[b]The conveyance size is an estimate by SEA based on proposed lengths of similar crossings. The final conveyance would be determined during final design.

Table E-25a
Summary of Impacts for Salcha Alternative Segment 1 – Short-Term Construction
Physiographic Region - Tanana River Valley

Type of Waterbody	**Stream**	**Drainageway**	**Floodplain Slough**	**Wetland**
Name of large waterbody (if applicable)	***Tanana River***			
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Culvert***
Rivers and Streams				
Blockages or Changes in Channel Planform	2	1	2	
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	2	1
Altered Flood Hydraulics	3	1	3	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	1	3	1
Increased Scour, Bank Erosion and/or Channel Aggradation	3	1	3	1
Stresses on Natural Water Balances	1	1	1	1
Lakes and Ponds				
Stresses on Natural Water Balances	NI	NI	NI	NI
Water Quality				
Increased Turbidity and Sediment Loads	1	2	2	2
Chemically Contaminate Waters	1	1	1	1
Groundwater				
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1
Dewatering of Aquifers	1	1	1	1
Floodplains				
Increased Potential for Flooding	2	1	2	2
Reduced Floodplain Area	2	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-25b
Summary of Impacts for Salcha Alternative Segment 1 – Short-Term Construction
Physiographic Region Tanana Valley Flats

Type of Waterbody	Drainageway	Stream	Wetland Flow-way
Activity/Structure	***Culvert***	***Culvert***	***Culvert***
Rivers and Streams			
Blockages or Changes in Channel Planform	2	2	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1
Altered Flood Hydraulics	3	3	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	3	3	1
Increased Scour, Bank Erosion and/or Channel Aggradation	3	3	1
Stresses on Natural Water Balances	1	1	1
Lakes and Ponds			
Stresses on Natural Water Balances	NI	NI	NI
Water Quality			
Increased Turbidity and Sediment Loads	2	2	2
Chemically Contaminate Waters	1	1	1
Groundwater			
Removal of Surface Soils - Changes in Recharge Potential	1	1	1
Dewatering of Aquifers	1	1	1
Floodplains			
Increased Potential for Flooding	2	2	2
Reduced Floodplain Area	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-25c
Summary of Impacts for Salcha Alternative Segment 1 – Short-Term Construction
Physiographic Region - *Tanana River Valley and Tanana Valley Flats*

Type of Waterbody / *Name of large waterbody (if applicable)*	Adjacent to Streams, Floodplain Sloughs, Drainageways and Wetlands within Riparian Area				
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	1	1	1	NI
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	1	NI
Altered Flood Hydraulics	1	1	2	1	NI
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	2	1	NI
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1	1	NI
Stresses on Natural Water Balances	1	1	2	1	NI
Lakes and Ponds					
Stresses on Natural Water Balances	NI	NI	NI	NI	NI
Water Quality					
Increased Turbidity and Sediment Loads	2	2	2	1	NI
Chemically Contaminate Waters	1	1	1	1	NI
Groundwater					
Removal of Surface Soils - Changes in Recharge Potential	2	2	1	1	NI
Dewatering of Aquifers	1	1	1	1	NI
Floodplains					
Increased Potential for Flooding	1	1	2	1	NI
Reduced Floodplain Area	1	1	1	1	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-25d
Summary of Impacts for Salcha Alternative Segment 1 – Long-Term Operations
Physiographic Region - Tanana River Valley

Type of Waterbody	**Stream**	**Drainageway**	**Floodplain Slough**	**Wetland**
Name of large waterbody (if applicable)	***Tanana River***			
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Culvert***
Rivers and Streams				
Blockages or Changes in Channel Planform	2	2	2	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1
Altered Flood Hydraulics	3	2	3	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	3	
Increased Scour, Bank Erosion and/or Channel Aggradation	3	2	3	1
Stresses on Natural Water Balances	1	1	1	1
Lakes and Ponds				
Stresses on Natural Water Balances	1	1	1	1
Water Quality				
Increased Turbidity and Sediment Loads	1	1	1	1
Chemically Contaminate Waters	1	1	1	1
Groundwater				
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1
Dewatering of aquifers	1	1	1	1
Floodplains				
Increased Potential for Flooding	1	2	2	2
Reduced Floodplain Area	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-25e
Summary of Impacts for Salcha Alternative Segment 1 – Long-Term Operations
Physiographic Region - Tanana Valley Flats

Type of Waterbody	Drainageway	Stream	Wetland Flow-way
Activity/Structure	***Culvert***	***Culvert***	***Culvert***
Rivers and Streams			
Blockages or Changes in Channel Planform	2	2	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1
Altered Flood Hydraulics	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1
Stresses on Natural Water Balances	1	1	1
Lakes and Ponds			
Stresses on Natural Water Balances	1	1	1
Water Quality			
Increased Turbidity and Sediment Loads	1	1	1
Chemically Contaminate Waters	1	1	1
Groundwater			
Removal of Surface Soils - Changes in Recharge Potential	1	1	1
Dewatering of aquifers	1	1	1
Floodplains			
Increased Potential for Flooding	2	2	2
Reduced Floodplain Area	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-25f
Summary of Impacts for Salcha Alternative Segment 1 – Long-Term Operations
Physiographic Region - Tanana River Valley and Tanana Valley Flats

Type of Waterbody	Adjacent to Streams, Floodplain Sloughs, Drainageways and Wetland Flow-ways within Riparian Area	
Activity/Structure	***Use of Gravel Roads***	***Borrow - Gravel Extraction***
Rivers and Streams		
Blockages or Changes in Channel Planform	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1
Altered Flood Hydraulics	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1
Stresses on Natural Water Balances	1	1
Lakes and Ponds		
Stresses on Natural Water Balances	1	1
Water Quality		
Increased Turbidity and Sediment Loads	2	1
Chemically Contaminate Waters	1	1
Groundwater		
Removal of Surface Soils - Changes in Recharge Potential	1	2
Dewatering of aquifers	1	1
Floodplains		
Increased Potential for Flooding	1	1
Reduced Floodplain Area	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-26a
Summary of Impacts for Salcha Alternative Segment 2 - Short-Term Construction

Physiographic Region	*Tanana River Valley*							
Type of Waterbody	Floodplain Slough	Stream	Overflow	Floodplain Slough	Overflow Channel	Stream	Wetland Flow-way	Stream
Name of large waterbody (if applicable)	*Tanana River side channels*	*Tanana River*	*Little Salcha River*					*Salcha River*
Activity/Structure	*Bridge*	*Bridge*	*Bridge*	*Culvert*	*Culvert*	*Culvert*	*Culvert*	*Bridge*
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	2	2	2	2	2	2
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	2	2	2	2	2
Altered Flood Hydraulics	3	3	2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	2	2	2	2	2
Increased Scour, Bank Erosion and/or Channel Aggradation	3	3	2	2	2	2	2	2
Stresses on Natural Water Balances	1	1	1	1	1	1	1	1
Lakes and Ponds								
Stresses on Natural Water Balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased Turbidity and Sediment Loads	1	1	1	2	2	2	2	1
Chemically Contaminate Waters	1	1	1	1	1	1	1	1
Groundwater								
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1	1	1	1	1
Dewatering of Aquifers	1	1	1	1	1	1	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-26b
Summary of Impacts for Salcha Alternative Segment 2 - Short-Term Construction
Physiographic Region - Tanana River Valley

Type of Waterbody	Adjacent to Streams, Floodplain Sloughs, Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	***Gravel Roads***	***Borrow/ Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	1	1	1	NI
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	1	NI
Altered Flood Hydraulics	1	1	2	1	NI
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	2	1	NI
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1	1	NI
Stresses on Natural Water Balances	1	1	2	1	NI
Lakes and Ponds					
Stresses on Natural Water Balances	NI	NI	NI	NI	NI
Water Quality					
Increased Turbidity and Sediment Loads	1	2	2	1	NI
Chemically Contaminate Waters	1	1	1	1	NI
Groundwater					
Removal of Surface Soils - Changes in Recharge Potential	1	2	1	1	NI
Dewatering of Aquifers	1	1	1	1	NI
Floodplains					
Increased Potential for Flooding	1	1	2	1	NI
Reduced Floodplain Area	1	1	1	1	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-26c
Summary of Impacts for Salcha Alternative Segment 2 - Long-Term Operation and Maintenance

Physiographic Region	*Tanana River Valley*							
Type of Waterbody	**Floodplain Slough**	**Stream**	**Overflow**	**Floodplain Slough**	**Overflow Channel**	**Stream**	**Wetland**	**Stream**
Name of large waterbody (if applicable)	***Tanana River Side Channels***	***Tanana River***	***Little Salcha River***					***Salcha River***
Activity/Structure	***Bridge***	***Bridge***	***Bridge***	***Culvert***	***Culvert***	***Culvert***	***Culvert***	***Bridge***
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	2	2	2	2	1	2
Disturbances to Permafrost - Thermal Erosion of Streambanks		2	2	2	2	2	1	2
Altered Flood Hydraulics	3	3	2	3	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	3	3	2	3	2	2	1	2
Increased Scour, Bank Erosion and/or Channel Aggradation	3	3	2	3	2	2	1	2
Stresses on Natural Water Balances	1	1	1	1	1	1	1	1
Lakes and Ponds								
Stresses on Natural Water Balances	1	1	1	1	1	1	1	1
Water Quality								
Increased Turbidity and Sediment Loads	1	1	1	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1	1
Groundwater								
Removal of Surface Soils - Changes in Recharge Potential	1	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-26d Summary of Impacts for Salcha Alternative Segment 2 - Long-Term Operation and Maintenance Physiographic Region - Tanana River Valley		
Type of Waterbody	**Adjacent to Streams, Floodplain Sloughs, Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**	
Activity/Structure	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams		
Blockages or Changes in Channel Planform	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1
Altered Flood Hydraulics	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1
Stresses on Natural Water Balances	1	1
Lakes and Ponds		
Stresses on Natural Water Balances	1	1
Water Quality		
Increased Turbidity and Sediment Loads	1	1
Chemically Contaminate Waters	1	1
Groundwater		
Removal of Surface Soils - Changes in Recharge Potential	1	1
Dewatering of aquifers	1	1
Floodplains		
Increased Potential for Flooding	1	1
Reduced Floodplain Area	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-27
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Central Alternative Segment 1

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
82	un-named	Seep	Clear		None	ice	Culvert	10
83	un-named	Seep	Clear		None	ice	Culvert	10
84	un-named	Stream	Clear	+50	None	flow	Bridge	40
197	un-named	Wetland Flow-way	N/A		None	Wetland continuity	Culvert	4
198	un-named	Stream	Clear		None	Ice	Culvert	4
199	un-named	Wetland Flow-way	N/A		None	Wetland continuity	Culvert	4
200	un-named	Seep	Clear		None	ice	Culvert	10
201	un-named	Wetland Flow-way	N/A		None	Wetland continuity	Culvert	10
347	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
348	un-named	Drainway	N/A		None	Flow	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-28
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Central Alternative Segment 2

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
34	un-named	Wetland Flow-way	Glacial	+3100	None	Wetland Continuity	Culvert	10
35	un-named	Overflow	Mixed	+200	None	Flow	Bridge	130
36	un-named	Overflow	Glacial	+325	None	Flow	Culvert	10
37	un-named	Overflow	Glacial	-440	None	Flow	Culvert	10
38	un-named	Overflow	Glacial	+80	None	Flow	Bridge	75
272	un-named	Wetland Flow-way	Glacial		None	Wetland Continuity	Culvert	4
391	un-named	Overflow	Clear		None	Flow	Culvert	10
392	un-named	Overflow	Clear		None	Flow	Culvert	10
393	un-named	Overflow	Clear		None	Flow	Culvert	10
394	un-named	Overflow	Clear		None	Flow	Culvert	10
395	un-named	Overflow	Clear		None	Flow	Culvert	10

*+=upstream of site, -=downstream of site, no value= no field site

Table E-29a
Summary of Impacts for Central Alternative Segment 1 – Short-Term Construction
Physiographic Region - Tanana River Valley

Type of Waterbody	*Overflow Channel*	*Overflow Channel*	*Wetland Flow-way*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	2	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	1	NI	2	1
Altered Flood Hydraulics	2	3	2	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	2	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	1	NI	1	2
Lakes and Ponds								
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased turbidity and sediment loads	1	2	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	1	NI	2	1
Groundwater								
Removal of surface soils - changes in recharge potential	1	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	1	NI	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-29b
Summary of Impacts for Central Alternative Segment 1 – Long-Term Operations and Maintenance
Physiographic Region - Tanana River Valley

Type of Waterbody	*Overflow Channel*	*Overflow Channel*	*Wetland Flow-ways*	Adjacent to Drainageways, Overflow Channels and Wetlands Flow-ways within Riparian Area	
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1
Altered Flood Hydraulics	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	1	1	1	1	1
Water Quality					
Increased turbidity and sediment loads	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	2
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-29c
Summary of Impacts for Central Alternative Segment 2 – Short-Term Construction

Physiographic Region	*Tanana River Valley*							
Type of Waterbody	*Overflow Channel*	*Overflow Channel*	*Wetland Flow-ways*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	*Bridge*	*Culvert*	*Culvert*	*Gravel Roads*	*Borrow - Gravel Extraction*	*Ice Roads/ Bridges*	*Staging Areas and Camps*	*Camp Well Water Supply Extraction*
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	1	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1	NI	2	1
Altered Flood Hydraulics	2	3	2	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	1	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	1	NI	1	2
Lakes and Ponds								
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased turbidity and sediment loads	1	2	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	1	NI	2	1
Groundwater								
Removal of surface soils - changes in recharge potential	1	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	1	NI	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-29d
Summary of Impacts for Central Alternative Segment 2 – Long-Term Operations and Maintenance
Physiographic Region - Tanana River Valley

Type of Waterbody	***Overflow Channel***	***Overflow Channel***	***Wetland Flow-ways***	**Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**	
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1
Altered Flood Hydraulics	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	1	1	1	1	1
Water Quality					
Increased turbidity and sediment loads	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	2
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-30
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Connector A Segment

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
85	un-named	Stream	Clear	+450	None	flow	Bridge	40
180	un-named	Wetland Flow-way	N/A	+400	None	Wetland continuity	Culvert	10
196	un-named	Wetland Flow-way	N/A		None	Wetland continuity	Culvert	4
390	un-named	Drainway	N/A		None	Flow	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-31
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Connector B Segment

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
27	un-named	Slough	Clear	-490	None	flow	Culvert	2x10
86	Fivemile Clearwater RIver	Stream	Mixed	-900	Boat	flow	Bridge	160
293	un-named	Drainway	N/A		None	over flow	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-32
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Connector C Segment

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
342	un-named	Stream	Clear		None	Fish/Flow	Bridge	90
343	un-named	Slough	Clear		None	Flow	Culvert	2x10
344	un-named	Overflow	Clear	-675	None	Flow/Fish	Culvert	2x10
345	Fivemile Clearwater RIver	Stream	Clear	0	Boat	Flow/Fish	Bridge	135
346	un-named	Stream	Clear		None	Flow/Fish	Culvert	3x10
396	un-named	Stream	Clear	+550	None	Flow/Fish	Bridge	40
397	un-named	Wetland Flow-way	N/A	+450	None	Wetland Continuity	Culvert	10

*+=upstream of site, -=downstream of site, no value= no field site

Table E-33
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Connector D Segment

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
501	Un-named	Stream	Clear		None	Flow	Bridge	90
502	un-named	Stream	Clear		None	flow	Culvert	2x10
503	un-named	Stream	Clear		None	flow	Bridge	90
504	un-named	Stream	Clear		None	flow	Bridge	90

*+=upstream of site, -=downstream of site, no value= no field site

Table E-34
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for Connector E Segment

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
273	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	10
274	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	10
291	un-named	Drainway	N/A		None	Flow	Culvert	4
350	un-named	Wetland Flow-way	N/A	-640	None	Wetland Continuity	Culvert	4
351	Fivemile Clearwater River	Stream	Clear	+4600	Boat	Flow/Fish	Bridge	115
427	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-35a
Summary of Impacts for Connector A – Short-Term Construction
Physiographic Region - Tanana Valley Flats

Type of Waterbody	*Stream*	*Drainageway*	*Wetland Flow-way*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	1	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1	NI	2	1
Altered Flood Hydraulics	2	3	2	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	1	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	1	NI	1	2
Lakes and Ponds								
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased turbidity and sediment loads	1	2	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	1	NI	2	1
Groundwater								
Removal of surface soils - changes in recharge potential	1	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	1	NI	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-35b
Summary of Impacts for Connector A – Long-Term Operations
Physiographic Region - Tanana Valley Flats

Type of Waterbody	*Stream*	*Drainageway*	*Wetland Flow-way*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area	
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1
Altered Flood Hydraulics	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	1	1	1	1	1
Water Quality					
Increased turbidity and sediment loads	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	2
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-36a
Summary of Impacts for Connector B – Short-Term Construction
Physiographic Region - Tanana River Valley

Type of Waterbody	Fivemile Clearwater River	Drainageway	Floodplain Slough	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	2	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	1	NI	2	1
Altered Flood Hydraulics	2	3	2	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	2	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	1	NI	1	2
Lakes and Ponds								
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased turbidity and sediment loads	1	2	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	1	NI	2	1
Groundwater								
Removal of surface soils - changes in recharge potential	1	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	1	NI	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-36b
Summary of Impacts for Connector B – Long-Term Operations
Physiographic Region - Tanana River Valley

Type of Waterbody	*Fivemile Clearwater River*	*Drainageway*	*Floodplain Slough*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area	
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	1
Altered Flood Hydraulics	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	2	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	1	1	1	1	1
Water Quality					
Increased turbidity and sediment loads	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	2
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-37a
Summary of Impacts for Connector C – Short-Term Construction
Physiographic Region - Tanana River Valley and Tanana Valley Flats

Type of Waterbody	Stream	Floodplain Slough	Overflow Channel	Wetland Flow-way	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	**Bridges**	**Culvert**	**Culvert**	**Culvert**	**Gravel Roads**	**Borrow - Gravel Extraction**	**Ice Roads/ Bridges**	**Staging Areas and Camps**	**Camp Well Water Supply Extraction**
Rivers and Streams									
Blockages or Changes in Channel Planform	2	2	2	1	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	1	1	NI	2	1
Altered Flood Hydraulics	2	3	3	2	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	3	1	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	1	1	NI	1	2
Lakes and Ponds									
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality									
Increased turbidity and sediment loads	1	2	2	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	NI	2	1
Groundwater									
Removal of surface soils - changes in recharge potential	1	1	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	1	1	NI	1	1
Floodplains									
Increased Potential for Flooding	2	2	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-37b
Summary of Impacts for Connector C – Long-Term Operations
Physiographic Region - Tanana River Valley and Tanana Valley Flats

Type of Waterbody	*Stream*	*Floodplain Slough*	*Overflow Channel*	*Wetland*	Adjacent to Drainageways, Overflow Channels and Wetlands within Riparian Area	
Activity/Structure	*Bridges*	*Culvert*	*Culvert*	*Culvert*	*Use of Gravel Roads*	*Presence of Borrow - Gravel Pits*
Rivers and Streams						
Blockages or Changes in Channel Planform	1	1	1	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	1	1	1
Altered Flood Hydraulics	1	1	1	1	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	1	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1	1	1	1
Stresses on natural water balances	1	1	1	1	1	1
Lakes and Ponds						
Stresses on natural water balances	1	1	1	1	1	1
Water Quality						
Increased turbidity and sediment loads	1	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1	1
Groundwater						
Removal of surface soils - changes in recharge potential	1	1	1	1	1	2
Dewatering of aquifers	1	1	1	1	1	1
Floodplains						
Increased Potential for Flooding	1	1	1	1	1	1
Reduced Floodplain Area	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-38a
Summary of Impacts for Connector D – Short-Term Construction
Physiographic Region - Tanana River Valley

Type of Waterbody	*Stream*	*Stream*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area				
Activity/Structure	***Bridge***	***Culvert***	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams							
Blockages or Changes in Channel Planform	2	2	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	NI	2	1
Altered Flood Hydraulics	2	3	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	NI	1	2
Lakes and Ponds							
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI
Water Quality							
Increased turbidity and sediment loads	1	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	NI	2	1
Groundwater							
Removal of surface soils - changes in recharge potential	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	NI	1	1
Floodplains							
Increased Potential for Flooding	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-38b
Summary of Impacts for Connector D – Long-Term Operations and Maintenance
Physiographic Region - Tanana River Valley

Type of Waterbody	*Stream*	*Stream*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area	
Activity/Structure	***Bridge***	***Culvert***	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams				
Blockages or Changes in Channel Planform	2	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1
Altered Flood Hydraulics	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	1
Stresses on natural water balances	1	1	1	1
Lakes and Ponds				
Stresses on natural water balances	1	1	1	1
Water Quality				
Increased turbidity and sediment loads	1	1	2	1
Chemically Contaminate Waters	1	1	1	1
Groundwater				
Removal of surface soils - changes in recharge potential	1	1	1	2
Dewatering of aquifers	1	1	1	1
Floodplains				
Increased Potential for Flooding	2	2	1	1
Reduced Floodplain Area	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-39a
Summary of Impacts for Connector E – Short-Term Construction
Physiographic Region - Tanana River Valley and Tanana Valley Flats

Type of Waterbody	***Stream***	***Drainageway***	***Wetland Flow-way***	**Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**				
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	1	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1	NI	2	1
Altered Flood Hydraulics	2	3	2	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	1	1	1	NI	1	1
Stresses on natural water balances	1	1	1	1	1	NI	1	2
Lakes and Ponds								
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased turbidity and sediment loads	1	2	2	2	2	NI	1	1
Chemically Contaminate Waters	1	1	1	1	1	NI	2	1
Groundwater								
Removal of surface soils - changes in recharge potential	1	1	1	2	2	NI	2	1
Dewatering of aquifers	1	1	1	1	1	NI	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	1	1	NI	1	1
Reduced Floodplain Area	1	1	1	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-39b
Summary of Impacts for Connector E – Long-Term Operations and Maintenance
Physiographic Region - Tanana River Valley and Tanana Valley Flats

Type of Waterbody	*Stream*	*Drainageway*	*Wetland Flow-way*	Adjacent to Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area	
Activity/Structure	***Bridge***	***Culvert***	***Culvert***	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1	1
Altered Flood Hydraulics	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	1	1	1	1	1
Water Quality					
Increased turbidity and sediment loads	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	2
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-40
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for the Donnelly Alternative Segment 1

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
	Little Delta River	Stream	Glacial	Onsite	Boat	Flow	Bridge	800
	Delta Creek	Stream	Glacial	Onsite	Boat	Flow	Bridge	700
73	un-named	Overflow	Clear	Onsite	None	Flow	Bridge	150
74	Kiana Creek	Stream	Clear		None	Flow	Bridge	65
75	un-named	Wetland Flow-way	Clear		None	Wetland Continuity	Culvert	10
76	West Kiana Creek	Stream	Clear	-275	None	Flow	Bridge	40
78	un-named	Drainway	Clear	Onsite	None	Flow	Culvert	10
79	un-named	Drainway	Clear	Onsite	None	Flow	Culvert	10
81	un-named	Stream	Clear	-2800	None	Flow	Culvert	3x10
137	Un-named	Stream	Clear	-380/-1500	None	Flow	Bridge	40
146	un-named	Drainway	Clear		None	Flow	Culvert	4
147	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	2x4
148	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	2x4
149	un-named	Wetland Flow-way	N/A	Onsite	None	Wetland Continuity	Culvert	4
155	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
156	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
157	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
159	un-named	Drainway	N/A		None	Flow	Culvert	10
166	un-named	Drainway	N/A	Onsite	None	Flow	Culvert	4
167	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
168	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
429	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
275	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
276	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
277	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
278	un-named	Drainway	Clear		None	Flow	Culvert	4
279	un-named	Stream	Clear	+110	None	Flow/Fish	Culvert	2x10
280	un-named	Drainway	N/A		None	Flow	Culvert	4
283	un-named	Drainway	N/A		None	Flow	Culvert	4
284	un-named	Drainway	N/A		None	Flow	Culvert	4
285	un-named	Drainway	N/A		None	Flow	Culvert	4
286	un-named	Drainway	Clear		None	Flow	Culvert	10
287	un-named	Stream	Clear		None	Flow	Culvert	10
288	un-named	Drainway	N/A		None	Flow	Culvert	4

Table E-40
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for the Donnelly Alternative Segment 1 (continued)

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
289	un-named	Drainway	N/A	+1010	None	Flow	Culvert	4
290	un-named	Drainway	N/A		None	Flow	Culvert	4
169	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-41
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for the Donnelly Alternative Segment 2

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
	Little Delta River	Stream	Glacial	onsite	Boat	Flow	Bridge	900
	Delta Creek	Stream	Glacial	onsite	Boat	Flow	Bridge	700
39	un-named	Overflow	Glacial		None	Flow	Culvert	10
40	un-named	Stream	Clear		None	Flow	Culvert	3x10
41	Un-named	Stream	Clear	+500	None	Flow	Bridge	40
42	un-named	Overflow	Glacial	-450	None	Flow	Culvert	10
43	un-named	Overflow	Glacial		None	Flow	Culvert	10
45	un-named	Overflow	Glacial	-220	None	Flow	Culvert	10
46	un-named	Seep	Clear	+400	None	Ice	Culvert	10
49	un-named	Seep	Clear	+575	None	Ice	Culvert	10
51	un-named	Seep	Clear	-150	None	Ice	Culvert	10
52	un-named	Seep	Clear		None	Ice	Culvert	10
54	un-named	Seep	Clear		None	Ice	Culvert	10
100	Kiana Creek	Stream	Clear	0	None	Flow	Bridge	80
101	un-named	Stream	Clear	-100	None	Flow	Culvert	2x10
102	un-named	Stream	Clear	+70	None	Flow	Culvert	10
125	un-named	Seep	Clear	+700	None	Ice	Culvert	10
138	un-named	Stream	Clear	-1400	None	Ice	Culvert	10
139	un-named	Stream	Clear		None	Ice	Culvert	10
141	un-named	Seep	Clear		None	Ice	Culvert	10
205	un-named	Drainway	N/A		None	Ice	Culvert	10
206	un-named	Drainway	N/A		None	Ice	Culvert	10
207	un-named	Drainway	N/A		None	Ice	Culvert	10
252	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

Table E-41
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for the Donnelly Alternative Segment 2 (continued)

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
253	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
254	un-named	Seep	Clear		None	Wetland continuity	Culvert	10
255	un-named	Seep	Clear		None	Ice	Culvert	10
256	un-named	Seep	Clear		None	Ice	Culvert	10
257	un-named	Seep	Clear		None	Ice	Culvert	10
258	un-named	Seep	Clear		None	Ice	Culvert	10
259	un-named	Seep	Clear		None	Ice	Culvert	10
292	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
349	un-named	Wetland Flow-way	N/A	-1500	None	Wetland Continuity	Culvert	4
354	un-named	Drainway	N/A		None	Flow	Culvert	10
360	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
361	un-named	Wetland	N/A		None	Wetland Continuity	Culvert	4
362	un-named	Drainway	N/A		None	Flow	Culvert	4
363	un-named	Drainway	N/A		None	Flow	Culvert	4
364	un-named	Drainway	N/A		None	Flow	Culvert	4
365	un-named	Drainway	N/A		None	Flow	Culvert	4
366	un-named	Drainway	N/A		None	Flow	Culvert	4
367	un-named	Drainway	N/A		None	Flow	Culvert	4
368	un-named	Stream	Clear		None	Flow	Culvert	10
369	un-named	Drainway	N/A		None	Flow	Culvert	4
370	un-named	Drainway	N/A		None	Flow	Culvert	4
371	un-named	Drainway	N/A		None	Flow	Culvert	4
372	un-named	Drainway	N/A		None	Flow	Culvert	4
428	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	10

*+=upstream of site, -=downstream of site, no value= no field site

Table E-42a
Summary of Impacts for Donnelly Alternative Segment 1 – Short-Term Construction

Physiographic Region	**Delta Moraine Wetlands**		**Lower Foothills**						
Type of Waterbody	**Drainageway**	**Wetland Flow-way**	**Overflow**	**Stream**			**Drainageway**	**Wetland Flow-way**	**Stream**
Name of large waterbody (if applicable)			***un-named***	***Little Delta River***	***Delta Creek***	***Kiana Creek***			
Activity/Structure	**Culvert**	**Culvert**	**Bridge**	**Bridge**			**Culvert**	**Culvert**	**Culvert**
Rivers and Streams									
Blockages or Changes in Channel Planform	2	1	2	2	2	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	1	2	2	2	2	1	1	1
Altered Flood Hydraulics	2	1	2	2	2	2	1	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	1	2	2	2	2	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	1	2	2	2	3	1	1	1
Stresses on natural water balances	1	1	1	1	1	1	1	1	1
Lakes and Ponds									
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality									
Increased turbidity and sediment loads	1	2	1	1	1	1	1	2	2
Chemically Contaminate Waters	1	1	1	1	1	1	1	1	1
Groundwater									
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1	1	1
Floodplains									
Increased Potential for Flooding	2	2	2	2	2	2	1	1	1
Reduced Floodplain Area	1	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-42b
Summary of Impacts for Donnelly Alternative Segment 1 – Short-Term Construction

Physiographic Region	**Tanana Valley Flats**				**Tanana River Valley**
Type of Waterbody	**Stream**	**Drainageway**	**Stream**	**Wetland Flow-way**	**Wetland Flow-way**
Name of large waterbody (if applicable)	***Unnamed***				
Activity/Structure	**Bridge**	**Culvert**	**Culvert**	**Culvert**	**Culvert**
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	1
Altered Flood Hydraulics	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	2	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	NI	NI	NI	NI	NI
Water Quality					
Increased turbidity and sediment loads	1	1	2	2	2
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-42c
Summary of Impacts for Donnelly Alternative Segment 1 – Short-Term Construction

Physiographic Region	Delta Moraine Wetlands, Lower Foothills, Tanana Valley Flats and Tanana River Valley				
Type of Waterbody	**Adjacent to Streams, Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**				
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1	2	1
Altered Flood Hydraulics	1	1	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1	1	1
Stresses on natural water balances	1	1	2	1	2
Lakes and Ponds					
Stresses on natural water balances	NI	NI	NI	NI	NI
Water Quality					
Increased turbidity and sediment loads	2	3	2	1	1
Chemically Contaminate Waters	1	1	1	2	1
Groundwater					
Removal of surface soils - changes in recharge potential	2	2	1	2	1
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	1	1	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-42d
Summary of Impacts for Donnelly Alternative Segment 1 – Long-Term Operations and Maintenance

Physiographic Region	Delta Moraine Wetlands		Lower Foothills						
Type of Waterbody	**Drainageway**	**Wetland Flow-way**	**Overflow**	**Stream**			**Drainageway**	**Wetland Flow-way**	**Stream**
Name of large waterbody (if applicable)			***Un-named***	***Little Delta River***	***Delta Creek***	***Kiana Creek***			
Activity/Structure	**Culvert**	**Culvert**	**Bridge**	**Bridge**			**Culvert**	**Culvert**	**Culvert**
Rivers and Streams									
Blockages or Changes in Channel Planform		1		2	2	2	2	2	2
Disturbances to Permafrost - Thermal Erosion of Streambanks		1		2	2	2	2	1	2
Altered Flood Hydraulics				2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams		1		2	2	2	2	1	2
Increased Scour, Bank Erosion and/or Channel Aggradation		1		2	2	2	2	1	2
Stresses on natural water balances	1	1	1	1	1	1	1	1	1
Lakes and Ponds									
Stresses on natural water balances	1	1	1	1	1	1	1	1	1
Water Quality									
Increased turbidity and sediment loads	1	1	1	1	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1	1	1
Groundwater									
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1	1	1
Floodplains									
Increased Potential for Flooding	2	2	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-42e
Summary of Impacts for Donnelly Alternative Segment 1 – Long-Term Operations and Maintenance

Physiographic Region	Tanana Valley Flats				Tanana River Valley
Type of Waterbody	**Stream**	**Drainageway**	**Stream**	**Wetland Flow-way**	**Wetland Flow-way**
Activity/Structure	**Bridge**	**Culvert**	**Culvert**	**Culvert**	**Culvert**
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	1
Altered Flood Hydraulics	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	2	1	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	1	1	1	1	1
Water Quality					
Increased turbidity and sediment loads	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-42f
Summary of Impacts for Donnelly Alternative Segment 1 – Long-Term Operations and Maintenance

Physiographic Region	Delta Moraine Wetlands, Lower Foothills, Tanana Valley Flats and Tanana River Valley		
Type of Waterbody	**Adjacent to Streams, Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**		
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***
Rivers and Streams			
Blockages or Changes in Channel Planform	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1	1
Altered Flood Hydraulics	1	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1
Stresses on natural water balances	1	1	1
Lakes and Ponds			
Stresses on natural water balances	1	1	1
Water Quality			
Increased turbidity and sediment loads	2	1	1
Chemically Contaminate Waters	1	1	1
Groundwater			
Removal of surface soils - changes in recharge potential	1	1	1
Dewatering of aquifers	1	1	1
Floodplains			
Increased Potential for Flooding	1	1	1
Reduced Floodplain Area	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-43a
Summary of Impacts for Donnelly Alternative Segment 2 – Short-Term construction

Physiographic Region	Delta Moraine Wetlands		Lower Foothills				
Type of Waterbody	Stream	Drainageway	Stream			Drainageway	Overflow Channel
Name of large waterbody (if applicable)			*Little Delta River*	*Delta Creek*	*Kiana Creek*		
Activity/Structure	Culvert	Culvert	Bridge			Culvert	Culvert
Rivers and Streams							
Blockages or Changes in Channel Planform	2	2	2	2	2	2	2
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	2	2	2	2
Altered Flood Hydraulics	2	2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	2	2	2	2
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	2	2	3	2	2
Stresses on natural water balances	1	1	1	1	1	1	1
Lakes and Ponds							
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI
Water Quality							
Increased turbidity and sediment loads	2	1	1	1	1	1	2
Chemically Contaminate Waters	1	1	1	1	1	1	1
Groundwater							
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1
Floodplains							
Increased Potential for Flooding	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-43b
Summary of Impacts for Donnelly Alternative Segment 2 – Short-Term Construction

Physiographic Region					Tanana Valley Flats			
Type of Waterbody	Seep	Overflow Channel	Drainageway	Wetland Flow-way	Stream	Drainageway	Seep	Wetland Flow-way
Name of large waterbody (if applicable)					*Unnamed*			
Activity/Structure	Culvert	Culvert	Culvert	Culvert	Bridge	Culvert	Culvert	Culvert
Rivers and Streams								
Blockages or Changes in Channel Planform	2	2	2	1	2	2	2	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	1	2	2	2	1
Altered Flood Hydraulics	2	2	2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	1	2	2	2	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	2	1	2	2	2	1
Stresses on natural water balances	1	1	1	1	1	1	1	1
Lakes and Ponds								
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality								
Increased turbidity and sediment loads	2	2	1	2	2	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1	1
Groundwater								
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1	1
Floodplains								
Increased Potential for Flooding	2	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-43c
Summary of Impacts for Donnelly Alternative Segment 2 – Short Tem Construction

Physiographic Region	**Delta Moraine Wetlands, Lower Foothills, Tanana Valley Flats and Tanana River Valley**				
Type of Waterbody	**Adjacent to Streams, Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**				
Name of large waterbody (if applicable)					
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	1	1	2	1
Altered Flood Hydraulics	1	1	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	1	1	1
Stresses on natural water balances	1	1	2	1	2
Lakes and Ponds					
Stresses on natural water balances	NI	NI	NI	NI	NI
Water Quality					
Increased turbidity and sediment loads	2	3	2	1	1
Chemically Contaminate Waters	1	1	1	2	1
Groundwater					
Removal of surface soils - changes in recharge potential	2	2	1	2	1
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	1	1	2	1	1
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-43d
Summary of Impacts for Donnelly Alternative Segment 2 – Long-Term Operations and Maintenance

Physiographic Region	Delta Moraine Wetlands		Lower Foothills				
Type of Waterbody	Stream	Drainageway	Stream			Drainageway	Overflow Channel
Name of large waterbody (if applicable)			*Little Delta River*	*Delta Creek*	*Kiana Creek*		
Activity/Structure	Culvert	Culvert	Bridge			Culvert	Culvert
Rivers and Streams							
Blockages or Changes in Channel Planform	2	2	2	2	2	2	2
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	2	2	2	2	2
Altered Flood Hydraulics	2	2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	2	2	2	2	2
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	2	2	2	2	2
Stresses on natural water balances	1	1	1	1	1	1	1
Lakes and Ponds							
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI
Water Quality							
Increased turbidity and sediment loads	1	1	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1
Groundwater							
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1
Floodplains							
Increased Potential for Flooding	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-43e
Summary of Impacts for Donnelly Alternative Segment 2 – Long-Term Operations and Maintenance

Physiographic Region	Tanana River Valley						Tanana Valley Flats			
Type of Waterbody	Wetland Flow-ways	Stream	Seep	Overflow Channel	Drainageway	Wetland Flow-way	Stream	Drainageway	Seep	Wetland Flow-way
Name of large waterbody (if applicable)							*Unnamed*			
Activity/Structure	Culvert	Culvert	Culvert	Culvert	Culvert	Culvert	Bridge	Culvert	Culvert	Culvert
Rivers and Streams										
Blockages or Changes in Channel Planform	1	2	2	2	2	1	2	2	2	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	2	2	2	2	1	2	2	2	1
Altered Flood Hydraulics	2	2	2	2	2	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	2	2	2	2	1	2	2	2	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	2	2	2	2	1	2	2	2	1
Stresses on natural water balances	1	1	1	1	1	1	1	1	1	1
Lakes and Ponds										
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Water Quality										
Increased turbidity and sediment loads	1	1	1	1	1	1	1	1	1	1
Chemically Contaminate Waters	1	1	1	1	1	1	1	1	1	1
Groundwater										
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1	1	1	1
Floodplains										
Increased Potential for Flooding	1	1	1	1	1	1	1	1	1	1
Reduced Floodplain Area	1	1	1	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-43f
Summary of Impacts for Donnelly Alternative Segment 2 – Long-Term Operations and Maintenance

Physiographic Region	Delta Moraine Wetlands, Lower Foothills, Tanana Valley Flats and Tanana River Valley	
Type of Waterbody	**Adjacent to Streams, Drainageways, Overflow Channels and Wetland Flow-ways within Riparian Area**	
Activity/Structure	***Use of Gravel Roads***	***Presence of Borrow - Gravel Pits***
Rivers and Streams		
Blockages or Changes in Channel Planform	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	1	1
Altered Flood Hydraulics	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1
Stresses on natural water balances	1	1
Lakes and Ponds		
Stresses on natural water balances	NI	NI
Water Quality		
Increased turbidity and sediment loads	2	1
Chemically Contaminate Waters	1	1
Groundwater		
Removal of surface soils - changes in recharge potential	1	1
Dewatering of aquifers	1	1
Floodplains		
Increased Potential for Flooding	1	1
Reduced Floodplain Area	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-44
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for South Common Segment

Crossing Number	Stream Name	Water Body Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
103	un-named	Stream	Clear	+920	None	Fish	Bridge	65
104	un-named	Stream	Clear	onsite	None	Fish	Bridge	40
136	un-named	Stream	Clear	-200	None	Flow	Bridge	50
170	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	10
171	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	10
184	un-named	Wetland Flow-way	N/A	+200	None	Wetland Continuity	Culvert	4
249	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
250	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
251	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
281	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
282	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4
379	un-named	Drainway	N/A		None	Flow	Culvert	4
385	un-named	Drainway	N/A		None	Flow	Culvert	4
426	un-named	Wetland Flow-way	N/A		None	Wetland Continuity	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-45a
Summary of Impacts for South Common Segment – Short-Term Construction

Physiographic Region	Delta Moraine Wetlands				
Type of Waterbody	**Stream**	**Drainageway**	**Wetland Flow-way**	**Stream**	**Wetland Flow-way**
Name of large waterbody (if applicable)	***Headwaters of Richardson Clearwater River***			***Headwaters of Richardson Clearwater River***	
Activity/Structure	**Bridge**	**Culvert**	**Culvert**	**Bridge**	**Culvert**
Rivers and Streams					
Blockages or Changes in Channel Planform	2	2	1	2	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	3	2	1	3	1
Altered Flood Hydraulics	2	2	2	2	2
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	2	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	2	1
Stresses on natural water balances	1	1	1	1	1
Lakes and Ponds					
Stresses on natural water balances	NI	NI	NI	NI	NI
Water Quality					
Increased turbidity and sediment loads	1	2	2	1	2
Chemically Contaminate Waters	1	1	1	1	1
Groundwater					
Removal of surface soils - changes in recharge potential	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1
Floodplains					
Increased Potential for Flooding	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-45b
Summary of Impacts for South Common Segment – Short-Tem Construction
Physiographic Region - Delta Moraine Wetlands

Type of Waterbody	**Adjacent to Streams, Drainageways and Wetland Flow-ways within Riparian Area**				
Activity/Structure	***Gravel Roads***	***Borrow - Gravel Extraction***	***Ice Roads/ Bridges***	***Staging Areas and Camps***	***Camp Well Water Supply Extraction***
Rivers and Streams					
Blockages or Changes in Channel Planform	1	1	NI	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	1	NI	2	1
Altered Flood Hydraulics	1	1	NI	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	1	1	NI	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	1	1	NI	1	1
Stresses on natural water balances	1	1	NI	1	2
Lakes and Ponds					
Stresses on natural water balances	NI	NI	NI	NI	NI
Water Quality					
Increased turbidity and sediment loads	2	2	NI	1	1
Chemically Contaminate Waters	1	1	NI	2	1
Groundwater					
Removal of surface soils - changes in recharge potential	2	2	NI	2	1
Dewatering of aquifers	1	1	NI	1	1
Floodplains					
Increased Potential for Flooding	1	1	NI	1	1
Reduced Floodplain Area	1	1	NI	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-45c
Summary of Impacts for South Common Segment – Long-Term Operations

Physiographic Region	Delta Moraine Wetlands						
Type of Waterbody	Stream	Drainageway	Wetland Flow-way	Stream	Wetland Flow-way	Adjacent to Streams, Drainageways and Wetland Flow-ways within Riparian Area	
Name of large waterbody (if applicable)	*Headwaters of Richardson Clearwater River*			*Headwaters of Richardson Clearwater River*			
Activity/Structure	Bridge	Culvert	Culvert	Bridge	Culvert	*Use of Gravel Roads*	*Presence of Borrow - Gravel Pits*
Rivers and Streams							
Blockages or Changes in Channel Planform	2	2	1	2	1	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	2	1	1	1
Altered Flood Hydraulics	2	2	2	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	2	1	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	2	1	2	1	1	1
Stresses on natural water balances	1	1	1	1	1	1	1
Lakes and Ponds							
Stresses on natural water balances	1	1	1	1	1	1	1
Water Quality							
Increased turbidity and sediment loads	1	1	1	1	1	2	1
Chemically Contaminate Waters	1	1	1	1	1	1	1
Groundwater							
Removal of surface soils - changes in recharge potential	1	1	1	1	1	1	1
Dewatering of aquifers	1	1	1	1	1	1	1
Floodplains							
Increased Potential for Flooding	2	2	2	2	2	2	2
Reduced Floodplain Area	1	1	1	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-46
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for the Delta Alternative Segment 1

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)*	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
Delta Alternative Segment 1								
	Delta River	Stream	Glacial	onsite	Boat	Flow	Bridge	2,000
386	un-named	Drainway	N/A		None	Flow	Culvert	4

*+=upstream of site, -=downstream of site, no value= no field site

Table E-47
Stream Crossing Types, Controlling Factors and Conveyance Characteristics for the Delta Alternative Segment 2

Crossing Number	Stream Name	Waterbody Type	Water Type	Distance to Surveyed Site (feet)	Navigation	Controlling Factor	Conveyance Type	Conveyance Size (feet)
Delta Alternative Segment 1								
	Delta River	Stream	Glacial	onsite	Boat	Flow	Bridge	2,000

Table E-48a
Summary of Impacts for Delta Alternative Segment 1 – Short-Term Construction

Physiographic Region	Delta Moraine Wetlands	Lower Foothills	Delta Moraine Wetlands and Lower Foothills				
Type of Waterbody	Drainageway	Stream	Adjacent to Streams, Drainageways and Wetland Flow-ways within Riparian Area				
Name of large waterbody (if applicable)		*Delta River*					
Activity/Structure	Culvert	Bridge	*Gravel Roads*	*Borrow - Gravel Extraction*	*Ice Roads/ Bridges*	*Staging Areas and Camps*	*Camp Well Water Supply Extraction*
Rivers and Streams							
Blockages or Changes in Channel Planform	2	3	1	2	1	1	NI
Disturbances to Permafrost - Thermal Erosion of Streambanks		2	1	1	1	1	NI
Altered Flood Hydraulics	2	3	1	1	2	1	NI
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1	2	1	NI
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	1	1	1	1	NI
Stresses on natural water balances	1	1	1	1	2	1	NI
Lakes and Ponds							
Stresses on natural water balances	NI	NI	NI	NI	NI	NI	NI
Water Quality							
Increased turbidity and sediment loads	2	1	2	3	2	1	NI
Chemically Contaminate Waters	1	1	1	1	1	1	NI
Groundwater							
Removal of surface soils - changes in recharge potential	1	1	2	2	1	1	NI
Dewatering of aquifers	1	1	1	1	1	1	NI
Floodplains							
Increased Potential for Flooding	2	2	1	1	2	1	NI
Reduced Floodplain Area	1	1	1	1	1	1	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-48b
Summary of Impacts for Delta Alternative Segment 1 – Long-Term Operations and Maintenance

Physiographic Region	**Delta Moraine Wetlands**	**Lower Foothills**	**Delta Moraine Wetlands and Lower Foothills**	
Type of Waterbody	**Drainageway**	**Stream**	**Adjacent to Streams, Drainageways and Wetland Flow-ways within Riparian Area**	
Name of large waterbody (if applicable)		***Delta River***		
Activity/Structure	**Culvert**	**Bridge**	***Use of Gravel Roads***	***Presence of Burrow/ Gravel Pits***
Rivers and Streams				
Blockages or Changes in Channel Planform	2	3	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	2	1	1
Altered Flood Hydraulics	2	2	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	3	1	1
Stresses on natural water balances	1	1	1	1
Lakes and Ponds				
Stresses on natural water balances	1	1	1	1
Water Quality				
Increased turbidity and sediment loads	1	1	2	1
Chemically Contaminate Waters	1	1	1	1
Groundwater				
Removal of surface soils - changes in recharge potential	1	1	1	1
Dewatering of aquifers	1	1	1	1
Floodplains				
Increased Potential for Flooding	2	2	1	1
Reduced Floodplain Area	1	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-49a
Summary of Impacts for Delta Alternative Segment 2 – Short-Term Construction

Physiographic Region	Tanana River Valley					
Type of Waterbody	Stream	Adjacent to Streams within Riparian Area				
Name of large waterbody (if applicable)	*Delta River*					
Activity/Structure	Bridge	*Gravel Roads*	*Borrow - Gravel Extraction*	*Ice Roads/ Bridges*	*Staging Areas and Camps*	*Camp Well Water Supply Extraction*
Rivers and Streams						
Blockages or Changes in Channel Planform	2	1	2	1	1	NI
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	1	1	1	1	NI
Altered Flood Hydraulics	3	1	1	2	1	NI
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	1	1	2	1	NI
Increased Scour, Bank Erosion and/or Channel Aggradation	2	1	1	1	1	NI
Stresses on natural water balances	1	1	1	2	1	NI
Lakes and Ponds						
Stresses on natural water balances	NI	NI	NI	NI	NI	NI
Water Quality						
Increased turbidity and sediment loads	1	1	3	2	1	NI
Chemically Contaminate Waters	1	1	1	1	1	NI
Groundwater						
Removal of surface soils - changes in recharge potential	1	1	2	1	1	NI
Dewatering of aquifers	1	1	1	1	1	NI
Floodplains						
Increased Potential for Flooding	2	1	1	2	1	NI
Reduced Floodplain Area	1	1	1	1	1	NI

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

Table E-49b
Summary of Impacts for Delta Alternative Segment 2 – Long-Term Operations and Maintenance
Physiographic Region – Tanana River Valley

Activity/Structure	Bridge	*Use of Gravel Roads*	*Presence of Borrow - Gravel Pits*
Rivers and Streams			
Blockages or Changes in Channel Planform	2	1	1
Disturbances to Permafrost - Thermal Erosion of Streambanks	2	1	1
Altered Flood Hydraulics	3	1	1
Increased Potential for Overbank Flooding and/or Ice/Debris Jams	2	1	1
Increased Scour, Bank Erosion and/or Channel Aggradation	2	1	1
Stresses on natural water balances	1	1	1
Lakes and Ponds			
Stresses on natural water balances	1	1	1
Water Quality			
Increased turbidity and sediment loads	1	1	1
Chemically Contaminate Waters	1	1	1
Groundwater			
Removal of surface soils - changes in recharge potential	1	1	1
Dewatering of aquifers	1	1	1
Floodplains			
Increased Potential for Flooding	2	1	1
Reduced Floodplain Area	1	1	1

Key: NI: No Impact 1: low impact 2: moderate impact 3: high impact

E.5 Wetlands

The project area, defined as the area within 500 feet of the proposed alternative segments for the purposes of the wetlands evaluation (HDR, 2007a), is about 33 percent wetlands. About a third of the project area wetlands are forested, composed of 1 percent broadleaf forested wetlands, 96 percent needleleaf forested wetlands, and 3 percent mixed forest wetlands. Nearly half of the wetlands within the project area are scrub/shrub wetlands, composed of 26 percent broadleaf scrub/shrub wetlands, 24 percent needleleaf scrub/shrub wetlands and 50 percent mixed and other scrub/shrub wetlands. Emergent and aquatic bed wetlands are relatively rare within the project area, comprising about 3 percent of project area wetlands. About an eighth of the project area is classified as other waters; comprised primarily of riverine waters (11 percent), with some palustrine waters (1 percent). The following sections describes the wetland classification or the vegetation communities, soils, and hydrology patters for wetlands within the project area (HDR, 2007a); functional capacities identified for project area wetland classes (HDR, 2007b); and brief descriptions of wetlands within the 200-foot right-of-way (ROW) for alternative segments and ancillary facilities.

E.5.1 Wetland Classifications

Forested Wetlands

Broadleaf forested wetlands are uncommon within the project area and are primarily associated with streams, small drainages, and the Tanana River floodplain (Figure E-1). A site next to the Tanana River contains an overstory of paper birch (*Betula papyrifera*) with a mixed understory of thin-leafed alder (*Alnus tenuifolia*) and bluejoint reedgrass (*Calamagrostis canadensis*) (Figure E-1). Soils are mineral with faint mottles in the B horizon. Wetland hydrology indicators include drainage patterns in wetlands and water marks on tree trunks (HDR, 2007a).

Figure E-1 – Example of a Broadleaf Forested Wetland (left) and an Aerial Plan View of Broadleaf Forested Wetland Distribution (right) in the Project Area (HDR, 2007a).

Needleleaf forest wetlands are common in the project area across a wide range of landscape positions, including broad flat areas, depressions, and along stream corridors (Figure E-2). These wetlands generally include an overstory dominated by black spruce (*Picea mariana*) greater than 20 feet tall, with an understory of Labrador tea (*Ledum groenlandicum*), lowbush cranberry (*Vaccinium vitis-idaea*), field horsetail (*Equisetum arvense*), bluejoint reedgrass, and Bigelow's sedge (*Carex bigelowii*). Most needleleaf forested wetlands are located either on histosols (soils composed primarily of organic material) or on mineral soils with histic epipedons. Some soil test pits exhibit a strong sulfidic odor, indicating anaerobic conditions, and most of these sites have saturated soils within the top 12 inches. Other wetland hydrology indicators are wetland drainage patterns, wet swales and surface water in low-lying depressions, and a shallow aquitard (HDR, 2007a).

Figure E-2 – Example of a Needleleaf Forested Wetland (left) and an Aerial Plan View of Needleleaf Forested Wetland (right) in the Project Area (HDR, 2007a).

Mixed broadleaf and needleleaf forested wetlands are uncommon in the project area and are generally associated with slopes and drainages and other broadleaf or needleleaf forested wetlands. The most prominent area of mixed forested wetland occurs on the north-facing hillside between the Little Delta River and Delta Creek (HDR, 2007a).

Scrub/Shrub Wetlands

Broadleaf scrub/shrub wetlands are common in the project area generally occurring within bogs and along streams or open-water fringes (Figure E-3). Bog-type scrub/shrub wetlands extend across broad flat areas, are saturated, and have an open canopy of resin birch (*Betula gladulosa*), tussock-forming cottongrass (*Eriophorum brachyantherum*), bluejoint reedgrass, and bog blueberry (*Vaccinium uliginosum*). Riparian fringe scrub/shrub wetlands occur in floodplains and around lakes and ponds. Riparian scrub/shrub wetlands are seasonally flooded or semi-permanently flooded with a closed canopy dominated by willows or alder and ground cover of sedges, bluejoint reedgrass, and horsetail (HDR, 2007a). Many broadleaf scrub/shrub wetlands have either histosols or mineral soils with histic epipedons. Some sites are inundated, and test pits exhibit a strong hydrogen sulfide odor in the top 12 inches, or both. Other signs of wetland hydrology include reduced iron, oxidized root channels, wetlands drainage, sediment deposits, and water marks on vegetation (HDR, 2007a).

Figure E-3 – Example of a Bog-type Broadleaf Scrub/Shrub Wetland (left) and an Aerial Plan View of Bog-type Broadleaf Scrub/Shrub Wetland (right) in the Project Area (HDR, 2007a).

Needleleaf scrub/shrub wetlands are common in the project area and generally occur on broad flat expanses with associated permafrost (Figure E-4). This wetland type includes an open or closed canopy of shrub-height black spruce (less than 20 feet tall), lowbush cranberry, Labrador tea, bog blueberry, polar grass (*Arctagrostis latifolia*), and tussock cottongrass. Histosols or mineral soils with histic epipedons are the predominant soils within this wetland type, permafrost is frequent, and most soils are saturated in the upper 12 inches (HDR, 2007a).

Figure E-4 – Example of a Needleleaf Scrub/Shrub Wetland (left) and an Aerial Plan View of Needleleaf Scrub/Shrub Wetland (right) in the Project Area (HDR 2007a).

Mixed scrub/shrub wetlands are common in the project area and occur generally on large flat expanses and within floodplains (Figure E-5). Dominant plant species include shrub-height black spruce, less than 20 feet tall, resin birch, bog blueberry, lowbush cranberry, paper birch, tussock cottongrass, and bluejoint reedgrass. Soils include histosols or mineral soils with histic epipedons, and are frequently associated with permafrost and saturated in the upper 12 inches (HDR, 2007a).

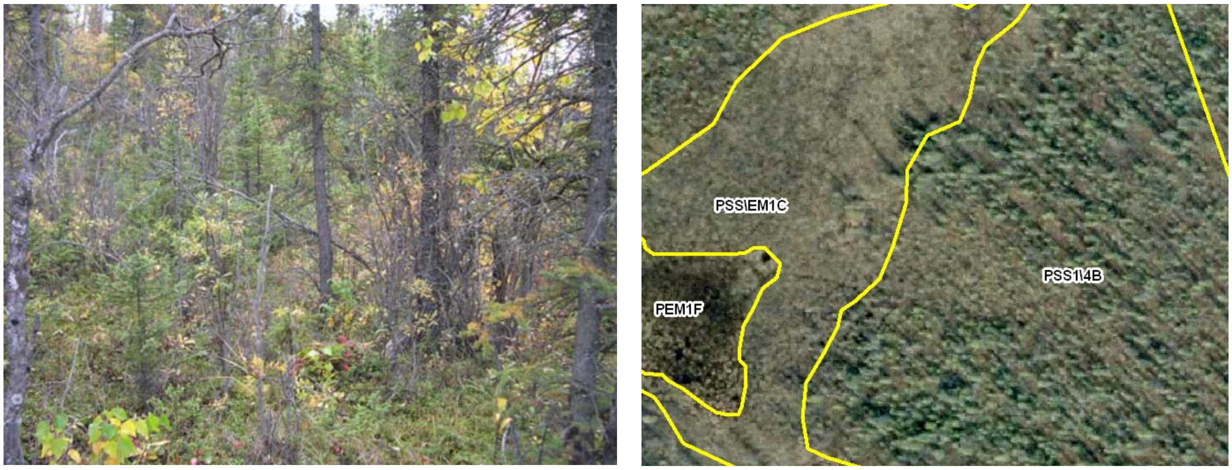

Figure E-5 – Example of a Mixed Broadleaf-Needleleaf Scrub/Shrub Wetland (left) and Aerial Plan View of Mixed Broadleaf-Needleleaf Scrub/Shrub Wetland (right) in the Project Area (HDR, 2007a).

Emergent Wetlands

Emergent wetlands are uncommon in the project area, generally extending across wide, flat, poorly drained areas or in depressions (Figure E-6). Most emergent wetlands are dominated by graminoid (grass or grasslike) vegetation, although some patterned bogs contain mounds with shrubby vegetation. Graminoid vegetation includes bluejoint reedgrass, water sedge (*Carex aquatilis*), russet sedge (*Carex saxatilis*), other sedges (*Carex spp*.), and narrow-leaf cottongrass (*Eriophorum angustifolium*). Mounds with shrubby vegetation include diamondleaf willow (*Salix pulchra*), Bebb's willow (*Salix bebbiana*), and little-tree willow (*Salix arbusculoides*) (HDR, 2007a). Hydric soils, histosols, or histic epipedons generally have a strong hydrogen sulfide odor in the top 12 inches and are either inundated or saturated in the upper 12 inches. Other wetland hydrology indicators include geomorphic position, wetland drainage patterns, and water-stained leaves (HDR, 2007a).

Figure E-6 – Example of an Emergent Wetland (left) and Aerial Plan View of Emergent Wetland (right) in the Project Area (HDR 2007a).

Other Wetlands and Waters

Other wetlands and waters of the United States in the project area include ponds, streams, and rivers as discussed above (Figure E-7, HDR, 2007a). Ponds include both unvegetated open water and water with visible floating or submerged vegetation such as aquatic bed vegetation. Ponds with aquatic beds were generally shallower than unvegetated ponds. Some perennial and all intermittent streams are mapped as linear features because they are too narrow to map effectively using polygonal regions (HDR, 2007a).

Figure E-7 – Examples of Pond Wetland (top left), Aerial Plan of Pond Wetland (top right), Stream Wetland (above left), and Stream Wetland Distribution (above right) in the Project Area (HDR, 2007a).

E.5.2 Wetland Functions and Values

The functional values of each vegetated wetland type within 500 feet or proposed rail line are presented in Table E-50 Functional capacities are evaluated as an index from 0 to 1, with 0 equivalent to providing no function and 1 providing full function. Functions for wetlands within the project area that would most likely be affected by construction and operation of the rail line include:

- high functional capacity of all wetlands to modify of water quality,

- high functional capacity of all wetlands to contribute to the abundance and diversity of wetland vegetation,
- high functional capacity of all wetlands to contribute to the abundance and diversity of wetland fauna,
- high functional capacity of permanently and semi-permanently flooded emergent wetlands to perform groundwater discharge,
- high functional capacity of wetlands with an outlet to export detritus,
- moderate functional capacity of wetlands with an outlet to store storm and floodwaters,
- moderate functional capacity of wetlands with an outlet to modify stream flow, and
- high functional capacity of wetlands without an outlet to store storm and floodwaters (HDR, 2007b).

E.5.3 Wetland Assessment Methodology

Wetland types and areas within 500 feet of the alternative segments were identified by ARRC through implementation of the U.S. Army Corps of Engineers (USACE) wetlands jurisdictional determination methodology during August 23-31, 2005; July 20-27, 2006; and August 14-20, 2006 (HDR, 2007a; HDR, 2007b). The methodology for establishing wetland boundaries and types is contained in the U.S. Army Corps of Engineers Wetlands Delineation Manual (Environmental Laboratory 1987) and the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual Alaska Region (USACE, 2007). The Wetland boundaries and types presented herein are under review by the USACE and will require their approval prior to initiation of the USACE wetland permit process for the project.

The aerial extent of wetlands that would be directly impacted by the proposed rail project was calculated by Geographic Information System (GIS) analysis of delineated wetland areas within the 200-foot wide rail ROW. Areas outside the 200-foot ROW proposed for ancillary facilities, such as communication towers, large bridge staging areas, access roads, highway relocations, river gravel areas and passenger terminals were also analyzed. Wetland types and areas for these ancillary facilities were estimated from National Wetland Inventory (NWI) data in instances where their locations were not included within the areas delineated by ARRC. Results of these GIS analyses are presented for each alternative segment by individual wetland class. Class data were summarized by categories of needleleaf forested wetlands, broadleaf forested wetlands, mixed broadleaf/needleleaf forested wetlands, broadleaf scrub/shrub wetlands, needleleaf scrub/shrub wetlands, mixed and other scrub/shrub wetlands, emergent wetlands, aquatic bed wetlands, and other waters in Chapter 4. Brief descriptions of wetlands within the 200-foot ROW for the alternative segments are presented in Tables E-51 through E-63.

Table E-50
Average Functional Capacities for Project Area Wetlands (Magee and Hollands, 1998; HDR, 2007b).

Vegetated Wetland Type	Area[1] (acres)	Storm and Flood-Water Storage (wetlands with outlets)	Modification of Stream Flow (wetlands with outlets)	Modification of Groundwater Discharge	Modification of Groundwater Recharge	Modification of Water Quality	Export of Detritus (wetlands with outlets)	Abundance and Diversity of Wetland Vegetation	Contribution to Abundance and Diversity of Wetland Fauna
Broadleaf (BL) Forest	16.6	0.56	0.52	0.47	0.61	0.83	0.82	0.87	0.73
Needleleaf (NL) Forest	1,816.8	0.52	0.52	0.43	0.54	0.86	0.83	0.82	0.72
Mixed Forest	62.8	0.52	0.52	0.43	0.54	0.86	0.83	0.82	0.72
BL Shrub Semipermanently Flooded	27.3	0.47	0.67	1	0	0.53	0.83	0.87	0.88
BL Shrub Seasonally Flooded	376.9	0.56	0.44	0.53	0.51	0.78	0.82	0.87	0.80
BL Shrub Saturated	159.2	0.60	0.50	0.53	0.52	0.79	0.77	0.85	0.75
BL Shrub Temporarily Flooded	28.2	0.60	0.50	0.53	0.52	0.79	0.77	0.85	0.75
NL Shrub Seasonally Flooded	33.4	0.53	0.44	0.25	0.73	0.73	0.79	0.53	0.79
NL Shrub Saturated	683.3	0.53	0.44	0.42	0.56	0.82	0.79	0.83	0.73
Mixed Shrub Seasonally Flooded	67.4	0.53	0.44	0.40	0.64	0.80	0.83	1.00	0.79
Mixed Shrub Saturated	707.8	0.53	0.44	0.47	0.51	0.81	0.83	0.85	0.76
Emergent Permanently Flooded	0.5	0.49	0.64	0.76	0.24	0.84	0.68	0.73	0.83
Emergent Semipermanently Flooded	43.4	0.49	0.64	0.74	0.32	0.75	0.68	0.78	0.82
Emergent Seasonally Flooded	75.8	0.57	0.44	0.52	0.55	0.73	0.78	0.78	0.73
Emergent Saturated	2.6	0.67	0.52	0.50	0.54	0.84	0.71	0.80	0.66

Notes: [1] Area within 500 feet of all alternative segments, collectively. If the STB authorizes construction and operation of the rail line, that authority would only extend to a subset of the alternatives. Therefore, the acreages above do not represent a range or even maximum value of potential wetland impacts. Furthermore, the proposed ROW would be 200-feet wide and the wetland acreages presented here are for a 1,000-foot wide project area defined for wetland delineation purposes.

Table E-51
Wetlands within the Proposed Eielson and Delta Construction Staging Areas (USFWS, 2005).

NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO4/1B	Saturated needleleaf evergreen/broadleaf deciduous forest	2	5.6	30
PSS1A	Temporarily flooded broadleaf deciduous scrub/shrub	3	12.9	70
Wetland			**18.5**	
Upland			**161.5**	

Note: National Wetland Inventory (NWI) classifications for riverine habitat R5UBH and R5USC are presented as R3UBH and R3USA for consistency with ARRC wetland data (USFWS, 2005, HDR, 2007a). Regions are individual contiguous wetland areas as mapped by USFWS (2005).

Table E-52
Estimated Borrow Area Wetland Areas for 33 Borrow Areas at 2.5-Mile Intervals Along 80 miles of Rail ROW Based on the Proportional Distribution of Wetland Types Within 500 Feet of Proposed Alternatives (HDR, 2007a).

NWI Code	Definition	Estimated Area (acres)	Wetland Proportion (percent)
PFO4/SS4B	Saturated needleleaf evergreen forest with needleleaf scrub/shrub understory	18.5	10
PFO4/1B	Saturated needleleaf evergreen/broadleaf deciduous forest	1.8	1
PFO4/EM1C	Seasonally flooded needleleaf evergreen forest with persistent emergent understory	1.3	1
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub under story	8.7	5
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub understory	7.9	4
PFO4B	Saturated needleleaf evergreen forest	24.0	13
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	4.3	2
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent understory	10.2	6
PSS1/4B	Saturated broadleaf deciduous scrub-shrub\needleleaf evergreen scrub-shrub	1.1	1
PSS1B	Saturated broadleaf deciduous scrub/shrub	1.3	1
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub	2.8	2
PSS3/4B	Saturated broadleaf evergreen/needleleaf evergreen scrub/shrub	2.6	1
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	20.3	11
PSS4/1C	Seasonally flooded needleleaf evergreen/broadleaf deciduous scrub/shrub	1.8	1
PSS4/3B	Saturated needleleaf evergreen/broadleaf evergreen scrub/shrub	22.2	12

Table E-52
Estimated Borrow Area Wetland Areas for 33 Borrow Areas at 2.5-Mile Intervals Along 80 miles of Rail ROW Based on the Proportional Distribution of Wetland Types Within 500 Feet of Proposed Alternatives (HDR, 2007a). (continued)

NWI Code	Definition	Estimated Area (acres)	Wetland Proportion (percent)
PSS4/EM1C	Seasonally flooded needleleaf evergreen scrub/shrub with persistent emergent understory	1.3	1
PSS4B	Saturated needleleaf evergreen scrub/shrub	22.4	12
PEM1C	Seasonally flooded persistent emergent	2.6	1
PEM1F	Semipermanently flooded persistent emergent	1.5	1
PUBHx	Excavated pond –unconsolidated bottom	1.7	1
R3UBH	Upper perennial stream – unconsolidated bottom	11.1	6
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	12.9	7
U/R3USA	Mosaic of upland and temporarily flooded upper perennial stream – unconsolidated shore	2.6	1
Upland		**375.2***	
Wetland		**184.9***	

Legend: National Wetland Inventory=NWI

* assumes distribution of 33 borrow areas at 2.5 mile intervals. Acreages could change based upon specific site selection.

Table E-53
Wetlands Within 200-foot ROW for the North Common Segment (HDR, 2007a).

NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)
PSS1A	Temporarily flooded broadleaf deciduous scrub/shrub	4	1.1	30
PSS1B	Saturated broadleaf deciduous scrub/shrub	1	0.9	24
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent under story	4	0.7	20
PEM1C	Seasonally flooded persistent emergent	1	0.3	7
PEM1F	Semi-permanently flooded persistent emergent	1	0.1	2
R3UBH	Upper perennial stream – unconsolidated bottom	2	0.6	16
Wetland			**3.7**	
Upland			**60.3**	

Note: Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-54
Wetlands Within 200-foot ROW for the Eielson Alternative Segments (HDR, 2007a).

		Eielson Alternative Segment 1			Eielson Alternative Segment 2			Eielson Alternative Segment 3		
NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO4/SS4B	Saturated needleleaf evergreen forest with needleleaf scrub/shrub under story	1	0.5	3	3	3.7	5	3	4.7	5
PFO4/1B	Saturated needleleaf evergreen/broadleaf deciduous forest	-	-	-	-	-	-	1	0.1	0
PFO4/EM1B	Saturated needleleaf evergreen forest with persistent emergent under story	-	-	-	1	1.2	2	-	-	-
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub under story	6	5.3	32	7	12.6	18	7	15.2	15
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub under story	-	-	-	-	-	-	1	11.4	11
PFO4B	Saturated needleleaf evergreen forest	1	1.1	7	12	5.8	8	11	5.2	5
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent under story	1	0.1	0	4	7.1	10	4	7.8	8
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent under story	7	4.1	24	18	6.3	9	24	7.8	8
PSS1/EM1F	Semi-permanently flooded broadleaf deciduous scrub/shrub with persistent emergent under story	-	-	-	1	0.4	1	1	0.4	0

Table E-54
Wetlands Within 200-foot ROW for the Eielson Alternative Segments (HDR, 2007a). (continued)

		Eielson Alternative Segment 1			Eielson Alternative Segment 2			Eielson Alternative Segment 3		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PSS1/4B	Saturated broadleaf deciduous scrub-shrub\needleleaf evergreen scrub-shrub	-	-	-	-	-	-	1	0.2	0
PSS1B	Saturated broadleaf deciduous scrub/shrub	1	0.7	4	3	0.7	1	4	0.7	1
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub	1	1.3	8	3	1.7	2	1	0.2	0
PSS1F	Semi-permanently flooded broadleaf deciduous scrub/shrub	1	0.0	0	1	0.0	0	-	-	-
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	1	0.7	4	10	19.0	27	9	24.1	24
PSS4/1C	Seasonally flooded needleleaf evergreen/broadleaf deciduous scrub/shrub	-	-	-	1	0.6	1	-	-	-
PSS4/3B	Saturated needleleaf evergreen/broadleaf evergreen scrub/shrub	-	-	-	3	3.9	5	3	1.1	1
PSS4/EM1B	Saturated needleleaf evergreen scrub/shrub with persistent emergent under story	1	0.2	1	2	1.1	2	1	1.3	1
PSS4/EM1C	Seasonally flooded needleleaf evergreen scrub/shrub with persistent emergent under story	-	-	-	4	0.6	1	4	0.3	0
PSS4B	Saturated needleleaf evergreen scrub/shrub	-	-	-	8	1.7	2	7	4.7	5
PEM1B	Saturated persistent emergent	1	0.4	2	1	0.4	1	1	0.4	0

Table E-54
Wetlands Within 200-foot ROW for the Eielson Alternative Segments (HDR, 2007a). (continued)

		Eielson Alternative Segment 1			Eielson Alternative Segment 2			Eielson Alternative Segment 3		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PEM1C	Seasonally flooded persistent emergent	1	0.1	0	9	1.7	2	13	2.4	2
PEM1F	Semi-permanently flooded persistent emergent	4	1.0	6	8	1.3	2	9	3.0	3
PABH	Aquatic bed pond	-	-	-	-	-	-	1	0.0	0
PABHx	Excavated aquatic bed pond	-	-	-	-	-	-	2	0.8	1
PUBH	Pond	-	-	-	-	-	-	1	0.1	0
PUBHx	Excavated pond	1	0.1	1	-	-	-	7	6.6	7
R3UBH	Upper perennial stream – unconsolidated bottom	5	1.2	7	4	0.8	1	4	1.9	2
R3USC	Seasonally flooded upper perennial stream – unconsolidated shore	-	-	-	1	0.1	0	-	-	-
Wetland			**16.8**			**70.8**			**100.3**	
Upland			**230.9**			**171.2**			**143.2**	

Note: Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-55
Wetlands within 200-foot ROW for the Salcha Alternative Segments (HDR, 2007a).

		Salcha Alternative Segment 1			Salcha Alternative Segment 2		
NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO4/SS4B	Saturated needleleaf evergreen forest with needleleaf scrub/shrub understory	1	1.4	2	5	10.1	9
PFO4/EM1C	Seasonally flooded needleleaf evergreen forest with persistent emergent understory	-	-	-	1	4.5	4
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub understory	6	5.8	9	7	5.4	5
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub understory	-	-	-	1	0.0	0
PFO4B	Saturated needleleaf evergreen forest	-	-	-	9	27.3	25
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	-	-	-	3	6.1	6
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent understory	4	1.1	2	8	2.3	2
PSS1A	Temporarily flooded broadleaf deciduous scrub/shrub	3	0.3	0	8	1.2	1
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub	7	1.5	2	9	9.3	8
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	4	16.9	25	2	2.1	2
PSS4/3B	Saturated needleleaf evergreen/broadleaf evergreen scrub/shrub	6	7.3	11	-	-	-
PSS4B	Saturated needleleaf evergreen scrub/shrub	5	12.4	18	8	8.1	7
PEM1C	Seasonally flooded persistent emergent	1	0.2	0	11	2.7	2
PEM1F	Semi-permanently flooded persistent emergent	-	-	-	2	0.2	0
PABH	Aquatic bed pond	-	-	-	1	0.0	0

Table E-55
Wetlands within 200-foot ROW for the Salcha Alternative Segments (HDR, 2007a). (continued)

		Salcha Alternative Segment 1			Salcha Alternative Segment 2		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PUBH	Pond	-	-	-	1	0.0	0
R3UBH	Upper perennial stream – unconsolidated bottom	6	14.2	21	18	20.4	18
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	17	6.9	10	15	10.8	10
R3USC	Seasonally flooded upper perennial stream – unconsolidated shore	-	-	-	2	0.3	0
Wetland			**68.0**			**110.9**	
Upland			**215.7**			**222.1**	

Note: Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-56
Wetlands within the Salcha Alternative Segments 1 and 2 bridge staging areas, levees, riprap areas, gravel extraction sites, access roads, and highway relocations (USFWS, 2005).

		Salcha Alternative Segment 1			Salcha Alternative Segment 2		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PFO1A	Temporarily flooded broadleaf deciduous forest	-	-	-	6	11.2	7%
PFO4B	Saturated needleleaf evergreen forest	1	25.0	22%	-	-	-
PSS1A	Temporarily flooded broadleaf deciduous scrub/shrub	2	17.3	16%	6	11.5	8%
PSS1B	Saturated broadleaf evergreen scrub/shrub	-	-	-	1	1.5	1%
PSS4B	Saturated needleleaf evergreen scrub/shrub	-	-	-	1	<0.1	0%
PSS1/EM1C	Temporarily flooded broadleaf deciduous scrub/shrub/ Seasonally flooded persistent emergent	-	-	-	9	21.2	14%
PSS4/2B	Saturated needleleaf evergreen/needleleaf deciduous scrub/shrub	-	-	-	1	53.0	35%
PSS4/3B	Saturated needleleaf evergreen/broadleaf evergreen scrub/shrub	-	-	-	1	3.8	3%

Table E-56
Wetlands within the Salcha Alternative Segments 1 and 2 bridge staging areas, levees, riprap areas, gravel extraction sites, access roads, and highway relocations (USFWS, 2005). (continued)

		Salcha Alternative Segment 1			Salcha Alternative Segment 2		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
R3UBH	Upper perennial stream – unconsolidated bottom	7	38.5	34%	13	48.1	32%
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	23	24.7	22%	-	-	-
R3USC	Seasonally flooded upper perennial stream – unconsolidated shore	1	6.4	6%	17	1.1	1%
Wetland			**111.9**			**151.4**	
Upland			**137.7**			**155.7**	

Note: NWI classifications for riverine habitat R5UBH and R5USC are presented as R3UBH and R3USA for consistency with ARRC wetland data (USFWS 2005, HDR 2007a). Regions are individual contiguous wetland areas as mapped by USFWS (2005).
Legend: National Wetland Inventory=NWI

Table E-57
Wetlands within 200-foot ROW for the Central Alternative Segments (HDR, 2007a).

		Central Alternative Segment 1			Central Alternative Segment 2		
NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO4/EM1C	Seasonally flooded needleleaf evergreen forest with persistent emergent understory	2	0.1	0	-	-	-
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub understory	7	3.1	6	-	-	-
PFO4/SS1C	Seasonally flooded needleleaf evergreen forest with broadleaf deciduous scrub/shrub understory	1	0.2	0	-	-	-
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub understory	2	4.1	8	-	-	-
PFO4B	Saturated needleleaf evergreen forest	17	15	29	-	-	-
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	9	3.0	6	-	-	-
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent understory	11	13.2	26	4	3.3	51
PSS1/EM1F	Semipermanently flooded broadleaf deciduous scrub/shrub with persistent emergent understory	2	1.5	3	1	0.4	6
PSS1/4B	Saturated broadleaf deciduous/needleleaf evergreen scrub/shrub	6	3.8	7	-	-	-
PSS1/4C	Seasonally flooded broadleaf deciduous/needleleaf evergreen scrub/shrub	1	0.0	0	-	-	-
PSS1B	Saturated broadleaf deciduous scrub/shrub	1	0.1	0	-	-	-
PSS4/EM1B	Saturated needleleaf evergreen scrub/shrub with persistent emergent understory	1	0.5	1	-	-	-
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	7	2.1	4	3	2.8	43
PSS4B	Saturated needleleaf evergreen scrub/shrub	2	0.1	0	1	0.0	0

Table E-57
Wetlands within 200-foot ROW for the Central Alternative Segments (HDR, 2007a). (continued)

		Central Alternative Segment 1			Central Alternative Segment 2		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PEM1B	Saturated persistent emergent	5	1.6	3	-	-	-
PEM1C	Seasonally flooded persistent emergent	7	0.8	2	-	-	-
PEM1F	Semi-permanently flooded persistent emergent	8	1.8	4	-	-	-
R3UBH	Upper perennial stream – unconsolidated bottom	1	0.2	0	-	-	-
Wetland			**51.1**			**6.5**	
Upland			**71.5**			**80.5**	

Note: Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-58
Wetlands within 200-foot ROW for the Connector Segments (HDR, 2007a).

		Connector A			Connector B			Connector C			Connector D			Connector E		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PFO1/EM1C	Seasonally flooded broadleaf deciduous forest with persistent emergent understory	1	0.1	0	-	-	-	-	-	-	-	-	-	-	-	-
PFO1/SS4B	Saturated broadleaf deciduous forest with needleleaf evergreen scrub/shrub understory	2	4.9	9	-	-	-	1	1.9	7	-	-	-	2	0.8	22
PFO1/SS4C	Seasonally flooded broadleaf deciduous forest with needleleaf evergreen scrub/shrub understory	-	-	-	-	-	-	1	0.0	0	-	-	-	-	-	-
PFO2/SS1B	Saturated needleleaf deciduous forest with broadleaf deciduous scrub/shrub understory	1	1.5	3	-	-	-	-	-	-	-	-	-	-	-	-
PFO4/EM1C	Seasonally flooded needleleaf evergreen forest with persistent emergent understory	4	0.4	1	-	-	-	4	0.4	1	-	-	-	-	-	-
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub understory	5	6.3	11	1	0.3	18	-	-	-	-	-	-	-	-	-
PFO4/SS1C	Seasonally flooded needleleaf evergreen forest with broadleaf scrub/shrub understory	-	-	-	-	-	-	1	0.2	1	-	-	-	-	-	-

Table E-58
Wetlands within 200-foot ROW for the Connector Segments (HDR, 2007a). (continued)

		Connector A			Connector B			Connector C			Connector D			Connector E		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub understory	5	5.3	9	-	-	-	3	2.1	8	-	-	-	-	-	-
PFO4B	Saturated needleleaf evergreen forest	13	13.5	24	-	-	-	7	5.8	22	-	-	-	-	-	-
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	6	1.9	3	-	-	-	4	1.9	7	2	0.1	5	2	0.1	3
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent understory	10	12.6	22	2	0.2	11	12	6.0	23	12	1.3	47	-	-	-
PSS1/4C	Seasonally flooded broadleaf deciduous scrub-shrub\needleleaf evergreen scrub-shrub	2	2.9	5	-	-	-	2	3.5	13	-	-	-	-	-	-
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub	-	-	-	1	0.2	13	-	-	-	-	-	-	-	-	-
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	12	3.0	5	-	-	-	9	1.6	6	-	-	-	8	2.0	-
PSS4/1C	Seasonally flooded needleleaf evergreen/broadleaf deciduous scrub/shrub	1	0.0	0	-	-	-	3	0.2	1	-	-	-	-	-	0

Table E-58
Wetlands within 200-foot ROW for the Connector Segments (HDR, 2007a). (continued)

		Connector A			Connector B			Connector C			Connector D			Connector E		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PSS4/3B	Saturated needleleaf evergreen/broadleaf evergreen scrub/shrub	3	2.4	4	-	-	-	-	-	-	-	-	-	-	-	-
PSS4/EM1B	Saturated needleleaf evergreen scrub/shrub with persistent emergent understory	1	0.2	0	-	-	-	-	-	-	-	-	-	-	-	-
PEM1C	Seasonally flooded persistent emergent	4	0.8	1	2	0.2	13	15	1.1	4	9	0.2	6	2	0.3	7
PEM1F	Semi-permanently flooded persistent emergent	5	0.4	1	-	-	-	2	0.3	1	-	-	-	-	-	-
PABH	Aquatic bed pond	-	-	-	-	-	-	1	0.0	0	-	-	-	-	-	-
R3UBH	Upper perennial stream – unconsolidated bottom	2	0.2	0	3	0.5	32	7	1.4	5	9	1.2	43	1	0.4	12
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	-	-	-	2	0.2	13	-	-	-	-	-	-	-	-	-
Wetland			**56.2**			**1.6**			**26.3**			**2.9**			**3.5**	
Upland			**49.4**			**77.8**			**29.6**			**18.3**			**54.9**	

Note: NWI classifications for riverine habitat R5UBH and R5USC are presented as R3UBH and R3USA for consistency with ARRC wetland data (USFWS 2005, HDR 2007a). Regions are individual contiguous wetland areas as mapped by USFWS (2005).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-59
Wetlands within 200-foot ROW for the Donnelly Alternative Segments (HDR, 2007a).

NWI Code	Description	Donnelly Alternative Segment 1			Donnelly Alternative Segment 2		
		Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO1/EM1B	Saturated broadleaf deciduous forest with persistent emergent understory	-	-	-	2	0.1	0
PFO1/EM1C	Seasonally flooded broadleaf deciduous forest with persistent emergent understory	1	0.2	0	5	1.3	1
PFO4/SS4B	Saturated needleleaf evergreen forest with needleleaf scrub/shrub understory	15	46.4	13	9	36.3	14
PFO1/4B	Saturated broadleaf deciduous/needleleaf evergreen forest	-	-	-	2	0.1	0
PFO1/4C	Seasonally flooded broadleaf deciduous/needleleaf evergreen forest	1	0.4	0	-	-	-
PFO4/1B	Saturated needleleaf evergreen/broadleaf deciduous forest	-	-	-	8	10.6	4
PFO4/EM1B	Saturated needleleaf evergreen forest with persistent emergent understory	-	-	-	2	1.9	1
PFO4/EM1C	Seasonally flooded needleleaf evergreen forest with persistent emergent understory	1	1.2	0	6	1.9	1
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub understory	5	8.7	2	18	13.1	5
PFO4/SS1C	Seasonally flooded needleleaf evergreen forest with broadleaf scrub/shrub understory	-	-	-	1	1.7	1
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub understory	9	27.6	8	5	12.8	5
PFO4B	Saturated needleleaf evergreen forest	24	38.5	11	57	60.0	23
PFO4C	Seasonally flooded needleleaf evergreen forest	2	0.7	0	4	0.2	0
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	-	-	-	4	10.0	4
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent understory	9	2.6	1	20	5.5	2

Table E-59
Wetlands within 200-foot ROW for the Donnelly Alternative Segments (HDR, 2007a). (continued)

NWI Code	Description	Donnelly Alternative Segment 1			Donnelly Alternative Segment 2		
		Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PSS1/EM1F	Semi-permanently flooded broadleaf deciduous scrub/shrub with persistent emergent understory	-	-	-	6	1.0	0
PSS1/4B	Saturated broadleaf deciduous scrub-shrub\needleleaf evergreen scrub-shrub	-	-	-	2	6.1	2
PSS1/4C	Seasonally flooded broadleaf deciduous scrub-shrub\needleleaf evergreen scrub-shrub	-	-	-	4	2.7	1
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub	1	0.1	0	6	4.4	2
PSS1F	Semi-permanently flooded broadleaf deciduous scrub/shrub	1	0.5	0	-	-	-
PSS3/4B	Saturated broadleaf evergreen/needleleaf evergreen scrub/shrub	5	15.8	4	3	2.5	1
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	1	31.2	0	15	25.3	10
PSS4/1C	Seasonally flooded needleleaf evergreen/broadleaf deciduous scrub/shrub	-	-	-	3	3.2	1
PSS4/2B	Saturated needleleaf evergreen/needleleaf deciduous scrub/shrub	-	-	-	1	0.7	0
PSS4/3B	Saturated needleleaf evergreen/broadleaf evergreen scrub/shrub	18	100.9	28	12	27.1	11
PSS4/EM1B	Saturated needleleaf evergreen scrub/shrub with persistent emergent understory	-	-	-	1	0.1	0
PSS4/EM1C	Seasonally flooded needleleaf evergreen scrub/shrub with persistent emergent understory	8	2.9	1	1	0.0	0
PSS4B	Saturated needleleaf evergreen scrub/shrub	27	84.5	24	18	8.3	3
PSS4C	Seasonally flooded needleleaf evergreen scrub/shrub	-	-	-	1	0.3	0
PEM1B	Saturated persistent emergent	-	-	-	1	0.1	0
PEM1C	Seasonally flooded persistent emergent	6	1.9	1	13	2.2	1

Table E-59
Wetlands within 200-foot ROW for the Donnelly Alternative Segments (HDR, 2007a). (continued)

		Donnelly Alternative Segment 1			Donnelly Alternative Segment 2		
NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PEM1F	Semi-permanently flooded persistent emergent	2	0.2	0	8	1.9	1
PABH	Aquatic bed pond	1	0.2	0			
R3UBH	Upper perennial stream – unconsolidated bottom	9	2.4	1	8	2.9	1
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	23	13.9	4	9	12.5	5
U/R3USA	Mosaic of upland and temporarily flooded upper perennial stream – unconsolidated shore	4	5.0	1	-	-	-
Wetland			**356.1**			**257.0**	
Upland			**264.8**			**373.3**	

Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-60
Wetlands within the Donnelly Alternative Segment 1 and Donnelly Alternative Segment 2 Little Delta River and Delta Creek large bridge staging areas and gravel sites (USFWS, 2005).

		Donnelly Alternative Segment 1			Donnelly Alternative Segment 2		
NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO1A	Seasonally flooded broadleaf deciduous forest	1	2.1	5%	1	4.0	9%
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent understory	1	5.1	13%	1	1.7	4%
R3UBH	Upper perennial stream – unconsolidated bottom	2	14.2	34%	3	6.2	13%
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	5	19.5	48%	3	33.6	74%
Wetland			**40.9**			**45.5**	
Upland			**21.8**			**17.1**	

Note: NWI classifications for riverine habitat R5UBH and R5USC are presented as R3UBH and R3USA for consistency with ARRC wetland data (USFWS 2005, HDR 2007a). Regions are individual contiguous wetland areas as mapped by USFWS (2005).

Table E-61
Wetlands within 200-foot ROW for the South Common Segment (HDR 2007a).

NWI Code	Description	Regions (number)	Area (acres)	Wetland Proportion (percent)
PFO1/SS1B	Saturated broadleaf deciduous forest with broadleaf deciduous scrub/shrub under story	2	0.0	0
PFO4/SS4B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub understory	1	0.4	1
PFO1/4C	Seasonally flooded broadleaf deciduous/needleleaf evergreen forest	1	0.2	0
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub under story	4	5.0	9
PFO4B	Saturated needleleaf evergreen forest	7	5.7	10
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	2	0.9	2
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent under story	10	22.9	41
PSS1B	Saturated broadleaf deciduous scrub/shrub	1	5.9	11
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub	1	1.2	2
PSS1F	Semi-permanently flooded broadleaf deciduous scrub/shrub	1	1.8	3
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	2	3.8	7
PSS4/EM1C	Seasonally flooded needleleaf evergreen scrub/shrub with persistent emergent under story	5	1.2	2
PSS4B	Saturated needleleaf evergreen scrub/shrub	7	5.7	10
PEM1B	Saturated persistent emergent	2	0.0	0
PEM1C	Seasonally flooded persistent emergent	9	0.8	1
R3UBH	Upper perennial stream – unconsolidated bottom	4	0.3	1
Wetland			**55.8**	
Upland			**196.9**	

Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI

Table E-62
Wetlands within 200-foot ROW for the Delta Alternative Segments (HDR, 2007a).

		Delta Alternative Segment 1			Delta Alternative Segment 2		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportio n (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PFO4/SS4B	Saturated needleleaf evergreen forest with needleleaf scrub/shrub under story	4	3.6	5	-	-	-
PFO4/SS1B	Saturated needleleaf evergreen forest with broadleaf scrub/shrub under story	4	0.2	0	3	0.6	2
PFO4/SS3B	Saturated needleleaf evergreen forest with broadleaf evergreen scrub/shrub under story	2	7.5	11	-	-	-
PFO4B	Saturated needleleaf evergreen forest	1	0.3	0	-	-	-
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	4	0.7	1	2	1.0	3
PSS1/EM1C	Seasonally flooded broadleaf deciduous scrub/shrub with persistent emergent under story	-	-	-	8	2.5	7
PSS1/EM1F	Semi-permanently flooded broadleaf deciduous scrub/shrub with persistent emergent under story	-	-	-	2	2.1	6
PSS1/4B	Saturated broadleaf deciduous scrub-shrub\needleleaf evergreen scrub-shrub	4	0.4	1	-	-	-
PSS1B	Saturated broadleaf deciduous scrub/shrub	1	0.1	0	-	-	-
PSS1C	Seasonally flooded broadleaf deciduous scrub/shrub				2	0.7	2
PSS4/1B	Saturated needleleaf evergreen/broadleaf deciduous scrub/shrub	5	31.0	45	9	7.5	21
PSS4/1C	Seasonally flooded needleleaf evergreen/broadleaf deciduous scrub/shrub	-	-	-	4	4.5	13
PSS4/EM1C	Seasonally flooded needleleaf evergreen scrub/shrub with persistent emergent under story	20	0.7	1	11	0.7	2
PEM1C	Seasonally flooded persistent emergent	4	0.1	0	5	1.1	3
PEM1F	Semi-permanently flooded persistent emergent	1	0.0	0	1	0.0	0
R3UBH	Upper perennial stream – unconsolidated bottom	4	2.3	3	1	1.4	4
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	11	12.5	18	3	13.8	38
U/R3USA	Mosaic of upland and temporarily flooded upper perennial stream – unconsolidated shore	2	10.1	15	1	0.0	0
Wetland			**69.5**			**35.9**	
Upland			**208.8**			**241.1**	

Regions are individual contiguous wetland areas as mapped by HDR (2007a).
Legend: National Wetland Inventory=NWI, Right-of-Way=ROW

Table E-63
Wetlands within the Delta Alternative Segments 1 and Delta Alternative Segment 2 large bridge staging areas, river gravel areas, overpass staging areas, access roads, and passenger terminals (USFWS, 2005).

		Delta Alternative Segment 1			Delta Alternative Segment 2		
NWI Code	**Description**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**	**Regions (number)**	**Area (acres)**	**Wetland Proportion (percent)**
PFO1A	Seasonally flooded broadleaf deciduous forest	2	2.4	9			
PFO4/1B	Saturated needleleaf evergreen/broadleaf deciduous forest				1	3.6	13
PSS1/EM1B	Saturated broadleaf deciduous scrub/shrub with persistent emergent understory	1	1.1	5	1	0.6	2
R3UBH	Upper perennial stream – unconsolidated bottom				1	1.8	19
R3USA	Temporarily flooded upper perennial stream – unconsolidated shore	3	21.9	86	1	18.1	66
Wetland			**25.4**			**24.1**	
Upland			**15.2**			**18.7**	

Note: NWI classifications for riverine habitat R5UBH and R5USC are presented as R3UBH and R3USA for consistency with ARRC wetland data (USFWS 2005, HDR 2007a). Regions are individual contiguous wetland areas as mapped by USFWS (2005).
Legend: National Wetland Inventory=NWI

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Appendix F –
Biological Resources

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F. BIOLOGICAL RESOURCES

This appendix provides additional background information and analyses in support of the assessments presented in Chapter 5 of the Northern Rail Extension (NRE) Environmental Impact Statement. Background information includes supporting information, additional descriptions, technical data, and results of quantitative analyses summarized in Chapter 5. The format and order of this appendix follows the general order of Chapter 5, that is, Vegetation Resources (F.1), Fisheries Resources (F.2), Game Mammal Resources (F.3), and Bird Resources (F.4).

F.1 Vegetation Resources

Existing conditions for vegetation types were based on Gallant *et al.*, 1995; Magoun and Dean, 2000; Viereck *et al.*, 1992; and ANHP *et al.*, 2006. Quantification of vegetation and habitat types within the NRE project area are based on the Tanana Flats Earth Cover Classification (TFECC; BLM *et al.*, 2002) for an area within 5 miles of all proposed alternatives (Table F-1). Table F-2 lists vegetation communities by landscape positions and vegetation types for the Tanana Flats Earth Cover Classification.

Table F-1
Vegetation Cover Classes Within 5 Miles of the Proposed NRE[a]

Grid Code	Class Name	Area (acres)	Proportion of Area (%)[b]
1	Closed Needleleaf Forest	73,637	12
2	Open Needleleaf Forest	179,600	28
3	Closed Broadleaf Forest	52,464	8
4	Open Broadleaf Forest	29,131	5
5	Closed Mixed Broadleaf/Needleleaf Forest	89,310	14
6	Tall Shrub	15,364	3
7	Low Shrub	64,289	10
8	Dwarf Shrub	1,615	<1
9	Graminoid	10,580	2
10	Bryoid/Lichen	862	<1
14	Aquatic Bed	1,169	<1
15	Clear Water	9,778	2
16	Turbid Water	32,843	5
17	Ice	26	<1
19	Sparse Vegetation	2,438	<1
20	Gravel/Rock	3,323	1
21	Mud/Silt/Sand	19,564	3
22	Urban	8,843	1
23	Agriculture	20,086	3
24	Other	18,688	3
Total		**633,610**	

[a] Source: BLM *et al.*, 2002.
[b] < means less than.

No Federal or State of Alaska protected threatened, endangered, or candidate plants occur within the project area. Twenty-seven rare plants have been reported to occur within the Donnelly and Tanana Flats training areas near the NRE (Table F-3), and one rare willow, *Salix setchelliana*, was identified during field investigations for wetlands along Delta Alternative Segment 2 (HDR, 2007).

Table F-2
Vegetation Communities[a] for Tanana Flats Earth Cover Classifications[b]

TFECC	Landscape Position	Vegetation Type	Common Plants
Closed Needleleaf (canopy 60 to 100%)	Well-drained hillsides or young river terraces	Closed white spruce forest	White spruce (*Picea glauca*), willows (*Salix* spp.), prickly rose (*Rosa acicularis*), lowbush cranberry (*Vaccinium vitis-idaea*), bluebell (*Mertensia paniculata*), woodland horsetail (*Equisetum sylvaticum*), Canada dogwood (*Cornus canadensis*), feathermoss (*Hylocomium splendens*)
	Poorly-drained silts on floodplain terraces or north-facing slopes	Closed black spruce forest	Black spruce (*Picea mariana*), green alder (*Alnus crispa*), Labrador tea (*Ledum groenlandica*), lowbush cranberry, polar grass (*Arctagrostis latifolia*), feathermoss
	Poorly-drained silts on floodplain terraces	Closed black spruce-white spruce forest	Black spruce, white spruce, green alder, Labrador tea, lowbush cranberry, feathermoss
	Wet lowlands, shallow permafrost	Closed black spruce-tamarack forest	Black spruce, tamarack (*Larix laricina*), Labrador tea, lowbush cranberry, lichens and mosses
Open Needleleaf (canopy 25 to 60%)	Well-drained hillsides or young river terraces	Open white spruce forest	White spruce, Bebb's willow (*Salix bebbiana*), Canada dogwood, highbush cranberry (*Viburnum edule*), prickly rose, twinflower (*Linnaea borealis*), feathermosses (*Hylocomium splendens*, *Rhytidiadelphus loreus* and others), common horsetail (*Equisetum arvense*)
	Poorly-drained silts on floodplain terraces	Open black spruce forest	Black spruce, prickly rose, willows, green alder, Labrador tea, lowbush cranberry, crowberry (*Empetrum nigrum*), grasses, feathermosses, Sphagnum mosses (*Sphagnum* spp.)
	Wet lowlands, shallow permafrost	Open black spruce-tamarack forest	Black spruce, tamarack, shrub birch, Labrador tea, mosses
	Very poorly-drained lowlands, shallow permafrost scrub	Open dwarf black spruce forest	Black spruce, Labrador tea, tussock forming cottongrasses (*Eriophorum brachyantherum or Eriophorum vaginatum*), feathermosses, Sphagnum mosses
Closed Broadleaf (canopy 60 to 100%)	Floodplain terraces	Closed balsam poplar forest	Balsam poplar (*Populus balsamifera*), white spruce, prickly rose, bluejoint reedgrass (*Calamagrostis canadensis*), common horsetail
	Upland loess soils	Closed paper birch forest	Paper birch (*Betula papyrifera*), green alder, prickly rose, highbush cranberry, Canada dogwood, common horsetail, bluejoint reedgrass, Labrador tea, lowbush cranberry
	Well-drained slopes, upland slopes, south-facing	Closed quaking aspen forest	Quaking aspen (*Populus tremuloides*), prickly rose, twinflower, soapberry (*Shepherdia canadensis*), bearberry (*Arctostaphylos uva-ursi*)
	Well-drained slopes	Closed paper birch-quaking aspen forest	Paper birch, quaking aspen, white spruce, green alder, prickly rose, soapberry, lowbush cranberry, grasses, clubmosses (*Lycopodium* spp.)
	Well-drained slopes, floodplain terraces	Closed quaking aspen-balsam popular forest	Quaking aspen, balsam poplar, prickly rose

Table F-2
Vegetation Communitiesa for Tanana Flats Earth Cover Classifications[b] (cont'd)

TFECC	Landscape Position	Vegetation Type	Common Plants
Open Broadleaf (canopy 25 to 60%)	Upland loess soils	Open paper birch forest	Paper birch, green alder, Labrador tea, bluejoint reedgrass, leaf litter
	Well-drained slopes, upland slopes, commonly south-facing	Open quaking aspen forest	Quaking aspen, willows, bearberry, fireweed (*Epilobium* spp.), bluejoint reedgrass, lichens
	Floodplain terraces	Open balsam poplar forest	Balsam poplar, willows, alder, bluejoint reedgrass, horsetail (*Equisetum* spp.)
Closed Mixed (canopy 60 to 100%	Well-drained slopes, poorly drained slopes, floodplain terraces	Closed spruce-paper birch forest	white spruce, paper birch, green alder, Bebb's willow, prickly rose, bluejoint reedgrass, common horsetail lowbush cranberry, feather mosses
	Well-drained slopes, upland slopes	Closed Quaking aspen-spruce forest	Quaking aspen, white spruce, Canada dogwood
	Floodplain terraces	Closed balsam poplar-white spruce	Balsam poplar, white spruce, thinleaf alder (*Alnus tenuifolia*), prickly rose, lowbush cranberry, common horsetail
Tall Shrub (less than 1.3 meters tall)	Active and young floodplains, river bars, and after fires	Tall willow scrub	Alaska willow (*Salix alaxensis*), sandbar willow (*Salix interior*), grayleaf willow (*Salix glauca*), Bebb's willow, littletree willow (*Salix arbusculoides*), bluejoint, fireweed, horsetail
	Along rivers and after fires, Upland drainageways, seepages	Tall alder scrub	Thinleaf alder, green alder, bluejoint reedgrass
	Active and young floodplains, river bars	Tall alder-willow scrub	Thinleaf alder, green alder, Alaska willow, bebb willow, common horsetail, in wet areas with water sedge (*Carex aquatilis*), bluejoint, marsh fivefinger (*Potentilla palustris*), swamp horsetail (*Equisetum fluviatile*)
Low Shrub (0.25 to 1.3 meters tall)	Non-patterned wetlands with thick organic mat	Low mixed shrub-sedge tussock bog	Resin birch (*Betula gladulosa*), willows, tussock forming cottongrasses, bog blueberry (*Vaccinium uliginosum*), thinleaf Labrador tea, Sphagnum mosses
	Non-patterned wetlands with thick organic mat	Ericaceous scrub bog	Leatherleaf (*Chamaedaphne calyculata*), willows, water sedge (*Carex* spp.)
	Non-patterned wetlands with thick organic mat	Shrub birch-willow scrub	Resin birch, diamondleaf willow (*Salix pulchra*), grayleaf willow
Dwarf Shrub (less than 0.25 meter tall)	Non-patterned wetlands with thick organic mat	Low scrub	Labrador tea, bog blueberry, willows, feathermosses
Graminoid	Poorly drained silty lowlands to well-drained upland slopes	Bluejoint meadow	Bluejoint reedgrass, sedge (*Carex rostrata*), cinquefoil (*Potentilla* spp.), fireweed
	Lake and pond margins, sloughs, silty or organic soils	Subarctic lowland sedge wet meadow	Water sedge (*Carex aquatilis*, *Carex rostrata),* narrow-leaf cottongrass (*Eriophorum angustifolium*), marsh fivefinger, swamp horsetail

Table F-2
Vegetation Communitiesa for Tanana Flats Earth Cover Classifications[b] (cont'd)

TFECC	Landscape Position	Vegetation Type	Common Plants
Sparse Vegetation	River bars (dry to mesic)	Seral herbs	Yellow dryas (*Dryas drummondii*), river beauty (*Epilobium latifolium*), fireweed (*Epilobium angustifolium*)
Aquatic Bed	Sloughs, oxbow lakes, lake margins, silty or organic soils, fens	Fresh herb marsh	Buckbean (*Menyanthes trifoliate*), swamp horsetail, water smartweed (*Polygonum amphibium*)
	Shallow Lakes and ponds	Aquatic bed	Yellow pondlilly (*Nuphar polysepalum*), pondweed (*Potamogeton* spp.), water milfoil (*Myriophyllum spicatum*)

[a] Sources: Viereck *et al.*, 1992; Jorgenson *et al.*, 1999, 2001; HDR, 2007.
[b] Source: TFECC; BLM *et al.*, 2002.

Table F-3
Rare Plants Reported Near and Within the NRE Project Area

Species[a] (Synonym[b])	Common Name/ Habitat[b]	Global Status[a,c]	State Status[a,c]	Donnelly Training Area[d,e]	Tanana Flats Training Area[e,f]	NRE Project Area[g]
Apocynum androsaemifolium	Dogbane / Woods, hot springs	G5	S2S3		√	
Artemisia laciniata	Siberian Wormwood / Open forests	G4?	S2	√	√	
Carex crawfordii	Crawford's Sedge / Dry grasslands, roadsides	G5	S3	√	√	
Carex deweyana	Dewey Sedge / Probably introduced	G5	S2?	√		
Carex eburnea	Bristleleaf sedge / Dry sand, rocky places	G5	S3	√		
Carex sychnocephala	Manyhead Sedge / Meadows, grassy slopes	G4	S1	√		
Ceratophyllum demersum	Hornwort / Quiet water	G5	S1		√	
Cicuta bulbifera	Water Hemlock / Marshes, bogs	G5	S2		√	
Cryptogramma stelleri	Fragile Rockbrake / Rock crevices	G5	S2S3	√	√	
Draba incerta	Yellowstone Draba / Rocky slopes	G5	S2S3	√		
Festuca lenensis (Festuca ovina)	Tundra Fescue / Alpine slopes	G4G5	S3		√	
Glyceria pulchella	MacKenzie Valley Mannagrass / Wet places	G5	S2S3	√	√	
Lycopus uniflorus	Northern Bugleweed / Wet places	G5	S3		√	
Minuartia yukonensis	Yukon Stitchwort / Dry places, scree slopes	G4?	S3		√	
Myriophyllum verticillatum	Water Milfoil / Shallow water	G5	S3		√	
Oxytropis tananensis (Oxytropis campestris)	Field Locoweed / Dry, sandy places	G2G3Q	S2S3		√	
Pedicularis macrodonta	Muskeg Lousewort / Swamps, muskeg	G4Q	S3		√	
Phlox hoodii	Carpet Phlox / Dry mountain slopes	G5	S1S2	√		
Phlox richardsonii ssp. *Richardsonii (Phlox siberica)*	Richardson's Phlox / Dry mountain slopes	G4T2T3 Q	S2?	√		

Table F-3
Rare Plants Reported Near and Within the NRE Project Area (cont'd)

Species[a] (Synonym[b])	Common Name/ Habitat[b]	Global Status[a,c]	State Status[a,c]	Donnelly Training Area[d,e]	Tanana Flats Training Area[e,f]	NRE Project Area[g]
Potamogeton obtusifolius	Bluntleaf Pondweed / Water	G5	S2S3	√		
Rorippa curvisiliqua	Yellowcress / Wet places	G5	S1		√	
Rosa woodsii var. *woodsii*	Woods' Rose / Dry slopes	G5T5	S1S2		√	
Salix setchelliana	Setchell's Willow / Gravel bars, shores	G4	S3	√		√
Saxifraga adscendens ssp. *oregonensis*	Small Saxifrage / Rock crevices, sandy places	G5T4T5	S2S3	√		
Sisyrinchium montanum	Blue-eyed Grass / Moist places	G5	S1	√		
Stellaria alaskana	Alaska Starwort / Stony slopes	G3	S3	√		
Viola selkirkii	Selkirk's violet / Woods	G5?	S3	√		

[a] Source: Lipkin, 2007.
[b] Source: Hultén, 1968.
[c] Global and State Ranks: G = Global, S = State, Q = Taxonomically questionable, T = Rank of species and rank of described variety or subspecies, ? = Inexact, 1 = Critically imperiled, 2 = Imperiled, 3 = Rare or uncommon, 4 = Apparently secure, but with cause for long-term concern, 5 = Demonstrably secure.
[d] Source: Racine *et al.*, 2001.
[e] Occurrence = √.
[f] Source: Tande *et al.*, 1996.
[g] Source: HDR, 2007.

F.1.1 Noxious Weeds

Prohibited and restricted noxious weeds are regulated by the State of Alaska. Federally designated noxious weeds are regulated by the U.S. Department of Agriculture, Animal and Plant Health Inspection Service. No federally designated noxious weeds are known to occur in Alaska. Noxious weeds are generally introduced through contaminated seed sources, equipment, vehicles, materials and supplies used in revegetation and they are typically spread by construction vehicles, water, and wind. Noxious weeds could also be introduced to the NRE during operation of the rail line through spills of contaminated grain or animal feeds (hay, pellets). The State of Alaska regulates 12 prohibited weed species and nine restricted weed species (Table F-4). Of these listed weeds, three prohibited weeds and eight restricted weeds have been reported within the NRE project area (ANHP *et al.*, 2006). Comprehensive surveys for invasive plants have not been completed for all alternatives. Data presented include surveys compiled by the Alaska Natural Heritage Program primarily for transportation corridors and municipalities (ANHP *et al.*, 2006). The highest concentrations of invasive plants within the project area are found in the more highly disturbed areas of North Pole and Delta Junction, although noxious weeds occur throughout the Richardson Highway alignment. Alternative segments near these source areas would have a greater probability of contributing to the spread of invasive plants.

Table F-4
Occurrence of Prohibited and Restricted Noxious Weeds Within the Project Area

Common Name	Species	Occurrence
Prohibited Noxious Weeds		
Quackgrass	*Agropyron repens*	No occurrence
Whitetops and its varieties	*Cardaria drabe, C. pubescens, Lepidium latifolium*	No occurrence
Knapweed, Russian	*Centaurea repens*	No occurrence
Thistle, Canada	*Cirsium arvense*	No occurrence
Field Bindweed	*Convolvulus arvensis*	2 sites
Spurge, leafy	*Euphorbia esula*	No occurrence
Galensoga	*Galensoga parviflora*	No occurrence
Hempnettle	*Galeopsis tetrahit*	8 sites
Lettuce, blue-flowering	*Lactuca puichella*	No occurrence
Fieldcress, Austrian	*Rorippa austriaca*	No occurrence
Horsenettle	*Solanum carolinense*	No occurrence
Sowthistle, Perennial	*Sonchus arvensis*	29 sites
Restricted Noxious Weeds		
Oats, Wild	*Avena fatua*	No occurrence
Mustard	*Brassica kaber, juncea*	No occurrence
Blue Burr	*Lappula echinatat*	No occurrence
Toadflax, Yellow	*Linaria vulgaris*	8 sites
Plantain, Buckhorn	*Plantago* sp	34 sites
Annual Bluegrass	*Poa annua*	5 sites
Wild Buckwheat	*Polygonum convovulus*	4 sites
Radish	*Raphanus raphanistrum*	No occurrence
Vetch, Tufted	*Vicia cracca*	32 sites

[a] Source: ANHP *et al.*, 2006.

F.1.2 Alaska Railroad Corporation Vegetation Management

The Alaska Railroad Corporation (ARRC) manages vegetation on railbeds and facilities to:

- Eliminate plants and roots that impede drainage, or obstruct or interfere with train movement;
- Allow track inspectors to visually inspect ties, track, and fasteners;
- Maintain sight lines at crossings, and visibility of track flags, mileposts, and other signage;
- Remove potential fuels that can cause wildland fires;
- Maintain safe walking areas; and
- Prevent spread of invasive and noxious weeds (ARRC, 2006a; 2006b).

ARRC has used mechanical and other non-chemical methods of vegetation management since 1983. Permission to use herbicides has been intermittently requested by ARRC to assist in management of vegetation, but issuance of a permit has been consistently denied under 18 Alaska Administrative Code 90.505 by the Alaska Department of Environmental Conservation (ADEC, 2007). Alternative vegetation management techniques used by ARRC have included: inmate hand clearing, hydro-ax brush cutting, modified ballast regulator, reballasting, hot water/steam, weed burning and infrared burning treatments, and have been largely ineffective at controlling vegetation within the track ballast section (Kemenosh, 1999). ARRC uses manual and mechanical vegetation control including brush-cutting the right-of-way (ROW) and manual and mechanical ballast clearing (Burnham *et al.*, 2003). The Federal Railroad Administration has cited ARRC under the Railroad Safety Statutes Title 49 Code of Federal Regulations, Part 213, Section 37, annually for failing to control vegetation (Kemenosh, 1999).

Plants that tend to dominate the railbed are common within the project area and are difficult to remove, including tree saplings (balsam poplar, birch, aspen); shrubs (alder, willow, raspberry [*Rubus idaeus*]); herbaceous plants (fireweed, bluejoint reedgrass, horsetail, yarrow [*Achillea borealis*]); and introduced weeds (dandelion [*Taraxacum officinale*], white sweetclover [*Melilotus alba*], red clover [*Trifolium pretense*]) (Table F-4; Kemenosh, 1999; Lapina *et al.*, 2007).

Mechanical removal of vegetation results in ground disturbance, which promotes erosion. Use of heavy equipment for spot-control of vegetation may result in removal of more vegetation than is necessary. Vegetation removal by hand-clearing would result in some soil disturbance if weeds are pulled. Use of chain saws or other hand-held power tools would reduce soil disturbance but the chance of small fuel spills would be increased. Removing excess vegetation by burning would increase the risk of fire spreading beyond the vegetation management target area and potentially result in the unintentional destruction of forest resources (ARRC, 1984).

F.1.3 Fire Management and Wildland Fire History

The NRE crosses four levels of fire protection—Limited, Modified, Full, and Critical—under the Alaska Fire Services 2007 fire management options (Table F-5; BLM AFS, 2007a). Of the area crossed by the alternatives, 58 percent falls within the full protection classification, followed by limited protection (17 percent), critical protection (11 percent), unplanned protection (10 percent), and modified protection (4 percent). Portions of the Eielson alternative segments cross military lands that are under the jurisdiction of Eielson Air Force Base (AFB); these areas are identified as unplanned for wildland fire protection by the Alaska Fire Service (BLM AFS, 2007a). Table F-5 lists fire protection classes for each alternative segment.

Table F-5
Fire Protection Classes for NRE Alternative Segments[a]

	Fire Management Options 2007					
Segment	**Critical (miles)**	**Full (miles**	**Modified (miles)**	**Limited (miles)**	**Unplanned (miles)**	**Total Length (miles)**
North Common	-	2.6	-	-	-	2.6
Eielson 1	-	6.2	-	-	4.1	10.3
Eielson 2	1.9	3.3	-	-	4.8	10.0
Eielson 3	1.9	0.8	-	-	7.4	10.1
Salcha 1	-	1.5	-	10.3	-	11.8
Salcha 2	1.0	12.1	-	0.7	-	13.8
Central 1	-	3.4	-	1.7	-	5.1
Central 2	-	0.2	-	3.5	-	3.7
Connector A	-	-	-	4.4	-	4.4
Connector B	-	-	-	3.3	-	3.3
Connector C	-	-	-	2.3	-	2.3
Connector D	-	-	-	0.9	-	0.9
Connector E	-	2.4	-	-	-	2.4
Donnelly 1	-	17.8	6.2	1.6	-	25.6
Donnelly 2	-	26.1	-	-	-	26.1
South Common	-	10.5	-	-	-	10.5
Delta 1	2.4	9.1	-	-	-	11.5
Delta 2	10.4	1.2	-	-	-	11.6
Total Length (miles)	**17.6**	**97.2**	**6.2**	**28.7**	**16.3**	**166.0**

[a] Source: BLM AFS, 2007a.

Definitions of fire protection levels, as defined by Todd and Jewkes, (2006) are:

- Critical – Areas where human life and settlements are at risk. These areas receive the highest priority and aggressive suppression efforts.
- Full – Areas that are uninhabited but contain valuable resources. These areas receive suppression priority second only to critically designated areas.
- Modified – Fires are suppressed during the peak fire season, but later are converted to a limited management option.
- Limited – Areas where fires are generally allowed to burn and only monitored. However, adjacent lands are considered so that a fire does not burn into a higher priority option.

Of the 166 miles of alternative segments, 13 miles, or 8 percent, have been burned by fires greater than 100 acres (1988 through 2006) or greater than 1,000 acres (1950 through 1987) since 1949 (Table F-6). The largest and most recent burn area (4.2 miles of South Common Segment burned in 1998) caused forested habitats to be replaced by primarily herbaceous and low shrub habitats. Interruption of wildland fires by the railbed and adjacent roadbed on the west side of the Tanana River in areas designated as limited protection would alter the natural pattern of wildland fire-generated succession and would potentially lead to increased fuel and increased risk for intense wildland fire in the area of Salcha Alternative Segment 1, and Central and Central Connector alternative segments where fire management is limited. A fuel break along the Tanana River Valley could also be beneficial in the protection of late-succession riparian forests and private property.

Table F-6
Post-1949 Fire History for NRE Alternative Segments[a]

Segment	Unburned Length (miles)	Burned Length (miles)	Fire Year	Total Length (miles)
North Common	2.6	-		2.6
Eielson 1	9.5	0.8	1950	10.3
Eielson 2	9.6	0.4	1950	10.0
Eielson 3	10.1	-		10.1
Salcha 1	8.1	3.6	1957	11.7
Salcha 2	13.8	-		13.8
Central 1	4.5	0.6	1981	5.1
Central 2	3.6	-		3.6
Connector A	3.4	1.0	1981	4.4
Connector B	3.3	-		3.3
Connector C	1.3	1.0	1981	2.3
Connector D	0.9	-		0.9
Connector E	2.4	-		2.4
Donnelly 1	25.7	-		25.7
Donnelly 2	26.1	-		26.1
South Common	6.3	4.2	1998	10.5
Delta 1	11.5	-		11.5
Delta 2	9.6	1.9	1971	11.5
Total Length (miles)	**152.3**	**13.5**		**165.8**

[a] Source: BLM AFS, 2007b.

F.2 Fisheries Resources

Analysis of affects to fisheries from the construction and operation of the proposed alternative segments were evaluated based on habitat use, habitat requirement, and seasonal movement of fish within the project area. Habitat analysis was based on analysis of stream crossings presented in Chapter 4, anadromous fish stream data, and fish occurrence and habitat data provided by the ADF&G (ADF&G, 2005a) and collected at or near proposed crossing sites during 2005 to 2007 (Noel, 2007b).

F.2.1 Recreational Fisheries

Recreational fisheries in the project area are managed by the Alaska Department of Fish and Game (ADF&G) Sport Fish Division; which divides the drainage into two management areas; the Lower Tanana Management Area or Fairbanks Management Area and the Upper Tanana Management Area or Delta Management Area. The Lower Tanana Management Area consists of the Tanana River and its tributaries downstream of the Fairbanks North Star Borough boundary. Waters in this area crossed by the project include Piledriver Slough, Twentythreemile Slough, the Tanana River, the Little Salcha River, the Salcha River, the Fivemile Clearwater River, Kiana Creek, Delta Creek, tributaries of the Richardson Clearwater River, and the Little Delta River. The Upper Tanana River Management Area consists of the Tanana River and its tributaries upstream of the Fairbanks North Star Borough boundary. Waters in this area crossed by the project include Delta Creek, the Delta River and Jarvis Creek (ADF&G, 2008a).

The Richardson Highway, secondary roads from North Pole to Delta Junction, navigable waters, and overland trail systems provide access to fisheries resources within the project area. Angling opportunity is available year-round. In summer, fishing occurs in all waters where game fish are present; however, most anglers concentrate on lakes, sloughs and clearwater tributaries of the mainstem Tanana River (ADF&G, 2007b; ADF&G, 2008a). During winter months, fishing occurs through the ice primarily on stocked lakes, although some fishing occurs on the Tanana River for burbot and northern pike (ADF&G, 2008a). In the project area most fishing effort and harvest has focused on the Salcha River, where arctic grayling and Chinook salmon dominated the harvest (Figure F-1). Many people practice catch-and-release fishing, especially for Chinook salmon, arctic grayling, and rainbow trout. Catch estimates could be as much as ten times higher than harvest estimates for these species in this region (Brase, 2008).

F.2.2 Commercial and Subsistence/Personal Use Fisheries

Commercial, subsistence and personal use fisheries are managed by the ADF&G Division of Commercial Fisheries. The project area lies in ADF&G's Commercial Fisheries Yukon Management Area. There are three commercially harvested salmon within the project area, which also support sport and subsistence/personal use fish harvest: Chinook (king) salmon, coho (silver) salmon and chum (dog) salmon. No commercial or federally regulated subsistence fishing occurs in the project area. The primary management concern for these salmon in the Tanana River drainage is maintenance of adequate returns of spawning adults to meet subsistence needs and provide for commercial and personal use fisheries.

All salmonids in the Tanana River are considered to be Yukon River stocks because the Tanana River is a major tributary of the Yukon River. Chinook salmon arrive in the Tanana River as far as Fairbanks and areas upstream in early July, and are known to spawn in the Salcha River (Table F-7; Eiler *et al.*, 2004). Chinook salmon from the Tanana River drainages comprise about 20 percent of the Yukon River Chinook salmon run (Eiler *et al.*, 2004). This run is one of the most productive Alaskan fisheries, and is an important commercial and subsistence resource for both Alaska and Western Canada (Eiler *et al.*, 2004; Woodby *et al.*, 2005). In the project area Chinook salmon spawn and rear in the Salcha River and occur in the Fivemile Clearwater River (Figure F-2; Johnson and Weiss, 2007).

Table F-7
Run Timing for Salmon that Move Through and/or Spawn in the Project Area[a,b]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook salmon							■	■				
Coho salmon									▒	■	■	
Chum salmon							■	▒	▒	▒	■	

[a] Source: ADF&G, 2008b.
[b] Shading indicates run timing; darkest shading indicates peak availability.

Coho or silver salmon spawn in clear water tributaries of the Tanana River including: the Fivemile Clearwater River, Kiana Creek, and unnamed tributaries to the Richardson Clearwater River (Figure F-2; Johnson and Weiss, 2007) during September through November (Table F-7). In addition to its importance as a commercial and subsistence resource, coho salmon is a popular sport fish. The Delta Clearwater River near Delta Junction is a popular sport fishing spot (Delta Junction CoC, 2008).

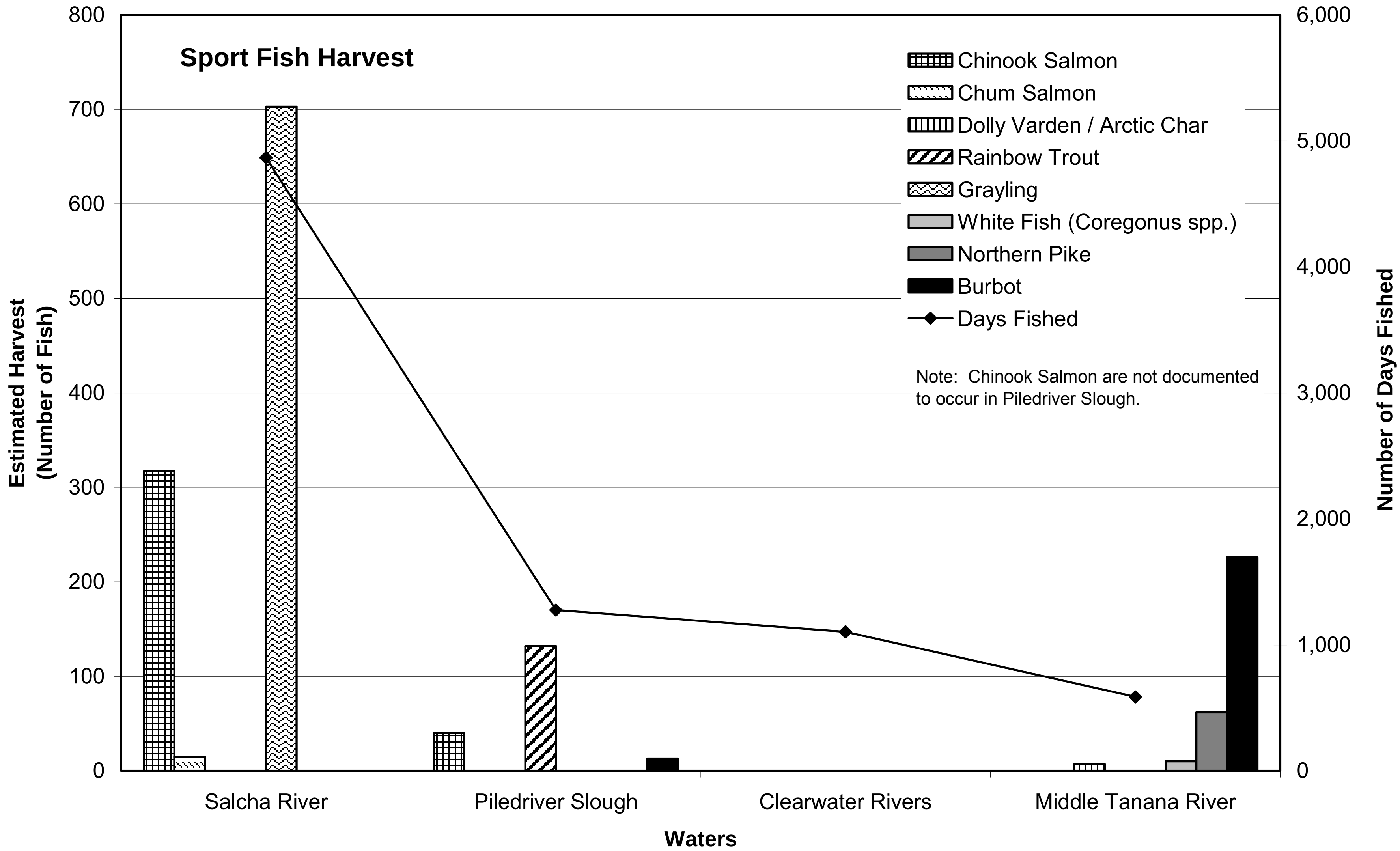

Figure F-1
Sport Fish Harvest and Angler Effort during 2006 for Waters in the Project Area Based on Angler Surveys (ADF&G, 2008a)

The summer run of chum salmon first arrives in the Fairbanks area in early July. The summer run of chum salmon generally uses north bank tributaries of the Tanana River such as Piledriver Slough, Moose Creek, Twentythreemile Slough, the Little Salcha River, and the Salcha River (Figure F-2). The fall run arrives during October through November (Table F-7) and generally uses the south bank tributaries such as the Richardson Clearwater River and the Delta River (Figure F-2). The Tanana River produces 30 percent of the Yukon fall chum salmon, an important resource to the people of the entire Yukon River. Many fall spawning chum salmon use the mainstem Tanana River as described by Barton (1992) and illustrated by recent telemetry data (Driscoll, 2008). Alaskan commercial, subsistence, personal use and sport harvests of Yukon River stocks of Chinook, coho and chum salmon during 1970 to 2007 are illustrated in Figure F-3.

Species commonly fished in this area, and their habitats and ecology, are listed in Table F-8.

F.2.3 Aquatic Animals of Conservation Concern

Aquatic animals that are of conservation concern are listed in the Alaska Comprehensive Wildlife Conservation Strategy (ADF&G, 2006). Five fish of conservation concern may occur in the project area, as well as one amphibian, one insect that has an aquatic larval stage, and one mollusk (Table F-9).

The Alaska blackfish is typically found in densely vegetated lowland swamps and ponds, and occasionally in larger rivers and lakes (Mecklenburg *et al.*, 2002; ADF&G, 2006). Alaska blackfish are relatively small (less than 8 inches) bottom-dwelling fish that primarily hunt small invertebrates. They spawn from May to August and the eggs adhere to vegetation, hatching within two weeks. Newly hatched larvae live off the yolk sac for about 10 days before beginning to feed and grow relatively quickly, reaching an average of 7 inches by age 4 in the interior (ADF&G, 2006). Alaska blackfish have a modified esophagus capable of gas absorption which allows them to live in small stagnant muskeg pools in which they can survive in damp mosses during dry periods. Alaska blackfish are found in densely vegetated lowland areas of the Tanana River Basin and may be locally abundant. Alaska blackfish may be used as a winter subsistence resource, although there are few data on the effect of take or population trends (ADF&G, 2006).

The Alaskan brook lamprey is a non-parasitic lamprey that lives in streams and lakes in the Tanana River Basin. The juvenile stage, or ammocoetes, burrows into sediment of pools and muddy backwaters where they feed on microorganisms, algae and other detritus. After 2 to 3 years, ammocoetes transform into adults (about 5 to 7 inches long) during the fall, and migrate downstream. Adults overwinter in lakes and sluggish pools of larger streams, and return to upstream spawning areas in spring and early summer. The adults die soon after spawning (Mecklenburg *et al.*, 2002). Abundance and trends for this lamprey are unknown, but they are considered to be rare. Populations occur in the Chena and Chatanika rivers and may occur farther upstream in the Tanana River Basin within the project area.

The Arctic lamprey is an anadromous lamprey that spends 3 to 7 years in fresh water and 1 to 4 years at sea (ADF&G, 2006). This lamprey spawns in the spring, digging redds in the gravel riffles and runs of cool, clear headwater streams. Eggs hatch 1 to 2 weeks later into ammocoetes, which burrow into mud, sand, or silt in streams or lakes where they feed on microorganisms, algae, and other detritus and grow to up to 4 inches in length (ADF&G, 2006; Mecklenburg *et al.*, 2002). After 3 to 7 years they develop adult features and migrate to the sea where they spend 4 to 7 years living parasitically on other fish or marine mammals before returning to freshwater

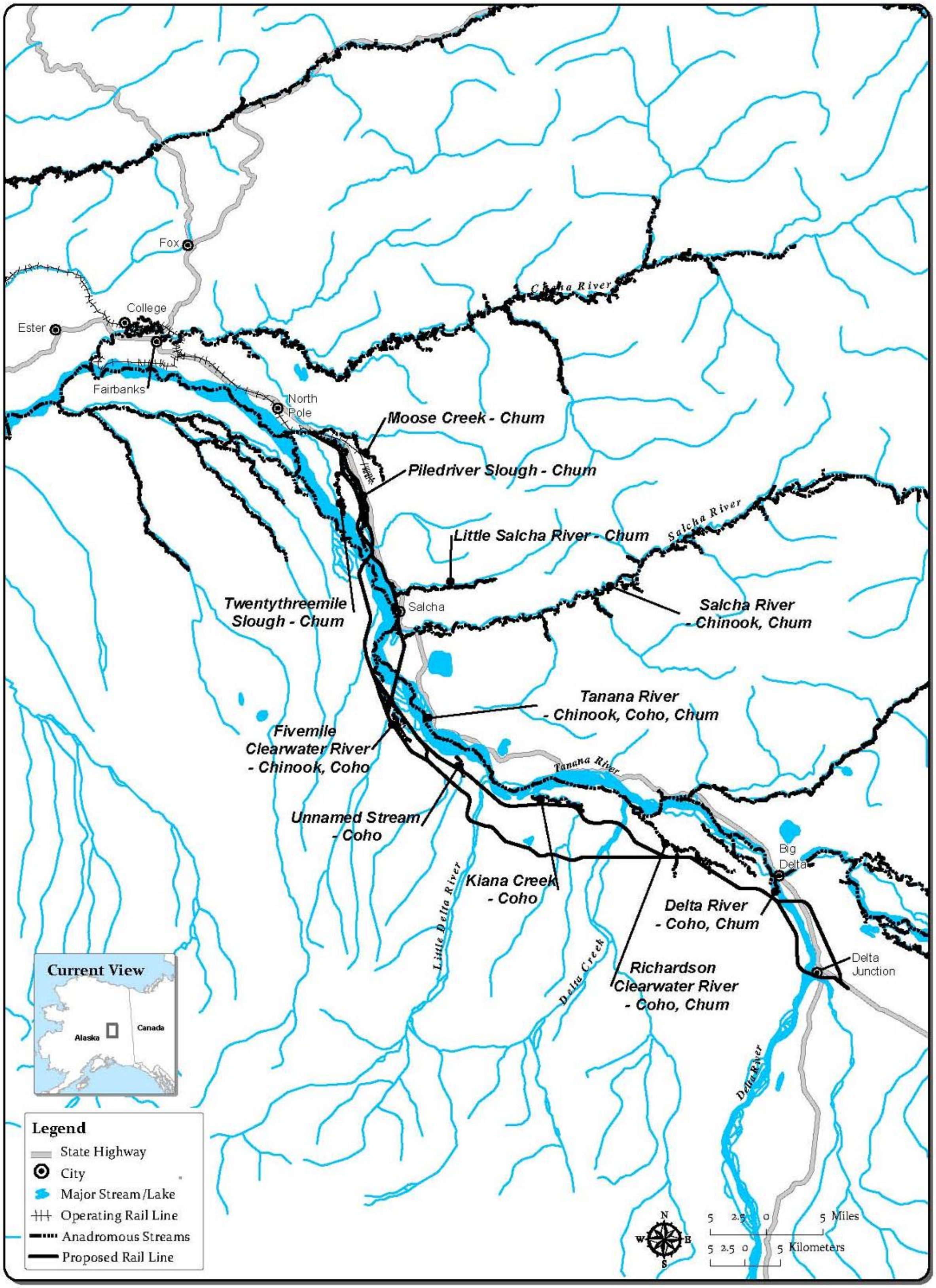

Figure F-2
Waters Documented as Important for Chinook, Coho, and Chum Salmon Under Alaska Statute 16.15.871(a) in the Project Area (Johnson and Weiss, 2007)

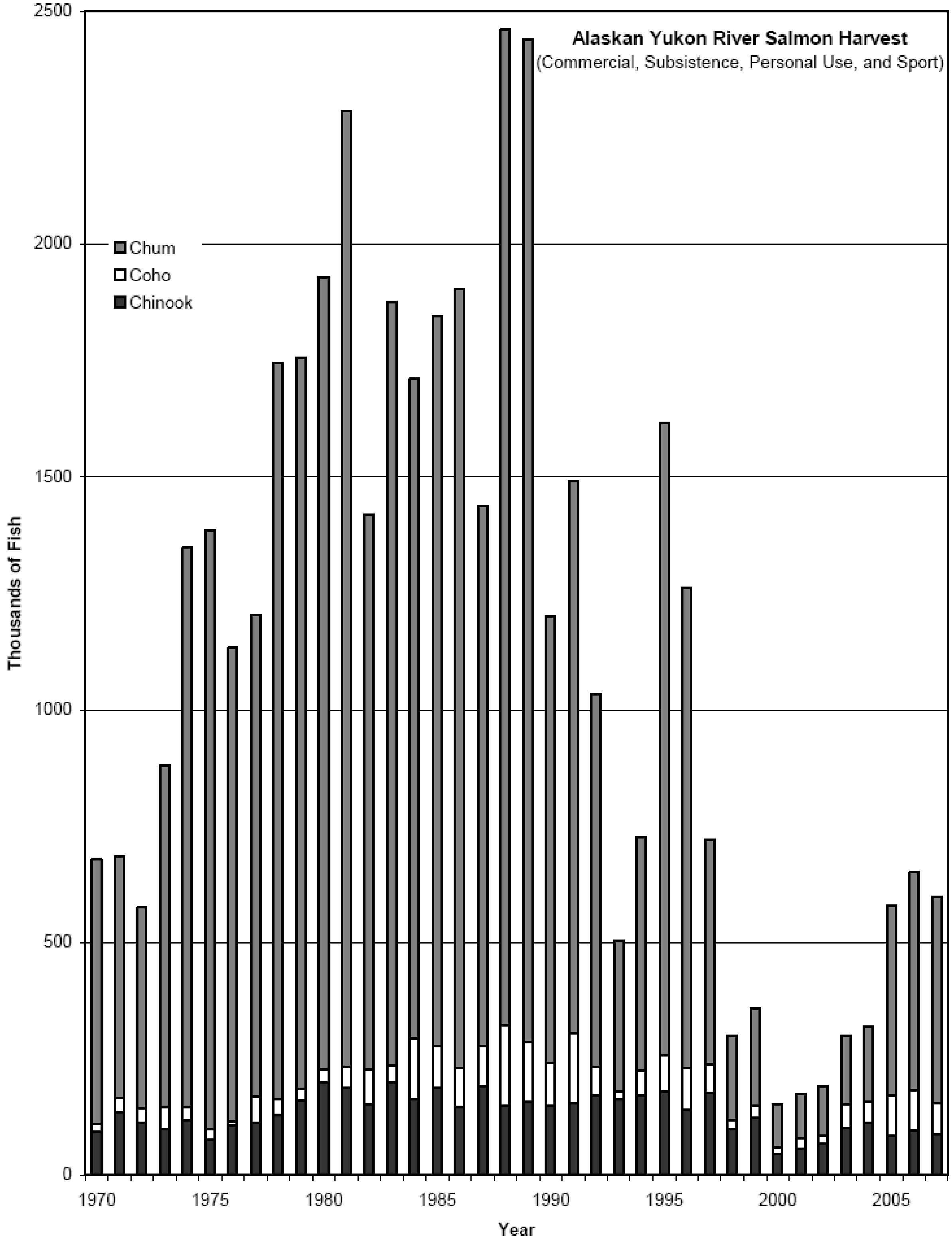

Figure F-3
Alaskan Harvest of Yukon River Chinook, Coho and Chum Salmon, 1970 to 2007 (JTC, 2008)

Table F-8
Habitat and Ecology of Important Commercial, Recreational and Subsistence/Personal Use Fish[a]

Common Name	Spawning Habitats/Rearing Habitats	Overwinter Habitats	Ecology
Burbot	Spawn under the ice in late winter in Tanana River. Young burbot feed on insects and other invertebrates, larger subadults and adults feed on fish.	Deep areas of rivers and lakes, uses Tanana River throughout their life history.	Nocturnal, long-lived and slow-growing, sexual maturity at 8 years, 18 inches. Extensive movements and interchange within the Tanana drainage, may colonize smaller lakes and gravel pits when the river overflows.
Chinook Salmon	Spawn in fast deep water over gravelly or rocky bottoms of non-glacial tributaries of glacial rivers where they can dig redds; fry and juveniles use sloughs, backwaters, tributaries, braids, channel edges, terraces and off-channel habitat, brush piles, beaver houses, shallows along gravel bars.	Overwinter as eggs or juveniles.	Juveniles smolt and outmigrate in the spring following hatching, and outmigration appears to occur soon after breakup peaking in mid to late May. Extensive movement within the river system in the first year of life, adults return to spawn after 4 to 5 years marine residence.
Chum Salmon	Spawn in small side channels, and areas of larger rivers with upwelling springs; fry emerge from the gravel in the spring and immediately outmigrate downriver, feeding on small insects and other detritus.	Overwinter as eggs.	Fry emerge from the gravel in early to mid April with peak outmigration occurring before the end of May. Adults return to spawn after 3 to 5 years marine residence.
Coho Salmon	Spawn in gravel areas of clearwater habitats-usually spring-fed; juveniles use ponds, lakes and pools in streams and rivers or stream margins, usually amongst submerged woody debris and in scour pools.	Juveniles overwinter near springs and in spring-fed streams, areas with upwelling are important for both egg and fry survival.	Spend 1 to 3 years in streams and may spend up to five winters in lakes before migrating to the sea, adults return after 18 months marine residence.
Dolly Varden	Spawn from mid-August to November in streams with gravel, may use braided reaches of glacial rivers; juveniles rear in streams remaining under rocks, logs or undercut banks feeding from the stream bottom.	Overwinter in lakes and large rivers, often found in shallow water and near areas of upwelling.	Anadromous and freshwater populations. Eggs hatch in March and fry emerge as late as June, maturity at 5 to 9 years, with three to four summers marine residence, about 16 to 24 inches.
Arctic Grayling	Cool, clear small headwater streams with gravelly substrate, may travel up to 100 miles, move little during the summer feeding season; feed on drifting aquatic insects, salmon eggs, outmigrating salmon smolts and terrestrial insects; juveniles and subadults move between overwintering grounds in the main Tanana and feeding grounds in the clearwater tributaries.	Overwinter in lakes, in the lower reaches and deeper pools of medium-sized rivers such as the Chena or in the main channel of the Tanana.	Highly migratory within a river system using different streams for spawning, juvenile rearing, summer feeding, and overwintering. May travel up to 100 miles to spawning streams, after breakup, migrating to summer feeding areas and spawning grounds. Spawn at about age 4 or 5, 11 to 12 inches long and generally return to the same spawning and feeding areas each year.

Table F-8
Habitat and Ecology of Important Commercial, Recreational and Subsistence/Personal Use Fish[a] (cont'd)

Common Name	Spawning Habitats/Rearing Habitats	Overwinter Habitats	Ecology
Humpback Whitefish	Gravel bottom upper reaches of river systems, braided reaches, of mainstem glacial reaches. Summer feeding areas seem to consist mainly of lakes and sloughs. Their diet consists mainly of clams, snails, crustaceans, insects and larvae.	Move downstream from spawning sites to overwinter but overwintering sites are unknown.	Some populations are anadromous. First spawning is at 4 or 5 years of age, upstream movement of spawning fish occurs at the end of the summer feeding period (August through September) and downstream movement probably occurs October through November.
Lake Trout	Shallow rocky shoals, clean, rocky lake bottom; feed on phytoplankton.	Overwinter in deep lakes.	Deep, oligotrophic mountain lakes, rarely found at the lower elevations of the Tanana River drainage, maturity and spawn for the first time at approximately 7 or 8 years of age and after that, spawn every other year or even less frequently, live to about 20 years of age but can live up to 40 years.
Least Cisco	Clear streams with gravel bottoms, sand and gravel substrate, such as braided reaches of mainstem glacial rivers; feed on plankton with river dwelling populations also feeding on terrestrial and aquatic insects.	Move downriver from spawning areas to overwinter but overwintering sites are largely unknown.	Migrate upstream in the fall to spawn. Found in a wide variety of habitats in freshwater: lakes, sloughs, large river and shallow tributary streams. Upstream migration shortly after breakup, moving into lakes and sloughs to feed. In late summer (August) the mature fish move further upstream and spawn.
Longnose Sucker	Spawn in lakes, ponds or they may travel to streams with gravel bottoms and cold water; juveniles prefer shallow silty backwaters, forms dense schools along the margins of lakes, sloughs, rivers, etc in early summer.	October they leave the spawning grounds and move downstream to deeper water or lakes to overwinter, overwinter in deep holes in the river or in lakes.	Spawn between May and July, often found in sloughs and backwaters where they move slowly along the bottom in search of invertebrates.
Northern Pike	Spawn in marshy, grassy banks with no little or no current; young pike emerge and begin to feed on insects and small crustaceans, quickly beginning to feed on smaller fish.	Believed to overwinter in the deep slow waters of larger rivers and in deeper lakes.	Not believed to travel long distances. Found in large and small lakes and in many sloughs and tributaries of the Tanana River, found in areas with high water clarity and cover; sight predators.
Inconnu	This species doesn't spawn or rear within the project area.	Overwinter in the lakes and deep rivers of the Minto Flats.	Do not normally ascend the Tanana much beyond Fairbanks.

[a] Sources: ADF&G, 2007a; ADF&G, 2007b; ADF&G, 2008c; Mecklenburg *et al.*, 2002.

Table F-9
Aquatic Animals of Conservation Concern Potentially Occurring in the Project Area[a]

Common Name	Species	Conservation Rank[b] Global	State
Fish			
Alaska Blackfish	*Dallia pectoralis*	G5	S5
Alaskan Brook Lamprey	*Lampetra alaskense*	G3	S3
Arctic Lamprey	*Lampetra japonica*	G4	S4
Broad Whitefish	*Coregonus nasus*	G5	S4S5
Trout Perch	*Percopsis omiscomaycus*	G5	S3
Amphibians			
Wood Frog	*Rana sylvatica*	G5	S3S4
Insects			
Treeline Emerald	*Somatochlora sahlbergi*	G4	S3S4
Molluscs			
Yukon Floater	*Anodonta beringiana*	G4	S3S4

[a] Source: ADF&G, 2006.
[b] G5 = Globally secure, G5 = Globally secure, G4 = Globally apparently secure, G3 = Globally vulnerable, S5 = State secure, S4 = State apparently secure, S3 = State vulnerable, SNR = State not ranked.

to spawn. It is believed that some arctic lampreys may overwinter in the river system as non-feeding adults and spawn the following spring (ADF&G, 2006). Adults die shortly after spawning. Arctic lampreys are known to occur throughout the Tanana River drainage and are considered the most common lamprey in Alaska, though little is known about current population trends (ADF&G, 2006). Recent evidence indicates that the Alaskan brook lamprey and Artic lamprey may represent anadromous parasitic and fresh water non-parasitic populations, respectively, of a single species of lamprey.

Broad whitefish are widespread throughout Alaska and the Yukon River drainage. In fall, broad whitefish leave summer feeding areas and travel upstream to spawning grounds where they spawn in areas of gravel substrates such as braided reaches of mainstem glacial streams. In the Tanana River drainage they are common in the Minto Flats, lower Tolovana, Chatanika, and Tatalina Rivers (all outside the study area). Adults move downstream after spawning (probably in November) and overwinter in deeper water or in estuaries (Mecklenburg *et al.*, 2002). This species is considered abundant and population trends are reported to be stable; however subsistence users in the Yukon Flats area have recently noted lower harvest rates (ADF&G, 2006).

The trout perch is a small fish, with adults ranging in size from two to four inches that typically lives in lakes, but also lives in deep flowing pools over sandy substrates. By day, the trout perch remain in deep water, but they move into shallow waters to feed at night. The trout perch spawn in spring, often moving into shallow streams to spawn. It is considered an important prey item for many native fish and can be an important nutrient transporter in thermally stratified lakes due to the habit of feeding in shallow waters at night and moving to deeper waters during the day. In Alaska, this species is rare, but it is considered to be expanding its range within the Yukon River drainage (ADF&G, 2006).

The wood frog is common throughout North America. In Alaska, wood frogs are associated with interior forests. The wood frog is a generalist living in a diverse range of vegetation types, from grassy meadows to open forests and muskeg. Tadpoles occur in small fishless ponds, intermittent streams, ephemeral pools and emergent wetlands associated with forested floodplains. Adults hibernate under logs, rocks or in leaf litter during winter. Breeding occurs shortly after emergence from hibernation in early June, and adults may enter hibernation as early as late August in Interior Alaska. This species is widespread, relatively common and the population appears to be stable (ADF&G, 2006).

The treeline emerald is the most northerly breeding dragonfly occurring as far north as the Arctic latitudinal treeline. Dragonfly larvae are aquatic, living in pools, bogs, fens or lakes. Waterbodies in which the larvae are found are often lined with sedges, contain aquatic mosses such as sphagnum mosses and lie atop permafrost. Larvae of the treeline emerald have never been observed in moving water. Adults are terrestrial; however, they are always found in association with larval habitat. Abundance and population trends of this species are unknown. Most specimens of this dragonfly have been collected from the Delta Junction area (ADF&G, 2006).

The Yukon floater is one of four Alaska native freshwater mussels. Freshwater mussels are benthic filter feeders and the Yukon floater is most often found in lakes, ponds and slow moving streams with sand and gravel substrates. Freshwater mussels have a complex life history, with the larval stage (glochidium) parasitic on fish. Glochidia attach to fish fins or gills encysting until they transform and emerge as juveniles. Once the transformation is complete, juveniles drop off of their hosts and burrow into the substrate. The Yukon floater parasitize Chinook salmon, sockeye salmon and the three-spine stickleback (Nedeau *et al.*, undated), although there is some evidence that it may use a wider range of host species (ADF&G, 2006). Abundance and trends for the Yukon floater are unknown; however, significant declines in freshwater mussel populations across North America over the last 30 years in response to declining water quality and invasive exotic species such as the zebra mussel are causes for concern.

F.2.4 Fish-Bearing Stream Crossings along Each Alternative Segment

The following site-specific discussions are based primarily on Surface Transportation Board Section of Environmental Analysis (SEA) field surveys of proposed stream crossing locations (Noel, 2007b), published anadromous fish habitat use data (Johnson and Weiss, 2007), and unpublished fish distribution data (ADF&G, 2005a) supported by numerous other reports and publications.

North Common Segment

North Common Segment would cross Piledriver Slough (stream number 334-40-11000-2490-3315; Johnson and Weiss, 2007). Piledriver Slough was once part of Chena Slough, which flowed northwest through Fairbanks and then back into the Tanana River. Construction of the Moose Creek Dike in 1945 split Chena Slough into the current Chena Slough and Piledriver Slough (Ihlenfeldt, 2006). Construction of that project resulted in sloughs that are mostly groundwater-fed systems with low discharge and low sediment loads (Ihlenfeldt, 2006). Piledriver Slough is currently a clearwater stream that flows for some 21 miles parallel to and between Richardson Highway and the Tanana River adjacent to Eielson AFB.

Piledriver Slough seasonally supports populations of arctic grayling, round whitefish, humpback whitefish, least cisco, northern pike, burbot, longnose suckers, slimy sculpins, lake chubs, arctic lamprey, and a few sheefish. There is some spawning of chum salmon in the slough (Johnson and Weiss, 2007). ADF&G annually stocks Piledriver Slough with sterile rainbow trout (ADF&G, 2008a). The un-named slough (Crossing 105; Table F-10) contains rearing habitats for fish present in Piledriver Slough; and northern pike were observed near the crossing location (Noel, 2007b; Record 2, 11).

Table F-10
Fish-bearing streams North Common Segment Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
1	Piledriver Slough	Slough	Anadromous	65	Bridge	100
105	Unnamed	Slough	Resident	20	Culvert	2 x 10

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Tables F-10 and F-11 list fish and fish habitats in the clearwater sloughs that North Common Segment would cross that would be affected by construction of the NRE. Piledriver Slough (Crossing 1; Table F-10) is an entrenched tributary of the mainstem Tanana River with pool and riffle habitat. The substrate of this clearwater stream is dominated by silt with sand and gravel (Noel, 2007b; Record 1). The unnamed slough crossing (Crossing 105) is over a pond-like tributary to Piledriver Slough that can freeze completely during winter. Northern Pike were observed near this crossing and habitats appeared suitable for other resident fish (Noel, 2007b; Record 2).

Table F-11
Fish Species, Life Stages, and Habitats That Could be Affected by Construction and Operation of North Common Segment[a]

	Life Stages				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Piledriver Slough (Crossing 1)									
Chum Salmon	X	X		X	X		X		X
Arctic Grayling	X	X	X	X	X	X	X	X	X
Burbot			X	X		X		X	X
Inconnu (Sheefish)				X				X	X
Lampreys		X	X	X		X	X		X
Northern Pike	X	X	X	X	X	X	X	X	X
Rainbow Trout			X	X			X	X	
Suckers	X	X	X	X	X	X	X	X	
Freshwater mussels			X	X	X	X	X	X	
Whitefish			X	X		X	X	X	X
Unnamed (Crossing 105)									
Northern Pike	X	X	X	X	X	X		X	
Suckers	X	X	X	X	X	X		X	

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Eielson Alternative Segments

Each of the Eielson alternative segments would cross Piledriver Slough. Eielson Alternative Segment 1 and Eielson Alternative Segment 2 would cross Twentythreemile Slough (stream number 334-40-11000-2490-4010; Johnson and Weiss, 2007) near where it flows into Piledriver Slough. Twentythreemile Slough flows for about 6 miles and is used by chum salmon (Johnson and Weiss, 2007) and arctic grayling.

Tables F-12 and F-13 list fish and fish habitats at the ten locations where the Eielson alternative segments would cross fish-bearing clearwater sloughs. Within the last several years, the quality and quantity of favorable fish spawning and rearing habitat in Piledriver Slough has declined. Fish passage has been restricted by undersized culverts, beaver dams, and filling in of gravel riffles/pools with sediment. Recent flooding in the Salcha area caused water to back up and block culverts, damage road crossings and deposited excess sediment in Piledriver Slough and tributary sloughs. These processes have had negative effects on local fish populations. The slough has become braided, increased its width/depth ratio, and is now reduced in the quantity and quality of habitat available for chum salmon, Arctic grayling, northern pike and burbot (Ihlenfeldt, 2006). The U.S. Fish and Wildlife Service (USFWS) have been working to improve fish habitat in Piledriver Slough by working to repair improperly placed culverts and to replace some culverts with bridges (Ihlenfeldt, 2006).

Table F-12
Fish-bearing Streams the Eielson Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Eielson Alternative Segments 1 & 2						
3	Twentythreemile Slough	Slough	Anadromous	100	Bridge	100
Eielson Alternative Segment 1						
10	Piledriver Slough	Slough	Anadromous	30	Culvert	3 x 10
Eielson Alternative Segment 2						
314	Piledriver Slough	Slough	Anadromous	105	Bridge	330
Eielson Alternative Segment 3						
113	Piledriver Slough	Slough	Anadromous	80	Bridge	300
111	Unnamed	Slough	Resident	30	Culvert	3 x 10
110	Unnamed	Slough	Resident	20	Culvert	3 x 10
129	Unnamed	Slough	Resident	20	Culvert	3 x 10
131	Unnamed	Slough	Resident	20	Culvert	3 x 10
5	Unnamed	Slough	Resident	25	Bridge	130
Eielson Alternative Segments 2 & 3						
13	Unnamed	Slough	Resident	80	Bridge	60

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Each Eielson alternative segment would cross Piledriver Slough at a different location. Eielson Alternative Segment 3 would cross Piledriver Slough nearest the outflow of the slough where it receives flow from Moose Creek and rejoins the Tanana River (Crossing 113; Noel, 2007b; Record 117). Eielson Alternative Segment 2 would cross Piledriver Slough before its confluence with Twentythreemile Slough (Crossing 314; Noel, 2007b; Records 42 and 154). Eielson Alternative Segment 1 would cross Piledriver Slough just north of where it would connect to the Tanana River; connection is blocked by fill in the channel (Crossing 10; Noel, 2007b; Record 22). Of these crossings, the crossings farther downstream (Crossings 314 and 113) have the largest flows from groundwater exchange and would have the largest affect on instream resident and anadromous fish habitats. Riffles were dominated by gravel substrates, while stream margins and pools were primarily covered in organic debris. Emergent vegetation was abundant and juvenile and adult arctic grayling were collected (Noel, 2007b; Record 42, 117, 154). Groundwater upwelling was evident, and there was evidence of salmon and grayling spawning

Table F-13
Fish, Life Stages, and Habitats that Would be Affected by Construction and Operation of the Eielson Alternative Segments[a]

	Life Stages				Habitats				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Twentythreemile Slough (Crossing 3)									
Chum salmon	X	X		X	X		X		X
Arctic Grayling	X	X	X	X	X	X		X	X
Lampreys		X	X	X		X		X	X
Suckers			X	X		X		X	X
Piledriver Slough (Crossings 10, 314, 113)									
Chum salmon	X	X		X	X		X		X
Arctic Grayling	X	X	X	X	X	X	X	X	X
Burbot			X	X		X		X	X
Lampreys		X	X	X		X	X		X
Northern Pike	X	X	X	X	X	X	X	X	X
Inconnu (Sheefish)				X				X	X
Northern Pike	X	X	X	X	X	X	X	X	X
Rainbow Trout			X	X			X	X	
Suckers	X	X	X	X	X	X	X	X	
Freshwater mussels			X	X	X	X	X	X	
Whitefish			X	X		X	X	X	X
Unnamed Sloughs (Crossings 111, 110, 129, 131, 5, 13)									
Lake Chub			X	X		X		X	
Suckers			X	X		X		X	

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Slough (Crossing 3; Noel, 2007b; Record 40). There was an inactive beaver dam that had been breached near the crossing at the confluence, resulting in substrates primarily composed of organic debris and silt at the crossing with a heavy vegetation mat (Noel, 2007b; Record 40). However, there are gravelly areas upstream where grayling redds were observed. Both grayling and juvenile salmonids were observed at the site.

Eielson Alternative Segment 3 would cross an unnamed slough that meanders east and west five times (Crossings 111, 110, 129, 131, and 5). This slough contained pool habitats used by resident fish (lake chub), likely for rearing and summer forage (Noel, 2007b; Record 118, 119, 153). The dominant substrates were silt, with organic debris making up the balance. Some emergent vegetation was present, and stream margins were covered with overhanging vegetation. Eielson Alternative Segment 2 and Eielson Alternative Segment 3 would cross another unnamed slough (Crossing 13), which is considered locally as Piledriver Slough, and contains pool and riffle habitats suitable for rearing, migration and spawning habitats for resident fish (Noel, 2007b; Record 26).

Salcha Alternative Segments

Both Salcha alternative segments would cross the Tanana River. Burbot occur primarily in the mainstem of the Tanana River; while Dolly Varden are found primarily in the upper reaches of tributaries of the Tanana River. Chinook, chum, and coho salmon are found in the Tanana River during migration and fall run chum salmon spawn in the mainstem Tanana River in the project area. The mainstem Tanana River is transitional habitat for resident fish migrating between seasonal feeding grounds and spawning habitat such as arctic grayling, round whitefish, humpback whitefish, least cisco, longnose suckers, slimy sculpins, lake chubs, arctic lamprey, and Alaska brook lamprey (ADF&G, 2008a). Many fish return to the Tanana River during the fall and winter as smaller tributaries and backwaters freeze.

Salcha Alternative Segment 2 would cross both the Little Salcha River and the Salcha River. The Salcha River (stream number 334-40-11000-2490-3329, Johnson and Weiss, 2007) supports Chinook salmon and a summer run of chum salmon. Salcha River salmon have traveled about 950 miles from the Bering Sea to the mouth of the Salcha River. By the time they reach the Salcha River, salmon are in full spawning colors and the flesh is beginning to deteriorate. To maintain a Chinook salmon run on the Salcha River, the ADF&G has set an escapement (the number of adult salmon allowed to return upstream to spawn) of between 3,300 and 6,500 fish. Resident fish in the Salcha River include arctic grayling, round whitefish, humpback whitefish, northern pike, burbot, longnose suckers, slimy sculpins, and arctic lamprey (ADF&G, 2008a). The Little Salcha River (stream number 334-40-11000-2490-3325, Johnson and Weiss, 2007) is a clear-water stream that flows into the Tanana River. About 6 miles of this river supports chum salmon.

Tables F-14 and F-15 list fish and fish habitats the Salcha alternative segments would cross.

Table F-14
Fish-bearing Streams Crossed by the Salcha Alternative Segments[a]

Crossing Number	Stream Name	Water-body Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Salcha Alternative Segment 1						
	Tanana River	Stream	Anadromous	3,800	Bridge	3,600
89	Unnamed	Slough	Resident	34	Culvert	3 x 10[b]
295	Unnamed	Stream	Resident	125	Culvert	125
Salcha Alternative Segment 2						
16	Little Salcha River	Stream	Anadromous	65	Bridge	160
17	Unnamed	Overflow	Probable	20	Culvert	3 x 10
18	Unnamed	Slough	Anadromous	15	Bridge	390
	Salcha River	Stream	Anadromous	195	Bridge	2,500[b]
	Tanana River	Stream	Anadromous	1,500	Bridge	4,000
22	Unnamed	Slough	Anadromous	130	Bridge	4,000
23	Unnamed	Slough	Anadromous	150	Culvert	3 x 10[b]
340	Unnamed	Stream	Probable	10	Culvert	10
341	Unnamed	Stream	Anadromous	20	Culvert	2 x 10

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.
[b] The conveyance size is a SEA estimated based on proposed lengths of similar crossings. The final conveyance distance will be determined during final design.

Many fish use the Tanana River as a migratory route to upstream spawning grounds including Chinook, chum, and coho salmon and whitefish (Table F-15). Side channels of the Tanana River (Crossings 89, 16, 17, 18, 22, and 23) were dominated by gravel and cobble with groundwater upwelling at the channel margins. These areas provide summer foraging and rearing habitats for resident and anadromous fishes and spawning habitat for fall run chum salmon (Barton, 1992; Noel, 2007b; Record 48, 35, 36, 158, 159). Salcha Alternative Segment 1 at Crossing 295 is a

Table F-15
Fish, Life Stages, and Habitats That Would be Affected by Construction and Operation of the Salcha Alternative Segments

	Potential Life Stages				Potentially Affected Habitat				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Tanana River and Side Channels (Crossings 89, 16, 17, 18, 22, 23)									
Chinook salmon			X	X		X		X	X
Chum salmon	X	X		X	X		X		X
Coho salmon				X					X
Burbot				X			X	X	X
Freshwater Mussels			X	X	X	X	X	X	
Arctic Grayling				X		X	X	X	
Inconnu (Sheefish)				X				X	
Lampreys		X	X	X		X	X		X
Suckers				X			X	X	X
Whitefish				X					X
Little Salcha River (Crossing 16)									
Chum salmon	X	X		X	X		X		X
Burbot			X	X			X		X
Arctic Grayling	X	X	X	X			X	X	X
Northern Pike		X	X	X		X	X	X	X
Lampreys		X	X	X			X	X	X
Suckers			X	X			X	X	X
Whitefish			X	X			X	X	X
Salcha River									
Chinook Salmon			X	X		X	X	X	X
Chum salmon	X	X		X	X		X		X
Burbot			X	X		X	X	X	X
Arctic Grayling	X	X	X	X		X	X	X	X
Lampreys		X	X	X			X		X
Suckers			X	X		X	X	X	X
Whitefish			X	X		X	X		X
Unnamed Streams and Sloughs (Crossings 295, 340, 341)									
Coho Salmon			X	X		X	X	X	X
Arctic Grayling	X	X	X	X			X	X	X
Suckers			X	X			X	X	X
Whitefish			X	X			X	X	X

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

small perennial stream that drains a large wetland complex and empties into the Tanana River (Noel, 2007b; Record 157). About 2 miles upstream from this crossing, high-quality spawning and rearing habitat for arctic grayling occurs (Noel, 2007b; Record 8, 9), and this reach likely serves as migratory habitat. The Salcha Alternative Segment 2 would have 11 fish-bearing stream crossings, including the Tanana River, the Little Salcha River and the Salcha River. Nine of these crossings are anadromous fish streams (Table F-14).

Salcha Alternative Segment 2 at Crossing 18 is a side channel of the Tanana River that connects to the Little Salcha River outflow. Flow into this channel is limited during low-flow periods due to the presence of a large gravel berm at the inflow of the channel. During periods of low flow the channel contains large clear pools, which contain juvenile salmonids in high densities (Noel, 2007b; Record 36). During high flows, the pools would be connected to the mainstem by a series of pools and riffles of gravel with some cobble and silt. Salcha Alternative Segment 2 would cross the Salcha River about 1 mile above its confluence with the Tanana River. The crossing would pass over a shallow glide in a meander bend of the river (Noel, 2007b; Record 47). There is potential for fall chum salmon spawning in this area, and Chinook salmon must pass through this crossing to reach upstream spawning habitats.

Passage of river flow is critical for anadromous fish use of side-channel Tanana River habitats such as at Crossings 89, 17, 18, 22, 23, 340, and 341. Blockage or filling of side-channels would cause significant habitat alteration resulting in the eventual loss of salmon spawning. Similarly modified side channels of the Tanana River near Fairbanks exhibit lower dissolved oxygen levels, reduced flows, substrates of finer particle size, and increased pH, hardness, water temperature, specific conductance, and cover (Mecum, 1984); conditions generally unsuitable for salmonids. These changes would reasonably be expected to alter fish use of affected channels by shifting habitats from a riverine to a more littoral character. The channel modification illustrated in Figure 2-17 would result in the creation of a major new channel. As a result, flow from the existing side channel would be directed and would likely lead to the destruction of the portions of the vegetated island that are not protected by the shot-rock revetment. The potential for instability of this channel alteration is high, given the highly permeable nature of the gravels supporting the Tanana River bars as discussed in Chapter 4.

Central Alternative Segments and Connectors

Central Alternative Segment 1 would cross an unnamed clearwater stream that provides habitat for resident fish (Tables F-16 and F-17).

Central Alternative Segment 2 would cross two unnamed sloughs (crossings 35 and 38), one used by resident fish and one that exhibits potential fish habitat (Tables F-16 and F-17). The channel at Crossing 35 appears to periodically receive flow from the Tanana River. This stream would likely serve as a temporary refuge for fish during high-flow events and as a route for resident and possibly anadromous fishes to and from habitats in the Fivemile Clearwater River and its tributaries. Both crossings periodically receive flow from the Tanana River, and seasonal use by resident fish would be expected.

Connector A would cross an unnamed stream (Crossing 85) that supports resident fishes.

Connector B would cross the Fivemile Clearwater River (Crossing 86), which serves as a migratory corridor for Chinook and coho salmon and resident fishes. The crossing site is a broad straight channel with heavily armored substrates; which are not likely suitable for salmonid spawning habitat (Noel, 2007b; Record 55).

Connector C would cross tributaries to the Fivemile Clearwater River (Crossings 345 and 346), which serves as a migratory corridor for Chinook and coho salmon and resident fishes.

Streams that would be crossed by Connector D (Crossings 501, 502, 503, and 504) provide habitat for the fall run of chum salmon.

Connector E would cross the upper reach of the Fivemile Clearwater River at Crossing 351, where substrates were sand and organic debris (Noel, 2007b; Record 85).

Table F-16
Fish-bearing Streams the Central Alternative Segments and Connectors Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Central 1						
84	Unnamed	Stream	Resident	40	Bridge	40
Central 2						
35	Unnamed	Overflow	Resident	50	Bridge	130
38	Unnamed	Overflow	Probable	30	Bridge	75
Connector A						
85	Unnamed	Stream	Anadromous	80	Bridge	40
Connector B						
27	Unnamed	Slough	Anadromous	90	Culvert	2 x 10
86	Fivemile Clearwater	Stream	Anadromous	105	Bridge	160
Connector C						
342	Unnamed	Stream	Anadromous	35	Bridge	90
343	Unnamed	Slough	Probable	20	Culvert	2 x 10
344	Unnamed	Overflow	Anadromous	90	Culvert	2 x 10
345	Fivemile Clearwater	Stream	Anadromous	135	Bridge	135
346	Unnamed	Stream	Anadromous	30	Culvert	3 x 10
396	Unnamed	Stream	Anadromous	80	Bridge	40
Connector D						
501	Unnamed	Stream	Anadromous	35	Bridge	90
502	Unnamed	Stream	Anadromous	4	Culvert	2 x 10
503	Unnamed	Stream	Anadromous	20	Bridge	90
504	Unnamed	Stream	Anadromous	20	Bridge	90
Connector E						
351	Fivemile Clearwater	Stream	Anadromous	65	Bridge	115

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Donnelly Alternative Segments

Both Donnelly alternative segments would cross the Little Delta River, Kiana Creek, and Delta Creek. The Little Delta River is a glacial tributary of the Tanana River that runs north for 24 miles before joining the Tanana River. There is little documentation of fish presence in reaches of this river that intersect the project area; however, portions of this stream and its tributaries are likely to support resident fish, such as burbot, near the confluence with the Tanana River. Resident fish may also use the Little Delta River for seasonal movements. Kiana Creek (stream number 334-40-11000-2490-3362; Johnson and Weiss, 2007) is a clearwater tributary of the Tanana River whose confluence lies approximately 4 miles upstream of the Little Delta River/Tanana River confluence. The first 7 miles of Kiana Creek support coho salmon during rearing (Johnson and Weiss, 2007) and it is likely that there are spawning areas upstream of the rearing areas. Based on SEA field surveys, additional coho rearing habitat has been documented east of the cataloged reach of Kiana Creek (Noel, 2007b; Record 68, 69). Larval arctic grayling also occurred upstream from the cataloged reach of this Tanana River tributary (Noel, 2007b; Record 179).

Table F-17
Fish Species, Life Stages, and Habitats That Could be Affected by Construction and Operation of the Central Alternative Segments and Connectors[a]

	Life Stages				Habitat				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Unnamed Sloughs (Crossings 35, 38, 84, 85)									
Arctic Grayling			X	X		X		X	X
Burbot				X		X		X	X
Suckers	X	X	X	X	X	X	X	X	
Whitefish			X	X		X	X	X	
Fivemile Clearwater River (Crossing 86)									
Chinook Salmon			X	X		X	X	X	X
Coho Salmon			X	X		X	X	X	X
Burbot			X	X		X	X	X	X
Freshwater Mussels		X	X	X		X	X	X	
Arctic Grayling			X	X		X	X	X	X
Lampreys		X	X			X	X	X	X
Northern Pike		X	X	X		X	X	X	X
Suckers		X	X	X		X	X	X	X
Whitefish		X	X	X		X	X	X	X
Unnamed Streams and Sloughs (Crossings 27, 342, 343, 344, 345, 346, 396)									
Coho Salmon			X	X		X	X	X	X
Arctic Grayling	X	X	X	X			X	X	X
Suckers			X	X			X	X	X
Whitefish			X	X			X	X	X
Fivemile Clearwater River (Crossing 351)									
Coho Salmon			X	X		X		X	X
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b

Delta Creek is a glacial tributary of the Tanana River whose confluence lies about 7 miles upstream from the mouth of Kiana Creek. Resident fish species have been documented near the mouth of Delta Creek, but no anadromous fish habitat is known to occur within this stream.

Tables F-18 and F-19 list fish and fish habitats at the 14 crossings of the Little Delta River, Kiana Creek and its tributaries, Delta Creek, and unnamed streams.

On Donnelly Alternative Segment 1, the stream reach at Crossing 137 is within a heavily forested area, but is likely the same anadromous stream as crossed by Donnelly Alternative Segment 2 at Crossing 41 (Noel, 2007b; Record 128), based on review of recent aerial photography. The stream at Crossing 137 was not evaluated during SEA field studies because it was inaccessible by helicopter. This stream has an abundance of large woody debris, and appeared to have some gravel substrates suitable for grayling spawning. The Donnelly Alternative Segment 1 crossings of the Little Delta River and Delta Creek may be less likely to contain fish habitats than the Donnelly Alternative Segment 2 crossings because they are farther

Table F-18
Fish-bearing Streams the Donnelly Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Donnelly Alternative Segment 1						
137	Unnamed	Stream	Resident	10	Bridge	40
	Little Delta River	Stream	Resident	30	Bridge	800
279	Unnamed	Stream	Resident	6	Culvert	2 x 10
76	West Kiana Creek	Stream	Resident	3	Bridge	40
74	Kiana Creek	Stream	Resident	55	Bridge	65
	Delta Creek	Stream	Resident	200	Bridge	700
Donnelly Alternative Segment 2						
40	Unnamed	Stream	Anadromous	75	Culvert	3 x 10
41	Unnamed	Stream	Anadromous	18	Bridge	40
	Little Delta River	Stream	Resident	240	Bridge	900
252	Unnamed	Wetland	Probable	85	Culvert	4
100	Kiana Creek	Stream	Anadromous	35	Bridge	80
	Delta Creek	Stream	Resident	160	Bridge	700
101	Unnamed	Stream	Resident	10	Culvert	2 x 10
102	Unnamed	Stream	Resident	5	Culvert	10

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Table F-19
Fish, Life Stages, and Habitats That Could be Affected by Construction and Operation of the Donnelly Alternative Segments[a]

	Life Stages				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Unnamed Streams (Crossings 40, 41, 137)									
Coho Salmon			X	X		X		X	X
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	
Little Delta River									
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	
Kiana Creek and Tributaries (Crossings 76, 74, 100, 252, 279)									
Coho Salmon			X	X		X		X	X
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	
Delta Creek									
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	
Whitefish			X	X				X	X
Unnamed Streams (Crossings 101, 102)									
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

from the Tanana River. Arctic grayling use both of these glacial rivers to move between summer foraging habitats and over-wintering habitats in the Tanana River; Delta Creek is also used by whitefish (Parker, 2006).

Both Donnelly Alternative Segment 1 (Crossing 74) and Donnelly Alternative Segment 2 (Crossing 100) would cross Kiana Creek, including tributary streams at Crossing 76 and 252. Donnelly Alternative Segment 2 would cross the Kiana Creek drainage in the lower reaches at Crossing 100; while Donnelly Alternative Segment 1 would cross Kiana Creek at Crossing 74 and an unnamed tributary at Crossing 76. A tributary draining a large wetland between the alternative segments also provides coho salmon rearing habitat (Noel, 2007b; Record 68, 69). Upper reaches of this watershed appear to depend on precipitation to maintain summer flows during at least a portion of the summer (Noel, 2007b; Record 168, 169, 179). The lower portions of the Kiana Creek drainage support coho salmon rearing, and coho salmon spawning and there likely are arctic grayling spawning habitats in the upper reaches of the watershed, but none have been identified.

Donnelly Alternative Segment 2 Crossings 101 and 102 would both occur at narrow clearwater streams that flow into a beaver complex at the base of a ridge (Noel, 2007b; Record 71, 138, 139). There are adult arctic grayling in this pond and a long-nose sucker with breeding tubercles was also found at the stream flowing from this beaver pond complex (Noel, 2007b; Record 138, 139). These streams appear to be primarily ground-water fed. It appears that ridges block subsurface flows and force them to the surface. Icings were observed throughout this area during late-winter and spring surveys, indicating that the area may provide thermal refuge for over-wintering fish or eggs. The outflow channel from this complex just down river from where Donnelly Alternative Segment 2 would cross Delta Creek may contain habitat suitable for fall spawning chum salmon.

South Common Segment

South Common Segment would cross several tributaries of the Richardson Clearwater River (stream number 331-40-11000-2490-3370; Johnson and Weiss, 2007), which is a clearwater stream that flows northwest for about 14 miles before joining the Tanana River. This stream supports populations of coho salmon, chum salmon, arctic grayling, round whitefish, and longnose suckers. Coho and chum salmon spawn and eggs overwinter in the stream. Juvenile coho salmon and other resident fish use it as a summer feeding ground (Ridder, 1983; Johnson and Weiss, 2007). The two unnamed tributaries of the Richardson Clearwater River that would be crossed by project alternatives (stream numbers 331-40-11000-2490-3370-4030 and 331-40-11000-2490-3370-4040; Johnson and Weiss, 2007) both support coho spawning and rearing.

Tables F-20 and F-21 list fish and fish habitats South Common Segment would cross. Although anadromous fish were not found during limited surveys of the area, it is likely that Crossing 103 provides habitat for coho salmon because spawning gravels were present (Noel, 2007b; Record 141).

South Common Segment Crossing 103 is a clearwater stream with gravel substrates, groundwater upwelling, and a mix of run riffle and pool habitat (Noel 2007b; Record 141). Spawning of summer run chum salmon and fall run coho salmon occur in the Richardson Clearwater River (Johnson and Weiss, 2007), into which this stream flows. The occurrence of suitable spawning habitat at this site, along with connection to a known anadromous stream, make it likely that coho salmon use this stream for spawning. Crossing 104 is similar to Crossing 103, and also contains gravels suitable for spawning.

Table F-20
Fish-bearing Streams South Common Segment Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
136	Unnamed	Stream	Anadromous	10	Bridge	50
103	Unnamed	Stream	Probable	35	Bridge	65
104	Unnamed	Stream	Anadromous	15	Bridge	40

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Table F-21
Fish, Life Stages, and Habitats That Could be Affected by Construction and Operation of South Common Segment[a]

	Life Stages				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Richardson Clearwater River Tributaries (Crossings 136, 103, 104)									
Chum Salmon				X					X
Coho Salmon			X	X		X		X	X
Arctic Grayling			X	X		X		X	X
Suckers	X	X	X	X	X	X	X	X	
Whitefish			X	X		X	X	X	

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Delta Alternative Segments

The Delta River (stream number 331-10-11000-2490-3390; Johnson and Weiss, 2007) supports resident fish especially during seasonal movements. The lower 2 miles of this river also support fall chum and coho spawning. Upwelling in this area cleans gravels of glacial silts and maintains sufficient flows to remain unfrozen during the winter, providing overwinter incubation habitat for eggs and larvae of chum and coho salmon. Although alternatives would not cross that area, Delta Alternative Segment 1 would cross the Delta River near the confluence of Jarvis Creek. Jarvis Creek supports resident fish populations especially during seasonal movements to and from upstream foraging, rearing and spawning habitats. Jarvis Creek is not known to support anadromous fish.

Tables F-22 and F-23 list fish and fish habitats at Delta alternative segment crossings.

Table F-22
Fish-bearing Streams the Delta Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Delta Alternative Segment 1						
	Delta River	Stream	Resident	630	Bridge	2,000
Delta Alternative Segment 2						
	Delta River	Stream	Resident	290	Bridge	2,000

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

Table F-23
Fish, Life Stages, and Habitats That Could be Affected by Construction and Operation of the Delta alternative Segments[a]

	Life Stages				Habitat				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Delta River and Jarvis Creek (Crossings 35, 38)									
Arctic Grayling			X	X		X		X	X
Burbot			X	X		X		X	X
Suckers	X	X	X	X		X		X	X
Whitefish			X	X		X		X	X

[a] Sources: ADF&G, 2005a; Johnson and Weiss, 2007; Noel, 2007b.

F.3 Game Mammal Resources

This section presents additional information on game mammals within ADF&G's Game Management Units (GMUs) 20A, 20B, and 20D. The descriptions of abundance, distribution, harvest, and life histories developed for this section were compiled from various sources including ADF&G's GMU 20A, 20B, and 20D Management Reports; ADF&G's Wildlife Notebook Series; and NatureServe, Animal Diversity Web.

F.3.1 Affected Environment

Moose and black bear are the primary big game mammals occurring within the project area, defined as the area within 5 miles of the proposed alternative segments (Table F-24). The Delta bison herd ranges within the eastern end of the proposed rail project. Trappers harvest primarily marten, beaver, red fox, lynx, mink, and wolves. The following sections provide additional information on game mammal population trends and harvest levels within the sections of GMU 20 the NRE would cross.

Bison

Plains bison (*Bison bison bison*) were introduced to Alaska in 1928 to the Delta River area near the mouth of Jarvis Creek. The animals came from the National Bison Range in Montana. At the time of this introduction, biologists did not recognize the existence of the wood bison (*Bison bison athabascae*), which was the last bison subspecies to occur in Alaska. Plains bison are about 10 percent to 30 percent smaller and lighter in color than wood bison (ADF&G, 2008d).

The Delta bison herd grew to more than 500 animals during the 1950s, when hunting was initiated along with agricultural development and fire suppression (DuBois and Rogers, 2000). The free-ranging Delta bison herd has been maintained by hunting at around 450 animals since the 1990s (Figure F-4; DuBois, 2004). Fire suppression led to an increase in forested habitats that reduced foraging habitat for the plains bison, which feeds on graminoid vegetation such as sedges and grasses. With the development of agriculture in the Delta area, bison began to use hay crops and cereal grains during the fall and winter as farms were developed within the herd's traditional winter range. Conflict between bison and the agricultural community escalated with development of the Delta Agricultural Project in 1979; which lead to the establishment of the

Table F-24
Large Game Mammals Occurring Within the NRE Project Area

Game Mammal	Scientific Name	Generalized Hunting Seasons by GMU	Mean Annual Harvest 2001-2006 (GMU 20)[a]	Population Estimate (GMU 20)	Population Estimate (20A, 20B, 20D)	Project Area Density[b]
Bison (Delta Herd)	*Bison bison bison*	October to March	98 (22%)	450	450	
Black Bear	*Ursus americanus*	No closed season	262 (5%)	4,975	2,325	12 to 18 per 100 square miles
Brown Bear	*Ursus arctos*	September to May	57 (5%)	1,200	675	3 to 8 per 1,000 square miles
Caribou (Delta Herd)	*Rangifer tarandus*	August to September	37 (1%)	2,540		
Caribou (Macomb Herd)	*Rangifer tarandus*	August	24 (4%)	625		
Moose	*Alces alces*	September	1,885 (4%)	44,000	32,100	
		20A: Bulls - September Antlerless – August to February	775 (5%)		14,700	3.1 per square mile
		20B: September	660 (5%)		12,900	1.6 per square mile
		20D: September	310 (7%)		4,500	0.8 per square mile
Wolf	*Canis lupus*	August to May	250 (26%)	970	495 wolves 62 packs	36 wolves 4 packs

[a] Harvest percentage of estimated population appears in parentheses. Mean annual harvest of moose for subunits 20A, 20B, and 20D are listed on separate table lines. All harvested wolves are required to be sealed (registered and recorded). Wolf harvest records are reported from sealing files. No same day airborne hunting of wolves was in affect for GMU 20 during the reporting period. The National Research Council estimated sustainable harvest rates for wolves of from 30 percent up to 40 percent of early winter populations (NRC, 1997).

[b] Sources: Dubois 2006a, 2006b, 2006c, 2005a, 2005b, 2005c; Seaton 2005; Young 2006a, 2006b, 2006c, 2005a, 2005b.

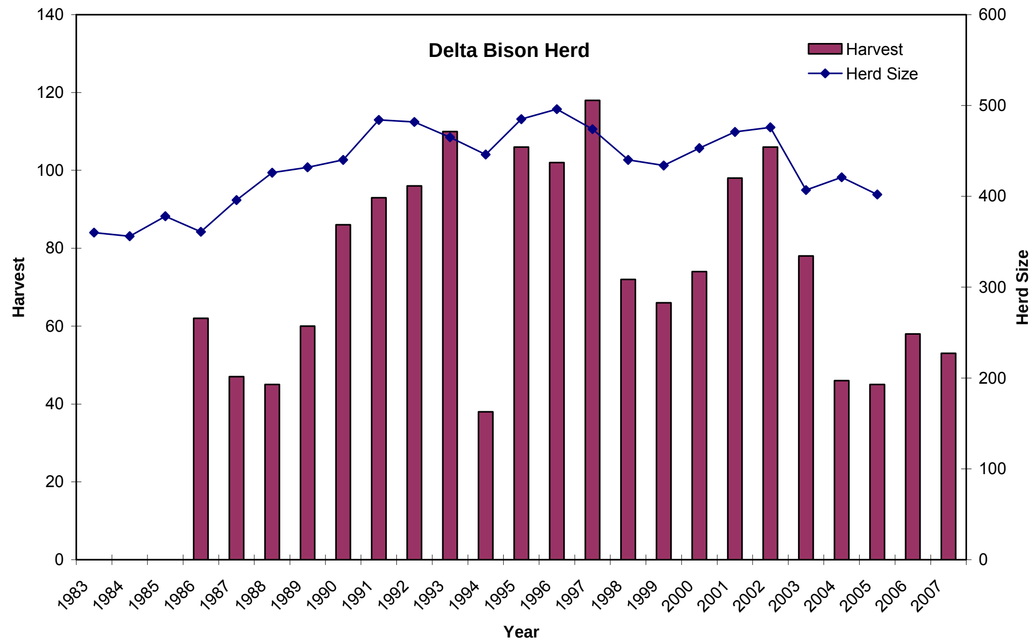

Figure F-4
Population and Harvest Trends for the Delta Bison Herd 1983 to 2007 (ADF&G, 2008d; DuBois, 2004; DuBois, 2006a)

90,000-acre Delta Junction State Bison Range (Figure F-5). The purpose of the bison range is to provide adequate winter range and to alter seasonal movements of bison to reduce damage to agriculture. Winter habitat development in the bison range includes annual fertilization of about 500 acres, forage management using controlled burns, and mowing and disking to control invasion of the native bluejoint reedgrass.

Bison may occur in the area the Delta alternative segments would cross at the eastern edge of the NRE project area. Bison feed on sedges and grasses, migrate to the Delta River during calving in May, and use riparian habitats along this river southwest of Delta Junction through the summer. In the fall, bison migrate from the Delta River toward Delta Junction, crossing the Alaska Highway. During the fall migration, bison leave the Delta River and move to the bison range instead of moving into agricultural lands (ADF&G, 2008d). Delta bison have established many traditional trails inside and outside of the bison range and they cross transportation corridors in many areas (Figure F-5; ADF&G, 2008d). Bison were hit by vehicles on the Alaska Highway near Delta Junction at the rate of two bison every 5 years during 2001 through 2005 (ADF&G, 2005b).

Bears

Hunters harvested an average of 222 black bears per year in GMUs 20A, 20B, and 20D from 2001 to 2003 (Figure F-6). Most black bears are harvested during May and June by local resident hunters at bait stations as bears emerge from their dens. Harvest is generally concentrated in areas where road systems facilitate access and transport of baits. Hunters harvested an average of 34 brown bears in GMUs 20A, 20B, and 20D from 2000 to 2004 (Figure F-7). Most brown bears are harvested during the fall, often in conjunction with moose hunts.

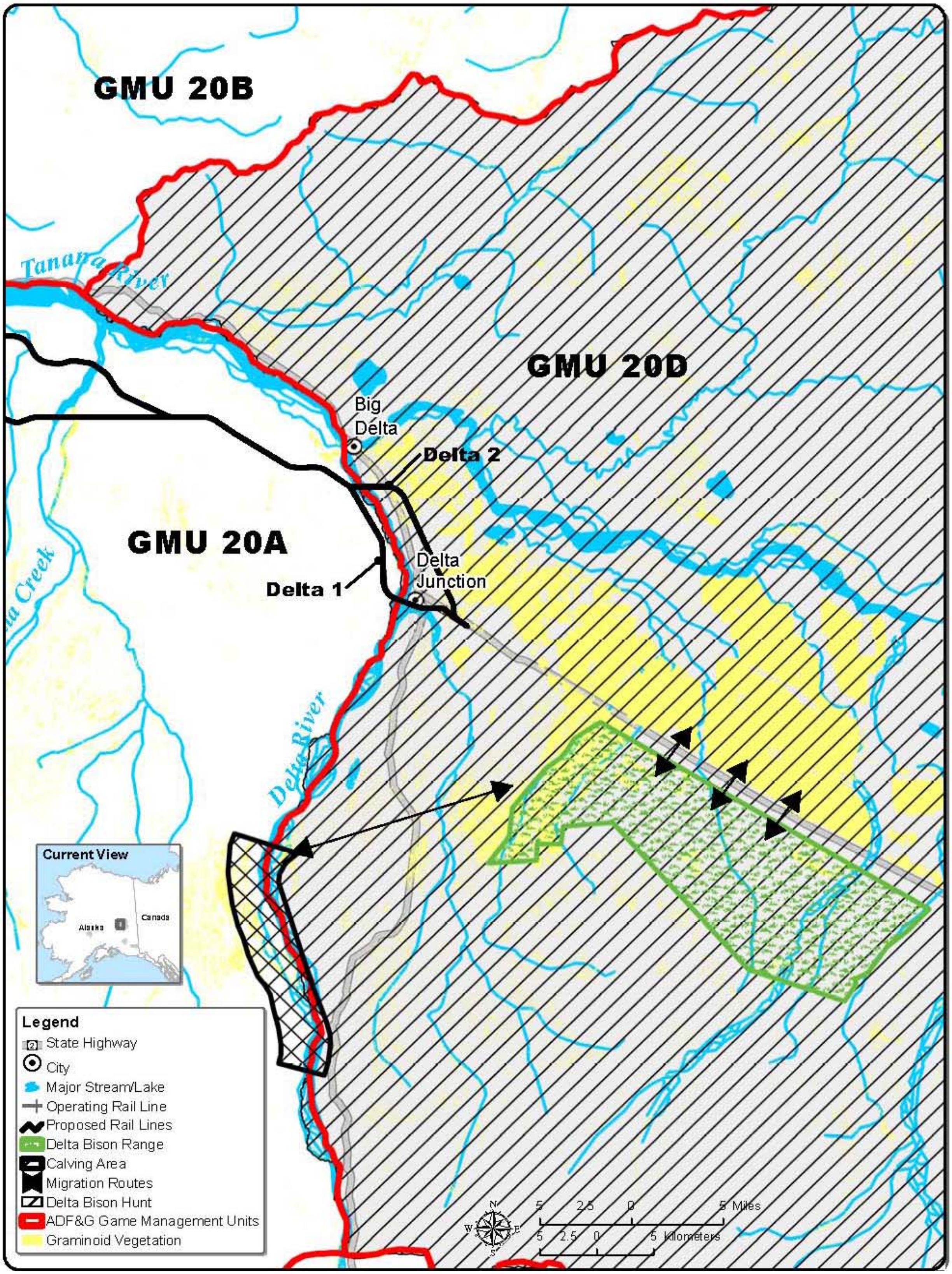

Figure F-5
Delta Bison Herd Range and Migration Routes in the Project Area (DuBois and Rogers, 2000)

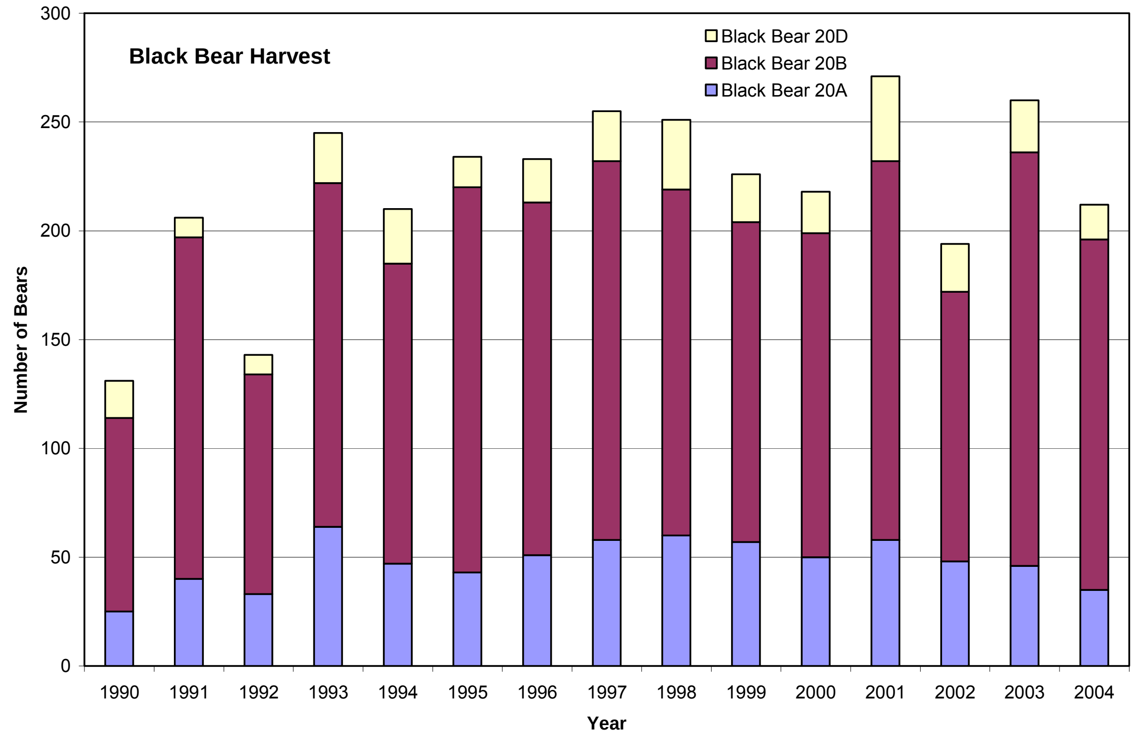

Figure F-6
Harvest Trends for Black Bears 1990 to 2004 (Seaton, 2005; DuBois, 2005b)

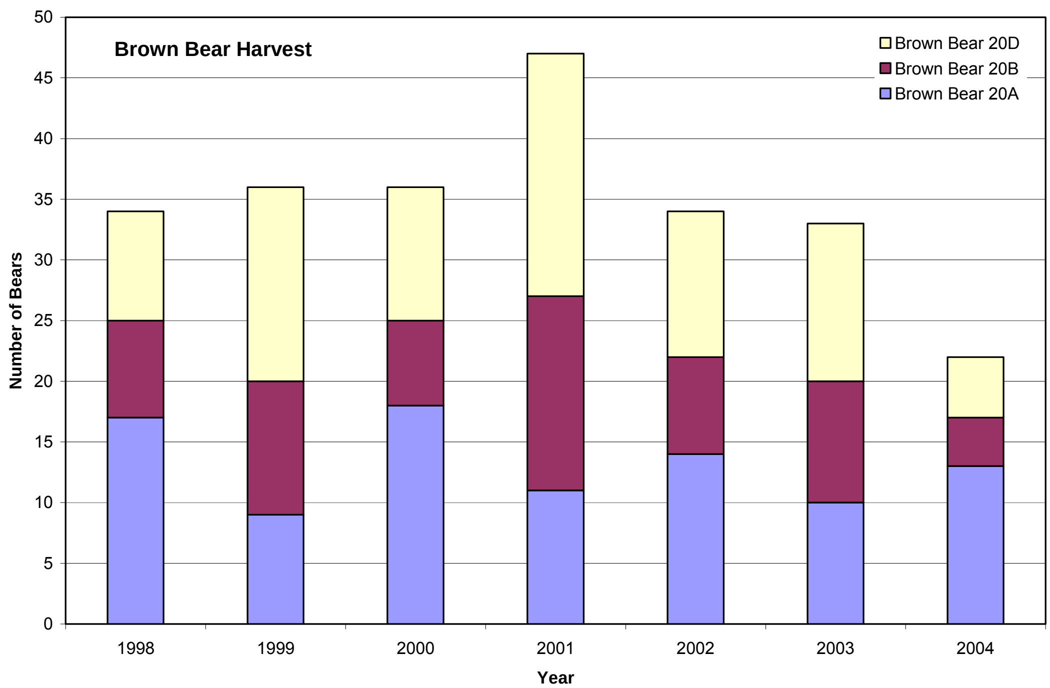

Figure F-7
Harvest Trends for Brown Bears 1998 to 2004 (Young, 2005b; DuBois, 2005c)

Both black and brown bears can become problems when they have learned to associate humans with food. Bears become conditioned to human food when they access improperly stored garbage, or human or animal foods. Bears have a keen sense of smell and habitually seek the same foods in the same places year after year. Because cubs learn about what and where to forage from their mothers, sows that are conditioned to human foods, condition their cubs to human foods. Once exposed to human foods and garbage, conditioned bears can become so problematic that they ultimately must be destroyed.

Caribou

Caribou herds that may occur within the project area include the Delta caribou herd that ranges in the northern foothills of the central Alaska Range between Parks and Richardson Highways, and the Macomb caribou herd that ranges in the northern foothills of the eastern Alaska Range between Richardson Highway and the Robertson River. If the Fortymile caribou herd were to increase in size and range, these animals would also winter along the Tanana River.

Human harvest affected the population dynamics of the Delta herd during 1969 to 1973, and again during 1981 to 1991. In other years, the hunting season was closed or restricted to permit drawing hunts primarily for bulls. Delta caribou herd harvest is managed through a bull-only special permit drawing in GMU 20A (ADF&G Hunt DC827; Figure F-8) with a mean annual harvest of 37 bulls (2000 to 2007). The Macomb caribou herd is managed as a subsistence and registration permit hunt (ADF&G Hunt RC835; Figure F-9) with a mean annual harvest of 23 bulls (2000 to 2007).

The Delta caribou herd historically ranges in the Alaska Range foothills north of the divide separating the Tanana and Susitna drainages in GMU 20A (Young, 2005a); to the south and outside of the project area. Recent range expansions include use of the upper Nenana and the Susitna drainages north of the Denali Highway. This herd was estimated at 1,500 to 2,500 animals in 1975 but by 1989 the Delta herd had grown to nearly 11,000 animals. The Delta herd declined from 11,000 animals in the early 1990s to 2,000 or fewer animals in the early 2000s (Figure F-8; Young, 2005a). After the initiation of a wolf-control program, the heard estimates were higher during 1994 and 1995; but the herd subsequently declined apparently because of high mortality of calves from birth through 16 months (Valkenberg *et al.*, 2002). Caribou generally calve during mid to late May.

Populations of caribou in Interior Alaska are primarily influenced by predation and weather; although population dynamics, nutrition, and body condition for the Delta caribou herd are also limited by shortages of winter food (Valkenburg *et al.*, 2002). Wolves are the primary predator of caribou calves, followed by grizzly bears, golden eagles, and lynx (Valkenburg *et al.*, 2002). Human harvest was a significant factor in the size of the Delta Caribou herd during the 1980s and early 1990s (Valkenburg *et al.*, 2002), but has not had a notable influence on herd size during the late 1990s to 2000s, averaging 37 caribou per year during 2000s.

The Macomb is a small caribou herd of about 500 to 600 caribou that ranges foothills of the Alaska Range generally south of the Alaska Highway, and primarily between the Robertson River and Richardson Highway. This herd was estimated at 350 to 400 caribou in 1972, and it received little sport harvest (Figure F-9). Hunting pressure increased on the Macomb herd during the early 1970s coincident with ADF&G imposing hunting restrictions on other nearby road-accessible caribou herds (DuBois, 2005a).

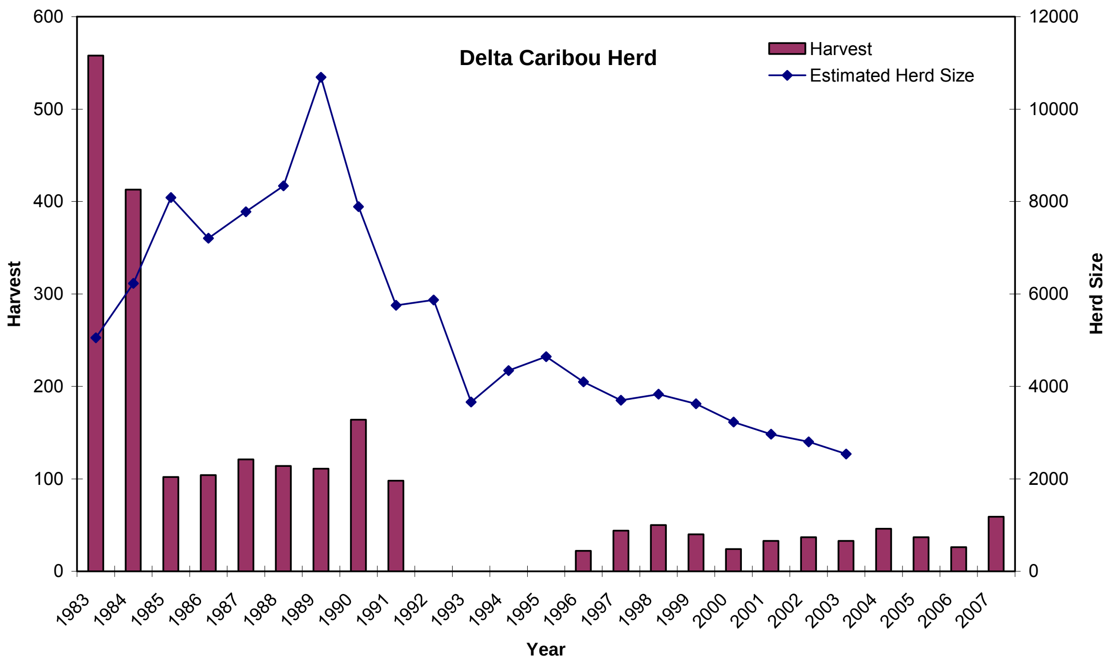

Figure F-8
Population and Harvest Trends for the Delta Caribou Herd 1983 to 2007 (ADF&G, 2008e; Young, 2005a)

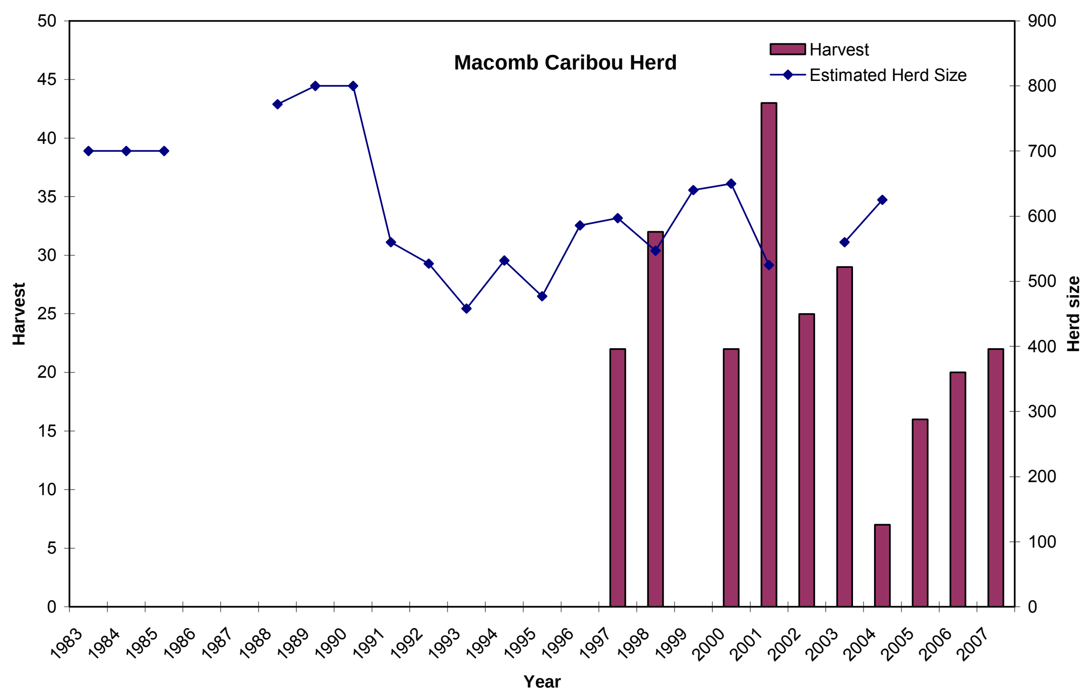

Figure F-9
Population and Harvest Trends for the Macomb Caribou Herd 1983 to 2007 (ADF&G, 2008e; DuBois, 2005a)

Moose

Moose are distributed throughout Alaska and are the primary large mammal harvested within the NRE project area in the Tanana River Valley. The moose population in the central GMU 20A has been the subject of intensive research and management for decades. Moose in central GMU 20A have been maintained at a high density and were considered to be increasing during 1997 to 2005 (Figure F-10; Boertje *et al.*, 2007). Review of the nutritional status of this population, including age at first reproduction, twinning rates, short-yearling mass, and indices of browse removal rates all indicate that this population is nutritionally stressed (Boertje *et al.*, 2007). Primary predators of moose calves in the region are wolves, black bears, and grizzly bears (Boertje *et al.*, 2000). Calf harvests were initiated in 2002 to help stabilize this high-density, food-stressed population and to compensate for the declining harvests of bulls (Young and Boertje, 2004). Many permit holders protested the calf hunt; with 61 percent not participating and only 30 percent of those who did participate harvesting a calf (Young and Boertje, 2004), contributing only marginally to the harvest mandate objective of 500 to 720 moose (Figure F-10). While acceptance of the calf hunt decreased, acceptance of cow hunts increased during 2002 to 2003 (Young and Boertje, 2004). The moose population in GMU 20A appears to have peaked in 2003, followed by a declining trend in 2004 and 2005 (Figure F-10). The population decline may be attributable to the increased antlerless harvests.

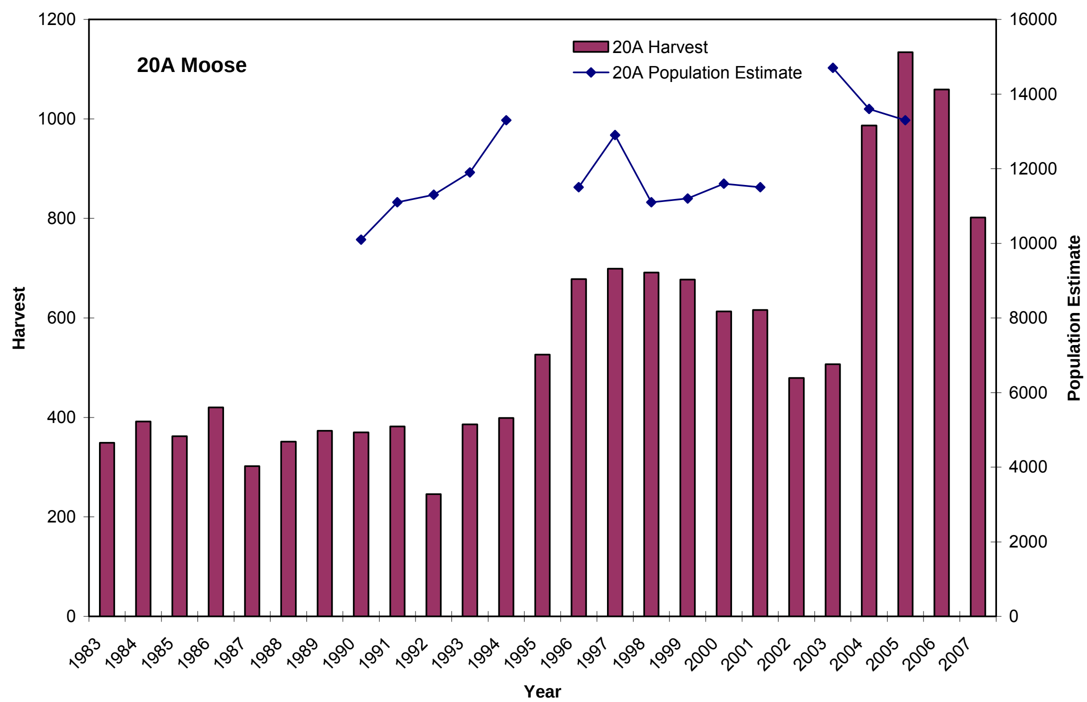

Figure F-10
Population and Harvest Trends for GMU 20A Moose 1983 to 2007 (ADF&G, 2008e; Young, 2004a; Young, 2006a)

The moose population in GMU 20B is also managed for high density because of high demand for moose hunting opportunities in this region, which is accessible by roads and waterways. This population appears to have increased since the early 1990s and supports an average harvest of about 650 moose per year (Figure F-11; Young, 2006b). The moose population in GMU 20D appears to have been increasing since the mid 1990s, although population and harvest management objectives have not been met (Figure F-12; DuBois, 2006b).

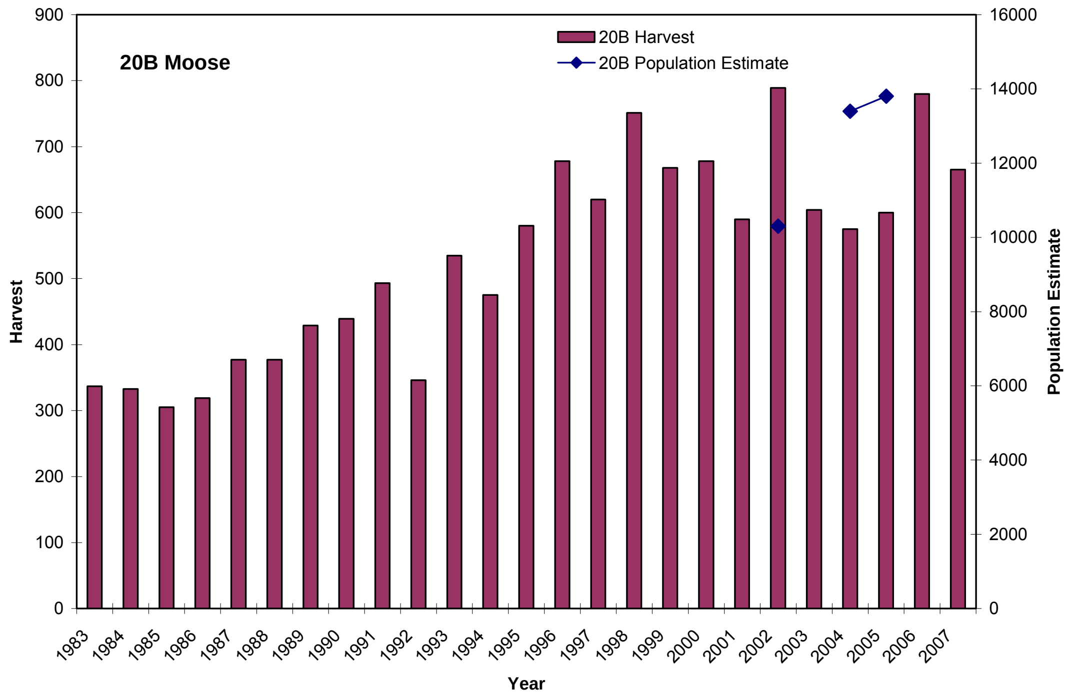

Figure F-11
Population and Harvest Trends for GMU 20B Moose 1983 to 2007 (ADF&G, 2008e; Young, 2004b; Young, 2006b)

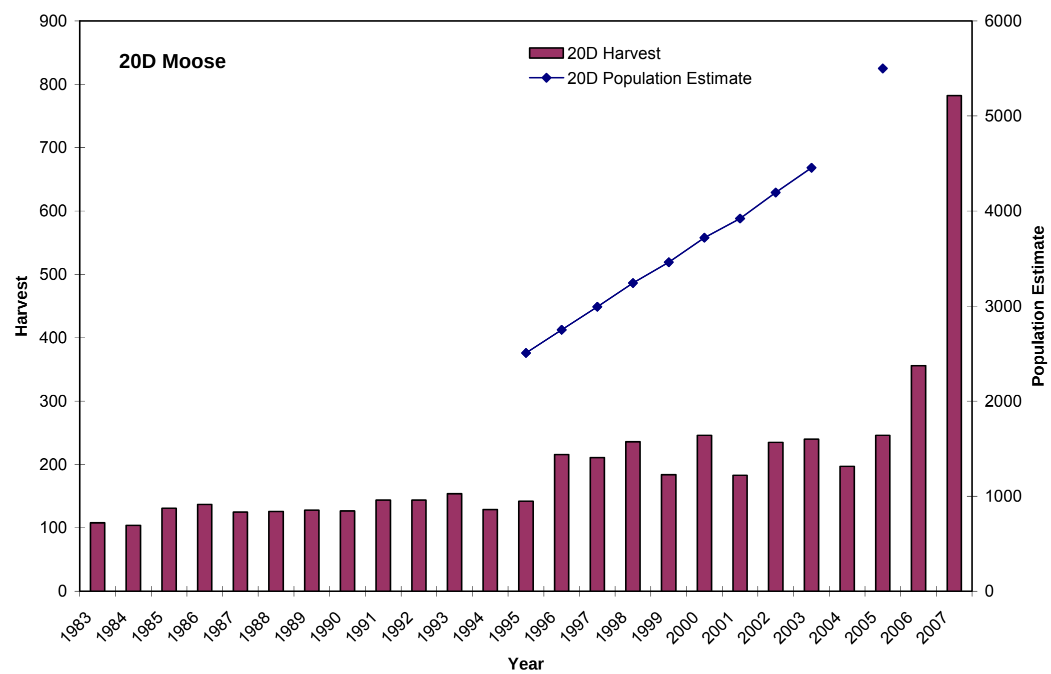

Figure F-12
Population and Harvest Trends for GMU 20D Moose 1983 to 2007 (ADF&G, 2008e; Young, 2004b; Young, 2006b)

Moose in this region include both migratory and non-migratory populations (Gasaway *et al.*, 1983). Migratory moose may range over 200 square miles, while non-migratory moose may range 100 square miles (Ballard *et al.*, 1991). Moose range size is influenced by the sex and age of the individual, the range characteristics of the cow, and habitat conditions. Most moose move to areas traditionally used for calving, rutting and wintering, thereby making use of different habitat types throughout the year. Moose movements within the project area follow general patterns, with movements from foothills areas of the Alaska Range and Yukon-Tanana Uplands toward the Tanana-Kuskokwim Lowlands during late winter to early spring and back to the foothills during late summer to early fall. Movement extent and timing during fall and winter from upland forested areas to lowlands, such as river valleys, is influenced primarily by snow depth. Moose are well adapted to traveling across snow, but depths of more than 28 inches can affect moose movements and habitat use. As snowpack reaches more than 38 inches moose may seek closed-canopy needleleaf forests, which generally have lower snow depths (Peek 1997). Moose wintering in the Salcha and Chena river drainages of GMU 20B and the Alaska Range foothills in GMU 20A move into the Tanana Flats in February to April where cows calve in central GMU 20A (Gasaway *et al.*, 1983). Migratory moose return to the Salcha and Chena river drainages or the Alaska Range foothills during August to October (Gasaway *et al.*, 1983). Moose from the western portion of GMU 20D make similar movements into the eastern portion of GMU 20A (Gasaway *et al.*, 1983). Moose tend to use traditional migratory routes and calves learn migratory behavior as they follow their mothers on annual migration routes (Hundertmark, 1997).

Based on early-winter densities presented in Table F-24, an estimated 2,300 moose would occur within 5 miles of the proposed project alternatives. Seasonal migrants increase the density of moose in the Tanana Flats from 1.8 to 2.0 times the early-winter density (Rodney Boertje, ADF&G, personal communication, February 14, 2008; Gasaway *et al.* 1983). If an estimated 30 percent of the moose in the project area are seasonal migrants from the foothills of GMU 20B and 20D, approximately 690 moose would be expected to move into and out of the proposed project area across the rail alignment twice a year, once during spring and once during fall.

About 200 moose-vehicle collisions were reported by Alaska State Troopers along the stretch of Richardson Highway paralleling the proposed NRE during 2001 to 2005 (ADF&G, 2005b), averaging 42 moose-vehicle kills per year. Collisions were most frequent at the west and east ends of the project area in the vicinity of Fairbanks, North Pole, and Delta Junction. Increased traffic near these communities was the most likely cause of the higher incidence of moose-vehicle collision reports in these areas. Moose-vehicle kills occurred most frequently during January and December, when only 4 to 5 hours of daylight may affect drivers' ability to see moose on the highway, and during July to September, when more moose may be moving across the highway alignment (Figure F-13).

Wolves

Wolf populations in GMUs 20A, 20B, and 20D are managed to provide for compatible human uses including hunting, trapping, photography, viewing, listening, and scientific and educational purposes (Young, 2006c; DuBois, 2006c). Compatible uses include consumptive harvest of wolves for pelts as well as non-consumptive uses such as wildlife viewing and scientific research. Not all human uses are allowed in all areas or at all times. Management of wolves focuses on providing sustained, diverse uses as listed in the ADF&G's Wolf Conservation and Management Policy for Alaska (for additional discussion of Alaska's Wolf Control Programs,

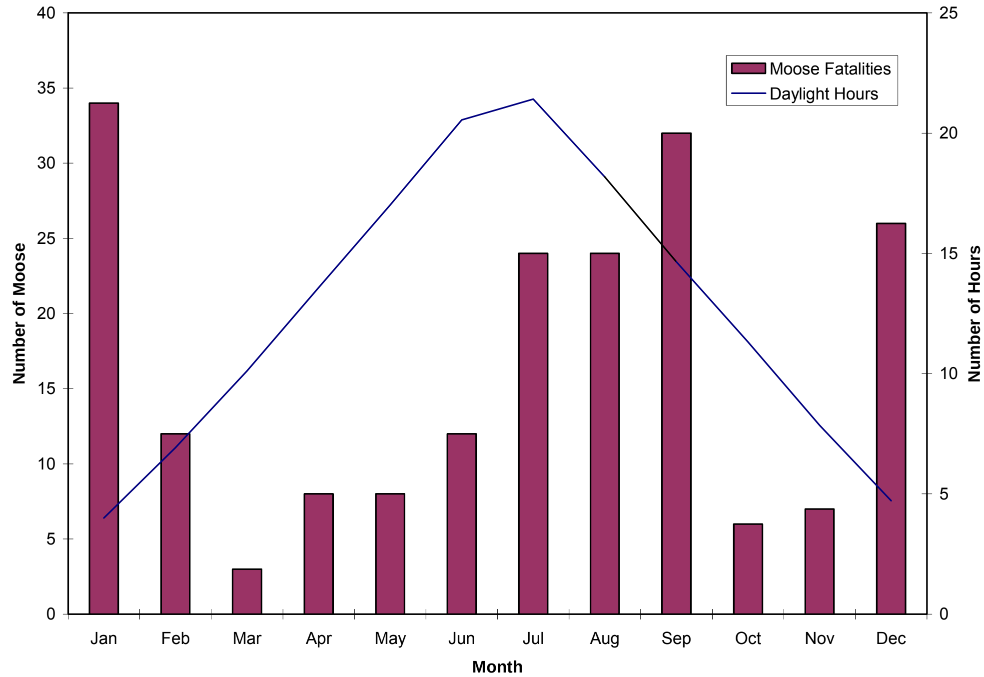

Figure F-13
Monthly Moose Collisions Mortalities During 2001 to 2005 Reported from Alaska State Troopers Logs for GMU 20B and 20D for Richardson Highway with Daylight Hours by Month (ADF&G, 2005b)

see http://www.wc.adfg.state.ak.us/index.cfm?adfg= wolf.main). Most harvested wolves are taken by trappers, although some are shot by hunters, with an average annual harvest of 78 wolves in GMU 20A; 79 wolves in GMU 20B; and 29 wolves in GMU 20D (Figure F-14; Young, 2006c; DuBois, 2006c).

Wolves are carnivorous and in GMU 20 their primary foods are moose and caribou. During winter a pack may kill a moose every few days. Wolf and prey populations can be affected by a number of factors including weather and food availability. Severe winters coupled with active wolf and bear predation can contribute to local big game scarcities. Within GMU 20, wolf numbers are primarily regulated by prey availability (Gasaway *et al.*, 1983; NRC, 1997), but wolf control programs have periodically been used to reduce wolf populations to enhance the harvestable surplus of moose and caribou. Because availability of moose and caribou for human consumption has been a dominant interest of GMU 20 residents, wolf-control measures were initiated within the GMU to reverse moose and caribou population declines. Wolf predation control programs occurred in Unit 20A (fall 1975 to spring 1982, and October 1993 to November 1994), Unit 20B (fall 1979 to spring 1986), and 20D (fall 1979 to spring 1983, July 1997 to July 2002). Fall wolf populations within these three subunits appear to have remained fairly stable during 1998 to 2005, remaining at around 500 individuals (Figure F-14; Young, 2003 and 2006c; DuBois, 2003 and 2006c).

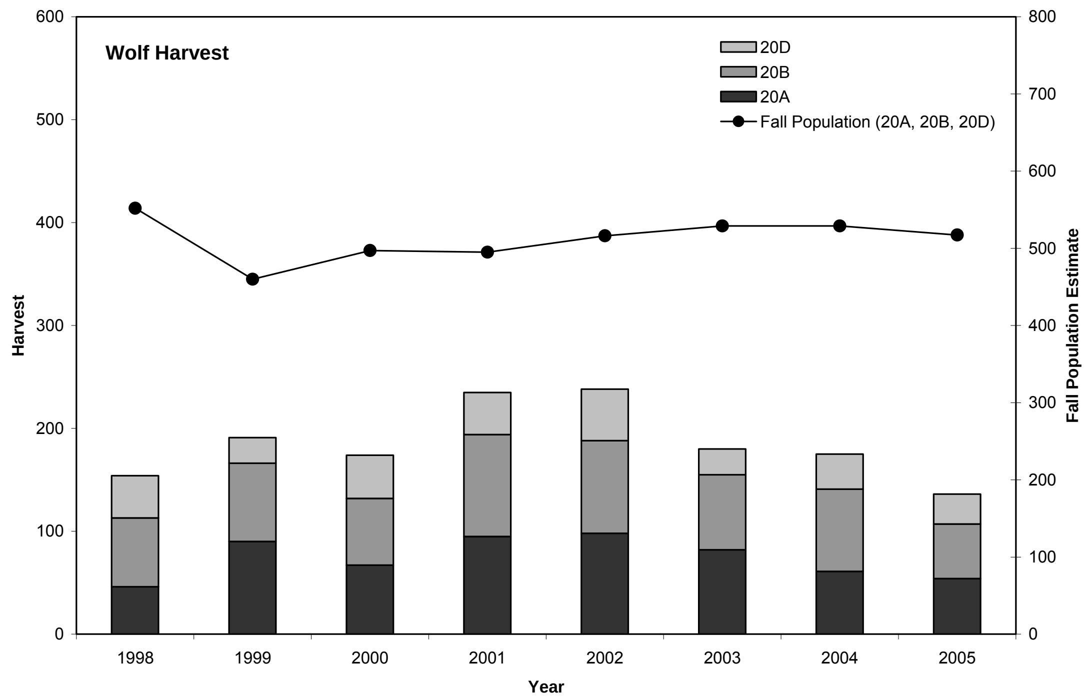

Figure F-14
Harvest Trends for Wolves 1998 to 2005 GMU 20A, 20B and 20D (Young, 2003 and 2006c; DuBois, 2003 and 2006c)

F.3.2 Environmental Consequences

Habitat Loss or Alteration

Habitat loss and alteration would result from construction of the proposed NRE. Loss and alteration within the project footprint as it relates to game mammals is summarized in Chapter 5. Habitat loss and level of game mammal use is further described below by game mammal for each alternative segment. As stated in Chapter 5, habitat loss for all vegetation cover types represents less than 1 percent of available habitats for all game mammals within 5 miles of the project area.

Habitats used by game mammals would be lost due to construction of the Eielson alternative segments (Table F-25). Eielson Alternative Segment 3 would affect the least amount of forested habitat, while Eielson Alternative Segment 1 would affect the greatest amount of forested habitat. Open broadleaf forest and tall shrub habitats would be the most valuable for moose forage within this area; Eielson Alternative Segment 1 would affect the largest area of these habitat types, while Eielson Alternative Segment 2 would affect the smallest area of these habitat types. Eielson Alternative Segment 2 would affect the largest area of needleleaf and mixed forest habitats, while Eielson Alternative Segment 3 would affect the smallest area of these habitat types.

Habitats used by game mammals would be lost due to construction of the Salcha alternative segments (Table F-26). Salcha Alternative Segment 1 would affect the smallest area of forested habitat. Salcha Alternative Segment 1 would affect a few more acres of open broadleaf and mixed forests and tall shrub habitat types than Salcha Alternative Segment 2.

Table F-25
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW for the Eielson Alternative Segments[a,b]

		Alternative Segment			Level of Game Mammal Use[c]						
Grid Code	**Class Name**	**Eielson 1 (acres)**	**Eielson 2 (acres)**	**Eielson 3 (acres)**	**Bison**	**Black Bear**	**Brown Bear**	**Caribou**	**Moose**	**Wolf**	**Fur-bearers**
1	Closed Needleleaf	20.6	13.7	11.8	N	M	L	L	M	L	M
2	Open Needleleaf	72.0	104.9	91.4	N	M	L	L	H	L	L
3	Closed Broadleaf	38.6	30.5	43.5	N	M	L	L	H	L	M
4	Open Broadleaf	30.2	18.1	10.2	N	M	L	L	H	L	M
5	Closed Mixed	73.6	54.0	53.5	N	M	L	L	M	L	M
	Forested	*235.0*	*221.2*	*210.5*	N	M	L	L	M	L	M
6	Tall Shrub	2.2	1.7	11.5	N	M	L	N	H	L	M
7	Low Shrub	8.2	8.3	5.5	N	M	L	N	H	L	L
9	Graminoid	1.0	9.7	11.0	N	M	L	N	H	L	L
15	Clear Water	0.0	0.1	2.8	N	L	L	N	H	L	M
Total Area		**246.4**	**241.1**	**241.3**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

Table F-26
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW, Extra Staging Areas, and Access Roads for the Salcha Alternative Segments[a,b]

		Alternative Segment		Level of Game Mammal Use[c]						
Grid Code	**Class Name**	**Salcha 1 (acres)**	**Salcha 2 (acres)**	**Bison**	**Black Bear**	**Brown Bear**	**Caribou**	**Moose**	**Wolf**	**Fur-bearers**
1	Closed Needleleaf	50.0	167.0	N	H	L	L	M	M	H
2	Open Needleleaf	41.1	100.6	N	H	L	L	H	M	M
3	Closed Broadleaf	52.8	64.8	N	H	L	L	H	M	H
4	Open Broadleaf	82.7	28.2	N	H	L	L	H	M	H
5	Closed Mixed	154.7	110.9	N	H	L	L	H	M	H
	Forested	*381.3*	*471.4*	N	H	L	L	H	M	H
6	Tall Shrub	45.0	34.6	N	H	M	N	H	M	H
7	Low Shrub	7.3	26.1	N	H	M	N	H	M	M
9	Graminoid	1.3	3.0	N	H	L	N	H	M	M
15	Clear Water	13.7	16.2	N	H	M	N	H	M	H
16	Turbid Water	71.2	42.3	N	H	M	N	H	M	H
19	Sparse Vegetation	0.0	1.4	N	M	L	N	M	M	M
20	Gravel/Rock	0.4	2.4	N	M	L	N	M	M	M
21	Mud/Silt/Sand	12.3	40.8	N	M	L	N	M	M	M
Total Area		**532.5**	**638.3**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

The Central alternative segments and Central Connectors would affect primarily forested habitats (Tables F-27 and F-28).

Table F-27
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW for the Central Alternative Segments[a,b]

				Level of Game Mammal Use[c]						
Grid Code	**Class Name**	**Central 1 (acres)**	**Central 2 (acres)**	**Bison**	**Black Bear**	**Brown Bear**	**Caribou**	**Moose**	**Wolf**	**Fur-bearers**
1	Closed Needleleaf	16.5	64.7	N	H	L	L	M	M	H
2	Open Needleleaf	40.0	7.8	N	H	L	L	H	M	M
3	Closed Broadleaf	1.8	0	N	H	L	L	H	M	H
4	Open Broadleaf	9.2	0	N	H	L	L	H	M	H
5	Closed Mixed	21.1	11.8	N	H	L	L	H	M	H
	Forested	*88.6*	*84.3*	N	H	L	L	H	M	H
6	Tall Shrub	0.4	0	N	H	M	N	H	M	H
7	Low Shrub	17.0	0	N	H	M	N	H	M	M
9	Graminoid	0.2	0	N	H	L	N	H	M	M
21	Mud/Silt/Sand	0.2	2.0	N	H	N	N	M	M	M
24	Other	16.5	0.6	N	H	M	L	M	M	M
Total Area		**122.9**	**86.9**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

Table F-28
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW for the Central Connector Segments[a,b]

		Alternative					Level of Game Mammal Use[c]						
Grid Code	**Class Name**	**Central Connector A (acres)**	**Central Connector B (acres)**	**Central Connector C (acres)**	**Central Connector D (acres)**	**Central Connector E (acres)**	**Bison**	**Black Bear**	**Brown Bear**	**Caribou**	**Moose**	**Wolf**	**Fur-bearers**
1	Closed Needleleaf	29.4	56.6	30.6	19.4	8.2	N	H	L	L	M	M	H
2	Open Needleleaf	30.7	12.2	8.6	0.4	8.0	N	H	L	L	H	M	M
3	Closed Broadleaf	0.4	-	0.1	-	1.3	N	H	L	L	H	M	H
4	Open Broadleaf	3.6	0.2	2.0	-	0.1	N	H	L	L	H	M	H
5	Closed Mixed	26.2	9.6	3.6	1.4	6.8	N	H	L	L	H	M	H
	Forested	*90.2*	*78.5*	*44.9*	*21.2*	*24.3*	N	H	L	L	H	M	H
6	Tall Shrub	0.8	-	0.4	-	0.2	N	H	M	N	H	M	H
7	Low Shrub	14.2	-	10.1	-	-	N	H	M	N	H	M	M
9	Graminoid	0.5	-	0.2	-	-	N	H	L	N	H	M	M
15	Clear Water	-	0.8	0.4	0.0	-	N	H	N	N	M	M	M
21	Mud/ Silts/ Sand	-	-	-	-	0.3	N	H	M	L	M	M	M
24	Other	-	-	-	-	33.6	N	H	L	L	M	M	M
Total Area		**105.8**	**79.4**	**56.0**	**21.2**	**58.5**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

Habitats used by game mammals would be lost due to construction of the Donnelly alternative segments (Table F-29).

Table F-29
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW, Extra Staging Areas, and Access Roads for the Donnelly Alternative Segments[a,b]

		Alternative Segment		Level of Game Mammal Use[c]						
Grid Code	**Class Name**	**Donnelly 1**	**Donnelly 2**	**Bison**	**Black Bear**	**Brown Bear**	**Caribou**	**Moose**	**Wolf**	**Fur-bearers**
1	Closed Needleleaf	123.0	209.4	N	H	L	L	M	M	H
2	Open Needleleaf	324.1	149.7	N	H	L	L	H	M	M
3	Closed Broadleaf	7.1	36.1	N	H	L	L	H	M	H
4	Open Broadleaf	17.1	8.4	N	H	L	L	H	M	H
5	Closed Mixed	75.3	157.4	N	H	L	L	H	M	H
	Forested	*546.6*	*561.0*	N	H	L	L	H	M	H
6	Tall Shrub	3.2	3.8	N	H	M	N	H	M	H
7	Low Shrub	22.9	12.7	N	H	M	N	H	M	M
8	Dwarf Shrub	0.6	0.0	N	H	M	N	H	M	M
9	Graminoid	11.2	2.7	N	H	L	N	H	M	M
15	Clear Water	2.9	2.1	N	H	M	N	H	M	H
16	Turbid Water	22.0	21.3	N	H	M	N	H	M	H
19	Sparse Vegetation	0.0	0.4	N	M	L	N	M	M	M
20	Gravel/Rock	9.1	11.8	N	M	L	N	M	M	M
21	Mud/Silt/Sand	22.2	21.0	N	M	L	N	M	M	M
24	Other	43.0	56.1	N	M	M	L	H	M	M
Total Area		**683.7**	**692.9**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

South Common Segment would affect habitats used by game mammals (Table F-30). Habitat mapping (BLM *et al.*, 2002) for this segment is different than the current habitat type. An extensive wildland fire in 1998 reset the successional stage for this area. This large expanse is currently shrub habitat with scattered patches of forested habitats; and was used by moose during spring and late-summer prior to the fire (Noel, 2007a).

Construction of the Delta alternative segments would affect habitats used by game mammals (Table F-31).

Table F-30
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW for South Common Segment[a,b]

Grid Code	Class Name	South Common Segment (acres)	Level of Game Mammal Use[c] Bison	Black Bear	Brown Bear	Caribou	Moose	Wolf	Fur-bearers
1	Closed Needleleaf	57.8	N	H	M	L	M	M	H
2	Open Needleleaf	99.1	N	H	M	L	H	M	M
3	Closed Broadleaf	18.7	N	H	M	L	H	M	H
4	Open Broadleaf	8.5	N	H	M	L	H	M	H
	Forested	*244.2*	N	H	M	L	H	M	H
5	Closed Mixed	60.1	N	H	M	L	H	M	H
7	Low Shrub	6.1	N	H	M	N	M	M	M
9	Graminoid	0.9	N	H	M	N	H	M	M
15	Clear Water	1.5	N	H	M	N	H	M	H
Total Area		**252.7**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

Table F-31
Direct Loss of Habitats Used by Game Mammals Within the 200-foot ROW, Extra Staging Areas, and Access Roads for the Delta Alternative Segments[a,b]

Grid Code	Class Name	Alternative Segment Delta 1	Delta 2	Level of Game Mammal Use[c] Bison	Black Bear	Brown Bear	Caribou	Moose	Wolf	Fur-bearers
1	Closed Needleleaf	124.3	44.8	N	H	L	L	M	L	M
2	Open Needleleaf	63.8	53.1	N	H	L	L	H	L	L
3	Closed Broadleaf	9.0	21.5	N	H	L	L	H	L	M
4	Open Broadleaf	5.3	6.6	N	H	L	L	H	L	M
5	Closed Mixed	44.0	80.8	N	H	L	L	H	L	M
	Forested	*246.4*	*206.9*	N	H	L	L	H	L	M
6	Tall Shrub	1.1	2.1	M	H	M	N	H	L	M
7	Low Shrub	4.7	2.3	M	H	M	N	H	L	L
9	Graminoid	4.2	0.0	H	H	L	N	H	L	L
15	Clear Water	0.5	0.3	L	H	M	N	H	L	M
16	Turbid Water	6.3	12.4	L	H	M	N	H	L	M
19	Sparse Vegetation	6.7	1.5	L	M	L	N	M	L	L
20	Gravel/Rock	6.9	3.8	L	M	L	N	M	L	L
21	Mud/Silt/Sand	36.0	17.7	L	M	L	N	M	L	L
23	Agriculture	4.6	69.7	H	M	M	L	H	L	L
Total Area		**317.4**	**316.6**							

[a] Source: BLM *et al.*, 2002.
[b] Evaluations based on typical habitat use patterns, developed characteristics within the alternative area, and numbers of game mammals expected to occur within the alternative area.
[c] H = high, M = moderate, L = low, N = none.

Because furbearers are such a diverse group, habitat use, breeding season, den type and use, and home range size estimates and estimated habitat impact area for common furbearers within the project area are further described in Table F-32. Forested and riparian habitats would be the primary habitats used by the diverse assemblage of furbearing animals within the project area. Minimum and maximum impacts to habitats used by each furbearing animal are quantified in Table F-32.

Habitat Fragmentation

Habitat fragmentation would result from construction of the proposed NRE and would have variable effects on game mammals, depending on the species considered. Fragmentation was reviewed by evaluating the location and distribution of core habitats, riparian habitats, and at a landscape scale using road and trail densities. Review and analysis of land cover mapping (BLM *et al.*, 2002) indicates that the rail line would contribute to habitat fragmentation of core forested habitats (Figure F-15). The rail line would also contribute to fragmentation of riparian habitats.

Bears, wolves, and other furbearers commonly use riparian corridors for travel and forage. Fragmentation of riparian habitats would occur due to construction of the rail line across rivers and streams, and by excavation of gravel sources within river beds. Most major rivers would be crossed by bridges, which generally would have sufficient height and span to allow for bears to cross beneath the bridge. Riparian corridors occupy 9 percent of the project area and various alternative segments contain less than 1 to 45 acres of riparian habitat.

The Salcha alternative segments, Central alternative segments and Central Connectors would primarily affect forested riparian habitats. These segments include the Tanana, Salcha, Little Salcha, and Fivemile Clearwater rivers, which provide riparian habitats for bears, moose, and furbearers. Furbearers would be expected to be more abundant in the area of Salcha Alternative Segment 1, Central alternative segments, and Central Connectors due to the remoteness of these areas. Moose would also be abundant within this portion of the project area.

Road and trail densities vary across the proposed rail line. Construction and operation of the proposed rail line would increase road densities by more than 0.4 mile per square mile within two blocks (6 percent of analysis blocks), and by more than 0.25 mile per square mile within 19 blocks (64 percent of analysis blocks; Figure F-16). During the winter, wolves attracted by carcasses to the rail line could experience reduced survival because of the facilitated access for hunters along the maintenance and tower access roads. Road densities of 1.0 to 1.3 miles per square mile have been found to provide sufficient access to hunters such that they can limit wolf population numbers by trapping or hunting (Jalkotzy *et al.*, 1997). Construction of the rail line would increase road density within analysis blocks between 0.02 to 0.50 mile per square mile throughout the project area and does not include communication tower access roads that would potentially be part of the project. Road density for two blocks (Figure F-16) would be increased to above the threshold of 1.0 mile per square mile.

Moose-Train Collision Mortality

Rail collision mortality for moose was estimated based on the reported annual mortality for moose from the existing 58 miles of rail line currently running through GMU 20B. Locations with suspected increased frequency of collisions were evaluated based on winter moose track survey data (Noel, 2006b), and moose distribution data collected during spring and fall aerial transect surveys (Noel, 2007a). Track surveys were flown during the winter along the NRE

Table F-32
Home Range Size Estimates and Habitats for Common Furbearers Within the NRE Project Area[a]

Furbearers	Home Range Size	General Habitat/Impact Summary[b]	Breeding and Den Habitat
Beaver	0.62-mile (1-kilometer) stream channel riparian habitat within 50 meters of water 43.5 acres (17.6 hectares) – solitary 19.0 acres (7.7 hectares) – families	Streams, ponds, backwaters (16 to 20 acres clear water); forage on shrubs and aquatic vegetation (101 to 107 acres tall shrub, 72 to 78 acres riparian habitat).	Breed January or February, young born late April to June. Bank den or lodge near dammed streams or on ponds – 2 feet x 3 feet x 3 feet – used year-round.
Coyote	2,471 to 24,710 acres (10 to 100 square kilometers)	Forests, grasslands, scrub/shrub, agricultural (2,544 to 2,606 acres); forage primarily on hares, rodents, carrion.	Breed February and March. Den in hills, floodplain terrace, aboveground or hollow logs, used only during whelping, may be occupied during March to July, may use more than one den, may use repeatedly.
Short-tailed Weasel (Ermine)	24.7 to 49.4 acres (10 to 20 hectares)	Forests, riparian woodlands and scrub/shrub (2,234 to 2,272 acres); forage primarily on small rodents and lemmings, but will eat birds, eggs, frogs, fish, insects.	Breed mid to late summer, young born early May through June. Den in rodent burrows, stumps, rock out crops, may remain June to August.
Lynx	5 to 100 square miles (3,200 to 64,000 acres), depending on food abundance	Spruce and hardwood forest habitats (2,127 to 2,171 acres), especially mosaic habitats caused by fire; forage primarily on hares, grouse, ptarmigan, squirrels, rodents.	Breed March and early April, kittens born May to June. Den in natural shelters such as windblown trees, hollow logs, log jams, rock crevices.
Marten	1 to 15 square miles (640 to 9,600 acres), depending on food abundance	Black spruce forests and bogs (633 to 786 acres); forage primarily on rodents, but also eat berries, small birds, eggs, vegetation, and carrion.	Breed July and August, young born in April or early May. Den in natural shelters such as hollow logs, windblown trees, standing snags/hollow trees.
Mink	Female, 20 to 50 acres Male, 1,900 acres	Riparian forests, marshes and scrub/shrub wetlands (461 to 513 acres); forage on fish, birds, eggs, rodents.	Breed March to April, most young born in June. Den in burrow or hollow log near a pond or stream, young remain in den through July.
Muskrat	2.5 to 4.9 acres (1 to 2 hectares) marshes 0.25 mile (411 meters) streams	Marshes, riparian areas, floodplains of large rivers, ponds (122 to 134 acres); forage on aquatic plants, lilies, sedges, grasses, mussels, small fish.	Breed during late April to mid May, two litters per year, first mid June, second mid July. Den vegetation piles 2 to 3 feet above water and 5 to 6 feet diameter; also may tunnel into banks used year-round.
Red Fox	Summer, 150 to 1,300 acres Winter, 3,104- to 49,658-acre (2- to 8-kilometer) radius	Mosaic habitats, lowland marshes (1,628 to 1,751 acres); forage on rodents, small mammals, birds, eggs, insects, vegetation, carrion.	Breeds February to March, young born April to May. Den 15 to 20 feet long, usually located on the side of a hill with several entrances; may use abandoned wolf dens.

Table F-32
Home Range Size Estimates and Habitats for Common Furbearers Within the NRE Project Areaa (cont'd)

Furbearers	Home Range Size	General Habitat/Impact Summary[b]	Breeding and Den Habitat
Red Squirrel	0.5 to 1.0 acre	Spruce forests (1,794 to 1,830 acres); forage on seeds, berries, buds, fungi, and occasionally insects and birds' eggs.	Breed February and March, young born April to May. Nest in hole in tree trunk or constructed mass of twigs, leaves, mosses and lichens, several nests maintained per territory, ground burrows or middens used primarily for food storage.
River Otter	1.2 to 48.5 miles (2 to 78 kilometers) waterway	Riparian habitats, rivers, lakes, marshes (122 to 134 acres); forage on fish, mussels, snails, birds, mammals, vegetation.	Breed in May, young born late January to June. Burrows in soil or uses fallen/hollow logs, overturned tree root wads; may use year-round.
Wolf	600 square miles (384,000 acres) per pack	Variable (2,676 to 2,739 acres); forages on moose, caribou, hares, rodents, birds.	Breed February and March, young born in May or early June. Den in well-drained soil up to 10 feet deep; young moved from den during mid to late summer.
Wolverine	Female, 50 to 100 square miles (32,000 to 64,000 acres) Male, 240 square miles (153,600 acres)	Variable, coniferous forests, riparian areas may be important winter habitat (1,901 to 1,932 acres); forages on moose and caribou carcasses, rodents, squirrels, hares, birds.	Breed May through August, young born January through April. Den made in snow; occupies dens in caves, under fallen trees or thickets when inactive.

[a] Compiled from various sources including ADF&Gs Alaska Wildlife Notebook, NatureServe, Animal Diversity Web.
[b] Numbers in parenthesis represent the range of potential impacts from the proposed NRE.

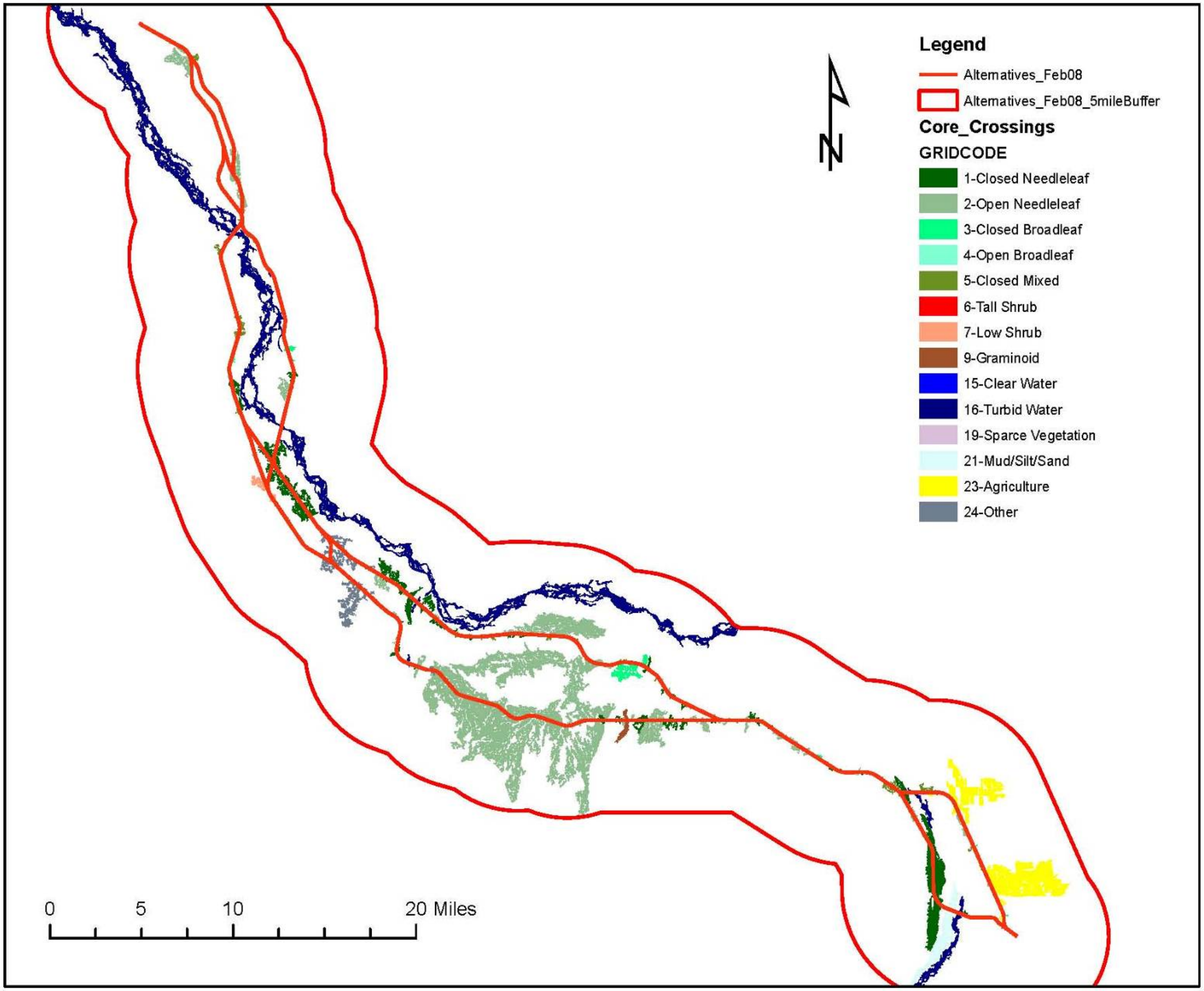

Figure F-15
Core Habitat Areas Crossed by NRE Alternatives (BLM *et al.*, 2002)

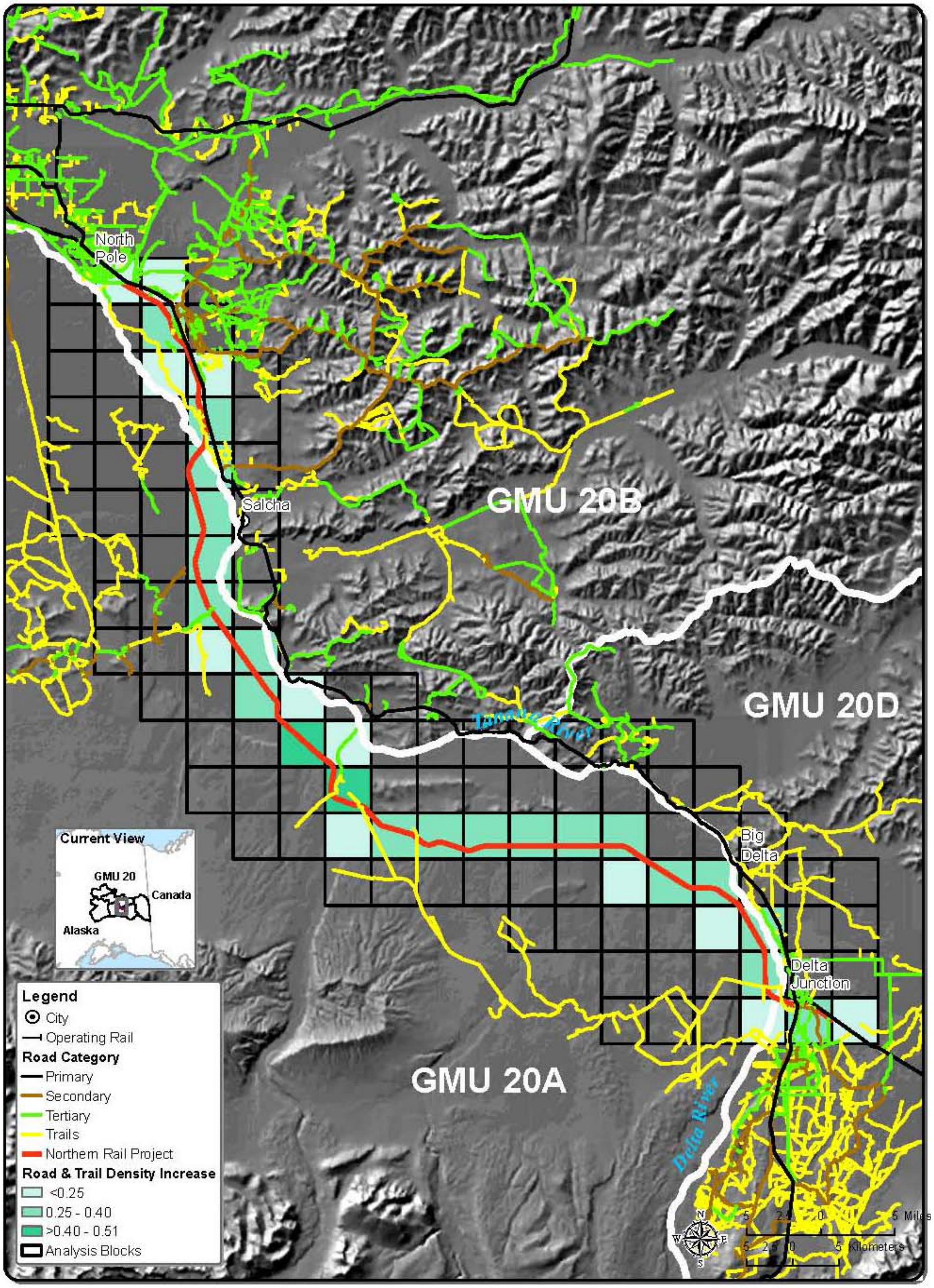

Figure F-16
Road and Trail Density Increases (miles per square miles) within Analysis Blocks Due to the NRE (Proposed Action)

alignments proposed at the time (Noel, 2006b). Spring and fall survey data for moose were collected during systematic north-south strip transect surveys of the project area (Noel, 2007a).

The existing rail line through GMU 20B averages annual moose-train collision mortalities of 0.35 moose per mile or about 20 moose per year (range 0.16 to 1.05 moose per mile) (Young, 2004b and 2006b). Assuming that the frequency of trains for the NRE would be roughly 40 percent higher than the frequency of trains on the existing rail line, the increase in moose-train collision mortality from operation of the approximately 80-mile NRE would average 40 moose per year, ranging from 18 to 120 collision mortalities per year. If the frequency of trains also increased on the existing rail line because of NRE operations, the number of moose-train collision mortalities would be expected to increase on the existing line.

During 2004-2005, most (63 percent) reported moose-train collisions on the existing rail line occurred during November, December and January (Figure F-17; ADF&G, 2005b). Collision mortality within this stretch of track appears to be influenced by February snow depth at the French Creek snow course (NRCS, 2008; Figure F-18). Collisions at this location occurred throughout the day. For those collisions that occurred before the solar noon, the time of the collisions averaged 4.4 hours (plus or minus 2.19 hours Standard Deviation (SD), range 2.2 to 9.4 hours) before sunrise. For those collisions that occurred after the solar noon, the time of collisions averaged 4.0 hours (plus or minus 2.63 hours SD, range 1.1 to 8.4 hours) after sunset (ADF&G, 2005b).

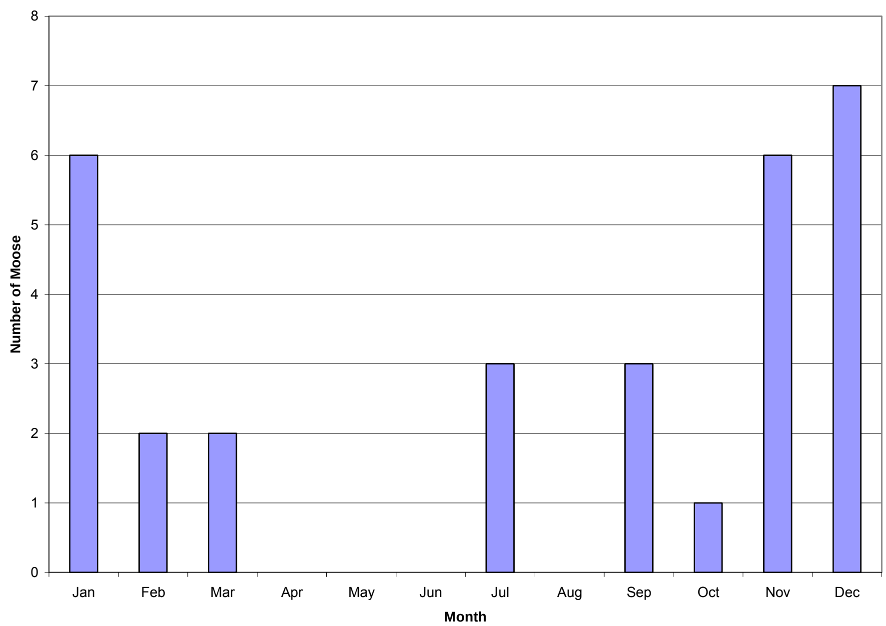

Figure F-17
Frequency of Moose-Train Collision Mortalities by Month Along 58 Miles of Existing Rail Line Within GMU 20B at the Western End of the NRE Project Area During 2004-2005 (ADF&G, 2005b)

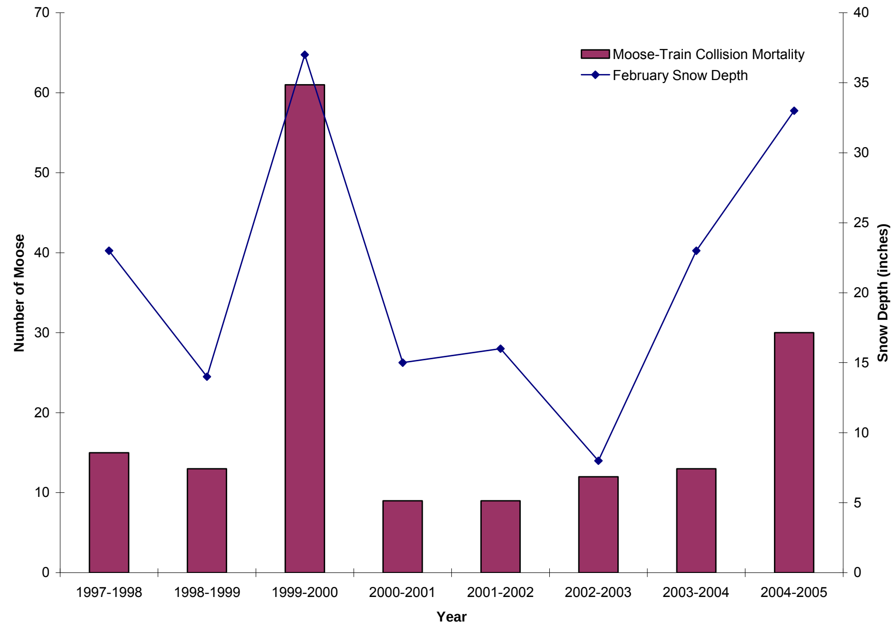

Figure F-18
Reported Annual Moose-Train Collision Mortality for 58 miles of Existing Rail Line Within GMU 20B at the Western End of the NRE Project Area with February Snow Depth at the French Creek Station (Young, 2004b and 2006b; NRCS, 2008)

The seasonality and distribution of existing moose-vehicle and moose-train collisions, winter moose-track survey data (Figure F-19), and spring and late-summer moose distribution data within the project area were reviewed (Figures F-20 and F-21). This review indicates that the estimated 40 (range 18 to 120) moose-train collision mortalities each year on the proposed rail line would most likely occur during November, December and January and would likely be concentrated along portions of Salcha Alternative Segment 1, Central Alternative Segment 1, Central Connectors A and B, Donnelly Alternative Segment 2, and South Common Segment. Mortalities would likely range higher during years with snow depths greater than 30 inches, or if a greater proportion of seasonal moose movements would occur across the proposed rail line than occur across the existing rail line.

F.4 Bird Resources

A suite of resident (designated R on tables) birds occur within the project area, including owls, ptarmigan and grouse, ravens and jays, woodpeckers, chickadees, and finches. Many other birds occurring within the project area are migratory, arriving or passing through in the spring beginning with raptors and waterfowl in April continuing with the arrivals of songbirds through May and passing through or leaving in late summer and fall (during July through October). Migratory birds fall into two classes, (1) long distance (L on tables) or Neotropical migrants (those that winter south of the Tropic of Cancer), and (2) short distance (S on tables) or Nearctic migrants (those that winter north of the Tropic of Cancer).

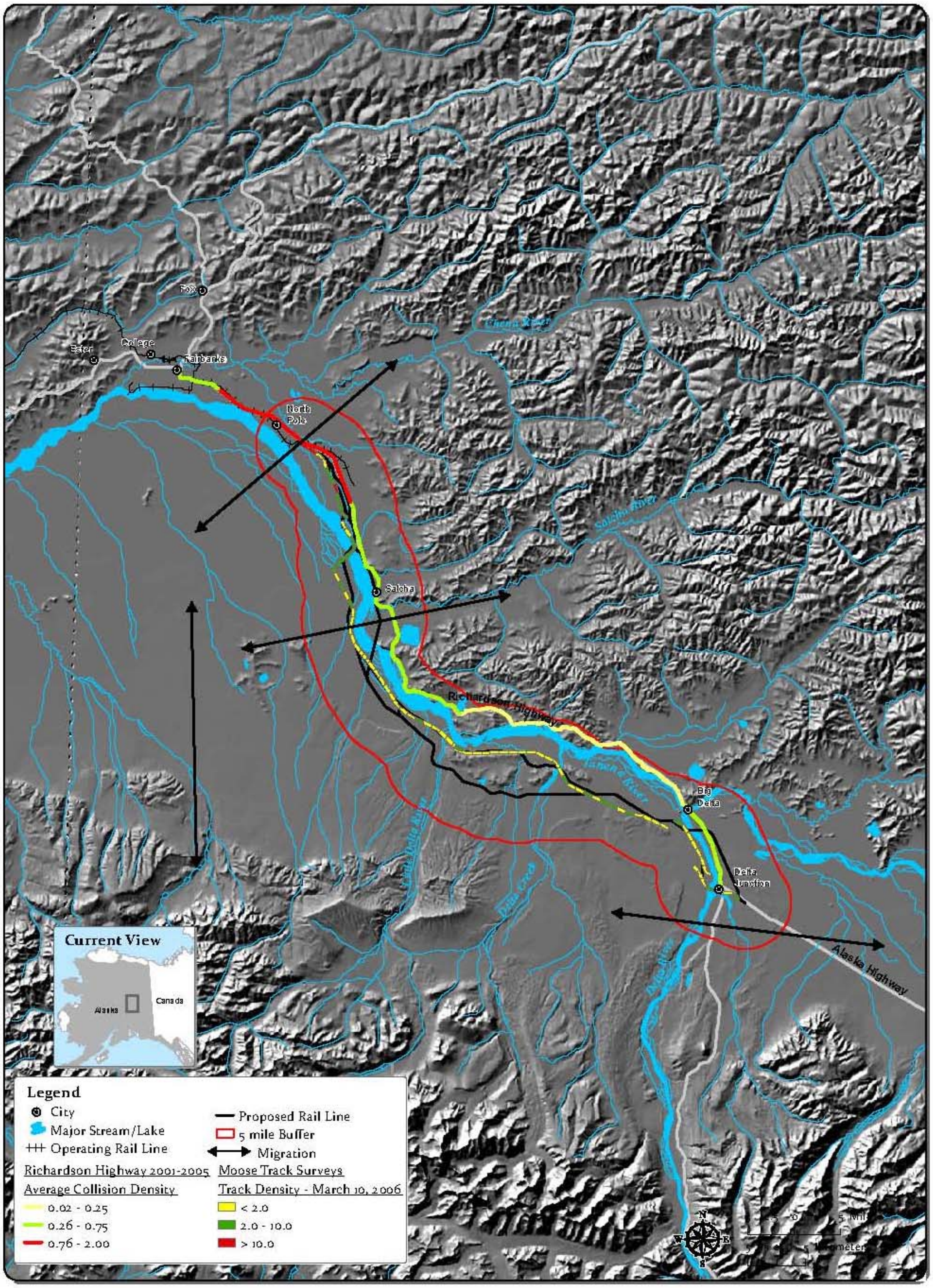

Figure F-19
Generalized Winter-Spring and Late-Summer Fall Moose Migration Directions (Gasaway *et al.*, 1983), Collision Mortality Along the Richardson Highway (ADF&G, 2005b), and Track Density Along and Near Portions of Proposed Alternative Segments (Noel, 2006b)

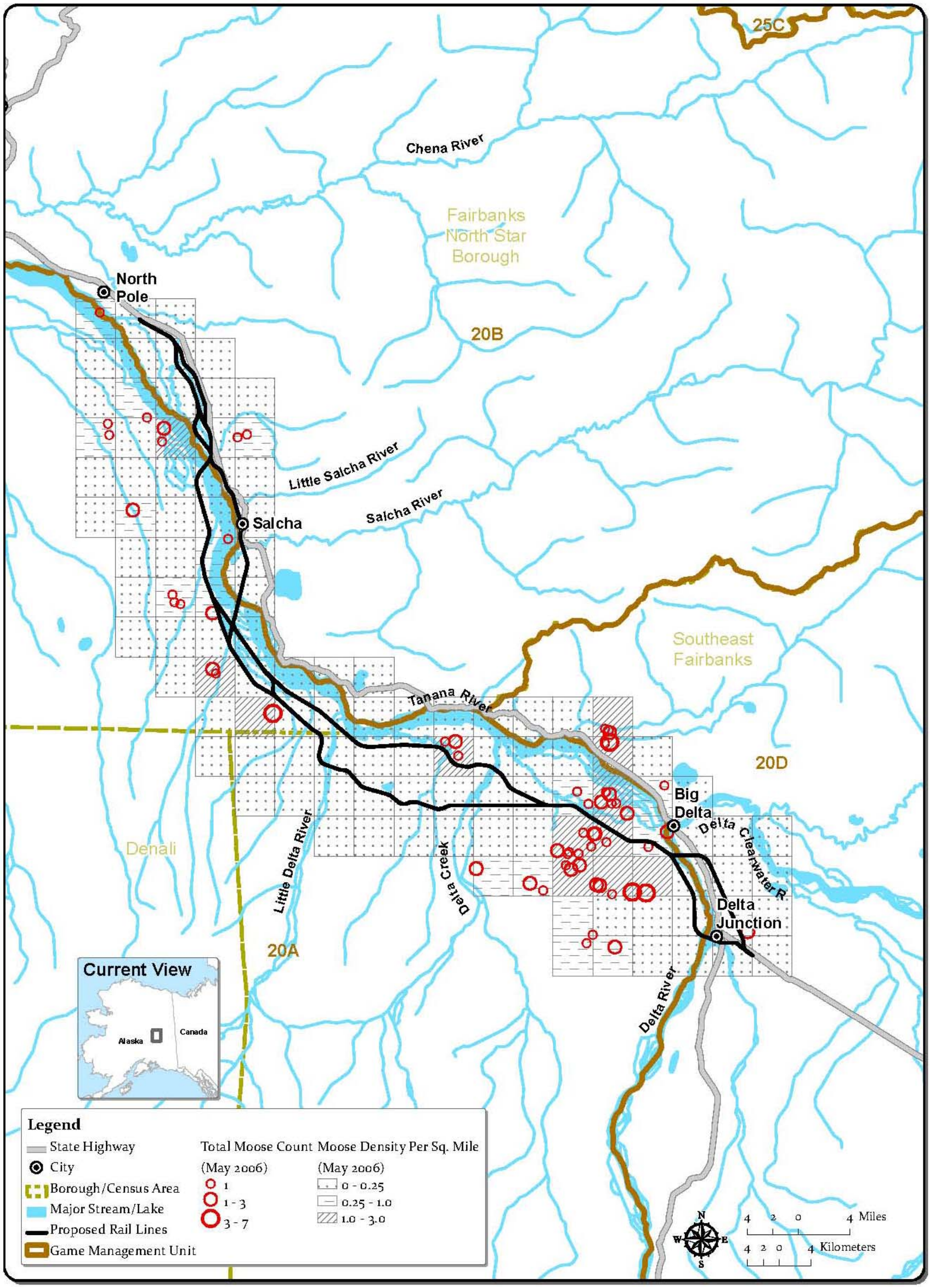

Figure F-20
Spring Moose Distribution and Densities Recorded During Aerial Transect Surveys Within the Project Area (Noel, 2007a)

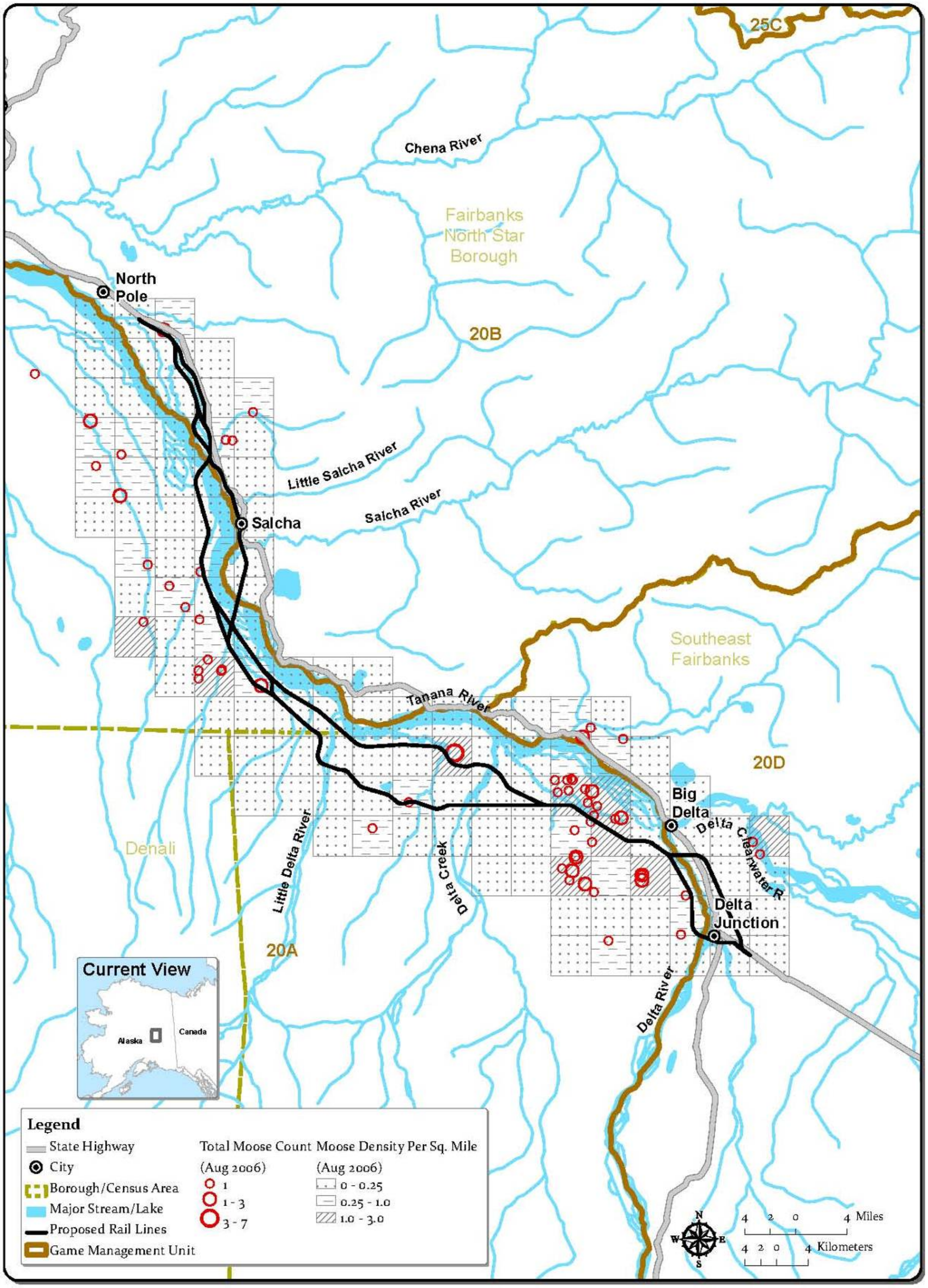

Figure F-21
Late-Summer Moose Distribution and Densities Recorded During Aerial Transect Surveys Within the Project Area (Noel, 2007a)

F.4.1 Waterfowl and Waterbirds

Waterfowl are hunted in Alaska and hunters harvested an average estimate of 70,000 ducks and 6,500 geese during 2005 and 2006 or less than 1 percent of the average estimated harvest of ducks and geese for the United States. Mallard, American wigeon, and American green-winged teal accounted for 74 percent of the duck harvest and Canada goose accounted for 71 percent of the goose harvest (USFWS, 2007). Alaska hunters harvested an average of 550 sandhill cranes during 2005 and 2006 (USFWS, 2007).

Table F-33 lists waterfowl and waterbirds that commonly occur within the project area based on aerial and ground-based surveys (Benson, 1999; Benson, 2001; Anderson *et al.*, 2000; Platte, 2003; Harding and Sharbaugh, 2005) and estimated numbers within 5 miles of the proposed NRE (990-square-mile area) based on regional USFWS aerial waterfowl surveys (USFWS, 2008). Some waterfowl and waterbirds nest within habitats crossed by the proposed rail line and many more waterfowl and waterbirds migrate through Interior Alaska on their way to and from nesting grounds in western and arctic Alaska. Most waterfowl and waterbirds nest on the ground near waterbodies. Herring and mew gulls nest on river bars in the Tanana River. Potential habitat loss due to construction of the NRE is listed in Table F-33. These potential losses are based on project area nest season densities.

Sandhill crane and swan use in the project area is shown in Figures F-22 and F-23. Based on SEA field surveys, sandhill cranes use exposed and submerged gravel bars in the Tanana River, the Little Delta River, Delta Creek and the Delta River for roosting (Figure F-22). Sandhill cranes roost in riverine areas surrounded by flowing water which afford protection from predators while the cranes sleep (Norling *et al.*, 1992). Some swans were also found on riverine habitats during dawn and dusk surveys (Figure F-22). During the day sandhill cranes forage in wetland habitats and grain fields, while swans generally remain on or near water (Figure F-23). Foraging habitats used by cranes were most closely associated with the Eielson alternative segments, Donnelly Alternative Segment 2 and Delta Alternative Segment 2 (Figure F-23). Cranes flying back and forth between riverine roosting habitats and foraging habitats (Currier, 1997; Morkill and Anderson, 1991) would potentially cross the NRE rail line several times a day while staging within the project area.

F.4.2 Raptors and Owls

Bald and golden eagles in Interior Alaska are primarily summer residents, arriving in late April and departing by freeze-up in mid-to-late September (Ritchie and Ambrose, 1996). Golden eagles migrate through the project area but are not known to rest in the vicinity of the NRE. Bald eagle nests within the project area during 2005-2007 were primarily associated with habitats along the Tanana River; occurring in balsam poplar trees (77 percent), and spruce trees (20 percent, presumably white spruce) (Prichard and Ritchie, 2007). Most nests on the Tanana River were within 300 feet of a shoreline (Ritchie and Ambrose, 1996) and clusters of nest structures may be associated with side channels with chum salmon spawning areas. Waterfowl are important in the diet of Tanana River nesting bald eagles, especially in the spring. Salmon are more important prey in late summer and fall (Ritchie and Ambrose, 1996). Bald eagles regularly occur on the lower Delta River during midwinter where they are found near open water associated with wintering waterfowl and fall spawning chum salmon (Ritchie and Ambrose, 1996). The few migration and winter band recoveries suggest that Tanana River bald eagles migrate through inland areas and overwinter in western North America including Washington

Table F-33
Waterbird Densities, Estimated Nesting Season Populations, and Estimated Number of Nesting Birds Affected[a] by the Proposed NRE

Common Name	Species	Donnelly Area[b]	Chena and Tanana Flats Area[c]	Tanana-Kuskokwim Lowlands Density (birds/square mile)[d]	Project Area Density (birds/square mile)[e]	Estimated Project Area Population[f]	Estimated Proposed Action Impact[g]	Estimated Minimum Project Area Impact[h]	Estimated Maximum Project Area Impact[i]
Waterbirds									
Common Loon	*Gavia immer*		√	0.052	0.013	13	0	0	0
Pacific Loon	*Gavia pacifica*	√		0.047	0.036	36	0	0	0
Horned Grebe	*Podiceps auritus*	√							
Red-necked Grebe	*Podiceps grisegena*	√	√	0.060	0.018	18	0	0	0
Sandhill Crane	*Grus Canadensis*			0.039	0.018	18	0	0	0
Large Shorebirds				0.026	0.031	31	0	0	0
Small Shorebirds				0.355	0.181	179	1	1	1
Herring Gull	*Larus argentatus*		√						
Mew Gull	*Larus canus*		√	0.220	0.161	159	1	1	1
Merganser	*Mergus* spp.	√		0.047	0.026	26	0	0	0
Geese & Swans									
Canada Goose	*Branta Canadensis*		√	0.104	0.114	113	1	1	1
Trumpeter Swan	*Cygnus buccinators*		√	0.254	0.205	203	1	1	1
Ducks									
American Green-winged Teal	*Anas crecca*	√		0.306	0.256	254	1	1	1
American Wigeon	*Anas americana*	√	√	0.622	0.430	426	2	2	2
Bufflehead	*Bucephala albeola*	√		0.443	0.344	341	2	2	2
Goldeneye	*Bucephala* spp.		√	0.414	0.293	290	1	1	1
Long-tailed Duck	*Clangula hyemalis*	√		0.060	0.008	8	0	0	0
Mallard	*Anas platyrhynchos*	√	√	0.596	0.487	482	2	2	2
Northern Pintail	*Anas acuta*	√		1.225	1.158	1,146	6	6	6
Northern Shoveler	*Anas clypeata*		√	0.277	0.298	295	1	1	1
Ring-necked Duck	*Athya collaris*	√		0.031	0.018	18	0	0	0
Scaup	*Aythya* spp.	√		1.329	0.860	851	4	4	4
Scoter	*Melanitta* spp.	√		0.492	0.150	149	1	1	1

Table F-33
Waterbird Densities, Estimated Nesting Season Populations, and Estimated Number of Nesting Birds Affected[a] by the NRE (cont'd)

[a] Number of nesting birds affected is based on the estimated project area nesting density multiplied by the area of footprint impact for the proposed action, the minimum area alternative, and the maximum area alternative.
[b] Source: Anderson *et al.*, 2000.
[c] Source: Benson, 1999; Harding and Sharbaugh 2005.
[d] Source: Platte, 2003.
[e] Source: USFWS, 2008.
[f] Estimate based on Project Area density (USFWS, 2008) and 5-mile area surrounding the proposed alternative segments (990 square miles)
[g] Proposed Action includes North Common, Eielson 3, Salcha 1, Central 2, Connectors B and E, Donnelly 1, South Common, and Delta 1.
[h] Minimum Project Area includes North Common, Eielson 2, Salcha 1, Central 2, Central Connector B, Donnelly 2, South Common, and Delta 2.
[i] Maximum Project Area includes North Common, Eielson 1, Salcha 2, Central 1, Connector C, Donnelly 1, South Common, and Delta 1.

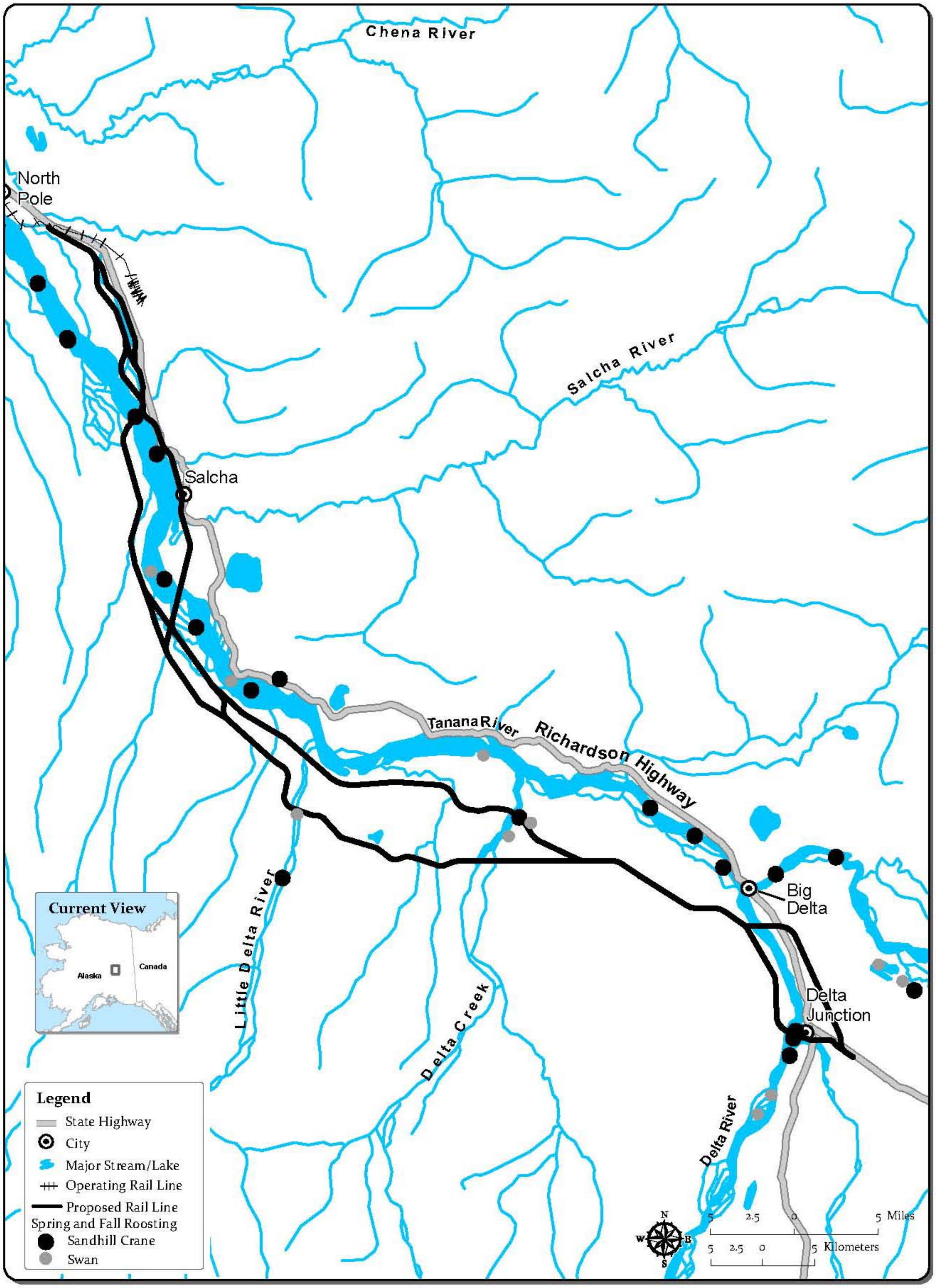

Figure F-22
Sandhill Crane and Swan Roosting Locations During Spring and Fall Migrations (Noel, 2006a)

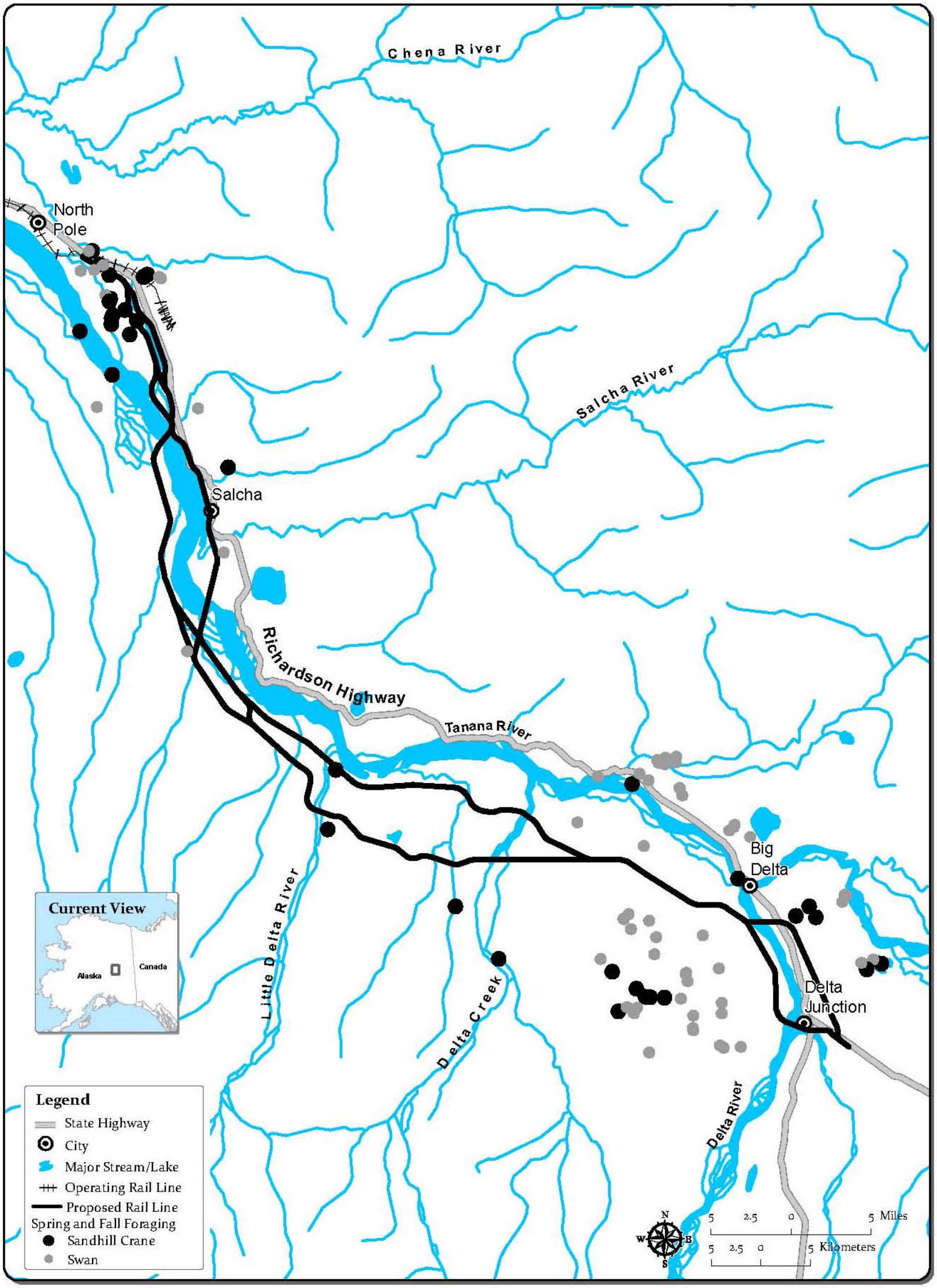

Figure F-23
Sandhill Crane and Swan Staging and Foraging Locations During Spring and Fall Migrations (Noel, 2006a)

and northwestern Wyoming (Ritchie and Ambrose, 1996). Table F-34 describes raptors and owls reportedly occurring in the project area, their population status, and estimates for project area and statewide populations and habitats.

There were approximately 20 active eagle nests in the project area during 2005 through 2007, representing about 20 reproducing pairs and their associated territories (Prichard and Ritchie, 2007; Figure F-24). This number appears consistent with the estimated 75 nesting pairs for the Tanana River Basin and represents about 25 percent of this population consistent with findings reported by Ritchie and Ambrose (1996). There were seven bald eagle nests within about 0.5 mile of the proposed NRE (Figure F-24). There were approximately 13 peregrine falcon nests in the project area during 2005 through 2007 (Prichard and Ritchie, 2007). Peregrine falcons nest on cliffs; four of these nests were within about 0.5 mile of the proposed NRE (Figure F-24).

Five species of owls commonly occur within the project area (Table F-34). The two largest of these owls, the great gray owl and the great horned owl, nest in white spruce trees within closed canopy forests (Table F-34; Prichard and Ritchie, 2007; BLM *et al.*, 2002). Six of the seven nests of large owls were associated with clear-water, anadromous-fish streams (Figure F-25). The two active great gray owl nests within the project area represent two breeding pairs of owls. Although the two nests were a little more than a mile apart, they are believed to be two separate breeding pairs because both nests were active in a single year (Prichard and Ritchie, 2007). Both of the great gray owl nests were located within about a half mile from the South Common Segment as was one of three great horned owl nests (Figure F-25). Two great horned owl nests were within about a half mile from Salcha Alternative Segment 1 (Figure F-25).

F.4.3 Upland Game Birds and Landbirds

Ptarmigan and grouse are the primary upland game birds in the project area (Table F-35). Ptarmigan are harvested during August to February and grouse are harvested August to March. Landbirds belong to many diverse groups and include both migrant and resident birds. Resident birds remain active during the winter. Resident ptarmigan, grouse, woodpeckers, chickadees, crossbills, and redpolls rely primarily on fruit and seed crops. Resident ravens and gray jays scavenge on winter or predator-killed carion. Ravens may associate with wolves in a beneficial relationship to both; as ravens assist packs in spotting prey and then scavenge the wolf-kill. Many landbirds, however, feed primarily on insects that are not available during the winter and these birds remain in Interior Alaska only during the summer breeding season when insects are abundant.

Upland game and landbirds nest within habitats crossed by the NRE and many more landbirds migrate through Interior Alaska on their way to and from nesting grounds in western and arctic Alaska. Upland gamebirds nest on the ground while most landbirds nest in trees or shrubs.

F.4.4 Birds of Conservation Concern

USFWS defines birds of conservation concern as species, subspecies, and populations that are not already federally listed as threatened or endangered but without additional conservation actions, are likely to become candidates for Federal listing (USFWS, 2002). Birds of conservation concern that have been reported to occur within the project area include 25 species, including two shorebirds, three raptors, one owl, one upland gamebird, and 18 landbirds (Table F-36). The 18 priority landbirds include four resident species, eight short-distance migrants, and six long-distance migrants (Table F-36).

Table F-34
Raptors and Owls Documented Within the Project Area and Estimated Impacts Due to Construction of the NRE[a,b]

Common Name (Migration and Annual Alaska Trend 1966-2005)[c]	Species	Primary Habitats (Nest Substrate)	Estimated Nests or Density in NRE Project Area	Estimated Alaska Population[d]	Estimated U.S. and Canada Population (Data Quality[e])	Estimated Project Area Population[f]	Estimated Proposed Action Impact[g] (No. of Birds)	Estimated Minimum ROW Impact[h] (No. of Birds)	Estimated Maximum ROW Impact[i] (No. of Birds)
Bald Eagle (S) (5.8%)	*Haliaeetus leucocephalus*	Closed or Open Broadleaf or Needleleaf Forests, Tall Shrub-65% (Poplar-75%)	22	50,000 to 70,000 (BCR4 – 22,000)	330,000 (3 A)	40	6	4	12
Northern Harrier (L) (7.4%)	*Circus cyaneus*	Riverine Tall Shrub, Upland Moist Low and Tall Scrub (Ground)	0	0	450,000 (3 A)	0	0	0	0
Northern Goshawk (R) (-6.1%)	*Accipiter gentilis*	Riverine Broadleaf Forest (Aspen-75%)	1	32,200 (BCR4 – 13,000)	240,000 (3 A)	2	0	0	2
Red-tailed Hawk (L) (-4.7%)	*Buteo jamaicensis*	Closed Broadleaf or Mixed Forest, Open Needleleaf Forest (Spruce-62%)	9	0	2,000,000 (4 A)	9	4	4	4
Golden Eagle (S) (5.9%)	*Aquila chrysaetos*	Low Wet Scrub (Cliffs or Trees)	0	0	80,000 (3 A)	0	0	0	0
Peregrine Falcon (L)	*Falco peregrinus*	Closed or Open Broadleaf or Needleleaf Forests-80% (Cliffs 100%)	13	2,900; 750 to 900 nesting pairs (BCR4 - 1,100)	28,000 (2)	26	0	0	8
Great Horned Owl (R) (9.4%)	*Bubo virginianus*	Closed Broadleaf or Mixed Forest, Lowland Wet Mixed Forest, Riverine Gravelly Dry Broadleaf Forest (Spruce 100%)	6	0	2,300,000 (3 A)	6	6	6	4
Northern Hawk Owl (R)	*Surnia ulula*	Lowland Needleleaf Forest, Fen Meadow (Black Spruce)	6.5 per square mile	0	65,000 (2 C)	6,410	31	31	32
Great Gray Owl* (R)	*Strix nebulosa*	Closed Needleleaf Forest - Lowland Forest (Spruce 100%)	2	0	32,000 (2 C)	4	4	4	4

Table F-34
Raptors and Owls Documented Within the Project Area and Estimated Impacts Due to Construction of the NRE [a,b] (cont'd)

Common Name (Migration and Annual Alaska Trend 1966-2005)[c]	Species	Primary Habitats (Nest Substrate)	Estimated Nests or Density in NRE Project Area	Estimated Alaska Population[d]	Estimated U.S. and Canada Population (Data Quality[e])	Estimated Project Area Population[f]	Estimated Proposed Action Impact[g] (No. of Birds)	Estimated Minimum ROW Impact[h] (No. of Birds)	Estimated Maximum ROW Impact[i] (No. of Birds)
Short-eared Owl (S, L) (7.7%)	*Asio flammeus*	Lowland Low Scrub, Slope Drainage Complex, Fen Meadow (Ground)	3.9 per square mile	150,000 (BCR4 – 18,000)	700,000 (2 A)	3,846	19	19	19
Boreal Owl* (R)	*Aegolius funereus*	Lowland Forest Thermokarst Complex (Black Spruce)	1.3 per square mile		600,000 (2)	1,282	6	6	6

[a] Sources: Prichard and Ritchie, 2007; Benson, 1999; Anderson *et al.*, 2000; Blancher *et al.*, 2007.
[b] Number of nesting birds impacted is based on the estimated project area nesting density multiplied by the area of footprint impact for the proposed action, the minimum area alternative, and the maximum area alternative. "Impact" refers to the nesting habitat loss based on nesting densities and total footprint of area of impact.
[c] (R) = Resident, (S) = Short-distance migrant, (L) = Long-distance migrant.
[d] Population estimate for the Alaska portion of the Partners in Flight Bird Conservation Region 4 (Blancher *et al.*, 2007).
[e] Data Quality Accuracy: 2 = Poor, 3 = Fair, 4 = Moderate; Precision: A = Very high, B = High, C = Good.
[f] Estimate based on survey data and regional densities within 5 miles of all proposed alternatives.
[g] Proposed Action includes North Common, Eielson 3, Salcha 1, Central 2, Connectors B and E, Donnelly 1, South Common, and Delta 1.
[h] Minimum Project Area includes North Common, Eielson 2, Salcha 1, Central 2, Connector B, Donnelly 2, South Common, and Delta 2.
[i] Maximum Project Area includes North Common, Eielson 1, Salcha 2, Central 1, Connector D, Donnelly 1, South Common, and Delta 1.

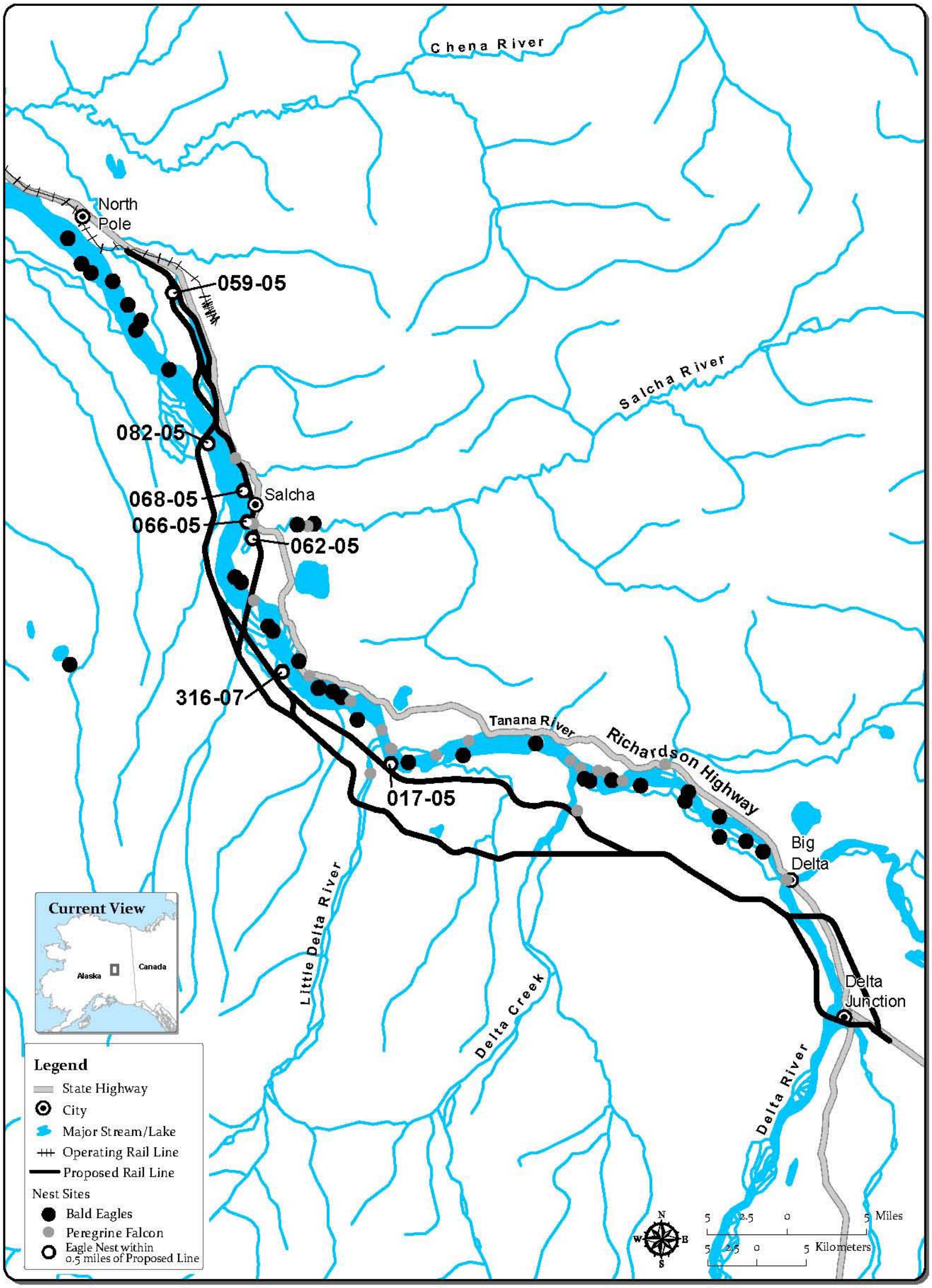

Figure F-24
Bald Eagle and Peregrine Falcon Nest Sites in the NRE Project Area (Prichard and Ritchie, 2007)

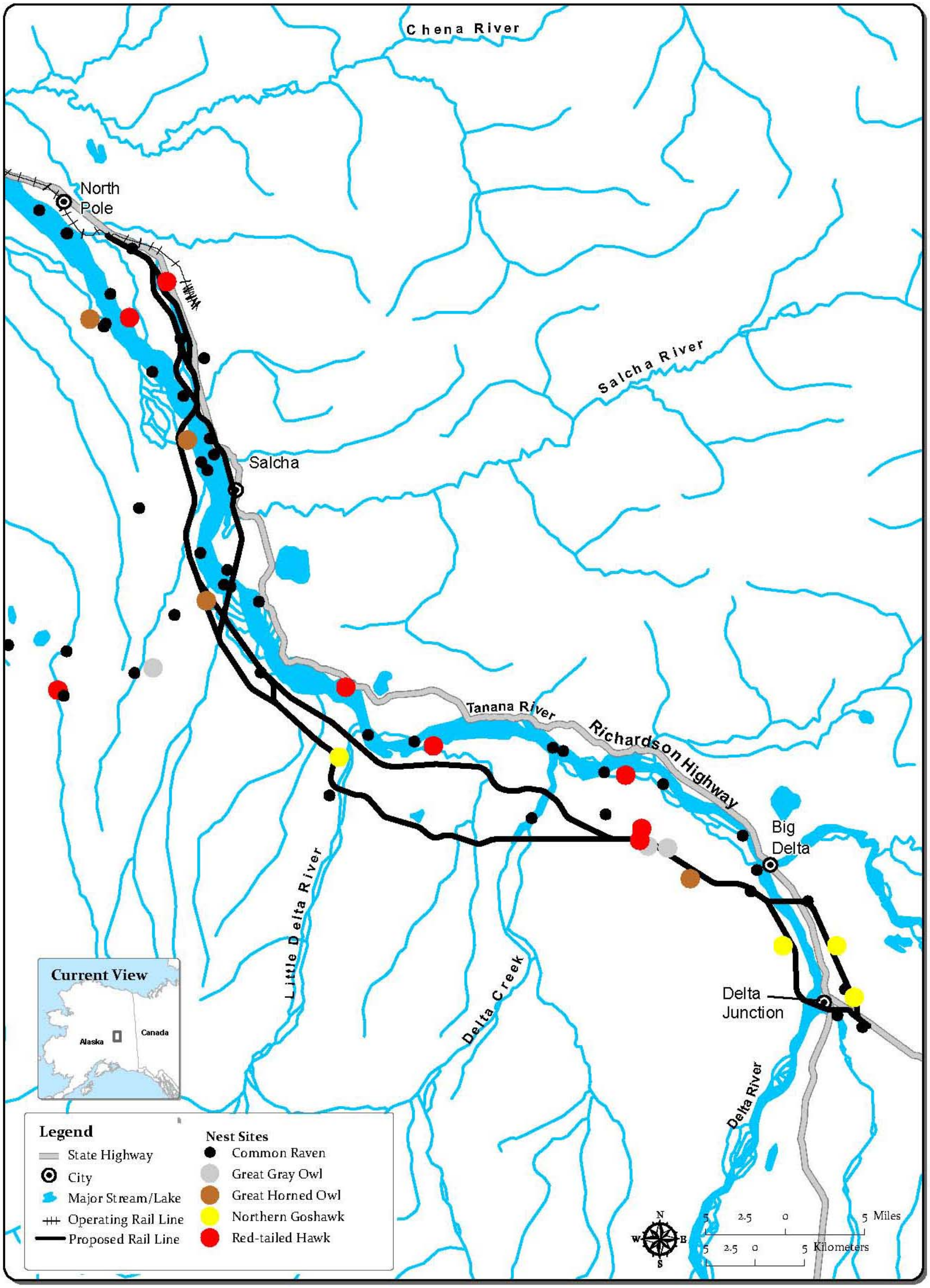

Figure F-25
Raptor and Raven Nest Sites in the NRE Project Area (Prichard and Ritchie, 2007)

Table F-35
Common Upland Game Birds and Landbirds Occurring During the Breeding Season and Estimated Impacts Due to Construction of the NRE[a]

Common Name[b]	Species	Primary Habitats	Project Region Density (birds/square mile)[c]	Alaska BCR 4 Population Size (annual trend, Data Quality)[d]	Estimated Project Area Population[e]	Estimated Proposed Action Impact (No. Birds)[f]	Estimated Minimum Project Area Impact (No. Birds)[g]	Estimated Maximum Project Area Impact (No. Birds)[h]
Upland Game Birds								
Spruce Grouse (R)	*Falcipennis Canadensis*	Needleleaf forest	6.41	40,000 (3 O)	6,344	31	31	31
Sharp-tailed Grouse (R)	*Tympanuchus phasianellus*	Willows, Open black spruce forest	2.56	5,000 (4 R)	2,539	12	12	13
Landbirds								
Belted Kingfisher (S)	*Ceryle alcyon*	Riparian shrub and forest	0	140,000 (-2.4%, 2 Y)	0	0	0	0
Hairy Woodpecker (R)	*Picoides villosus*	Needleleaf forest	1.28	120,000 (4.2%, 2 Y)	1,269	6	6	6
American Three-toed Woodpecker (R)	*Picoides dorsalis*	Needleleaf forest		200,000 (1.2%, 3 O)				
Northern Flicker (S)	*Colaptes auratus*	Needleleaf forest	1.47	180,000 (-0.7%, 2 Y)	1,454	7	7	7
Olive-sided Flycatcher (L)	*Contopus cooperi*	Needleleaf forest - black spruce	1.74	200,000 (-1.5%, 2 Y)	1,718	8	8	9
Western Wood-Peewee (L)	*Contopus sordidulus*	Riparian shrub - black spruce bogs/successional	0.85	200,000 (-4.0%, 2 Y)	846	4	4	4
Alder Flycatcher (L)	*Empidonax alnorum*	Shrub/successional	34.20	11,000,000 (-0.4%, 2 Y)	33,862	164	164	168
Hammond's Flycatcher (L)	*Empidonax hammondii*	Riparian needleleaf and mixed forest	5.95	1,300,000 (0.4%, 2 Y)	5,895	29	29	29
Gray Jay (R)	*Perisoreus canadensis*	Needleleaf and mixed forest	30.16	3,000,000 (2.2%, 2 Y)	29,857	145	145	148
Common Raven (R)	*Corvus corax*	Needleleaf forest	30 (nests)	60,000 (2.5%, 2 Y)				
Tree Swallow (L)	*Tachycineta bicolor*	Broadleaf and needleleaf forest	0.85	700,000 (3.8%, 2 Y)	846	4	4	4
Black-capped Chickadee (R)	*Poecile atricapillus*	Riparian broadleaf, and needleleaf forest	8.33	1,400,000 (1.9%, 2 Y)	8,249	40	40	41
Boreal Chickadee (R)	*Poecile hudsonia*	Needleleaf forest	10.77	1,100,000 (0.7%, 2 Y)	10,667	52	52	53
Ruby-crowned Kinglet (S)	*Regulus calendula*	Open needleleaf and mixed forests	12.79	6,000,000 (-0.2%, 2 Y)	12,662	61	61	63
Swainson's Thrush (L)	*Catharus ustulatus*	Riparian needleleaf and mixed forest	49.27	18,000,000 (0.0%, 2 Y)	48,783	237	237	242
Hermit Thrush (S)	*Catharus guttatus*	Riparian needleleaf forest and tall shrubs	5.46	1,300,000 (-1.1%, 2 Y)	5,405	26	26	27
American Robin (S)	*Turdus migratorius*	Forest and shrub	12.07	14,000,000 (1.6%, 2 Y)	11,946	58	58	59
Varied Thrush (S)	*Ixoreus naevius*	Forest and shrub	0.95	15,000,000 (0.1%, 2 Y)	938	5	5	5
Bohemian Waxwing (R)	*Bombycilla garrulus*	Needleleaf and mixed forest	7.45	300,000 (2 Y)	7,377	36	36	37

Table F-35
Common Upland Game Birds and Landbirds Occurring During the Breeding Season and Estimated Impacts Due to Construction of the NRE[a] (cont'd)

Common Name[b]	Species	Primary Habitats	Project Region Density (birds/square mile)[c]	Alaska BCR 4 Population Size (annual trend, Data Quality)[d]	Estimated Project Area Population[e]	Estimated Proposed Action Impact (No. Birds)[f]	Estimated Minimum Project Area Impact (No. Birds)[g]	Estimated Maximum Project Area Impact (No. Birds)[h]
Orange-crowned Warbler (L)	*Vermivora celata*	Low and tall shrub	45.77	13,000,000 (-0.3%, 2 Y)	45,309	220	220	224
Yellow Warbler (L)	*Dendroica petechia*	Needleleaf forest and shrub	4.89	1,600,000 (-0.7%, 2 Y)	4,839	23	23	24
Yellow-rumped Warbler (L)	*Dendroica coronata*	Needleleaf forest	50.79	16,000,000 (0.9%, 2 Y)	50,286	244	244	249
Townsend's Warbler (L)	*Dendroica townsendi*	Mature needleleaf forest	0	1,500,000 (0.9%, 3 O)	0	0	0	0
Blackpoll Warbler (L)	*Dendroica striata*	Riparian forest and shrub	24.79	4,000,000 (-2.7%, 2 Y)	24,544	119	119	122
Northern Waterthrush (L)	*Seiurus noveboracensis*	Black spruce forest	2.23	3,000,000 (7.8%, 2 Y)	2,208	11	11	11
Wilson's Warbler (L)	*Wilsonia pusilla*	Mixed forest and shrub	7.45	7,000,000 (1.1%, 2 Y)	7,375	36	36	37
American Tree Sparrow (S)	*Spizella arborea*	Low shrub	4.82	1,700,000 (2 Y)	4,772	23	23	24
Savannah Sparrow (L)	*Passerculus sandwichensis*	Low shrub and graminoid	36.30	2,000,000 (-0.2%, 2 Y)	35,937	174	174	178
Fox Sparrow (S)	*Passerella iliaca*	Low and tall shrub	5.98	2,000,000 (2.4%, 2 Y)	5,923	29	29	29
Lincoln's Sparrow (L)	*Melospiza lincolnii*	Low shrub and black spruce bog	70.17	2,000,000 (7.8%, 2 Y)	69,466	337	337	344
White-crowned Sparrow (L)	*Zonotrichia leucophrys*	Low shrub	26.50	13,000,000 (-1.3%, 2 Y)	26,236	127	127	130
Dark-eyed Junco (S)	*Junco hyemalis*	Mix and needleleaf forest and tall shrub	120.85	40,000,000 (-0.3%, 2 Y)	119,646	581	580	593
Red-winged Blackbird (L)	*Agelaius phoeniceus*	Wetland and graminoid	0.43	30,000 (-1.2%, 3 O)	423	2	2	2
Rusty Blackbird (L)	*Euphagus carolinus*	Needleleaf and mixed forest with wet graminoid	8.03	400,000 (6.3%, 2 Y)	7,954	39	39	39
White-winged Crossbill (R)	*Loxia leucoptera*	Mature needleleaf forest	20.00	2,000,000 (31.0%, 2 Y)	19,800	96	96	98
Common Redpoll (R)	*Carduelis flammea*	Needleleaf forest and shrub	12.49	5,000,000 (2 Y)	12,370	60	60	61
Pine Siskin (S)	*Carduelis pinus*	Needleleaf forest	0	500,000 (3.5%, 3 O)	0	0	0	0
Total Landbirds					**618,863**	**3,004**	**3,002**	**3,065**
Total Resident Landbirds					**89,589**	**435**	**435**	**444**
Total Long-Distance Migrants					**366,526**	**1,779**	**1,778**	**1,815**
Total Short-Distance Migrants					**162,747**	**790**	**790**	**806**

Table F-35
Common Upland Game Birds and Landbirds Occurring During the Breeding Season and Estimated Impacts Due to Construction of the NRE[a] (cont'd)

[a] Number of nesting birds impacted is based on the estimated project area nesting density multiplied by the area of footprint impact for the proposed action, the minimum area alternative, and the maximum area alternative.
[b] (R) = Resident, (S) = Short-distance migrant, (L) = Long-distance migrant.
[c] Derived from transect data within project area from Benson, 1999; Anderson *et al.*, 2000; Harding and Sharbaugh, 2005.
[d] Blancher *et al.*,2007; ADF&G, 2006: Estimate Accuracy 2 = Poor, 3 = Fair; Breeding Bird Survey Data Quality Y = yellow-10% or more of the range covered, O = orange-less than 10% of range covered.
[e] Estimates based on project region density and area within 5 miles of all proposed alternative segments (990 square miles) were generated only for species with an abundance estimate within the region.
[f] Proposed Action includes North Common, Eielson 3, Salcha 1, Connector B, Central 2, Connector E, Donnelly 1, South Common, Delta 1 and associated facilities.
[g] Minimum Project Area includes North Common, Eielson 2, Salcha 1, Central 2, Connector B, Donnelly 2, South Common, and Delta 2.
[h] Maximum Project Area includes North Common, Eielson 1, Salcha 2, Central 1, Connector C, Donnelly 1, South Common, Delta 1.

Table F-36
Estimated Priority Bird Nesting Habitat Loss Impacts from the NRE Based on Project Area Nesting Densities[a,b]

Species (Migration)[c]	Rationale	Estimated Project Area Population[d]	Habitat Impact Description	Estimated Proposed Action Impact (No. Birds)[e,f]	Estimated Minimum Project Area Impact (No. Birds)[f,g]	Estimated Maximum Project Area Impact (No. Birds)[f,h]
American Three-toed Woodpecker (R)	Sensitive to Forest Management - Cavity Nester	Unknown	1,900 acres needleleaf/mixed forested habitats removed, fragmented	√	√	√
American Golden Plover (L)	Small declining population	Unknown	Impacts unlikely	√	√	√
Bald Eagle (S)	Sensitive to changes in forests	40	Disturbance during nesting and foraging, potential removal of nest trees	6	4	12
Belted Kingfisher (S)	Widespread long-term population declines	Unknown	70 acres riparian habitat removed, fragmented 300 acres shrub habitat removed, fragmented	√	√	√
Blackpoll Warbler (L)	In Decline (Sensitive to changes in riparian habitats)	24,544	70 acres riparian habitat removed, fragmented 300 acres shrub habitat removed, fragmented	119	119	122
Boreal Chickadee (R)	Sensitive to Forest Management - Cavity Nester	10,667	1,900 acres needleleaf/mixed forested habitats removed, fragmented	52	52	53
Dark-eyed Junco (S)	Widespread long-term population declines	119,646	1,900 acres needleleaf/mixed forest and shrub habitats removed, fragmented	581	580	593
Gray-cheeked Thrush (L)	Long-term declines, sensitive to removal of riparian shrubs	Unknown	300 acres shrub habitats, 70 acres riparian habitats removed fragmented	√	√	√

Table F-36
Estimated Priority Bird Nesting Habitat Loss Impacts from the NRE Based on Project Area Nesting Densities [a,b] (cont'd)

Species (Migration)[c]	Rationale	Estimated Project Area Population[d]	Habitat Impact Description	Estimated Proposed Action Impact (No. Birds)[e,f]	Estimated Minimum Project Area Impact (No. Birds)[f,g]	Estimated Maximum Project Area Impact (No. Birds)[f,h]
Hairy Woodpecker (R)	Sensitive to Forest Management - Cavity Nester	1,269	1,400 acres needleleaf forested habitats removed, fragmented	6	6	6
Hermit Thrush (S)	Long-term declines	5,405	1,700 acres needleleaf forest, shrub habitats removed, fragmented	26	26	27
Northern Flicker (S)	Sensitive to Forest Management - Cavity Nester	1,454	1,900 acres needleleaf/mixed forested habitats removed, fragmented	7	7	7
Northern Goshawk (R)	Breeding sensitivity to forest changes	2	2,300 acres forested habitats removed, fragmented	0	0	2
Olive-sided Flycatcher (L)	In Decline (Sensitive to Forest Management - Canopy Nester)	1,718	1,900 acres needleleaf/mixed forested habitats removed, fragmented	8	8	9
Peregrine falcon (L)	Recently delisted - Sensitive to changes on cliffs, rocks, etc. & vulnerable to contaminants	26	Distrubance during nesting and foraging	0	0	8
Pine Siskin (S)	Sensitive to Forest Management - Canopy Nester	Unknown	1,900 acres needleleaf/mixed forested habitats removed, fragmented	√	√	√
Ruffed Grouse (R)	Sensitive to changes in forests	Unknown	2,300 acres forested habitats removed, fragmented	√	√	√
Rusty Blackbird (S)	In Decline (Sensitive to climate and riparian habitat changes)	7,954	1,900 acres needleleaf/mixed forest graminoid removed, fragmented	39	39	39
Short-eared Owl (L)	Declining population	3,846	200 acres low shrub and graminoid habitats removed, fragmented	19	19	19
Smith's Longspur (S)	Small population, restricted distribution	Unknown	Impacts unlikely	√	√	√
Townsend's Warbler (L)	Sensitive to Forest Management - Canopy Nester	Unknown	1,900 acres needleleaf/mixed forested habitats removed, fragmented	√	√	√
Varied Thrush (S)	Sensitive to Forest Management - Canopy Nester	938	2,300 acres forested habitats removed, fragmented	5	5	5
Whimbrel (L)	Declining population trend, small population	Unknown	Impacts unlikely	√	√	√
White-crowned Sparrow (L)	Long-term declines	26,236	200 acres low shrub and graminoid habitats removed, fragmented	127	127	130

Table F-36
Estimated Priority Bird Nesting Habitat Loss Impacts from the NRE Based on Project Area Nesting Densities [a,b] (cont'd)

Species (Migration)[c]	Rationale	Estimated Project Area Population[d]	Habitat Impact Description	Estimated Proposed Action Impact (No. Birds)[e,f]	Estimated Minimum Project Area Impact (No. Birds)[f,g]	Estimated Maximum Project Area Impact (No. Birds)[f,h]
White-winged Crossbill (R)	Sensitive to Forest Management - Canopy Nester	19,800	1,900 acres needleleaf/mixed forested habitats removed, fragmented	96	96	98
Wilson's Warbler (L)	Sensitive to changes in riparian habitats	7,375	870 acres mixed forest/shrub habitat removed, fragmented	36	36	37

a Sources: Anderson *et al.*, 2000; Benson, 1999; Benson, 2001; Harding and Sharbaugh, 2005; Prichard and Ritchie, 2006.
b Number of nesting birds impacted is based on the estimated project area nesting density multiplied by the area of footprint impact for the proposed action, the minimum area alternative, and the maximum area alternative.
c (R) = Resident, (S) = Short-distance migrant, (L) = Long-distance migrant.
d Estimates generated only for species with an abundance estimate within the project area.
e Proposed Action includes North Common, Eielson 3, Salcha 1, Connector B, Central 2, Connector E, Donnelly 1, South Common, and Delta 1.
f √ indicates the species has been documented in the project area and impacts would occur, but data are insufficient to estimate the scale of impact.
g Minimum Project Area includes North Common, Eielson 2, Salcha 1, Central 2, Connector B, Donnelly 2, South Common, and Delta 2.
h Maximum Project Area includes North Common, Eielson 1, Salcha 2, Central 1, Connector C, Donnelly 1, South Common, Delta 1.

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Appendix G –
Essential Fish Habitat

G. ESSENTIAL FISH HABITAT ASSESSMENT

This assessment of Essential Fish Habitat (EFH) is for the Alaska Railroad Corporation (ARRC or the Applicant) proposed Northern Rail Extension (NRE). The assessment considers the Applicant's proposed action and a range of reasonable alternatives that have been included in the Surface Transportation Board (STB or the Board) Section of Environmental Analysis (SEA) Environmental Impact Statement (EIS).

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established procedures designed to identify, conserve, and enhance EFH for those species regulated under a Federal fisheries management plan. Section 305(b)(2) of the Magnuson-Stevens Act requires Federal agencies to consult with the National Oceanic and Atmospheric Administration National Marine Fisheries Service (Marine Fisheries Service) on all actions, or proposed actions, authorized, funded, or undertaken by the agency that may adversely affect EFH.

The EFH guidelines (50 Code of Federal Regulations [CFR] 600.06-600.930) outline the process for Federal agencies, the Marine Fisheries Service, and the Fishery Management Councils to satisfy the EFH consultation requirements under Section 305((b)(2)-(4)) of the Magnuson-Stevens Act. As part of the EFH consultation process, the guidelines require Federal agencies to prepare a written EFH assessment describing the effects of their actions on EFH.

This appendix provides an EFH assessment for STB actions related to the proposed project.

G.1 Description of the Proposed NRE

The Applicant proposes to construct and operate a single-track rail line in Interior Alaska starting south of the community of North Pole and ending south of the community of Delta Junction. The rail line would transport commercial freight, military supplies, and passengers. The Applicant would construct other facilities, such as communication towers, offloading structures, and a passenger platform in Delta Junction, to support rail line operations.

The rail line would generally follow the Tanana River, which is a relatively fast-moving river with a wide floodplain and a braided channel. The rail line would require one crossing of the Tanana River and crossings of the Delta River, the Little Delta River, Delta Creek, and potentially the Salcha River. The Tanana River bridge would be a dual-modal structure able to support both rail and military vehicular traffic. The Little Delta River, Delta Creek, and all other stream crossings on the west side of the Tanana River would have separate bridges for the track and vehicles. ARRC has not proposed vehicle access over the Salcha and Delta Rivers.

ARRC proposes a 200-foot-wide right-of-way (ROW) for the rail line. Rail line construction and operations activities would occur within this ROW unless otherwise noted. Thirteen rail alternative segments and five connector segments provide for several routing alternatives that extend approximately 80 miles from North Pole to Delta Junction. Table G-1 lists and Figure G-1 shows the segments evaluated in the EIS; Table G-1 also identifies the Applicant's preferred segments. Rail bridges and culverts would be required for crossing numerous EFH-bearing streams.

Table G-1
Rail Line Segments

Segments in the EIS	Applicant's Preferred Segments
North Common Segment	✓
Eielson Alternative Segments 1, 2 and 3	**Alternative Segment 3**
Salcha Alternative Segments 1 and 2	**Alternative Segment 1**
Connector Segments A, B, C, and D	**Connector B**
Central Alternative Segments 1 and 2	**Alternative Segment 2**
Connector Segment E	✓
Donnelly Alternative Segments 1 and 2	**Alternative Segment 1**
South Common Segment	✓
Delta Alternative Segments 1 and 2	**Alternative Segment 1**

G.2 Essential Fish Habitat

Congress defined EFH for federally managed fish species as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" and a catalog of streams used by federally managed salmon (Chinook [king] salmon – *Oncorhynchus tshawytscha*, coho [silver] salmon – *Oncorhynchus kisutch*, and chum [dog] salmon – *Oncorhynchus keta*) is maintained by the Alaska Department of Fish and Game (ADF&G) (Johnson and Weiss, 2007). Some streams crossed by the alternatives have been identified as probable salmon habitat, but have not been documented as EFH or as important for Chinook, coho, or chum salmon under Alaska Statute 16.15.871(a) (Johnson and Weiss, 2007).

All salmon in the Tanana River are considered to be from Yukon River stocks, because the Tanana River is a major tributary of the Yukon River. Chinook salmon arrive in the Tanana River as far as Fairbanks and areas upstream in early July and are known to spawn in the Salcha River (Table G-2; Eiler *et al.*, 2004). Chinook salmon from the Tanana River drainages comprise about 20 percent of the Yukon River Chinook salmon run (Eiler *et al.*, 2004). This run is one of the most productive Alaskan fisheries and is an important commercial and subsistence resource for both Alaska and Western Canada (Eiler *et al.*, 2004; Woodby *et al.*, 2005). In the project area, Chinook salmon spawn and rear in the Salcha River and rear in the Fivemile Clearwater River (Figure G-2; Johnson and Weiss, 2007).

Table G-2
Run Timing for Salmon that Move Through and/or Spawn in the Project Area[a,b]

Common Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Chinook salmon												
Coho salmon												
Chum salmon												

[a] Source: ADF&G, 2008
[b] Shading indicates run timing; darkest shading indicates peak availability.

Coho or silver salmon spawn in clearwater tributaries of the Tanana River, including the Fivemile Clearwater River, Kiana Creek, and unnamed tributaries to the Richardson Clearwater River (Figure G-2; Johnson and Weiss, 2007) during September through November (Table G-2). In addition to its importance as a commercial and subsistence resource, coho salmon is a popular sport fish.

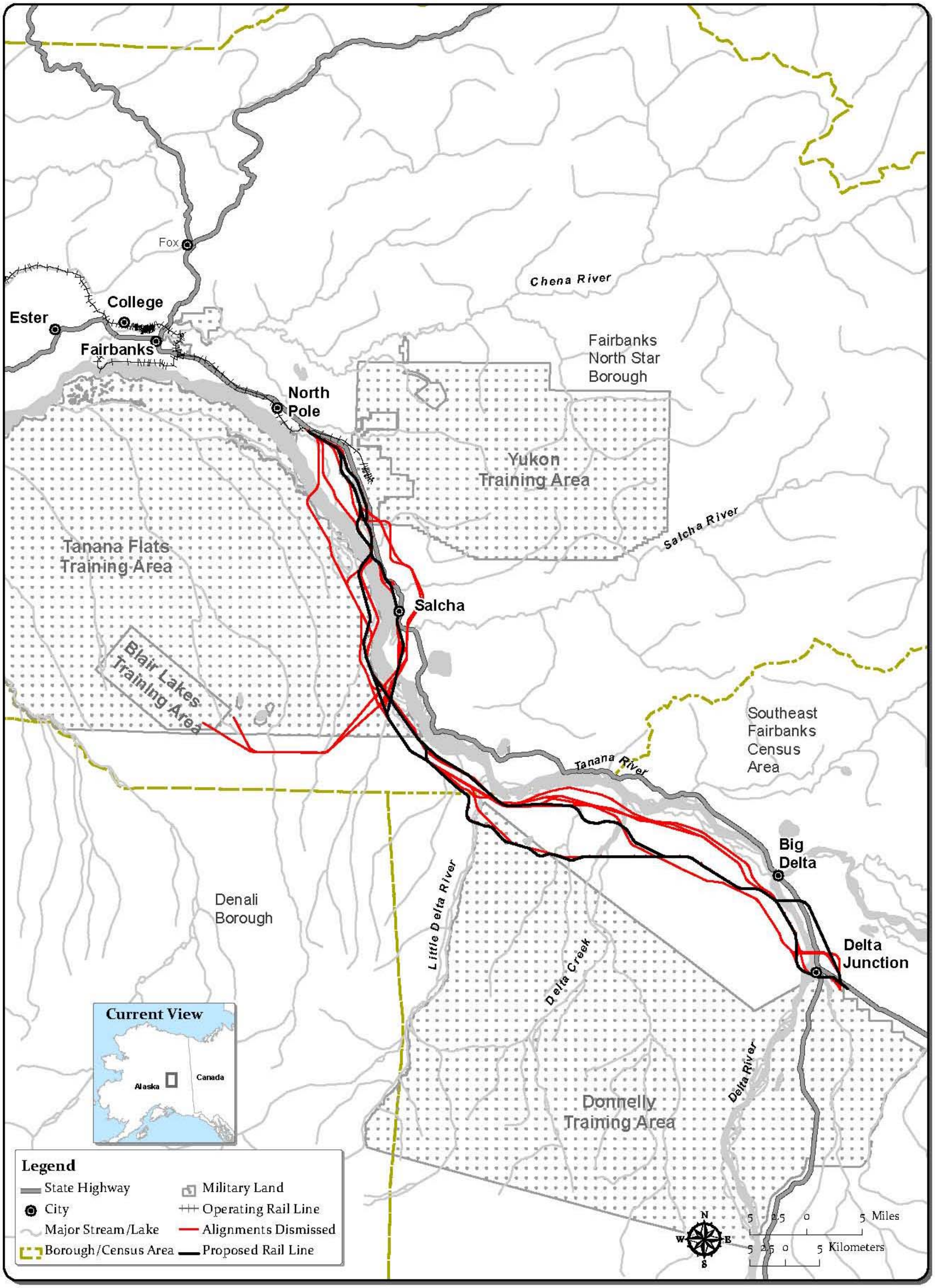

Figure G-1 – Overview Map of Alternative Segments Evaluated in the EIS

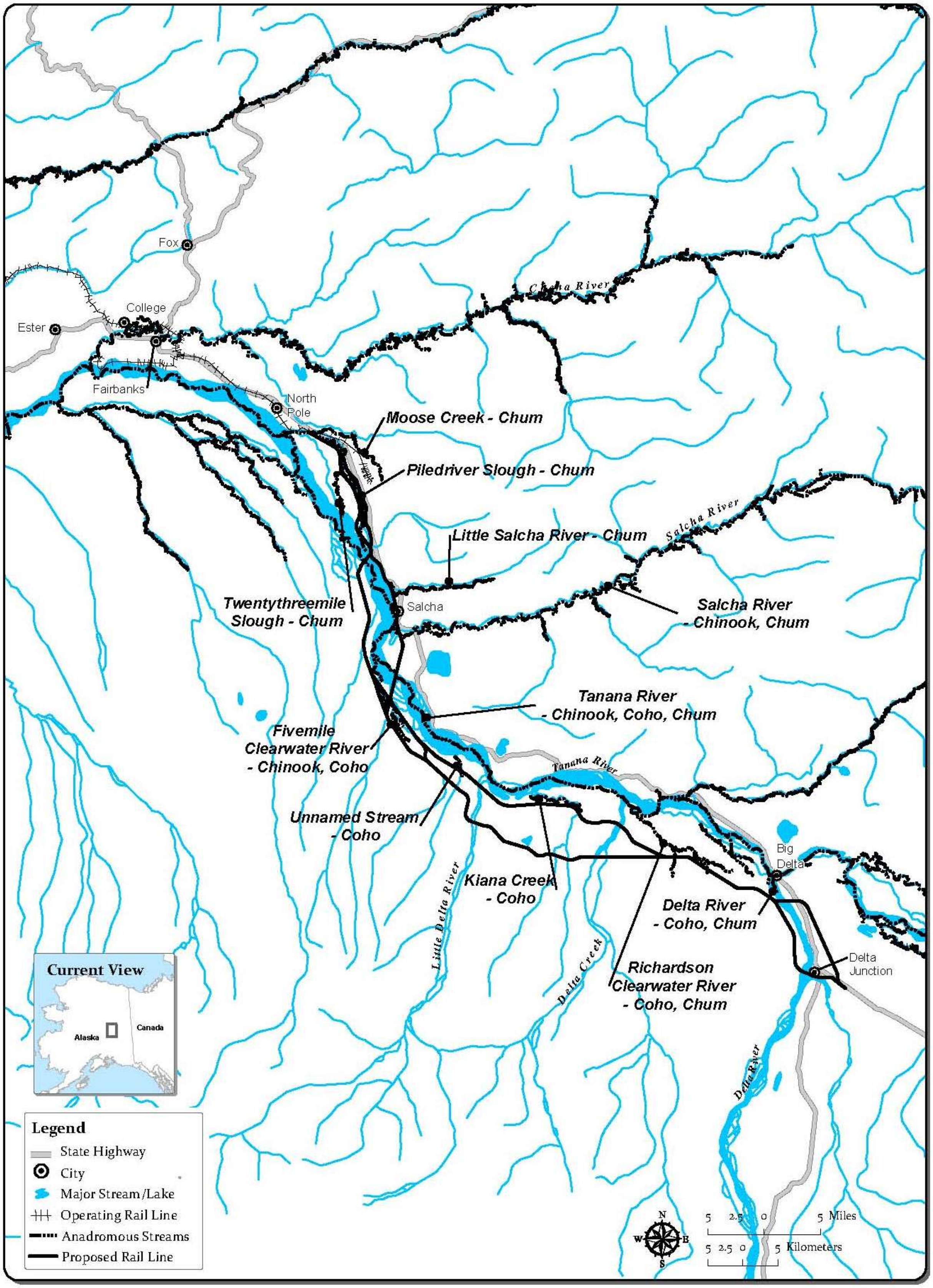

Figure G-2 – Waters Documented as Important for Chinook, Coho and Chum Salmon Under Alaska Statute 16.15.871(a) in the Project Area (Johnson and Weiss, 2007)

The summer run of chum salmon first arrives in the Fairbanks area in early July. The summer run of chum salmon generally uses north bank tributaries of the Tanana River such as Piledriver Slough, Moose Creek, Twentythreemile Slough, the Little Salcha River, and the Salcha River (Figure G-2). The fall run arrives during October and November (Table G-2) and generally uses the south bank tributaries such as the Richardson Clearwater River and the Delta River (Figure G-2). The Tanana River produces 30 percent of the Yukon fall chum salmon, an important resource to the people of the entire Yukon River. Many fall spawning chum salmon use the mainstem and side channels of the Tanana River as described by Barton (1992) and illustrated by recent telemetry data (Driscoll, 2008). Figure G-3 illustrates Alaskan commercial, subsistence, personal use, and sport harvests of Yukon River stocks of Chinook, coho, and chum salmon from 1970 to 2007. Table G-3 describes habitat use and life history traits for Chinook, coho, and chum salmon in the project area subject to EFH consultation.

Table G-3
Habitat and Ecology of Mid-Tanana River Basin Salmon

Common Name	Spawning Habitats/ Rearing Habitats	Overwinter Habitats	Ecology
Chinook Salmon	Spawn in fast deep water over gravelly or rocky bottoms of non-glacial tributaries of glacial rivers where they can dig redds; fry and juveniles use sloughs, backwaters, tributaries, braids, channel edges, terraces and off-channel habitat, brush piles, beaver houses, shallows along gravel bars	Overwinter as eggs or juveniles	Juveniles smolt and outmigrate in the spring following hatching and outmigration appears to occur soon after breakup peaking in mid to late May, extensive movement within the river system in the first year of life, adults return to spawn after 4-5 year marine residence
Coho Salmon	Spawn in gravel areas of clearwater habitats-usually spring-fed, juveniles use ponds, lakes and pools in streams and rivers or along stream margins usually amongst submerged woody debris and in scour pools	Juveniles overwinter near springs and in spring-fed streams, areas with upwelling are important for both egg and fry survival	Spend one to three years in streams and may spend up to five winters in lakes before migrating to the sea, adults return after 18 month marine residence
Chum Salmon	Spawn in small side channels, and areas of larger rivers with upwelling springs; fry emerge from the gravel in the spring and immediately outmigrate downriver, feeding on small insects and other detritus	Overwinter as eggs	Fry emerge from the gravel in early to mid April with peak outmigration occurring before the end of May, adults return to spawn after 3-5 year marine residence

G.3 Effects of the Proposed NRE on Essential Fish Habitat

The magnitude of the effects of proposed NRE construction and operations on fisheries resources would be influenced by the stream type, type of conveyance structure, type and timing of fish occurring within the stream, and timing of construction. The primary impacts of conveyance structures are loss and degradation of instream habitats due to instream placement of structures, alteration of stream hydrology and blockage of fish movements. Alterations of stream hydrology

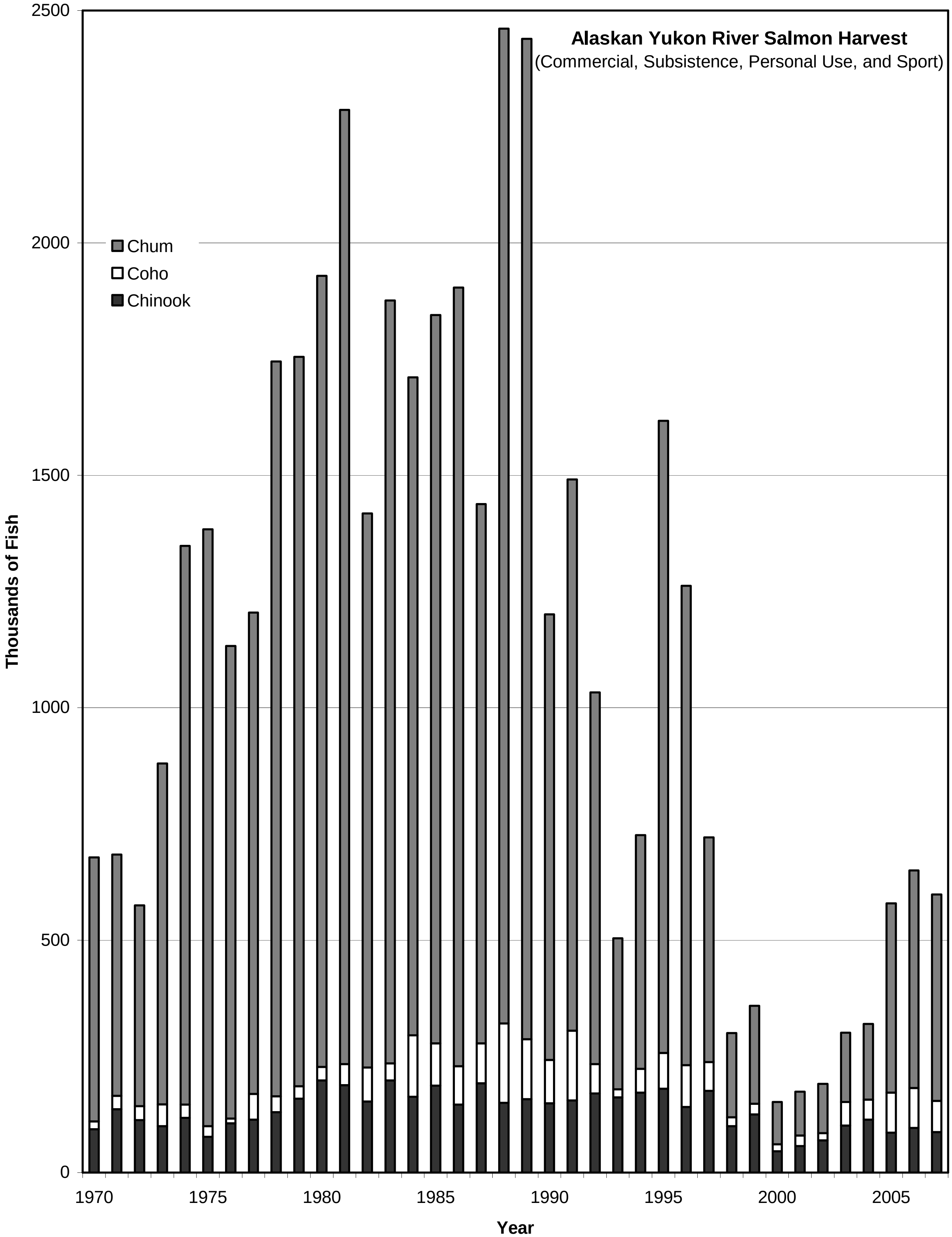

Figure G-3 - Alaskan Harvest of Yukon River Chinook, Coho and Chum Salmon During 1970 to 2007 (JTC, 2008)

caused by conveyance structures are discussed in Chapter 4. The primary impacts of instream gravel removal could be temporary or permanent habitat alteration depending on the amount of gravel removed and the gravel recharge rate. Most effects from proposed rail line construction and operations would include increased erosion and sedimentation (infiltration of fine particles into substrate interstices) due to riparian vegetation removal and loss or alteration of stream and riparian habitats.

G.3.1 Methodology

Effects to EFH from proposed NRE construction and operations were evaluated based on habitat use, habitat requirement, and seasonal movement of salmon within the project area. SEA completed field studies to assess proposed stream crossing locations for fish habitat and hydrology in the project area from September 18 through 30, 2005; July 5 through 8, 2006; October 27, 2006; and June 25 through 28, 2007 (Noel, 2007). The purpose of these field studies was to document fish habitat and hydrologic properties of a selection of stream crossings for proposed alternative segments. For the purposes of this assessment, all waters identified as containing or probably containing Chinook, coho or chum salmon based on Alaska Department of Fish and Game (ADF&G) data (ADF&G, 2005), SEA field surveys (Noel, 2007), and other historical reports have been included, while those waters documented as important for these species have been specifically identified as EFH (Johnson and Weiss, 2007).

G.3.2 Construction Impacts

Construction of the rail line would result in short-term disturbance and long-term habitat modification along the approximately 80-mile rail line. The following paragraphs describe the types of potential construction-related impacts to EFH and streams used by anadromous salmon that would be applicable to all of the alternative segments proposed for the NRE.

Loss or Alteration of Instream and Riparian Habitats

Installation of bridge pilings, bank armoring, and culverts would permanently remove streambed area that would otherwise be available for fish use. Loss of gravel bottoms, sandy shoal areas, stands of emergent vegetation, and other habitat would impact rearing, foraging, and spawning. Temporary loss of instream habitat would also occur if water is diverted from the channel to facilitate installation of bridge pilings, bank armoring, or culverts. Removal of gravel from glacial river beds would also cause a temporary alteration in the river bed. The pit formed for gravel removal would generally be refilled with gravel during the following spring breakup periods by bed load migration and would generally not result in permanent fish habitat loss or alteration.

Riparian vegetation would be removed as a result of bridge, culvert, and access road construction. Trees and other woody vegetation provide protection to fish habitat by filtering runoff, shading the stream, and providing large woody debris and other organic matter to the stream. Riparian clearing would also eliminate important streambank habitats such as undercut banks. Removal of riparian vegetation and disturbance to streambanks could result in erosion, sediment loading and turbidity, elevated water temperatures, reduced productivity, and a reduction in habitat complexity.

Mortality from Instream Construction

Instream construction activities could cause direct mortality of fish when equipment or materials are placed in the stream bed. Small, larval, or juvenile fish could become stranded in pools created when equipment is driven through the stream. Pools could then subsequently drain or dry, resulting in desiccation of the fish. Fry are particularly vulnerable because they are weak swimmers and are susceptible to stranding by wave action created as equipment is driven through or along the stream bed. Large fish would be expected to avoid vehicle wheels and ruts. Redds, eggs, and fry within or downstream of the construction site could be impacted by sedimentation, excessive vibration, and scour (Banner and Hyatt, 1973; Crisp, 1990). Water diversions and temporary dewatering could also impact fish embryos and pre-emergent fry (Becker *et al.*, 1982; Holland, 1987) through desiccation or freezing.

Blockage of Fish Movement

In-stream construction activities would impact fish movements during construction where water diversions created temporary physical barriers to fish passage or altered stream flows sufficiently to create either high-water or low-water conditions that would prevent fish passage. Water diversions and culverts could physically restrict access to spawning habitat, and turbidity created during construction could also trigger avoidance behavior that would lead to a behavioral blockage of movements (Bisson and Bilby, 1982; Warren and Pardew, 1998). These impacts would be expected to be temporary during bridge construction. Ice-bridge stream crossings can alter timing of spring breakup and create ice jams with high flows that restrict movements of resident fish and out-migrating salmon.

Improperly installed conveyance structures could impede fish passage by increasing the velocity or decreasing the depth of water flowing through the structure. Culverts could pose a physical barrier (as with a hung culvert) if not installed properly. Conveyance structures blocking or impeding fish passage could result in a loss of access to spawning and rearing habitat, which could reduce fish productivity. Water diversions could also create temporary physical barriers to fish passage or alter stream flows sufficiently to create either high-water or low-water conditions that would prevent fish passage, potentially restricting access to rearing and spawning habitat.

Bridges and culverts can also create choke points where the downstream movement of ice is restricted. Culverts often freeze solid and are very slow to melt due to the insulation of road or rail embankments. Fish that migrate to upstream spawning or foraging areas in the spring can be blocked by frozen culverts.

Degradation of Water Quality

Clearing of the ROW, grading and placement of conveyance structures, and construction of new access roads would expose soil to the erosive forces of wind, rain, and surface runoff during the construction period. Such erosion would deliver sediment into streams, which would degrade water quality and fish habitat. Increased turbidity from suspended sediment would degrade spawning and rearing habitat for a variety of species (Wood, 2004; Grieg *et al.*, 2005). Sedimentation can smother eggs and newly hatched fry, reducing survival (Wood, 2004; Grieg *et al.*, 2005). High turbidity could also trigger avoidance behavior, affect foraging success in fish that rely on sight for feeding (Barret *et al.*, 1992), and clog gills.

Small fuel or oil leaks from construction equipment could contribute to water quality degradation during construction. Spills and leaks could enter the water either directly as equipment crossed the stream or indirectly with runoff from the bridge or adjacent roadbed or railbed.

Alteration of Stream Hydrology and Breakup

The hyporheic zone is a region beneath a stream bed where there is mixing of shallow groundwater and surface water. Hyporheic flow and warm groundwater upwelling are important factors in salmonid egg development, and provide a warm-water refuge for overwintering fishes (Brown and Mackay, 1995; Baxter and McPhail, 1999). Construction activities would cause changes in flow patterns through the hyporheic zone by dislodging fine sediments during excavation and vegetation clearing (which can infiltrate the hyporheic zone and clog interstitial spaces) and by vibrations from construction equipment (which can cause substrates to settle and become compacted) (Sear, 1995; Huggenberger *et al.*, 1998). Permanent alterations in subsurface flows could result from the changes in permafrost distribution, bank and substrate armoring, instream support structures, and changes in channel morphology associated with bridges and culverts (Sear, 1995; Hanrahan, 2006). Subsurface structures that stabilize bridges can alter flow patterns within the hyporheic zone. Warm-water upwelling can also prevent a stream from freezing, thus allowing fish to overwinter in areas that would otherwise be unavailable.

Ice bridges used during winter construction of conveyance structures could alter spring breakup timing and create ice jams that redirect flows. Fish species moving upstream or downstream could experience difficulty passing areas where ice bridges had been constructed. In extreme cases, this could lead to the formation of ice dams that limit flow downstream of the bridge. Downstream habitat could be dewatered, which can be particularly problematic for anadromous salmonids whose eggs and fry over-winter in glacial streams such as the Tanana River. Water tends to back up behind ice dams that can result from stream constriction at bridges and culverts, and once the ice dam is breached, a large volume of water can be released over a short period. This sudden flush of water can scour downstream substrates, radically altering channel morphology, eliminating redds, and causing high mortality in overwintering sac-fry.

Noise and Vibration Impacts

Noise and vibration caused by pile driving and culvert installation during bridge construction could impact egg mortality and hatch timing in areas at and near stream crossings. Vibrations could be of sufficient magnitude to negatively impact the development of salmonid eggs in redds near bridges and culverts. Vibration could disrupt egg membranes and lead to egg death. Salmonid eggs are especially susceptible to disruption just after laying and fertilization prior to hardening. Exposure to vibration could affect fish by disrupting their sense of hearing and the function of the lateral line, a sensory organ that detects vibration (Hastings *et al.*, 1996; McCauley *et al.*, 2003). Noise and vibration from winter construction activities could also trigger avoidance behavior, displacing fish from overwintering habitat, especially near the Tanana River bridge crossings.

G.3.3 Operations Impacts

Maintenance activities such as clearing drainage ditches and management of vegetation in the ROW could cause some increase in sedimentation and turbidity over background levels in streams. Water quality could be negatively affected in the unlikely event of a release of hazardous materials from a train derailment or collision. However, the likelihood of a release is low because ARRC anticipates few shipments of hazardous materials, and railcars used for transportation of hazardous materials are designed to withstand various types of impacts.

G.3.4 Impacts by Alternative Segment

The ADF&G Anadromous Fish Catalog (Johnson and Weiss, 2007) identifies specific streams and stream crossing sites that contain EFH; project-specific field studies (Noel, 2007) characterized those streams and stream crossing sites. Central Alternative Segment 1, Donnelly Alternative Segment 1, and both Delta alternative segments would not cross streams containing EFH. The remaining alternative segments would cross streams containing EFH and would potentially cause impacts. The following paragraphs describe notable site-specific impacts on EFH and other salmon habitats.

North Common Segment

North Common Segment would cross Piledriver Slough (334-40-11000-2490-3315, Johnson and Weiss, 2007), once part of Chena Slough, which flowed northwest through Fairbanks and then back into the Tanana River. Construction of the Moose Creek Dike in 1945 split Chena Slough into Chena Slough and Piledriver Slough, and resulted in sloughs that are mostly groundwater-fed systems with low discharge and low sediment loads (Ihlenfeldt, 2006). At present, Piledriver Slough is a clearwater stream that flows for approximately 21 miles parallel to and between Richardson Highway and the Tanana River adjacent to Eielson Air Force Base. Piledriver Slough supports some spawning of chum salmon (Johnson and Weiss, 2007).

Tables G-4 and G-5 list and Figure G-4 shows EFH that would be affected by construction of the North Common Segment. Piledriver Slough (Crossing 1) is an entrenched tributary of the mainstem Tanana River with pool and riffle habitat. The substrate of this clearwater stream is dominated by silt with sand and gravel (Noel, 2007, Record 1). Blockage of fish migration at Piledriver Slough would be of consequence to in-migrant adult chum salmon headed to spawning habitats and out-migrant chum salmon fry headed to marine rearing habitats that would pass beneath the potential bridge. Out-migration of chum fry would coincide with spring breakup during April and May and could be hindered by ice jams that could result from channel constriction at the proposed bridge site.

Table G-4
EFH-bearing Streams North Comment Segment Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
1	Piledriver Slough	Slough	EFH	65	Bridge	100

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-5
Fish Species, Life Stages, and Habitats that Would Be Affected by Construction and Operation of North Common Segment[a]

	Life Stage				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Piledriver Slough (Crossing 1)									
Chum Salmon	X	X		X	X		X		X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

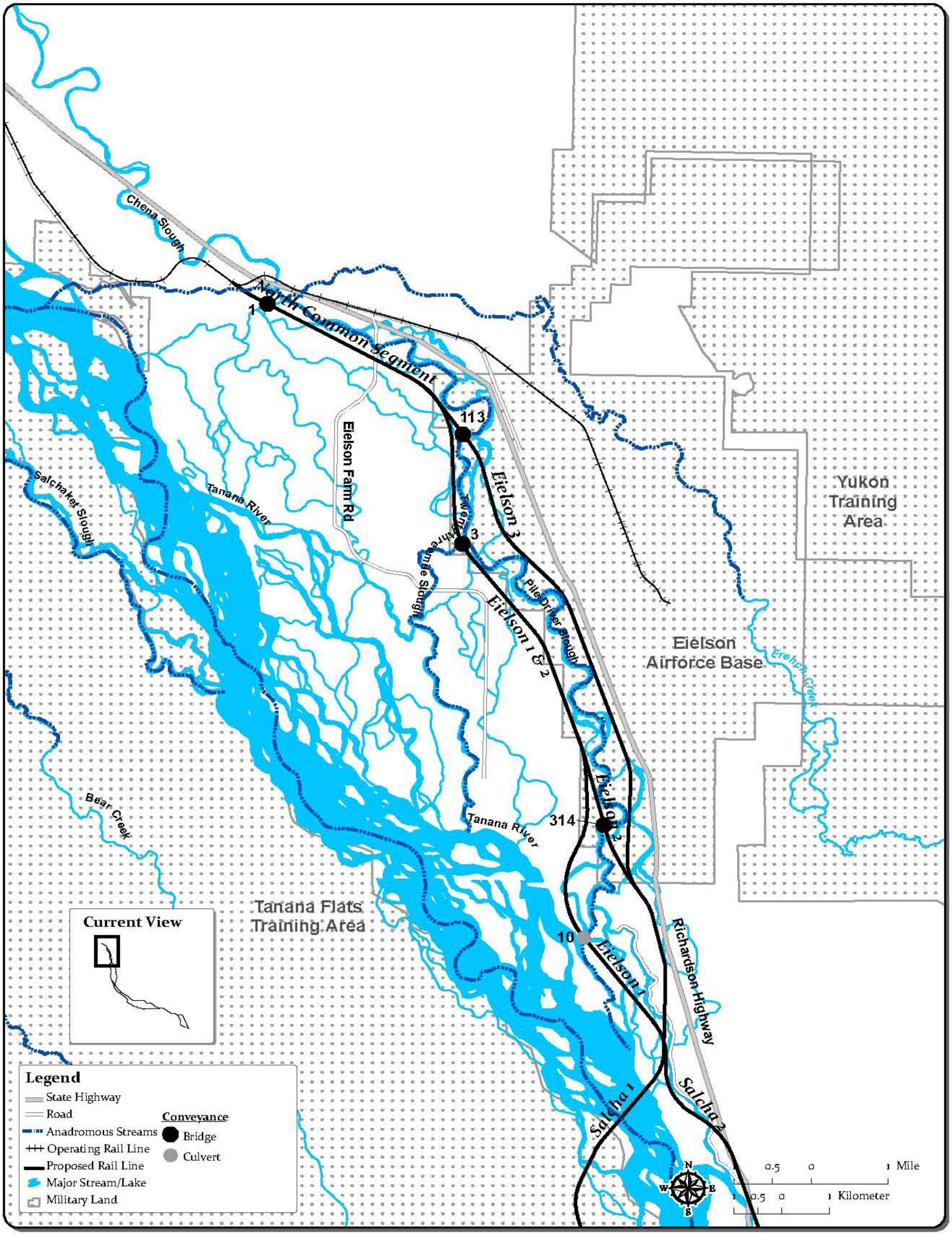

Figure G-4 – EFH-Bearing Streams Crossed by the North Common Segment and Eielson Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

Piledriver Slough is blocked from receiving direct flow from the Tanana River, so stream flows are maintained by precipitation and surface water/groundwater exchange. Any changes in the local hydrology could have corresponding impacts on spawning or overwintering habitat within this reach.

Eielson Alternative Segments

Each of the Eielson alternative segments would cross Piledriver Slough. Eielson Alternative Segment 1 and Eielson Alternative Segment 2 would cross Twentythreemile Slough (334-40-11000-2490-4010, Johnson and Weiss, 2007) near where it flows into Piledriver Slough (Figure G-4). Twentythreemile Slough flows for about 6 miles and is used by chum salmon (Johnson and Weiss, 2007).

EFH that would be affected by construction of the Eielson alternative segments are listed in Tables G-6 and G-7. In the last several years, the quality and quantity of favorable fish spawning and rearing habitat in Piledriver Slough has declined. Fish passage has been restricted by undersized culverts, beaver dams, and filling in of gravel riffles/pools with sediment.

Table G-6
EFH-Bearing Streams the Eielson Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Eielson 1 & 2						
3	Twentythreemile Slough	Slough	EFH	100	Bridge	100
Eielson 1						
10	Piledriver Slough	Slough	EFH	30	Culvert	3 x 10
Eielson 2						
314	Piledriver Slough	Slough	EFH	105	Bridge	330
Eielson 3						
113	Piledriver Slough	Slough	EFH	80	Bridge	300

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-7
Fish, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Eielson Alternative Segments[a]

	Life Stage				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Twentythreemile Slough (Crossing 3), Piledriver Slough (Crossings 10, 314, 113)									
Chum salmon	X	X		X	X		X		X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Recent flooding in the Salcha area has also caused water to back up and block culverts, damage road crossings, and deposit excess sediment in Piledriver Slough and tributary sloughs. These processes have had negative effects on local fish populations. The slough has become braided, increased its width/depth ratio, and is now reduced in the quantity and quality of habitat available for chum salmon (Ihlenfeldt, 2006). The U.S. Fish and Wildlife Service (USFWS) has been working to improve fish habitat in Piledriver Slough by working to repair improperly placed culverts and to replace some culverts with bridges (Ihlenfeldt, 2006).

Each Eielson alternative segment would cross Piledriver Slough in a different location. Eielson Alternative Segment 3 would cross Piledriver Slough (Crossing 113; Noel, 2007, Record 117) nearest the outflow of the slough where it receives flow from Moose Creek and rejoins the Tanana River. Eielson Alternative Segment 2 would cross Piledriver Slough (Crossing 314; Noel, 2007, Records 42 and 154) before its confluence with Twentythreemile Slough. Eielson Alternative Segment 1 would cross Piledriver Slough (Crossing 10; Noel, 2007, Record 22) just north of where it would connect to the Tanana River; however, the connection is blocked by fill in the channel. Of these crossings, the crossings farther downstream (Crossings 314 and 113) have the largest flows from groundwater exchange and would have the largest affect on anadromous fish habitats. Based on SEA field investigations, riffles are dominated by gravel substrates, while stream margins and pools are primarily covered in organic debris, and emergent vegetation was abundant (Noel, 2007, Records 42, 117, 154). Groundwater upwelling is evident, and there is evidence of salmon spawning (Noel, 2007, Records 42, 117, 154). Eielson Alternative Segment 1 and Eielson Alternative Segment 2 would also cross Twentythreemile Slough (Crossing 3; Noel, 2007, Record 40) just above its confluence with Piledriver Slough. There is an inactive beaver dam that had been breached near the crossing at the confluence, resulting in substrates primarily composed of organic debris and silt at the crossing, with a heavy vegetation mat (Noel, 2007, Record 40). However, there are gravelly areas upstream and juvenile salmonids, likely Chinook or coho salmon, were observed at this site. These species are reported to use the Piledriver Slough, Moose Creek, and Twentythreemile Slough system occasionally.

Clearing of the rail line ROW would increase erosion and thereby sedimentation, which would potentially lead to reduced egg survival. Bridges and culverts could also cause channel constrictions, inhibiting in-migrating chum salmon, or where ice dams might form during spring break up, inhibiting out-migration of chum salmon fry.

Salcha Alternative Segments

Both the Salcha alternative segments would cross the Tanana River. Chinook salmon, summer and fall run chum salmon, and coho salmon are found in the Tanana River during migration. Juvenile rearing (Chinook and coho), and fall-run chum salmon spawn in the mainstem and side channels of the Tanana River in the project area.

Salcha Alternative Segment 2 would cross both the Little Salcha River and the Salcha River (Figure G-5). The Salcha River (334-40-11000-2490-3329, Johnson and Weiss, 2007) supports Chinook salmon and summer-run chum salmon. The Salcha River salmon travel about 950 miles from the Bering Sea to the mouth of the Salcha River. By the time they reach the Salcha River, salmon are in full spawning colors, and the flesh is beginning to deteriorate. To maintain a Chinook salmon run on the Salcha River, the ADF&G has set an escapement (number of returning salmon) of between 3,300 and 6,500 fish. The Little Salcha River (334-40-11000-2490-3325, Johnson and Weiss, 2007) is a clearwater stream that flows into the Tanana River, and about 6 miles of this river supports chum salmon.

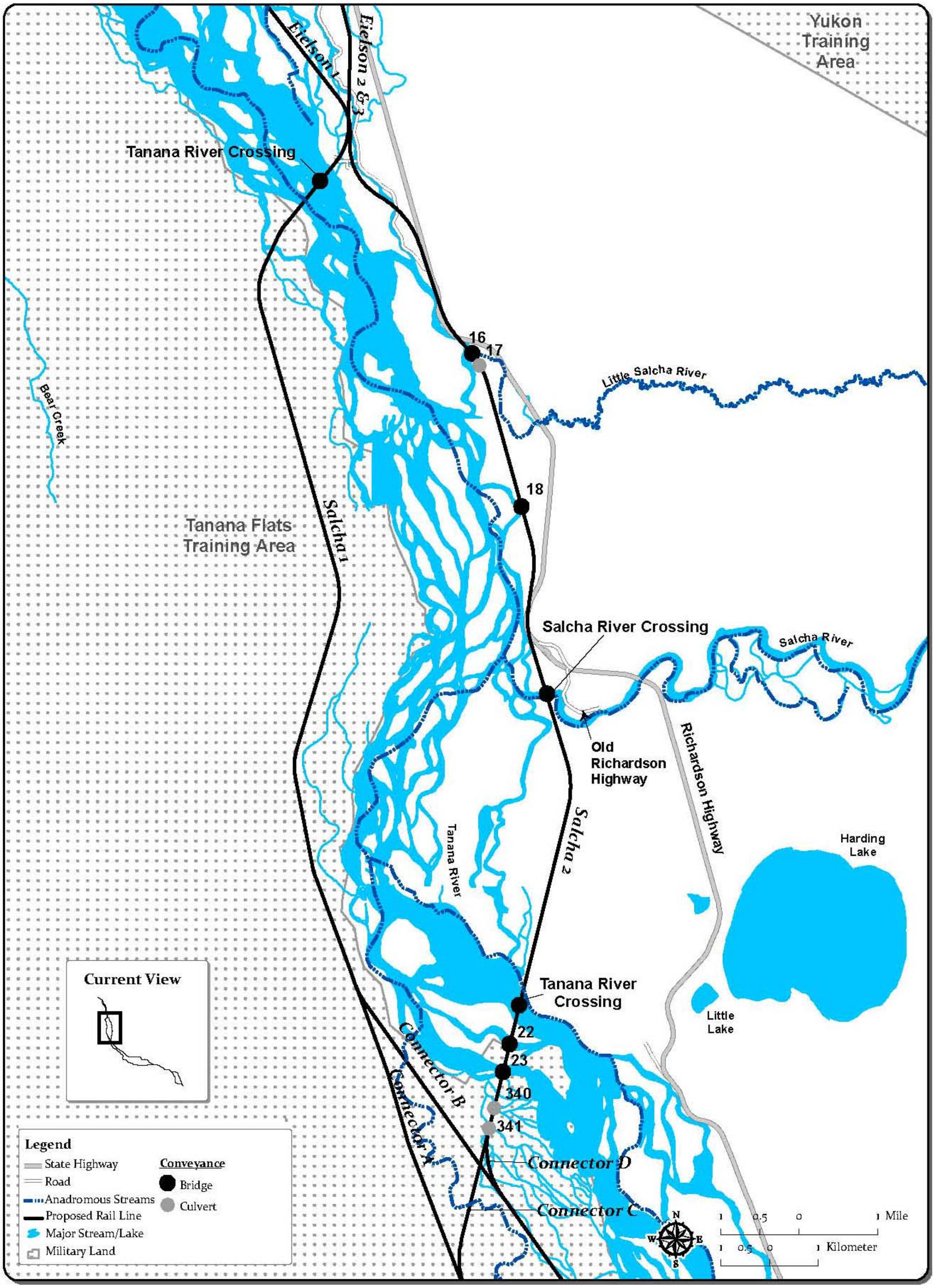

Figure G-5 – EFH-bearing Streams Crossed by the Salcha Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

Tables G-8 and G-9 list EFH the Salcha alternative segments would cross.

The bridges crossing the Tanana River would include bank armoring, rock revetments and levee construction upstream from the bridges and channel plugs for side channels on the east and west

Table G-8
EFH-bearing Streams the Salcha Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Salcha Alternative Segment 1						
	Tanana River	Stream	EFH	3,800	Bridge	3,600
Salcha Alternative Segment 2						
16	Little Salcha River	Stream	EFH	65	Bridge	160
17	Unnamed	Overflow	Anadromous	20	Culvert	3 x 10
18	Unnamed	Slough	Anadromous	15	Bridge	390
	Salcha River	Stream	EFH	195	Bridge	2,500[b]
	Tanana River	Stream	EFH	1,500	Bridge	4,000
22	Unnamed	Slough	EFH	130	Bridge	4,000
23	Unnamed	Slough	EFH	150	Culvert	3 x 10[b]
340	Unnamed	Stream	Anadromous	10	Culvert	10
341	Unnamed	Stream	Anadromous	20	Culvert	2 x 10

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.
[b] The conveyance size is a SEA estimate based on proposed lengths of similar crossings. The final conveyance distance will be determined during final design.

Table G-9
Fish, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Salcha Alternative Segments[a]

	Life Stage				Habitats				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Tanana River and Side Channels (Crossings 17, 18, 22, 23)									
Chinook salmon			X	X		X	X	X	X
Chum salmon	X	X		X	X		X		X
Coho salmon				X					X
Little Salcha River (Crossing 16)									
Chum salmon	X	X		X	X		X		X
Salcha River									
Chinook Salmon			X	X	X	X	X	X	X
Chum salmon	X	X		X	X		X		X
Unnamed Streams and Sloughs (Crossings 340, 341)									
Coho Salmon			X	X		X	X	X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Salmon use the Tanana River as a migratory route to upstream spawning habitats (Table G-9). Habitat at the stream margins used by larval and juvenile salmon would be altered by construction and maintenance of the bridge and ROW.

Side channels of the Tanana River (Noel, 2007, Crossings 16, 17, 18, 22, and 23) are dominated by gravel and cobble, with groundwater upwelling at the channel margins. These areas provide migration habitat for all three salmon, potential summer foraging and rearing habitats for Chinook and coho salmon, and spawning habitat for fall-run chum salmon (Barton, 1992; Driscoll, 2008; Noel, 2007, Records 48, 35, 36, 158, 159). Shot-rock revetments and channel plugs would be placed across the upstream connections of the side channels at Crossings 22 and 23, which would result in these side channels becoming groundwater-fed, clearwater sloughs following the same process as Piledriver Slough. Finally, sediment transport needed to replenish downstream spawning and rearing habitats could be inhibited by localized changes in stream hydraulics and depositional patterns. Passage of river flow is critical for anadromous fish use of side-channel habitats. Blockage or filling of side channels would cause significant habitat alteration, resulting in the eventual loss of salmon spawning. Similarly, modified side channels of the Tanana River near Fairbanks exhibit lower dissolved oxygen levels, reduced flows, substrates of finer particle size, and increased pH, hardness, water temperature, specific conductance, and cover (Mecum, 1984), conditions generally unsuitable for salmonids. These changes would reasonably be expected to alter fish use of affected channels by shifting habitats from a riverine to a more littoral character. The channel modification illustrated in Figure 2-17 would result in the creation of a major new channel, redirecting all the flow from the existing side channel and likely leading to the destruction of the portions of the vegetated island that are not protected by the shot-rock revetment. The potential for instability of this channel alteration is high, given the highly permeable nature of the gravels supporting the Tanana River bars, as discussed in Chapter 4.

Salcha Alternative Segment 2 would have nine crossings, including crossings of the Tanana River, the Little Salcha River, and the Salcha River. Five of these crossings are EFH (Table G-8). Salcha Alternative Segment 2 would include running the railbed through a side channel of the Tanana River at the confluence of the Little Salcha River (Crossing 16). This side channel has been identified as EFH and supports fall chum salmon spawning habitat (Barton, 1992; Driscoll, 2008). The Little Salcha River also supports chum salmon spawning (Johnson and Weiss, 2007).

The railbed and bridge at the Little Salcha River confluence would create a potential choke point where ice dams could form during spring breakup, which could inhibit out-migration of chum salmon fry. Salcha Alternative Segment 2 Crossing 18 is a side channel of the Tanana River that connects to the Little Salcha River outflow. Flow into this channel is limited during low-flow periods due to the presence of a large gravel berm at the inflow of the channel. During periods of low flow, the channel contains large clear pools, which contain juvenile salmonids in high densities (Noel, 2007, Record 36). During high flows, the pools would be connected to the mainstem by a series of pools and riffles of gravel with some cobble and silt. Salcha Alternative Segment 2 would cross the Salcha River about 1 mile above its confluence with the Tanana River. The crossing would pass over a shallow glide in a meander bend of the river (Noel, 2007, Record 47). Fall chum salmon spawning occurs in this area (Driscoll, 2008), and Chinook salmon must pass through this crossing to reach upstream spawning habitats. As with a bridge at the Little Salcha River, there is potential for negative impacts on upstream migration of Chinook and chum salmon. This site could also be a potential choke point where ice dams could form during spring break up, which could inhibit out-migration of chum salmon fry.

Central Alternative Segments and Connectors

Tables G-10 and G-11 list EFH the Central alternative segments and connectors segments would cross. Central Alternative Segment 2 would cross an unnamed slough with probable salmon habitat.

Table G-10
EFH-bearing Streams the Central Alternative Segments and the Central Connectors would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish Use	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Central 1						
none						
Central 2						
38	Unnamed	Overflow	Anadromous	30	Bridge	75
Connector A						
85	Unnamed	Stream	Anadromous	80	Bridge	40
Connector B						
27	Unnamed	Slough	Anadromous	90	Culvert	2 x 10
86	Fivemile Clearwater	Stream	EFH	105	Bridge	160
Connector C						
342	Unnamed	Stream	Anadromous	35	Bridge	90
343	Unnamed	Slough	Anadromous	20	Culvert	2 x 10
344	Unnamed	Overflow	Anadromous	20	Culvert	2 x 10
345	Fivemile Clearwater	Stream	EFH	135	Bridge	135
346	Unnamed	Stream	Anadromous	30	Culvert	3 x 10
396	Unnamed	Stream	Anadromous	80	Bridge	40
Connector D						
501	Unnamed	Stream	Anadromous	35	Bridge	90
502	Unnamed	Stream	Anadromous	4	Culvert	2 x10
503	Unnamed	Stream	Anadromous	20	Bridge	90
504	Unnamed	Stream	Anadromous	20	Bridge	90
Connector E						
351	Fivemile Clearwater	Stream	Anadromous	65	Bridge	115

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-11
Fish Species, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Central Alternative Segments and Central Connectors[a]

	Life Stage				Habitat				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Fivemile Clearwater River (Crossings 86, 345) and Tanana River Side Channels (Crossing 38)									
Chinook Salmon			X	X		X	X	X	X
Coho Salmon			X	X		X	X	X	X

Table G-11
Fish Species, Life Stages, and Habitats that Would Be Affected by Construction and Operation of the Central Alternative Segments and Central Connectors[a] (continued)

	Life Stage				Habitat				
Fish Presence	**Eggs**	**Fry/Larvae**	**Juveniles**	**Adults**	**Spawning**	**Rearing**	**Over-wintering**	**Summer Foraging**	**Migratory**
Unnamed Streams (Crossings 27, 85, 342, 501, 502, 503, 504, 343, 344, 346, 396)									
Coho Salmon			X	X		X	X	X	X
Unnamed Stream (Crossing 351)									
Coho Salmon			X	X		X		X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Connectors B, C, and E would cross the Fivemile Clearwater River, which provides migration and rearing habitat for Chinook and coho salmon. Connectors A and D would cross unnamed streams that provide migration and rearing habitat for coho salmon. The connectors vary widely in length and number of stream crossings.

Central Alternative Segment 1 would not cross streams that provide EFH, but for this alternative to be connected to other alternative segments, connector segments that would cross EFH streams could be required.

Central Alternative Segment 2 would cross an unnamed slough with probable Chinook and coho salmon habitat (Tables G-10 and G-11). The channel at Crossing 38 appears to periodically receive flow from the Tanana River. This stream would likely serve as a temporary refuge during high-flow events and as a migration route for adult and juvenile Chinook and coho salmon to and from habitats in the Fivemile Clearwater River and its tributaries (Figure G-6).

Connector A would cross an unnamed stream at Crossing 85 that likely provides some habitat for coho salmon, although this stream is not cataloged.

Connector B would cross the Fivemile Clearwater River (Crossing 86), which serves as a migratory corridor for Chinook and coho salmon. The crossing site is a broad straight channel with heavily armored substrates, which are not likely to be suitable for salmonid spawning habitat (Noel, 2007, Record 55). The bridge on the Fivemile Clearwater River and the culvert at Crossing 27 could act as choke points where ice dams could form during spring breakup, thereby inhibiting movements between spawning habitats and rearing habitats.

Connector C would cross the Fivemile Clearwater River and several tributaries (Crossings 342, 343, 344, 345, 346, and 396) that might serve as migratory corridors for Chinook and coho salmon.

Connector D would cross streams (Crossings 501, 502, 503, 504) that likely provide habitat Chinook and coho salmon.

Connector E would cross the Fivemile Clearwater River at Crossing 351, upstream of the cataloged section, where substrates consist of sand and organic debris (Noel, 2007, Record 86).

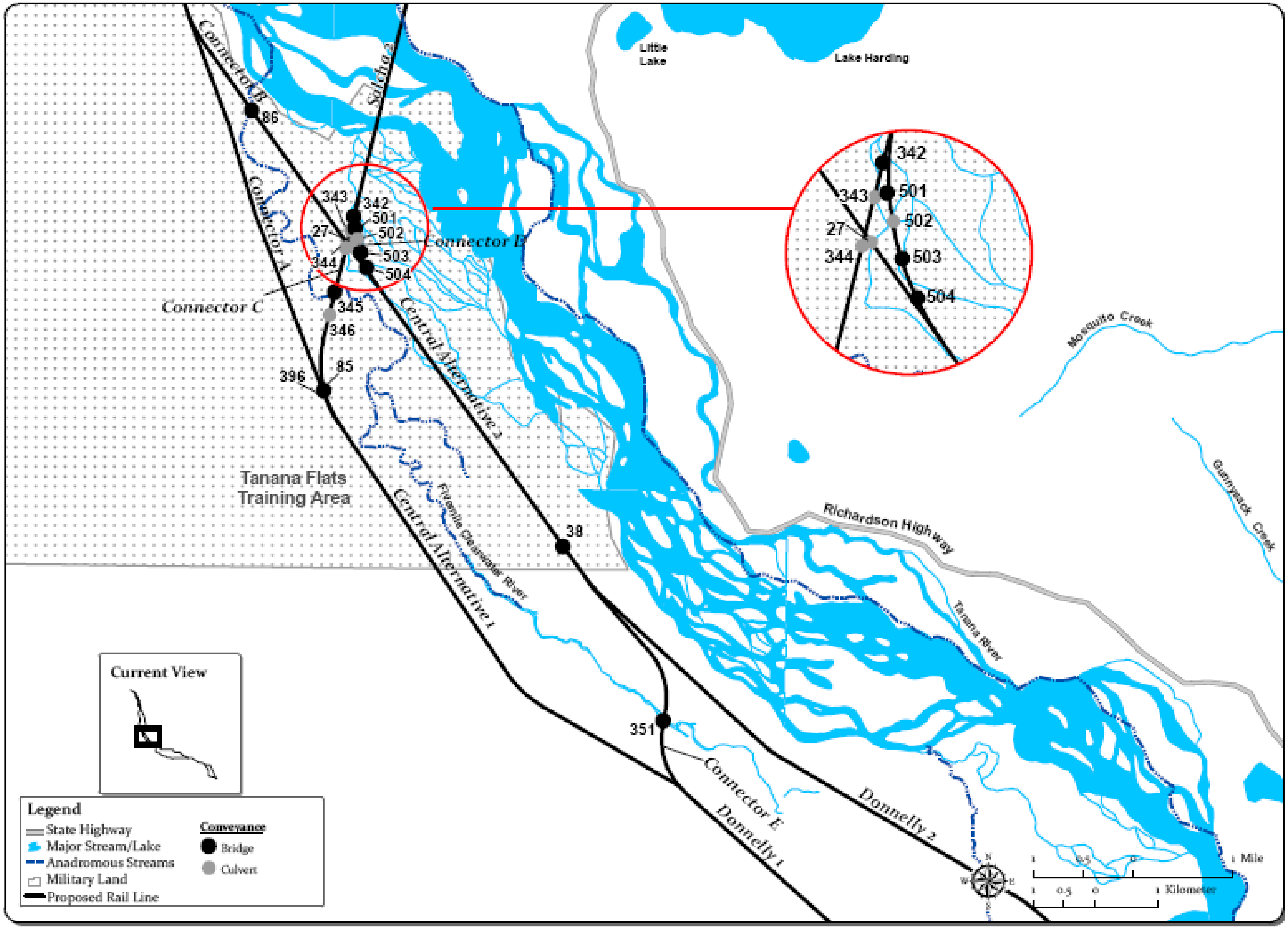

Figure G-6 – EFH-Bearing Streams Crossed by the Central Alternative Segments and Central Connectors (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

Donnelly Alternative Segments

Both Donnelly alternative segments would cross the Little Delta River, Kiana Creek, and Delta Creek (Figure G-7). The Little Delta River is a glacial tributary of the Tanana River that runs north for 24 miles before joining the Tanana River. There is little documentation of fish presence in reaches of this river. Kiana Creek (334-40-11000-2490-3362, Johnson and Weiss, 2007) is a clearwater tributary of the Tanana River whose confluence lies approximately 4 miles upstream of the Little Delta River/Tanana River confluence. The first 7 miles of Kiana Creek support coho salmon during rearing (Johnson and Weiss, 2007), and it is likely that there are spawning areas upstream of the rearing areas. Additional coho rearing habitat has been documented east of the cataloged reach of Kiana Creek (Noel, 2007, Records 68 and 69). Delta Creek is a glacial tributary of the Tanana River whose confluence lies about 7 miles upstream from the mouth of Kiana Creek. Resident fish species have been documented near the mouth of Delta Creek, but no anadromous fish habitat is known to occur within this stream.

Donnelly Alternative Segment 1 would not cross any streams supporting EFH or anadromous fish. Tables G-12 and G-13 list EFH Donnelly Alternative Segment 2 would cross.

Table G-12
EFH-bearing Streams the Donnelly Alternative Segments Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
Donnelly 1						
none						
Donnelly 2						
40	Unnamed	Stream	Anadromous	75	Culvert	3 x 10
41	Unnamed	Stream	EFH	18	Bridge	40
252	Unnamed	Wetland	Anadromous	85	Culvert	4
100	Kiana Creek	Stream	Anadromous	35	Bridge	80

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-13
Fish, Life Stages, and Habitats that Could Be Affected By Construction and Operation of the Donnelly Alternative Segments[a]

Fish Presence	Life Stages: Eggs	Life Stages: Fry/ Larvae	Life Stages: Juveniles	Life Stages: Adults	Habitat: Spawning	Habitat: Rearing	Habitat: Over-wintering	Habitat: Summer Foraging	Habitat: Migratory
Unnamed Streams (Crossings 40, 41), Kiana Creek and Tributaries (Crossings 100, 252)									
Coho Salmon			X	X		X		X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Donnelly Alternative Segment 2 would cross the lower reach of Kiana Creek at Crossing 100. Crossing 252 is at a tributary of Kiana Creek that is downstream of Crossing 100. A Tanana River tributary (Crossing 40) draining a large wetland between the Donnelly alternative segments also provides coho salmon rearing habitat (Noel, 2007, Record 68, 69). Another Tanana River tributary (Crossing 41) provides coho salmon habitat. Upper reaches of this watershed appear to depend on precipitation to maintain summer flows during at least a portion

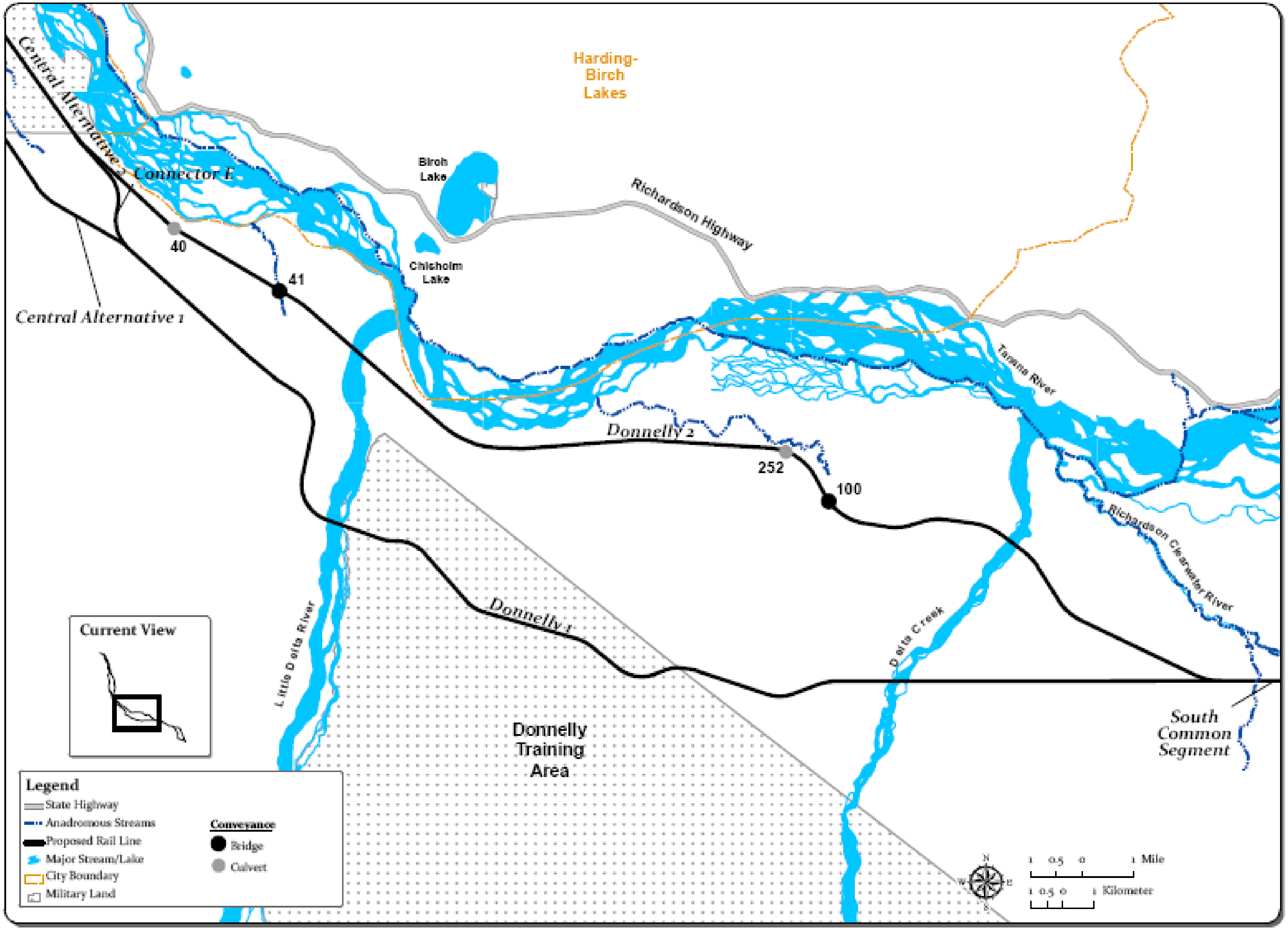

Figure G-7 – EFH-bearing Streams Crossed by the Donnelly Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007) of the summer (Noel, 2007, Record 168, 169, 179). The lower portions of the Kiana Creek drainage support coho salmon rearing, and coho salmon spawning. The outflow channel from a clearwater stream complex, just down river from the Donnelly Alternative Segment 2 Delta Creek crossing, could contain habitat suitable for fall spawning chum salmon.

South Common Segment

South Common Segment would cross several tributaries of the Richardson Clearwater River (331-40-11000-2490-3370, Johnson and Weiss, 2007), a clearwater stream that flows northwest for about 14 miles before joining the Tanana River (Figure G-8). This stream supports populations of coho salmon and chum salmon; their eggs and likely juvenile coho salmon overwinter in the stream. Juvenile coho salmon and other resident fish use it as a summer feeding ground (Ridder, 1983; Johnson and Weiss, 2007). Project alternatives would cross the two unnamed tributaries of the Richardson Clearwater River (331-40-11000-2490-3370-4030 and 331-40-11000-2490-3370-4040, Johnson and Weiss, 2007) that support coho spawning and rearing. A third unnamed stream likely contains anadromous fish.

Tables G-14 and G-15 list EFH South Common Segment would cross. Although anadromous fish were not found during limited surveys of the area, because spawning gravels were present, it is likely that Crossing 103 provides habitat for coho salmon (Noel, 2007, Record 141). Construction of road and rail line bridges at these three crossings would lead to the removal of trees next to the streams. The wildland fire that occurred in this area in 1998 burned most of the trees along these streams, and crossings at these three streams would remove some of the few remaining trees that line the streams.

Table G-14
EFH-bearing Streams South Common Segment Would Cross[a]

Crossing Number	Stream Name	Waterbody Type	Fish	Channel Width (feet)	Conveyance Type	Conveyance Size (feet)
136	Unnamed	Stream	EFH	10	Bridge	50
103	Unnamed	Stream	Anadromous	35	Bridge	65
104	Unnamed	Stream	EFH	15	Bridge	40

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

Table G-15
Fish, Life Stages, and Habitats That Could Be Affected By Construction and Operation of South Common Segment[a]

	Life Stages				Habitat				
Fish Presence	Eggs	Fry/Larvae	Juveniles	Adults	Spawning	Rearing	Over-wintering	Summer Foraging	Migratory
Richardson Clearwater River Tributaries (Crossings 136, 104)									
Chum Salmon	X	X		X	X		X		X
Coho Salmon	X	X	X	X	X	X	X	X	X
Richardson Clearwater River Tributaries (Crossing 103)									
Coho Salmon	X	X	X	X	X	X	X	X	X

[a] Sources: ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007.

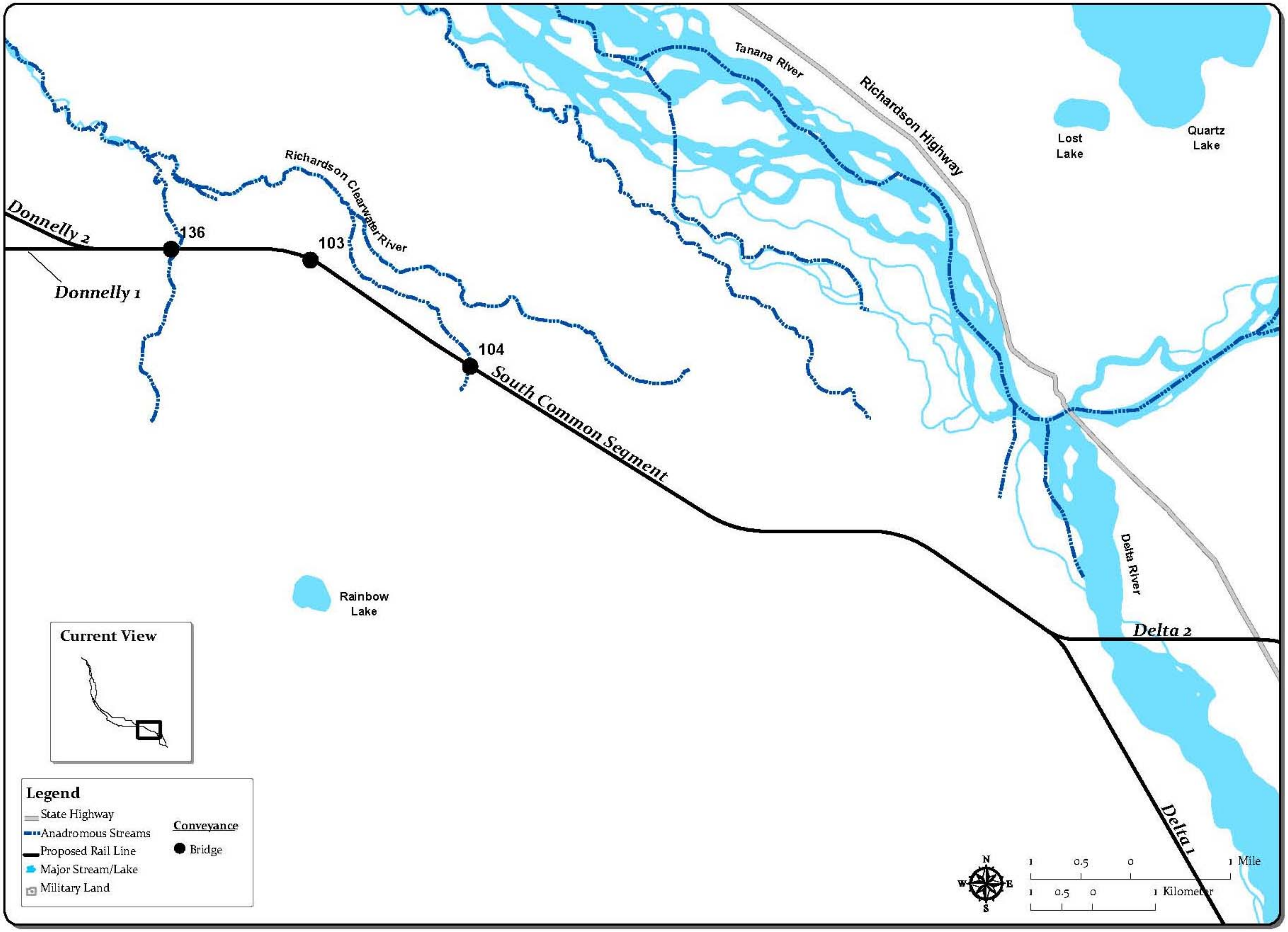

Figure G-8 – EFH-bearing Streams Crossed by South Common Segment (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007

South Common Segment Crossing 103 is a clearwater stream with gravel substrates, groundwater upwelling, and a mix of run riffle and pool habitat (Noel, 2007, Record 141). Spawning of summer-run chum salmon and fall-run coho salmon occur in the Richardson Clearwater River (Johnson and Weiss, 2007), into which this stream flows. The occurrence of suitable spawning habitat at this site, along with connection to a known anadromous stream, make it likely that coho salmon use this stream for spawning. Crossing 104 is similar to Crossing 103 and also contains gravels suitable for spawning.

Delta Alternative Segments

The Delta River (331-10-11000-2490-3390, Johnson and Weiss, 2007) supports resident fish, especially during seasonal movements, and the lower 2 miles of this river downstream of the crossings also support fall chum and coho spawning (Figure G-9). Upwelling in this area cleans gravels of glacial silts and maintains sufficient flows to remain unfrozen during winter, providing overwinter incubation habitat for eggs and larvae of chum and coho salmon. The Delta alternative segments would not cross this area.

The Delta alternative segments would not directly cross EFH. Gravel mining within the channel of the Delta River and channel constriction caused by the placement of gravel fill within the active channel and floodplain of the Delta River have the potential to affect the subsurface water flow and sediment movement that maintain the EFH downstream from the Delta River crossing sites.

G.4 Mitigation

This section identifies mitigation measures that would avoid, minimize, or compensate for potential adverse impacts to EFH. Federal, State of Alaska, and local regulations and permit processes are in place to ensure that construction and operations activities are conducted in an environmentally responsible manner, and the Applicant would be required to comply with these various regulatory requirements and associated best management practices.

Section G.4.1 describes voluntary measures proposed by the Applicant, some of which are regulatory-related requirements and associated best management practices, and Section G.4.2 describes SEA’s recommended preliminary mitigation measures. SEA’s preliminary mitigation measures are based on the information available to date, consultations with appropriate agencies, and the environmental analysis in the EIS.

G.4.1 Applicant’s Voluntary Mitigation Measures

The Applicant has identified the following voluntary measures as potential mitigation for impacts to water resources and fisheries resources:

Erosion and Sedimentation Controls

The Applicant shall be subject to U.S. Environmental Protection Agency jurisdiction under the National Pollutant Discharge Elimination System (NPDES) for stormwater discharges resulting from construction activities. Requirements that are commonly part of a Stormwater Pollution Prevention Plan associated with a NPDES Stormwater Construction Permit include the following:

- Ground disturbance shall be limited to only the areas necessary for project-related construction activities.

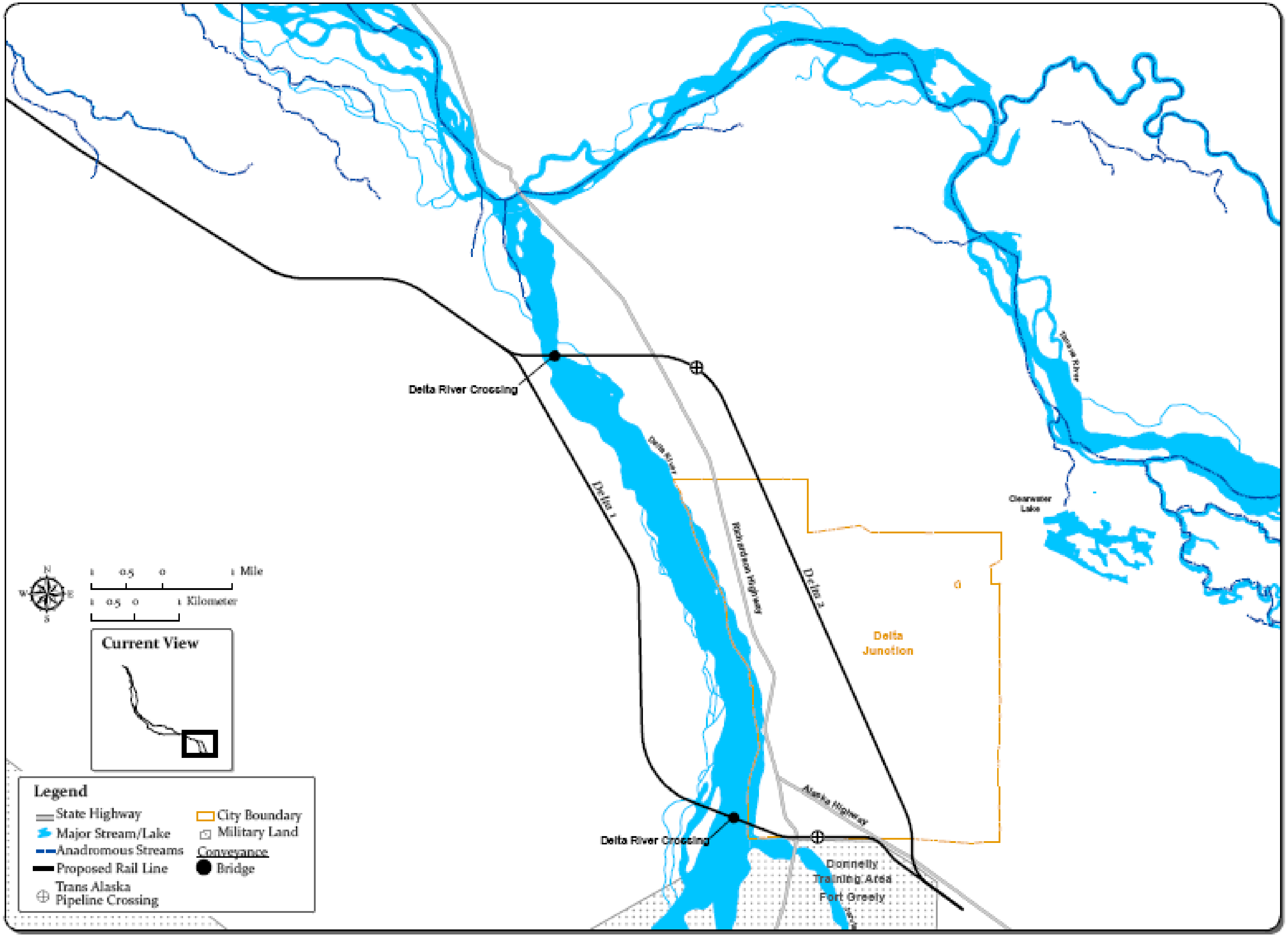

Figure G-9 – EFH -Bearing Streams Crossed by the Delta Alternative Segments (ADF&G, 2005; Johnson and Weiss, 2007; Noel, 2007)

- During earthmoving activities, topsoil shall be reused wherever practicable and stockpiled for later application during reclamation of disturbed areas.
- Appropriate erosion control measures shall be employed to minimize the potential for erosion of soil stockpiles until they are removed and the area is restored.
- Disturbed areas shall be restored as soon as practicable after construction ends along a particular stretch of rail line, and the goal of restoration shall be the rapid and permanent reestablishment of native ground cover on disturbed areas to prevent soil erosion.
- The bottom and sides of drainage ditches shall be revegetated using natural recruitment from the native seed sources in the stockpiled topsoil or a seed mix free of invasive plant species.
- If weather or season precludes the prompt reestablishment of vegetation, temporary erosion control measures shall be implemented.

Water Resources Protection

- Prior to initiating any project-related construction activities, a spill prevention, control, and countermeasure plan for petroleum products or other hazardous materials, as required by Federal and state regulations, shall be developed. The plan shall prevent discharges and contain such discharges if they occur. The plan shall include a requirement to conduct weekly inspections of equipment of any fuel, lube oil, hydraulic, or antifreeze leaks. If leaks are found, the Applicant shall require the contractor(s) to immediately remove the equipment from service and repair or replace it.
- Federal permits, including those required by Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, shall be obtained from the U.S. Army Corps of Engineers prior to initiation of construction. The Applicant shall also obtain necessary state permits and authorizations (*e.g.*, Alaska Department of Fish & Game Fish Habitat Permit, Alaska Department of Natural Resources Land Use Permit, and an Alaska Department of Environmental Conservation Section 401 water quality certification). Permit stipulations shall be incorporated into construction contract specifications.
- The new rail line shall be designed and constructed in such a way as to maintain natural water flow and drainage patterns to the extent practicable. This shall include placing equalization culverts through the embankment as necessary, preventing impoundment of water or excessive drainage, and maintaining the connectivity of floodplains and wetlands.
- The smallest area practicable around any streams shall be disturbed and, as soon as practicable following construction activities, disturbed areas shall be revegetated using native vegetation.
- Bridges and culverts shall be designed, constructed, and operated to maintain existing water patterns and flow conditions as practicable.
- Culverts shall be designed and constructed for new fish-stream crossings with a width greater than or equal to 125 percent of the width of the stream at the ordinary high water stage. The culvert grade shall approximate the surrounding slope of the stream channel. Whenever possible, new culverts shall be buried to approximately 40 percent of their diameter with substrate material that would remain stable at expected flood discharge rates. This shall not apply to any water crossing more than 15 feet in bank-to-bank width due to span length limitations. Alternative design measures shall be required to meet the same design goals on streams more than 15 feet wide at ordinary high water.

- When project-related construction activities, such as culvert and bridgework, shall require work in streambeds, these activities shall be conducted during low-flow conditions or as otherwise permitted.
- During construction, project-related construction vehicles shall be directed to avoid driving in or crossing streams at other than established crossing points.
- Temporary stream crossings shall be placed across waterways during construction to provide access for contractors, work crews, and heavy equipment.
- Temporary structures shall avoid overly constricting active channels and shall be removed as soon as practicable after the crossing is no longer needed.
- As part of the National Pollutant Discharge Elimination System Stormwater Construction Permit and Stormwater Pollution Prevention Plan, during construction:
  - Temporary barricades, fencing, and/or flagging shall be used to contain project-related impacts to the construction area and avoid impacts beyond the project footprint.
  - Areas disturbed, except for the rail line embankment, shall be returned to their preconstruction contours to the extent practicable, and reseeded or replanted with native vegetation within one growing season following construction to provide permanent stabilization and minimize the potential for erosion.
  - Contaminant-free embankment and surface materials shall be used.
  - Appropriate best management practices shall be used within parallel drainage ditches that are within 1,000 feet of perennial waters to provide stormwater retention and filtration. Drainage ditches shall be maintained as necessary (e.g., by removing accumulated sediments to maintain stormwater retention capacity and function).
- For the portions of the project within the Fairbanks North Star Borough (FNSB), the Applicant shall coordinate with the local FNSB Floodplain Administrator to ensure that new project-related stream and floodplain crossings were appropriately designed. For crossings within the mapped 100-year floodplain, drainage crossing structures shall be designed to pass a 100-year flood.

Fisheries Resources Protection

- State permits and authorizations, like the Alaska Department of Fish and Game Fish Habitat Permit, shall be obtained. Permit stipulations shall be incorporated into the construction contract specifications.
- Construction in anadromous streams shall be timed where practicable to minimize adverse effects to salmon during critical life stages. Timing windows, as specified by Alaska Department of Fish and Game’s Division of Habitat, shall be incorporated into construction contract specifications for instream work. Stream crossings shall be designed and constructed so as not to impede fish passage or impair the hydrologic functioning of the waterbody.
- When project-related construction activities, such as culvert and bridgework, require work in streambeds, activities shall be conducted, to the extent practicable, during either summer or winter low-flow conditions.
- Construction in anadromous streams shall be timed where practicable to minimize adverse effects to salmon during critical life stages. Timing windows, as specified by Alaska

Department of Fish and Game's Division of Habitat, shall be incorporated into construction contract specifications for instream work. Stream crossings shall be designed and constructed so as not to impede fish passage or impair the hydrologic functioning of the waterbody.

- Essential Fish Habitat (EFH) conservation measures shall be implemented as agreed upon with the National Marine Fisheries Service during the EFH consultation process.

G.4.2 SEA's Preliminary Mitigation Measures

SEA has identified the following preliminary measures as potential mitigation for impacts to water resources and fisheries resources:

Water Resources Mitigation

- During the final design process and facility siting, the Applicant shall conduct pre-siting investigations of potential borrow areas, staging areas, camps, and access roads to:
    - Identify the highly sensitive areas within the project area (in consultation with U.S. Fish and Wildlife Service and Alaska Department of Fish and Game) and locate facilities in previously disturbed sites and not in sensitive habitat areas, to the extent practicable.
    - Avoid to the extent practicable areas that could affect or be affected by flooding (especially with frequent recurrence intervals during the construction window); areas that have moderate to high densities of fine-grained permafrost soils, especially if the permafrost area is adjacent to or nearby a waterbody; and areas that are otherwise sensitive.
    - Minimize to the extent practicable the total number and footprint area of facilities (*e.g.*, for borrow areas, by hauling material longer distances to avoid environmentally sensitive areas adjacent to water bodies; and for access roads, by minimizing width).
    - During construction, minimize the duration and extent of activity to develop the facilities and provide surface treatments to minimize soil compaction (*e.g.*, scarify compacted soils through the compacted zone during reclamation to promote infiltration) and promote vegetation regrowth, including a reclamation plan that addresses rehabilitating recharge characteristics to maintain long-term hydrologic stability, habitat, and final usage (*e.g.*, recreation, aquatic habitat). Plans for excavation depths shall be developed in cooperation with appropriate agency staff to both minimize areal extent (by maximizing depth) and maximize post-project function (through such measures as leaving shelves or gently sloping littoral areas).
- For conveyance structures located in active braided channels, the Applicant shall examine the seasonal and annual stages and extent of flooding for the braided rivers to determine the optimum construction window and to estimate heights for protective berms or dikes necessary to minimize flooding during the construction period and to minimize the effect on drainage patterns during flooding.
- The Applicant shall avoid potential ice-jam locations and permafrost areas, fine-grained sediments, and steep, high streambanks when locating ice bridges and approaches. Specially adapted best management practices shall be applied for construction activities within these types of areas. For example, the Applicant shall slot ice bridges in several areas to accommodate faster disintegration of the bridge during the spring breakup period.

- The Applicant shall evaluate construction water needs in relation to streamflow rates and minimize effects of water supply extraction from watercourses. If the Applicant uses groundwater as a water supply source, the Applicant shall evaluate estimated groundwater withdrawal rates in relation to annual and seasonal recharge rates and minimize effects of water withdrawal on surface water and groundwater.
- The Applicant shall conduct detailed site-specific hydraulic analyses and modeling (*e.g.*, as indicated in Roach, 2007, and Zufelt, 2007), including examination of potential ice-jam and scour effects, for the Tanana River crossings to predict changes to flow paths, velocity profiles, and scour at high-flow discharges.
- The Applicant shall conduct site-specific analyses of seasonal variations in sediment transport mechanisms before the bridge construction work proposed in the two large braided streams (Delta Creek and the Little Delta River) to minimize the potential for disturbance.
- During final design, rail line and access roads located in floodplains shall allow for the flow of floodwaters to floodplain storage areas by incorporating a sufficient number and size of culverts or bridges. The Applicant shall conduct site-specific analyses that incorporate flood conveyance and hydraulics and flood storage requirements of the 100-year flood as part of the design. For crossings within the mapped 100-year floodplain, the Applicant shall design drainage crossing structures to pass a 100-year flood without increasing the surface water elevation of the base flood by more than 1 foot, consistent with Federal Emergency Management Agency regulations (44 Code of Federal Regulations Part 9).
- Spill barriers or absorbent material shall be provided at the down-gradient ends of staging areas and camp sites to contain any potentially contaminated surface runoff. Erosion and sediment controls shall also be required as needed at these locations.
- Standard protocols for transporting hazardous substances and other deleterious compounds to minimize the potential for a spill occurrence near or adjacent to water bodies shall be followed.
- Tank storage facilities shall be placed at the farthest practical locations away from any streams or rivers, and standard protocols (*i.e.*, lined and bermed pits for secondary containment) for storing chemical and petroleum products shall be implemented. The Applicant shall consult with Alaska Department of Environmental Conservation to determine appropriate measures and distances.
- As specified in the U.S. Army Corps of Engineers Alaska District's Nationwide Permits General Best Management Practice guide (USACE, 2007b):
    - Sediment and turbidity at the work site shall be contained by installing diversion or containment structures.
    - Dredge spoils or unusable excavated material not used as backfill at upland disposal sites shall be disposed of in a manner that minimizes impacts to wetlands.
    - Wetlands shall be revegetated as soon as possible, preferably in the same growing season, by systematically removing vegetation, storing it in a manner to retain viability, and replacing it after construction to restore the site.
    - Stream banks shall be restored and revegetated using techniques such as brush layering, brush mattressing, and use of jute matting and coir logs to stabilize soil and reestablish native vegetation.

  - Topsoil and organic surface material, such as root mats, shall be stockpiled separately from overburden and returned to the surface of the restored site.
  - Fill materials that are free from fine material shall be used.
  - The load of heavy equipment shall be dispersed such that the bearing strength of the soil shall not be exceeded, either by using mats when working in wetlands or by using tracked rather than wheeled vehicles.
- Stream channels and existing culvert locations shall be marked before snowfall to avoid damage to these areas.
- Road and track crossings of water bodies shall be aligned perpendicular or near perpendicular to watercourses to minimize crossing length and potential bank disturbance.
- The impact of development on key wetlands, including fens, shall be minimized. Key wetlands are those that are important to fish, waterfowl, shorebirds, and other wildlife species because of their high value or scarcity in the region.
- All construction debris (including construction materials, soil, or woody debris) shall be removed from surface waters immediately upon placement during the open-water period, or prior to break-up for debris on top of or within ice or snow crossings.
- Except at approved crossing or other approved work locations, riparian vegetation shall not be cleared within 100 feet of fish-bearing water bodies.
- Gravel mining required for construction or operations shall be restricted to the minimum necessary to develop and operate the rail line efficiently and with minimal environmental damage. Gravel mine sites shall not be located within the active floodplain of a watercourse unless the Alaska Department of Natural Resources Division of Mining, Land, and Water, after consultation with Alaska Department of Fish and Game, determines that there would be no feasible and prudent alternative, or that a floodplain mine site would enhance fish and/or wildlife habitat after mining operations were completed and the site was appropriately closed. Mine site development and rehabilitation within floodplains shall follow the general procedures and guidelines outlined in *North Slope gravel pit performance guidelines* (Mclean, 1993).

Fisheries Resources Mitigation

- The Applicant shall accommodate the restoration efforts underway by U.S. Fish and Wildlife Service for Piledriver Slough and other sloughs occurring within the Piledriver Slough drainage during rail line construction and operations. Crossings shall be consistent with ongoing and planned fish habitat restoration efforts.
- The Applicant shall not place bridge piers or abutments in known areas of permafrost.
- Ice or snow bridges and approach ramps constructed at stream crossings shall be substantially free of extraneous material (*e.g.*, soil, rock, wood, or vegetation) and must be removed or breached before spring breakup.
- Under Title 16 of the Alaska Statutes (AS), the measures listed below would be imposed by ADF&G for all activities below the ordinary high water mark in specified anadromous water bodies and for activities in fish-bearing waters that could block fish passage. Exceptions to these requirements, including exceptions for the use of spill containment and recovery equipment or material source development, may be allowed on a case-by-case basis.

- All ice crossings would be drilled before equipment crossing to determine the ice thickness.
- Alteration of river, stream, or lake banks or beds, except for approved permanent crossings, would be prohibited.
- The operation of equipment, excluding boats, in open water areas of rivers and streams would be prohibited. Exceptions to this for water withdrawal would be permitted on a site-specific basis.
- Ice or snow bridges and approach ramps constructed at river, slough, or stream crossings would be substantially free of extraneous materials (*e.g.*, soil, rock, wood, or vegetation) and would be removed or breached before spring breakup.
- Bridges are the preferred watercourse crossings in fish spawning and important rearing habitats. In areas where culverts are used, they would be designed, installed, and maintained to provide efficient passage of fish.

• Detonation of explosives within, beneath, or close to fish-bearing waters would not result in overpressures exceeding 2.7 pounds per square inch unless the water body, including its substrate, is frozen solid. Peak particle velocity stemming from explosives detonation would not exceed 0.5 inch per second during the early stages of egg incubation. (Blasting criteria have been developed by ADF&G and are available on request.)

• Winter ice bridge crossing and summer ford crossing of all anadromous and resident fish streams would require prior ADF&G permit authorization under AS 16.05.841 and AS 16.05.871. If necessary, natural ice thickness may generally be augmented (through removing snow, adding ice or water, or other techniques) if site-specific conditions, including water depth, are sufficient to protect fish habitat and maintain fish passage. Factors to be considered include whether augmented ice thickness is likely to 1) cause freeze down into gravels used for spawning or fish overwintering habitat, 2) cause bed scouring that disturbs gravels used for fish spawning or fish overwintering habitat, 3) excessively reduce the quality or volume of fish overwintering habitat, or 4) adversely alter stream flow patterns above or below the crossing.

• The Applicant would not narrow an anadromous waterbody between its ordinary high water marks unless specifically authorized in writing by ADF&G prior to construction.

• Water withdrawal from fish-bearing waters would be subject to prior written approval by the ADNR Division of Mining, Land & Water and ADF&G Division of Habitat, would reserve adequate flow to support indigenous aquatic life, and the watercourse would not be blocked to the passage of fish. Each water intake directly accessible by fish would be designed to prevent the intake, impingement, or entrapment of fish. Maximum screen mesh size and approach velocities for various fish species are available from ADF&G.

G.5 Summary of Impacts to EFH

The primary impacts to EFH and anadromous fish habitat from crossing structures would be loss and degradation of instream habitats due to placement of structures, alteration of stream hydrology, and blockage of movements. All stream crossings would result in some loss and degradation of instream and riparian habitats, and alterations of stream hydrology, as discussed in Chapter 4 of the EIS. Bridged crossings would normally result in a smaller area of instream habitat loss compared to closed bottom culverts. In general, clear-span bridges (those without instream bridge pilings) would have less potential to create conditions that would cause blockage of salmon movements. The primary impact of instream gravel removal would be temporary or permanent habitat alteration, depending on the amount of gravel removed and the gravel recharge rate. Most alternative segments would cross documented EFH with bridges. The proposed action would require 10 anadromous fish-stream crossings including 6 crossings of EFH and 4 crossings of streams likely to contain anadromous salmon and habitat (Table G-16). Salcha Alternative Segment 2 would result in filling and alteration of Tanana River side channels near the outflow of the Little Salcha River and across from Flag Hill. Both side channels are used for fall-run chum salmon spawning. Construction and operation of the Tanana River bridge and river training structures in the river channels associated with both Salcha Alternative Segment 1 and Salcha Alternative Segment 2 would have direct adverse effects on EFH (chum salmon spawning and migration habitats) both upstream and downstream from the proposed structures. Stream crossings on the west side of the Tanana River would each include two crossing structures, one for the rail and one for the maintenance road, although this had been identified as a single crossing in tables. The minimum number of EFH and anadromous salmon stream crossings that would be required for the proposed NRE would be 8 (87 percent bridges, 75 percent EFH), and the maximum number would be 21 (62 percent bridges, 52 percent EFH). All EFH crossings for the proposed action would use bridges, and most anadromous salmon stream crossings would use bridges (75 percent, Table G-16). Construction of the proposed NRE would have moderate impacts to anadromous salmon resources in the project area.

Table G-16
Summary of EFH and Anadromous[a] Fish-bearing Streams Crossed by the NRE Alternative Segments

	EFH				Anadromous Fish Habitat			
Alternative Segment	**Bridge**	**Culvert**	**None**	**Total EFH Crossings**	**Bridge**	**Culvert**	**Total Anadromous Crossings**	**Total EFH and Anadromous Crossings**
North Common Segment	1			1				1
Eielson 1	1	1		2				2
Eielson 2	2			2				2
Eielson 3	1			1				1
Salcha 1	1			1				1
Salcha 2[b]	4	1	1	6	1	3	4	10
Central 1								
Central 2					1		1	1
Connector A					1		1	1
Connector B	1			1		1	1	2
Connector C	1			1	2	3	5	6
Connector D					3	1	4	4
Connector E					1		1	1
Donnelly 1								
Donnelly 2	1			1	1	2	3	4
South Common Segment	2			2	1		1	3
Delta 1								
Delta 2								
Proposed Action[c]	6	0	0	6	3	1	4	10
Minimum Crossings Alternative[d]	5	1	0	6	2	0	2	8
Maximum Crossings Alternative[e]	9	1	1	11	4	6	10	21

[a] EFH includes important spawning, rearing, or migration habitat for Chinook, coho, or chum salmon (Johnson and Weiss, 2007); anadromous habitats are those areas with probable-use based on proximity and habitat or documented, but uncataloged use by these species

[b] Salcha 2 would fill rather than cross a side channel; there would be no conveyance ("none" column) structure.

[c] Proposed Action (the Applicant's preferred route): North Common, Eielson 3, Salcha 1, Connector B, Central 2, Connector E, Donnelly 1, South Common, and Delta 1.

[d] Minimum stream crossings: North Common, Eielson 1, Salcha 1, Connector A, Central 1, Donnelly 1, South Common, and Delta 1.

[e] Maximum stream crossings: North Common, Eielson 3, Salcha 2, Central 1, Connector C, Donnelly 1, South Common, and Delta 1.

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Appendix H –
Draft Programmatic Agreement

**DRAFT PROGRAMMATIC AGREEMENT
AMONG**

**SURFACE TRANSPORTATION BOARD,
ADVISORY COUNCIL ON HISTORIC PRESERVATION,
ALASKA STATE HISTORIC PRESERVATION OFFICER,
U.S. BUREAU OF LAND MANAGEMENT, ALASKA STATE OFFICE,
U.S. ARMY CORPS OF ENGINEERS, ALASKA DISTRICT,
U.S. DEPARTMENT OF DEFENSE, ALASKAN COMMAND,
U.S. AIR FORCE 354th FIGHTER WING, EIELSON AIR FORCE BASE,
FEDERAL RAILROAD ADMINISTRATION,
AND U.S. COAST GUARD, SEVENTEENTH COAST GUARD DISTRICT**

REGARDING

**THE ALASKA RAILROAD CORPORATION, NORTHERN RAIL EXTENSION
BETWEEN NORTH POLE AND DELTA JUNCTION, ALASKA**

STB Finance Docket No. 34658

WHEREAS, the Surface Transportation Board (STB)[1], the lead Federal agency, has received an application for the construction and operation of a rail line by the Alaska Railroad Corporation (ARRC or applicant), extending its existing system between North Pole and Delta Junction, Alaska (Undertaking); and,

WHEREAS, the STB has determined that the proposed project is an Undertaking which may have an effect upon historic properties included on or eligible for inclusion on the National Register of Historic Places (NRHP), the full extent of which is unknown, and is in consultation with the Advisory Council on Historic Preservation (ACHP); Federal Railroad Administration (FRA); the United States Department of the Interior - Bureau of Land Management, Alaska State Office (BLM); the United States Army Corps of Engineers, Alaska District (USACE); U.S. Department of Defense, Alaskan Command (ALCOM); U.S. Air Force, 354th Fighter Wing, Eielson Air Force Base (354th Fighter Wing); U.S. Coast Guard (USCG), Seventeenth Coast Guard District; and the Alaska State Historic Preservation Officer (SHPO), pursuant to Section 800.14(b) of the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act, 16 U.S.C. 470f (NHPA); and,

WHEREAS, the STB, ACHP and SHPO are Signatories pursuant to 36 CFR 800.6(c)(1) and have authority to execute, amend or terminate this Programmatic Agreement (Agreement); and,

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1 The Surface Transportation Board (STB) was created with the passage of the ICC Termination Act of 1995 (Pub. L No. 104-88). The STB, an independent agency administratively housed within the U.S. Department of Transportation, is responsible for administering rail, pipeline, and certain adjudicatory functions involving motor and water carriers. These responsibilities are similar to those duties formerly administered by the Interstate Commerce Commission. The STB is the lead agency under the National Environmental Policy Act (NEPA) for the Northern Rail Extension Project.

WHEREAS, the FRA, BLM, USACE, ALCOM, 354th Fighter Wing, USCG and ARRC are Invited Signatories pursuant to 36 CFR 800.6(c)(2) and have authority to amend or terminate this Agreement; and,

WHEREAS, the State of Alaska's Department of Natural Resources (ADNR) and invited Tribes and Indian Organizations are Concurring Parties pursuant to 36 CFR 800.6(c)(3). The refusal of any party invited to concur with this Agreement does not invalidate the Agreement; and,

WHEREAS, STB has consulted with and continues to consult with the Indian Tribes and Alaska native corporations outlined in Appendix A.3 of this Agreement who may attach a religious and/or cultural significance to properties that may be affected by the Undertaking and these Tribes have been invited to participate in this Agreement as Concurring Parties; and

WHEREAS, the STB, as lead Federal agency, in conjunction with the FRA, BLM, USACE, ALCOM, 354th Fighter Wing, Alaska DNR, and USCG (i.e., cooperating agencies) has prepared an Environmental Impact Statement (EIS) in accordance with the requirements of the National Environmental Policy Act (NEPA) to address the potential impacts of the Undertaking on a variety of human and natural resources; and,

WHEREAS, the STB, in consultation with the Signatories and Invited Signatories, developed an Identification Plan (ID Plan) for inventory of cultural resources prior to construction, and has conducted cultural resource inventories for a range of alternatives, which were subsequently narrowed down for inclusion in the EIS. Efforts thus far have included 949 shovel test pits across 5,382 acres of track alignment and 2,339 acres of ancillary facility locations, and have identified a total of 63 cultural resource sites in this largely unstudied area of interior Alaska (see Potter 2006, *Site Location Model and Survey Strategy for Cultural Resources in the Alaska Railroad Northern Rail Extension Project Area;* Potter et al. 2007a, *Results of the 2006 Cultural Resource Survey of Proposed Alaska Railroad Northern Rail Extension Routes and Ancillary Facilities, Alaska*, and Potter et al. 2007b, *Results of the 2007 Cultural Resource Survey of Proposed Alaska Railroad Northern Rail Extension Routes, Alaska*); and,

WHEREAS, the STB has made determinations of resource eligibility for the National Register of Historic Places (NRHP) for certain historic properties within the project area and SHPO has concurred with those findings; and,

WHEREAS, the applicable requirements of the NHPA, the American Indian Religious Freedom Act, 42 U.S.C. 1996 et. seq. (AIRFA), and the Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001 et. seq. and 43 CFR 10 (NAGPRA), have been considered in the development of the ID plan and this agreement does not waive the responsibilities of the Signatories and Invited Signatories under these acts and regulations; and,

WHEREAS, the STB has determined that this Undertaking may affect historic properties eligible for the NRHP during the life span of this Undertaking; and has consulted with the ACHP and the SHPO pursuant to Section 800.14(b) of the regulations (36 CFR 800) implementing Section 106 of the NHPA; and

WHEREAS, the STB has deferred final identification and evaluation of historic properties that may be effected by this Undertaking through the establishment of this Agreement; and,

WHEREAS, the ACHP has been invited to participate in this Agreement.

NOW, THEREFORE, the Signatories and Invited Signatories to this Agreement consent that the proposed Undertaking shall be implemented in accordance with the following stipulations in order to consider the effect of the Undertaking on historic properties and to satisfy all Section 106 NHPA responsibilities for all aspects of the Undertaking.

STIPULATIONS

The STB shall ensure that the following measures are carried out:

I. Administrative Considerations:

A. The STB and Invited Signatories shall attach this Agreement or the measures (stipulations) called for in this Agreement to any Record(s) of Decision (ROD), approved permit(s), or other condition(s) issued for this Undertaking so that this Agreement and its requirements become legally enforceable and binding on those actions.

B. This Agreement and all of its requirements shall be binding on ARRC, as the current applicant for STB authorization, and on its heirs, successors, and assignees.

C. Because of both singular and overlapping legal authorities and purviews among the Signatories and Invited Signatories regarding individual Undertaking components or activities, any or all of these agencies may be responsible to carry out the terms of this Agreement for a given Undertaking component or activity. That agency or agencies that has/have purview over a given Undertaking component or activity is referred to in this Agreement as the "responsible agency(ies)," hereinafter. To promote coordination among the agencies and to expedite the conduct of tasks pursuant to this Agreement, the responsible agency(ies) can make informal arrangements among themselves regarding the implementation of this Agreement so long as the substance of this Agreement is followed. However, if there is more than one agency with purview over a given Undertaking component or activity, all involved agencies shall remain aware of the substance, progress, and any problems with implementing this Agreement for that Undertaking component or activity and remain involved to prevent and resolve problems. For certain larger Undertaking components and activities, it may be advisable for all involved agencies to carry out the terms of this Agreement jointly.

D. No later than 30 days after issuance of any STB Final Decision granting ARRC the authority to construct and operate the Undertaking, the STB and the SHPO shall consult and develop an Agency Consultation and Coordination Plan (ACCP) that outlines how the agencies shall coordinate with each other in carrying out the terms of this Agreement. The ACCP shall include a list of anticipated

Undertaking components and activities and which agency will be the "responsible agency(ies)" for each. The ACCP should also include procedures for review and approval of resource determinations, treatment plans, any preliminary field reports, and final technical reports, according to the reporting structure described in Stipulation IX(C) of this Agreement. This ACCP may be amended as needed by these parties.

E. The Signatories and Invited Signatories shall enforce the terms of this Agreement, approvals, and other conditions that incorporate this Agreement and its terms. Each shall notify the others if any of them becomes aware of an instance of possible non-compliance with the terms and conditions of this Agreement or permit or conditions as they relate to this Agreement. In such case, the "responsible agency(ies)" shall ensure compliance consistent with its/their legal authorities and consult with the other agencies, as needed.

II. Historic Properties, Areas of Potential Effect, and the Applicability of this Agreement:

A. This Agreement shall apply to the Undertaking and all components of it, including actions specified in the EIS, permits and approvals, or other documents so long as they are within the jurisdiction of the STB and Invited Signatories.

B. The STB has made a reasonable and good faith effort to identify and evaluate historic properties eligible for the NRHP for the purposes of comparing impacts in the EIS. A total of 63 cultural resource sites were discovered during the 2006 and 2007 surveys, including 51 prehistoric/subsurface sites and 12 historic sites. Forty seven sites (75% of total) were considered eligible to the NRHP, 7 (11%) were considered not eligible, and 4 (6%) require more data (Potter et al. 2007a and 2007b; and letters from SHPO to STB dated 9/24/07 and 7/16/08 documenting consensus agreement with these findings).

C. This Programmatic Agreement is being implemented because the impacts of the proposed Undertaking can not be completely known at this time. The STB and SHPO have reached consensus agreement on historic properties identified in the 2006 and 2007 surveys. STB will provide final determinations of eligibility for the National Register and findings of effect to the SHPO for concurrence for those sites that are identified within the APE. It is further anticipated that such agency action shall occur after execution of this Agreement, the APE is further refined (as may be needed) based on final design of the Undertaking, and after such time as the STB issues a decision on the application to construct and operate a new rail line by ARRC. Any future refinements to an APE in conjunction with this Undertaking shall be made in consultation with the SHPO, consistent with 36 CFR 800.4. All determinations of APE and of the effects of the Undertaking shall take into account the professional standards, guidance, and research of both the cultural resources and railroad design professions. Consistent with 36 C.F.R. § 800.4(d)(1), the STB may determine that there are historic properties within the APE, but that the Undertaking will have no effect on them.

III. Tribal Consultation:

STB initiated consultation with the tribal organizations outlined in Appendix A.3 of this Agreement regarding the Section 106 process, in conjunction with the preparation of the EIS. Consultation will continue as the terms of this Agreement are carried out. No later than 30 days after issuance of any STB Final Decision granting ARRC the authority to construct and operate the Undertaking, and prior to the initiation of construction in an area previously identified through the section 106 process as being eligible to the NRHP, STB, in consultation with the SHPO and tribal organizations, shall develop a Tribal Consultation Plan (TCP) that outlines procedures for agencies to consult with tribal organizations in carrying out the terms of this Agreement. This TCP shall be acceptable to the tribal organizations and describe when and how these organizations shall be consulted, the contact names and information for each organization, procedures for review of treatment plans (as appropriate), and other matters. This TCP may be amended as needed. The procedures in the TCP will be integrated into the ACCP and the agencies' implementation of this Agreement as necessary.

IV. Identification Plan for Historic Properties and Assessment of Effects:

A. Additional identification and evaluation efforts for cultural resources may be required as the activities related to this Undertaking progress, including (but not limited to):

1. Any areas of surface/subsurface disturbance related to this Undertaking and within the jurisdiction of the STB authority, including rail alignments as well as ancillary facilities, staging areas, and borrow areas, which are outside the 200-foot-wide APE surveyed in 2006-2007.

2. Portions of any alternative or alignment for which ARRC has received authority from the STB to construct and operate that were not surveyed during the 2006-2007 investigations, such as portions of the Salchaket Village that were not surveyed due to the presence of private property and native allotments.

3. Previously identified sites within the surveyed APE, and along the alignments that may receive authorization from the STB to construct and operate, which require additional evaluation to establish boundaries and/or to determine the effects of the Undertaking.

B. Additional identification and evaluation efforts shall follow the administrative and consultation procedures established in the ACCP and TCP, as described in Stipulations I(D) and III. Additional identification and evaluation shall conform with Federal and state guidelines for fieldwork in Alaska, be compatible with previous investigations for this Undertaking, and may include a phased approach to testing and evaluation, as described in 36 CFR 800.4b2 and 800.5a3.

C. The STB, as the lead agency, shall review identification and evaluation efforts and prepare final determinations of site eligibility and assessment of effect for concurrence by the SHPO.

V. Treatment of Historic Properties:

A. Any design changes, modifications, and refinements of the Undertaking shall endeavor to avoid impacts to cultural resources.

B. For historic properties determined by the STB as eligible for the NRHP that cannot be avoided by the Undertaking, ARRC shall develop a treatment plan to minimize or mitigate the effects. Treatment plans shall be developed in consultation with STB, SHPO, the Invited Signatories, and tribal organizations that may attach religious and/or cultural significance to the identified property. During the preparation of treatment plans, the STB shall consider the views of these parties and the public. All treatment plans must be approved by STB, SHPO, any land managing agencies (as appropriate to their jurisdiction), and any tribes (as appropriate) prior to implementation. Under 43 CFR 7.7(a) "Protection of Archaeological Resources," tribes that consider any sites on public lands within the APE as having scared or cultural importance have 30 days within which to comment on the treatment plans.

1. Most historic properties identified through the 2006 and 2007 surveys are archaeological sites. For historic properties that are archaeological in nature and significant for their research data potential (criterion D), the treatment measures may follow standard mitigation through data recovery. Treatment plans for data recovery shall include, at a minimum, a research design with provisions for data recovery and recordation, analysis, reporting, and curation of resulting collection and records, and shall be consistent with the *Secretary of Interior's Standards and Guidelines* (48 FR 44734-44737). Treatment plans must be consistent with easement and permit requirements of other agencies, when applicable. To the extent possible, treatment plans should group related sites or areas, so that the treatment of related resources can be considered in context, and to minimize the burden of review and approval by agencies.

2. A number of the resources identified during the 2006 and 2007 surveys were sites relating to the historic period, or were significant for values other than their potential research value (e.g., eligible under criteria A, B, or C), including those related to the Salchaket Village site. Treatment plans for such resources, if warranted, shall specify approaches for treatment or mitigation of the property in accordance with the principles, standards, and guidelines appropriate to the resource. This may include, but not be limited to, use of such approaches as relocating a historic property, re-landscaping to reduce effects, public interpretation, ethnographic recordation, oral history, archival research, or prescribing use of a component or activity of this Undertaking in such as way as to minimize effects to historic properties or to those concerned about the effects of that component or activity. Methods of recordation and documentation described in the treatment plan shall conform with the

Secretary of the Interior's Standards for Architectural and Engineering Documentation (48 FR 44730-44734) or other standards specified by SHPO.

C. In lieu of standard mitigation approaches described above, treatment plans may adopt other alternative approaches to minimize or mitigate effects to historic properties, including assisting in the development of tribal historic preservation plans, developing detailed historic contexts for the region, developing educational materials, purchasing properties containing historic resources, or developing historic property management plans. Such alternative options must be approved in writing by all Signatories and Invited Signatories to the Agreement.

D. Treatment plans shall be reviewed according to the procedures established in the ACCP and TCP. Disputes or objections to treatment plans shall be resolved in accordance with stipulation XIII below.

VI. Treatment of Human Remains:

It is the intent of this Undertaking to avoid the disturbance or removal of any human remains. No activity will knowingly disturb human graves or human remains. If human remains, sacred objects, or mortuary objects are inadvertently discovered during the course of construction or operation, all activities in the vicinity shall immediately cease and the Plan of Action (POA) for the treatment of human remains (Appendix A) shall be implemented. The STB and ARRC shall ensure that any and all human remains, sacred objects, and objects of cultural patrimony discovered as a result of the Undertaking shall at all times be treated with dignity and respect.

VII. Monitoring:

A. If stipulated as part of a treatment plan, when the probability to uncover unidentified archaeological or historic materials is determined likely by the consulting archaeologist or SHPO, ARRC shall ensure that an archaeologist meeting the qualifications of the Standards and Guidelines is present to monitor specific ground-disturbing activities.

B. The results of monitoring shall be included in a report to the STB and SHPO. This report shall be developed, within 3 months of fieldwork and be acceptable to both the "responsible agency(ies)" and the SHPO.

C. If sites are discovered during monitoring, ARRC shall follow the procedures outlined in Stipulation X of this Agreement.

D. If human remains are discovered during monitoring, ARRC shall follow the procedures outlined in the Plan of Action (Appendix A).

VIII. Curation:

A. ARRC shall ensure that all artifacts, faunal remains, samples, records and field notes, and related materials collected during activities covered by this Agreement are deposited in the University of Alaska Museum of the North in Fairbanks, or another repository or institution approved by the SHPO. The curatorial facility shall meet requirements found in 36 CFR 79, *Curation of Federally Owned and Administered Archaeological Collections.*

B. Curation arrangements between ARRC, or their cultural resources consultant, and an approved institution must be part of any treatment plan.

C. ARRC shall incur all reasonable costs charged by the approved institution for curation of materials collected in conjunction with recovery actions under this Agreement. "Reasonable costs" shall be determined by the curatorial facility and approved by SHPO, and be consistent with professionally acceptable curatorial standards.

D. Consistent with 36 CFR 79, collections shall be packaged in archival quality materials and in a manner appropriate to the material type. Collection preparation and packaging shall be acceptable to SHPO and receiving institution, and consultation in advance is recommended.

E. Materials collected in conjunction with recovery actions under this Agreement will remain the property of the landowner unless a gift or purchase agreement is negotiated.

IX. Annual Meeting and Reports:

A. <u>Meetings</u>

Annual Meeting: A meeting of the STB, SHPO, and Invited Signatories, as well as the Concurring Parties if they so wish, shall be held each year to discuss the previous year's activities, and activities scheduled for the upcoming year. ARRC or their designated consultant shall prepare an annual report on the progress of cultural resources activities as they relate to compliance with the stipulations of this Agreement, and shall distribute it to all parties to this Agreement at least 45 days prior to the Annual Meeting. The meeting shall be held in Anchorage at the Alaska Office of History and Archaeology, or at another location by consensus of the Signatories and Invited Signatories. The parties may participate by telephone if they so desire, and minutes of the meetings will be distributed as soon as possible afterwards. The annual report shall include the following:

(a) A description of the past year's effort and anticipated upcoming efforts for identification, evaluation, mitigation, and protection of historic properties. This can include descriptions of sites, artifacts encountered, or other archaeological or historic materials encountered, including representative photographs and illustrations;

(b) A description of the progress of the Undertaking and any known or expected changes to the Undertaking;

(c) An evaluation of the effectiveness of this Agreement and whether any amendments or changes are needed based on deficiencies or project modifications.

B. <u>Additional Meetings</u>

The ACCP may establish an additional meeting schedule among all or some of the parties to this Agreement. If any party deems a meeting necessary in addition to the annual meeting described above their request shall be considered in consultation with the other parties.

C. <u>Reporting</u>

Implementation of this Agreement shall include administrative reporting as well as the preparation of technical reports on resource investigations. The reporting shall use the following procedures unless modifications to this reporting structure are agreed to by the STB, SHPO, and Invited Signatories and reflected in the ACCP.

(a) Progress reports. Progress reports shall be submitted quarterly by ARRC to the STB for the duration of the construction portion of the Undertaking following execution of this Agreement. Progress reports may be in letter format and shall describe fieldwork activities for cultural resources as well as relevant construction progress that was initiated, underway, or completed for the most recent performance period, and identify steps to be initiated, continued, or completed in the next quarter. These reports may be combined with other STB reporting requirements.

(b) Progress summaries. Progress summaries shall be submitted by the STB to the SHPO and Invited Signatories every six months for the duration of the construction portion of the Project. The first progress summary shall be distributed six months following execution of this Agreement, with subsequent summaries following each six months thereafter until the construction portion of the Undertaking is completed. The progress summaries shall identify steps initiated, underway, or completed for the most recent performance period and identify steps to be initiated, continued, or completed in the next six-month period.

(c) Preliminary field reports. Preliminary reports on the progress of cultural resource fieldwork shall be prepared by ARRC that demonstrate the completion of data recovery, or other procedures, investigations and site treatments approved in the treatment plans. The use of preliminary field reports is designed to facilitate a phased approach to resource evaluation and mitigation, as provided for in 36 CFR 800, and to facilitate reasonable construction planning and progress. ARRC shall distribute preliminary reports to the STB, SHPO, and the appropriate land managing agency(ies), and those parties will have twenty (20) business days to review the report and either concur or request additional fieldwork, after which concurrence will be presumed. Construction may proceed, in the area of the completed fieldwork, after the STB, SHPO, and appropriate land managing agency(ies) concur with the preliminary field report. If additional work is deemed necessary the parties will consult with ARRC to determine the nature and scope of that work.

(d) Technical reports. Technical reports describing the results of background research, fieldwork activities, and laboratory analyses shall be prepared according to the standards and permit guidelines appropriate to the resource, including final report standards for archaeological excavation. The extent of report distribution as well as procedures for review of draft and final technical reports shall be established in the ACCP. ARRC shall issue final technical reports no later than two years from the completion of fieldwork activities and, in consultation with the SHPO, shall prepare sufficient copies for dissemination to the Concurring Parties, appropriate public libraries, educational institutions, and other repositories.

X. Procedures for Inadvertent or Unanticipated Discoveries:

A. Upon the inadvertent discovery of a potential historic property in any activity's APE, all work in the vicinity shall immediately cease and ARRC shall protect the discovery site against further disturbance.

B. Upon the inadvertent discovery of human remains, sacred objects, or mortuary objects in any activity's APE, all work in the vicinity shall immediately cease and a plan of action for the treatment of human remains (Appendix A) shall be implemented. ARRC shall ensure that any and all human remains, sacred objects, and objects of cultural patrimony discovered as a result of activities related to the Undertaking will be treated with dignity and respect.

C. Upon the unanticipated discovery of cultural resources during construction that are not human remains, the Unanticipated Discoveries Plan shall be followed (Appendix A.2).

XI. Training:

A. On an annual basis, ARRC ensure that on-site supervisory-level employees and contractors are trained in procedures for identifying and reporting historic properties that may potentially be discovered during the course of their work. Minimally, the training shall include guidelines for identification of cultural resources, and notification procedures when archaeological materials, human remains, and historic period sites are discovered.

B. ARRC shall also ensure that its supervisory-level contractors and employees are advised against the illegal collection of historic and prehistoric materials, including human remains, and are familiarized with the scope of applicable laws and regulations.

C. Prior to the implementation of training, the curriculum shall be reviewed and approved by the STB and SHPO.

D. Training shall be conducted by an archaeologist meeting the qualifications of the Standards and Guidelines. However, ARRC's supervisory level employees and contractors may attend the above training and convey the information to staff unable to attend.

E. On an annual basis, ARRC shall supply to the STB and SHPO a list of employees and contractors who attended the annual training, and procedures through which the information was conveyed to employees and contractors who did not attend.

XII. Procedures for Consultation:

Consultation shall be an ongoing process throughout the construction phase of the Undertaking. The STB, SHPO, Indian tribes and Native Alaska Corporations, Invited Signatories and the ACHP may consult at any time in writing, including e-mail, or telephone. Formal contacts and reviews will be established in the ACCP and TCP.

XIII. Dispute Resolution:

Should any party to this agreement object within 30 days of any treatment plan or report provided for review or actions proposed pursuant to this Agreement, STB and the SHPO shall consult with the objecting party to resolve the objection.

A. If the STB and/or SHPO determine that the objection cannot be resolved, the STB shall forward all documentation relevant to the dispute to the ACHP. Within 30 days after receipt of all pertinent documentation, the ACHP will either:

(1) Provide the STB with recommendations, which the agency will take into account in reaching a final decision regarding the dispute; or

(2) Notify the STB that it will comment pursuant to 36 CFR 800.6(b), and proceed to comment. Any ACHP comment provided in response to such a

request shall be taken into account by the STB in accordance with 36 CFR 800.7 with reference to the subject of the dispute.

(3) Any recommendation or comment provided by the ACHP shall be understood to pertain to the subject of the dispute; the STB's responsibility to carry out all actions under this Agreement that are not the subjects of the dispute shall remain the same.

B. At any time during implementation of the measures stipulated in this Agreement, should an objection to any such measure or its manner of implementation be raised by a member of the public, the STB shall take the objection into account and consult as needed with the objecting party, SHPO, or the ACHP to resolve the objection.

XIV. Amendments:

Any Signatory or Invited Signatory to this Agreement may request that the other Signatories consider amending it, whereupon the parties shall consult to consider the amendment(s). Amendments will be executed in the same manner as the original Agreement. Concurring Parties may suggest proposed amendments to the Signatories and Invites Signatories, who shall consult to consider them.

XV. Termination:

Any Signatory or Invited Signatory to this agreement may terminate it by providing thirty (30) days notice to the other parties explaining the reasons for the termination. The Signatory or Invited Signatory shall consult during this period to seek agreement on amendments or other actions that will avoid termination. In the event of termination, the STB will comply with 36 CFR 800.1 through 800.7 on remaining Undertaking components, activities, or outstanding issues.

XVI. Failure to Carry Out Agreement:

If the STB does not ensure that the terms of this Agreement are carried out, or if the ACHP determines that the terms of this Agreement are not carried out, the STB shall comply with 36 CFR Part 800.1 through 800.7 with regard to individual Undertakings covered by this Agreement.

XVII. Duration:

This Agreement shall become effective upon execution by the STB, the ACHP and SHPO, and shall remain in effect for a term of five years from its date of execution, at which point the Agreement may be renewed.

XVIII. Execution and Implementation:

Execution and implementation of this Agreement evidences that the STB has satisfied responsibilities under Section 106 of the National Historic Preservation Act pursuant to 36 CFR 800, and that SHPO has satisfied responsibilities under the Alaska Historic Preservation Act pursuant to AS 41.35.

A. SIGNATORIES

Surface Transportation Board

By: ____ Date: __________________
(Victoria Rutson, Chief, Section of Environmental Analysis)

Advisory Council on Historic Preservation

By: ____ Date: __________________
(Name, Title)

Alaska State Historic Preservation Officer

By: ____ Date: __________________
Judith E. Bittner,
State Historic Preservation Officer

B. INVITED SIGNATORIES

Cooperating Agencies and Applicant

Cooperating Federal Agencies
U. S. Department of Interior - Bureau of Land Management, Alaska State Office

By: ____ Date: __________________
(Name, Title)

U. S. Army Corps of Engineers

By: ____ Date: __________________
(Name, Title)

U.S. Air Force 354th Fighter Wing, Eielson Air Force Base

By: ____ Date: __________________
(Name, Title)

U.S. Department of Defense, Alaska Command

By: ____ Date: __________________
(Name, Title)

Federal Railroad Administration

By: ____ Date: __________________
(Name, Title)

United States Coast Guard, Seventeenth Coast Guard District

By: ____ Date: __________________
(Name, Title)

Applicant
Alaska Railroad Corporation

By: ____ Date: __________________
(Name, Title)

C. Concurring Parties

Agencies
State of Alaska, Department of Natural Resources

By: ______________________________ Date: ______________
Director, Division of Mining, Land, and Water

Tribes
Healy Lake Village

By: ______________________________ Date: ______________
(Name, Title)

Village of Dot Lake

By: ______________________________ Date: ______________
(Name, Title)

Northway Village

By: ______________________________ Date: ______________
(Name, Title)

Native Village of Tetlin

By: ______________________________ Date: ______________
(Name, Title)

Native Village of Tanacross

By: ______________________________ Date: ______________
(Name, Title)

Native Village of Eagle

By: ______________________________ Date: ______________
(Name, Title)

Nenana Native Association

By: ____ Date: __________________
(Name, Title)

Native Village of Minto

By: ____ Date: __________________
(Name, Title)

Tok Native Association

By: ____ Date: __________________
(Name, Title)

Indian Organizations
Tanana Chiefs Conference, Inc.

By: ____ Date: __________________
(Name, Title)

Doyon, Ltd.

By: ____ Date: __________________
(Name, Title)

Upper Tanana Inter-Tribal Coalition

By: ____ Date: __________________
(Name, Title)

Glossary of Terms/Acronyms

Adverse Effect: When an undertaking may alter, directly or indirectly, the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative.

Area of Potential Effect: The Area of Potential Effect (APE) is the geographic area within which the project may cause physical, visual or audible effects to the character or use of historic properties. It includes all areas of construction, such as rights-of-way (ROW), staging areas, extra work spaces, yards, access roads, borrow areas, and other ancillary facilities. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking. Determination of the APE may take into account the professional standards, guidance, and research of both the cultural resources and railroad design professions.

Borrow Area(s): An excavated area where material has been or will be dug for use as fill at another location.

Consulting Parties: Consulting parties include SHPO, Indian tribes, representatives of local governments, applicants for Federal assistance, permits, licenses and other approvals, and certain individuals and organizations with a demonstrated interest in the undertaking.

Cultural Resource: A cultural resource is any prehistoric or historic district, site, building, structure or object in American history, architecture, engineering, archeology, or culture. This term includes artifacts, records, and remains that are related to and located within such properties. The term also includes properties of traditional religious and cultural importance to an Indian Tribe that may meet the National Register criteria.

Curation: The preservation of material remains that are excavated or removed during a survey, excavation, or other study of a prehistoric or historic resource, and associated records that are prepared or assembled in connection with the survey, excavation or other study.

Days: Calendar days.

Eligible for the National Register of Historic Places: The term eligible for the National Register includes both properties formally determined as such in accordance with the regulations of the Secretary of the Interior and all other properties that meet the National Register criteria.

Federal Agency(s): Any Federal entity with a statutory obligation to fulfill the requirements of Section 106 who has jurisdiction over an undertaking and takes legal and financial responsibility for Section 106 compliance in accordance with Subpart B 36 CFR 800. The Federal Agency(s) has approval authority for the undertaking and can commit the Federal agency to take appropriate action for a specific undertaking as a result of Section 106 compliance.

Historic Property: Any prehistoric or historic district, site, building structure, or object included in or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe that meet the National Register criteria.

Human Remains: The physical remains of a human body.

ID Plan: Identification Plan.

Indian Tribe: An Indian Tribe, band, nation, or other organized group or community, including a Federally-recognized Native Village, Regional Corporation or Village Corporation, as those terms are defined in Section 3 of the Alaska Native Claims Settlement Act (43 U.S.C. 1602) which is recognized eligible for the special programs and serviced provided by the United States to Indians because of their status as Indians.

Keeper of the National Register: The Keeper is the individual who has been delegated the authority by the National Park Service (NPS) to list properties and determine their eligibility for the National Register. The Keeper may further delegate this authority as he or she deems appropriate.

NAGPRA: Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 et. seq.).

National Register: The National Register lists properties formally determined eligible for the National Register of Historic Places.

National Register Criteria: National Register criteria are criteria established by the Secretary of the Interior for use in evaluating the eligibility of properties for the National Register (36 CFR 60). The National Register of Historic Places criteria are listed below:

The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship and feeling and:

a. that are associated with the events that have made a significant contribution to the broad patterns of our history; or

b. that are associated with the lives of persons significant in our past; or

c. that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

d. that yielded, or may be likely to yield, information on prehistory or history.

Criteria considerations: ordinarily cemeteries, birthplaces, or graves of historical figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations, commemorative in nature; and properties that have achieved their significance within the past 50 years shall not be considered eligible for the

National Register of Historic Places (36 CFR 60.4).

NRHP: National Register of Historic Places.

PA: Programmatic Agreement.

SHPO: State Historic Preservation Officer.

Site: Site definition is different for each state but is generally defined by Willey and Phillips (1958:18), as any reasonably definable spatial unit that contains features or is fairly continuously covered with artifacts that are indicative of an occupation 50 years or older. A site may be defined as "a spatial cluster of cultural features, or items, or both" (Binford 1972:46). These definitions apply to both prehistoric and historic sites. Archaeological context may be defined by the inclusion of any of the following: soil staining, associated fire-cracked rock, ceramics, features, or a concentration of materials within a reasonably defined spatial boundary.

STB: Surface Transportation Board.

Traditional Cultural Properties: A Traditional Cultural Property can be defined generally as an object, site, landscape feature, or other form of feature that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that communities' history, and (b) are important in maintaining the continuing cultural identity of the community. For additional information, reference Parker and King 1995.

Treatment Plan: A proposal for the mitigation of effects upon any historic property that a project would affect. It can include data recovery, documentation, restoration or other measures.

Undertaking: An undertaking is a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit; license or approval; and those subject to state or local regulation pursuant to a delegation or approval by a Federal agency.

Appendix A.

Plan of Action for the Treatment of Unanticipated Discovery of Human Remains, Graves and Historic Properties

A.1. Human Remains and Graves

As set forth in Native American Graves Protection and Repatriation Act (NAGPRA) regulations (43 CFR 10), a specific plan of action is required in the event that human remains are uncovered during survey or construction of the Alaska Railroad Corporation (ARRC) proposed Northern Rail Extension (i.e., Undertaking). The following steps must be taken if human remains, or suspected human remains, are discovered:

(1) Stop all work in the immediate vicinity of the remains.

(2) Mark the area in which the remains are located, as well as a minimum buffer area with a radius of 20 meters surrounding the remains. This buffer area may be larger if there is the possibility of more remains in the area or in the case of slopes or cut banks where work located nearby may impact the site of the remains. Make sure that the remains are protected from possible impacts while contacting the appropriate parties[2].

(3) If remains are found that are not clearly human, but are suspected to be so, a specialist must be called in for identification.[3]

(4) The ARRC Project Manager should contact the following people or agencies within 24 hours of uncovering the remains.

(a) The State Historic Preservation Officer (SHPO):
Judith Bittner
Alaska Department of Natural Resources
Office of History and Archaeology
550 West 7th Avenue
Anchorage, AK 99501-3561
Phone: (907) 269-8715
Fax: (907) 269-8908

(b) Federal agency official in charge:

[2] Ways of protecting the remains include: covering with a tarp or other protection from the elements; shoring up cut banks or trench walls so that no further exposure occurs; making sure that no water will collect on or around the remains.

[3] The specialist must meet the professional qualifications for the NHPA as set forth in 36 CFR 61, section 112 (a)(1).

Victoria Rutson
Chief, Section of Environmental Analysis
Surface Transportation Board
395 E Street SW
Washington, DC 20423
Phone: (202) 245-0295
Fax: (202) 245-0454

(c) The appropriate land managing agency contact for the relevant parcel.

(d) The responsible Native representative for the area of discovery.

Gary Lee
Doyon Ltd.
1 Doyon Place, Suite 300
Fairbanks, AK 99701
Phone: (907) 459-2037
Fax: (907) 459-2062

and

Robert Sattler
Tanana Chiefs Conference, Inc.
122 1st Avenue, Suite 600
Fairbanks, AK 99701
Phone: (907) 452-8251, ext. 3343
Fax: (907) 459-3936

and

(d) The Alaska State Troopers
Alaska State Troopers
Communications Center Manager
Phone: (907) 451-5100
Fax: (907) 451-5165

Notification should include available information regarding the nature and extent of the remains and an accurate and precise location including GPS coordinates.

NAGPRA dictates that work in the immediate vicinity of the remains cannot proceed until 30 days after the reply from the Federal agency in charge or appropriate Native group that the documents regarding the finding were received, unless a written and binding agreement is issued from the Federal agency in charge and the affiliated Native American group(s) (NAGPRA 25 U.S.C. 3002 Sec 3(d)).

The remains will then be assessed and treated based on the guidance of the Federal agency in charge and the appropriate Native group as defined by NAGPRA.

A.2 Plan for Unanticipated Discoveries

Cultural resources may be encountered above ground and below ground during work on the Undertaking, and might include historic and prehistoric materials as well as Traditional Cultural Properties. In the event that cultural materials are discovered, this plan shall be followed, and implemented in compliance with both NAGPRA and the National Historic Preservation Act (NHPA) of 1966, as amended (16 U.S.C. § 470) as well as implementing regulations (36 CFR 800).

If archaeological or historic materials are encountered the following series of steps must be followed:

(1) Stop all work in the immediate vicinity of any cultural resources or suspected cultural resources.

(2) Mark the area in which the resources are located, as well as a minimum buffer area with a radius of 20 meters surrounding them. This buffer area may be larger if there is the possibility of more resources in the area or in the case of slopes or cut banks where ongoing work may impact the site. Make sure that all cultural materials are protected from possible impacts while contacting the appropriate parties[4].

(3) ARRC's Project Manager should contact the following people or agencies within 24 hours of discovering the resources.

 (a) See previous list at A.1(4).

Notification of unanticipated discoveries should include available information regarding the nature and extent of the cultural resources and an accurate and precise location including GPS coordinates.

The discovery shall be investigated by a professional meeting the appropriate qualification standards, such as a consulting archaeologist, no longer than seventy-two (72) hours from discovery. The STB, SHPO, ARRC and land managing agency (as appropriate) shall consult, by telephone or other means, on the nature of the discovery and whether any additional investigation is warranted. The STB shall contact the appropriate Tribal representative if necessary. A decision shall be provided to ARRC within five (5) working days. If the parties agree that the discovery is not significant, verbal authorization to proceed may be given by the SHPO, and SHPO shall provide

[4] Options for protecting the cultural resources include: covering with a tarp or other protection from the elements; shoring up cut banks or trench walls so that no further exposure occurs; making sure that no water will collect on or around the site.

written confirmation to the parties within five (5) working days. A report of the investigation shall be provided by the investigator, following the guidelines for Monitoring described in Stipulation VII. If additional investigation is agreed to, the guidelines for Additional Investigations described in Stipulations IV(B) shall be followed, unless modified evaluation and reporting are agreed to.

A.3 List of contacts for Native Alaskan representatives

Common Name: Dot Lake
President, William Miller
Village of Dot Lake
P.O. Box 2279
Dot Lake, Alaska 99737
Voice: (907)-882-2695 Fax: (907)-882-5558

Common Name: Healy Lake
President, Fred Kirsteatter
Healy Lake Village
P.O. Box 60300
Fairbanks, Alaska 99706
Voice: (907)-876-5018 Fax: (907)-876-5013

Common Name: Minto
Chief, Roy Charles
Native Village of Minto
P.O. Box 26
Minto, Alaska 99758
Voice: (907)-789-7112 Fax: (907)-798-7627

Common Name: Nenana
Chief, Mitch Demientieff
Nenana Native Association
P.O. Box 356
Nenana, Alaska 99760
Voice: (907)-832-5461 Fax: (907)-832-1077

Common Name: Northway
President, Gerald Albert
Northway Village
P.O. Box 516
Northway, Alaska 99764
Voice: (907)-778-2311 Fax: (907)-778-2220

Common Name: Tanacross
Executive Director, Jerry Isaac
Native Village of Tanacross

P.O. Box 76009
Tanacross, Alaska 99776
Voice: (907)-883-4496 Fax: (907)-883-4497

Common Name: Tetlin
President, Bently Mark, Sr.
Native Village of Tetlin
P.O. Box TTI
Tetlin, Alaska 99780
Voice: (907)-324-2130 Fax: (907)-324-2131

Common Name: Eagle Village
President, David Howard
Native Village of Eagle
P.O. Box 19
Eagle, Alaska 99738
907-547-2271

The Upper Tanana Inter-Tribal Coalition consists of six Federally recognized tribes:

Tribe: Village of Dot Lake
ANSCA Corporation: Dot Lake Native Corporation
Phone: 907-882-2695

Tribe: Native Village of Eagle
ANSCA Corporation: Hungwitchin Corporation
Phone: 907-547-2271

Tribe: Healy Lake Village
ANSCA Corporation: Mandas Chaag Native Corporation
Phone: 907-876-5055, 907-876-5018

Tribe: Northway Village
ANSCA Corporation: Northway Natives Incorporated
Phone: 907-778-2311

Tribe: Native Village of Tanacross
ANSCA Corporation: Tanacross Incorporated
Phone: 907-883-5024

Tribe: Native Village of Tetlin
ANSCA Corporation: Tetlin Native Corporation
Phone: 907-324-2130

Appendix I – Subsistence Methodology and Communities

I. SUBSISTENCE METHODOLOGY AND COMMUNITIES

This appendix summarizes the subsistence methodology and baseline data and potential impacts to communities on four variables of subsistence: use areas, user access, resource availability, and competition.

I.1 Methodology

The following methods of analysis and assumptions were used to evaluate each of the four variables mentioned above.

I.1.1 Subsistence Use Areas

Because a direct effect is caused by the action and occurs at the same time and place as the action, the proximity of communities' resource use areas to the Northern Rail Extension (NRE) was examined by overlaying subsistence use areas and/or Alaska Department of Fish and Game (ADF&G) moose harvest ticket information for the study communities on a map depicting the project area. Any individual participating in a moose hunt is required to fill out an ADF&G harvest ticket identifying the date, location, and success of the hunt which ADF&G later uses for wildlife management. ADF&G records the location of these hunts by various geographic units including Game Management Unit (GMU), Sub-unit, Major River Drainage, and Minor River Drainage. If a community's subsistence use area overlapped the project area, the potential for a direct effect on subsistence uses is greater. The farther a community's subsistence use area is from the project area, the less the potential for a direct impact on residents' subsistence uses. Several of the communities' use areas depicted in this appendix were collected over 20 years ago, and although they represent the best available data, they may not represent the full extent of these communities' current use areas.

I.1.2 User Access

Impact analysis includes an examination of changes in access resulting from the proposed NRE. Assumptions regarding access are:

1. Alaska Railroad Corporation (ARRC) regulations would prohibit the general public from crossing the rail line except at designated crossing areas.
2. The access road in the right-of-way would not be available for general public use.
3. Access over the Tanana River bridge would be restricted to only military and ARRC vehicles and personnel.

The proposed Tanana River bridge would provide the only point of vehicle access to areas west of the Tanana and Delta rivers. Construction of ice bridges may or may not continue if the proposed bridge is completed. Decreased access to an area could cause users to travel farther and spend more time and money to meet their harvest needs.

I.1.3 Resource Availability

ADF&G sport hunting and fishing regulations, community harvest data, and data on the seasonal round of subsistence users provided information on the types of resources harvested by subsistence users in the region and the timing and location of resource harvests. Successful subsistence harvests not only depend on continued access to subsistence resources; the resources must also be available in adequate numbers to be harvested. Furthermore, subsistence resources should be in healthy condition and available in areas where residents have traditionally hunted them. An unhealthy or depleted resource could cause users to travel farther, hunt longer, or turn to store-bought food to meet their harvest needs.

I.1.4 Competition

ADF&G harvest ticket records provide data that can be used to show the level of competition among users for moose in GMU 20A. GMUs are areas of the state defined by ADF&G, each with their own set of regulations governing the harvest limit and timing of hunts for various wildlife species within that unit. Many of the GMUs are further divided into subunits with additional regulations. Of all available harvest records, moose—with just over 7,500 total successful harvests reported over the last 10 years in GMU 20A—provides the most complete documented indicator of resource competition in the project area. Furthermore, from 2005 to 2007, GMU 20A had the highest total number of moose harvesters and successful moose harvests of any GMU subunit within the state, providing a significant portion of the statewide moose harvest (see Table 7-3). By comparison, caribou was only reported with 385 successful harvests in GMU 20A over the last 10 years. In general, depictions of competition based on harvest ticket records are most representative for non-Native communities. Andersen and Alexander (1992:i) explain that in Interior Alaska, harvest ticket reports have proven effective in recording urban-based, non-Native harvests, but are less successful in recording Native harvests because many Natives view harvest tickets as in-season enforcement tools rather than post-season reporting mechanisms. Therefore, ADF&G Division of Wildlife Conservation Area Management biologists generally factor unreported harvests, even in urban areas, into their population models because not all Alaska residents comply with the harvest reporting requirements. Changes in access can result in increased competition for resources. Increased access to an area may result in more competition for resources from outsiders and/or from nearby community residents who did not previously use the area. A decrease in access may decrease competition in the potentially affected area and introduce additional competition in new areas because harvesters can no longer access previously used hunting or fishing areas. A decrease in resource availability may result in increased competition among harvesters as they try to meet their harvest needs from a depleted resource stock.

I.2 Communities

There are 12 communities identified for review as part of this subsistence analysis. Table I-1 summarizes the wild food harvest for those communities. The following sections provide information about each community, its location, and its subsistence use.

I.2.1 Cantwell

The community of Cantwell is located at the junction of George Parks and Denali highways (see Figure I-1). Cantwell borders the eastern boundary of Denali National Park. In the year 2000, 222 people lived in Cantwell, with 65 percent of the population reported as white and 23 percent reported as Alaska Native (U.S. Census, 2002). Updated estimates in 2006 by the Alaska Department of Labor and Workforce Development (ADOLWD) lowered the total population in Cantwell to 204 people (ADOLWD, 2006). The primary subsistence resources contributing to residents' overall harvest of wild foods include moose, caribou, grayling, lake trout, and salmon.

Table I-1
Wild Food Harvest by Study Community[a]

Community	Annual Wild Food Harvest (pounds/person)	Study Years[b]
Minto	1,015	1984
Northway	278	1987
Tanacross	250	1987
Tetlin	214	1987
Tok	149	1987
Cantwell	135	1999
Dot Lake	116	1987
Nenana	98	2004
Salcha	No Data	No Data
Healy Lake	No Data	No Data
Dry Creek	No Data	No Data
Delta Junction	No Data	No Data

[a] Source: ADF&G, 2008.
[b] ADF&G most representative year or best available data.

Seasonal Round

The seasonal round is the yearly process or cycle by which subsistence users exploit different resources at different times as seasons change and different resources become available. Some resources are available year-round, while others have peak times and places, such as a ripening season for berries or a spawning run for fish. The seasonal round means that subsistence activities are concentrated in different areas at different times throughout the year to exploit a range of subsistence harvests across ecological zones, multiple plant and animal species, seasonal availabilities, and so forth. The seasonal round is generally scheduled around the availability of natural resources but the process is strongly linked to traditional cultural practices that have determined how, why, and where certain practices are conducted.

Simeone (2002, Figure 4) described the cycle of yearly subsistence activities for Cantwell residents based on their harvests from April 1999 through March 2000. During the winter months, residents engage in caribou and upland bird hunting as well as furbearer trapping activities for income. Community members also collect wood throughout the winter, spring, and early summer. In the spring, residents hunt both brown and black bears. Although some ice fishing occurs in the winter, the main season of freshwater fishing begins in late April and continues through the arrival of the first salmon in late June/early July. Cantwell harvesters hunt moose and Dall sheep and collect berries and plants in August and September, and in late fall, caribou and migratory waterfowl become the primary focus of residents' subsistence pursuits.

Subsistence Harvests

Cantwell harvest data exist for three ADF&G study years (1982, 1999, and 2000) (ADF&G, 2008; Simeone, 2002). According to ADF&G, harvest data from 1999 constitute the most representative, comprehensive, and current depiction of Cantwell's overall subsistence harvests (ADF&G, 2008).

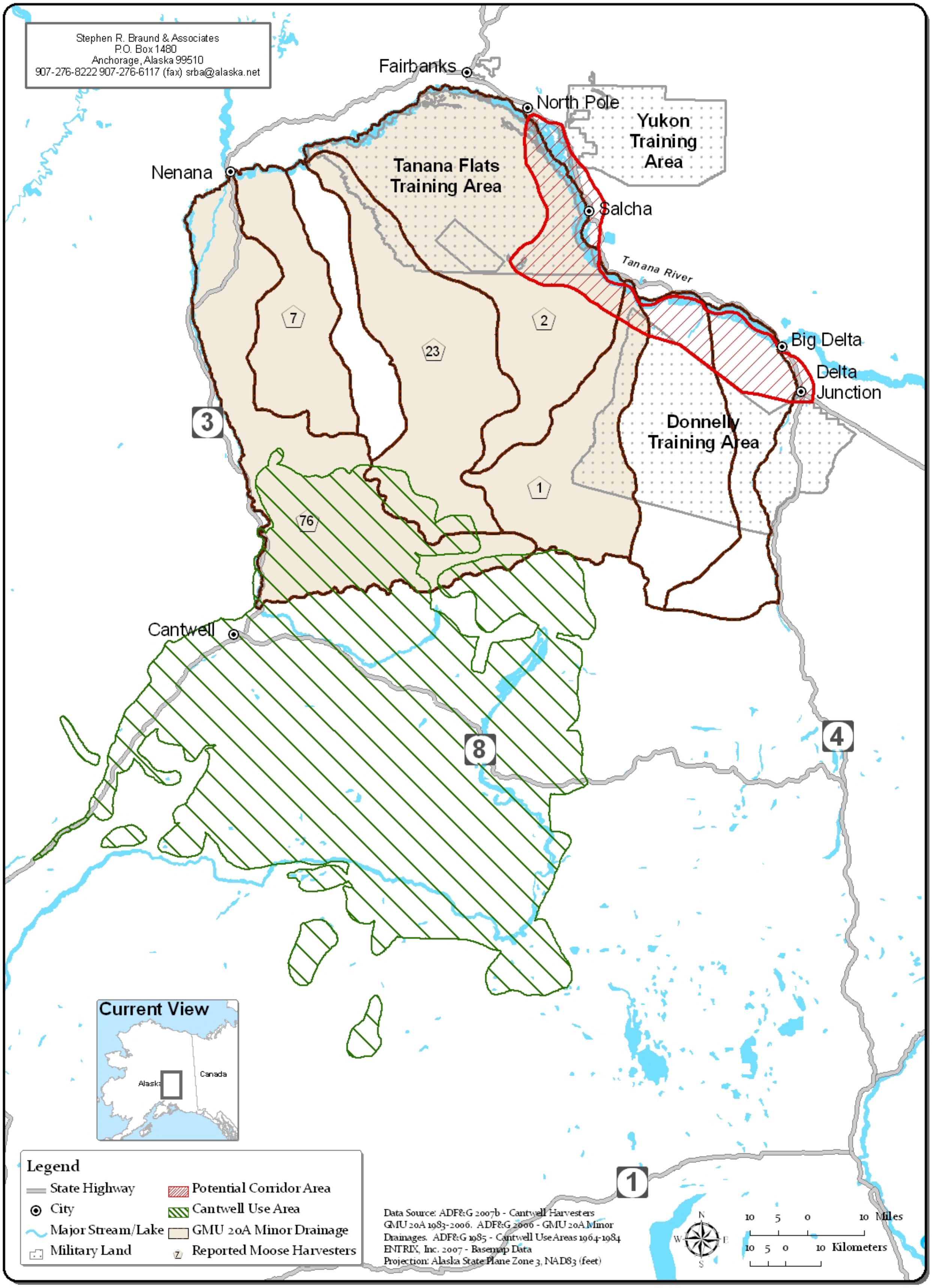

Figure I-1 – Cantwell Subsistence Use Areas

In 1999, 97 percent of households reported use of at least one subsistence resource. Over 80 percent of Cantwell households reported using non-salmon fish, large land mammals, and berries. Between 1982 and 1999, use of large land mammals and berries increased by more than ten percent while use of small land mammals and upland birds decreased. Household use of salmon increased substantially from 23 percent to 70 percent of households. The per capita harvest increased from 111 pounds in 1982 to 135 pounds in 1999. Moose, at 45 percent of the total harvest, represented the single greatest contribution to the community's overall harvests in 1999. Sixty-two percent of households reported giving away subsistence resources in 1999 and 91 percent of households reported receiving at least one subsistence resource (Simeone, 2002).

Subsistence Use Areas

Figure I-1 shows Foster's (1983) and Stratton's (1984) documented Cantwell subsistence use areas from 1964 through 1984. The majority of these use areas appear east of George Parks Highway, to the north and south of Denali Highway, and do not overlap the project area. A recent study by Simeone (2002) documented lifetime subsistence use areas of seven Cantwell households for moose, caribou, black bear, sheep, furbearers, salmon, non-salmon fish, birds, berries, and plants and represents the minimum extent of Cantwell residents' land use (Simeone, 2002, Figures 6, 7, and 8). Similar to the use areas documented by Foster (1983) and Stratton (1984), respondents reported the majority of their lifetime use areas east of George Parks Highway in areas located north and south of Denali Highway.

ADF&G moose harvest ticket records show the number of Cantwell harvesters who reported hunting moose within GMU 20A from 1983 through 2006 (ADF&G 2007). During this time period, 109 individuals reported hunting in minor drainages within GMU 20A. Of these 109 hunters, only three people reported hunting in areas that overlap the proposed NRE.

I.2.2 Delta Junction, Big Delta, and Deltana

Delta Junction lies at the intersection of Alaska and Richardson highways, approximately 95 miles southeast of Fairbanks (see Figure I-2). Two other communities, Big Delta and Deltana, are located near Delta Junction. Because of the proximity of these three communities to each other and their similar demographics, history, and economic characteristics, all three communities are referred to as Delta Junction in this appendix. In 2002, 3,159 people lived in Delta Junction, with over 95 percent of the population reported as white (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 3,663 individuals (ADOLWD, 2006).

Seasonal Round

No seasonal round data are available for the community of Delta Junction.

Subsistence Harvests

Table I-1 shows the annual pounds of wild game harvest per person for the study communities. Per capita harvest data are not available for the community of Delta Junction.

Subsistence Use Areas

Subsistence use area data are not available for the community of Delta Junction.

ADF&G moose harvest ticket records show that 389 Delta Junction residents hunted moose in GMU 20A minor drainages from 1983 through 2006 (Figure I-2). Of these individuals, 302 reported hunting moose in a minor drainage that overlaps the project area.

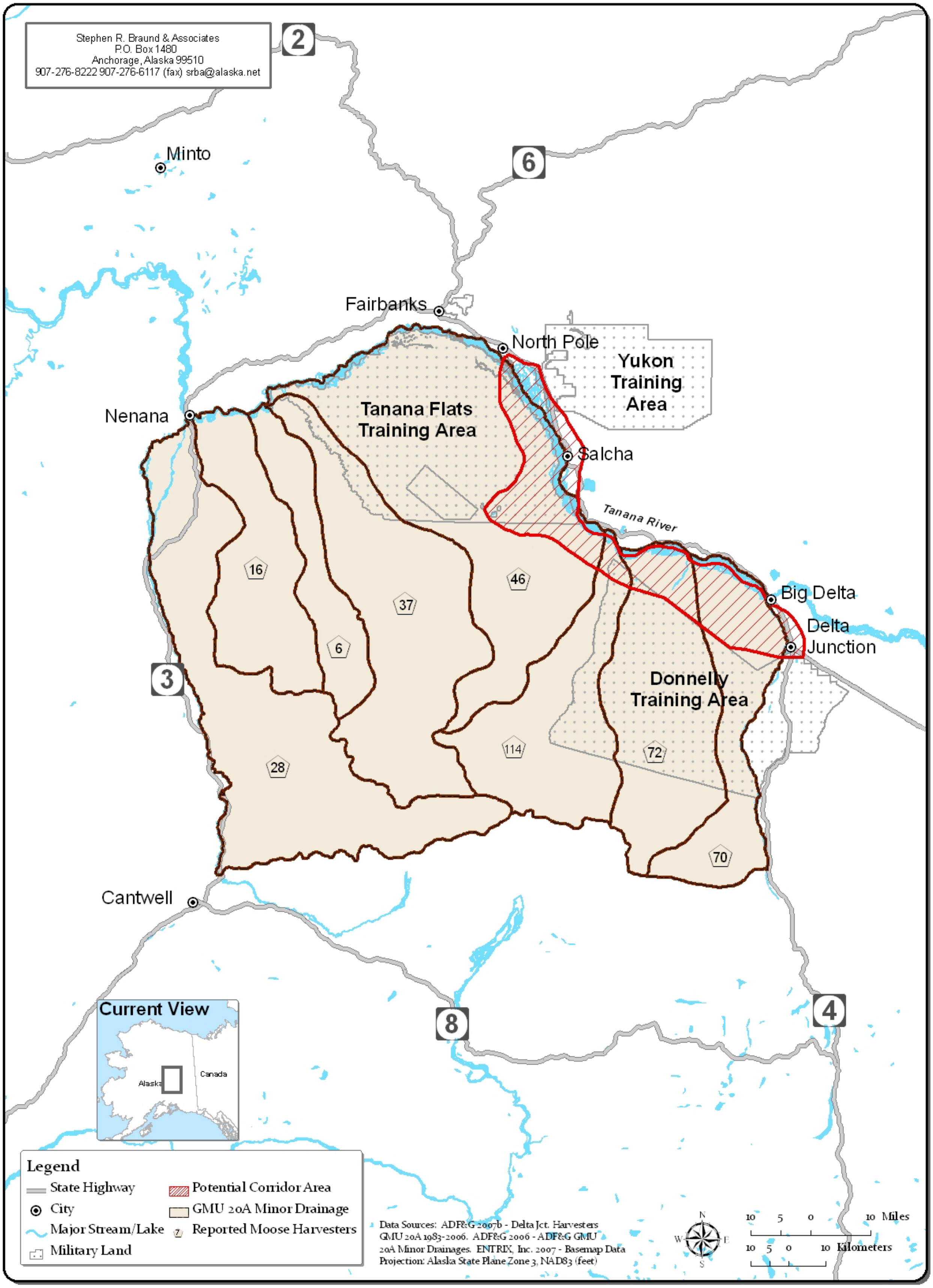

Figure I-2 – Delta Junction Moose Harvest Areas from 1983 through 2006

I.2.3 Dot Lake and Dot Lake Village

The community of Dot Lake is situated along Alaska Highway between Delta Junction and Tok (see Figure I-3). Its location along Alaska Highway makes it an easily accessible community. According to the 2000 U.S. Census, two recognized communities exist at Dot Lake: Dot Lake Village and Dot Lake. In 2000, 38 people resided in Dot Lake Village, with 58 percent reported as Alaska Native. The same year, the community of Dot Lake had a population of 19 residents, 84 percent of whom were reported as white (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents of Dot Lake Village at 22 and the community of Dot Lake at 32 individuals (ADOLWD, 2006). Given the proximity of these two communities to each other and their similar demographics, history, economic characteristics, and subsistence activities, both communities are referred to as Dot Lake in this appendix. Moose, whitefish, salmon, trout, caribou, and berries constitute the bulk of residents' subsistence harvests.

Seasonal Round

Martin (1983, Figure 3) and Marcotte (1991, Figure 5) illustrated the seasonal round of subsistence activity for Dot Lake in 1983. According to these data, Dot Lake residents' winter subsistence activities focus on the harvest of caribou and trapping and hunting of furbearers such as marten, mink, wolverine, lynx, red fox, wolf, and otter. Occasional harvests of small game, such as hare, porcupine, squirrel, and upland birds also occur during the winter. Residents begin harvesting porcupine and fish more actively in the spring. Berry and plant gathering begin in late May and extend through the summer and into early fall. During the summer months of June and July, fish comprise the bulk of harvests. The primary period of harvest for many subsistence species is August, September, and October. During these months, residents target large game such as caribou, moose, sheep, and bear, as well as smaller game such as waterfowl, upland birds, hare, and squirrel.

Subsistence Harvests

ADF&G harvest data for Dot Lake exist for the years 1987, 2000, and 2004 (ADF&G, 2008). According to ADF&G (2008), the 1987 data provide the most representative depiction of Dot Lake residents' subsistence harvests. During that year, 100 percent of households reported using subsistence resources, with non-salmon fish, large land mammals, and edible plants used by 93 percent of households. The per capita harvest was 116 pounds (Table I-1). According to Marcotte (1991), moose contributed to 34 percent of the total harvest, the highest for a single species, and fish contributed 45 percent of the total harvest. Sharing, an important component of traditional Athabascan culture, was reported among the majority of households, with 87 percent receiving and 60 percent giving away subsistence resources.

In a 2004 study focusing on non-salmon fish, large land mammals, and small land mammals, 81 percent of households used large land mammals; 75 percent used non-salmon fish; and 31 percent used small land mammals (ADF&G, 2008).

Subsistence Use Areas

Martin (1983) documented Dot Lake subsistence use areas from 1946 to 1982 (see Figure I-3). These use areas extend north and south of the Tanana River and west and east between the Gerstle River and lands just east of the Robertson River. These use areas do not overlap with the project area. Salmon use areas were located in the Copper, Tanana, and Yukon rivers, with residents fishing most frequently in the Copper River basin (Martin, 1983). Figure I-3 includes

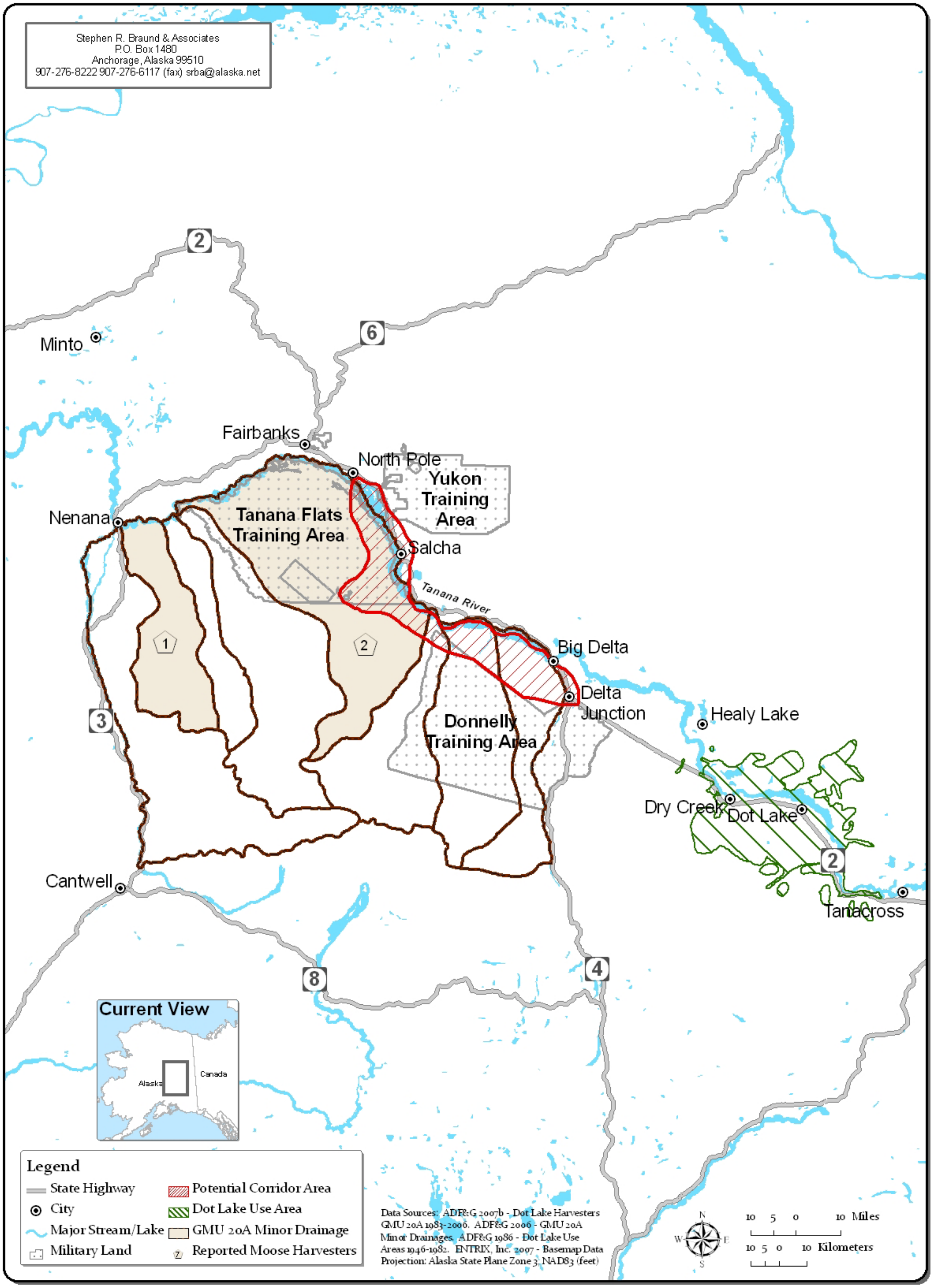

Figure I-3 – Dot Lake Subsistence Use Areas

use areas for moose, caribou, Dall sheep, non-salmon fish, furbearers, waterfowl, and plants, as well as moose harvest ticket information for minor drainages in GMU 20A. From 1983 through 2006, only three Dot Lake residents reported hunting moose within GMU 20A minor drainages; two of these individuals hunted in minor drainages which overlap the project area.

I.2.4 Dry Creek

The community of Dry Creek is located a few miles east of the Johnson River and approximately 46 miles east of Delta Junction. Dry Creek is accessible via a gravel road south of Alaska Highway. The community has a 3,000-foot gravel airstrip as well (ADCED, No Date). In 2000, 128 people lived in Dry Creek, with 100 percent of the population reported as white (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 94 individuals (ADOLWD, 2006).

Seasonal Round

No seasonal round data are available for the community of Dry Creek.

Subsistence Harvests

No subsistence harvest data exist for the community of Dry Creek (Table I-1).

Subsistence Use Areas

No subsistence use area data are available for the community of Dry Creek.

I.2.5 Healy Lake

The community of Healy Lake is located on the eastern shore of Healy Lake approximately 30 miles east of Delta Junction (see Figure I-3). Access to Healy Lake is limited to transport by plane year-round, snowmachine in winter, boat in summer, and vehicle during winters, depending on construction of the Tanana River ice bridge (Korvola, 2000). In 2000, 37 people lived in Healy Lake, with 73 percent reported as Alaska Native (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 46 individuals (ADOLWD, 2006). According to Korvola (2000, Figure 7.1-15), the Healy Lake economy is based on subsistence with some residents working periodically outside of the community.

Seasonal Round

Healy Lake residents' contemporary seasonal round is similar to the seasonal round reported by Marcotte (1991, Figure 5) in 1983 for Dot Lake, the closest Alaska Native community to Healy Lake. These data are generally consistent with information gathered in 2001 from Healy Lake residents (Stephen R. Braund & Associates [SRB&A], 2002). Winter subsistence activities focus on hunting for moose, caribou, upland birds, and small mammals, as well as ice fishing and trapping. Spring months are dedicated to hunting waterfowl, with some moose hunting and fish harvesting reported as well. During the summer, residents harvest a wide variety of subsistence resources including whitefish, salmon, moose, caribou, upland birds, wood, berries, and plants. Subsistence activities intensify during August through October as residents focus on the hunting of moose, caribou, sheep and both migratory and upland birds. Bear, squirrel, and porcupine are occasionally hunted during this time as well.

Subsistence Harvests

Except for a 2000 ADF&G migratory bird harvest survey, no comprehensive ADF&G subsistence harvest data are available for Healy Lake (Table I-1). See above under "Dot Lake, Subsistence Harvests" for an example of Upper Tanana area community harvests.

Subsistence Use Areas

Subsistence research conducted by others in 2001 documented Upper Tanana River Valley Athabascan historical and contemporary (1992-2001) subsistence use areas (SRB&A, 2002). The research included mapping interviews with Healy Lake tribal members residing in Healy Lake, Dot Lake, Fairbanks, Tanacross, Northway, and Delta Junction (SRB&A, 2002). The report documented contemporary use areas concentrated around the Healy Lake, Lake George, Delta Junction, and Shaw Creek Flats areas (SRB&A, 2002, Figure 17). Portions of these use areas overlap the project area. Lifetime (historical) uses encompassed an even larger area including the project area.

I.2.6 Minto

Minto, just south of Elliott Highway along Old Minto Road, lies just outside the Minto Flats State Game Refuge (see Figure I-4). While only approximately 40 miles northwest of Fairbanks by plane, the distance to Minto from Fairbanks via Elliott Highway is over 100 miles. In 2000, 258 people resided in Minto, with 92 percent reported as Alaska Natives (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 186 individuals (ADOLWD, 2006). Chum salmon, moose, whitefish, northern pike, and migratory birds contribute the most to Minto residents' subsistence diet.

Seasonal Round

Seasonal round data collected by Andrews (1988, Figure 9) from May 1984 through 1986 described a cycle of year-round subsistence harvest activity. According to these data, residents regularly harvest wood, ptarmigan, marten, beaver, and moose during the winter months in addition to occasional harvests of other furbearers and porcupine. Beaver, muskrat, and blackfish are the main resources harvested in March and April. Beginning in May, residents focus their efforts on waterfowl, bear, longnose suckers, and northern pike. As spring progresses into summer, residents primarily engage in fishing for Chinook salmon, longnose suckers, whitefish, sheefish; and harvesting berries and plants. Subsistence activities intensify from August through October as residents prepare for the upcoming winter. Moose, bear, grouse, ptarmigan, whitefish, sheefish, coho salmon, and chum salmon all become the focus of community members' subsistence pursuits during the fall months.

Subsistence Harvests

Two ADF&G harvest studies exist for the community of Minto. The harvest study from 1984 (Andrews, 1988) provides the most comprehensive information on the community's overall subsistence uses, while the 2004 study (ADF&G, 2008) provides harvest information for non-salmon fish, large land mammals, and small land mammals only.

No household use data exist for the 1984 study year; however, in 2004, 84 percent of households reported using moose, and 57 percent of households reported using non-salmon fish and small land mammals. In 1984, residents reported harvesting just over 1,000 pounds of wild food per capita (Table I-1). This per capita harvest ranks first among all study communities. During that

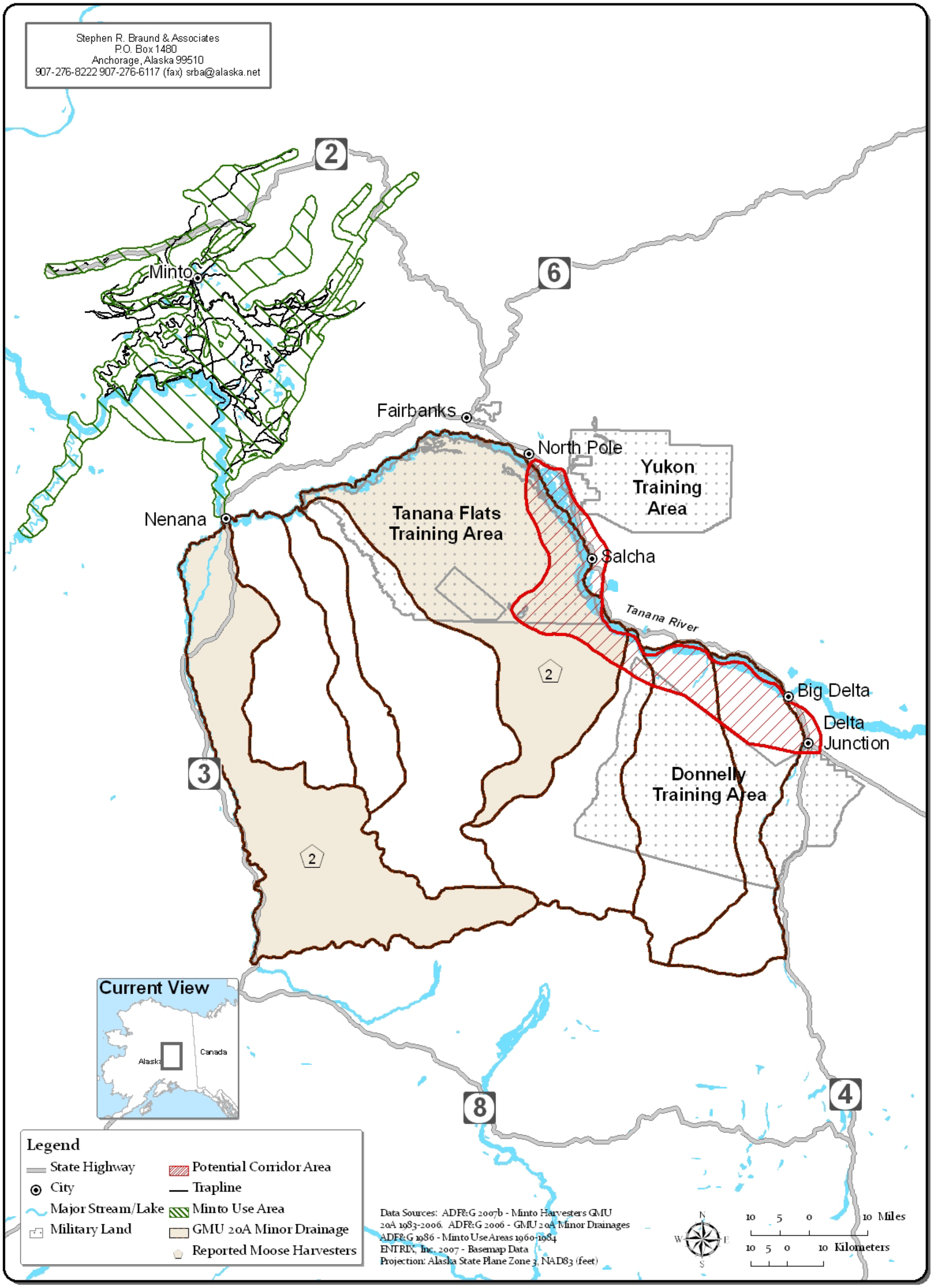

Figure I-4 – Minto Subsistence Use Areas

year, chum salmon accounted for 62 percent of the community's total harvest, and moose (7 percent) and northern pike (8 percent) represented the next closest subsistence resources in terms of percent of total harvest.

Subsistence Use Areas

Andrews (1988) documented Minto subsistence use areas for the time period of 1960 to 1984 (see Figure I-4). The majority of Minto fishing use areas occur in the Tanana River between Nenana and Swanneck Slough and in the rivers, creeks, and lakes south of the community. Much of their other subsistence pursuits, including moose, waterfowl, small game, and furbearer trapping and hunting areas are located near the community and in the Minto Flats State Game Refuge. These use areas do not overlap the proposed NRE area. From 1983 through 2006, four Minto individuals reported hunting in GMU 20A minor drainages (see Figure I-4). Two of these residents hunted in areas that overlap the project area.

I.2.7 Nenana

Nenana is located along Parks Highway on the south bank of the Tanana River. The community is approximately 55 miles west of Fairbanks along Parks Highway (see Figure I-5). Due to its location, Nenana is an important rail-to-river barge transportation center for many Interior communities (ADCED, No Date). In 2000, 402 people resided in Nenana, with just over half reported as white and 41 percent reported as Alaska Native. Recent estimates for 2006 report the total number of residents at 359 individuals (ADOLWD, 2006). Moose hunting, fishing, small game harvesting, and trapping are common subsistence activities among Nenana households (Shinkwin and Case, 1984).

Seasonal Round

Shinkwin and Case (1984) provided a brief description of Nenana residents' yearly cycle of subsistence harvest activities based on fieldwork conducted in 1981. They reported that residents primarily harvest small game and furbearers during the winter. Salmon becomes the main focus of community members' summer harvest pursuits, with other fish, such as whitefish, sheefish, grayling, pike, and burbot harvested at other times. Berries and plants are also gathered throughout the summer months. Moose and waterfowl hunting occupy much of residents' subsistence activities during the fall season.

Subsistence Harvests

ADF&G harvest data for Nenana exist only for the year 2004 (ADF&G, 2008). This study year contains information for only non-salmon fish, large land mammals, and small land mammals. A total of 64 percent of households reported using at least one of these three resources in 2004. Fifty percent of households reported using non-salmon fish and large land mammals, and 16 percent reported use of small land mammals. According to Table I-1, Nenana's annual wild food harvest for 2004 equals 98 pounds per person.

Subsistence Use Areas

A study completed by Shinkwin and Case (1984) documented Nenana use areas north towards Minto and south along Parks Highway towards Cantwell (see Figure I-5). Nenana use areas also reach well into lands west of Parks Highway, particularly along major rivers, and southeast of Nenana as far as the Wood River. Figure I-5 depicts Nenana use areas from 1981 through 1982 and represents the use areas of three former distinct Athabascan bands whose descendents now reside in Nenana (Shinkwin and Case, 1984). None of their reported use areas from this time

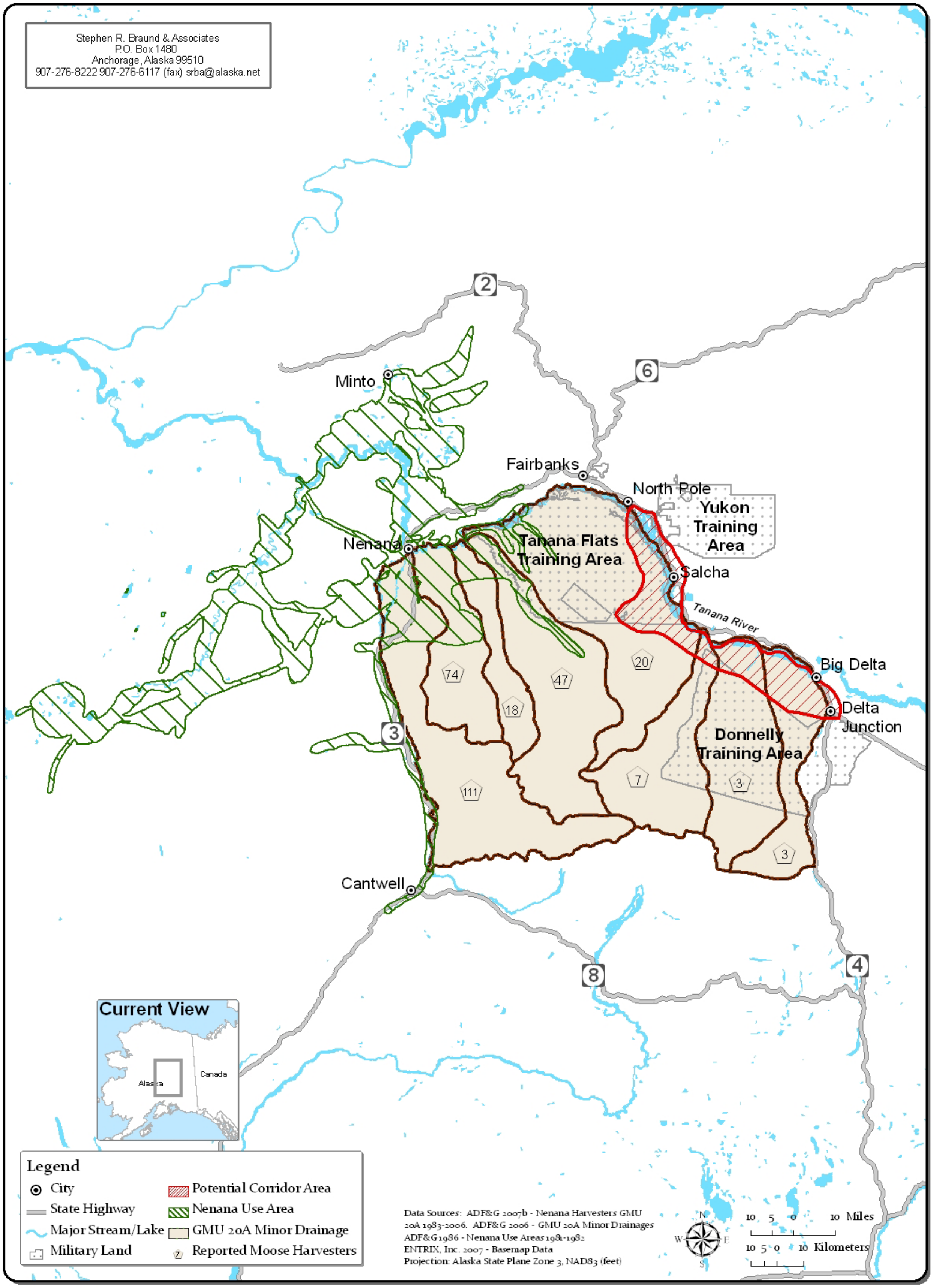

Figure I-5 – Nenana Subsistence Use Areas

period overlaps with the project area. From 1983 through 2006, 283 Nenana individuals reported hunting moose within GMU 20A minor drainages. Of these 283 harvesters, 33 people reported hunting in areas that overlap with the proposed NRE area.

I.2.8 Northway, Northway Junction, and Northway Village

Northway, Northway Junction, and Northway Village are three closely connected communities that are separately designated by the U.S. Census and are located near the Nabesna River approximately 50 miles east of Tok (see Figure I-6). Northway Road, connected to Alaska Highway, and a runway in Northway provide access to all three communities. Given the proximity of these three communities to each other and their similar demographics, history, economic characteristics, and subsistence activities, all three communities are referred to as Northway in this appendix. In 2000, the combined population for the communities was 274 people, with 73 percent reported as Alaska Natives (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 227 individuals (ADOLWD, 2006). Use of subsistence resources such as whitefish, moose, hare, grouse, ducks, grayling and berries occur among many Northway households.

Seasonal Round

Seasonal round data reported by Case (1986, Figure 4) and based on field research conducted in 1984 and 1985 described a pattern of year-round subsistence use for the community of Northway. The primary periods of harvest for caribou, hare, ptarmigan/grouse, burbot, and several species of furbearers occur during the winter season. In May, community members focus on harvesting non-salmon fish such as northern pike and grayling, as well as wild plants. As summer arrives, residents harvest a wider variety of fish, including whitefish, suckers, and salmon (at the Copper River) in addition to berries and plants. Residents continue harvesting fish and wild plants into August and September, when harvests of small game, migratory waterfowl, bear, moose, and wood are also common.

Subsistence Harvests

A subsistence harvest study conducted in 1987 best represents the subsistence harvests of Northway residents (Marcotte, 1991). Harvest data for selected subsistence resources also exist for the years 2000 and 2004 (ADF&G, 2008).

All households surveyed in 1987 reported using at least one subsistence resource during that year. Over 90 percent of households used non-salmon fish, large land mammals, small land mammals, and birds and eggs (minimal egg harvests). The 2004 survey of non-salmon fish and large and small land mammal harvests reported 92 percent of households using at least one of these resources in that year (ADF&G, 2008). In 1987, the per capita harvest of Northway residents equaled 278 pounds, the highest reported for the five communities included in the study (*i.e.*, Dot Lake, Tanacross, Tok, Tetlin, and Northway) (Marcotte, 1991, Chapter 7, Table 7-1). Similar to other upper Tanana communities, moose (27 percent) and whitefish (36 percent) were the two greatest contributors to Northway's subsistence harvests. Sixty percent of households reported giving away subsistence resources, and 93 percent reported receiving them.

Subsistence Use Areas

Figure I-6 depicts Northway use areas for all resources from 1974 through 1984. Case (1986) describes Northway subsistence areas expanding out from the community with an emphasis on river and roadway areas for moose, waterfowl, small game, and bird hunting. Moose hunting

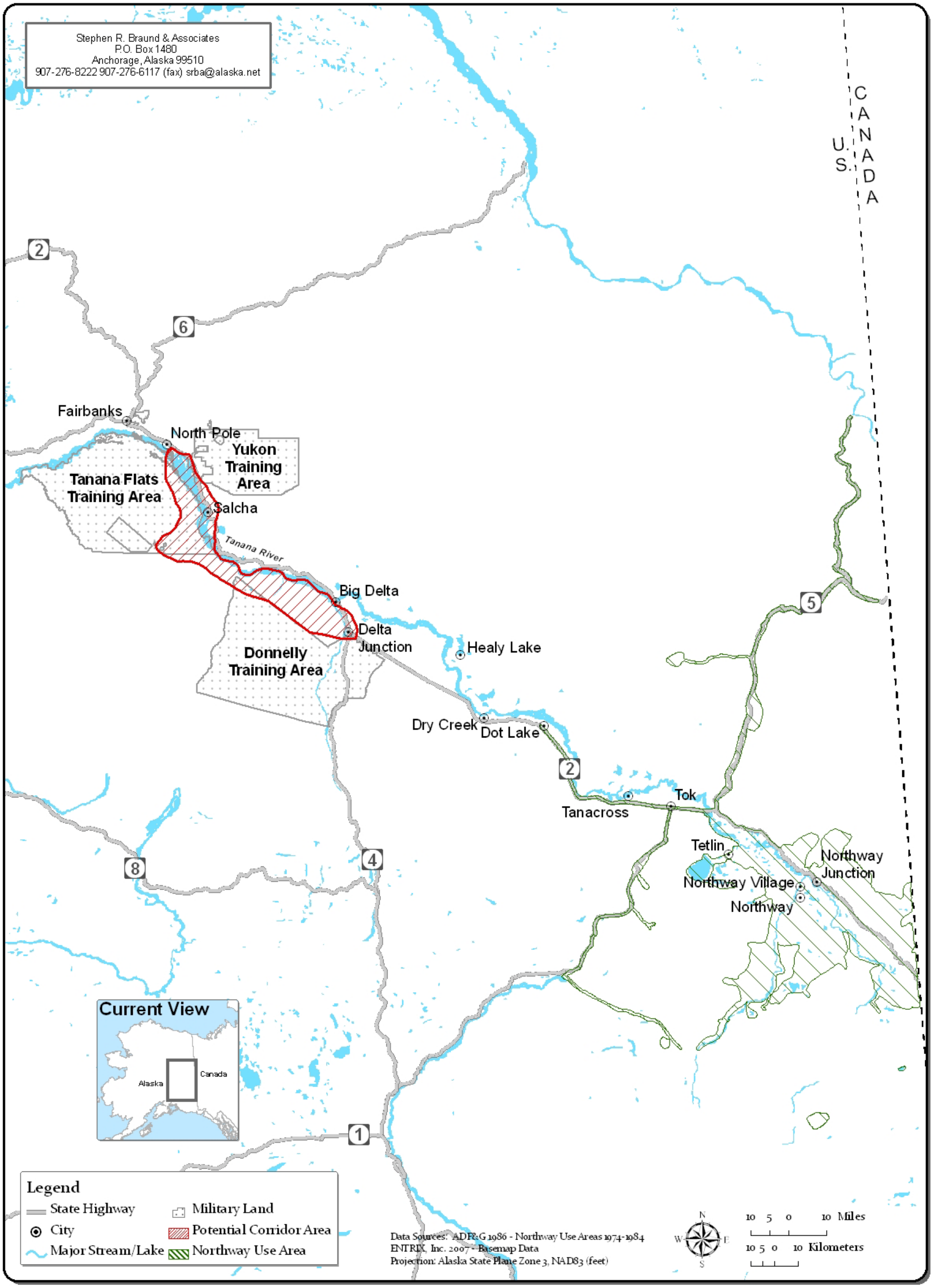

Figure I-6 – Northway Subsistence Use Areas

extended along the Alaska Highway as far west as Dot Lake. Much of the non-salmon fishing occurred in the lakes, rivers, and streams nearest to the community. These reported use areas do not overlap with the proposed NRE area.

I.2.9 Salcha

The community of Salcha is situated between Delta Junction and Fairbanks along Richardson Highway near the mouth of the Salcha River, a tributary of the Tanana River. The community is approximately 40 miles southeast of Fairbanks and 60 miles northwest of Delta Junction (see Figure I-7). The community is located near the former Native Village of Salchaket. In 2000, 854 people resided in Salcha, with 88 percent reported as white and 4 percent reported as Alaska Native (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 946 individuals (ADOLWD, 2006).

Seasonal Round

Andrews (1975, Table 4) reported on the traditional seasonal round of the Salcha Athabascan band. Their seasonal round focused on moose, caribou, sheep, berries, and fall fish during the autumn months. Rabbit, ptarmigan, caribou, and waterfowl were harvested in the late winter and early spring. During the summer, band members primarily focused on harvesting Chinook salmon and berries. No current seasonal round data are available for the community of Salcha.

Subsistence Harvests

No ADF&G subsistence harvest data are available for the community of Salcha (See Table I-1).

Subsistence Use Areas

Subsistence use area data are not available for the community of Salcha. ADF&G moose harvest ticket records show 284 Salcha residents reported hunting moose in GMU 20A minor drainages over a period from 1983 through 2006 (see Figure I-7). Of these individuals, 184 reported hunting moose on minor drainages overlapping the project area.

I.2.10 Tanacross

Twelve miles west of Tok, the community of Tanacross is located along the south bank of the Tanana River (see Figure I-8). A one-mile gravel road connects the community to Alaska Highway (Marcotte, 1991). In 2000, 140 people resided in Tanacross, with 89 percent reported as Alaska Native (U.S. Census, 2002). Recent estimates for 2006 indicate an increase of only six individuals since the last census (ADOLWD, 2006). Most residents depend on subsistence resources for their livelihood with moose, whitefish, salmon, and northern pike representing a large portion of their subsistence diet.

Seasonal Round

Haynes *et al.* (1984, Figure 2) described the seasonal round of selected subsistence resources for the community of Tanacross based on fieldwork conducted in 1984. During the winter months from November to February, residents harvest a variety of furbearers including hare, marten, mink, fox, lynx, wolf, wolverine, coyote, and otter. Residents fish for burbot and gather wood during the early winter months. Beaver, porcupine, and grayling are the three primary resources harvested during the early spring (March/April). During the summer, residents harvest fish, berries, plants, and bear. Residents intensify their subsistence activity during August and

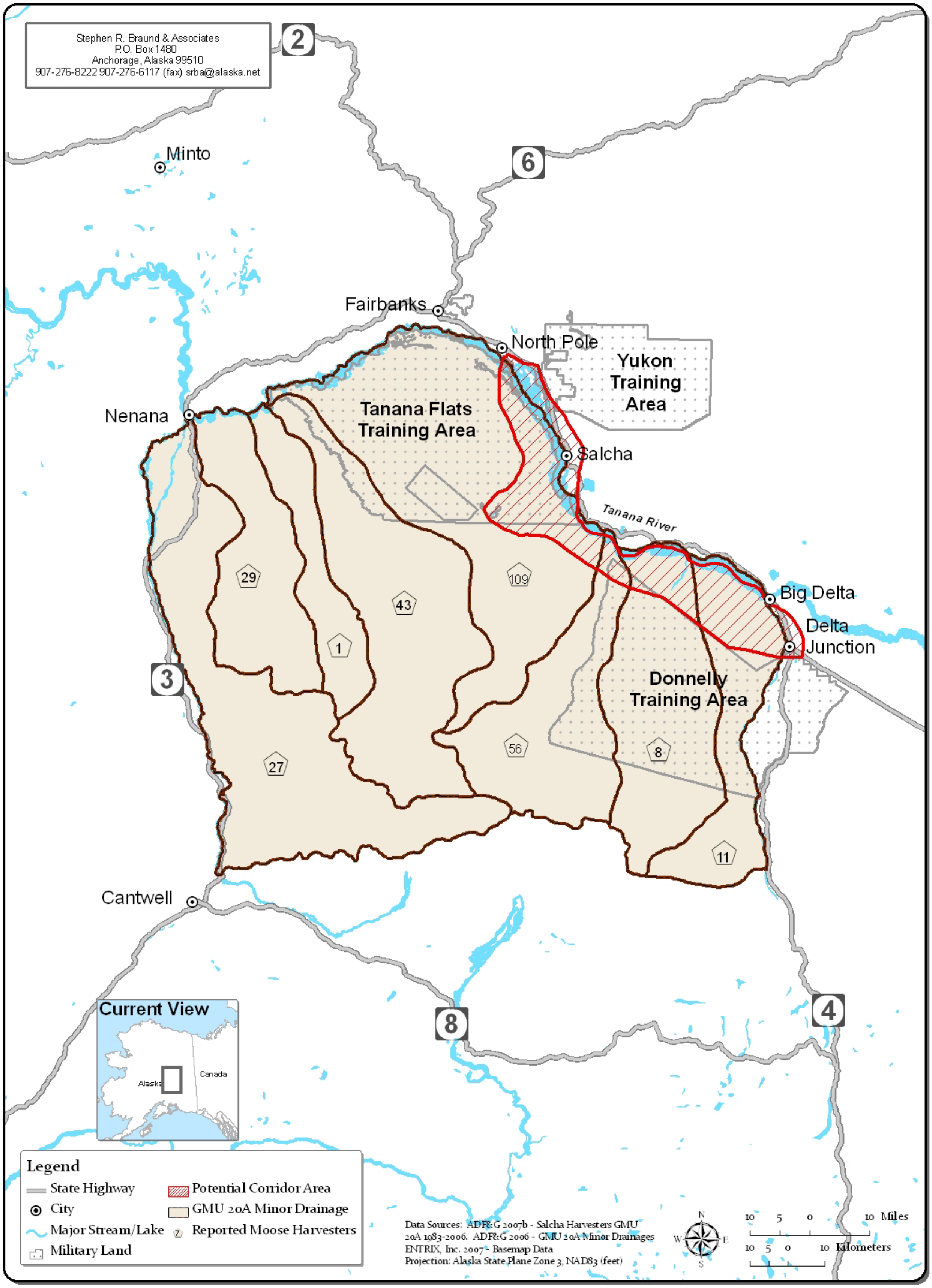

Figure I-7 – Salcha Moose Harvest Areas from 1983 through 2006

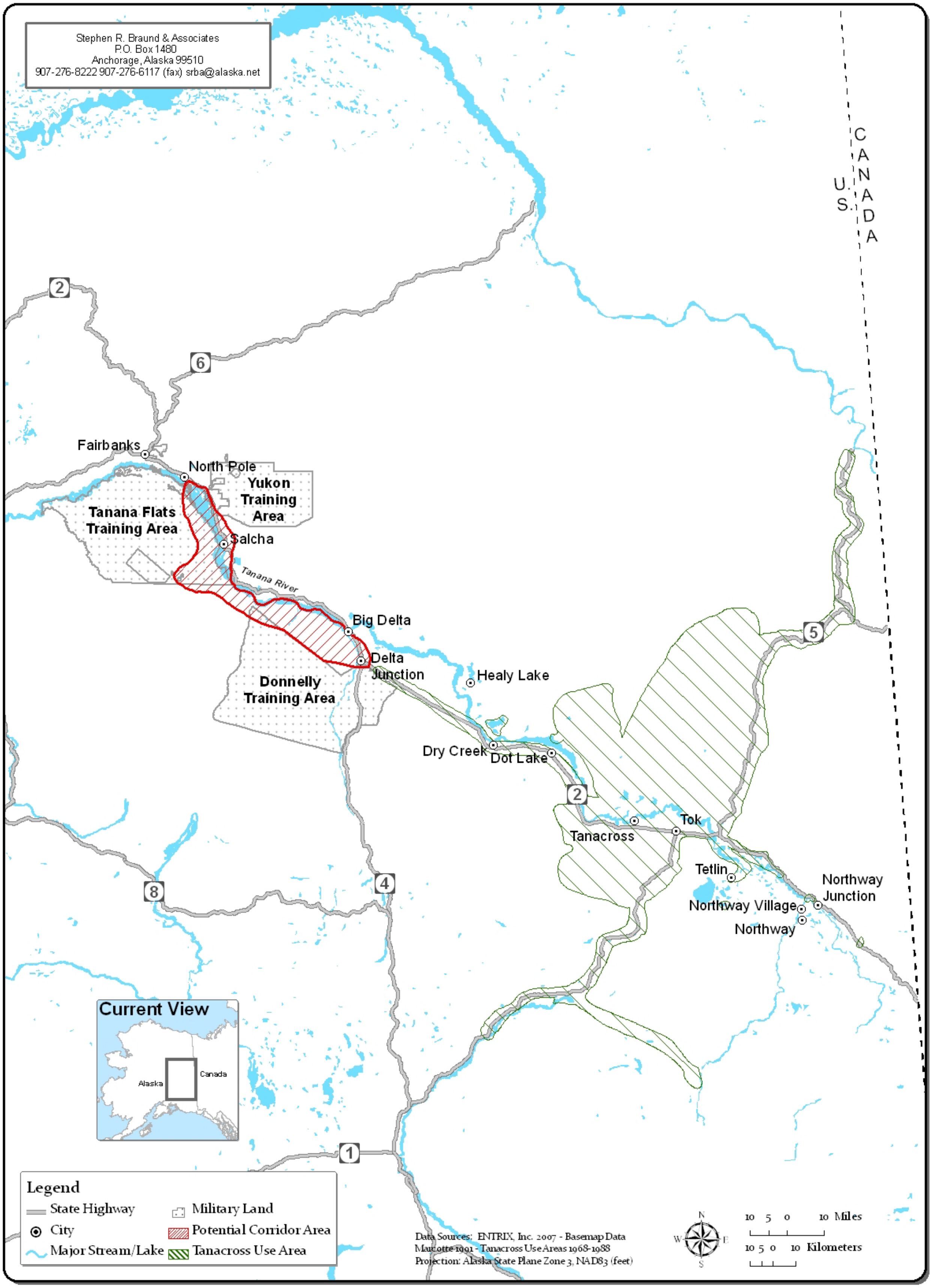

Figure I-8 – Tanacross Subsistence Use Areas

September, when they harvest moose, caribou, northern pike, geese, ducks, and ptarmigan/grouse. Community members continue to harvest porcupine, berries, and plants during these months and begin to harvest their winter supply of wood.

Subsistence Harvests

ADF&G harvest data for Tanacross are available for the years 1987 and 2004 (ADF&G, 2008). The 2004 study only contains data for non-salmon fish, large land mammals, and small land mammals.

In 1987, 96 percent of households reported using at least one subsistence resource. Approximately 85 percent of households used salmon, non-salmon fish, large land mammals, and birds and eggs (minimal egg harvests). In 2004, household use dropped to 54 percent for non-salmon fish and 62 percent for large land mammals. Small land mammal use dropped from 78 percent of households in 1987 to 24 percent in 2004. In 1987, the per capita harvest was 250 pounds (Table I-1). Moose and whitefish comprised over 60 percent of the community's total harvest. Other key subsistence resources include grayling, burbot, northern pike, caribou, hare, birds and berries (Marcotte, 1991). Sharing occurred among the majority of households.

Subsistence Use Areas

Figure I-8 shows Tanacross subsistence use areas documented by Marcotte (1991) over a 20-year period from 1968 through 1988. These use areas reach as far west as the Delta Junction area but do not overlap the proposed NRE area. The figure depicts the majority of Tanacross fishing and hunting use areas extending north and south of the community. Residents reported many Tanacross fishing areas in nearby lakes and along the Tanana River just north of the community. Moose, bear, small game, and vegetation harvesting occurs along the Alaska, Glenn (Tok-Cutoff), and Taylor highways, as well as on lands north and south of the community.

I.2.11 Tetlin

Tetlin is located on the Tetlin River, between the Tanana River and Tetlin Lake, 20 miles southeast of Tok (see Figure I-9). The community is accessible via Alaska Highway and by plane. In 2000, 117 people lived in Tetlin, with 95 percent reported as Alaska Native (U.S. Census, 2002). Recent estimates for 2006 report the total number of residents at 125 individuals (ADOLWD, 2006). Most residents actively participate in subsistence activities, harvesting whitefish, moose, northern pike, ducks, upland birds, small land mammals, berries and plants.

Seasonal Round

Halpin (1987, Figure 3) documented the seasonal round of Tetlin residents during fieldwork conducted in 1983 through 1984. Similar to other upper Tanana communities, residents primarily hunt ptarmigan, hare, and other furbearers during the winter season and harvest caribou when available. During March, April, and May, Tetlin harvesters collect edible roots, hunt and trap muskrat, and harvest ducks and geese during their spring migration. During the summer, residents focus on harvesting fish (whitefish, northern pike, grayling, and sucker fish), berries, and plants. Residents intensively pursue moose, caribou, porcupine, geese, ducks, grouse, northern pike, burbot, and berries during the months of August and September. Residents harvest wood year round.

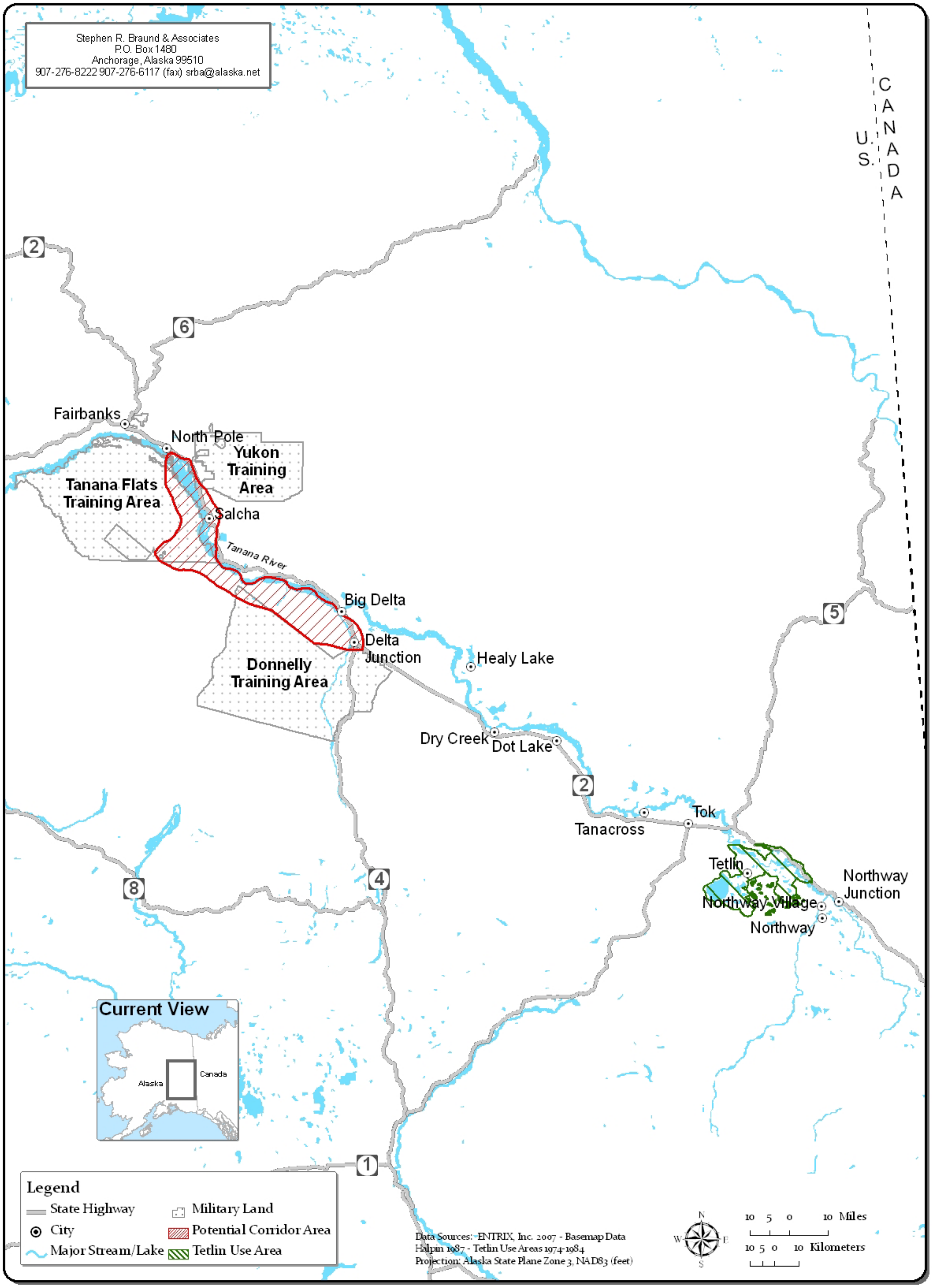

Figure I-9 – Tetlin Subsistence Use Areas

Subsistence Harvests

ADF&G subsistence harvest data for Tetlin exists for the years 1987, 2000, and 2004, and according to ADF&G 1987 is the most representative and complete study year (ADF&G, 2008; Marcotte, 1991). One hundred percent of Tetlin households surveyed in 1987 reported using subsistence resources; the per capita harvest was 214 pounds (Table I-1). At least 80 percent of households reported using non-salmon fish, large land mammals, small land mammals, migratory birds, and berries, plants and wood that year. Whitefish and moose were the two largest contributors to Tetlin's total harvest in 1987, with whitefish representing the greatest single-resource contribution for the region (Marcotte 1991). Only 10 percent of households reported using caribou in 1987; however, in 2004, 55 percent reported caribou use (ADF&G, 2008). Halpin (1987) attributed low caribou harvests in 1987 to the variability of caribou populations; changing migration routes; and expanding winter range of caribou from the Nelchina and Mentasta herds. In 1987, widespread resource sharing occurred among households, with 90 percent receiving and 79 percent giving away subsistence resources.

Subsistence Use Areas

The majority of Tetlin subsistence use areas, as reported by Halpin (1987), are located east of Tok and do not overlap with the proposed NRE area. Figure I-9 shows the extent of Tetlin's use areas. This figure includes use areas for moose, furbearer, waterfowl, fish, and plants. Most Tetlin use areas, documented from 1974 through 1984, are located on the 768,000-acre Tetlin Indian Reserve lands set aside by the Federal government in 1930 (Marcotte 1991).

I.2.12 Tok

The community of Tok is located at the junction of Alaska Highway and the Tok Cut-Off, 108 miles east of Delta Junction and 90 miles west of the Canadian border (see Figure I-10). In 2000, 1,393 people resided in the community of Tok, with 78 percent reported as white and 13 percent as Alaska Native. Recent estimates for 2006 report the total number of residents at 1,347 individuals (ADOLWD, 2006). Subsistence activities in the region include the taking of moose, bear, rabbit, grouse, ptarmigan, and berries in the Tok area, and salmon at the Copper River (ADCED, No Date).

Seasonal Round

Haynes *et al.* (1984, Figure 6) provided the most recent description of the Tok seasonal round, based on research conducted from October 1983 to September 1984. The usual periods of harvest for furbearer species, including marten, mink, fox, lynx, wolf, wolverine, coyote, otter, and hare occur from November to February. Residents also harvest caribou in the early winter (November through December) and burbot beginning in January and continuing into the spring, summer, and fall. In May, harvesters begin to fish for northern pike and grayling as well as hunt for bear. Residents continue to harvest the abovementioned fish species through the summer, as well as whitefish, trout, and salmon. Plant and berry harvesting occur during the summer and into August and September. Large game including moose, bear, caribou, and Dall sheep, are the focus of residents' subsistence pursuits during August and September. Hunting for waterfowl and upland birds also begins in August and continues into October. Residents gather wood year round.

Subsistence Harvests

ADF&G harvest data for Tok are available for the years of 1987, 2000, and 2004 (ADF&G, 2008). Only harvest data from 1987 contain information for all subsistence species and provide the most comprehensive overview of the community's overall harvest (ADF&G, 2008). Harvest data for 2000 were only collected for migratory and upland birds, and the 2004 study year documented only non-salmon, large land mammal, and small land mammal harvests.

In 1987, 94 percent of households reported using subsistence resources, with 80 percent of households using salmon and non-salmon fish and 74 percent using large land mammals. In 2004, slightly fewer households (62 percent) reported using large land mammals, and use of non-salmon fish dropped to 54 percent of households. In 1987, moose and salmon comprised 57 percent of the community's total harvest. According to Marcotte (1991) the overall composition of Tok's harvests differed from the other regional communities because large game and salmon represented the majority of the harvest while non-salmon fish constituted a comparatively smaller proportion. The per capita harvest in 1987 equaled 149 pounds (See Table I-1). At least 80 percent of households gave or received subsistence resources that year.

Subsistence Use Areas

Marcotte (1991) documented Tok subsistence use areas for the period of 1968 to 1988 for fish, moose, sheep, bear, caribou, small game, waterfowl, furbearers, and berries (see Figure I-10). Similar to Tanacross, the majority of Tok subsistence use areas extend from the community to areas located north and south of the Alaska Highway. However, moose and fishing use areas were documented as far west as Richardson Highway and Gulkana River, and also east towards the Canadian border for a variety of resources. Tok residents' documented use areas are more extensive and diverse than other Upper Tanana communities. This may be attributed in part to larger community size, greater availability of aircraft and motor vehicles for access to resources, and the more recent settlement of the community without any long-term ties to particular use areas (Marcotte 1991). As shown on Figure I-10, a small portion of Tok's use areas to the west of the community overlaps the eastern portion of the project area. This figure also shows 22 Tok harvesters reported hunting moose within GMU 20A minor drainages from 1983 through 2006. Seventeen of these individuals hunted in minor drainages that overlap the project area.

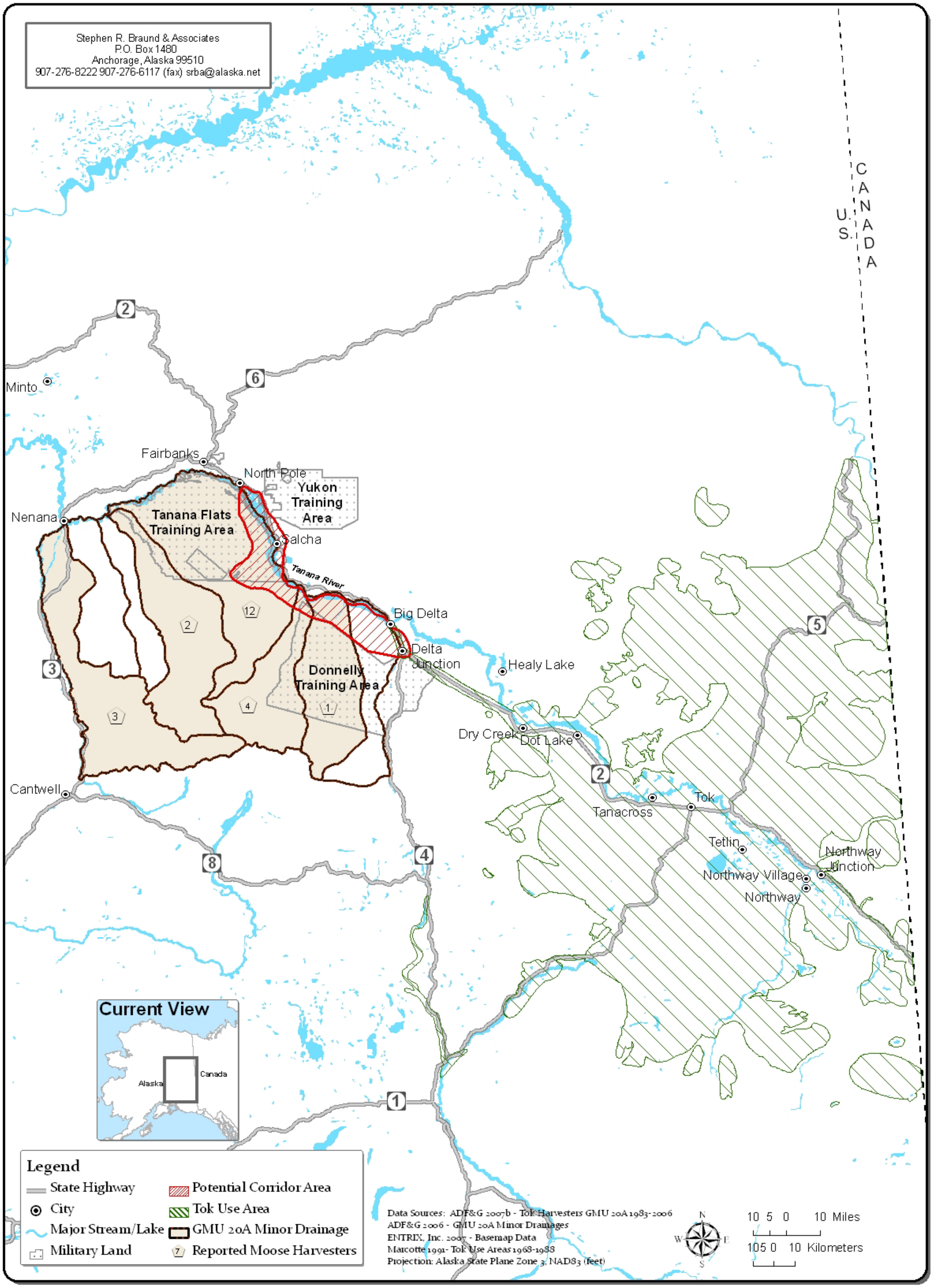

Figure I-10 – Tok Subsistence Use Areas

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Appendix J –
Noise and Vibration

J. NOISE AND VIBRATION

This appendix describes the methods used to model the potential noise and vibration effects of the proposed Northern Rail Extension (NRE). Discussion of effects can be found in Chapter 9.

J.1 Wayside Noise Model Methodology

Wayside noise collectively refers to noise generated by railcars and locomotives, but not including locomotive horn noise. The Surface Transportation Board Section of Environmental Analysis (SEA) used noise measurements from past noise studies including the Final Environmental Impact Statement for the Conrail Acquisition and the Draft Environmental Assessment for the Canadian National/Illinois Central Acquisition Environmental Assessment to provide the basis for the wayside noise level projections.

The basic equation used for the wayside noise model is:

- $SEL_{cars} = L_{eqref} + 10\log(T_{passby}) + 30\log(S/S_{ref})$

For locomotives, which can be modeled as moving monopole point sources, the corresponding equation is as follows:

- $SEL_{locos} = SEL_{ref} + 10\log(N_{locos}) – 10\log(S/S_{ref})$

The total train sound exposure level is computed by logarithmically adding SEL_{locos} and SEL_{cars}

- $DNL_{100'} = SEL + 10\log(N_d + 10*N_n) – 49.4$
- $DNL = DNL_{100'} + 15\log(100/D)$

The parameters that apply to the equations above are:

- SEL_{cars} = Sound Exposure Level of railcars
- L_{eqref} = Level Equivalent of railcar
- T_{passby} = Train passby time, in seconds
- S = Train speed, in miles per hour
- S_{ref} = Reference train speed
- SEL_{locos} = Sound Exposure Level of locomotive
- SEL_{ref} = Reference Sound Exposure Level of locomotive
- DNL = Day-night average noise level
- N_{locos} = Number of locomotives
- N_d = Number of trains during daytime
- N_n = Number of trains during nighttime
- D = Distance from tracks, in feet

Table J-1 shows the reference wayside noise levels used in this study and Figure J-1 shows the wayside noise frequency spectrum used in the calculations.

Table J-1
Reference Wayside Noise Levels

Description	Average Level (dBA)
Locomotive SEL (40 miles per hour at 100 feet)[a]	95
Railcar L_{eq}[b]	82

Notes: dBA = A-weighted decibels; L_{eq} = level equivalent; SEL = Sound Exposure Level.
[a] STB, 1998a.
[b] STB, 1998b.

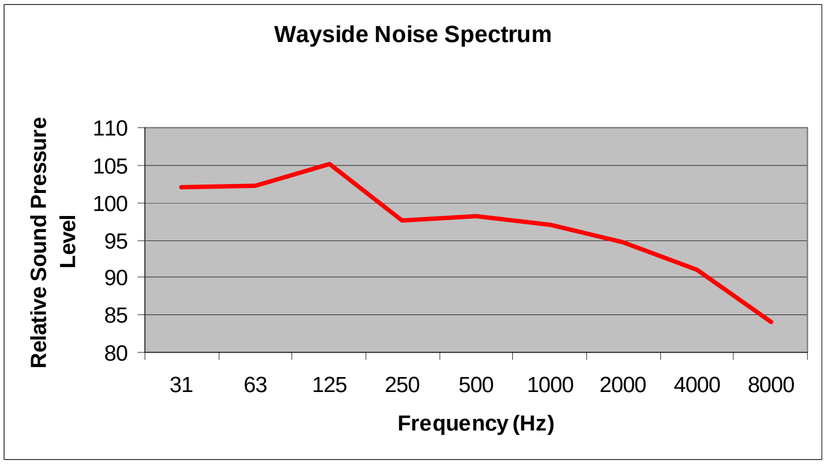


Figure J-1 – Wayside Noise Spectrum

J.2 Horn Noise Model Methodology

Freight train horn noise levels can vary for a variety of reasons, including the manner in which an engineer sounds the horn. Consequently, it is important to base horn noise reference levels on a large sample size. A substantial amount of horn noise data is available from the Draft Environmental Impact Statement, Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings (Federal Railroad Administration [FRA] 1999), hereinafter referred to as the 1999 FRA Draft EIS.

FRA data indicate that horn noise levels increase from the point at which the horn is sounded 0.25 mile (0.40 kilometer) from the grade crossing to when it stops sounding at the grade crossing. In the first 0.125-mile (0.201-kilometer) segment, the energy average sound exposure level measured at a distance of 100 feet (30 meters) from the tracks was found to be 107 dBA, and in the second 0.125-mile segment it was 110 dBA. The 1999 FRA Draft EIS simplified the horn noise contour shape as a five-sided polygon, when it is actually a teardrop shape. The Final Environmental Impact Statement, Construction and Operation of a Rail Line from the Bayport Loop in Harris County, Texas (STB, 2003) discusses this subject in detail. SEA used the more accurate teardrop horn noise contour shape for this analysis. The attenuation, or drop-off rate, of horn noise is assumed to be 4.5 dBA per doubling of distance away from the tracks (FRA, 1999).

Table J-2 shows the reference horn noise levels used in this study and Figure J-2 shows the horn noise spectrum used in the calculations.

Table J-2 Reference Horn Noise Levels	
Description	**Average Level (dBA)**
Horn SEL 1st 0.25 mile[a,b]	110
Horn SEL 2nd 0.25 mile[a,b]	107

Notes: dBA = A-weighted decibels; SEL = Sound Exposure Level.
[a] To convert kilometers to miles, multiply by 1.6093.
[b] FRA, 1999.

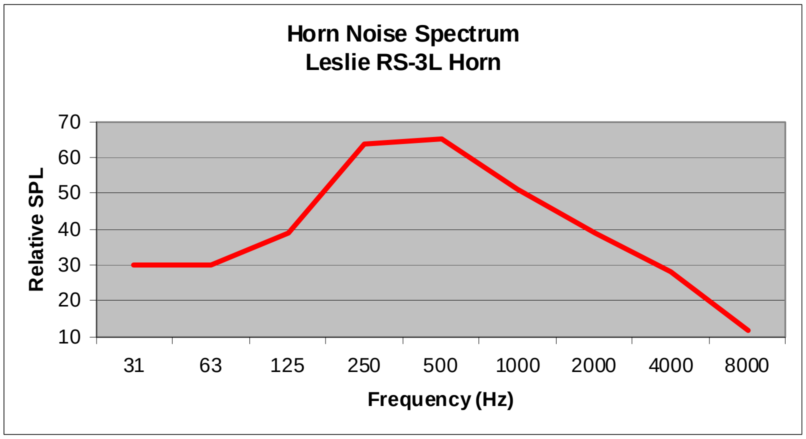


Figure J-2 – Horn Noise Spectrum

J.3 Construction Noise Methodology

SEA based the construction noise impact assessment on Federal Transit Administration (FTA) methods Transit Noise and Vibration Impact Assessment, General Assessment, construction noise guidelines (FTA, 2006), shown in Table J-3.

Table J-3 FTA General Assessment Construction Noise Guidelines		
	1-hour L_{eq} (dBA)	
Land Use	**Day**	**Night**
Residential	90	80
Commercial	100	100
Industrial	100	100

Note: dBA = A-weighted decibels

The FTA General Assessment for construction noise is used when details of the construction schedule are not known. The method calls for estimating combined noise levels from the two noisiest pieces of construction equipment and determining locations that would exceed the noise guidelines in Table J-3.

J.4 Rail Operations Vibration Methodology

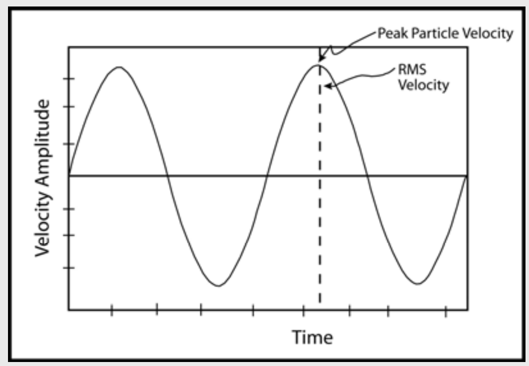
SEA based the vibration methodology on FTA methods (FTA, 2006). Vibration level due to train passbys is approximately proportional to

$$V = 20 \times \log(\text{speed}/\text{speed}_{ref})$$

Where

- V is the ground-borne vibration velocity.
- speed is the train speed.
- speed_{ref} is the reference speed of the train relative to its corresponding vibration level.

Published FTA ground-borne vibration levels are adjusted for train speed by this equation and distance from the rail line to estimate vibration levels at receptor locations.



Peak Particle Velocity (PPV)
Instantaneous positive or negative peak of a vibration signal, measured as a distance per time.

There are two ground-vibration impacts of general concern: annoyance to humans and damage to buildings. In special cases, activities that are highly sensitive to vibration, such as micro-electronics fabrication facilities, are evaluated separately. There are two measurements corresponding to human annoyance and building damage for evaluating ground vibration: peak particle velocity and root-mean-square (RMS) velocity. Peak particle velocity (PPV) is the maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage. The root-mean-square velocity is an average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in decibels (VdB) referenced to 0.000001×10^{-6} inch per second and is not to be confused with noise decibels. It is more suitable for addressing human annoyance and characterizing background vibration conditions because it better represents the response time of humans to ground vibration signals.

J.5 Rail Construction Vibration Methodology

Construction vibration levels are estimated according to the following equation:

$$PPV_{equipment} = PPV_{ref} \times (25/D)^{1.5}$$

Where

- $PPV_{equipment}$ is the peak particle velocity in inches per second of the equipment, adjusted for distance.
- PPV_{ref} is the reference vibration level in inches per second at 25 feet.

- D is the distance from the equipment to the receptor.

Estimated construction vibration levels are then compared with building damage criterion.

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Appendix K –
Transportation Safety and Delay

K. TRANSPORTATION SAFETY AND DELAY

K.1 Rail Transportation

This section provides background information on rail safety used to provide context and evaluate potential impacts of the proposed action and alternatives, including the No-Action Alternative. The information is based on accident/incident reports that railroads are required by law to submit within 30 days after occurrence. Federal Railroad Administration (FRA) interchangeably uses the terms "accidents" and "incidents" to describe all reportable events. As defined by FRA in *Railroad Safety Statistics*, accidents/incidents are divided into three major groups for reporting purposes (FRA, 2005):

- Train accident. A safety-related event involving on-track rail equipment (both standing and moving), causing monetary damage to the rail equipment and track above a threshold amount.
- Highway–rail grade crossing incident. Any impact between a rail and highway user (both motor vehicles and other users of the crossing) at a designated crossing site, including walkways, sidewalks, etc., associated with the crossing.
- Other incident. Any death, injury, or occupational illness of a rail line employee that is not the result of a train accident or highway-rail incident.

Table K-1 summarizes rail accident data for the top five freight rail line companies in the United States and the Alaska Railroad (FRA, 2008). Alaska Railroad Corporation's (ARRC's) accident rates (per million train miles traveled) are lower than the rates of four of the top five rail lines.

Table K-1
System-wide Accident Frequencies

Rail line	Total Number of Accidents[a]		Total Train Miles[a] (millions)		Accidents per Million Train Miles	
	5-Year (2003–2007)	10-Year (1998–2007)	5-Year (2003–2007)	10-Year (1998–2007)	5-Year (2003–2007)	10-Year (1998–2007)
Union Pacific	3,947	7,554	901	1,705	4.38	4.43
BNSF Railway	2,853	5,272	868	1,612	3.29	3.27
CSX	2,015	3,819	500	979	4.03	3.90
Norfolk Southern	1,321	2,373	459	853	2.88	2.78
Kansas City Southern	498	968	45	90	11.04	10.80
Alaska Rail Road	12	31	7	14	1.62	2.28
All Rail lines	13,814	26,746	3,585	6,856	3.85	3.90

[a] Source: FRA, 2008

K.2 Road Transportation

Table K-2 characterizes the public roads at current and proposed new at-grade crossings that would be used by new rail traffic associated with the proposed action and alternatives, including road classification, annual average daily traffic (AADT) in 2008, number of lanes in both directions, whether the road is paved, and level of service (LOS).

The Section of Environmental Analysis (SEA) obtained AADT volumes on public roads in the region of influence from multiple sources, including FRA's *Highway-Rail Crossing Inventory* (FRA, 2007a) and the Alaska Department of Transportation and Public Facilities' (ADOT&PF) *2006 Northern Region Annual Traffic Volume Report* (ADOT&PF, 2006). Where AADT values available from these sources were out of date, SEA used the historical growth rate in vehicle-miles traveled (VMT), which was calculated using VMT data from the Federal Highway Administration (FHWA) Highway Statistics publications (FHWA, multiple years), to update the AADT values. For existing at-grade crossings without available AADT data, SEA assigned a traffic volume value by extrapolation, using the value of the closest crossing sharing the same road classification for which AADT information was available.

SEA estimated the current levels of service, shown in Table K-2, according to the guidelines in the *Highway Capacity Manual 2000* (TRB, 2001). Two-lane roads were modeled as two-way, two-lane, highway segments; and roads with more than two lanes were modeled as multi-lane, highway segments. One-way roads had very little traffic, and a formal analysis was not conducted based on the results obtained for the roads with higher traffic volumes.

Table K-2
Public Roads That Cross Existing or Proposed Rail Lines

Rail Segment[e]	Road	Road Classification[b]	2008 AADT[c]	Number of Lanes[a]	Paved Road	LOS[f]
Eielson 1 (existing)	College Road	U. Oth. Prin. Arterial	16,259	4	Yes	A
	Old Steese Hwy	U. Minor Arterial	13,943	2	Yes	D
	New Steese Expressway	U. Oth. Fwy & Expwy	13,393	5	Yes	A
	C Street	U. Local	1,868	2	Yes	A
	D Street	U. Local	847	2	Yes	A
	E Street	U. Local	847	2	Yes	A
	Farewell Ave.	U. Collector	1,810	2	Yes	A
	River Road	R. Local	901	2	Yes	A
	Trainor Gate Bridge	R. Minor Collector	1,324	1	Yes	A
	Vest Road	R. Local	360	2	No	A
	Vest Road	R. Local	360	2	No	A
	Gaffney Road	U. Oth. Prin. Arterial	7020	4	Yes	A
	Whidden Road	R. Local	901	2	Yes	A
	10 Ave.	R. Local	901	2	Yes	A
	Neely Road	U. Minor Arterial	10,159	2	Yes	D
	Alder Ave.	R. Local	451	2	No	A
Eielson 2 (existing)	3 Mile Gate	R. Local	10,229	2	Yes	D
Eielson 3 (existing)	Badger Road	R. Minor Arterial	12,000	4	Yes	A
	Five Houses	R. Local	54	2	No	A
	Dennis Road	R. Minor Collector	2,390	2	Yes	A
	Baptist Church	R. Local	90	2	No	A
	K&K Recycle (Spur Ct.)	R. Local	180	2	No	A
	Mitch Road (Durango Tr.)	R. Local	90	2	No	A
	Rental Street	R. Local	451	2	No	A
	Club 11	R. Local	360	2	No	A
	Richardson Hwy.	R. Interstate	11,739	4	Yes	A
	Ruby Drive	R. Local	90	2	No	A
	Cross Way Road	U. Local	654	2	Yes	A
	5th Ave.	U. Collector	2,677	2	Yes	A
	8th Ave.	U. Collector	10,452	2	Yes	D
	Small Crossing	R. Local	90	1	No	A

Table K-2
Public Roads That Cross Existing or Proposed Rail Lines (continued)

Rail Segment[e]	Road	Road Classification[b]	2008 AADT[c]	Number of Lanes[a]	Paved Road	LOS[f]
Eielson 4 (existing)	Laurance Road	R. Minor Collector	2,238	2	Yes	A
	Armistice St.	R. Local	270	2	No	A
	Dyke Road	R. Minor Collector	1,007	2	Yes	A
North Common (new)	Chena Flood Road	R. Local	80	2	No	A
	Eielson Farm Road	R. Local	80	2	No	A
Eielson Alt. 1 (new)	Old Valdez Trail	R. Local	80	2	No	A
Eielson Alt. 2/3 (new)	Stringer Road	R. Minor Collector	205	2	No	A
	Old Richardson Hwy	R. Minor Collector	190	2	No	A
Salcha Alt. 1 (new)	Ruger Trail	R. Local	80	1	No	A
Salcha Alt. 2 (new)	Ruger Trail	R. Local	80	1	No	A
	Old Richardson Hwy	R. Minor Collector	190	2	No	A
	Old Richardson Hwy	R. Minor Collector	190	2	No	A
	Country Road	R. Local	80	1	No	A
Delta Alt. 1 (new)	No at-grade crossings					
Delta Alt. 2 (new)	Jack Warren Road	R. Major Collector	1,091	2	Yes	A
	Nistler Road	R. Minor Collector	168	2	Yes	A

[a] In both directions.
[b] Based on the classification included in FRA's Highway-Rail Crossing Inventory (FRA, 2007a). U = Urban. R = Rural.
[c] Annual average daily traffic (AADT), considering both directions of traffic.
[d] These crossings would be grade separated.
[e] Segment 1: FBX depot to Fairbanks airport turn-off
Segment 2: Airport turn-off to SE corner of Fort Wainwright
Segment 3: SE corner of Fort Wainwright to North Pole Refinery
Segment 4: North Pole Refinery to Chena Flood Road
[f] Level of service (LOS)

All references to levels of service shown in Table K-2 are defined by the *Highway Capacity Manual 2000*, which is an industry standard for traffic engineering published by the Transportation Research Board (TRB, 2001). This manual defines six levels of service that reflect the level of traffic congestion and qualify the operating conditions of a road. The six levels are given letter designations ranging from A to F, with A representing the best operating conditions (free flow, little delay) and F the worst (congestion, long delays). Various factors that influence the operation of a road or intersection include speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety.

Levels of service A, B, and C are typically considered good operating conditions in which motorists experience minor or tolerable delays of service. Based on the annual average daily traffic listed in Table K-2, most roads within the region of influence are currently operating at LOS A. The exceptions are four roads that are operating at LOS D. These are Old Steese Highway in Fairbanks; Neely Road in Fairbanks; 3-mile Gate, just south of Fort Wainwright; and 8th Avenue in North Pole. For these four roads, the LOS rating of D is the result of road characteristics other than the highway-rail grade crossing.

K.3 Grade Crossing Safety

To characterize the existing transportation safety conditions at existing and proposed grade crossings, SEA used several data sources:

- Information on current rail traffic from an ARRC response to a Surface Transportation Board (STB) information request (ARRC, 2007). This information is included in Table 11-1.
- Alaska Department of Transportation and Public Facilities (ADOT&PF) traffic count maps provided information on annual average daily vehicle traffic volumes at some grade crossings (ADOT&PF, 2005). Vehicle traffic volumes for the remaining grade crossings were provided by FRA's Highway-Rail Crossing Inventory. This information is included in Table K-2.
- FRA's *Highway-Rail Crossing Inventory* provided information on road and train traffic characteristics at highway-rail crossings, including number of tracks, number of road lanes, warning devices, daily vehicle traffic volume, road paving, road classifications, and 5 years of accident history (FRA, 2007a).
- FRA's Personal Computer Accident Prediction System (PCAPS) predicted accident frequencies for existing grade crossings along the Eielson Branch (FRA, 2007b).

SEA analyzed the potential impacts of the proposed action and alternatives on grade crossings and considered whether the proposed rail construction and operation would significantly affect traffic safety at-grade crossings. To evaluate the potential need for grade separation at proposed at-grade crossings, SEA analyzed the proposed at-grade crossings based on FHWA guidelines (FHWA, 2002). These guidelines suggest that-grade crossings should be considered for grade separation or otherwise eliminated across the rail line right-of-way whenever one or more of the following conditions exist:

- The highway is a part of the designated Interstate Highway System;
- The highway is otherwise designed to have full controlled access;
- The posted highway speed equals or exceeds 70 mph;
- AADT exceeds 100,000 in urban areas or 50,000 in rural areas;
- Maximum authorized train speed exceeds 110 mph;
- An average of 150 or more trains per day or 300 million-gross-tons per year;
- An average of 75 or more passenger trains per day in urban areas or 30 or more passenger trains per day in rural areas;
- Crossing exposure (the product of the number of trains per day and AADT) exceeds 1,000,000 in urban areas or 250,000 in rural areas;
- Passenger train crossing exposure (the product of the number of passenger trains per day and AADT) exceeds 800,000 in urban areas or 200,000 in rural areas;
- The expected accident frequency for active devices with gates, as calculated by U.S. Department of Transportation's (USDOT) Accident Prediction Formula, including 5-year history, exceeds 0.5; and
- Vehicle delay exceeds 40 vehicle hours per day.

SEA evaluated the proposed grade crossings in relation to these FHWA criteria for requirement of grade separation. SEA concluded that-grade separation is not warranted for any of the at-grade crossings that would be created by the proposed action and alternatives because the proposed location and operational characteristics of the proposed new rail crossings would not meet any of the FHWA criteria.

SEA quantitatively analyzed the traffic safety at existing grade crossings using the accident history from the past 5 years and calculated the potential change in the number of years between accidents resulting from operation of the proposed rail line. SEA did not calculate predicted accident frequencies for new grade crossings because it lacks the necessary data on accident history. SEA used PCAPS to calculate baseline accident frequencies and accident frequencies that would result from an increase of an average of ten trains per day. In doing so, SEA used the information on public grade crossings in the FRA *National Highway-Rail Crossing Inventory* (FRA, 2007a), with the exception of train count and AADT information. The train count information used in the analysis is described in Chapter 11 and an explanation of the methods used to obtain the information is described in Section K.2.

PCAPS requires that the user specify the number of day trains, the number of night trains, and the number of switching trains. For this analysis, SEA assumed that the trains would be distributed uniformly throughout a 24-hour period. For safety analysis purposes, FRA daytime hours were set as 6 a.m. to 6 p.m. Thus, SEA assumed that 50 percent of the trains would be night trains and 50 percent day trains.[1]

PCAPS also requires that the user specify a warning device code for each crossing. In situations where the FRA inventory provided two warning device codes for a crossing, SEA selected the code that yielded the higher predicted accident frequency.

Table K-4 shows the results of the grade crossing safety analysis for the proposed action and alternatives.

K.4 Grade Crossing Delay

For each grade crossing analyzed, SEA calculated the time that a particular crossing would be blocked for each train-crossing event and estimated the average delay per vehicle at that crossing in a 24-hour period. SEA used the average delay per vehicle at-grade crossings to determine the LOS. LOS is also used as a qualitative measure of road operating conditions and comfort level of passengers. SEA analyzed average traffic delays for all vehicles over a 24-hour period and used the average delay per vehicle to determine LOS for each grade crossing based on ratings described in Table K-3.

[1] Train counts entered into the PCAPS model must be integer values. For rail segments with an odd number of trains, SEA assumed for this analysis that there would be one more day train than night train. For example, for a segment with 21 trains, SEA assumed 11 trains would be day trains and 10 trains would be night trains. This is a conservative assumption in that it yields a higher predicted accident frequency than would result from the opposite assumption. Further, SEA rounded non-integer train traffic estimates upwards for input into PCAPS, which also results in conservative (higher) predicted accident frequencies.

Table K-3
Grade Crossings Level of Service

Level of Service (LOS)	Average Total Delay (seconds per vehicle)
A	<= 10
B	> 10 and <= 20
C	> 20 and <= 35
D	> 35 and <= 55
E	> 55 and <= 80
F	> 80

Source: TRB, 2001

SEA used the following calculations to determine traffic delay for at-grade crossings. The traffic delay at a crossing includes the time for the train to pass, along with time for any warning device to engage. For simplification purposes, it is assumed that both rail and road traffic are uniform throughout the day.

The first step includes the calculation of gate-down time per train event (T).

$$T = T_W + \frac{L}{V}$$

T_W = Gate warning time
L = Average train length (weighted average between freight and passenger trains)
V = Average train speed (weighted average between freight and passenger trains)

The number of vehicles delayed per day (N_V) can be calculated as follows:

$$N_V = \frac{T}{24} * N * ADT$$

N = Number of trains per day
ADT = Average daily traffic
24 = Hours per day

The average delay per vehicle in a 24-hour period (D_V) is:

$$D_V = \frac{N_V}{ADT} * \frac{T * \frac{R_D}{R_D - R_A}}{2}$$

R_D = Departure rate (vehicles/lane/hour)[2]
R_A = Arrival rate, average daily traffic converted to vehicles/lane-hour
2 = Denominator to reflect that vehicles do not experience the entire time the train is blocking the grade crossing. They are assumed to arrive on average at the midpoint of the train crossing period.

[2] Based on the *Highway Capacity Manual* (TRB, 2001), departure rates (in vehicles/lane-hour) are the following: highways (1,800), arterials (1,400), collectors (900), and local roads (700).

Total vehicle delay (D) is the product of average delay per vehicle (D_V) and number of vehicles delayed per day (N_V).

$$D = D_V * N_V$$

Table K-4 presents the results of the grade crossing delay analysis for the proposed action and alternatives.

Table K-4
Results from Transportation Safety and Delay Analysis at Grade Crossings

Rail Segment Name	Crossing ID	Street	Average daily traffic in both directions (veh/day[a])	Number of Daily Trains (including loaded and empty)		Number of vehicles delayed per day (veh/day)		Average Delay per Stopped Vehicle (min/veh[b])		Average delay per vehicle in a 24-hour period (sec/veh[c])		Total delay in a 24-hour period (hours)		Predicted Accident Frequency (accidents/year)	
				No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
EIELSON SEGMENT 1	868405C	COLLEGE ROAD	17,319	6	16	191	294	1.52	1.25	1.01	1.27	4.85	6.13	0.0317	0.0439
	868406J	OLD STEESE HWY	14,598	6	16	161	248	1.69	1.39	1.12	1.42	4.55	5.75	0.2692	0.4131
	868296B	NEW STEESE EXPRESSWAY	13,393	6	16	148	228	1.41	1.16	0.94	1.18	3.48	4.40	0.1113	0.1350
	868407R	C STREET	2,117	6	16	23	36	1.41	1.16	0.94	1.18	0.55	0.70	0.0209	0.0308
	868408X	D STREET	960	6	16	11	16	1.36	1.12	0.90	1.14	0.24	0.30	0.0238	0.0358
	868409E	E STREET	960	6	16	11	16	1.36	1.12	0.90	1.14	0.24	0.30	0.0238	0.0358
	868410Y	FAREWELL AVE	2,210	6	16	24	38	1.40	1.15	0.93	1.17	0.57	0.72	0.0212	0.0311
	868412M	RIVER RD	1,014	6	16	16	23	1.92	1.62	1.79	2.20	0.50	0.62	0.0234	0.0353
	868413U	TRAINOR GATE BRIDGE	1,538	6	16	24	35	2.01	1.69	1.87	2.29	0.80	0.98	0.0162	0.0244
	868417W	VEST RD	406	6	16	6	9	1.89	1.59	1.76	2.16	0.20	0.24	0.0103	0.0166
	868419K	VEST ROAD	406	6	16	6	9	1.89	1.59	1.76	2.16	0.20	0.24	0.0103	0.0166
	868422T	GAFFNEY RD	7,477	6	16	116	169	1.97	1.66	1.84	2.26	3.81	4.69	0.0394	0.0525
	868423A	WHIDDEN RD	1,014	6	16	16	23	1.92	1.62	1.79	2.20	0.50	0.62	0.0234	0.0353
	868424G	10 AVE.	1,014	6	16	16	23	1.92	1.62	1.79	2.20	0.50	0.62	0.0234	0.0353
	868425N	NEELY ROAD	10,637	6	16	165	241	2.47	2.08	2.30	2.83	6.80	8.35	0.0434	0.0566
	868426V	ALDER AVE.	507	6	16	8	11	1.89	1.59	1.76	2.16	0.25	0.30	0.0112	0.0179
EIELSON SEGMENT 2	868427C	3 MILE GATE	11,508	5	15	93	154	1.77	1.36	0.86	1.09	2.75	3.50	0.1702	0.2166
EIELSON SEGMENT 3	868434M	BADGER ROAD	13,407	5	15	109	180	1.29	0.99	0.63	0.80	2.34	2.98	0.0287	0.0412
	868438P	FIVE HOUSES	61	5	15	0	1	1.17	0.90	0.57	0.72	0.01	0.01	0.0054	0.0093
	868441X	DENNIS ROAD	2,778	5	15	22	37	1.25	0.96	0.61	0.77	0.47	0.59	0.0216	0.0326
	868442E	BAPTIST CHURCH	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
	868443L	K & K RECYCLE (Spur Ct.)	203	5	15	2	3	1.17	0.90	0.57	0.72	0.03	0.04	0.0082	0.0139
	868445A	MITCH ROAD (Durango Tr.)	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
	868447N	RENTAL STREET	507	5	15	4	7	1.18	0.91	0.57	0.73	0.08	0.10	0.0113	0.0187
	868449C	CLUB 11	406	5	15	3	5	1.18	0.90	0.57	0.73	0.06	0.08	0.0104	0.0174
	868453S	RICHARDSON HWY.	12,121	5	15	98	163	1.25	0.96	0.61	0.77	2.05	2.60	0.0281	0.0404
	868454Y	RUBY DRIVE	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
	868456M	CROSS WAY RD.	741	5	15	6	10	1.19	0.91	0.58	0.74	0.12	0.15	0.0643	0.0863

Table K-4
Results from Transportation Safety and Delay Analysis at Grade Crossings (continued)

Rail Segment Name	Crossing ID	Street	Average daily traffic in both directions (veh/day[a])	Number of Daily Trains (including loaded and empty)		Number of vehicles delayed per day (veh/day)		Average Delay per Stopped Vehicle (min/veh[b])		Average delay per vehicle in a 24-hour period (sec/veh[c])		Total delay in a 24-hour period (hours)		Predicted Accident Frequency (accidents/year)	
				No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action
	868461J	5TH AVE.	3,268	5	15	26	44	1.26	0.97	0.61	0.78	0.56	0.71	0.0227	0.0341
	868463X	8TH AVE.	12,758	5	15	103	171	1.65	1.27	0.80	1.02	2.85	3.62	0.0469	0.0648
	868479U	SMALL CROSSING	101	5	15	1	1	1.17	0.90	0.57	0.72	0.02	0.02	0.0065	0.0110
EIELSON SEGMENT 4	868480N	LAURANCE ROAD	2,601	1	11	2	16	0.46	0.54	0.02	0.20	0.01	0.14	0.0153	0.0492
	868482C	ARMISTICE ST (VFW St.)	304	1	11	0	2	0.43	0.51	0.02	0.19	0.00	0.02	0.0046	0.0137
	868484R	DYKE RD	1,170	1	11	1	7	0.44	0.52	0.02	0.19	0.01	0.06	0.0127	0.0211
	TOTALS[d]		**137,806**	**-**	**-**	**1,415**	**2,225**	**1.67**	**1.34**	**1.03**	**1.30**	**39.45**	**49.65**	**1.1800**	**1.7200**

[a] veh/day = vehicles per day.
[b] min/veh – minutes per vehicle.
[c] sec/veh = seconds per vehicle.
[d] Totals might not equal sums of values due to rounding.

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Appendix L –
Identified Hazardous Material Sites and Regulated Facilities, and Database Records

L. IDENTIFIED HAZARDOUS MATERIAL SITES AND REGULATED FACILITIES, AND DATABASE RECORDS

This appendix describes:

- Known hazardous material sites and regulated facilities; and
- Federal, state and local databases and records.

L.1 Identified Hazardous Material Sites and Regulated Facilities

Table L-1 lists and describes all known hazardous material sites and regulated hazardous facilities within one mile of the proposed alternative segments. Table L-1 also identifies each site by reference map and latitude/longitude. Sites of concern that could present environmental consequences related to construction (excavation) activities are identified with an asterisk.

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW

Map No.	Name	Address	Longitude	Latitude	Notes	Status
Map 1 of 11 (Along North Common Segment)						
1	Harvey Residence Underground Storage Tank (UST)	3439 Dyke Road	64°43'23.44"N	147°17'13.45"W	Permanently out of service UST	Closed
2	Chena Lakes Recreation Area	Chena Lakes, North Pole	64°44'0.97"N	147°15'51.99"W	Closed USTs and one active UST. Stained soil removed during UST closure.	Closed
3	MAT-SU, INC.	Mile 7.5 Old Richardson Highway	64°43'16.97"N	147°13'35.01"W	2,000-gallons diesel fuel spill from tank rollover. Contamination estimated at 17,000 square feet (sf). Contaminated snow and soil removed.	Closed
4	OIT, Inc.	Richardson Highway	64°43'18.96"N	147°14'5.07"W	Regulated facility handling hazardous and solid waste	Active
5	Sani-Klean Service Station, Former SKS Texaco	Richardson Highway (Moose Creek)	64°43'12.81"N	147°12'57.58"W	Former service station with history of releases. Five regulated USTs and two heating oil tanks were removed in 2004. Also 400-cubic yards (cy) of contaminated soil removed from the site. Identified for a Brownfield site assessment.	Active
Map 2 of 11 (Along North Common Segment)						
6	Moose Creek General Store	4402 Al Cory Drive (Moose Creek)	64°43'1.04"N	147°11'39.83"W	1990 water well samples with high benzene levels and strong chemical odor. Benzene found at 2,500 times the maximum contaminant level (MCL). Possible sources: Leaking USTs (LUSTs) or oil spills. Threat to human health is great. Extent of contamination is unknown. Alaska Department of Environmental Conservation (ADEC) institutional controls (ICs) in place.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
7	Moose Creek Bus Barn LUSTs and Heating Oil Tank (HOT)	4440 Moose Creek Avenue (Moose Creek)	64°43'0.77"N	147°11'15.16"W	Contaminated fuel found during removal of 2000-gal and 4000-gal gasoline USTs, and one non-regulated 500-gal buried HOT. Groundwater monitoring wells installed and water samples collected. ADEC ICs in place.	Closed
8	MP 20.3 Eielson Pipeline JP4 Release	Baker Road (Moose Creek)	64°43'1.30"N	147°10'29.09"W	Release of JP4 fuel discovered during building foundation excavation in 1980's. Soil and groundwater exceed ADEC cleanup levels for gasoline range organics (GRO), diesel range organics (DRO), and benzene, toluene, ethylbenzene and total xylenes (BTEX). ADEC ICs in place.	Active
Map 3 of 11 (Along Eielson Alternative Segment 3)						
9	Hazardous Waste (HW) Satellite Accumulation Point (SAP)	Arctic Avenue	64°41'5.72"N	147°5'30.88"W	Aircraft flight operations and maintenance, as well as installation maintenance, require storage and use of hazardous materials. Once containers of HW at a SAP are full, the SAP has 3 days to transfer the HW from the SAP to the base HW 90-day storage.	Active
10	Eielson Air Force Base (EAFB) 90-day HW Storage Facility	Flight Line Avenue	64°39'5.17"N	147°4'40.24"W	Following HW are stored for up to 90 days at facility: flammable and combustible liquids, include acids, corrosives, caustics, glycols, compressed gases, aerosols, batteries, hydraulic fluids, solvents, paints, pesticides, herbicides, lubricants, fire retardants, photographic chemicals, alcohols, and sealants.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
11	HW SAP	Central Avenue	64°41'6.52"N	147°5'45.75"W	HW SAP	Active
12	HW SAP	Flight Line Avenue	64°40'53.02"N	147°6'14.67"W	HW SAP	Active
13	HW SAP	Flight Line Avenue	64°40'46.65"N	147°6'5.45"W	HW SAP	Active
14	HW SAP	Flight Line Avenue	64°40'42.83"N	147°6'5.45"W	HW SAP	Active
15	HW SAP	Flight Line Avenue	64°40'35.33"N	147°6'5.45"W	HW SAP	Active
16	HW SAP	Flight Line Avenue	64°40'34.61"N	147°6'5.45"W	HW SAP	Active
17	HW SAP	Flight Line Avenue	64°40'34.09"N	147°6'5.45"W	HW SAP	Active
18	HW SAP	Flight Line Avenue	64°40'20.47"N	147° 4'49.73"W	HW SAP	Active
19	HW SAP	Arctic Avenue	64°40'32.63"N	147°4'50.95"W	HW SAP	Active
20	HW SAP	Flight Line Avenue	64°40'24.82"N	147°5'45.21"W	HW SAP	Active
21	HW SAP	Flight Line Avenue	64°40'12.06"N	147°5'35.30"W	HW SAP	Active
22	HW SAP	Flight Line Avenue	64°40'24.82"N	147°5'37.38"W	HW SAP	Active
23	HW SAP	Flight Line Avenue	64°40'24.82"N	147°5'38.63"W	HW SAP	Active
24	HW SAP	Flight Line Avenue	64°40'10.90"N	147°5'35.30"W	HW SAP	Active
25	HW SAP	Wabash Avenue	64°40'15.50"N	147°5'15.19"W	HW SAP	Active
26	Power Plant HW Accumulation Point (AP)	Division and Industrial Streets	64°40'18.57"N	147°4'36.62"W	EAFB requires that AP transfer HW waste to the 90-day facility within 30 days after first HW waste is deposited in a container to avoid exceeding the 90-day limit for the facility.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
27	HW SAP	Division Street and Central Avenue	64°40'13.91"N	147°4'45.04"W	HW SAP	Active
28	HW SAP	Division Street	64°40'9.06"N	147°4'58.80"W	HW SAP	Active
29	HW SAP	Division Street	64°40'8.09"N	147°4'58.80"W	HW SAP	Active
30	HW SAP	Division Street	64°40'8.09"N	147°5'1.22"W	HW SAP	Active
31	HW SAP	Flight Line Avenue	64°40'1.50"N	147°5'20.28"W	HW SAP	Active
32	HW SAP	Central Avenue	64°39'52.99"N	147°4'46.37"W	HW SAP	Active
33	HW SAP	Central Avenue	64°39'36.18"N	147°4'59.29"W	HW SAP	Active
34	HW SAP	Central Avenue	64°39'34.16"N	147°4'38.31"W	HW SAP	Active
35	HW SAP	Flight Line Avenue	64°39'21.87"N	147°4'54.07"W	HW SAP	Active
36	HW SAP	Flight Line Avenue	64°39'6.57"N	147°4'37.02"W	HW SAP	Active
37	HW SAP	E-7 and E-8 Complexes	64°39'1.10"N	147°4'21.73"W	HW SAP	Active
38	HW SAP	E-7 and E-8 Complexes	64°39'4.78"N	147°3'50.54"W	HW SAP	Active
39	HW SAP	E-7 and E-8 Complexes	64°39'1.10"N	147°4'21.73"W	HW SAP	Active
40	HW SAP	E-7 and E-8 Complexes	64°39'3.94"N	147°3'34.94"W	HW SAP	Active
41	HW SAP	E-7 and E-8 Complexes	64°39'4.04"N	147°3'29.16"W	HW SAP	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
42	EAFB (SER-2) (LF01) Landfill	West of Richardson Highway	64°39'10.45"N	147°5'53.60"W	Disposal of empty cans and 55-gallon drums; may have received waste oils, spent solvents, paint residues and thinners from 1950 to 1960. In 1992, 2,500 open drums were removed and disposed in the Fairbanks North Star Borough (FNSB) landfill. EAFB Site ICs in place and long term monitoring (LTM) of groundwater established.	Active
43	EAFB (OU-2) (ST11) Bakery	Central Avenue, South of Division	64°40'11.51"N	147°4'57.92"W	Groundwater and soil contaminated with diesel fuel; possibly released from spills and leaks from tanks at former bakery or former boiler house. Floating product was detected on water table. EAFB Site ICs in place and LTM established.	Active
44	EAFB (OU-2) (ST13) Hydrant System	Flight Line	64°39'2.47"N	147°4'42.83"W	Diesel and motor gasoline (MOGAS) from ruptured, leaking, or overfilled fuel bladders at E-4 refueling/defueling area. Bioventing and product recovery system installed in 1997 and operated continuously. EAFB Site ICs in place and LTM established.	Active
45	EAFB (OU-2) (ST18) Old Boiler Plant	Buildings 3405,3409,3411, 3386	64°40'10.37"N	147°4'49.52"W	Product floating on the water table found during construction activities; possibly from older boiler plant (Building 3405), which reportedly had a cesspool and drywell associated with it. EAFB Site ICs in place and LTM established.	Active
46	EAFB (SER-1) (DP29) Drum Burial	Central Avenue	64°41'59.27"N	147°6'43.67"W	Drum patch; drums removed.	Closed

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
47	EAFB (OU-1) (ST20) Refueling Loop	E-7, E-8 and E-9 Complexes	64°38'43.73"N	147°3'54.04"W	JP-4 fuel spills in the refueling area; also leaks of JP-4 fuel from UST piping. Bioventing system has treated the soil, but groundwater is still impacted. EAFB Site ICs in place and LTM established.	Active
48	EAFB (OU-1) (ST48) Power Plant	Division and Industrial Streets	64°40'18.57"N	147°4'35.02"W	GRO and DRO contamination in soil and groundwater from abandoned 3-inch pipeline near EAFB power plant. Bioventing system has treated soil south of Division street; soil to north is still in question. EAFB Site ICs in place and LTM established.	Active
49	EAFB (OU-3) (SS57) Bldg. 1206	Parking Lot at Flight Line Avenue and Division Street	64°39'58.11"N	147°5'26.62"W	Five USTs at Building 1207 plus a maintenance shed located at the northwest corner of the fire station are believed to be the primary sources of solvent contamination in soil and groundwater. EAFB Site ICs in place and LTM established.	Active
50	EAFB (SER-2) (ST58) Old Quartermaster Station	Wabash Avenue and Division Street	64°40'9.57"N	147°5'13.72"W	Possible releases from above-ground storage tanks (ASTs). In 1993 approximately 700 cy were removed from an excavation for use in an ex-situ composting project. EAFB Site ICs and LTM in place.	Active
51	EAFB (OU-2) (DP26) T300 Sludge Pit	Flight line and Hazmat Yard	64°39'5.65"N	147°4'41.70"W	Fuel in weathered sludge from periodic fuel storage tank cleaning, buried in pit. Site is undergoing active remediation via bioventing since 1997. EAFB Site ICs in place and LTM established.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
52	EAFB (SER-1) (DP28) Fly Ash	Industrial Avenue and Quarry Road	64°39'40.80"N	147°4'0.48"W	Fly ash from Central Heating and Power Plant was deposited in a nearby gravel pit. Site not currently in use.	Closed
53	EAFB (SER-2) (WP32) Sewage Treatment Plant	Central Avenue and Transmitter Road	64°41'42.95"N	147°6'55.63"W	Ponds provide additional contact time for chlorination of primary treated effluent; also serve as diversion ponds for petroleum, oil and lubricant (POL) spills; major spill of unknown industrial chemical or solvent reported 1975. LTM established.	Active
54	EAFB (OU-4) (SS37)	Asphalt Mixing Area	64°39'16.80"N	147°4'40.46"W	Mixing area for asphalt and staging area for road oiling; possible leaks from tanks containing tar and asphalt emulsion, waste oil and contaminated fuel; drums of waste oil, diesel fuel, JP-4 and PD-680. LTM established.	Active
Map 4 of 11 (Along Eielson Alternative Segment 3)						
55	EAFB (OU-4) (SS39)	South of Richardson Highway	64°40'34.40"N	147°7'9.04"W	Asphalt emulsion leaked from several hundred rusted drums over 1 acre area; drums and miscellaneous debris embedded in soft tar to depth of 6-12 inches. EAFB Site ICs in place and LTM established.	Closed
56	EAFB (SER-1) (FT08)	Central Avenue	64°42'11.96"N	147°7'35.83"W	Source may have been used as a fire training area in the past (1948-55). B-29 submerged in lake. LTM established.	Closed
57	EAFB (OU-3) (WP45) Photo Lab	Flight Line Avenue and Division Street	64°40'8.10"N	147°5'27.63"W	Photo chemicals discharged to dry well; trichloroethylene, benzene, and other solvents present in groundwater. EAFB Site ICs in place and LTM established.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
58	EAFB (OU-3) (DP44) Battery Shop	Near Building 1140	64°40'39.39"N	147°6'1.31"W	Battery shop solvents possibly drained to leach fields. EAFB Site ICs in place and LTM established.	Active
59	EAFB (OU-1) (ST49) Bldg. 1300	Combat Alert Hangar	64°38'46.28"N	147°4'33.67"W	Diesel fuel generator discharged through floor drains in combat alert hanger complex to septic system leach field. Free product in groundwater extending 300 feet northwards. EAFB Site ICs in place and LTM established.	Active
60	EAFB (SS67) Garrison Slough PCBs (Base-wide)	2258 Central Avenue	64°40'54.99"N	147° 5'18.05"W	Polychlorinated biphenyls (PCBs) were found in sediment and soil in Garrison Slough as well as in fish. Contaminated groundwater and surface runoff from site. Garrison Slough is a main drainage ditch at Eielson. EAFB Site ICs in place and LTM established.	Active
61	EAFB (OU-5) (LF03) Landfill	East of Hazmat Yard	64°39'14.41"N	147°4'1.34"W	General refuse; landfill received waste oils, spent solvents, paint residues and thinners, radioactive photographic chemicals; POL wastes burned during fire training. Contaminants of concern include BTEX and chlorinated solvents. EAFB Site ICs in place and LTM established.	Active
62	EAFB (SER-1) (LF05) Landfill	South of Runway	64°37'52.93"N	147°3'46.69"W	General refuse including scrap materials and empty drums and containers; probably received small quantities of waste oils and spent solvents. Landfill closed/capped. EAFB Site ICs in place and LTM established.	Closed

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
63	EAFB (SER-1) (ST12) Bldg. 2351	Building 2351	64°41'1.80"N	147°5'35.36"W	5,000-gallon JP-4 fuel spill with majority contained within building, 100 gallons flowed outside building.	Closed
64	EAFB (SER-1) (SS42)	Along Central Avenue	64°41'35.27"N	147°6'0.38"W	Site used for burial of empty drums and containers; possibly small quantities of POL waste, including solvents, as residue in drums. LTM established.	Closed
65	EAFB (SER-1) (SS47) Com Parking Lot	Central Avenue and Broadway Street	64°40'49.54"N	147°5'33.63"W	Fuel contaminated soil in parking lot found at a depth of 9 feet in 1987; parking lot covers 150,000 square feet.	Closed
66	EAFB (SER-1) (SS30) Bldg. 2339	Near Hurley Gate	64°41'22.25"N	147°5'44.84"W	Formerly stored PCB containing materials including out-of-service transformers and capacitors, and PCB-contaminated soil and liquid from clean-up of PCB spill.	Closed
67	EAFB (SER-1) (SS31) Bldg. 3424	Warehouse Court	64°40'2.72"N	147°4'37.55"W	Formerly stored PCB containing materials including transformers and capacitors, and PCB- contaminated soil and liquid form clean-up of PCB spill. EAFB Site ICs in place and LTM established.	Closed
68	EAFB (OU-3) (SS61)	Vehicle Maintenance Shop (Building 3213)	64°40'7.38"N	147°5'3.75"W	Contaminated soil and groundwater in 3-acre area east and south of Building 3213 contains BTEX and chlorinated volatile organic compounds (VOCs) from disposal of shop wastewater into two drywells. Drywells removed, and LTM and ICs in place. EAFB Site ICs in place and LTM established.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
69	EAFB (OU-3) (SS64)	Transportation Maintenance Drum Storage Area	64°40'6.87"N	147°5'8.76"W	Drum storage area. EAFB Site ICs in place and LTM established.	Closed
70	EAFB (OU-4) (SS35)	Asphalt Mixing and Drum Burial Area	64°39'56.58"N	147°4'52.56"W	Asphalt mixing and drum burial area. EAFB Site ICs in place and LTM established.	Closed
71	EAFB (OU-4) (SS63)	Asphalt Lake Spill Site	64°40'25.40"N	147°7'17.16"W	"Asphalt Lake" spill site	Closed
72	EAFB (OU-5) (FT09)	Former Fire Training Area	64°39'9.07"N	147°4'0.73"W	Former fire training area in LF03. EAFB Site ICs in place and LTM established.	Closed
73	EAFB (SER-1) (SS41) Old Hobby Shop	Central Avenue and Quarry Road	64°39'21.84"N	147°4'43.29"W	Waste oil and contaminated fuel from 55 gallon drums; small quantities of industrial solvents	Closed
74	EAFB (WP34) Sewage Treatment Plant	Near Main Gate and Quarry Road	64°41'20.16"N	147°6'49.54"W	Sewage treatment plant	Closed
75	EAFB (WP33) Sewage Treatment Waste Pond	Near Main Gate and Quarry Road	64°41'19.16"N	147°6'49.54"W	19 acre effluent infiltration pond receiving treated liquid effluent from the wastewater treatment plant discharged into unlined pond.	Active
Map 5 of 11 (Along Eielson Alternative Segments 2 and 3)						
76	Residence - 7139 Old Richardson Hwy HOT	7139 Old Richardson Highway (Salcha)	64°35'22.87"N	147°4'22.85"W	DRO-contaminated soil found at 7.5 to 9.5 feet below ground surface in the vicinity of a partially buried HOT.	Closed

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
Map 6 of 11 (Along Salcha Alternative Segment 2)						
77	Nike Site Jig	Johnson Access Road (Salcha)	64°32'12.10"N	146°59'52.32"W	U.S. Army Corps of Engineers (USACE) conducted soil sampling under Formerly Used Defense Sites (FUDS) program. Found 45 cy of PCB contaminated soil and numerous incidental spills. ADEC ICs in place.	Active
78	Residence 6432 Richardson Highway HOT*	6432 Richardson Highway	64°31'34.93"N	146°59'22.37"W	Confirmed 1,200 gallon heating oil release from corroded leaking UST that was removed at the residence. Contaminated soil removal limited at western end of excavation by structures. Soil confirmation sample at western end of excavation had BTEX, GRO and DRO above cleanup levels. Over 500 gallons of product was removed from the culvert recovery well. Four soil stockpiles left onsite were thermally treated. ADEC ICs in place.	Active
Map 7 of 11 (Along Salcha Alternative Segment 2)						
79	Haines Fairbanks Pipeline (HFP) Mile 541.5*	Salcha River Crossing Gate Valve #67	64°28'11.38"N	146°56'8.85"W	HFP valve area on north side of Salcha River; contamination found in 2007. Extent unknown.	Active
80	HFP Mile 539*	Section 21, Township 9 South/Range 10 East (T9S/R10E), FM	64°28'11.38"N	145°45'52.40"W	Delta Alternative Segment 2 railbed right-of-way (ROW) parallels HFP in area with documented herbicide use in 1960's and undocumented releases.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
Map 8 of 11 (Along Salcha Alternative Segment 2)						
81	Harding Lake Micro Repeater	Milepost 322; Richardson Highway	64°24'22.49"N	146°57'6.14"W	A 4,000-gallon diesel UST was removed in 1990. Fuel contamination at the filler pipe area was discovered. About 80 cy of soil was removed and stockpiled onsite. Subsequent total petroleum hydrocarbon (TPH) analysis indicated that the excavation pit is below cleanup guidelines.	Closed
Map 9 of 11 (Along Delta Alternative Segment 2)						
82	HFP Mile 538.5 to Mile 536.5 (section-wide)*	Sections 22 and 27, T9S/ R10E, FM	64° 6'47.84"N	145°45'43.99"W	Delta Alternative Segment 2 railbed ROW parallels HFP in area with 1960's herbicide use and undocumented releases.	Active
83	HFP Mile 536.5 to Mile 535 (section-wide site)*	Sections 26 and 35, T9S/R10E, FM	64° 5'49.11"N	145°45'6.44"W	Delta Alternative Segment 2 railbed ROW parallels HFP in area with documented herbicide use in 1960's and undocumented releases.	Active
84	HFP Mile 535 to Mile 534 (section-wide)*	Sections 34and 35 T10S/R10E, FM	64° 4'14.10"N	145°43'16.28"W	Delta Alternative Segment 2 railbed ROW parallels HFP. 1960's documented herbicide use and undocumented POL releases.	Active
Map 10 of 11 (Along Delta Alternative Segment 1)						
85	Delta Jct. Micro Repeater	Milepost 1422; Alaska Highway	64° 2'16.07"N	145°43'38.43"W	During removal of four USTs in 1989, about 50 cy of contaminated soil was stockpiled. Excavation sidewalls and bottom were clean. Contaminated soils spread onsite.	Closed

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
86	Alaska Department of Transportation & Public Facilities (ADOT&PF) Delta Junction Maintenance Camp	MP 265.5 Richardson Highway; Corner of Alaska and Richardson Highways	64° 2'15.96"N	145°44'1.91"W	A 3000-gallon heating oil UST was removed in 1992; 130 cy of contaminated soil also was removed and stockpiled onsite. Contaminated soil exceeding ADEC cleanup levels remained beneath the building. In 1998, three more USTs were removed; 2,950 mg/kg DRO and 0.088 mg/kg benzene contamination were detected at the bottom of the excavation. ADEC ICs in place.	Cond. closure
87	ADOT&PF Delta Maintenance Facility	Richardson Highway (Delta Junction)	64° 1'48.77"N	145°43'51.44"W	Removal of 3,000 gallon HOT resulted in the excavation of 135 cubic yards of soil. Stockpile was approved for use in a non-environmentally sensitive area. ADEC ICs in place.	Cond. closure
Map 11 of 11 (Along Delta Alternative Segments 1 and 2)						
88	HFP Mile 534 to Mile 531.8 (section-wide site)*	Sections 11, 12 and 15, T10S/ R10E, FM	64° 2'50.47"N	145°41'21.49"W	Delta Alternative Segment 2 railbed ROW parallels HFP in area with documented herbicide use in 1960's and undocumented releases.	Active
89	HFP Mile 531.8 to Mile 530.5 (section-wide site)*	Section 19 T10S/R10E and Section 24, T10S/ R11E, FM	64° 1'50.00"N	145°40'37.04"W	Delta Alternative Segment 2 railbed ROW parallels HFP in area with documented herbicide use in 1960's and undocumented releases.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status
90	HFP Ft Greely Pump Station and Terminal Mile 528.5*	Sections 25 T10S/R10E and Section 30 T10S/R11E, FM	64° 1'27.42"N	145°40'20.00"W	Investigation of terminal and pump station underway by U.S. Army as an active U.S. Department of Defense (DoD) installation. Documented past practices for purging fuels between different runs and documented releases indicate extensive soil and groundwater contamination.	Active
91	HFP Mile 530 to Mile 529 (section-wide site)*	Section 29, 30 and 32, T10S/R11E , FM	64° 1'11.12"N	145°39'12.91"W	Delta Alternative Segment 1 railbed ROW parallels HFP in area with documented herbicide use in 1960's and undocumented releases.	Active
Maps 1,2, 3, 4, 5, 6, 7, 9, 10 and 11 of 11 (Along North Common Segment, Eielson Alternative Segment 2, Eielson Alternative Segment 3, Salcha Alternative Segment 2, Delta Alternative Segment 1, and Delta Alternative Segment 2)						
92	Alaska-Canadian (ALCAN) Highway construction camps (Project-wide orphan site[s])	Project-wide	N/A	N/A	FUDS investigation of ALCAN Highway construction camps from 1940's underway. Anecdotal information on disposal practices suggests potential for contaminated sites.	Active

Table L-1
Known Hazardous Material Sites and Regulated Facilities Within 1 Mile of the Rail ROW (continued)

Map No.	Name	Address	Longitude	Latitude	Notes	Status

Notes:
* Indicates sites that present a high risk of environmental consequences related to construction (excavation) activities.

EAFB Institutional Controls (ICs) include:
- Prohibition on the installation or use of drinking water wells
- All monitoring wells are secured with locks
- Any activity that may result in exposure to contaminated soil and groundwater requires approval of Civil Engineering Squadron/Environmental Flight (CES/CEV)
- Contaminated soil/groundwater removed from the source must be disposed of or treated in accordance with regulation
- Any activity disturbing a remedial action requires approval of CES/CEV
- Notify ADEC and U.S. Environmental Protection Agency of any proposal to change the existing land use or land use controls at the site.

ADEC Institutional Controls include:
- Site added ADEC Contaminated Sites Database identifying the nature and extent of contamination remaining onsite.
- In accordance with 18 AAC 78.274(b) OR 18 AAC 75.370(b), ADEC approval must be obtained prior to removal and/or disposal of soil or groundwater from this site to an offsite location.

Active Risk sites include:
- Sites within the ROW where potential contamination remains or is suspected and where excavations for railbed cuts, separated crossings, retaining walls and embankments may occur.
- Sites within 1 mile of route alternatives where contamination remains or is suspected and there are no land restrictions or ICs for borrow pit development.

L.2 Federal, State and Local Databases and Records

Table L-2 summarizes Federal, state, and local databases that were reviewed to identify known contaminated sites within the project area. Table L-2 also lists the regulatory agencies responsible for oversight and their administrative programs.

Table L-2
Database and Records Reviewed

Database/Records	Agency/ Program	Source/ Release Date	Description
Federal Records			
Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)	USEPA/ Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), also known as Superfund	http://www.USEPA.gov/superfund/sites/npl/ak.htm (11/27/07)	USEPA's computerized inventory of potential hazardous substance release sites.
National Priority List (NPL)	USEPA/ Superfund	http://www.USEPA.gov/superfund/sites/npl/ak.htm (11/27/07)	Subset of CERCLIS of 1,200 sites identified for priority cleanup under the Superfund program.
NPL sites with Record of Decisions (RODs) documentation	USEPA/ Superfund	http://yosemite.USEPA.gov/R10/CLEANUP.NSF/0/5583e4d056ffb3e08825650d004f1d2d?OpenDocument (5/22/06)	Lists sites with RODs (mandated permanent cleanup remedies containing technical & health information to aid in cleanup).
CERCLA Consent Decrees	USEPA/ Superfund	http://yosemite.USEPA.gov/R10/CLEANUP.NSF/0/5583e4d056ffb3e08825650d004f1d2d?OpenDocument (5/22/06)	Lists Superfund (CERCLA) sites where cleanup by owners has been negotiated with the USEPA resulting in a Consent Decree
Proposed NPL sites	USEPA/ Superfund	http://www.USEPA.gov/superfund/sites/npl/ak.htm (11/27/07)	Lists a subset of CERCLIS sites undergoing evaluated to determine if they should be listed for priority cleanup under Superfund.
NPL Liens	USEPA/ Superfund	http://www.USEPA.gov/superfund/sites/npl/ak.htm (11/27/07)	Lists NPL sites with superfund liens held against them by the USEPA

Table L-2
Database and Records Reviewed

Database/Records	Agency/ Program	Source/ Release Date	Description
Delisted NPL sites	USEPA/ Superfund	http://www.USEPA.gov/superfund/sites/npl/ak.htm (11/27/07)	Lists sites deleted from the NPL due to cleanup or USEPA finding of no harm to environment or human health exists.
NPL sites with Engineering Controls and/or with Institutional Controls	USEPA/ Superfund	http://www.USEPA.gov/superfund/sites/npl/ak.htm (11/27/07)	Lists NPL sites with engineering controls in place.
Resource Conservation & Recovery Act (RCRA) Info database.	USEPA/ RCRA	http://www.USEPA.gov/enviro/html/em/index.html and http://yosemite1.USEPA.gov/R10/OWCM.NSF/webpage/homUSEPAge/ (3/12/06)	Information onsites generating, storing, transporting, treating and/or disposing of RCRA-defined hazardous waste.
CORRACTS list.	USEPA/ RCRA	http://www.nv.blm.gov/lvdiseis/docs/EIS/Appendix%20D%20%20Environmental%20Database.pdf (9/17/03)	Corrective action list of non-compliance in generating, transporting, treating, storing, disposing hazardous waste
Open Dump Inventory (ODI)	USEPA/ RCRA	http://www.osti.gov/energycitations/product.biblio.jsp?osti_id=6269222 (1/21/08)	Lists open dumps on Federal lands
Emergency Response Notification System (ERNS)	USEPA/ National Reporting Center (NRC)	www.nrc.uscg.mil/wdbcgi/wdbcg. and EDR (12/31/02)	Stores information from all Federal agencies on releases of oil & hazardous substances in a standardized format.
Hazardous Material Information Resource System (HMIRS)	DoD/ Defense Logistics Agency (DLA)	http://www.dec.state.ak.us/spar/csp/DoD_sites.htm#fuds (1/21/08)	Central repository for Material Safety Data Sheets (MSDS) for U.S. military services, civil agencies and contractors.
DoD Sites/ U.S. Army, U.S. Air Force, U.S. Navy and Defense Energy Support Center	USEPA	http://www.dec.state.ak.us/spar/csp/DoD_sites.htm#fuds (1/21/08)	Lists active DoD sites with known contamination by the primary Federal agency responsible for oversight

Table L-2
Database and Records Reviewed

Database/Records	Agency/ Program	Source/ Release Date	Description
Formerly Used Defense Sites (FUDS)	DoD/ USACE	http://www.poa.usace.army.mil/fuds/index.htm (1/09/08)	Lists properties formerly operated by DoD containing hazardous, toxic, or radioactive wastes in soil or groundwater.
US Brownfields	USEPA/ Brownfields	http://www.brownfieldstsc.org/ (1/21/08)	Lists properties where redevelopment or reuse may be complicated by the presence or potential presence of a contamination.
Superfund (CERCLA) Consent Decrees	U.S. Department of Energy (DOE)/ Office of Environmental Management	http://www.em.doe.gov/StatePages/AK (1/21/08)	Superfund (CERCLA) Consent Decrees
DOE Legacy Management (LM)	USEPA/ Toxic Release Inventory (TRI)	http://www.energy.gov/environment/index.htm (1/9/08)	Lists sites associated with the legacy of the nation's nuclear weapons program or other USDOE research and development activities.
Toxic Release Inventory System	USEPA/ TSCA	http://www.USEPA.gov/tri/ (8/31/07)	Provides annual information on toxic chemical releases & other waste management activities by certain industry groups & Federal facilities

Table L-2
Database and Records Reviewed

Database/Records	Agency/ Program	Source/ Release Date	Description
State Records			
ADEC/Division of Spill Prevention and Response (ADEC/SPAR) Contaminated Sites Program (CSP) DoD contaminated sites database	ADEC/CSP	http://www.dec.state.ak.us/spar/csp/DoD_sites.htm#fuds and http://www.dec.state.ak.us/spar/csp/sites/eielson.htm (1/21/08)	Interactive Web site tracks, lists and describes DoD facilities containing contaminated sites. This includes sites listed as Formally Used Defense Sites (FUDS) plus active US Air Force and U.S. Army sites
ADEC CSP Contaminated Sites and Leaking Underground Storage Tanks (LUST) database	ADEC/CSP	http://info.dec.state.ak.us/SPAR/CSP/Search/csites_search.asp (1/19/08)	Interactive Web site tracks, lists and describes all reported contaminated sites and LUSTs
ADEC CSP Voluntary Cleanup Program (VCP) and Institutional or Engineering Controls (ICE) database	ADEC/CSP	http://info.dec.state.ak.us/SPAR/CSP/Search/csites_search.asp (1/19/08)	Interactive Web site tracks, lists and describes all contaminated in the VCP and/or containing ICE.
ADEC CSP Regulated Underground Storage Tank (UST) and Aboveground Storage Tank (AST) database	ADEC Industry Preparedness Program	http://www.dec.state.ak.us/spar/ipp/ust/search/default.htm (1/19/08)	Interactive Web site tracks, lists and describes all active, inactive and closed USTs and ASTs.
Solid Waste Landfills (SWL)	ADEC Division of Health, Solid Waste Program (SWP)	http://www.dec.state.ak.us/eh/sw/index.htm (1/10/08)	Interactive Web site tracks, lists and describes all active and closed regulated landfills by region and disposal permit. Also list known unregulated landfills.

Appendix M –
Section 4(f) Evaluation

M. Section 4(f) Evaluation

The U.S. Department of Transportation (USDOT) regulation known as "Section 4(f)" is not applicable to Surface Transportation Board (STB or the Board) actions, however, it is applicable to the proposed Northern Rail Extension (NRE or project) through the involvement of the Federal Railroad Administration (FRA) and the Federal Transit Administration (FTA).[1] FRA is administering grant funding to the Alaska Railroad Corporation (ARRC) for preliminary engineering and environmental analysis of the NRE. FRA could also provide funding for rail line construction and would enforce rail safety regulations on the operating rail line. FTA is involved because of the project's passenger rail component.

Section 4(f) was originally established in the U.S. Department of Transportation Act of 1966 (49 United States Code [U.S.C.] Section 1653(f) and later recodified as 49 U.S.C. 303. In 2005, Congress enacted legislation that required the USDOT to issue additional regulations that clarify 4(f) standards and procedures. These new regulations were finalized in March, 2008, at 23 Code of Federal Regulations (CFR) 774. Section 4(f) mandates that the Secretary of Transportation shall not approve any transportation project requiring the use of publicly owned parks, recreation areas or wildlife and waterfowl refuges, or significant historic sites, regardless of ownership, unless:

- There is no prudent and feasible alternative to using that land.
- The program or project includes all possible planning to minimize harm to the public park, recreation area, wildlife or waterfowl refuge, or significant site, resulting from that use.

In order to be protected under Section 4(f), public parks and recreation facilities must be considered "significant" (USDOT, 2005). Historic sites qualifying for 4(f) protection must be officially listed on, or eligible for inclusion in, the National Register of Historic Places (NRHP), or contribute to a historic district that is eligible for or listed on the NRHP.

For all types of properties protected under Section 4(f) there are three possible types of impact, as defined in 23 CFR 771.135(p):

- A "direct use" of a Section 4(f) property occurs when land from a qualifying 4(f) property is acquired and permanently incorporated into a transportation facility.
- A "use" under Section 4(f) also occurs when there is a temporary occupancy of 4(f) land during construction of the transportation facility that is considered adverse to the preservationist purposes of the Section 4(f) statute.
- A "constructive use" may occur when no land is acquired from a Section 4(f) property but the proximity of the project results in indirect impacts which would "substantially impair" the current use of the property such as visual, noise, or vibration impacts, or impairment of property access.

Table M-1 summarizes the Section 4(f) uses by alternative segment. The No-Action Alternative is presented for comparison.

[1] The lead agency for the Northern Rail Extension is the STB. FRA and FTA are cooperating agencies in the EIS process. Section 4(f) does not apply to the STB, so the FRA and FTA act as lead agencies in regard to the Section 4(f) analysis.

M.1 Purpose and Need

The Alaska Railroad Corporation (ARRC or the Applicant) has stated that the purpose and need for the NRE is to provide freight and passenger rail service to the region south of North Pole, Alaska. This service would provide options for moving goods and people, and would also allow for greater military access to training areas west of the Tanana River. Any full combination of the alternative segments would meet the project purpose and need.

M.2 Proposed Action and Alternatives

The proposed NRE would involve construction of an approximately 80-mile rail line extension from the existing Eielson Branch. The Eielson Branch runs from Fairbanks, Alaska, through the community of North Pole to the Eielson Air Force Base (AFB). The proposed extension would begin at Milepost 20.18 of the Eielson Branch (Milepost 0 for the Northern Rail Extension) at the east end of the Chena River Overflow Bridge, just south of the community of North Pole, and extend to the southern side of the community of Delta Junction. ARRC would also construct a dual-modal bridge over the Tanana River that would be capable of supporting both rail and vehicular traffic.

Construction activities would include railbed construction, which would require clearing, excavating earth and rock on previously undisturbed lands, and removing and stockpiling topsoil where needed. Construction would require both cuts and fills. Suitable material excavated from cuts would be used as fill material in other areas. The railbed would form the base upon which the ballast, concrete rail ties, and rail would be laid.

The alternative segments are the outcome of an extensive alternatives analysis process that began in 2005 when ARRC presented potential alignments for NRE. Since that time, ARRC refined and evaluated potential routes both internally and through a public outreach and consultation process. The Board's Section of Environmental Analysis (SEA) alternative development process started in 2006 with ARRC's Alternatives Analysis Study, and continued until July 2007 when ARRC filed a petition with STB to construct and operate a new rail line extension.

Existing topographic and other data were used in ARRC's early phases of alignment development and analysis. ARRC's alignment development and refinement process occurred in three general phases. In Phase 1 (Study Area Identification), the general study area within which the rail line extension could be developed was identified, along with potential points for bridging the Tanana River and several representative routes.

In Phase 2 (Corridor Development), a preliminary screening was conducted by ARRC of the representative routes and Tanana River crossing locations identified in Phase 1 to eliminate any alignment segment with fatal flaws before continuing with alignment segment development. This included consideration of technical and practical considerations including natural barriers such as rivers and topography; engineering design; cost-effectiveness; geological considerations; and general land use patterns.

ARRC's Phase 3 (Corridor Analysis) involved a qualitative comparison of the relative advantages and disadvantages of various alignment segments. The evaluation of each alignment segment's relative merits was based primarily on engineering and environmental considerations, including issues raised by regulatory or resource agencies or the public during agency

Table M-1
Section 4(f) Property Summary

	No-Action Alternative	North Common Segment	Eielson Alternative Segment 1	Eielson Alternative Segment 2	Eielson Alternative Segment 3	Salcha Alternative Segment 1	Salcha Alternative Segment 2	Connector A	Connector B
Recreation Resources									
Chena River Flood Control Project Management Units I2 and I4		X							
Twentythreemile Slough Dog-Sledding Trails			X	X					
Eielson Air Force Base (AFB) Outdoor Recreation Area					X				
Salcha School Grounds and Salcha Ski Area							X		
Silver Fox Lodge Trail									
U.S. Army Permit Route									
ADNR Winter Trail									
Koole Lake Trail									
Donnelly-Washburn Trail									
Alaska Department of Natural Resources (ADNR) Forestry Winter Road									
Rainbow Lake Trail									
Phillips Road/Delta Junction Area Trail Network									
Alaska Department of Natural Resources (ADNR) Dispersed Use Areas (Public Recreation Primary Use)									
Wildlife or Waterfowl Refuge*									
Cultural Resources									
2 archaeological sites within Salcha Alternative Segment 2 Area of Potential Effect (APE)							X		

Table M-1
Section 4(f) Property Resources Summary (continued)

	Connector C	Connector D	Central Alternative Segment 1	Central Alternative Segment 2	Connector E	Donnelly Alternative Segment 1	Donnelly Alternative Segment 2	South Common Segment	Delta Alternative Segment 1	Delta Alternative Segment 2
Recreation Resources										
Chena River Flood Control Project Management Units I2 and I4										
Twentythreemile Slough Dog-Sledding Trails										
Eielson AFB Outdoor Recreation Area										
Salcha School Grounds and Salcha Ski Area										
Silver Fox Lodge Trail						X	X			
U.S. Army Permit Route						X				
ADNR Winter Trail						X	X			
Koole Lake Trail						X				
Donnelly-Washburn Trail						X	X			
ADNR Forestry Winter Road						X		X		
Rainbow Lake Trail								X		
Phillips Road/Delta Junction Area Trail Network										X
ADNR Dispersed Use Areas (Public Recreation Primary Use)						X	X	X	X	X
Wildlife or Waterfowl Refuge*										
Cultural Resources										
2 archaeological sites within Salcha Alternative Segment 2 APE										

* No wildlife or waterfowl refuge would be affected by the proposed NRE.

coordination and public outreach efforts. Many of the preliminary alignment segments were eliminated by ARRC or combined with other similar alignment segments because they presented no clear advantages over adjacent alignment segments or they had more disadvantages than other alignments.

SEA reviewed the alignment development process during the project scoping period, and requested refinements to alignment segments based on public comment and consultation with cooperating agencies. Both SEA and cooperating agencies utilized the purpose and need factor (as described above) to review the alignments initially developed by ARRC. Through this review, SEA and cooperating agencies selected a set of reasonable alternatives to study in detail in the Environmental Impact Statement (EIS), and to eliminate alternatives and alternative segments from detailed study. Those alternative segments that did not meet fundamental components of the purpose and need, led to substantially greater adverse environmental impacts, or featured insurmountable construction and/or operational limitations, were eliminated by SEA and the cooperating agencies from detailed study. Consideration of alternatives under the criteria of Section 4(f) is discussed below in section M.5, Avoidance Alternatives.

A summary of the alignment segment development process and alternatives analyzed and eliminated from consideration is available in Chapter 2 and Appendix D of the EIS. There is no option to authorize an individual alternative segment; only a complete route from North Pole to Delta Junction would be authorized, which would be comprised of a combination of the alternative segments under consideration.

M.3 Section 4(f) Property Description

A publicly owned park, recreation area or wildlife and waterfowl refuge must be a "significant" resource for Section 4(f) to apply. Pursuant to 23 C.F.R. 771.135(c), 4(f) resources are presumed to be significant unless the official having jurisdiction over the site concludes that the entire site is not significant. This section describes SEA's preliminary determination of Section 4(f) properties that are located within the project area.

M.3.1 Parks and Recreation Areas

Ten parks and recreation areas are located within the project area. These areas range from trails to general recreation uses.

Chena River Lakes Flood Control Project

Size and Location: The flood control project includes approximately 20,000 acres at the northernmost section of the proposed Project Area. North Common Segment would cross portions of this area (Figure M-1).

Ownership[2] and Type of Section 4(f) Property: The parcel is owned by the U.S. Army Corps of Engineers. Flood project management units I2 and I4 would be considered a direct use of Section 4(f) property.

[2] "Ownership" refers to the current owner of the property.

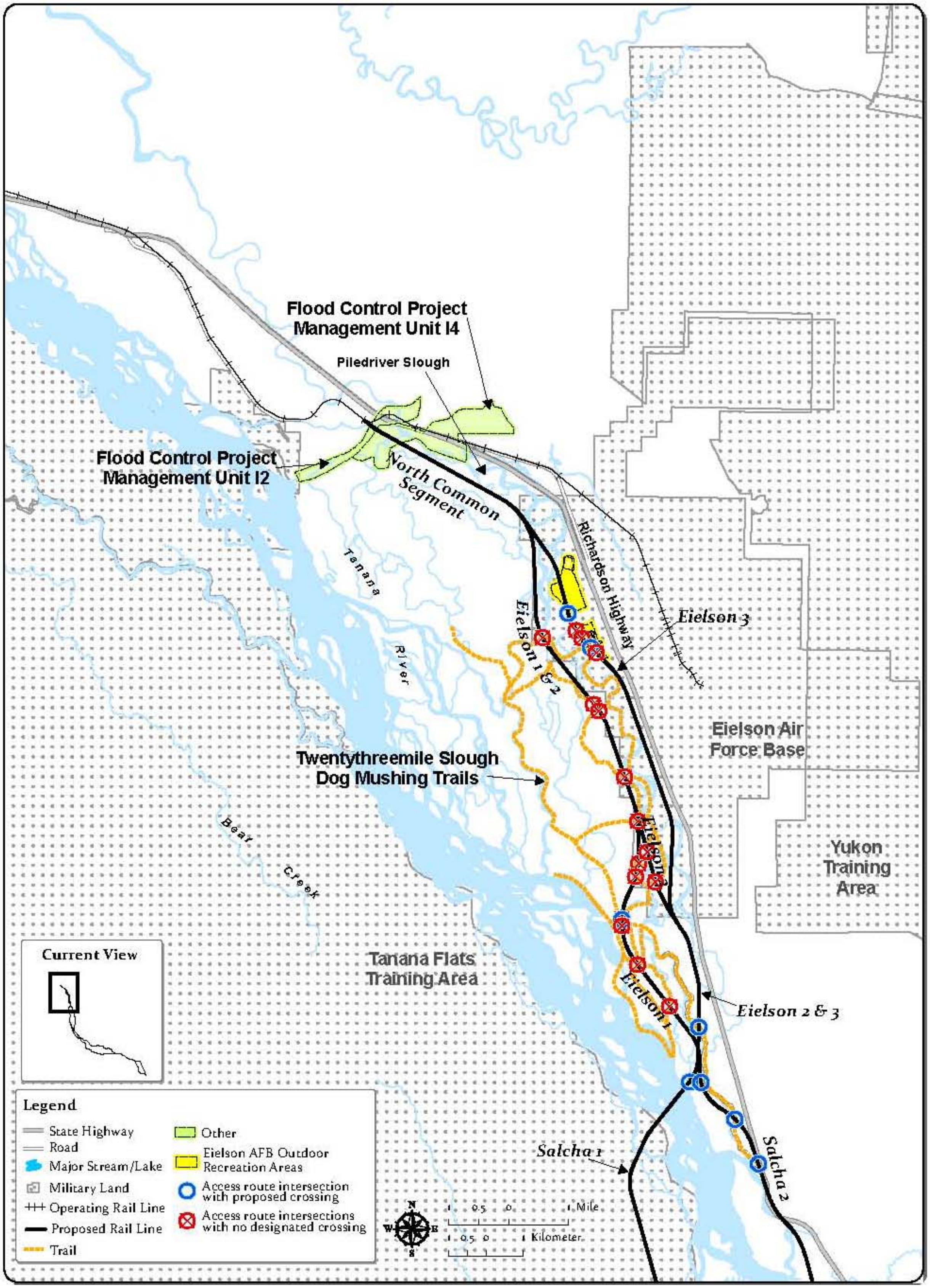

Figure M-1 – Park and Recreational Facilities along North Common and Eielson Alternative Segments 1, 2, and 3

Function of the Property and Available Activities: The property functions primarily as part of the Chena Lakes Flood Control Project, and includes portions of the Chena River Floodway and its southern levee. In non-flood periods, the area is used for public recreation. The floodway accommodates a portion of Fairbanks North Star Borough's (FNSB) 100-Mile Loop Trail, a multi-use public trail (FNSB, 1985, 2005; USACE, 1989). The proposed NRE begins just south of the floodway, and crosses a private road that follows the southern levee toward the Tanana River.

Description of Existing and Planned Uses: The flood control project's management units I2 and I4 crossed by the proposed project are designated for recreation and wildlife management in the Chena River Lakes Master Plan for Resource Use (Schaake, 2008; USACE, 1989). There are no planned additional facilities or improvements for the area.

Access: Access is available from Richardson Highway, Chena Flood Road, and the Chena River Floodway.

Relationship to other Similarly Used Lands in the Vicinity: Nearby Alaska Department of Natural Resources (ADNR) and U.S. military lands provide access to some dispersed recreation activity. There is a designated public recreation area within Eielson AFB immediately south of the flood control project area. This area provides opportunities for fishing, boating, picnicking, camping, and trails use.

Applicable Clauses Affecting the Ownership: There are no known applicable clauses that would affect acquisition of the property.

Unusual Characteristics Reducing or Enhancing the Value of the Property: Portions of the parcel are within the Chena River Floodway, and may be subject to emergency flood conditions.

Twentythreemile Slough Area Trails

Size and Location: The multi-use trails total more than 30 miles in length, and are located along Piledriver Slough and Twentythreemile Slough west of Eielson AFB proper (Figure M-1). Most of the trails are upland of frozen sloughs and waterways. Trails would be crossed by all three of the Eielson alternative segments.

Ownership and Type of Section 4(f) Property: Trails are located on land owned by the U.S. Air Force, ADNR, U.S. Bureau of Land Management (BLM), FNSB, and private land. The trails are classified as "Class C" public trails by FNSB in its Comprehensive Recreational Trails Plan (FNSB, 1985, 2005; Hancock, 2007). "Class C" trails are defined as "neighborhood recreational trail systems" and are maintained by user groups – the Salcha Dog Mushers Association, in this instance. The trails would be considered direct use of Section 4(f) properties.

Function of the Property and Available Activities: The majority of trails are located on U.S. military land. This land functions first and foremost for military uses; however, the area includes a variety of recreational activities, including berry picking, picnicking, camping, canoeing, trapping, bird watching, and off-road vehicle (ORV) , snowmachine use, fishing, and hunting. Surrounding non-military public lands on which the trails are located are managed for general land use, including recreational use. The trails themselves are multi-use, but the primary activity is winter dog-sledding.

Description of Existing and Planned Uses: The trail system is managed for multi-use by a variety of recreationists. There are no planned additional facilities or improvements for the trail system.

Access: Access is available directly from Richardson Highway at multiple points and from secondary roads west of Richardson Highway on Eielson AFB. Individuals are required to obtain free permits from Eielson AFB prior to using Air Force lands for recreation activities.

Relationship to other Similarly Used Lands in the Vicinity: Multi-use trails exist within the Chena River Lakes Flood Control Project area. The floodway is located immediately north of the northernmost point of the proposed NRE, and accommodates a variety of trail-based recreation activities. A portion of the Fairbanks 100-mile Loop Trail follows a braided path through the floodway area. These trails are approximately 4.4 miles northwest of the Twentythreemile Slough trail system.

Applicable Clauses Affecting the Ownership: There are no known applicable clauses that would affect the property to be acquired.

Unusual Characteristics Reducing or Enhancing the Value of the Property: There are no unusual characteristics of the property.

Eielson AFB Outdoor Recreation Area

Size and Location: The recreation area is located directly across Richardson Highway from the Eielson AFB airfield (Figure M-2). The area totals approximately 22 acres in size, and includes several miles of access roads and trails. The larger undeveloped portion of Eielson AFB designated for recreation use would be crossed by all three Eielson alternative segments, while the more formal recreation area described in detail here would be crossed only by Eielson Alternative Segment 3.

Ownership and Type of Section 4(f) Property: The property is owned by the U.S. Air Force. The area would be considered both a direct and constructive use of Section 4(f) property.

Function of the Property and Available Activities: The area is designated for outdoor recreation use in the Eielson AFB Integrated Natural Resources Management Plan (USAF, 2003). The surrounding areas are designated for open space (Piledriver Slough area), fish and wildlife (Piledriver Slough itself and several small areas within recreation areas), and training areas (between Richardson Highway and recreation areas). The recreation area includes several lakes, campsites, picnic sites (including a picnic pavilion), a playground area, and access trails. Activities available in the recreation area and adjacent open space areas include berry picking, canoeing, trapping, bird watching, ORV, snowmachine use, dog-sledding, fishing, and hunting.

Description of Existing and Planned Uses: The area is currently used for recreational purposes. The lakes within the recreation area are currently stocked by the Alaska Department of Fish and Game (ADF&G). There are no planned additional facilities or improvements for the recreational use areas.

Access: Access is available directly from Richardson Highway at several points adjacent to the recreation area.

Relationship to other Similarly Used Lands in the Vicinity: Eielson AFB includes several other areas designated for recreational use east of Richardson Highway, including athletic fields, nature and cross-country ski trails, picnic areas, a skeet-shooting range, an archery range, a downhill ski area and winter sports area, and opportunities for hiking. North of the recreation areas, the Chena Lakes Flood Control Project Area is also open to dispersed, low-intensity public recreation (Slater, 2008).

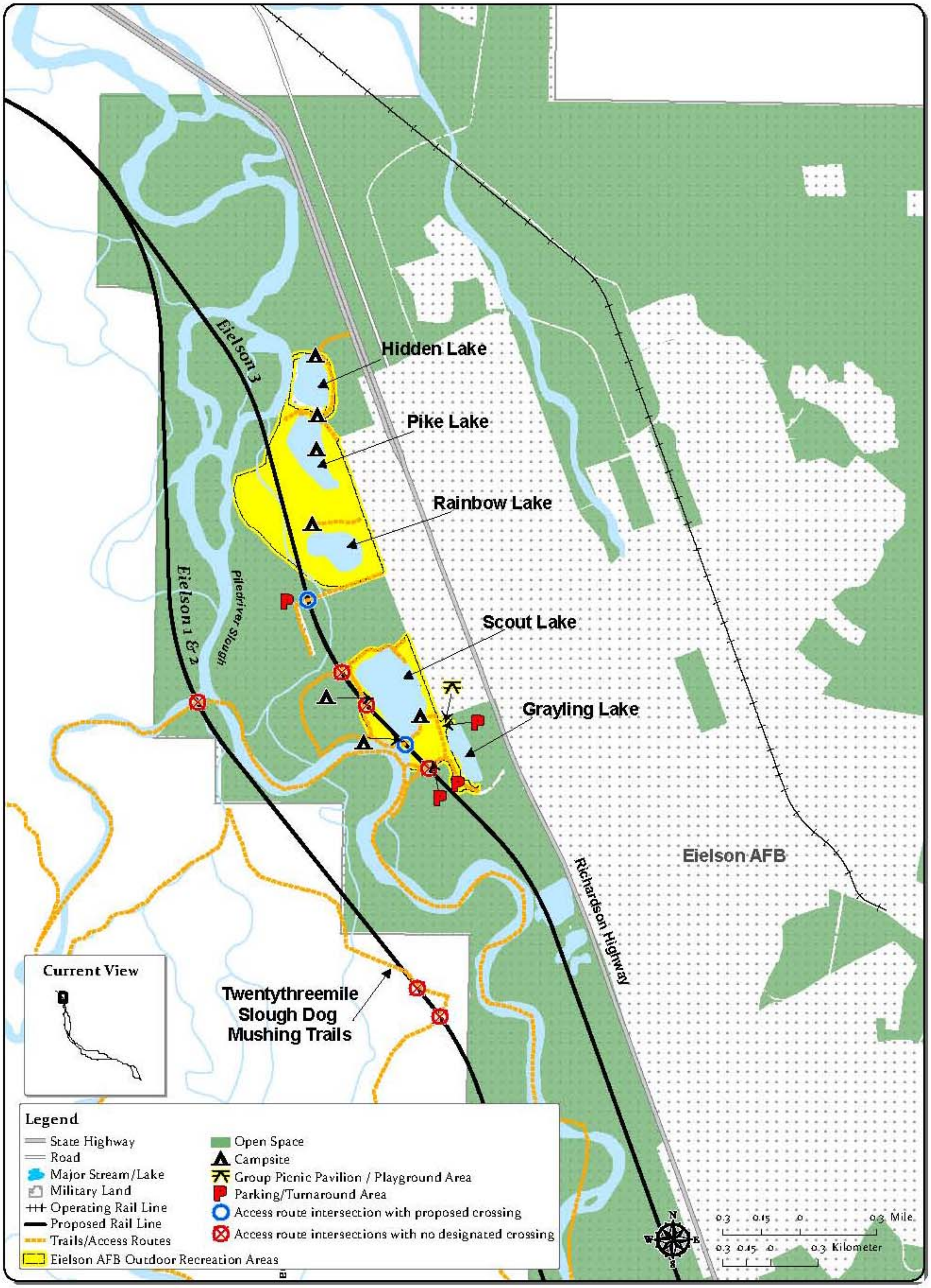

Figure M-2 – Map of Recreational Facilities along Eielson Alternative Segments 1, 2, and 3

Applicable Clauses Affecting the Ownership: There are no known applicable clauses that would affect the property to be acquired.

Unusual Characteristics Reducing or Enhancing the Value of the Property: There are no unusual characteristics of the property.

Salcha Elementary School Grounds and Salcha Ski Area

Size and Location: Salcha Alternative Segment 2 would cross the Salcha Elementary School grounds and an adjacent public ski area approximately 1 mile north of the Salcha River (Figures M-3 and M-4). The school and trails are adjacent to Richardson Highway. The school includes recreational features, totaling approximately one-half acre. School grounds are open for public use on a first-come, first-serve basis any time they are not being used by the school or school district personnel (Vargo, 2008). The ski area includes multi-use trails totaling 15 kilometers, and a start/finish and stadium area just north of the school totals approximately 2.2 acres.

Ownership and Type of Section 4(f) Property: The school, recreation facilities, and ski area are all located on land owned by FNSB, Department of Land Management. The ski trail and school grounds would be considered a direct use of Section 4(f) property.

Function of the Property and Available Activities: The school recreation fields and facilities function to provide physical education opportunities to students of Salcha Elementary School, and for members of the public when not in use for school activities.

This is also a primary purpose of the ski trails. Available activities on the school grounds include organized sports such as baseball, soccer and basketball, as well as a playground area. The Salcha Ski Area trails are multi-use running, hiking, and skiing trails. The Salcha Ski Area also functions to provide recreational opportunities to the general public, and to host competitive events.

Description of Existing and Planned Uses: Existing uses on the school grounds include a ballfield, a basketball court, a playground area, several outbuildings that house recreational equipment, a public parking/turnaround area, and the school itself. The ski area includes a large open start/finish and stadium area, several small structures that house recreational equipment, and the multi-use trails. No other uses are known to be planned for the site at this time.

Access: The school grounds and ski area are easily accessible directly from Richardson Highway. The school parking lot is used by the general public for accessing the ski area.

Relationship to other Similarly Used Lands in the Vicinity: A system of multi-use trails exists near Eielson AFB to the north; however, these are used primarily for dog-sledding. FNSB maintains a groomed trail system at Birch Hill Recreation Area north of Fairbanks; this site is approximately 35 miles north of Salcha School.

Applicable Clauses Affecting the Ownership: The Salcha Ski Area is recognized in the FNSB Comprehensive Recreational Trails Plan.

Unusual Characteristics Reducing or Enhancing the Value of the Property: No known unusual characteristics exist regarding the school or trail system.

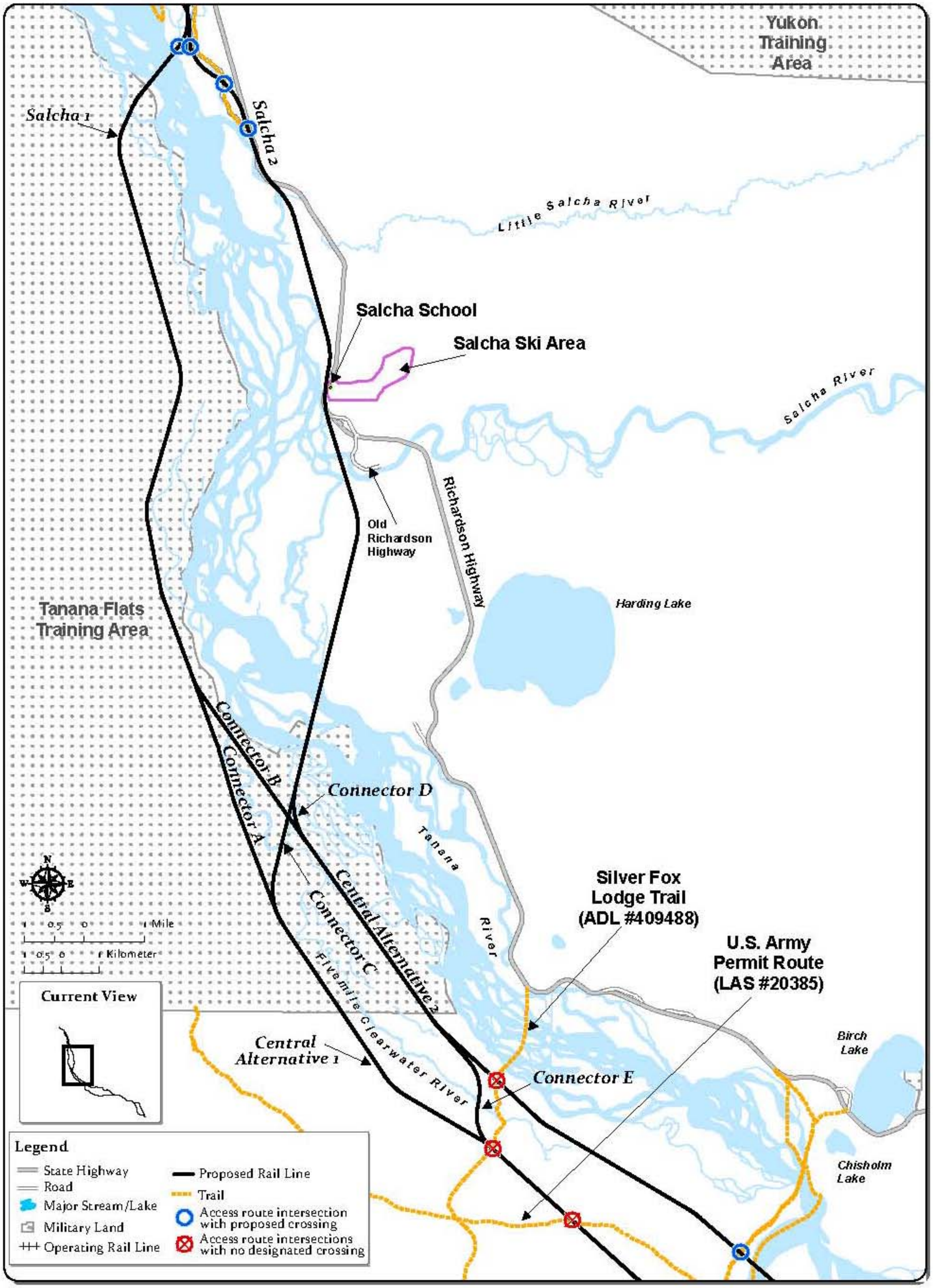

Figure M-3 – Map of Recreational Facilities along the Salcha, Connector, and Central Alternative Segments 1 and 2

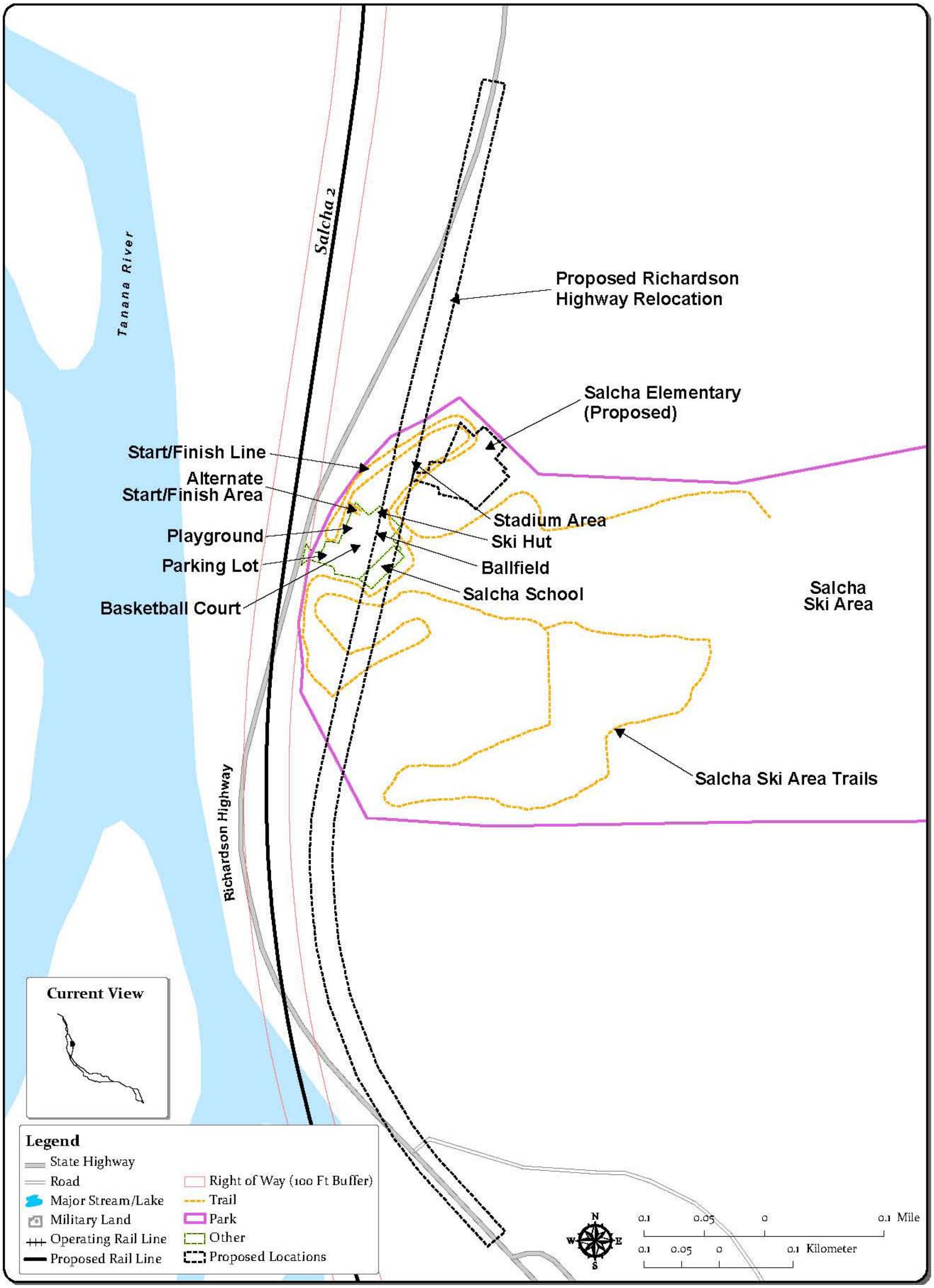

Figure M-4 - Map of the Salcha Elementary School Grounds and Skiing Area

Silver Fox Lodge Trail

Size and Location: Donnelly Alternative Segments 1 and 2 would cross an ADNR trail approximately 1.3 miles southeast of the Central alternative segments (Figures M-5 and M-6). The trail is approximately 6.1 miles long, and leads south from the Silver Lake Lodge historical site along Richardson Highway (about 5 miles south of Harding Lake).

Ownership and Type of Section 4(f) Property: The trail crosses the Tanana River and is located on ADNR land south of the river. It provides access to state land disposals[3] along the Fivemile Clearwater River, so portions of the trail may intersect some land now in private ownership. The portions of the trail that cross land in private ownership are not protected under Section 4(f). The trail is established and recognized by the ADNR (lease assignment, or ADL lease number 409488). The trail would be considered a direct use of Section 4(f) property.

Function of the Property and Available Activities: The trail functions to provide public access across the Tanana River to areas surrounding the Fivemile Clearwater River. The trail also provides public access to ADNR lands further west (Japan Hills, North Slope of the Alaska Range), which may otherwise be inaccessible due to the military lands to the north and south of this site.

Description of Existing and Planned Uses: The trail is multi-use. ADNR land surrounding the trail is designated for forestry and wildlife habitat uses in the Tanana Basin Area Plan. One management subunit contains accessible white spruce stands, and forestry activity has been ongoing. No other planned uses are known for this trail and its immediate vicinity.

Access: This area is remote and roadless. Access to the area is mainly available via the trail itself and the Fivemile Clearwater River.

Relationship to other Similarly Used Lands in the Vicinity: Although another established and recognized trail exists nearby (see Koole Lake Trail, located approximately 5.3 miles southeast), no other trail or road provides access to the private forestry lands adjacent to the trail.

Applicable Clauses Affecting the Ownership: This trail is established and recognized by the ADNR with a lease assignment number.

Unusual Characteristics Reducing or Enhancing the Value of the Property: No known unusual characteristics exist regarding this trail.

Koole Lake Trail (Donnelly-Washburn Trail)

Size and Location: Donnelly Alternative Segments 1 and 2 would cross segments of winter trails at four points (Figure M-5). These trails were established by ADNR, Revised Statute 2477 (RS 2477)[4], and ADF&G (ADNR, 2001; Durst, 2008). Donnelly Alternative Segment 1 would also cross a U.S. Army permit route across ADNR land at one point (Taylor, 2008). The trails are

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[3] The Department of Natural Resources has the authority under Alaska Statute 38.05.035(e) to sell state land for private ownership if determined to be in the best interest of the state. These sales are referred to as “land disposals.”

[4] RS 2477 is found in section 8 of the Mining Law of 1866. The statute grants the right-of-way for construction of foot trails, pack trails, sled dog trails, and other corridors for transportation over public land, not reserved for public uses. Under the statute, people created legal right-of-way by using or constructing routes across unreserved federal land. Once a right-of-way was established, it became a valid, existing right owned by the state. Typically, RS 2477 rights-of-way are available for public use under ADNR’s regulations (ADNR, 2001).

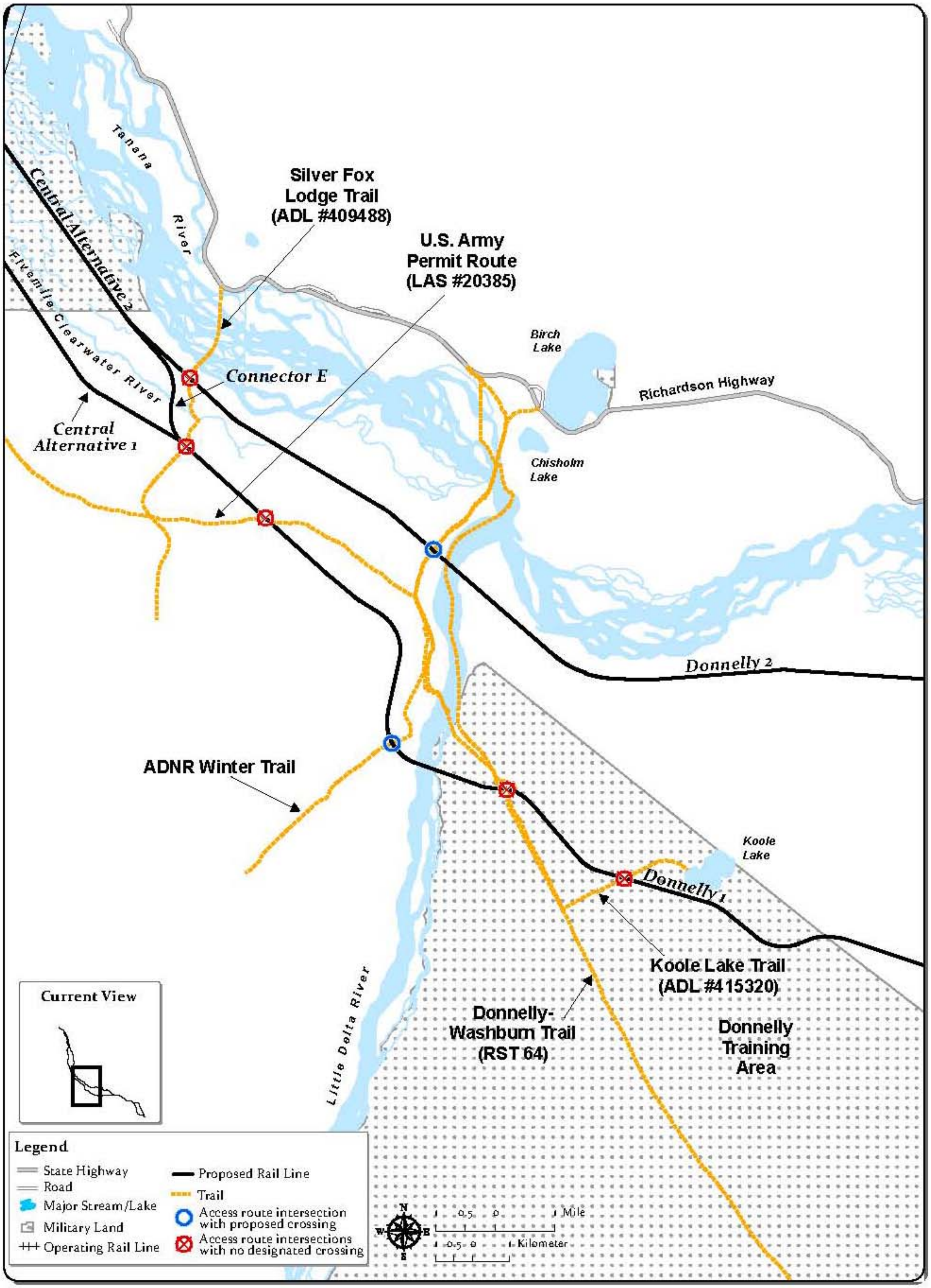

Figure M-5 – Map of Recreational Facilities along Donnelly Alternative Segments 1 and 2

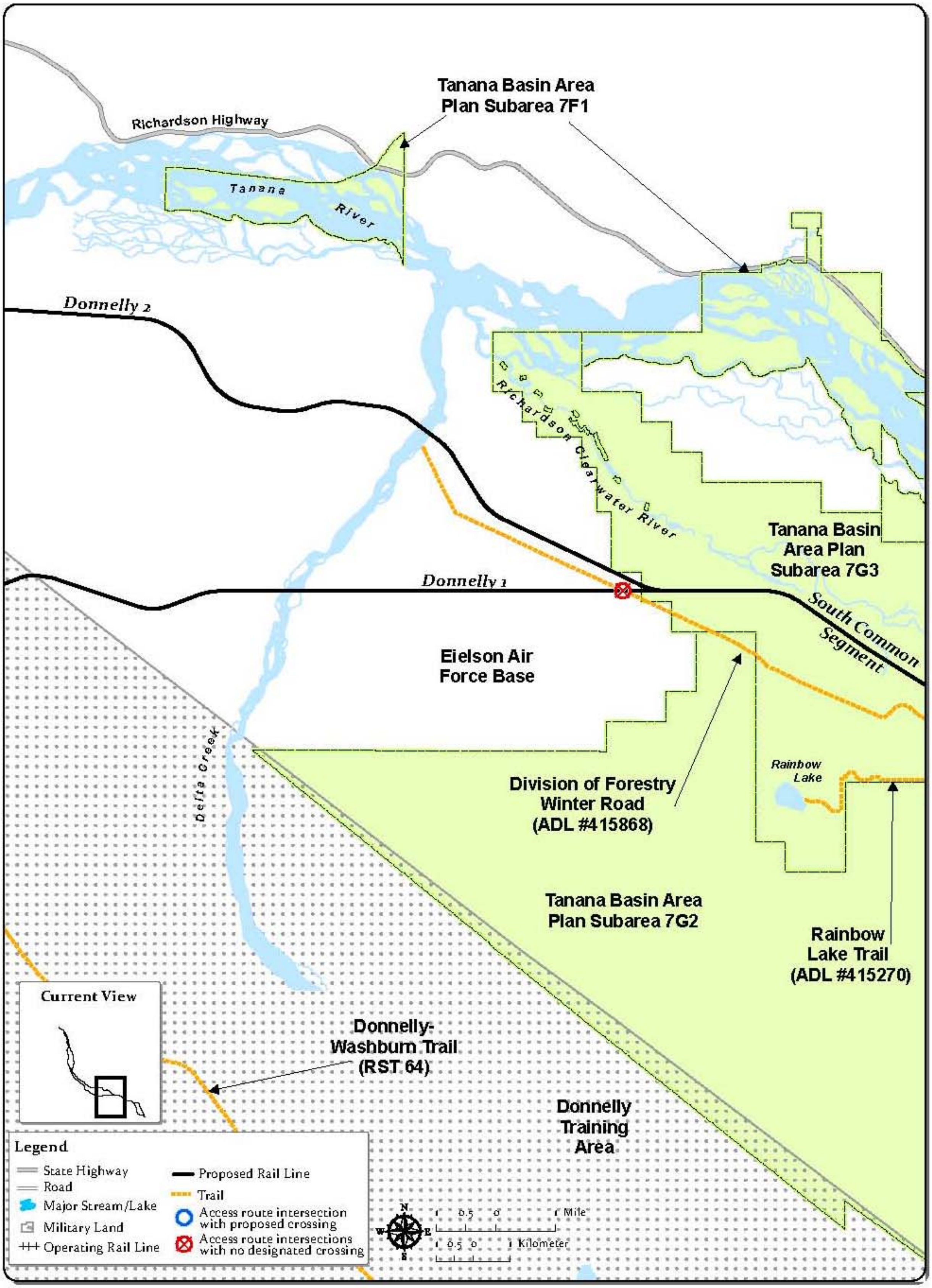

Figure M-6 – Map of Recreational Facilities along Donnelly Alternative Segments 1 and 2 and South Common Segment

located on both the east and west sides of the Little Delta River, on the west side of the Tanana River.

The ADF&G trail (Koole Lake Trail) collocates with the RS 2477 trail (Donnelly-Washburn Trail) from a trailhead at Richardson Highway near Birch Lake south along the western bank of the Little Delta River, crossing the Little Delta to a point within the Donnelly Training Area (TA). At this point, the Koole Lake Trail diverges toward Koole Lake and the Donnelly-Washburn Trail continues to the southeast through the Donnelly TA.

The ADNR Winter Trail collocates with the Koole Lake Trail and Donnelly-Washburn Trail from the Birch Lake trailhead along the western bank of the Little Delta River, at which point the Koole Lake/Donnelly-Washburn trail crosses the Little Delta River toward the Donnelly TA. The ADNR Winter Trail continues southwest through ADNR land on the western side of the Little Delta River. The U.S. Army trail crosses the Little Delta River with the Koole Lake/Donnelly-Washburn Trail and collocates with all trails on the river's western bank for a stretch of approximately 1.5 miles, then diverges west across ADNR land toward the Tanana Flats Training Area (TA).

<u>Ownership and Type of Section 4(f) Property</u>: The trails cross land owned by the ADNR and the U.S. Army. The Donnelly-Washburn Trail is RS 2477 trail number 0064. The ADF&G trail has been validated with a 100-foot-wide easement held by the ADF&G (ADL File #415320, application complete but not yet issued). The ADNR Winter Trail does not have an ADNR permit, but appears on topographic maps and ADNR's Mapguide resource (Mapguide is an online mapping application identifying a variety of state lands managed for recreation, access, or other resource management purposes). The U.S. Army route permits access across ADNR land (case file LAS #20385). The rights-of-way (ROWs) are listed as "official" within ADNR lands, but this status does not cover areas where the trail crosses military land. The trails would be considered a direct use of Section 4(f) properties.

<u>Function of the Property and Available Activities</u>: The trails are multi-use, but primarily receive winter use, such as dog-sledding and snowmachining. Trails are located on both ADNR and U.S. Army land. ADNR land in this area is managed primarily for forestry and wildlife habitat according to the Tanana Basin Area Plan (ADNR 1991), while military land is primarily for military use, but is provisionally open to recreation activities. Activities facilitated via the trails include hunting, trapping, and fishing (Koole Lake is one of the ADF&G's remote stocked lakes). The U.S. Army permit route is used primarily to move vehicles and equipment between the Donnelly and Tanana Flats TAs in winter months, but it is open for public recreational use and provides access to ADNR lands from the Little Delta River.

<u>Description of Existing and Planned Uses</u>: The trails are designated as ADNR and ADF&G winter trails, and an RS 2477 trail. The U.S. Army permit route is not designated for public access, but public access is a generally-allowed use across ADNR-owned lands. There are no planned additional facilities or improvements for the trail system.

<u>Access</u>: Access to the trail system is available via a parking lot at Birch Lake, off Richardson Highway, and from the Tanana and Little Delta rivers. The trails cross the Tanana River, and are used primarily for winter access, as is the U.S. Army permit route.

<u>Relationship to other Similarly Used Lands in the Vicinity</u>: A similar ADF&G trail crosses the Delta River northwest of Delta Junction, and leads to Rainbow Lake, another of the ADF&G's remote stocked lakes. This trail is approximately 32 miles southeast of Birch Lake. An

established and recognized ADNR trail crosses the Tanana from the Silver Fox Lodge on Richardson Highway (several miles north of Birch Lake), providing access to a portion of the Fivemile Clearwater River and forestry areas. No other trail is known to provide access to Koole Lake.

Applicable Clauses Affecting the Ownership: The Koole Lake Trail, Donnelly-Washburn Trail, and U.S. Army permit route are established and recognized by the ADNR with a lease assignment or permit number. The Donnelly-Washburn Trail has RS 2477 status.

Unusual Characteristics Reducing or Enhancing the Value of the Property: Trails may not be as readily accessed outside of winter, when trail users are able to cross the frozen Tanana River.

ADNR Forestry Winter Road

Size and Location: Donnelly Alternative Segment 1 and South Common Segment would cross a winter road established by ADNR's Forestry Division approximately 0.6 miles before Donnelly Alternative Segment 1 and Donnelly Alternative Segment 2 reconnect (Donnelly Alternative Segment 1 crossing) and approximately 3.5 miles west of the Delta River (South Common Segment crossing) (Figure M-6). The road is approximately 14.8 miles long, and connects the Delta River and Delta Creek across the benchlands above the Richardson Clearwater River.

Ownership and Type of Section 4(f) Property: The trail is located entirely on ADNR-owned land. The trail is established and recognized by the ADNR (ADL# 415868). The trail would be considered a direct use of Section 4(f) property.

Function of the Property and Available Activities: The road provides public access to a number of public and commercial timber sales in the Tanana Flats, and is also used for recreational vehicle activity.

Description of Existing and Planned Uses: The road is multi-use. ADNR land surrounding the road is designated for forestry, wildlife habitat, public recreation, agriculture, and watershed uses in the Tanana Basin Area Plan (ADNR 1991). No other planned uses are known for this trail and its immediate vicinity.

Access: This area is remote and roadless. Access to the trail is via the Delta River, Delta Creek and a winter ice bridge across the Delta River.

Relationship to other Similarly Used Lands in the Vicinity: Although other established and recognized trails exist nearby (*e.g.*, Koole Lake Trail, Rainbow Lake Trail), no other trail or road provides access across the stretch of terrain between the Delta River and Delta Creek.

Applicable Clauses Affecting the Ownership: This road is established and recognized by the ADNR with a lease assignment number. All applicable ADNR management subunits crossed by the winter road reserve a 300-foot-wide ROW for the proposed NRE, according to the Tanana Basin Area Plan.

Unusual Characteristics Reducing or Enhancing the Value of the Property: No known unusual characteristics exist regarding this road.

Rainbow Lake Trail

Size and Location: South Common Segment would cross an approximately 10-mile long ADF&G winter trail located northwest of the City of Delta Junction (Figure M-6). The trail crosses the Delta River via an ice bridge.

Ownership and Type of Section 4(f) Property: The Rainbow Lake Trail crosses land owned by ADNR. The trail has been validated with a 100-foot-wide easement held by ADF&G (ADL File #415270, issued 3/12/02). The trail would be considered a direct use of Section 4(f) property.

Function of the Property and Available Activities: The trail functions to provide public access to Rainbow Lake, one of ADF&G's remote stocked lakes. Activities include fishing, hunting, trapping, as well as recreational vehicle use, dog-sledding, and cross-country skiing.

Description of Existing and Planned Uses: Rainbow Lake Trail is multi-use. ADNR land surrounding the road is designated for forestry, wildlife habitat, public recreation, agriculture, and watershed uses in the Tanana Basin Area Plan (ADNR, 1991). There are no planned additional facilities or improvements for the trail system.

Access: Access is available from Old Richardson Highway and an ice bridge across the Delta River, approximately 6.5 miles north of Delta Junction.

Relationship to other Similarly Used Lands in the Vicinity: Established and recognized trails are available nearby (*e.g.*, Koole Lake Trail, ADNR Forestry Winter Road, and Phillips Road); however, no other established trail provides access to Rainbow Lake.

Applicable Clauses Affecting the Ownership: This trail is established and recognized by ADNR with a lease assignment number. All applicable ADNR management subunits crossed by the trail reserve a 300-foot-wide ROW for the proposed NRE, according to the Tanana Basin Area Plan.

Unusual Characteristics Reducing or Enhancing the Value of the Property: No known unusual characteristics exist regarding this road.

Phillips Road/Delta Junction Area Trail Network

Size and Location: Delta Alternative Segment 2 would cross a winter trail established by the ADNR approximately 2.5 miles north of Delta Junction (Figure M-7). The trail is approximately 5.3 miles long, and connects to a larger trail network in the Big Delta Area.

Ownership and Type of Section 4(f) Property: The trail is located on ADNR land interspersed with many private agricultural landholdings. The trail is established and recognized by the ADNR (ADL# 400064). The trail would be considered a direct use of Section 4(f) property.

Function of the Property and Available Activities: The trail functions as a recreational resource. Activities include snowmachining, dog-sledding, cross-country skiing and non-winter motorized and non-motorized vehicle uses.

Description of Existing and Planned Uses: The trail is multi-use. ADNR land in the vicinity is designated for agriculture and settlement uses in the Tanana Basin Area Plan (ADNR, 1991). Most areas adjacent to the trail are agricultural fields. No other planned uses are known for this trail and its immediate vicinity.

Access: The trail is easily accessible from Jack Warren Road and secondary roads off Richardson Highway.

Relationship to other Similarly Used Lands in the Vicinity: Other established and recognized trails exist nearby (*e.g.*, Koole Lake Trail, ADNR Forestry Winter Road, Rainbow Lake Trail). However, all other established trails are on the undeveloped side of the Tanana River, and are generally less accessible than this trail system. A large group of trails exist to the south and southeast of this trail.

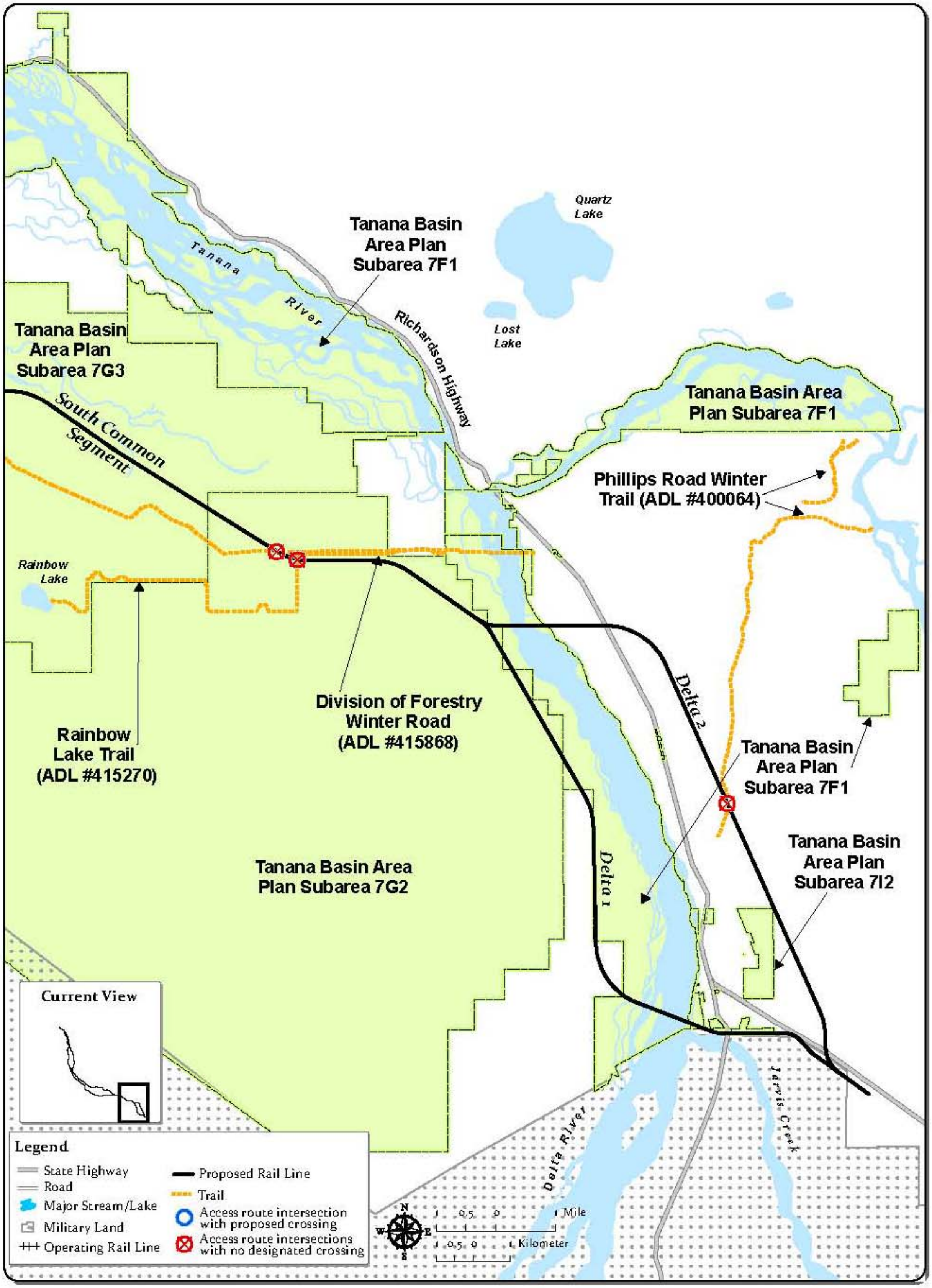

Figure M-7 – Map of Recreational Facilities along South Common and Delta Alternative Segments 1 and 2

Applicable Clauses Affecting the Ownership: This trail is established and recognized by ADNR with a lease assignment number.

Unusual Characteristics Reducing or Enhancing the Value of the Property: There are no known unusual characteristics that exist regarding this trail.

Dispersed Use Areas

Areas where dispersed recreation takes place represent the vast majority of lands that would be crossed by the proposed project and its alternatives. Section 4(f) applies to lands that are narrowly defined as parks and recreation areas, but also includes areas that have been officially designated as important recreational resources or have recreation activities as primary uses. Dispersed use areas specifically designated for recreation as a primary use would be crossed by Donnelly Alternative Segment 1, Donnelly Alternative Segment 2, South Common Segment, Delta Alternative Segment 1 and Delta Alternative Segment 2.

Size and Location: Parcels total in the thousands of acres and are located at many points along the proposed project route. ADNR parcels in this analysis include Tanana Basin Area Plan management subunits 7F1 (Delta River from Tanana River south to Delta Junction), 7G2 (west of Delta River, north of Donnelly TA), 7G3 (Richardson Clearwater River area, east of Delta Creek and west of Delta River), and 7I2 (small parcels south of Delta Junction and east of Delta River).

Ownership and Type of Section 4(f) Property: These lands are owned by the ADNR. These areas would be considered a direct use of Section 4(f) properties.

Function of the Property and Available Activities: These areas can be characterized as vast and remote. They are open to a variety of public uses, with recreation one among many. Recreation on these lands includes dog-sledding, cross-country skiing, snowshoeing, fishing and ice fishing, hunting, trapping, snowmachining, camping, cabin stays, sightseeing, berry gathering, hiking, wildlife and botanical viewing, boating (both non-motorized and motorized), water skiing, and swimming. The ADNR management subunits discussed here are designated for public recreation as a primary use in the Tanana Basin Area Plan.

Description of Existing and Planned Uses: The ADNR parcels are designated for public recreation use, in addition to several other uses (forestry, wildlife habitat, agriculture, and watershed). ADNR lands are occasionally subject to land disposals. No land disposals are known to be in planning for these subunits within the ROW. There are no known planned additional recreational facilities or improvements for these areas.

Access: The ADNR parcels west of the Tanana River are accessible to the public via boat, ORV and foot during summer months, and snowmachine, dog sled, and cross-country skis during the winter. Tributaries to the Tanana River provide access to backcountry areas in both winter and summer. These lands may also be accessed via airplane. ADNR subunit 7I2 (south of Delta Junction) is accessible via side roads off Richardson Highway and undesignated trails that parallel Jarvis Creek.

Relationship to other Similarly Used Lands in the Vicinity: Similar ADNR land, FNSB land, and military areas along the proposed alternative segments exist in proximity to these areas; however, recreation is not their primary use. Much of the land on the east side of the Tanana River (adjacent to Richardson Highway) exhibits similar use designations and recreational opportunities.

Applicable Clauses Affecting the Ownership: Several ADF&G and ADNR trail easements cross through these areas (see Koole and Rainbow Lake Trails, and ADNR Forestry Winter Road, above). These trails are shown on Alaska State Lands Records maps. At least one of the trails is listed as an RS 2477 trail. The Tanana Basin Area Plan specifies that management subunits 7F and 7G would reserve a 300-foot-wide ROW for the proposed NRE.

Unusual Characteristics Reducing or Enhancing the Value of the Property: No known unusual characteristics exist at this time for general use lands.

M.3.2 Wildlife or Waterfowl Refuges

No wildlife or waterfowl refuge would be affected by the proposed NRE; therefore, no Section 4(f) analysis is required for this type of resource.

M.3.3 Cultural Resource Areas

Cultural resources known to exist from previous surveys and historic documentation were reviewed for their proximity to the Area of Potential Effect (APE). The area was also surveyed for cultural resources, using a site location model to guide the survey methods used. Areas determined to be of high potential for the discovery of archaeological resources were examined with subsurface testing, and determinations of eligibility for the NRHP were made for identified resources. A full description of cultural resources findings and the analysis process can be found in Chapter 6 of the EIS.

Surveys for the proposed NRE identified 51 archaeological sites that are considered eligible for the NRHP under Criterion D, for their potential to yield information important to history or prehistory. In the case of archaeological sites, Section 4(f) applies to those sites that are on or eligible for inclusion in the NRHP and that warrant preservation in place. It does not apply to sites that are eligible only for their research potential. Two sites were identified in the APE that may be eligible under criteria A and B, and that could warrant preservation in place (sites XBD-293 and XBD-294). Both sites are along Salcha Alternative Segment 2. More information is needed to complete a determination of eligibility for these sites, but they are treated here, based on preliminary determinations, as if they are eligible for protection under Section 4(f).

Salcha Alternative Segment 2 Area of Potential Effect

Size and Location: Two historic archaeological sites have been identified within the APE associated with Salchaket Village. Site size has not been fully determined, as archaeological surveys were limited. The Salchaket Village site is located near the mouth of the Salcha River.

Ownership and Type of Section 4(f) Property: Property along Salcha Alternative Segment 2 includes land owned by the ADNR, FNSB, the University of Alaska, the Alaska State Mental Health Trust, and private owners. The historic sites associated with Salchaket Village require further analysis to fully determine eligibility, but would likely qualify for inclusion in the NRHP under Criteria A, B, and D. Criterion A includes resources associated with significant events in history, and Criteria B includes resources associated with the lives of persons significant in the past. These sites would be considered direct use Section 4(f) properties.

Function of the Property and Available Activities: The Tanana Basin Area Plan designates land near the mouth of the Salcha River primarily for wildlife habitat and secondarily for public recreation. A wide variety of activities may occur on these lands.

Description of Existing and Planned Uses: Salcha Alternative Segment 2 lies within areas having high potential for both prehistoric and historic sites. There are no known planned additional recreational facilities or improvements for these areas.

Access: Access is available to this area via Richardson Highway and secondary roads near the Town of Salcha.

Relationship to other Similarly Used Lands in the Vicinity: Ten other prehistoric and historic sites are known to exist between 100 and 500 meters from the APE.

Applicable Clauses Affecting the Ownership: There are no known applicable clauses that would affect the property to be acquired.

Unusual Characteristics Reducing or Enhancing the Value of the Property: There are no known unusual characteristics associated with the property.

M.4 Impacts to Section 4(f) Resources

Impacts to Section 4(f) resources were evaluated for each proposed alternative segment. This section presents the potential impacts to park and recreation areas and cultural resources as a result of the proposed project.

M.4.1 Park and Recreation Areas

Chena River Lakes Flood Control Project

North Common Segment tracks in a southeastern direction across this area, affecting approximately 14.3 acres within the Chena River Lakes Flood Control Project. Construction would result in a temporary suspension of recreational activities. Construction and operation would likely result in clearance and maintenance of a 200-foot-wide ROW. The associated vegetation clearance would be a highly-visible line of deforestation which could reduce user enjoyment of the area, and could decrease the game productivity if this area is used for hunting. However, analysis of aerial photography shows that the area is already affected by substantial maintained vegetation lines along the flood project, and is also subject to other visual features such as roads, levees, and ARRC's existing Eielson Branch. The visual impact of the new ROW to this recreational area would be consistent with other features that currently make this area uncharacteristic of a natural or wilderness setting.

Twentythreemile Slough Area Trails

All three Eielson alternative segments would cross trail segments at numerous points, many of which are the same, as Eielson Alternative Segments 1 and 2 collocate for several miles toward their northern ends, and Eielson Alternative Segments 2 and 3 collocate toward the south. In addition, Salcha Alternative Segment 2 crosses trail segments in the Twentythreemile Slough area. These trails are heavily used for dog-sledding, and any at-grade interactions between dog teams and trains would pose public safety concerns. Most trails are located upland of sloughs and waterways, though some are located on frozen waterways. Construction activities would likely result in temporary closure of both types of trails. For operational impacts, a permanent rail line could serve as a barrier for both waterway trails and land trails, depending on whether adequate clearance or at-grade crossings are made available. The presence of a new rail line would likely detract from user enjoyment of the trail resource, in that a highly visible line of deforestation would be introduced to the area, and the rail line would also be a source of intermittent noise. Ambient noise levels in the vicinity of Eielson AFB are relatively high due to the proximity of Richardson Highway and aircraft operations. The STB does not consider trails a sensitive receptor, and some trail activities (such as snowmachine use) are themselves substantial sources of noise.[5]

Eielson AFB Outdoor Recreation Area

Eielson Alternative Segment 3 would directly cross portions of the designated outdoor recreation areas. Eielson Alternative Segment 3 would be west of the stocked lakes and permanent recreation facilities (campgrounds, picnic sites and playground); however, it would cross trails or access routes at five points. Two of these – a road south of Rainbow Lake, and a road south of Scout Lake – have been proposed by the ARRC for at-grade crossings, so no long-term access impacts would be expected at these sites. Construction impacts would be similar to those described for Twentythreemile Slough Area Trails. Three access roads/trails (two west of Scout Lake, one west of Grayling Lake) would be crossed by Eielson Alternative Segment 3 and are not currently proposed as accessible crossings by ARRC; the rail line would prevent crossing by vehicles and pedestrians.[6]

Eielson Alternative Segment 3 ROW would cross the southwestern corner of Scout Lake. This 0.85-acre portion of the lake could be filled to create a stable railbed. Fill activities could result in increased turbidity and decreased lake area (corresponding to decreased fish habitat) in Scout Lake, which is stocked by ADF&G.

Eielson Alternative Segment 3 would cross a parking/turnaround area for the access route west of Grayling Lake. This trail is primarily used by fishermen and hand-carry canoeists accessing Piledriver Slough. The parking lot is within a portion of the proposed 200-foot rail ROW, and the space available for parking could be diminished.

Eielson Alternative Segment 3 would pass in proximity to several campsites located among the various lakes. The closest is located approximately 100 feet from the proposed 200 foot ROW, on the west side of Scout Lake. The access road to this campsite is well within the ROW, and access to this campsite could be affected during both construction and operation. The access road to a campsite on the southern end of Scout Lake would be similarly affected. Users of campsites and the recreation area in general would experience impacts including increased noise and visible deforestation. Two campsites are within the affected area that could experience high-intensity locomotive horns, a safety-related requirement for the proposed at-grade crossings west of Scout Lake. Two other campsites (east side of Scout Lake and in the center of Rainbow Lake) are just on the edge of the whistle zone.[7]

Salcha Elementary School Grounds and Salcha Ski Area

Construction and operation of Salcha Alternative Segment 2 would require the re-routing of Richardson Highway through the public school grounds and portions of the ski area and its trails.

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[5] Section 4(f) defines noise impacts as a “constructive use,” with the significance criteria as an effect that would “substantially impair” the resource. The STB considers an adverse noise impact as exposure to “day night level” (DNL) of 65 decibels or greater in combination with an increase (compared to current conditions) of at least 3 decibels. See Chapter 9 and Appendix J for a full description of noise impacts and methodology. This measure is considered an adverse impact and not “substantial impairment” in the context of Section 4(f).

[6] State law prohibits individuals, dog-sleds, or vehicles from crossing the ROW except at designated crossings.

[7] “Whistle zone” refers to the 65 DNL noise contour, inside of which sensitive receptors would be affected by a noise level of 65 decibels in combination with an increase of at least 3 decibels above existing conditions. See Chapter 9 for noise contour maps.

The proposed re-routing would directly affect the school's outdoor ballfield, several outbuildings that house recreation equipment and the school itself. The re-routed highway would bisect the existing school, as well as the existing public parking area, basketball court, and playground area. These facilities would likely be moved slightly to the east to different parts of the school property.

The highway re-routing would directly affect the start/finish stadium portion of the ski area and several trails, including the Lower Loop and the Fall Loop. The proposed relocation of the school grounds and facilities would subsequently affect another portion of the start/finish stadium area. These actions would require the closure of the stadium area in its current location and prevent access to trails. As mentioned above, the highway re-route would affect the school parking area, which also serves the general public to access the ski area.

Silver Fox Lodge Trail

Donnelly alternative segments would both cross this trail several miles northwest of the Little Delta River. Construction and operational impacts are similar to those listed for the Twentythreemile Slough trail system. User enjoyment would also be similarly affected. ARRC has not proposed any designated trail crossings for either alternative segment, without which public access would be prevented on this established and recognized ADNR trail.

Koole Lake Trail (Donnelly-Washburn Trail)

Donnelly Alternative Segment 2 would cross the collocated ADNR Winter /Koole Lake/Donnelly-Washburn Trail approximately 1.3 miles southwest of the Tanana River. ARRC has proposed a public crossing at this intersection. An appropriately-designed crossing serving the multiple uses of the trail would have no impact on long-term public recreation access.

Donnelly Alternative Segment 1 would cross the ADNR Winter Trail approximately 4.75 miles south of the Tanana River; ARRC has proposed a public crossing at this intersection. An appropriately-designed crossing serving the multiple uses of the trail would have no impact on public recreation access.

Donnelly Alternative Segment 1 would cross the U.S. Army permit route approximately 1.85 miles south of the Tanana River and 3 miles west of the Little Delta River; it would cross the collocated Koole Lake/Donnelly-Washburn Trail approximately 1.25 miles east of the Little Delta River; and it would cross the Koole Lake Trail approximately 3.15 miles east of the Little Delta River. No public crossings have been proposed by ARRC for these routes. Without designated crossings, public access on these trails would be prevented.

For all trails, construction and operational impacts would be similar to those listed for the Twentythreemile Slough trail system. User enjoyment would also be similarly affected.

ADNR Forestry Winter Road

Donnelly Alternative Segment 1 and South Common Segment would cross this route at two different points (Donnelly Alternative Segment 1 crossing approximately 5.5 miles east of Delta Creek; South Common Segment crossing approximately 3.5 miles west of the Delta River). Construction and operational impacts are similar to those listed for the Twentythreemile Slough trail system. User enjoyment would be similarly affected. ARRC has not proposed designated trail crossings for either intersection, without which public access would be prevented on this established and recognized ADNR trail.

Rainbow Lake Winter Trail

South Common Segment would cross this trail at one point, approximately 0.3 miles southeast of the point where the South Common Segment would cross the ADNR Forestry Winter Road. Construction, operations, and user enjoyment impacts would be similar to the Twentythreemile Slough trail system. ARRC has not proposed designated trail crossings at this intersection, without which public access would be prevented on this established and recognized ADNR and ADF&G trail.

Phillips Road/Delta Junction Area Trail Network

Delta Alternative Segment 2 would cross this trail approximately 2.5 miles north of Delta Junction. Construction and operational impacts are similar to those listed for the Twentythreemile Slough trail system. User enjoyment would be similarly affected. ARRC has not proposed a designated crossing for this intersection, without which public access would be inhibited on this established and recognized ADNR trail.

Dispersed Use Areas

Dispersed use areas would be affected through ROW clearance activities, similar to the Chena River Flood Control Project. Donnelly and Delta alternative segments and South Common Segment would affect the dispersed use areas. Areas open to recreation could be temporarily disrupted during the construction period. Operation issues could include limited access or access prevention across these lands, which are used for a variety of recreation activities. Individuals and vehicles would not be allowed to cross the rail ROW at undesignated crossing points. Although crossing would be likely to occur, it would be illegal and individual recreationists could be subject to enforcement penalties.

M.4.2 Cultural Resource Areas

Salcha Alternative Segment 2 exhibited cultural resource sites that could be protected under Section 4(f). Field investigations may identify additional, as yet undiscovered, archaeological resources that may be eligible for the NRHP.

Cultural resources can be directly damaged (adversely effected) in a number of ways. Removal of surface artifacts, surface disturbance (resulting in artifact and feature dislocations), subsurface disturbance, and contamination of organic residues, such as hearths and fauna, are major types of direct impacts.

Construction-related direct impacts could result from construction of the main track segments and related facilities. Temporary direct impacts could result from construction camps, construction staging areas, and temporary construction bridges.

Operations impacts would result from replacement/repair of rail components (main track rail, sidings, buildings, bridges, *etc*.), acquisition of additional borrow materials, possible wrecks or spills from railcars and subsequent clean-up operations, and other activities resulting in ground-disturbing impacts.

Indirect (and cumulative) impacts can be divided into two categories: access-related impacts (including other uses of the NRE access routes) and erosion. With the exception of public and private crossings, access to the proposed NRE ROW and access road would require a permit from ARRC. However, it is likely that some unauthorized use would occur. These unauthorized uses of the rail line ROW and access road could increase recreational use in this area, such as hunting and hiking, and use of ORVs. These activities can lead to increased site vandalism, removal of artifacts, and adverse effects from increased camping. Additionally, construction of the project could alter the watershed and groundwater in the area, leading indirectly to changes in soils and, by extension artifacts.

M.4.3 Summary of Impacts to Section 4(f) Resources

Table M-2 provides a comparison of impacts to Section 4(f) resources by alternative segment. Effects to trails were measured in linear feet of impact and the number of recreation access route intersections, and impacts to recreation areas was measured by the number of acres affected. Cultural resource areas are presented by the number of confirmed historic sites potentially affected by the project.

M.5 Avoidance Alternatives

This section provides a discussion of avoidance alternatives considered early in the project development process, and potential avoidance techniques applied to the alternative segments considered in detail in the EIS.

All alternative segments considered in this analysis are considered feasible because they can be designed and built. An alternative that is not prudent could be eliminated from consideration for the following reasons:

- It involves extraordinary operational or safety problems;
- There are unique problems or truly unusual factors present with it;
- It results in unacceptable and severe adverse social, economic or other environmental impacts;
- It would cause extraordinary community disruption;
- It has additional construction costs of an extraordinary magnitude; or
- There is an accumulation of factors that collectively, rather than individually, have adverse impacts that present unique problems or reach extraordinary magnitudes.

M.5.1 Alternatives Eliminated from Detailed Study

A number of alternatives were considered early in the National Environmental Policy Act (NEPA) process but were eliminated from further consideration. Chapter 2 discusses the process of narrowing the alternatives, and Table 2-1 summarizes 13 alternatives eliminated from consideration. None of those alternatives provides a clear advantage under the criteria of Section 4(f) for avoidance or minimization of Section 4(f) uses.

Two of the Eielson area alternatives, the one that suggests crossing to the western side of the Tanana River from the Eielson Farm Community and the one that would cross at the Chena River overflow, would need to pass through a considerable amount of the military's Tanana Flats TA. These alternatives are not feasible as the military has indicated that it would not allow that much intrusion into their TA. The other two Eielson alternative segments would bring the rail line eastward, through the Eielson AFB property. These alternatives are not feasible, as the military has expressed concerns of encroachment into runway taxi areas and that movement of trains through the base is highly undesirable. The related idea of continuing around the base to the east would add construction costs of an extraordinary magnitude.

Table M-2
Comparison of Potential Impacts per Alternative

Alternatives	Feasible and Prudent Alternative?[a]	Uses 4(f) Land? (Resource and Area Impacted)	Number of 4(f) Recreation Access Route Intersections[b]
No-Action Alternative	No	No	0
North Common Segment	Yes	- Chena River Flood Control Project (14.3 acres)	0
Eielson Alternative Segments			
Eielson Alternative Segment 1	--	- Twentythreemile Slough Dog-Sledding Trails (1,172.6 feet or 0.22 mile)	11
Eielson Alternative Segment 2	--	- Twentythreemile Slough Dog-Sledding Trails (1,728.61 feet or 0.33 mile)	8
Eielson Alternative Segment 3	--	- Twentythreemile Slough Dog-Sledding Trails (239.65 feet or 0.045 mile) - Eielson AFB Outdoor Recreation Area (21.79 acres)	6
Salcha Alternative Segments			
Salcha Alternative Segment 1	Yes	No	1
Salcha Alternative Segment 2	Yes	- Twentythreemile Slough Dog-Sledding Trails (567 feet or 0.11 mile) - Salcha School Grounds (0.93 acre) - Salcha Ski Area (3.45 acres and 1,254 feet of trails or 0.24 mile) - Salcha 2 Alignment cultural resource sites (2) within 100 meters of the APE	3
Connector A	Yes	No	0
Connector B	Yes	No	0
Connector C	Yes	No	0
Connector D	Yes	No	0
Central Alternative Segments			
Central Alternative Segment 1	Yes	No	0
Central Alternative Segment 2	Yes	No	0
Connector E	Yes	No	0
Donnelly Alternative Segments			
Donnelly Alternative Segment 1	--	- Silver Fox Lodge Trail (202 feet or 0.04 mile) - Koole Lake Trail (541 feet or 0.1 mile) - ADNR Forestry Winter Road (482 feet or 0.09 mile) - Donnelly-Washburn Trail (1,023 feet or 0.2 mile) - U.S. Army Permit Route (416 feet or 0.08 mile) - ADNR Winter Trail (201 feet or 0.04 mile) - ADNR Dispersed Use Areas (Public Recreation Primary Use) (10.5 acres)	6

Table M-2
Comparison of Potential Impacts per Alternative (continued)

Alternatives	Feasible and Prudent Alternative?[a]	Uses 4(f) Land? (Resource and Area Impacted)	Number of 4(f) Recreation Access Route Intersections[b]
Donnelly Alternative Segment 2	--	- Silver Fox Lodge Trail (216 feet or 0.04 mile) - Koole Lake Trail (226 feet or 0.04 mile) - Donnelly-Washburn Trail (200 feet or 0.04 mile) - ADNR Winter Trail (266 feet or 0.05 mile) - ADNR Dispersed Use Areas (Public Recreation Primary Use) (11.5 acres)	3
South Common Segment	Yes	- ADNR Forestry Winter Road (402 feet or 0.08 mile) - Rainbow Lake Trail (205 feet or 0.04 mile) - ADNR Dispersed Use Areas (Public Recreation Primary Use) (254.2 acres)	2
Delta Alternative Segments			
Delta Alternative Segment 1	--	- ADNR Dispersed Use Areas (Public Recreation Primary Use) (307 acres)	0
Delta Alternative Segment 2	--	- Phillips Road/Delta Junction Area Trail Network (503 feet or 0.1 mile) - ADNR Dispersed Use Areas (Public Recreation Primary Use) (28.5 acres)	1

[a] According to Federal Highway Administration's Section 4(f) Policy Paper, if all alternatives use Section 4(f) resources, a prudent and feasible avoidance alternatives analysis is not required (U.S. DOT, 2005).
[b] Includes both the recreation access route intersections with crossings proposed by ARRC and those that are not currently designated for crossings.

One of the potential Salcha area alternatives, called N1, would cross the Tanana River and run along the southwestern side of the river. This option, like those described earlier, would cross too much of the Tanana Flats TA, and is not feasible. The alternative known as N3 was an alignment on the eastern side of the river in the Salcha area. This alternative would affect the same Section 4(f) resources as the Salcha Alternative Segment 2, providing no avoidance scenario. Additionally, the alternative would impact 304 acres of wetlands and more directly affect the historic Salchaket Village, which are environmental impacts considered unacceptable. The alternative that suggests the rail alignment cross into the Tanana River channel to bypass Salchaket Village and the Flag Hill area before crossing back to the northeastern bank is not feasible due to the river hydraulics and shifting sands.

One alternative suggested following Richardson Highway all the way to Delta Junction but this alternative is not feasible to design due to topography and slope issues. The Blair Lakes Spur and the Alaska Range alternatives do not meet the project's purpose and need. Two alternatives in the Donnelly area would cross the same trails as Donnelly Alternative Segments 1 and 2, providing no avoidance option and also affecting more residential property, with the potential for safety issues in steep terrain.

Alternatives to the South Common Segment included routes further to the east and west. Alternatives east of the South Common Segment (formerly named S2 and Donnelly East) raised concerns regarding fish habitat along the Tanana River and also crossed the same trails as the South Common Segment. Alternative routes to the west encounter topography with poor geotechnical conditions for a rail line, and an option to route even farther southwest (formerly called S5) added considerable distance and cost and encroached on military training areas.

The Delta Central alternative would share some of the same Section 4(f) impacts of the Delta Alternative Segments 1 and 2 and involve greater adverse impacts to residential property and impacts to 40 percent more wetlands. For the reasons discussed above, none of the eliminated alternatives can provide avoidance or minimization options for Section 4(f) resources.

M.5.2 Avoidance Techniques by Alternative Segment

North Common Segment

This segment would affect Section 4(f) resources in the Chena River Flood Control Project. Avoidance of this resource would not be possible, as the North Common Segment bisects a large swath of Flood Control Project land, which cannot be avoided through minor route alteration or changes in the facility footprint.

Eielson Alternative Segments

These segments would affect Section 4(f) resources including Twentythreemile Slough Dog-Sledding Trails and Eielson AFB Outdoor Recreation Area. Avoidance of the Twentythreemile Slough Dog-Sledding Trails would not be possible, as trails are numerous on either side of the alternative segment and various trails cross the route at numerous points. Avoidance of the Eielson AFB Outdoor Recreation Area would not be possible, as segments cross Piledriver Slough and continue southward near Richardson Highway, which requires traversing Eielson AFB land.

Salcha Alternative Segments

Salcha Alternative Segment 1 would not affect Section 4(f) resources; therefore, avoidance measures would not be required. Salcha Alternative Segment 2 would affect Twentythreemile

Slough Dog-Sledding Trails, Salcha School, Salcha Ski Area, and cultural resource sites. Avoidance of the dog sled trail crossing would not be feasible, as it would require bridging several watercourses by continuing directly south, which would be cost prohibitive. Although Salcha School and Salcha Ski Area are grazed by the Salcha Alternative Segment 2 ROW, avoidance would not be possible, as the proposed segment would wrap around Salcha Bluff at this location, and topographic considerations dictate that the alternative segment would need to pass through this area to successfully navigate the bluff and the Salcha River to the south. Likewise, the connected action of re-routing Richardson Highway at the site (where it would directly cross both the school and ski area) would most likely be unavoidable, as the displaced road alternative segment could not shift away from the school to the west due to topography. The precise extent of cultural resource discoveries is not known; therefore site-specific avoidance measures cannot be determined at this time.

Connector Segments and Central Alternative Segments

These segments would not affect Section 4(f) resources; therefore, avoidance measures would not be required.

Donnelly Alternative Segments

Donnelly Alternative Segment 1 would affect Silver Fox Lodge, Koole Lake, Donnelly-Washburn, U.S. Army Permit Route, ADNR Winter Trail, ADNR Forestry Winter Road, and ADNR dispersed use recreation areas. None of the trails could be avoided without substantial route alterations. Although only a small portion of dispersed use recreation areas would be affected, avoidance would not be possible as Donnelly alternative segments would eventually need to connect with the South Common Segment, which ends within a dispersed use area.

South Common Segment

This segment would affect ADNR Forestry Winter Road, Rainbow Lake Trail, and ADNR dispersed use recreation areas. The trails extend from the Tanana River and cannot be avoided, as routes further south and west, away from the trails, are not feasible. South Common Segment passes entirely through dispersed use recreation areas, so avoidance would not be possible.

Delta Alternative Segments

Delta alternative segments would affect ADNR dispersed use recreation areas. Additionally, Delta Alternative Segment 2 would affect Phillips Road Winter Trail. Total avoidance would not be possible as the segments traverse a long stretch of dispersed use area. Avoidance of the Phillips Road Trail would not be possible without substantial route alteration.

M.6 Measures to Minimize Harm

Many of the Section 4(f) resources affected by the proposed NRE are trails; however, ARRC has proposed only 10 trail crossings at this time. SEA has also made preliminary recommendations for additional trail crossings as part of the proposed mitigation package (see Chapter 20). As part of the land conveyance process, ARRC would consult with affected agencies to come to agreement on trail crossing locations along the proposed rail line (see Chapter 20). Other measures to minimize impacts to Section 4(f) resources are discussed below.

M.6.1 Park and Recreation Areas

Chena River Lakes Flood Control Project

Minimization techniques for construction-period impacts (increased noise, dust and visual effects, including presence of construction vehicles and vegetation clearance) would include timing construction activities to result in the least disturbance to recreation users, and best practices for noise and dust control. Mitigation for vegetation clearance activities would include use of the minimum ROW required for construction of the rail line, and restoration of the ROW as near as possible to its original condition following construction.

Twentythreemile Slough Area Trails

Minimization techniques for construction-period impacts include selecting a construction period that would have the least impact on trail recreation to minimize the impact of temporary construction-period disruptions to trail use. Both dog-sledders and ARRC have indicated that at-grade crossings could present a safety hazard for dog teams.

Eielson AFB Outdoor Recreation Area

Measures for minimizing construction-period impacts include timing construction to have the least impact on the outdoor recreation area. Use of best available practices for dust suppression and noise reduction during construction and operation would decrease potential user impacts; however, periodic noise would remain an issue during operation. Minimizing impacts to campsites would include relocation of campsites to locations outside of the affected area.

Potential impacts arising from fill operations in Scout Lake would be decreased through implementation of water quality mitigation measures proposed in Chapter 20 of the EIS. These would include compensation or in-kind habitat replacement, and development of best management practices specific to minimizing turbidity during construction (*i.e.*, use of silt membranes in lake, silt fences and hay bales on construction cuts, and limiting construction period windows). In addition, minimization methods would include timing the construction period to have minimal impact on public fishing activity at Scout Lake. Please refer to Chapter 20 for a more detailed discussion of mitigation measures to preserve water quality.

At this time, ARRC has proposed two trail crossings along Eielson Alternative Segment 3 for access to Scout Lake and Rainbow Lake within the outdoor recreation area. Minimization of impacts to recreational users would include adequate trail crossings and grade crossings for park roads. Minimization of impacts to parking within Scout Lake campsites would include replacing entrances and parking areas in other locations, or constructing alternate campsites outside the affected area, in consultation with Eielson AFB staff.

Salcha Elementary School and Salcha Ski Area

Minimization of impacts to school and ski area recreation facilities would include, but is not limited to, determination of a construction period with the least disruption possible to school and ski area recreation activities, and replacement of all recreation facilities to be removed from school and ski area grounds to areas outside of Richardson Highway re-route ROW. These facilities would include the public parking area, playground, ball field, basketball court, start/finish stadium area, Lower Loop trail, Fall Trail, and all support buildings that service school and ski area recreation activities.

Silver Fox Lodge Trail

Donnelly Alternative Segments 1 and 2 would each cross this trail. No trail crossings have been proposed by ARRC at this time. Mitigation measures would be the same as for the Twentythreemile Slough trail system.

Koole Lake Trail (Donnelly-Washburn Trail)

Donnelly Alternative Segment 2 would cross the Koole Lake Trail (Donnelly-Washburn Trail) at two locations and Donnelly Alternative Segment 1 would cross trails at two points; however, land managers have indicated that Donnelly Alternative Segment 2 could have adverse effects on recreational and other resources due to its proximity to the Tanana River. ARRC has proposed crossings for the collocated Koole Lake/ADNR Winter/Donnelly-Washburn Trail for Donnelly Alternative Segment 2 and for the ADNR Winter Trail at Donnelly Alternative Segment 1. Points where Donnelly Alternative Segment 1 would cross the U.S. Army permit route, the collocated Koole Lake/Donnelly-Washburn Trail, and the Koole Lake Trail (on its own) have no proposed crossings and would require mitigation to preserve public recreation access. Mitigation measures would be the same as for the Twentythreemile Slough trail system.

ADNR Forestry Winter Road

Donnelly Alternative Segment 1 and South Common Segment would cross this route at separate points. Mitigation measures would be the same as for the Twentythreemile Slough trail system.

Rainbow Lake Winter Trail

The South Common Segment would cross this trail. Mitigation measures would be the same as for the Twentythreemile Slough trail system.

Phillips Road/Delta Junction Area Trail Network

Delta Alternative Segment 2 would cross one segment of the trail network. Mitigation measures would be the same as for the Twentythreemile Slough trail network.

Dispersed Use Areas

Mitigation for vegetation clearance activities and for impacts to ADNR lands would be the same as for the Twentythreemile Slough area.

M.6.2 Cultural Resource Areas

Large portions of the Salchaket village area were not surveyed due to the presence of private property and native allotments. Predictive modeling identified the area as having high probability for prehistoric and historic archaeological resources. This information would be used to guide subsequent field investigations if the segment was a component of any overall route authorized for construction and operation by the STB.

If Salcha Alternative Segment 2 were chosen, future data collection would be necessary to determine National Register eligibility. A comprehensive survey supported with oral history and archival research to situate these resources within the overall context of Salchaket Village is recommended. The two sites identified are likely to be considered eligible under Criteria A, B, and D, but more research is needed to fully assess their significance.

If additional resources were discovered during field investigations, they could be subject to a separate 4(f) evaluation depending on eligibility and other factors. As part of agency coordination, mitigation and/or avoidance measures for each significant site would be developed.

Mitigation of adverse effects to significant archaeological sites could include preservation in place, accomplished through avoidance, easements, or protection. When preservation in place is not feasible, adverse effects to significant archaeological sites generally could be mitigated through data recovery (excavation) of the site's valuable information.

A draft Programmatic Agreement (PA) has been developed by the STB for consideration by the Alaska State Historic Preservation Office (SHPO), Advisory Council on Historic Preservation and cooperating agencies. If executed, the PA would guide future efforts to identify and evaluate cultural resources, as well as procedures for avoiding and mitigating impacts. The draft PA is provided as Appendix H of the EIS.

M.7 Coordination

M.7.1 Parks and Recreation Areas

The location and status of recreational features was determined through informal consultation with public land managers and review of land management plans. SEA has conducted informal consultations with the FNSB's Department of Parks and Recreation, ADF&G, ADNR, Alaska State Mental Health Trust Authority, Eielson AFB, Fort Greely, and Fort Wainwright. Discussions included characterization of recreational access and available activities, and possible impacts that would result from selection of various alternative segments. Section 4(f) applicability, impact avoidance, and possible mitigation were subjects of discussion.

Prior to publishing the EIS, SEA presented a preliminary determination of Section 4(f) resources and requested that affected agencies provide their formal response to the significance of the resources. SEA will continue coordination with public land managers to determine the significance of resources identified in this evaluation.

M.7.2 Cultural Resources Coordination

Following consultation with the Alaska State SHPO and the BLM, SEA surveyed the APE where available for entry (*i.e.*, excluding private and Native land) to identify cultural historical resources and characterize the affected environment. By agreement with the above mentioned parties, SEA focused on identification, and did not conduct systematic excavation to determine site boundaries horizontally. Therefore, systematic survey and testing was shifted to a later phase of the project (*i.e.*, pre-construction surveys).

As part of the Section 106 process, the STB will continue with the consultation process with appropriate regulatory agencies, tribal entities, and affected private parties. Future consultation could involve meetings to determine protocols for assessment and mitigation of cultural resource data, and by formalizing and signing a PA among agencies and consulting parties. The Draft PA stipulates specific cultural resource considerations for administration, definitions of terms, tribal consultation, identification and evaluation of historic properties and assessment of adverse effects, treatment of historic properties and human remains, monitoring, curation, annual review and reports, procedures for inadvertent discoveries, training for ARRC employees, procedures for consultation, dispute resolution, procedures for amendment or termination of the PA, failure to carry out the PA, duration; and execution and implementation.

Execution and implementation of the Final PA would evidence that the STB has satisfied its responsibilities under Section 106 of the National Historic Preservation Act pursuant to 36 CFR 800, and that the state has satisfied responsibilities under the Alaska Historic Preservation Act pursuant to AS 41.35. Coordination with the involved parties will be ongoing to determine the proper handling of identified Section 4(f) resources.

M.8 Conclusion

SEA has identified 14 potential resources protected under Section 4(f) of the USDOT Act that could be affected by the proposed NRE. Most are recreational trails used for dog-sledding, snowmachining, and skiing, and two are cultural resources. All of the proposed route segments evaluated in the EIS and discussed in this Section 4(f) evaluation are technically feasible to build. Likewise, any combination of the alternative segments between the project's termini of North Pole and Delta Junction satisfy the project's purpose and need.

The alternative route with the least impact to Section 4(f) resources would include the North Common Segment, Eielson Alternative Segment 3, Salcha Alternative Segment 1, any of the connectors, either of the Central Alternative Segments, Donnelly Alternative Segment 2, South Common Segment, and either Delta alternative segment.

Minimization techniques for impacts to Section 4(f) resources would include timing construction to avoid times of heavy trail use, ensuring adequate trail crossings appropriate to the use of the trail, moving campsites and facilities where appropriate, and incorporating best practices for management of dust and noise emissions during construction activities. Implementation of the measures to minimize harm and consultations with the managing agencies for eligible Section 4(f) properties described in Section M.6 would reduce overall impacts to Section 4(f) resources. Mitigation of adverse effects to significant archaeological sites could include preservation in place, accomplished through avoidance, easements, or protection. When preservation in place is not feasible, adverse effects to significant archaeological sites generally would be mitigated through data recovery (excavation) of the site's valuable information.

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Appendix N –
Visual Inventory and Visual Contrast Analyses

N. VISUAL INVENTORY AND VISUAL CONTRAST ANALYSES

This appendix presents the application of the Bureau of Land Management's (BLM's) Visual Resource Management (VRM) methodology to evaluate potential effects on visual resources within the area of the proposed Northern Rail Extension (NRE). BLM has certain management authorities for Federal public lands in the project area that have been withdrawn for military use, including the authority to issue a linear right-of-way grant. The project area also includes Alaska state lands and private lands; however, none of these entities has a system or methodology to assess the visual impacts to the existing landscape. The VRM methodology was also used—for consistency—to assess potential visual impacts for the entire Northern Rail Extension.

N.1 Visual Inventory

A visual resource inventory was conducted for the Tanana River Basin areas from the City of North Pole to Delta Junction, Alaska. The inventory was conducted in accordance with the BLM (2007c) guidelines. The VRM methodology uses three factors to evaluate the visual value of BLM-administered lands:

- Scenic quality of the resource
- Viewer sensitivity
- Observation distance

Based on these factors, visual resources are classified as follows:

- Class I: Most Value
- Class II: High Value
- Class III: Moderate Value
- Class IV: Least Value

The BLM had not previously established a classification of the visual resources within the study area. The assessment presented in this appendix establishes the Interim Visual Resource Management Class for these resources.

N.1.1 Scenic Quality

Scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given an A, B, or C rating based on the apparent scenic quality. Seven key factors determine scenic quality: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. All public lands have scenic value, but areas with the most variety and most harmonious composition have the greatest scenic value. Cultural modifications within a landscape do not necessarily detract from the scenic value; if structures complement the natural landscape, they may enhance the scenic value. VRM evaluations should avoid any bias against cultural modification to natural landscape (BLM 2007a).

Scenic Quality Rating Units

Defining Scenic Quality Rating Units (SQRUs) is the first step of a visual inventory/visual contrast analysis. SQRUs are broad geographic classifications, such as Lowlands, within which specific visual characteristics can be evaluated. BLM Manuals include the following guidelines for delineating SQRUs.

"The planning area is subdivided into scenic quality rating units for rating purposes. Rating areas are delineated on a basis of: like physiographic characteristics; similar visual patterns, texture, color, variety, *etc.*; and areas which have similar impacts from man-made modifications. The size of SQRUs may vary from several thousand acres to 100 or less acres, depending on the homogeneity of the landscape features and the detail desired in the inventory. Normally, more detailed attention would be given to highly scenic areas or areas of known high sensitivity" (BLM, 2007c).

As directed by these BLM guidelines, the project area was grouped into three SQRUs on the basis of similar physiographic characteristics or impacts from man-made modifications (see Figure N-1). The first (Lowlands) contains terrain in the lowlands of the Tanana River Basin up to a 500-foot elevation. The visual area is dominated by the Tanana River, its tributaries, and the surrounding vegetation in the floodplain and hillsides. The area is characterized by the broad blue and brown waters that meander through the flat, muddy floodplain, creating multiple waterways around mud and rock bars, some of which become side sloughs and oxbow lakes. The shoreline is dominated by spruce and hardwood species surrounded by tall scrub thickets. Roads, agricultural fields, power lines and dispersed residential structures occur throughout this unit.

The second SQRU (Communities) is delineated by physiographic qualities common to the project area's densest cultural modifications, including Eielson Air Force Base (AFB), the communities of Moose Creek, Salcha, and Delta Junction, as well as the adjacent residential areas, agricultural lands, parks, and highways. The visual qualities of the built communities in this SQRU are very different from the surrounding terrain.

The third SQRU (Uplands) contains the foothills of the Alaska Range to the south and bluffs to the north of the Tanana River. This area is dominated by the hills and drainages carved by the glacial and snowmelt water from higher elevations.

SQRU 1 – Lowlands

Landform

The landform of this SQRU is characterized by the Tanana River Basin, which is composed of flat to nearly flat bottomlands, with some hills. Variation in elevation is generally limited to a slope gradient of less than 1 degree (Gallant *et al.*, 1995).

Vegetation

Vegetation communities are dominated by black spruce with occasional stands of white spruce and paper birch, with tall scrub thickets of willow occurring on floodplains, and wetlands of sedge and grass tussocks occurring in wetter sites.

Water

This SQRU is defined by the water features within the Tanana River Basin. Riverine features, such as meandering rivers, side sloughs, and oxbow lakes, are prevalent. The Tanana River is over two miles at its widest with numerous riverlets braiding through sand and gravel bars and islands. The abundant tributaries to the Tanana vary from a few feet to a half-mile wide and from a straight, fast-flowing river to a meandering, slow stream.

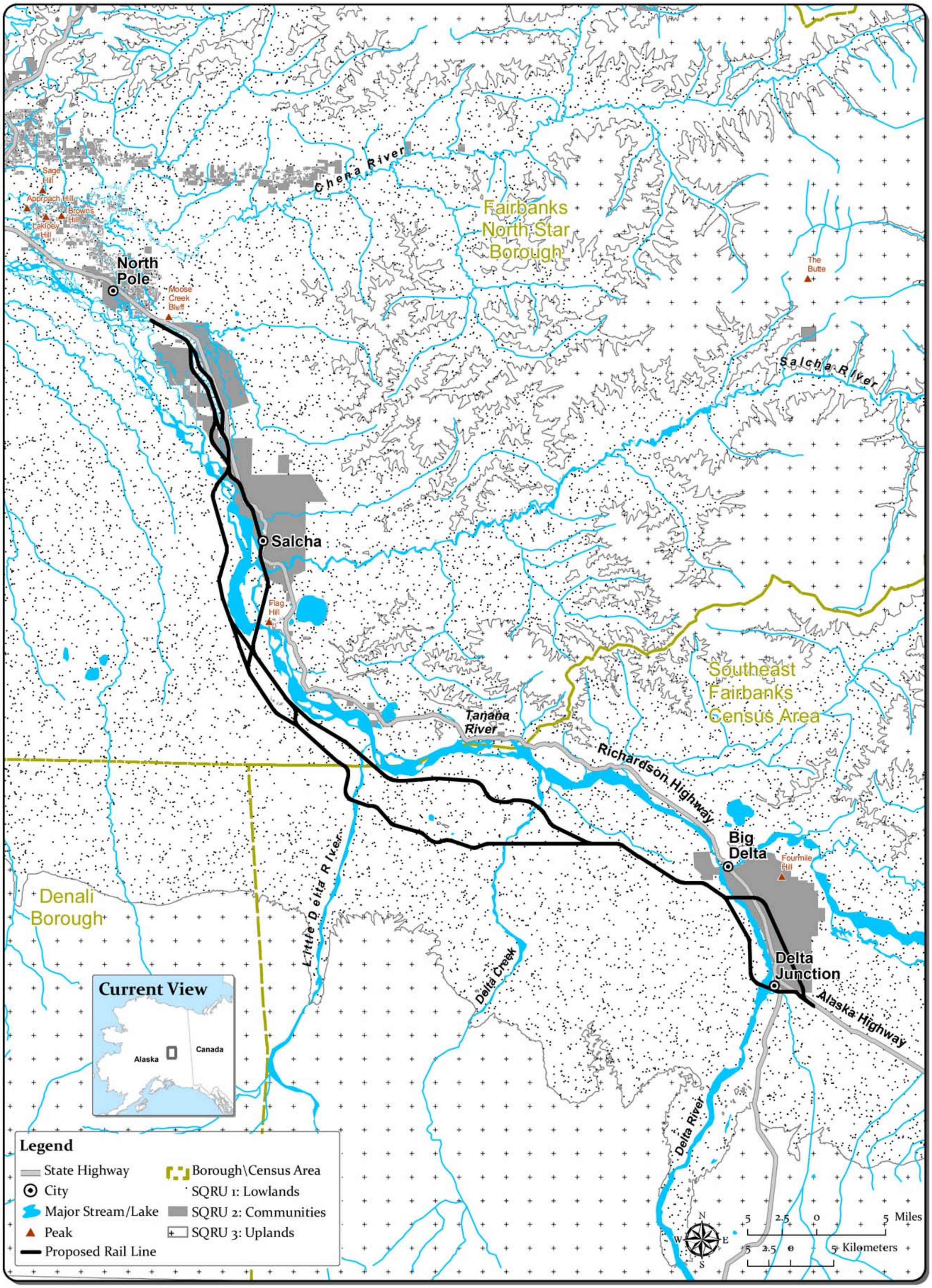

Figure N-1 - Scenic Quality Rating Unit

Color

The colors within this SQRU are primarily earthtone blues, browns, and light tans of the water features and landforms coupled with light to dark greens of the native vegetation. The few human modifications include the colors of gray, white, and yellow with a variety of colors within the communities.

Influence of Adjacent Scenery

At most points in this SQRU, viewing distances are limited, due to the combination of dense vegetation and fairly flat terrain. Longer viewing distances of adjacent scenery can be seen from some points along the river bottom where the expanse of unvegetated landscape provides more open views of the surrounding areas or from elevated positions above the lowlands. At these points, the landforms that can be seen include the larger hills that surround the river basin with a background of the Alaska Range. These views provide depth of perspective to the immediate landscape.

Scarcity

The landforms, water features, and vegetation within this SQRU are fairly unique in the region of Interior Alaska and generally contain unique structures or vegetative patterns that are different from other major interior rivers.

Cultural Modifications

Most cultural modifications within this SQRU consist of roads, telephone and electric poles, signage and dispersed housing structures. In general, the cultural modifications within the region are few but are disharmonious with the natural landscape.

SQRU 2 – Communities

Several residential communities exist near the proposed project area, so an SQRU was developed for these communities. Included in this category are Eielson AFB, the communities of Moose Creek, Salcha, and Delta Junction, and adjacent private residential and agricultural lands.

Landform

The landform of this SQRU is characterized by flat to nearly flat bottomlands, with some hills. Variation in elevation is generally limited to a slope gradient of less than 1 degree (Gallant et al 1995).

Vegetation

Vegetation communities are dominated by white spruce with occasional black spruce stands and hardwood species such as paper birch, balsam poplar and aspen with alder and willow undergrowth. This thick vegetation covers approximately 10 to 50 percent of the land within the towns. Various crops within the agricultural lands present different homogeneous plant communities.

Water

Water features are a major component of this SQRU with the Tanana River and its tributaries being integral parts of Salcha and Delta Junction. The Salcha River meanders through the Town of Salcha and adjacent agricultural lands, providing access to the Tanana River. Delta Junction is located at the junction of the Alaska and Richardson highways and also includes the confluence of the Delta and Tanana rivers, with the Tanana as a major travel route and the Delta

River as a major water attraction. Adjacent to Moose Creek and Eielson AFB are a number of lakes and sloughs that are visible, but not dominant, in the landscape. In general, the water features within this SQRU are a dominant feature.

Color

The colors within this SQRU have various hues of light to dark greens associated with the native vegetation intertwined with a variety of structures' more primary blacks, yellows, whites, and grays. Water bodies are blue to brown to the white colors of the glacial Tanana. Gravel bars and river banks display a variety of browns and tans.

Influence of Adjacent Scenery

At most points in this SQRU, adjacent scenery includes nearby meandering rivers and densely vegetated hills in the distance. This scenery generally has no cultural modifications and is of high quality.

Scarcity

The landforms, water features, and vegetation within this SQRU are fairly typical of the region and do not generally contain unique structures or vegetative patterns.

Cultural Modifications

The cultural modifications within this SQRU include residential housing, schools, business developments, aircraft hangers, and public and private buildings. Most of these enclosures are one-story buildings interspersed with the native vegetation. Roads, telephone and electric poles, and signage are the predominant fixtures of the communities' infrastructure. In general, the cultural modifications within the region are extensive and disharmonious with the natural landscape.

SQRU 3 – Uplands

Landform

This SQRU is defined by the Alaska Range foothills to the south and the bluffs to the north of the Tanana River. This area is composed of moderate to steep slopes carved into drainages by snowmelt.

Vegetation

Vegetation communities are dominated by white spruce with occasional black spruce stands and hardwood species such as paper birch, balsam poplar and aspen with alder and willow undergrowth, or by the various crops within the agricultural lands.

Water

The water features of this SQRU are characterized by the streams and rivers fed by glacial snowmelt from the mountains.

Color

The colors within this SQRU are primarily various hues of blues and browns of the water features and landforms coupled with light to dark greens of the native vegetation.

Influence of Adjacent Scenery

Views from the hills and mountains extend for many miles in all directions. Views generally include the lowland river drainages described above, as well as other nearby mountain ranges.

Scarcity

The landforms, water features, and vegetation within this SQRU are fairly unique in the region of Interior Alaska and generally contain unique structures or vegetative patterns that are different from other major mountain ranges.

Cultural Modifications

There are very few cultural modifications within this SQRU.

Scenic Quality Rating Summary

Based on the BLM methodology, each of the seven evaluation criteria discussed above for the three SQRU's is assigned a numerical value. For most criteria, scores range between 0 and 5; however, the range for Cultural Modifications is between -4 and 2. Higher values represent greater scenic quality. Tables N-1, N-2, and N-3 provide the ratings assessed for each of the three SQRU's in the project area.

Table N-1
Scenic Quality Rating Summary for SQRU 1 Lowlands

Key Factor	Rating
Landform	1
Vegetation	3
Water	5
Color	4
Adjacent Scenery	5
Scarcity	3
Cultural Modifications	0
Total Score	**21**

Table N-2
Scenic Quality Rating Summary for SQRU 2 Communities

Key Factor	Rating
Landform	1
Vegetation	5
Water	4
Color	3
Adjacent Scenery	5
Scarcity	1
Cultural Modifications	-4
Total Score	**15**

Table N-3
Scenic Quality Rating Summary for SQRU 3 Uplands

Key Factor	Rating
Landform	5
Vegetation	4
Water	4
Color	5
Adjacent Scenery	5
Scarcity	3
Cultural Modifications	0
Total Score	**26**

Scenic Quality Ratings

Scenic quality is summarized by the total score found by summing the numerical values of the seven criteria above and assigning an A, B, or C rating based on that sum. A rating of "A" demarks an area with high scenic quality while a rating of "C" demarks an area with low scenic quality. Scenic Quality is rated as follows:

A = 19 or more total score
B = 12–18 total score
C = 11 or less total score

Based upon BLM Manual Handbook 8410-1 (BLM, 2007c), the scenic quality of SQRU 1 Lowlands, with a total score of 21, is rated A. The scenic quality of SQRU 2 Communities, with a total score of 15, is rated B. The scenic quality of SQRU 3 Uplands, with a total score of 26, is rated A.

Viewer Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium, or low sensitivity levels by analyzing the various indicators of public concern (BLM 2007c). These factors include:

- Types of Users;
- Amount of Use;
- Public Interest;
- Adjacent Land Uses; and
- Special Areas.

Types of Users

There are three general types of users in the vicinity of the build alternatives: residents of the surrounding communities, sightseers and others using Richardson Highway, and outdoor enthusiasts who enjoy a variety of activities throughout the year. Typically, residents are highly sensitive to visual changes surrounding their homes or communities. Richardson Highway is a State Scenic Byway and sightseers travel that route to enjoy beautiful scenery and natural landscapes. These users are highly sensitive to changes in visual quality. Outdoor recreationalists are also sensitive to changes in visual quality. Since one of the major reasons that people participate in outdoor sports and activities is to remove themselves from the influences of cultural modification and civilization, generally they are highly sensitive to changes in visual quality. Therefore, the visual sensitivity of the users of the Tanana River Basin region would be considered "high."

Amount of Use

The amount of use by the residents, sightseers, and outdoor recreationalists varies per location. Richardson Highway has a large amount of traffic from all types of users year-round. Rivers, parks, trails and the scenic roads have a moderate to high amount of use throughout the year. Areas with no access by vehicle or boat have little use throughout the year.

Public Interest

The public interest in the visual quality of a region is difficult to measure, but is indicated by the public response to proposed activities. In 1990, Alaska Department of Natural Resources (ADNR) received public comments for updates to the Tanana Basin Area Plan, a regional general plan that contains the region evaluated in this document. In May of that year, ADNR held public meetings to discuss the updates to the plan. The cumulative attendance at the public meetings was approximately 200 people. Because of the relatively low population within the area, this level of attendance demonstrates a high rate of public interest in the region. Therefore, the sensitivity level for this factor would be "high" (ADNR 1990).

Adjacent Land Uses

Most of the lands surrounding the project area are undeveloped. These lands are either private, or are owned by the public and managed by the BLM, Department of Defense or State of Alaska. The adjacent lands are used for a variety of residential, agricultural, commercial, recreational and military training activities. While the population level in the surrounding areas is generally low, the residential and recreational land users would be very sensitive to visual quality of the region, and therefore the sensitivity level for this factor would be "high."

Special Areas

Special areas within the area include Richardson Highway, designated as a State Scenic Byway, and the Delta River Critical Habitat Area, which is managed by ADNR. Sightseers choose to travel a scenic byway to enjoy beautiful scenery and natural landscapes and are highly sensitive to changes in visual quality. Therefore the sensitivity level for this factor would be "high."

Sensitivity Level Rating Units

Based on analysis of the five factors above, the study area is grouped into similar sensitivity regions known as Sensitivity Level Rating Units (SLRUs). Because the Type of Users, Public Interest, and Adjacent Land Uses factors are fairly constant throughout the region, only the Amount of Use and Special Areas factors were used to determine the physical boundaries of the SLRUs. Based on these, two SLRUs were delineated (Figure N-2). The boundaries of SLRU 1, rated high sensitivity level, are defined by the roads, trails, parks, rivers, and towns that have high usage by residents, sightseers and outdoor enthusiasts. Views within the region are limited by the dense vegetation in the area; therefore, the boundaries of SLRU 1 are defined by the viewing distance from roads, trails, and rivers as wells as from the boundaries of parks and towns. The viewing distance was derived from the viewshed analysis conducted in the following section, Distance Zones. The boundaries of SLRU 2, rated medium sensitivity level, are defined as all other undeveloped areas within the project area that have far fewer visitors.

Observation Distance

The distance of potential observation points from an area is another determinant of visual value. In general, the greater the distance of an observer from an area, the less impact to the observer of changes in visual quality. For example, the details and dominance of a new action, and therefore impact, diminish with increased viewing distance. Delimiting the landscape into general regions according to their distances from observation points helps to classify the relative impact to observers of changes in an area's visual quality.

Landscapes are subdivided into three distance zones based on relative visibility from travel routes or observation points. The three zones are foreground-middleground, background, and seldom-seen. The foreground-middleground zone includes areas visible from highways, rivers, or other viewing locations within 3 to 5 miles. The background zone includes areas beyond the foreground-middleground zone, less than 15 miles away, but visible from viewing locations. The form, lines and colors in the background zone can still be seen, but texture is not discernable. Areas not seen as foreground-middleground or background (*i.e.*, hidden from view) are in the seldom-seen zone.

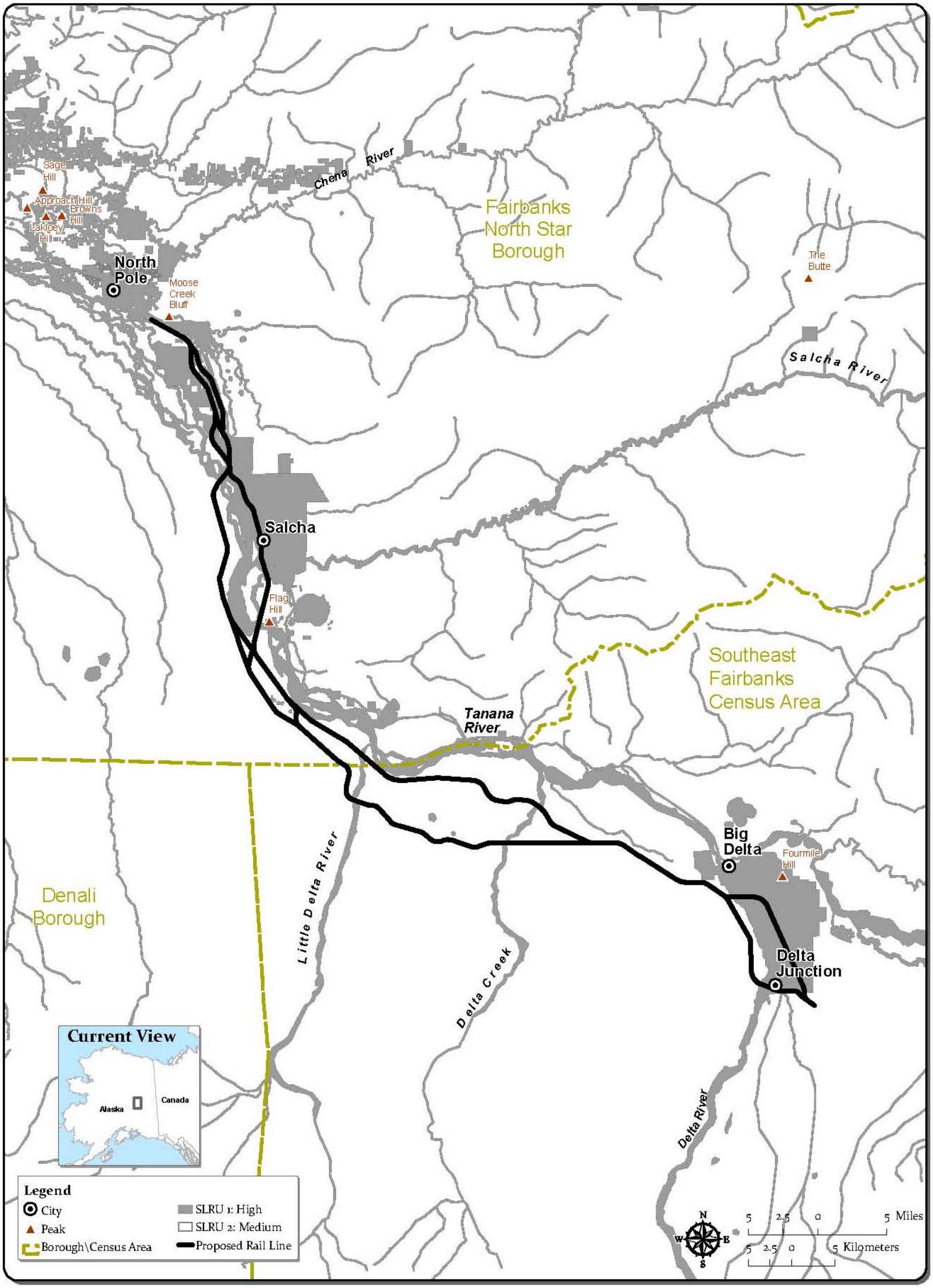

Figure N-2 – Sensitivity Level Rating Units

A viewshed analysis was conducted to determine the boundaries of the distance zones (see Figure N-3). The foreground-middleground zone is defined by the viewing distance from roads trails and rivers as wells as from the boundaries of parks, towns, and cultural modifications. Due to the relatively flat terrain and wide river expanse, views up and down the river and from elevated positions can extend up to 3 miles or more. Visitors use the parks and trails of this area, so that most of this area is within foreground-middleground region. However, the dense vegetation lining some areas of the highway and rivers typically limits the viewing distance to within a few hundred feet of the highway or river edge.

There are hills bordering Richardson Highway that would provide views of over 5 miles of the Tanana River Basin, but there is little road or trail access to most of these hills, resulting in few observation points of surrounding terrain. The Alaska Range and other surrounding mountains fall into the seldom-seen zone, where the vegetation is no longer discernable except as form and outline.

Visual Resource Inventory Class Assignment

Visual Management Inventory Classes for this project area are assigned based on scenic quality, sensitivity level, and distances zones. Table N-4 shows how the combination of the three evaluations establishes the VRM Classes.

Table N-4
Basis for Determining Visual Resource Inventory Classes

		Visual Sensitivity						
		High			**Medium**			**Low**
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III IV	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
		f/m	**b**	**s/s**	**f/m**	**b**	**s/s**	**s/s**
		Distance Zones						
		f/m = foreground/middleground b = background s/s = seldom seen						

Source: BLM, 2007c

Figure N-4 shows the results of combining the SQRU, SLRU, and Distance Zones map overlays to delineate the region's management classes. In general, the entire Tanana River Basin is designated Class II. Portions of Eielson AFB are rated Class III and IV because of their lower scenic quality, sensitivity, and location within the background Distance Zone. The management objectives for these Visual Resources Classes are defined below (BLM, 2007a).

Class II Objective: Preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class III Objective: Partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

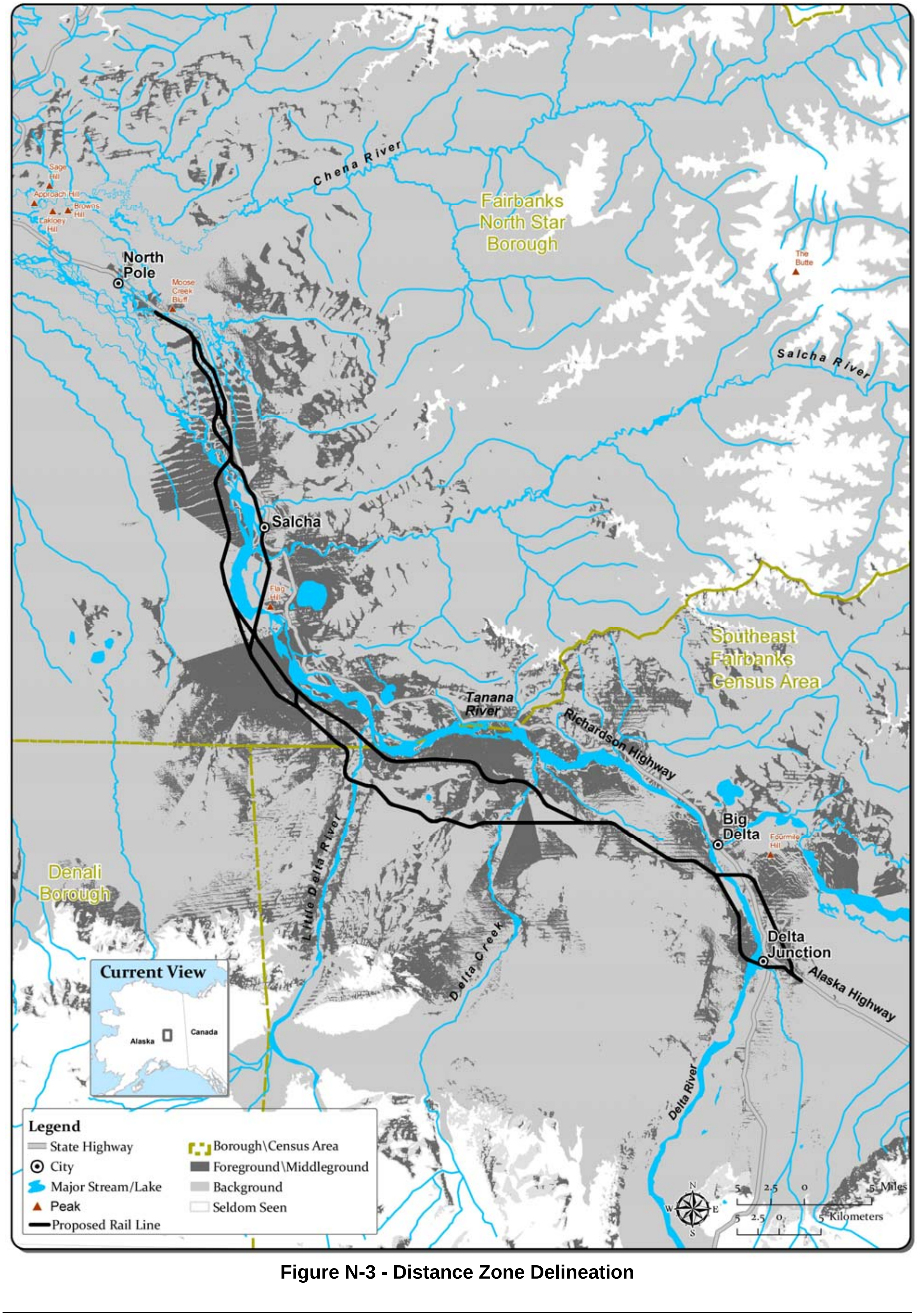

Figure N-3 - Distance Zone Delineation

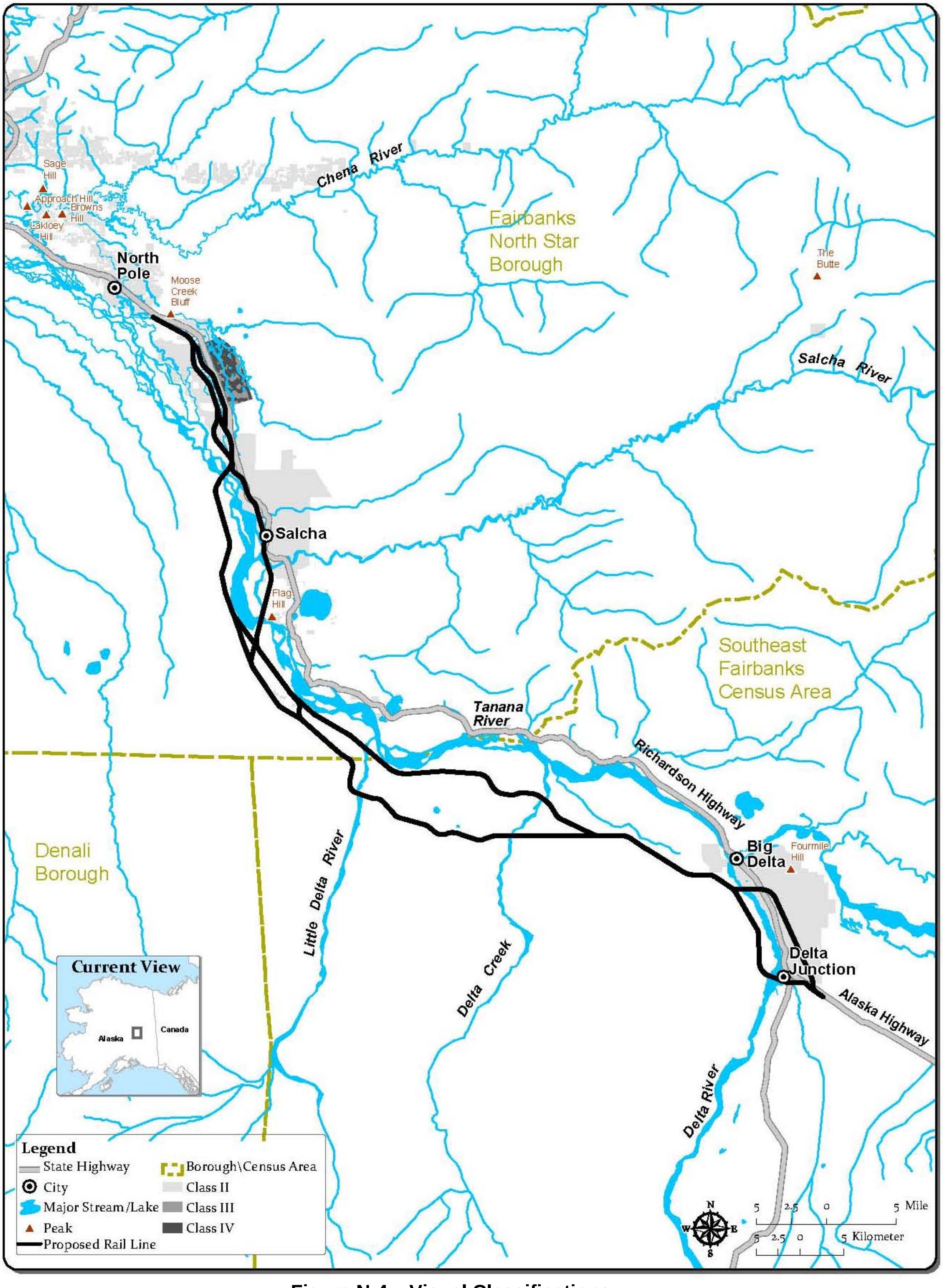

Figure N-4 – Visual Classifications

Class IV Objective: Provide for management activities that require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

N.1.2 Visual Contrast Rating

The Visual Contrast Rating process of BLM's VRM methodology was used to determine whether the potential visual impacts from the build alternatives would meet the management objectives established in the Visual Resources Inventory, or whether mitigation measures would be required. This process provides a systematic comparison of the proposed project components with the major features in the existing landscape using the basic design elements of form, line, color, and texture (BLM, 2007b). It also provides a mechanism for comparing impacts of the different alternative segments.

The Visual Contrast Rating process comprises the following five steps: obtain action description, identify VRM objectives, select key observation points, prepare visual simulations, and determine whether VRM objectives are met.

Using these five steps, the contrast of the alternative segments to the existing landscape was evaluated to determine if the VRM objectives would be met with project implementation. Mitigation measures for the action were developed to minimize the project's visual impacts in accordance with these objectives (see Chapter 20 for proposed mitigation measures).

Key Observation Points

Key Observation Points (KOPs) are locations selected to be representative of critical locations from which the project would be seen. Based on the KOP analysis, the potential visual impacts of the permanent mainline rail features as well as temporary features are discussed. In accordance with VRM methodology, visual impacts are examined in relation to their impacts on land and water features, vegetation, and structures. The associated facilities and temporary facilities are not evaluated through the KOP contrast analysis process due to a lack of available detail regarding location and structures as well as expected low visual impact of some of those features.

Select Key Observation Points

In July 2006, 29 KOPs were established and photographed (Figure N-5, Table N-5). The photographs document the various segments from Delta Junction to Fairbanks and were taken mainly from Richardson Highway and along the Tanana River and its tributaries. These points were chosen based on public use such as outdoor recreation and scenic viewing. Each of these points was visited in the field and analyzed to determine if the proposed rail line could be seen and to obtain a visual inventory. These 29 points were then narrowed down to eight KOPs for further analysis. These eight KOPs were selected because they best represented the various types of views of the project from likely observation points within the region. The eight KOPs analyzed for contrast rating are shaded grey in Table N-5, while the KOP number is highlighted in bold for the three KOPs analyzed that included photo simulations.

KOP selection is intended to identify those locations in proximity to the project site that best represent overall views of the segment that would be seen from public places such as roads, recreation areas and trails, as well as adjacent residential communities. KOPs are generally

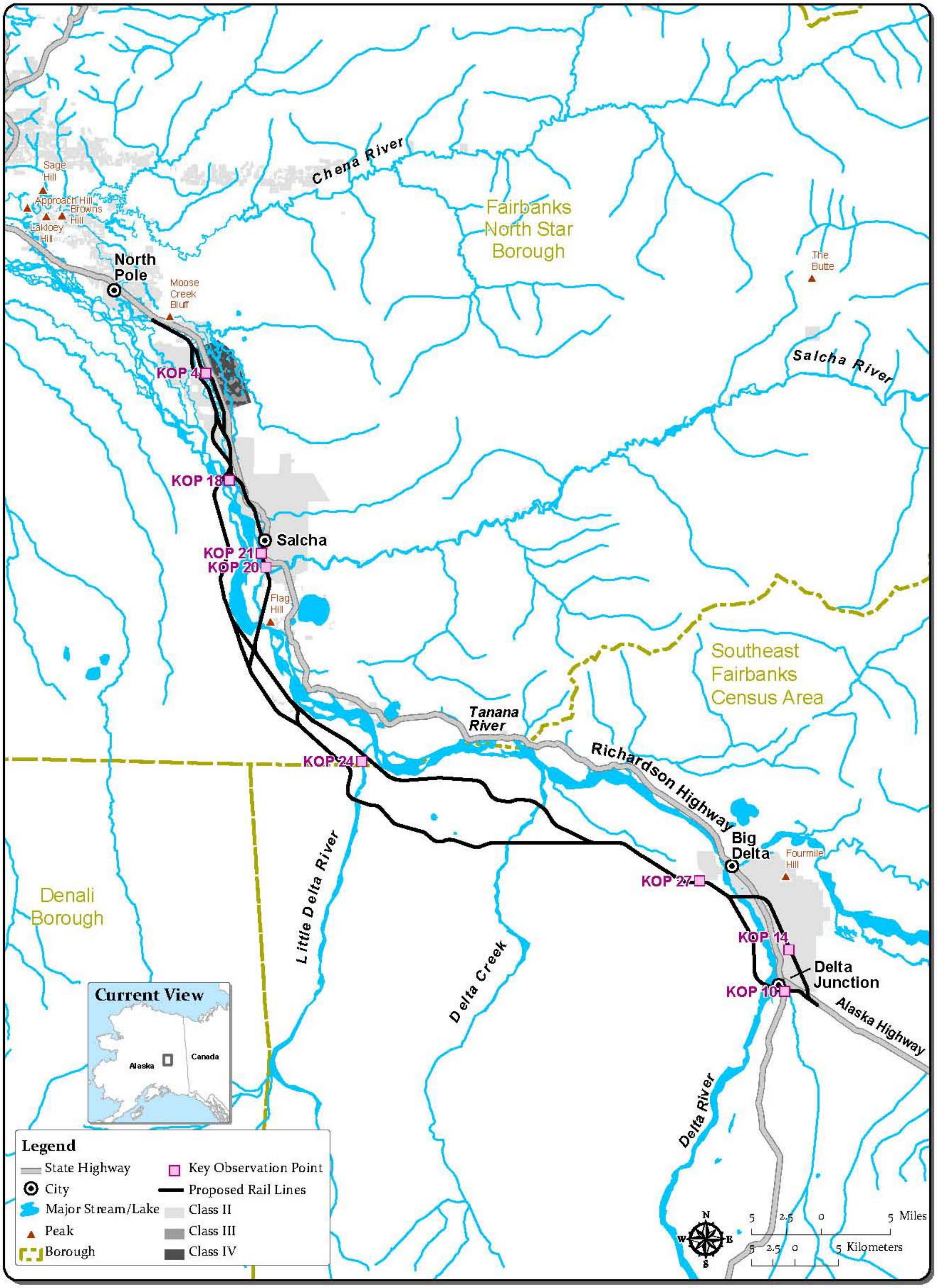

Figure N-5 – Select Key Observation Points

Table N-5
Key Observation Points
(Shaded segments were analyzed for contrast rating, bold for photo simulations)

			Proposed Action Segments									Alternative Segments									
KOP No.	**Viewing Location**	**Project Site Visibility**	**North Common**	**Eielson 3**	**Salcha 1**	**Connector B**	**Central 2**	**Connector E**	**Donnelly 1**	**South Common**	**Delta 1**	**Eielson 1**	**Eielson 2**	**Salcha 2**	**Connector A**	**Connector C**	**Connector D**	**Central 1**	**Donnelly 2**	**Delta 2**	**Comments**
								Views from a river													
17	Mainstem of the Tanana River	Open			✓																View of Tanana River crossing location
18	**Mainstem Tanana River upstream from Little Salcha River**	**Open**												✓							**Mainstem Tanana River from boating perspective**
19	Sandbar in Tanana River side channel near confluence with Little Salcha	Open												✓							View downstream of crossing an edge of the side channel.
20	South bank of the Salcha River just east of the proposed alternative crossing	Open												✓							Boat ramp just upstream, likely boat traffic in area
21	On a gravel bar on west bank of Salcha river south of the confluence with Tanana River, looking southeast towards the bank where the alternative would cut across the hillside	Open												✓							Potential hillside cutout highly visible from river
22	West side Tanana River south of confluence with Salcha River	Open												✓							View of Tanana River crossing location
23	East side of Tanana River south of confluence with Salcha River	Open												✓							View of Tanana River crossing location
24	Little Delta River just west of Tanana River	Open							✓												View of Little Delta River crossing location

Table N-5
Key Observation Points
(Shaded segments were analyzed for contrast rating, bold for photo simulations) (continued)

			Proposed Action Segments									Alternative Segments									
KOP No.	Viewing Location	Project Site Visibility	North Common	Eielson 3	Salcha 1	Connector B	Central 2	Connector E	Donnelly 1	South Common	Delta 1	Eielson 1	Eielson 2	Salcha 2	Connector A	Connector C	Connector D	Central 1	Donnelly 2	Delta 2	Comments
26	Sandbar in middle of Delta River just south of Big Delta	Open																		✓	View of Little Delta River crossing location
29	Sandbar in Delta creek just east of confluence with the Tanana River	Open																	✓		View of Delta creek crossing location
								Views from a Road													
1	Richardson Highway, north of proposed North Common Segment	None	.									.									View of existing rail line
2	East side of Bathing Beauty pond near Richardson Highway	None		.								.									Dense vegetation would screen view of Build alternative
3	Eielson Farm Road south of Bathing Beauty pond where alternative would cross the road	Open	✓									.									Signs of recreation use in area. There is an existing electricity line and newly constructed large utility lines running through the area also between alternative and most lakes.
4	West of Richardson Highway on east side of the Eielson Air Force Base	Open		✓																	Some recreation in area, close to Fairbanks
5	Richardson Highway location with view of Tanana Flats	Open												✓							Alternative would cause relocation of the Richardson Highway in this location

Table N-5
Key Observation Points
(Shaded segments were analyzed for contrast rating, bold for photo simulations) (continued)

			Proposed Action Segments									Alternative Segments									
KOP No.	Viewing Location	Project Site Visibility	North Common	Eielson 3	Salcha 1	Connector B	Central 2	Connector E	Donnelly 1	South Common	Delta 1	Eielson 1	Eielson 2	Salcha 2	Connector A	Connector C	Connector D	Central 1	Donnelly 2	Delta 2	Comments
6	Richardson Highway Viewpoint of Tanana at Mile 297.7	None																			The Northern Rail Extension at this point (Donnelly Alternatives) would be located across the Tanana River from the Richardson Highway and far enough from the river that the alternative is not expected to be visible
7	Richardson Highway Photo point of Tanana at mile 296.5	None																			Similar to KOP 6.
8	Richardson Highway just south of Big Delta	Open																		✓	View of grade separated alternative crossing Richardson Highway
9	Richardson Highway just north of Delta Junction	None																			
10	**Richardson Highway south of Delta Junction near Jarvis Creek**	**Open**																		✓	**Grade separated crossing of the Richardson Highway would be visible**
11	Alaska Highway just southeast of Delta Junction	Open																		✓	Grade separated crossing of the Alaska Highway would be visible
12	Emmaus Road east of Delta Junction	Open																		✓	At-grade crossing would be visible
13	Junction near Nestler and Emmaus Roads east of Delta Junction	Open																		✓	At-grade crossing would be visible

Table N-5
Key Observation Points
(Shaded segments were analyzed for contrast rating, bold for photo simulations) (continued)

KOP No.	Viewing Location	Project Site Visibility	Proposed Action Segments: North Common	Eielson 3	Salcha 1	Connector B	Central 2	Connector E	Donnelly 1	South Common	Delta 1	Alternative Segments: Eielson 1	Eielson 2	Salcha 2	Connector A	Connector C	Connector D	Central 1	Donnelly 2	Delta 2	Comments
14	Jack Warren Road just north of Delta Junction	Open																		✓	At-grade crossing would be visible
15	Boat Ramp on Salcha River near Richardson Highway crossing of river													✓							Parking lot full; popular boating area on Salcha River
16	Rock outcrop near Eielson AFB on the northeastern side of Richardson Highway	Limited	✓																		Popular hangout spot with elevated view.
25	East Bank of Delta River at Delta Junction	Open									✓										View of the crossing of the Delta River.
27	**View from recreation road northwest of Delta Junction**	**Limited**								✓											**Dense vegetation screens parallel alternative from this viewpoint**
28	Recreation “road” near proposed rail line crossing	Open								✓											Winter recreation road, not usable by a vehicle in summer – KOP accessed by helicopter

Project Site Visibility Terms: Open = an unobstructed view of the rail alternative segment; Limited = a partially obstructed view of the rail alternative segment; None = a fully obstructed view of the rail alternative segment.

selected for one or two reasons: (1) the location provides representative views of the landscape along a specific route segment or in a general region of interest; and/or (2) the viewpoint effectively captures the presence of a potentially significant project impact in that location. KOPs are typically established in locations that provide high visibility to relatively large numbers of viewers and/or sensitive viewing locations such as residential areas, recreation areas, and vista points.

While every view toward the project is not represented, the KOPs identified are representative of typical views with potential for visual impacts generated by the proposed rail line, and they facilitate review and discussion. The KOPs chosen are representative of key sensitive viewer types, key sensitive viewer locations, and/or key visual simulation locations that would best show typical views along the build alternatives.

Prepare Visual Simulations

Three KOPs were selected for visual simulation: KOP 10, KOP 18, and KOP 27. These KOPs represent three typical viewpoints; including a view of the proposed rail line crossing Richardson Highway (grade separated), a view of the proposed rail line parallel to a roadway, and a view of the proposed alternative crossing the Tanana River.

Determine Whether VRM Objectives Are Met

In this final step, contrast of the build alternatives to the existing landscape is evaluated to determine if the VRM objectives would be met with project implementation. In the VRM methodology, there are four degrees of contrast rating: none, weak, moderate, and strong. Only none to weak contrast ratings are typically considered to meet VRM Class II objectives. The VRM manual states that the Class II management class objective is to “retain the existing character of the landscape with a minimal level of change” and not attract attention. In this analysis, the build alternatives were evaluated for contrast and visual impact to the existing landscape to determine if VRM objectives would be met for the Class II management classification. Generalized potential visual impacts are derived from these site-specific analyses.

N.1.3 Common Impacts

This section describes potential visual impacts that would be common to many of the alternative segments. Much of the proposed NRE would be located in densely vegetated areas not visible from travel areas, urban areas, or other frequently visited sites. However, all segments include one or more visible facilities such as grade separated road crossings, at-grade road crossings, bridges for river crossings, and alternative segments paralleling both land and water transportation routes. The analysis focuses on these four common visible project features.

Based on the KOP analysis, the impacts of these four common features are generalized. In addition, the potential visual impacts of other permanent features as well as temporary features are discussed, although these are not evaluated through the KOP contrast analysis process due to a lack of available detail regarding location and structures as well as expected low visual impact of other features. Such features include offload and end of track facilities, passenger facilities, communication towers, borrow areas, rip-rap and ballast sources, as well as temporary construction bridges, construction staging areas, and construction camps. In accordance with VRM methodology, visual impacts are examined in relation to their impacts on land and water features, vegetation, and structures.

Impacts Evaluated by KOP Contrast

The eight KOPs selected for evaluation include one of the four frequent types of views that would occur repeatedly for the proposed NRE: the proposed rail line crossing a road via a bridge (*i.e.*, grade separated); the proposed rail line crossing a road at-grade; the proposed rail line crossing a river on a bridge; and the proposed rail line running parallel to a road or water travel area. The contrast rating analyses of the KOPs for these four common views of the rail line are generalized in Table N-6. As noted in the methodology section, contrast ratings of none to weak meet VRM Class II management objectives.

Table N-6
Visual Contrast Rating of Common Structures

Structure Type	Elements	Features: Land/ Water Body	Features: Vegetation	Features: Structures	Class II VRM Objectives Met?	Mitigation Measures Recommended?
Road Crossing At-Grade	Form	Weak	Moderate	Weak	No	Yes
	Line	Weak	Moderate	Moderate		
	Color	Weak	Weak	Moderate		
	Texture	Weak	Moderate	Weak		
Road Crossing Grade Separated	Form	Moderate	Moderate	Moderate-Strong	No	Yes
	Line	Moderate	Moderate	Moderate-Strong		
	Color	Weak	Moderate	Weak		
	Texture	Weak	Moderate	Moderate		
Alternative Parallel to Travel Area	Form	Moderate	Moderate	Moderate	No	Yes
	Line	Moderate	Moderate	Moderate		
	Color	Weak	Moderate	Weak		
	Texture	Weak	Moderate	Weak		
Bridge Over River	Form	Strong	Strong	Strong	No	Yes
	Line	Strong	Strong	Strong		
	Color	Moderate	Strong	Moderate		
	Texture	Moderate	Strong	Moderate		

At-Grade Road Crossings

Several proposed alternative segments would cross roads, and some would cross several roads. These can be found along the North Common Segment; Eielson Alternative Segments 1, 2 and 3; Salcha Alternative Segment 2; and Delta Alternative Segment 2. Except for crossings of the Alaska and Richardson highways, the crossings would typically be at-grade. At-grade is defined as an intersection (crossing) where roadways (and rail lines) join or cross at the same level (FHWA, 2007). Based on the KOP analysis, it is expected that the visual contrast at locations where the alternative would cross a road at-grade would result in weak to moderate visual impacts. In general, at-grade road crossings would require ballast to slightly elevate the rail line and access road alternative from the existing landscape to a level that would approximate the grade level of the road being crossed. Right-of-way clearing would also occur. The landform in the right-of-way may be leveled. Leveling would contrast slightly with the undulating, but generally flat, terrain of the road right-of-way and would result in weak impacts to land form. Ballast materials may contrast in color with the green hues of surrounding vegetation.

Regarding impacts to vegetation, right-of-way clearing for rail line construction and maintenance would create a contrast with the surrounding vegetation. However, a rail line at road crossings is typically perpendicular to the line of sight of travelers on the road, and is therefore largely obscured by adjacent vegetation except for the short length of time when passing the alternative. The at-grade road crossings are expected to be accompanied by minimal structures, typically consisting of road crossing warning devices such as gates with flashing lights. These devices are smooth, painted red and white, and vertical most of the time in a predominately irregular, green, horizontal landscape. These structures are common in the built environment associated with transportation facilities. Therefore, visual contrast of structures at road crossings is expected to be weak to moderate.

Grade-Separated Road Crossings

For segments that cross Richardson or Alaska highways, the rail line crossings would be grade separated, where the rail line would pass over the highway, or vice versa, on a bridge structure. These can be found along Delta Alternative Segments 1 and 2. Section of Environmental Analysis (SEA) anticipates that these crossings would result in moderate to strong visual contrast. In general, grade-separated road crossings would require fill to elevate the rail line or the road above the existing landscape to a level (18 feet, 6inches minimum for rail over road and 23 feet minimum for road over rail) that would allow traffic to pass underneath. Clearing of the right-of-way would also occur. The visual contrast of a grade separated crossing on land and vegetation features would result in an elevated horizontal line with blocky abutments in an irregular, flat landscape. SEA anticipates that the visual contrast to vegetation features would be weak to moderate based on the expectation that earthen sides of the bridge abutments would be covered in vegetation with similar color. The gray concrete of the bridge structure would be similar to the gray road, but would contrast with the green hues of the surrounding vegetation and therefore would have a moderate color contrast rating.

SEA anticipates that the visual contrast to existing structures on Richardson or Alaska highways would be moderate to strong. The form of the bridge, a long, flat, horizontal structure supported by straight, smooth, deck or platform, would have a moderate to strong contrast to a flat, generally straight road, and vertical but irregular vegetation. The smooth, regular textures of the bridge would have a moderate texture contrast when compared to the coarse vegetation and stippled (flecked) roads. The texture of a predominantly irregular forest landscape would contrast with a predominately smooth grass landscape of the abutment approaches.

Segments Parallel to Travel Area

At least a portion of all alternative segments would be parallel to another travel area, either a waterway, road, or trail. These can be found along all alternatives except the South Common rail line. A typical railbed is 10 to 12 feet wide and elevated above existing ground level to a minimum height of 4 feet with a width of 25 to 30 feet at existing grade. Where an access road would be constructed parallel to the rail line, it also would be built above existing ground level to a minimum height of 4 feet and add between 13 to 24 feet in width, resulting in a total width of 40 to 50 feet. This is comparable to the elevation and width of major travel routes in the project area. Clearance of the right-of-way would also change the patterns of the vegetation to contrast with the natural forest structures of the surrounding landscape.

It is expected that the visual contrast of the rail line at locations where the segment runs parallel to a travel area would be none to moderate. The proposed rail line would be sited at least 700 feet from a travel route or frequently used site, and generally on flat terrain, with the exception of locations immediately adjacent to where it would cross a travel route. Based on the visual resource analysis, often the only major visual contrast of a parallel alternative would be the temporary effects of a passing train or maintenance vehicles on the associated road due to the dense vegetation in the project area. Visual impacts would be greater, however, in any areas with less dense vegetation or where the alternative would be more elevated.

In general, SEA anticipates that the visual contrast of segments parallel to roads or rivers would be weak to moderate. The railbeds would introduce an elevated, horizontal, smooth, straight line and regular form into a predominately natural landscape characterized by irregular texture, irregular lines, and rough form. Ballast materials would introduce browns and grays into a predominately green landscape. These contrasts are common in the built environment associated with major ground transportation systems.

Bridges Over Rivers and Streams

Bridge crossings typically result in moderate to strong visual impacts due to the visual contrast of the structural features of the bridge to the surrounding landscape. These can be found along the Salcha Alternative Segments 1 and 2, Donnelly Alternative Segments 1 and 2, and Delta Alternative Segments 1 and 2. For the alternative segments that would cross the Tanana River, or where bridge crossings of several tributaries to the Tanana River would occur, SEA anticipates that the visual contrast created at these locations would be moderate to strong. Additionally, on each segment there would be small rail bridges that would cross streams and sloughs.

In general, changes to the landscape would result from right-of-way being cleared of vegetation, approach abutments, and the bridge structure itself. These potential impacts would be similar to those described under grade separated road crossings only as viewed from a water travel route. If viewed from a parallel travel route such as a trail or road, the impacts would be similar to those described above under Segments Parallel to Travel Area.

Major bridge crossing structures may have main spans 75 to 150 feet wide and 1,100 to 4,000 feet long, while spans on smaller bridges would be 35 to 75 feet wide and about that in length. At stream crossings on the west side of the Tanana River, vehicular bridges (for the access road) would be constructed adjacent to the rail bridges. Many of the rivers and streams in the project area are not currently spanned by a bridge. Therefore, most new bridges would be set in a natural landscape. The bridges' long, flat, structural form supported by straight, vertical piers, would have strong contrast to the wide, smooth, flat rivers and dense, multi-layered, rough and irregular vegetation. The horizontal or vertical continuous lines of the proposed structures would have a strong contrast with a curved river and the irregular lines of the vegetation. SEA anticipates that the grey and silver colors typical of bridges would have a moderate contrast against the silver, grey, blue, and tan hues of the gravel and sand bars and water and various hues of greens of surrounding vegetation. SEA anticipates that the smooth, regular textures of the bridges would have a moderate contrast when compared to the mixture of coarse and smooth textures of the sands, gravel, woody debris, river water and vegetation.

Common Impacts Not Evaluated by the KOP Analysis

The build alternatives also include other permanent structures as well as temporary features that were not analyzed in the KOP contrast analysis process due to the limited information available about their appearance. Permanent facilities include end-of-track facilities, passenger facilities, culverts, and communication towers and power lines. This section provides an overview of these facilities and discusses the potential for permanent and temporary visual impacts.

End-of-track and passenger facilities would be constructed in Delta Junction. Passenger facilities would be located on short sidings that would allow loading and unloading of passengers off the mainline to prevent platforms from interfering with freight transport. These facilities would be located in a built environment with existing structures such as roads and buildings. SEA anticipates that these facilities would result in relatively low visual contrast to the existing built environment.

Culverts would be constructed for crossing water bodies, including streams and wetlands, on all of the alternative segments. Because most culverts (as opposed to bridges) would not be visible from a KOP or frequently utilized travel area, SEA anticipates that they would result in low impacts to visual resources.

Other permanent structures that would be constructed by Alaska Railroad Corporation and common to all alternatives include communication towers. The three proposed towers, which would be on approximately 0.2-acre sites and a maximum of 180 feet tall, would be located at the following sites: Moose Creek Bluff at the Eielson Construction Staging Area along the North Common Segment, near Tanana Flats Training Area along Salcha Alternative Segment 1, and south of Delta Creek along the South Common Segment. All three towers would require a primitive or secondary gravel access road.

The visual impact of the proposed towers would vary depending on location, based on whether they are visible from travel areas or other frequently visited locations, and depending on the adjacent structures and vegetation. In general, the locations would be in the natural landscape. Because the towers are generally placed on the highest point in the area, they are expected to extend above the surrounding vegetation and landforms and be visible from a distance. They introduce a smooth, regular, shiny, straight structure into a rough, irregular landscape. Access roads would have similar impacts as those described in other sections with access roads.

The right-of-way for the rail line would include power lines. Power lines are assumed to be of similar height to some of the trees in the surrounding vegetation. The power poles would be brown, regular, vertical structures that would create contrast in color, form, and texture to the rough, primarily green and irregular vegetation and landscape. The horizontal lines of the power lines would contrast with the mainly vertical lines of the surrounding vegetation on the flat, rolling landscape. The visual impact of the power lines would vary depending on location, based on whether they are visible from travel areas or other frequently visited locations, and depending on the adjacent structures and vegetation.

Temporary construction facilities or operations common to all alternatives include borrow and bale areas (material source areas), construction bridges, construction staging areas, and construction camps. Many of these temporary facilities would be located away from travel areas, urban areas, or other frequently visited sites or would likely be hidden from view at KOP sites due to screening by vegetation.

Borrow and bale areas and source material sites would be located at approximately 2.5-mile intervals or other appropriate sites along the right-of-way in soils that would provide abundant granular material suitable for sub-grade construction. The borrow areas are expected to be 1,500 feet by 500 feet with excavation depths of up to 20 feet and cover approximately 17 to 20 acres each. The final locations of borrow pits are not yet determined. The visual impact of borrow areas and source material sites would vary substantially by location. If visible from travel areas or other frequently visited sites, borrow and bale areas and source material sites could result in strong visual contrast on vegetation and land features through the removal of vegetation and by altering the landform by the removal of topsoil, gravel materials, fill materials and rock for ballast. Bale areas located in Delta Creek, Little Delta River, and Delta River would provide large quantities of granular material for rail line construction. A temporary impact to visual resources would be the equipment used to process and the stockpiling of materials which would change the line, form, color and texture from the surrounding natural landscape and introduce smooth line, conical forms, browns, tans and grays and regular textures into a irregular line, irregular form, predominantly green or blue-brown irregular texture landscape.

Temporary construction facilities would include bridges, staging areas, and camps located throughout the project area. Temporary construction bridges would likely be needed in some areas, but the locations are not yet determined. While in use, these facilities would include a bridge span with pilings as needed and possible scaffolding and would introduce straight horizontal and vertical lines, angular or blocky forms, and smooth textures with hues of gray into a predominately natural landscape of irregular form, rough line and texture, and hues of green. It is anticipated that there would be four construction staging areas: the Eielson Construction Staging Area would be located along the North Common Segment and would cover approximately 140 acres; the Delta Construction Staging Area would be located along the South Common Segment and would cover approximately 40 acres; a rail-to-truck transload and staging area along the Eielson alternative segments that may require vegetation clearing depending upon location; and a storage yard at the Alaska Railroad Depot in Fairbanks. Construction staging areas would provide for staging, storing materials and supplies, and maintaining earth-moving equipment as well as potentially serving as construction camp facilities including space for recreational vehicles and housing facilities. As exact location of the construction areas is not yet determined, visibility of the proposed sites from travel areas and frequently visited areas is not known. If visible, these sites would likely have a strong visual impact due to expected strong contrast to existing vegetation and structural features of the landscape. These impacts would include introducing geometrical, straight lines, and forms, smooth texture, and bright colors into an irregular, rough, green landscape.

The actual use of the rail line and access roads would produce a temporary impact to visual resources. They introduce movement, color and blocky form into a static, predominately green, irregular landscape. Travel along the access roads would also introduce dust plumes temporally. The length of time these impacts would be visible would vary on the length of the train (maximum length of approximately 1.14 miles, average length of approximately 640 feet), train speed (anticipated to range from 20 mph to 76 mph depending on location), and the viewshed of the observer.

N.1.4 Alternative Segment Analysis

This section analyzes the visual impacts of facilities along specific rail segments. Each segment is described in detail below in conjunction with the KOPs selected for the area.

North Common Segment

North Common Segment would be a 2.7-mile length of track running parallel to Richardson Highway approximately 0.5 mile to the south. KOP 3 is the only KOP near the North Common Segment from which the rail line would be visible. This segment would cross streams and Eielson Farm Road. There are existing electricity and utility lines running through the same area.

Eielson Alternative Segment 1

Eielson Alternative Segment 1 would be located between Richardson Highway and the Tanana River, starting at the end of the North Common Segment west of the community of Moose Creek and ending at the start of the Salcha alternative segments south of Eielson AFB. Eielson

Alternative Segment 1 would be the farthest from Richardson Highway of the three Eielson alternative segments and would include one at-grade road crossing of the unimproved Old Valdez Trail near the Eielson Farm Community. This alternative segment would be to the west of Piledriver Slough, which is a recreation area for residents. However, this alternative segment would also be the most proximate to the Eielson Farm Community and farmland on the western side of Piledriver Slough and could potentially be seen from fields, roads, or residences.

Eielson Alternative Segment 2

Eielson Alternative Segment 2 would be located between Richardson Highway and the Tanana River, starting at the end of North Common Segment west of Moose Creek and ending at the start of the Salcha alternative segments south of Eielson AFB. Eielson Alternative Segment 2 would share the same right-of-way path as Eielson Alternative Segment 1 along the northern portion, then split to the southeast, farther away from the densest area of the Eielson Farm Community. While this alternative could come close to a few residential houses, it would not intersect the Eielson Farm Community as Eielson Alternative Segment 1 would. This alternative segment does not cross any existing roads; however, the rail line would bridge the southern section of Piledriver Slough.

Eielson Alternative Segment 3

Eielson Alternative Segment 3 would be located between Richardson Highway and the Tanana River, starting at the end of the North Common Segment west of the community of Moose Creek and ending at the start of the Salcha alternative segments south of Eielson AFB. A key observation point (KOP 4) analysis was performed for this alternative segment, as discussed below.

KOP 4 – View Looking West-Southwest along Eielson AFB Road

KOP 4 is located along an unnamed, unimproved road west of Richardson Highway on the Eielson AFB (see Figure 14-2 and Tables N-7 and N-8). From this point, there would be an open view to Eielson Alternative Segment 3 crossing the road at-grade. The landform consists of primarily flat terrain dotted with lakes and ponds and carved by the nearby Piledriver Slough. Vegetation consists of spruce and hardwood species surrounded by tall scrub thickets. The only existing structure that can be seen from this point is the unnamed road, a single-lane dirt road that curves between the surrounding water features. This KOP was chosen because it is located on Eielson AFB and relatively close to Fairbanks and there are signs of recreation in the nearby area.

Table N-7
Characteristic Landscape and Build alternatives Description for KOP 4

Characteristic Landscape Description			
	Land/Water Body	**Vegetation**	**Structures**
Form	Flat terrain	Dense, multi-layered vegetation	Long, flat, curving road
Line	Strongly horizontal	Vertical with a choppy upper edge	Horizontal and slightly curved
Color	Various hues of browns and grays of native rock	Light to dark green, yellow, brown with a little purple	Varying shades of gray, tan and silver
Texture	Medium to fine, random	Coarse	Coarse

Table N-7
Characteristic Landscape and Build alternatives Description for KOP 4 (continued)

Build alternatives Description – At-Grade Road Crossing			
	Land/Water Body	**Vegetation**	**Structures**
Form	Flat terrain	Dense, single-layered vegetation of grass	Low, regular, and geometric tracks with horizontal road on a small bed of ballast; Thin, horizontal and vertical crossing guards
Line	Strongly horizontal	Vertical with a smooth edge, some interrupted horizontal due to 200-foot clearing for rail line right-of-way	Horizontal and vertical very straight
Color	Various hues of browns and grays	Uniform green of grass	Black, gray, red, tan, and silver
Texture	Coarse, dense, even railbed	Smooth	Regular, smooth in some areas and coarse in others

Table N-8
Summary of Degree of Contrast for KOP 4

Structure Type	**Elements**	**Features**			**VRM Objectives Met?**	**Mitigation Measures Recommended?**
		Land/ Water Body	**Vegetation**	**Structures**		
Minor At-grade Road Crossing	Form Line Color Texture	Weak Weak Weak Weak	Moderate Moderate Weak Moderate	Weak Moderate Moderate Weak	No	Yes

The visual impacts found at KOP 4 are the same as those described above for at-grade road crossings. Some development of transportation or other facilities may be expected on minor access roads. This KOP is located within a VRM Class II area, which allows for little modification. Therefore, with weak to moderate contrast ratings for all feature types, the class objectives at this location would not be met.

Salcha Alternative Segment 1

Salcha Alternative Segment 1 would start at the southern end of the Eielson alternative segments north of the Town of Salcha on the northeastern bank of the Tanana River and would end at the north end of Connector Segments A and B. Salcha Alternative Segment 1 would cross to the southwestern side of the Tanana River almost immediately, and run primarily along the southwestern side of the river. KOP 17 was an observation point along the mainstem of the Tanana River from which Salcha Alternative Segment 1 could be viewed. As discussed above, the crossings of the Tanana River would have moderate to strong visual impacts.

Salcha Alternative Segment 2

Like Salcha Alternative Segment 1, Salcha Alternative Segment 2 would start at the southern end of the Eielson alternative segments north of the Town of Salcha on the northeastern bank of the Tanana River and would end at the north end of Connector Segments C and D. Salcha Alternative Segment 2 would remain on the northeastern side of the Tanana River and would parallel the river for several miles.

Salcha Alternative Segment 2 would cross the Tanana River when approximately parallel with Harding Lake to the east. This alternative includes a crossing of a popular river travel route, the Salcha River (the only segment to do so), as well as a relocation of a portion of Richardson Highway. The railbed and bridges in Salcha Alternative Segment 2 would have similar contrast to those described in the Impacts Common to all Alternatives section, with the exception to the impacts at KOP 21. North of the Salcha River crossing, Salcha Alternative Segment 2 would create several hill cuts in the terrain to accommodate the 200-foot-wide right-of-way crossing a hillside. The KOP 21 analysis assesses the visual impacts of a parallel alternative railbed hill cut. Finally, this segment would go through the Salcha residential community, an area that would be considered sensitive to visual changes.

KOP 21 – View Looking Southeast from Gravel Bar in the Tanana River toward the Salcha River Mouth

KOP 21 is located on a gravel bar towards the western bank of the Salcha River, just south of the confluence with the Tanana River, approximately 5.5 miles south of KOP 18 and 0.1 mile west of Richardson Highway. From this point, there would be an open view to a hill cut associated with Salcha Alternative Segment 2. The level terrain of the gravel bar is bordered by the Salcha River, with braided channels of the Tanana River nearby and a hill across the river to the east (Figure N-6). Vegetation on the islands and river banks consists of spruce and hardwood species surrounded by tall scrub thickets. Although Richardson Highway is only 0.1 miles away, the only visible evidence of cultural modifications is the linear cut of the road in the thick vegetation. This KOP was chosen because it would show the most extensive hill cut into elevated terrain visible to users of both Richardson Highway and the Salcha and Tanana rivers.

This alternative results in the proposed rail line running parallel to a travel area, and requiring a hill cut. It is expected that the visual contrast of this hill cut would be strong. The major visual contrast of a parallel rail line along this segment would be the cut and fill required for construction of the railbed and the temporary effects of trains. Any hill cut would result in the removal of vegetation and source material resulting in exposed soils. Clearance of the right-of-way would also change the patterns of the vegetation to contrast with the natural forest structures of the surrounding landscape. In general, the visual contrast of proposed rail lines parallel to roads or rivers with associated cut and or fill is expected to be moderate to strong due to the change in form, line and color produced by the cut (Table N-9). The rail line and railbed would introduce an elevated, horizontal, smooth, straight line and regular to irregular form into a predominately natural landscape characterized by irregular texture, irregular line, and rough form. Ballast and cut and fill materials would introduce shades of brown and gray into a predominately green landscape. Visual impacts may be greater in any areas with less dense vegetation than typical. These contrasts are common in the built environment associated with major ground transportation systems. However the contrast would be higher as viewed from roads, trails, and water routes.

Table N-9
Characteristic Landscape and Build Alternatives Description for KOP 21

Characteristic Landscape Description			
	Land/Water Body	**Vegetation**	**Structures**
Form	Prominent domed hill with wide linear river	Dense, multi-layered vegetation in the distance	Not visible from this location
Line	Curved landscape with a horizontal river, cut and fill visible for horizontal road	Vertical with a choppy, horizontal upper edge, weak, horizontal line in vegetation due to road cut	Not visible from this location
Color	Shades of brown and blue	Light to dark green, brown	Not visible from this location
Texture	Smooth water and coarse land	Coarse	Not visible from this location
Build Alternatives Description – Parallel Alternative Hill cut			
	Land/Water Body	**Vegetation**	**Structures**
Form	Flat, horizontal surface of cut into the domed hill	Short uniform vegetation in right-of-way	Flat railbed and access road
	Land/Water Body	**Vegetation**	**Structures**
Line	Straight and vertical	Horizontal cut in vegetation at base of hill, defined line of edge of vegetation around hill cut	Horizontal line of railbed and power line, vertical line of power poles
Color	Browns and grays	Light green	Shades of brown and gray
Texture	Regular rough	Smooth, uniform	Regular, coarse

Figure N-6 – Photograph of KOP 21

The visual impacts found at KOP 21 are unique from the common impacts described in Table N-10. At this location, the track's right-of-way would cut deeply into a hillside slope, removing the vegetation and exposing the soil. The cut would change the form and line of the hill from a gentle slope and curve to a square, flat form and sharp lines, resulting in a strong contrast rating.

Because the soil is covered by vegetation in the existing landscape, the soil's texture and color exposed by the hill cut would have a strong contrast to the surrounding vegetation. The form, line, and texture of the vegetation would have similar changes and would also have a moderate to strong contrast rating. The power lines and railbed structures may be visible from KOP 21, and would result in moderate to strong contrast. With the moderate and strong contrast ratings for the landscape, structure, and vegetation features, VRM Class II management criteria would not be met at this location.

Table N-10
Summary of Degree of Contrast for KOP 21

Structure Type	Elements	Features			VRM Objectives Met?	Mitigation Measures Recommended?
		Land/ Water Body	Vegetation	Structures		
Parallel	Form	Strong	Moderate	Moderate	No	Yes
Alternative	Line	Strong	Strong	Strong		
Hill Cut	Color	Moderate	Strong	Moderate		
	Texture	Moderate	Moderate	Moderate		

KOP 20 – View Looking West along Salcha River

KOP 20 is located downstream of the Salcha River State Recreation Site and a boat launch on the Salcha River approximately 1.0 mile upstream from the confluence with the Tanana River. From this point, there would be an open view to Salcha Alternative Segment 2 crossing the Salcha River (see Figure 14-3). The level terrain of the gravel point bar protrudes into the meandering river. Vegetation on the river banks consists of spruce and hardwood species surrounded by tall scrub thickets. No structures are apparent, but there are several residences in the vicinity as well as upstream of this site. This KOP was chosen because the views are representative of outdoor recreationalists' views on a popular clear water tributary to the Tanana River. The contrast at KOP 20 shown in Figure 14-3 is similar to other bridges over rivers analyzed above.

KOP 18 – View Looking Northwest in Tanana River

KOP 18 is located at a gravel bar in the Tanana River approximately 0.3 miles south from where Salcha Alternative Segment 1 would cross the Tanana River. From this point, there would be an open view to Salcha Alternative Segments 1 and 2. The level terrain of the multiple gravel bars is surrounded by the branching channels of the Tanana River with curving hills along the horizon. Vegetation on the distant river banks consists of spruce and hardwood species surrounded by tall scrub thickets. There are no currently visible cultural modifications at this site, as evident in Figure N-7. This KOP was chosen because the photograph simulation view depicted in Figure N-8 of the bridge at this location is representative of outdoor recreationalists' and sightseers' views on the Tanana River and illustrates the visual contrast of bridges over rivers or streams.

Figure N-7 – Photograph of KOP 18

Figure N-8 – Visual Simulation of KOP 18

The visual impacts found at KOP 18 are similar to those described under Bridges Over Rivers and Streams. The bridge's structure, changes to the landform due to the bridge approach, and vegetation on abutments would have a strong contrast with the natural landscape (Tables N-11 and N-12). The form, color and texture contrast are moderate to strong due to viewing distance and elements of the existing landscape. The line contrast would remain strong because the straight, horizontal line of the bridge is sharply outlined by the sky, vegetation and landform.

Table N-11
Characteristic Landscape and Build alternatives Description for KOP 18

Characteristic Landscape Description			
	Land/Water Body	**Vegetation**	**Structures**
Form	Flat terrain with irregular, gentle, rounded waterways	Thin ribbon of vegetation in the distance	None
Line	Strongly horizontal, curved waterways	Horizontal with a curving and irregular upper edge	None
Color	Brown, gray, tan and blue	Dark green	None
Texture	Varying from smooth to coarse	Stippled	None
Build Alternatives Description – Bridge over River			
	Land/Water Body	**Vegetation**	**Structures**
Form	Sloped, geometric approach abutments; flat railbed with vertical, geometric approach abutments	Regular form of grass and right-of –way clearings	Low flat, rectangular bridge divided by vertical rectangular shapes
Line	Horizontal and diagonal line of approach abutments; strongly horizontal railbed with straight, vertical abutments	Horizontal with a curving and regular edges	Straight horizontal and vertical
Color	Various hues of gray	Light green of grass on abutments	Black and gray
Texture	Varying from smooth to coarse	Smooth and regular of low growing vegetation	Regular, smooth in some areas and coarse in others

Table N-12
Summary of Degree of Contrast for KOP 18

Structure Type	Elements	Features			VRM Objectives Met?	Mitigation Measures Recommended?
		Land/ Water Body	Vegetation	Structures		
Bridge Over River	Form	Strong	Strong	Strong	No	Yes
	Line	Strong	Strong	Strong		
	Color	Moderate	Strong	Moderate		
	Texture	Moderate	Strong	Moderate		

This KOP is within a VRM Class II area, which allows for little modification. Therefore, with the moderate and strong contrast ratings for the structure, the class objectives at this location would not be met.

Connector Segments

The connector segments are rail alignments between 0.9 and 4.4 miles long that connect the Central alternative segments to the Salcha and Donnelly alternative segments. Each of the five connector segments is located on the west side of the Tanana River. The segments used for the project would depend on the selection of the Salcha, Central and Donnelly alternative segments. These segments would have no major river crossings or road crossings, but would cross winter recreation trails and streams. These segments are isolated from viewpoints along the Tanana River and Richardson Highway. The visual contrast of this segment is therefore weak, so SEA anticipates that the connector segments would meet the VRM Class II management objectives.

Central Alternative Segment 1

Central Alternative Segment 1 would be a 5.1-mile length of track connecting the Salcha alternative segments via Connector Segment A from Salcha Alternative Segment 1or Connector Segment C from Salcha Alternative Segment 2. The segment would run parallel to the southwestern shore of the Tanana River. This segment would have no major river crossings or road crossings, but would cross winter recreation trails. It is not expected that Central Alternative Segment 1 would be visible from Richardson Highway or other viewing locations on the northeastern side of the Tanana River. As Central Alternative Segment 1 would be farther away from the Tanana River shore than Central Alternative Segment 2, recreationalists would be less likely to see the visual contrast created by this segment.

Central Alternative Segment 2

Central Alternative Segment 2 would be a 3.6-mile length of track running parallel to the southeastern shore of the Tanana River between the Salcha alternative segments via Connector Segments B and D and the Donnelly alternative segments and Connector E. This segment would have no major river crossings or road crossings, but would cross winter recreation trails. Although Central Alternative Segment 2 would be located closer to the Tanana River, unless trains are passing SEA does not expect that it would be visible from Richardson Highway or other viewing locations on the northeastern side of the Tanana River because of the dense vegetation and flat terrain in the area.

Donnelly Alternative Segment 1

Donnelly Alternative Segment 1 would start at the south end of the Central Alternative Segment 1 and Connector E northwest of the Little Delta River and run southeast until it reaches the northern end of the South Common Segment. It would roughly parallel the Tanana River, but would be located several miles inland (south) of the river channel. Both Donnelly alternative segments would be located in areas of dense vegetation and cross the Little Delta River and Delta Creek. It is not expected that either Donnelly Alternative Segments 1 or 2 would be visible from Richardson Highway or other viewing locations on the northeastern side of the Tanana River. The railbed and bridges would have similar contrast to those described in the Impacts Common to All Segments Section. Figure N-9 is from KOP 24 looking north towards the proposed location for Donnelly Alternative Segment 1.

KOP 24 – View Looking North along the Little Delta River

KOP 24 is located on a gravel bar in the Little Delta River, approximately 2.0 miles upstream from the Tanana River. From this point, there would be an open view to Donnelly Alternative Segment 1. The level terrain of the multiple gravel bars is surrounded by the branching confluences of the Little Delta River with curving hills along the horizon. Vegetation on the distant river banks consists of spruce and hardwood species surrounded by tall scrub thickets. There are no visible cultural modifications at this site. This KOP was chosen because the views are representative of outdoor recreationalists' and sightseers' views on a typical tributary to the Tanana River.

Figure N-9 – Photograph of KOP 24

The visual impacts found at KOP 24 are similar to those described under Bridges Over Rivers and Streams. The bridge's structure, changes to the landform due to the bridge approach, and vegetation on abutments would have a strong contrast with the natural landscape. This KOP is within a VRM Class II area, which allows for little modification. The number of sensitive viewers in this location would be few but, with the moderate and strong contrast ratings for the structure, the class objectives at this location would not be met.

Donnelly Alternative Segment 2

Donnelly Alternative Segment 2 would start at the south end of Central Alternative Segment 2 northwest of the Little Delta River and roughly parallel the southwestern banks of the Tanana River until it reaches the northern end of the South Common Segment. While both Donnelly alternative segments would be located in areas of dense vegetation and cross the Little Delta River and Delta Creek, Donnelly Alternative Segment 2 would be located closer to the banks of the Tanana River. It is not expected that Donnelly Alternative Segment 2 would be visible from Richardson Highway or other viewing locations on the northeastern side of the Tanana River. The railbed and bridges would have similar contrast to those described in the Impacts Common to All Segments Section. The crossing of the Little Delta River would have similar impacts to those described for Donnelly Alternative Segment 1. However, since Donnelly Alternative Segment 2 would include a bridge crossing of the Little Delta River that is closer to the Tanana River, recreationists on the Tanana River would be more likely to see the bridge for Donnelly Alternative Segment 2.

South Common Alternative Segment

The South Common Segment would start at the southern end of the Donnelly alternatives east of Delta Creek and continue towards the southeast to the Delta River. This segment would cross four winter travel routes, but does not include any major river or paved road crossings. KOP 27 provides a view of the South Common Segment.

KOP 27 – View Looking South along Winter Travel Route

KOP 27 is located northwest of the Town of Delta Junction along a winter travel route approximately 2 miles from the Tanana River. From this point, the South Common Segment would be located approximately 700 feet away, screened by thick vegetation. The landform consists of primarily flat terrain with no nearby water features. Vegetation consists of spruce and hardwood species surrounded by tall scrub thickets. There are no structures in this area. This KOP was chosen because the views are representative of the predominant vegetation of the project area with a narrow viewshed at or below the level of the proposed structures and limited by black spruce with understory brush. This KOP was also chosen because at this location the proposed rail line is running parallel to a winter travel route at a distance of 700 feet, which is the closest distance of an alternative segment to a travel area, with the exception of where the proposed rail line crosses a road or waterway. The photograph simulation of the project at this location shows that the visual impact is confined to the temporary effect of a passing train visible through the dense vegetation (Figure N-10).

The visual impacts found at KOP 27 are the same as those described for Alternatives Parallel to Travel Areas (Tables N-13 and N-14). Due to the viewing distance and thick vegetation, the changes to land and water, vegetation features would not be seen at KOP 27, with the exception of seeing the top of an occasional passing train through the vegetation gaps. This KOP is within a VRM Class II area, which allows for little modification. The contrast rating for the land/water, vegetation, and structure features would be none and would meet the class objectives at this location.

Figure N-10 – Visual Simulation of KOP 27

Table N-13
Characteristic Landscape and Build Alternatives Description for KOP 27

	Land/Water Body	Vegetation	Structures
Characteristic Landscape Description			
Form	Flat terrain	Dense, multi-layered vegetation	Long, flat winter trail
Line	Strongly horizontal	Tall, vertical elements with curving lower lines of brush	Horizontal, parallel
Color	Varying shades of gray and white	Light to dark green, yellow, brown	Varying shades of green
Texture	Sandy and stippled	Coarse	Coarse
Build Alternatives Description Parallel to Travel Area			
Form	Flat terrain	Dense, multi-layered vegetation	Long, flat railbeded
Line	Strongly horizontal	Tall, vertical elements with curving lower lines of brush, horizontal line in the top of the vegetation showing the absence of vegetation in the ROW	Horizontal, parallel
Color	Varying shades of gray and white	Light to dark green, yellow, brown	Varying shades of gray, tan and silver
Texture	Sandy and stippled	Coarse	Coarse

Table N-14
Summary of Degree of Contrast for KOP 27

Structure Type	Elements	Features: Land/Water Body	Features: Vegetation	Features: Structures	VRM Objectives Met?	Mitigation Measures Recommended?
Alternative Parallel to Travel Area	Form	None	None	None	Yes	No
	Line	None	None	None		
	Color	None	None	None		
	Texture	None	None	None		

Delta Alternative Segment 1

Delta Alternative Segment 1 connects the southern end of the South Common Segment to the build alternative's terminus south of Delta Junction. Delta Alternative Segment 1 would extend south along the western side of the Delta River and cross the river south of Delta Junction, near Jarvis Creek and the northern edge of the Fort Greely Military Reservation. It would extend east to the southern rail terminus. KOP 10 provides a view of Delta Alternative Segment 1.

KOP 10 – View Looking North along Richardson Highway (South of Delta Junction)

KOP 10 is located on Richardson Highway just north of the bridge over Jarvis Creek. From this point, there would be an open view to Delta Alternative Segment 1 as it crosses Richardson Highway. The landform consists primarily of flat terrain with the nearby linear Jarvis Creek. Vegetation at the site consists of grassy vegetation adjacent to the highway, while farther from the highway the vegetation changes abruptly to dense stands of spruce and hardwood trees. In addition to the highway, structures at the site include a power line running parallel to the highway on the west side, a telephone line running parallel to the highway on the east side, and road signs next to the highway. This KOP was chosen because it is representative of the flat terrain, vegetation, and types of structures visible at sites along Richardson Highway. The photograph simulation of the project at this location is shown in Figure N-11.

Figure N-11 – Simulation of KOP 10

The visual impacts found at KOP 10 would be similar to those described for grade separated road crossings (Tables N-15 and N-16). Some development of transportation or other facilities are expected on major roads. This KOP is within a VRM Class II area, which allows for little modification. Therefore, with the moderate to strong contrast ratings for land and structure, the class objectives at this location would not be met.

Table N-15
Characteristic Landscape and Build Alternatives Description for KOP 10

Characteristic Landscape Description			
	Land/Water Body	**Vegetation**	**Structures**
Form	Flat terrain	Open grassland near the road, dense, tall, multi-layered vegetation several yards from the road	Long, flat, curving road, geometric structures and signs
Line	Strongly horizontal	Horizontal grasses, vertical trees and brush with a irregular upper edge	Horizontal and vertical with some curves
Color	Varying shades of gray	Light to dark green, yellow, brown and white	Gray, while, yellow, red, and silver
Texture	medium to fine and stippled	Coarse to fine and stippled	Stippled in some areas, smooth in others
Build Alternatives Description - Grade Separated Road Crossing			
	Land/Water Body	**Vegetation**	**Structures**
Form	Sloped terrain for abutments and rectangular terrain	Small, dense, single-layered vegetation on earthen fill	Rectangular, horizontal form with vertical rectangular supports. Thin, horizontal and vertical crossing guards

Table N-15
Characteristic Landscape and Build Alternatives Description for KOP 10 (continued)

	Land/Water Body	Vegetation	Structures
Line	Strongly horizontal railbed with vertical abutments	Rough edged line between existing vegetation and on the earthen fill for the bridge	Horizontal, diagonal, and vertical, very straight
Color	Varying shades of gray and white	Light to dark green	Grey, green, silver
Texture	medium to fine and stippled	Stippled and fine	Regular, smooth in some areas and coarse in others

Table N-16
Summary of Degree of Contrast for KOP 10

Structure Type	Elements	Features: Land/ Water Body	Features: Vegetation	Features: Structures	VRM Objectives Met?	Mitigation Measures Recommended?
Richardson Highway Crossing Grade Separated	Form	Moderate	Moderate	Moderate-Strong	No	Yes
	Line	Moderate	Moderate	Moderate-Strong		
	Color	Weak	Moderate	Weak		
	Texture	Weak	Moderate	Moderate		

Delta Alternative Segment 2

Delta Alternative Segment 2 would extend from the south end of the South Common Segment and cross the Delta River immediately. It would cross near the community of Big Delta and would extend south on the east side of the Delta River, crossing several minor roads and farmland prior to reaching the southern terminus. Delta Alternative Segment 2 includes one grade separated crossing of Old Richardson Highway and two grade separated crossings for Richardson and Alaska highways, as well as two additional at-grade crossings of less frequently traveled roads. In general, the railbed, bridges and at-grade road crossings and grade separated road crossings of Delta Alternative Segment 2 would have similar contrast ratings to those described in the Impacts Common to All Alternatives Section. Figure N-12 is a photograph from KOP 14, from which point Delta Alternative Segment 2 would be visible as it crosses Jack Warren Road.

KOP 14 – View Looking East along Jack Warren Road in Delta Junction

KOP 14 is located on Jack Warren Road less than 0.1 miles west of Phillips Road. From this point, there would be an open view to Delta Alternative Segment 2 as it crosses Jack Warren Road. The landform consists of primarily flat terrain with some undulating rises. Vegetation at the site consists of grassy vegetation adjacent to the road, while farther from the road the vegetation changes abruptly to dense stands of spruce and hardwood trees. In addition to the road, structures at the site include a power line running parallel to the road on the north side, several side roads intersecting Jack Warren Road, and road signs next to the road. This KOP was chosen because it is representative of the flat terrain, vegetation, and types of structures visible at sites along a typical minor roadway.

Figure N-12 – Photograph of KOP 14

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Appendix O – ANILCA
Section 810 Analysis of Subsistence Impacts

O. ANILCA Section 810 Analysis of Subsistence Impacts

Alaska Railroad Corporation (ARRC or the Applicant) is seeking authorization to construct and operate a new rail line approximately 80 miles long from North Pole to Delta Junction, Alaska. To this end, the Surface Transportation Board (STB) has prepared an Environmental Impact Statement (EIS) to assess the environmental consequences of the proposed rail line. Chapters 3 through 16 of the Northern Rail Extension (NRE) EIS provide a detailed description of both the affected environment of the project area and the potential adverse effects of the proposed action and alternatives. Chapter 7 specifically addresses the potential impacts to subsistence uses within the project area. Appendix I provides a summary of the subsistence methodology, baseline data and potential impacts to communities. Appendix O uses the detailed information presented in the NRE EIS to evaluate the potential impacts to subsistence pursuant to Section 810 of the Alaska National Interest Land Conservation Act (ANILCA), specifically.

O.1 Subsistence Evaluation Factors

Section 810(a) of ANILCA requires that an evaluation of subsistence uses and needs be completed for any Federal determination to "withdraw, reserve, lease, or otherwise permit the use, occupancy or disposition of public lands." Federal regulations define subsistence uses as follows:

> …the customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade. (ANILCA Title VIII Section 803)

The proposed NRE encompasses lands that are owned or managed by three different entities: private landowners (private lands), the State of Alaska (state lands), and the Bureau of Land Management (BLM) (Federal public lands). BLM would need to issue a right-of-way (ROW) for those portions of the NRE that cross Federal public lands.

Chapter 7 of the NRE EIS finds that neither state nor Federal subsistence regulations apply to the project area. Regarding state regulations, the project area is located within a state-designated nonsubsistence area. Regarding Federal regulations, all Federal public lands in the project area have been withdrawn for military uses, where subsistence regulations do not apply. As stated in the *Federal Register* (*Subsistence Management Regulations for Public Lands in Alaska*, Subpart A):

> [t]he military lands, including US Coast Guard, and Federal Aviation Administration have never been included in the Federal Subsistence Management Program because of national security and defense reasons. These lands have been and are closed to access by the general public, and are, therefore, not available for use by rural Alaska residents for harvest of subsistence resources. (70 *FR* 76400)

Despite the withdrawal of lands for military use, hunting and fishing activities are allowed under a Recreation Access Permit issued by the military. These activities must also be conducted in compliance with state sport hunting and fishing regulations. However, the U.S. Army Garrison Alaska (USAG-AK), which manages the military-withdrawn lands in the project area, recognizes that subsistence harvesters use subsistence resources on its lands and takes responsibility for managing these resources for subsistence users. The USAG-AK recognizes that the following communities have subsistence interests on USAG-AK lands: Healy Lake, Dot Lake, Tanacross, Tetlin, Northway, Delta Junction, Big Delta, Deltana, Dry Creek, Minto, Nenana, and Cantwell. Thus, although subsistence uses on lands in the project area are not recognized under Federal regulations, residents from nearby communities use subsistence resources from these lands and may use these lands to access subsistence use areas on Federal public lands outside of the project area.

Because ANILCA requires an evaluation of potential impacts to subsistence uses on Federal public lands, regardless of whether the lands in question are subject to Federal subsistence management regulations, an ANILCA Section 810 evaluation was completed and issued with the NRE EIS. The evaluation only applies to those lands administered by BLM. The impacts of the entire project, together with past, present, and reasonably foreseeable activities in the surrounding region, are evaluated in the cumulative impacts section of this Section 810 analysis.

ANILCA requires that the Section 810 evaluation include findings on three specific issues:

1. The effect of such use, occupancy, or disposition on subsistence uses and needs;

2. The availability of other lands for the purpose sought to be achieved; and

3. Other alternatives that would reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes (16 United States Code 3120).

The evaluation and findings required by ANILCA Section 810 are set out for the Federal public lands portion of each of the alternatives (including the No-Action Alternative) considered in the NRE EIS, and for all lands under the cumulative impacts analysis.

A finding that the proposed action could significantly restrict subsistence uses imposes additional requirements, including provisions for notices to the state and appropriate regional and local subsistence committees, a hearing in the vicinity of the area involved, and the making of certain determinations as required by Section 810(a)(3). If the evaluation finds that a significant restriction could occur, BLM must determine whether:

A. Such a significant restriction of subsistence uses is necessary, and consistent with sound management principles for the utilization of the public lands;

B. The proposed activity would involve the minimal amount of public lands necessary to accomplish the purposes of such use, occupancy, or other disposition; and

C. Reasonable steps would be taken to minimize adverse effects upon subsistence uses and resources resulting from such actions.

To determine if a significant restriction of subsistence uses and needs on Federal public lands could result from any one of the alternatives discussed in the NRE EIS, the following four factors in particular were considered: 1) the reduction in the availability of subsistence resources caused by a decline in the population or amount of harvestable resources, 2) reductions in the availability of resources used for subsistence purposes caused by alteration of their normal locations and distribution patterns, 3) limitations on access to subsistence resources, including from increased competition for the resources, and 4) limitations on the ability of harvesters to reach and use active subsistence harvesting sites.

A significant restriction to subsistence could occur in at least three instances: 1) when an action substantially could reduce resource populations or their availability to subsistence users, 2) when an action could substantially alter current patterns of subsistence use, and 3) when an action could substantially limit access by subsistence users to resources. Section 7.3 (Environmental Consequences, Subsistence) of the NRE EIS provides much of the data concerning the potential impacts of the NRE, and was used to determine whether the level of effects of each alternative is extensive enough to cause a possible significant restriction to subsistence uses on Federal public lands. Section 7.2, (Affected Environment, Subsistence), provides information regarding areas and resources important for subsistence use, and the degree of dependence of affected villages on different subsistence populations. Chapter 5 of the NRE EIS provides a description of the affected environment and environmental consequences regarding biological resources. The information contained in the NRE EIS is the primary data used in this analysis.

A subsistence evaluation and findings under ANILCA Section 810 must also include a cumulative impacts analysis. Section O.2, below, begins with an evaluation and finding for the proposed action and alternatives. Under the proposed action, ARRC describes common support facilities as well as seven segments of the proposed NRE. ARRC is considering alternative segments (discussed under Section O.2.3, Evaluation and Finding for Alternative Segments on Federal Public Lands). The cumulative case is analyzed by viewing the NRE as a whole, and including all proposed activities on all lands and by using the most intensive cumulative case as is discussed in Chapter 17 of the NRE EIS. This approach follows ANILCA regarding Federal public lands. The approach also allows for the evaluation of impacts on subsistence by portions of the NRE project that are proposed on state or private lands, as well as subsistence restrictions that could occur from past, present, and future activities in the project area and vicinity. Alternative segments not on Federal public lands are also discussed under the cumulative case (Section O.2.4).

In addition to ANILCA, Executive Order 12898, *Environmental Justice*, also calls for the analysis of Federal actions on minority populations. Environmental Justice is defined as:

> The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic group should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

Section 4-4 of the Executive Order requires Federal agencies to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence, and to communicate to the public any risks associated with the consumption patterns. The subsistence analyses in Chapter 7 comply with the Executive Order.

O.2 ANILCA 810(a) Evaluations and Findings for All Alternatives and the Cumulative Case

The following evaluations are based on information relating to the environmental and subsistence consequences of the proposed action and alternatives, No-Action Alternative, alternative segments, and the cumulative case. The evaluations and findings focus on potential impacts to the subsistence resources themselves, as well as access, economic, and cultural issues that relate to subsistence use. For each individual alternative segment, the evaluation and finding applies to Federal public lands—those lands that are under the stewardship of BLM, and are subject to ANILCA review. The proposed action, together with other past, present, and reasonably foreseeable future actions that could restrict subsistence, are evaluated in the cumulative case.

O.2.1 Evaluation and Finding for the Applicant's Proposed Action

Under the proposed action, ARRC would construct and operate the NRE starting south of North Pole and ending south of Delta Junction. For this project ARRC would require a 200-foot ROW from BLM. Because these Federal public lands have been withdrawn for military purposes, consultation and authorization from USAG-AK would also be required. The majority of construction activities would occur within the 200-foot ROW. The rail line would generally follow the Tanana River, and would cross the Tanana, Delta, and Little Delta rivers; Delta Creek; and potentially the Salcha River. In addition to the rail line and associated bridges, infrastructure would include an unpaved access road to support rail line construction and operation, grade crossings, six communication towers, a passenger facility at Delta Junction, two section facilities, and track sidings. The construction phase would require the development of construction staging areas and camps outside the 200-foot ROW.

Train operations would include transport of commercial freight, military supplies, and passengers. ARRC estimates an average of four round-trip passenger trains and one round-trip freight train per day. Maximum train speeds would 79 miles per hour (mph) for passenger trains and 60 mph for freight trains.

The NRE EIS considers alternatives by common segment, alternative segment, and connector segment designations. ARRC has proposed the following sequence of segments for the proposed action: Eielson Alternative Segment 3, Salcha Alternative Segment 1, Connector Segment B, Central Alternative Segment 2, Donnelly Alternative Segment 1, and Delta Alternative Segment 1. This analysis addresses only proposed action segments on Federal public lands, and thus excludes impacts associated with North Common Segment, Connector Segment E, and South Common Segment (see Table O-1). Those segments that do not occur on Federal public lands are discussed in the cumulative analysis.

Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The analysis of the proposed action and alternatives presented in Section 7.3 of the NRE EIS considers the direct and indirect effects of construction and operation of the NRE on subsistence

Table O-1
Federal Public Land Status, NRE Alternative Segments

Alternative Segment	Proposed Action	Federal (Military)	Not Federal	Proposed and Federal
Eielson Alternative Segment 3	X	X		X
Salcha Alternative Segment 1	X	X		X
Connector Segment B	X	X		X
Central Alternative Segment 2	X	X		X
Donnelly Alternative Segment 1	X	X		X
Delta Alternative Segment 1	X	X		X
North Common Segment	X		X	
Salcha Alternative Segment 2			X	
Connector Segment E	X		X	
Donnelly Alternative Segment 2			X	
South Common Segment	X		X	
Eielson Alternative Segment 1		X		
Eielson Alternative Segment 2		X		
Connector Segment A		X		
Connector Segment C		X		
Connector Segment D		X		
Central Alternative Segment 1		X		
Delta Alternative Segment 2		X		

uses in and around the project area. Section 7.2 describes subsistence uses in the project area, and Appendix I provides summary baseline data regarding use areas, user access, resource availability, and competition for the 12 study communities. The 12 study communities were chosen based on their proximity to the project area, documented subsistence uses in and near the proposed rail line, and the USAG-AK's recognition of communities with subsistence interests in the area. These communities include Cantwell, Delta Junction, Dot Lake, Dry Creek, Healy Lake, Minto, Nenana, Northway, Salcha, Tanacross, Tetlin, and Tok. This document only addresses potential effects of the NRE on subsistence uses and resources on Federal public lands and for residents qualified as Federal subsistence users. The Federal government does not recognize Salcha residents as federal subsistence users because the community is located within the nonrural Fairbanks North Star Borough; therefore, potential effects related to Salcha subsistence uses are not discussed further. The study communities with documented use areas or harvests within the project area are Cantwell, Delta Junction, Dot Lake, Healy Lake, Minto, Nenana, and Tok. Direct effects on subsistence uses and resources are most likely to occur for the communities of Delta Junction, Healy Lake, Nenana, and Tok due to more prevalent subsistence use overlaps in the project area. Communities' uses of the project area are low relative to their overall use areas. However, subsistence use area data are not available for certain communities, such as Delta Junction, which are located within or close to the project area. Subsistence users in communities located downstream from the project area may experience effects if construction and operational activities related to the NRE affect anadromous fish.

The NRE EIS analysis concludes that construction of the NRE would have temporary direct effects on subsistence uses for Delta Junction, Healy Lake, Nenana, and Tok, which have more documented use in the project area. User access would be limited if residents' harvest activities occur at the same time and place as construction activities, particularly during construction of bridges over waterways and segments over existing trails. Noise and activity related to construction could deflect resources away from use areas, making resources less available to subsistence users and resulting in heightened competition for resources in the area. Furthermore, subsistence users could begin hunting in other communities' use areas due to changes in resource availability or harvester avoidance of noise and human activities, resulting in increased competition for residents in communities that do not use the project area. The loss of traditional use areas for Alaska Natives (Healy Lake lifetime use areas show considerable use of the project area) could result in indirect effects on residents' connection to these lands, leading to a sense of loss or intrusion on traditionally important harvest areas. Impacts on user access could lead to indirect effects such as hunters having to spend more time and money to travel farther for subsistence activities, and related effects on hunter safety.

Chapter 7 addresses operations-related impacts and concludes that development and operation of the NRE would result in direct effects on those communities whose subsistence uses overlap the project area (Delta Junction, Healy Lake, Nenana, and Tok). A main impact is related to user access. ARRC regulations prohibit public users from crossing rail lines without a permit except at grade crossings where those activities are approved. Instead of taking the most direct route, subsistence users would have to travel to the nearest grade crossing in order to access use areas on either side of the rail line. This would result in individuals having to travel farther and spend more time and money for subsistence pursuits.

Harvests of moose, caribou, furbearers, and fish have been documented in Unit 20A (NRE EIS Chapter 7), and trails and routes crossing the Tanana River into Game Management Unit 20A are also documented (NRE EIS Chapter 13). Individuals who use those routes to access Unit 20A for hunting, trapping, and fishing activities would experience impacts on access. The NRE could also result in subsistence users and wildlife following the rail corridor, increasing the availability of moose in the area as well as increasing competition along that corridor, which could affect overall regional subsistence patterns. These impacts could be mitigated by placing grade crossings at appropriate intervals along the rail line.

The NRE EIS also addresses impacts on subsistence resources in Chapter 5, Biological Resources. The chapter analyzes the potential effects to vegetation, fish resources, game mammals, and birds. Clearing of vegetation within the 200-foot ROW could result in long-term loss of vegetation, which could affect berry and plant harvests for residents who use the project area for those purposes. The proposed action crosses 27 fish streams, and Chapter 5 concludes that stream crossings could result in fish (resident and anadromous) habitat loss and blockage of fish movements, resulting in "moderate" impacts to fisheries. Regarding land mammals, the primary impacts related to NRE construction and operation include a potential for an average of 40 moose-train collision mortalities per year, habitat loss and fragmentation, and disturbances from increased noise and human activity. However, overall effects on land mammal populations and habitat in the region are expected to be relatively small. Chapter 5 also indicates that vegetation clearing could reduce habitat for birds, especially landbirds, and construction of power lines and communication towers could result in collision mortality for birds. These impacts are expected to affect only a small proportion of bird habitat and population.

Most impacts on subsistence would be similar regardless of the alternative segment. However, some segments would result in a greater incidence of impacts due to the number of stream or bridge crossings or the number of recreation access routes affected. For the proposed action, Donnelly Alternative Segment 1 would require the highest number of bridges and culverts (37), followed by Eielson Alternative Segment 3 (17), Salcha Alternative Segment 1 (13), Central Alternative Segment 2 (11), Connector Segment B (3), and Delta Alternative Segment 1 (2). Of these segments, only Eielson Alternative Segment 3 requires a substantially higher number of bridges and culverts than its alternative segments (*i.e.*, Eielson alternative segments 1 and 2). Construction of segments with more bridges and culverts would have higher impacts on subsistence uses and travel in the project area. Construction and operation of those segments could have an effect on resident and anadromous fish populations and habitats, which could result in effects on the availability of these resources to subsistence users, including subsistence users in communities located downstream from the project area who harvest anadromous fish.

Of the proposed action alternative segments (on Federal public land), Eielson Alternative Segment 3 and Donnelly Alternative Segment 1 would have the highest number of recreation access route intersections (six). Two of the alternative segments would have more access route intersections than their alternatives, and two would have fewer access route intersections than their alternatives. Delta Alternative Segment 1 would not intersect any recreation access routes, but, as stated in the NRE EIS Table S-2, both Delta alternative segments would intersect "numerous legal, informal trails."

Overall, the differences among the proposed action and the alternative segments regarding the number stream or bridge crossings and the number of recreation access routes affected, are minimal. Additional alternative segments are discussed below in Section O.2.3.

Evaluation of the Availability of Other Lands for the Northern Rail Extension

The purpose of the proposed NRE is to extend current freight and passenger rail services to areas south of North Pole, and to provide an alternative to Richardson Highway for these services. The proposed rail line alternatives follow a relatively direct route from the end of the existing rail line, north of Eielson Air Force Base (AFB), to south of Delta Junction. The alternative segments follow the existing highway and/or the Tanana River relatively closely. Various alternatives were considered, some of which were eliminated during the alternatives development process. Alternatives were chosen for further analysis based on considerations of engineering and environmental factors as well as on issues raised by agencies or the public. Because the purpose of the proposed NRE is to construct and operate a rail line between two points (North Pole and Delta Junction) and because constructing and operating a rail line outside of the project area could lead to greater adverse environmental impacts and engineering obstacles, lands outside of the proposed project area would not satisfy the purpose and need of the NRE.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Federal Public Lands Needed for Subsistence Purposes

Other alternatives that would reduce or eliminate the use of Federal public lands needed for subsistence purposes are described in NRE EIS Chapter 7 and Appendix I, many of which became alternatives considered but eliminated from further analysis because they did not meet the purpose and need of the proposed project to provide freight and passenger services to areas south of North Pole; they could lead to greater adverse impacts on the environment; or they presented construction or operational limitations. Section 2.2.2 of the EIS provides a description of the alternatives eliminated from the study as well as the reasons for the elimination of these alternatives.

Finding

The effects of the proposed action fall below the level of significantly restricting subsistence use for the 12 study communities (Cantwell, Delta Junction, Dot Lake, Dry Creek, Healy Lake, Minto, Nenana, Northway, Tanacross, Tetlin, and Tok). The impacts to subsistence resources and access as discussed above would be minimal, and documented uses within the project area are relatively low.

According to BLM ANILCA policy, “significant restrictions are differentiated from insignificant restrictions by a process assessing whether the action undertaken shall have no or a slight effect as opposed to large or substantial effects” (BLM Instructional Memorandum No. AK86-350, Policy for Section 810 Compliance with the Alaska National Interest Lands Conservation Act). Further direction states “no significant restriction results when there would be ‘no or a slight’ reduction in the abundance of harvestable resources and no or only ‘occasional’ redistribution of these resources; there would be no effect (or slight inconvenience) on the ability of harvesters to reach and use active subsistence harvesting sites; and there would be no substantial increase in competition for harvestable resources” (*ibid.*).

O.2.2 Evaluation and Finding for the No-Action Alternative

Under the No-Action Alternative, ARRC would not construct or operate an extension of the existing rail line, nor would it construct or operate related passenger facilities, bridges (including the dual-modal bridge over the Tanana River), or other infrastructure. BLM would not issue a ROW to allow construction of the NRE.

Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

Under the No-Action Alternative, construction and operation of the NRE and related bridges and facilities would not occur. User access, resource abundance and distribution, and competition for subsistence resources would not be affected. No changes to subsistence for residents of the study communities would result from the No-Action Alternative. The possibility that other activities could occur in the project area that could result in adverse effects on subsistence uses is considered below under the cumulative impacts analysis.

Evaluation of the Availability of Other Lands for the Northern Rail Extension

Under the No-Action alternative, construction and operation of the NRE and related facilities would not occur. Therefore, the evaluation of the availability of other lands for the NRE is not necessary.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Federal Public Lands Needed for Subsistence Purposes

No rail line or related facilities would be constructed or operated in the project area under the No-Action Alternative, thus no additional Federal public lands would be made unavailable for subsistence uses.

Finding

The effects of the No-Action Alternative fall below the level of possibly significantly restricting subsistence uses and needs. As discussed above, there would be no impacts to subsistence resources and access.

O.2.3 Evaluation and Finding for Alternative Segments on Federal Public Lands

Under the alternative segments, ARRC would construct and operate the NRE starting south of North Pole and ending south of Delta Junction. For this project ARRC would require a 200-foot ROW from BLM. Alternative segments located on Federal public lands include Eielson Alternative Segments 1 and 2, Connector Segments A, C, and D, Central Alternative Segment 1, and Delta Alternative Segment 2. Rail construction and operation under these alternative segments would generally be the same; however, the segment routes would change. Changes in segment routes in some cases alters the number of stream or bridge crossings required, the number of recreation access route intersections, and the amount of habitat affected.

Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

As discussed under the evaluation for the proposed action, impacts on subsistence uses would be similar regardless of the alternative segment, and differences between the proposed action alternative segments and the remaining alternative segments are minimal. Thus the evaluation of the impacts to subsistence uses for the alternative segments would essentially be the same as that presented for the proposed action. Alternative segments could result in slight differences in impact levels due to differences in the number of bridge and stream crossings (which could affect access during construction and could disturb fish habitat resulting in decreased resource availability) and differences in the number of recreation access route intersections (which could affect user access).

The number of bridge and stream crossings required for the alternative segments would be highest for Eielson Alternative Segment 1 (14), followed by Eielson Alternative Segment 2 (13), Central Alternative Segment 1 (10), Connector Segment C (7), Connector Segments A and D (4), and Delta Alternative Segment 2 (1). The alternative segments that would require fewer bridge and stream crossings than the proposed action include Eielson Alternative Segments 1 and 2 and Central Alternative Segment 1. The other segments would require an equal or greater number of bridge and stream crossings than the proposed action. Overall, there are only minor differences between the alternative segments and the proposed action in regards to bridge and stream crossings.

The number of recreation access route intersections would be higher under Eielson Alternative Segments 1 and 2 than under Eielson Alternative Segment 3 (the proposed action). The remaining alternative segments would intersect either none or one access route intersection. As with Delta Alternative Segment 2 (the proposed action), Delta Alternative Segment 3 would intersect “numerous legal, informal trails” (see NRE EIS Table S-2).

Evaluation of the Availability of Other Lands for the Northern Rail Extension

The Applicant states that the purpose of the proposed NRE is to extend current freight and passenger rail services to areas south of North Pole, and to provide an alternative to Richardson Highway for these services. The alternatives follow a relatively direct route from the end of the existing rail line, north of Eielson AFB, to south of Delta Junction. The alternatives follow the existing highway and/or the Tanana River relatively closely. Various alternatives were considered, some of which were eliminated during the alternatives development process. The alternatives selected for detailed analysis were chosen based on considerations of engineering and environmental factors as well as on issues raised by agencies or the public. Because the purpose of the proposed NRE is to construct and operate a rail line between two points (North Pole and Delta Junction) and because constructing and operating a rail line outside of the project area could lead to greater adverse environmental impacts and engineering obstacles, lands outside of the proposed project area would not satisfy the purpose and need of the NRE.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Federal Public Lands Needed for Subsistence Purposes

Other alternatives that would reduce or eliminate the use of Federal public lands needed for subsistence purposes are described in Chapter 2 and Appendix D of the NRE EIS, many of which became alternatives considered but eliminated from further analysis because they did not meet the purpose and need of the proposed project; they could lead to greater adverse impacts on the environment; or they presented construction or operational limitations. Section 2.2.2 of the NRE EIS provides a description of the alternatives eliminated from the study as well as the reasons for the elimination of these alternatives.

Finding

The effects of the proposed action fall below the level of significantly restricting subsistence use for the 12 study communities (Cantwell, Delta Junction, Dot Lake, Dry Creek, Healy Lake, Minto, Nenana, Northway, Tanacross, Tetlin, and Tok). The impacts to subsistence resources and access as discussed above would be minimal, and documented uses within the project area are relatively low.

According to BLM ANILCA policy, "significant restrictions are differentiated from insignificant restrictions by a process assessing whether the action undertaken shall have no or a slight effect as opposed to large or substantial effects" (BLM Instructional Memorandum No. AK86-350, Policy for Section 810 Compliance with the Alaska National Interest Lands Conservation Act). Further direction states "no significant restriction results when there would be 'no or a slight' reduction in the abundance of harvestable resources and no or only 'occasional' redistribution of these resources; there would be no effect (or slight inconvenience) on the ability of harvesters to reach and use active subsistence harvesting sites; and there would be no substantial increase in competition for harvestable resources" (*ibid.*).

O.2.4 Evaluation and Finding for the Cumulative Case

Chapter 17 (Cumulative Impacts) of the NRE EIS outlines the cumulative effects of the NRE and other planned activities and developments on human and environmental resources in the project area. To analyze the potential cumulative impacts in the project area, the EIS considered all past, present, and reasonably foreseeable future projects and actions that could result in impacts in the project area. These include military activities, a proposed Alaska natural gas pipeline, and Richardson Highway upgrades. Other potential activities were considered in the NRE EIS but were not analyzed in detail because they were not considered reasonably foreseeable at this time.

Evaluation of the Effect of Such Use, Occupancy, or Disposition on Subsistence Uses and Needs

The cumulative case includes potential adverse effects on subsistence uses caused by construction and operation of the NRE as well as construction and operation related to expansion of military activities, the proposed natural gas pipeline, and Richardson Highway upgrades.

Effects on subsistence related to the NRE include effects to user access due to restrictions on access over the NRE rail line and restrictions on activities within and across the ROW; changes in resource distribution and availability due to the creation of a vegetation-free corridor, an increase in train-moose collisions, destruction of fish habitat, and blockage of fish movements; and increased competition due to changes in access and resource availability. Additional construction, operation, and infrastructure-related impacts associated with military expansion activities, roadway upgrades, and the proposed Alaska natural gas pipeline would contribute to cumulative impacts on subsistence access, resource availability and competition. Chapter 7 of the NRE EIS concludes that harvests of land mammals, furbearers, and fish occur within Game Management Unit 20A. Residents from the study communities who travel through the project area to access that unit would likely experience effects related to access. Any impacts related to subsistence access could also cause increased resource competition for other communities, even if they do not use the project area for subsistence activities.

Chapter 17 of the NRE EIS also addresses cumulative impacts on biological resources, which include land mammals and fish. Effects on land mammals include increased mortalities due to collisions with trains (predicted to occur primarily with moose); habitat disturbance related to clearing of vegetation and human activity and noise; and reduced survival and breeding success due to noise, human activity, and exposure to contaminants. Effects on resident and anadromous fish include habitat disturbance due to construction of bridges and culverts, and blockage of fish movements due to the installation of culverts and bridge-related structures. Changes in the abundance and distribution of biological resources could also affect the availability of these resources to subsistence users. Construction, operation, and infrastructure associated with military expansion activities, roadway upgrades, and the proposed Alaska natural gas pipeline would contribute to impacts on resource habitat, abundance, and distribution, thus leading to increased impacts on subsistence users in the area.

Future military-related projects that could affect subsistence uses in and around the project area include construction of new range complexes and new facilities in the Donnelly Training Area (TA), and replacement and upgrade of a rail loading facility at Fort Wainwright. The construction of new range complexes and facilities could result in loss of habitat due to removal of vegetation and increased noise and human activity; changes in resource distribution due to resource avoidance of human activity; and mortality from construction activities. The addition of new structures in Donnelly TA could also result in increased restrictions on subsistence user access in those areas.

Although the exact route of the proposed Alaska natural gas pipeline is unknown at this time, it could run through North Pole to Delta Junction. If this is the case, the pipeline and additional related infrastructure could further affect user access as well as resource availability, in a manner similar to the NRE. Construction activities could affect resource habitat and distribution. The pipeline would likely be located within a vegetation-free corridor, which could also affect resource distribution and create new competition for resources in that area. The pipeline could affect the movement of animals and subsistence users overland, depending on its height. An increase in the local population due to employment for construction of the pipeline could also create competition for local users.

Although Richardson Highway upgrades already occur on a regular basis, construction of the Alaska Natural Gas Pipeline as well as other infrastructure projects could spur more substantial upgrades to the road system, such as resurfacing and expansion for access and passing lanes. Specific projects that are planned for the future include a new weigh station, new ramps, interchange improvements, resurfacing, and bridge repair or replacement. An increase in construction activities along the roadway could temporarily displace resources from the roadway and road expansion could lead to habitat loss. Because the highway already exists and there are no plans to significantly alter its route, the additional construction would likely not result in major changes for subsistence users or resources in the area. However, effects of construction and habitat loss in concert with other developments could lead to greater cumulative effects.

The proposed NRE includes alternative segments not located on Federal public lands. These include North Common Segment (proposed action), South Common Segment (proposed action), Salcha Alternative Segment 2, Connector Segment E (proposed action), and Donnelly Alternative Segment 2. These segments would result in similar impacts to those described under the evaluation of the proposed action (see Section O.2.1). Alternative segments not on Federal public lands would intersect between zero and five recreation access routes, lower than some of the alternative segments on Federal public lands. Intersection of access routes could affect access to subsistence use areas. Two of the alternative segments would require a relatively high number of bridge or stream crossings, with Donnelly Alternative Segment 2 requiring 48 crossings (higher than any other alternative segment) and Salcha Alternative Segment 2 requiring

18 crossings. Construction of bridge and stream crossings could affect fish habitat and block fish movement, resulting in decreased availability for subsistence users.

Evaluation of the Availability of Other Lands for the Northern Rail Extension

The purpose of the proposed NRE is to extend current freight and passenger rail services to areas south of North Pole, and to provide an alternative to Richardson Highway for these services. The proposed rail line alternatives follow a relatively direct route from the end of the existing rail line, north of Eielson Air Force Base (AFB), to south of Delta Junction. The alternatives follow the existing highway and/or the Tanana River relatively closely. Various alternatives were considered, some of which were eliminated during the alternatives development process. The alternatives selected for detailed analysis were chosen based on considerations of engineering and environmental factors as well as on issues raised by agencies or the public. Because the purpose of the proposed NRE is to construct and operate a rail line between two points (North Pole and Delta Junction) and because constructing and operating a rail line outside of the project area could lead to greater adverse environmental impacts and engineering obstacles, lands outside of the proposed project area would not satisfy the purpose and need of the NRE.

Because the routes and locations of reasonably foreseeable activities that could affect subsistence uses in the project area are unknown at this time, it is not possible to evaluate the availability of other lands for these purposes.

Evaluation of Other Alternatives that would Reduce or Eliminate the Use, Occupancy, or Disposition of Federal Public Lands Needed for Subsistence Purposes

Other alternatives that would reduce or eliminate the use of Federal public lands needed for subsistence purposes are described in NRE EIS Chapter 2 and Appendix D, many of which became alternatives considered but eliminated from further analysis because they did not meet the purpose and need of the proposed project; they could lead to greater adverse impacts on the environment; or they presented construction or operational limitations. Section 2.2.2 of the EIS provides a description of the alternatives eliminated from the study as well as the reasons for the elimination of these alternatives.

Finding

Construction and operation of the NRE in addition to other planned developments that could result in increased restrictions on user access, changes in resource availability, and an increase in competition for subsistence resources. Harvests of land mammals, furbearers, and fish occur within Unit 20A, and residents from the study communities who travel through the project area to access that unit would likely experience effects related to access. Subsistence users who do not travel through that area still could experience changes in harvest success due to decreased resource availability or increased competition. However, subsistence uses on the lands in question are either undocumented or minimal for the majority of the study communities when compared to their overall use areas. Furthermore, overall impacts on the populations of biological resources related to NRE construction and operations are expected to be low. Thus, this evaluation concludes that the cumulative impacts would not result in a significant restriction to subsistence uses.

O.3 Notice and Hearings

ANILCA Section 810(a) provides that no "withdrawal, reservation, lease, permit, or other use, occupancy or disposition of the Federal public lands which would significantly restrict subsistence uses shall be effected" until the Federal agency gives the required notice and holds a hearing in accordance with Section 810(a)(1) and (2). BLM will provide notice in the *Federal Register* that it has made negative findings pursuant to Section 810 that all Alternatives in the NRE EIS fall below the "may significantly restrict" threshold.