2. PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Alaska Railroad Corporation (ARRC or the Applicant) proposed action and alternatives for the proposed Northern Rail Extension (NRE). The chapter also describes the No-Action Alternative. In addition, this chapter discusses the development of potential alignments and a reasonable range of alternatives for analysis from among the potential alignments considered. Appendix D provides additional details concerning the development and elimination of alternatives.

2.1 Background

ARRC is a Class II rail carrier owned by the State of Alaska that provides freight and passenger services. The Alaska Railroad network extends from Seward, Alaska, through Anchorage and Fairbanks, ending at Eielson Air Force Base (AFB) through the Eielson Branch rail line (see Figure 2-1). The existing Eielson Branch rail line service Eielson AFB and the North Pole Refinery. At present, commercial freight, other than fuels transported to and from Eielson AFB and the refinery, generally enters and leaves the project area by truck via Richardson Highway (Alaska Route 4 from Valdez to Delta Junction and Alaska Route 2 from Delta Junction to Fairbanks) or the Alaska Highway (Alaska Route 2 from Delta Junction to Tok and beyond).

The Applicant proposes to provide commercial freight service for communities and businesses, with an approximately 80-mile rail extension from North Pole and Eielson AFB to Delta Junction, Alaska. At present, there are no public transportation services between North Pole and Delta Junction. The proposed rail line would provide an alternative to Richardson Highway for area residents, visitors, and commercial and military freight.

U.S. Army Alaska (USARAK) maintains units at Fort Wainwright and Fort Richardson and significant numbers of combat enablers (Sustainment, Aviation, Maneuver Enhancement, Engineers and Military Police). Nearly all collective training requirements larger than company level conducted in Alaska occur in the Donnelly, Yukon, and Tanana Flats training areas (TAs). Military vehicles, including Strykers, travel Richardson Highway south (up to 100 miles) from Fort Wainwright or more than 300 miles north from Fort Richardson to the vicinity of the TAs.

Access to the Donnelly TA west of the Delta River and Tanana Flats TA is restricted by the Tanana River and Delta River. There are no permanent bridges across those rivers in the area of the proposed rail extension. In winter, the U.S. Army and U.S. Air Force construct ice bridges to transport vehicles, troops, and supplies to the TAs. The Army and Air Force also access the TAs by helicopter, plane, or boat during summer (USARAK, 2004).

USARAK has experienced more than 120-percent growth in assigned troop strength since 2003 and is projected to continue to expand through 2013. As USARAK grows the force in both numbers and capabilities, increases in collective training requirements are anticipated to result in additional TA usage. Gaining year-round ground access to the more than 1 million acres of training land in the Tanana Flats and Donnelly West TAs could contribute to providing safe and multi-spectrum training for forces training in Alaska.

The Tanana Flats and Donnelly West TAs are significant components of the ongoing growth in training infrastructure in the Pacific Alaska Range Complex. A combined vehicle and rail bridge providing access across the Tanana River could facilitate continuing range, trail, and TA infrastructure and maintenance improvements that would be needed for expanded training

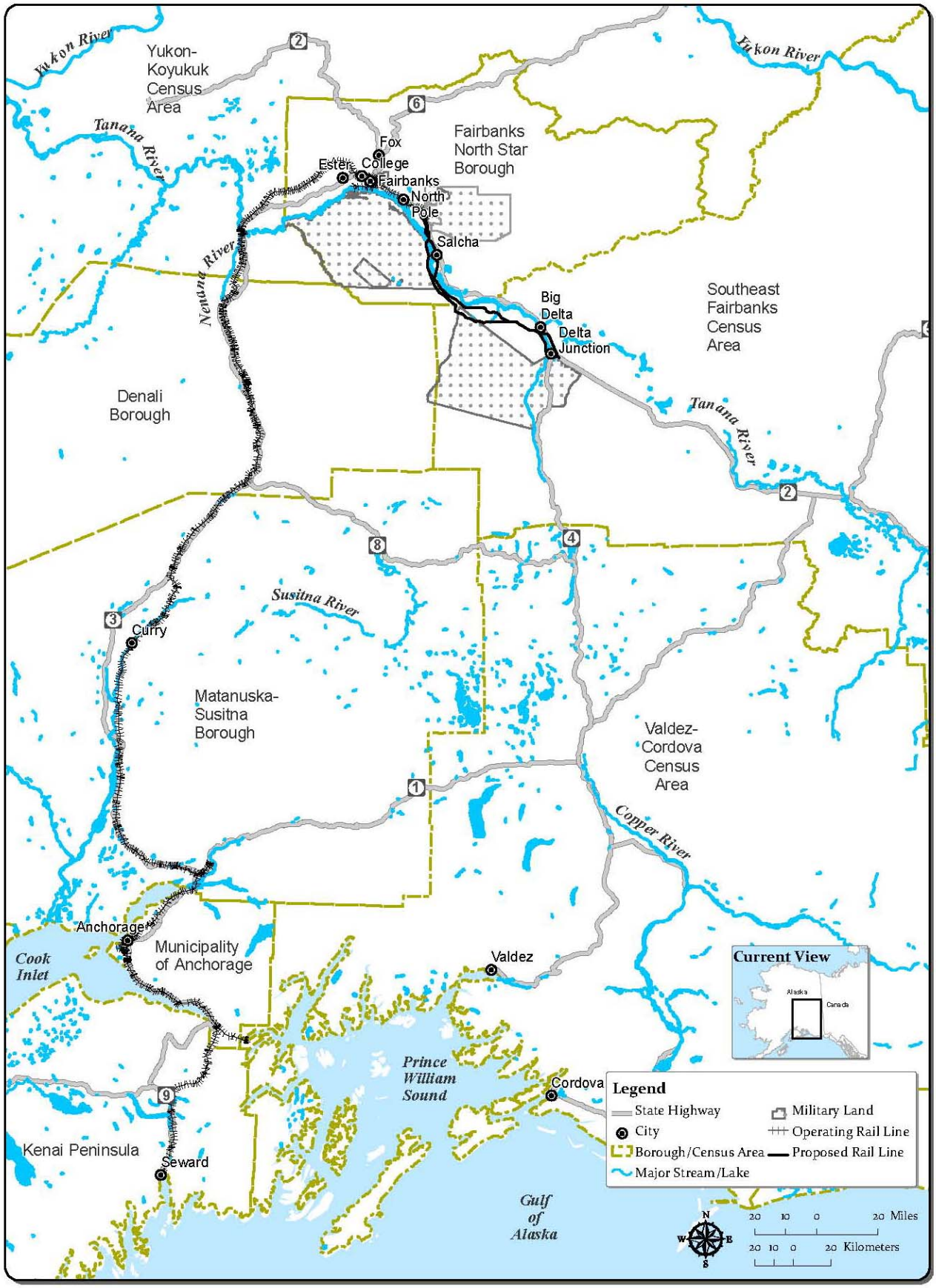

Figure 2-1 - Map of the ARRC Rail Network and Proposed Project Area

activities. The U.S. Department of Defense (DoD) Alaska Command (ALCOM) (Joint Headquarters) supports this requirement as a Joint Initiative. As changes in force structure necessitate planning for increased training in the Tanana Flats and Donnelly West TAs, ALCOM would need to complete an assessment of the potential environmental impacts of future expansion of DoD training and associated infrastructure requirements.

2.2 Alternatives Development and Elimination

In 2005, ARRC presented potential alignments (routes) for the proposed NRE. Since that time, those potential routes, together with additional alignments developed subsequently, were refined and evaluated during this environmental review process. This section provides information about the alternatives development process and the process used to consider these alternatives and eliminate some from further detailed study.

Section 2.3, Proposed Action and Alternatives, describes the alternatives that the Surface Transportation Board (STB or the Board) Section of Environmental Analysis (SEA) has identified for detailed analysis.

2.2.1 Alignment Development

In July 2007, ARRC filed a petition with the STB for the authority to construct and operate a new rail extension. As part of this application, ARRC defined its proposed action, which included a preferred alternative for the approximately 80-mile rail line. In arriving at its preferred alternative, ARRC identified and considered several other potential alignments, which are shown in Figure 2-2. ARRC's process for developing various alignments is described below, followed by an overview of SEA and cooperating agency input to ARRC's alignment development process.

Alignment Development Process

ARRC conducted its own public outreach to obtain opinions from communities, agencies, and Alaska Natives. ARRC developed a project Internet site, mailed project newsletters to stakeholders, and conducted a series of open houses. ARRC used feedback from stakeholders to refine alignments to reduce potential impacts. SEA reviewed all ARRC alignment changes and asked follow-up questions as needed.

According to ARRC's 2006 Alternatives Analysis Study (ARRC, 2006), the alignment development process started with a risk assessment and management process, which ARRC implemented as part of its early planning process for the NRE. The risk assessment and management process was launched with ARRC's Initial Risk Workshop in April 2005. At the workshop, risks to project success, such as resource needs for construction, environmental constraints, data availability and military impacts, were identified and characterized and mitigation measures were discussed. The alignment development process continued until ARRC filed its petition to construct and operate the proposed rail line extension with the Board in July 2007.

Existing topographic and other data were used in the early phases of alignment generation and analysis. ARRC's alignment generation and refinement process occurred in three general phases, as described below.

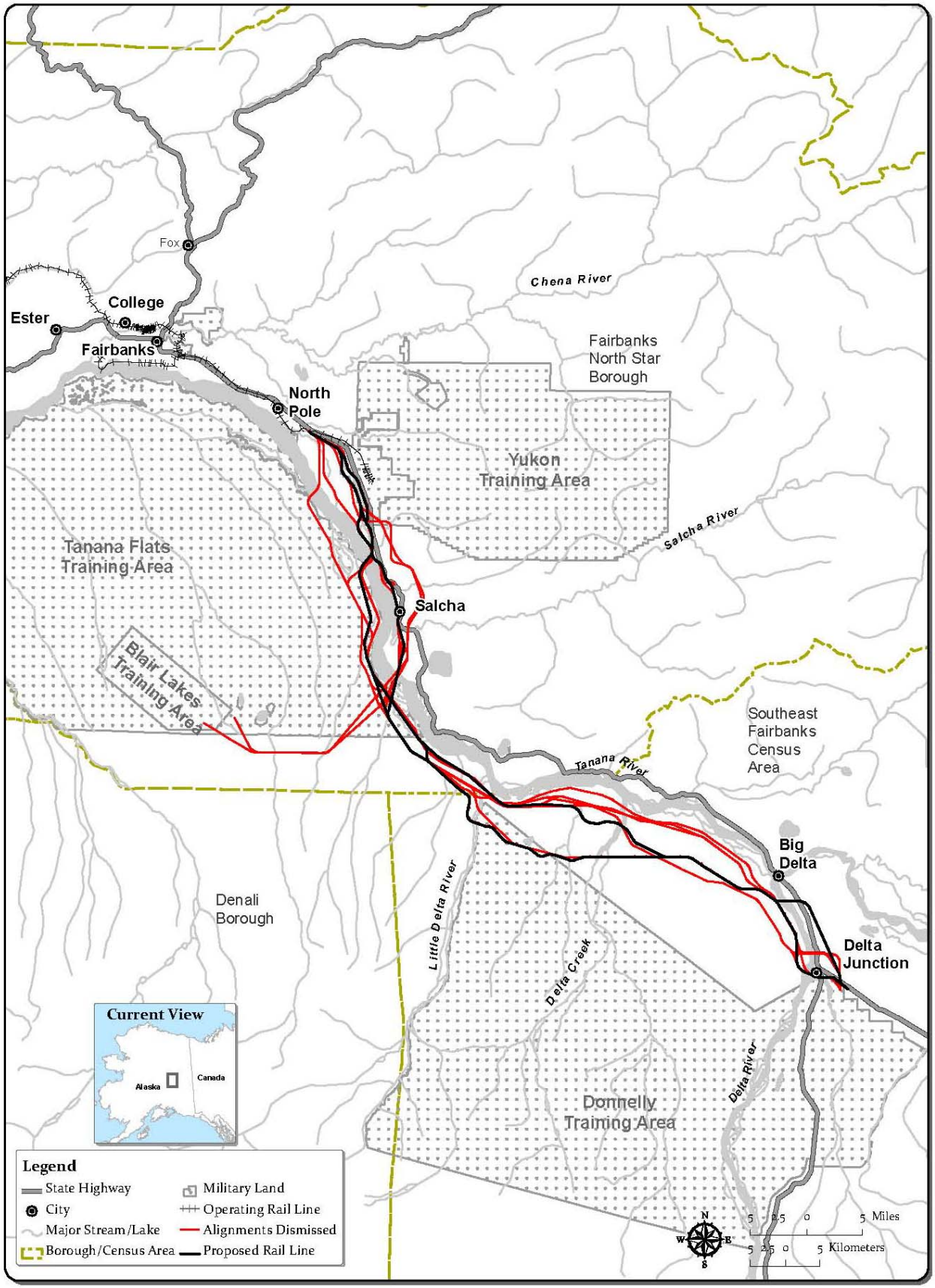

Figure 2-2 – Overview Map of the ARRC Alignments Considered

Phase 1 – Study Area Identification

According to ARRC's 2006d 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. The study area was defined by developing two alignments with common start and end points (North Pole and Delta Junction) consistent with the intended purpose of providing access to the Tanana Flats and Donnelly West 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 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 enabled ARRC to begin the collection of data and to define the area to be flown over for aerial photography and mapping.

Phase 2 – Corridor Development

Phase 2 included 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, 2006d). This phase began after the initial study area was defined and continued until ARRC's March 2007 Preferred Route Study. The remaining corridors were further developed in Phase 2 based primarily on technical and practical considerations including natural barriers such as rivers and topography; engineering design; cost-effectiveness; geological considerations; and general land use patterns. Based on the data collected and analyzed, and on input from various project stakeholders, corridors were generated and refined, and new corridors were identified to address specific issues.

Phase 3 – Corridor Analysis

This phase involved a comparison of alignment corridors. 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 agency coordination and public outreach efforts. Many of the preliminary alignment corridors 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.

SEA and Cooperating Agency Input to ARRC's Initial Alignment Development Process

During SEA's scoping process, SEA received comments from agencies and the public on the alignments developed by ARRC and suggestions for alternative alignments. SEA reviewed the alignments presented by ARRC and the comments received. In consultation with Alaska Natives and the cooperating agencies, SEA requested that ARRC consider refinements to their alignments, and consider the feasibility of additional alignments.

As the alignment development evolved through this process, so did the nomenclature used to distinguish the alignments. In the draft scope of study for the Northern Rail Extension Environmental Impact Statement (NRE EIS), alignments were named according to whether they were north or south of the Tanana River crossing at Flag Hill. Alignments were designated with an N for north and an S for south, and given a number and sometimes also a letter. Because the

nomenclature did not clearly identify locations or distinguish between sets of alignments, SEA suggested that ARRC adopt new nomenclature for future publications. The new nomenclature distinguished among project areas (*i.e.*, Eielson, Salcha, Tanana, Donnelly, and Delta) and among alignments by using relative location terms such as east and west.

Through the process described above, ARRC provided SEA with several versions of the potential alignments. ARRC presented the latest alignment versions and its preferred alignment to SEA in two key sources:

- ARRC's Preferred Route Alternative Report published in March 2007 (ARRC, 2007e); and
- ARRC's filing of its preferred route with the Board on July 6, 2007 (ARRC, 2007f).

2.2.2 Alternatives SEA Eliminated from Detailed Study

SEA and the cooperating agencies used the purpose and need for the proposed action as described in Chapter 1 as the main factor in their review of the alignments initial ARRC alignments and alignments proposed in scoping comments. Through this review, SEA and the cooperating agencies selected a set of reasonable alternatives to study in detail, and eliminated alternatives and alternative segments from detailed study. Alignments (or alternative segments) that did not meet fundamental components of the purpose and need, would lead to substantially greater adverse environmental impacts, or featured insurmountable construction or operational limitations, were eliminated from detailed study. Table 2-1 lists the alternatives eliminated from detailed study and explains why each was eliminated. Figure 2-2 illustrates the general location and alignment for each of these eliminated alternative segments. Appendix D provides more information about these alternatives and their elimination.

2.3 Proposed Action and Alternatives

The alternative development process resulted in a number of potentially feasible alignments (routes) between the communities of North Pole and Delta Junction. In addition, it became clear that portions of each of these alignments could be interchanged to provide additional routes between the two communities. To facilitate comparison of sections of the proposed project, SEA divided the alignments into segments based on common start, end, or intersection points that would allow direct comparison of the alternatives to each other or combined and compared as full or partial alternative alignments. Figure 2-3 illustrates this concept.

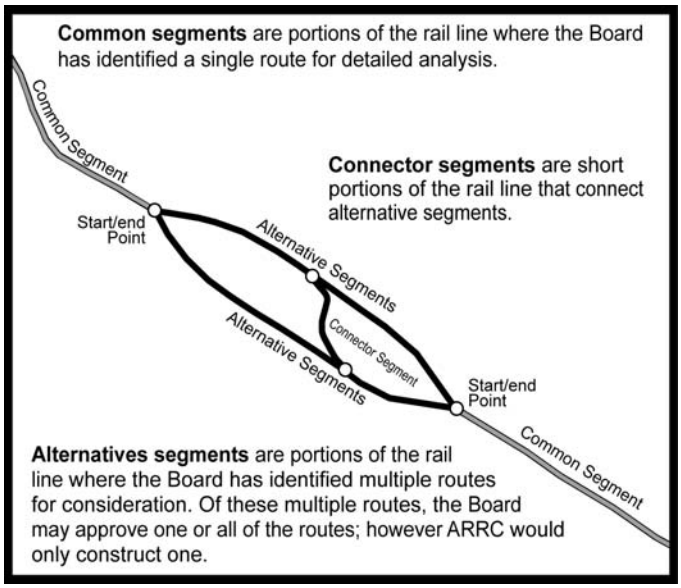

Figure 2-3 - Conceptual Display of Common and Alternative Segments

Three types of segments were identified as part of this process:

- Common segments are portions of the rail line with a single route option;
- Alternative segments provide multiple route options; and

- Connector segments are short pieces of a rail line that would connect alternative segments.

2.3.1 Proposed Action

Under the proposed action, ARRC would 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 be designed and constructed to Class 5 standards[1] and ARRC proposes to transport commercial freight, military supplies, and passengers on the rail line. Other facilities such as communications towers, offload structures, and a passenger platform in Delta Junction would be constructed 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, 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 and Delta Creek would have separate bridges for the track and vehicles. The proposed action does not include providing vehicle access over the Salcha and Delta Rivers. The rail line would also have multiple grade crossings and a possible relocation of a portion of Richardson Highway and Salcha Elementary School, depending on which alternative segments may be authorized by the Board.

ARRC proposes a 200-foot-wide right-of-way (ROW) for the rail line. For this EIS, it is assumed that all construction activities would occur within this ROW unless otherwise noted. The width of the ROW may be reduced, as necessary, to minimize the impact on sensitive resources or accommodate the terrain. The ROW would contain the rail line, sidings at several locations, a power line, a buried communications cable, and an unpaved access road (see Figure 2-4). Section 2.3.3, Rail Construction, explains the difference between the facilities anticipated in the ROW on the east and west sides of the Tanana River. The area in the ROW that is cleared of vegetation for construction but not needed for permanent structures would be restored to natural conditions, to the extent possible, consistent with rail line operating requirements.

ARRC would need to receive a ROW grant from the Bureau of Land Management (BLM) to use a corridor for the construction and operation of segments that run through BLM-administered public lands. The land covered by the ROW grant would include the 200-foot right-of-way. Where the ROW grant would involve lands withdrawn for military use, BLM would be required to obtain formal concurrence from the U.S. Army before issuing such a grant. ARRC also would need to go through a conveyance process specified under Alaska Statute (AS) 42.40.460 with the Alaska Department of Natural Resources (ADNR) to obtain rights for lands under state ownership. ARRC is working with ADNR per SB31 (2004 legislature) to obtain a fee-title ROW over state lands. Under Alaska Statute 42.40.460, ARRC would need to obtain a 500-foot reserved corridor for the construction of the rail line from ADNR on lands managed by the state. Upon completion of the project, the corridor width would be reduced to 200 feet and conveyed to ARRC for operation of the proposed rail line, while the remainder of the initially reserved corridor would continue to be administered by ANDR. In addition, ARRC would need to acquire some private lands.

[1] The Federal Railroad Administration (FRA) establishes the standards for class of track and maximum operating speed for passenger and freight on each class of track (49 Code of Federal Regulations [CFR] 213). Design and construction of the proposed NRE to Class 5 standards would be required for ARRC's desired operating speed for passenger (79 miles per hour) and freight (60 miles per hour) service.

Table 2-1
Summary of Alternatives Eliminated by SEA and the Cooperating Agencies

Alternative	Brief Description	Reason for Elimination
Eielson Area Alignments	N1 would cross the Tanana River from the Eielson Farm Community into the Tanana Flats TA. The alignment would then continue south through the TA on the western side of the Tanana River N2 alignment similar to N1	ALCOM expressed concern about the amount of encroachment this alignment would have on the TA. Strong concerns about the alignment passing through a prime moose calving area.
	Alternative through Eielson AFB along the east side of Richardson Highway	Proximity to the Eielson AFB was infeasible due to encroachment on the operating and runway/taxi areas.
	Alternative that would cross the Tanana River shortly before or after the Chena River overflow, bypassing the Eielson Farm Community	Would create further intrusion into the Tanana Flats TA and also affect important moose habitat; was not practicable because of the current grade crossing of Richardson Highway and topography.
	Alternative would cross Richardson Highway at Milepost 0. The recommended alignment would either continue through Eielson AFB using an existing track or go around the AFB to the east.	Use of the existing track through Eielson AFB for through-movement of trains highly undesirable. Potential private property impacts, concerns over existing land use, and steep topography.
Salcha Area Alignments	N1 on the western side of the Tanana River N3 on the eastern side of the Tanana River	N1 would have potential conflict with military use. N3 would affect approximately 300 acres of wetlands (nearly three times as many acres as other segment alternatives that were retained for analysis) and would more directly affect cultural resources including the remains of the historic Salchaket Village.
Alignments Proposed in Scoping Comments	Would cross the eastern-most main channel of the Tanana River to a pair of islands. Would continue south of the bluff and traverse the islands before crossing back to the east bank of the Tanana River.	Not feasible due to the river hydraulics, instability of the islands in this area, and long-term serviceability.
Richardson Highway	Would parallel Richardson Highway all the way to Delta Junction.	The hilly topography on the east side of the Tanana River is considerably less favorable for rail line construction south of Flag Hill. Would not provide access to military training lands on the southwestern side of the Tanana River.
Blair Lakes Spur	Spur to the Blair Lakes Range and/or other facilities to support military operations including sidings, offload facilities, and end-of-track facilities.	Military has indicated that they do not want such a spur.

Table 2-1
Summary of Alternatives Eliminated by SEA and the Cooperating Agencies (continued)

Alternative	Brief Description	Reason for Elimination
Donnelly Area Alignments	Donnelly East (S2) alignment would hug the west side of the Tanana River Donnelly East Revised shifted farther inland from the Tanana River due to fish habitat concerns.	Both alignments would create adverse impacts through the displacement of summer homes and vacation cabins that other alignments avoid, and would traverse steep hills with potential icing problems as well as areas that exhibit groundwater upwelling and quicksand-type conditions.
Delta Area Alignments	Delta Central (S1) located in the Delta Junction area would cross the Delta River from the Donnelly alignments and continue to the proposed rail terminus on the south side of Delta Junction.	Would involve greater adverse impacts to residential and commercial property in Delta Junction than the other alignments. Would affect approximately 83 acres of wetlands, more than 40 percent more than the two alternative segments being retained for detailed analysis.
Alignment along the Alaska Range	Alignment would connect to the ARRC mainline in the vicinity of Healy and run along the foothills of the Alaska Range to the military TAs on the west side of the Tanana River. Included non-rail alternative.	Did not meet two of the purposes of the proposed Northern Rail Extension: to provide passenger train service between Fairbanks and Delta Junction and to provide common carrier rail service to Delta Junction.

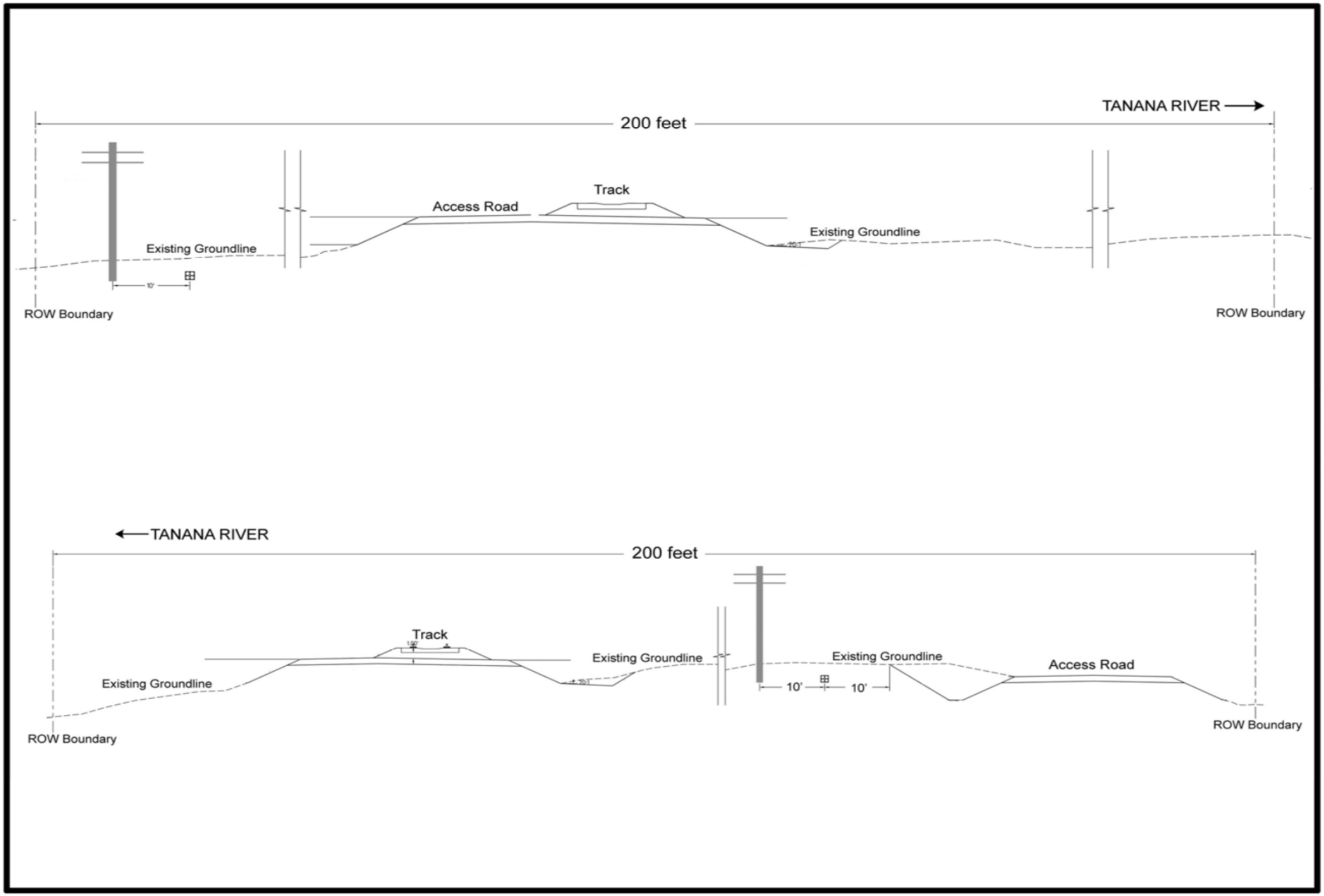

Figure 2-4 – Cross Sections of Rail Line Right-of-Way on East Side (top) and West Side (bottom) of Tanana River

Operations support facilities would be constructed in addition to the rail line. The location of some of the facilities would vary depending on which alternative segments were constructed. Temporary construction support facilities would also be built, but would be removed after construction is completed.

Most facilities would require permanent or temporary access roads. Locations for communications towers have been identified, but exact locations for other facilities would be determined in the final construction design. Some communications towers would have helicopter-only access. Sidings, a passenger facility, and bridge staging areas would be sited, where possible, in the 200-foot ROW.

2.3.2 Alternatives Considered in SEA's Environmental Review

The alternatives include common segments, alternative segments, and connector segments, as listed in Table 2-2 and shown in Figures 2-5 to 2-11. Table 2-2 also identifies the ARRC preferred segments. There are two common segments—North Common Segment and South Common Segment—with a combined length of 13.1 miles. Between these common segments are five sets of alternative segments with two or three segments each. Figure 2-5 shows the common segments, alternative segments, and connector segments, and divides the project into six areas. The six areas are shown in more detail in Figures 2-6 through 2-11.

Table 2-2
Potential Rail Line Segments

Segments Evaluated in this EIS	Applicant's Preferred Segments[a]
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**

[a] SEA does not identify preferred segments in the Draft EIS.

ARRC filed its proposed action with the Board on July 6, 2007 (ARRC, 2007f). Both common segments are part of ARRC's preferred alignment. The descriptions below identifies the ARRC preferred segments listed in Table 2-2. SEA does not identify a preferred set of alternatives in the Draft EIS.

In addition to these alternatives, this EIS considers a No-Action Alternative. Under the No-Action Alternative, ARRC would not construct an extension of the existing rail line or construct the bridge over the Tanana River to transport commercial freight, military cargo and personnel, or passengers by rail.

North Common Segment

North Common Segment would start at the east end of the Chena River Overflow Bridge off of the Eielson Branch and extend 2.7 miles southeast to meet the selected Eielson alternative

segment. The segment would run roughly parallel to Richardson Highway, cross Eielson Farm Road and Piledriver Slough, and run along the east side of the Tanana River (see Figure 2-6).

Eielson Alternative Segments

SEA is considering three alternative segments through the Eielson area that would start about 0.5 mile southeast of Eielson Farm Road. Each alternative segment has at least one shared segment section. The alternative segments would pass between the fence line of Eielson AFB on the east and the Eielson Farm Community on the west. The selected Eielson alternative segment would connect to the selected Salcha alternative segment (see Figure 2-6).

Eielson Alternative Segment 1 would take the most westerly route, closer to the farm community and farthest from Richardson Highway. The segment would cross through some farm community property while staying to the west along Piledriver Slough. The segment would cross a few roads before hugging the Tanana River for approximately the last 3 miles of the alternative segment. This alternative segment would cross Twentythreemile Slough and would be 10.3 miles long.

Eielson Alternative Segment 2 would follow the same route as Eielson Alternative Segment 1 for approximately 5.7 miles, at which point Eielson Alternative Segment 2 would bear more to the southeast, cross Piledriver Slough, and follow a route closer to Richardson Highway. The last 2.2 miles of Eielson Alternative Segment 2 share the same route as Eielson Alternative Segment 3. This alternative segment would be 10.0 miles long.

Eielson Alternative Segment 3 would take the most easterly route, remaining closer to Richardson Highway and located largely within Eielson AFB property, but outside the Base fence line. The segment would cross Piledriver Slough approximately 0.5 mile into its route and then stay east of the slough for approximately 4.2 miles before crossing Piledriver Slough again. This alternative segment would be 10.1 miles long. This is ARRC's preferred alternative segment.

Salcha Alternative Segments

SEA is considering two alternative segments for the Salcha section, each starting approximately 0.3 mile northwest of the intersection of Old Richardson Highway and Bradbury Drive. The segments would cross the Tanana River at different places and the selected Salcha alternative segment would meet the selected connector segment (A, B, C, or D) to connect to the selected Central alternative segment (see Figure 2-7).

Salcha Alternative Segment 1 would cross the Tanana River just west of the intersection of Bradbury Drive and Ruger Trail. After crossing the river, the alternative segment would run through the Tanana Flats TA on the west side of the river. The segment would be 11.8 miles long and would require a dual-modal bridge of approximately 3,600 feet in length to cross the Tanana River. This is ARRC's preferred alternative segment.

Salcha Alternative Segment 2 would remain on the east side of the Tanana River for most of its 13.8-mile route. For approximately the first 9 miles, the route would parallel the Tanana River and Richardson Highway. The river then curves east while the route would maintain a southerly direction. The segment would cross the river at Flag Hill, where it would connect with one of the Central alternative segments. ARRC has proposed crossing the Tanana River at Flag Hill

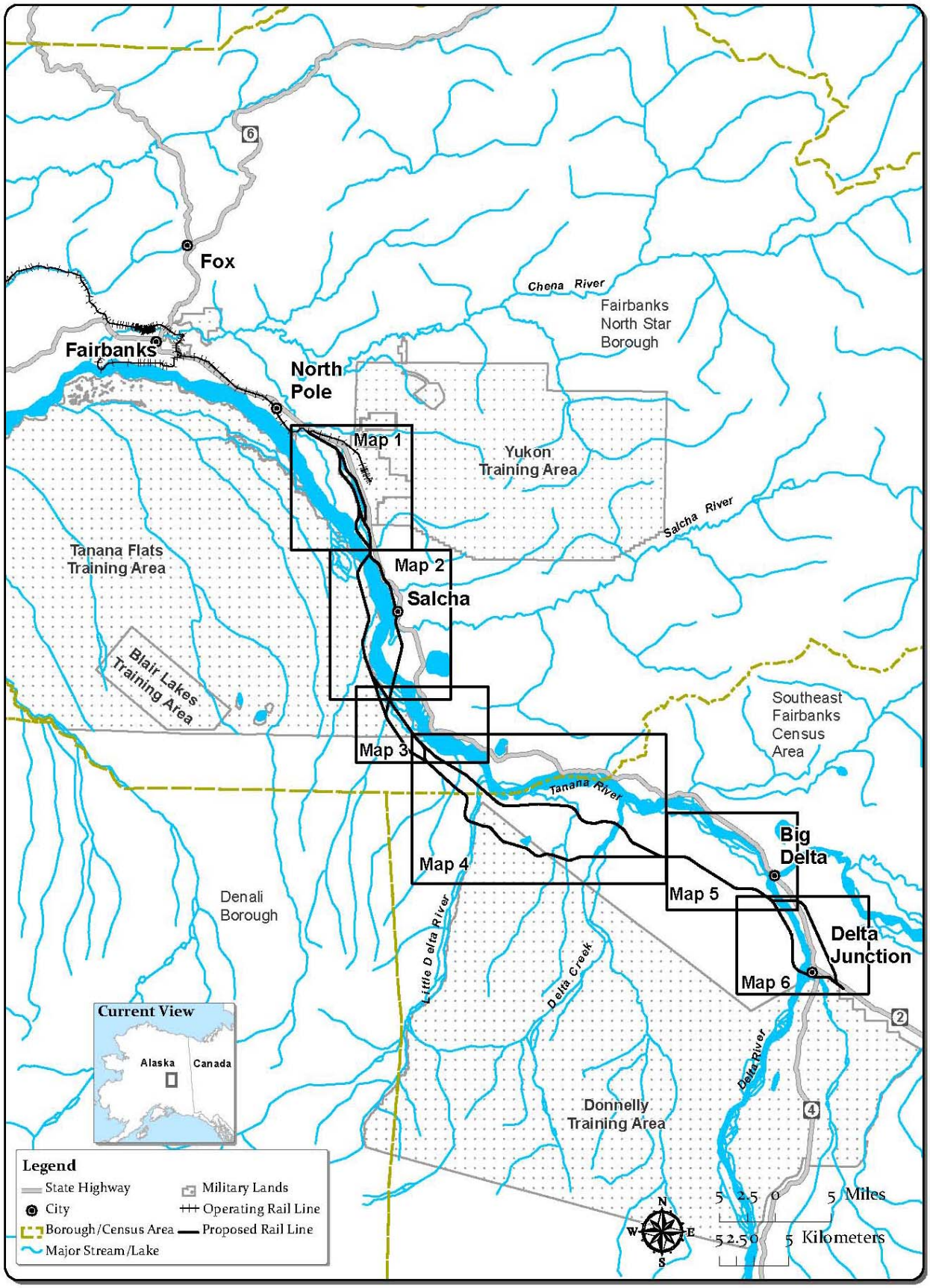

Figure 2-5 – Map Key for Areas Along the Proposed Northern Rail Extension

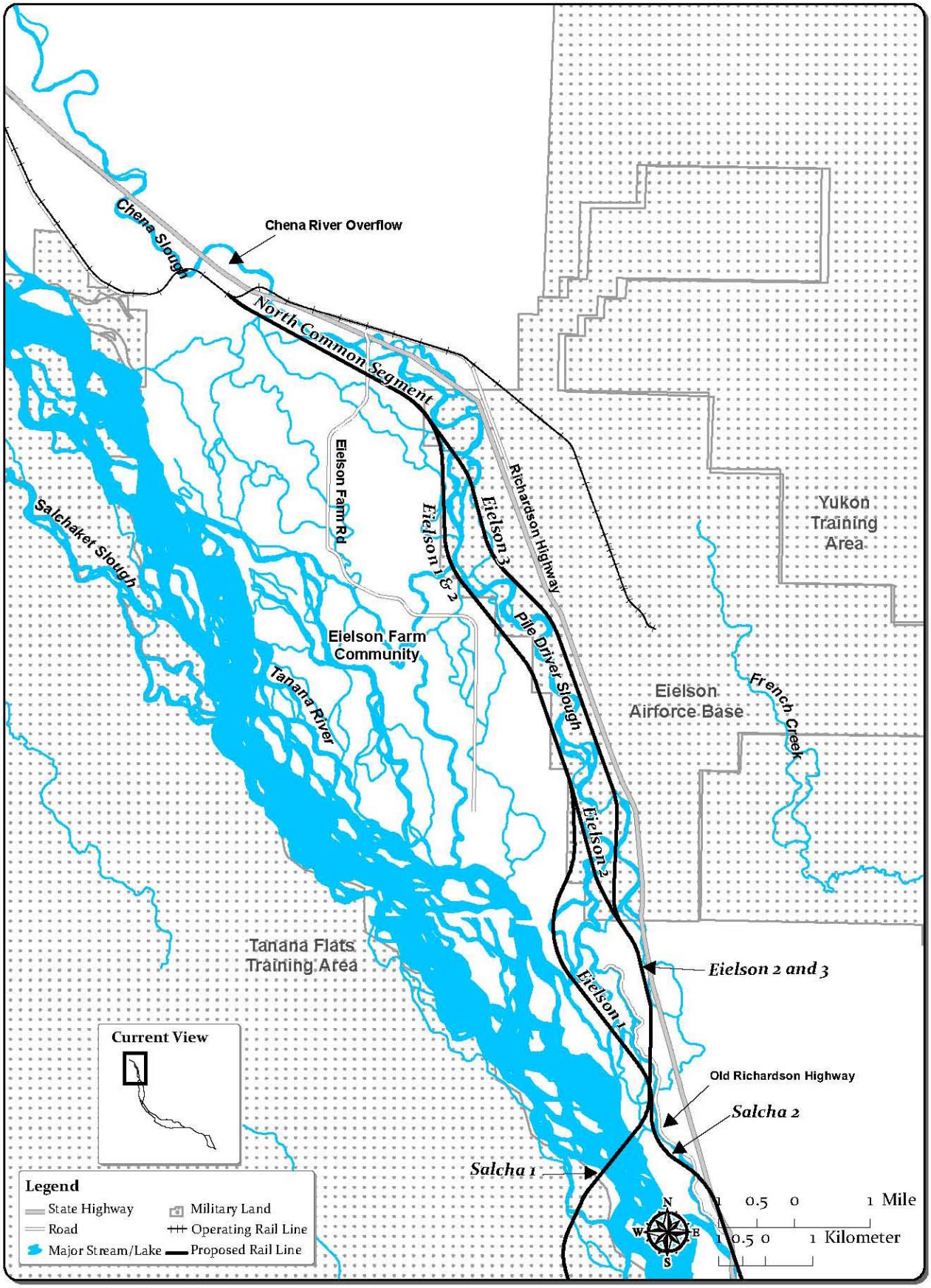

Figure 2-6 – North Common Segment and Eielson Alternative Segments Within Map Area 1

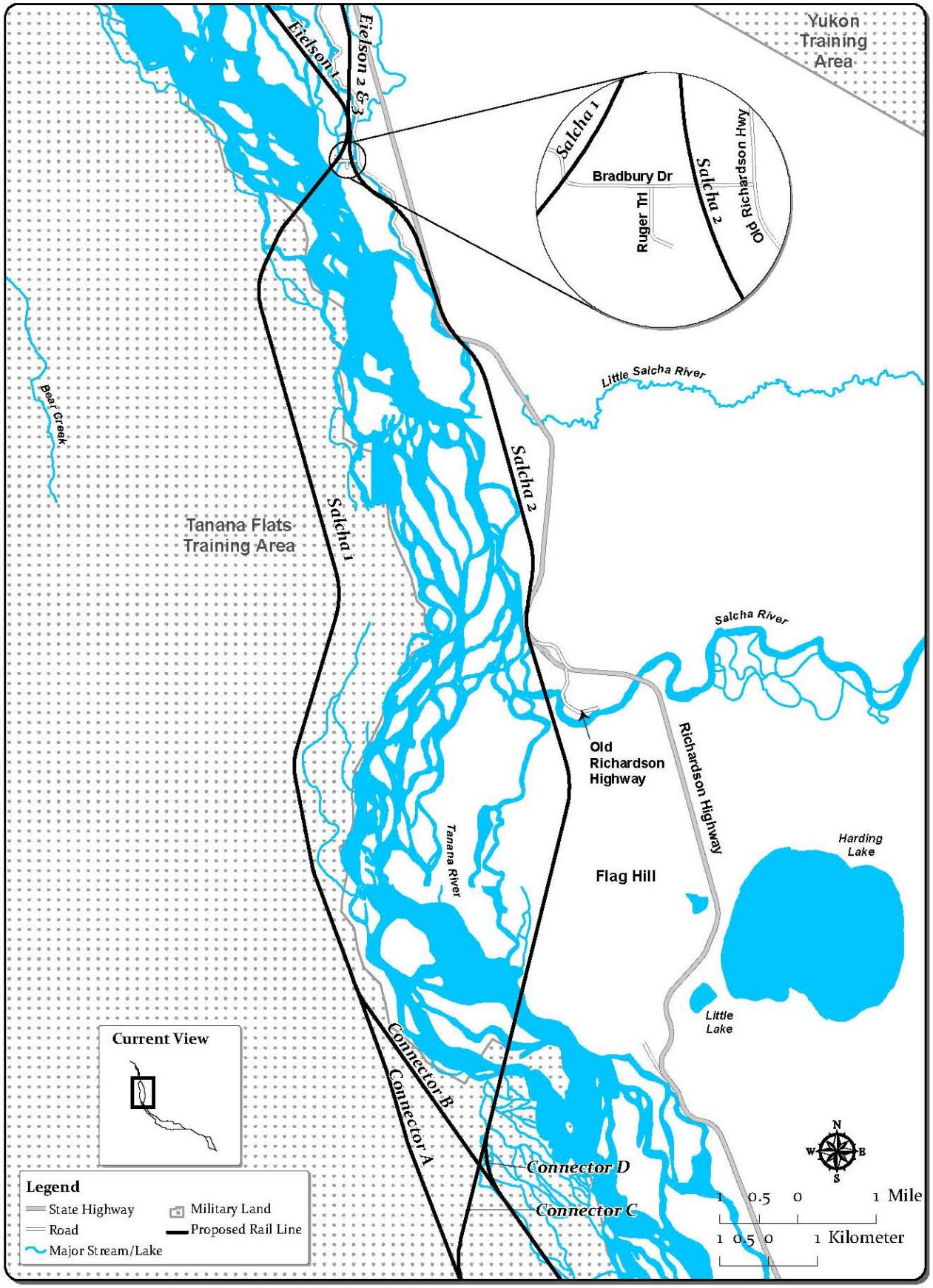

Figure 2-7 – Salcha Alternative Segments Within Map Area 2

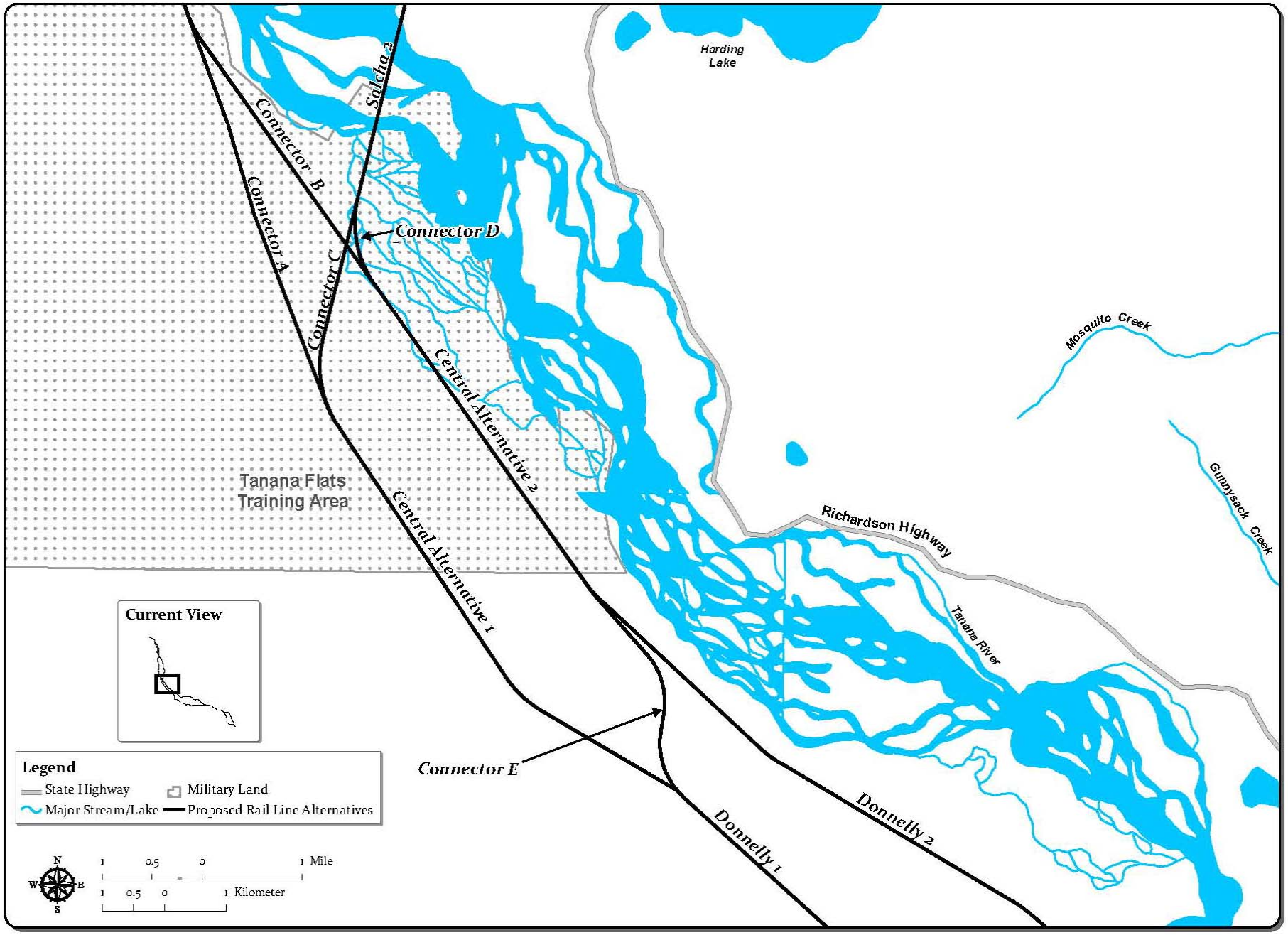

Figure 2-8 – Central Alternative Segments and Adjoining Alternative Segments Within Map Area 3

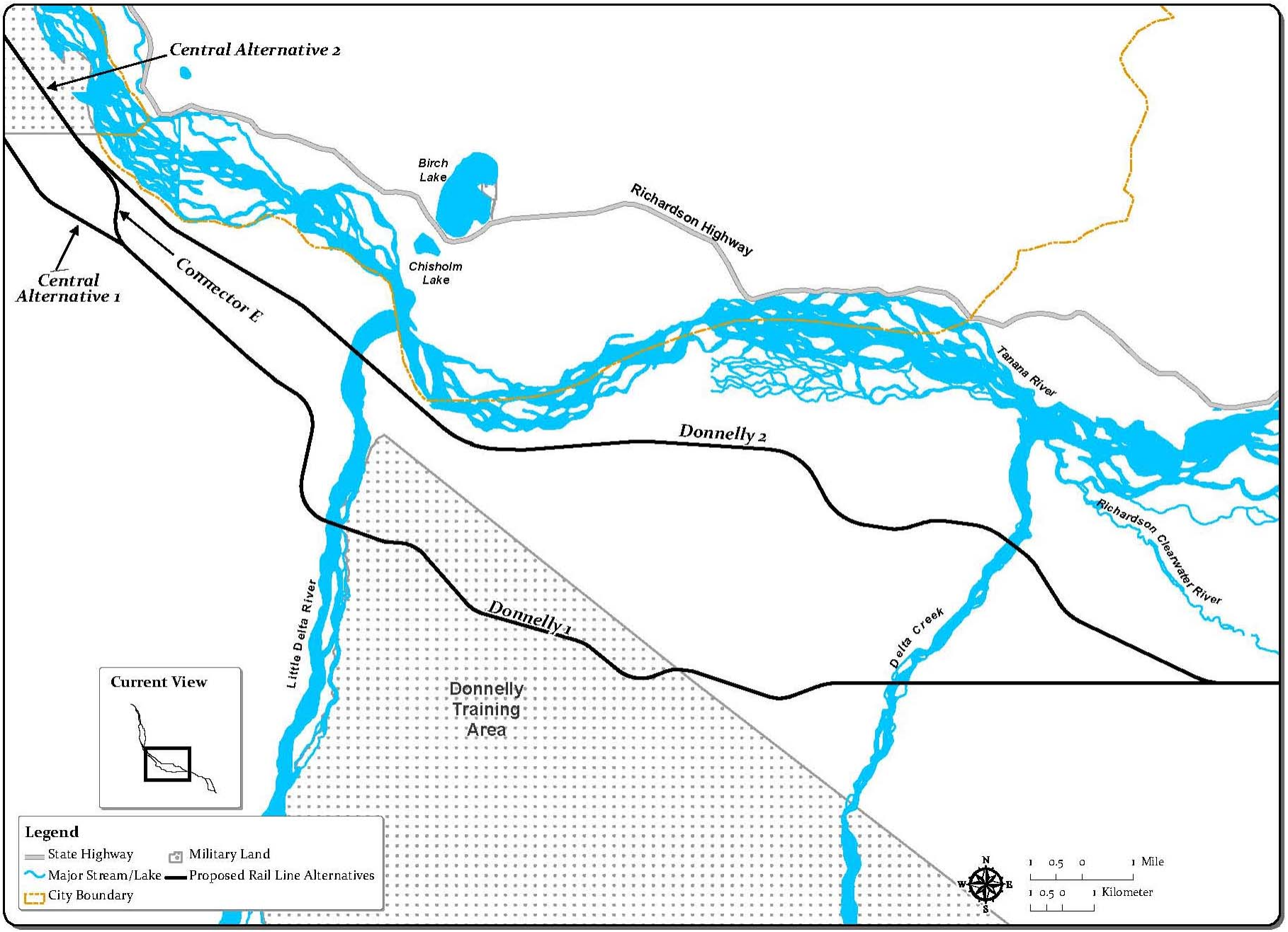

Figure 2-9 – Donnelly Alternative Segments Within Map Area 4

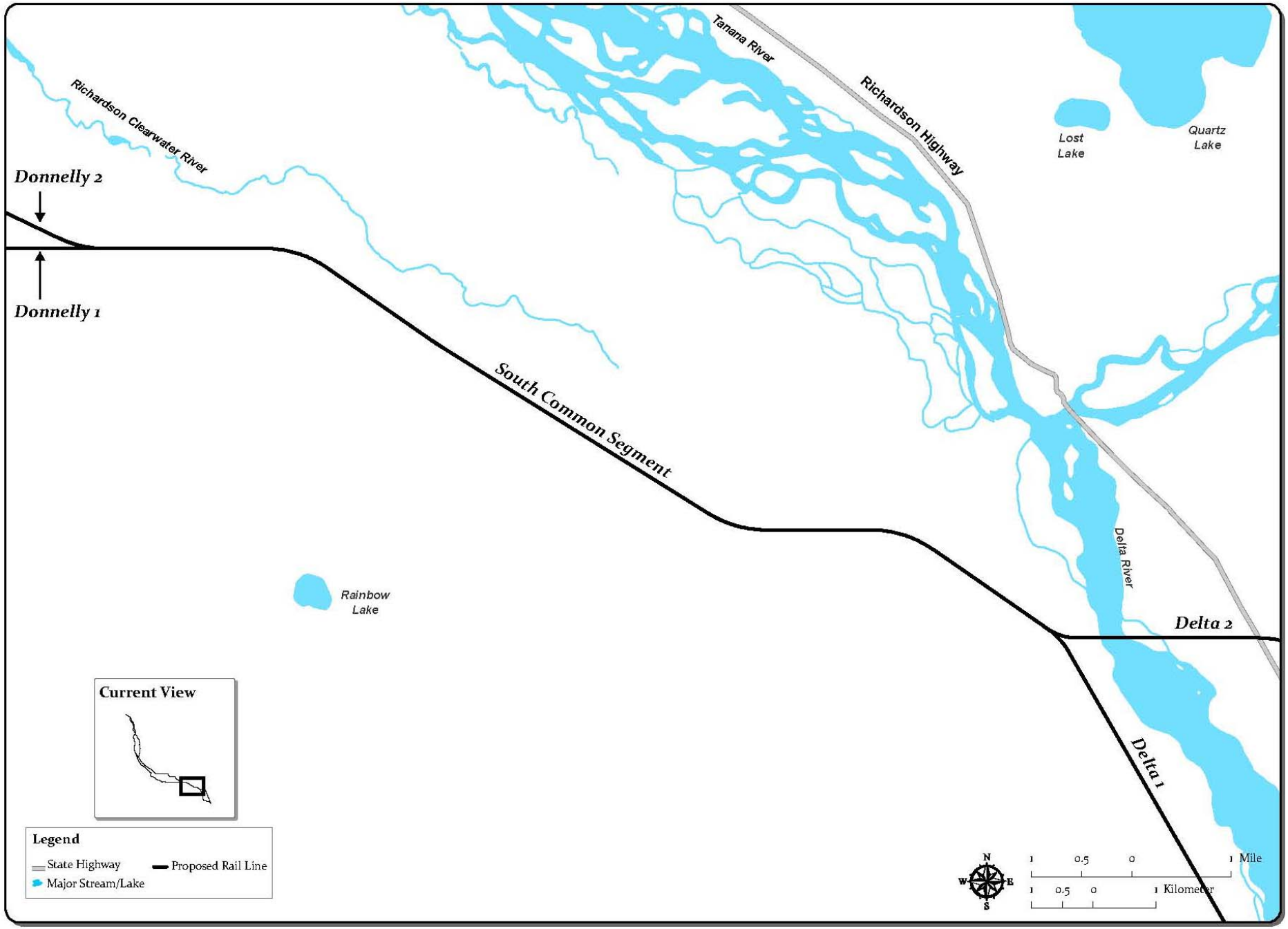

Figure 2-10 – South Common Segment and Alternative Segments Within Map Area 5

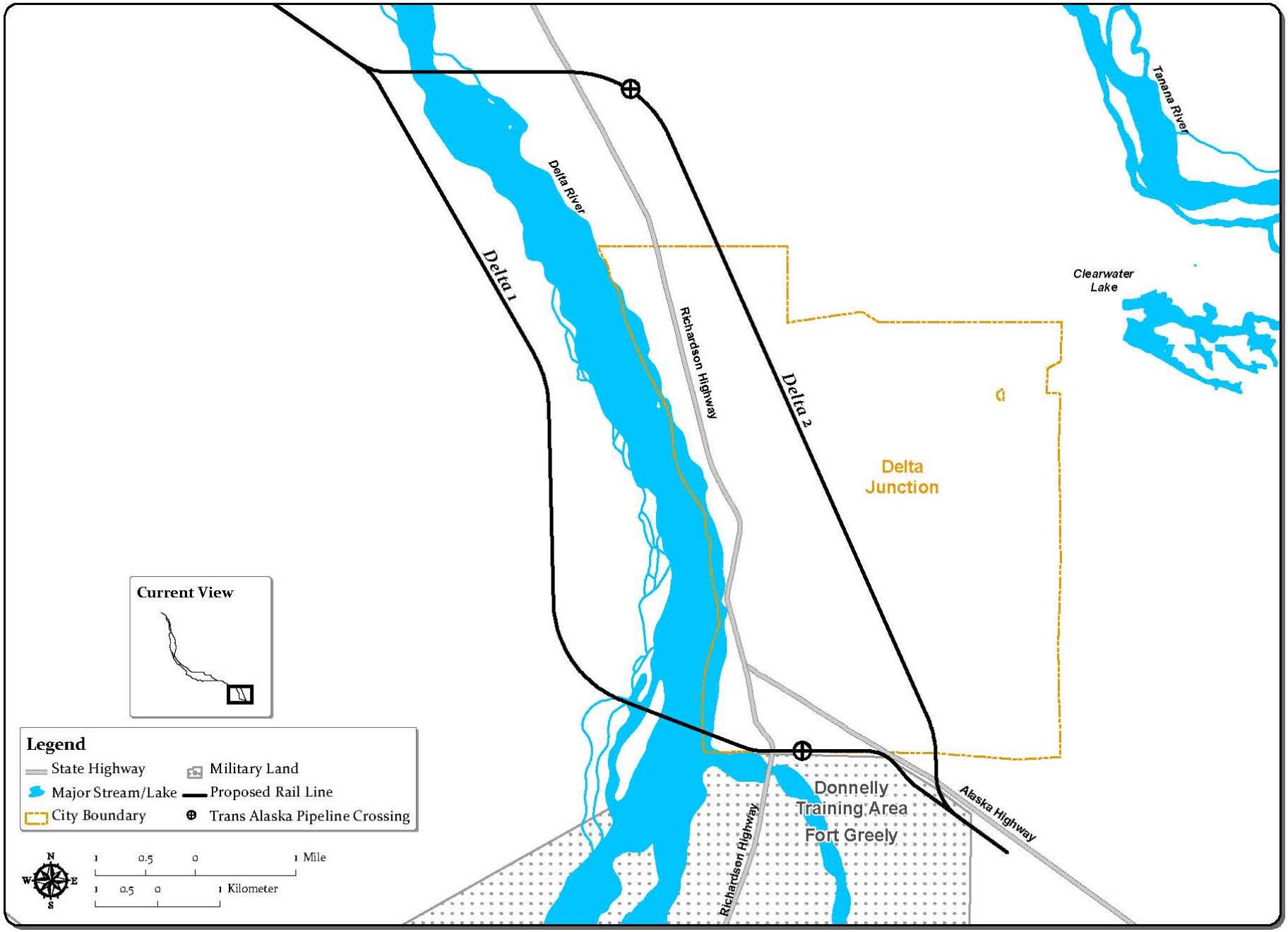

Figure 2-11 – Delta Alternative Segments Within Map Area 6

with a dual-modal bridge of approximately 4,000 feet in length. This alternative segment would require relocation of portions of Richardson Highway and Salcha Elementary School (see Figure 2-12) to provide adequate space for the highway and the rail line to pass between the river and the adjacent bluff. Approximately 2 miles of the highway would need to be relocated farther into the river bluff and the rail line would assume the location of the highway by the river. In addition to the Tanana River main channel crossing, the alternative segment would cross some Tanana River side channels, the Little Salcha River, and the Salcha River.

Connector Segments

The connector segments are short pieces of rail alignment between 0.9 and 4.4 miles long that would connect alternative segments that do not have a common start and end point. There are five connector segments on the west side of the Tanana River that would connect the Central alternative segments to the Salcha and Donnelly alternative segments (see Figure 2-8). Connector Segments B and E are part of ARRC's preferred route.

Central Alternative Segments

SEA is considering two alternative segments between the Salcha and Donnelly alternative segments. Both Central alternative segments would run parallel to the west bank of the Tanana River in a southeasterly direction (see Figure 2-8).

Central Alternative Segment 1 would connect to the Salcha alternative segments via Connector Segment A from Salcha Alternative Segment 1 or Connector Segment C from Salcha Alternative Segment 2 and would be farther from the Tanana River than Central Alternative Segment 2. The alternative segment would be 5.1 miles long and outside of the Tanana River floodplain. Central Alternative Segment 1 would not connect to Donnelly Alternative Segment 2 due to terrain considerations.

Central Alternative Segment 2 would connect to the Salcha alternative segments via Connector Segment B from Salcha Alternative Segment 1 or Connector Segment D from Salcha Alternative Segment 2. The alternative segment would be within the floodplain of the Tanana River and would cross several clearwater streams. Central Alternative Segment 2 would be 3.6 miles long and is ARRC's preferred alternative. The alternative segment would connect directly to Donnelly Alternative Segment 2 and to Donnelly Alternative Segment 1 via Connector Segment E.

Donnelly Alternative Segments

SEA is considering two alternative segments for the Donnelly area (see Figure 2-9). Both would run on the southwestern side of the Tanana River and end approximately 4 miles east of Delta Creek, where they would meet the South Common Segment. Both alternative segments would cross Delta Creek and the Little Delta River but run through distinct terrains with different elevation profiles.

Donnelly Alternative Segment 1 would take the southern route, farther from the Tanana River and through the northeastern corner of the Donnelly TA. This segment would be 25.8 miles long and would cross steep grades. The route would cross the Delta Creek paleochannel, an ancient water channel that appears to be no longer active but could become active during periods of high flow. This is ARRC's preferred alternative segment.

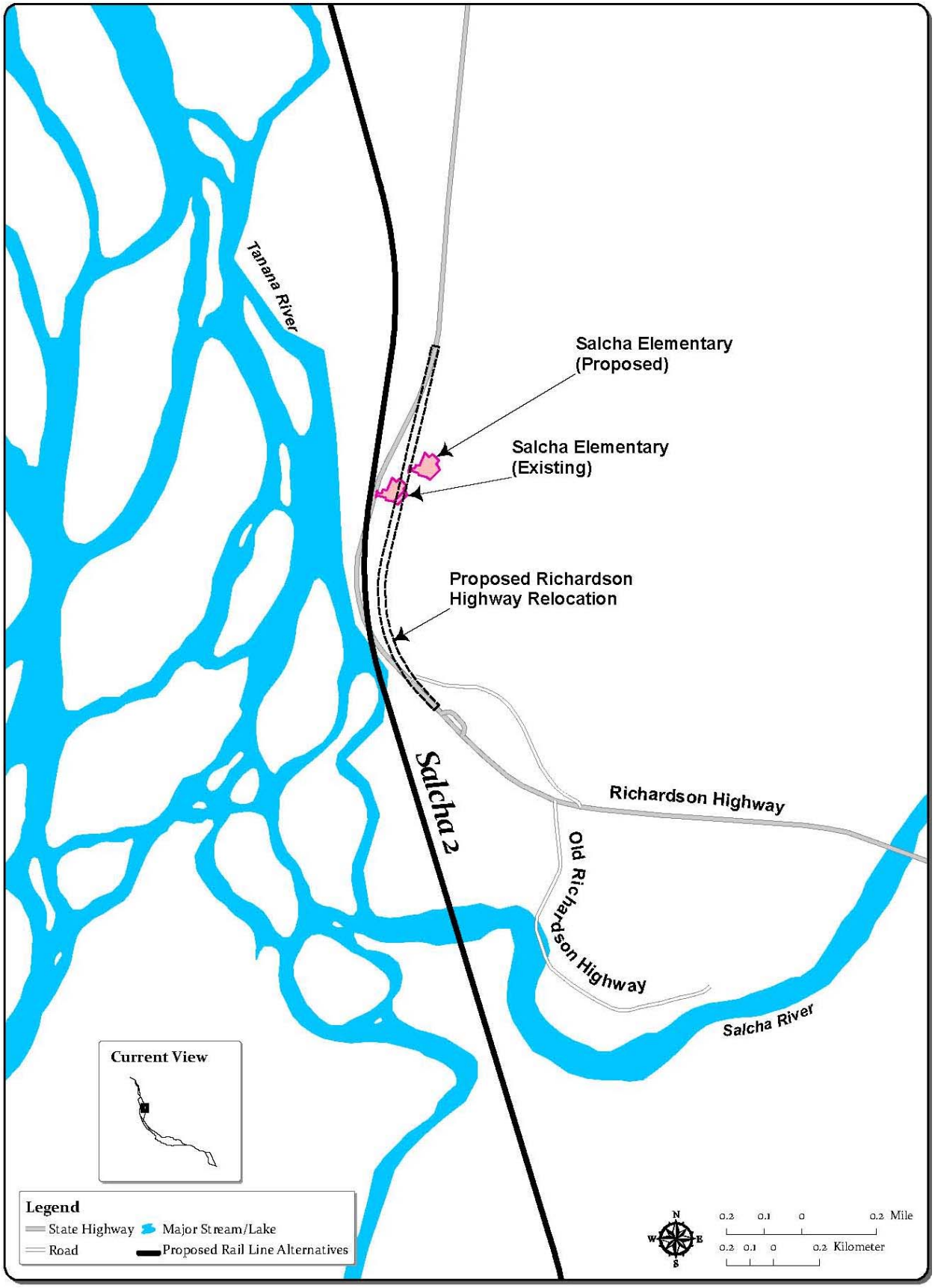

Figure 2-12- Richardson Highway and Salcha Elementary School Relocation

Donnelly Alternative Segment 2 would run closer to the Tanana River than Donnelly Alternative Segment 1. This segment would 26.2 miles long and would cross milder grades than Donnelly Alternative Segment 1, but would face more difficult geotechnical considerations than the other Donnelly alternative segment.

South Common Segment

This segment would connect the selected Donnelly alternative segment to the selected Delta alternative segment. The segment would begin approximately 4 miles east of Delta Creek and run roughly parallel to the Tanana River before curving southerly to parallel the Delta River near Big Delta. The segment would be 10.5 miles long (see Figure 2-10).

Delta Alternative Segments

SEA is considering two alternative segments for the Delta area. Each of these segments would cross the Delta River, one north and one south of Delta Junction. The alternative segment that would cross the Delta River south of Delta Junction, Delta Alternative Segment 1, is ARRC's preferred alternative segment. Delta Alternative Segment 1 would cross the Delta River just downstream of Jarvis Creek and would run toward the east until turning toward the southeast to parallel the Alaska Highway. Delta Alternative Segments 1 and 2 would both end at the end of the alignment about 3 miles east of the Delta River, adjacent to the Alaska Highway (see Figure 2-11).

2.3.3 Rail Construction

This section describes construction of the proposed rail line extension, including a description of ROW needs, rail line construction components and materials, roadways, bridges, and permanent and temporary facilities. This section also describes the general construction process and schedule.

Right-of-Way

Unless otherwise indicated, construction activities would occur within the 200-foot ROW. For purposes of analysis, it is assumed that the entire ROW would be permanently cleared of vegetation for construction and then operations; however, some areas might not require full use of the ROW, and those lands would be restored after construction or left undisturbed if not needed. State land would be reserved for construction of the rail line at a width of 500 feet in accordance with AS 42.40.460. Upon completion, the corridor width would be reduced to 200 feet and conveyed to ARRC for rail line operations.

Rail Line Access Roads

For rail line construction and post-construction operations, ARRC would build a permanent access road parallel to the rail alignment within the 200-foot ROW. The access road would be constructed before the rail line and would be used for construction of the rail line.

On the east side of the Tanana River, where access to the rail line construction area would be possible at multiple points from existing roads, a 13-foot-wide gravel access road would be constructed in the ROW. The road typically would be offset from the centerline of the proposed track by 12 feet.

On the west side of the Tanana River, which is a remote area without permanent, all-season road infrastructure, a 24-foot-wide permanent all-season access road would be constructed along the rail line. The road would be used to move construction personnel, equipment, and material along

the rail line during construction. Following construction, ARRC would use the road to support rail line operations and the military could also sue the road. In general, this road would be offset from the centerline of the proposed NRE track by approximately 40 feet to avoid interference of vehicle traffic with the rail line during both construction and operations. However, in difficult terrain this offset might be greater. The road would require culverts or vehicle bridges for all stream crossings, as described in more detail below.

ARRC would not maintain these roads as public roads. However, the military could use the access road on the west side of the Tanana River to access TAs.

Railbed Construction

Before any track could be placed, ARRC would construct a suitable railbed. The railbed would form the base upon which the ballast, rail ties, and rail would be laid. Construction of the railbed would require clearing, excavating earth and rock on previously undisturbed land, 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. Unsuitable material would be placed in borrow areas and used for restoration of disturbed areas.

Track Construction

In-place track construction would consist of placing ties, rail, and ballast on top of the railbed. First the ties would be placed on the subballast. ARRC would weld rails together to form rail strings. ARRC would then use special equipment to unload and secure the rail onto the ties, unload ballast from rail ballast cars or trucks, and dump ballast evenly along the skeleton track. Equipment would then be used to raise the rail line until the proper ballast depth is achieved.

Alternatively, skeleton track would be constructed as panels at ARRC facilities in Birchwood, Healy, Nenana, or Fairbanks. These panels, 40 to 80 feet in length, would consist of rails, ties, and fastening systems constructed and loaded onto railcars for delivery to the construction site. At the construction site, the panels would be lifted from the railcars and placed in their final location. The panels would be fastened together to form the skeletonized track.

Acquisition of Materials for Rail Line Construction

Ballast, subballast, large armor rock, rail ties, and rail would be required for construction of the proposed rail line and bridges. This section briefly describes the acquisition and use of these materials.

Approximately 491,000 cubic yards of ballast would be needed along the rail line. ARRC would obtain ballast from existing commercial quarries and/or the existing ARRC quarry in Curry, Alaska. Ballast would be transported from Curry to the project area by rail or by a combination of rail and truck. ARRC anticipates that ballast from other sources would likely be trucked directly to the construction site, or transloaded into railcars on the north side of the Tanana River for final placement along the route.

Approximately 600,000 cubic yards of subballast may be needed along the rail line. ARRC would obtain subballast primarily from materials excavated during railbed construction, from existing commercial sources, and from borrow areas established along the rail line ROW. Generally, borrow areas for embankment material are estimated to occur at approximately 3 to 5 mile intervals along the rail line and may or may not contain material suitable for subballast. The sites would each cover approximately 17 acres and reach excavation depths up to 20 feet. Some stripping of vegetation and organic soils would be required to obtain the desired material. Generally, the excavation would be completed with off-road scrapers or convenient loading

equipment. In areas with high groundwater tables, a dragline might be required to excavate below the water table. For areas with shallow groundwater, it could be difficult to reach the 20-foot excavation depth, even with the use of a dragline. In these circumstances, the borrow area may need to be larger than 17 acres.

As part of the final design and permitting process, the locations of borrow areas would be identified through geotechnical testing to identify locations with suitable material. Some of the borrow areas might not be needed, but ARRC plans to maintain short intervals between sites to decrease average haul distance. Any excess material (overburden) from these activities would be distributed evenly along the embankments as nonstructural fill to support revegetation.

The large armor rock would be needed for Tanana River training structures to protect the dual-modal bridge by directing channel flow. ARRC anticipates that the rock would come from its existing quarry in Curry, Alaska, and would be transported to the project area by rail or by a combination of rail and truck. As further discussed below, a facility for transloading to trucks also may be used.

ARRC may use glacial streams to acquire granular construction material, subject to need and permit approval. These sites would be located in glacial stream crossings on the south and west side of the Tanana River, including the Little Delta River, Delta Creek, and Delta River. Large quantities of granular material would be available at these locations as glacial streams provide continuous replacement. Each site would cover approximately 20 acres on each river. Material source sites within the limits of ordinary high water in fishbearing water bodies would include an outlet designed to prevent fish entrapment.

ARRC would obtain rail ties and steel rail from commercial sources to create rail strings. ARRC anticipates that these materials likely would be shipped to the project area by rail. For delivery of welded rail, the rail would be welded into strings either at a portable welding plant associated with the Eielson construction staging area, or at the railroad's existing facilities in Birchwood or Healy. Otherwise, the rail would be delivered to the site in short lengths individually, or as pre-constructed track panels. The rail would then be welded in place after the track had been fully constructed.

Construction Staging Areas

The proposed rail line might require construction staging areas to store material, weld sections of the rail line, and otherwise support rail construction activities. These staging areas would be outside the 200-foot ROW. SEA is considering the impacts of four construction staging areas that were identified by ARRC. The exact location of each of these staging areas would depend on which alternative segments were selected.

The Eielson Construction Staging Area would cover approximately 140 acres at a site near the Eielson Branch and North Common Segment. The site would be south of the Chena Overflow Bridge and would have road access to Richardson Highway and the existing Eielson Branch rail line. The site could be used for the rail welding operation and/or storage. The rail welding operation would involve welding 80-foot rail sections into quarter-mile strings. It is possible that this site would include a construction camp with space for recreational vehicles.

The second staging area, the Delta Construction Staging Area, would cover approximately 40 acres along South Common Segment. This site would be used for staging, storing, and maintaining earth-moving equipment and for construction camp facilities.

If ARRC chose to follow a phased construction scenario and constructed the Tanana River bridge before the rail line, then ARRC would need an interim rail-to-truck transload and staging site and 2,000-foot siding for materials and equipment shipped to the Fairbanks area via the Alaska Railroad. This structure would be located along the existing Eielson Branch and ARRC has identified two potential locations for this facility.

The first, and preferred location, would be on the north side of the Eielson Branch and would be along an existing gravel road and gravel pit (see Figure 2-13). The staging site would not require vegetation clearing. The pit has only been partially developed on speculation of construction work that did not develop. If selected, trucks would transport material approximately 13 miles from the staging site to the Salcha Alternative Segment 1 Tanana River bridge construction site and 26 miles to the Salcha Alternative Segment 2 Tanana River bridge construction site.

ARRC identified a second potential location for the rail-to-truck transload and staging site at the intersection of Richardson Highway and Claude Street (Figure 2-14). This staging site would require vegetation clearing and would require road improvements to accommodate the storage and staging of materials.

Along with these staging areas, ARRC indicated that there was potential for storing material at the storage yard at the Alaska Railroad Depot in Fairbanks. Construction material would be stored there until it was needed at the project site. This would limit the need for additional storage areas along the proposed rail line.

Construction Camps

ARRC has indicated that because construction of the proposed rail line would occur in an area with a limited workforce and infrastructure, it anticipates that up to three construction camps could be required. Such camps would provide housing for workers and a logistical base to conduct construction activities. The camps would include sleeping quarters, a cooking area, and a well for water.

The Eielson Construction Camp would be collocated with the Eielson Construction Staging Area described above. The camp would be located near the Eielson Branch and North Common Segment and would also contain space for recreational vehicles or motor home facilities.

The Tanana/Donnelly Construction Camp would possibly be collocated with a siding for the Tanana Flats TA. The 40-acre camp would be a combined construction camp with recreational vehicle facilities and an area for staging and maintenance of earth-moving equipment. Sleeping quarters could also be constructed. Although the exact location has not been determined, the site would be located near the southern Tanana River crossing alternative and would be closest to either Donnelly Alternative Segments 1 and 2 or the Central alternative segments.

The Big Delta Construction Camp would be located along South Common Segment and would cover 40 acres, although the exact location has not been identified by ARRC. The camp would be used until one of the Delta River bridge alternatives was constructed. It would contain an area for recreational vehicle facilities and could be collocated with a construction staging area.

Figure 2-13 – ARRC's Preferred Transload and Staging Site

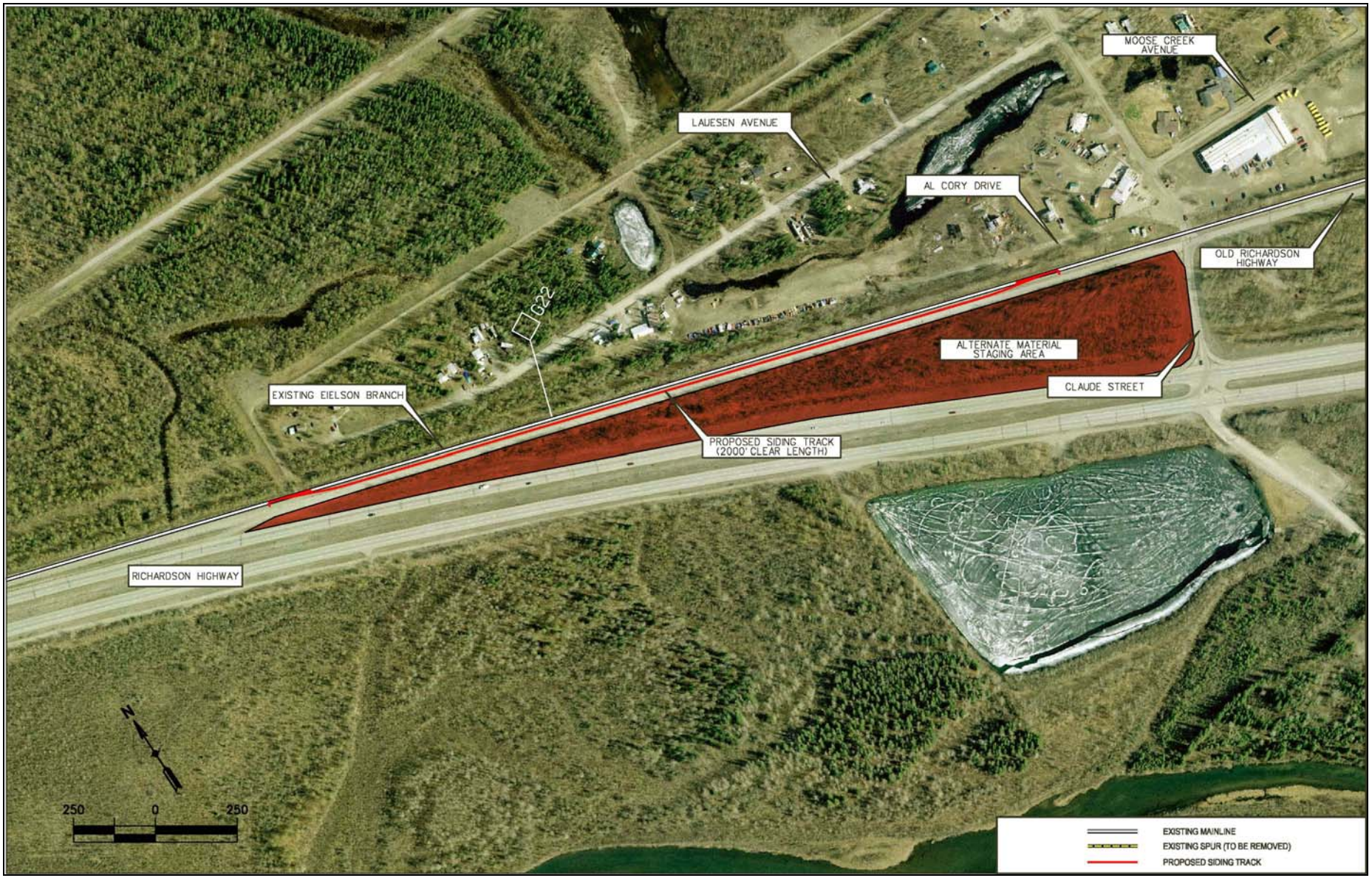

Figure 2-14 – ARRC's Alternative Transload and Staging Site

Bridges and Culverts

Rail bridges and culverts would be required for crossing water bodies, including streams, rivers, and some wetlands. As discussed in greater detail in Chapter 4, Water Resources, stream and river crossings are categorized as "large" or "small" depending on the size and hydrologic characteristics of the channel. Table 2-3 provides a summary of bridges and culverts proposed by ARRC; actual types and sizes of conveyance structures would be determined during final design and permitting. In general, conveyances were sized to equal or exceed the measured channel width or 90 percent of bank full width (to meet or exceed the Alaska Department of Fish and Game [ADF&G]/Alaska Department of Transportation and Public Facilities [ADOT&PF] mode of action fish passage requirements even where fish presence is undetermined). ARRC proposed bridges where the recommended conveyance width is longer than 20 feet. On the west side of the Tanana River, bridges and culverts for vehicles would also be constructed as part of a permanent, separate and parallel access road.

Table 2-3
Permanent Bridges and Culverts for Rail Crossings of Water Bodies by Alternative Segment

Alternative Segment	Small Bridges	Large Bridges[a]	Total Bridges	Culverts	Total Bridges and Culverts
North Common	1	0	1	1	2
Eielson 1	1	0	1	13	14
Eielson 2	3	0	3	10	13
Eielson 3	3	0	3	14	17
Salcha 1	0	1	1	12	13
Salcha 2	2	4[b]	6	12	18
Connector A	1	0	1	3	4
Connector B	1	0	1	2	3
Connector C	3	0	3	4	7
Connector D	3	0	3	1	4
Connector E	1	0	1	5	6
Central Alternative 1	1	0	1	9	10
Central Alternative 2	2	0	2	9	11
Donnelly 1	4	2	6	31	37
Donnelly 2	2	2	4	44	48
South Common	3	0	3	11	14
Delta 1	0	1	1	1	2
Delta 2	0	1	1	0	1
Minimum for entire rail line	11	4	15	77	92
Maximum for entire rail line	14	7	21	93	114

[a] Large bridges include bridges over the Tanana, Salcha, Delta, and Little Delta Rivers and Delta Creek.
[b] One large bridge would cross the Tanana and two side channels, but for the purposes of the impact analysis in the EIS, it is considered three separate large bridge crossings of the three waterbodies.

The proposed rail line would require construction of a major rail bridge across the Tanana River on one of the Salcha alternative segments. There are two options for the bridge location along Salcha Alternative Segment 1, and one proposal for the crossing on Salcha Alternative Segment 2, as described below.

Salcha Alternative Segment 1 Tanana River Bridge

The Tanana River at the proposed crossing location for Salcha Alternative Segment 1 has a relatively narrow channel that appears to be relatively stable based on vegetation and historical aerial photography. At this location, ARRC is proposing to construct an approximately 3,600-foot bridge, widen and upgrade access roads, place channel plugs in side channels to prevent future migration of the main channel of the Tanana River, extend a ADOT&PF revetment, and construct new revetments (see Figures 2-15 and 2-16).

Road improvements to Tom Bear Trail (also known as Grieme Road), Old Richardson Highway between Tom Bear Trail and Bradbury Road, and Bradbury Road would include widening and resurfacing.

ARRC would place several channel plugs in two channels on the west side of the Tanana River to ensure that surface water does not inundate the channels during high-water events. This would prevent the Tanana River from trying to reclaim these channels as major stems of the braided river system. ARRC would also combine two channels on the west side of the Tanana River into one at the northern-most crossing location. A natural bottom pipe structure would be sized to accommodate local drainage and fish habitat needs.

ARRC is proposing two options for stabilizing the eastern bank of the Tanana River. The first option would raise and extend Tom Bear Trail to act as a levee along an existing section line easement (see Figure 2-15). This levee would tie into a revetment to be constructed on the eastern side of the main channel of the Tanana River.

The second option would extend the eastern bank revetment upstream nearly 2 miles to an existing ADOT&PF revetment (see Figure 2-16). This revetment extension would prevent surface floodwater from inundating private property in the immediate area and force it under the proposed Tanana River bridge. The levee would either be placed in the Tanana River or along its bank. This revetment would not address groundwater up-welling associated with flooding in the area.

Salcha Alternative Segment 2 Tanana River Bridge Option

At the proposed location of the Tanana River bridge on Salcha Alternative Segment 2, the Tanana River has multiple channels that are widely dispersed and show greater fluctuation in both morphology and the volume of water carried than at the proposed Salcha Alternative Segment 1 bridge location. ARRC has indicated that highly permeable gravel to depths exceeding 50 feet at the Salcha Alternative Segment 2 crossing location makes it impractical to construct in-stream structures to control the volume of water in each channel, making crossings of individual channels impractical, and that a bridge structure over the entire length of the river channel would be approximately 6,100 feet long. As discussed further in Appendix D, ARRC has stated that a bridge of this length would be cost-prohibitive because it would cost approximately $80 to $100 million more than the Salcha Alternative Segment 1 Tanana River crossing. To provide an alternative with a bridge length comparable to that of Salcha Alternative Segment 1, ARRC has proposed forcing the flow of the river along the north bank, using revetments, multiple channel plugs, and fill in the river bed on the south side (see Figure 2-17; see also Appendix D for additional information on alternative crossing concepts considered but eliminated from detailed study). With this approach, the bridge would be approximately 4,000 feet long.

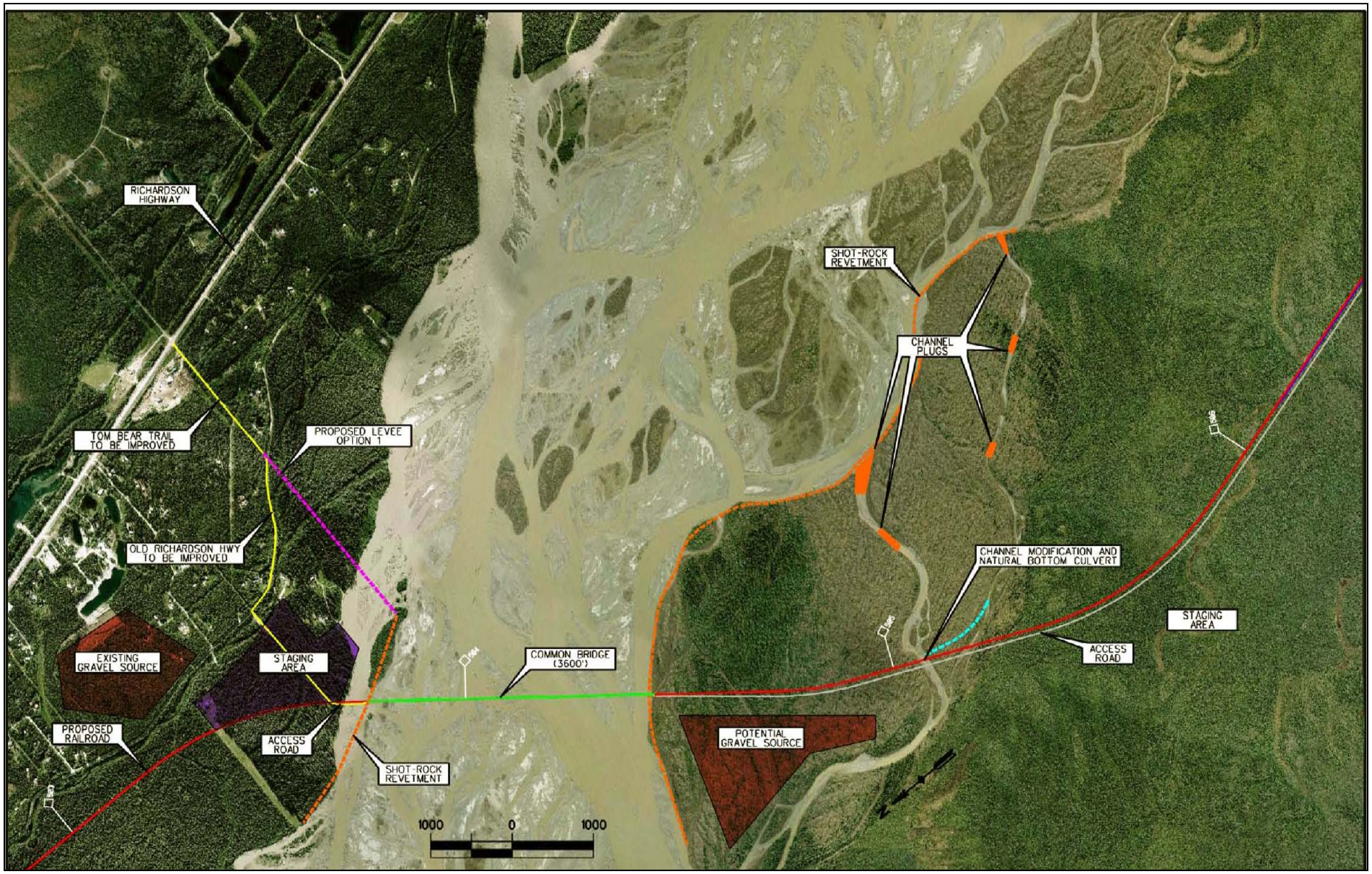

Figure 2-15 – Salcha Alternative Segment 1 Tanana River Crossing Option 1

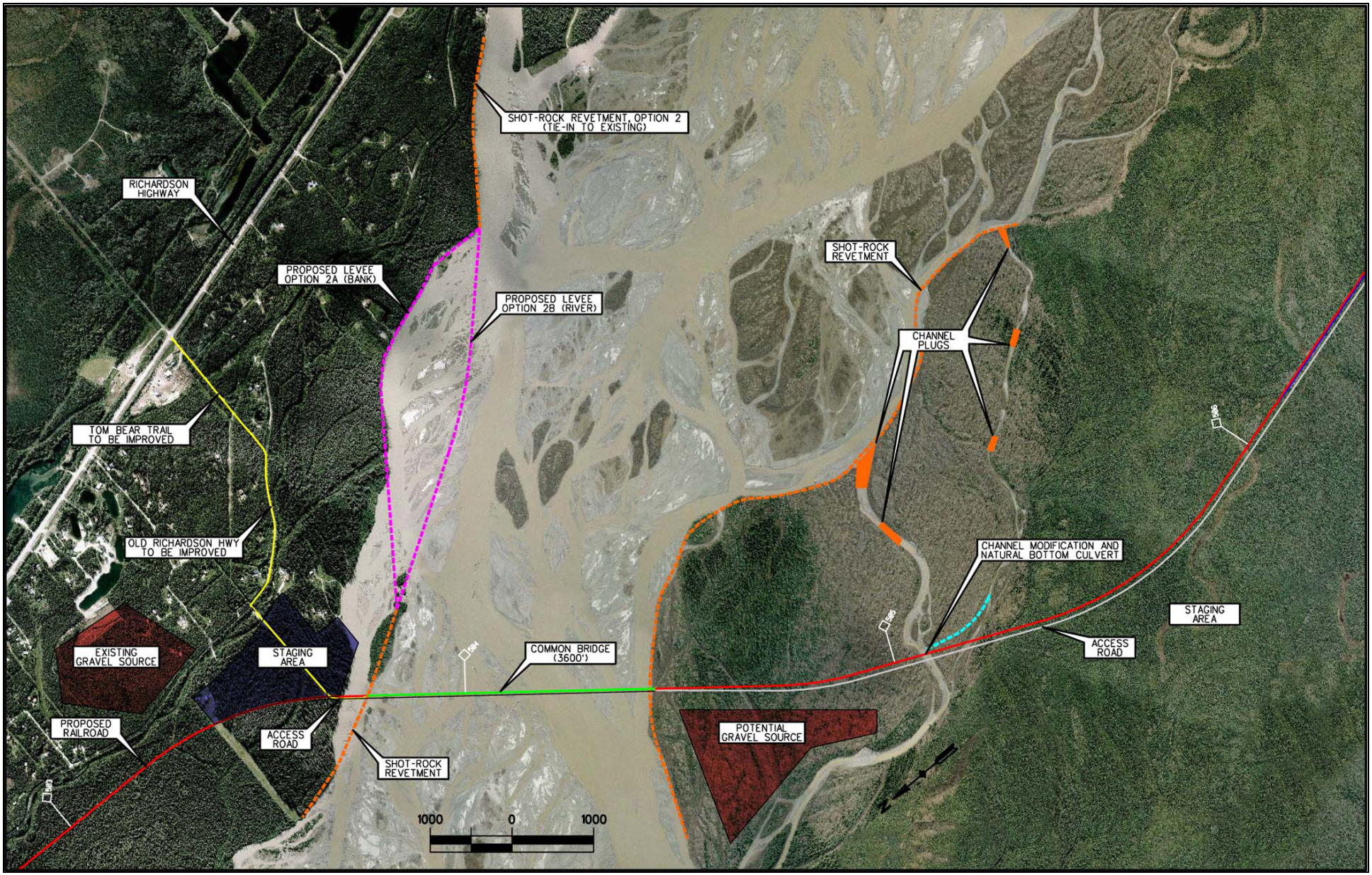

Figure 2-16 – Salcha Alternative Segment 1 Tanana River Crossing Option 2

Figure 2-17 – Salcha Alternative Segment 2 Tanana River Crossing

For either Salcha Alternative Segment 1 or 2, the Tanana River bridge would be a dual-modal bridge capable of providing both rail and vehicular access across the Tanana River. The bridge would consist of steel deck girders up to 150 feet long, supporting a common railroad-roadway deck (see Figure 2-18). The deck would be supported by concrete piers. These piers would either be excavated or driven to depth or have additional foundation features below the normal water surface elevation.

River training structures would consist of armored revetments, bank stabilization, and secondary channel plugs. The revetments would consist of rocks to protect the bank and would extend from the river floor to an elevation above the predicted 100-year flood elevation to hold back surface water (see Figure 2-19). Where revetments extended into the river, it is possible that the area behind them would fill with material. ARRC would maintain access roads on or behind revetments for inspection and maintenance.

Vehicular bridges would be required during construction for the movement of equipment, materials, and labor along the west side of the Tanana River. ARRC does not plan to construct vehicular bridges for the access road on the east side of the river because of the multiple points at which the rail line ROW could be accessed from existing roads. Rail bridges would not be wide enough to accommodate large earth-moving equipment (greater than 18 feet wide) and would not be useable for vehicles once track is placed on them. The vehicular bridge spans would be equal to or wider than the rail bridge spans. ARRC would likely use prefabricated spans obtained from commercial sources placed on pile piers and abutments. Following construction, vehicular bridges would be left in place to support long-term operation of the rail line and for possible use by the military.

Culverts would be built into the railbed and vehicle roadbeds to allow water to flow under the rail line and access roads. The project would require between 77 and 93 culverts along the rail line. On the west side of the Tanana River there would be culverts for the access road at between 55 and 80 locations. Culverts would be designed to allow fish passage when necessary.

In addition, major rail bridge crossings would also be required at Little Delta River, Delta Creek, Delta River, and—for one alternative segment—the Salcha River. Major rail bridges would include a combination of 150-foot main spans (for the Tanana River crossing), and combinations of 75-foot (see Figure 2-20) and similar 35-foot spans, and abutments. Numerous other crossings of smaller water systems would also be required. Small rail bridges would range between 40 and 800 feet in length and would include a combination of shorter to medium span lengths.

Temporary bridges, ice roads, or scaffolding might be needed to aid in construction of some of the bridges. These structures would be removed after bridge construction was completed.

At a minimum, large rail bridges would be designed for a 100-year flood to pass through with less than 1 foot of rise in the tail-water elevation. The designs would also consider local and broad backwater effects associated with large flood events on major tributaries, including potential flooding scenarios associated with the Chena River Flood Control project. At a maximum, large rail bridges would span a channel's width, as measured from vegetation to vegetation. Final bridge lengths would be determined during the final design process. Small bridges and culverts would also be designed for the 100-year flood stage.

ARRC would likely use prefabricated bridge sections for rail bridges to the greatest extent possible to limit the duration of bridge construction and area required for staging. Existing

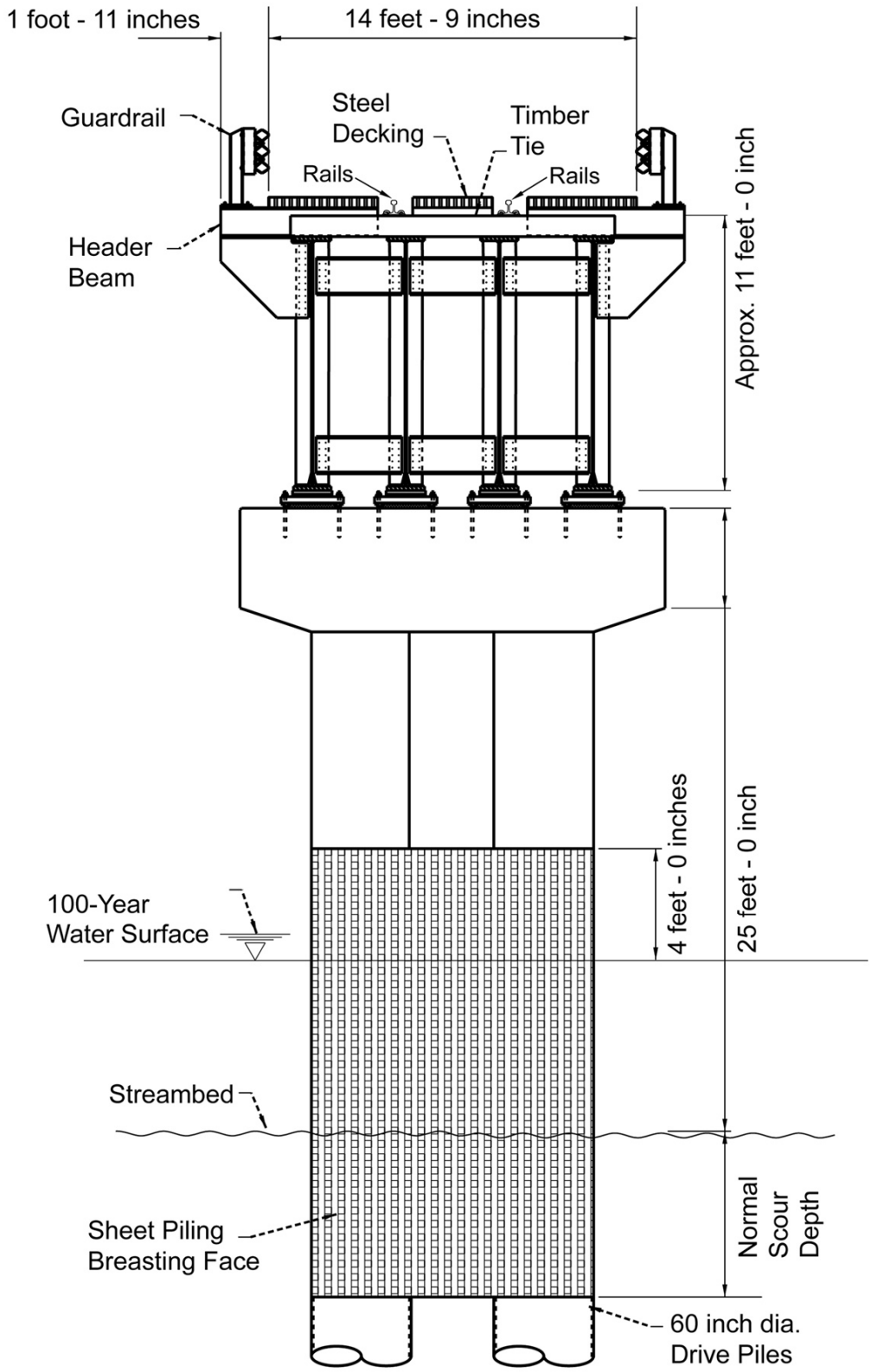

Figure 2-18 – Typical Cross Section of the Tanana River Bridge

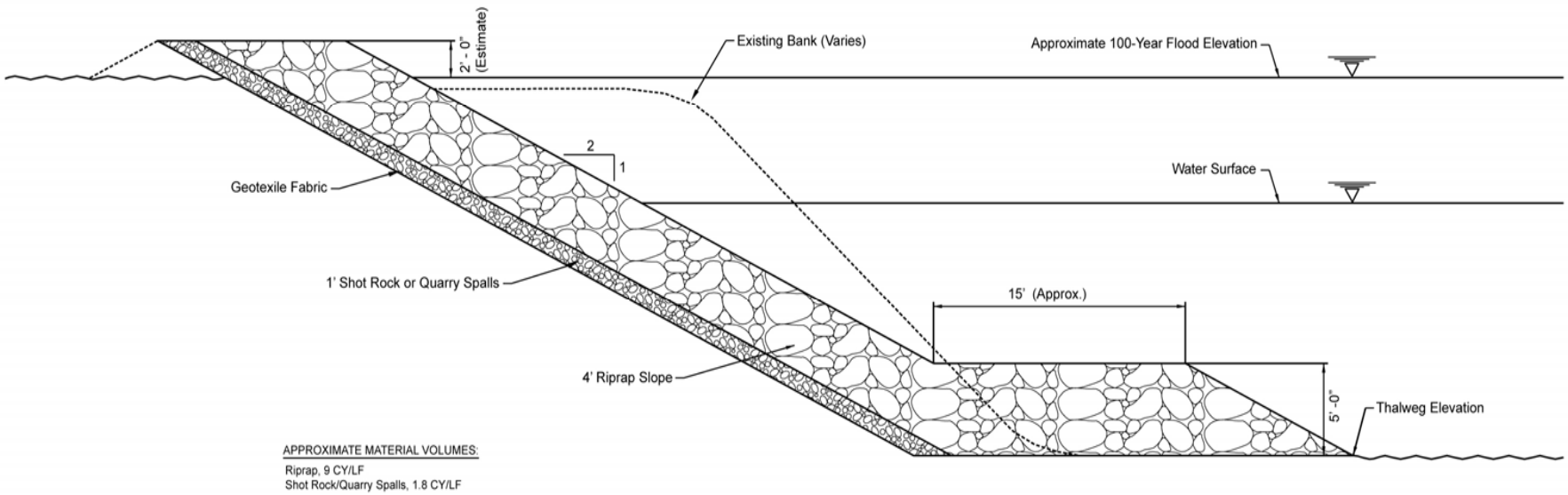

Figure 2-19 – Typical Cross Section of a Revetment

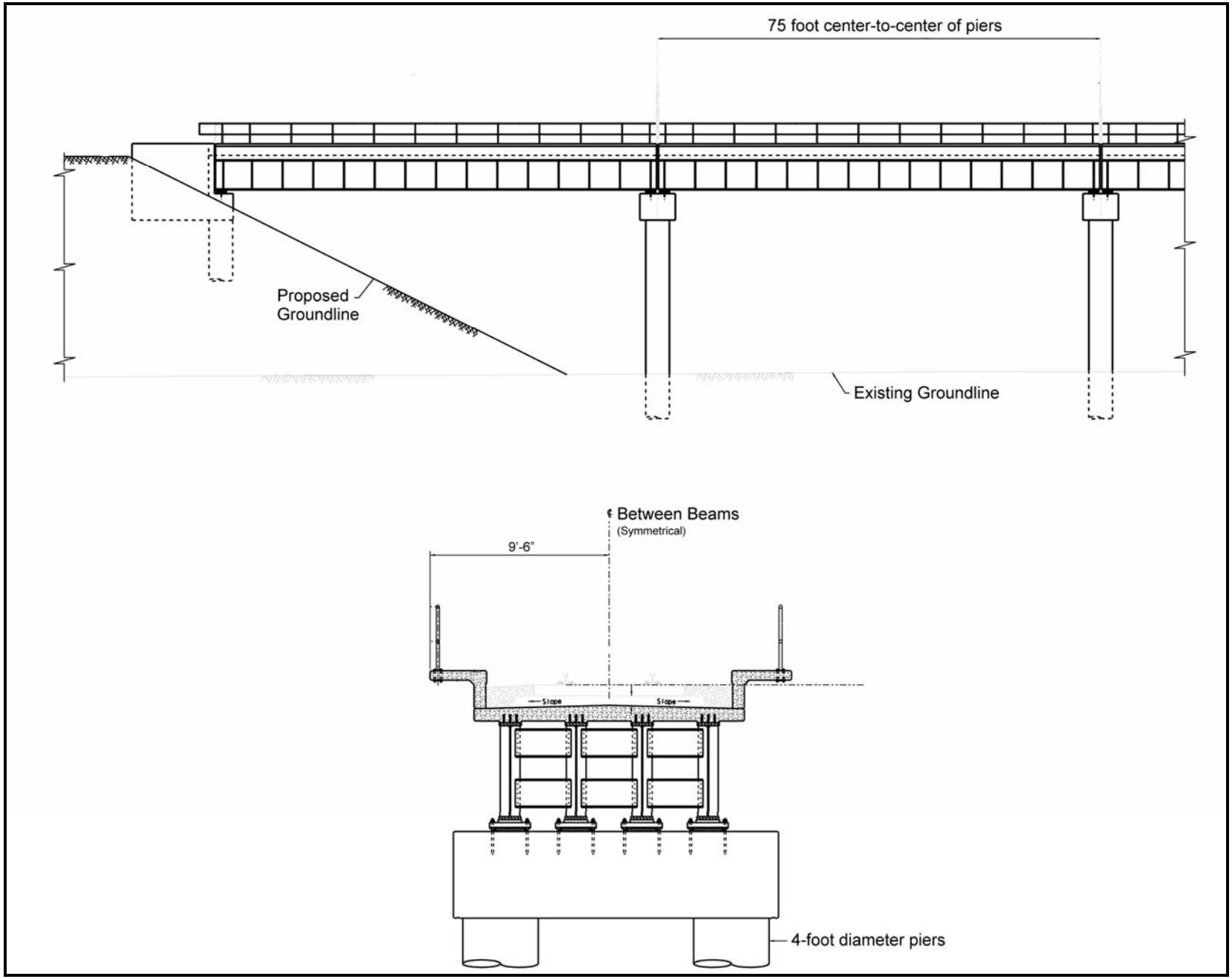

Figure 2-20 – Typical Profile (top) and Cross Section (bottom) of a 75-foot-span Bridge

manufacturers would supply the bridge sections, additional steel, and concrete required for bridge construction.

ARRC would start constructing bridges and large culverts before other infrastructure because they would take longer to construct and would be needed for construction activity. Most bridge foundation work likely would take place during the winter, when frozen conditions would facilitate access across rivers and avoid the need for temporary construction bridges.

Each bridge would require a bridge staging area. Most bridge staging areas would require approximately 1 acre along the closest alternative segment and would likely be in the 200-foot ROW. The staging areas for the Salcha Alternative Segment 1 and Salcha Alternative Segment 2 Tanana River crossings would cover approximately 43 acres and 84 acres, respectively, and would extend outside of the 200-foot ROW. Crossings of the Delta River, Little Delta River, Delta Creek, and the Salcha River could require bridge staging areas up to 5.7 acres.

Construction Schedule

The timeframe for construction would depend on funding, which could lead to one of three construction scenarios—a full construction scenario; a phased construction scenario with the Tanana River bridge constructed before railroad construction; or a phased construction scenario with the Tanana River bridge constructed after the first 13 or 18 miles of rail line from the Eielson Branch to the Tanana River.

Under a full construction scenario, construction would begin at both ends of the alignment from North Pole and Delta Junction and meet near the Little Delta River or Delta Creek crossing. ARRC anticipates that the project would be finished in 3 to 4 years under this scenario.

With a phased scenario, construction of the Tanana River bridge could start prior to railroad construction due to the long lead time associated with the bridge spans and a logistical need to complete the bridge early in the project to facilitate construction of the rail line on the southwest side of the Tanana River. Under this scenario, the Tanana River bridge could be constructed several months or years before the rail line is constructed. This scenario would require an interim rail-to-truck transload and staging site for materials and equipment shipped to the Fairbanks area via the existing Alaska Railroad system. Two potential locations have been identified for this staging site and are described in more detail previously in the Construction Staging Areas section.

Alternatively, another phased construction approach could involve the first 13 or 18 miles of the rail line from the Eielson Branch to the Tanana River, depending on which alternative segment was selected. Under this scenario, there would be no need for the rail-to-truck transload and staging site.

Because the Tanana River bridge would be dual-modal, military vehicles could use the bridge to access TAs on the southwest side of the Tanana River prior to completion of the rail line. Access over the dual-modal bridge to the west side of the Tanana River would be controlled by the military before and after the rail line was completed in accordance with a Memorandum of Agreement between ALCOM and ARRC.

With either approach, construction would be conducted throughout the year, although severe weather would limit winter-time construction to land clearing activities, material and equipment staging, most bridge construction, and interior work associated with facility buildings. The specific timeframe and sequence of construction would depend on funding, final design, and

permit conditions, such as requirements to avoid sensitive breeding periods for migratory birds and raptors and when salmon redds are present.

Grade Crossings

To maintain access to existing public and private roads and trails across the rail line, ARRC would install grade crossings where the rail line would cross a roadway. In places where the rail line would cross the Alaska or Richardson Highway, ARRC proposes to grade separate the crossings. Where the rail line would cross paved, public roadways, the routes would cross at grade and active warning devices, such as flashing lights and gates, would be installed. Where the rail line would cross unpaved roads and private crossings, the routes would cross at grade and ARRC would install passive warning devices such as crossbucks and stop signs. Where the rail line would cross legally authorized trails and FNSB trail easements, ARRC has indicated that the crossings would likely be grade separated.

In locations where ARRC would construct grade-separated crossings for the Alaska and Richardson Highways, additional staging work spaces outside the 200-foot ROW likely would be required.

2.3.4 Rail Line Operations Support Facilities

The proposed action includes the construction and operation of several rail line support facilities that would be required for proper operation of the proposed rail line. These permanent facilities would include:

- A passenger facility;
- Section facilities;
- Communications towers; and
- Track sidings.

These facilities would be constructed at the same time as the rail line. Shippers might want to construct offloading facilities along the proposed rail line; however, no offloading facilities are being proposed at this time.

Passenger Facility

The proposed action includes a passenger depot in Delta Junction. ARRC would construct the depot according to U.S. Department of Transportation (USDOT) and Federal Transit Administration (FTA) regulations and guidance regarding passenger accommodation and platform height. This facility would likely be collocated with the end-of-track facilities, such as a maintenance facility and a loading dock. The passenger station would be approximately 1 acre, including an access road and parking area; provide protection from the weather; and possibly accommodate automated ticketing.

The passenger depot associated with Delta Alternative Segment 1 would be located off the Alaska Highway (see Figure 2-21) and would be partially on Fort Greely property.[2] The passenger depot associated with Delta Alternative Segment 2 would be located off Emmaus Road. The rail line approach and the location of the passenger terminal for Delta Alternative Segment 2 would interfere with the intersection of Emmaus and Nestler Roads and block access to a subdivision off Emmaus Road. ARRC is proposing to reroute the intersection and construct a new access road to the subdivision from Nestler Road (see Figure 2-22).

[2] A security evaluation would be required in conjunction with development of facility details during final design.

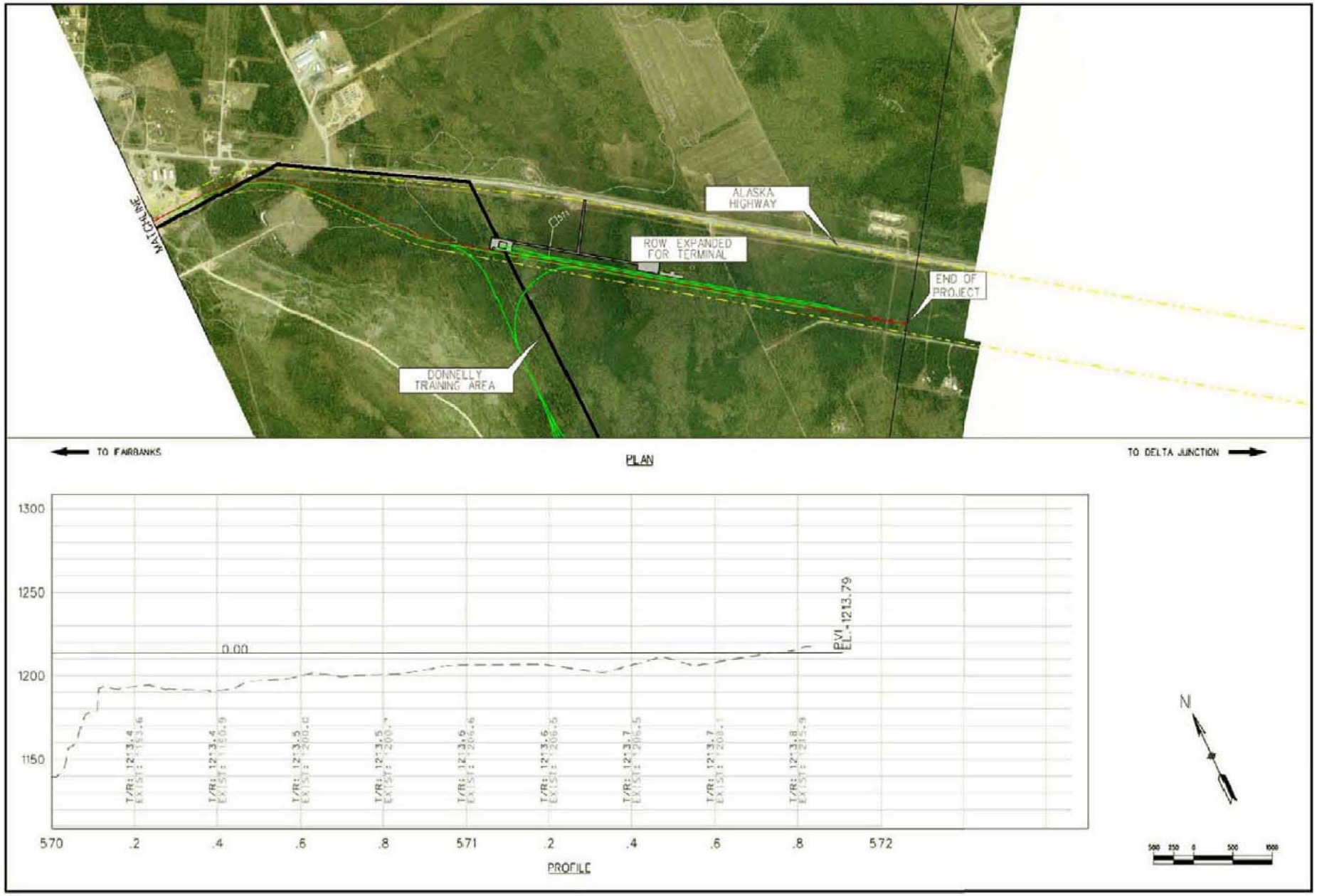

Figure 2-21 - Delta Alternative Segment 1 Passenger Facility

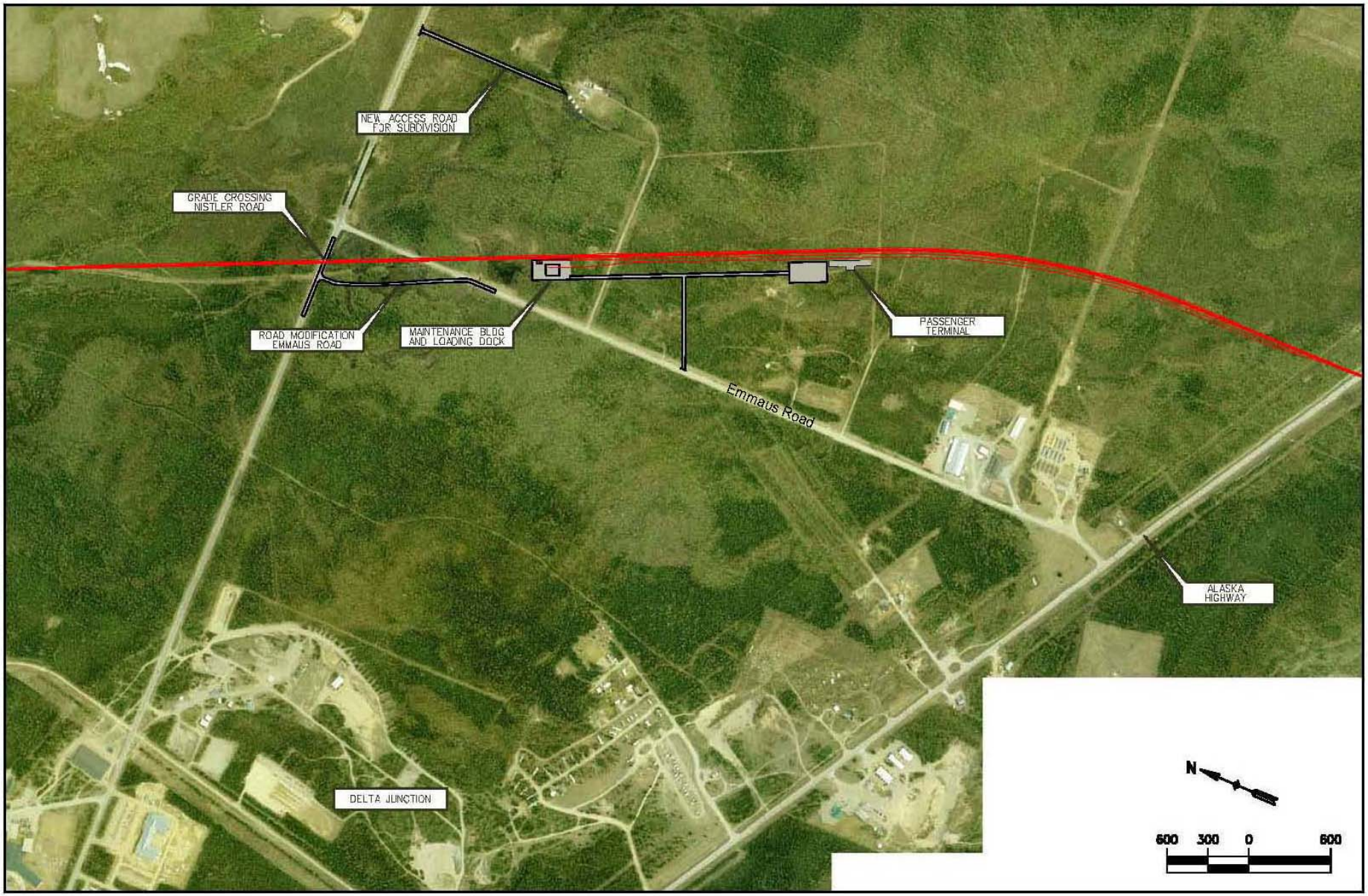

Figure 2-22 – Delta Alternative Segment 2 Passenger Facility

Section Facilities

ARRC would construct facilities at Delta Junction and at the bridge on the north side of the Tanana River. The Delta Junction facility would include the capability to spot a locomotive or rolling stock within the building for storage/light repair. The facility adjacent to the Tanana River bridge would be south of Piledriver Slough along Bradbury Road if Salcha Alternative Segment 1 were selected. If Salcha Alternative Segment 2 were selected, the facility would be in the vicinity of the staging area shown in Figure 2-17.

Communications Towers

Communications towers would be situated at six locations along the proposed rail line to provide for communications with the train crew. ARRC would construct three new tower sites along Moose Creek bluff, Site A, and Site B. Each new tower site would cover approximately 0.2 acre. Towers would be lit if required by the Federal Aviation Administration and would have a maximum height of 180 feet. The sites would require creation of access roads if they are not accessible by existing roads, except for remote sites, which would have helicopter access rather than road access for construction and operation.

ARRC also proposes to use existing State of Alaska towers at three locations—Harding Lake, Canyon Creek, and Delta Junction.

- **Moose Creek Bluff Communication Tower** would be a new tower located near North Common Segment, collocated with the Eielson Construction Staging Area. This site would require a permanent new access road within the Eielson Construction Staging Area.

- **Site A Communication Tower** would be a new tower located near Salcha Alternative Segment 1 in the Tanana Flats TA (or on ADNR land). This site would require a permanent access road.

- **Harding Lake Communication Tower** is an existing tower located on Flag Hill, near Salcha Alternative Segment 2. This site would use existing access roads.

- **Canyon Creek Communication Tower** is an existing tower along Richardson Highway between the Salcha and Big Delta communities. This site would use existing access roads.

- **Site B Communication Tower** would be a new tower located near South Common Segment, situated on high ground south of Delta Creek. This tower would have an access road connecting from an ADNR winter trail.

- **Delta Junction Communication Tower** is an existing tower located near Delta Alternative Segment 2, on high ground northeast of the terminus. This site would use existing access roads.

Track Sidings

ARRC would construct up to seven 6,200-foot (“in clear” length) sidings to allow train passage and/or access to rail services. The ARRC design and operation criteria indicate that sidings should be provided at every 20 minutes of running time along the route. Sidings would be placed, where possible, on tangent sections of the alignment. All sidings would be in the 200-

foot ROW. Two of the seven sidings might be located in conjunction with potential offloading facilities for the military at the Tanana Flats TA and Donnelly West TA.

Offloading Facilities

ARRC anticipates that the military might need offloading facilities along the NRE. These facilities could be located near the rail line terminus in Delta Junction, on the west side of the Tanana River just past the Tanana River bridge, and near the Donnelly TA along Donnelly Alternative Segment 1 or 2. Because the need for offloading facilities is uncertain, construction of such facilities for military use is not part of the proposed action.

Rail Line Operations and Traffic

After construction of the rail line, trains could transport commercial freight, military equipment and supplies, and passengers. Transport of military equipment, supplies, and personnel could support the operations of the U.S. Army at the Tanana Flats and Donnelly TAs. Commercial freight could include aggregate, agricultural products, building supplies, fertilizer, forest products, and petroleum products. Military shipments could include building supplies, equipment, fuel, munitions, troop food supplies, personnel, and vehicles

Train frequency would vary, but ARRC anticipates an average of approximately four round-trip passenger trains per day and one round-trip freight train per day, with approximately 13,000 loaded freight cars per year. Table 2-4 shows the annual frequency based on type of service the train would provide. Passenger service would involve four round trips per day (two in the morning and two in the evening) between the Fairbanks Intermodal Center and Delta Junction. Military train traffic for training activities, if requested, is assumed to originate at Fort Wainwright's offloading facility and travel to the Tanana Flats and Donnelly TAs. Train traffic between the Port of Anchorage and Fort Wainwright for DoD forces outside of Alaska could increase as a result of construction and operation of the NRE.

Table 2-4
Train Frequency

Type of Service	Round Trips Per Year
Freight Service	365
Passenger Service	1,460
Total Trains	1,825

Source: ARRC, 2007f

Some military traffic might elect not to access the Tanana Flats or Donnelly TAs by rail and instead access the TAs on the west side of the Tanana River using the vehicular portion of the dual-modal Tanana River bridge. In these instances, the military traffic would travel southward on Richardson Highway from the Fort Wainwright Main Post or Eielson AFB to the access road for the Tanana River bridge. The distance traveled on Richardson Highway would depend on which Salcha alternative segment was selected. Once on the west side of the Tanana River, the military could use existing trails or the access road parallel to the rail line to access the TAs.

Train lengths would vary depending on whether ARRC was transporting passengers or commercial and military freight. ARRC estimates that passenger train lengths would be 260 feet or less, depending on the type of equipment used. For passenger service, ARRC may use a diesel motorized unit or a locomotive with two coach cars, which could have a total capacity of approximately 185 passengers. Freight trains would be approximately 2,200 feet long.

Train speeds would be a maximum 79 miles per hour miles per hour for passenger trains and 60 miles per hour for freight trains.

Rail Line Maintenance

ARRC would conduct periodic maintenance and inspections to ensure operation of a safe and reliable rail line. The primary maintenance activities would include signal testing and inspection; minor rail, tie, and turnout replacement; and routine ballasting and surfacing tasks. Additional activities would be performed on an as-needed basis and would include vegetation control, snow removal, and vehicle and equipment maintenance.

2.4 Comparison of Environmental Impacts

Council on Environmental Quality NEPA implementing regulations require a comparison of the environmental impacts of the proposed action and alternatives to the proposed action, in order to sharply define the issues and provide a clear basis for choice among options (see 40 CFR 1502.14). This section compares the environmental impacts of the proposed action alternatives based on the information and analysis presented in the resource chapters. Sections 2.4.1 through 2.4.14 summarize potential impacts identified in the resource chapters. For more detailed impacts information, refer to each resource chapter.

2.4.1 Topography, Geology, and Soils

Impacts on soil from construction of the proposed rail line would mostly be associated with excavation and fill activities to provide the desired elevation and grade of the railbed, or with removal of compressible soils that are unsuitable for construction. The existing soil profile would be eliminated in areas subject to excavation or filling. Salcha Alternative Segment 2, Donnelly Alternative Segments 1 and 2, and Delta Alternative Segment 1 would require grading and fill to meet the design standard of no more than a 1-percent grade for the rail line. Construction of the railbed would cause some thawing of the permafrost, potentially leading to irregular subsidence of the surrounding soil. The predicted amount of permafrost encountered by each segment would range from 5 to 90 percent of total segment ROW area, and overburden would range from 2 feet to 14 feet. Among the sets of alternative segments, Salcha Alternative Segment 2 (75 to 90 percent, 2 to 7 feet overburden), Central Alternative Segment 1 (2 to 75 percent, 7 to 14 feet overburden), and Donnelly Alternative Segment 1 (5 to 90 percent, 2 to 14 feet overburden) would encounter substantially larger areas of permafrost than their counterparts (see Table 2-5 at the end of this chapter for area and overburden for all segments). Seismic activity in the area could affect any location on the proposed NRE. Both Salcha Alternative Segments 1 and 2 would cross the Salcha seismic zone, but mass wasting events such as landslides, rockslides, or slump would be more likely to affect Salcha Alternative Segment 2.

2.4.2 Water Resources

Impacts to water resources from construction of the proposed NRE could result from the building of unpaved access roads, excavation of gravel for use in construction, construction of bridges and culverts, use of ice roads and ice bridges, water supply withdrawals, transportation, and staging areas. The relevant effects of these activities on surface water, water quality, groundwater, wetlands, and floodplains are discussed below; Table 2-5 at the end of this chapter highlights the distinguishing impacts by segment.

Surface Water and Water Quality

Bridges and culverts would be used to convey water under the rail line and on the west side of the Tanana River, under the access road. Bridges would either completely or partially span (or clear) the stream channel and would require that construction occur along the streambanks (*i.e.*, to construct abutments) and/or in the channel (*i.e.*, to construct piers and footings). Culverts would require work to be completed in the channel and along streambanks. Impacts from bridges could include changes to natural drainage, sloughing and erosion of the streambank, impacts to permafrost, increased stages and velocities of floodwater, and increased channel scour or bank erosion. The construction of single or multiple culverts in waterbodies could result in localized disturbance of waterway banks to gain access to the channel and disturbance of the channel bed when installing the culverts. The installation of bridges and culverts would result in temporary impacts to water quality from increased sediment transport, increased sediment load, and increased turbidity due to bank and waterbody bed disruption.

Table 2-5 at the end of this chapter lists the numbers and types of crossings for each common and alternative segment. Generally, the more bridges or culverts along a given segment, the greater the occurrence of these impacts; however, the magnitude of effects at individual crossings would also depend on site- specific factors. Eielson Alternative Segment 3 would have more culverts than Eielson Alternative Segment 1 or 2 (14 versus 13 and 10, respectively), but Eielson Alternative Segments 2 and 3 would have more small bridge crossings than Eielson Alternative Segment 1 (3 each versus 1). Both Salcha Alternative Segment 1 and 2 would have a bridge crossing of the Tanana River. However, the anticipated impacts would differ, primarily due to differences in the location and extent of revetments and channel alterations and fill. Salcha Alternative Segment 2 would have more bridge crossings than Salcha Alternative Segment 1 (2 versus none for small bridges, and 4 versus 1 for large bridges). In addition, Salcha Alternative Segment 2 would require a bridge over the Salcha River. Central Alternative Segment 2 would have more small bridge crossings than Central Alternative Segment 1 (2 versus 1). Among the connector segments, E and C would have the most culvert crossings (5 and 4, respectively), and C and D would have the most small bridge crossings (3 versus 1 for all other connector segments). Both Donnelly Alternative Segments 1 and 2 would have bridge crossings of the Little Delta River and Delta Creek. Donnelly Alternative Segment 2 would have many more culverts than Donnelly Alternative Segment 1 (44 versus 31), but Donnelly Alternative Segment 1 would have two additional small bridge crossings (4 versus 2). Both Delta Alternative Segments 1 and 2 would have a bridge crossing of the Delta River. Delta Alternative Segment 1 would have a single culvert crossing, the only culvert crossing along either Delta alternative segment. Large bridge crossings along the Salcha, Donnelly, and Delta alternative segments would all likely result in impacts to surface waters due to altered flood hydraulics, increased scour surrounding the piers and downstream aggradation, and could increase the potential for overbank flooding and/or ice/debris jams.

Groundwater

Impacts to groundwater could include effects to infiltration, increased groundwater discharge through ponds created by borrow areas, permanent changes to permafrost thickness and vertical location of the active thaw zone, and temporary groundwater elevation declines from pumping. The extraction of materials from the borrow areas along all common and alternative segments, except Delta Alternative Segment 2, would likely affect groundwater due to the changes in local hydrogeologic regime resulting from the removal of saturated materials and the creation of new

ponds that would serve as sources of groundwater discharge through evaporation during the summer and sources of groundwater recharge during the break-up and major rainstorms.

Wetlands

A total of 33 percent of the area within 500 feet of the proposed alternative segments is wetlands. Assuming that the amount of wetlands on the sites of proposed ancillary facilities is the same as the area in general, 203.3 acres of wetlands would be affected by the facilities. In addition, construction in the ROW of each of the proposed alternative segments would affect wetlands. The ROW of the Applicant's preferred route includes 1,046.3 acres of wetlands and other waters. The minimum area alternative would include 884 acres of wetlands and other waters, while the maximum area alternative would include 1,111 acres. Among the sets of alternatives, Eielson Alternative Segment 3 (100.3 acres), Salcha Alternative Segment 2 (262.3 acres), Connector Segment A (56.2 acres), Central Alternative Segment 1 (51.0 acres), Donnelly Alternative Segment 1 (397.0 acres), and Delta Alternative Segment 1 (94.9 acres) would affect substantially greater areas of wetlands and other waters than their counterpart alternative segments (see Table 2-5 at the end of this chapter for wetland acreages by wetland type for all segments).

Floodplains

Portions of the proposed NRE would be constructed within the floodplain of the Tanana and Delta Rivers and some of their tributaries. Portions of the rail line, access road, staging areas and construction camps would likely be placed within the 100-year flood zone. The affected areas would be small compared to the total floodplain storage available; thus, effects on floodplain storage would be minimal. Borrow areas in the floodplain could alter the hydraulics and conveyance of the watercourse during flood stage, leading to a short-term increase in flood storage and/or the development of meander cutoffs and a change in sinuosity of the affected reaches. Effects would be more likely in streams crossing broad shallow floodplains and less likely for entrenched streams. At the sites of the Tanana River bridges on Salcha Alternative Segments 1 and 2, rock revetments (and a levee, in the case of Option 1 for Salcha Alternative Segment 1) would control surface flow and reduce the width of the floodplain near the bridge, but would not prevent flooding from groundwater upwelling on the upland side of the revetments. There are a number of differences among alternative segment groups in terms of floodplain impacts. Central Alternative Segment 2 would lie within the 100-year floodplain, while Central Alternative Segment 1 would lie outside it. Connector Segment A would lie within the 100-year floodplain, E and C would lie in the 100-year floodplain along half their routes, and B and D would be outside the 100-year floodplain.

2.4.3 Biological Resources

Vegetation Resources

Impacts on vegetation would occur through direct clearing for construction of the rail line, access roads, and other support facilities, and through the introduction and spread of noxious and invasive plants. Estimated vegetation clearing for common support facilities would be 721.6 acres. The Applicant's preferred route would result in the clearing or filling of a maximum of approximately 2,818.6 acres of vegetation. The minimum area alternative would affect approximately 2,791.3 acres, while the maximum area alternative would affect 2,885 acres of vegetation. See Table 2-5 at the end of this chapter for cleared vegetation acreage by segment. Vegetation clearing would be a long-term impact for forest communities due to the length of recovery time and the need to maintain cleared areas adjacent to the rail line and access road.

There are no threatened, endangered, or candidate plants protected by Federal or State of Alaska government agencies within the project area; 27 rare plants are known to occur in the vicinity of the project area and one rare willow was identified within the project area during field investigations for wetlands..

Fisheries Resources

Construction of the rail line would result in short-term disturbance and long-term habitat modification to fisheries. Construction- and operations-related impacts would include the loss or alteration of instream and riparian habitats, mortality from instream construction, possible blockage of fish movement during in-stream construction activities, and degradation of water quality. All alternative segments would cross streams or waterbodies with fish resources and would potentially cause the impacts discussed above. The proposed NRE would cross 27 fish-bearing streams. Among the sets of alternatives, the following segments would result in substantially greater numbers of fish stream crossings than their counterpart alternative segments: Eielson Alternative Segment 3 (7 crossings), Salcha Alternative Segment 2 (9 crossings), Connector Segments C and D (6 and 4 crossings, respectively), and Donnelly Alternative Segment 2 (8 crossings). Table 2-5 at the end of this chapter provides the total number of fish stream crossings and the number of anadromous and spawning stream crossings for each segment. Construction and operation of the Tanana River bridge and in-river revetments and channel plugs associated with Salcha Alternative Segments 1 and 2 would have direct adverse impacts on aquatic habitat in the vicinity. Regarding the proposed Salcha Alternative Segment 2 crossing of the Tanana River, ADNR has stated that flow through the side channel, which would be blocked and redirected by the proposed bridge design, is critical for anadromous fish use of the area.

Wildlife Resources

The environmental consequences of construction and operation of the proposed NRE on game mammals (particularly, bears, caribou, moose, wolves, bison, and furbearers) would be influenced by the animal's dependence on specific habitats, the availability of preferred and used habitats, the amount of preferred habitat affected by the project, ecology and life history, and past and current population trends. Common construction-related impacts would include habitat loss and fragmentation, direct mortality from construction, reduced winter survival and lowered breeding success from exposure to construction noise/human activity, and reduced survival or mortality from exposure to spills and leaks of fuels and lubricants. The Eielson alternative segments would have the highest moose and furbearers occurrence. Salcha Alternative Segment 1 and Donnelly Alternative Segment 2 would have higher densities of certain wildlife species than Salcha Alternative Segment 2 and Donnelly Alternative Segment 1. Central Alternative Segment 2 and Connector Segments B, C, and D would contribute to the fragmentation of large areas of closed needleleaf forest core habitats, resulting in mixed effects to wildlife. All game mammals except bison would be expected to be more common along Delta Alternative Segment 1 than Delta Alternative Segment 2. Among the sets of alternatives, the following segments would result in substantially greater losses of habitat for most game mammals than their counterpart alternative segments: Salcha Alternative Segment 2, Connector Segment A, and Central Alternative Segment 1 (see Table 2-5 at the end of this chapter for habitat acreages by species for all segments).

Bird Resources

In general, the proposed NRE would affect a small proportion of the available habitat and the total avian population within the project area, with the greatest potential for impacts to forest

nesting raptors, owls, and landbirds. The proposed NRE would reduce the amount of available habitat for nesting and migratory birds within the Tanana River Valley. Segments constructed through late-succession forest habitats would have the greatest impact on forest nesting landbirds. Power lines and communications towers built to support the rail line would increase collision mortality for all birds, especially when placed near raptor nests and foraging sites or between wetland or agricultural foraging habitats and riverine roosting habitats used by sandhill cranes, geese, swans, and ducks during migration. Twenty-five bird species of conservation concern and seven bird species listed as BLM Alaska Special Status Species have been documented using the project area and would be affected by reduced habitat availability and suitability. Table 2-5 at the end of this table describes relevant owl and raptor effects for each segment; a general overview of the notable differences among segments in alternative segment sets is presented below. Construction of Eielson Alternative Segments 1 and 2 and Central Alternative Segment 2 would result in impacts to identified bald eagle and other large-raptor nests, while Eielson Alternative Segment 3 and Central Alternative Segment 1 would not. Construction of Salcha Alternative Segment 2 would have a notably larger effect on nesting raptors than Salcha Alternative Segment 1. Construction of Connector Segments A and B would affect one nesting pair of owls, while Connector Segments B, C, and D would contribute to the fragmentation of raptor habitat. Construction of Donnelly Alternative Segment 2 would affect two raptors or their nests, while Donnelly Alternative Segment 1 would affect one raptor nest.

2.4.4 Cultural Resources

Surface and subsurface disturbances from construction activities generally would be the source of potential direct effects to historic properties and archaeological sites; indirect project effects could result from increased erosion and watershed changes. Impacts to these resources could include direct disturbance or destruction, contamination of organic residues of a site, exposure of archaeological resources, impacts to the aesthetics and visual site setting (depending on proximity), and changes to groundwater that affect soil pH level and harm the preservation of buried artifacts.

Negligible impacts to prehistoric and historic resources are expected from North Common Segment, the Eielson alternative segments, Salcha Alternative Segment 1, the Central alternative segments, and Connector Alternative Segments A, B, C, and D because they would lie in areas with relatively low archeological sensitivity for prehistoric sites, low or moderate sensitivity for historic sites, and have no known cultural resources within the Area of Potential Effect (APE). Salcha Alternative Segment 2 is in an area that has high potential for both prehistoric and historic sites. A prehistoric site and an historic site lie within or near the APE and are associated with Salchaket Village. The Donnelly alternative segments are located in areas with relatively high potential for prehistoric resources. Donnelly Alternative Segment 1 contains more identified archeological sites than Donnelly Alternative Segment 2. Eight buried prehistoric sites are located within the APE of Donnelly Alternative Segment 1. Seventeen additional cultural resources were identified within 1,312 feet of the APE boundary for Donnelly Alternative Segment 1. Radiocarbon dating indicated that one of the sites is approximately 13,000 years old (after date calibration), which would make it one of the earliest human habitation sites in North America. Four prehistoric archeological sites were recorded along Donnelly Alternative Segment 2, and 11 archaeological sites were identified within 1,312 feet of the APE boundary. Prehistoric sites were also identified within the APE for South Common Segment (low potential for historic and prehistoric resources), and Delta Alternative Segment 2 (moderate potential for prehistoric and high potential for historic resources). No cultural resources were identified

within the APE for Delta Alternative Segment 1 (moderate potential for historic and prehistoric resources). Table 2-5 at the end of this chapter identifies the potential impacts to prehistoric and historic resources within the APE by segment.

2.4.5 Subsistence

Subsistence impacts associated with the proposed NRE would result from restrictions on user access to use areas and resource availability in those areas. The project area lies within ADF&G's Fairbanks nonsubsistence designated area, meaning harvests of wildlife and fish in the area do not qualify as subsistence activities and are instead managed under general sport hunting regulations, or by personal use or sport fishing regulations. Potential impacts to subsistence were evaluated by examining changes in use areas, user access, resource availability, and competition. Subsistence resource uses in and near the project area would be affected similarly by the proposed rail line, regardless of the alternative segment selected. Restricted access along the proposed rail line would create a linear barrier preventing free range of hunters across the area. The proposed rail line could limit the prevalence and movement of wildlife in the immediate vicinity, especially west of the Tanana River, which subsistence users from the east generally access by traveling across the river. Moose mortality due to train-moose collisions could affect moose availability and hunting success in the area. More limited access and hunting and trapping success in the area could cause harvesters to utilize use areas of other communities, increasing the number of harvesters competing for resources in those areas. Such effects would be most likely to occur in Delta Junction, Healy Lake, Nenana, Salcha, and Tok. Impacts to resident and anadromous fish resources resulting from construction, including loss of riparian and stream habitat and potential blockage of fish movements, could decrease the availability of these fish species to harvesters. Construction activities would affect harvest activities, depending on construction timing, access points to the use area, and availability of alternative harvest locations.

2.4.6 Climate and Air Quality

SEA evaluated the potential impacts of increased emissions of National Ambient Air Quality Standards air pollutants by developing emissions estimates for construction and operation of the proposed rail line. The estimated emissions for all of the alternative segments would be similar because the length of new rail line would be similar regardless of alternative segment selected. Construction-related and estimated annual average operations emissions would be expected to be small fractions of the Fairbanks North Star Borough (FNSB) total annual emissions and would be minimal in the context of existing conditions. Construction-related emissions of nitrogen oxides (NO_x), particulate matter less than 10 microns (PM_{10}), and particulate matter less than 2.5 microns ($PM_{2.5}$) would range from 0.6 to 0.9 percent of FNSB total emissions for each pollutant. These emissions would be spread over the length of the new rail line and approximately half of the rail line would be outside FNSB. None of the construction would occur in the Fairbanks and North Pole carbon monoxide (CO) maintenance areas, and estimated emissions would be well below the *de minimus* conformity thresholds (100 tons per year for each pollutant). Operations emissions of NO_x would represent the largest increase in comparison with the existing area transportation conditions (highway vehicle emissions), but would still be relatively low. The proposed action would represent a 6.3 percent increase in carbon dioxide (CO_2) emissions by rail operations in Alaska, but the overall effect would be less than an 0.02-percent increase for the state as a whole (ADEC, 2008b).

2.4.7 Noise and Vibration

SEA evaluated whether the alternatives would result in vibration impacts or rail line noise levels (attributable to wayside noise and the locomotive warning horn) that would equal or exceed a 65 decibel day-night average noise level (DNL) and/or result in an increase of 3 a-weighted decibels (dBA) or greater. An estimated 32 noise receptors near the Salcha Alternative Segment 2, and an estimated four receptors near the Eielson Alternative Segment 3 would be exposed to adverse noise effects at greater than 65 DNL and an increase in noise level of 15 to 30 dBA. An estimated 446 receptors along the existing Eielson Branch between Fairbanks Depot and the connection point for the proposed NRE would experience an adverse noise impact at greater than 65 DNL with an increase of 4 to 10 dBA as a result of the increased rail traffic for the proposed NRE. An estimated four receptors along Salcha Alternative Segment 2 would experience vibration levels exceeding the 80 vibration decibels (VdB) criterion for human annoyance. Additional temporary construction noise would be generated from the proposed rock storage and transfer facility adjacent to the Eielson Branch near Eielson AFB. Table 2-5 at the end of this chapter identifies potential noise and vibration impacts by segment.

2.4.8 Energy Resources

The overall potential effects from the proposed rail line on electrical transmission lines, pipelines, recyclable commodities, and demand for energy resources would be negligible. Any change in energy consumption (fuel usage) as a result of the proposed project would be small.

2.4.9 Transportation Safety and Delay

Safety

Using available statistics on accidents per train mile, SEA estimated that the proposed NRE would result in an increase of 0.59 predicted train accidents per year. The increase would be essentially the same for all routes from North Pole to Delta Junction because the difference in the length of the routes is comparatively small. Similarly, the potential consequences of moving 63 hazardous material-containing railcars annually would be the same for all routes. The potential impacts of the NRE on road safety would be small during construction and minimal to potentially positive during operations, which would be equal for all routes. SEA's analysis of highway-rail grade crossing safety indicates that, during operations, accident frequency at each of the existing public at-grade crossings that would be used by proposed NRE rail traffic would range between a minimum rate per year of 0.0093 and a maximum of 0.413 (*i.e.*, one predicted accident every 2.4 to 108 years). The total estimated increase in predicted accident frequency of 0.54 accident per year (from 1.18 to 1.72) for all existing crossings that would be used by proposed NRE traffic is independent of the route of the rail line extension because the same existing crossings would be used for all routes. For new at-grade crossings, predicted accident frequency would be much lower than for the existing grade crossings because total estimated vehicle traffic at the new crossings would be less than 2 percent of that for the existing crossings for any of the alternative routes from North Pole to Delta Junction.

Delay

SEA does not expect that trains on the existing rail line would experience noticeable delays as a result of the projected additional construction or operations rail traffic. Construction activities would generate vehicle trips, and construction transportation could cause increased road delays. Temporary delays would occur where existing roads are widened to access the Tanana River

bridge location on Salcha Alternative Segments 1 and 2, and for traffic on Richardson Highway in the Salcha area during relocation of the highway for construction of Salcha Alternative Segment 2. Construction of grade-separated and highway/rail at-grade crossings could also cause temporary delays. SEA anticipates that the impacts of road transportation delay from drivers' commutes to rail stations would be minimal. Vehicle trips on Richardson Highway could decrease slightly during operations. SEA estimates that the number of vehicles delayed by rail traffic would increase as a result of the proposed NRE from approximately 1 percent of all vehicles using the highway/rail at-grade crossings to approximately 1.6 percent, and that the average delay experienced by each delayed vehicle would decrease from approximately 1.67 minutes per vehicle to 1.34 minutes per vehicle (because the average train length would decrease). Operations impacts on emergency-vehicle response time would be small.

2.4.10 Navigation

SEA evaluated whether the proposed project would affect navigation on U.S. Coast Guard- and ADNR-designated navigable waterways. It was determined that the proposed NRE would have a negligible effect on these waterways because the proposed crossing structures would be designed to allow the continued passage of watercraft. For bridges that do not clear-span the waterway, piers would be placed at appropriate locations in the channel based on design considerations that include navigation. ARRC would design these bridges to comply with Coast Guard, ADNR, and ADF&W permit conditions regarding bridge construction over designated navigable waters. Any temporary, construction-related impacts on commercial or personal navigation in these waterways would depend on the types of crafts using the waterway and the timing of bridge construction.

2.4.11 Land Use

Most of the land that would be directly affected by the rail line is owned by the Federal Government, the State of Alaska, and private entities. Two native allotments are in the vicinity of the proposed NRE near Salcha, but no tribal lands or native allotments have been identified in the ROW of any of the proposed common or alternative segments. Federal and state lands are used primarily for military training, recreation, hunting, fishing, mining, and timber harvest. Privately owned lands are primarily in agricultural and residential use or in a natural state. Existing land use in the ROW would be permanently changed. Any non-rail associated activities within the ROW would require a permit from ARRC, and any permissions required by the agency, corporation, or individual that owns the property. Permanent support facilities that would be constructed outside of the ROW include permanent access roads, communications towers, and facilities to support operations, including a passenger terminal. Existing land ownership or control and use in these areas would be permanently changed. Lands that would be affected by the project are generally undeveloped and away from residences and businesses, with several exceptions (see Table 2-5 at the end of this chapter for private property and structure impacts by segment). Temporary indirect effects to residences and business would occur during construction, primarily from noise and changes to the visual landscape, but these effects would generally be minor.

Recreation Resources

Because recreation activities within the project area are generally dispersed over a large area, most potential impacts to recreation would be common to all alternative segments. Impacts during the construction period would include temporary closure of some trails, and limited

access to some navigable rivers and other access routes. Where culverts would be used to convey water under the rail line, they would typically limit access for winter and summer use of the waterway. Main river access routes to areas west of the Tanana River via larger rivers and streams (Fivemile Clearwater Creek, Little Delta River, Delta Creek) would be maintained through use of bridges with ample clearance. During construction and operations, restricted access to the proposed rail line ROW would create a linear barrier, preventing free range of recreational users within the ROW and across the area. See Table 2-5 at the end of this chapter for the types of recreational activities affected and the number of recreation access route intersections by segment.

Unserialized trails (legally established trails on state lands that do not have recorded trail easements or ROWs) are quite common on state lands along many of the proposed alternative segments. Individuals are not required to report the use or location of these trails to the ADNR. The Alaska Division of Mining, Land and Water has indicated that it would consider closure of these generally allowed trails to be an impact, and would require further investigations to determine their location and use, and would require accommodation of these legal features (Proulx, 2008).

Section 4(f) Resources

SEA identified potential 4(f) resources that would be affected by the proposed NRE. Most of these properties are recreational trails used for dog-sledding, snowmachining, and skiing, but two are cultural resource sites (see Section 6.3). Ten alternative segments would require use of Section 4(f) resources, based on preliminary determination (see Appendix M).

By the criteria of Section 4(f) evaluation, the alignment that minimizes effects to 4(f) properties would include the following combination of segments: North Common Segment, Eielson Alternative Segment 3, Salcha Alternative Segment 1, any of the connector segments, either of the Central alternative segments, Donnelly Alternative Segment 2, South Common Segment, and either Delta alternative segment.

There may be opportunities to minimize or mitigate impacts to Section 4(f) resources, including timing construction to avoid times of heavy trail use, and minimization of dust and noise emissions. Coordination is ongoing with appropriate agencies to determine the significance of resources that are protected under Section 4(f) that would be affected by the proposed NRE.

Hazardous Materials/Waste Sites

Environmental effects could occur as a result of excavating contaminated sites during construction of roadbeds and railbeds, hill cuts, grade separations, and retaining walls. Borrow areas developed for fill materials could disturb or move contaminated materials. Eleven sites identified in the project area present potential risks due to site contamination if excavation were to occur at these locations. Potential sites in the project area include former highway construction camp sites and a petroleum pipeline ROW.

2.4.12 Visual (Aesthetic) Resources

The visual effects of the proposed NRE were measured using the BLM visual resource management (VRM) methodology, which establishes a set of management criteria for landscapes and a related level of acceptable visual alteration to those landscapes. The proposed action and alternative segments would meet VRM objectives with several exceptions. Salcha Alternative Segment 2 would not meet VRM objectives due to a hill cut, crossings of the Tanana and Salcha rivers, and its proximity to the Salcha community, and Salcha Alternative Segment 1 would not

meet VRM objectives at its crossing of the Tanana River. SEA anticipates that the Donnelly alternative segments would not meet VRM objectives at their crossings of Delta Creek and Little Delta River, and that Delta Alternative Segments 1 and 2 would not meet VRM objectives at their crossings of the Delta River and at highway crossings. Visual impacts from temporary facilities would be strong during construction; however, these facilities would be removed and the sites restored after construction was completed, and SEA believes they would likely meet VRM objectives in the long term. Depending on their location, some of the permanent communications towers may have a moderate to strong contrast with the surrounding landscape due to the elevation of the terrain and areas permanently cleared of vegetation surrounding the towers.

2.4.13 Socioeconomics

Most potential socioeconomic effects would be independent of the specific alternative segments that would be constructed if the STB granted a license for construction and operation of the proposed NRE. However, there are some socioeconomic effects that would differ across alternative segments, including effects on communities and neighborhoods. Salcha Alternative Segment 2 would require that ARRC relocate the Salcha Elementary School. The effects of all alternatives on community cohesion would be minimal. Eielson Alternative Segment 1 would result in the loss of approximately 2 acres of farming surface area from the Eielson Farm Community, but would have negligible effects on existing travel patterns and social interaction and agricultural output within the community. The effects of the proposed NRE on public services and housing in the project area would also be minimal. SEA estimates that NRE operations would result in the creation of between 10 and 17 ARRC full-time direct and secondary jobs. The number of new full-time ARRC employment positions that would be created for operation of the proposed NRE would be small, and the effects on housing and public facilities and services would be negligible.

2.4.14 Environmental Justice

SEA identified no potential high and adverse impacts to human populations in the project area. Therefore, there would be no high and adverse impacts to environmental justice populations as a result of the proposed NRE.

Table 2-5 summarizes and compares potential impacts for resource areas and topics for which are noteworthy differences among the alternatives. Table 2-5 does not include resource areas for which the potential impacts would be essentially the same for all the alternatives. Similarly, the table does not include the No-Action Alternative because, under that alternative, existing conditions would remain the same and there would be no impacts.

Table 2-5
Summary and Comparison of Potential Impacts

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Eielson Branch (existing)	Not applicable	Not applicable	Not applicable	Not applicable	Adversely affected noise receptors: 446	Not applicable	Not applicable
North Common Segment	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 1 bridge and 1 culvert.[b] Impacts to wetlands and other waters (acres): 3.5 (forested 0, scrub/shrub 2.6, emergent 0.3, other waters 0.6)	Total vegetation cleared (acres): 61.6 Fish-bearing stream crossings: 2 (2 spawning, 1 anadromous habitat) Direct habitat loss (acres): Bears, 60.5 Caribou, 21.7 Moose, 60.5 Wolves, 61.6 Furbearers, 42.0	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Federal/state land ownership Impacts to fishing 4(f) resource present Potential hazardous material/waste sites	Consistent with VRM objectives
Eielson Alternative Segment 1	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 13 culverts and 1 small bridge.[b] Impacts to wetlands and other waters (acres): 16.8 (forested 6.9, scrub/shrub 7.1, emergent 1.5, other waters 1.3)	Total vegetation cleared (acres): 246.4 Fish-bearing stream crossings: 2 (2 spawning, 2 anadromous habitat) Direct habitat loss (acres): Bears, 246.4 Caribou, 123.8 Moose, 246.4 Wolves, 247.3 Furbearers, 237.2 1 bald eagle and 1 red-tailed hawk nest affected	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	52 acres private land; 2 acres in agricultural use 2 to 3 residences directly affected 11 recreation access route intersections 4(f) resource present	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Eielson Alternative Segment 2	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 10 culverts and 3 small bridges.[b] Impacts to wetlands and other waters (acres): 70.8 (forested 23.3, scrub/shrub 43.1, emergent 3.5, other waters 0.9)	Total vegetation cleared (acres): 241.0 Fish-bearing stream crossings: 3 (2 spawning, 2 anadromous habitat) Direct habitat loss (acres): Bears, 241.0 Caribou, 146.4 Moose, 241.0 Wolves, 241.2 Furbearers, 222.9 1 bald eagle and 1 red-tailed hawk nest affected	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	78 acres private land; 2 acres in agricultural use 8 recreation access route intersections 4(f) resource present	Consistent with VRM objectives
Eielson Alternative Segment 3	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 14 culverts and 3 small bridges.[b] Impacts to wetlands and other waters (acres): 100.3 (forested 36.7, scrub/shrub 48.6, emergent 5.7, other waters 9.3)	Total vegetation cleared (acres): 238.5 Fish-bearing stream crossings: 7 (1 spawning, 1 anadromous habitat) Direct habitat loss (acres): Bears, 238.5 Caribou, 124.5 Moose, 238.5 Wolves, 239.3 Furbearers, 222.0	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	Adversely affected noise receptors: 4	55 acres private land 6 recreation access route intersections 4(f) resource present	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Salcha Alternative Segment 1	Minimal grading/filling 5 to 25% permafrost, 2 to 5 feet overburden Potential for seismic events	Crossings would include 12 culverts and 1 large bridge[b]; large bridge crossing of the Tanana River would result in high impacts due to altered flood hydraulics, increased scour, and downstream aggradation. Impacts to wetlands and other waters (acres): 179.9 (forested 32.2, scrub/shrub 56.7, emergent 0.2, other waters 90.8)	Total vegetation cleared (acres): 434.9 Fish-bearing stream crossings: 3 (2 spawning, 1 anadromous habitat); adverse impact from bridge Higher density of game mammals (particularly bears, wolves, furbearers) than Salcha 2; potential impact to prime moose calving area Direct habitat loss (acres): Bears, 434.9 Caribou, 175.2 Moose, 434.9 Wolves, 447.6 Furbearers, 426.4 1 pair bald eagles, 1 pair great horned owls affected	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	14 acres private land 25 to 30 residences directly or indirectly affected Impacts to fishing 1 recreation access route intersection	Inconsistent with VRM objectives: bridge crossing

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Salcha Alternative Segment 2	Substantial grading/filling 5 to 75% permafrost, 2 to 7 feet overburden Potential for seismic events and mass wasting	Crossings would include 12 culverts, 2 small bridges and 4 large bridges[b]; large bridge crossing of the Tanana River would result in high impacts due to altered flood hydraulics, increased scour, and downstream aggradation. Impacts to wetlands and other waters (acres): 262.3 (forested 58.5, scrub/shrub 120.1, emergent 3.0, other waters 80.7)	Total vegetation cleared (acres): 536.8 Fish-bearing stream crossings: 9 (7 spawning, 7 anadromous habitat); adverse impact from bridge Direct habitat loss (acres): Bears, 535.1 Caribou, 299.1 Moose, 536.2 Wolves, 580.4 Furbearers, 506.0 2 pair bald eagles and 3 nest structures; 3 pair peregrine falcon affected	High potential for impacts to historic and prehistoric resources Identified sites within APE: 2	Adversely affected noise receptors: 32 Adversely affected vibration receptors: 4	92 acres private land; 150 homes or businesses temporarily or permanently affected, including the Salcha School 3 recreation access route intersections; impacts to fishing and hunting Potential hazardous material/waste sites 4(f) resource present	Inconsistent with VRM objectives: hill cut, bridge crossing, community
Central Alternative Segment 1	Minimal grading/filling 75 to 90% permafrost, 7 to 14 feet overburden	Crossings would include 9 culverts and 1 small bridge.[b] Impacts to wetlands and other waters (acres): 51.0 (forested 22.5, scrub/shrub 24.1, emergent 4.2, other waters 0.2) Would lie outside 100-year floodplain	Total vegetation cleared (acres): 122.6 Fish-bearing stream crossings: 1 (1 spawning habitat) Direct habitat loss (acres): Bears, 122.6 Caribou, 65.9 Moose, 122.6 Wolves:, 22.8 Furbearers, 88.9	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Impacts to hunting	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Central Alternative Segment 2	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 9 culverts and 2 small bridges.[b] Impacts to wetlands and other waters (acres): 6.5 (forested 0, scrub/shrub 6.5, emergent 0) Would lie within 100-year floodplain of the Tanana River	Total vegetation cleared (acres): 84.9 Fish-bearing stream crossings: 2 (no spawning or anadromous habitat) Fragmentation of closed needleleaf habitat (benefit to moose, mixed adverse impact to furbearers) Direct habitat loss (acres): Bears, 84.9 Caribou, 72.5 Moose, 84.9 Wolves, 86.9 Furbearers, 84.3 1 pair bald eagles affected	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Impacts to hunting	Consistent with VRM objectives
Connector Segment A	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 3 culverts and 1 small bridge.[b] Impacts to wetlands and other waters (acres): 56.2 (forested 31.9 , scrub/shrub 23.0, emergent 1.1, other waters 0.2) Would lie within 100-year floodplain	Total vegetation cleared (acres): 105.7 Fish-bearing stream crossings: 1 (1 anadromous habitat) Direct habitat loss (acres): Bears, 105.7 Caribou, 64.1 Moose, 105.7 Wolves, 105.7 Furbearers, 91.0 1 pair great horned owls affected	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Federal/state land ownership 1 recreation access route intersection; impacts to hunting and fishing	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Connector Segment B	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 2 culverts and 1 small bridge.[b] Impacts to wetlands and other waters (acres): 1.6 (forested 0.3, scrub/shrub 0.4, emergent 0.2, other waters 0.7) Would lie outside 100-year floodplain	Total vegetation cleared (acres): 78.5 Fish-bearing stream crossings: 2 (1 spawning, 2 anadromous habitat) Fragmentation of closed needleleaf habitat (benefit to moose, mixed adverse impact to furbearers) Direct habitat loss (acres): Bears, 78.5 Caribou, 68.9 Moose, 78.5 Wolves, 78.5 Furbearers, 78.5 1 pair great horned owls affected	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Federal/state land ownership 1 recreation access route intersection; impacts to hunting and fishing	Consistent with VRM objectives
Connector Segment C	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 4 culverts and 3 small bridges.[b] Impacts to wetlands and other waters (acres): 26.3 (forested 10.4, scrub/shrub 13.2, emergent 1.3, other waters 1.4) Half of segment would lie within 100-year floodplain	Total vegetation cleared (acres): 55.6 Fish-bearing stream crossings: 6 (1 spawning, 5 anadromous habitat) Fragmentation of closed needleleaf habitat (benefit to moose, mixed adverse impact to furbearers) Direct habitat loss (acres): Bears, 55.6 Caribou, 41.4 Moose, 55.6 Wolves, 55.6 Furbearers, 45.3	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Federal/state land ownership Impacts to hunting	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Connector Segment D	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 1 culvert and 3 small bridges.[b] Impacts to wetlands and other waters (acres): 2.9 (forested 0, scrub/shrub 1.5, emergent 0.2, other waters 1.2) Would lies outside 100-year floodplain	Total vegetation cleared (acres): 21.2 Fish-bearing stream crossings: 4 (4 anadromous habitat) Fragmentation of closed needleleaf habitat (benefit to moose, mixed adverse impact to furbearers) Direct habitat loss (acres): Bears, 21.2 Caribou, 19.7 Moose, 21.2 Wolves, 21.2 Furbearers, 21.2	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Federal/state land ownership Impacts to hunting	Consistent with VRM objectives
Connector Segment E	Minimal grading/filling 25% permafrost, 5 feet overburden	Crossings would include 5 culverts and 1 small bridge.[b] Impacts to wetlands and other waters (acres): 3.5 (forested 0.7, scrub/shrub 2.1, emergent 0.3, other waters 0.4) Half of segment would lie within 100-year floodplain	Total vegetation cleared (acres): 58.2 Fish-bearing stream crossings: 1 (1 spawning, 1 anadromous habitat) Direct habitat loss (acres): Bears, 58.2 Caribou, 16.3 Moose, 58.2 Wolves, 58.4 Furbearers, 24.5	Negligible potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	6 acres private land Impacts to hunting and fishing	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Donnelly Alternative Segment 1	Substantial grading/filling 5 to 90% permafrost, 2 to 14 feet overburden	Crossings would include 31 culverts, 4 small bridges, and 2 large bridges[b]; large bridge crossing of Delta Creek and Little Delta River would result in high impacts due to altered flood hydraulics, increased scour, downstream aggradation, and increased potential for overbank flooding and/or debris jams. Impacts to wetlands and other waters (acres): 397.0 (forested 125.8, scrub/shrub 214.0, emergent 2.2, other waters 55)	Total vegetation cleared (acres): 627.5 Fish-bearing stream crossings: 6 (no spawning or anadromous habitat) Fragmentation of closed needleleaf habitat (benefit to moose, mixed adverse impact to furbearers) Direct habitat loss (acres): Bears, 626.9 Caribou, 475.3 Moose, 626.9 Wolves, 658.8 Furbearers, 549.8 1 northern goshawk nest affected	High potential for impacts to historic and prehistoric resources Identified sites within APE: 8	No adversely affected noise/vibration receptors	Federal/state land ownership 6 recreation access route intersections; impacts to hunting 4(f) resource present	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Donnelly Alternative Segment 2	Substantial grading/filling 4 to 12% permafrost, 4 to 12 feet overburden	Crossings would include 44 culverts, 2 small bridges, and 2 large bridges[b]; large bridge crossing of Delta Creek and Little Delta River would result in high impacts due to altered flood hydraulics, increased scour, downstream aggradation, and increased potential for overbank flooding and/or debris jams. Impacts to wetlands and other waters (acres): 302.5 (forested 144.1, scrub/shrub 99.0, emergent 4.2, other waters 55.2)	Total vegetation cleared (acres): 636.4 Fish-bearing stream crossings: 8 (3 spawning, 3 anadromous habitat) Fragmentation of open and closed needleleaf (benefit to moose, mixed adverse impact to furbearers) and closed broadleaf habitat; higher occurrence of furbearers than Donnelly 1 Direct habitat loss (acres): Bears, 636.4 Caribou, 370.2 Moose, 636.4 Wolves, 669.7 Furbearers, 564.9 1 pair peregrine falcons, 1 bald eagle nest affected	High potential for impacts to historic and prehistoric resources Identified sites within APE: 4	No adversely affected noise/vibration receptors	4 acres private land 3 recreation access route intersections; impacts to hunting Potential hazardous material/waste sites 4(f) resource present	Consistent with VRM objectives
South Common Segment	Minimal grading/filling 50 to 85% permafrost, 3 to 4 feet overburden	Crossings would include 11 culverts and 3 small bridges.[b] Impacts to wetlands and other waters (acres): 55.5 (forested 11.3, scrub/shrub 43.4, emergent 0.8, other waters 0.3)	Total vegetation cleared (acres): 251.2 Fish-bearing stream crossings: 3 (2 spawning, 2 anadromous habitat) Direct habitat loss (acres): Bears, 251.2 Caribou, 166.3 Moose, 251.2 Wolves, 251.2 Furbearers, 244.2 2 red-tailed hawk, 2 great gray owl, and 1 great horned owl nest affected	Low potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	Federal/state land ownership 2 recreation access route intersections; impacts to fishing 4(f) resource present	Consistent with VRM objectives

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources
Delta Alternative Segment 1	Substantial grading/filling 5 to 85% permafrost, 3 to 7 feet overburden	Crossings would include 1 culvert and 1 large bridge[b]; large bridge crossing of the Delta River would result in high impacts due to increased scour, bank erosion and/or downstream aggradation. Impacts to wetlands and other waters (acres): 94.9 (forested 14.0, scrub/shrub 34.0, emergent 0.1, other waters 46.8)	Total vegetation cleared (acres): 261.7 Fish-bearing stream crossings: 1 (no spawning or anadromous habitat) All game animals except bison more common than Delta 2; fragmentation of closed needleleaf habitat (benefit to moose, mixed adverse impact to furbearers) Direct habitat loss (acres): Bison, 14.6 Bears, 256.4 Caribou, 198.2 Moose, 256.4 Wolves, 311.2 Furbearers, 247.5	Moderate potential for impacts to historic and prehistoric resources Identified sites within APE: 0	No adversely affected noise/vibration receptors	3 acres private land Federal/state land ownership No recreation access route intersections; numerous legal, informal trails Potential hazardous material/waste sites 4(f) resource present	Inconsistent with VRM objectives: highway crossing
Delta Alternative Segment 2	Minimal grading/filling 5 to 85% permafrost, 2 to 7 feet overburden	Crossings would include 1 large bridge[b]; large bridge crossing of the Delta River would result in high impacts due to increased scour, bank erosion and/or downstream aggradation. Impacts to wetlands and other waters (acres): 60 (forested 4.2, scrub/shrub 19.6, emergent 1.1, other waters 35)	Total vegetation cleared (acres): 281.1; one rare willow identified. Fish-bearing stream crossings: 1 (no spawning or anadromous habitat) Greater disturbance of potential bison habitat than Delta 1; negligible impact to bison Direct habitat loss (acres): Bison, 74.2 Bears, 211.4 Caribou, 104.6 Moose, 211.4 Wolves, 304.0 Furbearers, 209.0	Moderate potential for impacts to historic and prehistoric resources; greater direct impacts on historic resources than Delta 1 Identified sites within APE: 1	No adversely affected noise/vibration receptors	59 acres of private land in agricultural and residential use 1 recreation access route intersection; numerous legal, informal trails Potential hazardous material/waste sites 4(f) resource present	Inconsistent with VRM objectives: highway crossing

Table 2-5
Summary and Comparison of Potential Impacts (continued)

Alternative Segments	Topography, Geology, Soils	Water Resources	Biological Resources	Cultural Resources	Noise and Vibration	Land Use[a]	Visual (Aesthetic) Resources

[a] Known trails and streams not including all trapping trails and other small winter trails.
[b] Generally, the more bridges or culverts, the greater the potential for the following environmental consequences: bridge construction impacts could include changes to natural drainage, sloughing, and erosion of the streambank, impacts to permafrost, increased stages and velocities of floodwater, and increased channel scour or bank erosion; impacts from construction of single or multiple culverts would likely include localized disturbance of the streambank to gain access to the channel and disturbance of the channel bed when installing the culverts.