

# **Appendix D – Alternatives Development and Elimination**



## **D. ALTERNATIVES DEVELOPMENT AND ELIMINATION**

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

### **D.1 Development of Alternatives**

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

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 Because some of the data were outdated, ARRC generated new aerial photography of the project area initiated field studies.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

#### **D.1.1 Phase 1 – Study Area Identification**

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

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

## D.1.2 Phase 2 – Corridor Development

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

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

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

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

### D.1.3 Phase 3 – Corridor Analysis

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

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

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

## D.2 Alternatives SEA Eliminated from Detailed Study

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

#### Alternatives Nomenclature in the EIS

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

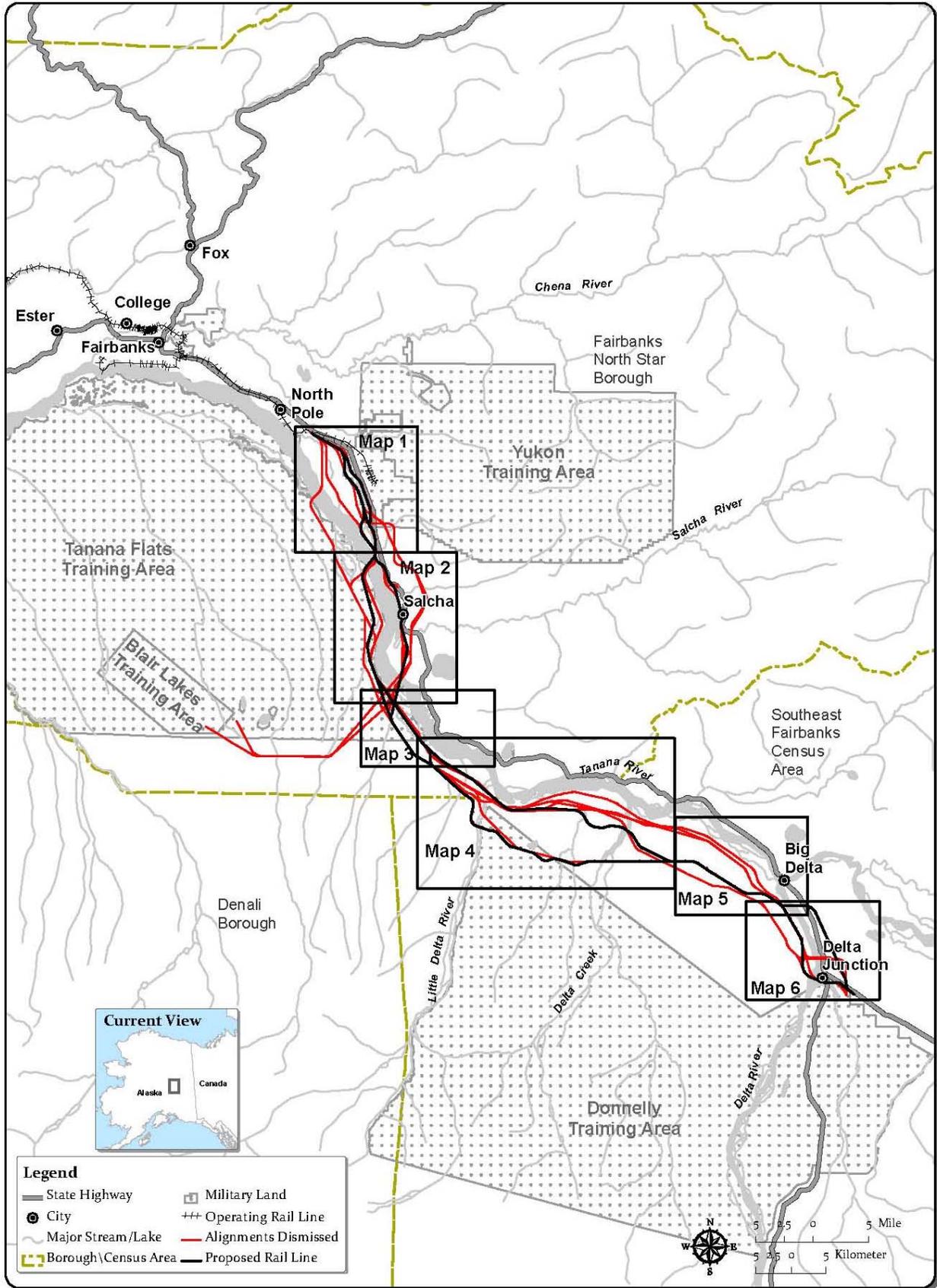


Figure D-1 – Map Key for Alignments Eliminated from Detailed Study along the Proposed NRE

## D.2.1 Eielson Area Alignments

### ARRC-proposed Alignments

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

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

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

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

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

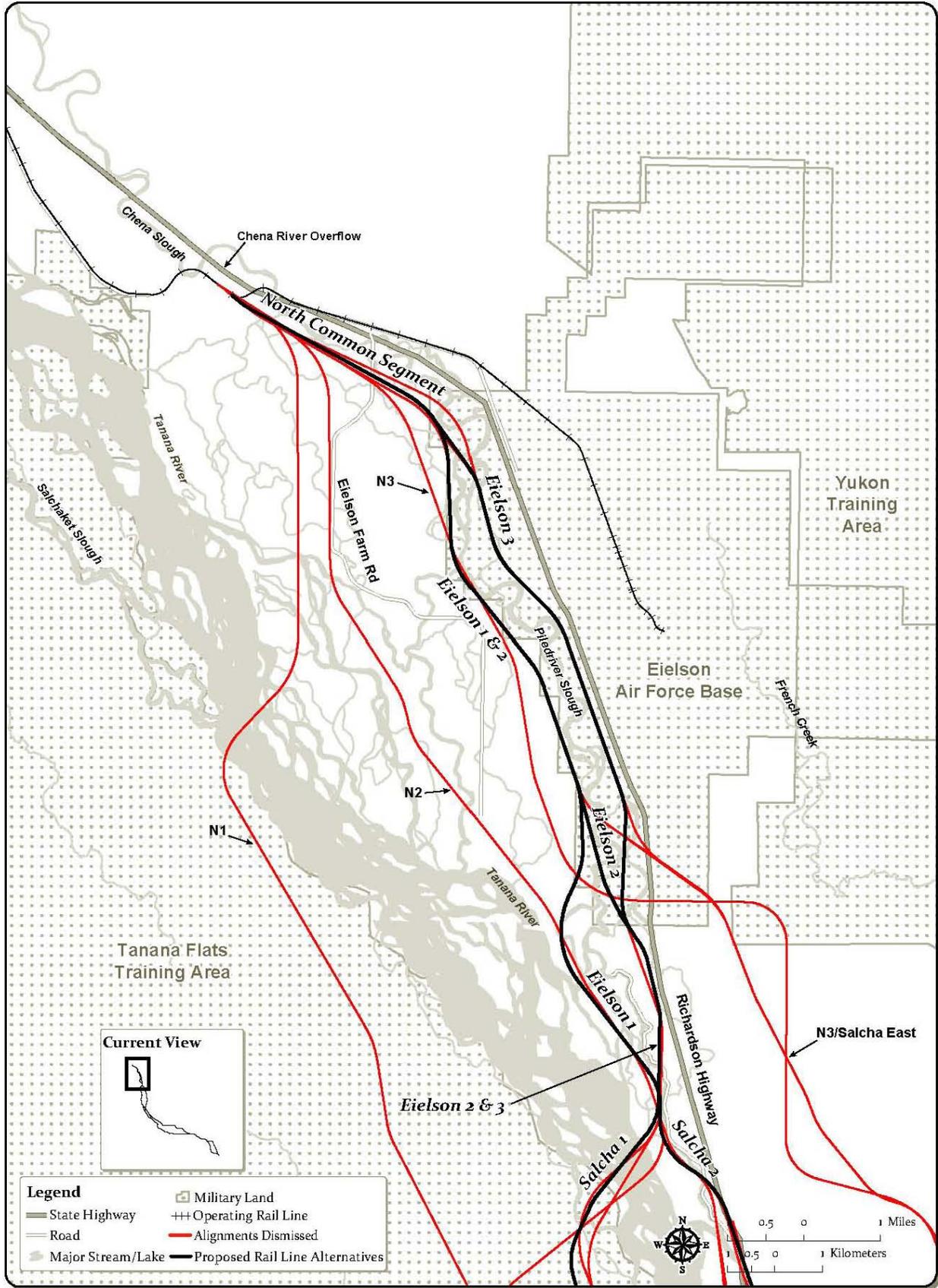


Figure D-2 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 1

## **Alignments Proposed in Scoping Comments**

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

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

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

### **D.2.2 Salcha Area Alignments**

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

#### **Alignments Proposed by ARRC**

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

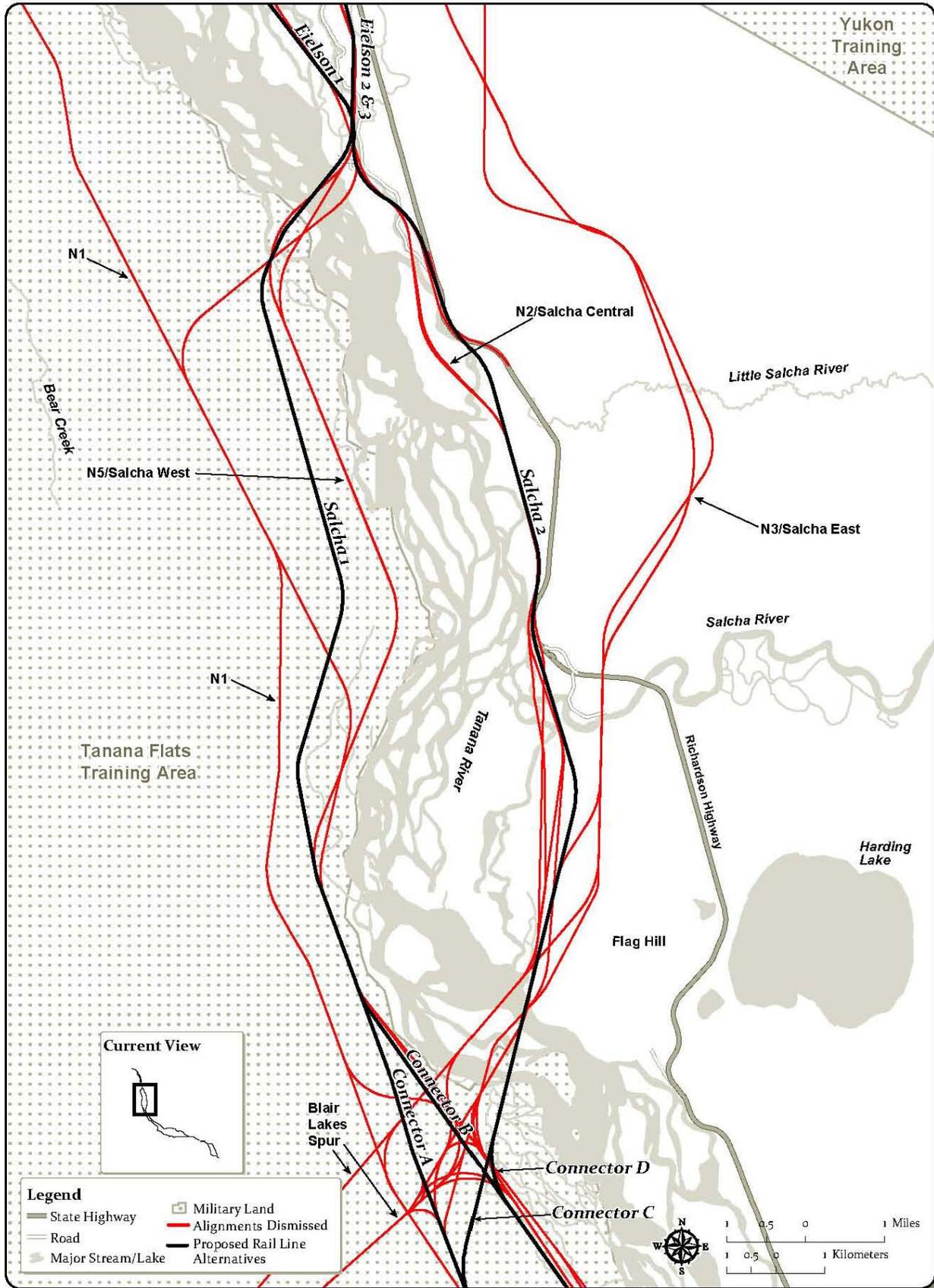


Figure D-3 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 2

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

## **Tanana River Crossing on Salcha Alternative Segment 2**

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

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

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

## **Alignments Proposed in Scoping Comments**

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



the Entire Tanana River for Salcha Alternative Segment 2

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

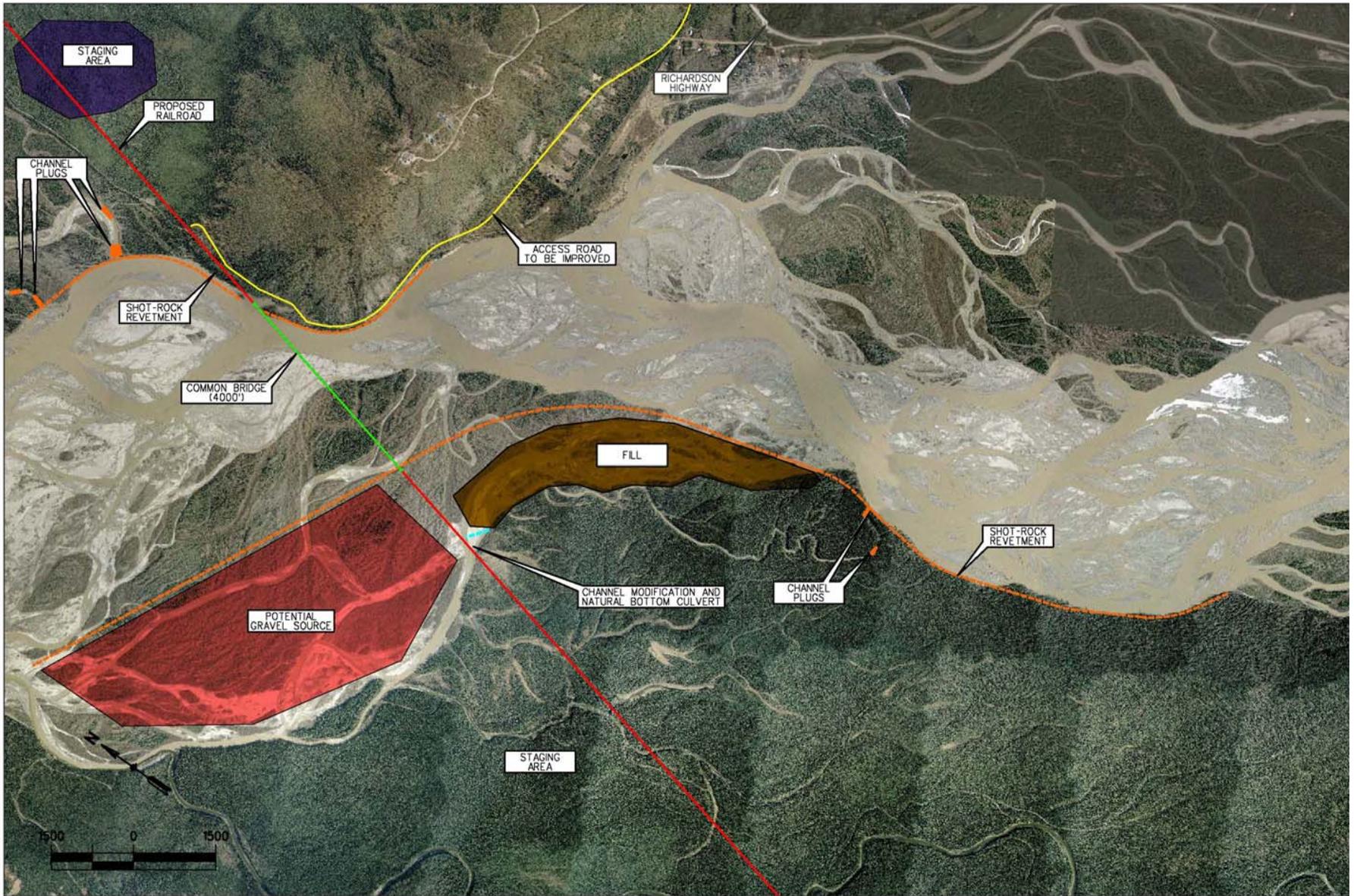


Figure D-5 – Initial Restricted Channel Crossing Concept for the Salcha Alternative Segment 2 River Crossing

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

### **D.2.3 Richardson Highway**

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

### **D.2.4 Blair Lakes Spur**

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

### **D.2.5 Tanana Area Alignments**

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

### **D.2.6 Donnelly Area Alignments**

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

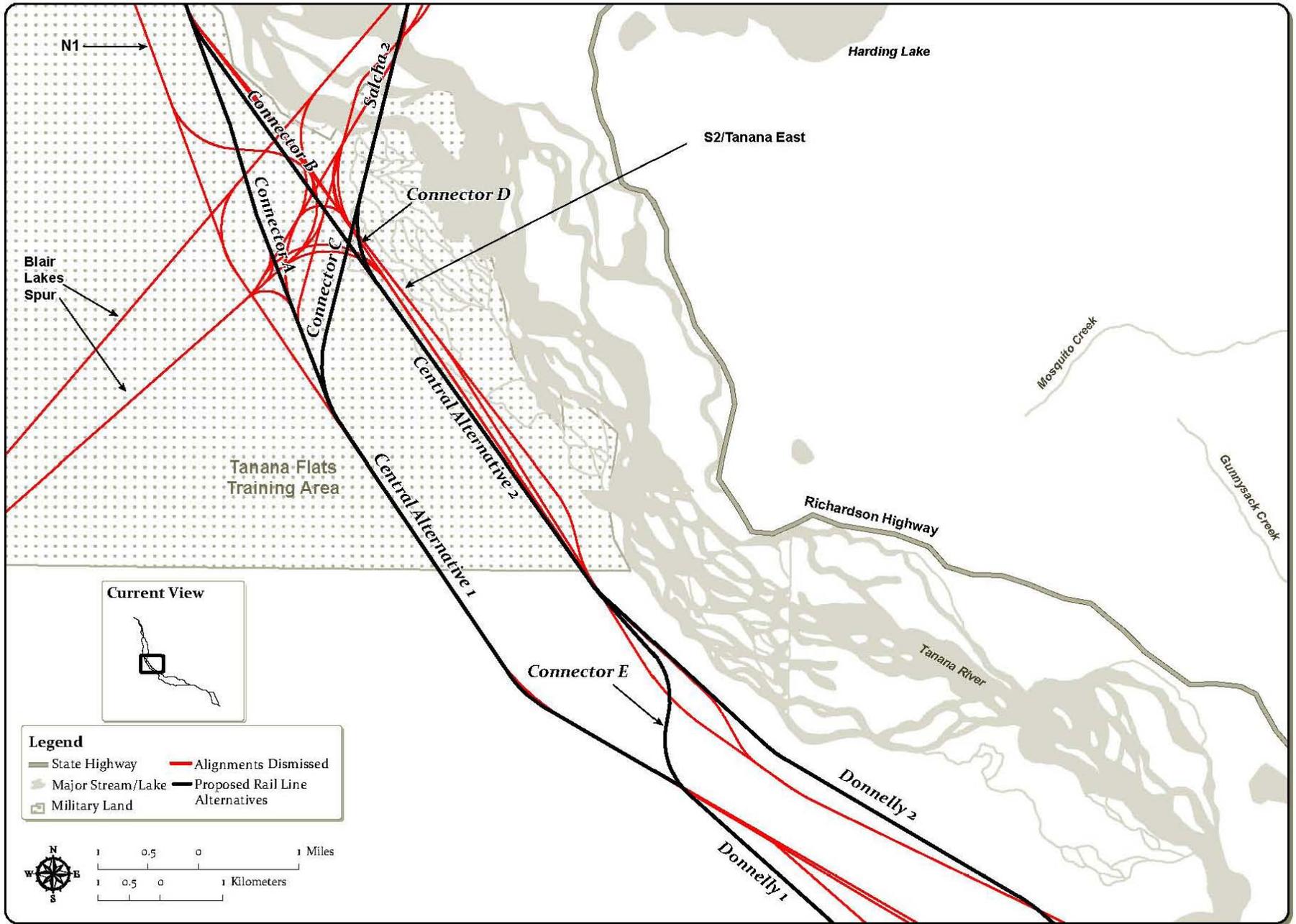


Figure D-6 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 3

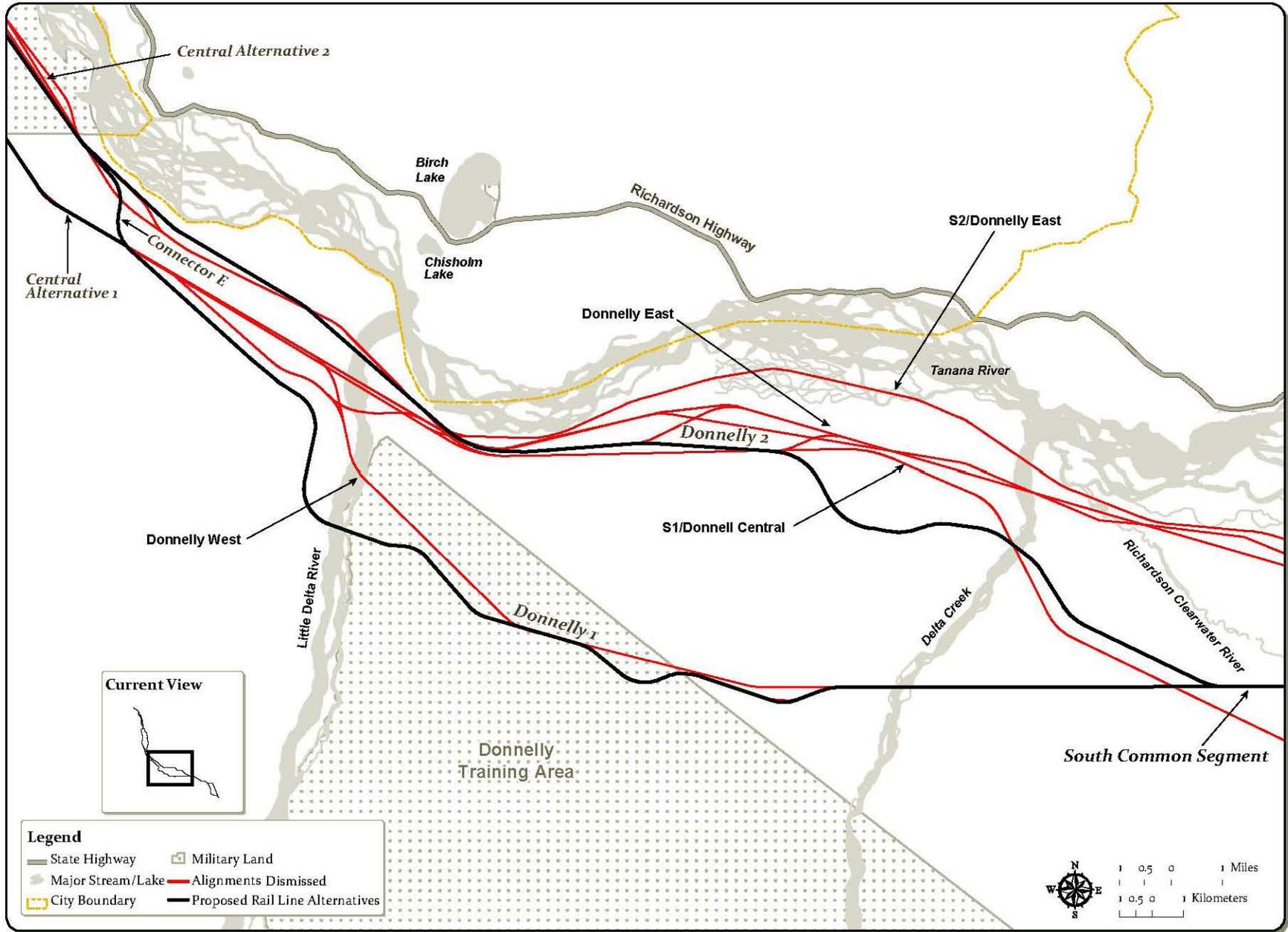


Figure D-7 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 4

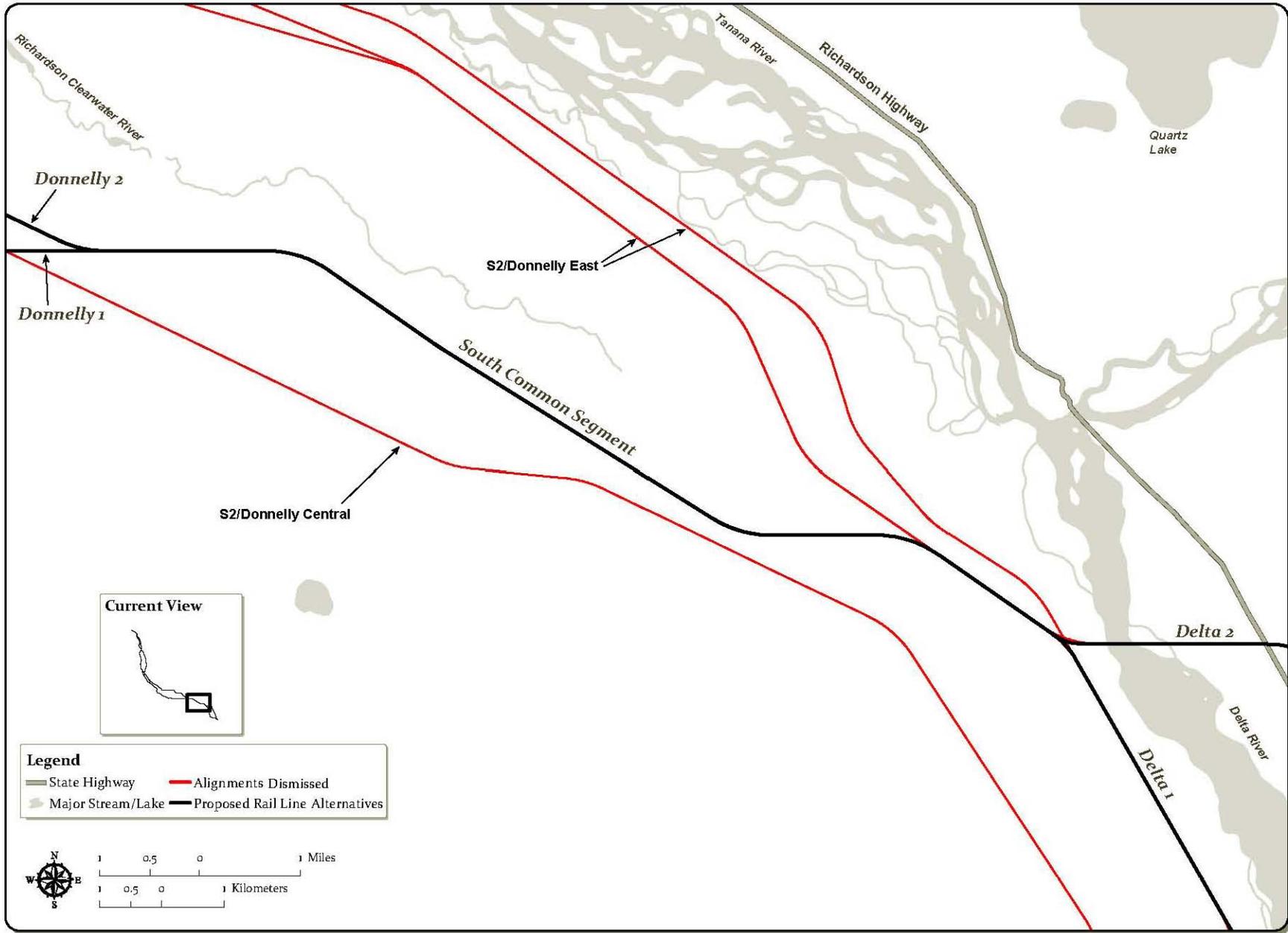


Figure D-8 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 5

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

## **D.2.7 Delta Area Alignments**

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

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

## **D.2.8 Alignment along the Alaska Range**

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

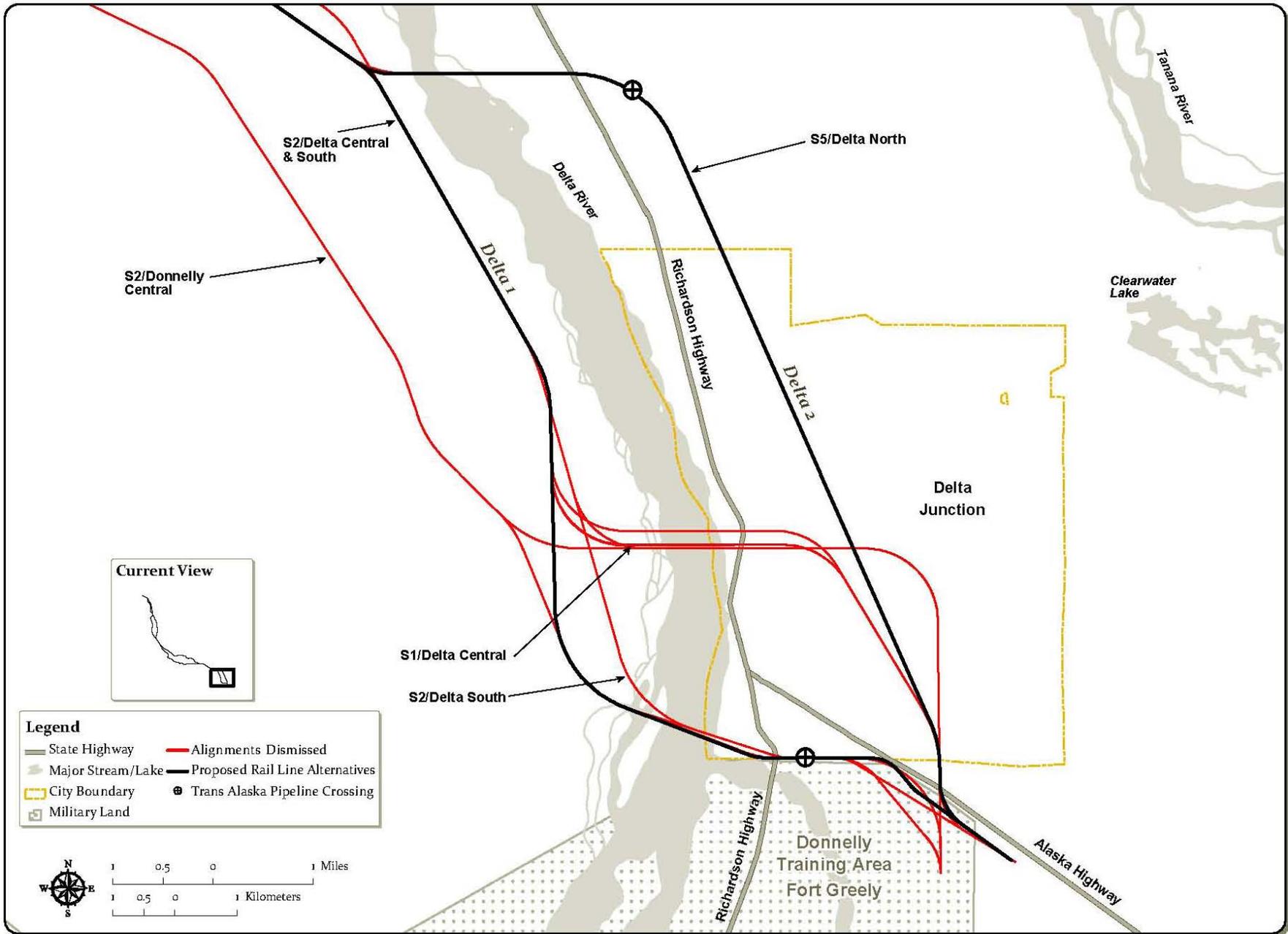


Figure D-9 – Alignments and Alternatives Eliminated from Detailed Study in Map Area 6

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