2013 Reconnaissance Engineering Report

Kenai Spur Highway Rehabilitation

Project No. 54594, Sports Lake Road to Swires Road

State of Alaska Department of Transportation & Public Facilities

October 11, 2013

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Alaska Department of Transportation & Public Facilities

STATE OF ALASKA

CENTRAL REGION, PRELIMINARY DESIGN AND ENVIRONMENTAL SECTION

RECONNAISSANCE ENGINEERING REPORT
for

Kenai Spur Highway Rehabilitation
Project No. 54594
October 2013

Prepared By:

Gerry Welsh, PE
PD&E Project Manager
DOT&PF

10/12/13
Date

Recommended By:

Eric Desentis, PE
Central Region PD&E Chief
DOT&PF

10.14.13
Date

Concurrence By:

Jennifer Witt
Central Region Planning & Administration Chief
DOT&PF

10/15/13
Date

Approved By:

Kenneth M. Morton, PE
Central Region Preconstruction Engineer
DOT&PF

10/16/2013
Date

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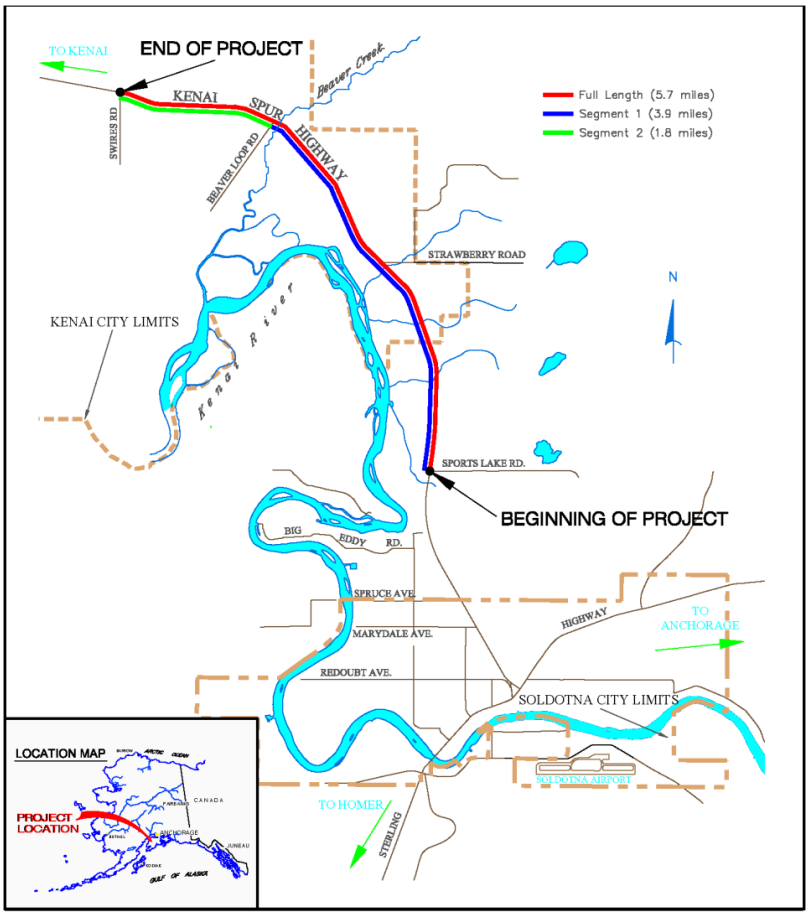
Executive Summary

The Kenai Spur Highway is a Rural Principal Arterial in the Kenai Peninsula Borough. This State-owned and -maintained facility is a critical surface transportation link between the communities of Soldotna and Kenai. It provides access to residential and business properties along its length.

This study examines the 5.7 mile long segment of highway from Sports Lake Road to Swires Road for a broad range of possible improvements. Two discrete segments corresponding to traffic data collection are analyzed: Sports Lake Road to Beaver Loop Road and Beaver Loop Road to Swires Road.



Central Region PD&E was tasked with identifying potential safety and capacity improvements. The corridor was initially evaluated according to 3R guidelines with a 10-year improvements design life, but there were no 3R-indicated (geometric) improvements. Corridor evaluation was expanded and improvement alternatives beyond 3R minimums were developed, these with an expanded 20-year design life. Because crash rates for both segments studied exceed the statewide average, safety improvement alternatives are developed.

Within the study area, the existing facility is an undivided two-lane roadway; the studied segment lies between two five-lane segments. At current growth rates, analysis indicates the level-of-service in this segment will deteriorate within 20 years to below levels deemed acceptable by AASHTO for rural arterials. Therefore, improvement alternatives to add capacity are developed in this study. Additional maintenance and operations costs of additional lanes are provided for each improvement.

The preliminary concepts developed range from left-turn pockets at six intersections to expansion of the facility to a divided four-lane highway for the entire segment of the study corridor. Preliminary cost estimates for the improvements are summarized in the following table. Also shown is clearing and re-vegetation of the right-of-way and continuous lighting along the corridor are highlighted as cost effective measures to reduce moose-vehicle collisions, which are a very real problem along this route.

Preliminary Cost Estimates	
Alternative	**$ Millions**
1: Auxiliary Left-turn Pockets	$11.2
2: Three-Lane Section	$28.1
3: Five-Lane Section	$40.5
4: Four-Lane Divided Section	$69.6
Clearing & Illumination	$ 9.5

The purpose of this report is to provide decision makers with sufficient information to plan and program future facility improvements. This report:

- Documents existing conditions;
- Identifies operational deficiencies;
- Estimates future traffic volumes and levels-of-service;
- Identifies and develops alternatives to address safety and capacity concerns;
- Examines potential impacts; and
- Offers planning level cost estimates.

This report is not *a project*, as such, but an effort at scope definition for project programming and support of local and regional planning. A logical next step to follow this study and its findings is for the City of Kenai and the Kenai Peninsula Borough to undertake public outreach to help them determine a preferred option for proceeding. The $20 million 2012 appropriation could cover construction of left turn pockets and the moose-vehicle collision measures identified. However, absent additional funding, more costly options would require phasing and, in order to be fully programed, additional funding would have to be identified.

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List of Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
DOT&PF	Alaska Department of Transportation and Public Facilities
KPB	Kenai Peninsula Borough
LOS	Level-of-Service
LUST	Leaking Underground Storage Tanks
M&O	Maintenance and Operation
MVM	Million-Vehicle-Miles
ROW	Right-of-Way
PCM	*Alaska Highway Preconstruction Manual*
USFWS	U.S. Fish and Wildlife Service
TWLTL	Two-Way Left-Turn Lane
UCL	Upper Control Limit

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1. Introduction

1.1. Location

Kenai Spur Highway, located in the Kenai Peninsula Borough (KPB), is a 39 mile long facility that begins at the Sterling Highway in Soldotna and extends north through Kenai and Nikiski to end at Bay Beach Road. This reconnaissance report examines only the 5.7 mile section of the highway between Sports Lake Road and Swires Road. To minimize confusion, intersection names are used in this report to identify segment termini instead of mile points or historic mileposts. The corridor is split into two discrete traffic volume segments: Sports Lake Road to Beaver Loop Road (3.9 miles) and Beaver Loop Road to Swires Road (1.8 miles). Refer to Figure 1.

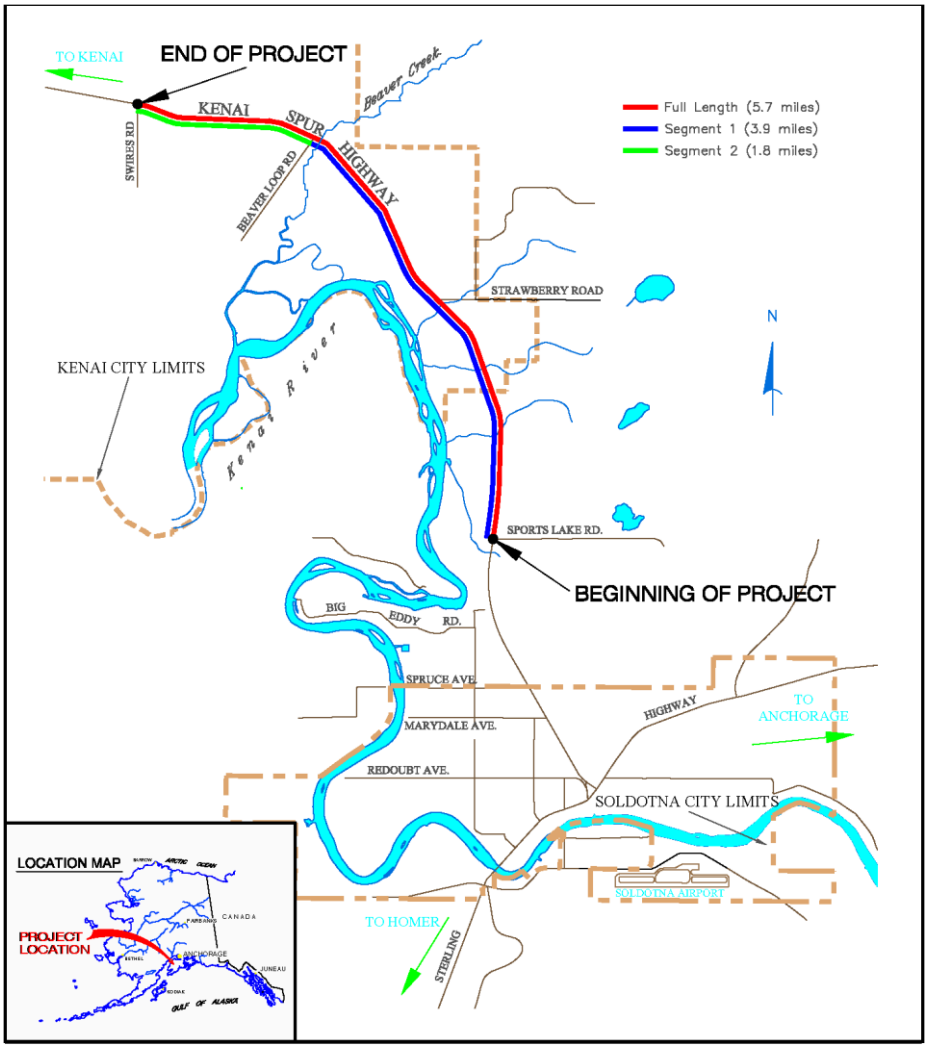


Figure 1 Vicinity Map

1.2. Project Origination

In 2012, the Alaska Department of Transportation and Public Facilities (DOT&PF) received a $20 million appropriation to rehabilitate Kenai Spur Highway between Sports Lake Road and Swires Road. This reconnaissance study was funded with Project Acceleration Funds with the aim of providing decision makers with information sufficient to select a scope and to plan and program a project for facility improvements. This report is not "*the project*," as such, but is an effort at scope definition for project programming to support local and regional planning. Its objectives are to:

- Document existing conditions and identify operational challenges;
- Analyze current and predicted traffic volumes for level-of-service (LOS);
- Develop feasible alternative(s) to address identified safety and capacity concerns; and
- Develop planning level cost estimates and identify potential impacts for each alternative.

The Department's Central Region Preliminary Design and Environmental Section (PD&E) was tasked with identifying corridor safety and capacity needs. Investigation was initially developed along 3R guidelines with the goal of identifying safety performance improvements. The principal objective of 3R projects is, "to restore the structural integrity of the existing roadway, thereby extending the service life of the facility," typically by 10 years. A 10-year study period from 2000 to 2009 was used for 3R (crash) analysis. The crash rate for the studied section of highway exceeded the statewide average of 1.176 crashes per million-vehicle-miles (MVM) by over 50% during that time period. Crash clusters and locations of high severity crashes were identified and mapped. The type and observed distribution of crashes were used to identify problem areas for developing a range of improvements. Findings of this analysis are detailed in Section 3 below.

Beyond 3R, a capacity analysis based on projected traffic growth was performed. It indicated the level-of-service on this segment would deteriorate within 20 years below those deemed acceptable by American Association of State Highway and Transportation Officials (AASHTO) for rural arterials. Therefore, alternatives to add capacity were developed with a 20-year design life, typical of new construction and reconstruction (4R) projects.

1.3. Ownership and Maintenance

Kenai Spur Highway is a state- owned and -maintained facility within the KPB. It is the main surface transportation link between Soldotna and Kenai and primarily serves local year round residents and summer seasonal recreation users and tourists. The study area begins north of Soldotna at Sports Lake Road, enters the Kenai city limits near Swallow Drive, and ends at Swires Road in City of Kenai.

1.4. Functional Classification

DOT&PF functional classification for the Kenai Spur Highway is Rural Principal Arterial. Arterials are intended to provide high degrees of mobility and to carry heavy volumes of traffic at relatively high speeds.

1.5. Zoning

KPB land use maps indicate the majority of properties adjacent to the study corridor are zoned residential or commercial. North of Sports Lake Road (the southern study-area terminus) an area on both sides of the road is classified as "Timber/Farm" land. There are two properties identified as "Institutional" and six properties identified as "Accessory Building" along the study corridor.

1.6. Roadside Development

Development along the highway is relatively dense in much of the corridor. Twenty-four intersections with local roadways and 55 driveway approaches exist within the 5.7 mile corridor. Most development is residential, with several commercial properties. The greatest density occurs in the segment between Sports Lake Road and Beaver Loop Road, especially in those areas just south of Silver Salmon Drive and near Lupine Drive. North of Beaver Loop Road, the presence of wetlands has limited development.

1.7. Population

According to the 2005 KPB Comprehensive Plan, between 1990 and 2003 the population of the KPB grew with an annual growth rate of 1.76% from 40,802 to 51,220. Kenai, the most populous city within the KPB representing nearly 14% of its total population in 2003, had a lower annual growth rate at 0.92%. Soldotna, the third most populous city in the KPB representing 8% of its total population in 2003, had an annual growth rate of 1.19%.

1.8. Public Involvement

It is anticipated the findings of this study will provide regional planners and decision makers with sufficient information to undertake public outreach to determine a locally acceptable scope of improvements. A briefing by DOT&PF of the City of Kenai City Council at a work session on September 10, 2013 is the only outreach as of this writing. Here it was made clear the Department's expectations that local government, working with citizens, would identify a path forward for available funding use on this segment of Kenai Spur Highway.

1.9. Preliminary Purpose and Need

This is not intended to be a "Project Purpose and Need Statement," which should be developed early in the process of programming any potential project.

According to the PCM, "The purpose of a 3R (Rehabilitation) project is to prolong and preserve the service life of existing highways and to enhance highway safety to protect investment in, and derive the maximum economic benefit from, the existing highway system."

The Kenai Spur Highway Rehabilitation Reconnaissance Study was initially investigated as a possible 3R-type project for these purposes. Investigation of broader improvement types followed 3R analysis findings that no "3R-indicated" improvements exist in the study area.

Safety improvement alternatives would address crash rates. Capacity improving alternatives would increase mobility and improve operating conditions.

2. Existing Conditions

2.1. Context

Kenai Spur Highway serves as the main thoroughfare between the cities of Kenai and Soldotna. Through the study area between Sports Lake Road and Swires Road, the existing highway is a paved two-lane facility between two five-lane segments. The posted speed limit is 55 mph for the majority of the corridor, but reduces to 45 mph as it approaches Swires Road.

As-built information from a 2001 repaving and pathway project indicates an existing typical section of two 12-foot lanes and eight-foot shoulders, for a total pavement width of 40 feet. See Figure 2.

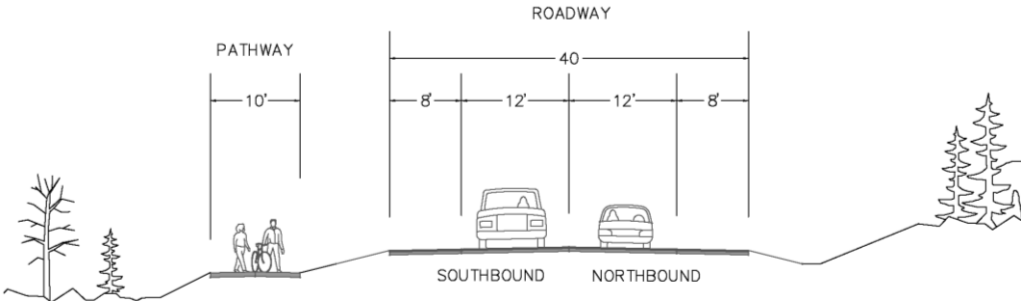


Figure 2 Existing Typical Section

South of Sports Lake Road, Kenai Spur Highway is five-lanes, transitioning to a two-lane section north of the intersection. Approaching Swires Road, Kenai Spur Highway transitions back to five lanes into Kenai.

2.2. Safe Routes to Schools

No schools directly access Kenai Spur Highway in the study area; however, Mountain View Elementary is located off Swires Road about one-quarter mile south of the Kenai Spur Highway.

2.3. Bicycles & Pedestrians

A shared use pathway from Sports Lake Road to Swires Road was constructed in 2004. The 10-foot wide paved pathway runs along the west side of the Kenai Spur Highway and is generally separated from the highway edge of pavement by 20 feet or more.

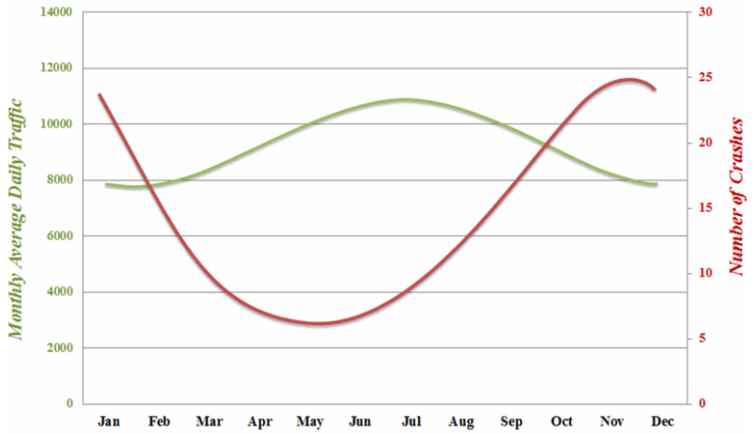
2.4. Right- of- Way

Initial investigation of tax maps, via the KPB's geographic information system website, indicated the Kenai Spur Highway right-of-way (ROW) varies in width along the corridor from about 160 to 300 feet. The majority of intersecting roads along the corridor have ROW widths of 60 to 80 feet. Preliminary tax map information and aerial photography indicate the existing pathway may be outside the existing ROW in some locations.

2.5. Utilities

Underground and overhead utilities are located throughout the study corridor, including water, electric, communication (fiber-optic and conventional,) and natural gas. Preliminary indications are that any roadway widening improvements could trigger a need for relocation of utilities. Homer Electric Associations plans to upgrade overhead power lines along the existing ROW. These upgrades are anticipated to be completed prior to construction of any potential roadway project.

3. Traffic and Accident Analysis



Average daily traffic on Kenai Spur Highway is lower in the winter months due in part to a reduction in recreational traffic. The number of crashes peaks in November and December, however, when roads are icy, daylight hours are short, and moose are using plowed roads to avoid deep snow.

In accordance with procedures laid out in the PCM, 3R analysis was conducted to determine if any safety improvements were indicated. The analysis considered lane and shoulder widths, horizontal curve modification, vertical curve modification, intersections, and moose-vehicle collisions. A 60 mph design speed was used for analysis. Although the 3R analysis did not indicate any improvements, the regional Traffic and Safety Section identified areas with above average crash rates for additional scrutiny. The draft 3R report, summarized below, is included as Appendix A.

3.1. Traffic Analysis

3.1.1. Traffic Projections

In order to determine capacity requirements for the highway, 20-year design life traffic volumes were forecast at a design year of 2037, a reasonable construction year of 2017, and a mid-year of 2027.

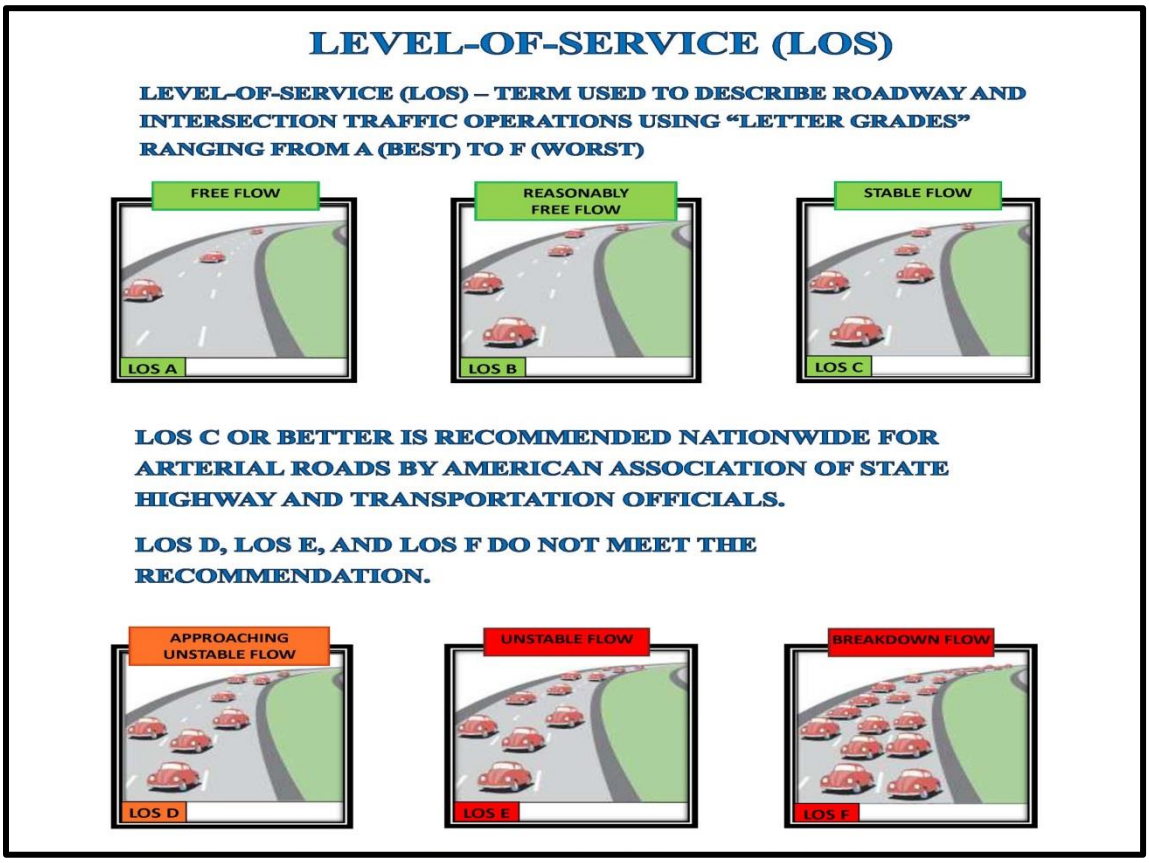
The 2010 Annual Average Daily Traffic (AADT) was 11,500 from Sports Lake Road to Beaver Loop Road and 9,450 from Beaver Loop Road to Swires Road. The DOT&PF Highway Data Section recommended a growth rate of 1.34% for projections, based on historical growth trends. By the design year (2037) the traffic volumes are forecast to increase to 16,450 and 13,550, respectively. The AADT data is summarized in Table A. Refer to Appendix B for Draft Design Designations.

Congestion is a measure of vehicular delay evaluated in terms of LOS, a qualitative rating of a facility's effectiveness at moving traffic. Roadway operating conditions range from LOS A, free flow, to LOS F, stop-and-go traffic. The levels-of-service shown in Table A are based on the *Florida Department of Transportation LOS Table 4-2, Generalized Annual average daily volumes for Florida's Areas Transition into Urbanized Areas*. Refer to Appendix C.

Table A Traffic Projections

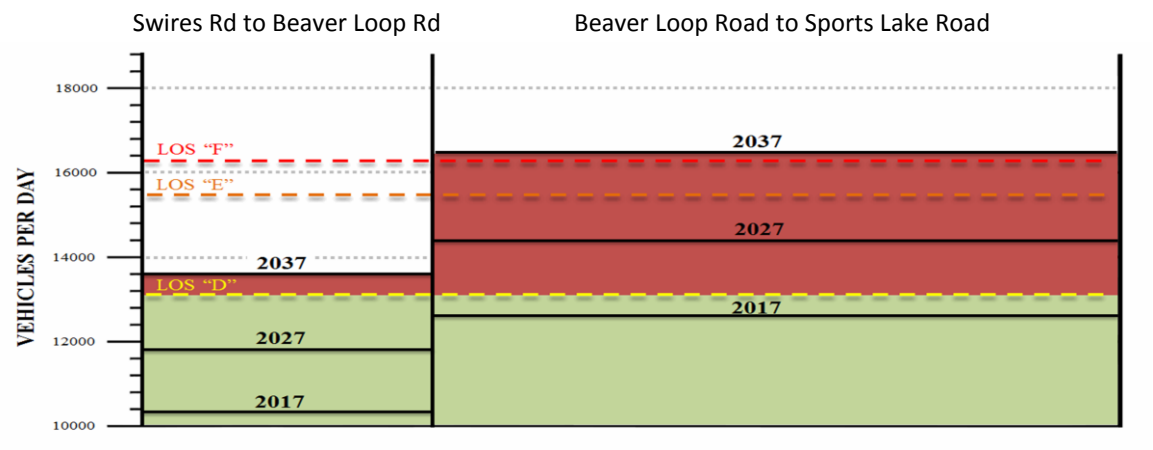
	AADT (LOS)	AADT (LOS)
Segment	**Swires to Beaver Loop**	**Beaver Loop to Sports Lake**
Existing year (2010)	9,450 (LOS C)	11,500 (LOS C)
Construction year (2017)	10,350 (LOS C)	12,600 (LOS C)
Mid-Life year (2027)	11,850 (LOS C)	14,400 (LOS D)
Design Year (2037)	13,550 (LOS D)	16,450 (LOS F)

Both segments of the corridor currently operate at a LOS C. The segment between Beaver Loop Road and Sports Lake Road is anticipated to decline to LOS D by 2027, indicating traffic flow would approach unstable conditions, limiting drivers' ability to maneuver within the traffic stream. If no improvements are made to the facility, the segment from Swires Road to Beaver Loop Road is projected to decline to LOS D in 2037 and LOS F on operation of the segment from Beaver Loop Road to Sports Lake Road. AASHTO policy recommends arterials in non-urban areas operate at LOS C.



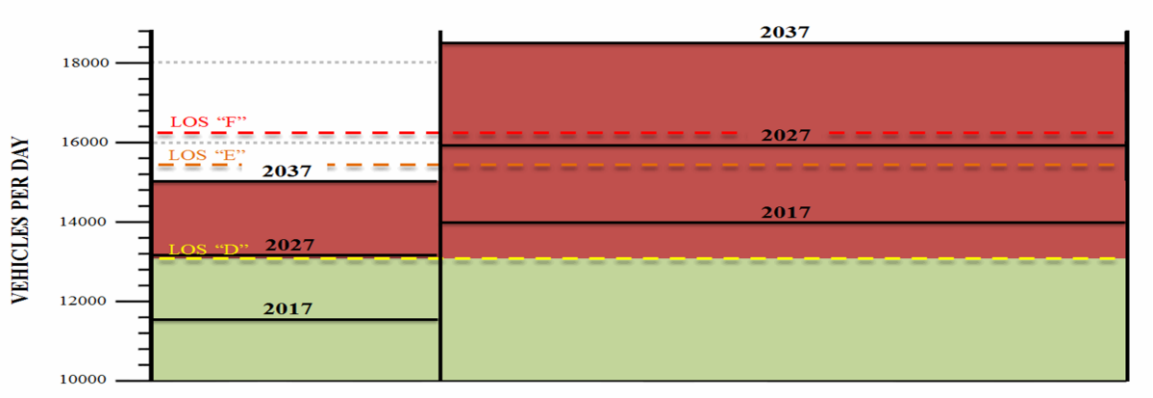
Forecast Traffic Plotted Against LOS Thresholds

Annual Average Daily Traffic



Without capacity improvements, average daily traffic is projected to approach breakdown south of Beaver Loop Road by 2037. [Reference: LOS Threshold Volumes based on Florida DOT LOS Tables, see Appendix C]

Seasonal Peak Traffic



Without capacity improvements, summer peak traffic is projected to breakdown south of Beaver Loop Road and be unstable north of Beaver Loop Road by 2037. [Reference: LOS Threshold Volumes based on Florida DOT LOS Tables, see Appendix C.]

3.1.2. Intersection Turning Movements

Central Region Traffic and Safety Section recommended analysis for left-turn warrants be performed at five intersections, Sports Lake Road, Strawberry Road, Beaver Loop Road, Togiak Street, and Swires Road. Each was checked for agreement with AASHTO recommendations for providing left-turns. The Togiak Street intersection does not meet the recommendations for left-turn lanes; it was not further analyzed. Intersections meeting these recommendations are summarized in Tables B. Refer to Appendix C. Dedicated left-turn lanes exist at the Sports Lake Road and Swires Road intersections.

Table B Left-turn Lane Warrants

Intersection	Approach	Meet Left-turn Warrant
Kenai Spur Hwy/ Sports Lake Road	North/ South	Currently Exist
Kenai Spur Hwy/ Strawberry Road	North/ South	Yes/ No
Kenai Spur Hwy/ Beaver Loop Road	North/South	No/ Yes
Kenai Spur Hwy/ Swires Road	North/South	Currently Exist

The four intersections listed in Table B were analyzed for the Manual on Uniform Traffic Control Devices signal warrants; none would meet any signal warrant in 2027. The Beaver Loop Road and Swires Road intersections would meet the peak hour signal warrant in 2037. Refer to the Traffic Analysis in Appendix C.

The intersections at Sports Lake Road, Beaver Loop Road, and Swires Road were also analyzed in the 3R report summarized in the next section.

3.2. 3R Crash Analysis Summary

The 3R Analysis is based on crash data from the DOT&PF's Traffic and Safety Section for the 10-year study period from 2000 to 2009. Preliminary analysis of crash location, severity (fatality, major injury, etc.) and type (head-on, rear-end, etc.) identified segments with higher than average crash rates and crash clusters near several major intersections. The crash rate in the study area was more than 50% above the statewide average for the study period.

3.2.1. Crash Data

DOT&PF crash data indicate 397 crashes occurred along the Kenai Spur Highway between Sports Lake Road and Swires Road during the study period. One fatal and 21 major-injury crashes were reported during the ten years. Table C shows a breakdown of crashes by severity. Of the 397 crashes reported, 358 were segment-related and 39 were intersection related.

Table C Total Crashes, 2000-2009

Fatal	Major Injury	Minor Injury	Non-Injury	Total
1	21	89	286	**397**

Table D, adapted from the 3R report, compares segment crash rates within the study corridor to the statewide average crash rate for rural undivided highways. For undivided rural principal arterials, the statewide average rate is 1.176 crashes per MVM.

Table D Segment Crash Rates

Segments	Segment Crashes	Segment Length (Miles)	Average AADT	MVM	Crashes per MVM	Statewide average; crashes per MVM	UCL ; crashes per MVM	Above Average	Above Critical
Sports Lake to Beaver Loop Road	259	3.78	9,821	135.5	1.91	1.176	1.332	Yes	Yes
Beaver Loop to Swires Road	99	1.74	8,878	56.38	1.76	1.176	1.422	Yes	Yes

Crash rates for both segments are above average and above the upper control limit (UCL). Accident rates above the UCL indicate crashes are an issue for these segments and are seen as not due solely to chance. Segment crash rates indicate a substantive safety performance problem. The 3R Analysis within those segments examines discrete or overlapping geometric elements, curves, and/or roadway widths not meeting current design standards for the 60 mph design speed.

3.2.2. Lane and Shoulder Widths

The 3R Analysis indicates the existing 12-foot travel lanes with eight-foot shoulders are adequate for this roadway.

3.2.3. Horizontal Curve Modification

There are nine horizontal curves located within the study limits, all of which meet current design criteria for 60 mph. None of the horizontal curves along this section of the highway requires improvement under 3R criteria.

3.2.4. Crest Vertical Curve Modification

The 3R Analysis procedure only applies to crest vertical curves; sag vertical curves are not analyzed. Two of the 11 existing crest vertical curves within this section of the highway do not meet current design standards for 60 mph. The number of actual crashes at these curves fell below their predicted crash rates; therefore, no 3R requirements for flattening or lengthening are indicated.

3.2.5. Intersection Improvement

The 3R Analysis examined three intersections along this section of the highway: Sports Lake Road, Beaver Loop Road, and Swires Road. Thirty-nine intersection crashes were recorded during the study period. The Sports Lake Road and Swires Road intersection crash rates fell below the statewide average; the Beaver Loop Road intersection crash rate exceeded the statewide average but fell below the critical rate for improvement. No 3R modifications at intersections are indicated.

3.2.6. Moose-Vehicle Collisions

Of the 358 segment-related crashes during the study period, 158 moose or general "animal" collisions occurred. For the purposes of this report, all "animal" crashes are attributed to moose; they constitute 44% of total segment crashes. The sole fatality during the study period was attributable to a moose-vehicle collision.

The 2003 "3R Analysis Moose Accident Clarification" memo specifies the moose-vehicle collisions frequency and rate thresholds for the 75th and 95th percentile. Table E shows these thresholds and corresponding observed quantities for this corridor during a five-year segment of the 3R study period.

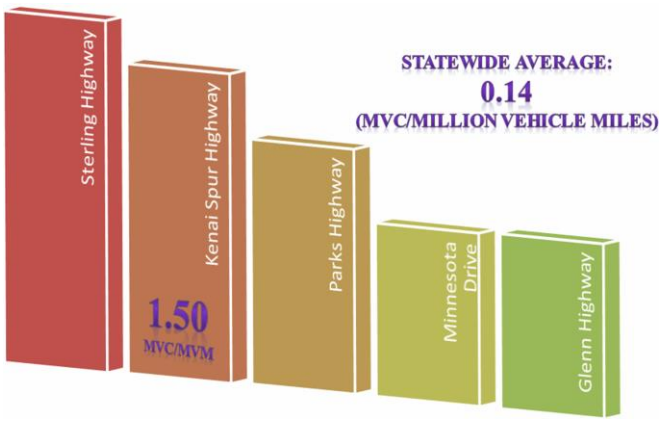
Table E Moose-Vehicle Collision Rates

Percentile	Frequency (acc/mi/5 yrs)	Rate (5 yrs acc/MVM)
75th	8	1.0
95th	15	1.5
Observed	**33**	**1.8**

The 2003 memo recommends any build-alternative include removal of vegetation from the existing clear zone and installation of moose warning signs. DOT&PF Central Region practice is to clear, grub, place top-soil, and hydro-seed to limit vegetation re-growth within 50 feet of the pavement edge. This treatment removes browse from the roadside and increases visibility,

allowing greater opportunity for drivers to react to animals approaching the road. The cost would be about $4.5 million for the entire study corridor.

Other potential mitigation measures include illumination, fencing, and grade-separated crossings. The density of development in this area largely diminishes the potential effectiveness of moose fencing. Twenty-four intersections with local roadways and 55 driveway approaches exist along the highway within the study corridor. Each of these approaches would require access treatment such as electromats or cattle guards for the fencing to function properly. Along the segment of highway between Beaver Loop Road and Swires Road, development is less dense and moose-vehicle collisions are more prevalent than they are south of Beaver Loop Road. While fencing would be a more fittings solution for this segment, it would still likely land-lock several parcels.



This segment of the Kenai Spur Highway ranks 2nd highest in the state for moose-vehicle collisions.

Grade-separated crossings are another potential tool. In order to function properly, though, these crossings require fencing to funnel moose to the safe crossing locations. Grade separations are very expensive to construct and they significantly enlarge the footprint of any construction, increasing environmental impacts and ROW takes; therefore, grade-separated crossings also are not considered desirable for this corridor.

3.3. Illumination

Continuous lighting on other corridors has reduced moose-vehicle collisions by 70 to 80% over clearing vegetation alone. Continuous lighting would cost about $5 million for the entire study corridor. Annual operation costs for lighting would be about $50,000.

Spot lighting in areas where clusters of moose-vehicle collisions are present could be effective at a lower installation and operation costs. High densities of moose-vehicle collisions found in localized areas could indicate natural migration corridors. For instance, a 0.6 mile segment of highway between Beaver Loop Road and Raven Street experienced 23 moose-vehicle collisions in the five-year period analyzed. Spot lighting at intersections would have benefits beyond mitigating moose-vehicle collisions; it could also reduce rear-end and angle collisions.

4. Preliminary Environmental Research

Preliminary environmental research was conducted along the study corridor. The results, summarized below, provide an overview of existing conditions.

4.1. Cultural and Historic Sites

Research of the Alaska Department of Natural Resources, Office of History & Archaeology records indicates two properties along the study corridor are classified as cultural, historical, or archaeological sites. Further research would be required to determine any potential impacts.

4.2. Wetlands

The wetland data, obtained from the U.S Fish and Wildlife Service (USFWS) National Wetlands Inventory Wetlands Mapper and the KPB wetlands map, indicates four drainages are presently bisected by the corridor, most notably the Beaver Creek drainage. The study area may encroach on several wetland areas adjacent to the corridor. Wetland locations would be field verified during the environmental phase. Refer to Figure 3.

4.3. Air Quality

Study area is not in a nonattainment area; therefore, no air quality analysis was performed.

4.4. Noise

No noise analysis was performed as part of this reconnaissance; however, noise abatement measures would be evaluated during a more advanced design phase of any potential project.

4.5. Floodplain

FEMA Flood Insurance Rate Map 2035 for the Kenai Peninsula Borough dated May 19, 1981 shows that the Kenai Spur Highway and cross culvert at Beaver Creek are in a mapped floodplain Zone A, meaning that inundation during the 100-year flood is expected but the base flood elevation and flood hazard factors have not been determined. An analysis would be performed during the design phase to determine the impact of improvements on inlet and outlet water levels. The City of Kenai does not participate in the National Flood Insurance Program; therefore, work within this floodplain would not require a KPB floodplain development permit.

4.6. National Parks, Preserves, Monuments and Wild and Scenic Rivers

Initial investigation of the area indicates no adverse impacts to local, state, National Parks, National Forests, or Wild and Scenic Rivers would occur from any potential project. The National Park Service and Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation websites were searched; no National Parks, Preserves, Monuments, Wild and Scenic Rivers, or State parks were indicated in the study area.

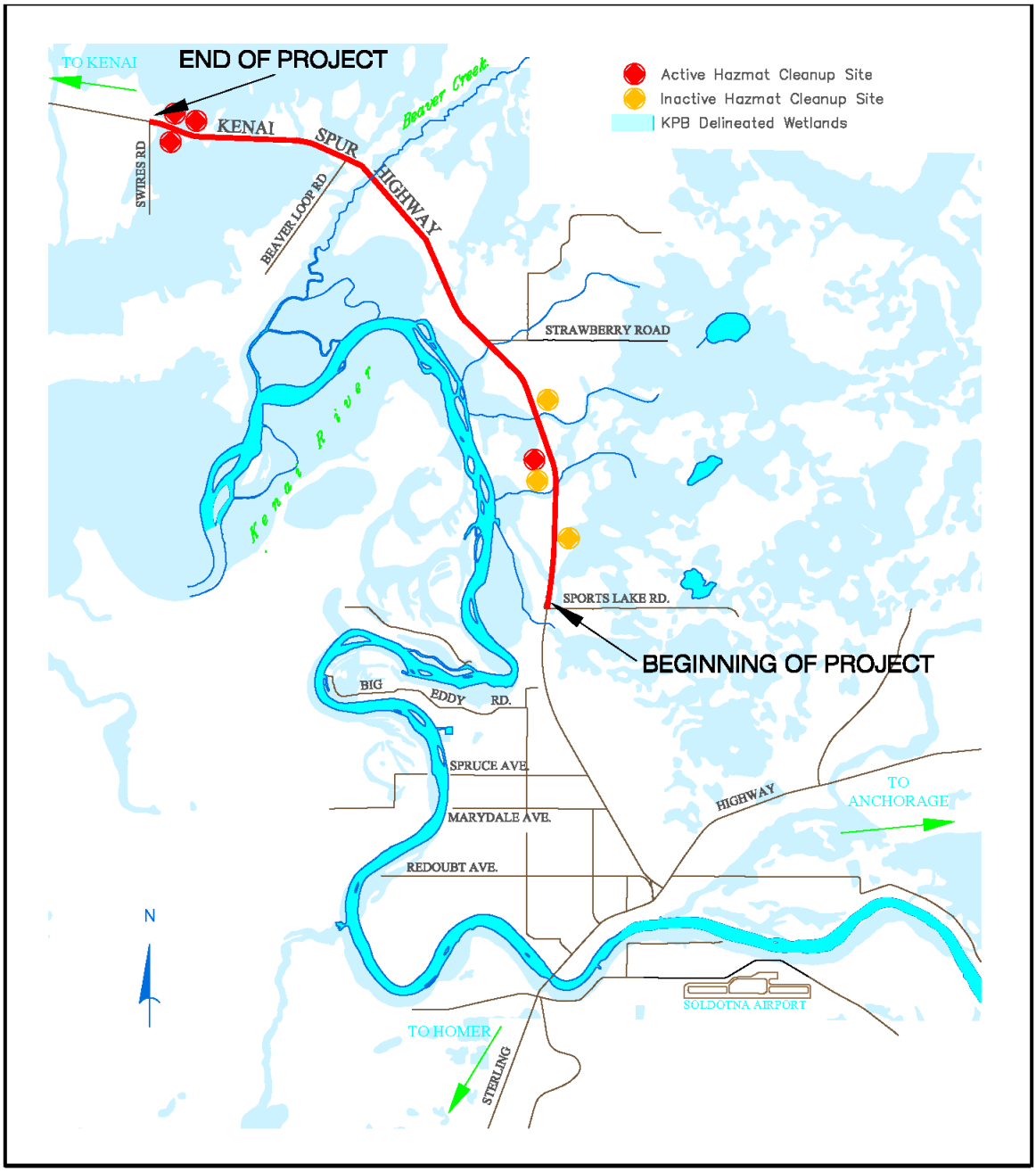


Figure 3 Preliminary Environmental Information

4.7. Hazardous Waste Sites

A search of the Department of Environmental Conservation Contaminated Sites Program database found seven hazardous waste sites along the study corridor. Three sites are listed as "cleanup complete" and four sites are listed as "active." Further research would be required to determine any potential impacts. Location, status, and presence of Leaking Underground Storage Tanks (LUST) are summarized for each location in Table F. Refer to Figure 3 for location of the seven sites.

Table F Hazardous Waste Sites

Site ID	Site Name	Location	Status	LUST
1836	Kenai Auto Inc.	37388 Kenai Spur Highway Soldotna, AK 99669	Cleanup Complete	No
24010	AT&T Alascom Soldotna Microwave	44890 Churchill Avenue Soldotna, AK 99669	Cleanup Complete	No
1004	AT&T Alascom Soldotna Microwave	44890 Churchill Avenue Soldotna, AK 99669	Active	No
23253	McLane and Associates	38240 Kenai Spur Highway Kenai, AK 99611	Cleanup Complete	Yes
4586	Duct or Sheet Metal, Inc.	7815 Kenai Spur Highway Kenai, AK 99611	Active	No
467	Drum Site – Mile 8 Kenai Spur Highway	7871 Kenai Spur Highway Kenai, AK 99611	Active	No
4593	Quonset Hut Apartments	7825 Kenai Spur Highway Kenai, AK 99611	Active	No

4.8. Fish and Wildlife

Fish Streams: The Alaska Department of Fish and Game *Atlas to the Catalog of Waters Important to the Spawning, Rearing or Migration of Anadromous Fishes* lists Beaver Creek as an anadromous fish stream. Any work done on the existing fish passage culvert at Beaver Creek would likely require a permit. One other unnamed stream bisects the study corridor and may require fish passage measures. The study corridor is in the vicinity of the Kenai River drainage, which is considered essential fish habitat. The Alaska Department of Fish and Game and USFWS would be consulted during the environmental phase of any potential project advanced.

State Refuges, Critical Habitat Areas and Sanctuaries: No State Refuges, Critical Habitat Areas, or Sanctuaries were identified in the vicinity of the study corridor.

Threatened and Endangered Species: Preliminary investigation of USFWS records does not indicate the presence of any Threatened and Endangered species in the study area. Additional field work during the environmental documentation process would be required to ensure Threatened and Endangered species would not be affected. USFWS would be consulted regarding this component of the environmental study.

Eagle Nests**:** Field research would be conducted during the environmental study to determine the location of eagle's nests in the vicinity of the study corridor. If active eagle nests are found within 660 feet of the study area, DOT&PF, in consultation with the USFWS, would determine appropriate actions. Appropriate actions could include restricting construction activities during sensitive nesting time periods or monitoring the nest during construction.

National Wildlife Refuges: The USFWS website indicates the entirety of the study corridor is outside of the boundaries of the Kenai National Wildlife Refuge.

4.9. Soil Conditions

The Kenai Spur Highway traverses a variety of glacial, glacio-lacustrine/marine, fluvial and eolian mineral soils. Commonly the core of larger hills in the Kenai lowland and study areas are composed of unsorted glacial drift, deposited during the Pleistocene Era. Lowland moraines and till sheets have been partially buried under a blanket of Pleistocene, sandy, glacio-lacustrine of glacio-marine sediment, deposited in an ice dammed ancestral water body that occupied the Cook Inlet basin.

Subsequent stream systems draining the Kenai Lowland have deposited large quantities of coarse grained sediment in valley bottom stream floodplains and terraces, and finer-grained materials in deltas. The majority of the Kenai Lowland area, including the study area, is mantled with several inches to several feet of silty eolian loess. Surface organic materials cover much of the study and range from six inches to several feet thick; the thicker deposits are in poorly drained muskegs.

The 1993 Design Study Report (Project #59872) indicated the existing roadway section is underlain, in localized areas, with a layer of peat. Also present in localized areas are frost susceptible silts.

5. Alternatives

Four "Build Alternatives" and one "No-Build Alternative" are presented below.

5.1. No-Build Alternative

The no-build alternative would not change the existing typical section. Refer to Figure 4. Only routine maintenance activities would occur throughout the study area during the next 20 years.

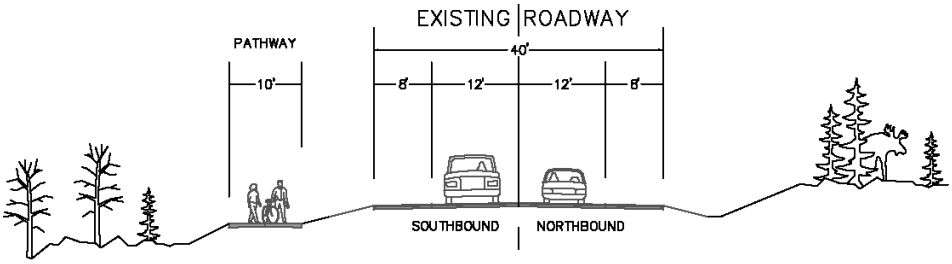


Figure 4 Typical Section, No-Build Alternative

5.2. Build Alternatives

The following assumptions were made in developing all preliminary "build" alternatives:

- 60 mph design speed for the entire study corridor
- Rolling terrain
- Drainage via culverts and open ditches; no curbs or storm drains
- Slopes are 4:1 within clear zone; 2:1 beyond the clear zone
- Structural section consists of two inches Hot Mix Asphalt, three inches asphalt treated base, three inches aggregate base course, and three feet Type A fill
- Existing horizontal and vertical alignments would remain

Alternative 1 would construct auxiliary left-turn lanes at six intersecting streets; the road typical section would remain a two-lane section between the improved intersections.

Alternative 2 would construct a three-lane section with a continuous two-way left-turn lane (TWLTL) for the entire length of corridor.

Alternative 3 would construct a five-lane section with a continuous TWLTL for the entire length of corridor.

Alternative 4 would construct a four-lane divided highway for the entire length of corridor.

Alternative details are presented in the following sections. Preliminary concept drawings for each alternative are presented in Appendix D.

5.3. Alternative 1: Auxiliary Left-turn Pockets

Alternative 1 would construct auxiliary left-turn pockets at six intersecting streets. Turn pockets at Swallow Drive, Strawberry Road, and Beaver Loop Road/Shotgun Drive met the criteria established in the AASHTO *Guide for Left-turn Lanes*. Refer to Table B. Additionally, left-turn pockets were included at North Lupine Drive, Togiak Street/Dogwood Road, and Silver Salmon Drive per the recommendation of the Regional Traffic and Safety Section. Existing five-lane sections would remain at Sports Lake Road and Swires Road. The typical section would transition to the existing two-lane roadway between improved intersections. Refer to Figures 5 and 6. The existing pathway would be relocated at intersections.

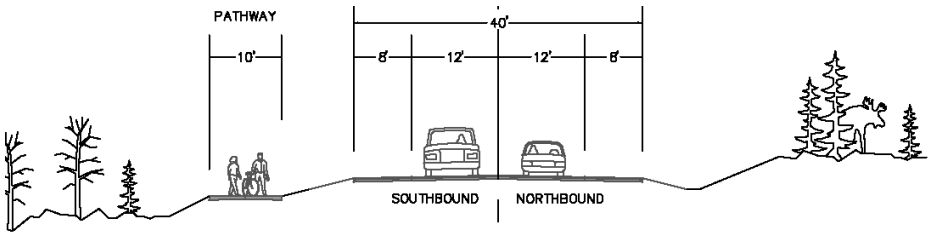


Figure 5 Alternative 1, Typical Section between Intersections

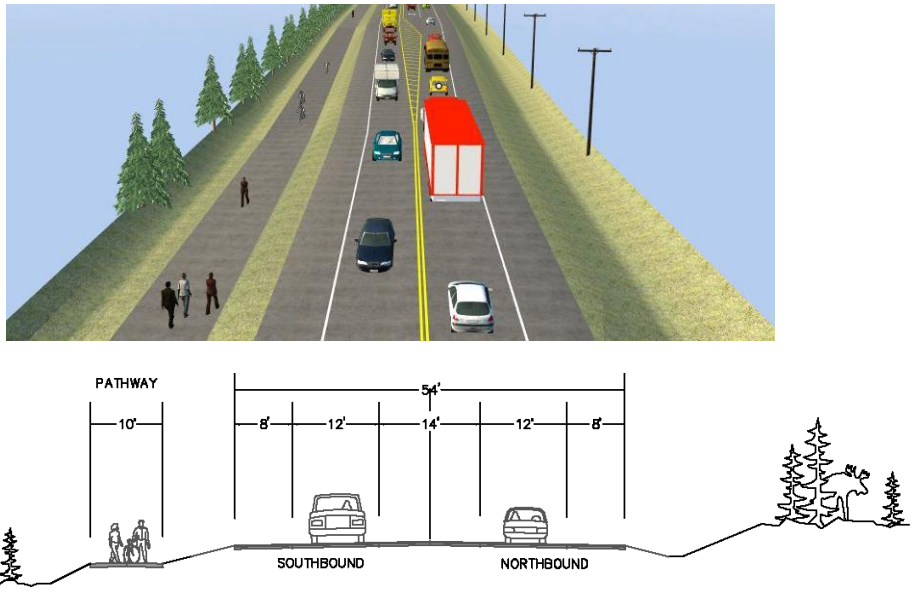


Figure 6 Alternative 1, Auxiliary Left-turn Pockets

A turn pocket conceptual plan is illustrated in Figure 7. Taper and storage lengths would be based on design speed and traffic volumes.

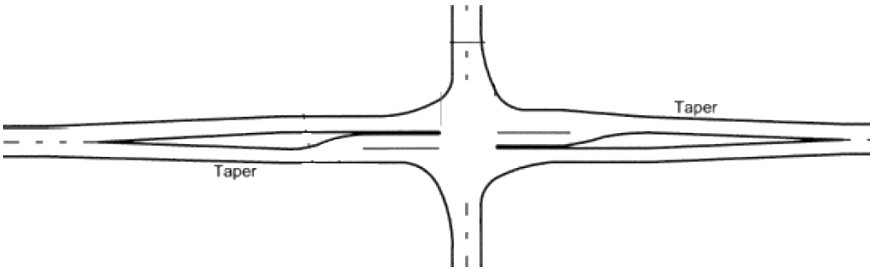


Figure 7 Turn Pocket, Preliminary Design

5.4. Alternative 2: Three-Lane Section

Alternative 2 would construct a three-lane section along the entire corridor from Sports Lake Road to Swires Road. The typical section would consist of one 12-foot through lane in each direction and a 14-foot continuous TWLTL. Refer to Figure 8. Dedicated left-turn pockets would be provided in the center lane at intersections with high incidences of crashes. The typical section would transition to the existing five-lane sections at Sports Lake Road and Swires Road. The existing pathway would be relocated as required.

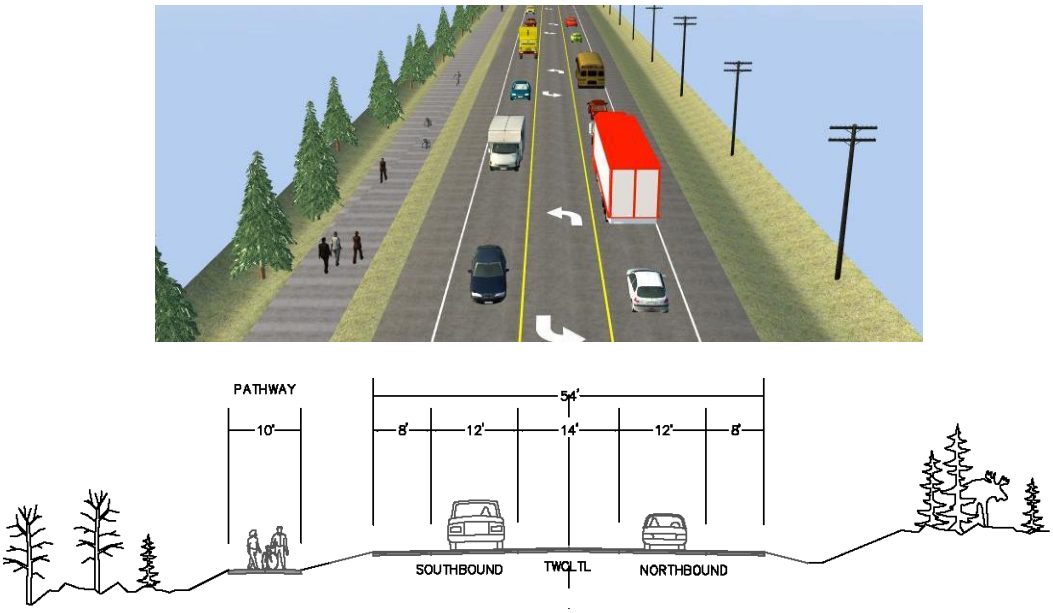


Figure 8 Alternative 2, Three-Lane Section

The continuous TWLTL would provide greater separation for opposing traffic, reducing the risk of head-on collisions; and would remove vehicles waiting for left-turn opportunities from through lanes, reducing the risk of rear-end collisions.

5.5. Alternative 3: Five-Lane Section

Alternative 3 would construct a five-lane section along the entire corridor from Sports Lake Road to Swires Road, connecting the existing five-lane sections at Sports Lake Road and Swires Road. The typical section would consist of two 12-foot through lanes in each direction and a continuous 14-foot TWLTL. Refer to Figure 9. Dedicated left-turn pockets would be provided in the center lane at intersections with high incidences of crashes. The existing pathway would be relocated as required.

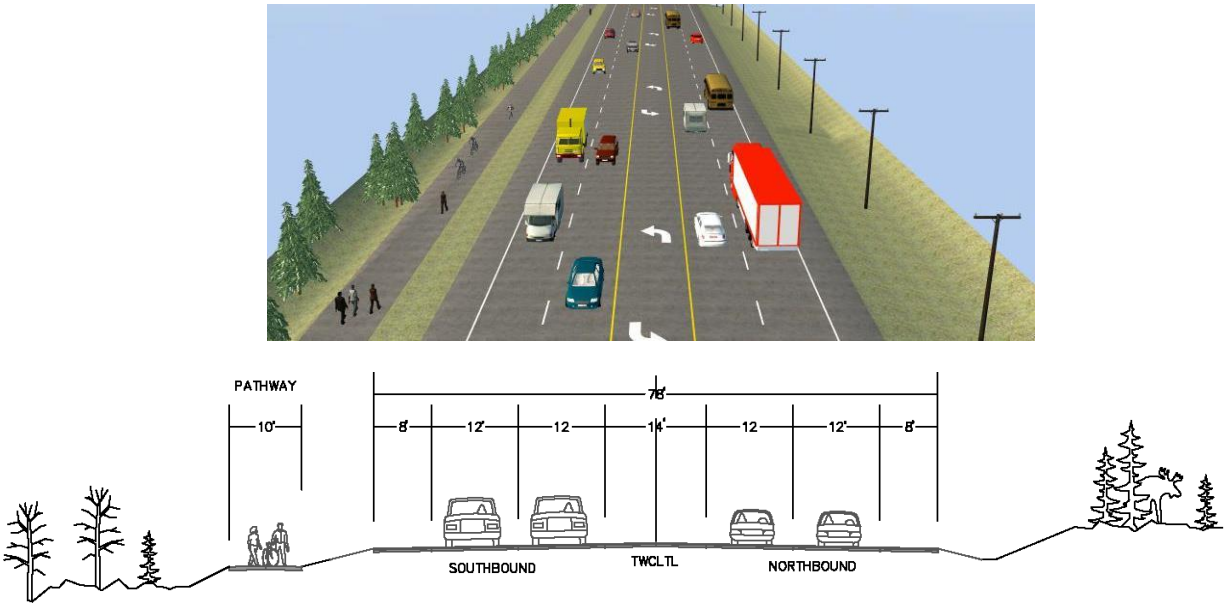


Figure 9 Alternative 3, Five-Lane Section

A high incidence of segment-related crashes occurred along the northern segment of the corridor from Beaver Loop Road to Swires Road. The additional through lanes would provide safe passing opportunities, reduce traffic platooning, and ease associated driver frustration. The continuous TWLTL would provide greater separation for opposing traffic, reducing the risk of head-on collisions; and would remove vehicles waiting for left-turn opportunities from through lanes, reducing the risk of rear-end collisions.

5.6. Alternative 4: Four-Lane Divided Section

Alternative 4 would construct a divided four-lane facility along the entire study corridor from Sports Lake Road to Swires Road. The proposed centerline would shift, with all widening occurring to the west. This would allow the existing lanes to carry traffic during construction of the new lanes. Refer to Figures 10 and 11. The typical section would consist of two 12-foot through lanes in each direction and a 30-foot depressed grass median. Outside shoulders would be eight-foot and inside shoulders would be six-foot. The typical section would transition to the existing five-lane sections at Sports Lake Road and Swires Road. The existing pathway would be relocated and reconstructed for the entire corridor length.

Existing left-turn lanes would remain at Sports Lake Road and Swires Road. Median crossings would be provided at about half-mile increments along the highway. The exact location of median crossings and associated auxiliary turn lanes would be determined during later phases of any project developed.

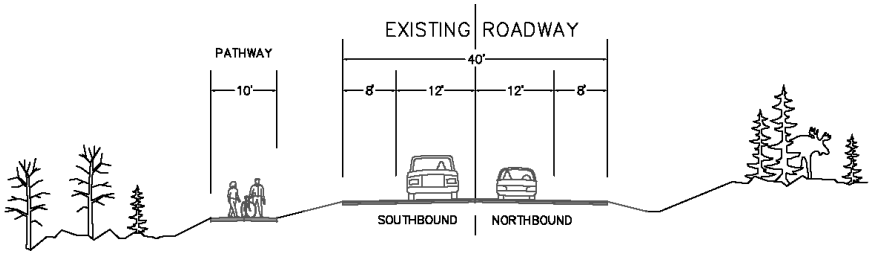
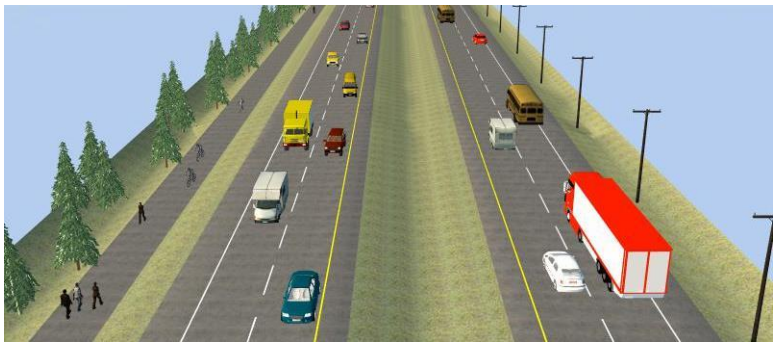


Figure 10 Existing Alignment



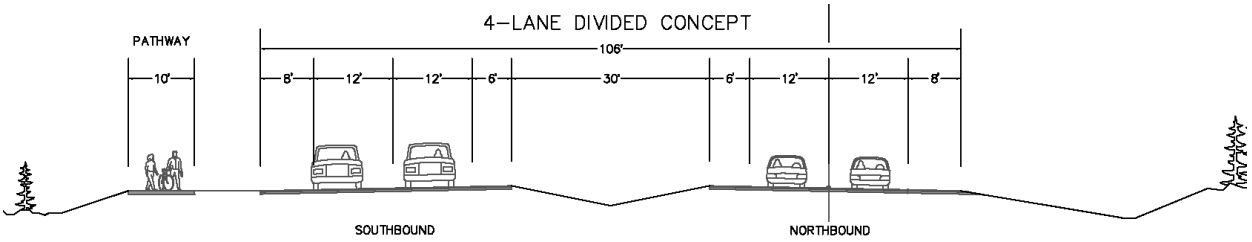


Figure 11 Alternative 4, Four-Lane Divided Section

Shifting the centerline west and reconstructing the pathway would have several advantages without significantly increasing construction costs compared to shifting the roadway to the east or widening to both sides of the roadway. The shift would:

- Minimize ROW impacts;
- Eliminate the need for a detour by utilizing the existing roadway during construction; and
- Minimize or avoid conflicts with upgraded Homer Electric Association power lines.

5.7. Moose-Vehicle Collision Options

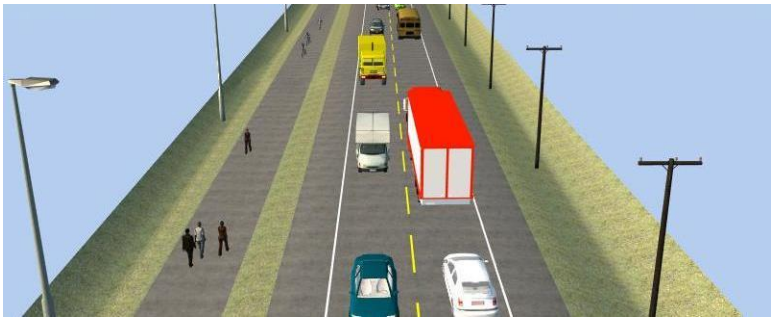
Moose-vehicle collisions are a significant concern along the studied corridor. Options were developed beyond Alternatives 1 to 4 to address these collisions specifically. These options could be added to any build alternative, implemented independent of any build alternative, and/or could be implemented together.

5.7.1. Clearing and Reseeding Option

The clearing and reseeding option would clear, grub, place top-soil, and hydro-seed to limit vegetation re-growth to the edge of the ROW and install moose warning signs along the entire study corridor from Sports Lake Road to Swires Road. Clearing and reseeding would decrease moose-vehicle collisions by removing browse from the roadside and improving visibility.

5.7.2. Continuous Illumination Option

Continuous illumination would provide lighting along the entire study corridor from Sports Lake Road to Swires Road reducing moose-vehicle collisions by giving motorists more opportunity to spot and avoid animals. Refer to Figure 12. Combining this option with the clearing and reseeding option would reduce moose-vehicle collisions significantly more than clearing and reseeding alone. Additionally, continuous illumination can reduce rear-end and angle collisions at intersections.



6. Cost Estimates

Table G summarizes preliminary costs estimates for the five build alternatives. Also included are costs to implement moose-vehicle collision reduction options. Refer to Appendix E.

Table G Preliminary Cost Estimates

Alternative	Design	ROW	Utilities	Construction	Total
1	$0.9	$1.6	$0.6	$8.1	**$11.2 Million**
2	$2.0	$2.0	$0.8	$23.2	**$28.1 Million**
3	$2.9	$2.8	$0.8	$34.0	**$40.5 Million**
4	$4.1	$14.3	$3.8	$47.4	**$69.6 Million**
Clearing	$0.1	$0.05	$0.05	$4.3	**$4.5 Million**
Illumination	$0.4	$0.05	$0.05	$4.5	**$5.0 Million**

Additional annual maintenance and operation (M&O) costs for each alternative and options to reduce moose-vehicle collisions are shown in Table H.

Table H Additional Annual M&O Costs

Alternative	Additional Lane-miles	Additional Annual M&O Costs (in Thousands $)
1	2.2	**$20**
2	5.7	**$50**
3	17.1	**$150**
4	17.1	**$150**
Clearing	0	**$0**
Illumination	0	**$50**

7. Summary

The 3R analysis did not indicate a need to improve the existing alignment, typical section, or intersections; however, crash rates on this section of the Kenai Spur Highway exceed the statewide average by more than 50%. Unless improvements are made to the facility, crash rates would likely continue to rise as traffic volumes increase with area growth and development.

Capacity analysis indicates LOS would deteriorate within a 20-year horizon, further reducing the operational performance and safety of the highway. Therefore, alternatives were developed beyond 3R requirements with a 20-year design life to add capacity to this two-lane Rural Principal Arterial. Additionally, options to reduce moose-vehicle collisions, an established problem along this segment of Kenai Spur Highway, were developed.

Recognizing major reconstruction (Alternative 4) exceeds available funding, three alternatives were developed to address specific issues at incrementally lower costs. Refer to Table I.

Table I Summary of Alternatives

Alternative	Through Lanes	Auxiliary Lanes	Through Lane Separation	Pathway Relocation	Estimated Cost
1	2	Left-turn Pockets	None	Intersection Only	**$11.2 Million**
2	2	TWLTL	14 feet	Intersection Only	**$28.1 Million**
3	4	TWLTL	14 feet	Intersection Only	**$40.5 Million**
4	4	Left-turn Pockets	42 feet	Full Length	**$69.6 Million**

All alternatives would address intersection-related crashes resulting from left-turns. Alternatives 2 and 3 would provide a continuous TWLTL to remove left-turning vehicles from the through lanes. Alternatives 3 and 4 would provide additional safe passing opportunities and increase capacity along the corridor with additional through lanes. Alternative 4 would increase safety and capacity by providing additional through lanes, left-turn pockets, and a non-traversable median to separate opposing traffic.

Options seen as cost effective at reducing moose-vehicle collisions include clearing the ROW and reseeding to limit regrowth and providing continuous lighting along the entire study corridor. These options could be added to any alternative selected or implemented individually or together as standalone measures. They would reduce not only moose-vehicle collisions, but also increase visibility along the corridor thereby reducing overall crash rates. If the selected alternative includes widening, illumination placed in advance should be coordinated with that ultimate build out.

8. Recommendations

Following this study, a logical next step for the City of Kenai and the Kenai Peninsula Borough is to undertake public outreach to help determine a locally preferred option for proceeding with a project. The $20 million 2012 appropriation could cover the $11.2 million cost of Alternative 1, left turn pockets, plus about $9.5 million to clear roadside vegetation and provide continuous lighting. Other combinations of options could be considered:

- Prioritize reduction of moose-vehicle crashes
- Develop a phased improvement program
- Spot treatments
- Seek additional funding
- Develop additional alternative(s)

9. Guidance

The following guidance was utilized in developing this study.

- Alaska DOT&PF, Alaska Highway Preconstruction Manual, 2005
- AASHTO, A Policy on Geometric Design of Highways and Streets, 2001
- AASHTO, Guide for the Development of Bicycle Facilities, 1999
- U.S. Department of Justice, ADA Standards for Accessible Designs, 2010
- Kenai Peninsula Borough Comprehensive Plan, 2005
- City of Kenai Comprehensive Plan, 2003

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APPENDIX A

3R REPORT

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Kenai Spur Highway MP 2.8-8.1: Sports Lake Road to Swires Road

Project No. 54594

3R Analysis Report

August 2012

Kenai Spur Highway MP 2.8-8.1 Sports Lake Road to Swires Road

Project No. 54594

3R Analysis Report

August 2012

EXECUTIVE SUMMARY

This 3R Analysis report for Kenai Spur Highway MP 2.8-8.1 addresses five major improvement areas: lane and shoulder width, horizontal curve modification, crest vertical curve modification, intersection improvement, and moose-vehicle collisions. By calculating and comparing a predicted number of crashes to the actual number of crashes, analysis and improvement recommendations are made.

For the purposes of this 3R analysis, Kenai Spur Highway MP 2.8-8.1 was divided into two segments: (1) Sports Lake Road to Beaver Loop Road and (2) Beaver Loop Road to Swires Road. These segments correspond to the State of Alaska Department of Transportation and Public Facilities' (DOT&PF) segments in the Annual Traffic Report. Traffic volumes, speeds, and terrain are consistent within each segment.

Lane and shoulder widths are evaluated in accordance with the procedures in Section 1160 of the Alaska Highway Preconstruction Manual (PCM). The evaluation uses encroachment and cross-section related crashes that occurred during the study period from 2000 through 2009 to determine if upgrades are needed. The predicted accident rates for lane and shoulder widths are based on average traffic volumes during the study period, current lane widths, shoulder widths, roadside hazard levels, side slopes, pavement surface conditions and pavement edge drops. The actual crash rate is then compared to the predicted crash rate to find additional roadway width/cross-sectional element upgrades required to reduce the actual crash rate. In order to meet driver expectation of a consistent road width, a uniform segment width is applied to the entire project length. For Kenai Spur Highway, 12-foot travel lanes and 8-foot shoulders are indicated by 3R criteria. The existing roadway already meets this requirement; therefore cross-sectional elements between Sports Lake Road and Beaver Loop Road should be evaluated during design.

3R guidelines allow horizontal curves with radii less than the standard for new construction to remain, unless the actual number of crashes on (or attributed to) them during the crash study period exceeds the crashes predicted through the computations outlined in PCM Section 1160.3.3. If actual rates do exceed predicted, the horizontal curve should be improved, if cost-effective. None of the horizontal curves along this section of the Kenai Spur Highway trigger 3R requirements for realignment.

Crest vertical curves on 3R projects with lengths less than current standard for new construction may remain unless the actual number of crashes at a curve during the study period exceeds the number of crashes predicted by the methods and equations set forth in PCM Section 1160. None of the existing crest vertical curves in this section of the Kenai Spur Highway trigger 3R requirements for flattening.

No 3R/crash history-based modifications are indicated or recommended at intersections along Kenai Spur Highway between Sports Lake Road and Swires Road.

The 3R analysis for Kenai Spur Highway calculated that the moose-vehicle collision rate and frequency lie above the 95th percentile. In order to reduce the number of moose-vehicle collisions in this section of Kenai Spur Highway, this report recommends that any build alternative include removing vegetation from the existing clear zone and installing moose awareness signs. Consideration should also be given to illumination, fencing and other mitigation measures.

Kenai Spur Highway MP 2.8-8.1: Sports Lake Road to Swires Road

Project No. 54594

3R Analysis Report

August 2012

INTRODUCTION

The primary purpose for 3R (Resurfacing, Restoration, and Rehabilitation) projects is to preserve the pavement structure, restore pavement surfaces and bring traffic control devices up to standards of the current Manual on Uniform Traffic Control Devices (MUTCD). 3R projects also include a total crash safety analysis component to develop feasible geometric and alignment improvements as countermeasures for crash patterns. Analysis procedures are presented in section 1160 of DOT&PF's *Alaska Preconstruction Manual* (PCM). Geometric and alignment improvements do not have to meet current standards for new construction unless there is a crash problem. For a fix to be considered cost-effective, the calculated crash cost saving should be greater than the repair cost throughout its design life.

PROJECT DESCRIPTION

Kenai Spur Highway within this project is functionally classified as a Rural Principal Arterial–Other. The existing two-lane facility has 12-foot lanes, 8-foot shoulders and open-ditch drainage. The terrain is generally rolling. The intersections at Sports Lake Road, Beaver Loop Road and Swires Road are unsignalized. There is no Illumination provided from MP 3 to MP 8. The posted speed limit along the route is 55 mph, but the limit is reduced to 45 mph approximately one-quarter mile from the end of project, just past Mapes Street. For evaluation purposes, the project was divided into two segments: 1) Sports Lake Road to Beaver Loop Road and 2) Beaver Loop Road to Swires Road. These segments provide analysis-consistent traffic volumes, speeds and terrain.

3R DESIGN STANDARDS AND PROCEDURES

Sources of design standards for this 3R project are:

- The *Alaska Preconstruction Manual* (PCM) by DOT&PF, January 2005
- American Association of State Highway and Transportation Officials (AASHTO) *A Policy on the Geometric Design of Highways and Streets,*(GDHS) 2001
- Transportation Research Board Special Report 214 *Designing Safer Roads Practices for Resurfacing, Restoration, and Rehabilitation* (TRB 214)
- Alaska Traffic Manual - DOT&PF, January 2012

Other references used in this analysis include:

- *The Highway Safety Improvement Program Handbook* (HSIP) by DOT&PF, May 2012

- *Central Region Annual Traffic Volume Report* for the years between 2000 and 2009, published by DOT&PF
- *Alaska Traffic Accidents* published by State of Alaska, DOT&PF 2007
- NCHRP Report 162, *Methods for Evaluating Highway Safety Improvements,* Laughland, et. Al.
- *AASHTO Strategic Highway Safety Plan,* AASHTO, 2005
- *Alaska's Strategic Traffic-Safety Plan,* DOT&PF, March 2012
- *AASHTO 1999 Guide for the Development of Bicycle Facilites,* 1999
- NCHRP 502 *Geometric Design Consistency on High-Speed Rural Two-Lane Roadways,* 2003
- State of Alaska DOT&PF Website on functional classification update: http://www.dot.state.ak.us/stwdplng/fclass/mapsdocs.shtml
- FHWA, *Selecting Roadway Design Treatments to Accommodate Bicyclists,* FHWA publication RD-92-073

When the 3R analysis procedure requires that an element be improved to meet new construction standards, the PCM (Figure 1100-3) is used to determine the design criteria.

TRAFFIC VOLUMES

DOT&PF's Central Region Highway Data Section publishes an Annual Traffic Volume Report which tabulates Average Annual Daily Traffic (AADT) volumes. The 3R traffic and safety analysis for this project evaluates crashes between 2000 and 2009. An AADT must be established for each segment in order to determine crash rates. Table 1 summarizes the AADT's for each segment of Kenai Spur Highway for this 10 year period. Table 2 summarizes the AADT's for the major cross streets. Since the growth trends for each segment are reasonably consistent, the average AADT's over the 10 years are representative of the growth trends, and are used in 3R computations.

Kenai Spur Highway (CDS Route 117600)										
Segment	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sports Lake Road to Beaver Loop Road	8,810	9,060	9,859	9,840	10,000	9,869	9,980	10,040	9,610	11,141
Beaver Loop Road to Swires Road	8,433	8,668	8,704	8,683	8,825	8,793	9,267	9,324	8,922	9,157

Table 1 – 10 Year AADTs for Kenai Spur Highway Segments

Sports Lake Road (CDS Route 117150)										
Segment	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Junction with Kenai Spur Highway	786	810	810	995	1,010	726	713	720	690	710

Beaver Loop Road (CDS Route 117770)										
Segment	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Junction with Kenai Spur Highway	1,310	1,068	1,070	1,070	1,189	1,531	1,550	1,397	1,340	1,380

Swires Road (CDS Route 117803)										
Segment	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Junction with Kenai Spur Highway	NO DATA									

Table 2 – 10 Year AADTs for Major Cross Streets

DESIGN SPEED

Sports Lake Road (MP 2.8) to Mapes Street (Approximately MP 8) utilizes a design speed of 60 mph. For the remaining one-quarter mile of the project from Mapes Street to Swires Road, the design speed is reduced to 50 mph. This design speed is used for 3R Analysis purposes only in order to test road geometrics. It is not an evaluation of, nor a recommendation for, the posted speed limit.

CRASHES

Three hundred and fifty-eight (358) total segment crashes are recorded in DOT&PF's crash database between study years 2000 to 2009. Table 3 summarizes this data based on crash category.

Crash Category	Crash Type	Number of Crashes	Percent of Total Crashes
Collision With	Animal	20	5.59%
	Moose	138	38.55%
Motor Vehicle in Transport	Head On	8	2.23%
	Rear End	68	18.99%
	Angle	42	11.73%
	Cargo Loss	1	0.28%
Fixed Object	Ditch	19	5.31%
	Embankment	5	1.40%
	Sign	3	0.84%
	Tree	1	0.28%
	Snow Berm	5	1.40%
	Vehicle Sideswipe	4	1.12%
	Guardrail	17	4.75%
	Culvert	2	0.56%
	Utility Pole	3	0.84%
	Other	4	1.12%
Non-Collision	Overturn	8	2.23%
	Ran Off Road	9	2.51%
	Aircraft	1	0.28%
Total		**358**	

Table 3 – Crashes by Type, 2000-2009

Five hundred forty-eight (548) vehicles were involved in these crashes. Two hundred sixty (260) crashes were property damage only incidences. Ninety-eight (98) crashes involved personal injuries that resulted in 1 fatality, 19 major injuries, and 86 minor injuries.

CRASH RATES

Crash Rate analysis is especially useful when there is a statewide crash rate for similar facilities; available for comparison. Crash rates are a good indicator of a motorist's risk of being involved in a crash while using a facility, because they take into account the motorist's exposure to traffic volume and road length. DOT&PF's HSIP Program has developed statewide crash rates for segments and intersections, which are available from the Central Region Traffic and Safety Section.

SEGMENT CRASH RATES

There were 358 segment-related crashes (does not include crashes at major intersections) between 2000 and 2009 within the project area. In Table 4, segment crash rates are compared to a corresponding State of Alaska average HSIP crash rate for similar facilities. For a rural principal arterial-other, the crash rate is 1.176 crashes per million vehicle miles (10 year average, 2000-2009).

The Rate Quality Control method of identifying hazardous road locations, as identified in Alaska's Highway Safety Improvement Program manual, establishes an upper control limit (UCL) to determine if the facility's crash rate is significantly higher than crash rates in facilities with similar characteristics (in this case a rural principal arterial-other). The UCL or critical rate is determined statistically as a function of the statewide average crash rate for the facility category (i.e., highway or intersection) and vehicle exposure at the location being considered. By comparing the rate of the facility under analysis to the UCL, roadway locations with higher rates can be classified as problem areas.

Segments	Segment Crashes 2000 to 2009	Million Vehicle Miles (MVM)	Crashes/ MVM	State Population (undivided rural interstate ; crashes/MVM)	UCL @ 95.00% Confidence (crashes/ MVM)	Above Average?	Above Critical?
Sports Lake Road to Beaver Loop Road	259	135.50	1.91	1.176	1.332	Yes	Yes
Beaver Loop Road to Swires Road	99	56.38	1.76	1.176	1.422	Yes	Yes

Table 4 – Segment Crash Rates, 2000-2009

Both segments have rates above average and above the 95% UCL. Accident rates above the UCL indicate crashes are an issue for these segments and not due solely to chance.

Segment crash rates indicate overall substantive safety performance. Within both segments, there are discrete or overlapping geometric elements: horizontal curves, vertical curves and roadway widths that are not adequate for the design speeds and contributory to crashes. Other factors, including wildlife and roadside obstructions may also be a contributing factor.

MOOSE-VEHICLE COLLISION

In accordance with ADOT&PF's Central Region *Moose Accident Clarification* memo for 3R Analysis (December 5, 2003), moose-vehicle collisions (MVC) are analyzed separate from 3R analysis. MVC's are analyzed for both rate (number of accidents/MVM/5-year period) and frequency (number of accidents/mile/5 year period). Analysis of Kenai Spur Highway MP 2.8-8.1 crash data indicates maximum MVC rate and frequency values of 1.8 and 33, respectively. A 1995 study, *Moose-Vehicle Accidents on Alaska's Rural Roads*, established 75th and 95th percentile threshold values for MVC rate at 1.0 and 1.5, and MVC frequency at 8 and 15. Kenai Spur Highway MP 2.8-8.1's MVC rate and frequency lie above the 95th percentile threshold value. In keeping with the recommendations of the 2003 memo, it is recommended that any build alternative include removing vegetation from the existing clear zone and installing moose awareness signs. Consideration should also be given to illumination, fencing and other mitigation measures. ADOT&PF's Central Region *Moose Accident Clarification* memo for 3R Analysis is provided in Appendix.

LANE AND SHOULDER WIDTHS

The 3R standards for lane and shoulder widths are determined through a crash evaluation and comparison to predicted safety standards. Where lane and shoulder widths are less than current standards, the existing widths may be retained unless the crash rate (eligible crashes / mile / year) for the roadway exceeds the calculated predicted rate. In that case, the width should be increased by 1 foot on each side for each 10% increment that the actual rate exceeds predicted rate. The widening should not exceed current standards for new construction. Where 3R project lane and shoulder widths already meet or exceed new construction standards and crash experience exceeds predicted, then the roadside and clear zone should be improved to meet new construction standards.

Exhibit 6-5 in the AASHTO GDSH presents new construction lane and shoulder width standards for traffic volumes (ADTs) greater than 2000. New construction standards for current ADTs greater than 2000 include 12-foot lanes and 8-foot shoulders (Exhibit 6-5, page 429).

Lane and shoulder widths are evaluated in accordance with the procedures in the Alaska PCM, Section 1160, using encroachment and cross-section related crashes during the study period. Moose accidents were not included in this part of the analysis per Central Region guidelines. Calculations are presented in Table 5.

	Segment: Sports Lake Road to Beaver Loop Road	**Segment: Beaver Loop Road to Swires Road**
Begin Mile Point	2.41	6.27
End Mile Point	6.27	8.09
Computed Accident Rate "A" in Accidents Per mile per Year		
ADT (Average ADT 2000 to 2009)	9,821	8,878
W (Nominal Lane Width), feet	12	12
PA (Nominal Paved Shoulder), feet	8	8
UP (Unpaved Shoulder), feet	0	0
H (Hazard Rating), From Fig. 1160- 1 to 7 and IHSDM Manual Descriptions	5	5
TER1 (TER1=1 for flat terrain, 0 otherwise; From PCM 1160-4)	0	0
TER2 (TER2=1 for mountainous terrain, 0 otherwise; From PCM 1160-4)	0	0
Computed A (Accident per mile-year)	1.59	1.46
$A=0.0019\ ADT^{0.882} \times 0.879^{W} \times 0.919^{PA} \times 0.932^{UP} \times 1.236^{H} \times 0.882^{TER1} \times 1.322^{TER2}$		
Encroachment Accidents related to Lanes and Shoulders	72	18
2000 to 2009 Encroachment and Cross-Section Related Accidents		
Accidents related to Lanes and Shoulders	72	18
Rate Accidents per Mile of 10 years	18.65	9.89
Current Average Accident Rate (Accidents per mile-year)	1.87	0.99
New Construction Design Standards Based 0n 2009 AADT		
Lanes (from GDHS for ADT>2000), in feet	12	12
Shoulder (from GDHS for ADT>2000), in feet	8	8
Total Pavement Width, New Construction in feet	40	40
Existing Pavement Width (lane and shoulder), in feet	40	40
Analysis of Need		
Case	II	II
Is Current Accident Rate>Computed Rate (A)?	Yes	No
Lane and Shoulder Action	Already meets new construction design standard	Actual Rate ≤ Computed Rate. No Action Required
Widening Necessary to Reduce Current Rate to Predicted Rate		
Current Accident Rate (CAR)	1.87	0.99
Computed A (Accidents per mile-year)	1.59	1.46
Incremental 10% Reduction of Current Accident Rate for each additional 2 feet of width (Table 1160-1) IR	0.187	0.099
Widening Necessary to Reduce Current Rate to Predicted Rate=(CAR-A)/IRx2' (Rounded Up to Nearest Foot)	--	--
Existing Pavement Width (lane and shoulder) in feet	40	40
Lane and Shoulder Width After Widening (Rounded up to Nearest 2-feet Increment Width)	No Action	No Action
Will rate be equal or less than Computed Rate (A) after widening?	--	--
Do roadside cross-sectional elements require evaluation?	Yes	No
Minimum Width Required for Entire Project	40 feet	

Table 5 – Lane and Shoulder Width Computations

The 3R procedure outlined in the Alaska PCM states that if the actual accident rate is greater than the predicted accident rate when existing roadway top width is equal or greater than required for new construction, cross section element evaluation is required. From Sports Lake Road to Beaver Loop Road, actual accident rates are greater than the predicted rate despite lane and shoulder widths that already meet new construction requirements. Therefore, analysis of cross sectional elements of that segment is required per Section 1130 of the Alaska PCM. See Section 1160.3.6.

HORIZONTAL CURVE 3R ANALYSIS

The 3R design speed for the majority of this section of Kenai Spur Highway is 60 mph. From Sports Lake Road (MP 2.8) to Mapes Street (Approximately MP 8) the design speed is 60 mph. For the remaining one-quarter mile of the project from Mapes Street to Swires Road, the design speed is 50 mph. AASHTO's GDHS Exhibit 3-14 shows a minimum horizontal curve radius for 60 mph, new construction, is 1,340 feet. Minimum radius for a 50 mph horizontal curve, new construction, is 835 feet. The curve design radii assume a maximum superelevation of 6% to conform to Alaska practices.

Horizontal curves with radii less than new construction standards may remain unless the actual number of crashes attributed to the horizontal curve during the study period (2000 through 2009) exceeds the number predicted by the method outlined in PCM Section 1160.3.3. In that case, the horizontal curve should be improved. This is consistent with context sensitive design/solutions practices, which advocates upgrade to new standards in cases where a curve doesn't meet nominal safety standards and has poor substantive safety (actual crash experience).

Curve Number	PI Station	Existing Radius (ft)	Existing Length (ft)	Design Speed (mph)	Design Super (e%)	Minimum Radius Required (ft)	Radius Check
1	20+70.73	5,732.23	395.18	60	6	1,340	OK
2	26+83.96	7,641.97	421.18	60	6	1,340	OK
3	53+51.12	2,547.47	909.35	60	6	1,340	OK
4	93+23.87	2,865.90	1,371.60	60	6	1,340	OK
5	128+30.68	2,865.90	1,106.52	60	6	1,340	OK
6	184+94.86	1,348.66	959.97	60	6	1,340	OK
7	225+45.95	2,750.00	1,099.06	60	6	1,340	OK
8	269+83.80	2,950.00	966.91	60	6	1,340	OK
9	284+89.06	3,819.70	754.191	60	6	1,340	OK

Table 6 – Horizontal Alignment Check

NG – Does not conform to current design standards
OK – Conforms to current design standards

All existing horizontal curves meet minimum radius requirements for design speeds. Refer to Table 6.

CREST VERTICAL CURVES

The 3R analysis procedure applies to crest vertical curves only; sag vertical curves are not analyzed. All of the crest vertical curves within the project limits were compared with new construction standards. Individual vertical curves that do not meet current standards were evaluated based on an actual number of accidents and compared to a predicted number of accidents. If the actual number of accidents is greater than the predicted number, then the curve should be improved to new construction standards, if proven to be cost effective. Refer to Table 7.

PVI Station	Design Speed (mph)	Existing Grade in (%)	Existing Grade out (%)	Existing A (%)	Existing Length (ft)	Design K Value	Design Length	Length Check	Existing SSD (ft)	Design SSD (ft)	SSD Check
2+37	60	1.32	-0.45	1.77	309	151	267	OK	764	570	OK
25+43	60	1.23	0.27	0.96	410	151	145	OK	1329	570	OK
37+86	60	0.27	-5.83	6.10	762	151	921	NG	519	570	NG
57+95	60	5.95	-5.47	11.42	968	151	1724	NG	428	570	NG
87+86	60	5.03	-1.99	7.02	1207	151	1060	OK	609	570	OK
117+93	60	-0.31	-1.57	1.26	1270	151	190	OK	1491	570	OK
163+28	60	0.19	-0.91	1.10	459	151	166	OK	1210	570	OK
188+17	60	0.26	-3.28	3.54	721	151	535	OK	663	570	OK
215+39	60	1.71	-0.10	1.81	1087	151	273	OK	1140	570	OK
231+03	60	-0.10	-0.27	0.17	150	151	26	OK	6422	570	OK
286+96	60	1.30	0.30	1.00	254	151	151	OK	1206	570	OK

Table 7 – Crest Vertical Curve Check

NG – Does not conform to current design standards

OK – Conforms to current design standards

Table 8 summarizes the crest vertical curves that do not meet current design standards. It determines if the curve length restricts safe stopping sight distance allowed for the 3R design speed. The table also presents actual number of crashes, "A_C", and the predicted number of crashes, "N_C", which are computed by 3R procedures. These crash numbers include intersection and driveway crashes that could be related to stopping sight distance.

Crest VPI Station	Begin Station	End Station	Length (Feet)	Required Length	Length of Curve Lv_c (Miles)	V for SSD	a_1	a_0	A	Length of Restricted SSD, L_r, (Miles)	Accident Rate Ar_h	g_1	g_2	Relative Hazard 1160-4	Speed Differential	1160-3 F_{ar}	ADT Average over 10 years	Actual Crashes A_C	Volume in million vehicles V	Predicted Accidents within CVC, N_c	**Is Actual > N_c ?**	**Requires Cost-Effective Analysis ?**
37+86	34+05	41+67	762	921	0.144	55	152.6	-138	6.10	0.150	1.872	0.27	-5.83	Significant	5	0.8	9821	9	35.85	17.74	No	No
57+95	53+11	62+79	968	1,724	0.183	50	120.9	-25	11.42	0.257	1.872	5.95	-5.47	Significant	10	0.8	9821	7	35.85	26.08	No	No

TABLE 8 – Crest Vertical Curve Analysis, 60 MPH

Actual crashes, "A_c", on crest vertical curves fell below the number of predicted crashes, "N_c", for each of the substandard crest vertical curves. Based on 3R analysis, no modifications are recommended for any crest vertical curves.

INTERSECTIONS

The PCM Section 1160.3.8 recommends intersections be evaluated to ascertain if crashes can be attributed to sub-standard roadway elements near the intersection.

Thirty-nine intersection related crashes were recorded between 2000 and 2009. These are presented in Table 9.

Cross Street	Intersection Crashes 2000 to 2009	Million Entering Vehicle (MEV)	Crashes/ MEV	Control	HSIP State Populations (2000 to 2009 Average)	UCL @ 95.00% Confidence	Above Average?	Above Critical?
Sports Lake Road	10	38.344	0.261	Stop	0.527	0.732	No	No
Beaver Loop Road	23	36.480	0.630	Stop	0.527	0.738	Yes	No
Swires Road	11	34.065	0.323	Stop	0.653	0.895	No	No

Table 9 – Intersection Crash Rates

Kenai Spur Highway intersections with Sports Lake Road, Beaver Loop Road and Swires Road each have intersection crash rates below the UCL. Based on 3R analysis, no modifications are recommended at these intersections.

MEMORANDUM

STATE OF ALASKA

Department of Transportation and Public Facilities
Central Region-Division of Design and Engineering Services
Traffic, Safety, & Utilities Section

To: **Design Project Managers** **Date:** December 5, 2003
Central Region

From: **Hank Wilson, P.E., Chief** **File No.:**
Highway Design Section
Central Region **Phone No.:** 269-0639

From: **Scott E. Thomas, P.E.** **Subject:** 3R Analysis
Central Region Traffic Engineer Moose Accident Clarification

For 3R Analysis, Section 1160.2, Accident Records, the latest revision states that "Moose accidents and alcohol related accidents are eligible." For more clarification, use the following guidelines in analyzing moose accidents:

ANALYSIS REQUIREMENTS

1. Do not include moose-vehicle accidents in the 3R Lane and Shoulder width computations.

2. Include moose-vehicle collisions in individual 3R horizontal and vertical curve computations on rural two-lane highways only when

   - headlight sight distance or stopping sight distance is not met, and
   - the 75 percentile threshold is exceeded along that geometric feature.

3. Also analyze moose-vehicle collisions independently from the 3R analysis formulas along the full project length of any rural two-lane highways:

   - Use "sliding" one-mile segments, measured forward from each accident site over each mile which captures the highest frequencies of moose-vehicle collisions.

   - Identify where the collision frequencies and rates meet or exceed 75 percentile and 95 percentile thresholds identified in the 1995 study Moose-Vehicle Accidents on Alaska's Rural Roads. This study uses data from the high moose-vehicle collision years of 1988-1992. The study identifies which corridors are most likely to be affected and need further analysis. To account for winter variability, the threshold values established in the study are *per mile over a five year period.* This study is available on the DOT Home Page through the search function.

- Threshold moose-vehicle collision values established in 1995 are:

Percentile	Frequency (acc/mi/5 yrs)	*Rate (acc/MVM)
75	8	1.0
95	15	1.5

* Five year period

- Analyze 10 years of moose collision data using 5 year blocks separated by one year to average for variable winters. Ten years of data will require screening six blocks of data for moose collisions frequencies and rates.

- Use the same accident period of study as used for the whole project, typically 10 years.

- Do not use moose-vehicle collision rate per MVM thresholds below 2000 vpd. Use collision frequencies per mile only on low volume roads.

SOLUTIONS OPTIONS

1. For segments below the 75 percentile threshold, no mitigation is required.

2. For segments between the 75 percentile threshold, but below the 95 percentile threshold,

   - provide a warning sign plan per the 1995 study, and
   - clear to the right-of-way where feasible. Clearing may be reduced to about 50 feet off the edge of pavement as needed to stop at a mature growth treeline, or at least the clear zone. If there are other environmental restrictions and clear zone is not required to be improved, then clearing can be reduced further.

3. For segments above the 95 percentile threshold,

   - provide a warning sign plan per the 1995 study, and
   - provide a public awareness signing plan as developed by ADF&G and DOT Traffic
   - clear, grub, topsoil & reseed to eliminate all browse out to the clear zone or treeline
   - evaluate maintainable slopes, fencing, and or, continuous lighting
   - Consider grade separations with fencing when an identifiable high use moose trail/collision area can be shown to conflict with the roadway route
   - Minimize grade separations and fencing by coordinating with planned bridges for drainage and topography.

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APPENDIX B

DRAFT DESIGN DESIGNATION

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Preliminary Design Designation prepared by ADOT&PF Preliminary Design & Environmental Section

DESIGN DESIGNATION

State Route Number: 117600 Route Name: Kenai Spur Highway

Project Limits: Sports Lake Road to Beaver Loop Road.

State Project Number: 54594 Federal Aid Number: N/A

Design Functional Classification: Urban Arterial ❑ Rural Arterial **X** Major Collector ❑ Minor Collector ❑ Local ❑

New Construction - Reconstruction: **X** Rehabilitation (3R): ❑ Other: _____

Project Design Life (years): 5 ❑ 10 ❑ 20 **X** Other _____

	Existing Year	Construction Year	Mid - Life Year	Future Year
	2010	2017	2027	2037
ADT*	11,500	12,600	14,400	16,450
DHV	10.7	10.7	10.7	10.7
Peak Hour Factor	0.88	0.88	0.88	0.88
Directional Distribution	50/50	50/50	50/50	50/50
Percent Recreational Vehicles	N/A	N/A	N/A	N/A
Percent Commercial Trucks	12	12	12	12
Compound Growth Rate	1.34	1.34	1.34	1.34
Pedestrians (Number/Day)	N/A	N/A	N/A	N/A
Bicyclists (Number/Day)	N/A	N/A	N/A	N/A

* If urban then ADT is not required. Intersection diagrams shall be attached as part of this document.

Design Vehicles for Turning: _____

_____

Design Vehicle Loading: HS15 ❑ HS20 ❑ HS25 ❑ Other ❑

Equivalent Axle Loads: _____

DRAFT

APPROVED:_____ DATE: _____
Regional Preconstruction Engineer

Figure 1100-1
Design Designation Form

Preliminary Project Design Criteria prepared by ADOT&PF Preliminary Design & Environmental Section

Project Kenai Spur Highway Rehabilitation

X New Construction / Reconstruction ❑ Rehabilitation (3R) ❑ Other _____

Design Functional Classification Rural Principle Arterial - Other

Design Year (Usually 5-year increment at least 20 years after construction) 2037

Present ADT (& year) 11,500 2010

Design Year ADT (& year) 16,450 2037

Mid Design Period ADT (& yr) 14,400 2027

DHV (%) 10.7%

Directional Split (%D) 50/50

Trucks (PTT)

Equivalent Single Axle Load (ESAL)

Pavement Design Year (Construction Year + n*)

Design Vehicle

Design Speed 60 MPH

Stopping Sight Distance 570' (AASHTO pg 449)

Passing Sight Distance 2135' (AASHTO pg 449)

Maximum Allowable Grade 4% (Best Regional Practice, Central Region)

Minimum Allowable Grade 0.5% (AASHTO pg 242)

Minimum Allowable Degree of Curvature

Minimum K-value for Vertical Curves: Sag K=136 (AASHTO pg 280) Crest K=151 (AASHTO pg 274)

Number of Roadways

Width of Traveled Way

Width of Shoulders: Outside 8' Inside 6'

Surface Treatment: T/W Asphalt Shoulders Asphalt

Side Slope Ratios: Foreslopes 4H to 1V Backslopes 2H to 1V

Degree of Access Control

Median Treatment (If applicable)

Illumination

Curb Usage and Type N/A

Bicycle Provisions Separated multipurpose path one side

Pedestrian Provisions Separated multipurpose path one side

Miscellaneous Criteria

Proposed by _____ Date: _____ Recommended by _____ Date _____
Designer (Consultant or Staff) Engineering Manager

DRAFT

Accepted by _____
Regional Preconstruction Engineer

*n is the number of years of expected pavement design life.

Figure 1100-2

Project Design Criteria

Preliminary Design Designation prepared by ADOT&PF Preliminary Design & Environmental Section

DESIGN DESIGNATION

State Route Number: 117600 Route Name: Kenai Spur Highway

Project Limits: Beaver Loop Road to Swires Road.

State Project Number: 54594 Federal Aid Number: N/A

Design Functional Classification: Urban Arterial ❑ Rural Arterial **X** Major Collector ❑ Minor Collector ❑ Local ❑

New Construction - Reconstruction: **X** Rehabilitation (3R): ❑ Other: _____

Project Design Life (years): 5 ❑ 10 ❑ 20 **X** Other _____

	Existing Year	Construction Year	Mid - Life Year	Future Year
	2010	2017	2027	2037
ADT*	9,450	10,350	11,850	13,550
DHV	10.7	10.7	10.7	10.7
Peak Hour Factor	0.88	0.88	0.88	0.88
Directional Distribution	50/50	50/50	50/50	50/50
Percent Recreational Vehicles	N/A	N/A	N/A	N/A
Percent Commercial Trucks	12	12	12	12
Compound Growth Rate	1.34	1.34	1.34	1.34
Pedestrians (Number/Day)	N/A	N/A	N/A	N/A
Bicyclists (Number/Day)	N/A	N/A	N/A	N/A

* If urban then ADT is not required. Intersection diagrams shall be attached as part of this document.

Design Vehicles for Turning: _____

_____

Design Vehicle Loading: HS15 ❑ HS20 ❑ HS25 ❑ Other ❑

Equivalent Axle Loads: _____

DRAFT

APPROVED:_____ DATE: _____
Regional Preconstruction Engineer

Figure 1100-1
Design Designation Form

Preliminary Project Design Criteria prepared by ADOT&PF Preliminary Design & Environmental Section

Project Kenai Spur Highway Rehabilitation

X New Construction / Reconstruction ❑ Rehabilitation (3R) ❑ Other _____

Design Functional Classification	Rural Principle Arterial - Other
Design Year (Usually 5-year increment at least 20 years after construction)	2037
Present ADT (& year)	9,450 2010
Design Year ADT (& year)	13,550 2037
Mid Design Period ADT (& yr)	11,850 2027
DHV (%)	10.7%
Directional Split (%D)	50/50
Trucks (PTT)	
Equivalent Single Axle Load (ESAL)	
Pavement Design Year (Construction Year + n*)	
Design Vehicle	
Design Speed	60 MPH
Stopping Sight Distance	570' (AASHTO pg 449)
Passing Sight Distance	2135' (AASHTO pg 449)
Maximum Allowable Grade	4% (Best Regional Practice, Central Region)
Minimum Allowable Grade	0.5% (AASHTO pg 242)
Minimum Allowable Degree of Curvature	
Minimum K-value for Vertical Curves:	Sag K=136 (AASHTO pg 280) Crest K=151 (AASHTO pg 274)
Number of Roadways	
Width of Traveled Way	
Width of Shoulders:	Outside 8' Inside 6'
Surface Treatment:	T/W Asphalt Shoulders Asphalt
Side Slope Ratios:	Foreslopes 4H to 1V Backslopes 2H to 1V
Degree of Access Control	
Median Treatment (If applicable)	
Illumination	
Curb Usage and Type	N/A
Bicycle Provisions	Separated multipurpose path one side
Pedestrian Provisions	Separated multipurpose path one side
Miscellaneous Criteria	

Proposed by _____ Date: _____ Recommended by _____ Date _____
Designer (Consultant or Staff) Engineering Manager

Accepted by _____
Regional Preconstruction Engineer

DRAFT

*n is the number of years of expected pavement design life.

Figure 1100-2

Project Design Criteria

APPENDIX C

TRAFFIC ANALYSIS & TURNING COUNTS

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Average Annual Daily Traffic

Table 1 presents the Average Annual Daily Traffic volumes (AADT) within the study area for Kenai Spur Highway. The 2010 AADT was collected by ADOT&PF and the 2017, 2022, 2027 and 2037 AADTs were estimated by applying a 1.34% average annual growth rate to the 2010 AADTs. The growth rate was derived from information obtained from ADOT&PF's permanent traffic recorders in the area.

Table 1 – AADTs for Kenai Spur Highway

Segment	Annual Average Daily Traffic				
	2010	2017	2022	2027	2037
Sports Lake Road to Beaver Loop Road	11,500	12,600	13,500	14,400	16,450
Beaver Loop Road to Swires Road	9,449	10,350	11,100	11,850	13,550

Table 2 presents the Average Summer Daily Traffic volumes within the study area for Kenai Spur Highway. The Average Summer Daily Traffic volumes were estimated by applying a 110.67% average summer traffic ratio to the AADTs. The average summer traffic ratio was derived from information obtained from ADOT&PF's permanent traffic recorders in the area.

Table 2 – Average Summer Daily Traffic Volumes for Kenai Spur Highway

Segment	Summer Average Daily Traffic				
	2010	2017	2022	2027	2037
Sports Lake Road to Beaver Loop Road	12,727	13,944	14,940	15,936	18,205
Beaver Loop Road to Swires Road	10,457	11,454	12,284	13,114	14,996

Segment Level of Service Analysis

Kenai Spur Highway was reviewed for capacity for current and projected (year 2017, 2022, 2027 and 2037) traffic volumes based on the average daily level of service thresholds. Table 3 shows the daily level-of-service thresholds for arterials with 0.00 to 1.99 signalized intersections per mile.

Table 3 – LOS Criteria for Arterials with 0.00 to 1.99 Signalized Intersections per mile

Lanes	Divided	Level of Service Criteria for Arterial with 0.00 to 1.99 signalized Intersections per mile					
		A	B	C	D	E	F
2	Undivided	--	≤ 4,000	4,001 – 13,100	13,101 – 15,500	15,501 – 16,300	≥ 16,301
4	Undivided	≤ 4,600	4,601 – 27,900	27,901 – 32,800	32,801 – 34,200	≥ 34,201	--
4	Divided	≤ 4,600	4,601 – 27,900	27,901 – 32,800	32,801 – 34,200	≥ 34,201	--
6	Divided	≤ 6,900	6,901 – 42,800	42,801 – 49,300	49,300 – 51,400	≥ 51,401	--

Tables 4 & 5 present the current and projected (year 2017, 2022, 2027 and 2037) segment levels of service results for Kenai Spur Highway within the study area.

Table 4 – Roadway Segment Level-of-Service Results for AADT

Kenai Spur Highway – Level of Service Results for AADTs						
Roadway	Lane Detail	Average Annual Daily Traffic Volumes				
		2010	2017	2022	2027	2037
Sports Lake Road to Beaver Loop Road		11,500	12,600	13,500	14,400	16,450
	2 Lane Undivided	C	C	C	D	F
	4 Lane Undivided	B	B	B	B	B
	4 Lane Divided	B	B	B	B	B
Beaver Loop Road to Swires Road		9,449	10,350	11,100	11,850	13,550
	2 Lane Undivided	C	C	C	C	D
	4 Lane Undivided	B	B	B	B	B
	4 Lane Divided	B	B	B	B	B

Based on the AADTs, the existing two-lane section between Sports Lake Road and Beaver Loop Road is anticipated to operate at LOS D in 2027 and LOS F for 2037 and the existing two-lane section between Beaver Loop Road and Swires Road is anticipated to operate at LOS C in 2017, 2022, and 2027 and LOS D in 2037.

Table 5 – Roadway Segment Level-of-Service Results for Average Summer Daily Traffic

Kenai Spur Highway – Level of Service Results for Average Summer Daily Traffic Volumes						
Roadway	Lane Detail	Average Summer Daily Traffic Volumes				
		2010	2017	2022	2027	2037
Sports Lake Road to Beaver Loop Road		12,727	13,944	14,940	15,936	18,205
	2 Lane Undivided	C	D	D	E	F
	4 Lane Undivided	B	B	B	B	B
	4 Lane Divided	B	B	B	B	B
Beaver Loop Road to Swires Road		10,457	11,454	12,284	13,114	14,996
	2 Lane Undivided	C	C	C	D	D
	4 Lane Undivided	B	B	B	B	B
	4 Lane Divided	B	B	B	B	B

Based on the Average Summer Daily Traffic Volumes, the existing two-lane section between Sports Lake Road and Beaver Loop Road is anticipated to operate at LOS D in 2017 and 2022, LOS E for 2027 and LOS F for 2037 and the existing two-lane section between Beaver Loop Road and Swires Road is anticipated to operate at LOS C in 2017 and 2022; it will decline to LOS D in 2027 and 2037.

With the improvements between Sports Lake Road and Beaver Loop Road (from two-lane undivided to four-lane) this entire project is anticipated to operate at LOS B, an acceptable level of service for all scenarios through the design year, 2037.

Peak Hour Turning Movements

The existing AM and PM peak hour turning movement volumes at major intersections were obtained from traffic counts taken in May, 2013. Figures 1 & 2 show the 2013 AM and PM peak hour traffic volumes at major intersections.

The 2017, 2022, 2027 and 2037 turning movement volumes were estimated by applying a 1.34% average annual growth rate to the 2013 turning movement volumes. The growth rate was derived from information obtained from ADOT&PF's permanent traffic recorders in the area. Figures 3, 4, 5, 6, 7, 8, 9 and 10 show the estimated 2017, 2022, 2027 and 2037 AM and PM peak hour traffic volumes at major intersections.

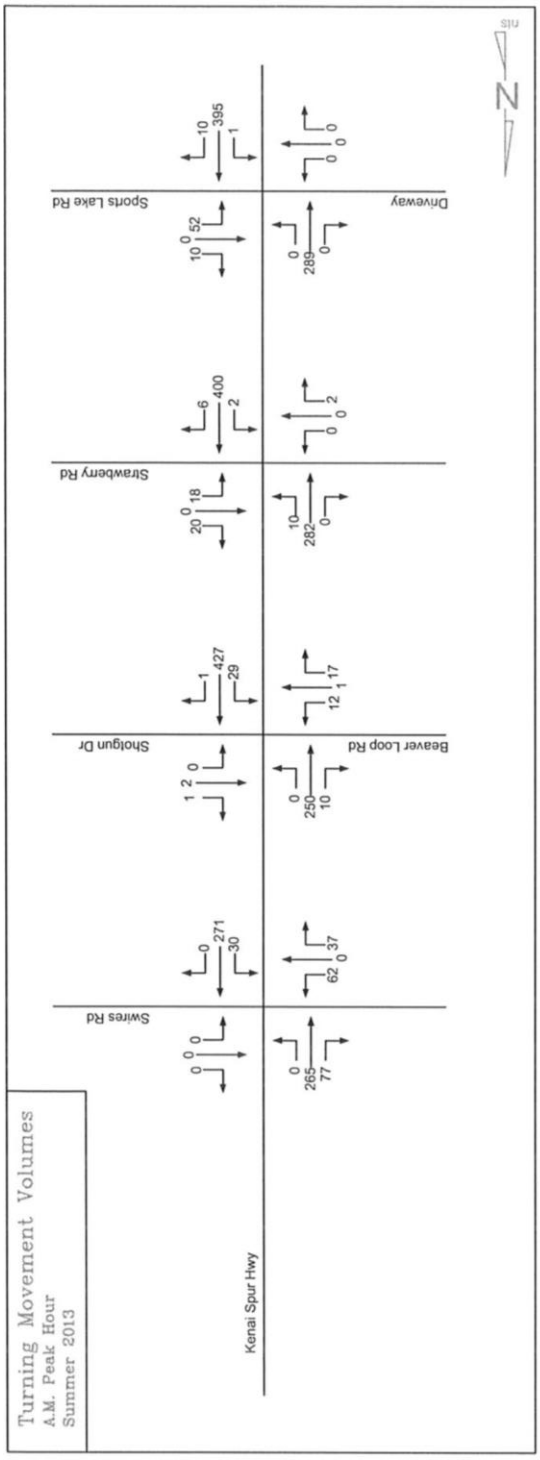

Figure 1 - 2013 AM Peak Hour Estimated Turning Movement Volumes

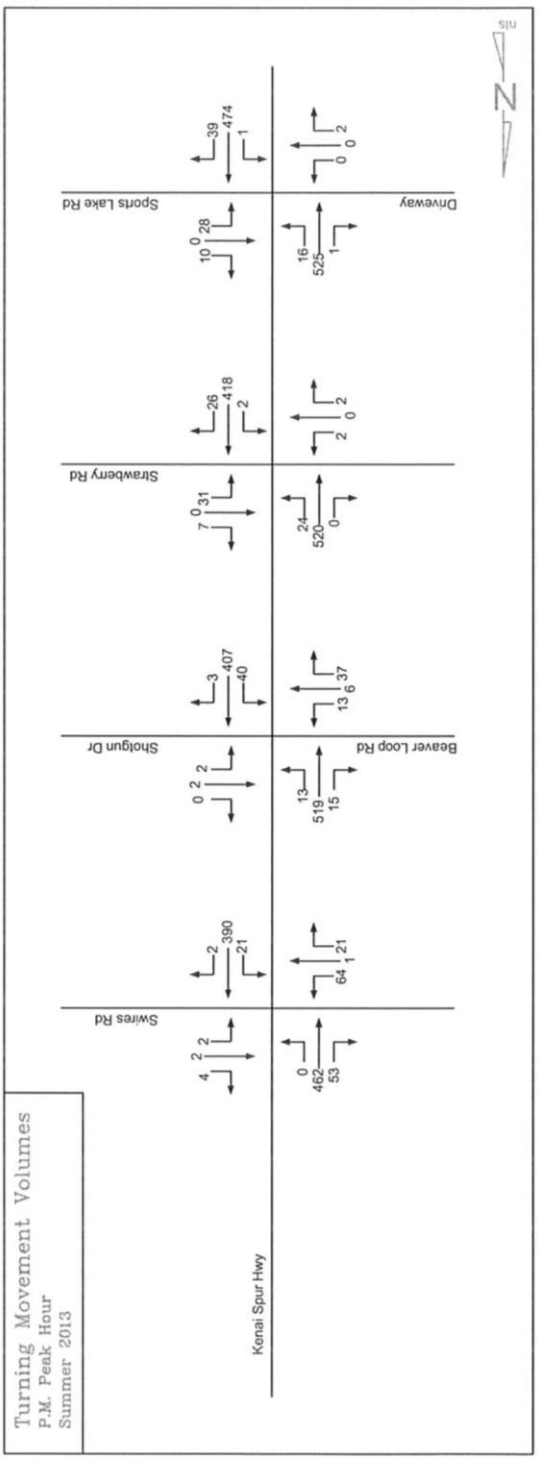

Figure 2 - 2013 PM Peak Hour Estimated Turning Movement Volumes

Figures 1 & 2, 2013 Peak Hour Estimated Turning Movement Volumes

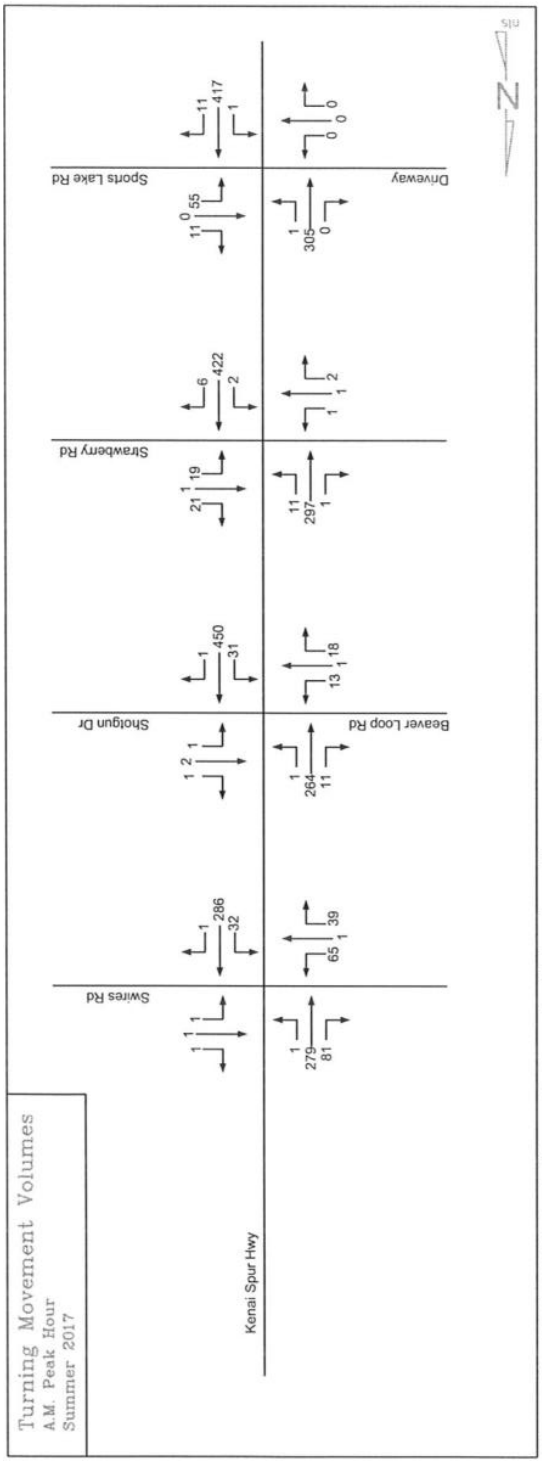

Figure 3 - 2017 AM Peak Hour Estimated Turning Movement Volumes

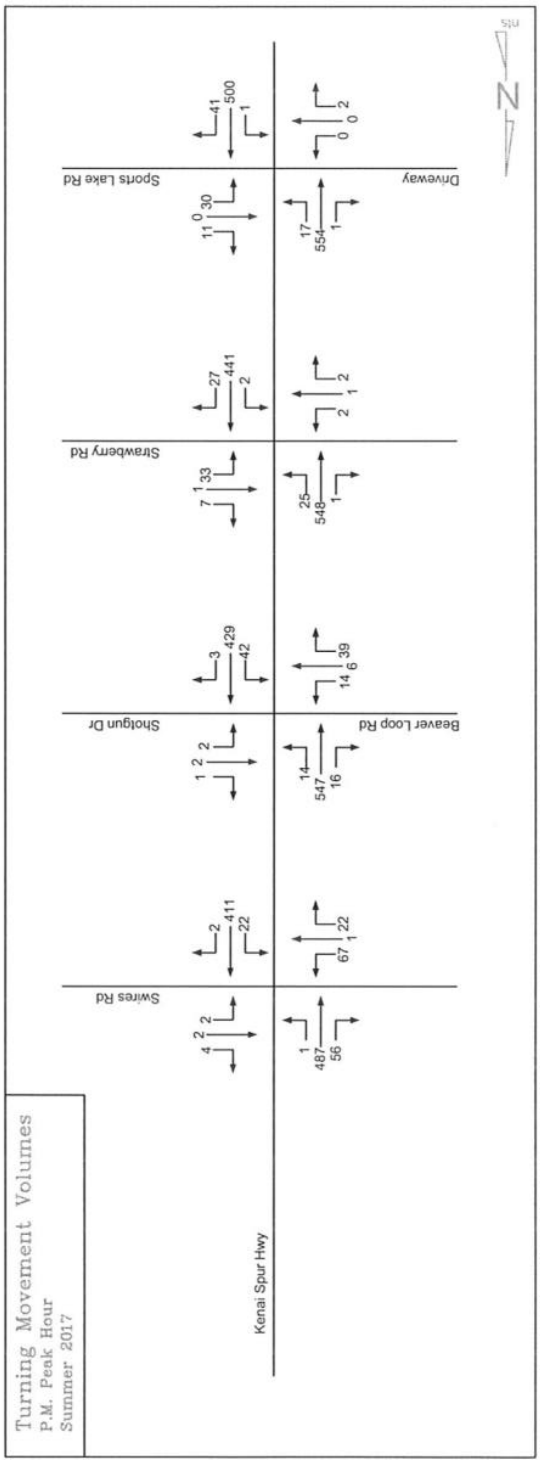

Figure 4 - 2017 PM Peak Hour Estimated Turning Movement Volumes

Figures 3 & 4, 2017 Peak Hour Estimated Turning Movement Volumes

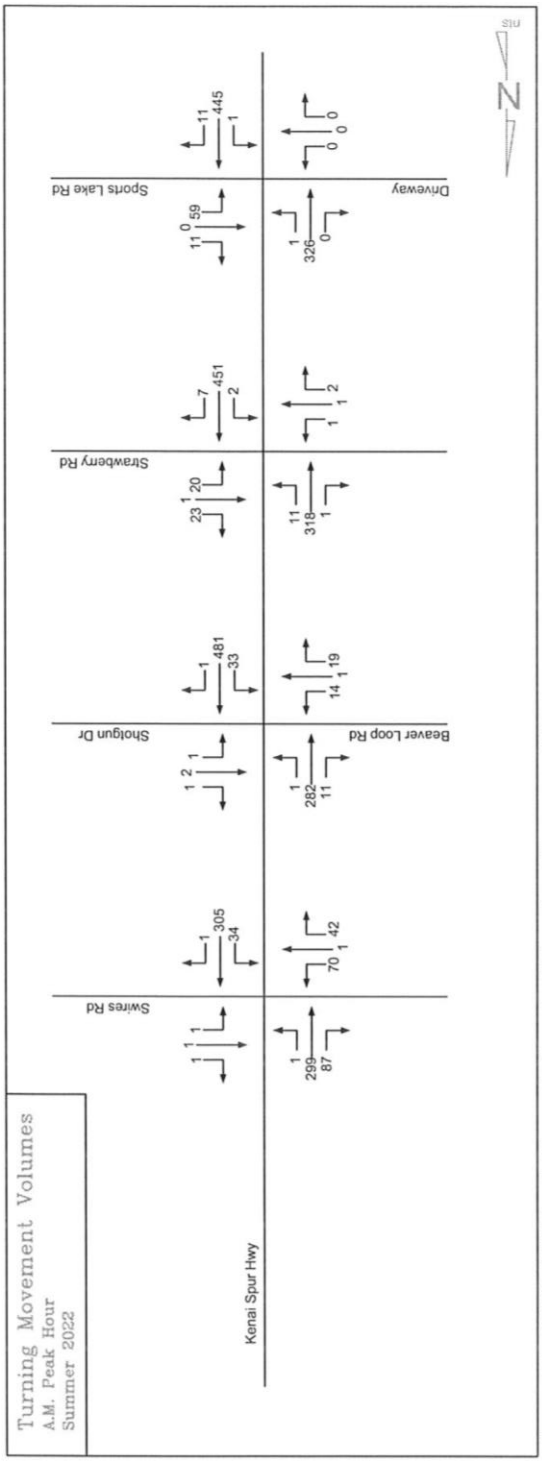

Figure 5 - 2022 AM Peak Hour Estimated Turning Movement Volumes

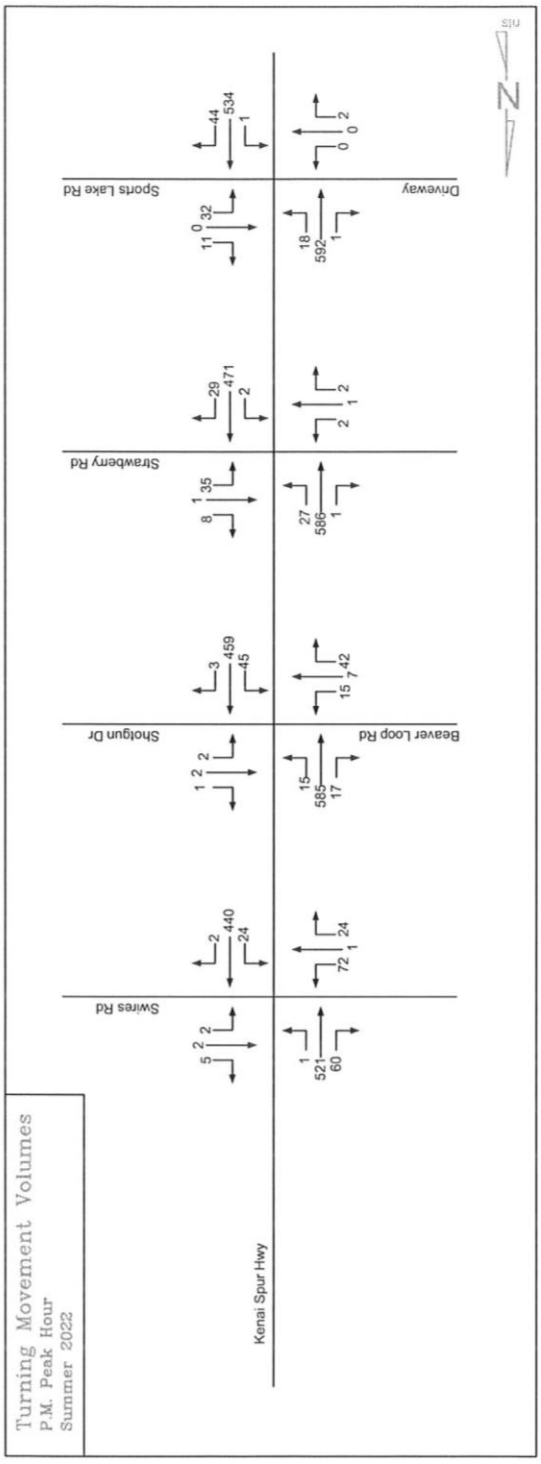

Figure 6 - 2022 PM Peak Hour Estimated Turning Movement Volumes

Figures 5 & 6, 2022 Peak Hour Estimated Turning Movement Volumes

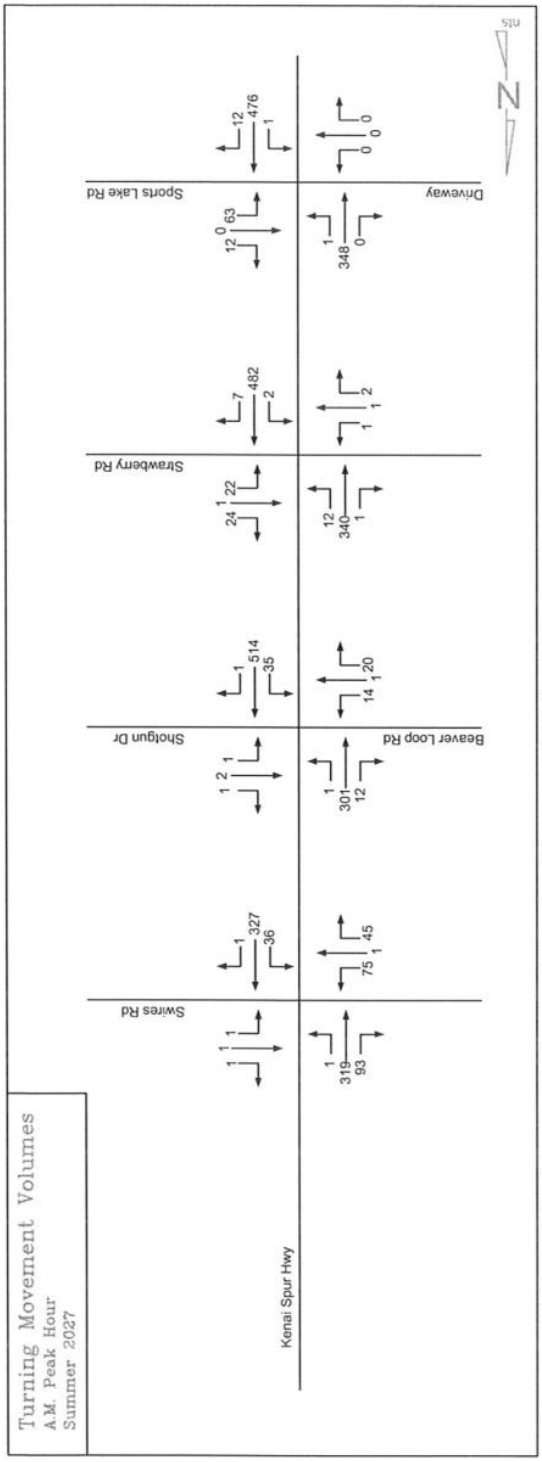

Figure 7 - 2027 AM Peak Hour Estimated Turning Movement Volumes

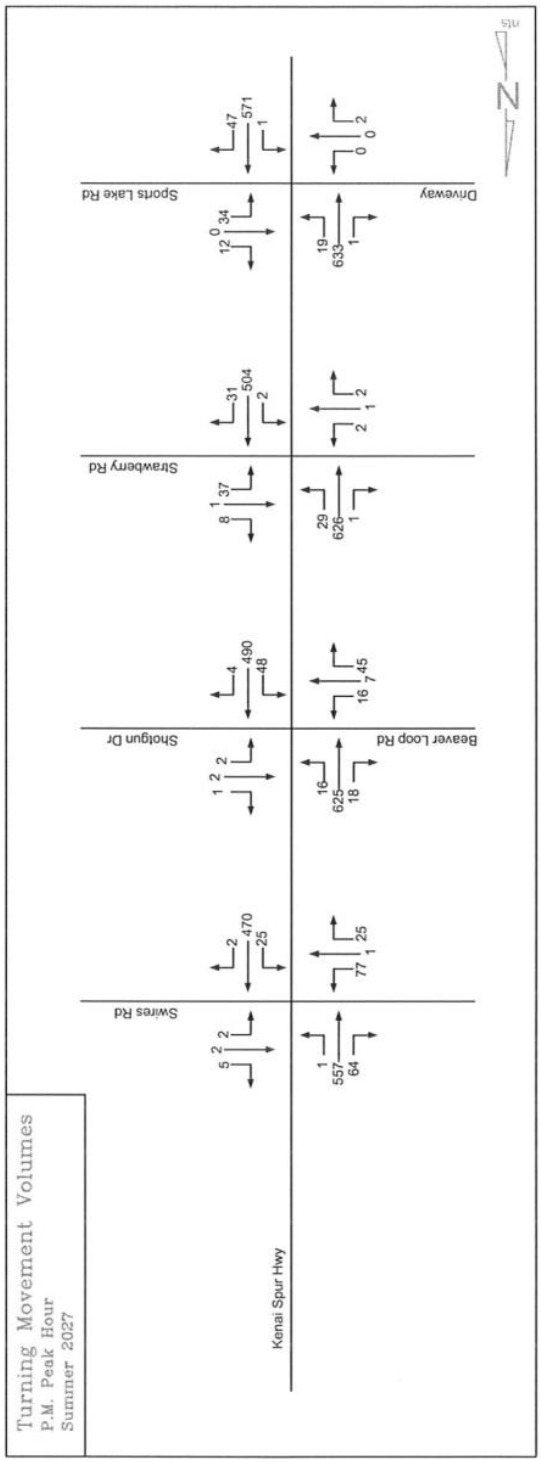

Figure 8 - 2027 PM Peak Hour Estimated Turning Movement Volumes

Figures 7 & 8, 2027 Peak Hour Estimated Turning Movement Volumes

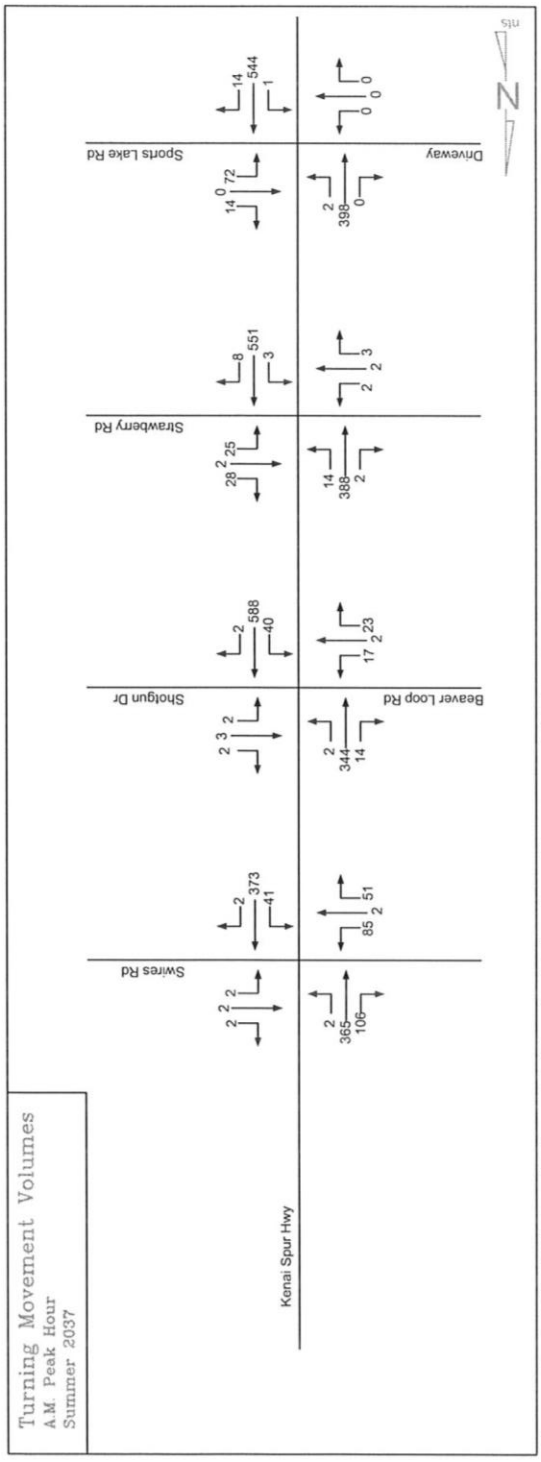

Figure 9 - 2037 AM Peak Hour Estimated Turning Movement Volumes

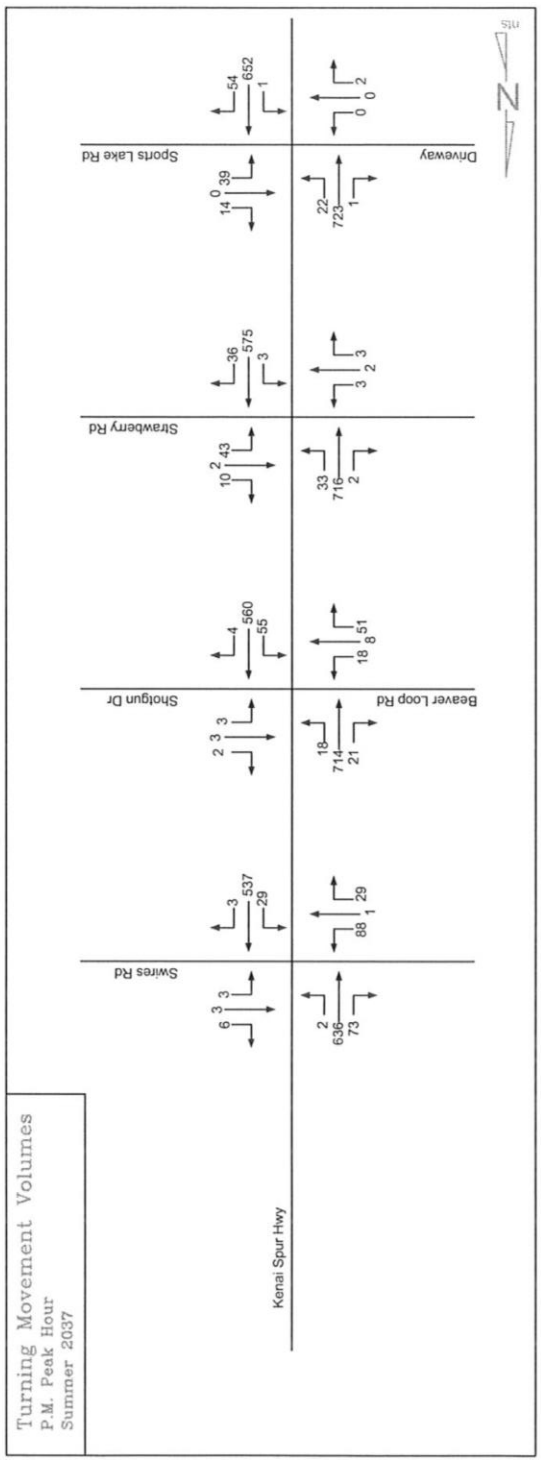

Figure 10 - 2037 PM Peak Hour Estimated Turning Movement Volumes

Figures 9 & 10, 2037 Peak Hour Estimated Turning Movement Volumes

Intersection Level of Service Analysis

The key intersection was analyzed for capacity based on procedures presented in the 2000 *Highway Capacity Manual*, prepared by the Transportation Research Board, for unsignalized intersections.

The result of capacity analysis is a LOS rating for each unsignalized intersection minor movement. LOS is a qualitative measure of traffic operating conditions where a letter grade "A" through "F", corresponding to progressively worsening traffic operation, is assigned to the intersection or movement.

The Highway Capacity Manual defines LOS for stop controlled intersections in terms of computed or measured control delay for each minor movement. LOS is not defined for the intersection as a whole. The unsignalized intersection LOS criteria are shown in Table 6.

Table 6 – Level of Service Criteria for Unsignalized Intersection

LOS CRITERIA FOR UNSIGNALIZED INTERSECTIONS	
Level of Service	**Delay Range (Sec/ Vehicle)**
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Level of Service, Left Turn Lane Warrants, and Signal Warrants are summarized in Tables 7, 8, and 9, following the analysis.

Kenai Spur Highway/Sports Lake Road

The Kenai Spur Highway/Sports Lake Road intersection was analyzed as an unsignalized intersection with stop sign control at the east and west approaches for all scenarios. The intersection critical movements currently operate at LOS C or better during the AM and PM peak hours. For the 2017and 2022 traffic volumes, the intersection critical movements are anticipated to continue to operate at the same LOS during the AM and PM peak hours. For the 2027 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the westbound left/thru/right turn movement which operates at LOS D during the PM peak hour. For the 2037 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the westbound left/thru/right turn movement which operates at LOS E during the PM peak hour. The intersection was analyzed with the existing approach lanes for all scenarios.

ADOT&PF's Central Region Traffic and safety section recently evaluate this intersection's volumes and crashes; and didn't recommend anything.

Peak hour traffic signal warrant #3, per Figure 4C-4 of the *Manual on Uniform Traffic Control Devices, 2003 Edition* (MUTCD), was reviewed for the Kenai Spur Highway/Sports Lake Road intersection to determine if the volume of traffic at this intersection necessitates installing a signal. The peak hour warrant is not met for the existing and year 2037 traffic volumes.

Kenai Spur Highway/Strawberry Road

The Kenai Spur Highway/Strawberry Road intersection was analyzed as an unsignalized intersection with stop sign control at the east and west approaches for all scenarios. The intersection critical movements currently operate at LOS C or better with the exception of the westbound left/thru/right turn movement which operates at LOS D during the PM peak hour. For the 2017 and 2022 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the westbound left/thru/right turn movement which operates at LOS D during the PM peak hour. For the 2027 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the eastbound and westbound left/thru/right turn movements which operate at LOS D/E during the PM peak hour, respectively. For the 2037 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the eastbound and westbound left/thru/right turn movements which operate at LOS D/F during the PM peak hour, respectively. The intersection was analyzed with the existing approach lanes for all scenarios.

Peak hour traffic signal warrant #3, per Figure 4C-4 of the *Manual on Uniform Traffic Control Devices, 2003 Edition* (MUTCD), was reviewed for the Kenai Spur Highway/Strawberry Road intersection to determine if the volume of traffic at this intersection necessitates installing a signal. The peak hour warrant is not met for the existing and year 2037 traffic volumes.

Kenai Spur Highway/Beaver Loop Road

The Kenai Spur Highway/Beaver Loop Road intersection was analyzed as an unsignalized intersection with stop sign control at the east and west approaches for all scenarios. The intersection critical movements currently operate at LOS C or better with the exception of the westbound left/thru/right turn movement which operates at LOS D during the PM peak hour. For the 2017 and 2022 traffic volumes, the intersection critical movements are anticipated to continue to operate at the same LOS during the AM and PM peak hours. For the 2027 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the eastbound and westbound left/thru/right turn movements which operate at LOS D during the PM peak hour. For the 2037 traffic volumes, the intersection critical movements are anticipated to operate at LOS A with the exception of the eastbound and westbound left/thru/right turn movements which operate at LOS D/E during the AM and PM

peak hour, respectively. The intersection was analyzed with the existing approach lanes for all scenarios.

Peak hour traffic signal warrant #3, per Figure 4C-4 of the *Manual on Uniform Traffic Control Devices, 2003 Edition* (MUTCD), was reviewed for the Kenai Spur Highway/Beaver Loop Road intersection to determine if the volume of traffic at this intersection necessitates installing a signal. The peak hour warrant is not met for the existing traffic volumes. However, the warrant is met for the year 2037 traffic volumes.

Kenai Spur Highway/Swires Road

The Kenai Spur Highway/Swires Road intersection was analyzed as an unsignalized intersection with stop sign control at the east and west approaches for all scenarios. The intersection critical movements currently operate at LOS C or better during the AM and PM peak hours. For the 2017 and 2022 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the eastbound left turn movement which operates at LOS D during the PM peak hour. For the 2027 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the eastbound left turn movement which operates at LOS E during the PM peak hour. For the 2037 traffic volumes, the intersection critical movements are anticipated to operate at LOS C or better with the exception of the eastbound left turn movement which operates at LOS D/F during the AM and PM peak hours, respectively. The intersection was analyzed with the existing approach lanes for all scenarios.

Peak hour traffic signal warrant #3, per Figure 4C-4 of the *Manual on Uniform Traffic Control Devices, 2003 Edition* (MUTCD), was reviewed for the Kenai Spur Highway/Swires Road intersection to determine if the volume of traffic at this intersection necessitates installing a signal. The peak hour warrant is not met for the existing traffic volumes. However, the warrant is met for the year 2037 traffic volumes.

Table 7 – Level of Service Results

UNSIGNALIZED INTERSECTION LEVEL OF SERVICE AND DELAY RESULTS										
Intersection	**2013**		**2017**		**2022**		**2027**		**2037**	
	AM	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**	**AM**	**PM**
Kenai Spur Highway/Sports Lake Road										
Eastbound Left/Thru/Right	A 0.0	B 10.1	A 0.0	B 10.2	A 0.0	B 10.4	A 0.0	B 10.6	A 0.0	B 11.0
Westbound Left/Thru/Right	C 15.1	C 19.4	C 15.9	C 20.8	C 17.1	C 23.3	C 18.5	D 26.2	C 22.8	E 35.9
Northbound Left	A 7.9	A 8.6	A 7.9	A 8.7	A 8.0	A 8.9	A 8.1	A 9.0	A 8.2	A 9.4
Southbound Left	A 0.0	A 8.6	A 8.3	A 8.8	A 8.4	A 8.9	A 8.5	A 9.1	A 8.7	A 9.4
Kenai Spur Highway/Strawberry Road										
Eastbound Left/Thru/Right	A 9.9	C 18.7	B 13.8	C 21.0	B 14.5	C 23.0	C 15.2	D 25.4	C 18.4	D 33.6
Westbound Left/Thru/Right	B 14.4	D 26.3	C 15.2	D 29.8	C 16.1	D 34.6	C 17.4	E 42.0	C 21.1	F 74.3
Northbound Left/Thru/Right	A 0.1	A 0.1	A 0.1	A 0.1	A 0.1	A 0.1	A 0.1	A 0.1	A 0.1	A 0.1
Southbound Left/Thru/Right	A 0.4	A 0.7	A 0.4	A 0.7	A 0.4	A 0.8	A 0.4	A 0.8	A 0.5	A 1.0
Kenai Spur Highway/Beaver Loop Road										
Eastbound Left/Thru/Right	C 15.9	C 18.7	C 16.9	C 20.2	C 18.4	C 22.8	C 19.8	D 26.0	D 26.6	E 38.0
Westbound Left/Thru/Right	C 17.2	D 26.6	C 19.6	D 25.4	C 21.2	D 28.5	C 23.0	D 32.3	D 28.6	E 42.9
Northbound Left/Thru/Right	A 0.9	A 1.2	A 0.9	A 1.3	A 1.0	A 1.4	A 1.0	A 1.5	A 1.2	A 1.8
Southbound Left/Thru/Right	A 0.0	A 0.3	A 0.0	A 0.4	A 0.0	A 0.4	A 0.0	A 0.4	A 0.1	A 0.5
Kenai Spur Highway/Swires Road										
Eastbound Left	C 17.4	C 23.8	C 18.8	D 26.3	C 20.7	D 30.9	C 23.1	E 37.0	D 31.6	F 51.4
Eastbound Thru/Right	A 9.8	B 10.8	B 10.1	B 10.9	B 10.3	B 11.2	B 10.5	B 11.5	B 11.2	B 12.1
Westbound Left/Thru/Right	A 0.0	B 14.9	B 14.7	C 15.5	C 15.4	C 15.8	C 16.3	C 16.9	C 18.9	C 21.3
Northbound Left	A 8.3	A 8.7	A 8.4	A 8.8	A 8.5	A 9.0	A 8.6	A 9.1	A 8.8	A 9.5
Southbound Left	A 0.0	A 0.0	A 8.0	A 8.3	A 8.1	A 8.4	A 8.1	A 8.5	A 8.3	A 8.7

Table 8 - Left Turn Lane Warrants

Intersection	Approach	Already has a left turn Lane ?	Meet Left Turn Warrant	Recommendations
Kenai Spur Highway/ Sports Lake Road	North	Yes 300' Total	--	100'storage + 580' deceleration length + 660'Taper
	South	Yes TWLTL	--	--
Kenai Spur Highway/ Strawberry Road	North	No	Yes	100'storage + 580' deceleration length + 660'Taper
	South	No	No	--
Kenai Spur Highway/Beaver Loop Road	North	No	No	
	South	No	Yes	125'storage + 580' deceleration length + 660'Taper
Kenai Spur Highway/Swires Road	North	Yes 225' Total (part of TWLTL)	--	--
	South	Yes 225' Total (part of TWLTL)	--	--

Table 9 - Signal Warrants

Intersection	Meet Signal Warrant 2013	Meet Signal Warrant 2017	Meet Signal Warrant 2027	Meet Signal Warrant 2037
Kenai Spur Highway/ Sports Lake Road	No	No	No	No
Kenai Spur Highway/ Strawberry Road	No	No	No	No
Kenai Spur Highway/Beaver Loop Road	No	No	No	2034
Kenai Spur Highway/Swires Road	No	No	No	2029

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Kenai Spur Highway Intersection Crash #'s 2005-2009

Cross Street (s)	# of "Intersection" Crashes*	Total # of Crashes w/in 200'+
Swallow Dr. (T)	2	3
Silver Salmon Dr.	4	5
Strawberry Rd.	3	5
N. Lupine Dr. (T)	2	5
Togiak St./ N. Dogwood Rd.	7	9
Beaver Loop Rd. /Shotgun Dr.	3	15

*Includes angle, sideswipe, and rear-end crashes

+Total crash # includes moose crashes

HSIP High Accident Location Screening Process Segments, 1/1/2006 - 12/31/2012

Kenai Spur Highway MP 2.8 - 8.1 Draft Reconnaissance Engineering Report

CDS Route Number	CDS Route Name	Mile Pt From	Street From	Mile Pt To	Street To	PDO	Min	Maj	Fat	ADT 5 Yr Avg	Segm Type	Segm Lgth	Mil Veh Miles in Period	Total Accid	Accid Rate	State Aver	Severity Indicator*	Comments
117600	Kenai Spur Highway	2.450	Sports Lake Road	4.549	Strawberry Road	33	14	4	0	10454	5	2.10	40.05	51	1.27	2.00	0.004	HOLD FOR CORRIDOR ANALYSIS
117600	Kenai Spur Highway	4.620	Strawberry Road	5.400	Lupine Drive North	12	3	1	1	10454	5	0.77	14.71	17	1.16	2.00	1.001	HOLD FOR CORRIDOR ANALYSIS. MOOSE-VEH = F. Maj
117600	Kenai Spur Highway	5.490	Lupine Drive North	6.230	Beaver Loop Road	28	8	3	0	10454	5	0.75	14.31	39	2.73	2.00	0.003	2 major injuries involved alcohol. Other-moose, SVROR, aggressive driving
117600	Kenai Spur Highway	6.310	Beaver Loop Road	8.050	Swires Road	38	4	0	1	9223	5	1.74	29.29	43	1.47	2.00	1.000	Moose. Lighting? Signing? Clearing?

* Value enumerates Fatal and Major Injury crashes by the following method: Fatal Crashes times 1plus Major Injuring Crashes times 0.001. Values in column may be used a quick visual assessment of crash data and for sorting crash locations in order by number of Fatal and Major Injuries.

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Comment 2: Change These in The Preferences Window
Comment 3: Select File/Preference in the Main Scree
Comment 4: Then Click the Comments Tab

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Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds			
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07:30	0	0	0	0	0	128	12	0	3	0	6	0	1	50	0	0	200		
07:45	0	1	0	0	0	138	9	0	8	0	2	0	3	83	0	0	244	688	
08:00	1	0	0	0	1	79	2	0	3	0	1	1	3	64	0	0	154	750	PHF=0.77
08:15	0	0	0	0	0	67	5	0	8	0	2	4	1	58	0	1	141	739	
08:30	1	0	0	0	2	70	3	0	8	0	4	1	2	73	0	0	163	702	
08:45	0	0	1	0	0	71	2	0	7	0	2	1	1	78	0	0	162	620	
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Comment 4: Then Click the Comments Tab

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16:30	0	0	0	0	0	92	5	0	11	3	2	4	6	124	2	2	245		
16:45	0	1	1	0	2	97	13	0	6	1	3	2	5	129	6	1	264	958	
17:00	0	1	1	0	1	108	9	0	10	2	4	1	2	140	4	2	282	1026	
17:15	0	0	0	0	0	110	13	0	10	0	4	0	2	126	1	1	266	1057	PHF= 0.94
17:30	2	4	1	0	0	88	5	0	6	0	3	1	5	125	2	0	241	1053	
17:45	0	0	2	0	2	75	7	0	3	0	2	0	1	111	2	1	205	994	
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Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds			
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07:15	0	61	0	0	3	0	14	0	2	97	0	0	0	0	0	0	177		
07:30	0	67	0	0	3	0	11	0	3	112	0	0	0	0	0	0	196		
07:45	0	100	0	0	1	0	13	0	3	89	0	0	0	0	0	0	206		
	0	61	0	0	3	0	14	0	2	97	0	0	0	0	0	0	177	756	PHF=0.92
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Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds			
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16:15	0	113	3	0	2	0	3	0	9	98	0	0	0	0	0	0	228		
16:30	0	120	5	0	3	0	7	0	7	107	0	0	0	0	0	0	249		
16:45	0	146	5	0	3	0	6	0	16	117	0	0	0	0	0	0	293		
17:00	0	139	1	0	1	0	8	0	9	143	0	0	0	0	0	0	301		
	0	120	5	0	3	0	7	0	7	107	0	0	0	0	0	0	249	1092	PHF=0.91
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Comment 3:
Comment 4:

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08:30	0	76	2	0	6	0	4	0	2	60	1	0	1	0	0	0	152
	0	65	3	0	4	0	5	0	1	66	0	0	0	0	0	1	144
	0	76	2	0	6	0	4	0	2	60	1	0	1	0	0	0	152
	0	282	10	0	20	0	18	0	6	252	2	0	2	0	0	2	
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Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
17:30	0	110	8	0	2	0	12	0	8	97	0	0	0	0	0	0	237
17:45	0	107	2	1	1	0	1	0	3	77	1	0	1	0	1	1	194
	0	110	8	0	2	0	12	0	8	97	0	0	0	0	0	0	237
	0	107	2	1	1	0	1	0	3	77	1	0	1	0	1	1	194
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Comment 4:

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08:30	0	0	0	0	0	60	18	0	19	0	22	0	45	65	0	0	229
08:45	0	0	0	0	0	72	3	0	8	0	22	0	6	69	0	0	180
	0	0	0	0	0	80	3	1	5	0	5	0	6	69	0	1	168
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17:45	0	0	0	0	0	76	1	1	2	0	1	0	2	111	1	0	194

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Comment 3:
Comment 4:

	SWIRES From North				KENAI SPUR From East				SWIRES From South				KENAI SPUR From West				Total 15 mins	
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds		
15:00	2	1	1	0	1	89	4	0	3	0	5	1	21	127	0	5	254	
15:15	0	0	0	0	0	101	12	0	8	1	25	1	22	114	0	0	283	
15:30	0	0	0	0	0	99	1	0	7	0	29	0	5	94	0	0	235	
	2	1	1	0	1	101	4	0	3	0	5	1	5	127	0	5	250	PHF=0.90
	4	2	2	0	2	390	21	0	21	1	64	3	53	462	0	10	1022	

File Name: Not Named 13
Start Date: 5/7/2013
Start Time: 3:00:00 PM
Site Code: 00000000
Comment 1:
Comment 2: Turning Movement Board 4737 used for this count.
Comment 3:
Comment 4:

	SWIRES From North				KENAI SPUR From East				SWIRES From South				KENAI SPUR From West				Total 15 mins
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
15:00	2	1	1	0	1	92	4	1	2	1	5	3	25	126	0	2	260
15:15	0	0	0	0	0	98	12	1	10	1	30	1	19	112	0	0	282
15:30	0	0	0	0	0	98	2	0	6	0	29	0	5	91	0	0	

File Name: Not Named 16
Start Date: 5/8/2013
Start Time: 7:15:00 AM
Site Code: 00000000
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	KENAI SPUR From North				TOGIAK DOGWOOD From East				KENAI SPUR From South				TOGIAK DOGWOOD From West				Total 15 mins		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds			
07:15	2	52	0	0	1	0	1	0	0	89	0	0	0	0	3	0	148		
07:30	0	53	1	0	2	0	1	0	0	132	0	0	0	0	6	0	195		
07:45	0	91	0	0	2	0	0	0	0	134	0	0	0	0	2	0	229		
	2	52	0	0	1	0	1	0	0	89	0	0	0	0	3	0	148	720	PHF=0.79
	4	248	1	0	6	0	3	0	0	444	0	0	0	0	14	0			

File Name: Not Named 14
Start Date: 5/7/2013
Start Time: 4:15:00 PM
Site Code: 00000000
Comment 1:
Comment 2:
Comment 3:
Comment 4:

	KENAI SPUR From North				TOGIAK DOGWOOD From East				KENAI SPUR From South				TOGIAK DOGWOOD From West				Total 15 mins		
Start Time	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds			
16:15	2	121	1	0	0	1	0	0	0	88	1	0	2	1	3	1	220		
16:30	4	124	1	4	0	0	1	0	0	97	1	3	1	0	3	0	232		
16:45	2	141	1	3	0	0	0	0	0	112	2	2	0	0	2	0	260		
17:00	10	139	2	4	0	0	1	0	0	116	5	0	0	0	0	0	273		
	4	124	1	4	0	0	1	0	0	97	1	3	1	0	3	0	232	997	PHF=0.91
	20	528	5	15	0	0	3	0	0	422	9	8	2	0	8	0			

TABLE 4 – 2

GENERALIZED ANNUAL AVERAGE DAILY VOLUMES FOR FLORIDA'S AREAS TRANSITIONING INTO URBANIZED AREAS OR AREAS OVER 5,000 NOT IN URBANIZED AREAS*

UNINTERRUPTED FLOW HIGHWAYS

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	2,400	8,000	14,900	21,100	26,700
4	Divided	18,600	30,200	43,600	56,500	64,200
6	Divided	27,900	45,200	65,500	84,700	96,200

STATE TWO-WAY ARTERIALS

Class I (>0.00 to 1.99 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	4,000	13,100	15,500	16,300
4	Divided	4,600	27,900	32,800	34,200	***
6	Divided	6,900	42,800	49,300	51,400	***

Class II (2.00 to 4.50 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	10,500	14,500	15,300
4	Divided	**	3,700	24,400	30,600	32,200
6	Divided	**	6,000	38,000	46,100	48,400

Class III (more than 4.5 signalized intersections per mile)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	5,000	11,800	14,600
4	Divided	**	**	11,700	27,200	30,800
6	Divided	**	**	18,400	42,100	46,300

NON-STATE ROADWAYS

Major City/County Roadways

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	7,000	13,600	14,600
4	Divided	**	**	16,400	29,300	30,900
6	Divided	**	**	25,700	44,100	46,400

Other Signalized Roadways
(signalized intersection analysis)

Lanes	Divided	Level of Service A	B	C	D	E
2	Undivided	**	**	4,400	9,400	12,000
4	Divided	**	**	10,300	20,200	24,000

Source: Florida Department of Transportation 05/17/07
Systems Planning Office
605 Suwannee Street, MS 19
Tallahassee, FL 32399-0450
http://www.dot.state.fl.us/planning/systems/sm/los/default.htm

FREEWAYS

Lanes	Level of Service A	B	C	D	E
4	23,500	38,700	52,500	62,200	69,100
6	36,400	59,800	81,100	96,000	106,700
8	49,100	80,900	109,600	129,800	144,400
10	61,800	101,800	138,400	163,800	182,000

BICYCLE MODE

(**Note:** Level of service for the bicycle mode in this table is based on roadway geometrics at 40 mph posted speed and traffic conditions, not number of bicyclists using the facility.) (Multiply motorized vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

Paved Shoulder/ Bicycle Lane Coverage	Level of Service A	B	C	D	E
0-49%	**	1,900	3,300	13,600	>13,600
50-84%	**	2,500	4,000	>4,000	***
85-100%	3,200	7,100	>7,100	***	***

PEDESTRIAN MODE

(**Note:** Level of service for the pedestrian mode in this table is based on roadway geometric at 40 mph posted speed and traffic conditions, not number of pedestrians using the facility.) (Multiply motorized vehicle volumes shown by number of directional roadway lanes to determine two-way maximum service volumes.)

% Sidewalk Coverage	Level of Service A	B	C	D	E
0-49%	**	**	**	6,300	15,400
50-84%	**	**	**	9,800	18,800
85-100%	**	2,200	11,200	>11,200	***

ARTERIAL/NON-STATE ROADWAY ADJUSTMENTS

(alter corresponding volume by the indicated percent)

Lanes	Median	Left Turn Lanes	Adjustment Factors
2	Divided	Yes	+5%
2	Undivided	No	-20%
Multi	Undivided	Yes	-5%
Multi	Undivided	No	-25%

ONE-WAY FACILITIES

Multiply the corresponding two-directional volumes in this table by 0.6.

*Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. Although presented as daily volumes, they actually represent peak hour direction conditions with applicable K and D factors applied. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Level of service letter grade thresholds are probably not comparable across modes and, therefore, cross modal comparisons should be made with caution. Furthermore, combining levels of service of different modes into one overall roadway level of service is not recommended. Calculations are based on planning applications of the Highway Capacity Manual, Bicycle LOS Model, Pedestrian LOS Model and Transit Capacity and Quality of Service Manual, respectively for the automobile/truck, bicycle, pedestrian and bus modes.

**Cannot be achieved using table input value defaults.

***Not applicable for that level of service letter grade. For automobile/truck modes, volumes greater than level of service D become F because intersection capacities have been reached. For bicycle and pedestrian modes, the level of service letter grade (including F) is not achievable, because there is no maximum vehicle volume threshold using table input value defaults.

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APPENDIX D

PRELIMINARY CONCEPT DRAWINGS

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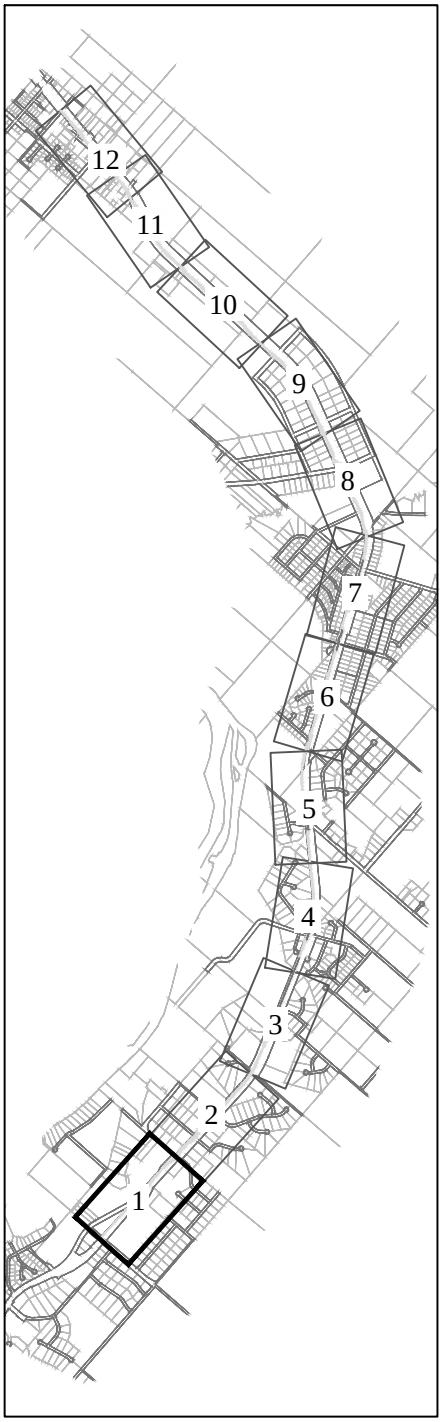
LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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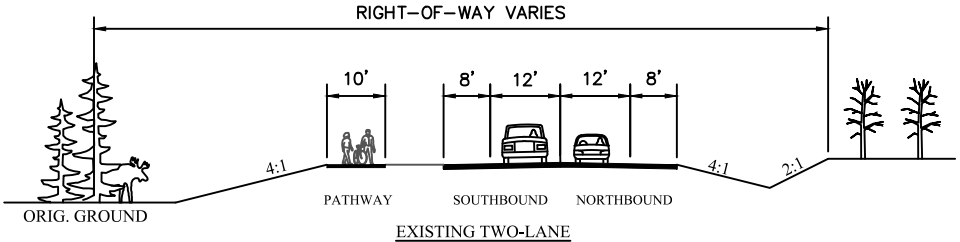


PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

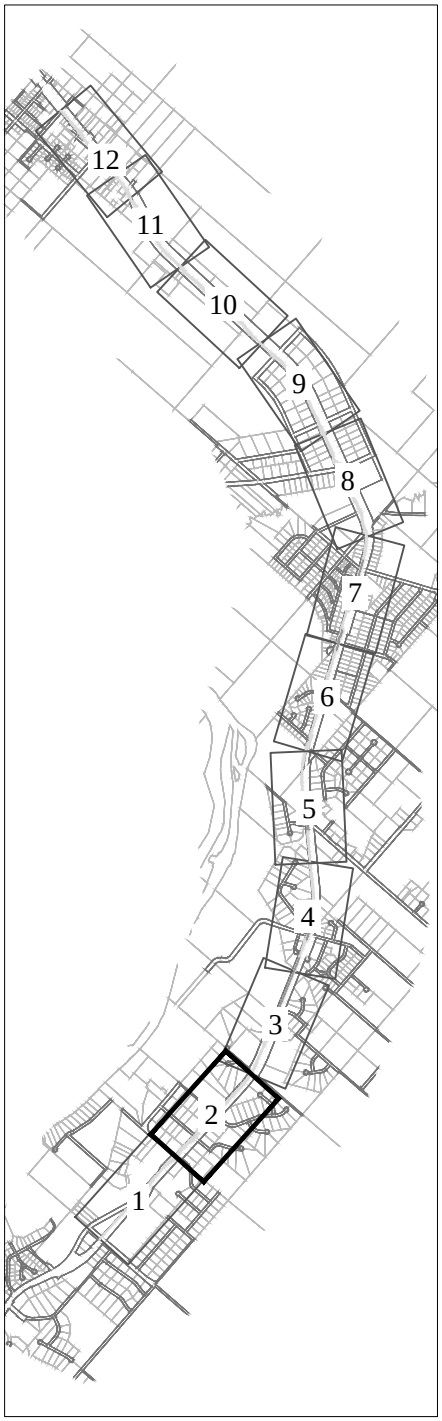
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 1 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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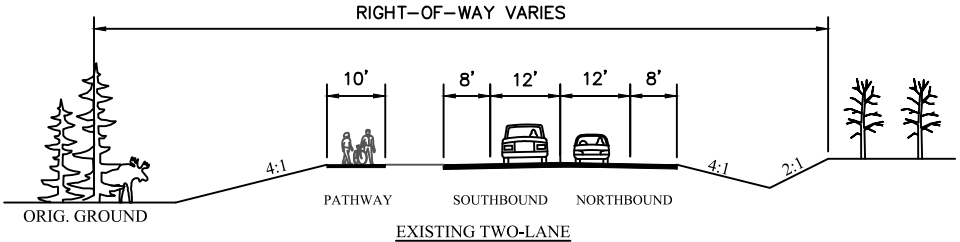


PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

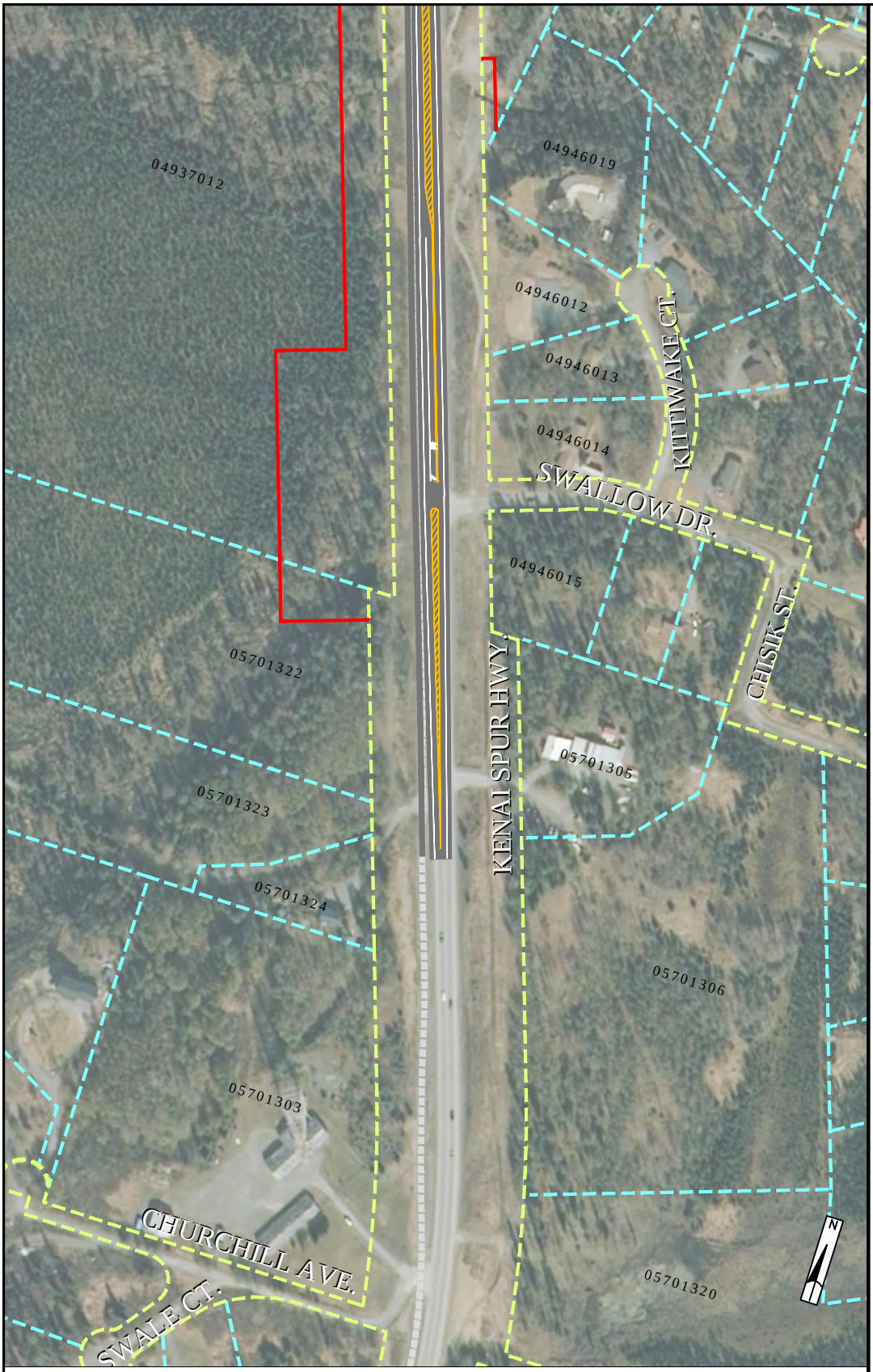
0 150 300 600

SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

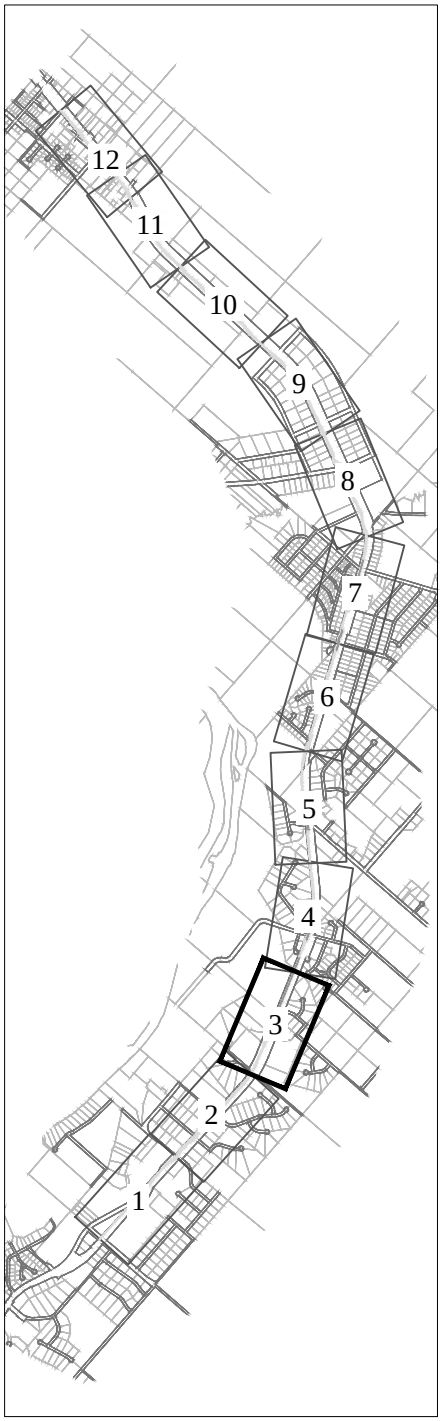
PROJECT# 54594

SHEET 2 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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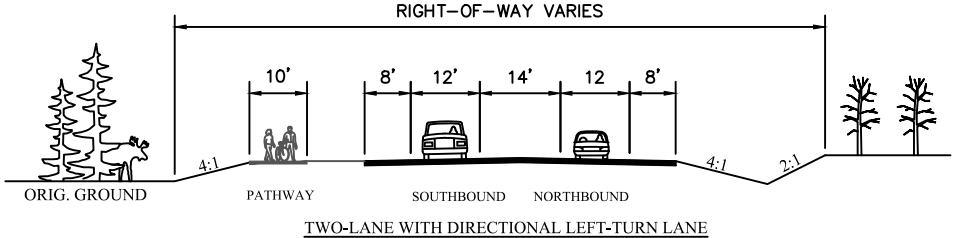


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

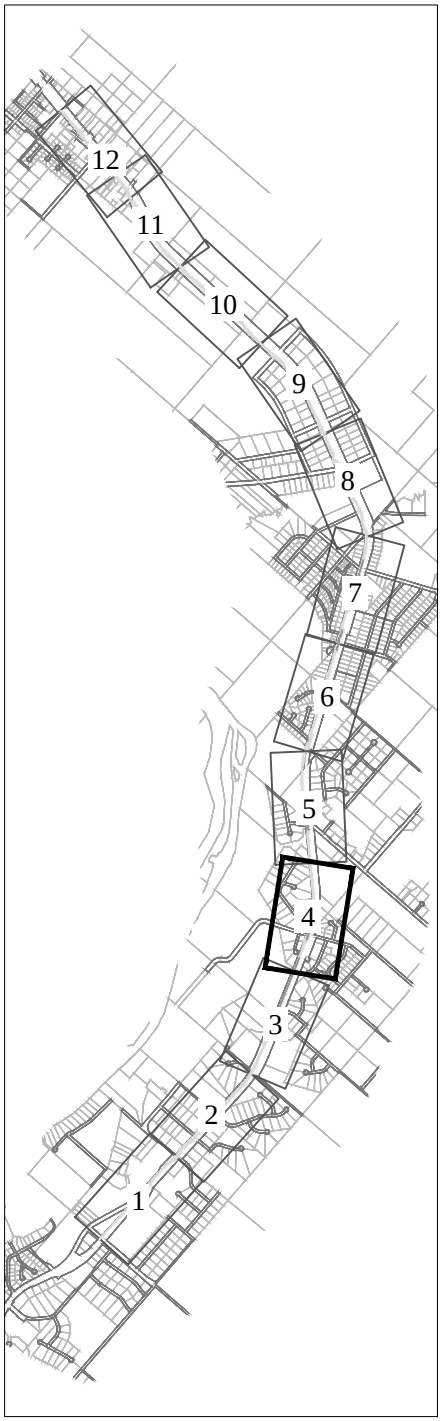
0 150 300 600

SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 3 OF 12

LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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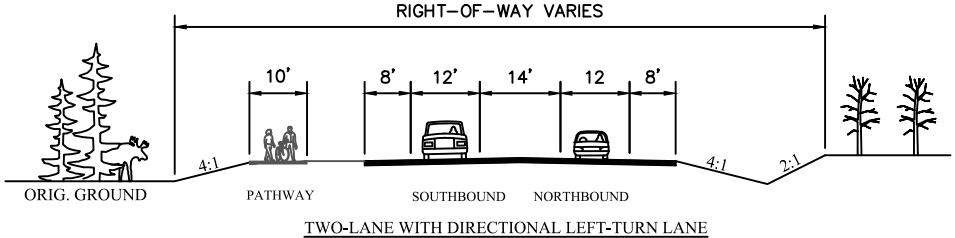
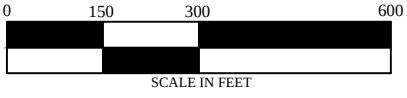


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

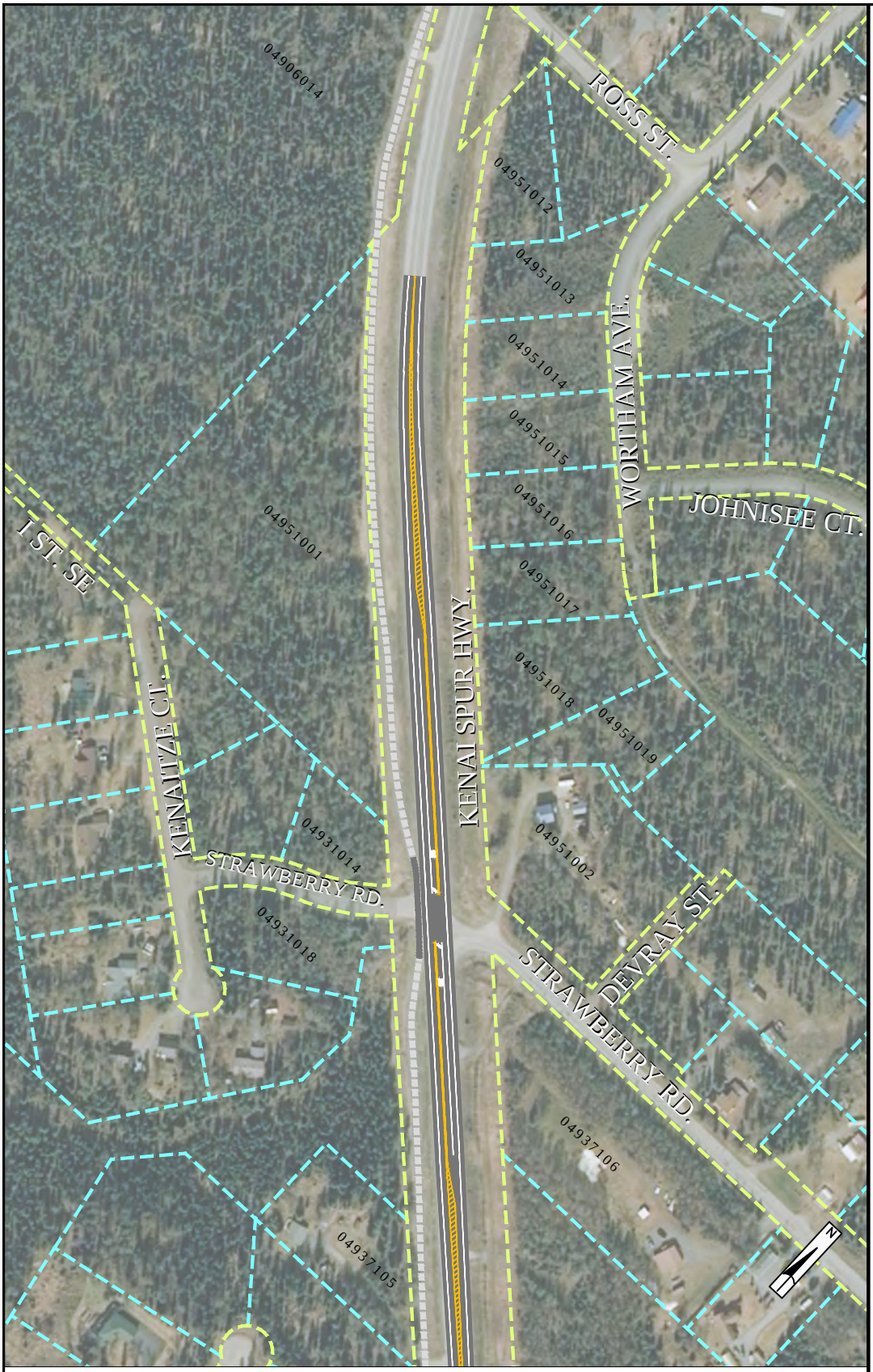
PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.



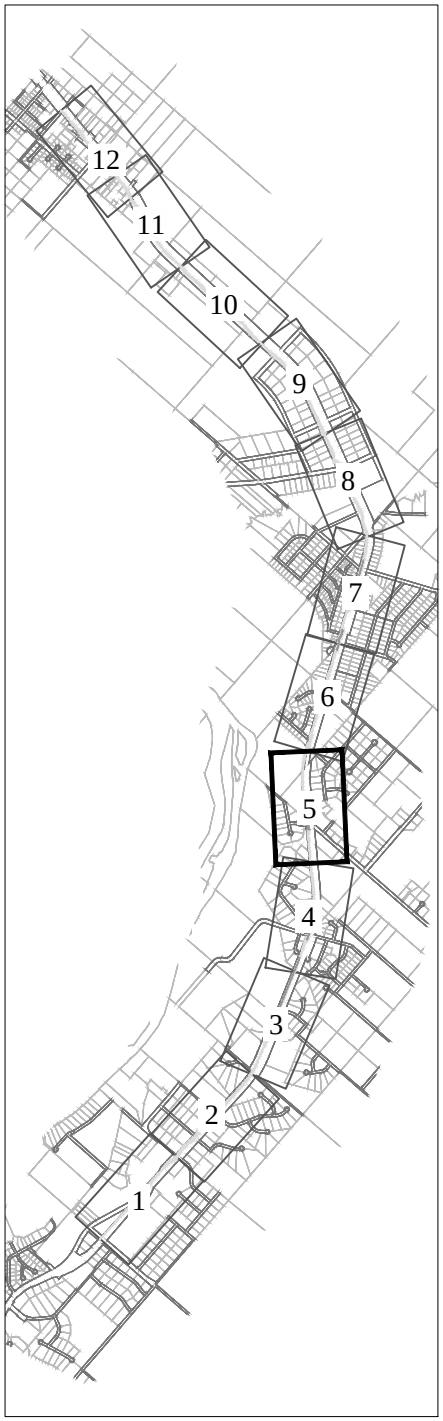
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 4 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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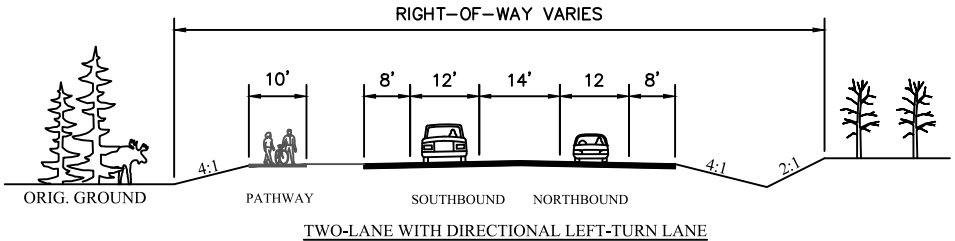


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

PRELIMINARY CONCEPT

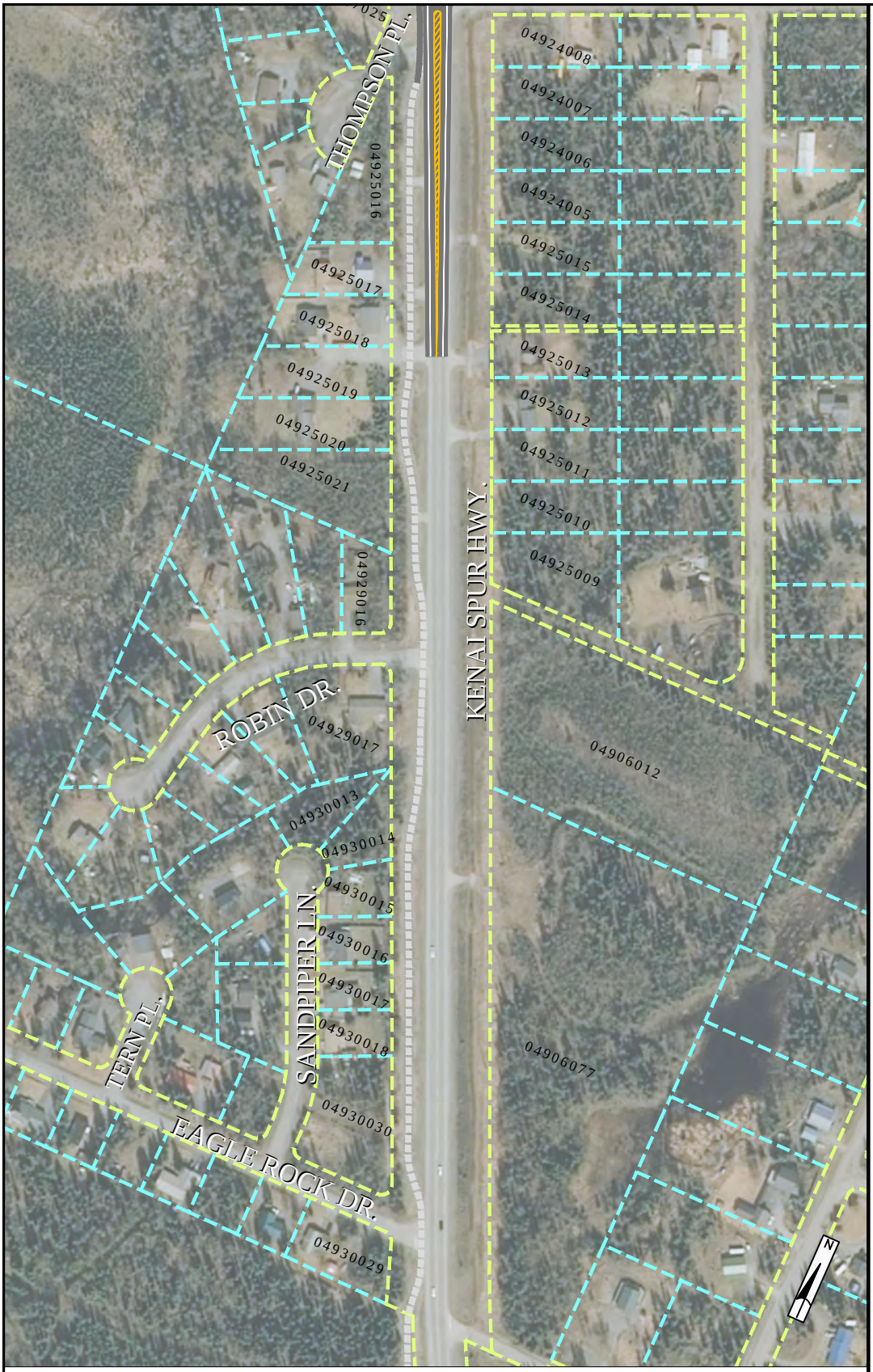
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

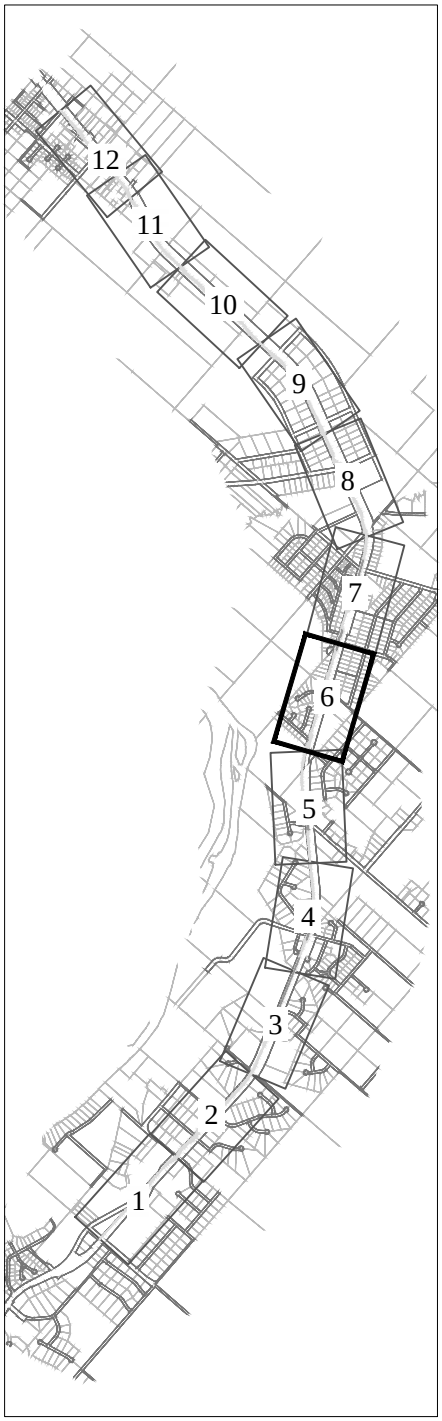
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 5 OF 12



LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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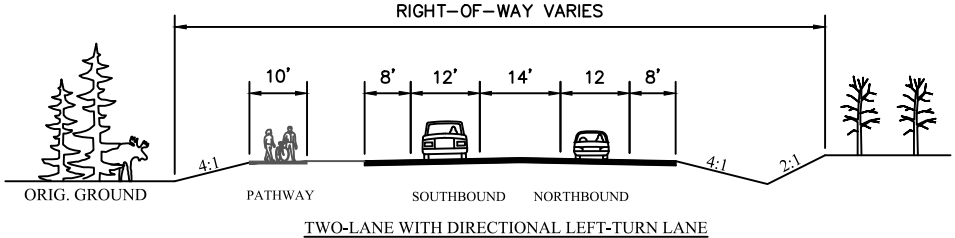


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

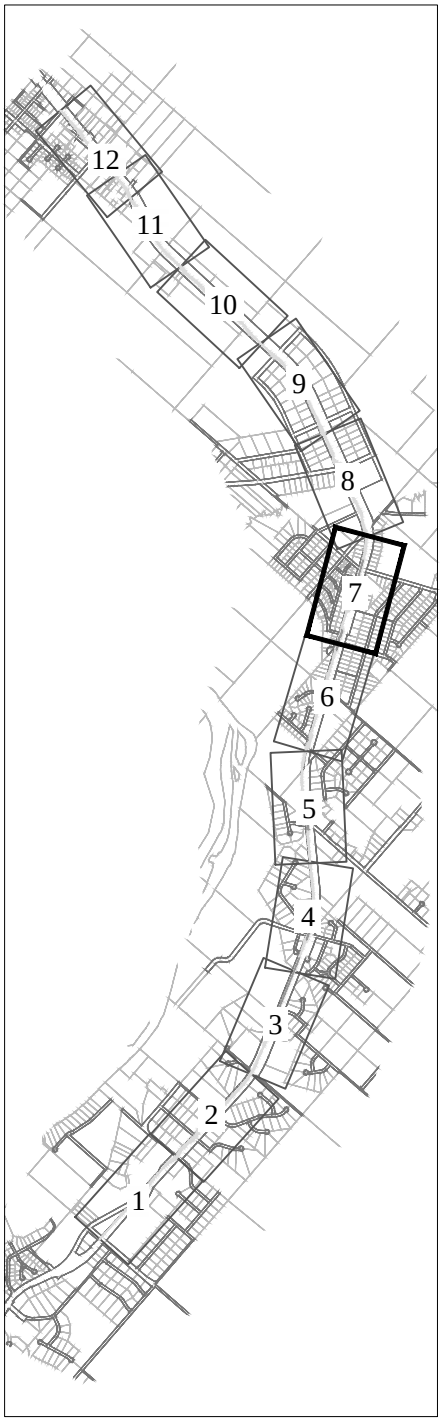
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 6 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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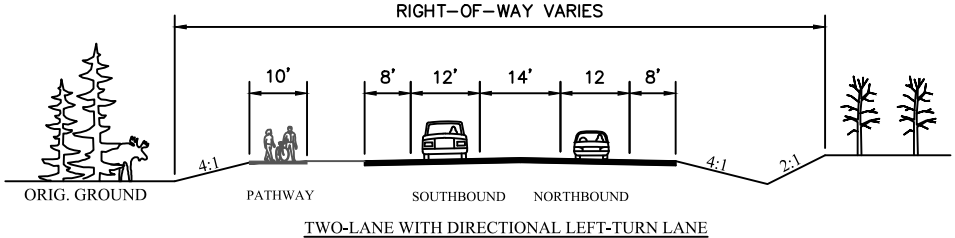


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

PRELIMINARY CONCEPT

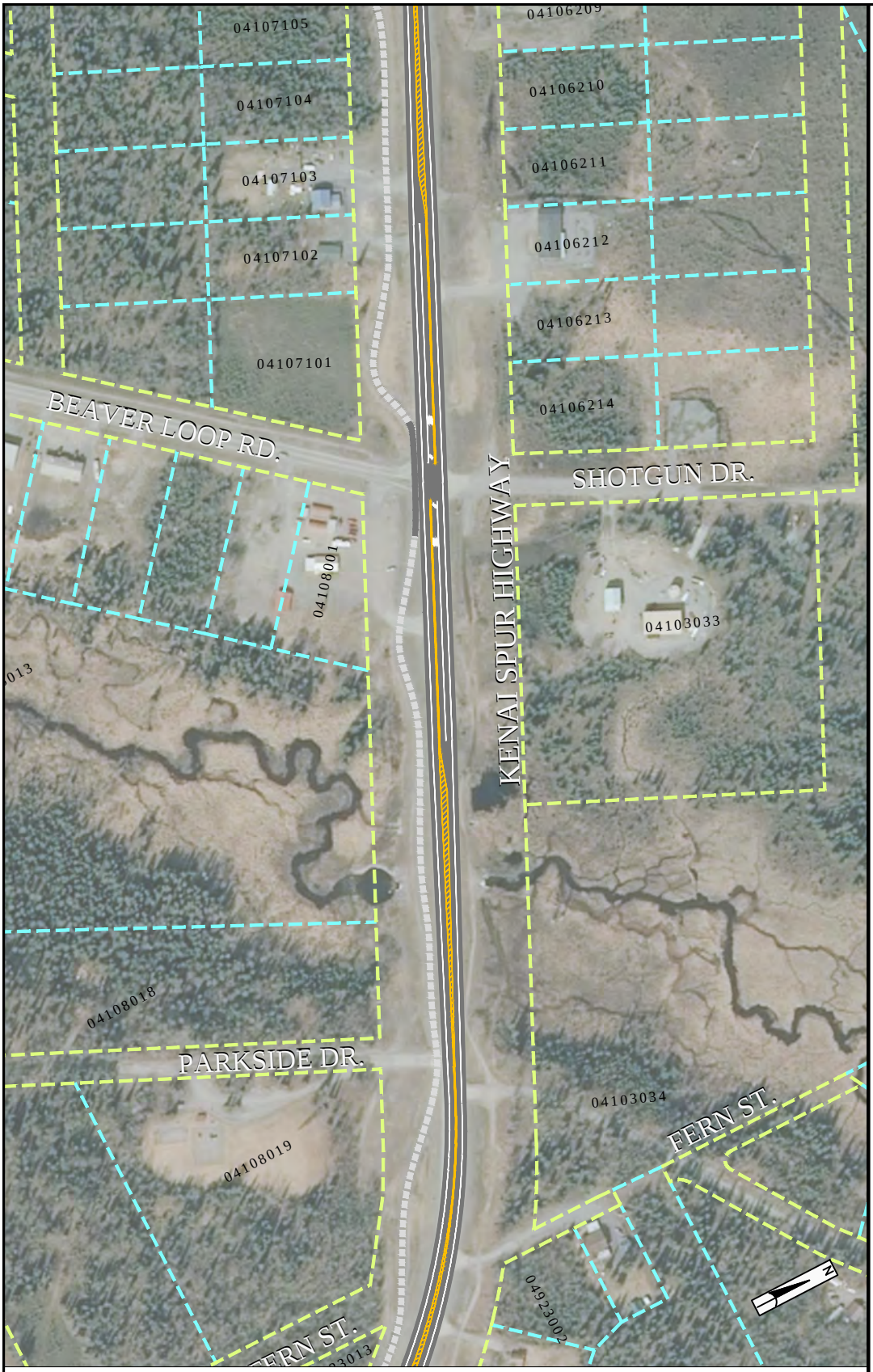
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

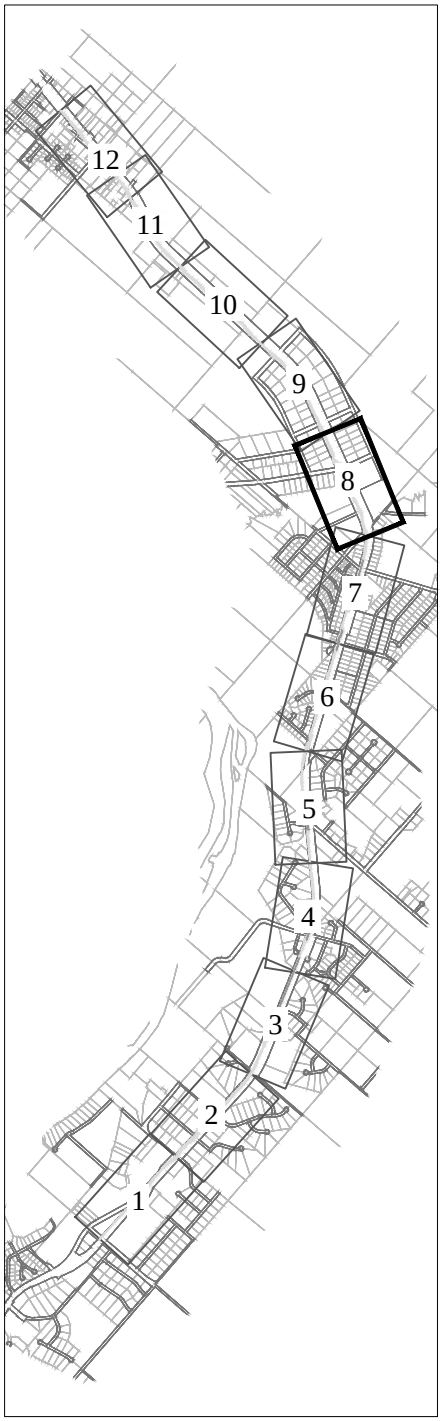
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 7 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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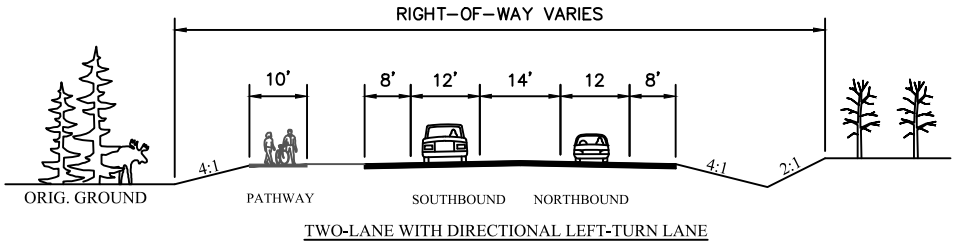


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

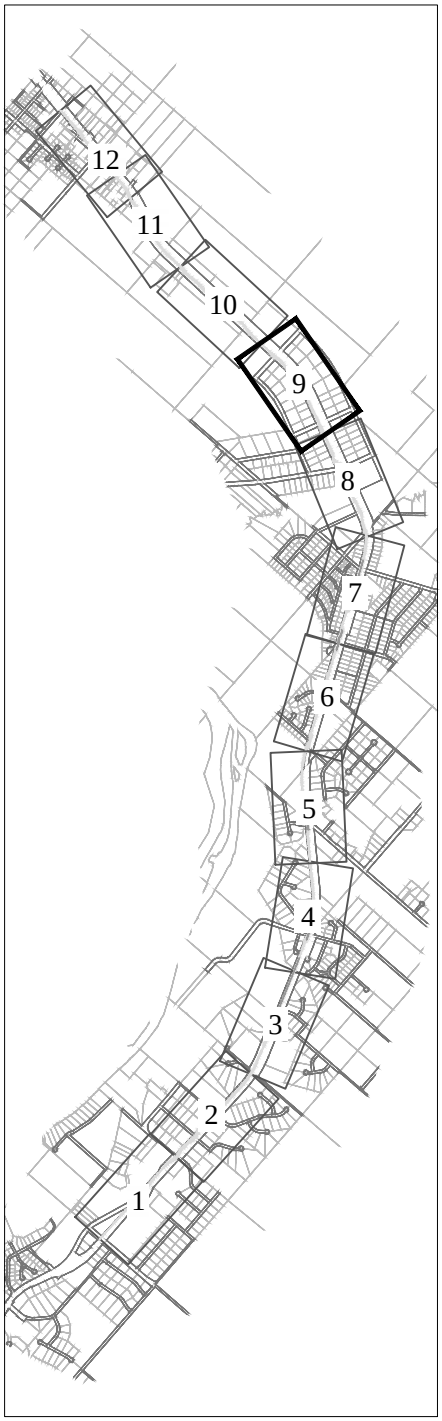
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 8 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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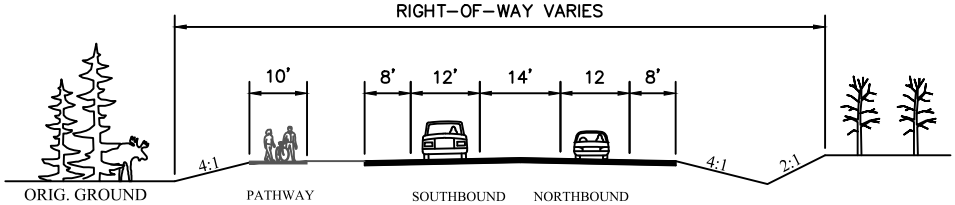


TWO-LANE WITH DIRECTIONAL LEFT-TURN LANE

PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

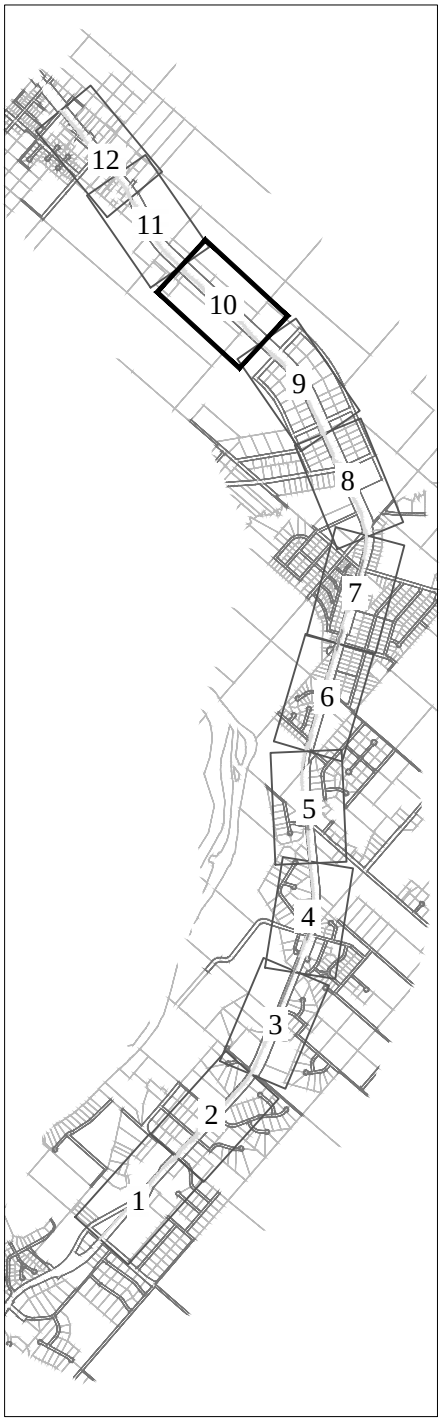
0 150 300 600

SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 9 OF 12

LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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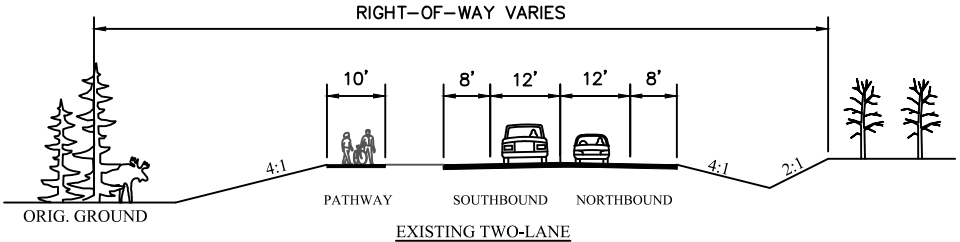


PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

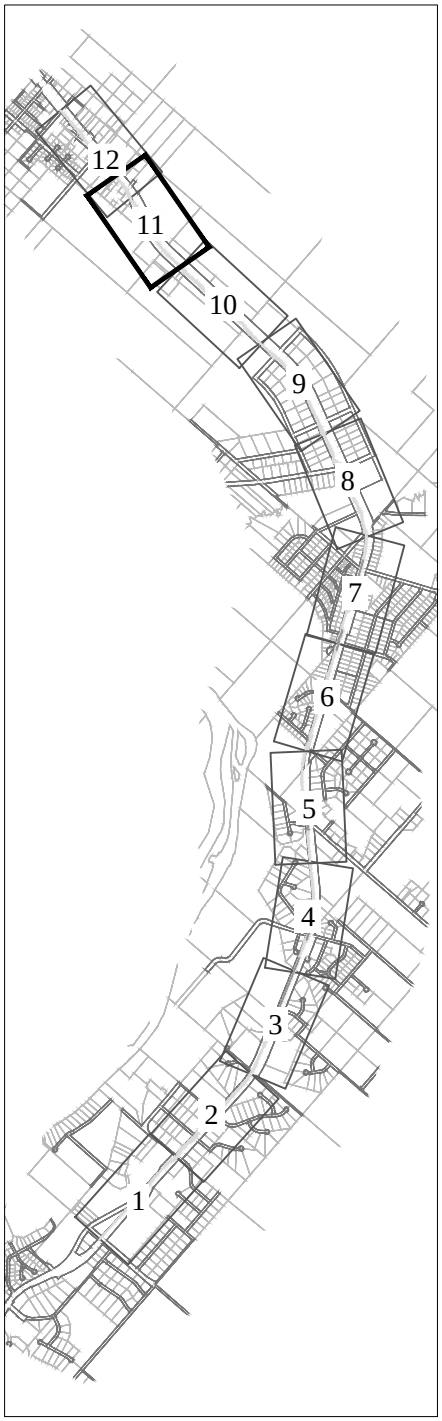
0 150 300 600

SCALE IN FEET

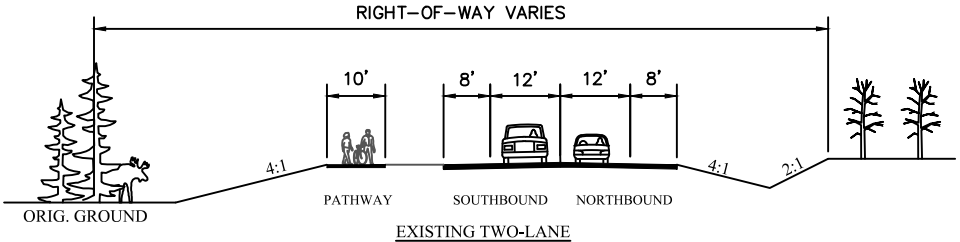
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 10 OF 12

LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



TYPICAL SECTION



PRELIMINARY CONCEPT

THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

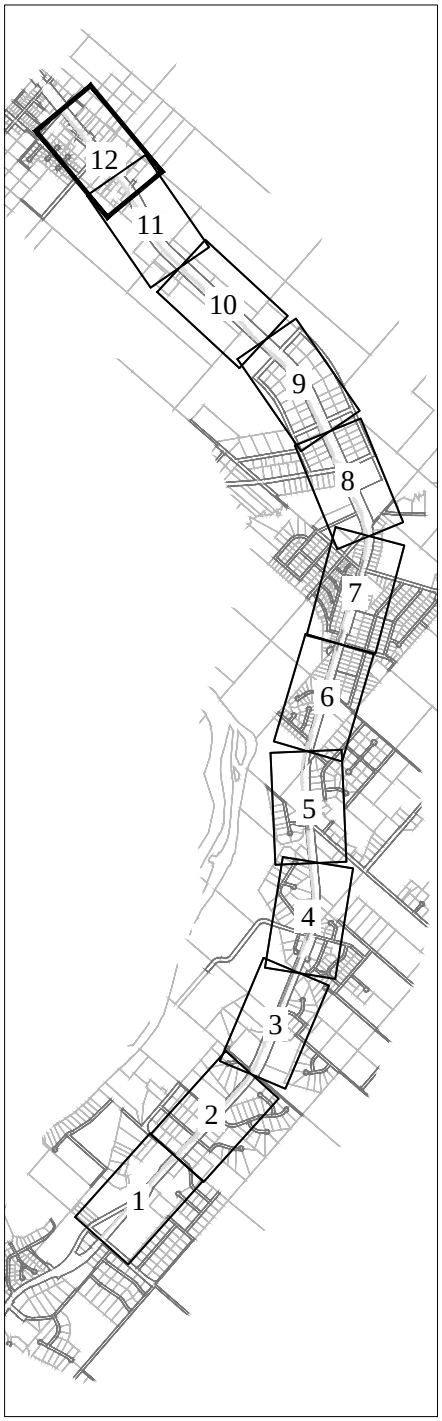
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 11 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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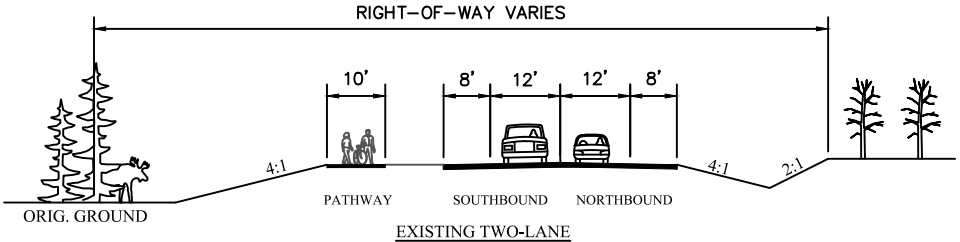

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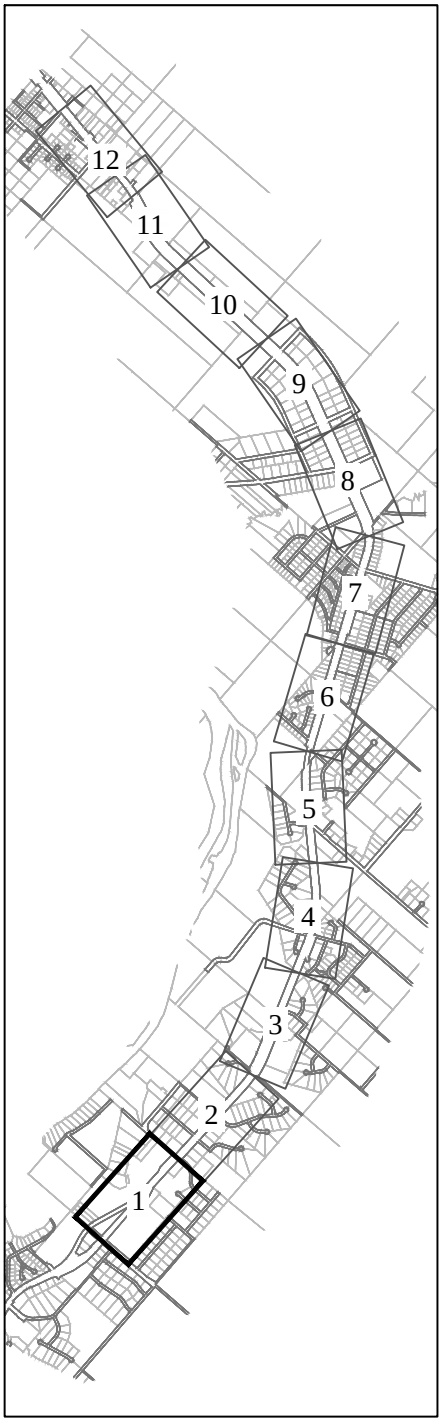
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 1: TURN POCKETS

PROJECT# 54594	SHEET 12 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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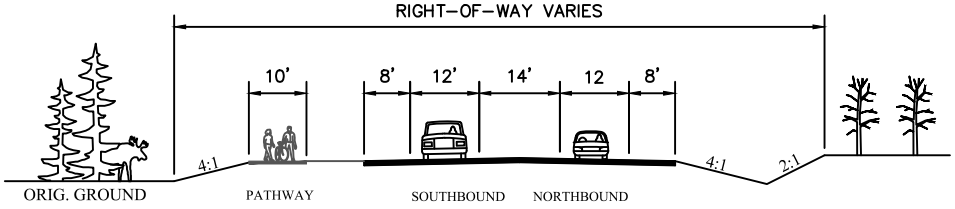

THREE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

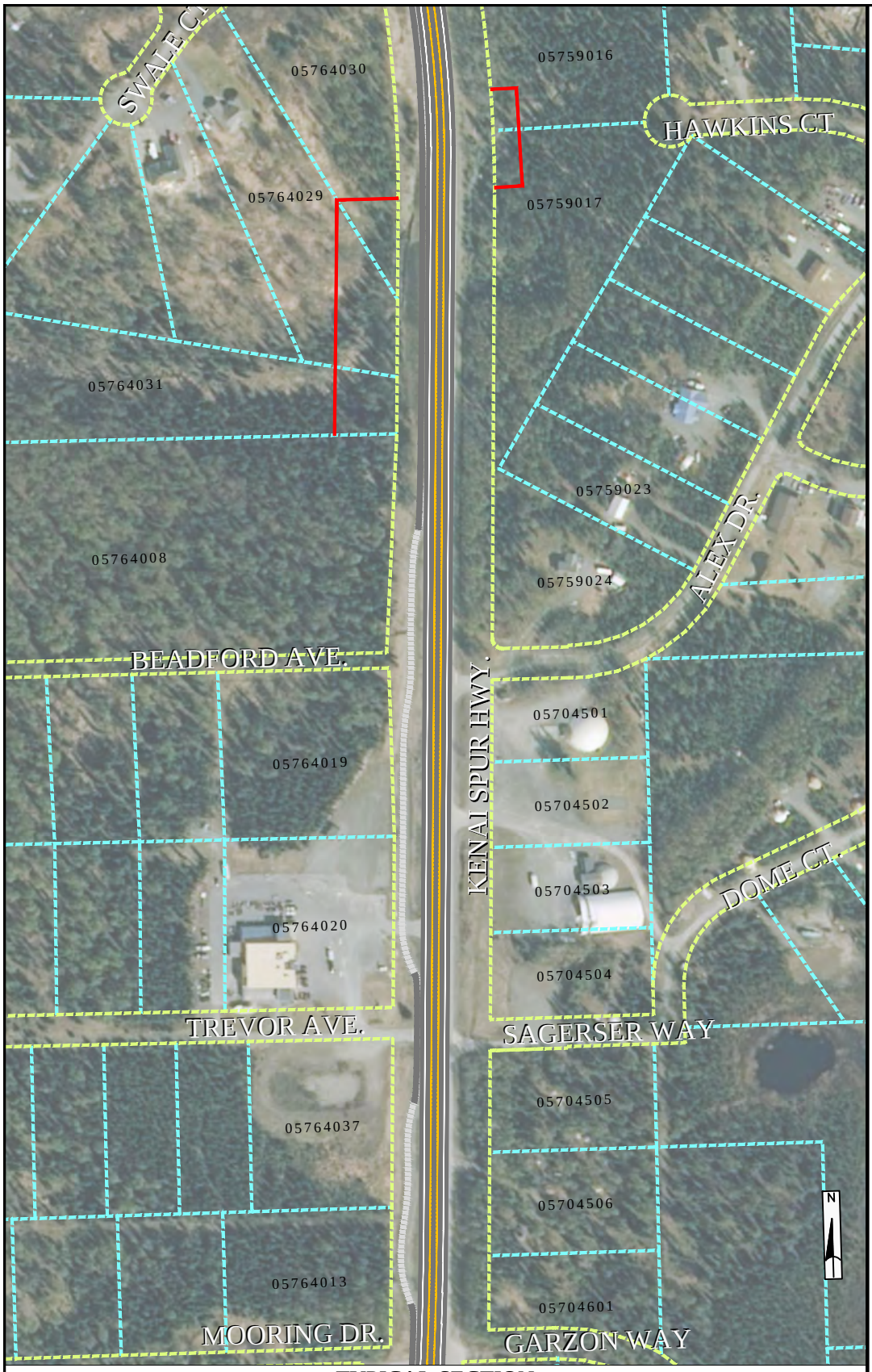
0 150 300 600

SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

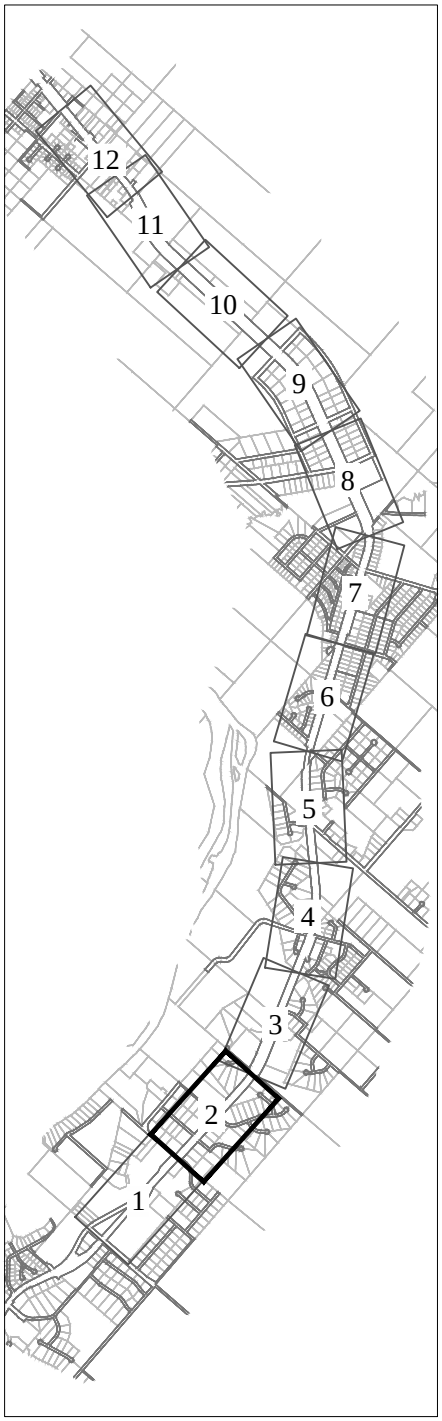
PROJECT# 54594

SHEET 1 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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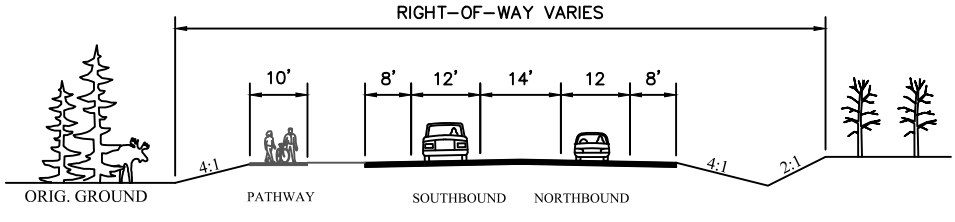

THREE-LANE WITH TWLTL

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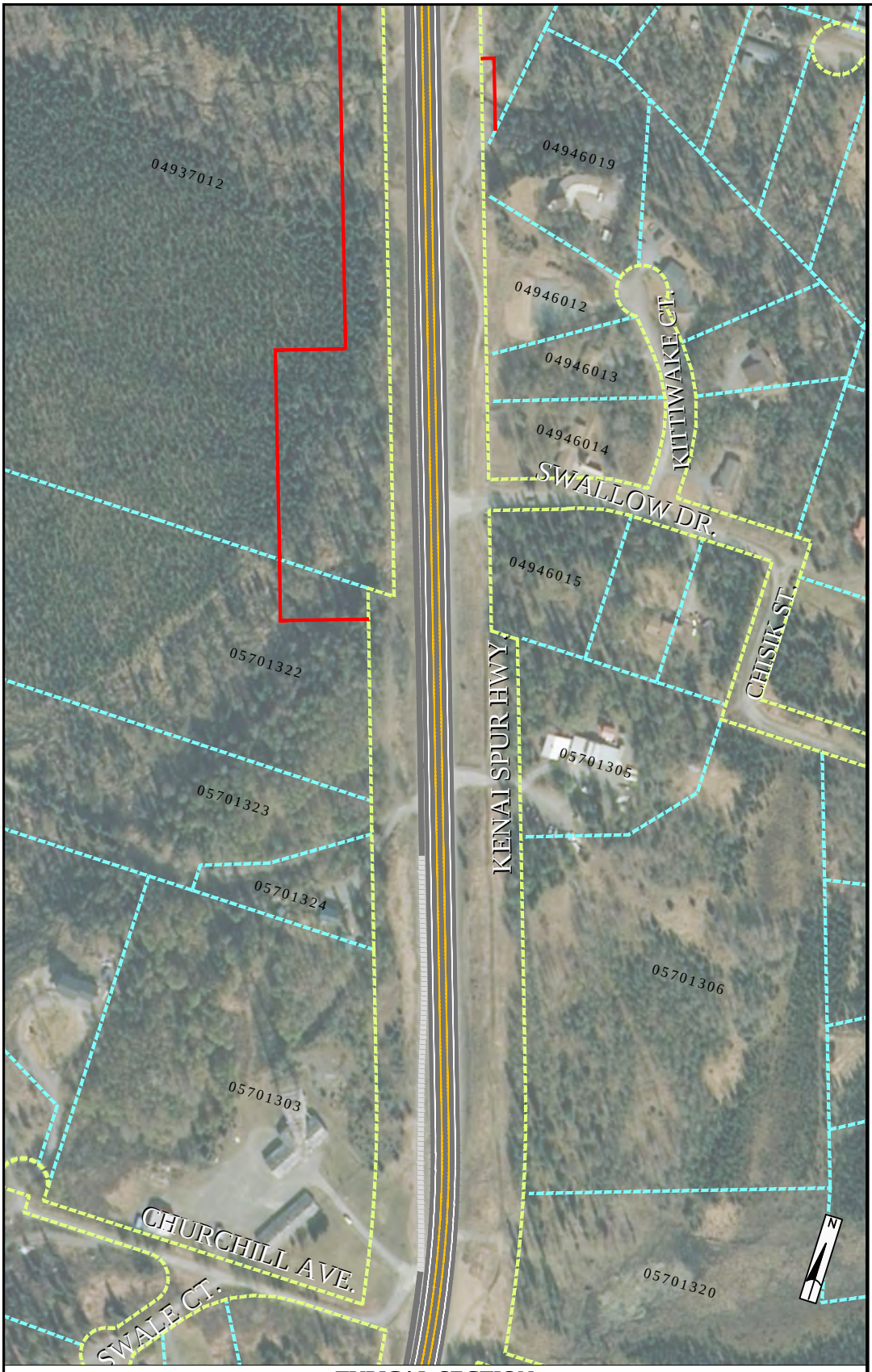
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

SHEET 2 OF 12



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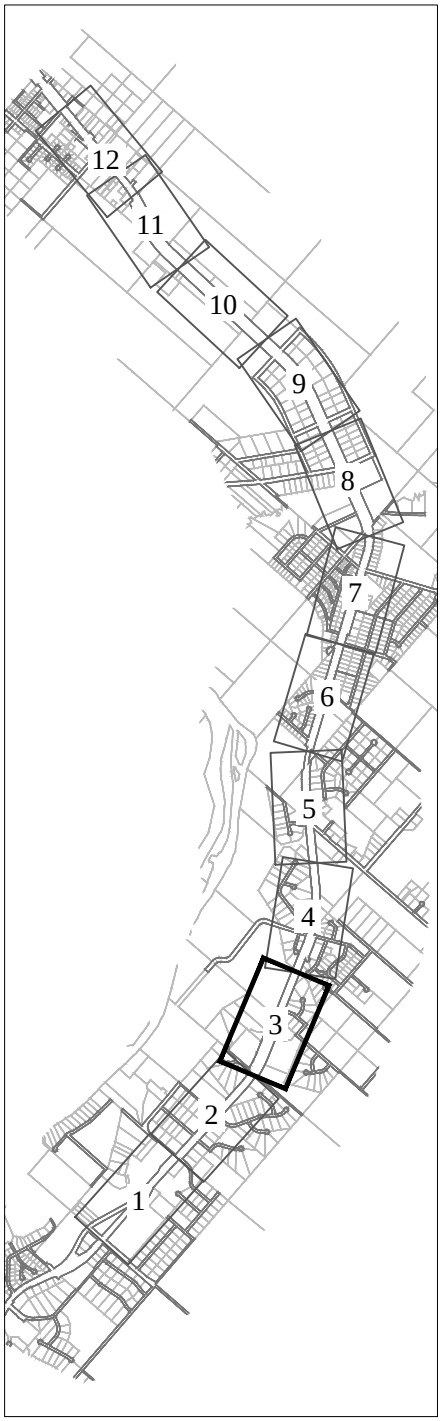
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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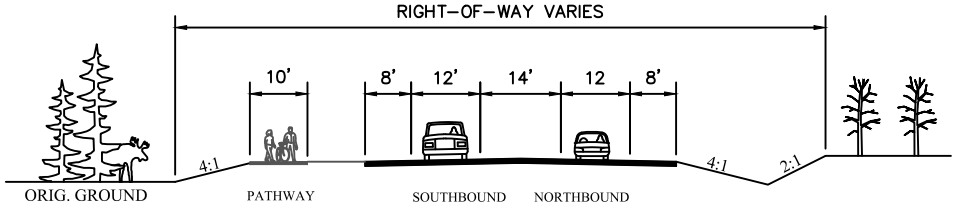

THREE-LANE WITH TWLTL

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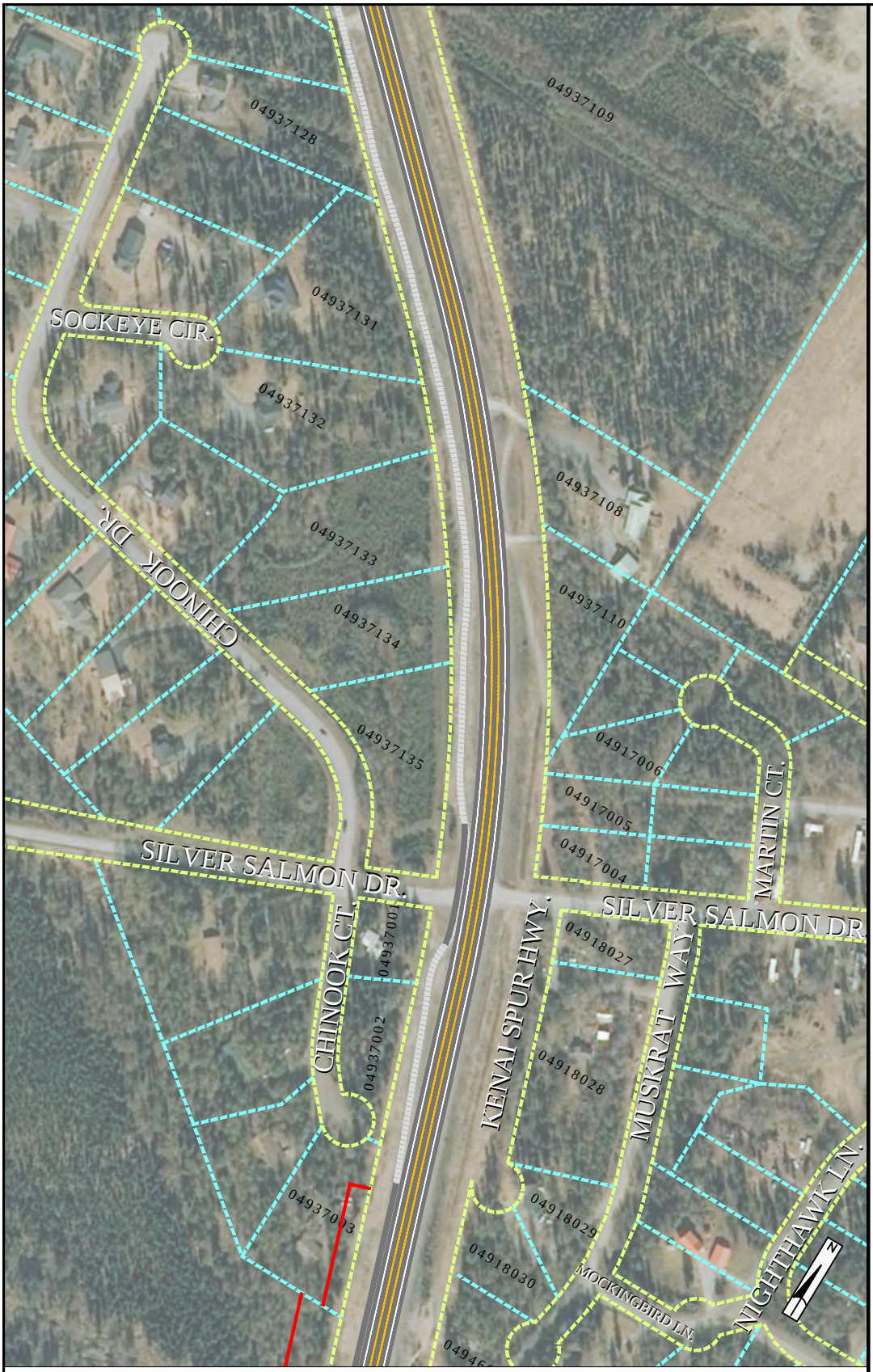
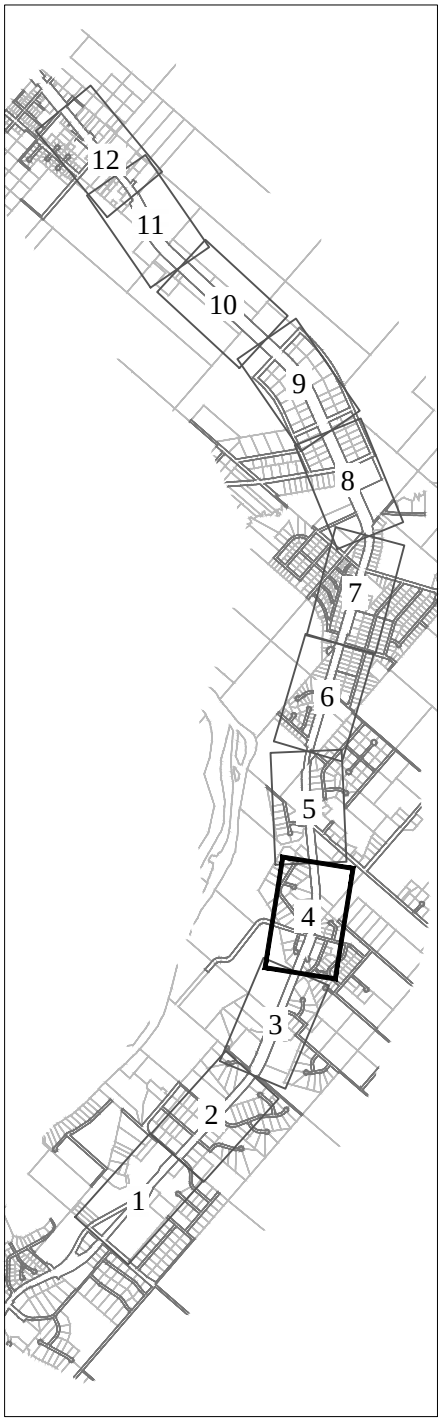
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

SHEET 3 OF 12

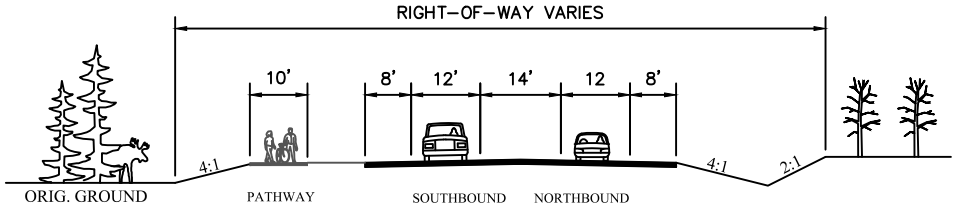




LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED

TYPICAL SECTION



THREE-LANE WITH TWLTL

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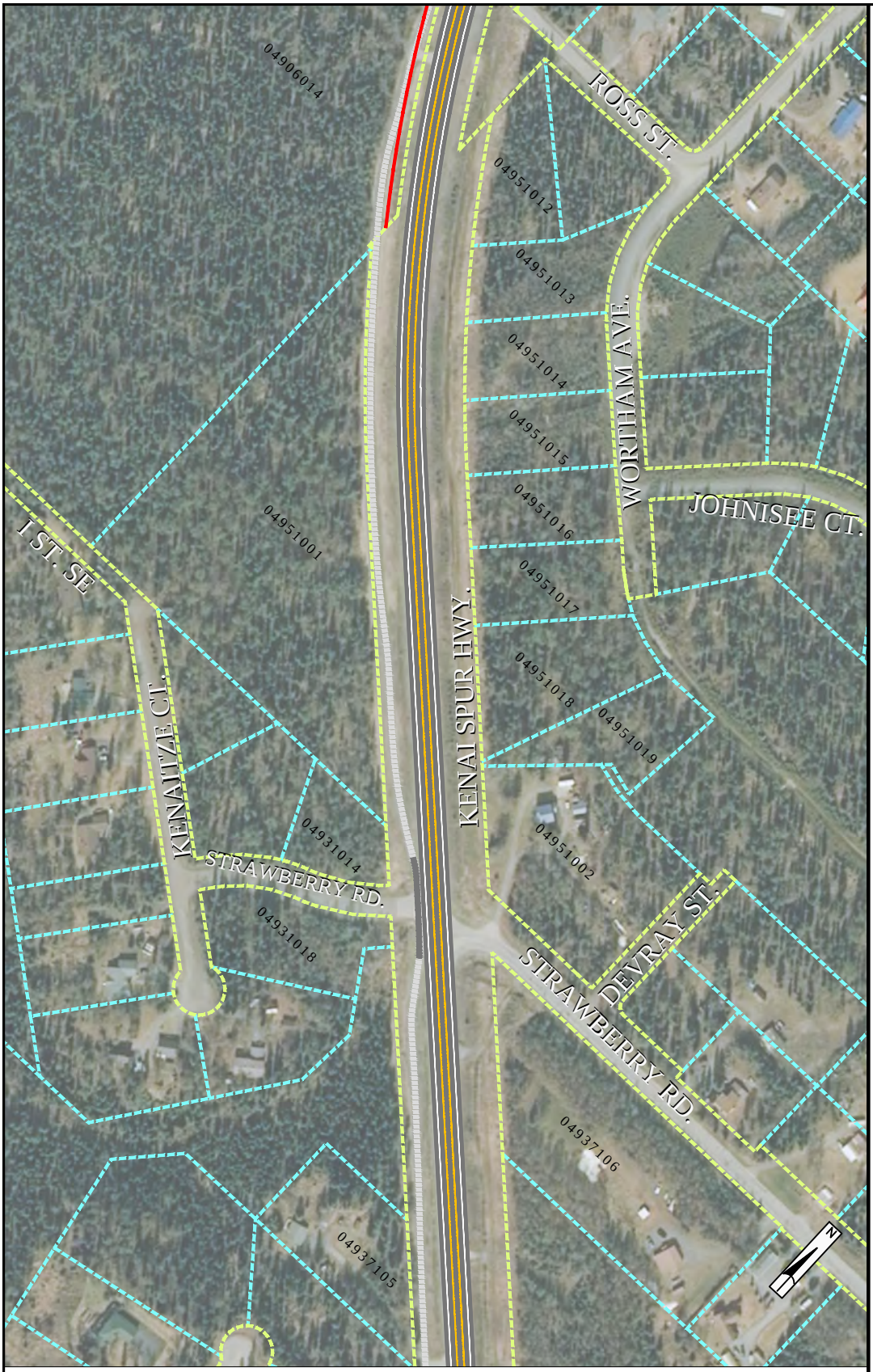
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

SHEET 4 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
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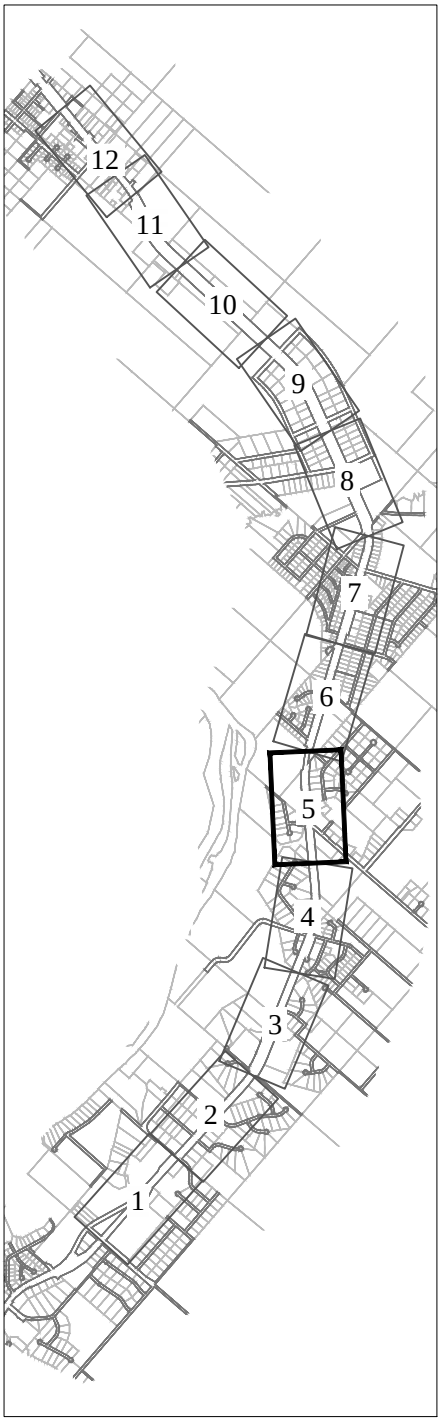

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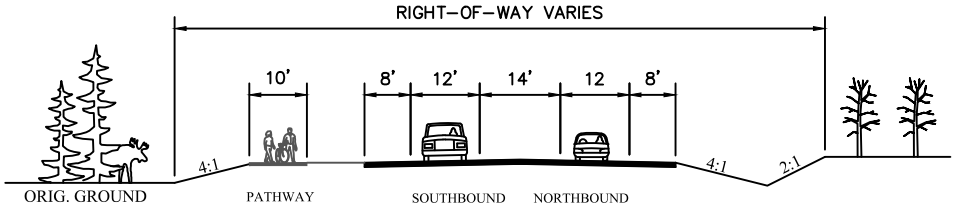

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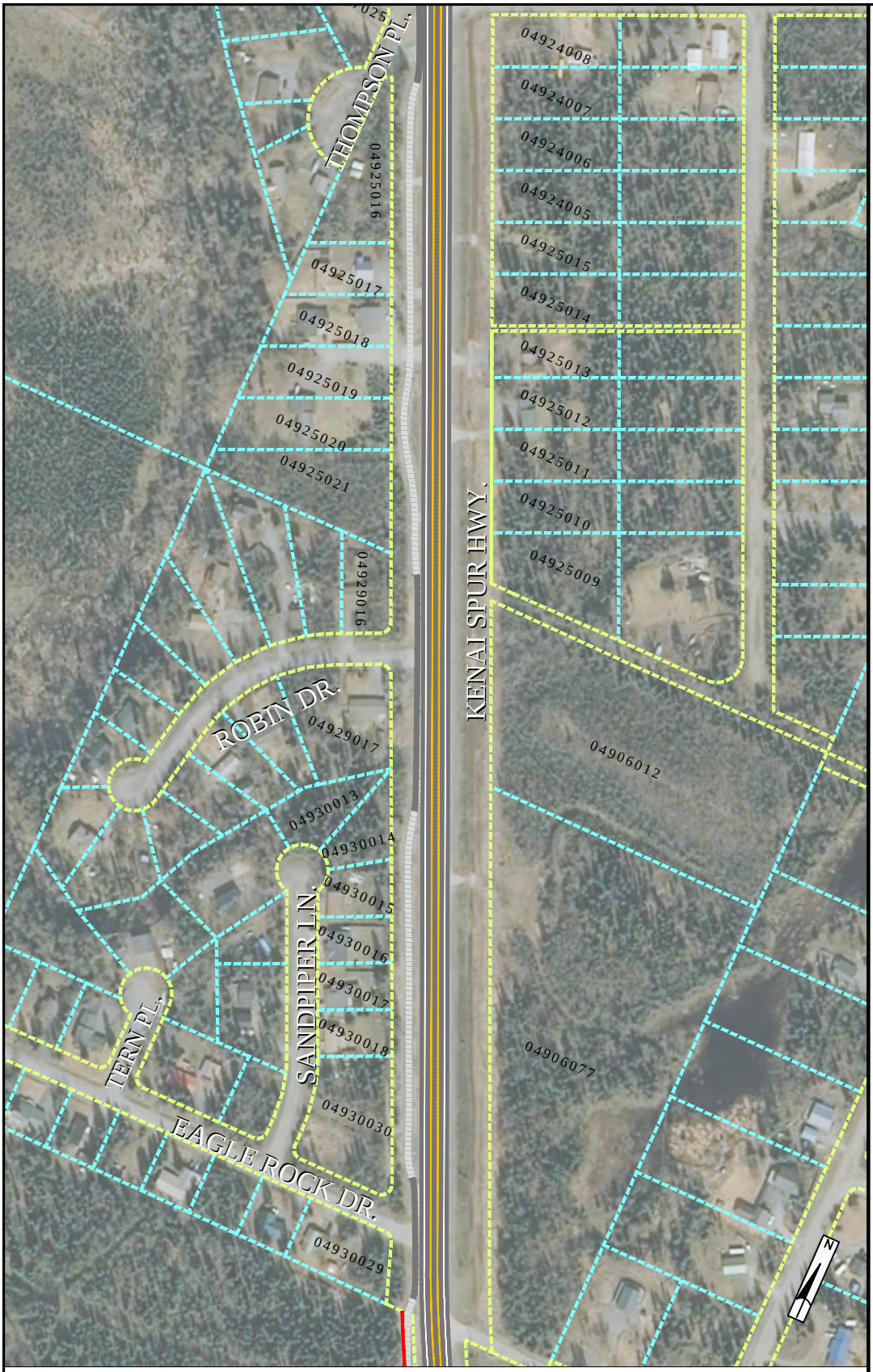
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

SHEET 5 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
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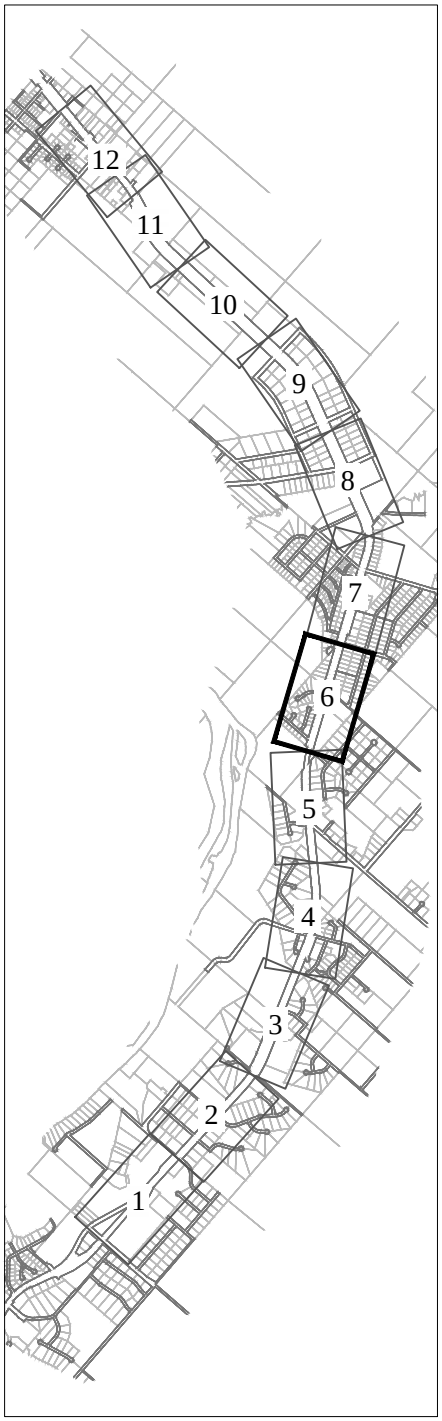

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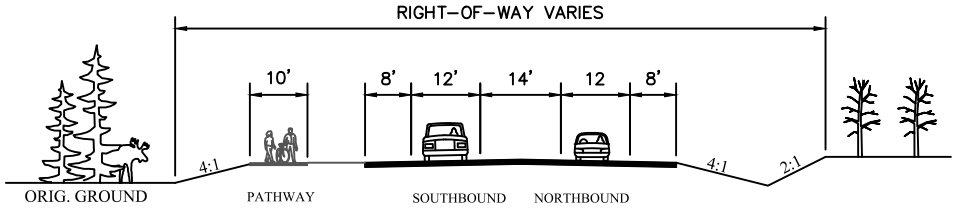

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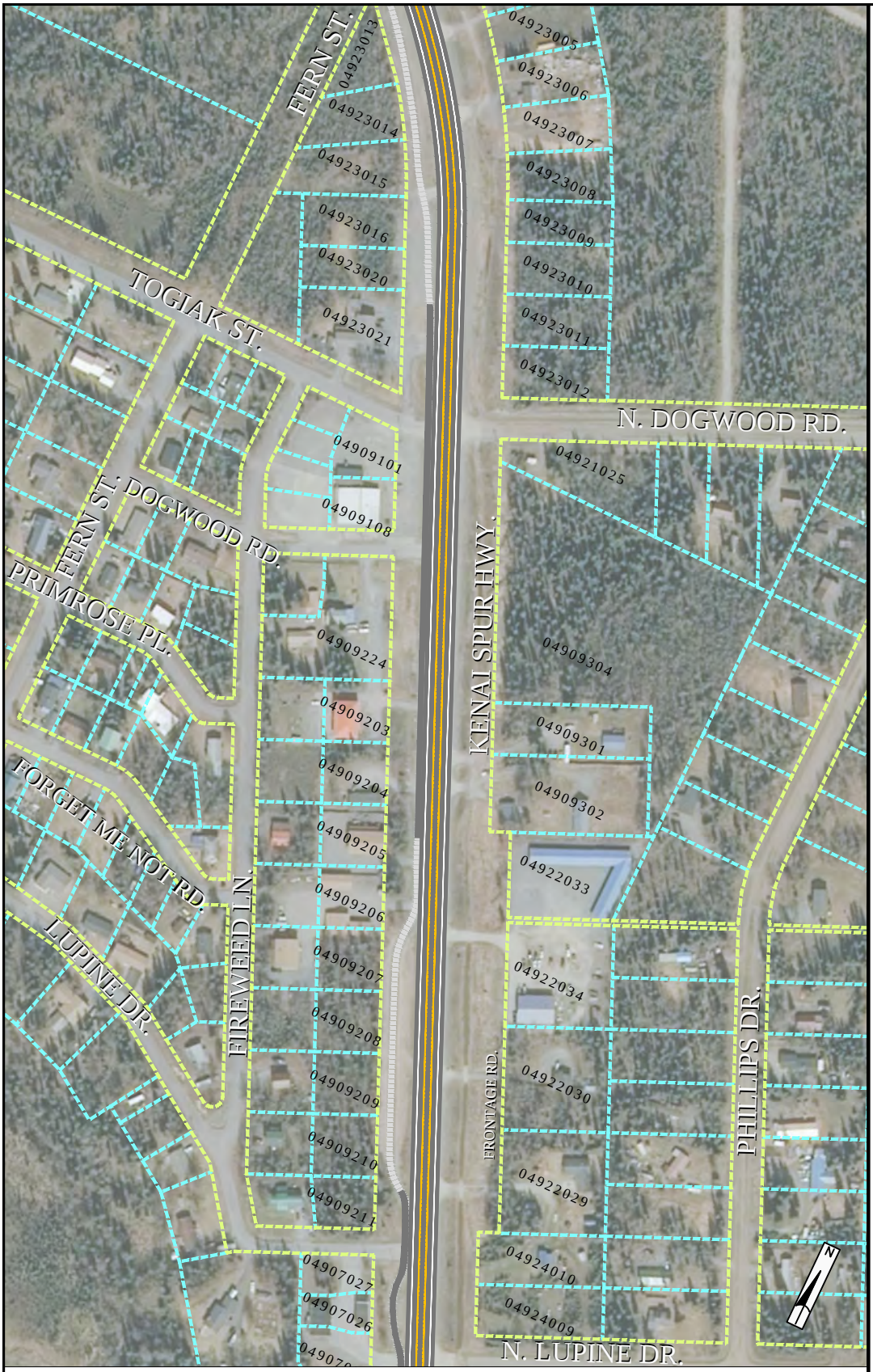
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
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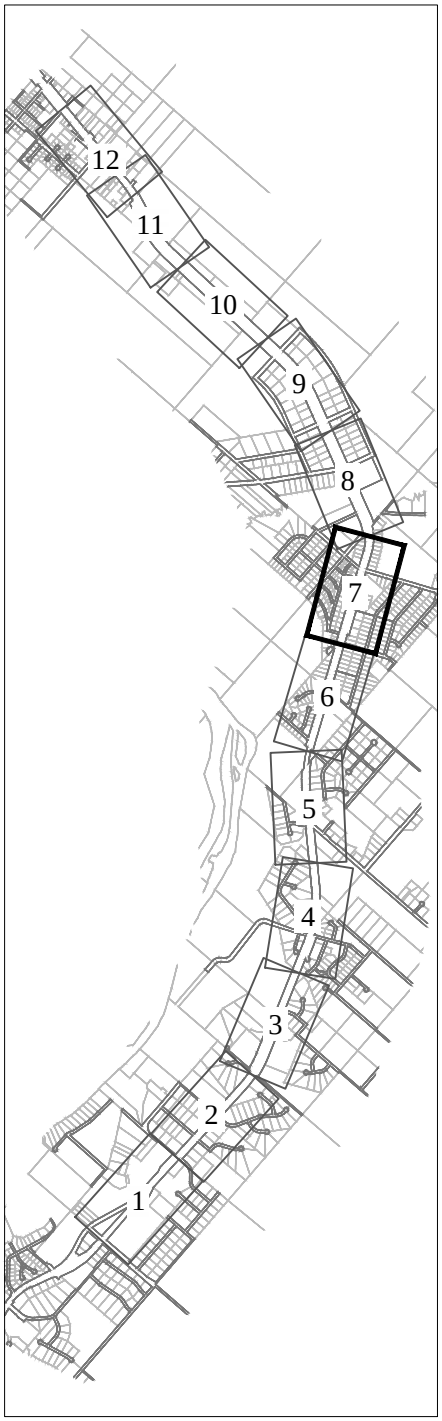

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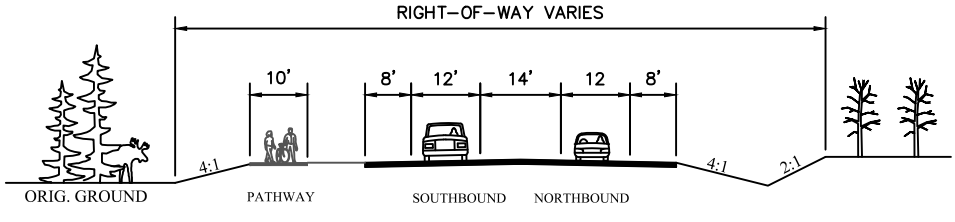

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SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
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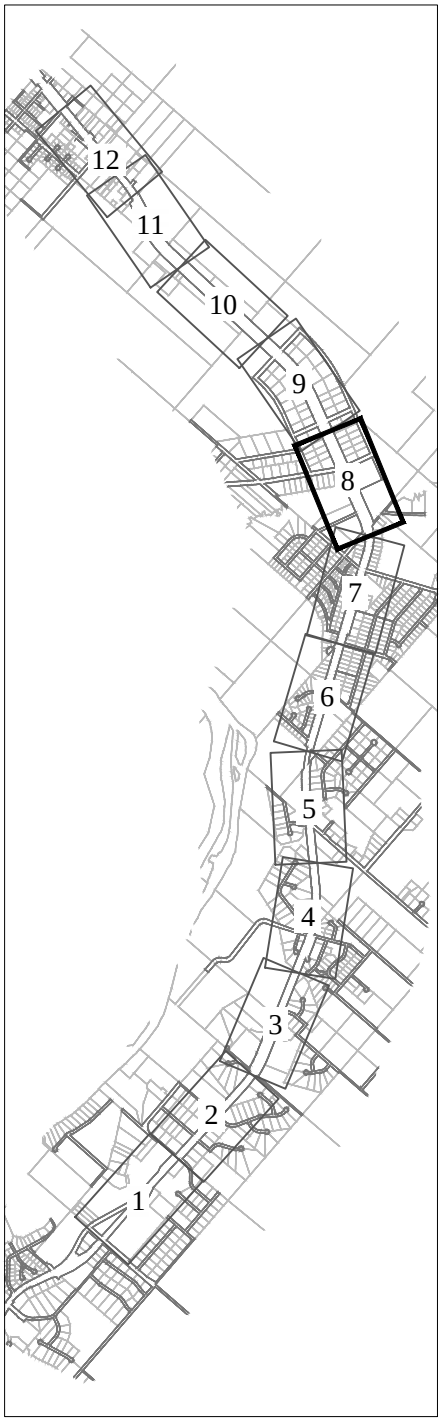

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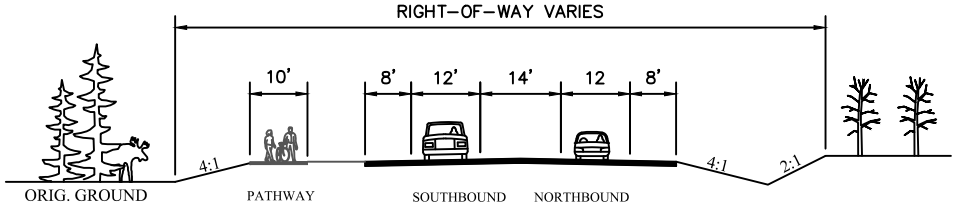

THREE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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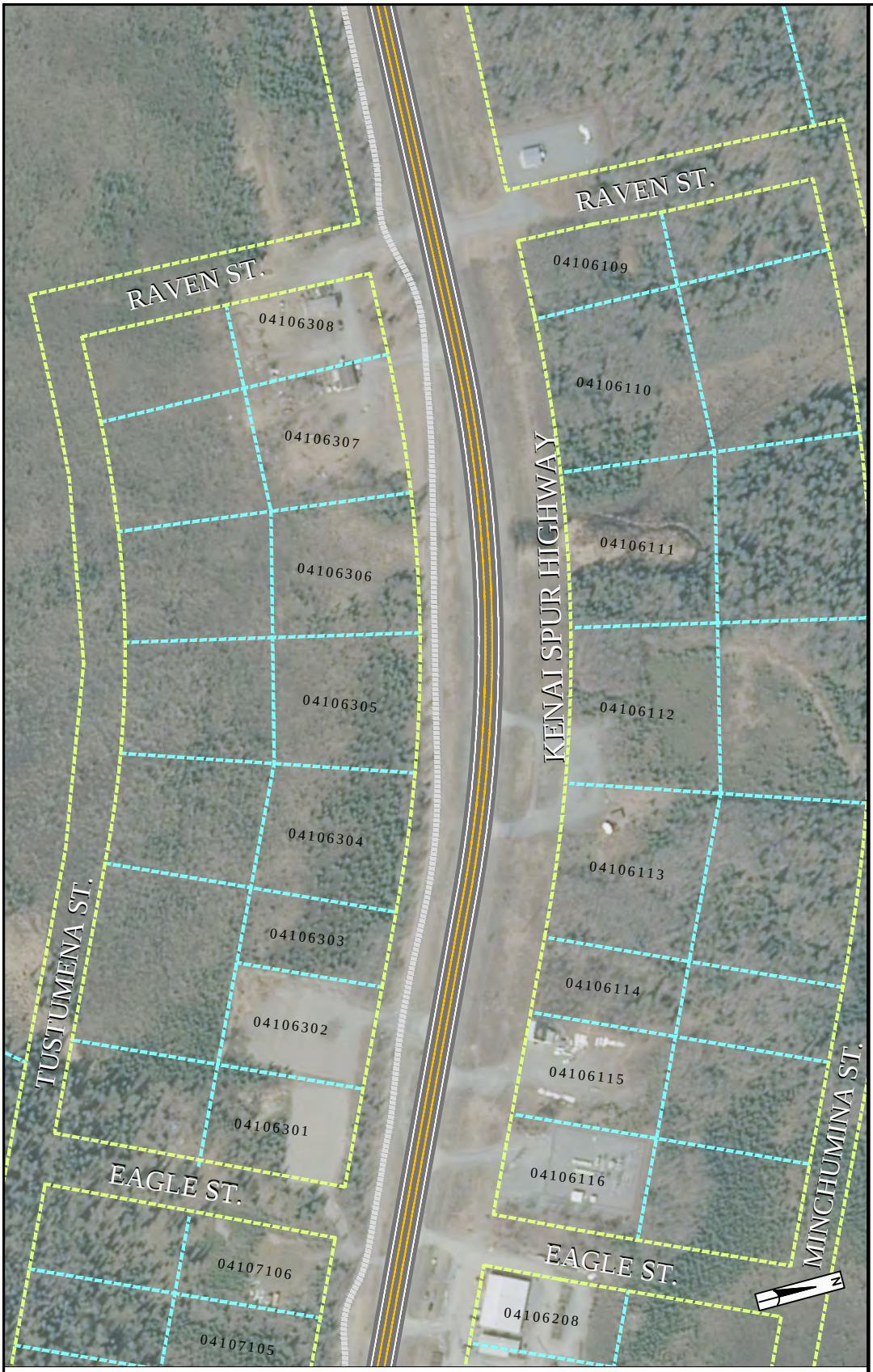
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

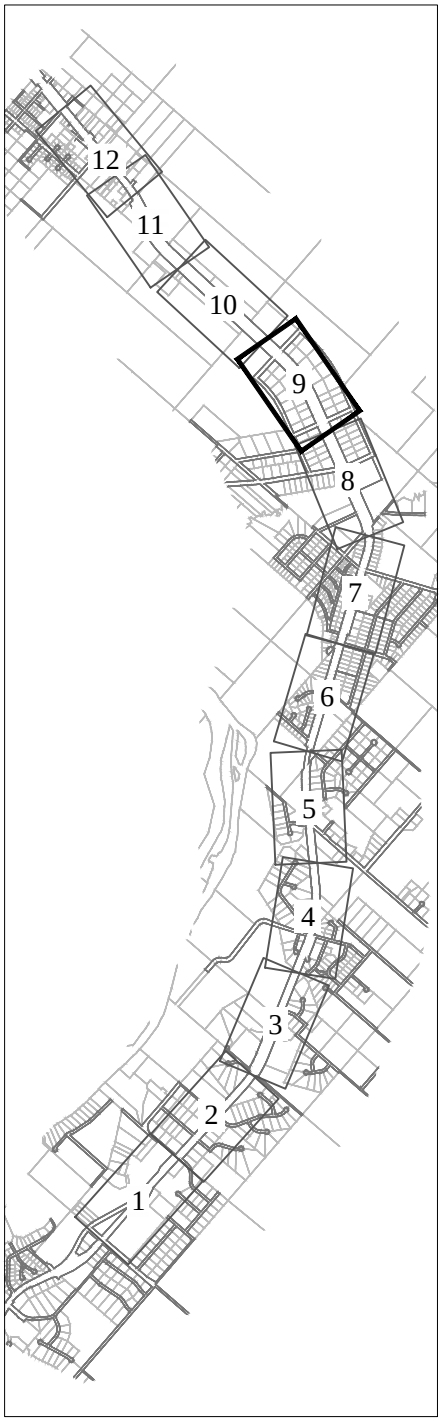
PROJECT# 54594

SHEET 8 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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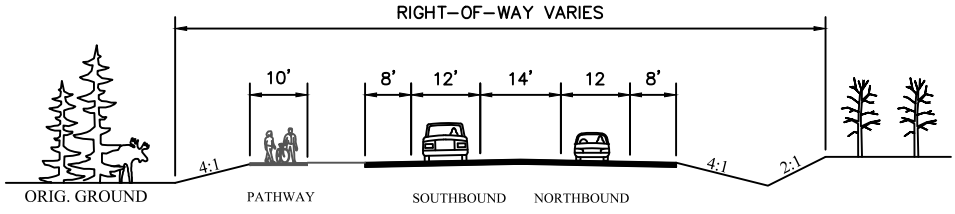

THREE-LANE WITH TWLTL

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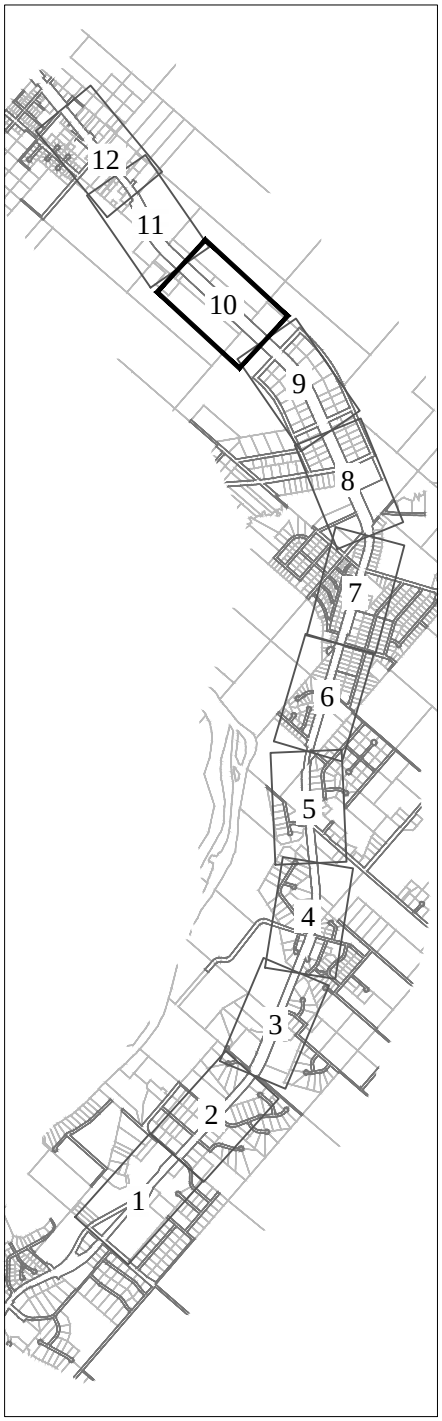
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

SHEET 9 OF 12

LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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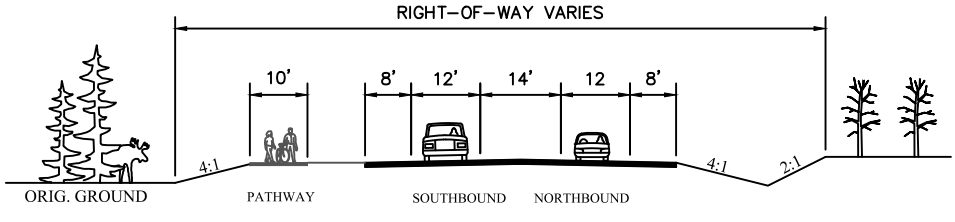

THREE-LANE WITH TWLTL

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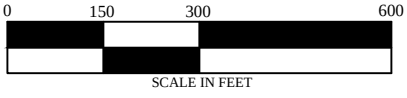
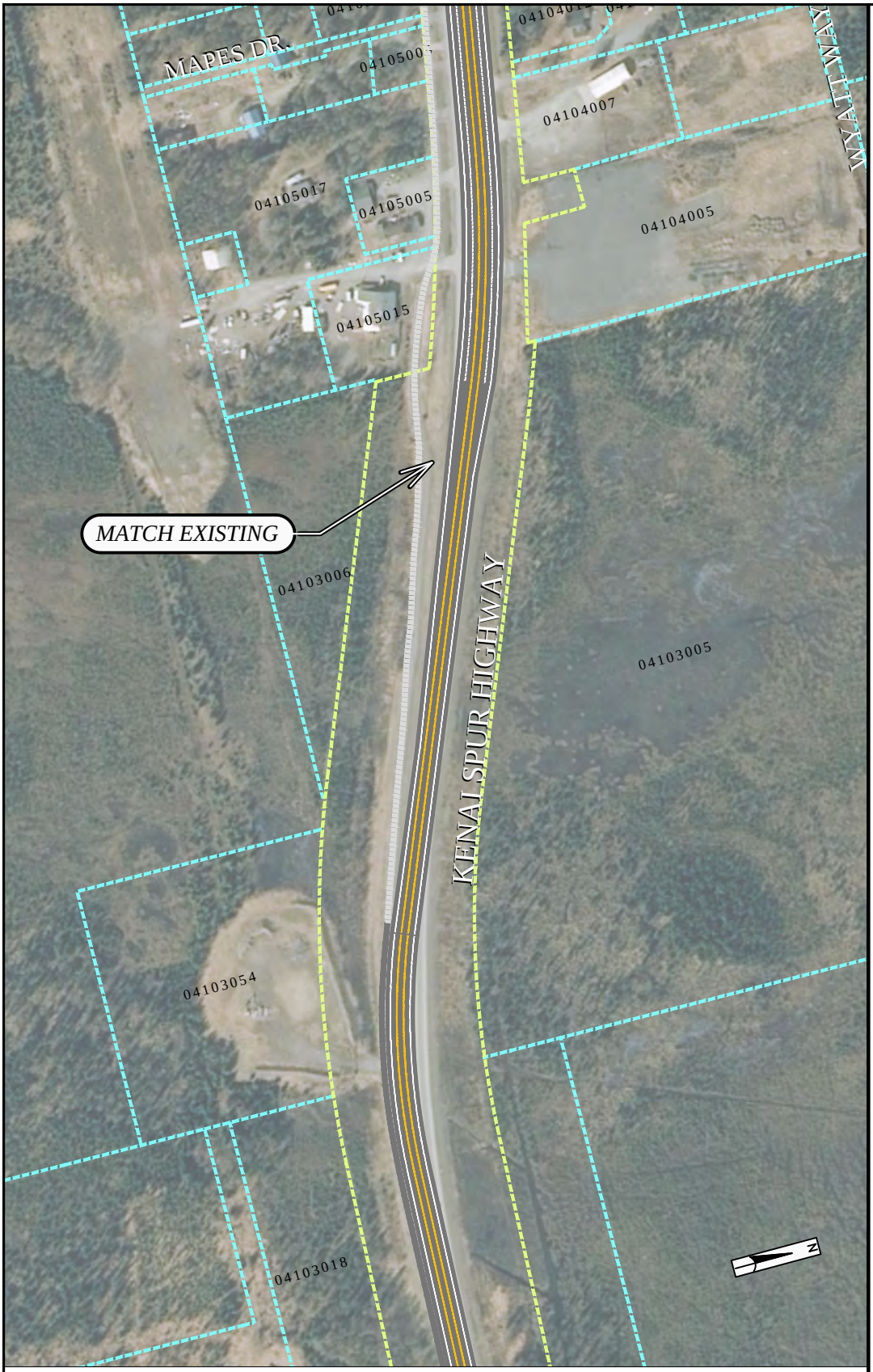


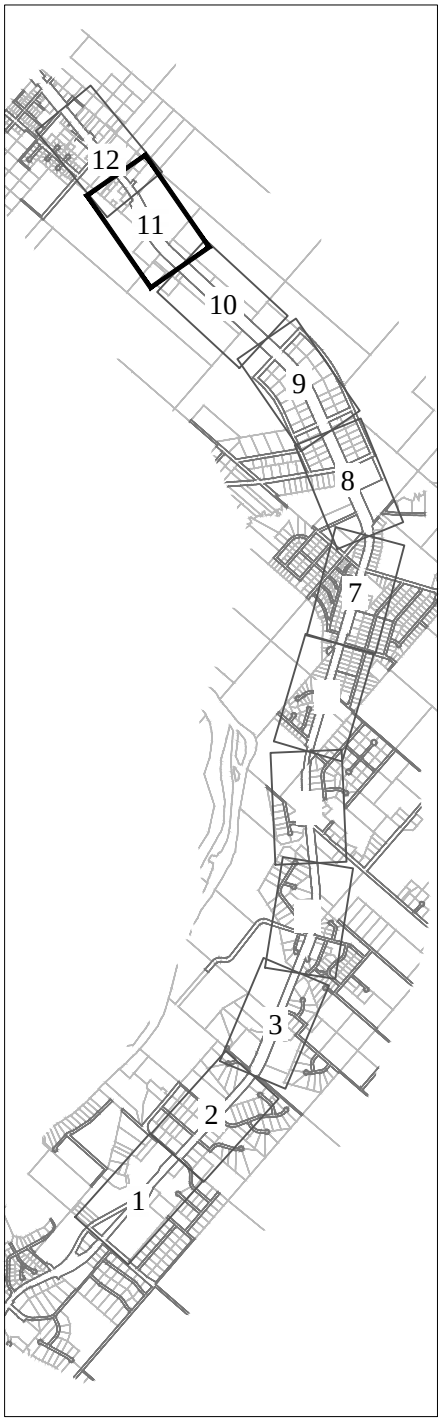
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594	SHEET 10 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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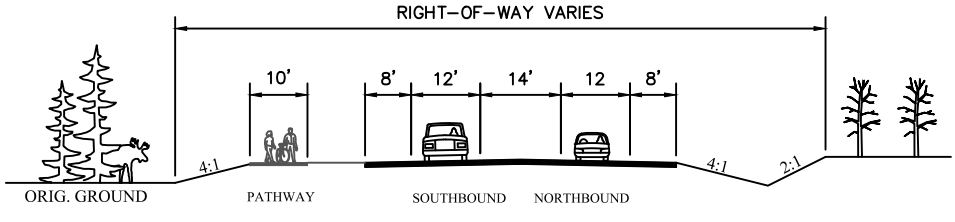

THREE-LANE WITH TWLTL

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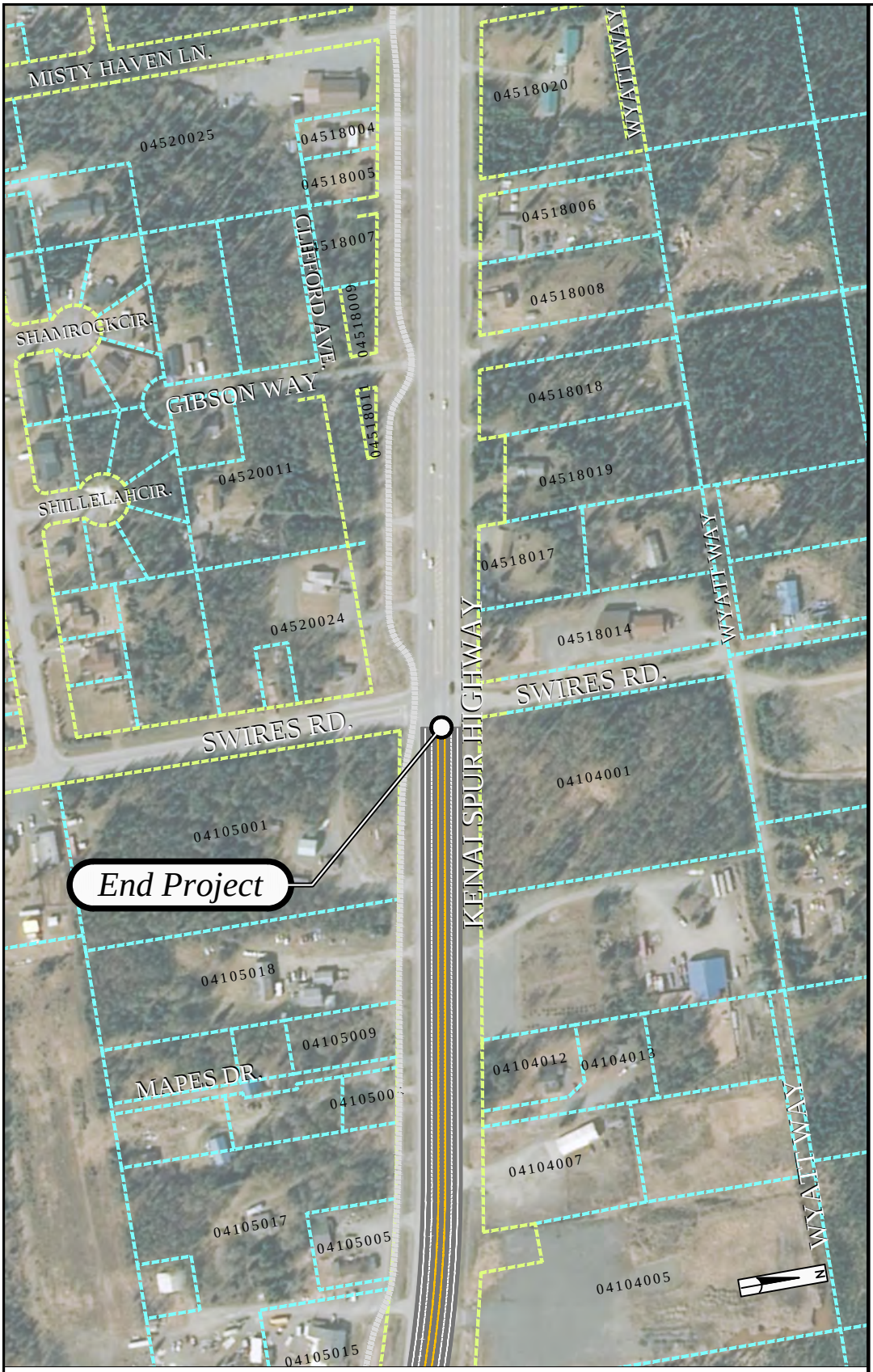
0 150 300 600

SCALE IN FEET

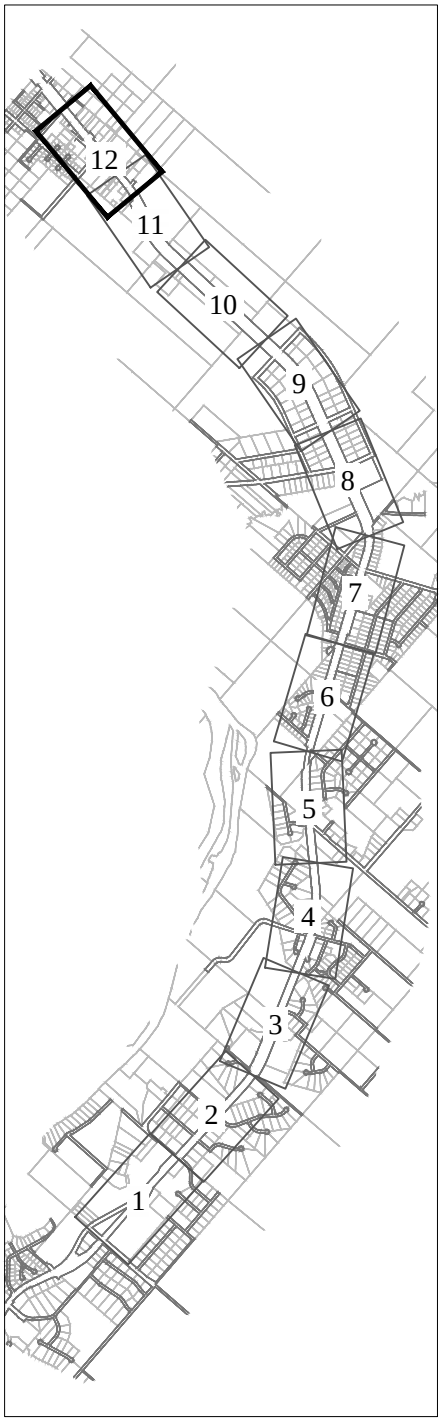
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594

SHEET 11 OF 12



LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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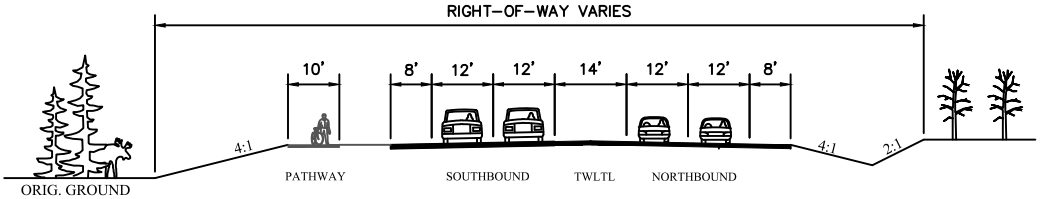

FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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0 150 300 600

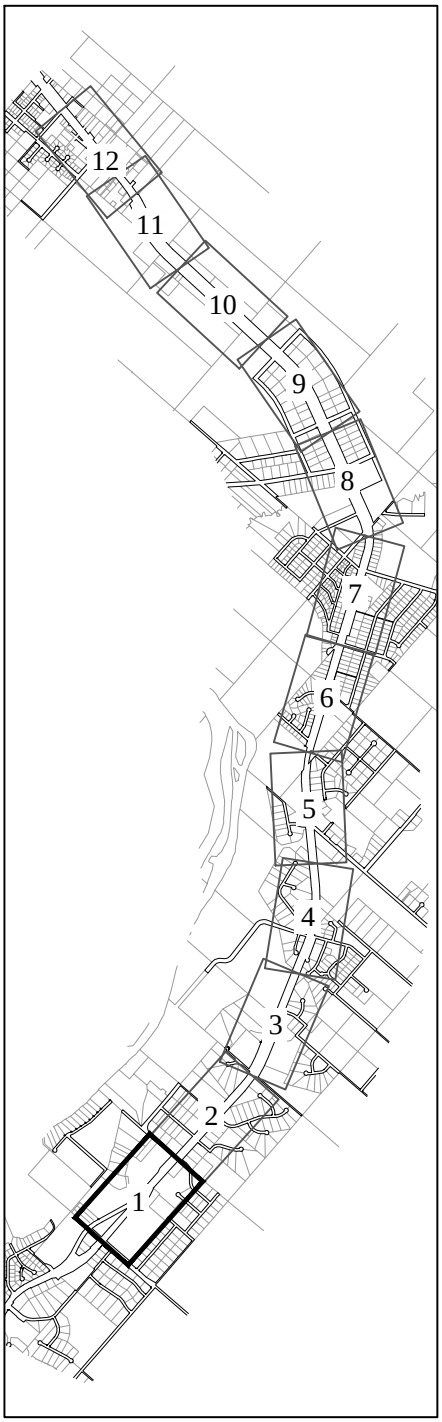
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 2: THREE-LANE

PROJECT# 54594	SHEET 12 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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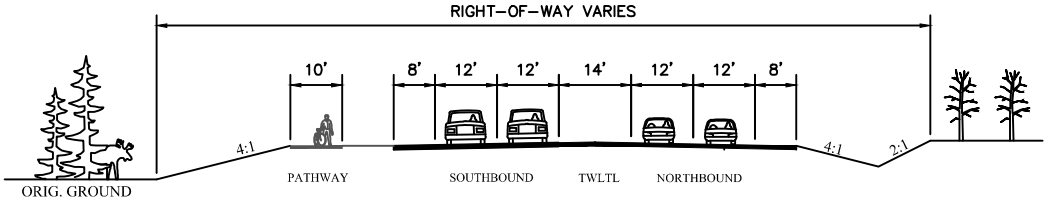

FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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0 150 300 600

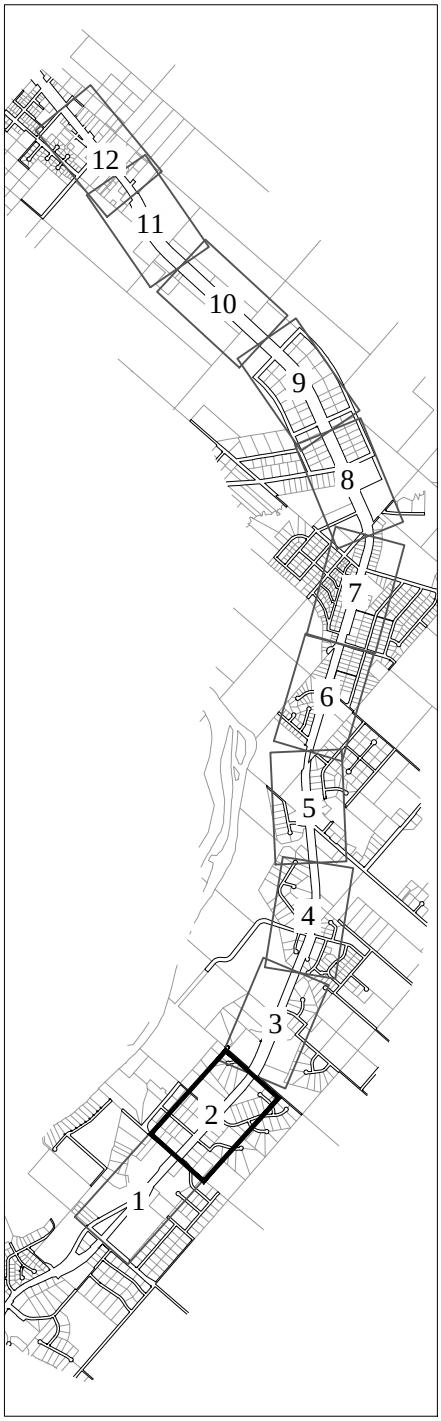
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 1 OF 12

LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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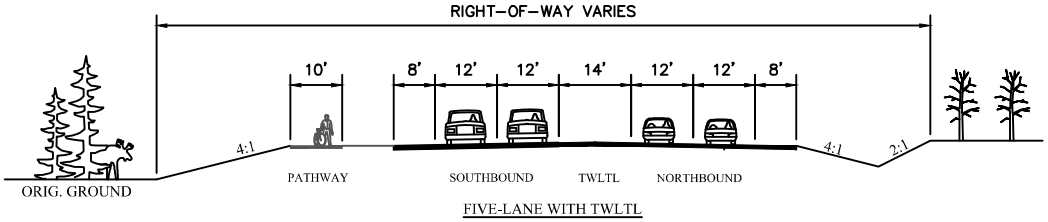

FIVE-LANE WITH TWLTL

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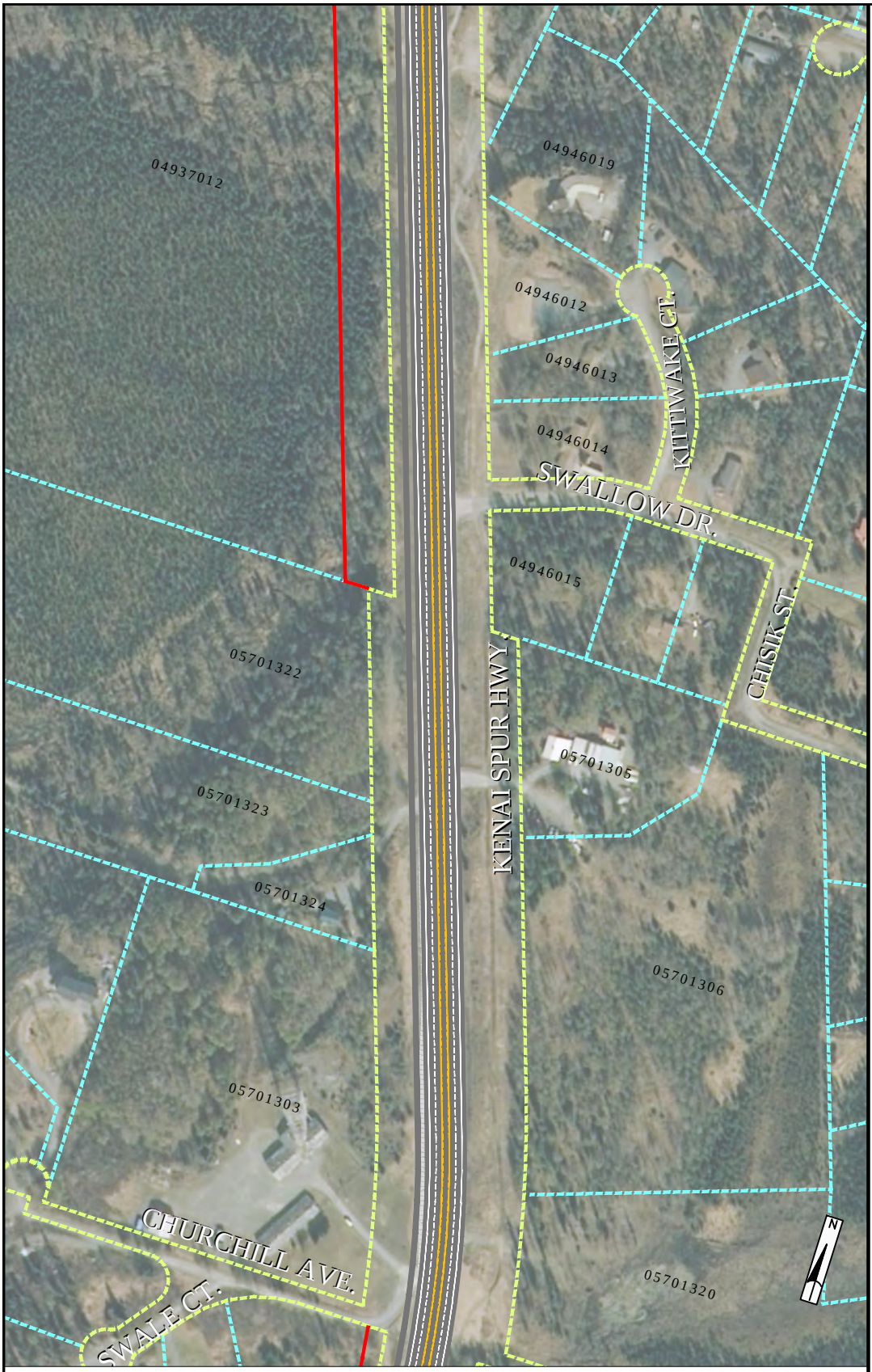
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

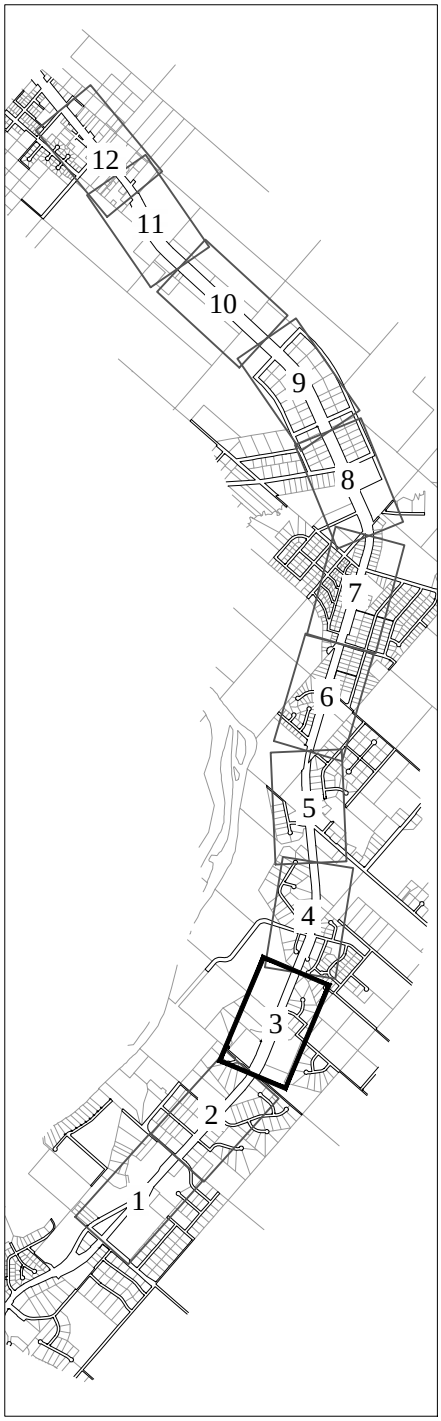
PROJECT# 54594

SHEET 2 OF 12

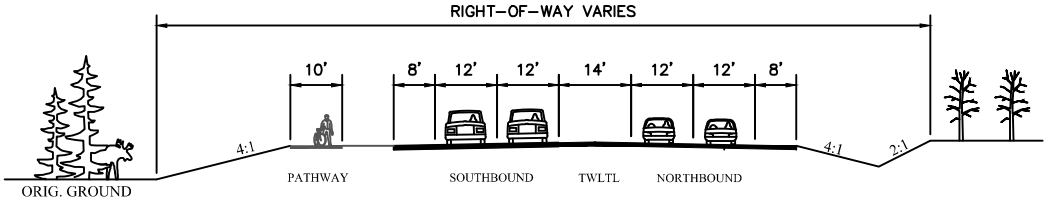


LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



TYPICAL SECTION



FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

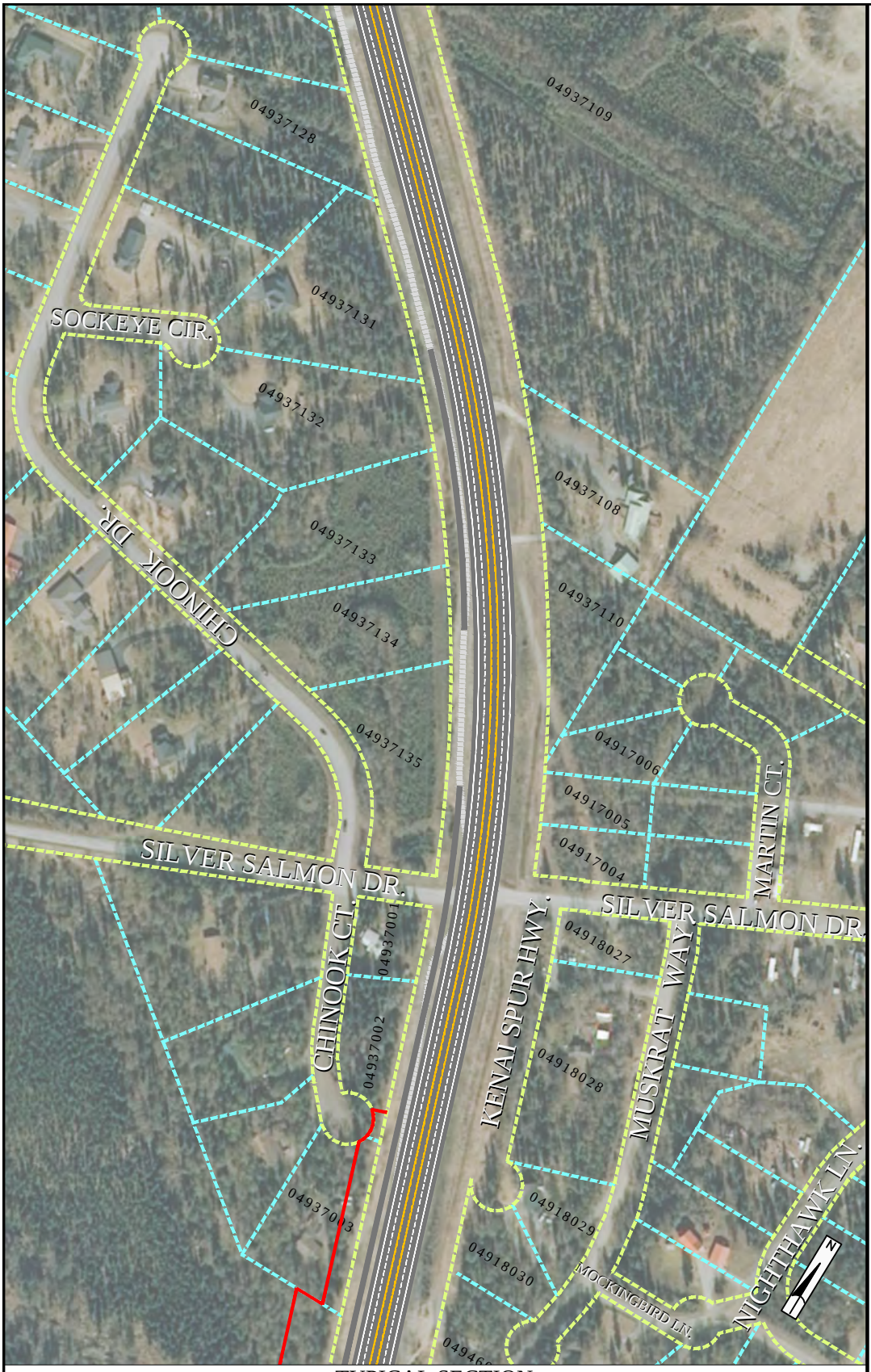
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

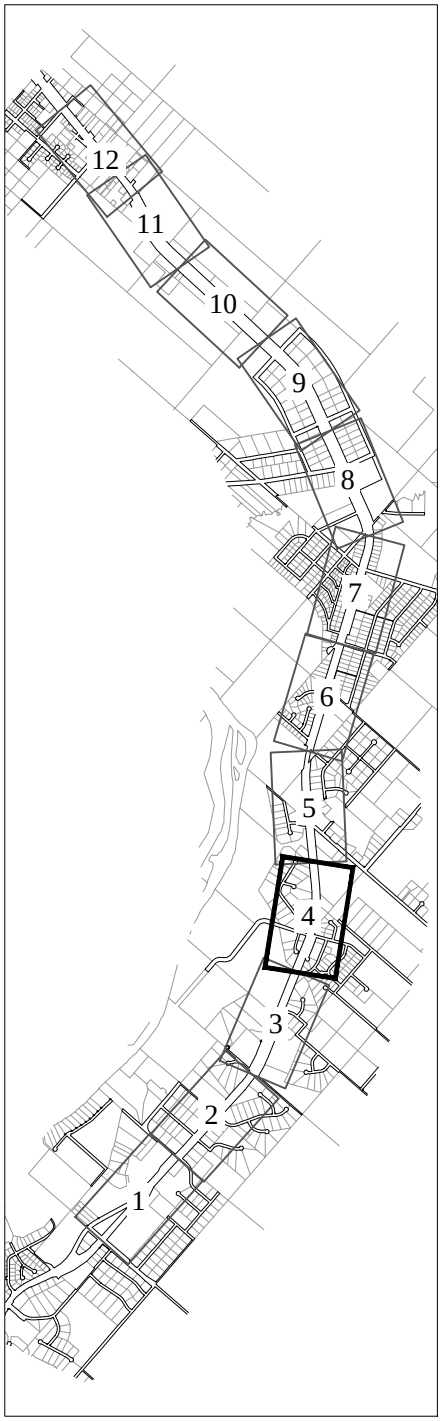
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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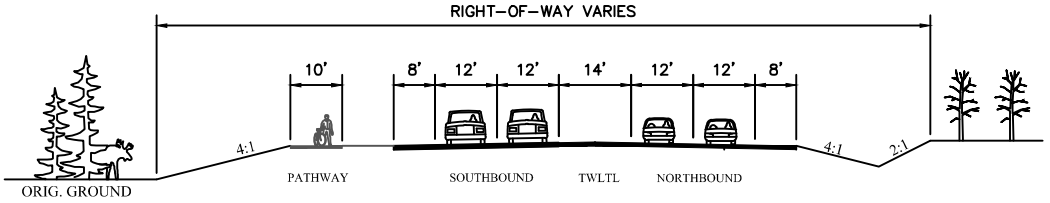

FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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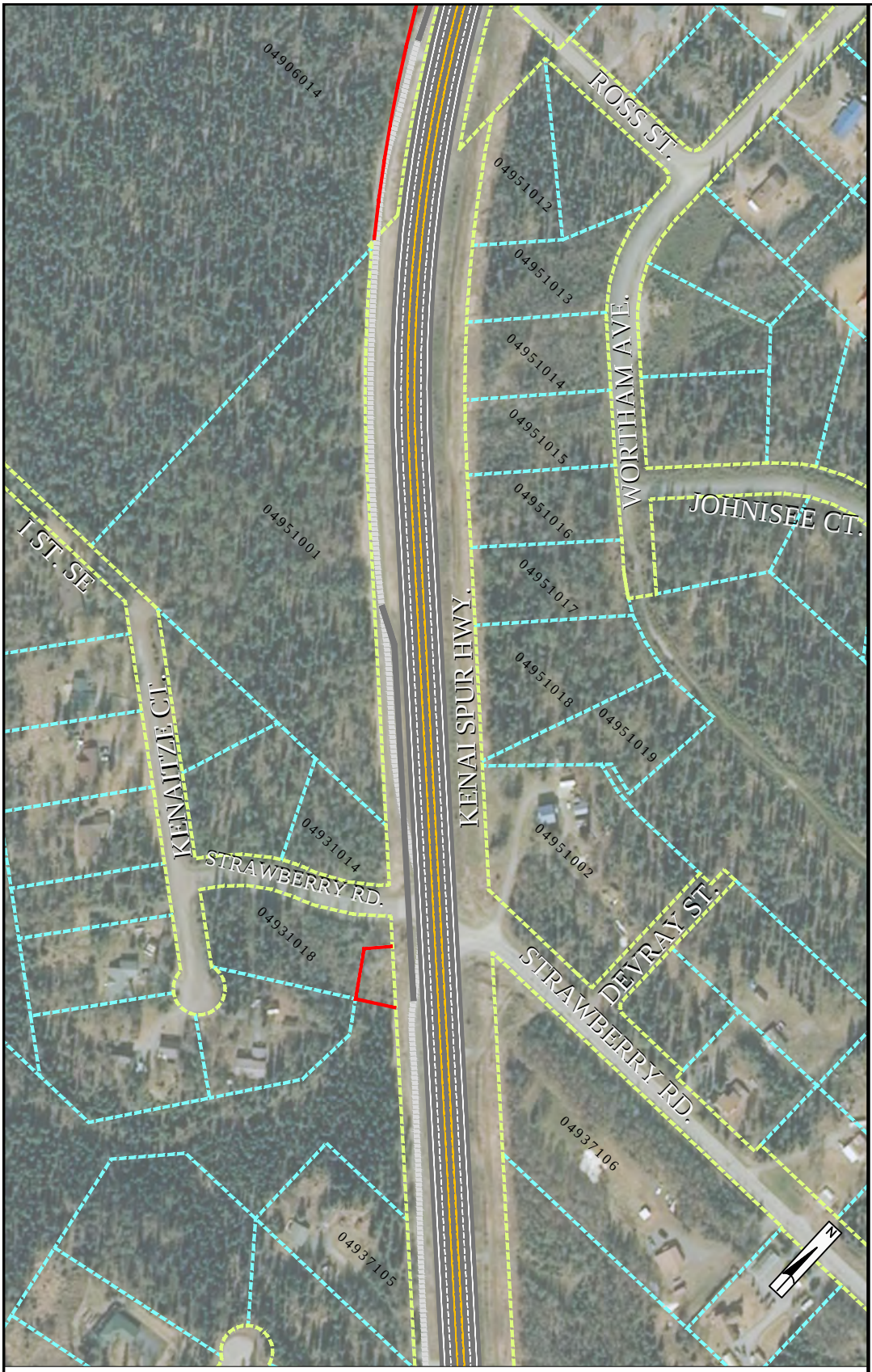
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

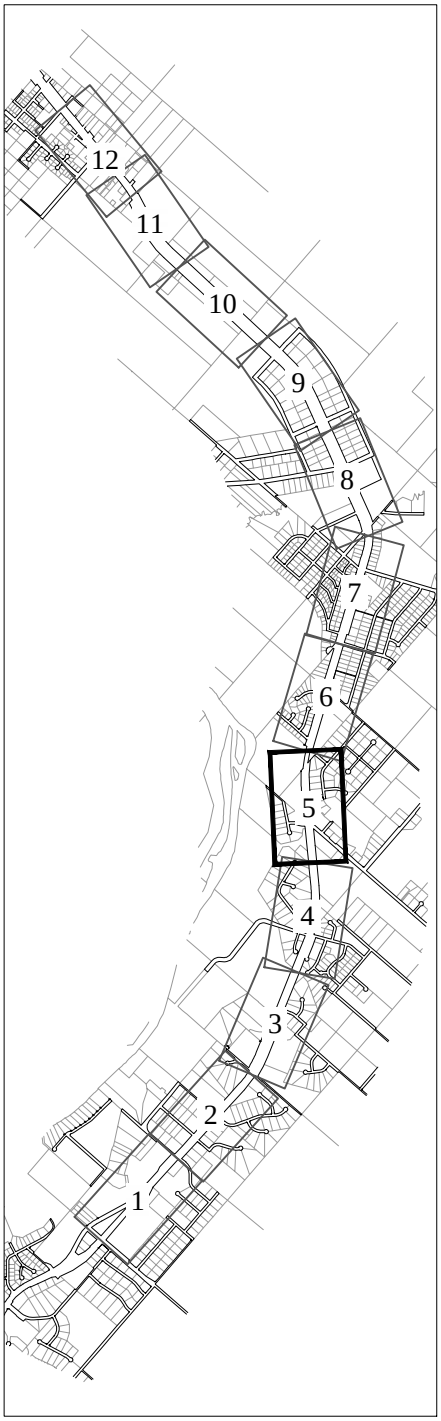
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594 | SHEET 4 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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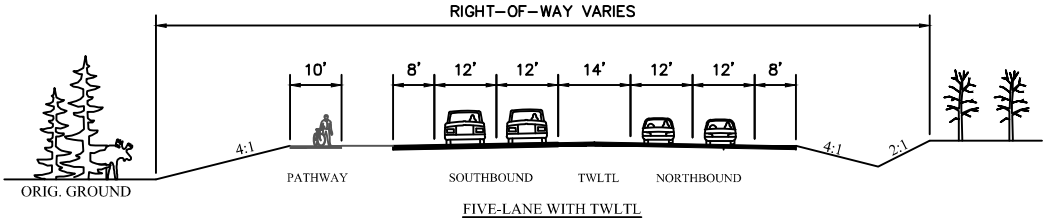

FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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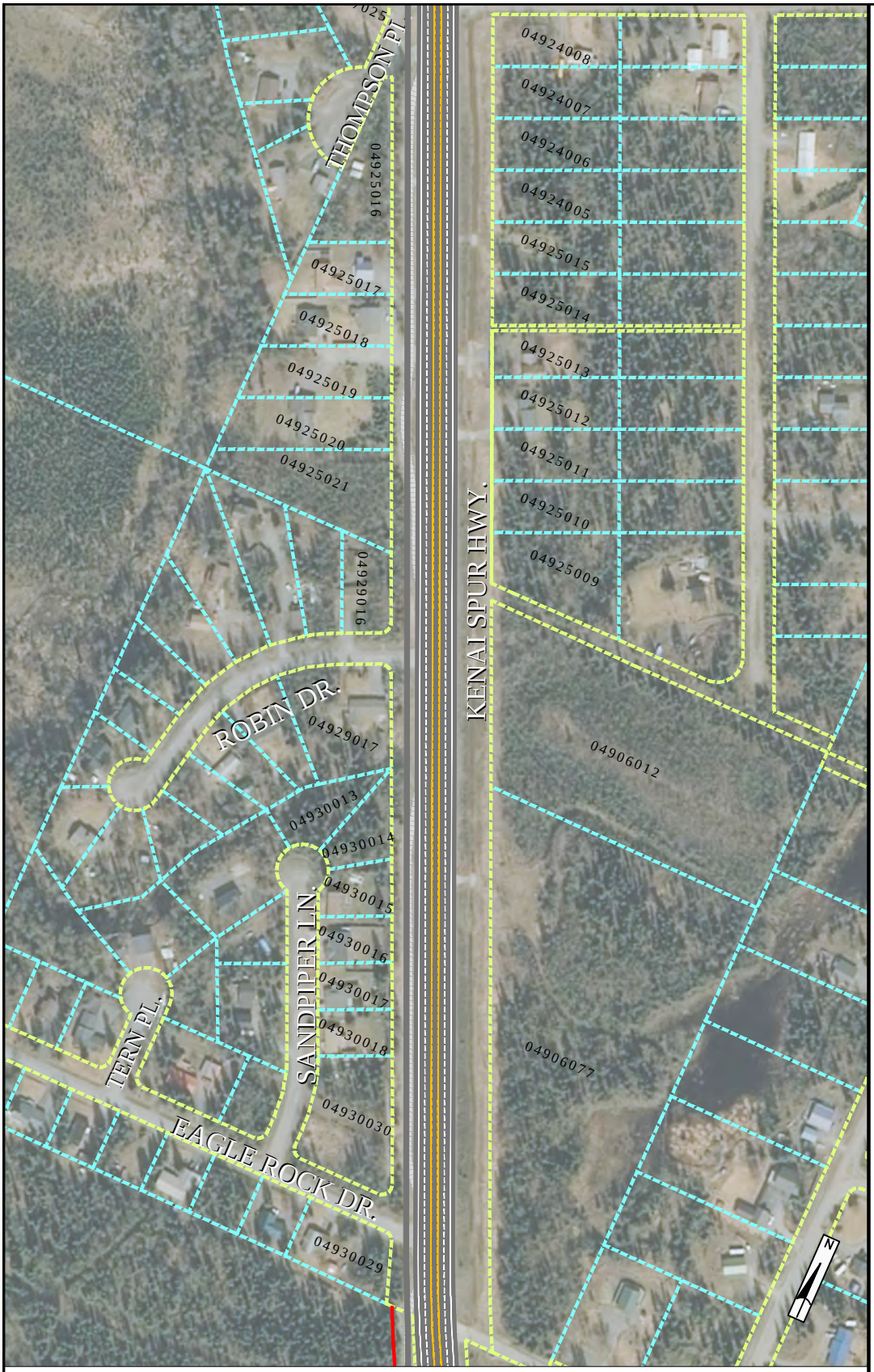
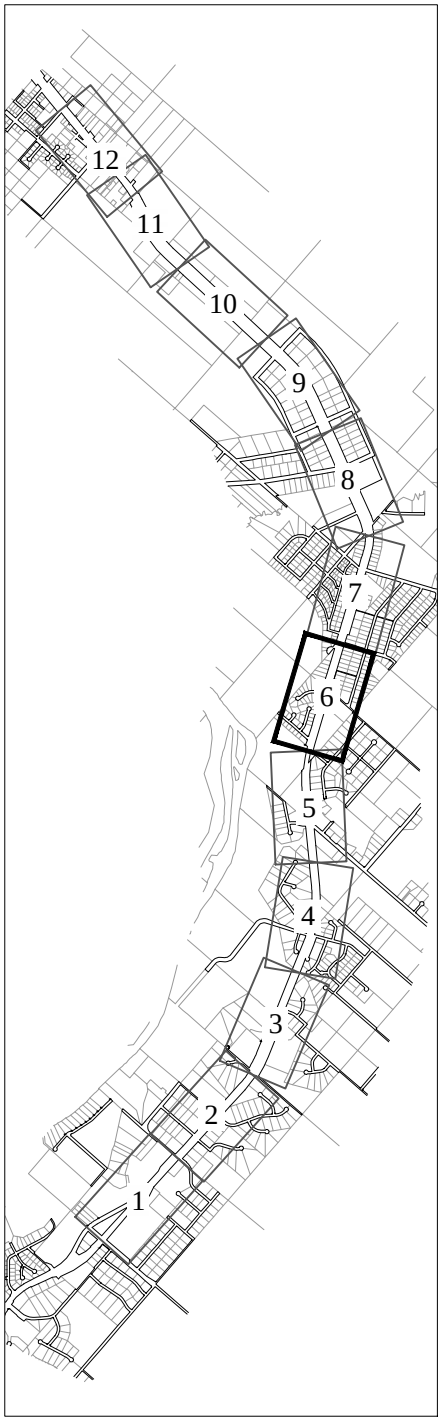
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 5 OF 12



LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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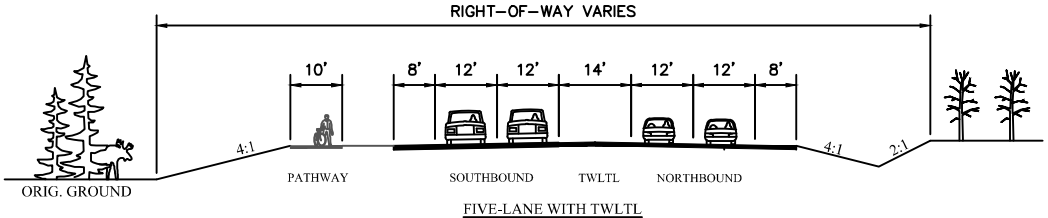

FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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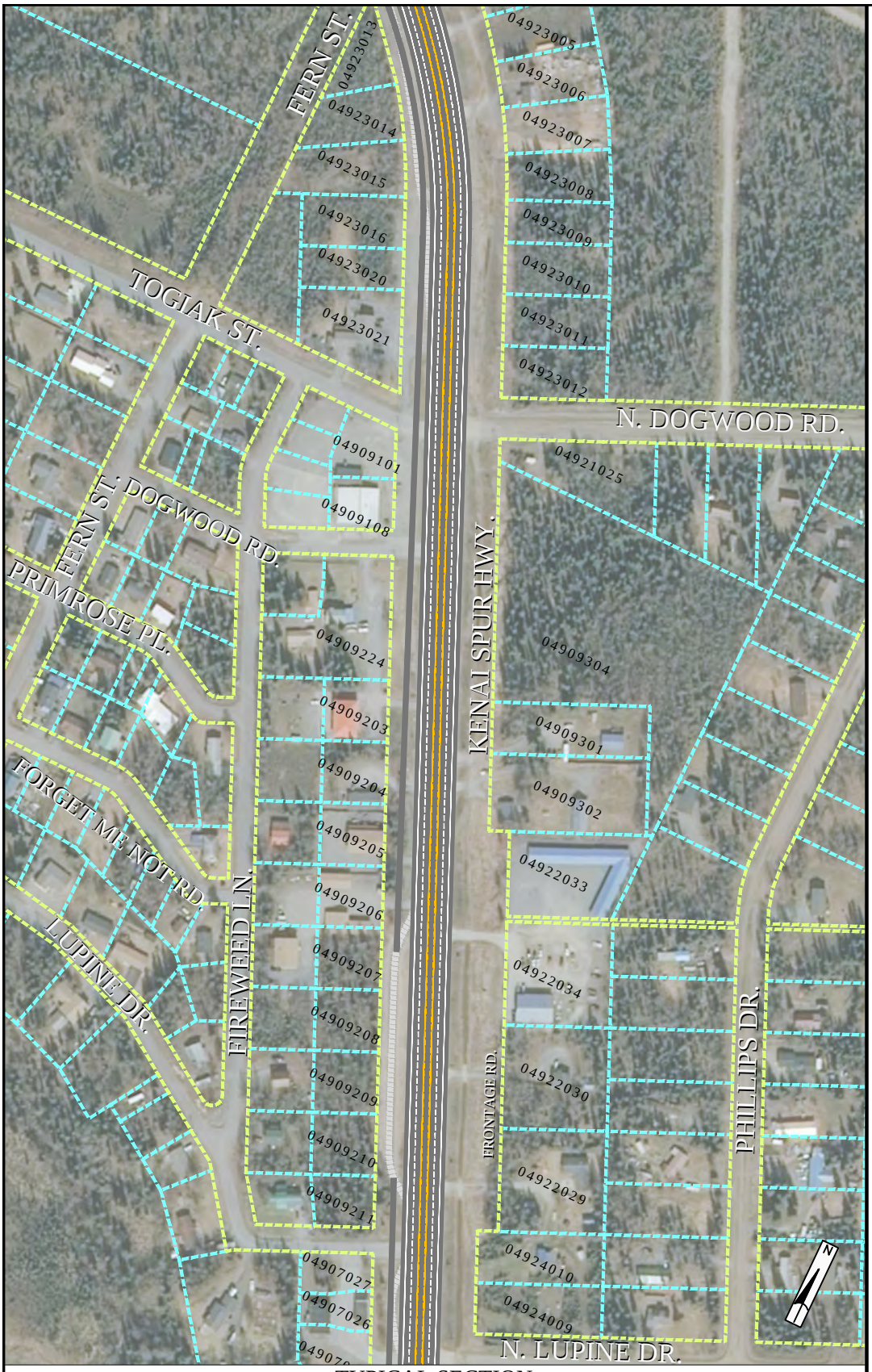
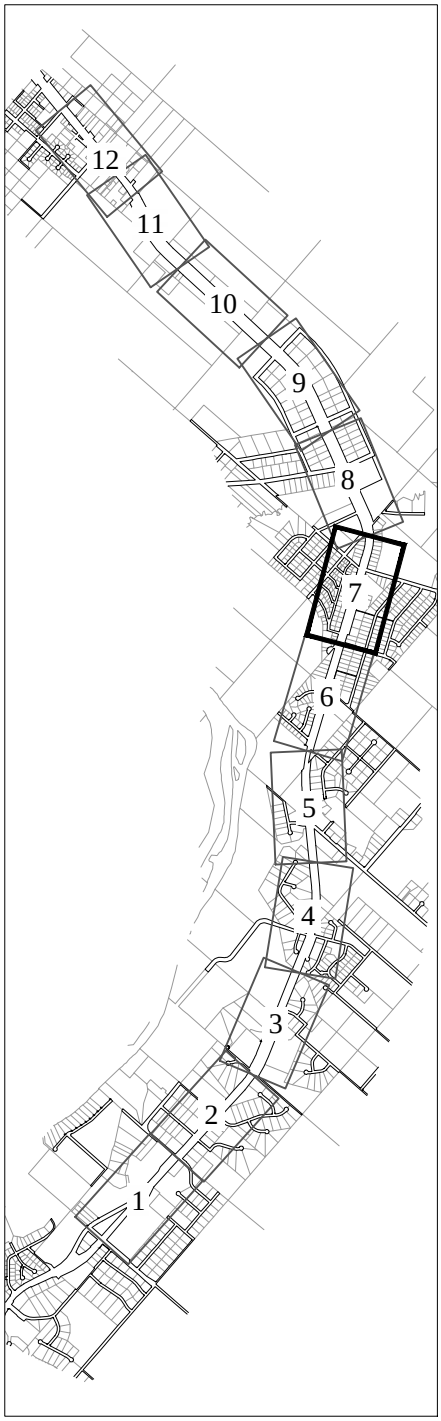
SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 6 OF 12



LEGEND	
EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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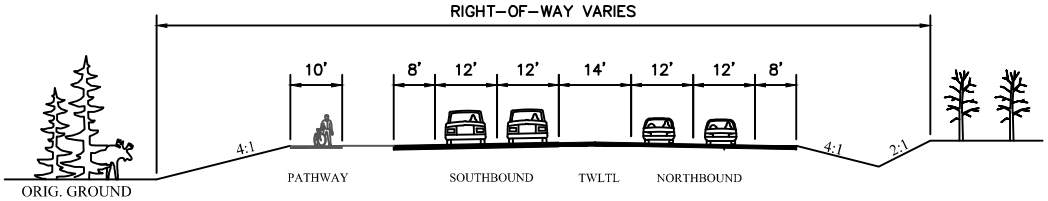

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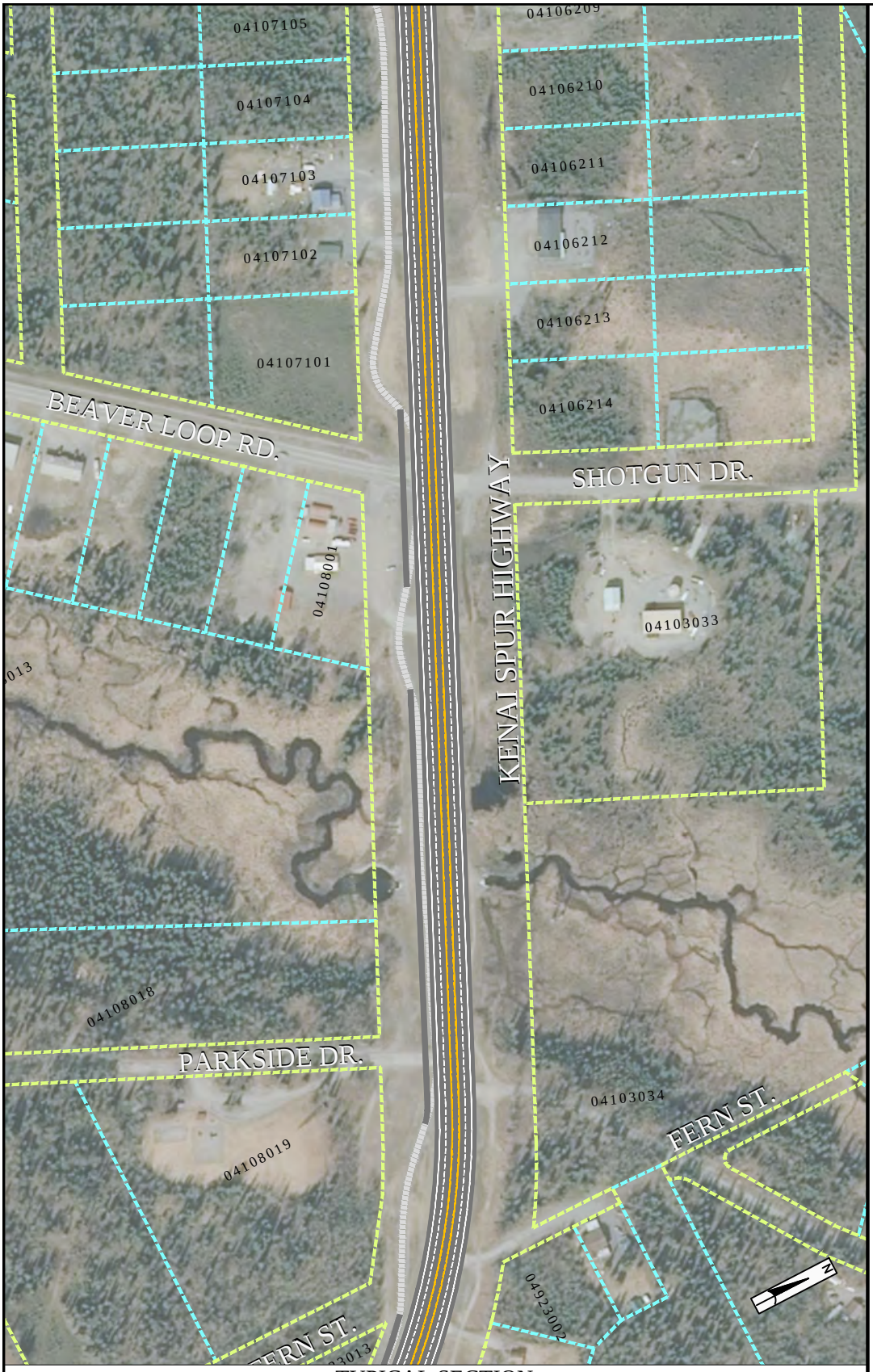
SCALE IN FEET

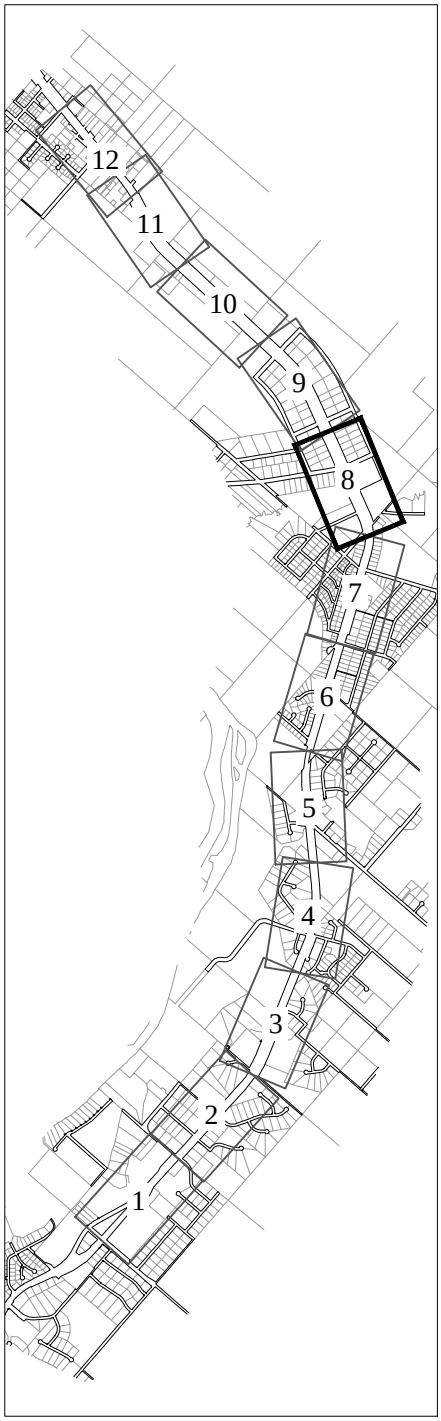
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 7 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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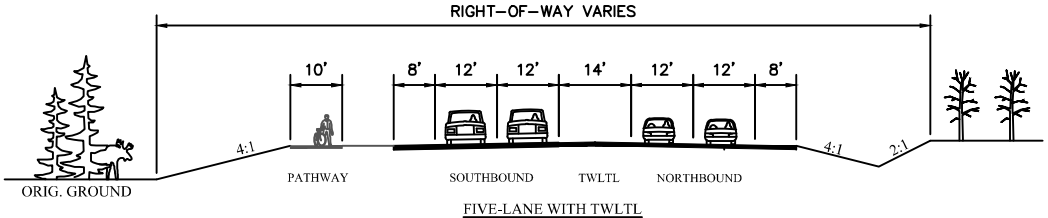

FIVE-LANE WITH TWLTL

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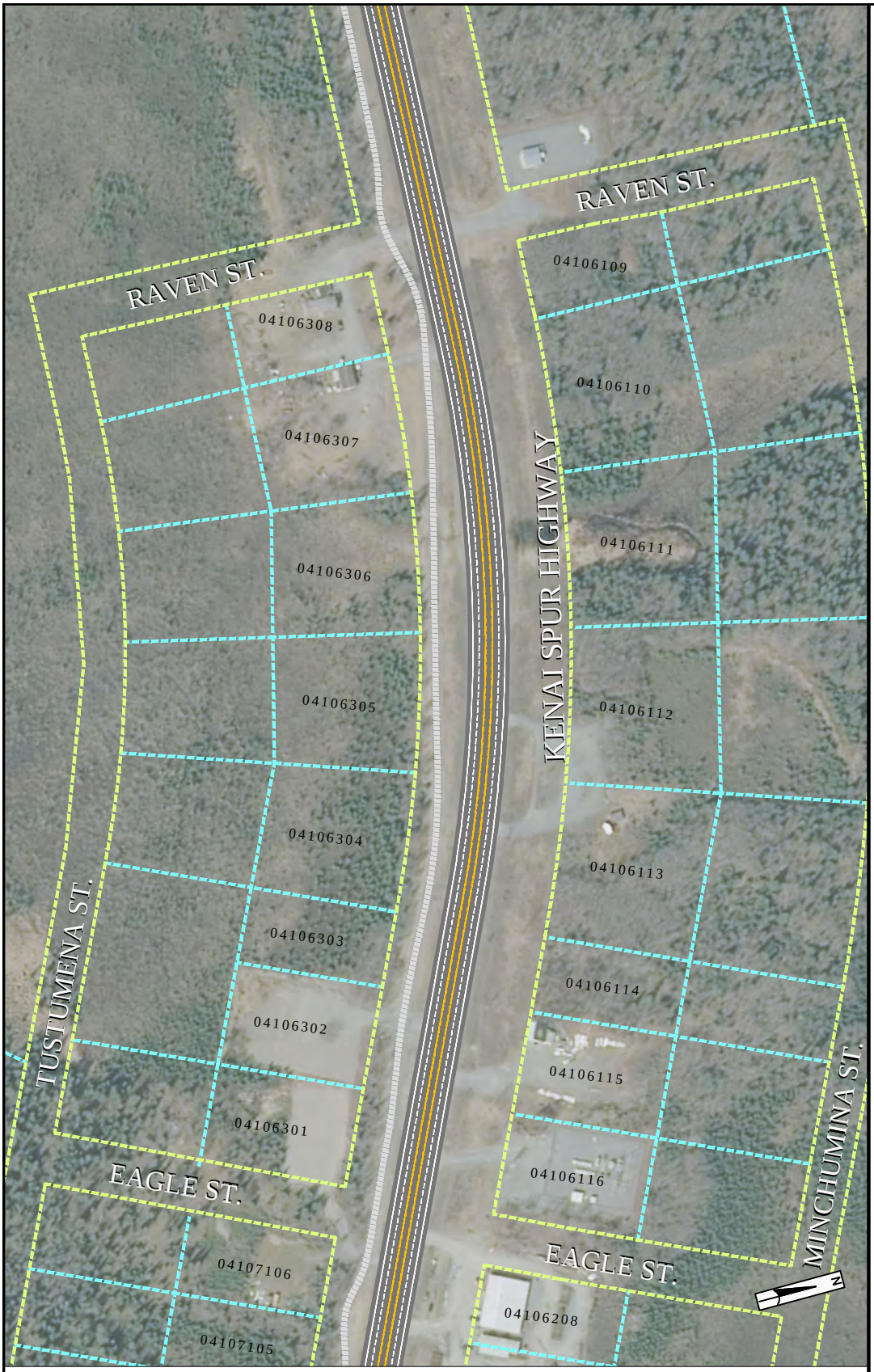
SCALE IN FEET

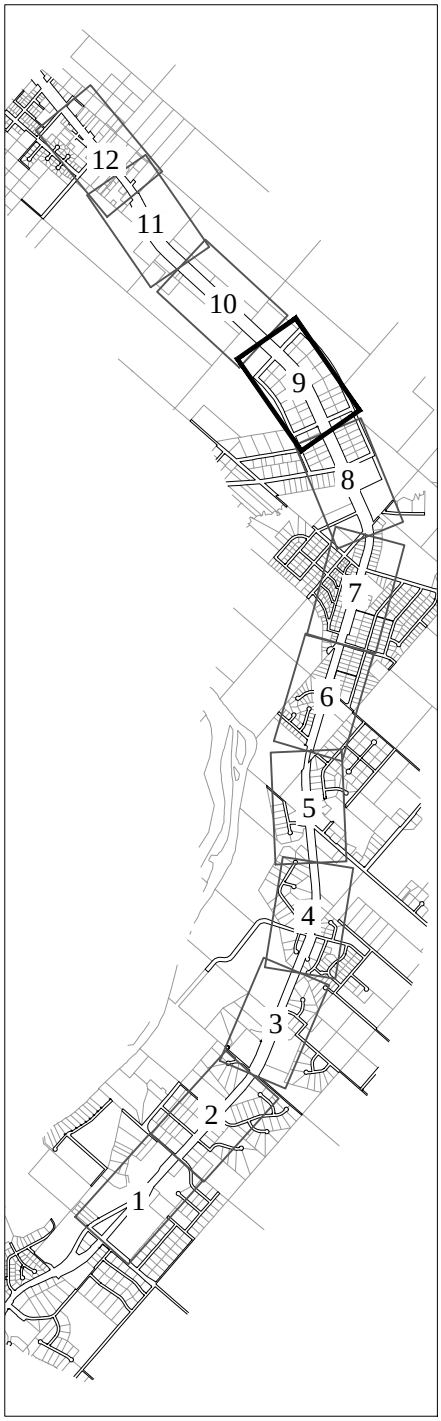
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 8 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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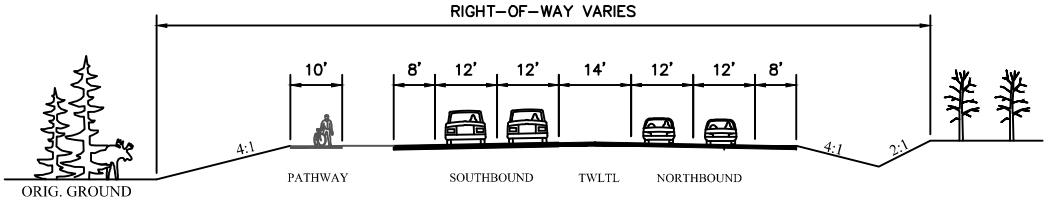

FIVE-LANE WITH TWLTL

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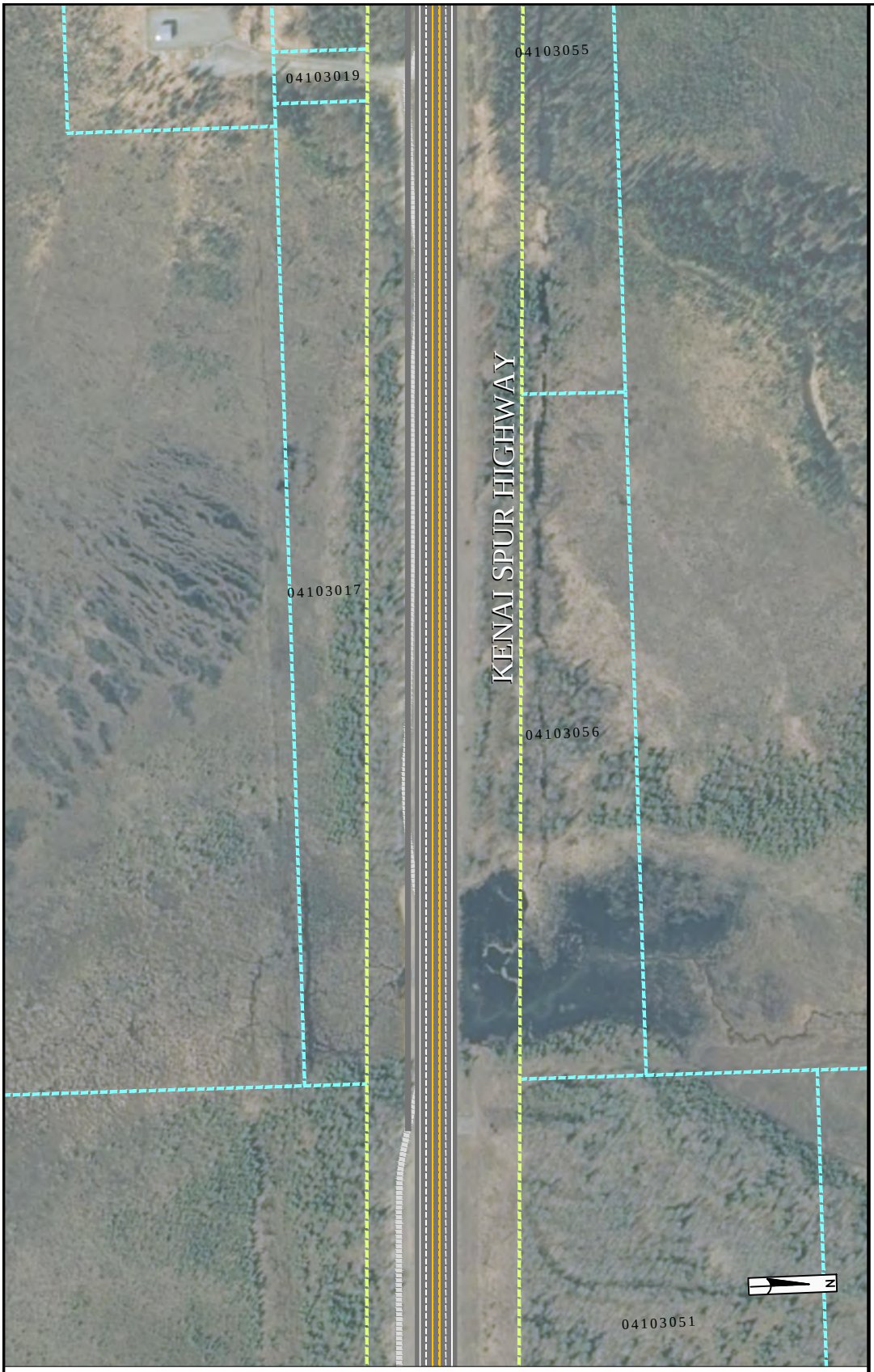
SCALE IN FEET

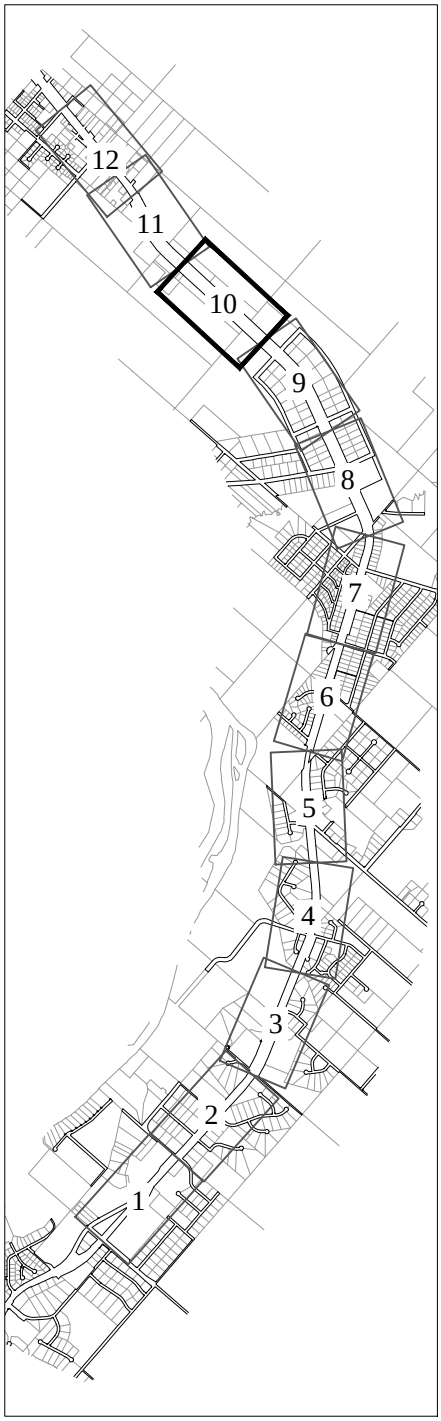
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 9 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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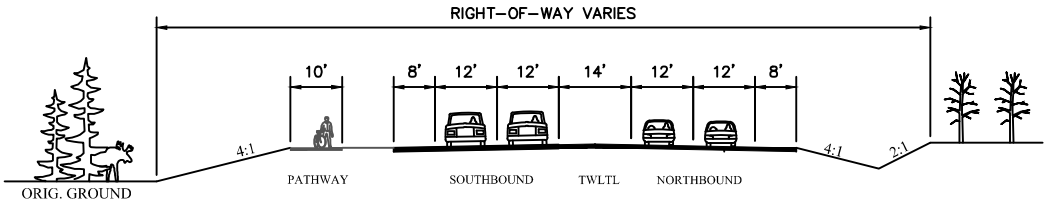

FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

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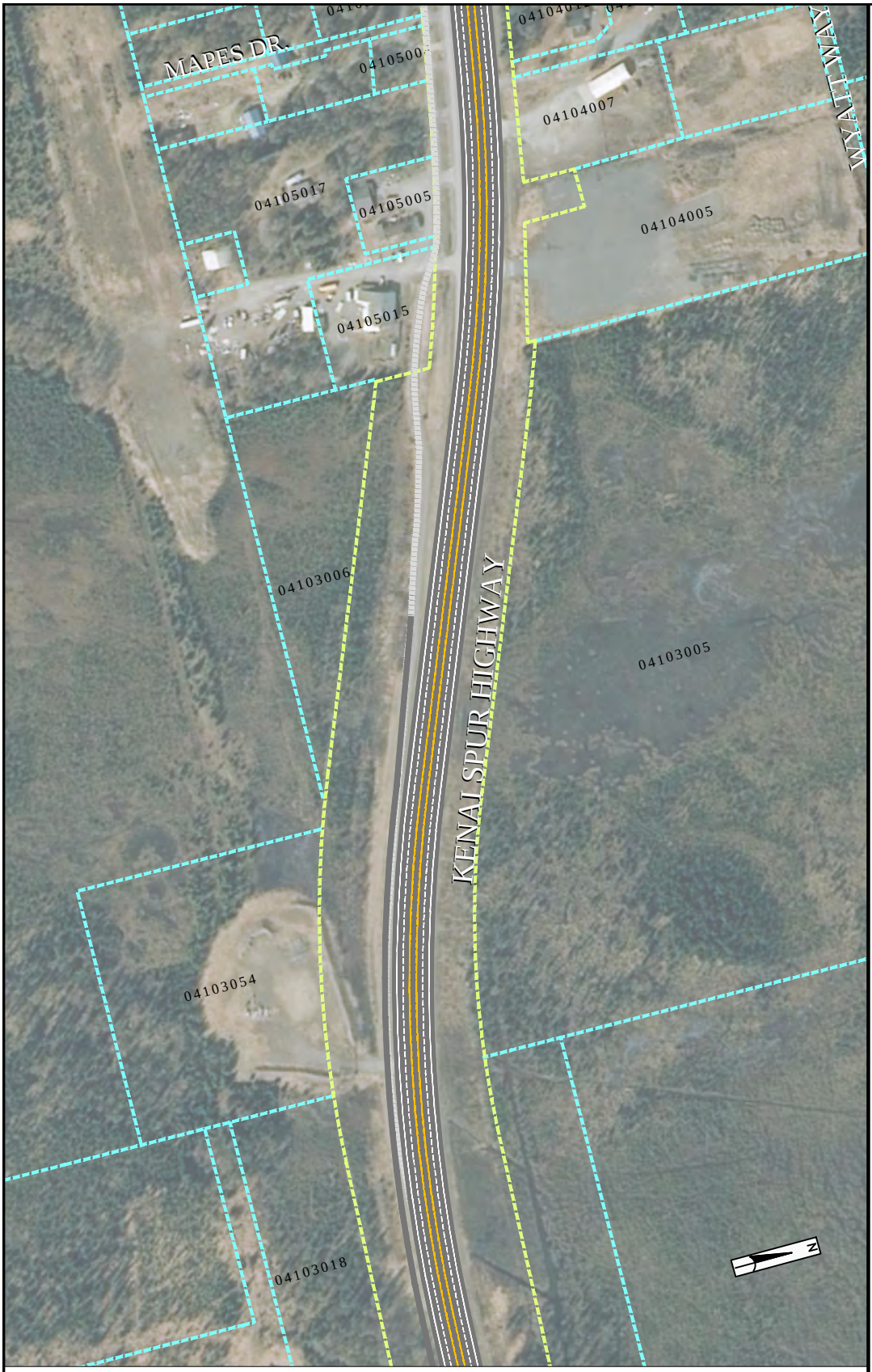
SCALE IN FEET

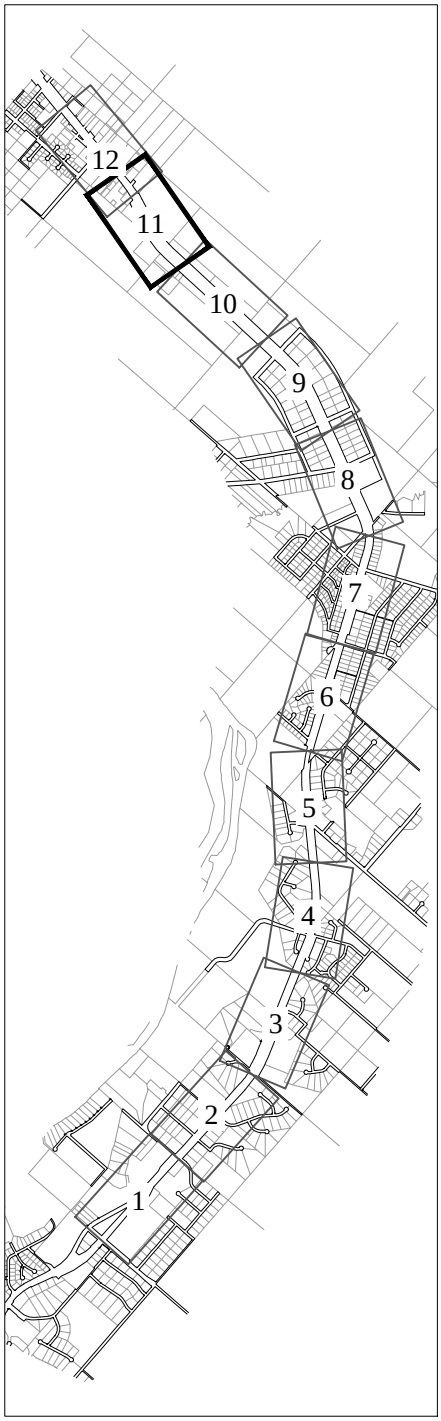
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594 | SHEET 10 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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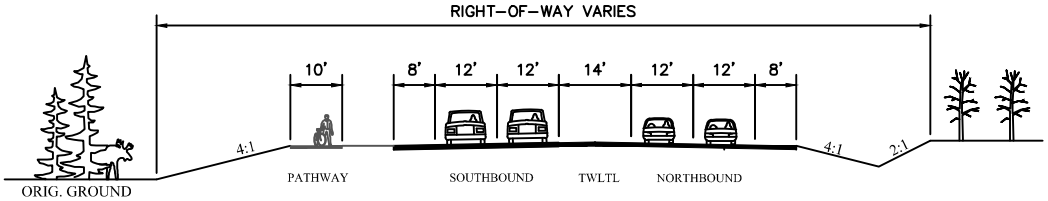


FIVE-LANE WITH TWLTL

PRELIMINARY CONCEPT

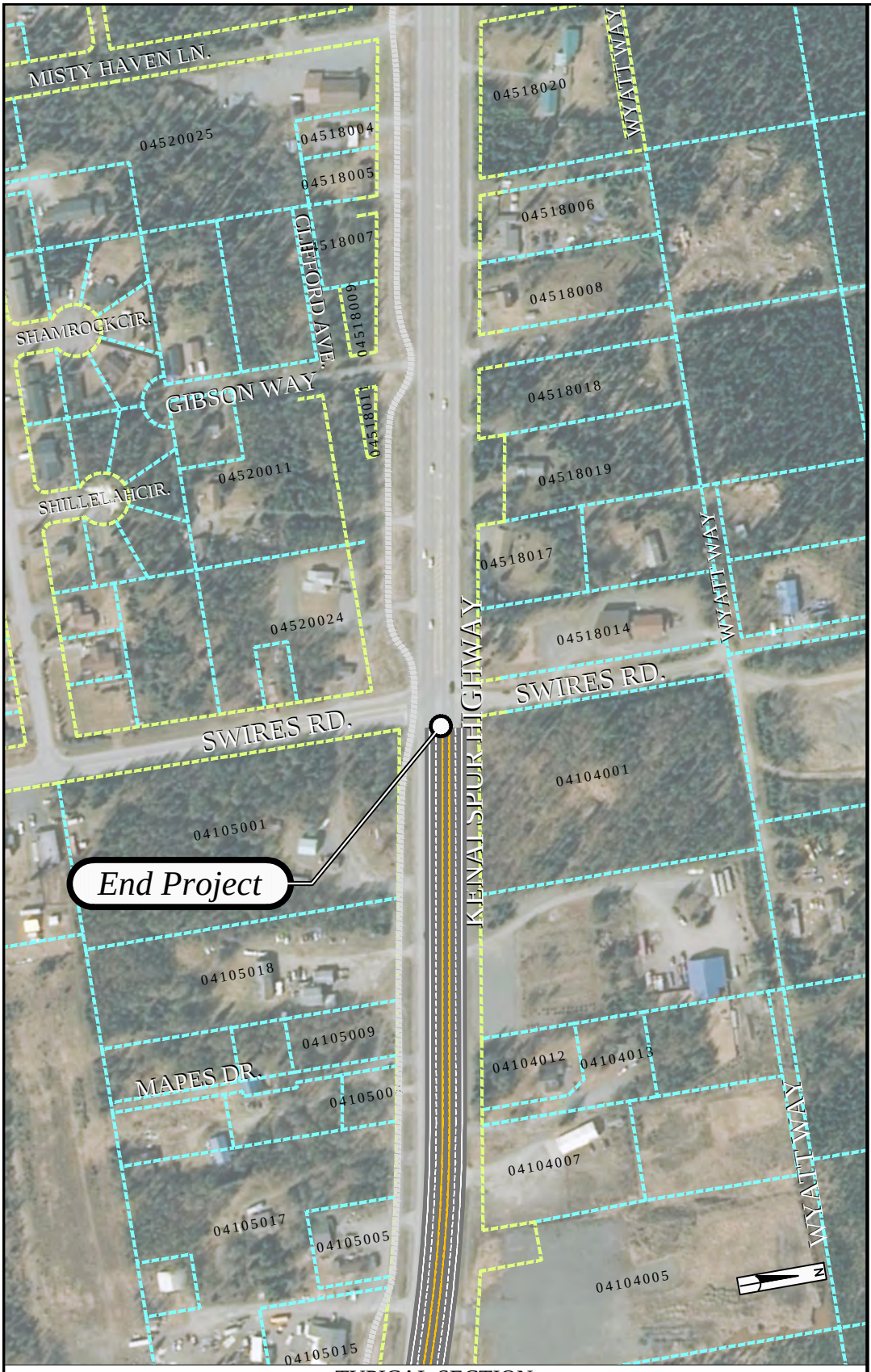
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

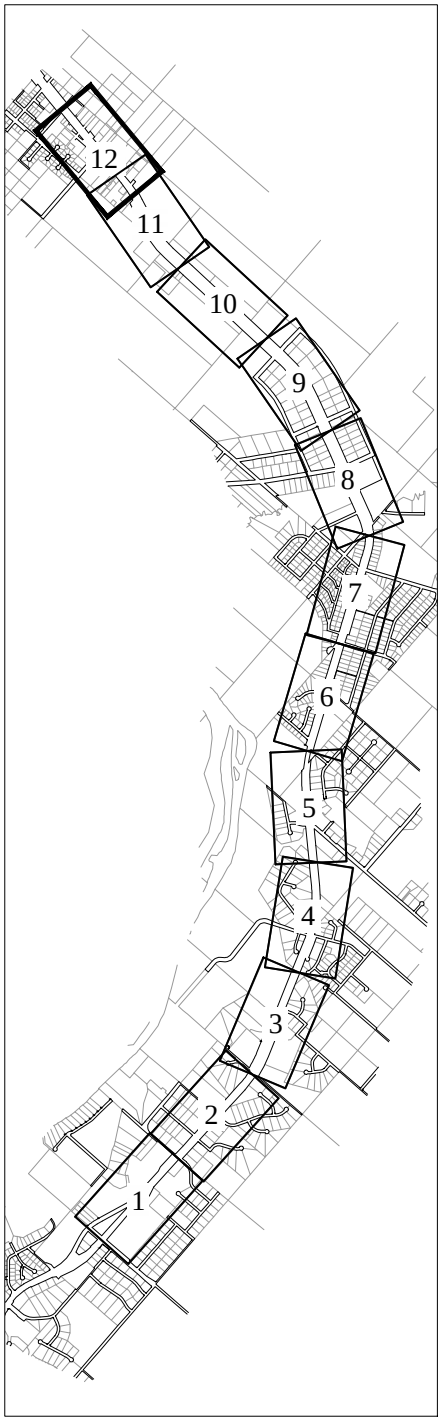
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 11 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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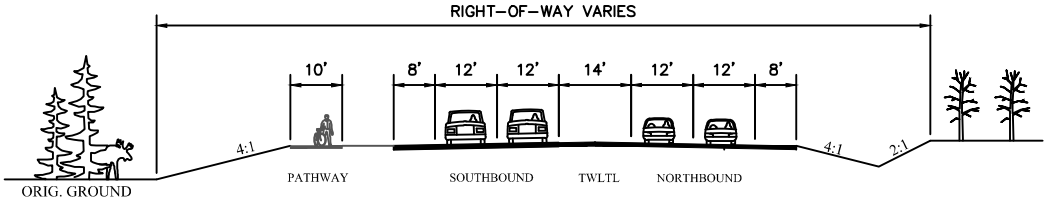

FIVE-LANE WITH TWLTL

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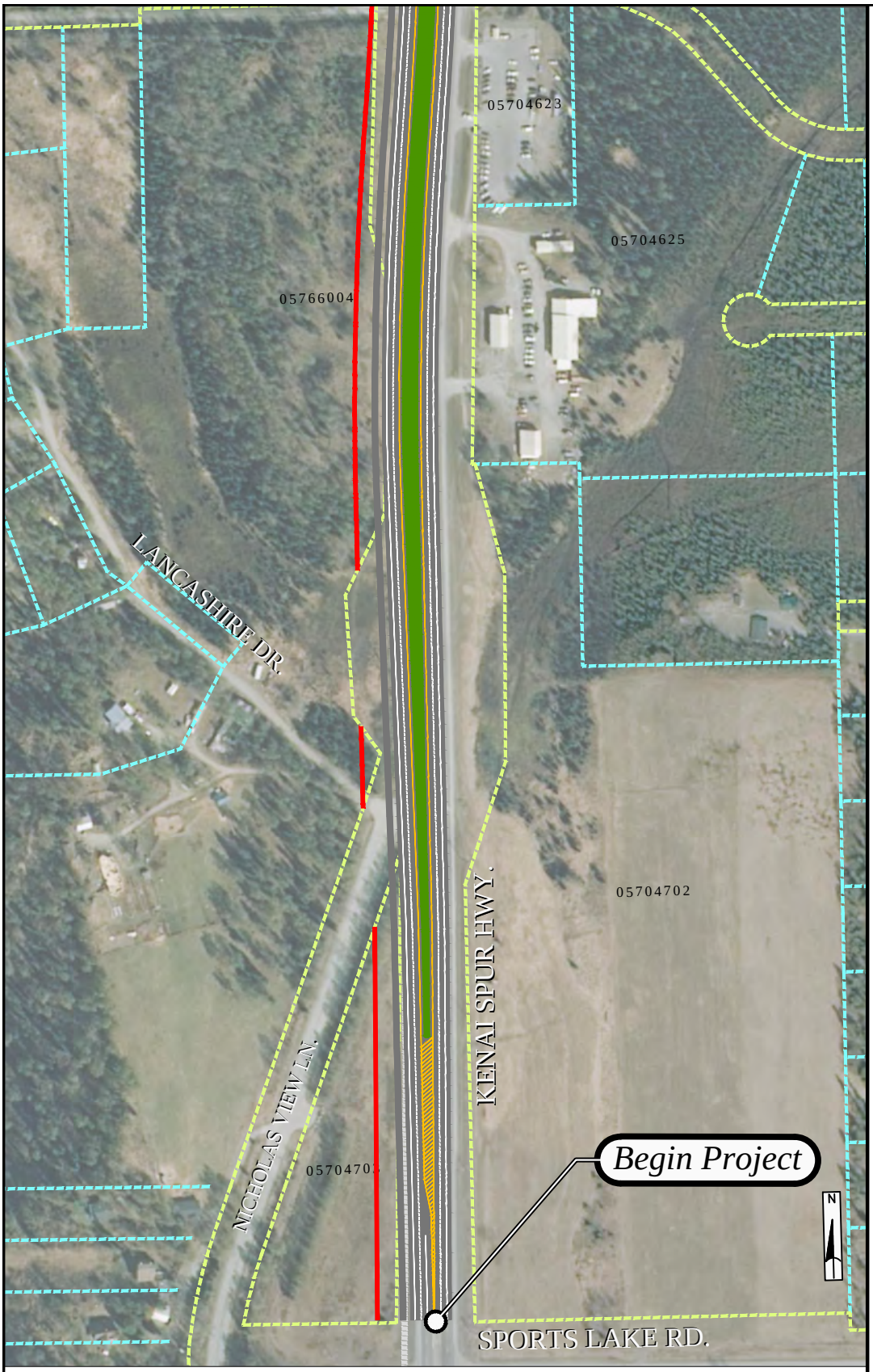
0 150 300 600

SCALE IN FEET

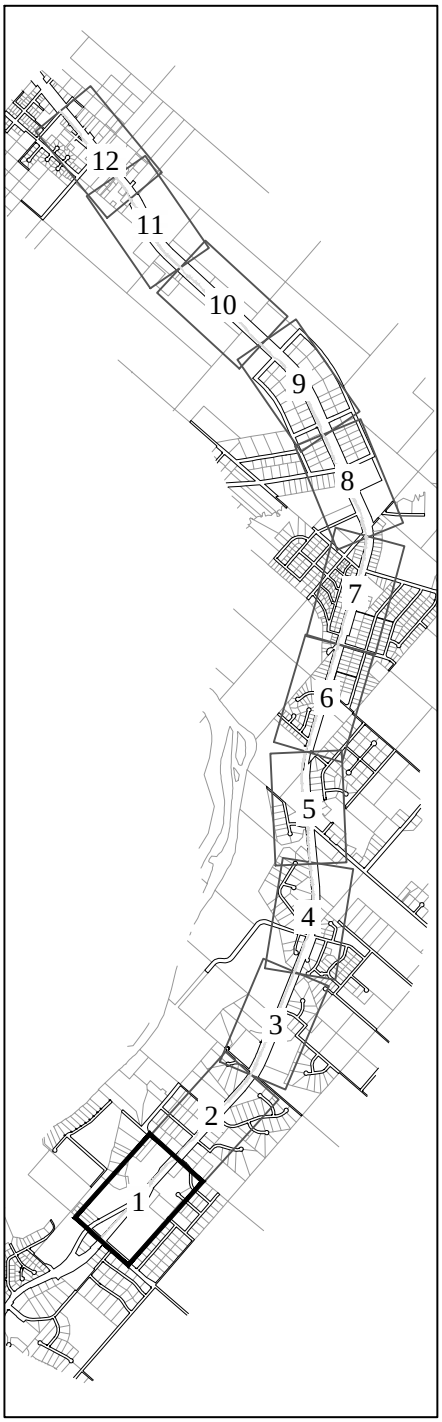
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 3: FIVE-LANE

PROJECT# 54594	SHEET 12 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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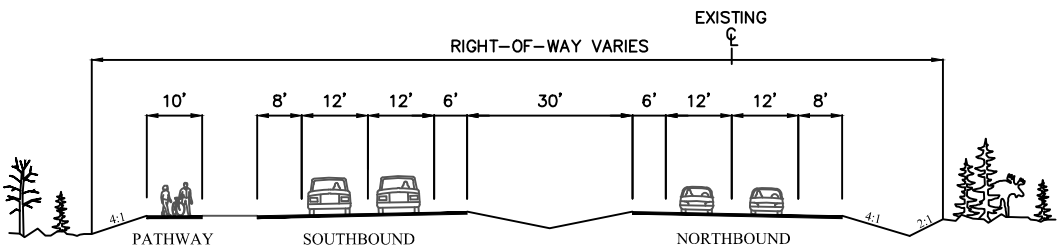


FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

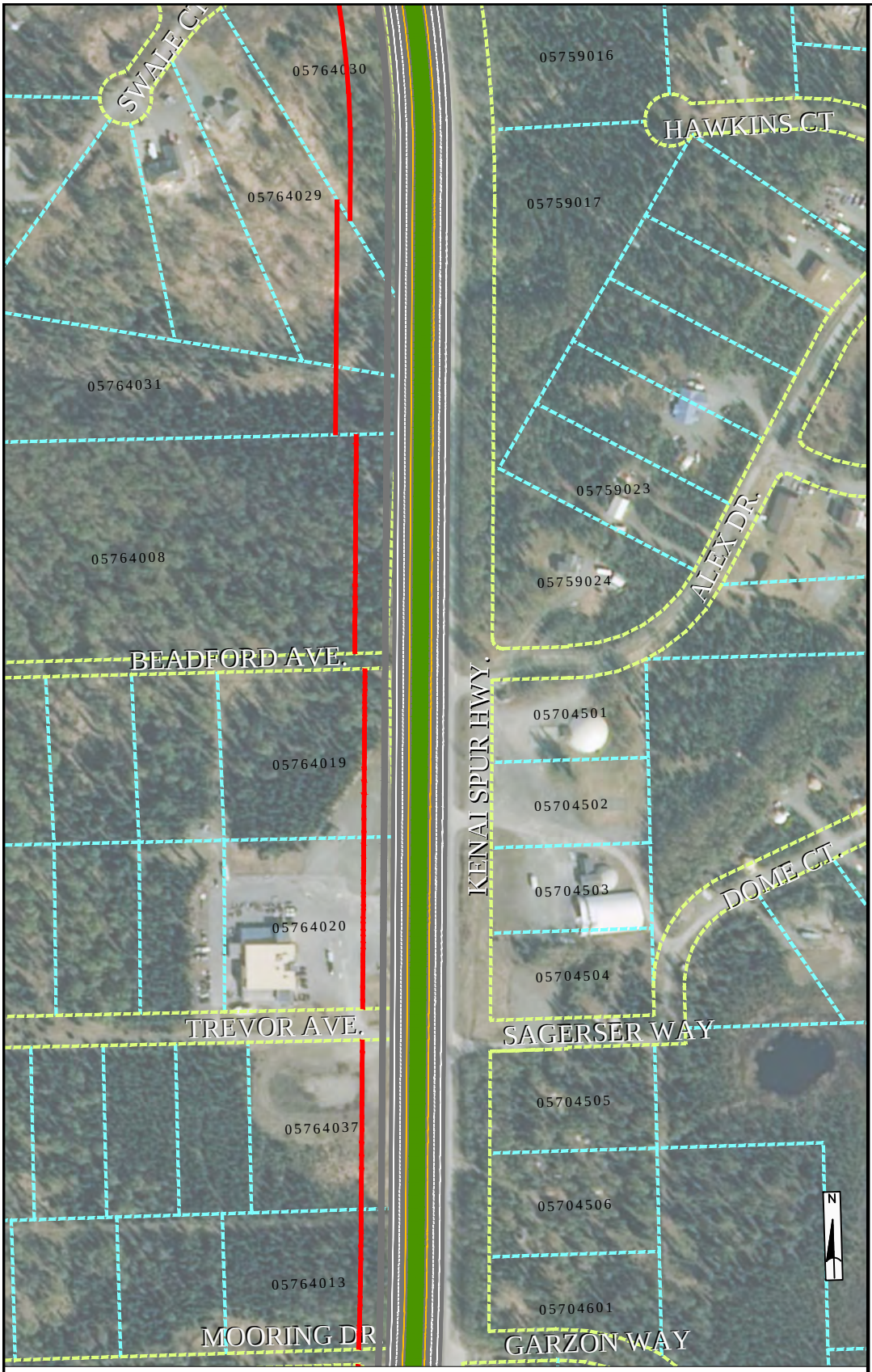
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

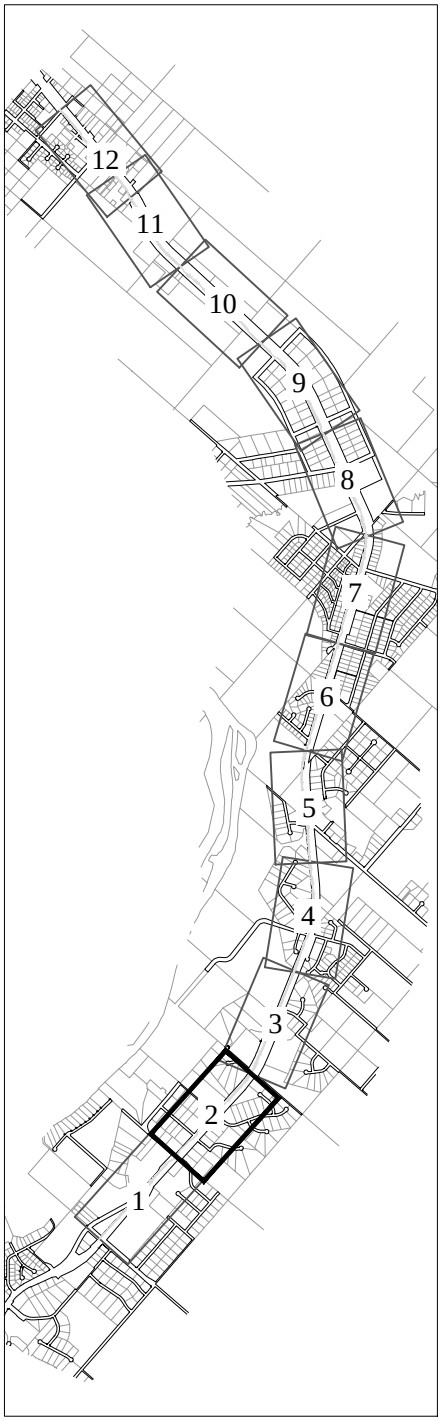
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 1 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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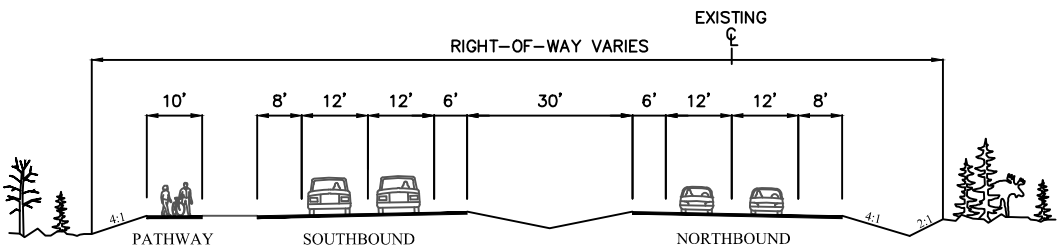

FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

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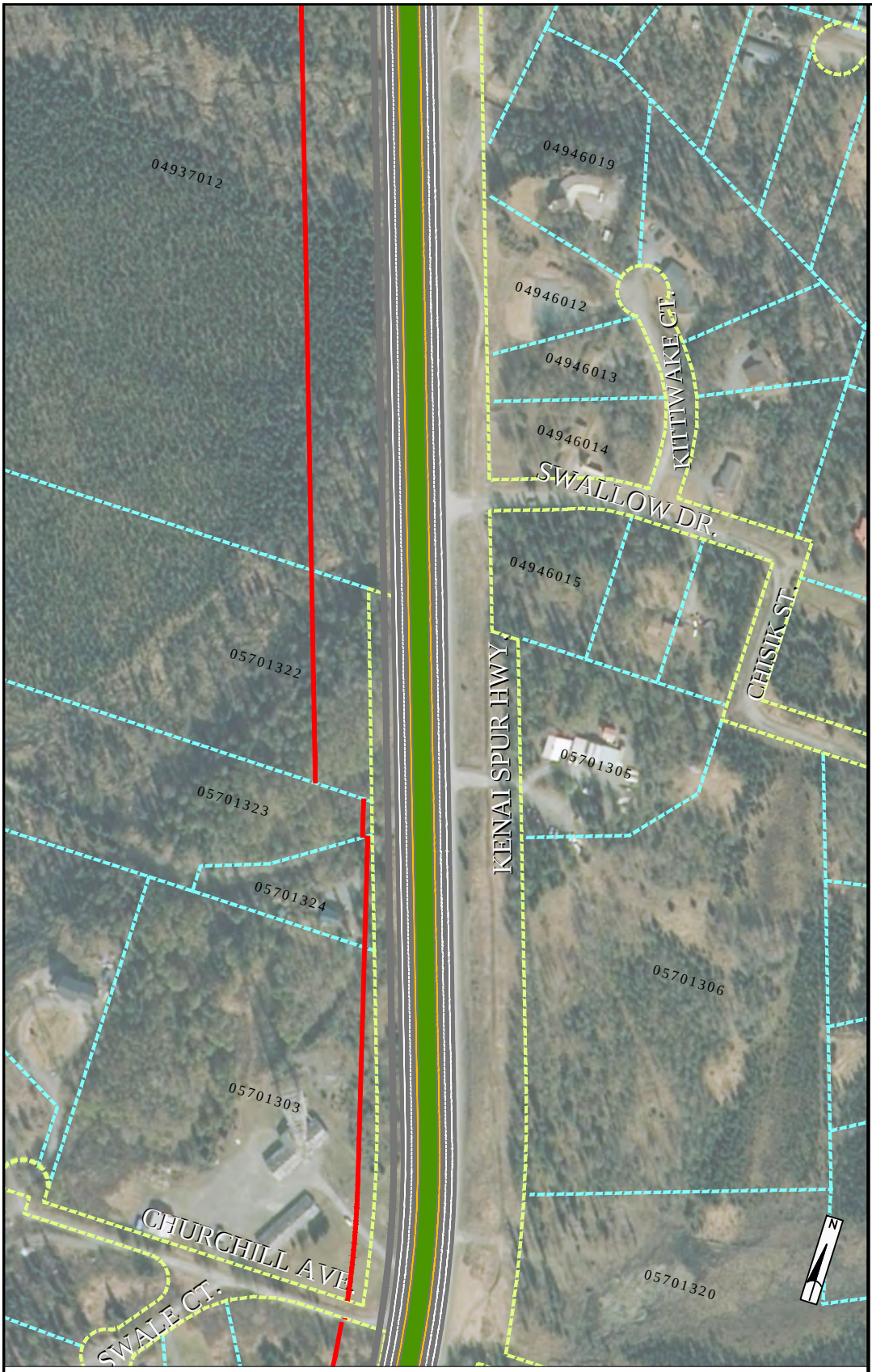
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

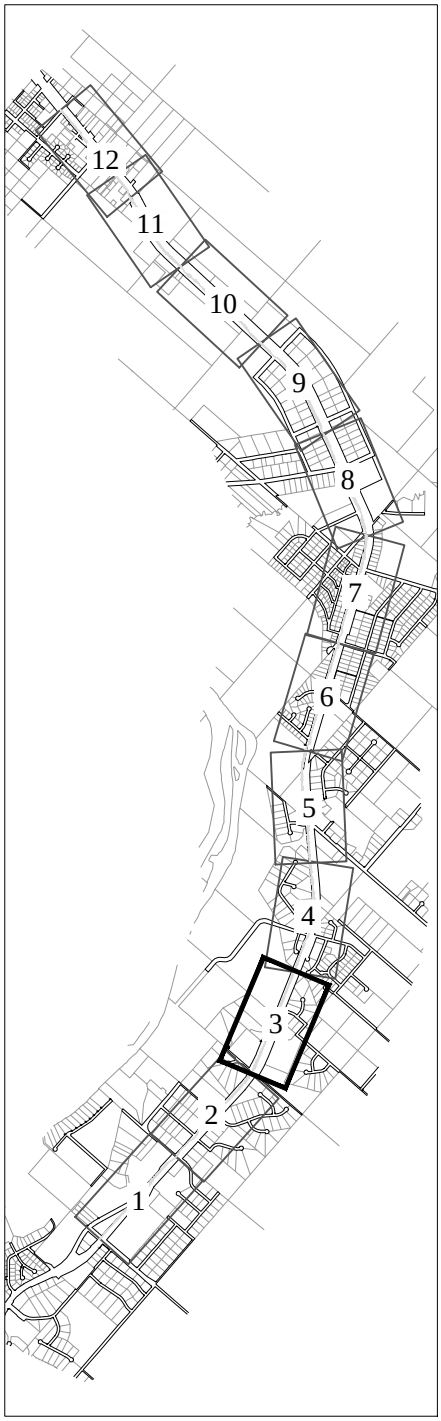
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594 | SHEET 2 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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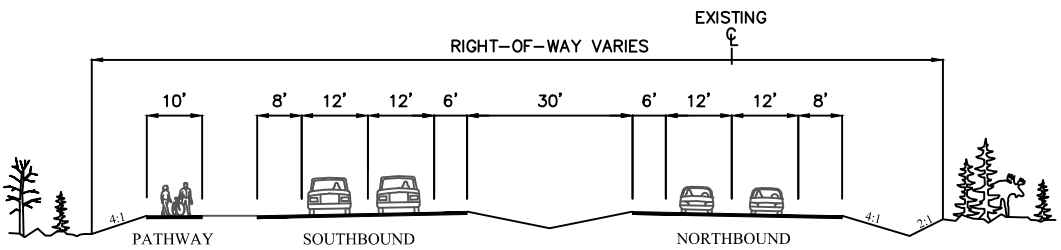

FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

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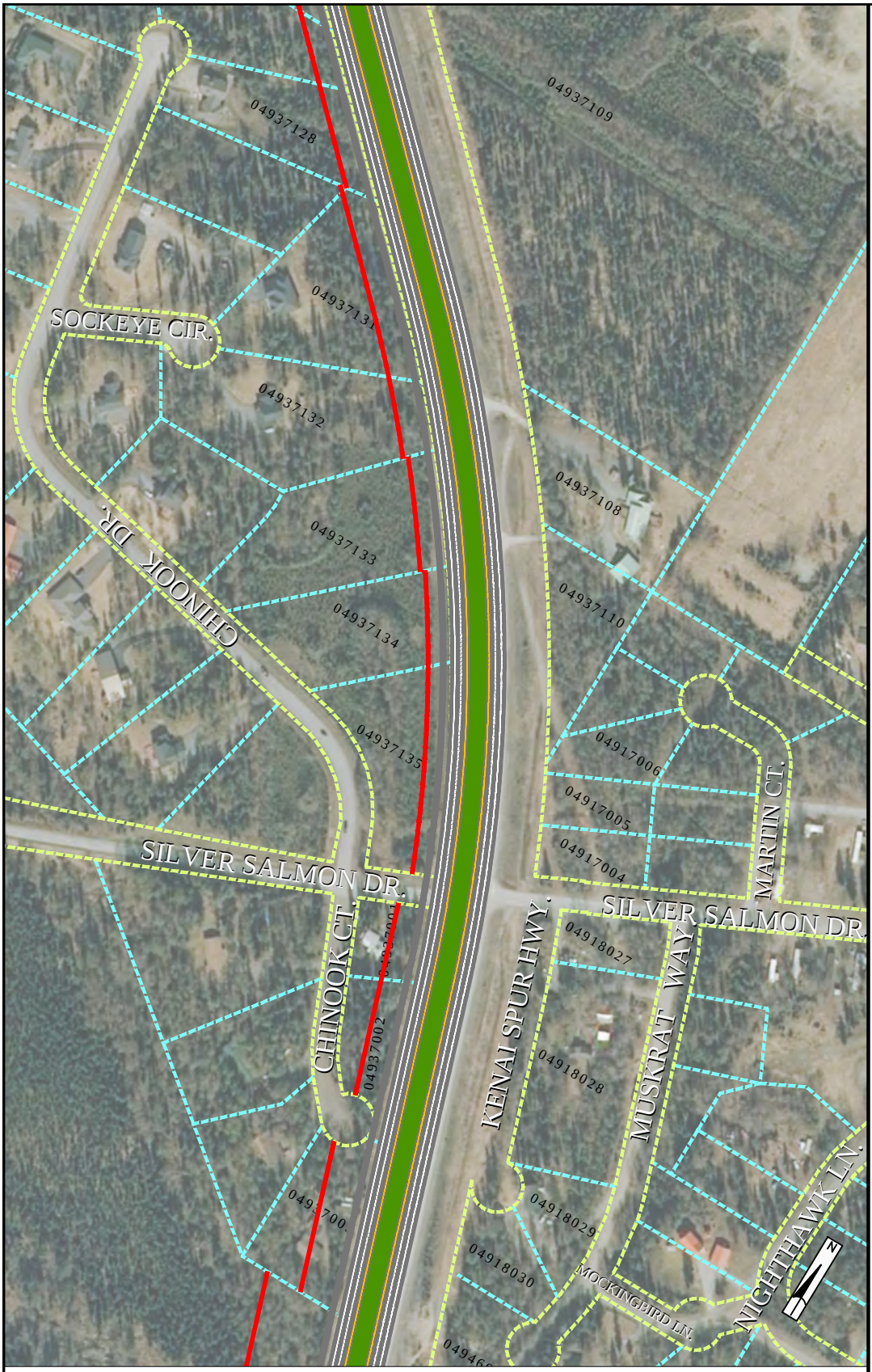
0 150 300 600

SCALE IN FEET

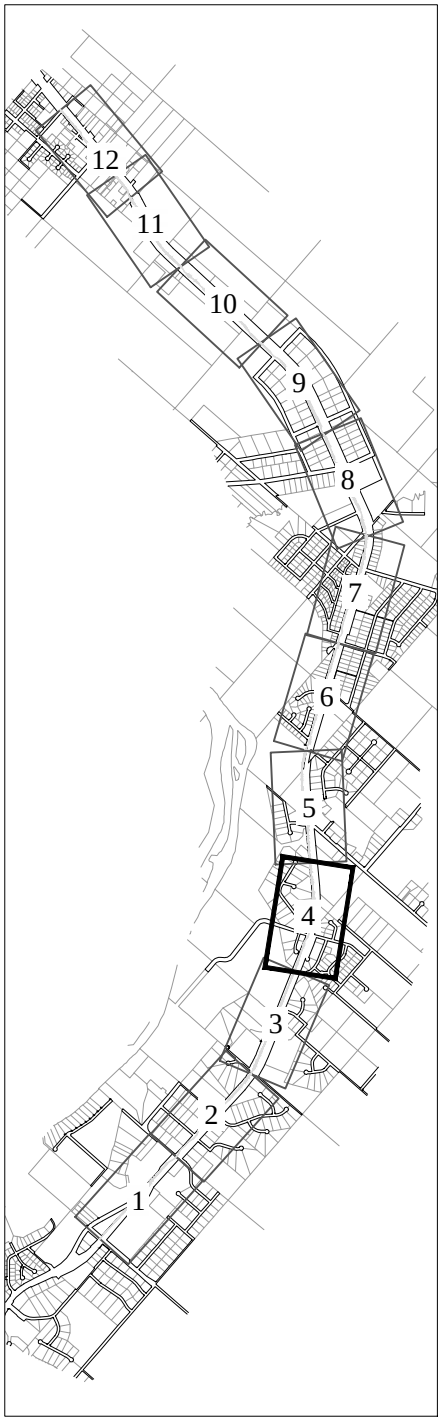
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 3 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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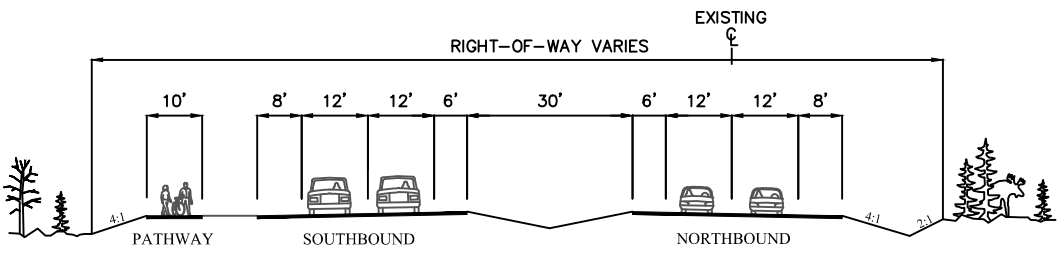

FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

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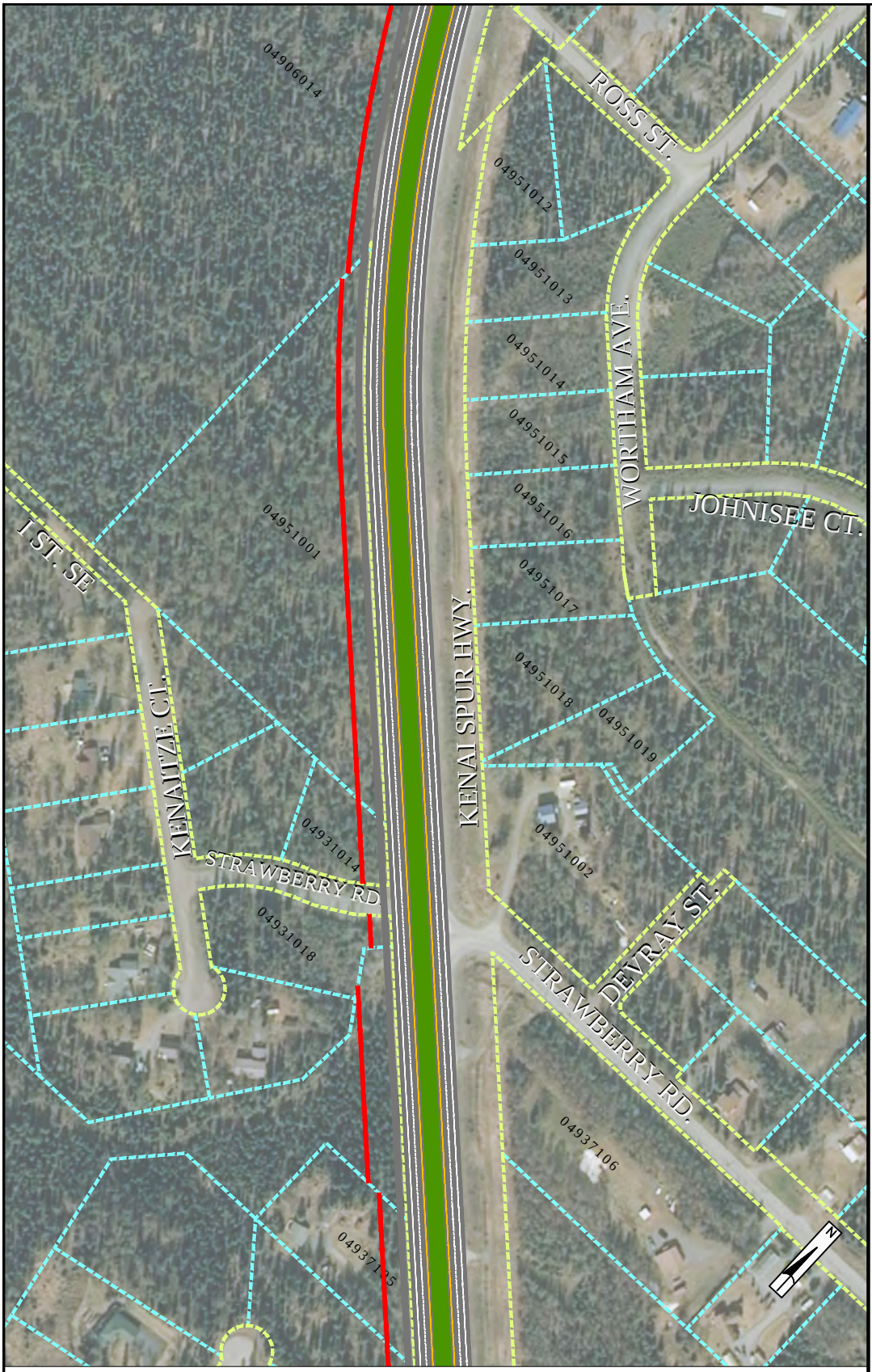
SCALE IN FEET

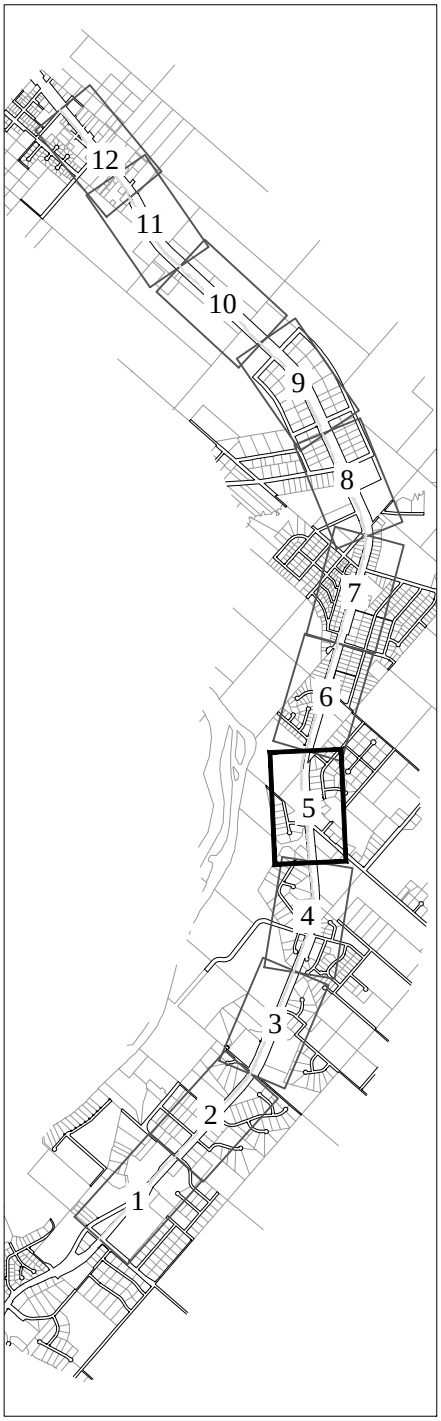
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 4 OF 12

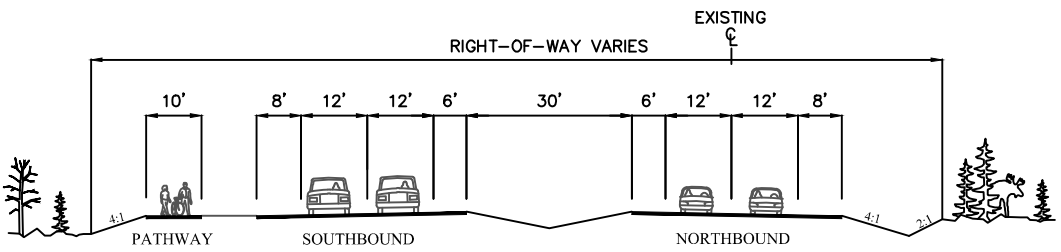


LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



TYPICAL SECTION



FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

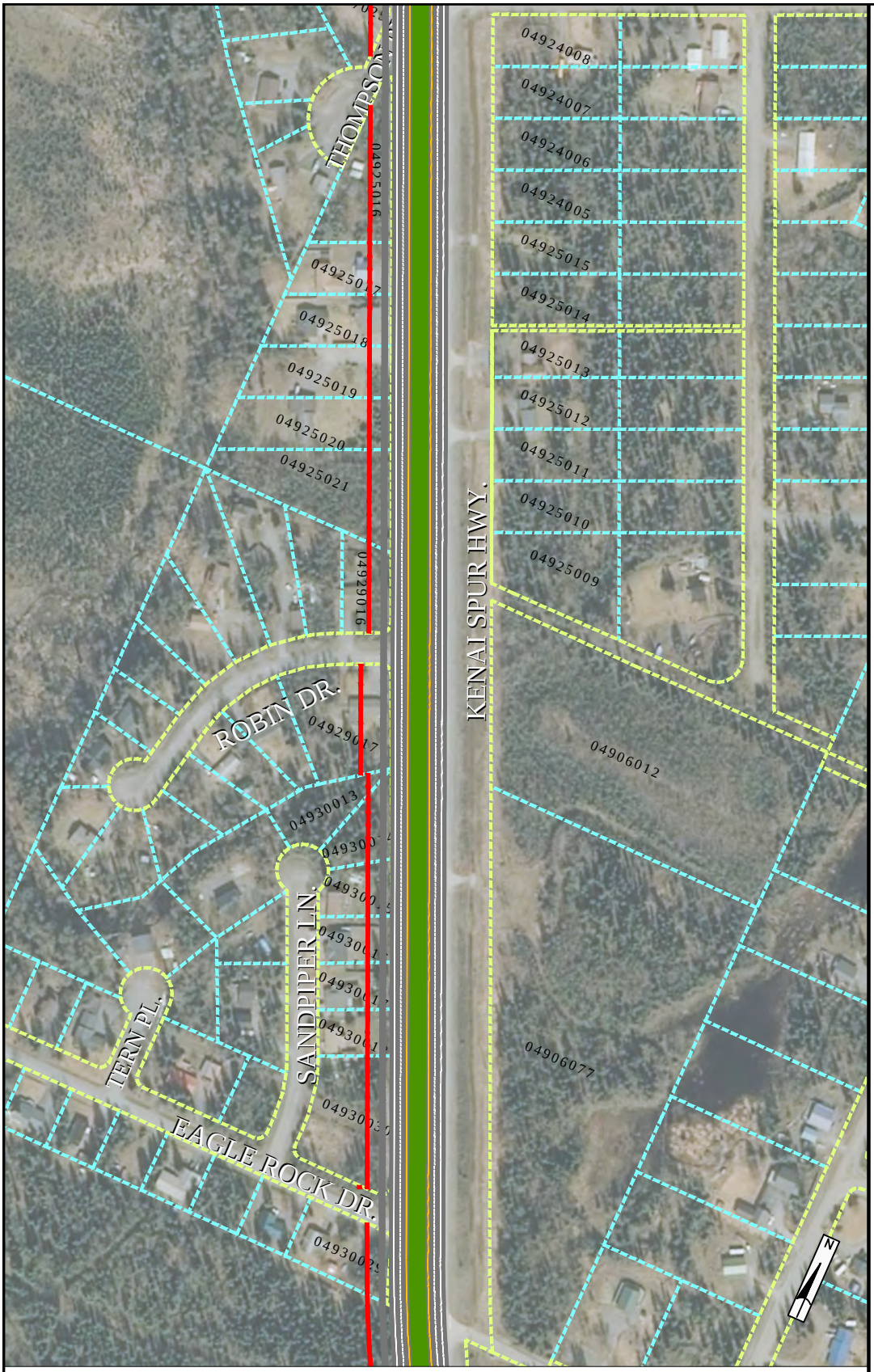
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

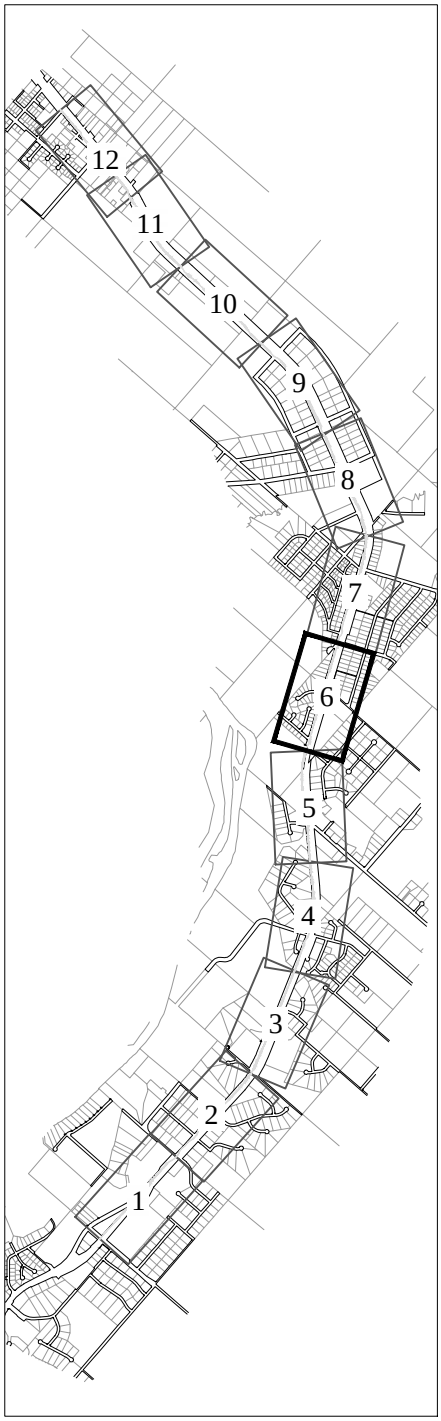
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 5 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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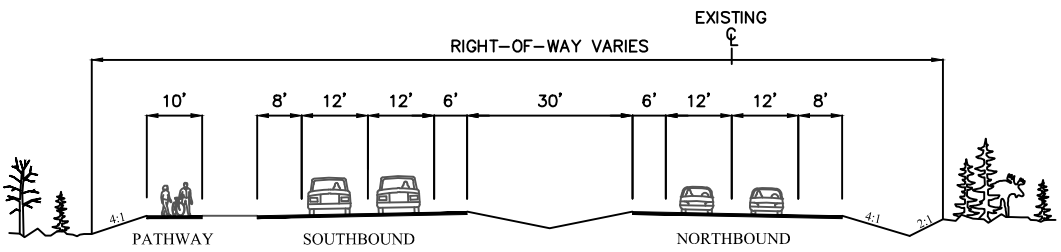


FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

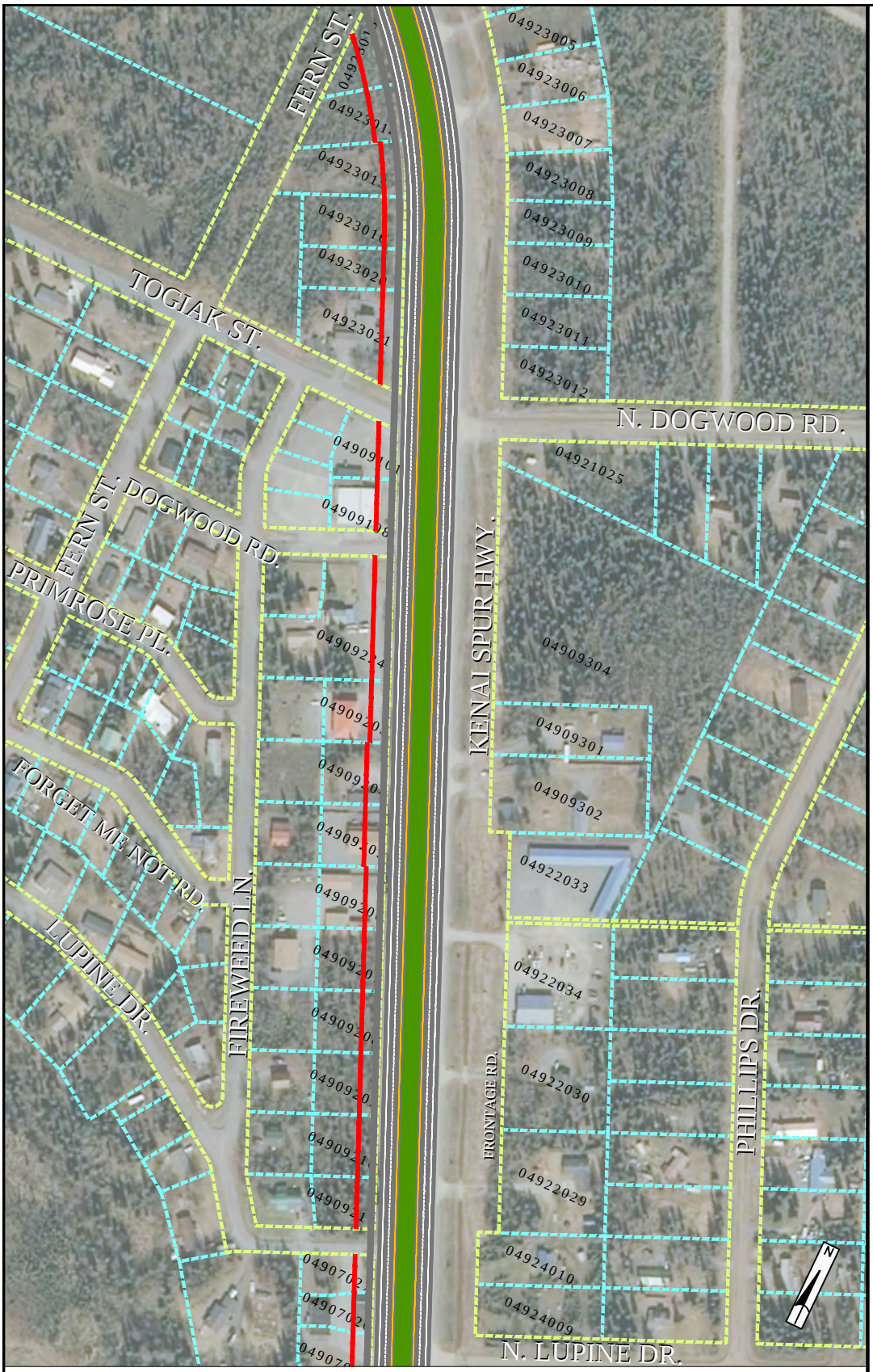
THE LOCATION AND TYPE OF ROADWAY MAY CHANGE.
PROPOSED RIGHT-OF-WAY WIDTHS ARE ESTIMATES.

0 150 300 600

SCALE IN FEET

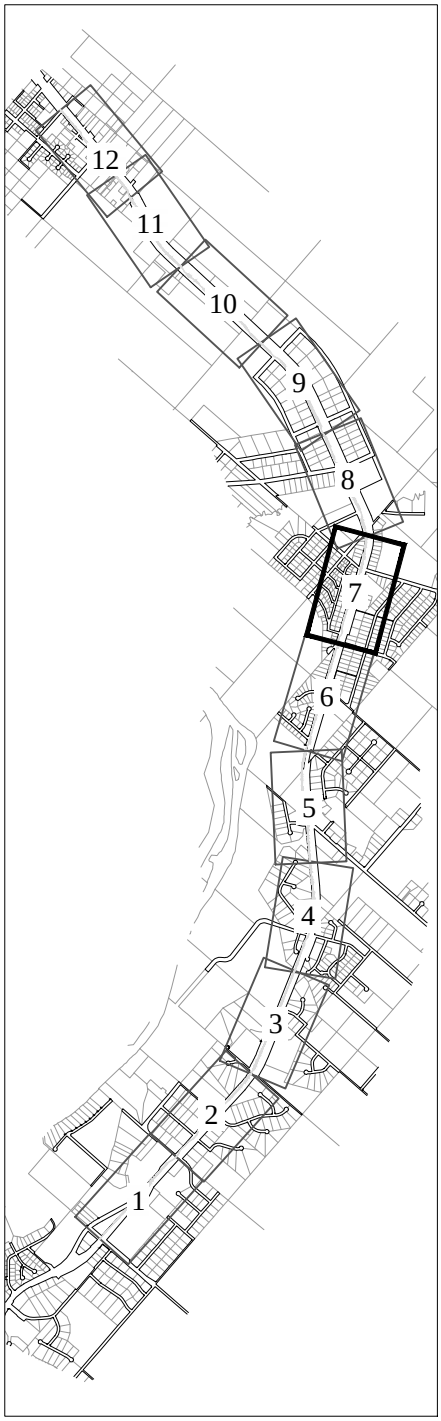
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 6 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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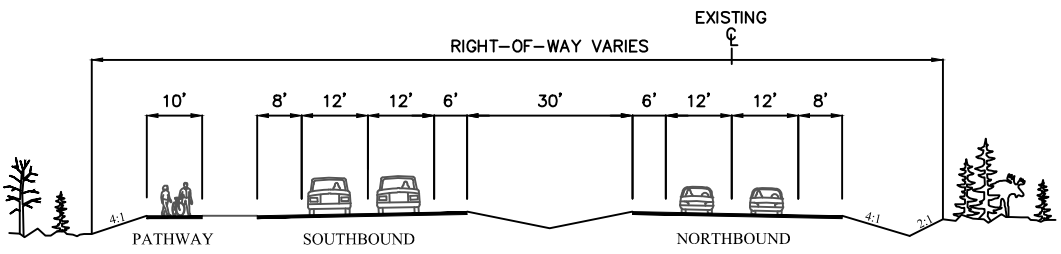

FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

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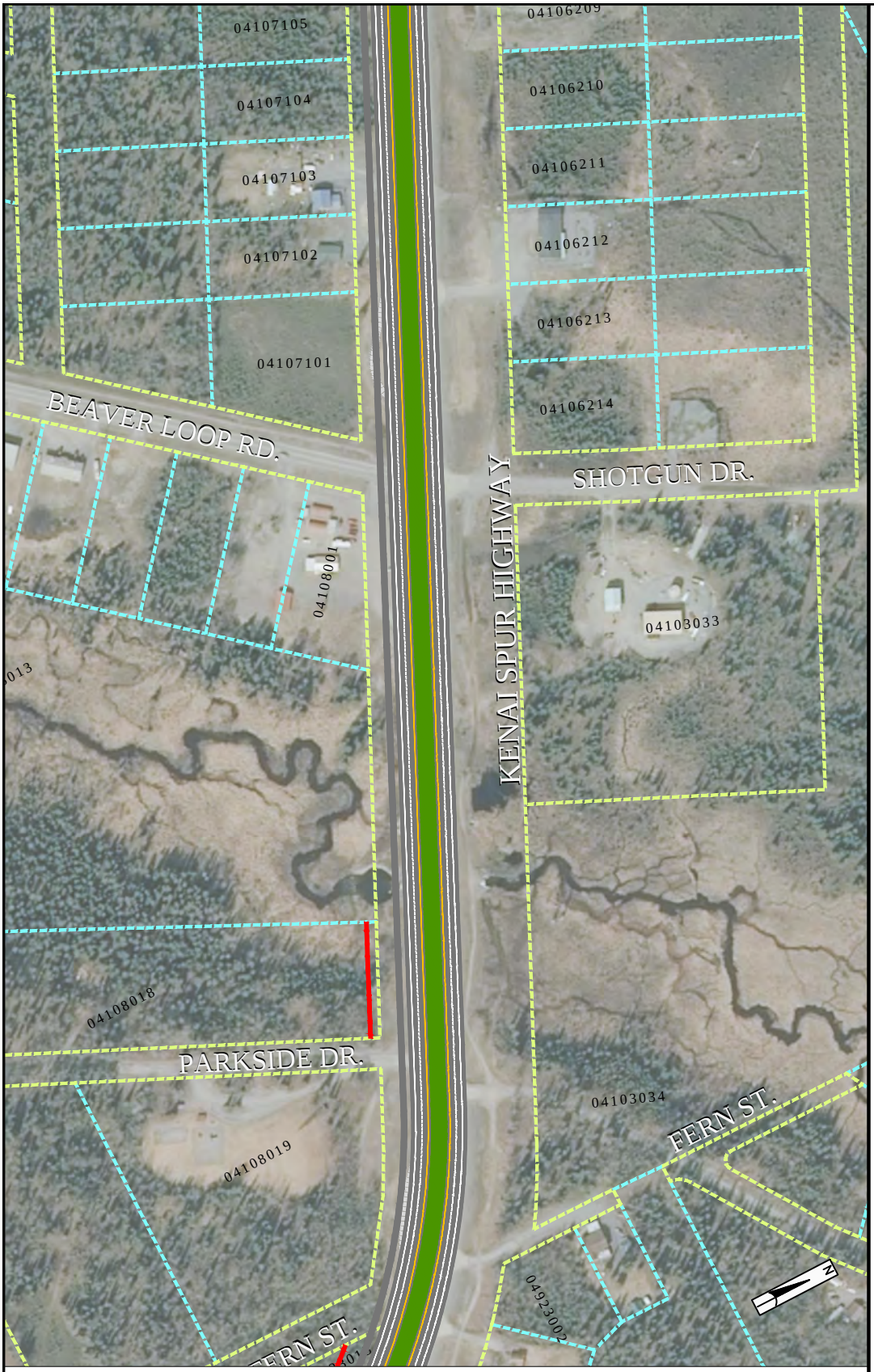
0 150 300 600

SCALE IN FEET

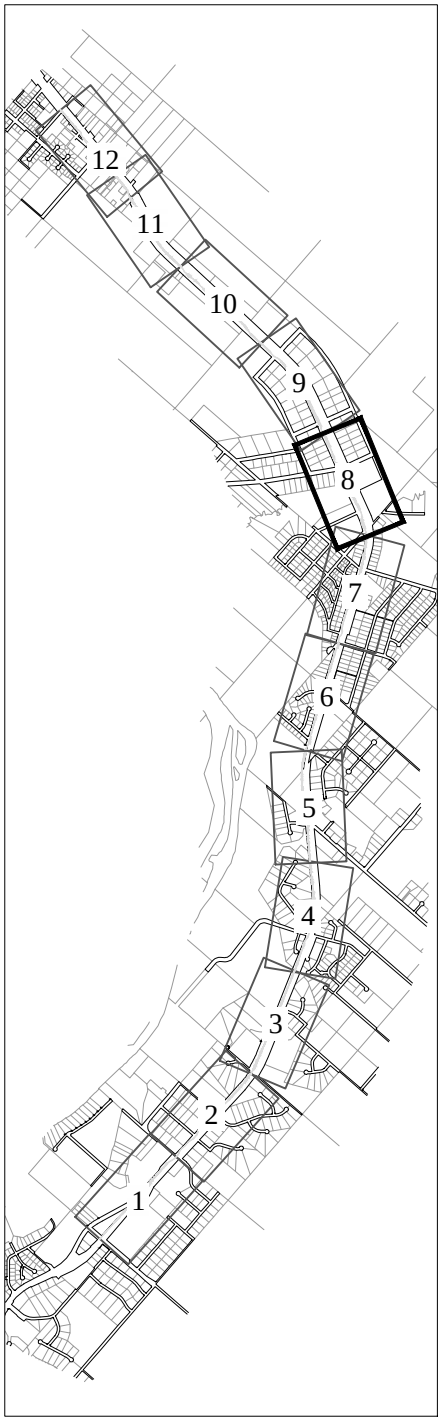
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 7 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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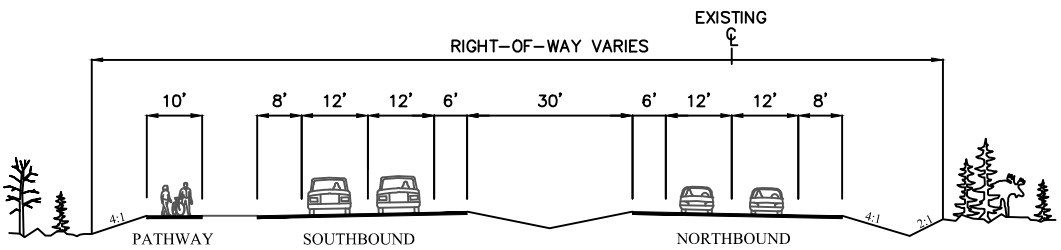

FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

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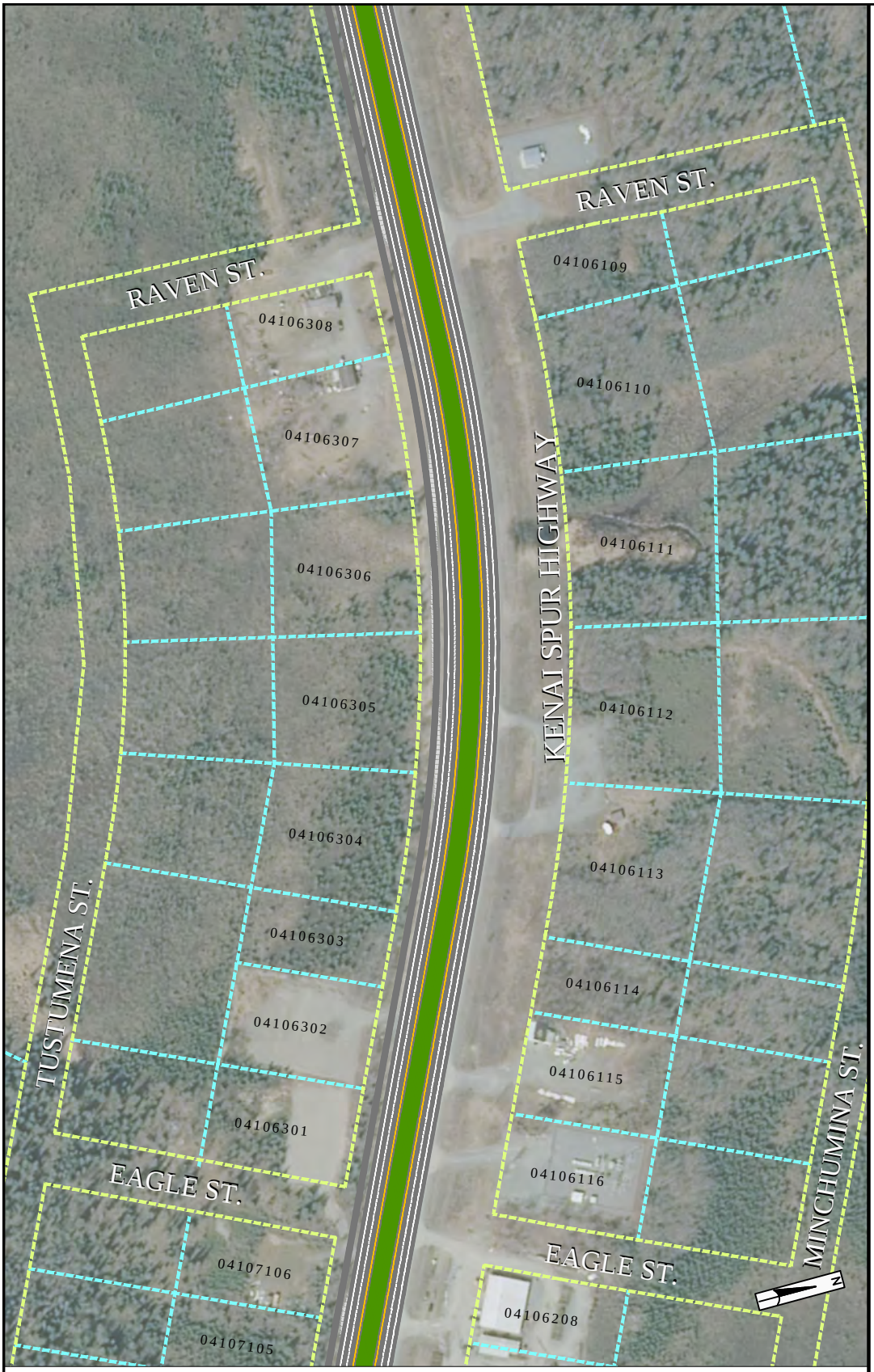
0 150 300 600

SCALE IN FEET

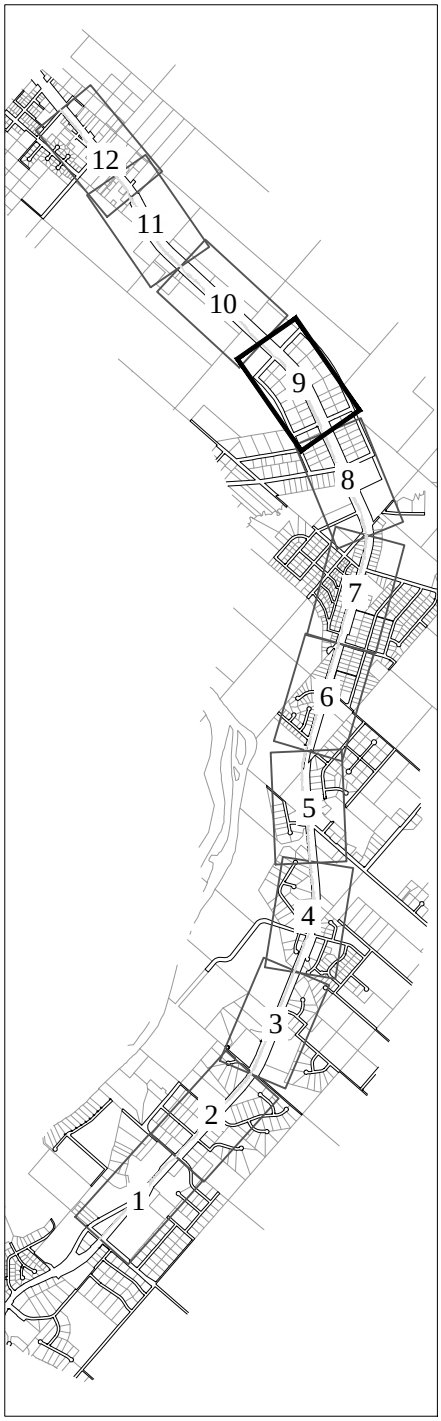
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 8 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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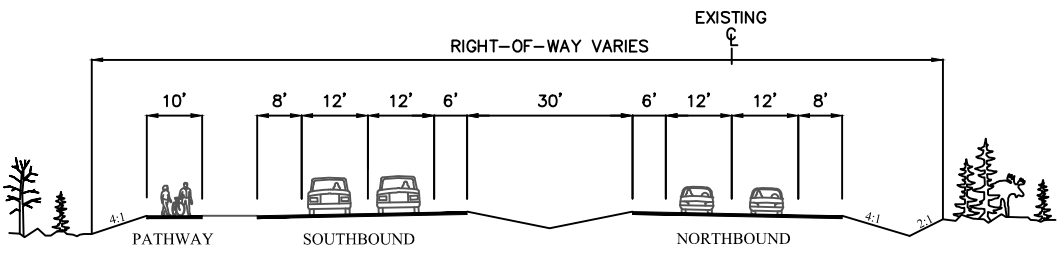

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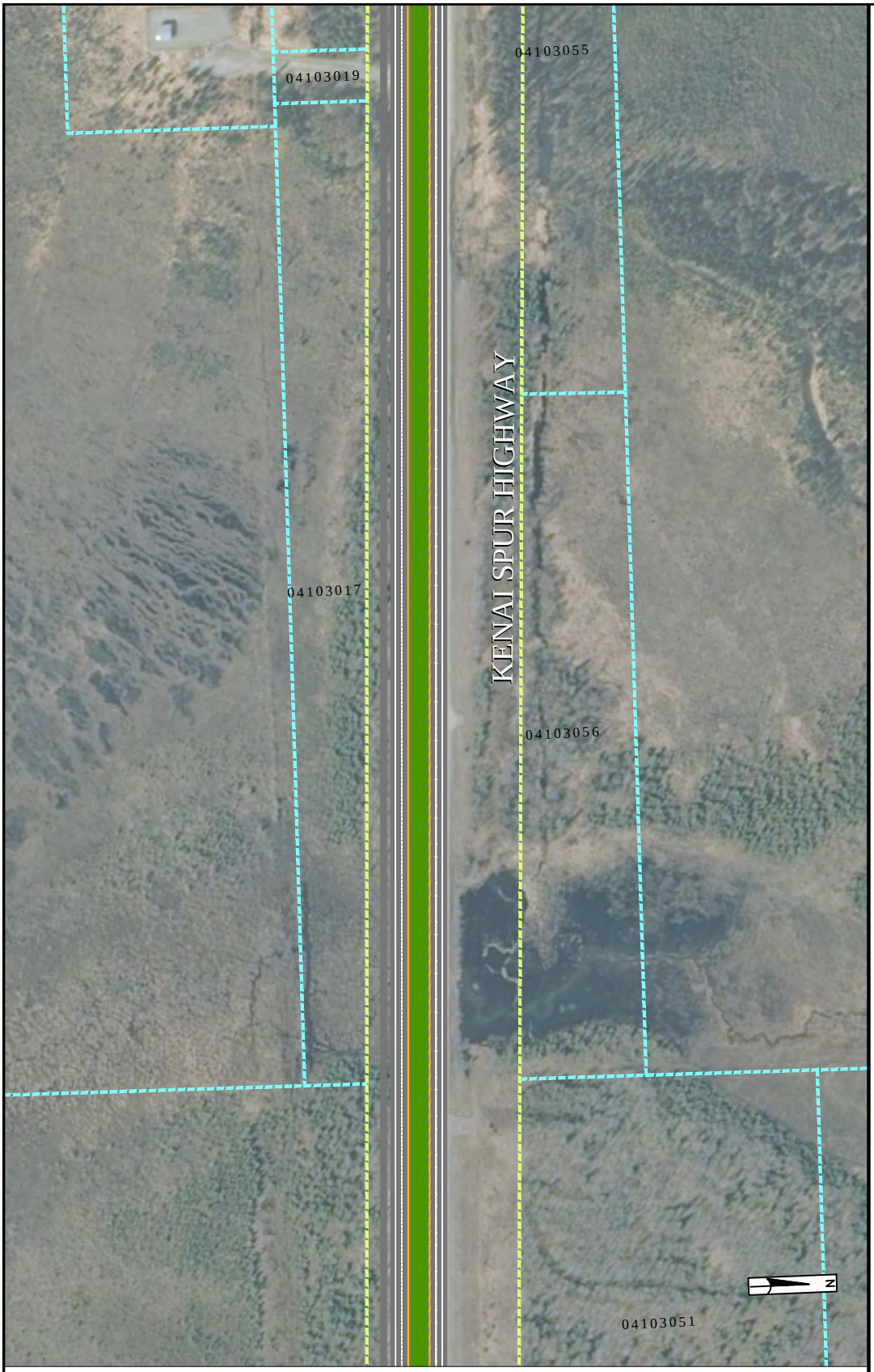
SCALE IN FEET

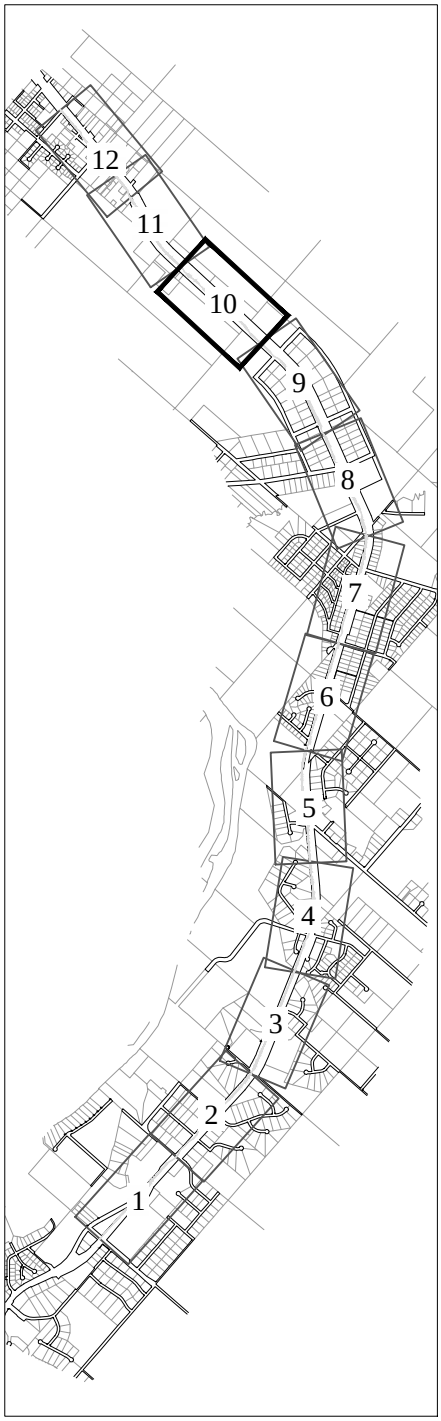
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 9 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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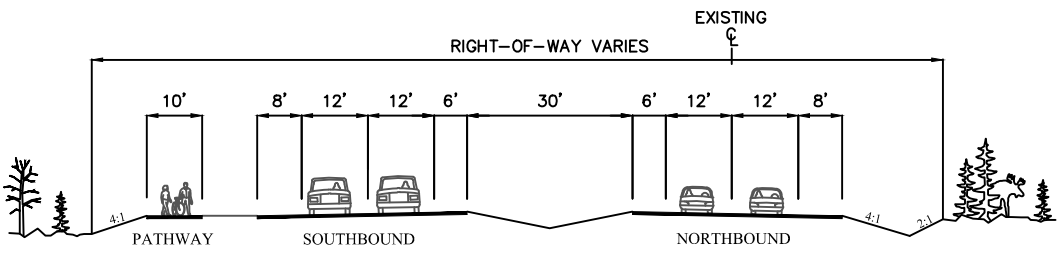

FOUR-LANE DIVIDED

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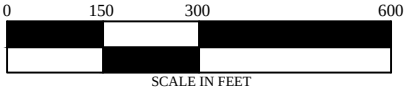
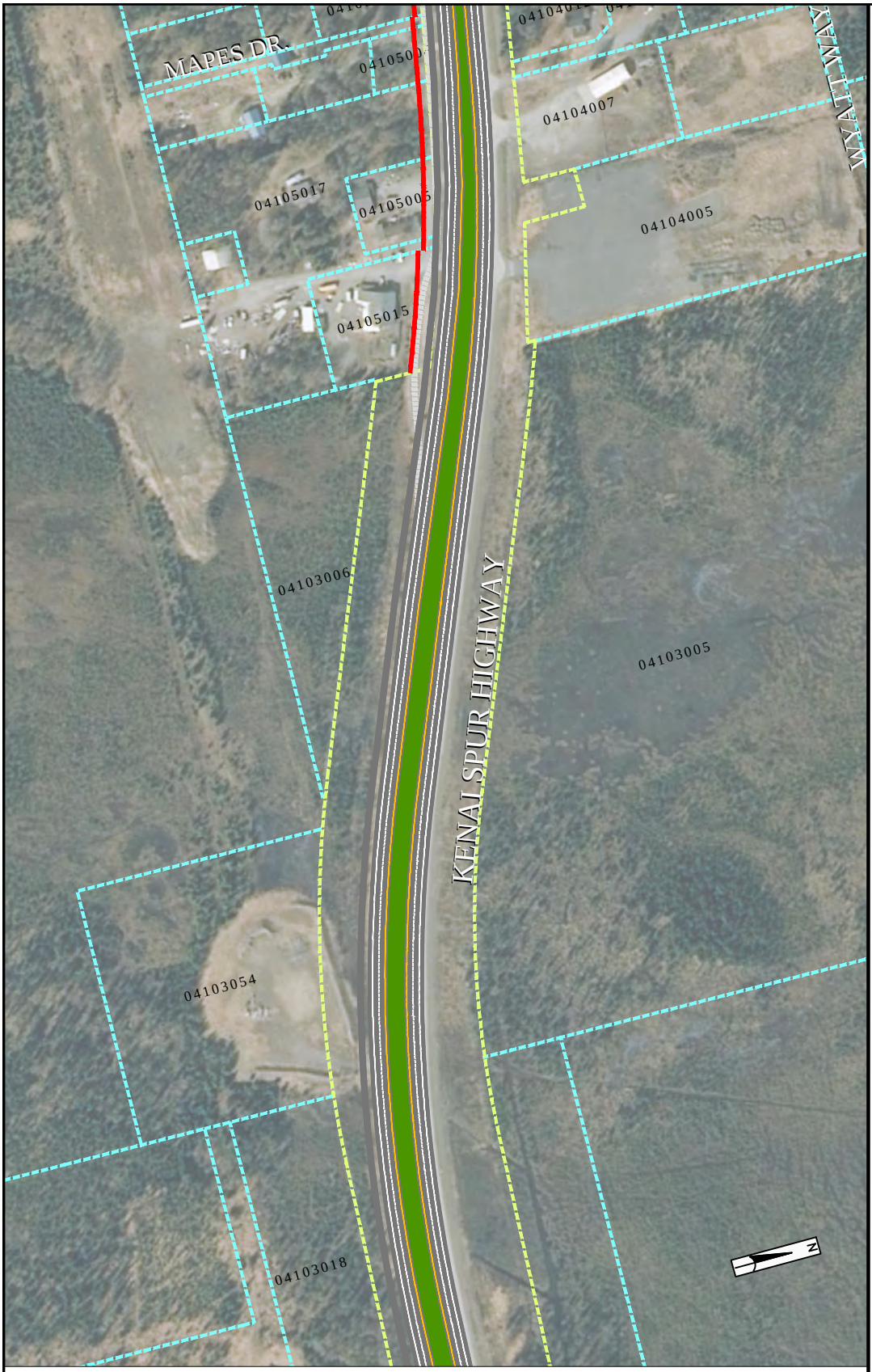


SCALE IN FEET

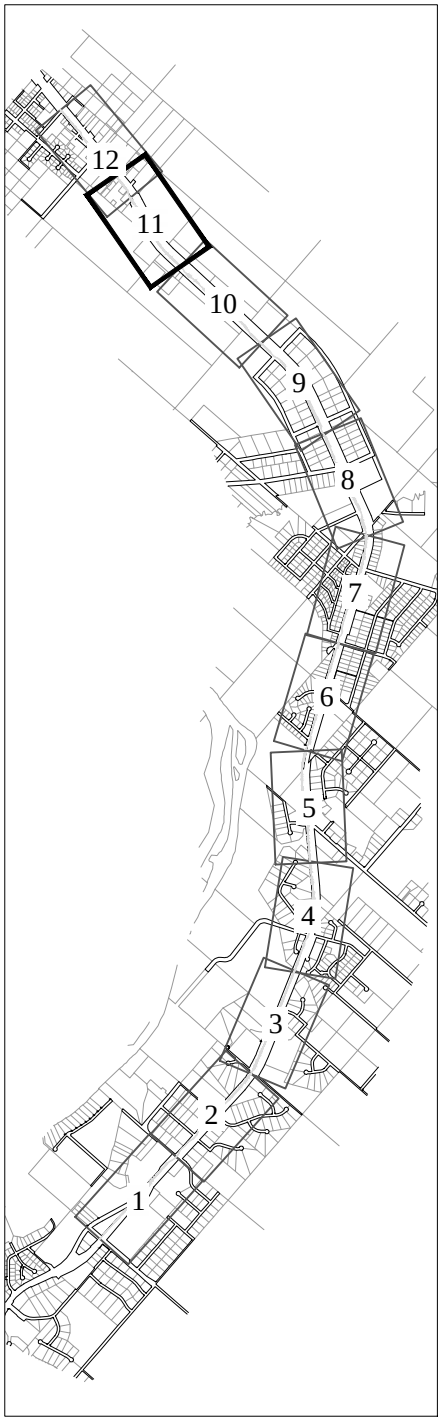
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 10 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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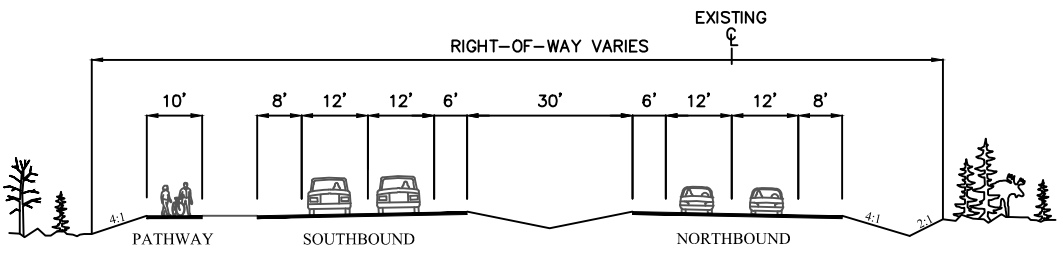

FOUR-LANE DIVIDED

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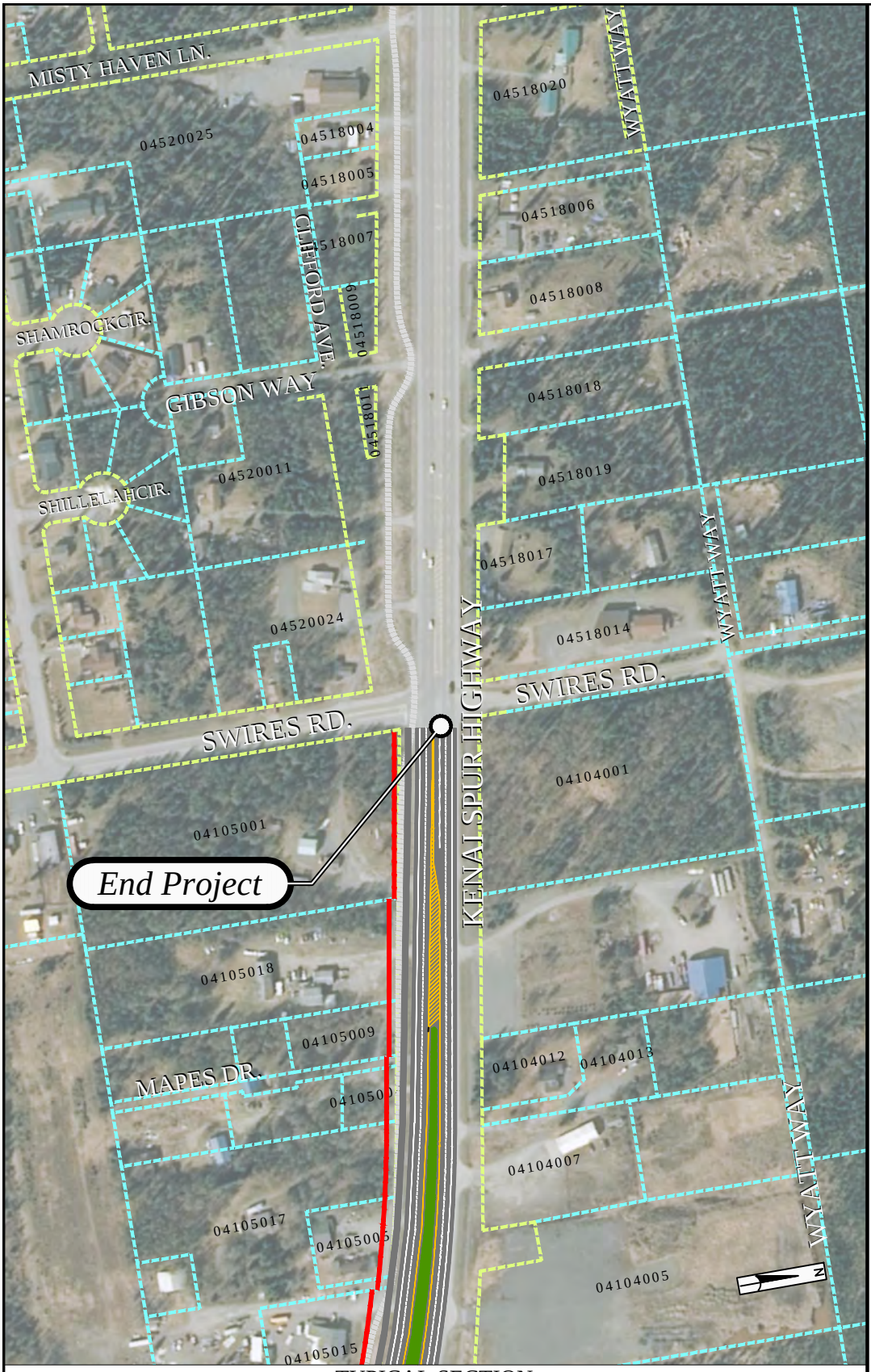
0 150 300 600

SCALE IN FEET

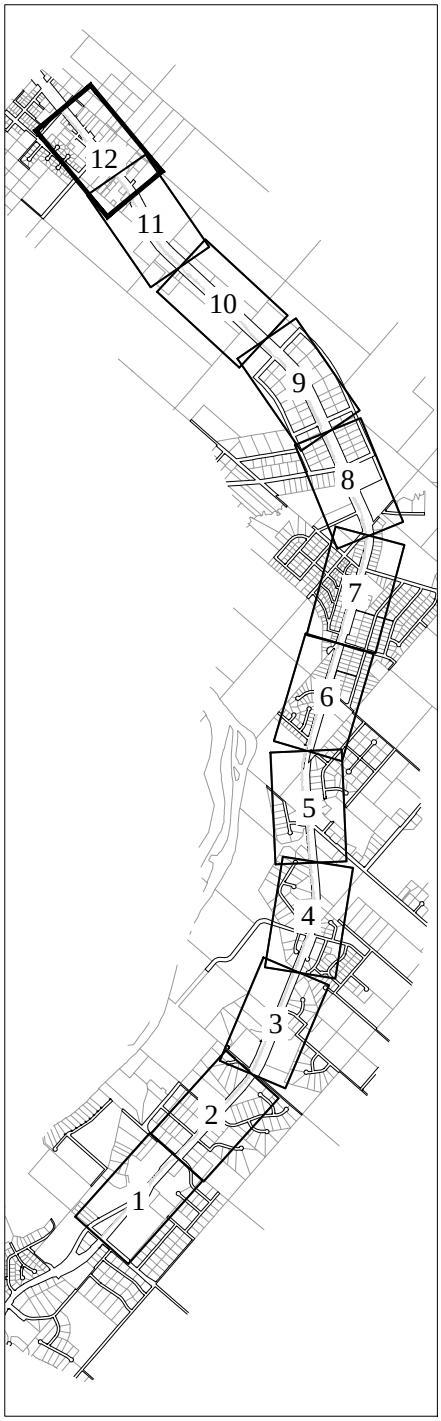
KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 11 OF 12



LEGEND

EXISTING INFORMATION	CONCEPT INFORMATION
RIGHT-OF-WAY	NEW PAVEMENT
PROPERTY LINES	GRASS MEDIAN
PATHWAY	APPROXIMATE RIGHT-OF-WAY REQUIRED



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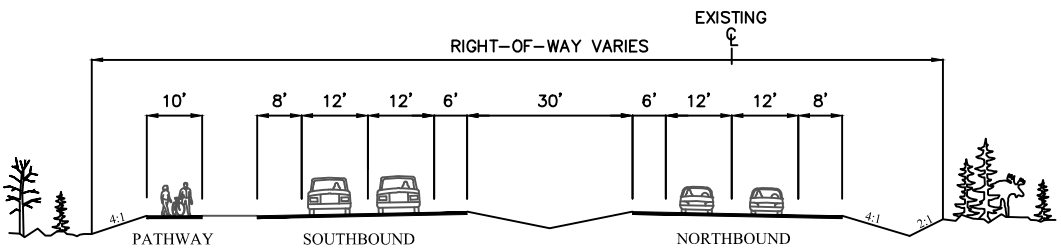

FOUR-LANE DIVIDED

PRELIMINARY CONCEPT

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SCALE IN FEET

KENAI SPUR HIGHWAY REHABILITATION
ALTERNATIVE 4: FOUR-LANE DIVIDED

PROJECT# 54594	SHEET 12 OF 12

APPENDIX E

PRELIMINARY COST ESTIMATES

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Kenai Spur Highway Rehabilitation: Alternative 1 (GF) ESTIMATE DATE:9/17/13			Planning Level Estimate	
	Unit	Quantity	Cost	
Preliminary Engineering				
Design		0.1	$570,000	
ROW Engineering			$200,000	
Utility Engineering			$96,000	
ICAP (4.79%)	0.0479		$42,000	
TOTAL Pre-Construction				**$908,000**
Right-of-Way				
Acquisitions			$1,500,000	
ICAP (4.79%)	0.0479		$72,000	
TOTAL Right-of-Way				**$1,572,000**
Utilities				
Relocation			$600,000	
ICAP (4.79%)	0.0479		$29,000	
TOTAL Utilities				**$629,000**
Construction				
Construction Contract			$5,700,000	
Bid Contingency (5%)	0.05		$285,000	
Change Order Contingency (15%)	0.15		$855,000	
Construction Engineering (15%)	0.15		$855,000	
Subtotal			$7,695,000	
ICAP (4.79%)	0.0479		$370,000	
TOTAL Construction				**$8,065,000**
PROJECT TOTAL				**$11,200,000**

Kenai Spur Highway Rehabilitation: Alternative 2 (GF) ESTIMATE DATE:9/17/13			Planning Level Estimate	
	Unit	Quantity	Cost	
Preliminary Engineering				
Design		0.1	$1,640,000	
ROW Engineering			$200,000	
Utility Engineering			$96,000	
ICAP (4.79%)	0.0479		$93,000	
TOTAL Pre-Construction				**$2,029,000**
Right-of-Way				
Acquisitions			$1,900,000	
ICAP (4.79%)	0.0479		$92,000	
TOTAL Right-of-Way				**$1,992,000**
Utilities				
Relocation			$800,000	
ICAP (4.79%)	0.0479		$39,000	
TOTAL Utilities				**$839,000**
Construction				
Construction Contract			$16,400,000	
Bid Contingency (5%)	0.05		$820,000	
Change Order Contingency (15%)	0.15		$2,460,000	
Construction Engineering (15%)	0.15		$2,460,000	
Subtotal			$22,140,000	
ICAP (4.79%)	0.0479		$1,070,000	
TOTAL Construction				**$23,210,000**
PROJECT TOTAL				**$28,100,000**

Kenai Spur Highway Rehabilitation: Alternative 3 (GF)			Planning Level Estimate	
ESTIMATE DATE:9/17/13				
	Unit	Quantity	Cost	
Preliminary Engineering				
Design		0.1	$2,400,000	
ROW Engineering			$200,000	
Utility Engineering			$120,000	
ICAP (4.79%)	0.0479		$131,000	
TOTAL Pre-Construction				**$2,851,000**
Right-of-Way				
Acquisitions			$2,700,000	
ICAP (4.79%)	0.0479		$130,000	
TOTAL Right-of-Way				**$2,830,000**
Utilities				
Relocation			$800,000	
ICAP (4.79%)	0.0479			
TOTAL Utilities				**$800,000**
Construction				
Construction Contract			$24,000,000	
Bid Contingency (5%)	0.05		$1,200,000	
Change Order Contingency (15%)	0.15		$3,600,000	
Construction Engineering (15%)	0.15		$3,600,000	
Subtotal			$32,400,000	
ICAP (4.79%)	0.0479		$1,560,000	
TOTAL Construction				**$33,960,000**
PROJECT TOTAL				**$40,500,000**

Kenai Spur Highway Rehabilitation: Alternative 4 (GF) ESTIMATE DATE:9/17/13			Planning Level Estimate	
	Unit	Quantity	Cost	
Preliminary Engineering				
Design		0.1	$3,400,000	
ROW Engineering			$350,000	
Utility Engineering			$200,000	
ICAP (4.79%)	0.0479		$190,000	
TOTAL Pre-Construction				**$4,140,000**
Right-of-Way				
Acquisitions			$13,600,000	
ICAP (4.79%)	0.0479		$652,000	
TOTAL Right-of-Way				**$14,252,000**
Utilities				
Relocation			$3,800,000	
ICAP (4.79%)	0.0479			
TOTAL Utilities				**$3,800,000**
Construction				
Construction Contract			$33,500,000	
Bid Contingency (5%)	0.05		$1,675,000	
Change Order Contingency (15%)	0.15		$5,025,000	
Construction Engineering (15%)	0.15		$5,025,000	
Subtotal			$45,225,000	
ICAP (4.79%)	0.0479		$2,170,000	
TOTAL Construction				**$47,395,000**
PROJECT TOTAL				**$69,600,000**

Kenai Spur Hwy Roadside Clear, Grub, Topsoil, Reseed (GF) Estimate Date: 9/25/13			Legislative Estimate	
	Unit	Quantity	Cost	
Preliminary Engineering				
Design		0.015	$46,350	
ROW Engineering			$5,000	
Utility Engineering			$5,000	
ICAP (4.79%)	0.0479		$3,000	
TOTAL Pre-Construction				**$59,000**
Right-of-Way				
Closeout			$20,000	
ICAP (4.79%)	0.0479		$1,000	
603(18)				**$21,000**
Utilities				
Review			$20,000	
ICAP (4.79%)	0.0479		$1,000	
TOTAL Utilities				**$21,000**
Construction				
Construction Contract			$3,090,000	
Bid Contingency (5%)	0.05		$154,500	
Change Order Contingency (15%)	0.15		$463,500	
Construction Engineering (15%)	0.15		$463,500	
Subtotal			$4,171,500	
ICAP (4.79%)	0.0479		$200,000	
TOTAL Construction				**$4,372,000**
PROJECT TOTAL				**$4,500,000**

Kenai Spur Hwy Continuous Lighting (GF)				Legislative Estimate
Estimate Date: 9/25/13				
	Unit	**Quantity**	**Cost**	
Preliminary Engineering				
Design		0.1	$316,000	
ROW Engineering			$5,000	
Utility Engineering			$5,000	
ICAP (4.79%)	0.0479		$16,000	
TOTAL Pre-Construction				**$340,000**
Right-of-Way				
Closeout			$20,000	
ICAP (4.79%)	0.0479		$1,000	
603(18)				**$20,000**
Utilities				
Review			$20,000	
ICAP (4.79%)	0.0479		$1,000	
TOTAL Utilities				**$20,000**
Construction				
Construction Contract			$3,160,000	
Bid Contingency (5%)	0.05		$158,000	
Change Order Contingency (15%)	0.15		$474,000	
Construction Engineering (15%)	0.15		$474,000	
Subtotal			$4,266,000	
ICAP (4.79%)	0.0479		$210,000	
TOTAL Construction				**$4,480,000**
PROJECT TOTAL				**$4,900,000**