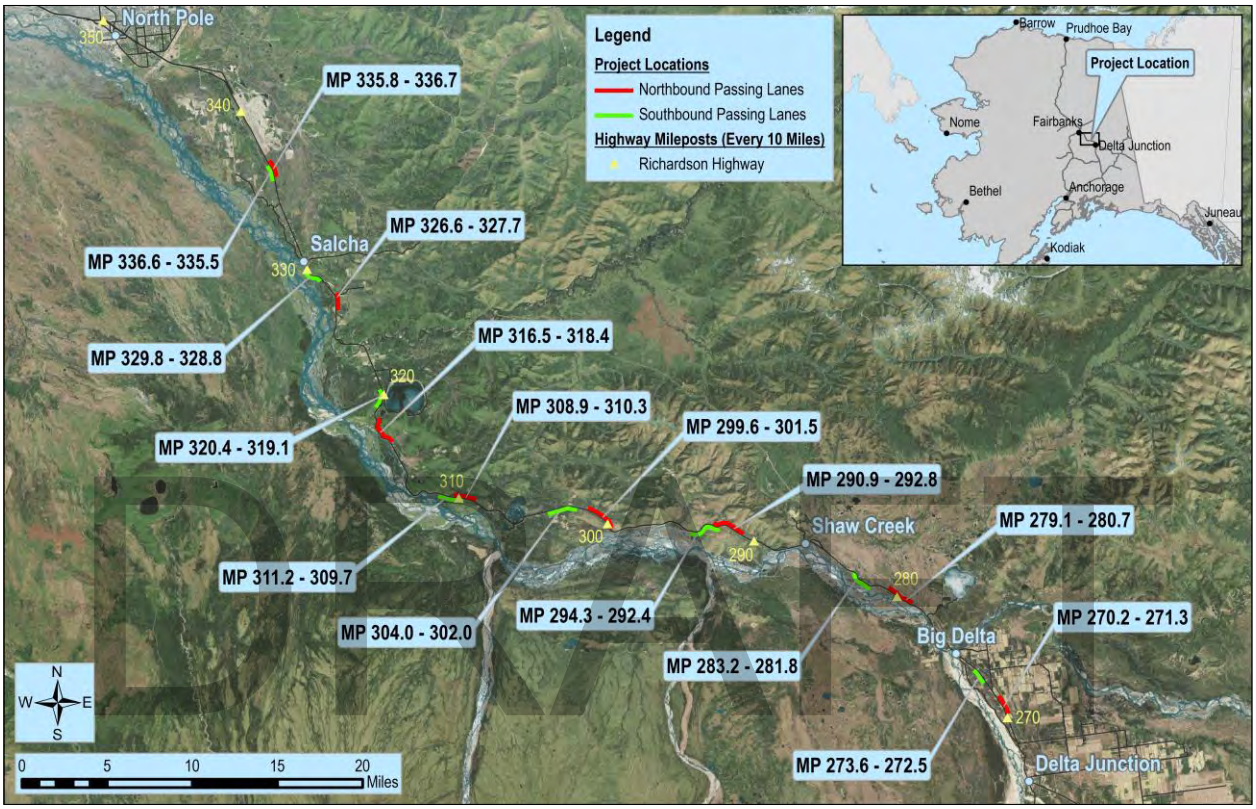
# STATE OF ALASKA
# Department of Transportation & Public Facilities
# Northern Region




# Richardson Hwy MP 266-341 Passing Lanes Route Selection Report

## Project No. 0A23(021)/Z607150000

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## ABBREVIATIONS

%.....percent
AASHTO ..... American Association of Highway and Transportation Officials
ADOT&PF ..... Alaska Department of Transportation and Public Facilities
EAFB..... Eielson Air Force Base
ft.....feet
HCM ..... Highway Capacity Manual
HSIP ..... Highway Safety Improvement Program
LiDAR..... Light Detection and Ranging
MP ..... milepost
mph..... miles per hour
MUTCD ..... Manual on Uniform Traffic Control Devices
PTR ..... permanent traffic recorder
RV .....recreational vehicle

## EXECUTIVE SUMMARY

The purpose of this report is to identify locations where passing lanes may be constructed along the Richardson Highway between Delta Junction and North Pole, Alaska. The Project limits are between milepost 266 and 341; a two-lane two-way highway designated as a Rural Interstate Highway. The Richardson Highway is part of the National Highway System providing vital transportation links to small rural communities of Salcha and Big Delta and between Fort Greeley and Fort Wainwright military bases. The terrain is rolling as the Richardson Highway follows the Tanana River Valley. The Average Daily Traffic counts ranged from 1,085 to 2,270 vehicles per day during the 2014 calendar year. The Richardson Highway supports a high percentage of fuel and chemical transport between Fairbanks and outlying rural Alaskan communities, as well as military convoy traffic between Fort Greeley and Fort Wainwright. There are four existing northbound and three existing southbound designated climbing/passing lane sections within the project study area that are included in the recommended passing lanes. Generally, the adjacent shoulder widths at these existing climbing/passing lane sections are less than required for new construction. The project terminates at both ends to four lanes; at Delta Junction and Eielson AFB the two-lane highway transitions to two northbound and two southbound lanes.

Passing lanes are an effective countermeasure to reduce head-on crashes and aggressive driving behavior, and improve capacity on two-lane rural highways. Passing lanes have been shown to reduce fatal and injury crashes up to 42 percent when constructed at three to 10 mile intervals on principal two-lane rural highways. This is due in part to the improved capacity that passing lanes have on a highway by reducing traffic platooning—a vehicle's time spent following a slow vehicle. Increased passing opportunities relieve driver frustration, inattention, and fatigue; thereby reducing aggressive driving behavior such as following too close, excessive speeding, and improper gap acceptance when passing occurs in the opposing lane. Constructing passing lanes along the Richardson Highway milepost 266 to MP 341 conforms to the implementation of Alaska's Strategic Highway Safety Plan to reduce head-on crashes and reduce aggressive driving.



This report evaluates passing lane locations subjectively using a two-tiered process to determine the most effective locations that improve safety and capacity, incorporate public input, minimize construction costs and environmental impacts, and conform to applicable design criteria. This report recommends 16 locations where passing lane improvements may be considered for construction which incorporate the 8 existing climbing/passing lane segments (four southbound and four northbound). The remaining eight recommended passing lane segments (four southbound and four northbound) are new construction.

## 1.0 INTRODUCTION

The Alaska Department of Transportation and Public Facilities (ADOT&PF) is proposing to add passing lanes on the Richardson Highway between Delta Junction and Eielson AFB (Mileposts [MP] 266 to 341)(Figure 1). This report presents the results of a location analysis and recommends locations to construct passing lanes within the project study area to improve highway safety, capacity, and overall traffic operations.

The Richardson Highway is a critical transportation link in Interior Alaska providing year-round fuel delivery to eastern Alaska communities and experiences significant increases in recreational traffic during the summer months. The mixture of lower speed "sightseeing," recreational vehicles (RVs), large trucks, and military convoy traffic with personal vehicles causes conflict. Traffic congestion in form of platooning, a vehicle's time spent following a slow vehicle, increases travel times and results in driver impatience. Existing passing in the opposing lane requires a driver to perceive and accept an available gap in the opposing traffic stream that is sufficiently long enough to pass a slow vehicle. Opportunities for passing in the opposing lane are:

- less available as traffic volumes increase and drivers must accept shorter gaps to complete passing maneuvers;
- further reduced when the slow vehicle ahead is an RV or truck that restricts sight distance;
- unavailable when the slow vehicle(s) ahead is a military convoy where limited gaps between military trucks are available to complete the pass and merge.

All of the above results in a greater risk to the traveling public and to the environment due to increased crashes resulting from frustrated and aggressive driving behavior.



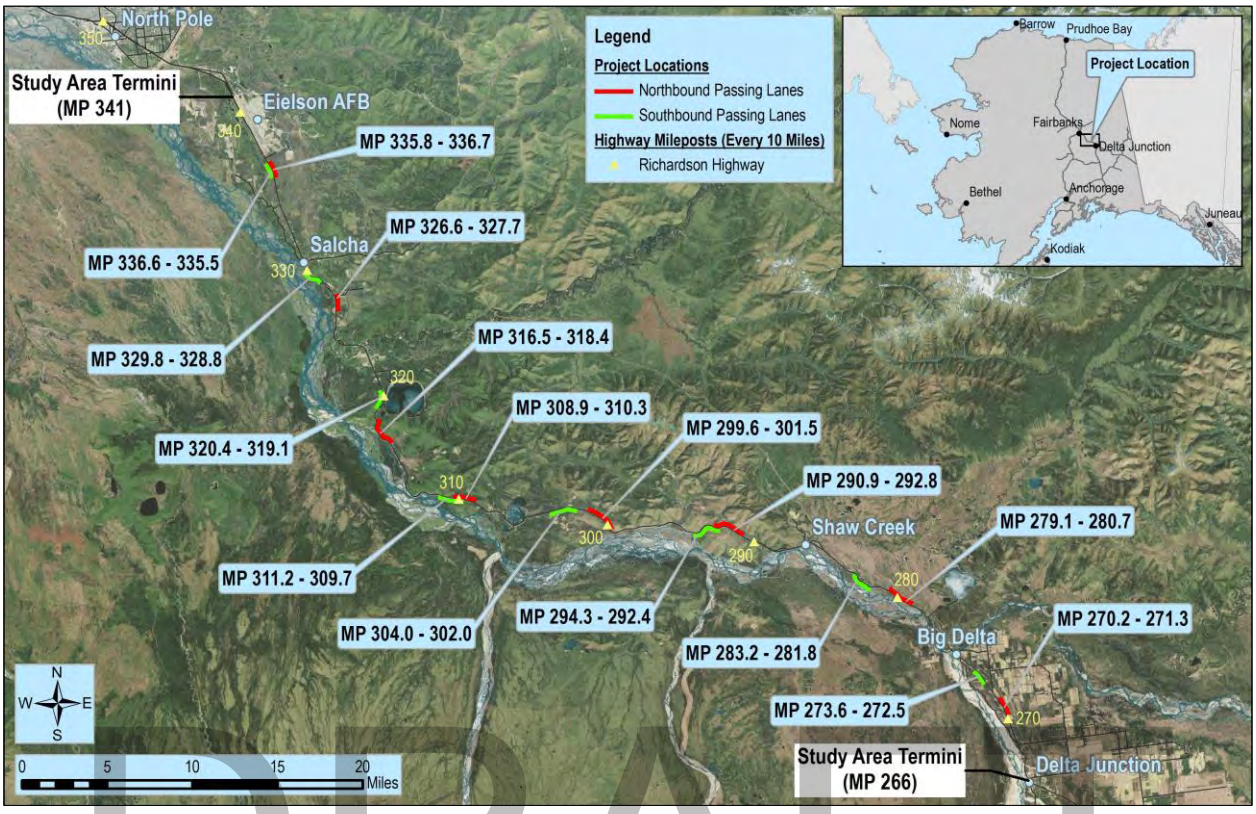
Passing lanes are an effective countermeasure to reduce head-on crashes and aggressive driving behavior, and improves capacity on two-lane rural highways. Passing lanes have been shown to reduce crashes up to 42 percent (%) when constructed at three to 10 mile intervals on principal two-lane rural highways. This is due in part to the improved capacity that passing lanes have on a highway by reducing traffic platooning. Increased passing opportunities relieve driver frustration, inattention, and fatigue; thereby reducing aggressive driving behavior such as following too close, excessive speeding, and improper gap acceptance when passing occurs in the opposing lane. Constructing passing lanes along the Richardson Highway MP 266 to MP 341 conforms to the implementation of Alaska's Strategic Highway Safety Plan to reduce head-on crashes and reduce aggressive driving.

Recommended passing lane locations are provided in Section 4.0.

## 2.0 OVERVIEW OF PROJECT STUDY AREA

The project study area extends between the intersection of the Richardson Highway and School Road in Delta Junction (MP 266) and extends north to the four-lane divided highway just south of North Pole, Alaska at Eielson Air Force Base (EAFB) (MP 341). The Richardson Highway between MP 266 and 341 is a two-lane, two-way highway designated as a Rural Interstate linking the small rural communities of Salcha and Big Delta, and is part of the National Highway System. The 2014 Average Daily Traffic counts ranged from 1,085 (south of Quartz Creek) to 2,270 (at Balch Way) vehicles per day. The closest permanent traffic recorders (PTRs) are located at MP 2018.2 at Trim's Camp south of Delta Junction (PTR ID 10200071) and at MP 344.35 at Moose Creek near this project study area's northern limit (PTR ID 11300062) (ADOT&PF 2015a).

**Figure 1: Project Study Area and Recommend Passing Lane Locations.**




## 2.1 Highway Characteristics

The highway is generally located in rolling terrain following the Tanana River Valley and provides freight and fuel haul to interior Alaskan communities and recreation access to multiple state and federal recreation sites.

There are four existing northbound and three existing southbound designated climbing/passing lane sections within the project study area that are included in the recommended passing lanes. Generally, the adjacent shoulder widths at these existing climbing/passing lane sections are less than required for new construction. The project terminates at both ends to four lanes; at Delta Junction and at EAFB the two-lane highway transitions to two northbound and two southbound lanes.

## 2.2 Traffic and Vehicle Characteristics

The Richardson Highway supports a high percentage of year-round fuel and chemical transport between Fairbanks and outlying rural Alaskan communities, and military convoy traffic between Fort Wainwright and Fort Greely. During the summer months, there is a considerable increase in RV and boat-trailer traffic as the Richardson Highway provides recreational connections to Harding Lake, Salcha River, Birch Lake, Shaw Creek, and Tanana River recreational boat access.

Traffic is composed of 13% commercial delivery and RVs, 7% combination tractor-trailer trucks, 1% buses, and 79% personal vehicles, derived from vehicle classifications taken at Birch Lake Maintenance Camp (MP 307.1) in 2014. This mixture of lower speed, 'sightseeing' personal vehicles, RVs, and large trucks causes conflicts with higher speed traffic resulting in driver impatience, inattention, following too close, excessive speed, improper passing, or driver fatigue. These are contributing factors in severe head-on and loss of control types of collisions that may

occur due to lack of passing opportunities at regular intervals where drivers are allowed to safely pass.

## 3.0 PROJECT EVALUATION CRITERIA

To determine where passing lanes would be most effective and improve safety, the analysis followed a two-tiered evaluation. First, locations where a slow vehicle is most likely to be encountered were identified. These locations include uphill grades, developed areas where left-turning traffic is likely to occur, and at eight to 13 mile intervals along the highway where platooning traffic is likely to develop. Truck climbing lanes are typically the initial countermeasure to relieve traffic congestion at uphill grades but are generally shorter than passing lanes. Left-turn lanes remove turning traffic out of the through-traffic stream; however, they do not address slow vehicles that aren't turning. Passing lanes are most effective where the public anticipates their location at expected intervals along the highway. An impatient driver may be more likely to hold back knowing a passing lane is available a short distance ahead.

Second, once the passing lane areas are identified, the beginning and end of the passing lane improvement is determined. Sight distances conforming to American Association of State Highway and Transportation Officials (AASHTO) and Federal Highway Administration (FHWA) recommended separation interval distances at conflict areas are used to identify the passing lane improvement limits. These are further defined in the sections below. Locations that do not satisfy these criteria or the project's purpose and need have been dropped from consideration and are not recommended in this report.



This selection process follows the planning sequence to meet the objectives and technical criteria listed below:

- Improve safety and capacity;
- Incorporate public input;
- Minimize construction costs and environmental impacts; and
- Apply applicable design criteria to passing lane selection.

### 3.1 Safety and Capacity

Passing lanes improve safety and level of service on two-lane highways not only within the length of the added passing lane but also downstream four to 5 miles on the highway. Installing passing lanes as a countermeasure has been shown to reduce crashes up to 42% (TTI 2011). In Alaska, the Highway Safety Improvement Program (HSIP) has allowed a crash reduction of 25% of all crashes to be applied 5 miles downstream of a passing lane, recognizing its influence over long highway segments. Improved safety may be extended even further downstream where passing lanes are constructed systemically at intervals due to reduced traffic platooning on rural two-lane highways where typically low volumes occur.

Safety

Passing lane locations should be selected and designed to improve safety by providing assured passing opportunities without the need for passing in the opposing lane where acceptable gap distance is perceived. Even though there are numerous opportunities within the project area to pass in the opposing lane, the efficiency of doing so is limited to one or two vehicles at the lead end of a platoon. As traffic volumes increase, sufficient gaps in the opposing traffic stream are reduced resulting in even greater driver frustration and willingness to accept unsafe gaps. Passing lanes

placed at reasonable intervals provide opportunities for platooned drivers to plan, prepare, and execute safe passing of slow vehicles.

Research completed for the Kansas Department of Transportation (MRI 2004) found that intersections located within passing lanes had lower traffic conflict rates than intersections located outside of passing lanes. Furthermore, this research found no difference in traffic conflict rate between intersections located immediately downstream of a passing lane and intersection located some distance away from the passing lane. Despite their finding, caution should be considered in locating intersections within passing lanes. Higher-volume intersections and intersections in the lane addition and lane drop areas are discouraged. In general, it is recommended that intersections be located near the middle of a passing lane, rather than near the ends. Where higher-volume intersection or driveways are present within a passing lane, the provision of a left-turn lane should be considered.

Traffic accidents reported from 2008 through 2012 (five-year period) were reviewed to determine crash experience on the Richardson Highway between North Pole and Delta Junction. During the five-year period, 250 crashes were reported and classified as follows:

- 80 crashes (32%) involved moose/animal collisions;
- 144 crashes (58%) are non-intersection related, and;
- 26 crashes (10%) are intersection related.

Analysis of Alaska's statewide crash data revealed that 35% of crashes involve impatient driving behavior from causation factors described in the *Alaska Highway Safety Plan, FFY2015* (ADOT&PF 2015b). Impatient driving behavior on highway segments is indicated by causation factors such as unsafe speed, following too closely, improper lane usage/change, improper passing, disregard for non-signal traffic control devices, and emotional driving. Similar behavior at intersections is indicated by causation factors such as failure to yield and improper turns. These causation factors were applied to the five-year period crashes pre-event condition to screen for crashes that should be directly addressed by passing lanes along the highway. That analysis resulted in 28 of the 144 non-intersection crashes and 12 of the 26 intersection related crashes that are related to impatient driving. Combined, this is 24% of the total crashes (not including moose/animal crashes) which correlates well with the 25% crash reduction used in the HSIP model for installing passing lanes as a countermeasure to reduce crashes.



Capacity/Level of Service

Passing Lanes improve overall traffic operations by breaking up traffic platoons where inadequate passing opportunities are available over substantial lengths of two-lane highways. Increased capacity is achieved by reducing delays at specific bottleneck locations, such as steep upgrades and curvilinear roadway sections where slow vehicles are present.

*Passing Lane Length*

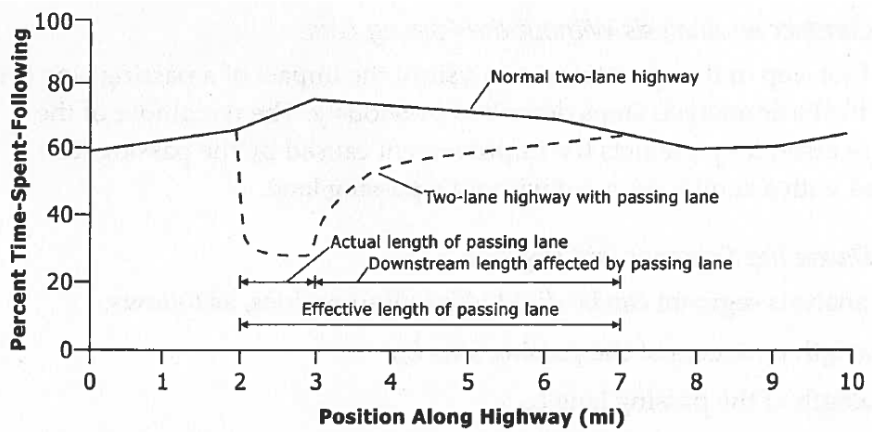
Short passing lanes are generally more cost-effective per unit length in improving traffic performance than extended sections of four-lane highway for two reasons:

1. The traffic entering the passing lane from a normal two-lane highway is more highly platooned and 'primed' to make the most of the added lane.
2. The benefits of platoon break-up from the added lane carries over as reduced delay on the downstream two-lane highway, until new platoons form over a number of miles.

Therefore, a highway with passing lanes at regular intervals has a cyclic pattern of platooning, with zones of buildup, passing, and improved downstream operations. An example of the effective

length of a passing lane influence area is depicted below from the *Highway Capacity Manual* (HCM 2010):

**Figure 2: Example of the Effect of Passing Lanes on Two-Lane Highway Traffic Operations.**




*Separation Interval between Passing Lanes*

Alaska does not have an established policy on the separation interval between passing lanes. However, AASHTO recognizes the benefits of installing passing lanes at three to 10 mile intervals. For the Richardson Highway, an 8-mile separation interval was used to determine potential locations due to its relatively low traffic volume and number of long tangent sections where existing passing opportunities in the opposing lane are available.

The HCM 2010 indicates that a vehicle's percent time spent following a slow vehicle (platooning) will be reduced for four to 13 miles downstream of a passing lane, depending on traffic volume.

Driver Perception

Passing Lanes should be located where expected by the public, generally located on uphill grades and at horizontal curves where slow vehicles are likely to be encountered.

### 3.2 Public Input

Input from local residents, commuters, and commercial operators as stakeholders in the Richardson Highway will be sought to help inform the passing lane selection process. Information collected during public outreach will be added to this report as it is obtained.

### 3.3 Minimize Construction Costs and Environmental Impacts

Estimates of construction costs, including pre-construction design work, utility relocations, and potential right-of-way acquisitions, will need to be developed in order to fully evaluate which passing lane locations are most cost-effective. This report does not provide detailed cost estimates; however, the recommended passing lane locations take into account the relative costs of factors such as bridges, large-diameter culverts, pipelines, significant excavations and embankments, wetland mitigation, and other site-specific factors that would add excessive relative costs to the project.

The actual locations should also incorporate existing climbing/passing lanes (Table 1) and be further adjusted to fit roadway character and adjacent land development, driver expectations, and construction cost. The desired maximum separation interval between existing and recommended

passing lane locations is approximately 8 miles. Separation intervals included consideration of the existing four-lane section at either end of the project study area at MP 266 and MP 341.

**Table 1: Existing Climbing/Passing Lanes on Richardson Highway.**

| Southbound | |
|---|---|
| MP | |
| Begin | End |
| 310.7 | 309.7 |
| 302.5 | 302.1 |
| 299.1 | 298.7 |
| 294.0 | 292.4 |

| Northbound | |
|---|---|
| MP | |
| End | Begin |
| 310.3 | 309.3 |
| 301.5 | 301.1 |
| 292.8 | 291.9 |
| 280.7 | 280.3 |

Passing lane locations should avoid impacting protected environmental resources to the maximum extent practicable, including but not limited to, wetlands, cultural resources, and recreation areas. Impacts that are unavoidable due to safety, design criteria, or traffic operations constraints will be further minimized during the design phase of the project.

### 3.4 Design Criteria

Passing lane selection should ensure passing lane locations conform to applicable AASHTO guidance and design criteria. The analysis performed to identify passing lane locations is based on the discussion outlined in the 2004 AASHTO Green Book, Chapter 3, pages 250-253 using aerial photography, horizontal alignment from record right-of-way maps, and vertical information from available Light Detection and Ranging (LiDAR) surveys (AASHTO 2004). The passing lane locations will be used to delineate design surveys and environmental studies for completion of the construction documents and the environmental analysis.



Passing Lanes should:

- Have lane addition and merge transition tapers conforming to the 2016 Alaska Traffic Manual (ATM) (ATM 2016). The desirable merge transition taper length is taper length (feet [ft]) = width (ft) x speed (miles per hour [mph]) (ATM 2016 Figure 2B-100). For 65 mph, the desirable merge taper length is 780 ft for a 12 ft lane drop. Transition taper length for a lane addition is one-half the length for a merge or 390 ft, but may be reduced to 300 ft.
- Begin at, or be extended to locations where truck speeds can be sustained to within a minimum of 10 mph, or desirably within 5 mph, of the design speed. Critical lengths of grade are provided in the 2004 AASHTO Green Book, Exhibit 3-59 (AASHTO 2004). Truck performance deceleration and acceleration on grades are provided in 2004 AASHTO Exhibits 3-55 and 3-56, respectively (AASHTO 2004). The exhibits were used to identify or compute truck speeds at the passing lane transitions.

Sight Distance

At the beginning and end of each passing lane, a clear line of sight of 1,000 ft is desirable as the vehicle enters the lane addition or merge transition taper. Sight distance was determined following the procedure described in the 2004 AASHTO Green Book Exhibit 3-8 (AASHTO 2004). Profile information was obtained from LiDAR data. Sight distance obstructed by changes in profile was measured from a height of eye of 3.5 ft through a clear line of sight to the roadway's surface ahead. Sight distance restricted by horizontal curvature is based on an unobstructed line of sight through a 42-foot offset from centerline, assuming a 12-foot lane and 30-foot clear zone width.

Passing Lane Configuration and Separations

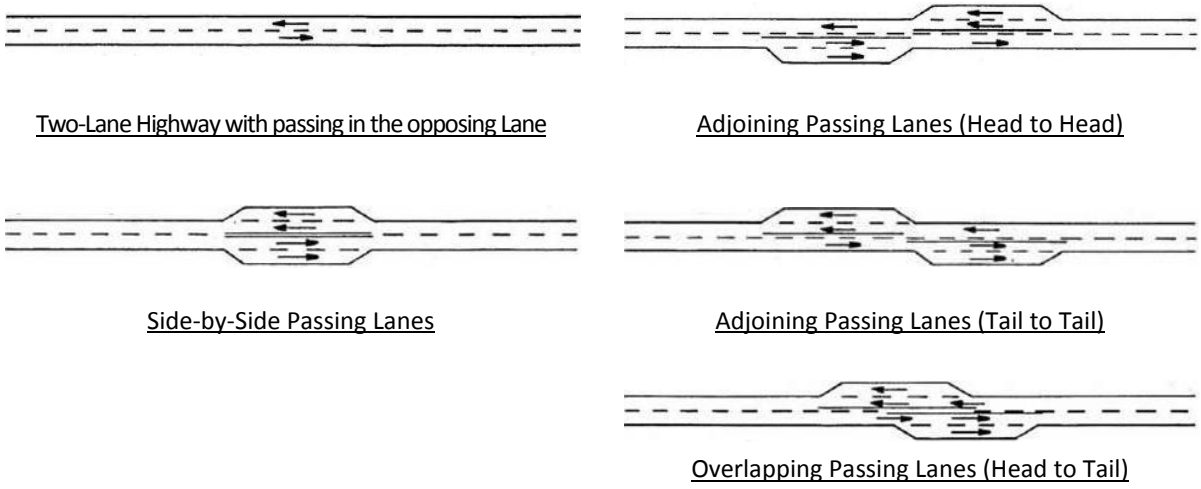
The location of passing lanes should take into account traffic operation of nearby intersections and passing lanes in the opposing direction of travel. Passing lanes recommended in this report are generally located in pairs due to existing improvements and located at regular intervals along the highway so as to provide their intended purpose. In the direction of travel, the merge end of a passing lane is referred to as its 'head'. The lane addition side is referred to as the passing lane's 'tail'. For moderate traffic volumes such as on the Richardson Highway and its number of existing climbing or passing lane improvements, the following configurations (Figure 3) are recommended in general order of preference:

- Adjoining configuration is most suited to the existing highway's character and passing lanes will be considered in pairs. The recommended minimum tail-to-tail separation is 500 ft and minimum head-to-head separation is 1,500 ft.
- Overlapping configuration is suitable at the crest of a hill where climbing lanes on both sides of the crest are provided. This configuration allows the lane drop for each of the passing lanes to occur on the downhill grade where traffic speeds can be maintained at the posted speed. The recommended minimum head-to-tail separation is 1,000 ft.
- Side-by-side configuration is appropriate where sufficient length for constructing adjoining passing lanes is not available. This includes where right-of-way, constructability, utility, driveway density, and/or environmental constraints discourage placing passing lanes in the adjoining configuration.

A 1,500 ft separation is recommended from nearby street intersections where high turning volumes occur so that the intersection's traffic operation is unaffected by the passing lane. This separation distance exceeds the perception and reaction times listed in Table 2C-4 of ATM 2016 for the 65 mph posted speed where a lane change is required.



**Figure 3: Passing Lane Configurations**




## 4.0 RECOMMENDATIONS

Prior to determining where passing lane improvements should be considered, ADOT&PF personnel and the design team identified areas that should be avoided when determining possible passing lane improvements. The areas where passing lanes should not be placed include the following:

- MP 275.5 Tanana River Bridge crossing at Big Delta;
- MP 286.6 Shaw River Bridge crossing and recreational access; and
- MP 323.3 to MP 326.5 from the Salcha River recreational access north through the community of Salcha Alaska where the speed limit is reduced.

Based on a site review and the above evaluation criteria, eight northbound highway segments and eight southbound highway segments have been identified for consideration of constructing passing lane improvements. Factors contributing to identifying the general location of each passing lane, followed by refining the length and limits of each passing lane are discussed below in order from north to south in Table 2.

**Table 2: Recommended Passing Lane Locations**

| Southbound | | | | Northbound | | | |
|---|---|---|---|---|---|---|---|
| MP | | Length (mi.) | Distance from Previous (mi.) | MP | | Length (mi.) | Distance from Previous (mi.) |
| Begin | End | | | End | Begin | | |
| 336.7 | 335.8 | 1.0 | 4.0 | 336.7 | 335.8 | 1.0 | 8.0 |
| 329.8 | 328.8 | 1.0 | 6.0 | 327.7 | 326.6 | 0.9 | 8.1 |
| 320.4 | 319.1 | 1.3 | 8.3 | 318.4 | 316.5 | 1.9 | 6.0 |
| 311.2 | 309.7 | 1.5 | 7.7 | 310.3 | 308.9 | 1.3 | 7.3 |
| 303.9 | 302.1 | 1.7 | 5.8 | 301.5 | 299.6 | 1.9 | 6.5 |
| 294.1 | 292.4 | 1.7 | 7.7 | 292.8 | 290.8 | 2.0 | 9.8 |
| 283.2 | 281.8 | 1.4 | 9.0 | 280.7 | 279.1 | 1.7 | 7.6 |
| 273.6 | 272.5 | 1.0 | 8.2 | 271.3 | 270.2 | 1.1 | 3.7 |



MP 335.8 – 336.7 Northbound and

MP 336.7 – 335.8 Southbound – Figure 4

One-mile long northbound and southbound passing lanes are recommended immediately south of south EAFB gated access road (planned site for F-35 entrance gate) maintaining 1,500 ft of separation from the intersection. This location is recommended as it provides suitable separation interval between the Richardson Highway four-lane section at Moose Creek and recommended passing lanes at Salcha. The location is south of EAFB, does not encroach on adjacent EAFB lands, and no approaches are affected. Approach densities to the south increase to approximately 25 per mile between MP 330 to 335 precluding moving these passing lanes south.

The northbound passing lane would begin 8.0 miles from the previous northbound passing lane, and would end 4.0 miles south prior to the existing four-lane section of the Richardson Highway at MP 341 at Moose Creek. The location of the beginning of the passing lane is based on the desired 8-mile separation interval between the end of the previous northbound passing lane at MP 327.7, and terminates at MP 336.7 maintaining separation from the southernmost access road to EAFB so as not to influence the operation of that intersection.

The southbound passing lane would begin 4.0 miles from the existing four-lane section of the Richardson Highway at MP 341. Placing the southbound passing lane adjacent to the northbound passing lane provides a side-by-side configuration to avoid additional wetland impacts to the south. A side-by-side configuration is appropriate; however, it is less desirable to an adjoining

configuration. The southbound passing lane's beginning (north side) and end (south side) could be shifted south 1,000 ft to provide sufficient head-to-tail separation from the northbound passing lane to achieve an overlapping configuration but will impact additional wetlands.

Northbound and southbound passing lanes recommended at this location may require placement of fill material into adjacent wetlands.

MP 329.8 – 328.8 Southbound – Figure 5

A 1-mile long southbound passing lane is recommended prior to the community center at Balch Way. This location was chosen based on the presence of horizontal curves with 55 mph speed advisory signage on the passing lane approach, low driveway density, available sight distance, and a 6 mile separation interval from the previous southbound passing lane. The recommended location would require widening the roadway toward the Tanana River, which is currently stabilized with rip rap slope protection. Widening may require guardrail and retained soils, or roadway alignment shift, to reduce encroaching toward the river and will be evaluated during the design phase of the project.

There is a signed school bus stop located within this segment which should not be a precursor for eliminating this alternative. Currently there are no scheduled bus stops at this location shown on Fairbanks North Star Borough School District's WebQuery mapper. Correspondence with the Delta/Greely School District, bus stops are determined by rider location and are subject to change depending on ridership. Both directions of traffic must stop during active bus stops, and kids are not allowed to cross the Richardson Highway. In-lane stops and enforcement is key to bus operation along the highway.



MP 326.6 – 327.7 Northbound – Figure 5

A 0.9-mile northbound passing lane is recommended north of the Salcha Elementary School speed reduction zone where the posted speed is reduced to 55mph. The separation distance is 8.1 miles from the previous northbound passing lane. This location is the first opportunity to provide a dedicated northbound passing lane north of where the posted speed increases to 65mph and north of driveway densities of 20 accesses/mile. The lane addition taper will begin just beyond an approach on the highway's east side. The north end of the passing lane would end approximately 800 ft prior to the Little Salcha River Bridge to avoid bridge widening. Minor improvements to the roadway profile are necessary for a passing lane at this location to improve sight distance ahead prior to the bridge. This location may involve minor impacts to wetlands on the east side of the roadway.

The length of this passing could be extended 0.2 mile south to just north of the Salcha Transfer Station access road intersection. However, the 65 mph speed limit should also be moved to be consistent with the traffic operation.

MP 320.4 – 319.1 Southbound – Figure 6

A 1.3-mile long southbound passing lane is recommended at Harding Lake providing a separation interval of 8.6 miles from the previous recommended southbound passing lane. This location takes advantage of an uphill grade where slow vehicles may be encountered. This passing lane cannot be extended or moved south as it would conflict with the recommended northbound passing lane at MP 316.5-318.4 where head-to-head separation is minimized at 1,500 ft between the opposing passing lanes. Extending or moving this location north on the nearly 2.5-mile tangent roadway section reduces its effectiveness as passing in the opposing lane is currently allowed and there are no roadway geometric features that prevent a slow vehicle from operating at the posted speed.

During the summer months, there is a higher number of left-turning RV and boat-trailer traffic accessing Harding Lake via S. Salcha and Salcha Drives, located 0.5 mile apart and both within this passing lane segment. The recommended passing lane begins 0.5 mile upstream (direction of traffic) of the first intersection and ends 0.2 mile downstream of the second intersection. The passing lane may be signed similar to a 'slow vehicle turnout' using R4-5 (Trucks use Right Lane) signing instead of advanced D17 and R4-16 (Keep Right Except to Pass) signing so that left-turning traffic do not excessively change lanes. The passing lane will effectively operate as a climbing lane for slow vehicles and reduce stopping on grade when left-turn queues are present.

MP 316.5 – 318.4 Northbound – Figure 6

South of Harding Lake, a 1.9-mile northbound passing lane is recommended providing a 6.0-mile interval from the previous passing lane ending at MP 310.3. This location takes advantage of an uphill grade and horizontal reverse curves improving efficient passing of slow vehicles. The passing lane begins south of reverse curves with 55 mph advisory speed signs, and terminates north of reverse curves with 50 mph advisory speed signs. This passing lane cannot be extended past the subsequent curve, due to conflict with the recommended southbound passing lane to the north maintaining a head-to-head separation of 1,500 ft. This location may involve minor impacts to wetlands on the north side of the roadway at MP 317.

MP 311.2 – 309.7 Southbound – Figure 7

A 1.5-mile long southbound passing lane is recommended to take advantage of an uphill grade and incorporate an existing southbound climbing lane (MP 309.7 to 310.7). The passing lane begins on the north side, extending the existing climbing lane approximately 0.5 mile, at the beginning of an uphill grade providing a separation interval of 7.8 miles from the previous southbound passing lane being recommended. The passing lane begins prior to the steep grade to improve efficiency as vehicle speed is unaffected by grade. The southbound passing lane's south end overlaps the northbound passing lane maintaining greater than 1,500 ft head-to-head separation. The southern end of the passing lane ends at the existing climbing lane's merge taper, past the hill crest, where truck speeds to within 10 mph of the posted speed can be achieved. Recommended improvements include widening the existing paved shoulder to 8 ft conforming to new construction standards.

Alternatively, the recommended passing lane may be shortened on the north side 0.3 mile, which would extend the existing climbing lane only 0.2 mile to reduce cost and consider truck climbing only. This alternative is less efficient as both passing and slow-vehicle speeds are reduced prior to beginning the dedicated passing lane. Impatient drivers are likely to begin their pass prior to the uphill grade, even if having to accept a shorter gap in the opposing traffic, rather than wait to pass on the uphill grade.

MP 308.9 – 310.3 Northbound – Figure 7

A 1.3-mile long northbound passing lane is recommended to take advantage of an uphill grade and incorporate an existing northbound climbing lane (MP 309.3 to 310.5). The passing lane begins 0.4 mile south of an existing climbing lane, providing a separation interval of 7.3 miles from the previous northbound passing lane. The passing lane begins at the toe of an uphill slope so that vehicle speeds are maintained as passing begins. The beginning of the passing lane may be moved north during design (shortening the passing lane) to avoid or minimize impacts to adjacent wetlands. There are no restrictions to sight distance that would prohibit this shift. At the north end, the recommended passing lane is terminated 800 ft short of the existing passing lane so that a longer merge distance is provided. Actual limits for this passing lane should be determined during design and coordinated to the adjacent southbound passing lane to maintain minimum head-to-

head separation distances and minimize wetland impacts. Recommended improvements include widening the existing paved shoulder to 8 ft conforming to new construction standards.

This location may involve minor impacts to wetlands on the north side of the roadway.

MP 303.9 – 302.1 Southbound – Figure 8

A 1.7-mile long southbound passing lane is recommended to take advantage of an uphill grade and incorporate an existing southbound climbing lane (MP 302.5-302.1). The southbound passing lane begins approximately 1.4 miles north of the existing climbing lane, providing a separation interval of 5.8 miles. The southbound passing lane terminates over the crest of the hill where the existing climbing lane ends and where truck speeds can be maintained to within 10 mph of the posted speed. The passing lane cannot be extended south due to limited head-to-head separation to the recommended northbound passing lane. It is assumed that very little traffic is generated at Tower Road. If this assumption is incorrect, the passing lane should be shortened on the south side so that the merge taper ends prior to the intersection. Recommended improvements include widening the existing paved shoulder to 8 ft conforming to new construction standards.

Approximately 3 miles south of this location, there is an existing southbound passing lane (MP 299.1-298.7). Although the existing passing lane provides additional opportunity it was dropped from consideration in this report since it is relatively short (0.4-mile long) and is preceded by a downhill section of roadway. Both of these factors reduce its effectiveness in providing a higher level of passing opportunity as a slow vehicle should be able to operate at the posted speed and an overtaking vehicle would have to 'accelerate-pass-merge' in the short distance provided. Converting this short passing segment to a 'slow vehicle turnout' and signing it accordingly is recommended.

MP 299.6 – 301.5 Northbound – Figure 8

A 1.9-mile long northbound passing lane is recommended to take advantage of an uphill grade and 55 mph advisory signed horizontal reverse curves where slow vehicles are likely to be encountered. This recommended northbound passing lane incorporates an existing northbound climbing lane (MP 301.5-301.1) and begins approximately 0.4 mile south of the existing climbing lane where adequate sight distance is available after the first horizontal curve. The separation interval from the previous northbound passing lane is 6.5 miles. Construction of this passing lane includes extensive cut and fill slopes as the roadway traverses away from the Tanana River Valley. The existing roadway through this area appears to not provide recoverable slopes within a clear zone offset required for new construction. Approximately 2,000 ft of roadway may require guardrail and/or retaining structures to reduce construction costs and will be evaluated during design. The passing lane cannot be extended north as it maintains 1,500 ft of head-to-head separation with the recommended southbound passing lane. Recommended improvements include widening the existing paved shoulder to 8 ft conforming to new construction standards.

This location may involve minor impacts to wetlands on the north side of the roadway.

MP 294.1 – 292.4 Southbound – Figure 9

A 1.7-mile long southbound passing lane is recommended to take advantage of an uphill grade and extends the existing passing lane (MP 294.0-292.4) only 0.1 mile north. The existing southbound passing lane begins at a suitable location regarding the uphill grade; however, there is insufficient sight distance ahead as it begins in a horizontal curve. To provide 1,000 ft of clear line of sight ahead, the existing passing lane should be extended 500 ft to the north. The separation interval is 7.7 miles from the previous southbound passing lane. The end of this passing lane currently ends at a suitable location where traffic speeds can be maintained at the posted speed. Recommended

improvements include widening the existing 2 ft paved shoulder to 8 ft conforming to new construction standards and guardrail sections where warranted. Recoverable slopes appear to not be provided within the clear zone offset adjacent to the existing passing lane. Widening will require either significant fills or guardrail to conform to current construction standards.

MP 290.8 – 292.8 Northbound – Figure 9

A 2-mile long northbound passing lane is recommended to take advantage of an uphill grade and extends the existing climbing lane (MP 291.9-292.8) approximately 1 mile south. The separation interval is 9.8 miles from the previous northbound passing lane. This location takes advantage of slowing vehicles on a 4-mile climb at grade as the roadway moves away from the Tanana River Valley. This recommended passing lane is longer than others due to its location beginning at the midpoint of a long uphill grade and its longer separation interval.

Moderate wetland impacts are anticipated at this passing lane location.

Consideration was made to balance the separation intervals either side of this location from the recommended 6.5 miles north and 9.8 miles south. Moving this passing lane south would place it near Shaw Creek Bridge. Recreational and mining turning traffic, extensive slope excavations, and wetlands impacts makes the Shaw Creek area an undesirable location for passing lane improvements. Moving this passing lane north would place it on a downhill grade reducing its effectiveness.

MP 283.2 – 281.8 Southbound – Figure 10

A 1.4-mile long passing lane is recommended south of Shaw Creek for separation interval and where passing in the opposing lane is prohibited through a series of horizontal reverse curves. The separation distance is 8.6 miles from the previous southbound passing lane. This location takes advantage of horizontal curvature where slow vehicles are likely to be encountered and wetland impacts are avoided. Along the middle section of this passing lane, a moderate shift of the alignment could be made to avoid an overflow channel of the Tanana River; or channel lining placed to protect the widened embankment from channel encroachment. These types of improvements will be evaluated during design.



MP 279.1 – 280.7 Northbound – Figure 10

A 1.7 mile passing lane is recommended for separation interval and where passing in the opposing lane is prohibited through a series of horizontal reverse curves. The existing northbound passing lane (MP 280.3-280.7) will be extended south approximately 1.3 miles. The separation distance is approximately 7.6 miles from the previous northbound passing lane. The southern beginning of this passing lane may be moved north to MP 279.8 resulting in a 0.9-mile passing lane. There are two other locations between MP 279.1 and MP 279.8 where there is sufficient clear line of sight greater than 1,000 ft to begin a passing lane. However, there is less than 500 ft of roadway where the required sight distance occurs. For those reasons and to include existing improvements, the longer 1.7-mile passing lane is recommended.

MP 273.6 – 272.5 Southbound and

MP 270.2 – 271.3 Northbound – Figure 11

One-mile long northbound and southbound passing lanes are recommended north of Delta Junction where the posted speed transitions to 65 mph northbound and prior to the 55 mph transition southbound. This location was selected for separation interval and where approach densities are lowest between Big Delta and Delta Junction, south of the Tanana River Bridge. The Tanana River Bridge and a number of residences close to the highway precluded placing these passing lanes

further north. Both passing lanes are located 1,500 ft or more away from the Deltana Volunteer Fire Department No. 5 driveway and/or Tanana Loop Road so as not to affect traffic operation at those intersections.

The southbound passing lane begins approximately 8.2 miles from the previous southbound passing lane, and ends 5.8 miles north of the existing Richardson Highway four-lane section at Delta Junction MP 266.4. The location of the passing lane is based on the desired 8-mile separation interval between the previous southbound passing lane at MP 281.8 and terminates at least 1,500 ft north of the Deltana Volunteer Fire Department No. 5 driveway.

The northbound passing lane would begin approximately 3.6 miles from the existing Richardson Highway four-lane section at Delta Junction (MP 266.4) where the posted speed increases to 65mph. This location provides the first dedicated passing lane opportunity after the increase in posted speed where passing in the opposing lane is currently prohibited. Placing the northbound lane away from the southbound passing lane as an adjoining configuration improves ingress/egress traffic movements to adjacent driveway access points; left-turning vehicles will have to cross one lane only. Potential impacts include relocation of the overhead fiber optic line to provide hazard-free recoverable slopes within the clear zone offset.

Conclusion

This report presents the most effective passing lane locations along the Richardson Highway between Delta Junction and Eielson AFB in Alaska. The above recommended locations will be used to obtain additional design surveys and delineate environmental studies. Local adjustments may be made during design to fit existing conditions, avoid costly impacts to existing facilities, or as needed by project requirements.



All of the existing climbing and passing lanes, except for one, have been incorporated into the recommended passing lane locations to reduce cost and, therefore, influence the separation interval between the recommended passing lanes that are being systemically placed. Many of the existing climbing and passing lanes are less than 0.5 mile and are based on truck performance where the sustained speed is less than the posted speed. For a platoon of vehicles to pass a slow vehicle on an uphill grade, they would have to accelerate, pass, and merge which requires considerably longer distance than is currently provided. The desirable length of passing lanes is 1 to 2 miles to allow a platoon of vehicles to pass. However, they may be shortened where required to reduce construction costs or minimize environmental impacts, reducing their effectiveness to improve capacity.

Constructing passing lanes systemically along the Richardson Highway is expected to reduce crashes by 25% improving safety and improve highway capacity by breaking up traffic platoons. Passing lanes provide dedicated passing opportunities at intervals that drivers are likely to anticipate and wait for that opportunity to complete safe passing maneuvers. Therefore, passing lanes should be located where slow vehicles are likely to be encountered rather than on straight and flat roadway sections where slow vehicles are likely to operate at highway speeds.

Potential passing lane locations that were dropped from consideration included highway segments at existing bridge structures, where adjacent residential development is generally close to the highway and driveway densities are relatively high, and at major intersections such as at recreational access points where greater turning traffic is expected. Impacts to large diameter culverts, anadromous stream crossings, and slope stabilization problem areas may affect the final location of these recommended passing lanes and should be evaluated during design.

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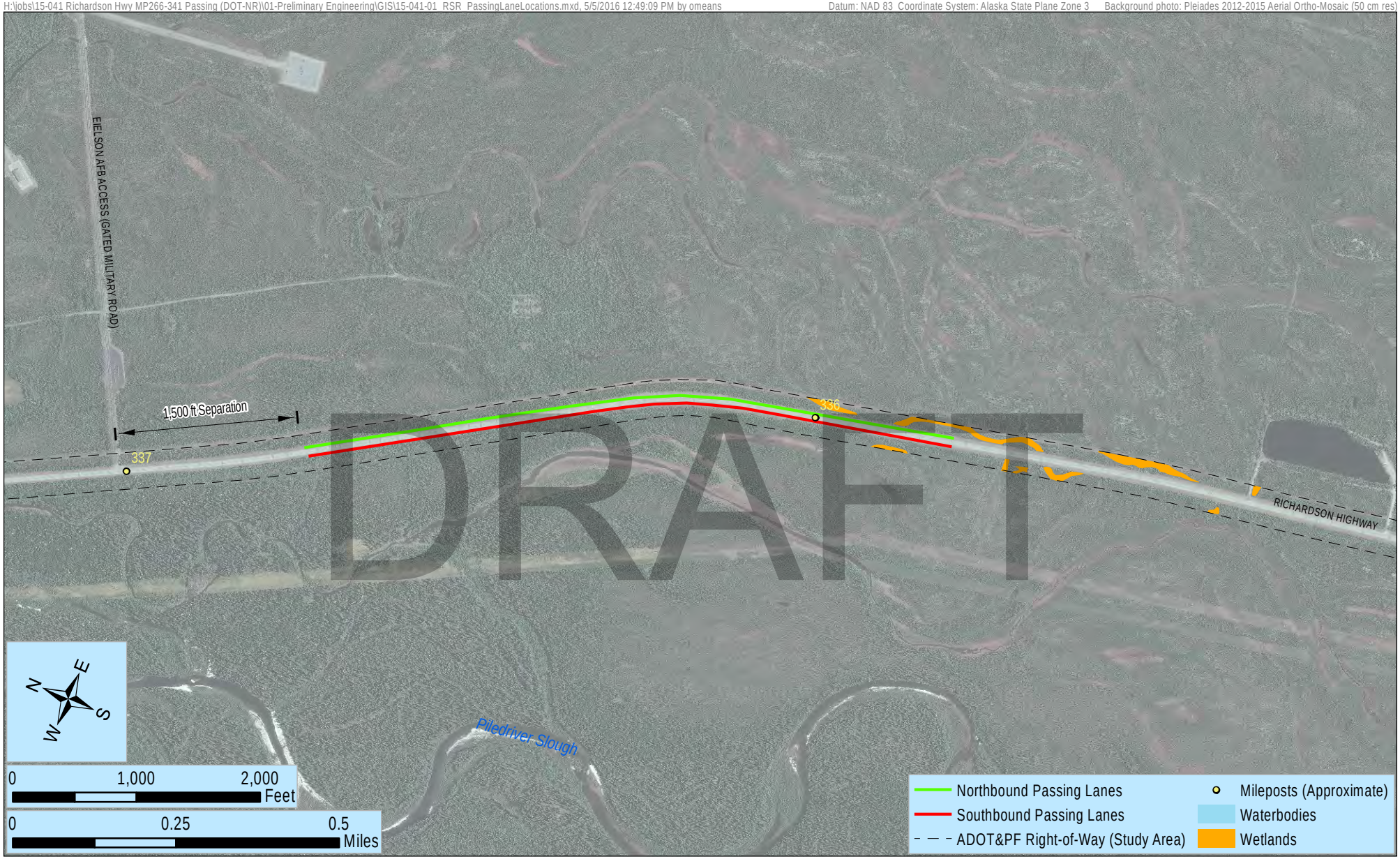


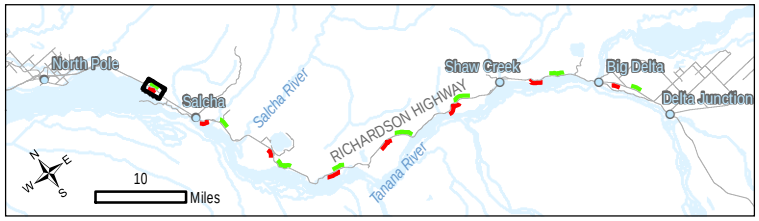


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Figure 4
Recommended Passing Lanes
MP 335.8-336.7 NB &
MP 335.8-336.7 SB

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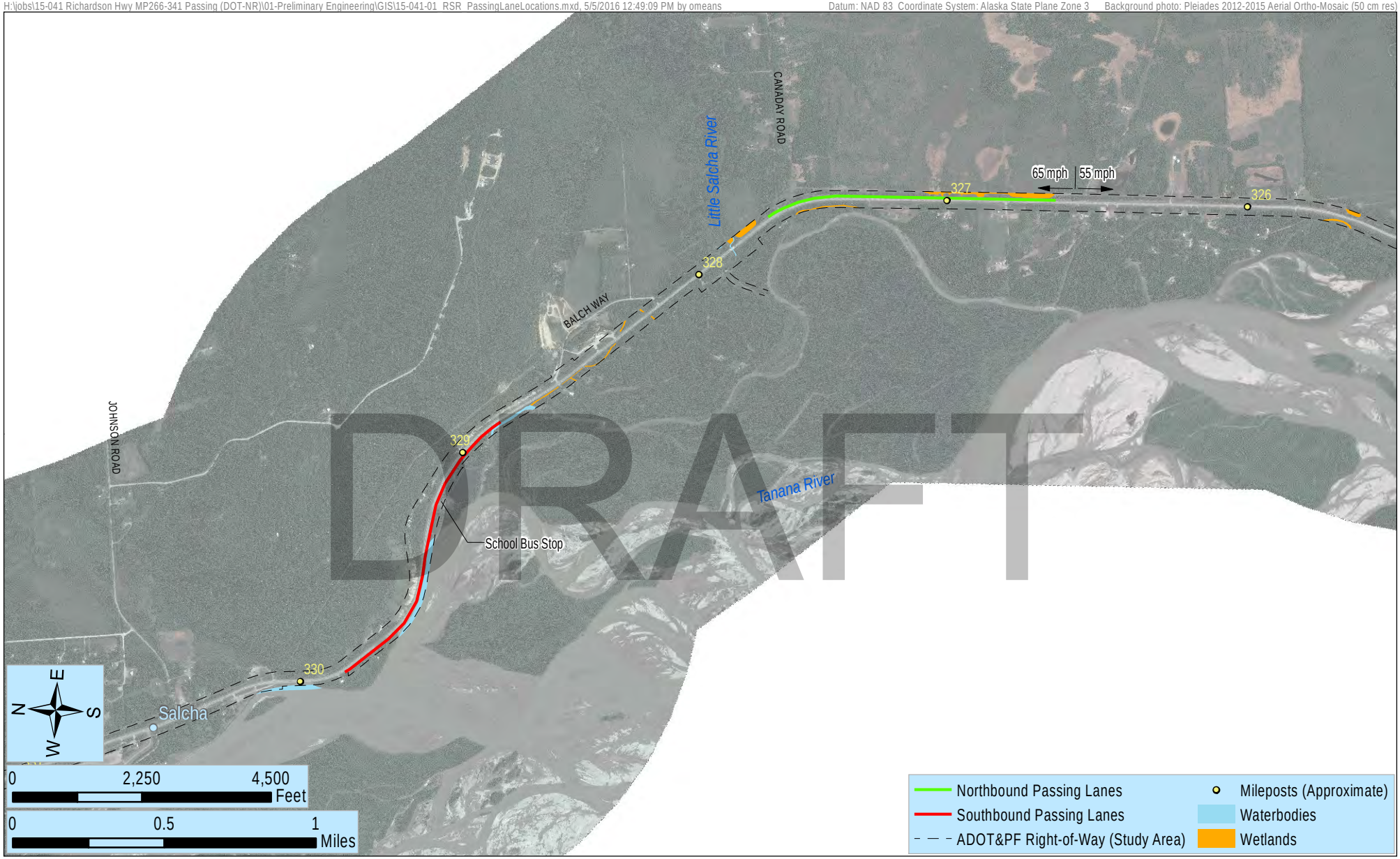




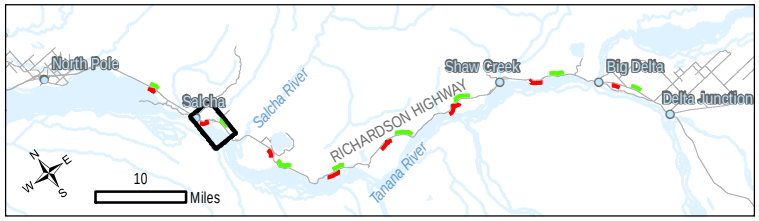


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Figure 5
Recommended Passing Lanes
MP 329.8-328.8 SB &
MP 326.6-327.7 NB


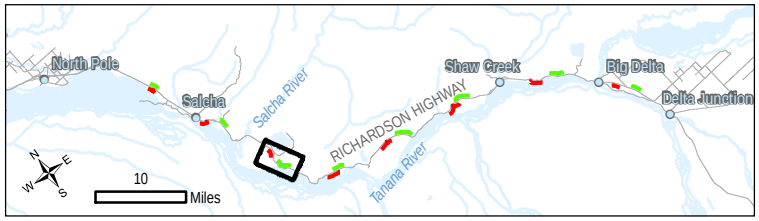


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Figure 6
Recommended Passing Lanes
MP 320.4-319.1 SB &
MP 316.5-318.4 NB

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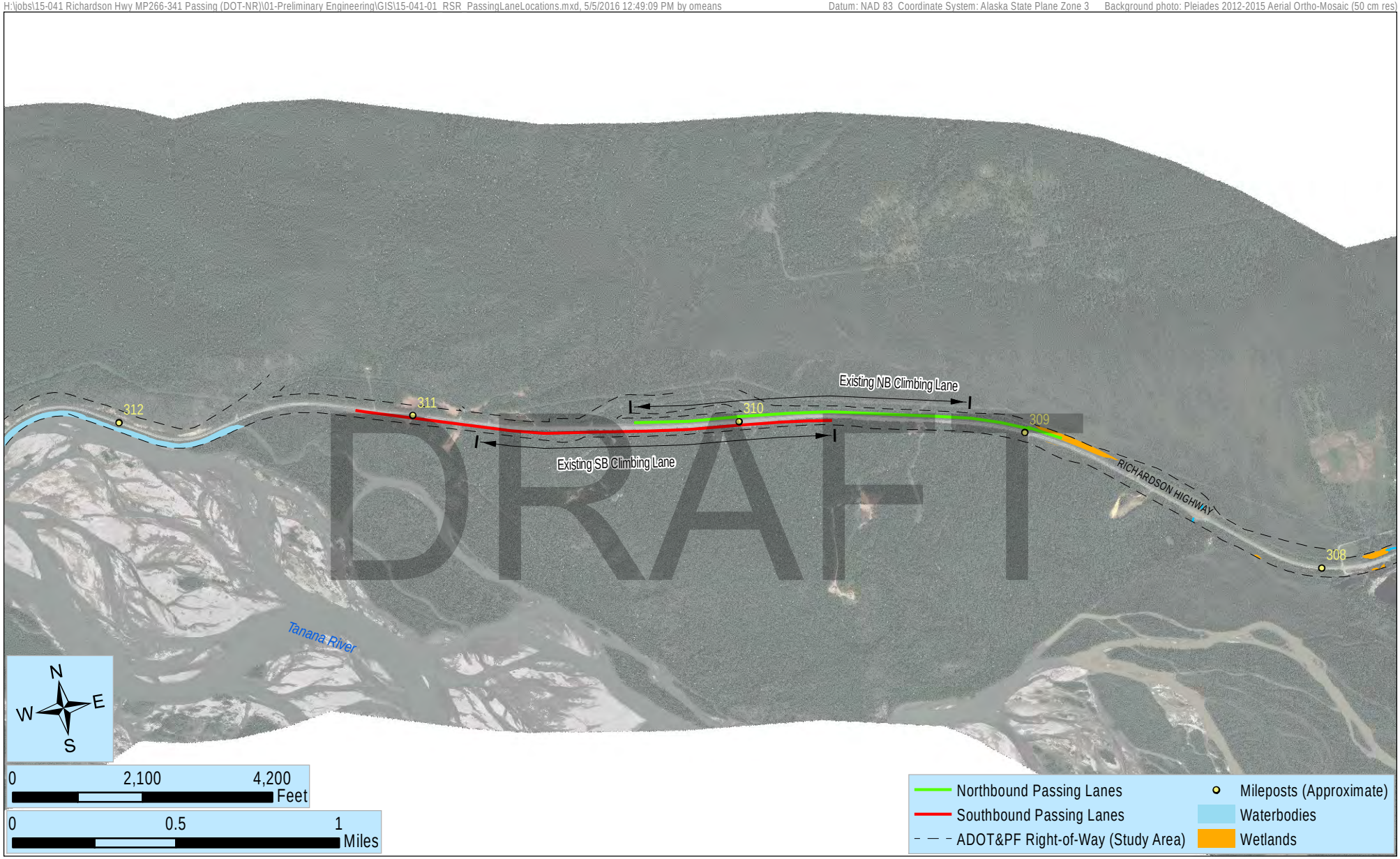


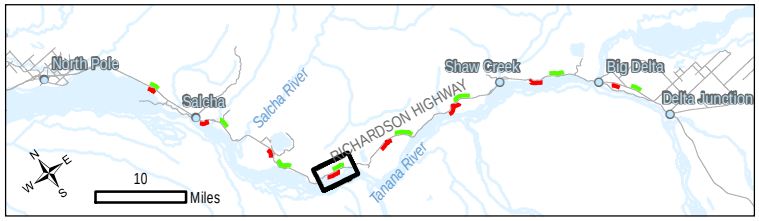


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Figure 7
Recommended Passing Lanes
MP 311.2-309.7 SB &
MP 308.9-310.3 NB

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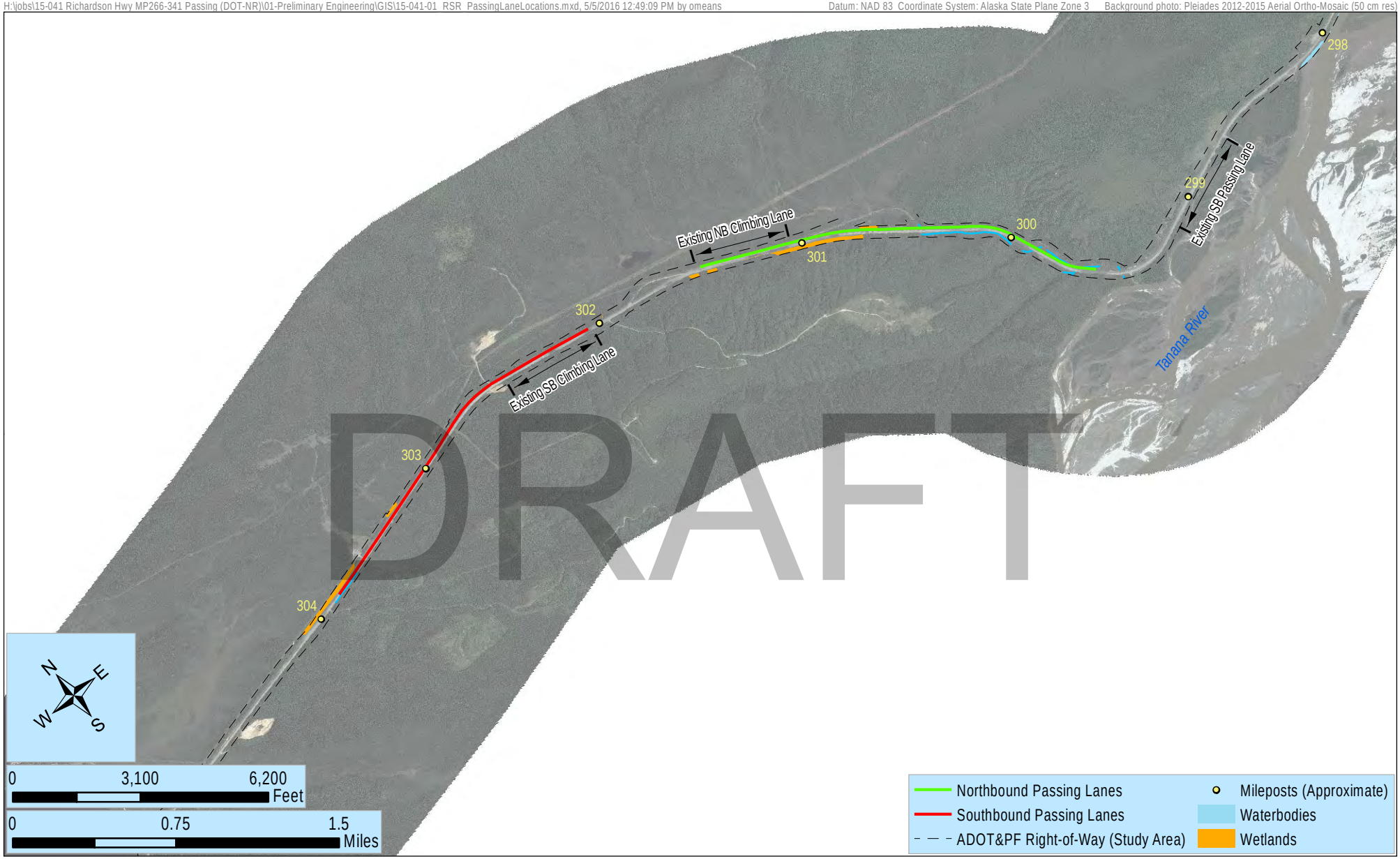


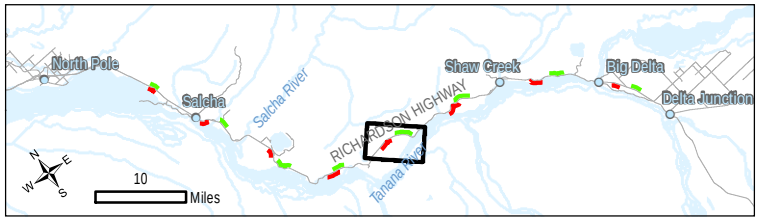


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Figure 8
Recommended Passing Lanes
MP 304.0-302.0 SB &
MP 299.6-301.5 NB

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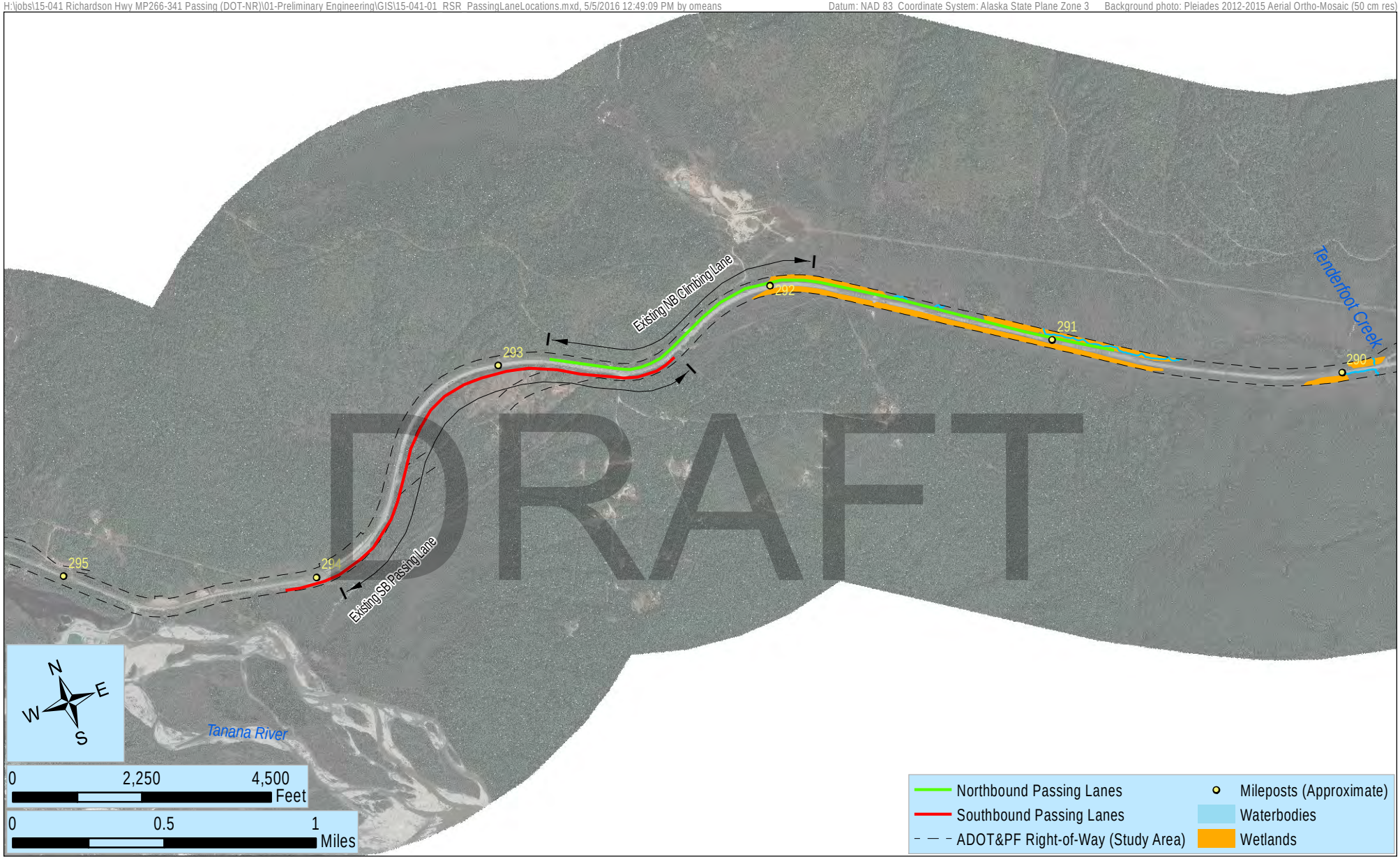


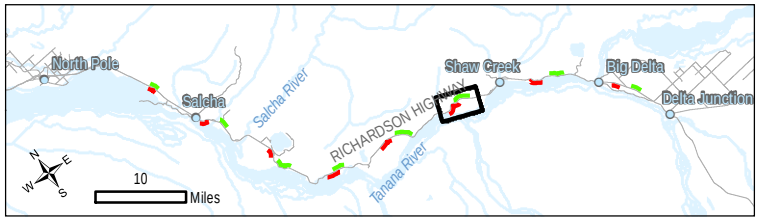


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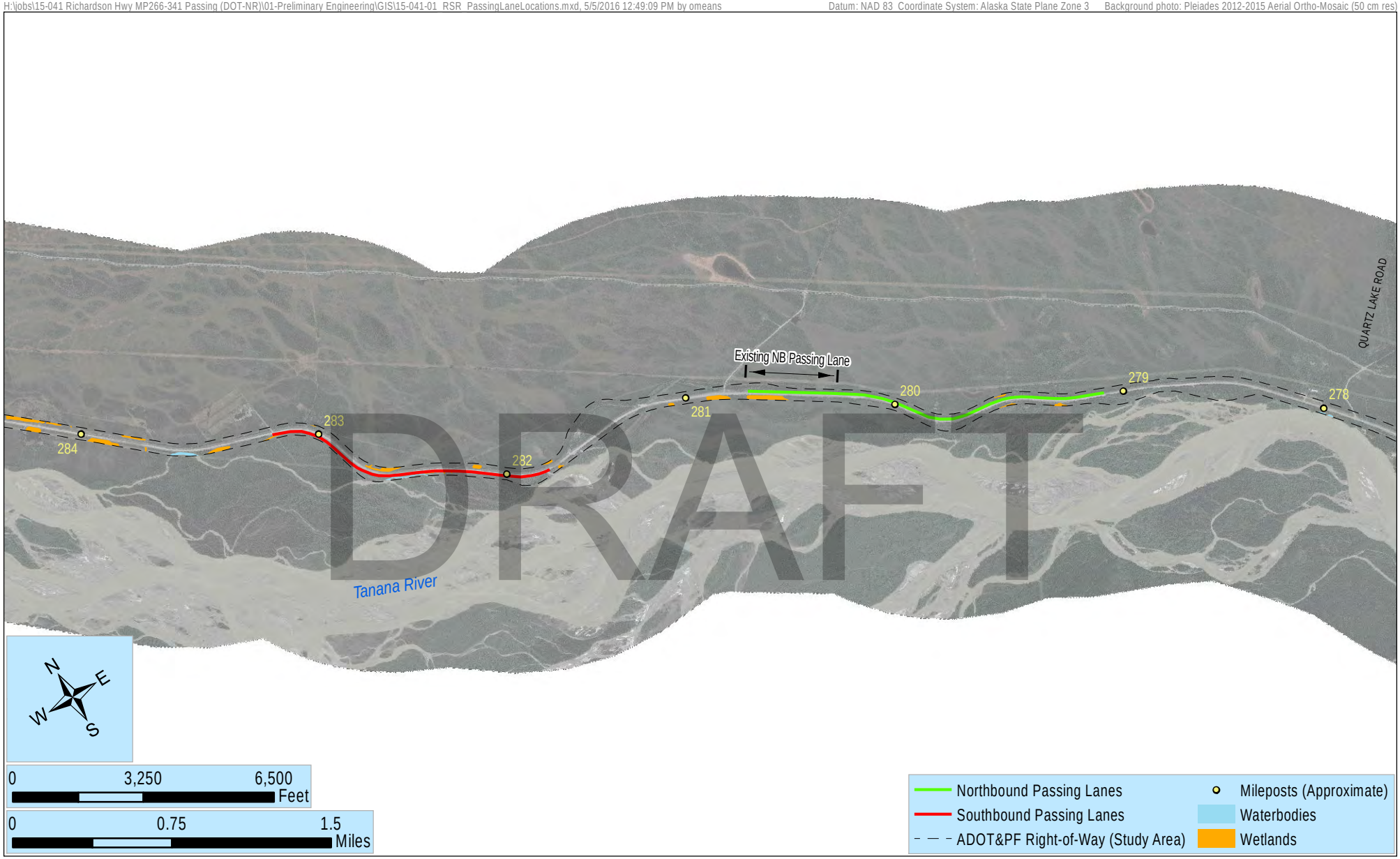
Figure 9
Recommended Passing Lanes
MP 294.1-292.4 SB &
MP 290.8-292.8 NB



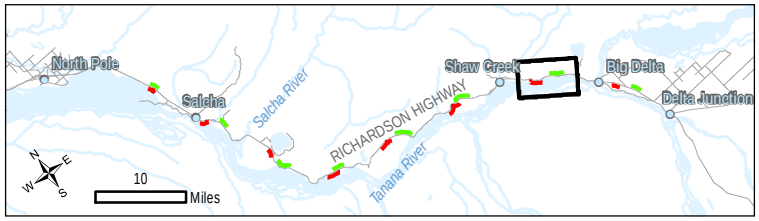




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Figure 10
Recommended Passing Lanes
MP 283.2-281.8 SB &
MP 279.1-280.7 NB

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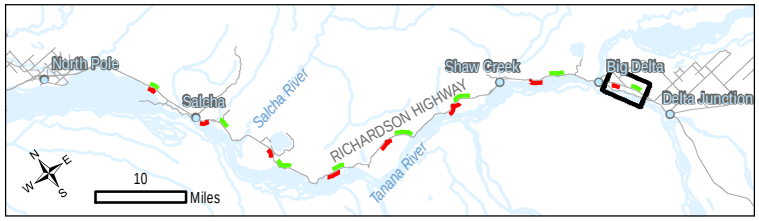


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Figure 11
Recommended Passing Lanes
MP 273.6-272.5 SB &
MP 270.2-271.3 NB