Nomad Engineering

Cooper Creek Bridge

Design Alternatives Analysis Report

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Whitley Mattern
Ryane Schrank
Aaron Murph
Jacob Kinder

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EXECUTIVE SUMMARY

Cooper Creek Bridge poses safety issues for vehicular and foot traffic in the surrounding area. The goal of the Cooper Creek Bridge Project, being designed by Nomad Engineering, is to connect the existing pathway near Alaska Wildland Adventures on the Sterling Highway to the Cooper Creek South campground and surrounding area near Sackett's Kenai Grill. Three options have been analyzed as possible connections between these two locations to provide safe travel across Cooper Creek. Each alternative poses unique characteristics which are outlined below and are further described in the body of this Alternatives Analysis Report.

Active Transportation Connection Alternatives

- Alternative 1:

  The Alternative 1 option would run parallel to the northern edge of the existing Sterling Highway alignment, and would be about ⅓ of a mile in length. The existing trail ending at Alaska Wildland Adventures is on the North side of the highway as well, just above the Kenai River. This alternative would provide a direct connection between the existing pathway, east of Cooper Creek, and Sackett's Kenai Grill, to the west. Travelers would primarily make this journey by way of an elevated boardwalk-style path, constructed between the highway's outside shoulder and Kenai River.

- Alternative 2:

  The Alternative 2 option would run parallel to the Sterling Highway as well, but on the southern in-land side. This option proposes extending the existing inside shoulder of the road and then constructing a 5 foot wide paved travel for non-motorized travel access. Guardrail would be placed between the pathway and the vehicular traffic to increase the level of safety along this path. The adjacent hillside would be stabilized by installing a row(s) of gabion baskets between the newly constructed path and toe of the slope. Travelers will cross Cooper Creek via a prefabricated steel bridge placed just south of the existing Cooper Creek Bridge.

- Alternative 3:

  The Alternative 3 option proposes constructing a switchback-style hard-packed earth trail up along the hillside across from Alaska Wildland Adventures, providing travelers an elevation gain around 250-300 feet above the existing roadway. The trail wraps around the north face of the hillside, just south of the existing powerline easement and then continues back down the hillside by use of a ramped boardwalk style structure. Travelers would cross Cooper Creek via a prefabricated steel footbridge.

Cost Estimates

Estimates for all three alternatives are included below. These are preliminary estimates based on costs of line items for projects previously done in areas near Cooper Landing. Factored costs include all items thought to be required in the construction of each alternative plan.

INTRODUCTION

Existing Conditions

Currently, conditions in this area of the Sterling Highway are unfit for active transportation across Cooper Creek. The only path provided between land on either side of Cooper Creek is the Cooper Creek Bridge. This bridge was constructed over 50 years ago and considerations for adequate shoulder width and pedestrian passage were not included. Therefore, travelers have no choice but to use this bridge to cross the creek but do so under dangerous conditions. Limited horizontal space and environmental space in the area do not permit the roadway to be updated to meet current highway geometric requirements. However, providing a safe east-west connection across Cooper Creek for active transportation traffic is necessary to increase the level of safety for visitors and residents within the Cooper Landing area.

Purpose and Need

The purpose of this project is to determine a safe alternative for non-motorized travelers to safely get around the Cooper Landing area. Tourists who are staying in the area may not have vehicular transportation or would prefer to explore the area by non-motorized methods. As tourism is a big draw to the Cooper Landing area it is important to consider visitors' best interest and safety.

Locals in the area also use alternate modes of transportation to get around or to their places of work. The bridge at Cooper Creek acts as a dangerous bottleneck and without other options to cross, pedestrians and drivers are put in an unsafe situation that could potentially be avoided.

DESIGN ALTERNATIVES

The three alternatives proposed to provide an east-west connection for active modes of transportation are described below.

Alternative 1

Overview

Alternative 1 proposes constructing a walkway along the north side of the Sterling Highway. This provides a direct connection between the existing trail east of Alaska Wildland Adventures (AWA) and the Cooper Creek North Campground. This walkway will follow the existing alignment of the highway and will function as a separate structure that serves as a path for non-motorized travelers. The walkway will overlook the Kenai River and be constructed as a boardwalk-style pathway which will make use of pillars due to the lack of soil on this side of the highway. A hard packed bare earth pathway will be provided east and west of this boardwalk so travelers can access AWA and a proposed crosswalk west of the existing Cooper Creek Bridge. This crosswalk would provide safe passage between Sackett's Kenai Grill and the Cooper Creek North Campground.

Design Criteria Overview

- 6 foot wide clear tread width
- 7-8 wide boardwalk structure
- Steel and wood
- Piles/boardwalk style
- 2% max cross slope
- Approximate path length: 1,850 ft (~ ⅓ mile)
- Time to traverse path (@ 3 mph): 10 min

Plan View (Horizontal Alignment)

This path runs adjacent to the existing Sterling Highway alignment. The conjoined path and boardwalk structure will be built three feet offset from the road. This alternative begins with a hard packed pathway connecting to the existing pathway on the east side of Alaska Wildland adventures. This section will run about 465 ft where it will transition into boardwalk. The boardwalk will run the majority of the pathway. Upon approaching Cooper Creek bridge, pillars that are used to stabilize the walkway until this point will cease in order to have a clear span across the connecting waterways of Kenai River and Cooper Creek. 100 ft past the footbridge adjacent to Cooper Creek Bridge, the alternative will meet once more with a hard packed pathway off of the boardwalk structure. This will carry travelers to the North Cooper Creek Campground where the trail will end.

Figure 1 displays the proposed horizontal alignment of this alternative.

Figure 2 displays potential Right of Way (ROW) impacts for the proposed path. For Alternative 1, no ROW impacts are evident.

Typical Section

This alternative does not require a significant need for large soil excavation or fill quantities due to the fact it will be primarily a structure based path. Based on elevation data within the area, the roadway has a varying cross slope that changes as the roadway transitions between curved and straight segments. Due to the varying gradient of the roadway, and the limited horizontal distance north of the Sterling Highway, developing a pathway on the existing ground is not safe or practical. With the boardwalk style of pathway, pillars will be able to go deep into the embankment soil in order to stabilize the structure. Because the pathway is right along a large river prone to flooding, the embankment soils are at a higher risk for erosion and potential failure. Therefore the piles must be driven deep enough into the ground, to meet the point of refusal, in order to avoid the risk of being washed out.

A representation of a typical section for Alternative 1 is shown in **Figure 3**.

Considerations / Potential Impacts

With this alternative, it is important to consider potential environmental impacts. Having a boardwalk just above the Kenai River poses potential for debris or pollution entering into the water below. Going forward, environmental permitting will need to be addressed, due to construction of this alternative being so close to an anadromous waterway.

It is important to also consider the location of this alternative being so close to the highway. Although improbable, car accidents, flying rocks, and loud noise could cause discomfort for walking travelers.

Alternative 2

Overview

Alternative 2 proposes developing a walkable path along the inside shoulder of the existing Sterling Highway alignment. The road will be widened along this inside shoulder to provide a five foot wide, paved trail for travelers. In addition, the existing inside shoulder will be extended five feet and guardrail will be placed between this shoulder and the provided path to increase the safety of non-motorized travelers. In order to maintain the existing drainage pattern and prevent water from directly spilling onto the trail from the adjacent hillside, a ditch will be constructed between the path and the face of the slope. This ditch will channel into the existing ditch at the path extents. Due to the steep slope of the hillside, at least one row of 3 foot x 3 foot (cross-section dimensions) gabion baskets will be placed between the ditch and the hillside. This

will provide stability to the slope and also will provide a means to connect the proposed cut back into the existing topography. Travelers will cross Cooper Creek via a footbridge located just south of the existing Cooper Creek Bridge and head west toward Sacketts via a hard packed trail separated from the existing roadway by a ten foot vegetative buffer.

Design Criteria Overview

- Five foot wide path
- Asphalt surface
- 5% max running slope
- 2% max cross slope
- Shoulder along the path will be extended to reach width of five feet
- Guardrail will act as barrier between motorized and non-motorized traffic
- Backslope not to exceed (be steeper than) 2H:1V slope
- Footbridge to be constructed across Cooper Creek, south of existing Cooper Creek Bridge
- Approximate path length: 2,818 ft (~ ½ mile)
- Time to traverse path (@ 3 mph): 10 min

Plan View (Horizontal Alignment)

This path would follow the existing alignment of the Sterling Highway, south of the highway and north of the steep hillside along the road. A pedestrian crosswalk would be established east of AWA, near Milepost 50, in order to connect the existing trail with this proposed pathway. Heading west, the trail would lead to a footbridge that would provide non-motorized access across Cooper Creek, just south of the existing Cooper Creek Bridge. In order to reduce cost and increase construction efficiency, a prefabricated steel bridge will be used at this location. The running slope of the path is not to exceed a grade of 5% in order to adhere to ADA standards.

Figure 4 displays the proposed horizontal alignment of this alternative.

Figure 5 displays potential Right of Way (ROW) impacts for the proposed path. For Alternative 2, minimal ROW impacts are evident.

Typical Section

This path design requires that a cut be made into the existing hillside face in order to accomodate space for an extended shoulder and five foot wide path. In order to meet ADA standards, a maximum 2% cross slope will be provided to ensure that water does not collect on the path. This path will slope down toward the hillside. The elevation data for the area represents the roadway as superelevated with a unidirectional cross slope across the entire width of the traveled way. In order to avoid a sudden difference in slopes between the traveled width and the inside shoulder that could alarm drivers and create unsafe driving conditions, the shoulder will be

sloped upward so that water falling on the shoulder would sheet across the roadway. The cross slope of the shoulder will be 4% in order to ensure adequate drainage.

Existing drainage patterns will be maintained by constructing a ditch along the toe of the hillside. The typical section for this alternative proposed a shallow one foot deep ditch with 2H:1V foreslopes and backslopes. If this alternative is selected as the preferred alternative, a hydrologic analysis will have to be performed in order to determine the required ditch dimensions.

The surface of the pathway would preferably be paved with asphalt in order to increase its durability and longevity. However, the extended width of the shoulder will be surfaced with non-bituminous materials, such as gravel and crushed rock in order to reduce the cost of paving this additional surface area.

A representation of a typical section for Alternative 2 is shown in **Figure 6**.

Considerations / Potential Impacts

The proximity of the path to motorized traffic presents a safety hazard if a vehicle were to lose control and approach the path. The guardrail and extended shoulder were included in the design in order to provide as much barrier as possible given the limited horizontal space. Additionally, it is anticipated that the construction of this path would not occur until after the Sterling Highway Bypass Project is at or near completion. It is anticipated that 70% of the existing highway traveling the existing Sterling Highway will be diverted to the new Bypass. This means that traffic along the existing stretch of the Sterling Highway will be drastically reduced, thereby increasing the level of safety for all travelers. If the adjacency to the roadway is still a concern however, an elevated pathway design can be developed.

Another thing to consider is the stability of the slope given the cuts that would be made into the hillside. Geotechnical reports within the area indicate that due to the silty composition of this hillside, large cuts into the slope could pose a high chance for slope instability and possible failure. Therefore, slope stability measures, in addition to the gabion baskets, may have to be included in the final design of this alternative.

Alternative 3

Overview

Alternative 3 proposes using the hillside that rises from the inside shoulder of the existing highway, as a means to provide a scenic route for active travelers. Heading west from AWA, travelers would cross the street near Milepost 50 of the Sterling Highway and then travel up the hillside along several ground-packed switchbacks for an elevation gain between 250-300 feet from the roadway. Travelers would then head west along the perimeter of the hillside, adjacent to

the existing powerline easement and then descend toward Cooper Creek with a series of elevated boardwalk-style ramps that eventually connect back to a traditional hard packed trail system. A foot bridge would be provided south of the existing Cooper Creek Bridge to provide access across Cooper Creek. Benefits of this design include travelers being separated from traffic, limited environmental impacts, and scenic views of the surrounding habitat. This route would be designed to meet American Disabilities Act (ADA) accessibility requirements.

Design Criteria Overview

- 5 foot width
- Trail surface will consist of hard-packed bare earth
- A boardwalk-style ramp structure will provide access along rapidly eroding areas; (approximate length: 1,860 ft)
- Average 5% running grade
- 8.33% max grade at running lengths of 200 ft; landing areas provided
- 5% max cross slope
- Footbridge to be constructed south of existing Cooper Creek Bridge
- Approximate Path Length: 7,800 ft (~1.5 miles)
- Time to traverse path (@ 3 mph): 30 min

Plan View (Horizontal Alignment)

This trail is designed to meet ADA accessibility requirements in order to provide access to as many people as possible. The USDA Forest Service Trail Accessibility Guidelines (FSTAG) were used as reference in order to meet ADA guidelines that consider the extreme topography of the area. These requirements permit a maximum running slope of 5% for any distance. A running slope of 8.33% may be provided for distances up to 200 ft. Where the trail grade exceeds 5%, resting intervals shall be provided that are at least 60 inches in length and shall at minimum match the width of the widest section of the trail.

In order to gain the required elevation difference, the trail will follow the contours of the hillside across from AWA, in a series of switchbacks, at a 5% grade, each about 1,000 feet in length. Upon reaching an elevation approximately 250 feet above the roadway, the trail will wrap around the ridge of the mountain and then run closely parallel to the existing powerline easement on the hillside. Due to the instability of the slope on the far west side of this hillside, developing a trail into the face of the slope is not feasible. Therefore, a series of ramps will be constructed that will be stabilized and supported by driven pile columns. Once the ramps reach stable ground, the trail will be constructed into the existing topography and then provide access across the Cooper Creek Bridge via a prefabricated steel footbridge. The trail will then cut north through the Cooper Creek South Campground and follow west toward Sackett's Kenai Grill along a path set back from the existing highway alignment by a ten foot vegetative buffer.

Figure 7 represents the proposed horizontal alignment of Alternative 3.

Typical Section

ADA requirements dictate that passing spaces must be provided at regular intervals on trails less than 60 inches in width. Therefore, the clear tread width of the trail will maintain a width of 60 inches along the entire traveled length in order to provide adequate room for travelers heading in different directions and those using strollers or wheelchairs. A maximum 5% outslope will provide drainage and maintain the integrity of the trail, while still allowing comfortable conditions for travelers.

This trail will be constructed using a bench cut, which is a section of tread cut across the side of a hill. A full bench cut is constructed by cutting the full width of the trail into the hillside. Given the silty and sandy materials that compose this hillside, a full bench trail construction will provide a stable platform for travelers that is resistant to erosion, provides longevity, and requires lower maintenance compared to a partial bench trail construction.

The inner edge of the trail will blend into the natural topography of the hillside by a diagonal backslope that will vary in degree of slope, depending on the trail location and adjacent terrain. However, these cuts (backslopes) are not to exceed a slope greater than 1H:1V in order to maintain the structural integrity of the hillside. The backslopes will be revegetated in order to slow water runoff as it approaches the trail surface and reduce sloughing of the hillside.

Aside from the piered ramps that traverse the west side of the hillside, the surface of the trail will be hard packed earth. A hard packed earth surface is easier to construct and reduces costs to construct and maintain the trail. Native soil will have to be tested in order to ensure it offers a reasonable level of slip resistance and compactibility; otherwise, additional material will have to be transported and incorporated into the design.

A representation of the switchback trail section is displayed in **Figure 8**.

Considerations / Potential Impacts

In order to move people away from the edge of the road, this trail would travel into land outside of the existing public Right of Way. The path crosses land owned by the Kenai Peninsula Borough and the USDA Forest Service. Easements across this land would have to be granted in order to continue development of this trail. Therefore, if this trail is selected as the preferred alternative, landowners would have to be contacted in order to determine feasibility of the trail.

Parcels impacted by the Alternative 3 design are displayed in **Figure 9**.

COST ESTIMATES

For the three pathway alternatives, a typical cross section was used to calculate quantities and costs for the entire length of each path. Costs for line items of similar projects in the area were referenced to get a relative unit price per each item. In addition, experienced engineers and contractors provided Nomad Engineering approximate quotes for item costs. Total costs were then calculated for each item based on the quantity and unit prices. The estimates for each alternative are outlined below. Please note that these are approximate estimates that would be refined with the progression of the design.

Alternative 1

Materials and Earth Quantity Estimates

As shown in the table below, the major costs for this alternative consist of the boardwalk pathway and general construction costs.

Cost Estimate #1

Item #	Description	Pay Unit	Unit Price	Quantity	Total
201(1A)	Clearing/Grubbing	Acre	$8,000	0.250	$2,000
640(1)	Mobilization and Demobilization	Lump Sum	$50,000	1	$50,000
641(2)	Temporary Erosion, Sediment and Pollution Control	Cont. Sum	$25,000	1	$25,000
642(1)	Construction Surveying	Lump Sum	$15,000	1	$15,000
643(2)	Traffic Maintenance	Lump Sum	$20,000	1	$20,000
643(15)	Flagging	Cont. Sum	$15,000	1	$15,000
643(25)	Traffic Control	Cont. Sum	$45,000	1	$45,000
644(1)	Field Office	Lump Sum	$12,000	1	$12,000
	Elevated Boardwalk Estimate	Linear Foot	$302.83	2000	$605,660.00
				TOTAL	$789,660

Alternative 2

Materials and Earth Quantity Estimates

As shown in the table below, the major costs for this alternative are the gabion baskets, pedestrian bridge, guardrail and general construction costs.

Cost Estimate #2

Item #	Description	Pay Unit	Unit Price	Quantity	Total
201(1A)	Clearing/Grubbing	Acre	$8,000	1.010	$8,081
203(3)	Unclassified Excavation	CY	$7.00	3259.26	$22,815
203(5)	Borrow	CY	$10	469.333	$4,693
301(1)	Aggregate Base Course (D-1)	TON	$35.00	912.38	$31,933
306(1)	ATB	TON	$85	0.000	$0
306(2)	Asphalt Binder	TON	$750.00	0.00	$0
504(1)	Structural Steel	Lump Sum	$70,000	1.000	$70,000
505(5)	Furnish Structural Steel Piles	Lump Sum	$25,000.00	1.00	$25,000
507(2)	Pedestrian Railing	Lump Sum	$35,000	1.000	$35,000
606(1)	W-beam Guardrail	Linear Foot	$40.00	2200.00	$88,000
608(2)	Asphalt Sidewalk	SY	$33	956.729	$31,572
636(1)	Gabion	CY	$350.00	733.33	$256,666
640(1)	Mobilization and Demobilization	Lump Sum	$50,000	1.000	$50,000
641(2)	Temporary Erosion, Sediment and Pollution Control	Cont. Sum	$25,000.00	1.00	$25,000
642(1)	Construction Surveying	Lump Sum	$15,000	1.000	$15,000
643(2)	Traffic Maintenance	Lump Sum	$20,000.00	1.00	$20,000
643(15)	Flagging	Cont. Sum	$15,000	1.000	$15,000
643(25)	Traffic Control	Cont. Sum	$45,000.00	1.00	$45,000
644(1)	Field Office	Lump Sum	$12,000	1.000	$12,000
670(12)	MMA Pavement Markings	Lump Sum	$1,000.00	1.00	$1,000
				TOTAL	$756,761

Alternative 3

Materials and Earth Quantity Estimates

As shown in the table below, the major costs for this alternative are the boardwalk, pedestrian bridge, excavation and general construction costs.

Cost Estimate #3

Item #	Description	Pay Unit	Unit Price	Quantity	Total
201(1A)	Clearing/Grubbing	Acre	$8,000	0.895	$7,163
203(3)	Unclassified Excavation	CY	$7.00	6101.11	$42,708
203(5)	Borrow	CY	$10	469.333	$4,693
301(1)	Aggregate Base Course (D-1)	TON	$35.00	912.38	$31,933
306(1)	ATB	TON	$85	0.000	$0
306(2)	Asphalt Binder	TON	$750.00	0.00	$0
504(1)	Structural Steel	Lump Sum	$70,000	1.000	$70,000
505(5)	Furnish Structural Steel Piles	Lump Sum	$25,000.00	1.00	$25,000
507(2)	Pedestrian Railing	Lump Sum	$35,000	1.000	$35,000
606(1)	W-beam Guardrail	Linear Foot	$40.00		$0
608(2)	Asphalt Sidewalk	SY	$33	956.729	$31,572
636(1)	Gabion	CY	$350.00		$0
640(1)	Mobilization and Demobilization	Lump Sum	$50,000	1.000	$50,000
641(2)	Temporary Erosion, Sediment and Pollution Control	Cont. Sum	$25,000.00	1.00	$25,000
642(1)	Construction Surveying	Lump Sum	$15,000	1.000	$15,000
643(2)	Traffic Maintenance	Lump Sum	$20,000.00	1.00	$20,000
643(15)	Flagging	Cont. Sum	$15,000	1.000	$15,000
643(25)	Traffic Control	Cont. Sum	$45,000.00	1.00	$45,000
644(1)	Field Office	Lump Sum	$12,000	1.000	$12,000
670(12)	MMA Pavement Markings	Lump Sum	$1,000.00	1.00	$1,000
	Ramped Boardwalk	Linear Foot	$302.83	1900.00	$575,377
				TOTAL	$1,006,446

FIGURES / DRAWINGS

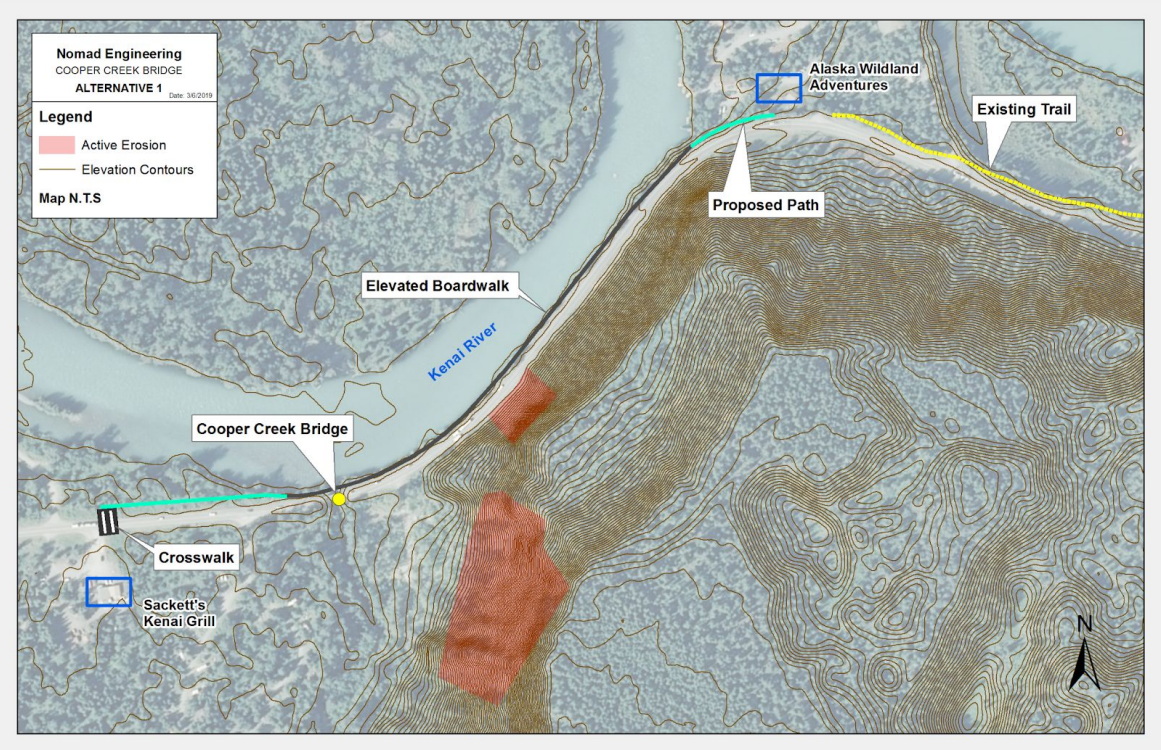

Figure 1. Alternative 1 Horizontal Alignment

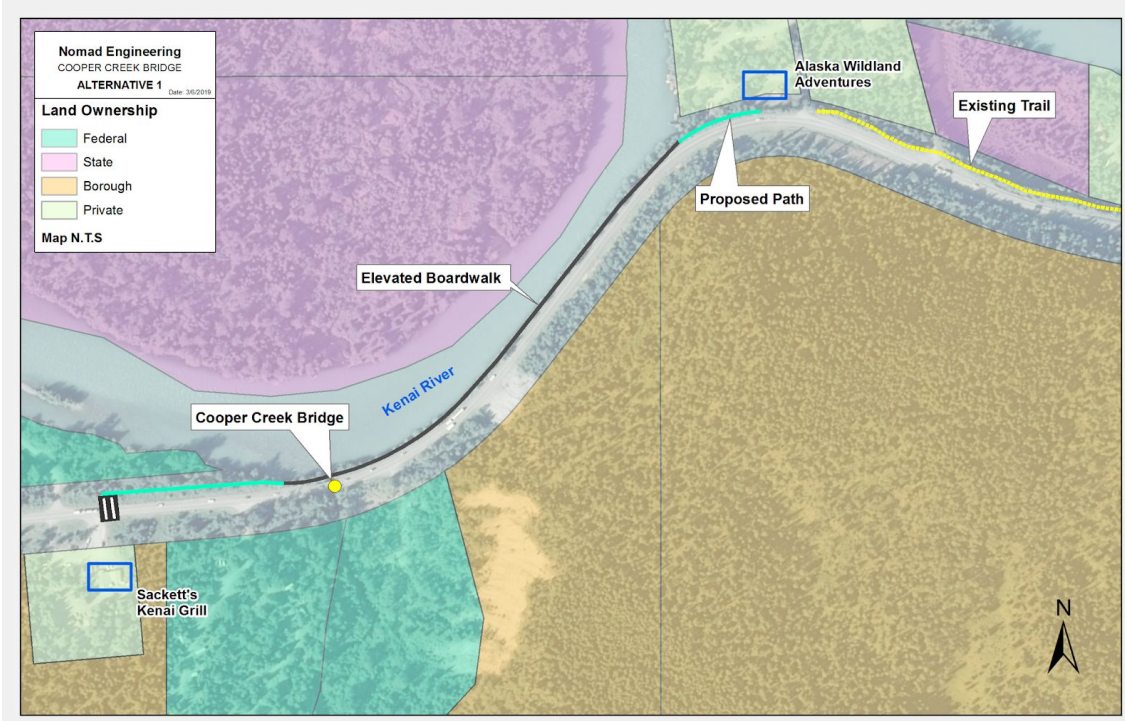

Figure 2. Alternative 1 Parcel Impacts

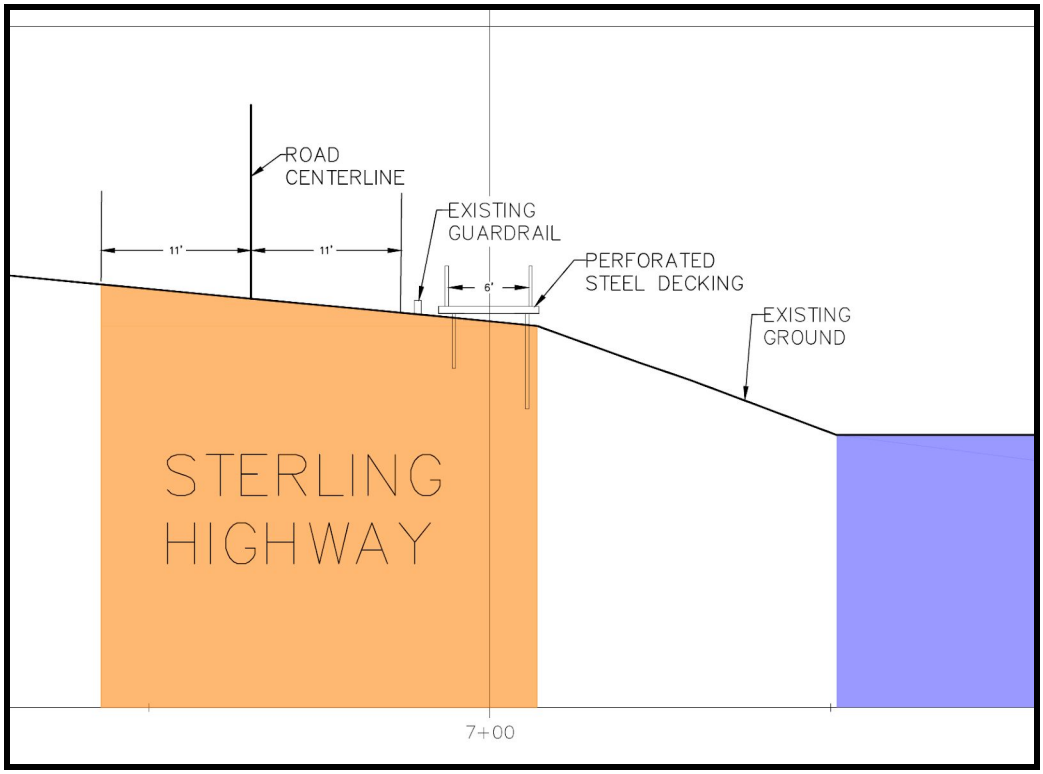

Figure 3. Alternative 1 Typical Section

**The position of the pathway will most likely be shifted farther north toward the Kenai River*

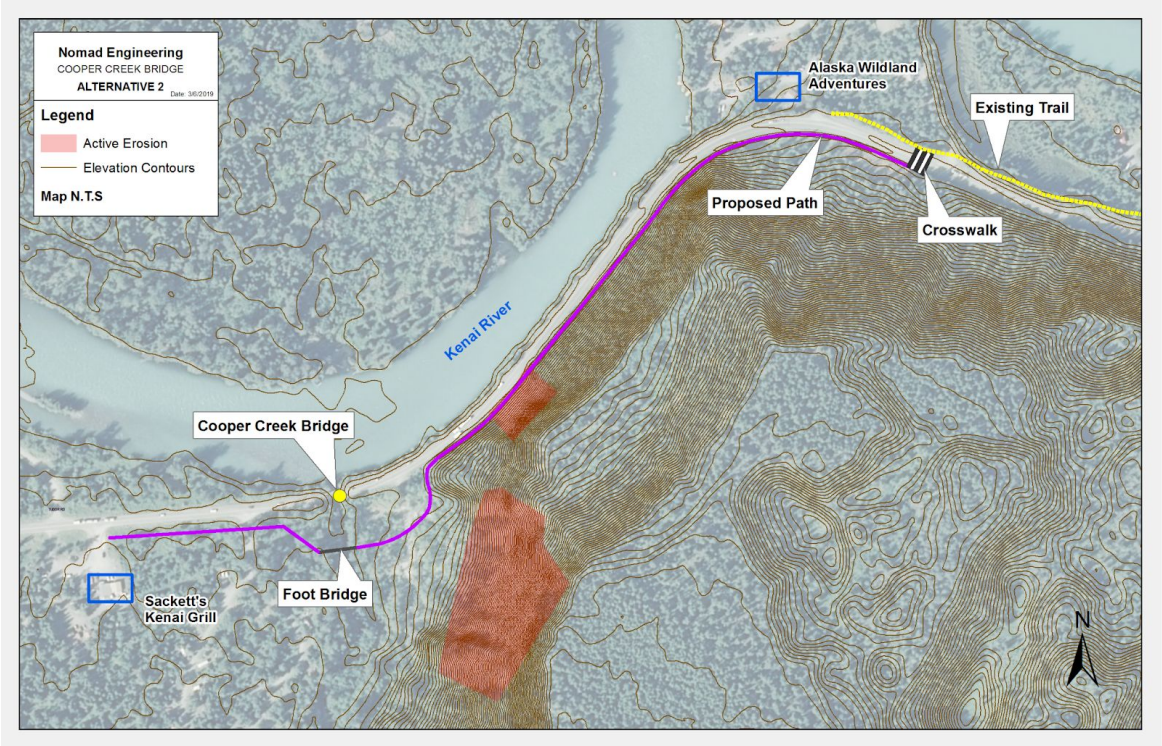

Figure 4. Alternative 2 Horizontal Alignment

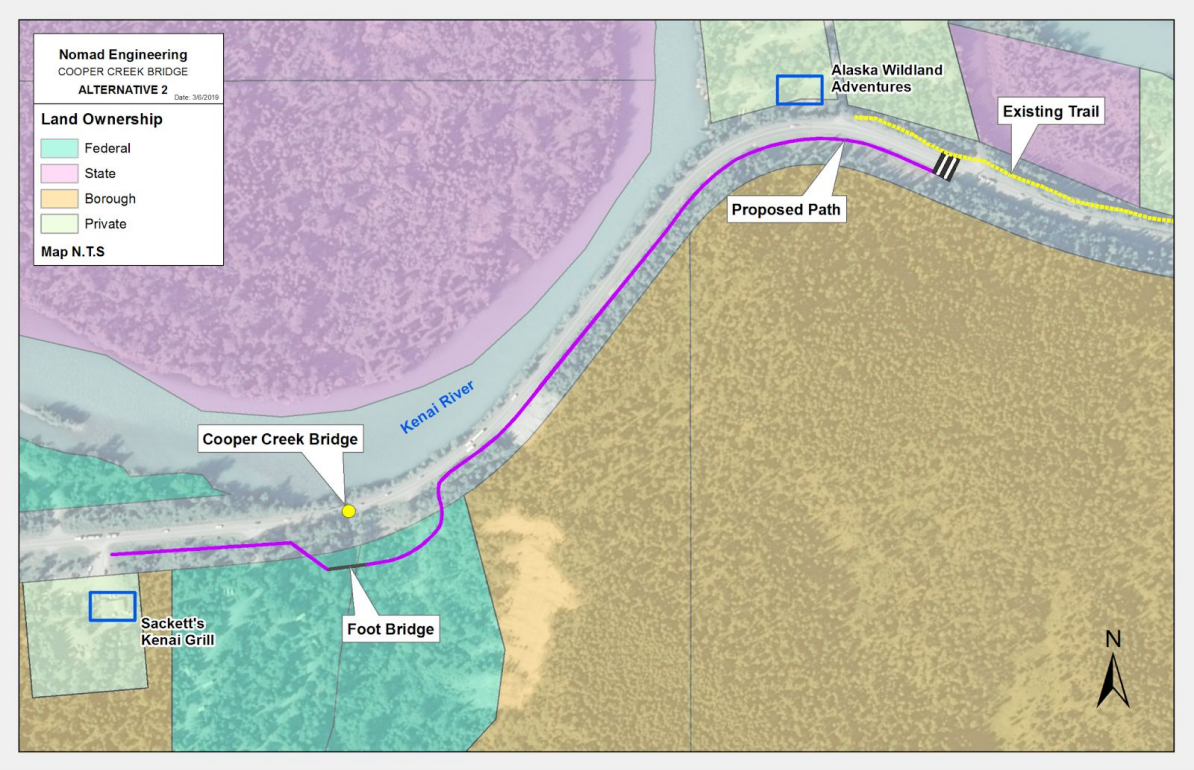

Figure 5. Alternative 2 Parcel Impacts

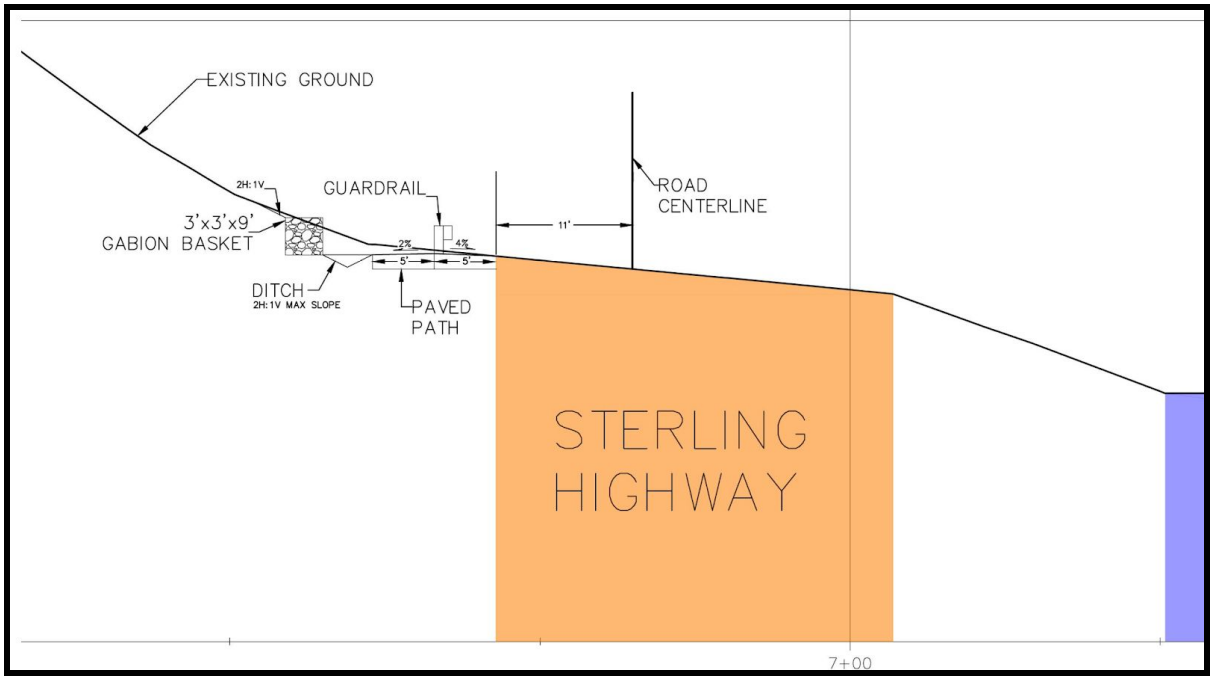

Figure 6. Alternative 2 Typical Section

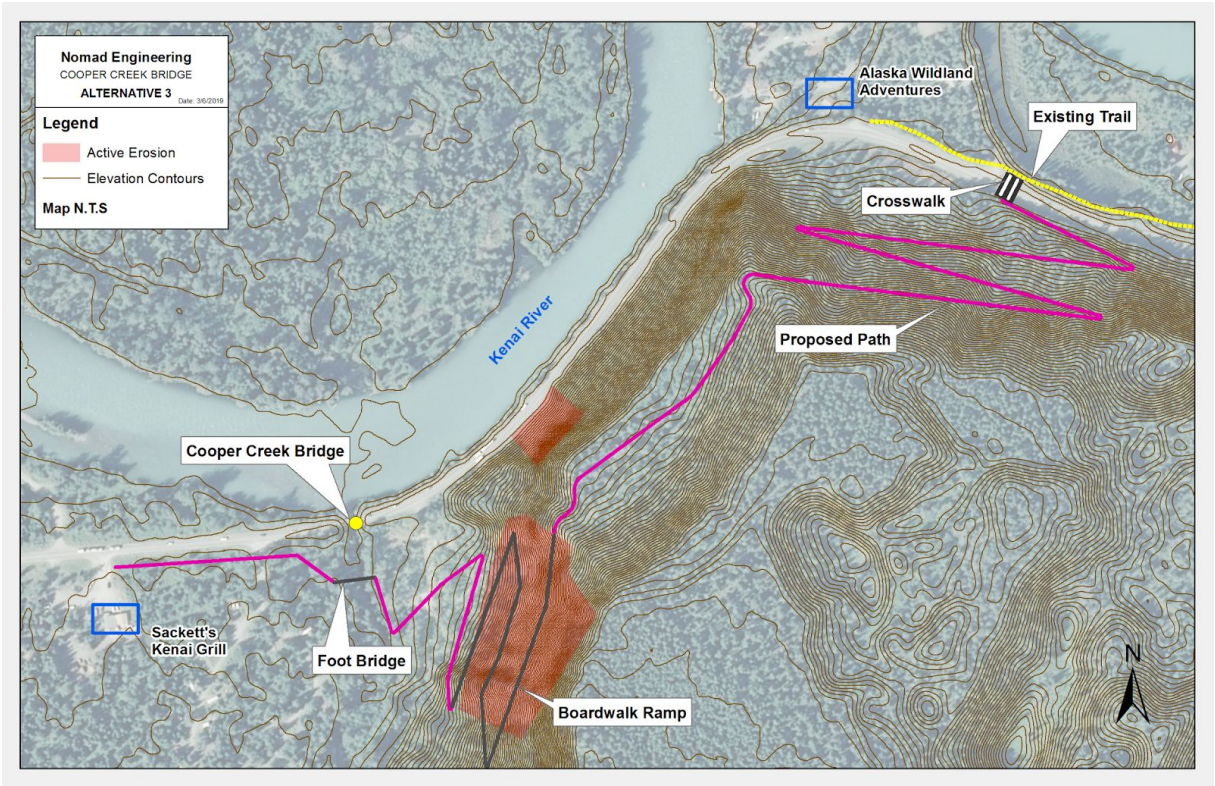

Figure 7. Alternative 3 Horizontal Alignment

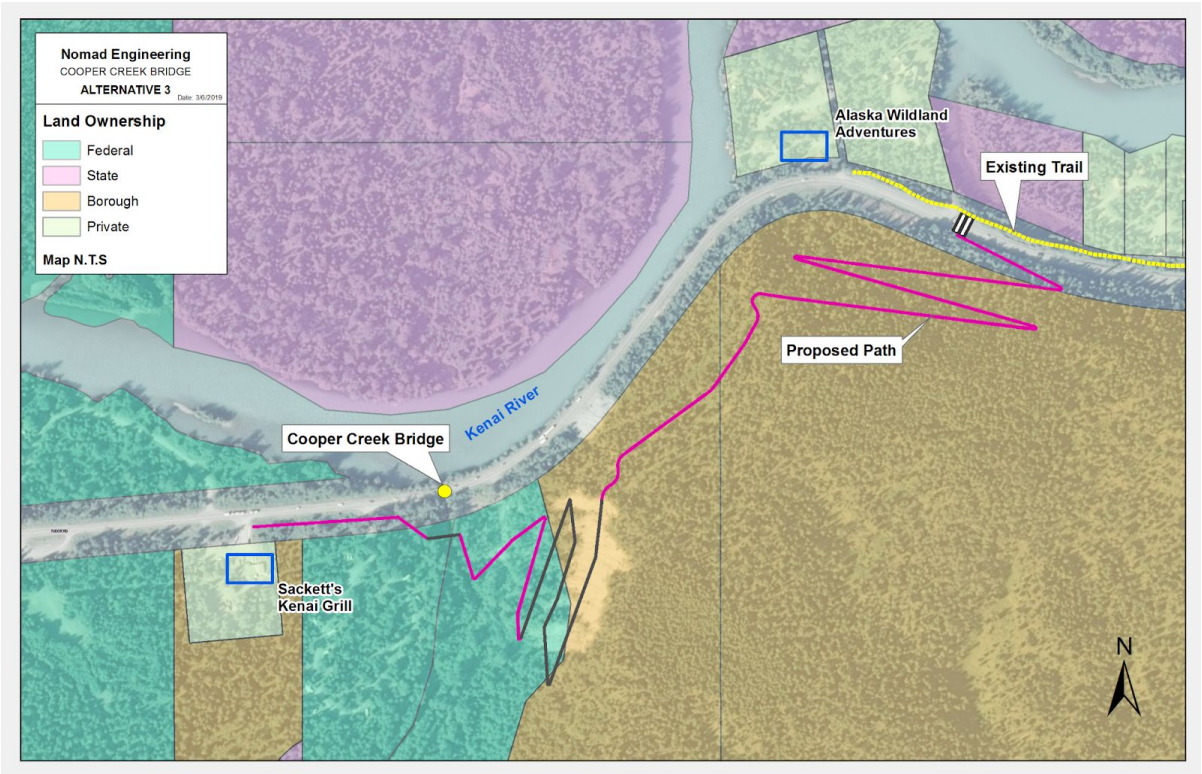

Figure 8. Alternative 3 Parcel Impacts

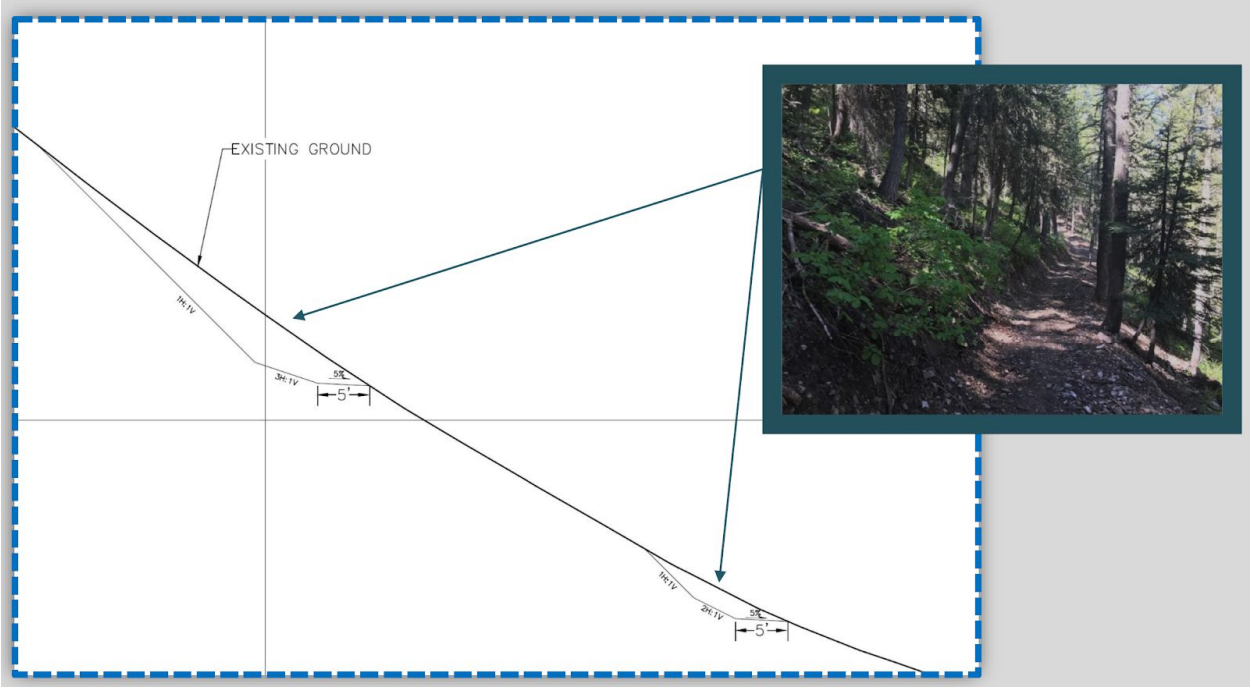

Figure 9. Alternative 3 Typical Section