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TECHNICAL MEMORANDUM

DATE: March 7, 2017

TO: Jason Rich
King County Parks and Recreation Division

FROM: Jenny Bailey

SUBJECT: Lake to Sound Trail—Segment C
Alternatives Analysis

CC:

PROJECT NUMBER: 554-1521-151

PROJECT NAME: Lake to Sound Trail—Segment C

INTRODUCTION

The Lake to Sound Trail—Segment C project is an approximately 2.2-mile (11,420 linear feet) component of what will ultimately be the 16-mile Lake to Sound Trail. Segment C would connect the southern terminus of the Lake to Sound Trail—Segment B (near the southwest corner of Seattle-Tacoma International Airport) with the Des Moines Creek Trail, located at S 200th Street in the cities of Burien and SeaTac, Washington. The Segment C project area is a linear corridor that occurs mostly within the existing road rights-of-way for State Route (SR) 509 and Des Moines Memorial Drive (Figure 1). The trail will have a typical width of approximately 12 feet of asphalt pavement bounded by two 2-foot-wide shoulders and two 1-foot-wide clear zones, in accordance with American Association of State Highway and Transportation Officials (AASHTO) guidelines.

This memorandum analyzes and compares the costs, critical area impacts, and traffic impacts of three alternative trail alignments along S 196th Street and 18th Avenue S. Project engineers have designed three alternative alignments for the trail: Alternatives 1, 2, and 3. Each alignment is described below. The sections that follow present preliminary opinions of cost; estimated impacts on wetlands, streams, and buffers; and modeled effects on traffic operation.

ALIGNMENT DESCRIPTIONS

Figure 1 depicts the study area for this alternatives analysis. The three alternative alignments for trail differ in their location relative to existing roadways (S 196th Street and 18th Avenue S):

- Alternative 1 is located primarily within the existing paved surface of S 196th Street and 18th Avenue S (Figure 2). This alternative assumes both streets would be vacated (i.e., closed to motor vehicular traffic) within the study area.
- Alternative 2 is located partially within the paved surface and partially north of S 196th Street and east of 18th Avenue S (Figure 3). This alternative assumes that both streets would be changed to accommodate a single 11-foot-wide lane for motor vehicular traffic in one direction (i.e., north on 18th Avenue S and west on S 196th Street). Any existing shoulder on the west and south side of the road is unchanged.

- Alternative 3 is located entirely off the existing paved surface, north of S 196th Street and east of 18th Avenue S (**Figure 4**). This alternative assumes that both streets would continue to operate with 2-way traffic (i.e., no changes to existing motor vehicular use); however, the shoulder on the east and north side of the road would be eliminated. Some right-of-way acquisition would be required.

ESTIMATED COST

The preliminary opinions of cost for the three alternative alignments are summarized in **Table 1** and details are provided in **Attachment 1**. Key assumptions are discussed in the text that follows.

Table 1. Estimated Construction Cost

Alternative	Description	Preliminary Opinion of Probable Construction Cost
1	Full road vacation	$376,000
2	Partial road vacation	$1,636,000
3	No road vacation	$2,164,000

The preliminary opinion of costs for Alternative 1 assumes that the crown and super-elevation of the road will be regraded to achieve Americans with Disabilities Act (ADA) compliance, the surface will be overlaid, crushed rock shoulders/paved shoulders will be created, and pavement markings for the shoulders will be added.

The preliminary opinion of costs for Alternatives 2 and 3 assume that the north and east side of the trail footprint would be bounded by a structural earth wall to minimize impacts on wetland buffers and to keep permanent improvements within the road right-of-way as much as possible. Please note that, as currently depicted, Alternative 3 does require some right-of-way acquisition, the costs of which are not included in the estimate. The increased costs associated with Alternative 3 compared to Alternative 2 are primarily due to additional fill and a taller wall.

These preliminary estimates do not include estimates for compensatory mitigation for unavoidable impacts on critical areas. Please refer to the discussion below.

CRITICAL AREA IMPACTS

Two wetlands (Wetland F and Wetland C) occur in the vicinity of S 196th Street and 18th Avenue S. One stream (Des Moines Creek) intersects S 196th Street. Wetland F is not affected by any of the three alternative alignments. The effects on Des Moines Creek are the same for each alternative. Thus, this analysis is focused on changes in impacts to Wetland C, as shown in **Table 2**.

Table 2. Wetland C Impacts for Three Alternative Alignments

		Wetland C Impacts (acres)		Wetland C Buffer Impacts (acres)	
Alternative	Description	Temporary	Permanent	Temporary	Permanent
1	Full road vacation	0	0	0.06	0.23
2	Partial road vacation	<0.01	<0.01	0.10	0.32
3	No road vacation	0.04	0.03	0.15	0.35

TRAFFIC IMPACTS

The three trail alignment alternatives were evaluated to determine if a full or partial street vacation will affect traffic operations in the study area. A full description of traffic analysis is included in Attachment 2.

Traffic volume data were provided by King County. Existing PM peak hour traffic volumes were collected on January 24, 2017 at the intersection of Des Moines Memorial Drive and S 200th Street. Additionally, 24-hour/7-day counts were collected the week of January 24 to January 30, 2017 on S 196th Street, east of Des Moines Memorial Drive for 7 days, including the same day as the PM peak hour counts were collected. Future traffic growth was estimated at the study intersection for the year of opening (2018) with an estimated 1 percent annual average growth rate.

Calculations for PM peak hour traffic operations for the year of opening were calculated at the study intersection based on methodologies described in the Highway Capacity Manual. Under each alignment alternative, vehicular traffic restricted from using S 196th Street and 18th Avenue S was rerouted instead through the intersection of Des Moines Memorial Drive and S 200th Street. The PM peak hour level of service (LOS) and delay for the study area intersection for existing conditions and the three alignment alternatives are shown in Table 3. The intersection of Des Moines Memorial Drive and S 200th Street is forecasted to operate at LOS B (minor traffic delays from limited congestion) under all proposed alignments.

Table 3. PM Peak Hour LOS for Existing and Alternatives Network

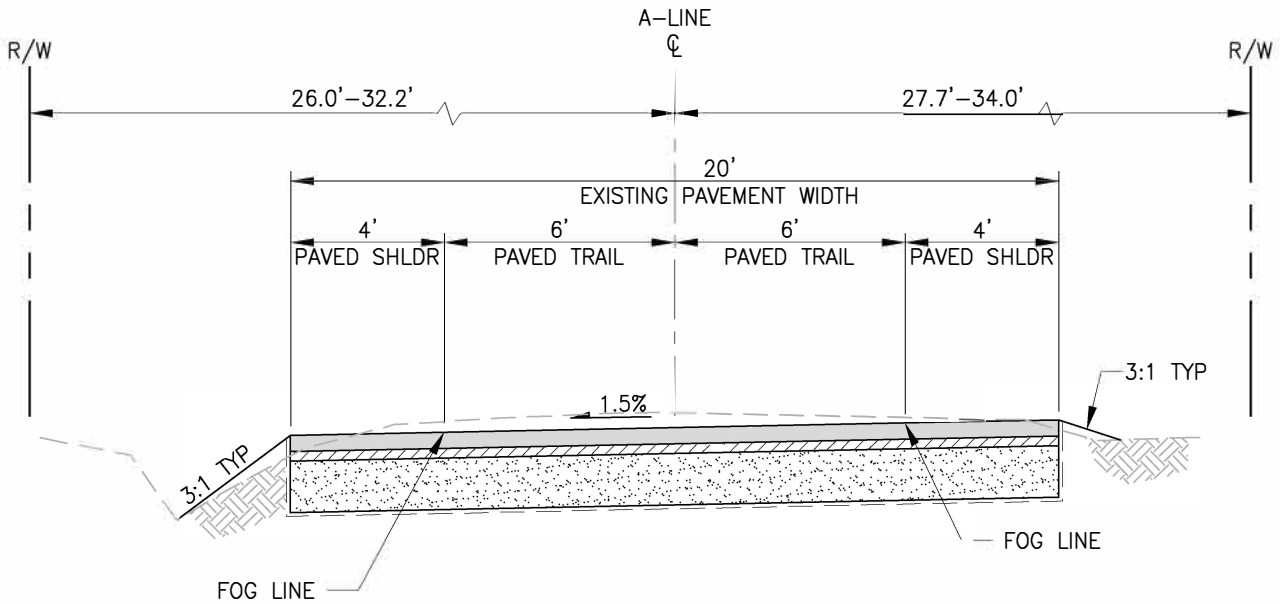
Alternative	Description	Overall LOS	Overall Delay
Existing	2018 Existing Conditions	B	11.6
1	Full Vacation	B	17.6
2	Northbound/Westbound Traffic Only	B	13.3
3	No road vacation	B	11.6

CONCLUSION

Alternative 1, the full vacation of S 196th Street and 18th Avenue S, appears to be the best option because it does not significantly affect traffic operations, it is much less expensive, and it has less ecological impacts.

Figures

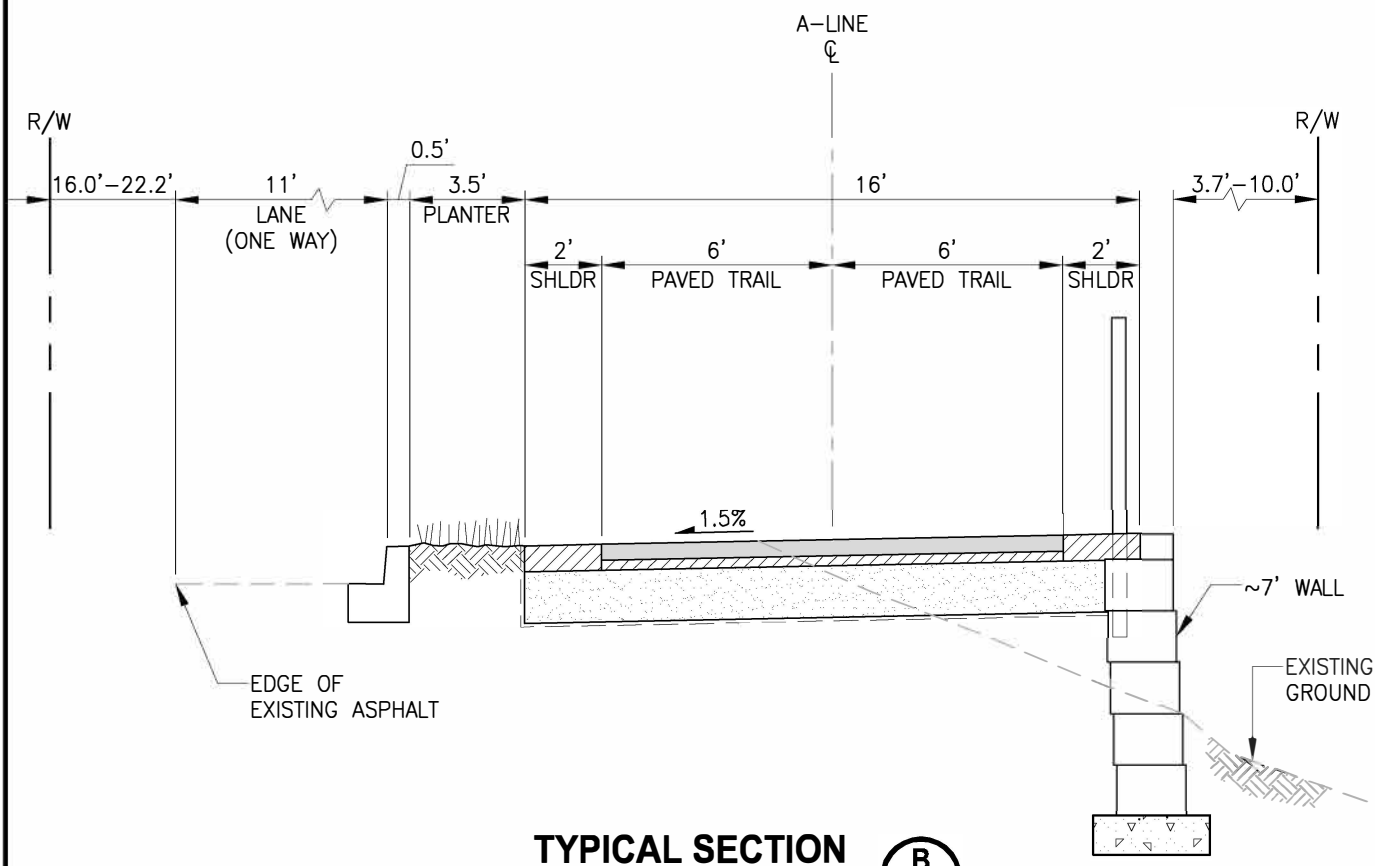
Figure 1
Study Area and Street Segments



TYPICAL SECTION A

NOT TO SCALE

Figure 2
(Alternative 1)
18th Ave S / S 196th St



TYPICAL SECTION B

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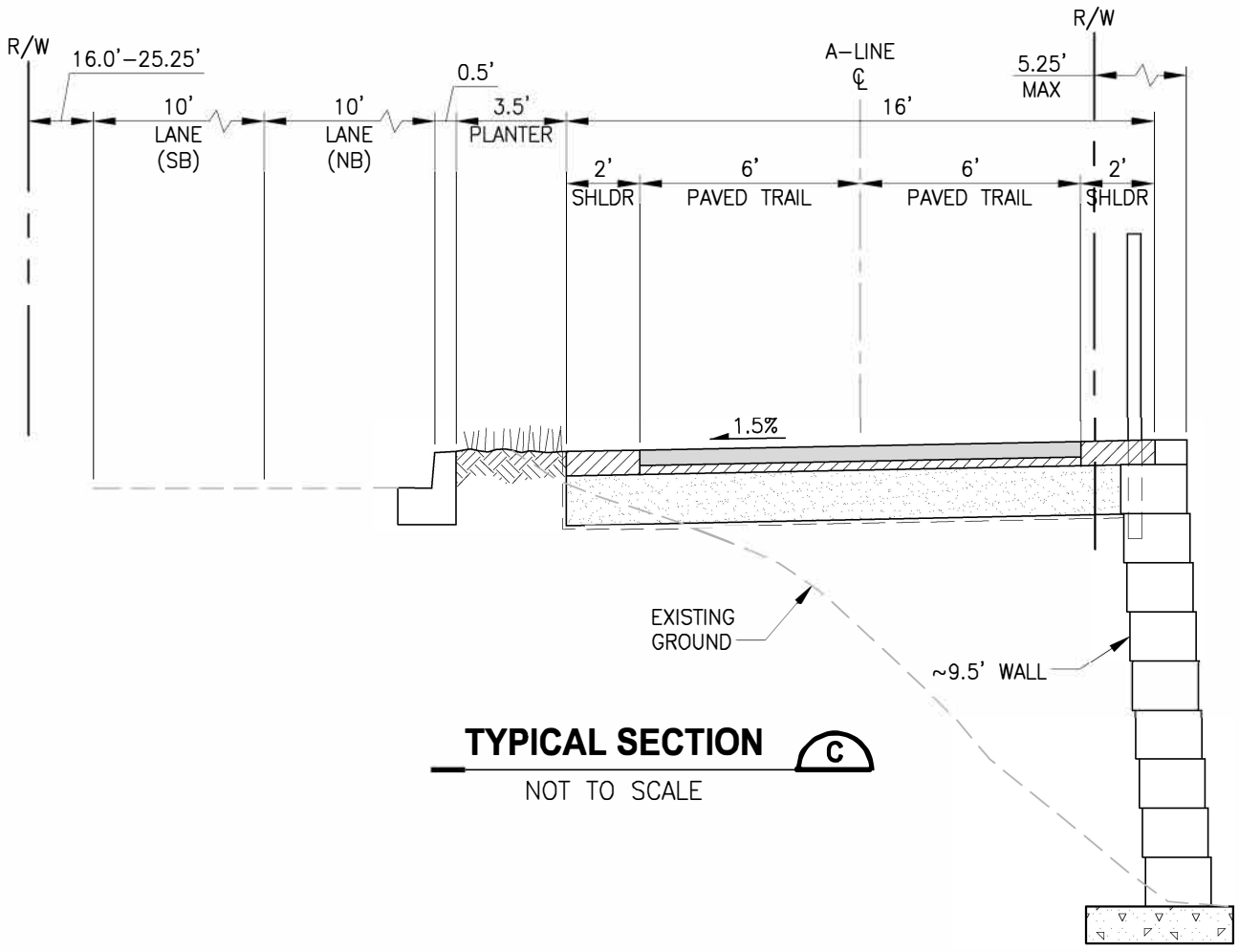
Parametrix DATE: March 3, 2017 FILE: PS1521151P2CT2T2F-01

Figure 3
(Alternative 2)
18th Ave S / S 196th St



TYPICAL SECTION C

NOT TO SCALE

Parametrix DATE: March 3, 2017 FILE: PS1521151P2CT2T2F-01

Figure 4
(Alternative 3)
18th Ave S / S 196th St

Attachment 1

Cost Estimates

Alternative Analysis - 196th St SE and 18 Ave SE

Project: Lake to Sound Trail Segment C

Alt 1: On the Road Alt Planning Level Opinion of Costs (2065 LF)

Date: 3-06-2017

ITEM #	WSDOT STD ITEM #	SPEC SECTION	UNIT	DESCRIPTION OF ITEM	UNIT PRICE	TOTAL QTY	TOTAL PRICE
				SECTION 1: PREPARATION			
1	0001	1-09	L.S.	MOBILIZATION	$ 28,000.00	1.0	$ 28,000.00
2	0025	2-01	ACRE	CLEARING AND GRUBBING	$ 15,000.00	0.4	$ 5,437.67
3	0120	-	S.Y.	REMOVING ASPHALT CONC. PAVEMNENT	$ 5.00	2,320.0	$ 11,600.00
				SECTION 2: GRADING			
4	0310	2-03	C.Y.	ROADWAY EXCAVATION INCL. HAUL	$ 25.00	1,860	$ 46,500.00
5	0408	2-03	TON	SELECT BORROW INCL. HAUL	$ 20.00	210	$ 4,200.00
6	0470	2-03	C.Y.	EMBANKMENT COMPACTION	$ 3.00	120	$ 360.00
				SECTION 9: SURFACING			
7	-	4-04	TON	1/2 IN. HMA AGGREGATE (MODIFIED)	$ 35.00	390	$ 13,650.00
8	5040	4-04	TON	PERMEABLE BALLAST	$ 32.00	2,080	$ 66,560.00
				SECTION 14: HOT MIX ASPHALT			
9	-	5-04	TON	POROUS HMA CL. 1/2 In. PG 70-22	$ 140.00	650.0	$ 91,000.00
				SECTION 17: EROSION CONTROL AND ROADSIDE RESTORATION			
10	6422	8-01	ACRE	SEEDING AND MULCHING	$ 6,100.00	0.9	$ 5,490.00
11	-	8-02	C.Y.	TOPSOIL TYPE A	$ 40.00	497	$ 19,880.00
				SECTION 18: TRAFFIC			
12	6807	8-22	L.F.	PLASTIC LINE	$ 3.00	4,510	$ 13,530.00
				CONSTRUCTION SUBTOTAL			$ 306,207.67
				CONTINGENCY FOR MISCELLANEOUS ITEM (25%)		25.0%	$ 69,551.92
				MACC			$ 375,760

Alternative Analysis - 196th St SE and 18 Ave SE

Project: Lake to Sound Trail Segment C

Alt 2: One-way Road Alt Planning Level Opinion of Costs (2168 LF)

Date: 3-06-2017

ITEM #	WSDOT STD ITEM #	SPEC SECTION	UNIT	DESCRIPTION OF ITEM	UNIT PRICE	TOTAL QTY	TOTAL PRICE
				SECTION 1: PREPARATION			
1	0001	1-09	L.S.	MOBILIZATION	$ 122,000.00	1.0	$ 122,000.00
2	0025	2-01	ACRE	CLEARING AND GRUBBING	$ 15,000.00	0.8	$ 12,007.23
3	0120	-	S.Y.	REMOVING ASPHALT CONC. PAVEMNENT	$ 5.00	3,930.0	$ 19,650.00
				SECTION 2: GRADING			
4	0310	2-03	C.Y.	ROADWAY EXCAVATION INCL. HAUL	$ 25.00	1,630	$ 40,750.00
5	0408	2-03	TON	SELECT BORROW INCL. HAUL	$ 20.00	12,010	$ 240,200.00
5	0470	2-03	C.Y.	EMBANKMENT COMPACTION	$ 3.00	6,490	$ 19,470.00
				SECTION 8: STRUCTURE			
7	4006	2-09	C.Y.	STRUCTURE EXCAVATION CLASS A INCL. HAUL	$ 35.00	1,420	$ 49,700.00
8	4013	2-09	L.S.	SHORING OR EXTRA EXCAVATION CL. A	$ 101,500.00	1.0	$ 101,500.00
9	7169	6-13	S.F.	STRUCTURAL EARTH WALL	$ 30.00	15,370	$ 461,100.00
				SECTION 9: SURFACING			
10	-	4-04	TON	1/2 IN. HMA AGGREGATE (MODIFIED)	$ 35.00	468	$ 16,368.56
11	5040	4-04	TON	PERMEABLE BALLAST	$ 32.00	1,761	$ 56,340.86
12	5120	4-04	TON	CRUSHED SURFACING TOP COURSE	$ 20.00	83	$ 1,650.61
				SECTION 14: HOT MIX ASPHALT			
13	5767	5-04	TON	HMA CL. 1/2 IN. PG 64-22	$ 150.00	116.7	$ 17,501.75
14	-	5-04	TON	POROUS HMA CL. 1/2 In. PG 70-22	$ 140.00	437.5	$ 61,256.13
				SECTION 17: EROSION CONTROL AND ROADSIDE RESTORATION			
15	6422	8-01	ACRE	SEEDING AND MULCHING	$ 6,100.00	0.3	$ 2,119.44
16	6407	8-02	C.Y.	TOPSOIL TYPE A	$ 40.00	343	$ 13,733.84
				SECTION 18: TRAFFIC			
17	6700	8-04	L.F.	CEMENT CONC. TRAFFIC CURB AND GUTTER	$ 25.00	2,161	$ 54,025.00
				SECTION 19: OTHER ITEMS			
18	7089	8-12	L.F.	COATED CHAIN LINK FENCE TYPE 6	$ 20.00	2,195	$ 43,900.00
				CONSTRUCTION SUBTOTAL			$ 1,333,273.42
				CONTINGENCY FOR MISCELLANEOUS ITEM (25%)		25.0%	$ 302,818.35
				MACC			$ 1,636,092

Alternative Analysis - 196th St SE and 18 Ave SE

Project: Lake to Sound Trail Segment C

Alt 3: Two-way Roads Alt Planning Level Opinion of Costs (2195 LF)

Date: 3-06-2017

ITEM #	WSDOT STD ITEM #	SPEC SECTION	UNIT	DESCRIPTION OF ITEM	UNIT PRICE	TOTAL QTY	TOTAL PRICE
				SECTION 1: PREPARATION			
1	0001	1-09	L.S.	MOBILIZATION	$ 161,000.00	1.0	$ 161,000.00
2	0025	2-01	ACRE	CLEARING AND GRUBBING	$ 15,000.00	1.3	$ 18,943.18
3	0120	-	S.Y.	REMOVING ASPHALT CONC. PAVEMNENT	$ 5.00	730.0	$ 3,650.00
				SECTION 2: GRADING			
4	0310	2-03	C.Y.	ROADWAY EXCAVATION INCL. HAUL	$ 25.00	1,650	$ 41,250.00
5	0408	2-03	TON	SELECT BORROW INCL. HAUL	$ 20.00	19,790	$ 395,800.00
6	0470	2-03	C.Y.	EMBANKMENT COMPACTION	$ 3.00	10,700	$ 32,100.00
				SECTION 8: STRUCTURE			
7	4006	2-09	C.Y.	STRUCTURE EXCAVATION CLASS A INCL. HAUL	$ 35.00	2,140	$ 74,900.00
8	4013	2-09	L.S.	SHORING OR EXTRA EXCAVATION CL. A	$ 139,300.00	1.0	$ 139,300.00
9	7169	6-13	S.F.	STRUCTURAL EARTH WALL	$ 30.00	21,100	$ 633,000.00
				SECTION 9: SURFACING			
10	-	4-04	TON	1/2 IN. HMA AGGREGATE (MODIFIED)	$ 35.00	474	$ 16,600.26
11	5040	4-04	TON	PERMEABLE BALLAST	$ 32.00	1,786	$ 57,138.38
12	5120	4-04	TON	CRUSHED SURFACING TOP COURSE	$ 20.00	84	$ 1,673.98
				SECTION 14: HOT MIX ASPHALT			
13	5767	5-04	TON	HMA CL. 1/2 IN. PG 64-22	$ 150.00	118	$ 17,749.49
14	-	5-04	TON	POROUS HMA CL. 1/2 In. PG 70-22	$ 140.00	444	$ 62,123.22
				SECTION 17: EROSION CONTROL AND ROADSIDE RESTORATION			
15	6422	8-01	ACRE	SEEDING AND MULCHING	$ 6,100.00	0.1	$ 684.25
16	6407	8-02	C.Y.	TOPSOIL TYPE A	$ 40.00	219	$ 8,746.90
				SECTION 18: TRAFFIC			
17	6700	8-04	L.F.	CEMENT CONC. TRAFFIC CURB AND GUTTER	$ 25.00	2,187	$ 54,675.00
				SECTION 19: OTHER ITEMS			
18	7089	8-12	L.F.	COATED CHAIN LINK FENCE TYPE 6	$ 20.00	2,221	$ 44,420.00
				CONSTRUCTION SUBTOTAL			$ 1,763,754.66
				CONTINGENCY FOR MISCELLANEOUS ITEM (25%)		25.0%	$ 400,688.66
				MACC			$ 2,164,443

Attachment 2

Traffic Study

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719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104 | P 206.394.3700

TECHNICAL MEMORANDUM

DATE: February 23, 2017
TO: Jenny Bailey
FROM: Alex Atchison, PE
SUBJECT: Lake to Sound Trail - Segment C: Traffic Analysis
CC: Michael Russu, EIT
PROJECT NUMBER: 554-1521-151
PROJECT NAME: Lake to Sound Trail Segment C

INTRODUCTION

The Lake to Sound Trail—Segment C project is an approximately 2.2-mile (11,420 linear feet) component of what will ultimately be the 16-mile Lake to Sound Trail. Segment C would connect the southern terminus of the Lake to Sound Trail—Segment B (near the southwest corner of Seattle-Tacoma International Airport) with the Des Moines Creek Trail, located at S 200th Street in the cities of Burien and SeaTac, Washington.

This memorandum analyzes traffic impacts of three alternative trail alignments along S 196th Street and 18th Avenue S. Project engineers have designed three alternative alignments for the trail: Alternatives 1, 2, and 3. Each alignment is described in the following section. The sections that follow present the expected traffic impacts of each of the proposed alignments.

ALIGNMENT DESCRIPTIONS

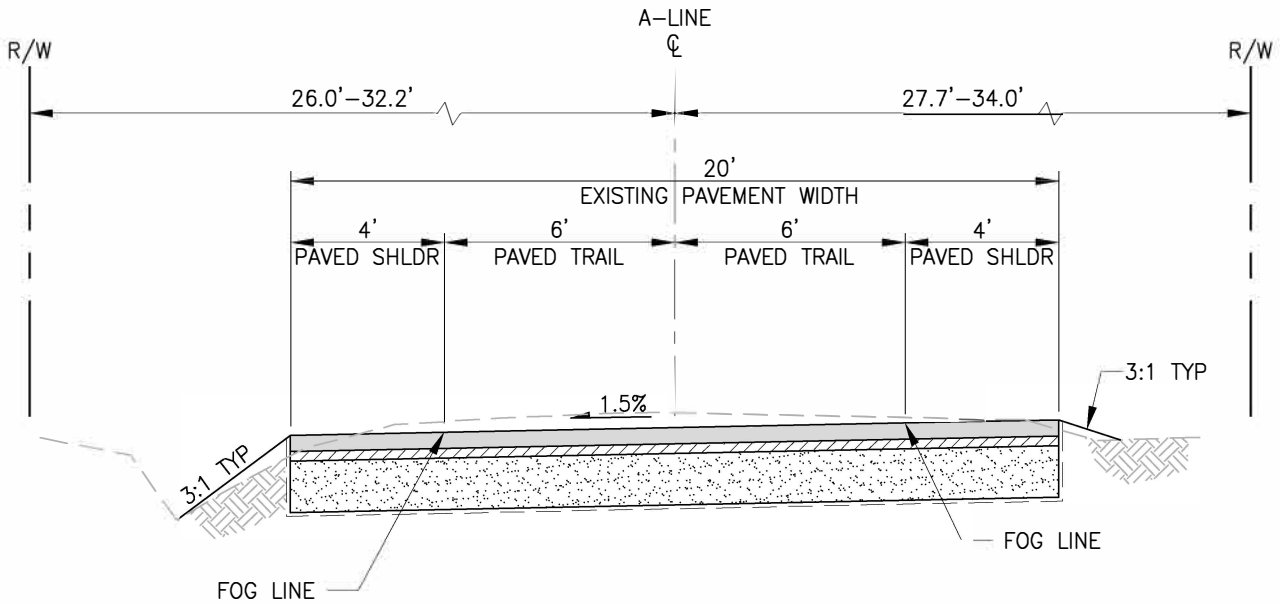
Figure 1 depicts the study area for this alternatives analysis. The three alternative alignments differ for the trail in their location relative to existing roadways (S 196th Street and 18th Avenue S):

- Alternative 1 is located primarily within the existing paved surface of S 196th Street and 18th Avenue S (Figure 2). This alternative assumes both streets would be vacated (i.e., closed to motor vehicular traffic) within the study area.

- Alternative 2 is located partially within the paved surface and partially north of S 196th Street and east of 18th Avenue S (Figure 3). This alternative assumes that both streets would be changed to accommodate a single 11-foot-wide lane for motor vehicular traffic in one direction (i.e., w on 18th Avenue S and west on S 196th Street). Any existing shoulder on the west and south side of the road is unchanged.

- Alternative 3 is located entirely off the existing paved surface, north of S 196th Street and east of 18th Avenue S (Figure 4). This alternative assumes that both streets would continue to operate with 2-way traffic (i.e., no changes to existing motor vehicular use); however, the shoulder on the east and north side of the road would be eliminated.

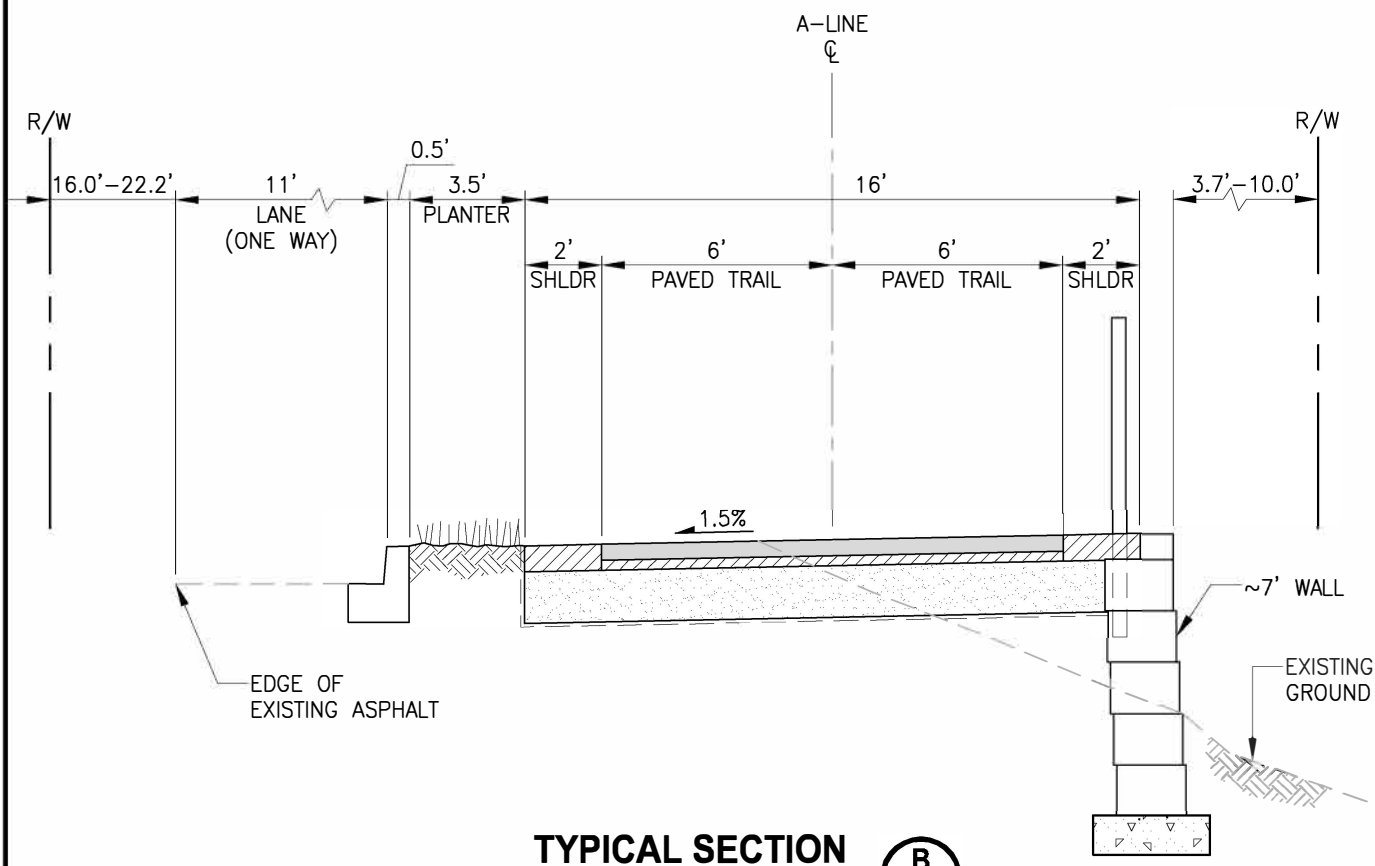
Figure 1
Study Area and Street Segments



TYPICAL SECTION A

NOT TO SCALE

Figure 2
(Alternative 1)
18th Ave S / S 196th St



TYPICAL SECTION B

NOT TO SCALE

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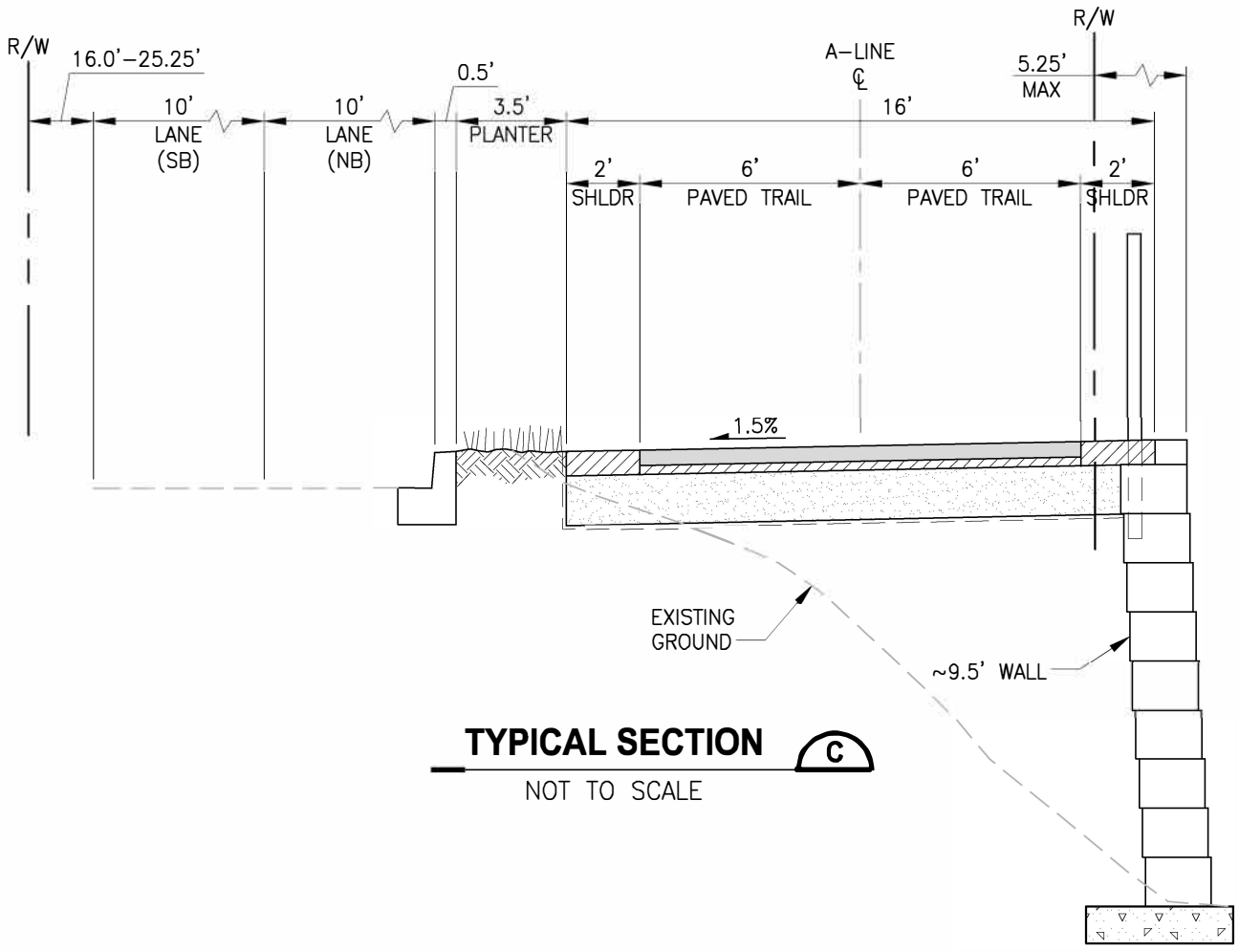
Figure 3
(Alternative 2)
18th Ave S / S 196th St



TYPICAL SECTION C

NOT TO SCALE

Parametrix DATE: March 3, 2017 FILE: PS1521151P2CT2T2F-01

Figure 4
(Alternative 3)
18th Ave S / S 196th St

TRAFFIC IMPACTS

Baseline Conditions

Des Moines Memorial Drive is a two-lane, north-south arterial with a speed limit of 35 miles per hour (mph). There are approximately 5 feet to 7 feet of paved shoulder width on the east and west sides of the street. Des Moines Memorial Drive intersects with S 200th Street and is signal-controlled with marked crosswalks at each of the four approaches. South 200th Street is a two-lane, east-west arterial with a speed limit of 25 mph. There are approximately 4 feet to 8 feet of paved shoulder width on the north and south sides of the street.

18th Avenue S intersects with S 200th Street approximately 2,300 feet east of Des Moines Memorial Drive. This intersection is a two-way stop-controlled intersection with no marked crosswalks. A paved sidewalk exists along the west side of 18th Avenue S, south of S 200th Street, at the southwest corner of the intersection.

South 196th Street is approximately 1,500 feet north of S 200th Street, intersecting with Des Moines Memorial Drive. South 196th Street and Des Moines Memorial Drive is a two-way stop-controlled intersection and has no marked crosswalks or sidewalks on either side of the street. South 196th Street, running in the east-west direction, merges with 18th Avenue S, running in the north-south direction, and is a two-lane non-arterial street with a speed limit of 25 mph. There is approximately 3 feet to 5 feet of gravel shoulder width on each side of the street.

Traffic volume data were provided by King County. Existing PM peak hour traffic volumes were collected on January 24, 2017 at the intersection of Des Moines Memorial Drive and S 200th Street. Additionally, 24-hour/7-day counts were collected the week of January 24 to January 30, 2017 on S 196th Street, east of Des Moines Memorial Drive for 7 days, including the same day as the PM peak hour counts were collected.

Average weekday (Tuesday through Thursday) daily volumes on S 196th Street are 2,000 vehicles, with trucks making up approximately 21 percent of total daily volumes. Average weekend daily volumes were 630 vehicles, with 16 percent truck traffic.

Future traffic growth was estimated at the study intersection for the year of opening (2018) with an estimated 1 percent annual average growth rate. Figure 5 summarizes the 2018 forecasted PM peak hour traffic.

Figure 5. Study Intersection Forecasted PM Peak Hour Volume and Non-Arterial Volume

Calculations for PM peak hour traffic operations for the year of opening were calculated at the study intersection based on methodologies described in the Highway Capacity Manual. Traffic operations are often measured by an approach called intersection level of service (LOS). LOS is a scale ranging from A to F in which rankings are based on the overall delay at a given intersection. LOS A represents the best conditions with minimal amount of delay, and LOS F represents the worst conditions with severe congestion and delay. Table 1 lists the intersection LOS delay thresholds for signalized intersections. At signalized intersections, LOS is calculated based on the delay of all vehicles entering the intersection.

Table 1. Level of Service Thresholds

	Average Delay per Vehicle (seconds)
Level of Service	Signalized Intersections
A	≤ 10
B	> 10 and ≤ 20
C	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

Note: The LOS criteria are based on control delay, which includes initial deceleration delay, queue move-up time, stopped delay, and final deceleration delay.

Source: Transportation Research Board 2000

The 2018 PM peak hour LOS and delay for Des Moines Memorial Drive and S 200th Street intersection evaluated is shown in Table 2. This intersection is forecasted to operate at LOS B.

Table 2. 2018 PM Peak Hour LOS

Intersection	Approach	LOS	Delay (seconds/vehicle)	Overall LOS	Overall Delay (seconds/vehicle)
Des Moines Memorial Drive/ S 200th Street	Eastbound	B	17.1	B	11.6
	Westbound	B	15.3		
	Northbound	A	6.5		
	Southbound	B	10.6		

Traffic Impacts of Proposed Alignments

Three trail alignment alternatives were evaluated to determine if a full or partial street vacation would affect traffic operations in the study area. The three alignment alternatives would include the following changes to traffic flow on S 196th Street and 18th Avenue S:

- Alternative 1 -Full vacation of S 196th Street and 18th Avenue S; no vehicular traffic allowed
- Alternative 2 - Northbound/westbound vehicular traffic only allowed on S 196th Street and 18th Avenue S
- Alternative 3 – No road vacation

Under each alignment alternative, vehicular traffic restricted from using S 196th Street and 18th Avenue S was rerouted instead through the intersection of Des Moines Memorial Drive and S 200th Street. Table 3 summarizes the traffic volumes for the three alignment alternatives; changes from baseline conditions are highlighted.

Table 3. PM Peak Hour Volumes at Des Moines Memorial Drive/S 200th Street

Alternative	Southbound Approach Southbound			Westbound Approach Westbound			Northbound Approach Northbound			Eastbound Approach Eastbound		
	Right	Through	Left	Right	Through	Left	Right	Through	Left	Right	Through	Left
1	14	669	120	210	126	47	24	339	20	127	175	19
2	14	669	73	210	126	47	24	339	20	127	175	19
Existing / Alt 3	14	669	73	53	126	47	24	339	20	127	175	19

The PM peak hour LOS and delay for the study area intersection for existing conditions and the three alignment alternatives are shown in Table 4. The intersection of Des Moines Memorial Drive and S 200th Street is forecasted to operate at LOS B under all proposed alignments.

Table 4. PM Peak Hour LOS for Existing and Alternatives Network

Alternative	Description	Overall LOS	Overall Delay (seconds/vehicle)
Existing	2018 Existing Conditions	B	11.6
1	Full Vacation	B	17.6
2	Northbound/Westbound Traffic Only	B	13.3
3	No road vacation	B	11.6