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Kamm Creek PRD Traffic Impact Analysis

Jurisdiction: City of Lynden
April 2020



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1. DEVELOPMENT IDENTIFICATION

The Kamm Creek PRD is proposed to consist of 40 single-family detached (SFD) homes. The proposed residential development is located on the west side of Northwood Road, south of Kamm Road. A site vicinity map is shown in Figure 1.

Zach Wieben, responsible for this report and traffic analysis, is a licensed professional engineer (Civil) in the State of Washington and member of the Washington State section of ITE.

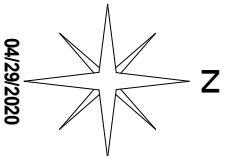
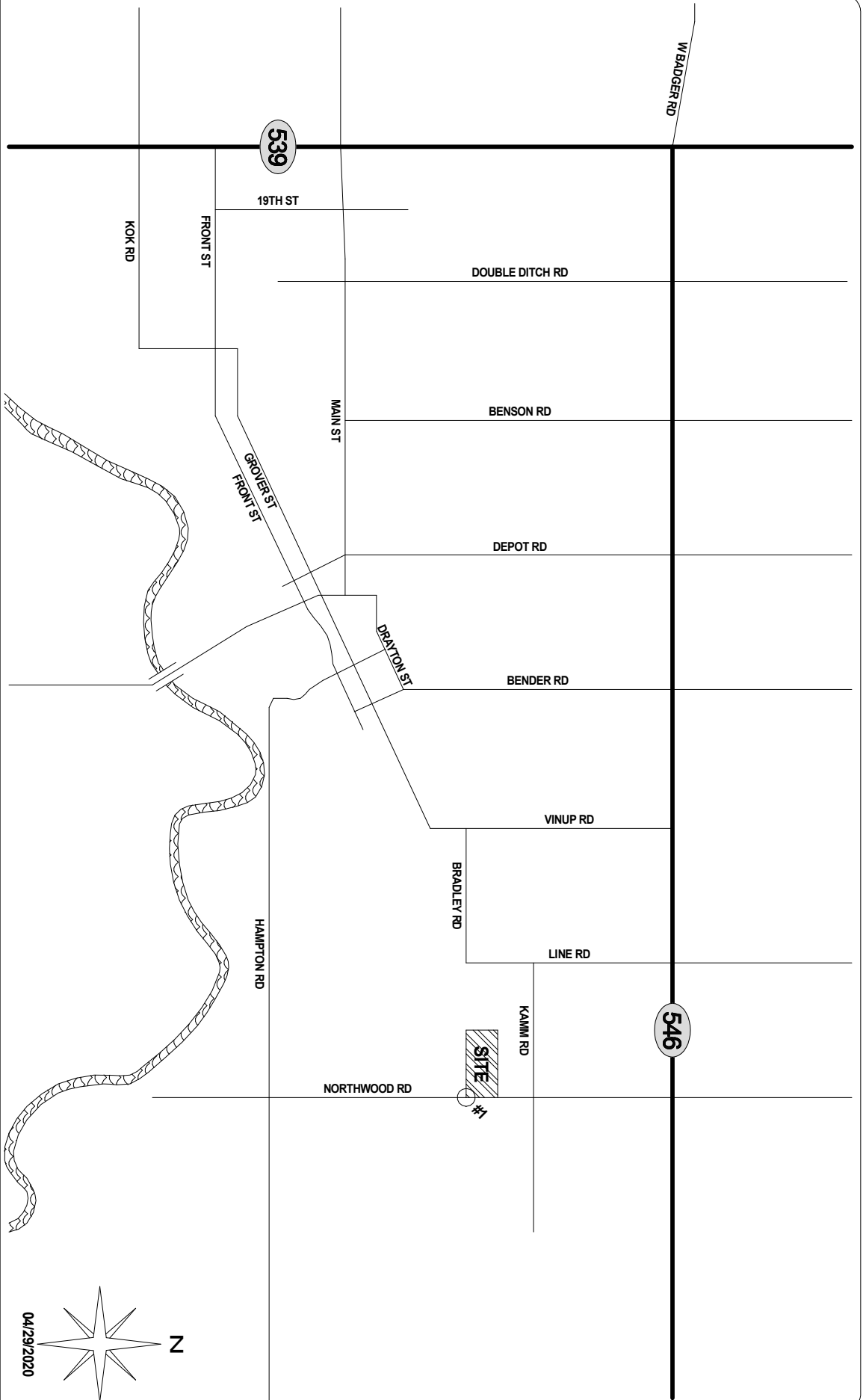
2. METHODOLOGY

2.1 General

Trip generation for the development is based on national data contained in *Trip Generation Manual, 10th Edition (2017)* by the Institute of Transportation Engineers (ITE). The average rates for Land Use Code 210, Single-Family Detached Housing, were used in the trip generation calculations.

2.2 Scope of Analysis

GTC performed future level of service analysis at a combined site access. Counts conducted by the City of Lynden in June and July 2019 on Northwood Road north of Kamm Road were reviewed for the access LOS analysis. Additionally, channelization warrants were performed for a combined site access.



04/29/2020

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TRAFFIC IMPACT STUDY
GTC #20-081

KAMM CREEK PRD
40 SFD UNITS

LEGEND



DEVELOPMENT SITE



STUDY INTERSECTION

FIGURE 1

SITE VICINITY
MAP

CITY OF LYNDEN

Congestion is generally measured in terms of level of service (LOS). The *Highway Capacity Manual 6th Edition* by the Transportation Research Board rates road facilities and intersections between LOS A and LOS F, with LOS A being free flow and LOS F being forced flow or over-capacity conditions. A summary of the level of service criteria is included in Table 1. The level of service at signalized, all-way stop-controlled and roundabout intersections is based on the average delay of all approaches. The level of service for two-way stop-controlled intersections is based on the average delay for the critical stopped approach. Geometric characteristics and conflicting traffic movements are taken into consideration when determining level of service values. The level of service analysis for this report has been performed using the *Synchro 10.2, Build 0* software for signalized and unsignalized intersections.

Table 1: Level of Service Criteria for Intersections

Level of ¹ Service	Expected Delay	Intersection Control Delay (Seconds per Vehicle)	
		Unsignalized Intersections	Signalized & Roundabout Intersections
A	Little/No Delay	≤10	≤10
B	Short Delays	>10 and ≤15	>10 and ≤20
C	Average Delays	>15 and ≤25	>20 and ≤35
D	Long Delays	>25 and ≤35	>35 and ≤55
E	Very Long Delays	>35 and ≤50	>55 and ≤80
F	Extreme Delays ²	>50	>80

The City of Lynden’s LOS standard is LOS D for signalized, roundabout, and all-way stop-control intersections. The LOS standard for unsignalized two-way stop-control intersections is LOS E.

¹ **Source:** *Highway Capacity Manual 6th Edition*.

LOS A: Free-flow traffic conditions, with minimal delay to stopped vehicles (no vehicle is delayed longer than one cycle at signalized intersection).

LOS B: Generally stable traffic flow conditions.

LOS C: Occasional back-ups may develop, but delay to vehicles is short term and still tolerable.

LOS D: During short periods of the peak hour, delays to approaching vehicles may be substantial but are tolerable during times of less demand (i.e. vehicles delayed one cycle or less at signal).

LOS E: Intersections operate at or near capacity, with long queues developing on all approaches and long delays.

LOS F: Jammed conditions on all approaches with excessively long delays and vehicles unable to move at times.

² When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection.

3. TRIP GENERATION

The trip generation calculations for the Kamm Creek PRD are based on average trip generation rates for Land Use Code 210, Single-Family Detached Housing, contained in *Trip Generation Manual, 10th Edition (2017)* by ITE. The development is proposed to include 40 total units. The trip generation is summarized in Table 2.

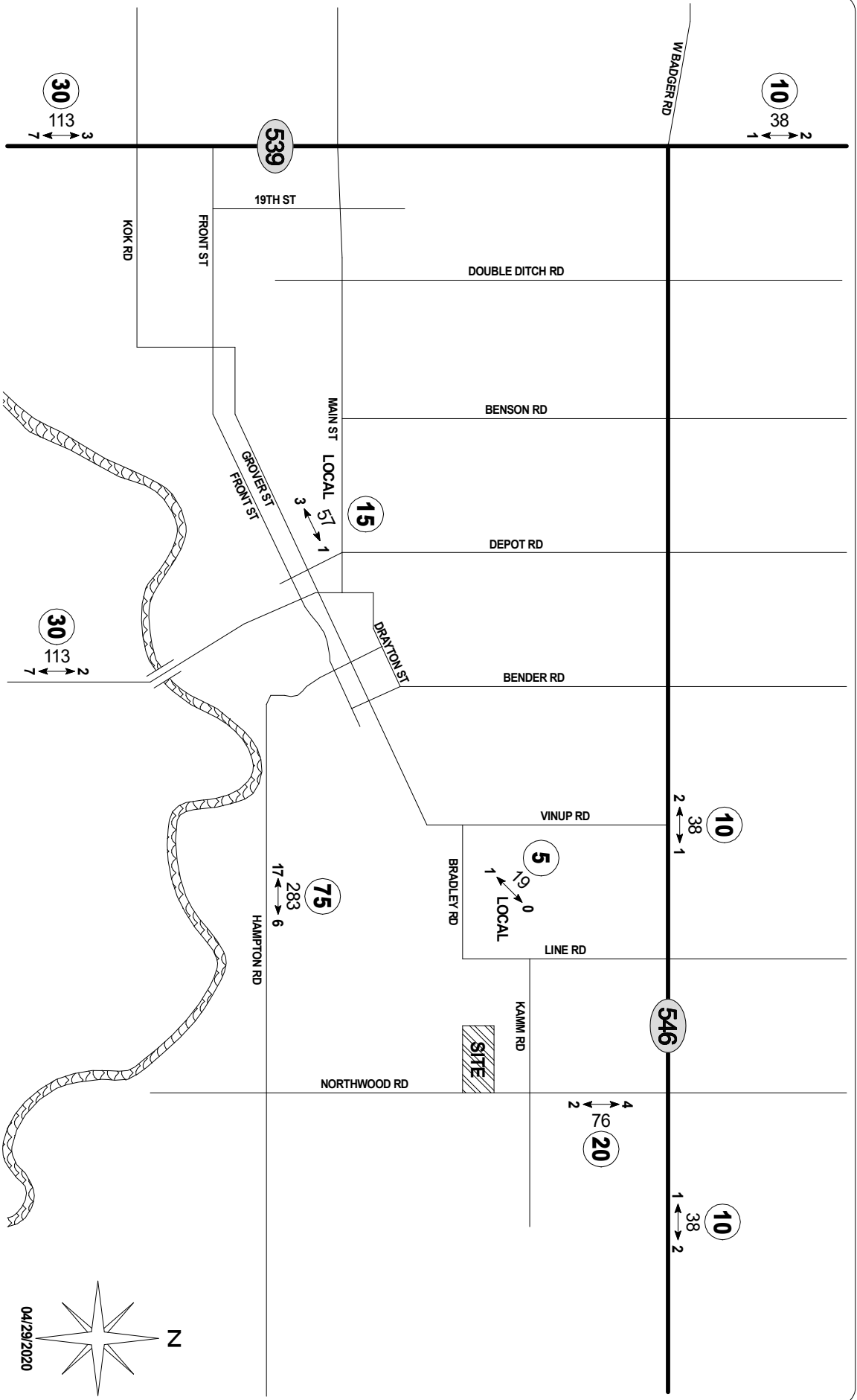
Table 2: Trip Generation Summary

40 Single-Family Units ITE LUC 210	Average Daily Trips			AM Peak-Hour Trips			PM Peak-Hour Trips		
	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total
Generation Rate	9.44 trips per unit			0.74 trips per unit			0.99 trips per unit		
Splits	50%	50%	100%	25%	75%	100%	63%	37%	100%
Trips	189	189	378	8	22	30	25	15	40

The 40 new residential units are estimated to generate 378 average daily trips (ADT) with 30 AM peak-hour trips and 40 PM peak-hour trips.

4. TRIP DISTRIBUTION

Trip distribution and traffic assignments for Kamm Creek PRD are based on employment and retail areas in the site vicinity. It is estimated that 75% of the site traffic will travel to and from the south on Northwood Road. The remaining 25% of the development's trips will travel to and from the north on Northwood Road. The AM and PM peak-hour trip distributions are included in Figure 2 and Figure 3, respectively.



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KAMM CREEK PRD
40 SFD UNITS

LEGEND
 AM ← AVDT → PEAK
 NEW DAILY TRIPS
 NEW AM PEAK-HOUR TRIPS

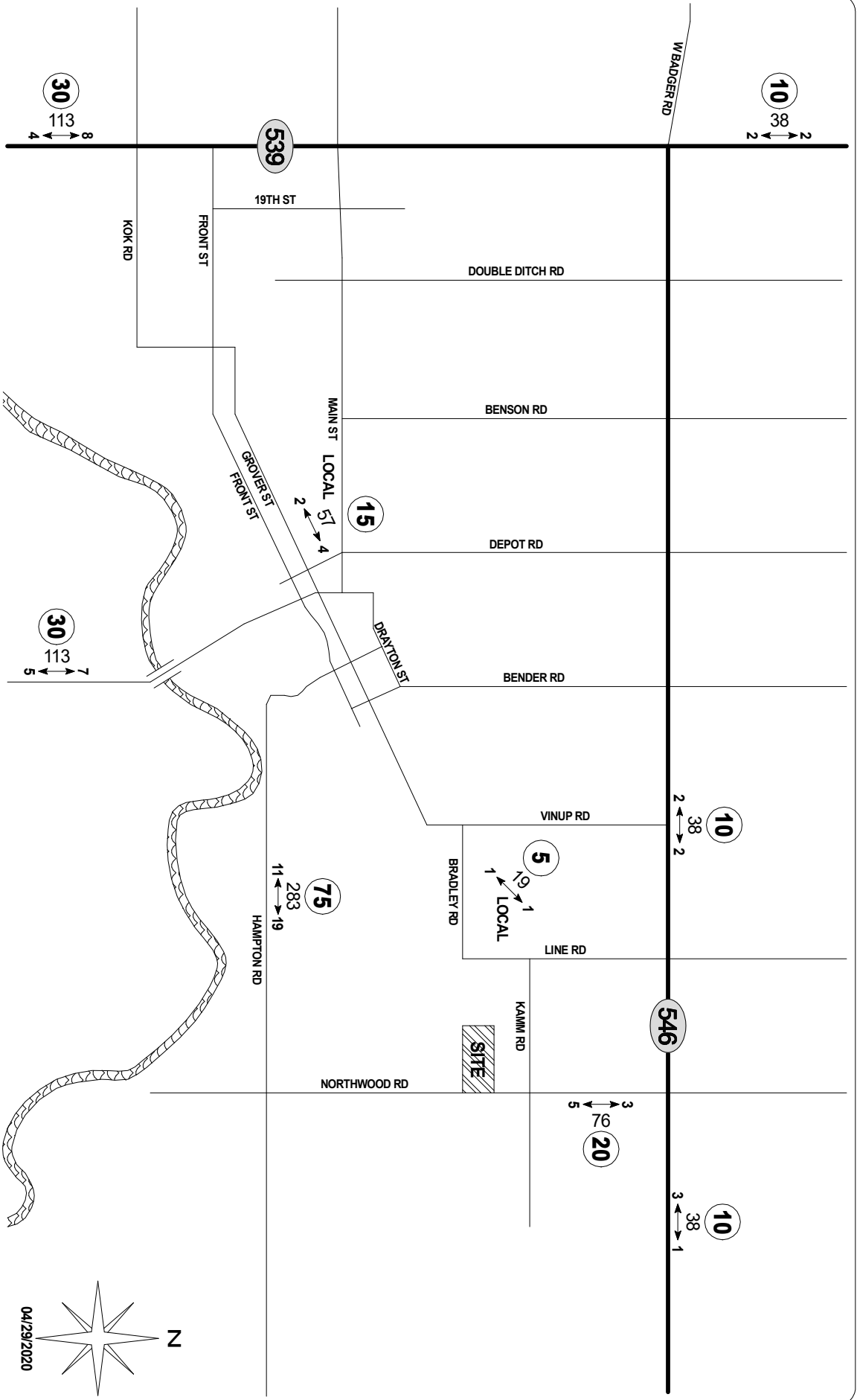


TRIP DISTRIBUTION %

CITY OF LYNDEN

FIGURE 2
 DEVELOPMENT
 TRIP DISTRIBUTION
 AM PEAK-HOUR

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KAMM CREEK PRD
40 SFD UNITS

LEGEND
 PM ← AWDT → PEAK
 NEW DAILY TRIPS
 NEW PM PEAK-HOUR TRIPS



TRIP DISTRIBUTION %

CITY OF LYNDEN

FIGURE 3
 DEVELOPMENT
 TRIP DISTRIBUTION
 PM PEAK-HOUR

5. LEVEL OF SERVICE ANALYSIS

Count data from the City of Lynden from June/July 2019 for Northwood Road north of Kamm Road was reviewed to estimate volumes on Northwood Road and the development's access locations. Review of the data showed weekday PM peak-hour volumes between 50-70 vehicles per hour in each direction. As a conservatively high assumption, 100 hourly vehicles in each direction were assumed for the existing volume on Northwood Road near the development site. The conservatively high existing volumes were then increased to 2026 volumes by applying a 2% annually compounding growth rate. This resulted in northbound and southbound volumes of approximately 115 vehicles per hour under 2026 baseline conditions.

The development's PM peak-hour trips were added to the 2026 baseline traffic volumes to determine the 2026 future with development traffic volumes. As an additional conservative assumption, all development trips were assigned to a single access even though the development is proposed to have two access locations. The 2026 future with development eastbound level of service at the assumed combined access was LOS A with an average of 9.4 seconds with a single lane, eastbound approach. The level of service calculations are included in the attachments.

6. ACCESS ANALYSIS

6.1 Sight Distance

Northwood Road is a two-lane Collector and has a posted speed limit of 35 mph in the vicinity of the site. City of Lynden road standards assume a design speed of 45 mph for arterials and 35 mph for access streets (it does not directly specify a design speed for Collectors). A 45 mph design speed results in a minimum stopping sight distance of 360 feet per AASHTO design standards. The development's two access locations are expected to have sufficient stopping sight distance for a 45-mph design speed. The City of Lynden also evaluates line of sight distance at public road intersections. A 45 mph design speed results in a minimum line of sight distance of 630 feet. Both access locations are expected to have sufficient line of sight distance.

6.2 Access Separation

The City of Lynden road standards identify a minimum spacing of 250 feet between access streets on arterial roadways. The development's two proposed access locations are separated by approximately 340 feet; therefore, the access locations will meet the spacing requirement.

6.3 Collision Data

Collision data from WSDOT was reviewed for the previous 5.5 years (Jan. 2014 through June 2019) along the development's frontage. There were no reported collisions along the development's frontage.

6.4 Channelization

WSDOT channelization warrants were performed for a combined access that assumed 100% of the development's volumes entering and exiting. The same conservatively high 2026 volume on Northwood Road calculated for the intersection level of service analysis was used in the channelization warrants as well. Neither right-turn nor left-turn channelization is warranted for a combined access. Channelization warrants are included in the attachments.

7. MITIGATION

The City of Lynden assesses traffic impact fees based on PM peak-hour trips generated by new development. The City of Lynden currently has a transportation impact fee of \$2,111 per PM peak-hour trip. The Kamm Creek PRD is expected to generate 40 new PM peak-hour trips and therefore have a proportional transportation impact fee of \$84,440.

8. CONCLUSIONS

The Kamm Creek PRD is proposed to consist of 40 single-family detached units. The development is located on the west side of Northwood Road, south of Kamm Road. The 40 new residential units are estimated to generate 378 average daily trips (ADT) with 30 AM peak-hour trips and 40 PM peak-hour trips. The development's access locations are expected to meet minimum sight distance and level of service standards even when development volumes are combined to a single access. The development will not warrant any additional channelization on Northwood Road. The development's proportionate transportation impact fee is \$84,440.

Trip Generation Calculations

Kamm Creek PRD
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**Trip Generation for: Development Peak Weekday
(a.k.a.): Average Weekday Daily Trips (AWDT)**

LAND USES	VARIABLE	ITE LU code	Gross Trips				Internal Crossover		NET EXTERNAL TRIPS BY TYPE							
			Trip Rate	% IN	% OUT	In+Out (Total)	% of Gross Trips	In+Out (Total)	IN BOTH DIRECTIONS		DIRECTIONAL ASSIGNMENTS					
									TOTAL	PASS-BY	DIVERTED LINK	NEW	PASS-BY	DIVERTED LINK	NEW	
								In+Out (Total)	% of Ext. Trips	In+Out (Total)	% of Ext. Trips	In	Out	In	Out	
Single-Family Detached Housing	40 Units	210	9.44	50%	50%	378	0%	0	0%	0	0%	0	0	0	0	189
Total						378		0		0		0	0	0	0	189

**Trip Generation for: Development Peak Weekday, Peak Hour of Adjacent Street Traffic, One Hour between 7 and 9 AM
 (a.k.a.): Weekday AM Peak Hour**

LAND USES		NET EXTERNAL TRIPS BY TYPE															
		IN BOTH DIRECTIONS					DIRECTIONAL ASSIGNMENTS										
		TOTAL	PASS-BY		DIVERTED LINK		NEW	PASS-BY		DIVERTED LINK		NEW					
ITE LU code	VARIABLE	Trip Rate	% IN	% OUT	In+Out (Total)	% of Gross Trips	% of Ext. Trips	In+Out (Total)	% of Ext. Trips	In+Out (Total)	In	Out	In	Out	In	Out	
Single-Family Detached Housing	40 Units	210	0.74	25%	75%	30	0%	0%	0	0%	0	0	0	0	0	0	0
Total					30	0	0	0	0	0	30	0	0	0	0	0	22

Kamm Creek PRD
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**Trip Generation for: Development Peak Weekday, Peak Hour of Adjacent Street Traffic, One Hour between 4 and 6 PM
 (a.k.a.): Weekday PM Peak Hour**

LAND USES		NET EXTERNAL TRIPS BY TYPE															
		IN BOTH DIRECTIONS					DIRECTIONAL ASSIGNMENTS										
		TOTAL	PASS-BY		DIVERTED LINK		NEW	PASS-BY		DIVERTED LINK		NEW					
ITE LU code	VARIABLE	Gross Trips	% IN	% OUT	In+Out (Total)	% of Gross Trips	% of Ext. Trips	In+Out (Total)	% of Ext. Trips	In+Out (Total)	In	Out	In	Out	In	Out	
	40 Units	210	0.99	63%	37%	40	0%	0%	0	0	40	0	0	0	0	0	0
	Single-Family Detached Housing																
	Total					40			0		40			0		0	15

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AM Peak-Hour

%	New ADT	New AM Peak Hour Trips		
		In	Out	Total
100%	378	8	22	30
1%	3.78	0.08	0.22	0.30
2%	7.56	0.16	0.44	0.60
3%	11.34	0.24	0.66	0.90
4%	15.12	0.32	0.88	1.20
5%	18.90	0.40	1.10	1.50
6%	22.68	0.48	1.32	1.80
7%	26.46	0.56	1.54	2.10
8%	30.24	0.64	1.76	2.40
9%	34.02	0.72	1.98	2.70
10%	37.80	0.80	2.20	3.00
11%	41.58	0.88	2.42	3.30
12%	45.36	0.96	2.64	3.60
13%	49.14	1.04	2.86	3.90
14%	52.92	1.12	3.08	4.20
15%	56.70	1.20	3.30	4.50
16%	60.48	1.28	3.52	4.80
17%	64.26	1.36	3.74	5.10
18%	68.04	1.44	3.96	5.40
19%	71.82	1.52	4.18	5.70
20%	75.60	1.60	4.40	6.00
21%	79.38	1.68	4.62	6.30
22%	83.16	1.76	4.84	6.60
23%	86.94	1.84	5.06	6.90
24%	90.72	1.92	5.28	7.20
25%	94.50	2.00	5.50	7.50
26%	98.28	2.08	5.72	7.80
27%	102.06	2.16	5.94	8.10
28%	105.84	2.24	6.16	8.40
29%	109.62	2.32	6.38	8.70
30%	113.40	2.40	6.60	9.00
31%	117.18	2.48	6.82	9.30
32%	120.96	2.56	7.04	9.60
33%	124.74	2.64	7.26	9.90
34%	128.52	2.72	7.48	10.20
35%	132.30	2.80	7.70	10.50
36%	136.08	2.88	7.92	10.80
37%	139.86	2.96	8.14	11.10
38%	143.64	3.04	8.36	11.40
39%	147.42	3.12	8.58	11.70
40%	151.20	3.20	8.80	12.00
41%	154.98	3.28	9.02	12.30
42%	158.76	3.36	9.24	12.60
43%	162.54	3.44	9.46	12.90
44%	166.32	3.52	9.68	13.20
45%	170.10	3.60	9.90	13.50
46%	173.88	3.68	10.12	13.80
47%	177.66	3.76	10.34	14.10
48%	181.44	3.84	10.56	14.40
49%	185.22	3.92	10.78	14.70
50%	189.00	4.00	11.00	15.00

%	New ADT	New AM Peak Hour Trips		
		In	Out	Total
100%	378	8	22	30
51%	192.78	4.08	11.22	15.30
52%	196.56	4.16	11.44	15.60
53%	200.34	4.24	11.66	15.90
54%	204.12	4.32	11.88	16.20
55%	207.90	4.40	12.10	16.50
56%	211.68	4.48	12.32	16.80
57%	215.46	4.56	12.54	17.10
58%	219.24	4.64	12.76	17.40
59%	223.02	4.72	12.98	17.70
60%	226.80	4.80	13.20	18.00
61%	230.58	4.88	13.42	18.30
62%	234.36	4.96	13.64	18.60
63%	238.14	5.04	13.86	18.90
64%	241.92	5.12	14.08	19.20
65%	245.70	5.20	14.30	19.50
66%	249.48	5.28	14.52	19.80
67%	253.26	5.36	14.74	20.10
68%	257.04	5.44	14.96	20.40
69%	260.82	5.52	15.18	20.70
70%	264.60	5.60	15.40	21.00
71%	268.38	5.68	15.62	21.30
72%	272.16	5.76	15.84	21.60
73%	275.94	5.84	16.06	21.90
74%	279.72	5.92	16.28	22.20
75%	283.50	6.00	16.50	22.50
76%	287.28	6.08	16.72	22.80
77%	291.06	6.16	16.94	23.10
78%	294.84	6.24	17.16	23.40
79%	298.62	6.32	17.38	23.70
80%	302.40	6.40	17.60	24.00
81%	306.18	6.48	17.82	24.30
82%	309.96	6.56	18.04	24.60
83%	313.74	6.64	18.26	24.90
84%	317.52	6.72	18.48	25.20
85%	321.30	6.80	18.70	25.50
86%	325.08	6.88	18.92	25.80
87%	328.86	6.96	19.14	26.10
88%	332.64	7.04	19.36	26.40
89%	336.42	7.12	19.58	26.70
90%	340.20	7.20	19.80	27.00
91%	343.98	7.28	20.02	27.30
92%	347.76	7.36	20.24	27.60
93%	351.54	7.44	20.46	27.90
94%	355.32	7.52	20.68	28.20
95%	359.10	7.60	20.90	28.50
96%	362.88	7.68	21.12	28.80
97%	366.66	7.76	21.34	29.10
98%	370.44	7.84	21.56	29.40
99%	374.22	7.92	21.78	29.70
100%	378.00	8.00	22.00	30.00

Kamm Creek PRD
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PM Peak-Hour

%	New ADT	New PM Peak Hour Trips		
		In	Out	Total
100%	378	25	15	40
1%	3.78	0.25	0.15	0.40
2%	7.56	0.50	0.30	0.80
3%	11.34	0.75	0.45	1.20
4%	15.12	1.00	0.60	1.60
5%	18.90	1.25	0.75	2.00
6%	22.68	1.50	0.90	2.40
7%	26.46	1.75	1.05	2.80
8%	30.24	2.00	1.20	3.20
9%	34.02	2.25	1.35	3.60
10%	37.80	2.50	1.50	4.00
11%	41.58	2.75	1.65	4.40
12%	45.36	3.00	1.80	4.80
13%	49.14	3.25	1.95	5.20
14%	52.92	3.50	2.10	5.60
15%	56.70	3.75	2.25	6.00
16%	60.48	4.00	2.40	6.40
17%	64.26	4.25	2.55	6.80
18%	68.04	4.50	2.70	7.20
19%	71.82	4.75	2.85	7.60
20%	75.60	5.00	3.00	8.00
21%	79.38	5.25	3.15	8.40
22%	83.16	5.50	3.30	8.80
23%	86.94	5.75	3.45	9.20
24%	90.72	6.00	3.60	9.60
25%	94.50	6.25	3.75	10.00
26%	98.28	6.50	3.90	10.40
27%	102.06	6.75	4.05	10.80
28%	105.84	7.00	4.20	11.20
29%	109.62	7.25	4.35	11.60
30%	113.40	7.50	4.50	12.00
31%	117.18	7.75	4.65	12.40
32%	120.96	8.00	4.80	12.80
33%	124.74	8.25	4.95	13.20
34%	128.52	8.50	5.10	13.60
35%	132.30	8.75	5.25	14.00
36%	136.08	9.00	5.40	14.40
37%	139.86	9.25	5.55	14.80
38%	143.64	9.50	5.70	15.20
39%	147.42	9.75	5.85	15.60
40%	151.20	10.00	6.00	16.00
41%	154.98	10.25	6.15	16.40
42%	158.76	10.50	6.30	16.80
43%	162.54	10.75	6.45	17.20
44%	166.32	11.00	6.60	17.60
45%	170.10	11.25	6.75	18.00
46%	173.88	11.50	6.90	18.40
47%	177.66	11.75	7.05	18.80
48%	181.44	12.00	7.20	19.20
49%	185.22	12.25	7.35	19.60
50%	189.00	12.50	7.50	20.00

%	New ADT	New PM Peak Hour Trips		
		In	Out	Total
100%	378	25	15	40
51%	192.78	12.75	7.65	20.40
52%	196.56	13.00	7.80	20.80
53%	200.34	13.25	7.95	21.20
54%	204.12	13.50	8.10	21.60
55%	207.90	13.75	8.25	22.00
56%	211.68	14.00	8.40	22.40
57%	215.46	14.25	8.55	22.80
58%	219.24	14.50	8.70	23.20
59%	223.02	14.75	8.85	23.60
60%	226.80	15.00	9.00	24.00
61%	230.58	15.25	9.15	24.40
62%	234.36	15.50	9.30	24.80
63%	238.14	15.75	9.45	25.20
64%	241.92	16.00	9.60	25.60
65%	245.70	16.25	9.75	26.00
66%	249.48	16.50	9.90	26.40
67%	253.26	16.75	10.05	26.80
68%	257.04	17.00	10.20	27.20
69%	260.82	17.25	10.35	27.60
70%	264.60	17.50	10.50	28.00
71%	268.38	17.75	10.65	28.40
72%	272.16	18.00	10.80	28.80
73%	275.94	18.25	10.95	29.20
74%	279.72	18.50	11.10	29.60
75%	283.50	18.75	11.25	30.00
76%	287.28	19.00	11.40	30.40
77%	291.06	19.25	11.55	30.80
78%	294.84	19.50	11.70	31.20
79%	298.62	19.75	11.85	31.60
80%	302.40	20.00	12.00	32.00
81%	306.18	20.25	12.15	32.40
82%	309.96	20.50	12.30	32.80
83%	313.74	20.75	12.45	33.20
84%	317.52	21.00	12.60	33.60
85%	321.30	21.25	12.75	34.00
86%	325.08	21.50	12.90	34.40
87%	328.86	21.75	13.05	34.80
88%	332.64	22.00	13.20	35.20
89%	336.42	22.25	13.35	35.60
90%	340.20	22.50	13.50	36.00
91%	343.98	22.75	13.65	36.40
92%	347.76	23.00	13.80	36.80
93%	351.54	23.25	13.95	37.20
94%	355.32	23.50	14.10	37.60
95%	359.10	23.75	14.25	38.00
96%	362.88	24.00	14.40	38.40
97%	366.66	24.25	14.55	38.80
98%	370.44	24.50	14.70	39.20
99%	374.22	24.75	14.85	39.60
100%	378.00	25.00	15.00	40.00

Counts and Turning Movement Calculations

Seven Day Volume

Interval Start	Wed 6/26/2019		Thu 6/27/2019		Fri 6/28/2019		Sat 6/29/2019		Sun 6/30/2019		Mon 7/1/2019		Tue 7/2/2019		Mon - Fri Average		7 Day Average	
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
12:00 AM - 1:00 AM	3	4	3	2	4	6	10	11	5	5	1	4	4	4	3.0	4.0	4.3	5.1
1:00 AM - 2:00 AM	2	4	0	5	2	3	6	6	3	7	1	5	1	4	1.2	4.2	2.1	4.9
2:00 AM - 3:00 AM	3	0	0	4	3	2	5	5	4	5	3	7	2	2	2.2	3.6	2.9	4.0
3:00 AM - 4:00 AM	1	3	4	2	4	4	1	3	1	6	6	6	4	4	3.4	3.8	2.7	4.0
4:00 AM - 5:00 AM	6	7	7	5	8	4	3	3	4	4	7	7	7	7	7.0	6.0	6.0	5.3
5:00 AM - 6:00 AM	4	17	10	14	11	11	5	14	7	5	13	15	12	14	10.0	14.2	8.9	12.9
6:00 AM - 7:00 AM	22	33	18	22	24	33	13	14	3	7	17	23	19	28	20.0	27.8	16.6	22.9
7:00 AM - 8:00 AM	28	46	27	41	30	22	12	18	6	6	35	40	24	37	28.8	37.2	23.1	30.0
8:00 AM - 9:00 AM	34	31	37	43	20	37	21	19	15	24	30	42	36	48	31.4	40.2	27.6	34.9
9:00 AM - 10:00 AM	25	36	23	36	28	46	29	28	44	39	28	55	42	42	27.6	43.0	30.1	40.3
10:00 AM - 11:00 AM	38	37	37	41	30	31	32	41	24	34	26	41	45	31	35.2	36.2	33.1	36.6
11:00 AM - 12:00 PM	36	44	39	37	29	33	41	35	21	48	45	40	44	44	38.6	37.0	36.4	38.3
12:00 PM - 1:00 PM	39	33	44	42	42	25	48	41	37	29	40	40	45	37	42.0	35.4	42.1	35.3
1:00 PM - 2:00 PM	41	39	38	52	32	43	39	36	40	36	39	35	35	36	37.0	41.0	37.7	39.6
2:00 PM - 3:00 PM	36	27	41	36	37	41	38	35	62	34	36	39	30	36	36.0	35.8	40.0	35.4
3:00 PM - 4:00 PM	38	43	42	45	48	37	42	41	40	49	34	46	47	51	41.8	44.4	41.6	44.6
4:00 PM - 5:00 PM	41	52	51	59	50	63	45	30	37	37	56	53	39	39	47.4	53.2	45.6	47.6
5:00 PM - 6:00 PM	63	51	63	59	60	49	48	37	38	44	64	57	64	59	62.8	55.0	57.1	50.9
6:00 PM - 7:00 PM	49	42	45	36	62	36	48	35	35	30	47	17	54	43	51.4	34.8	48.6	34.1
7:00 PM - 8:00 PM	38	25	44	31	44	39	28	34	31	32	34	25	26	37	37.2	31.4	35.0	31.9
8:00 PM - 9:00 PM	35	25	29	33	34	44	30	26	28	26	42	27	40	30	36.0	31.8	34.0	30.1
9:00 PM - 10:00 PM	21	19	27	20	28	20	16	26	16	13	24	29	30	24	26.0	22.4	23.1	21.6
10:00 PM - 11:00 PM	7	20	12	12	13	28	19	25	13	15	12	15	12	12	11.2	20.6	12.6	20.4
11:00 PM - 12:00 AM	9	12	6	9	8	19	11	22	12	9	10	5	7	8	8.0	10.6	9.0	12.0
Totals	619	650	647	686	651	676	590	585	526	544	650	673	659	683	645.2	673.6	620.3	642.4
Combined	1269	1333	1327	1333	1327	1327	1175	1175	1070	1070	1323	1323	1342	1342	1318.8	1318.8	1262.7	1262.7
Split (%)	48.8	51.2	48.5	51.5	49.1	50.9	50.2	49.8	49.2	50.8	49.1	50.9	49.1	50.9	48.9	51.1	49.1	50.9

Peak Hours

12:00 AM - 12:00 PM	10:00 AM	7:00 AM	10:15 AM	7:30 AM	6:45 AM	9:00 AM	11:00 AM	9:45 AM	9:00 AM	11:00 AM	11:00 AM	9:00 AM	10:30 AM	8:15 AM	11:00 AM	9:15 AM	11:00 AM	9:45 AM
Volume	38	46	40	48	32	46	41	48	44	48	45	55	54	51	38.6	43.2	36.4	41.9
Factor	0.79	0.82	0.91	0.86	0.62	0.61	0.68	0.75	0.52	0.67	0.70	0.81	0.71	0.80	0.88	0.78	0.86	0.79
12:00 PM - 12:00 AM	5:00 PM	4:30 PM	4:30 PM	4:30 PM	5:15 PM	4:00 PM	5:45 PM	3:15 PM	1:30 PM	3:00 PM	4:45 PM	4:45 PM	4:45 PM	5:00 PM	4:45 PM	4:45 PM	5:15 PM	4:45 PM
Volume	63	60	66	68	68	63	53	44	62	49	73	60	66	59	63.6	58.6	58.3	52.7
Factor	0.83	0.79	0.79	0.85	0.81	0.88	0.83	0.69	0.50	0.82	0.87	0.75	0.75	0.82	0.94	0.82	0.94	0.82

Seven Day Volume

Interval Start	Wed 7/3/2019		Thu 7/4/2019		Fri 7/5/2019		Sat 7/6/2019		Sun 7/7/2019		Mon 7/8/2019		Tue 7/9/2019		Mon - Fri Average		7 Day Average		
	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB	
12:00 AM - 12:00 PM	6	3	7	6	11	9	7	5	13	7	13	5	11	3	7	6.4	7.2	6.6	7.7
1:00 AM - 2:00 AM	2	3	2	6	3	3	6	4	2	7	2	2	1	2	3	2.2	3.2	3.4	3.1
2:00 AM - 3:00 AM	2	5	3	4	3	4	4	6	0	4	3	3	2	2	2	2.6	3.4	2.4	3.9
3:00 AM - 4:00 AM	2	3	2	2	1	4	0	1	4	5	2	2	3	2	2	1.8	2.8	1.9	2.9
4:00 AM - 5:00 AM	6	7	6	2	6	0	5	3	6	6	8	8	7	9	7.0	4.8	6.6	4.7	
5:00 AM - 6:00 AM	8	17	7	9	9	11	7	3	6	3	7	7	10	11	8.4	12.2	7.9	9.6	
6:00 AM - 7:00 AM	15	24	9	12	9	12	7	12	8	7	25	25	30	25	30	16.6	21.6	14.0	18.1
7:00 AM - 8:00 AM	34	38	13	11	16	30	14	21	11	17	27	27	46	21	46	22.2	34.2	19.4	29.9
8:00 AM - 9:00 AM	29	40	19	23	22	29	14	28	18	28	23	23	37	29	32	24.4	32.2	22.0	31.0
9:00 AM - 10:00 AM	30	28	20	22	37	34	23	19	36	20	39	39	35	29	36	31.0	31.0	30.6	27.7
10:00 AM - 11:00 AM	35	35	30	32	35	33	30	27	25	36	27	27	35	24	28	30.2	32.6	29.4	32.3
11:00 AM - 12:00 PM	31	53	30	37	33	47	33	51	36	44	40	40	40	35	31	33.8	41.6	34.0	43.3
1:00 PM - 2:00 PM	40	57	43	36	54	34	46	40	46	46	54	54	47	50	42	45.6	38.0	45.7	39.4
2:00 PM - 3:00 PM	35	36	32	40	38	44	33	37	43	38	49	49	46	48	47	43.6	48.6	42.0	45.4
3:00 PM - 4:00 PM	46	49	29	42	30	41	38	46	47	31	49	49	47	38	37	36.8	40.2	38.4	39.7
4:00 PM - 5:00 PM	58	55	40	46	40	35	33	33	44	35	46	46	58	56	60	48.0	50.8	45.3	46.0
5:00 PM - 6:00 PM	59	48	34	25	52	48	53	42	40	36	61	61	47	58	47	52.8	43.0	51.0	41.9
6:00 PM - 7:00 PM	51	39	29	39	54	45	40	40	35	38	46	46	53	39	54	43.8	46.0	42.0	44.0
7:00 PM - 8:00 PM	34	26	15	30	42	34	35	25	27	26	51	51	36	44	34	37.2	32.0	35.4	30.1
8:00 PM - 9:00 PM	40	24	18	25	33	30	33	30	25	23	34	34	30	30	19	31.0	25.6	30.4	25.9
9:00 PM - 10:00 PM	22	30	15	20	18	17	19	26	22	23	23	23	27	19	20	19.4	22.8	19.7	23.3
10:00 PM - 11:00 PM	7	20	30	25	18	21	22	23	10	12	18	18	17	14	12	17.4	19.0	17.0	18.6
11:00 PM - 12:00 AM	12	11	36	23	20	13	8	16	8	6	8	8	4	8	6	16.8	11.4	14.3	11.3
Totals	640	682	503	566	617	628	547	577	545	546	677	703	703	637	672	614.8	650.2	595.1	624.9
Combined	1322		1069		1245		1124		1091		1380		1309			1265.0		1220.0	
Split (%)	48.4	51.6	47.1	52.9	49.6	50.4	48.7	51.3	50.0	50.0	49.1	50.9	50.9	48.7	51.3	48.6	51.4	48.8	51.2

Peak Hours

12:00 AM - 12:00 PM	7:45 AM	11:00 AM	9:45 AM	11:00 AM	9:15 AM	11:00 AM	9:15 AM	11:00 AM	9:30 AM	10:45 AM	11:00 AM	11:00 AM	7:30 AM	11:00 AM	7:00 AM	9:15 AM	11:00 AM	9:15 AM	11:00 AM
Volume	40	53	31	37	44	47	33	51	44	45	40	48	48	35	46	35.2	41.6	35.7	43.3
Factor	0.63	0.78	0.86	0.84	0.69	0.84	0.59	0.85	0.79	0.70	0.67	0.80	0.80	0.67	0.82	0.85	0.84	0.82	0.85
12:00 PM - 12:00 AM	4:15 PM	4:45 PM	1:15 PM	1:30 PM	6:15 PM	5:15 PM	5:00 PM	1:15 PM	1:30 PM	3:30 PM	4:30 PM	4:15 PM	4:15 PM	4:30 PM	4:30 PM	4:30 PM	4:30 PM	4:30 PM	4:30 PM
Volume	66	61	45	53	62	51	53	46	51	50	63	61	61	61	61	54.2	51.8	51.3	47.4
Factor	0.87	0.76	0.75	0.70	0.82	0.80	0.74	0.82	0.61	0.74	0.88	0.80	0.80	0.80	0.85	0.93	0.94	0.92	0.94

Synchro ID: 1

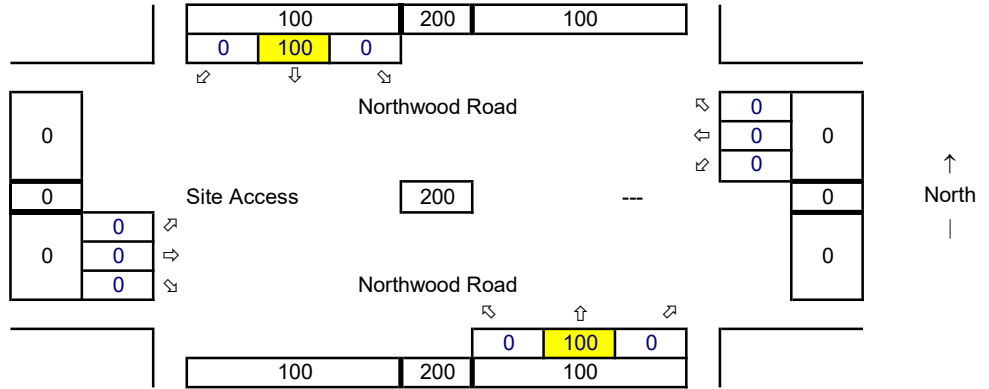
Existing

Average Weekday
PM Peak Hour

Year: 6/1/19

Data Source: City of Lynden

City count from north of Kamm Rd. Hourly volumes around 50-70 trips.



Future without Project

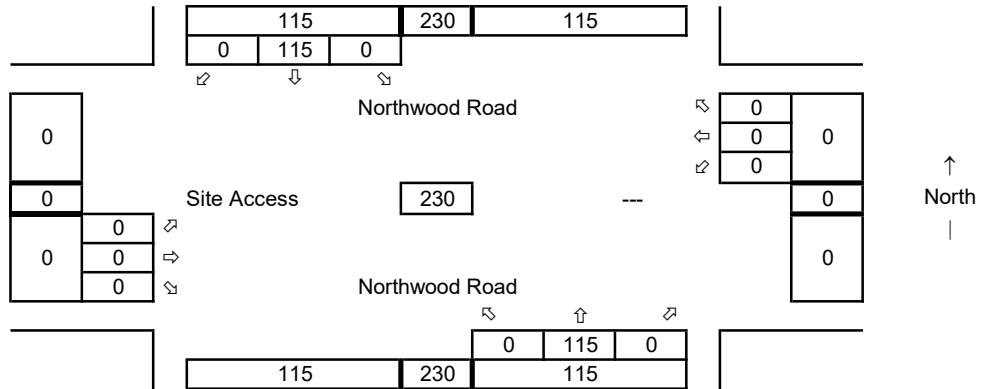
Average Weekday
PM Peak Hour

Year: 2026

Growth Rate = 2.0%

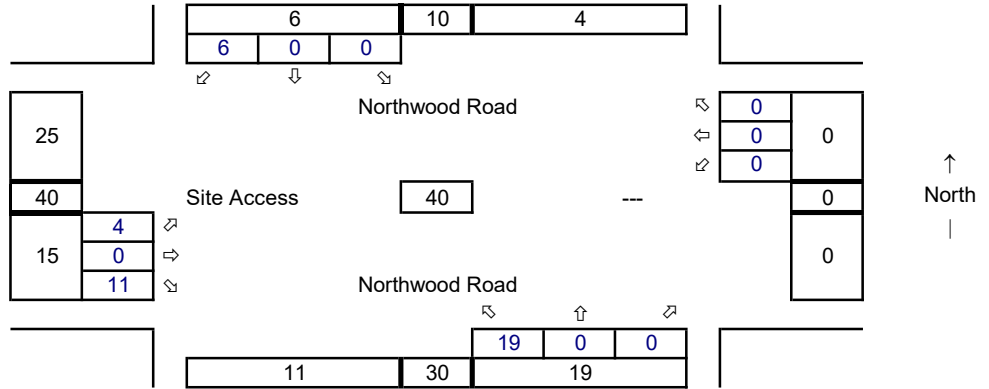
Years of Growth = 7

Total Growth = 1.1487



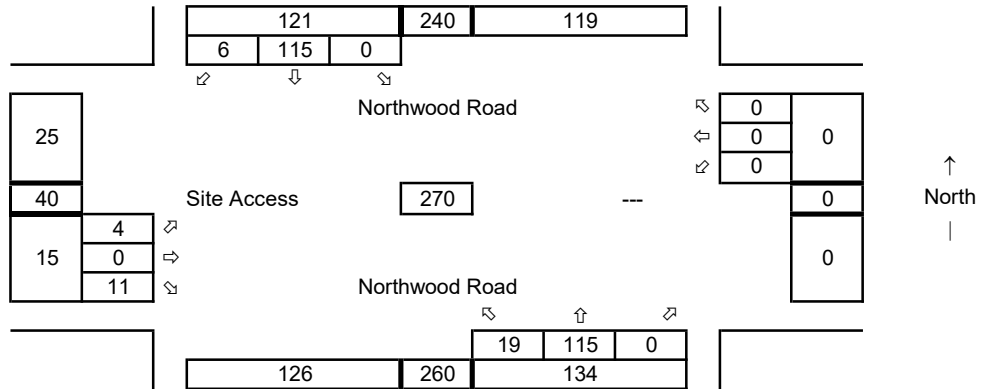
Total Project Trips

Average Weekday
PM Peak Hour



Future with Project

Average Weekday
PM Peak Hour



Level of Service Calculations

HCM 6th TWSC
1: Northwood Rd & Site Access

Kamm Creek PRD

Intersection

Int Delay, s/veh	1.1					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	11	19	115	115	6
Future Vol, veh/h	4	11	19	115	115	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	12	21	125	125	7

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	296	129	132	0	0
Stage 1	129	-	-	-	-
Stage 2	167	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	695	921	1453	-	-
Stage 1	897	-	-	-	-
Stage 2	863	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	684	921	1453	-	-
Mov Cap-2 Maneuver	684	-	-	-	-
Stage 1	883	-	-	-	-
Stage 2	863	-	-	-	-

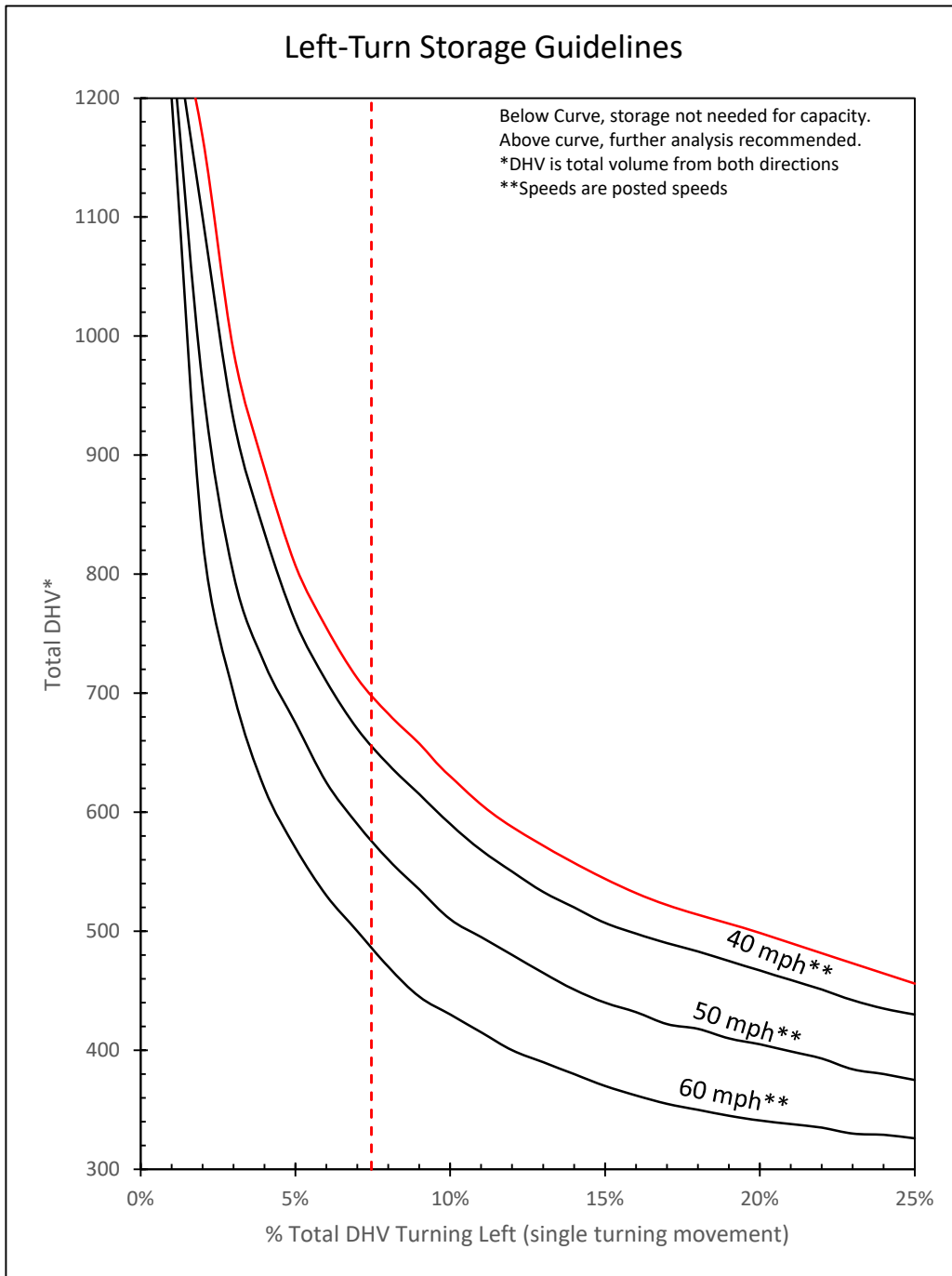
Approach	EB	NB	SB
HCM Control Delay, s	9.4	1.1	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1453	-	843	-	-
HCM Lane V/C Ratio	0.014	-	0.019	-	-
HCM Control Delay (s)	7.5	0	9.4	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Channelization Warrants

GIBSON TRAFFIC CONSULTANTS

Northwood Road @ Site Access



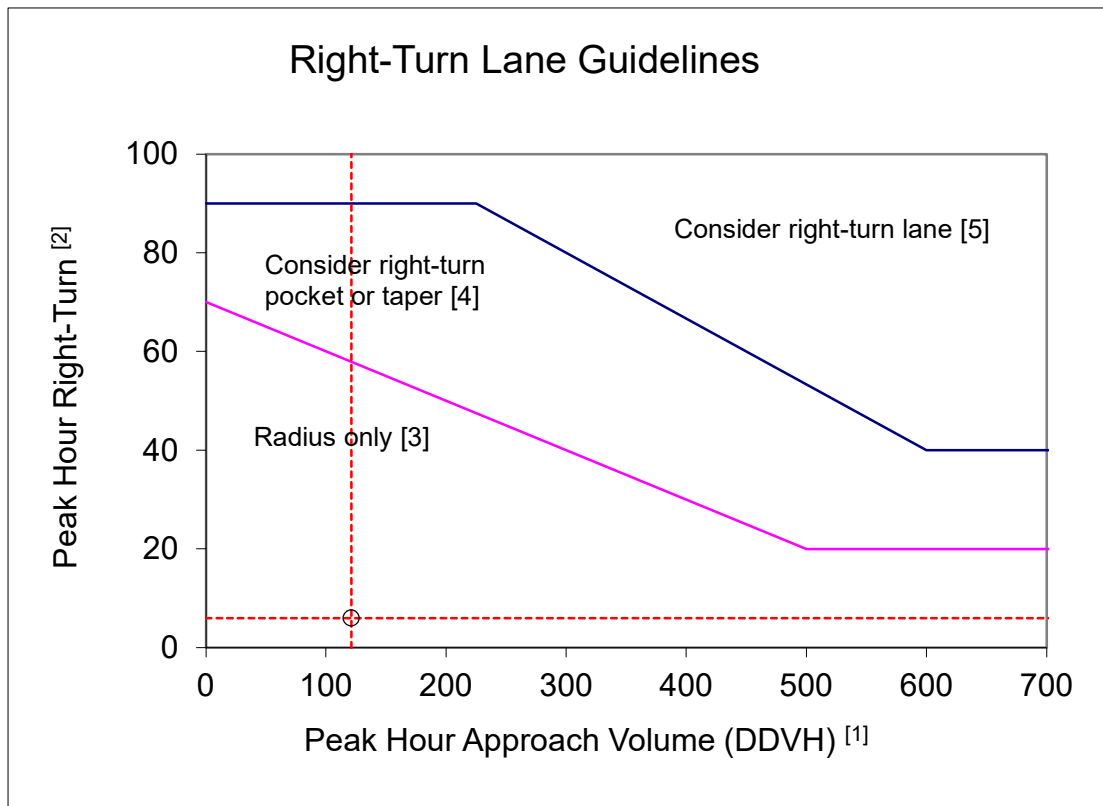
Total DHV: 255
Left Turns: 19
% Left: 7.5%

Posted Speed: 35 mph

Based on WSDOT July 2018 Design Manual: Exhibit 1310-7a, Page 1310-13.

GIBSON TRAFFIC CONSULTANTS

Northwood Road @ Site Access



Right Turn Volume:	6	[DDHV]		Posted Speed:	35 mph
Adjusted Right Turn Volume:	6	[DDHV]			
Pk Hr Curb Ln Approach Vol:	121	[DDHV]			

[1] For two-lane highways, use the peak hour DDHV (through + right turn).
 For multilane, high speed highways (posted speed 45 mph or above), use the right-lane peak hour approach volume (through + right turn).

[2] When all three of the following conditions are met, reduce the right-turn DDHV by 20:
 - The posted speed is 45 mph or less
 - The right-turn volume is greater than 40 VPH
 - The peak hour approach volume (DDHV) is less than 300 VPH.

[3] For right-turn corner design, see Exhibit 1310-6.
 [4] For right-turn pocket or taper design, see Exhibit 1310-12.
 [5] For right-turn lane design, see Exhibit 1310-13.