EXHIBIT D

Preliminary Storm Drainage Design and Calculations For the Bull Run Terrace Subdivision

November 20, 2019

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RENEWAL DATE: 12/31/2020

Table of Contents: **Page(s)**

Table of Contents and Appendices..... 1
Purpose..... 2
Project Location and Description..... 2
Proposed Improvements..... 2
Hydrograph Parameters..... 3-4
Detention Sizing Results..... 5
Water Quality Design..... 6
Conclusions..... 6

Appendices:

Appendix A
-Vicinity Map
-Site Layout
-Pre-Developed Areas
-Developed Areas

Appendix B
-Standard Formulas
-Coefficients
-SCS Runoff Curve Numbers (CN)
-Hydrograph Analysis Summary
-Detention System Summary
-Stage Storage Summary
-Rectangular, Sharp Crested Weir Calculations
-Contech CDS2015-4-C Detail

PURPOSE:

The purpose of this analysis is to:

- Describe existing and proposed site conditions.
- Provide detention calculations for the 2-yr, 5-yr, 10-yr, and 25-yr storm events.
- Provide water quality calculations.

PROJECT LOCATION AND DESCRIPTION:

The project site is located on the south side of the Mount Hood Highway in Sandy, Oregon. The site includes tax lots 900 and 1000. The +/- 15.9-acre site consists of grassy fields, and plentiful tree cover. The land is generally sloped to the north and west with an average slope of about 8%. A Vicinity Map and Site Layout (with proposed storm sewer layout) can be found in Appendix A.

PROPOSED IMPROVEMENTS

The proposed 7-lot Bull Run Terrace Subdivision project will consist of four single-family residential lots ranging from 5,748 SF to 7,444 SF. The project will also include three multi-family lots ranging in size from 52,667 SF to 292,076 SF. The site improvements will include streets, curbs, sidewalks, utilities, etc.

New storm sewer pipes, manholes, and catch basins will be installed to convey storm water to a public detention pond located in Tract B. A new water quality manhole will be installed downstream of the detention pond (See Site Layout – Appendix A).

The pond will be sized to detain the new public streets and the new homes to be built on lots 1 through 4. Lots 5, 6, and 7 will provide lot-level detention and water quality systems at the time of building construction. Lots 5 and 6 will drain through the detention pond, and the pond will be sized to accommodate these anticipated flows. The future detention system on lot 7 will bypass the pond and flow directly to the public storm system in the park west of the development.

The fill required to bring Dubarko Road up to grade with Highway 26 will impede the flows of an existing drainage way that flows through the site. To remedy this, a new culvert will be installed under Dubarko Road. In the future, when lots 6 and 7 develop, a new bypass system will be designed to intercept the off-site flows draining to the project site and reroute them to the existing storm system to the west.

In addition to the on-site storm, improvements to the storm system in the ODOT right of way will occur as well. A new water quality facility will be constructed along Highway 26. This facility will conform to the requirements of the newest ODOT stormwater management manual at the time of design and construction. An existing 24” culvert which currently drains to the site will be intercepted, and the flows routed through an existing storm system in the ODOT right of way.

Upstream and downstream analyses will be performed as needed at the time of final engineering.

HYDROGRAPH PARAMETERS:

Rainfall
The rainfall distribution numbers below were taken from the City of Sandy Stormwater Website: http://www.ci.sandy.or.us/Stormwater/

2 year, 24 hr. rainfall = 3.5”
5 year, 24 hr. rainfall = 4.5”
10 year, 24 hr. rainfall = 4.8”
25 year, 24 hr. rainfall = 5.5”

Soils
The soil data for this site is from *Soil Survey of Clackamas County, Oregon* published by the United Stated Department of Agriculture (USDA). The post-development soil is assumed to be the same as pre-development.

Soil Type: 15B, Cazadero silty clay loam. Hydrologic Group “C”
15C, Cazadero silty clay loam. Hydrologic Group “C”
24B, Cottrell silty clay loam. Hydrologic Group “C”

(See Appendix B for Runoff Curve Numbers)

Areas and Curve Numbers
Drainage basin areas were determined using a topographic map drafted in AutoCAD. See the Pre-Developed Area and Developed Area in Appendix A.

The impervious area for these post-developed basins includes the proposed roofs from lots 1 through 4, streets, sidewalks, driveways, and curbs. See the following tables for a specific breakdown of these areas.

Pre-Development		
Areas	**CN**	**Land Use Description**
Pervious (10.88 acres)*	83	Meadow & Young Second Growth Forest Land
Impervious (0.00 acres)	98	N/A
Post-Development		
Areas	**CN**	**Land Use Description**
Pervious (8.77 acres)**	83	Lawns "Good Condition", Meadow & Young Second Growth Forest
Impervious (2.11 acres)***	98	Buildings, AC, Sidewalks, etc.

*Pre-Developed Pervious CN: Weighted CN
Meadow or Pasture 5.19 AC: CN = 85
Wood or Forest Land "Young Second Growth" 5.68 AC: CN = 81
[(5.19AC x 85) + (5.68AC x 81)] / (5.19+5.68) = 82.91= **83.0**

Pre-Developed Impervious CN: See Runoff Curve Numbers Appendix B

**Post-Developed Pervious CN: Weighted CN
Meadow or Pasture 2.75 AC: CN = 85
Wood or Forest Land "Young Second Growth" 5.16 AC: CN = 81
Lawns "Good Condition" 0.85 AC: CN = 86
[(2.75AC x 85) + (5.16AC x 81)+ (0.85AC x 86)] / (2.75+5.16+0.85) = 82.74
= **83.0**
***Refer to Water Quality Design Section for detailed area breakdown.

Post-Developed Impervious CN: See Runoff Curve Numbers Appendix B

Time of Concentration
The times of concentrations (Tc), were assumed as follows.

Pre-development T_c= 30.0 minutes
Post-development T_c= 5.0 minutes

Hydrograph Modeling Results
Hydrographs for the site were determined using a spreadsheet based on the King County, Washington Hydrograph Program, version 4.21B, which uses the Santa Barbara Urban Hydrograph (SBUH) method.

DETENTION SIZING RESULTS:

The Post-Development flows were routed through a proposed 4-foot deep detention pond. The 4-foot deep detention pond has been designed so that the Post-Developed release rates for the entire site do not exceed the Pre-Developed rates for the 2-year, 5-year, 10-year, and 25-year storm events per the City of Sandy public Works Design Standards. See the Detention System Summary in Appendix B.

Hydrology Table			
Recurrence Interval (years)	**Pre-developed Flows (cfs)**	**Developed Flows (cfs)**	**Proposed Release Rates (cfs)**
2	3.42	6.14	3.23
5	5.30	8.99	4.77
10	5.88	9.87	5.71
25	7.26	11.94	7.07

The required storage volume is 12,323-cubic feet. This can be contained in a 4-foot deep pond with a bottom area of 2,443 square feet.

Flow Control:

The flow control orifices were designed to release the Post-development Peak-Q's at or below the Pre-developed Peak-Q's.
(See the Detention System Summary - Appendix B)

Orifice Table		
Orifice	**Dia. (inches)**	**Height (feet)**
Bottom	7.68	-2.50
Top	10.03	2.80

WATER QUALITY DESIGN:

CDS Storm Water Treatment Device
A CDS manhole by Contech Stormwater Solutions was designed for water quality for the site - see detail in Appendix B. The impervious area for the site includes AC pavement, sidewalks, and roofs. The impervious area is 2.11-acres.

Proposed asphalt, walks, etc.:	1.88 acres
Roof, Patio, Driveway*:	0.23 acres
Total Impervious Area:	2.11 acres

*40'x50' Building footprint:	2000SF
20'x20' Driveway:	400SF
10'x10' Patio:	100SF
Total:	2,500SF X 4 lots = 10,000SF

The flow (Q) from this runoff was calculated using the rational method (Q = CIA)

Where Q = flow (cfs)
C = runoff coefficient = 0.90 pavement and Roofs
I = Intensity = 0.2 inches per hour (Water Quality Design Storm)
A = Impervious Area = 2.11 Acres

Q = 0.90 X 0.2 X 2.11
Q = 0.38 cfs

The Contech Storm Water Treatment Device Model: CDS2015-4-C has a treatment capacity of 0.7 cfs which exceeds the required 0.38 cfs.

A Storm Water Treatment Device CDS Model CDS2015-4-C can be used to adequately treat the water for the site

CONCLUSIONS:

- The conveyance system for the proposed Bull Run Terrace Subdivision site has been sized to handle the peak 25-year, 24-hour storm.
- On-site detention has been designed to maintain existing downstream storm water runoff characteristics in accordance with the City of Sandy requirements.
- A CDS Storm Water Treatment Device will be used for water quality.

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Appendix A

-Vicinity Map
-Site Layout
-Pre-Developed Areas
-Developed Areas

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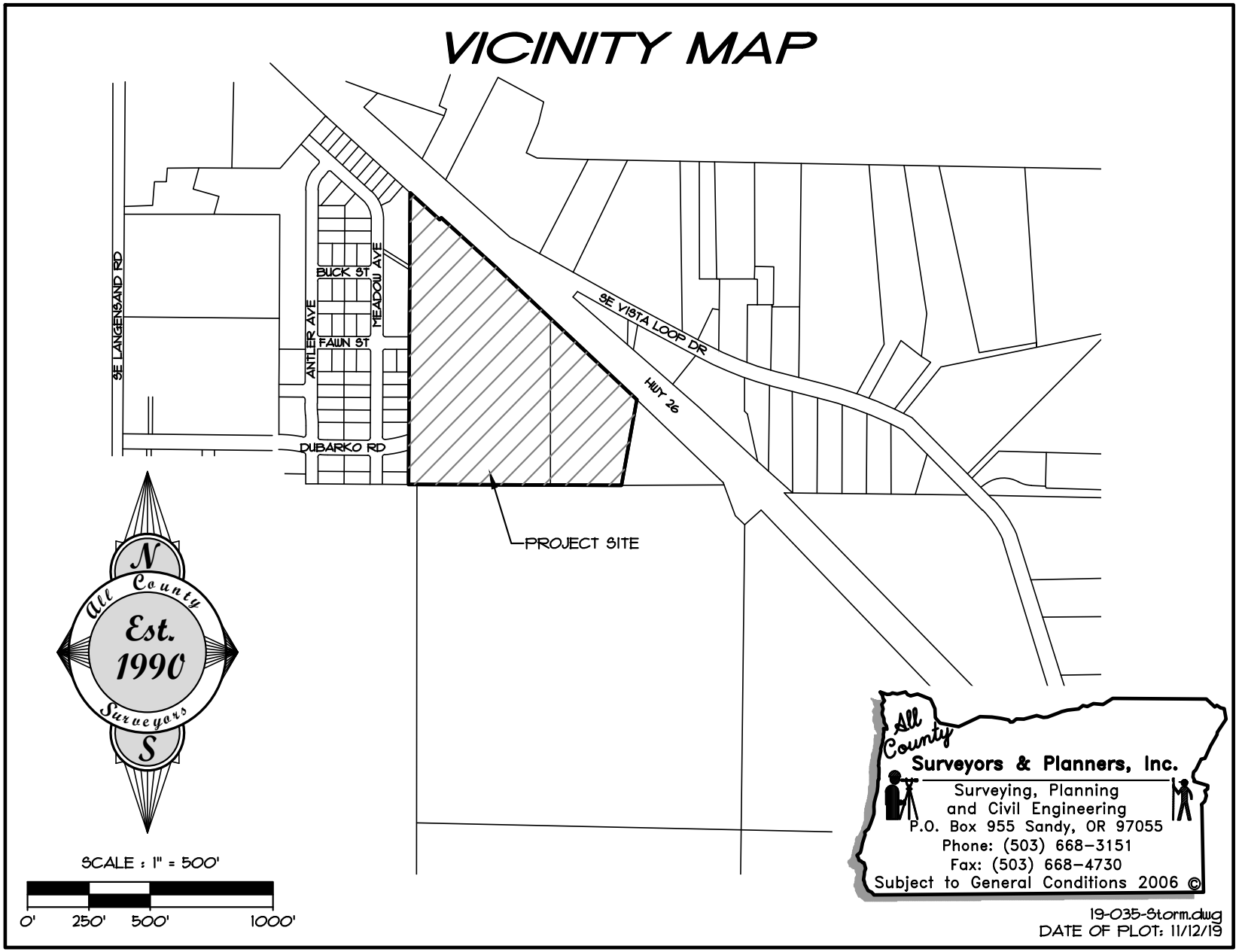
VICINITY MAP



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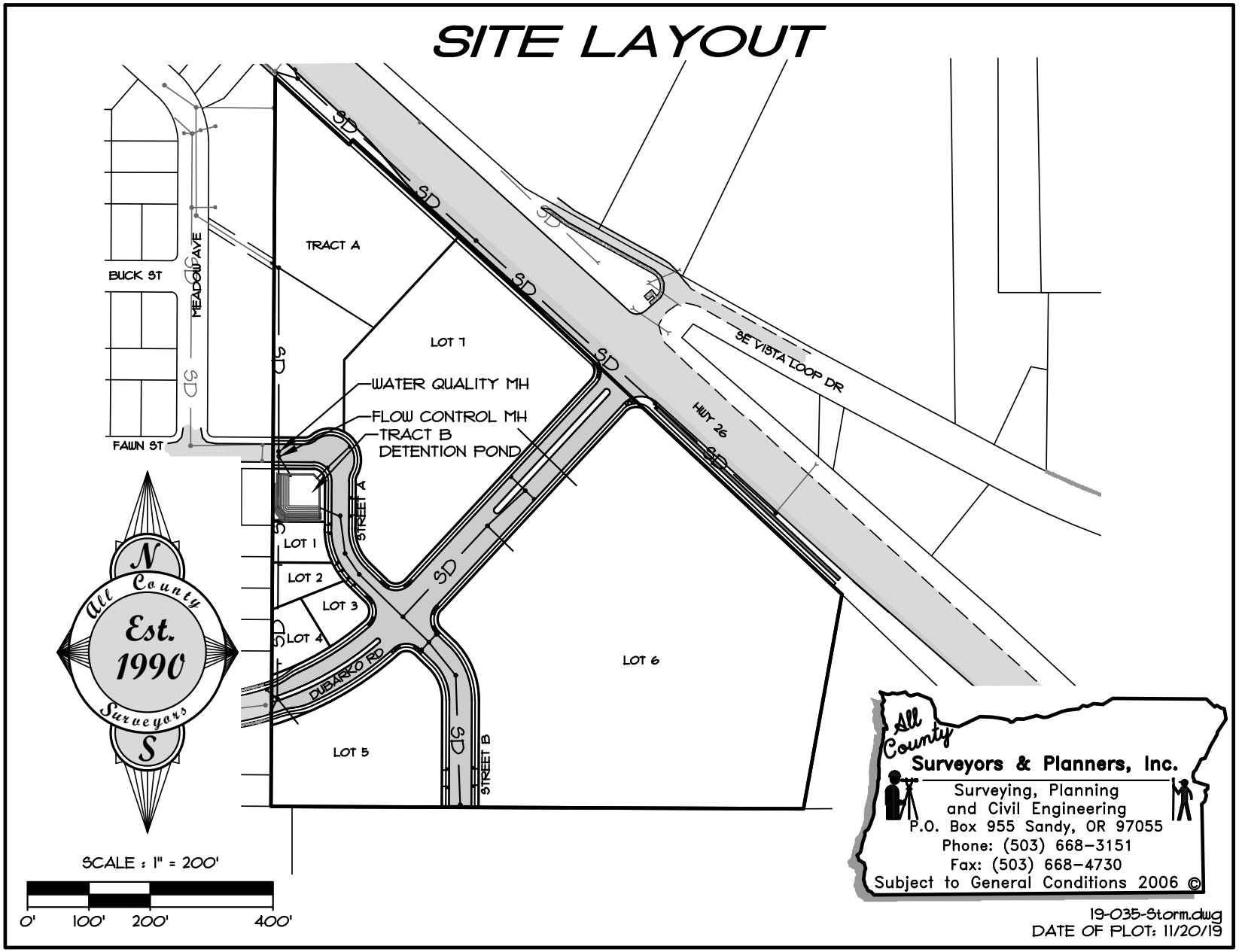
19-035-Storm.dwg
DATE OF PLOT: 11/12/19

SITE LAYOUT



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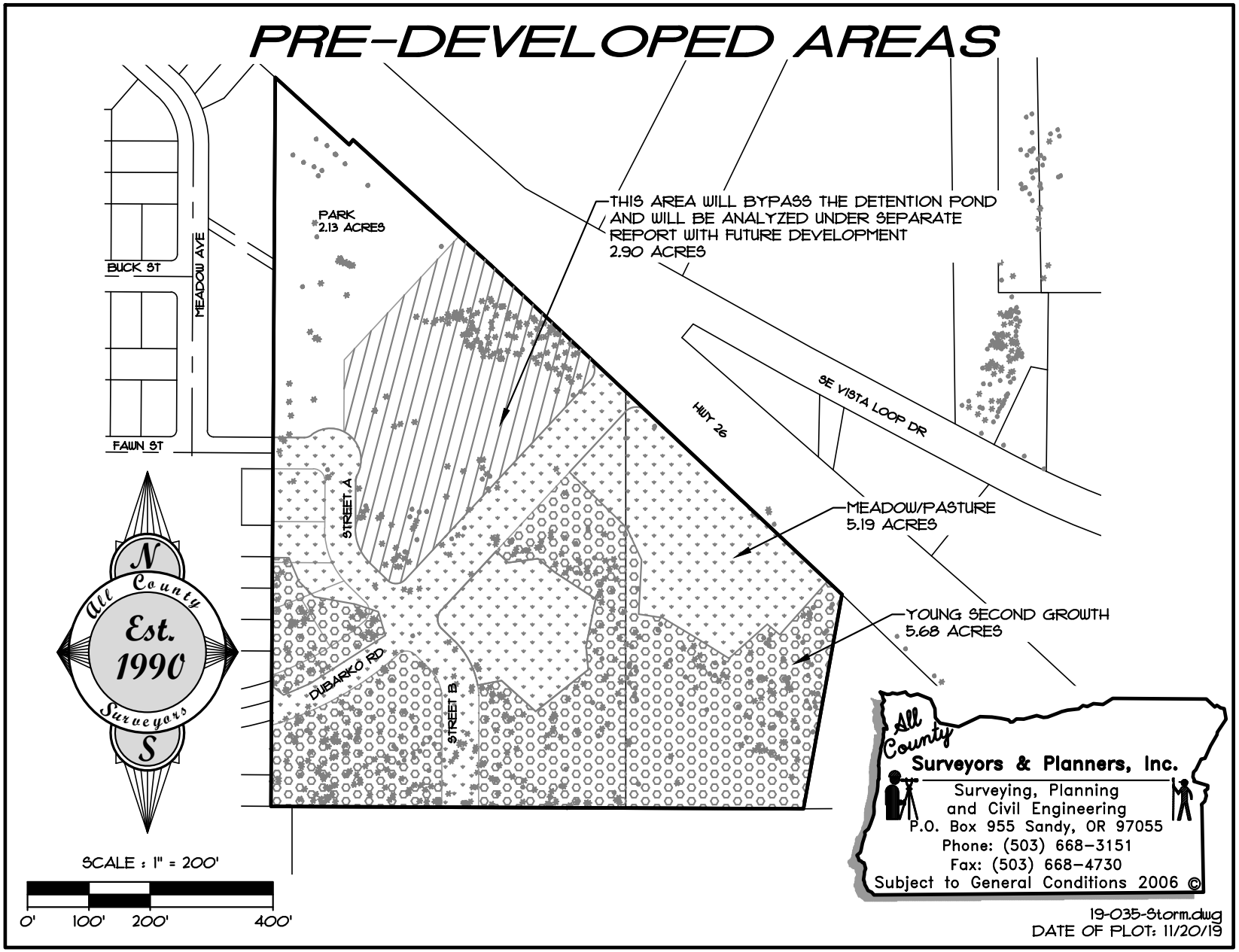
PRE-DEVELOPED AREAS



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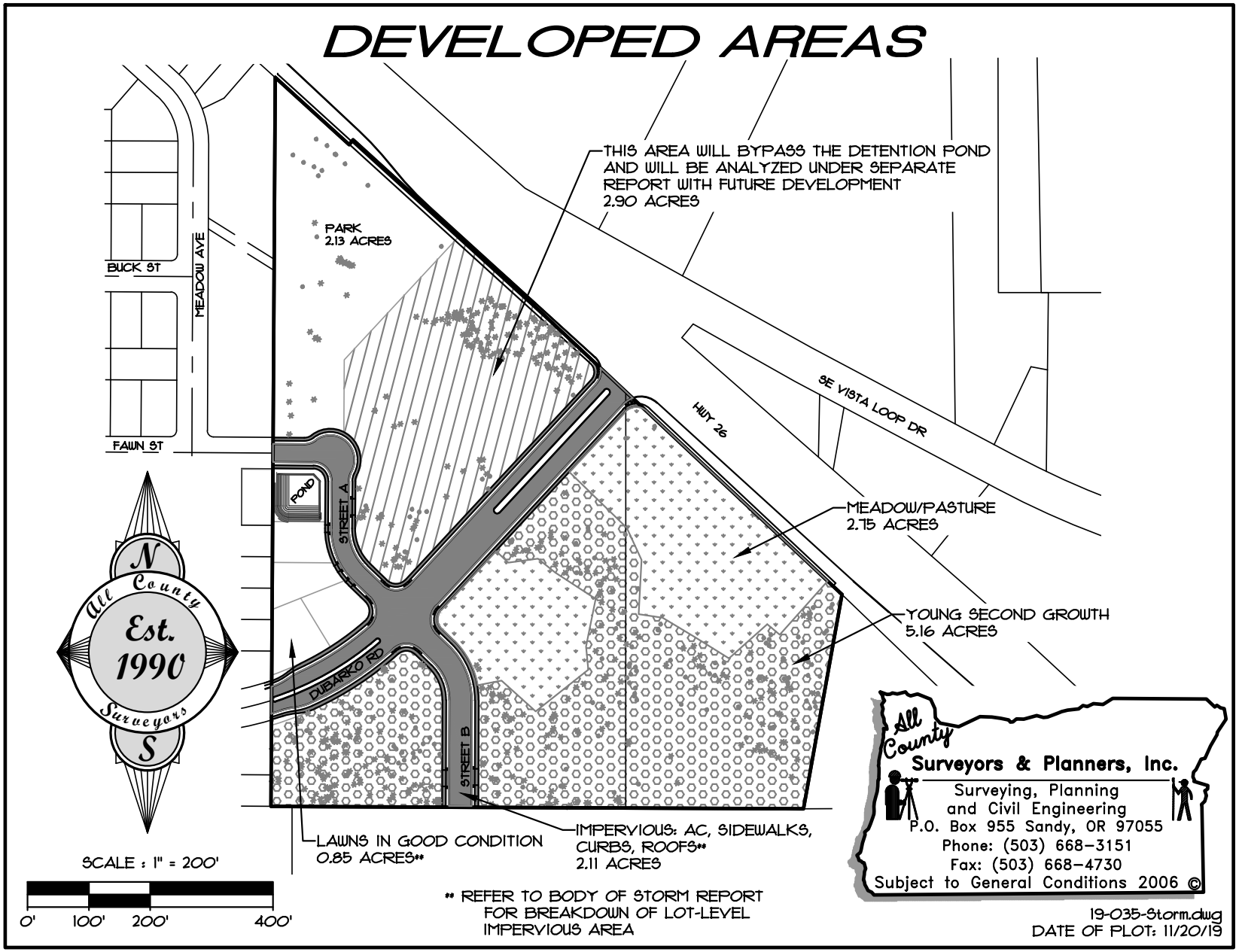
DEVELOPED AREAS



** REFER TO BODY OF STORM REPORT FOR BREAKDOWN OF LOT-LEVEL IMPERVIOUS AREA

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Appendix B

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Standard formulas used for the Time of Concentration Calculations

Overland Flow (max 300' total)

$$\frac{(0.42)[(Ns)(L)]^{0.8}}{(P_2)^{0.5}(S_0)^{0.4}}$$

Tc	= time of concentration for less than 300' of travel (minutes)
Ns	= sheet flow Manning's effective roughness coefficient
L	= flow length (ft)
P2	= 2-year, 24 hour rainfall (in)
So	= slope of hydraulic grade line (land slope, ft/ft)

Shallow Concentrated Flow (after initial 300')

$$T = \frac{L}{(60)(k\sqrt{S_0})}$$

T	= travel time for sheet flow (min)
L	= flow length (ft)
So	= slope of hydraulic grade line (land slope, ft/ft)
k	= time of concentration velocity factor (ft/s)

Flow in Swales

Q = (1.486/n) x A x R^2/3 x S^1/2 (Manning's Equation)

Tc	= time of concentration for gutter flow (minutes)
A	= area of flow (sf)
R	= hydraulic radius (ft)
Ls	= side slope
Q	= quantity of flow (ft^3/sec)
V	= average velocity of flow (ft/sec)
L	= length of flow
Ve	= vertical length of side slope
Ho	= horizontal length of side slope
Bw	= base width (in)
D	= depth (in)
S	= slope (ft/ft)
n	= Manning's n

Flow in gutters

$$V = \frac{1.12}{n}(S)^{0.5}(Sx)^{.67}(T)^{0.67}$$

Tc	= time of concentration for gutter flow (minutes)
V	= average velocity of flow (ft/sec)
Q	= quantity of flow (ft^3/sec)
S	= street longitudinal slope (ft/ft)
Sx	= street cross slope (ft/ft)
T	= total width of flow in the gutter (ft)
n	= sheet flow Manning's (pavement = 0.018)
L	= Length of flow (ft)

Flow in pipes

Mannings Equation

Tc	= time of concentration in pipe (minutes)
V	= calculated velocity pipe full (ft/sec)
Q	= quantity of flow (ft^3/sec)
n	= Manning's n
D	= pipe Diameter (in)
S	= slope (ft/ft)
L	= length of pipe

COEFFICIENTS

Ns = = Manning's coefficient (sheet flow)
n values are for sheet flow only

Design Value	
0.011	Concrete or asphalt
0.010	Bare soil
0.020	Graveled surface
0.020	Bare clay - loam (eroded)
0.150	Grass (short prairie)
0.240	Grass (dense lawn)
0.410	Grass (bermuda)
0.400	Woods (light underbrush)
0.800	Woods (dense underbrush)

k = = time of concentration velocity factor (ft/s)

Design Value	
3	Forest with heavy ground cover and meadows (n=0.10)
5	Brushy ground with some trees (n=0.060)
8	Fallow or cultivation (n=0.040)
9	High grass (n=0.035)
11	Short grass, pasture or lawns (n=0.030)
13	Nearly bare ground (n=0.025)
27	Paved and gravel areas (n=0.012)

n = = Manning's coefficient (channel)

Design Value	
	CONSTRUCTED CHANNELS
	A. Earth, straight and uniform
0.018	Earth (straight and uniform)
0.025	Gravel (straight and uniform)
0.027	Grass (with weeds)
	B. Earth, winding and sluggish
0.025	Earth (no vegetation)
0.030	Grass (some weeds)
0.035	Dense weeds (deep channel)
0.030	Earth (rubble bottom and sides)
0.035	Stony bottom and weedy banks
0.040	Cobble bottom with clean sides
	C. Rock lined
0.035	Smooth and uniform
0.040	Jagged and irregular
	D. Channels not maintained (weeds and brush uncut)
0.050	Dense weeds (high as flow depth)
0.050	Clean bottom (brush on sides)
0.100	Dense brush (high stage)
0.200	Water quality swales (mowed regulary)
	NATURAL STREAMS
0.029	Clean (straight no pools)
0.035	Clean (straight no pools with weeds and stones)
0.039	Clean (winding pools)
0.042	Clean (winding pools weeds and stones)
0.052	Clean (winding pools weeds and large stones)
0.065	Weedy (sluggish with deep pools)
0.112	Very weedy (sluggish with deep pools)

SCS RUNOFF CURVE NUMBERS (CN)

For Selected Land Uses

LAND USE DESCRIPTION		RUNOFF CURVE NUMBERS (CN) BY HYDROLOGIC SOIL GROUP A	B	C	D
Cultivated land (1):	winter condition	86	91	94	95
Mountain open areas:	low growing brush and grasslands	74	82	89	92
Meadow or pasture:		65	78	85	89
Wood or forest land:	undisturbed or older second growth	42	64	76	81
Wood or forest land:	young second growth or brush	55	72	81	86
Orchard:	with cover crop	81	88	92	94
Open spaces, lawns, parks, golf courses, cemetaries, landscaping					
Good condition:	grass cover on 75% or more of the area	68	80	86	90
Fair condition:	grass cover on 50% to 75% of the area	77	85	90	92
Gravel roads and parking lots		76	85	89	91
Dirt Roads and parking lots		72	82	87	89
Impervious surfaces:	pavement, roof, etc.	98	98	98	98
Open water bodies:	lakes, wetlands, ponds, etc.	100	100	100	100

Single Family Residential (2)		
Dwelling Unit/Gross Acre (DU/GA)	% Impervious (3)	Select separate curve numbers for the pervious and impervious portion of the site or basin.
1.0	15	
2.0	25	
3.0	34	
4.0	42	
5.0	48	
6.0	52	
7.0	56	
Planned unit developments, condominiums, apartments, commercial businesses and industrial areas.	Use actual impervious area.	

(1) Detailed information relating to specific agricultural land uses is available in the National Engineering Engineering Handbook, Section 4, Hydrology, chapter 9, August 1972.
(2) Assume site drains to storm system.
(3) For this land use, the remaining pervious areas are assumed to be lawn in good condition.

Project Name: Bull Run Terrace
Hydrograph Analysis Summary

Job # 019-035
Date: 11/20/2019

Rainfall (year)	Rainfall (inches)
2	3.50
5	4.50
10	4.80
25	5.50
100	0.00

Pre-Developed

Pervious		
Area =	10.88	acres
CN =	83	na
Impervious		
Area =	0	acres
CN =	98	na
Tc =	30	min
Total A =	10.88	acres

Developed

Pervious		
Area =	8.77	acres
CN =	83	na
Impervious		
Area =	2.11	acres
CN =	98	na
Tc =	5	min
Total A =	10.88	acres

Note: The hydrographs shown are based on the S.C.S. Type - 1A, 24 hour storm using the SBUH method based on the King County Model.

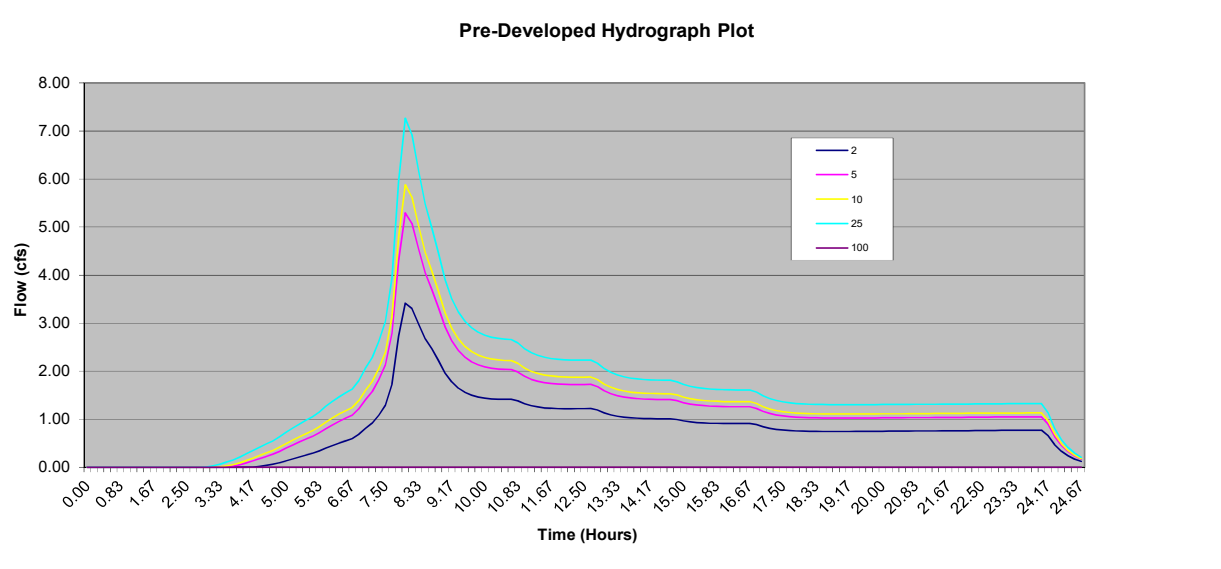
		Pre-Developed Hydrographs					Developed Hydrographs				
Year	=======>	2	5	10	25	100	2	5	10	25	100
Qpeak	cfs =>	3.42	5.30	5.88	7.26	0.00	6.14	8.99	9.87	11.94	0.00
Volume	cf =>	73,183	107,346	117,913	142,981	-	84,150	119,380	130,207	155,802	-
Tpeak	min =>	480	480	480	480	10	470	470	470	470	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17	7.83	7.83	7.83	7.83	0.17
Hydrograph Name=>		2	5	10	25	100	2	5	10	25	100
Time (min)	Time (hr)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.00
40	0.67	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.03	0.06	0.00
50	0.83	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.07	0.09	0.00
60	1.00	0.00	0.00	0.00	0.00	0.00	0.04	0.08	0.09	0.12	0.00
70	1.17	0.00	0.00	0.00	0.00	0.00	0.06	0.10	0.11	0.15	0.00
80	1.33	0.00	0.00	0.00	0.00	0.00	0.07	0.11	0.13	0.16	0.00
90	1.50	0.00	0.00	0.00	0.00	0.00	0.08	0.13	0.14	0.18	0.00
100	1.67	0.00	0.00	0.00	0.00	0.00	0.09	0.14	0.15	0.19	0.00
110	1.83	0.00	0.00	0.00	0.00	0.00	0.11	0.17	0.19	0.23	0.00
120	2.00	0.00	0.00	0.00	0.00	0.00	0.13	0.20	0.22	0.26	0.00
130	2.17	0.00	0.00	0.00	0.00	0.00	0.14	0.21	0.23	0.27	0.00
140	2.33	0.00	0.00	0.00	0.00	0.00	0.15	0.22	0.24	0.28	0.00
150	2.50	0.00	0.00	0.00	0.00	0.00	0.16	0.22	0.24	0.29	0.00
160	2.67	0.00	0.00	0.00	0.00	0.00	0.16	0.23	0.25	0.30	0.00
170	2.83	0.00	0.00	0.00	0.00	0.00	0.18	0.26	0.28	0.33	0.00
180	3.00	0.00	0.00	0.00	0.01	0.00	0.21	0.29	0.31	0.39	0.00
190	3.17	0.00	0.00	0.00	0.03	0.00	0.21	0.29	0.32	0.44	0.00
200	3.33	0.00	0.00	0.01	0.06	0.00	0.22	0.30	0.34	0.50	0.00
210	3.50	0.00	0.01	0.03	0.11	0.00	0.22	0.32	0.39	0.55	0.00
220	3.67	0.00	0.03	0.05	0.15	0.00	0.23	0.36	0.43	0.60	0.00
230	3.83	0.00	0.05	0.09	0.21	0.00	0.25	0.44	0.51	0.71	0.00
240	4.00	0.00	0.09	0.14	0.28	0.00	0.27	0.51	0.60	0.82	0.00
250	4.17	0.01	0.13	0.19	0.35	0.00	0.29	0.56	0.65	0.88	0.00
260	4.33	0.02	0.18	0.24	0.42	0.00	0.32	0.61	0.70	0.94	0.00
270	4.50	0.04	0.23	0.30	0.48	0.00	0.35	0.65	0.75	0.99	0.00
280	4.67	0.06	0.27	0.35	0.55	0.00	0.38	0.69	0.79	1.04	0.00
290	4.83	0.10	0.33	0.42	0.63	0.00	0.45	0.79	0.91	1.19	0.00
300	5.00	0.13	0.40	0.49	0.73	0.00	0.52	0.90	1.03	1.34	0.00
310	5.17	0.17	0.46	0.56	0.82	0.00	0.56	0.95	1.08	1.39	0.00
320	5.33	0.21	0.53	0.63	0.90	0.00	0.59	1.00	1.13	1.45	0.00
330	5.50	0.25	0.59	0.70	0.98	0.00	0.63	1.04	1.18	1.50	0.00
340	5.67	0.29	0.64	0.76	1.05	0.00	0.66	1.08	1.22	1.55	0.00
350	5.83	0.34	0.72	0.84	1.15	0.00	0.75	1.22	1.37	1.73	0.00
360	6.00	0.40	0.80	0.94	1.27	0.00	0.84	1.35	1.52	1.91	0.00
370	6.17	0.45	0.88	1.03	1.37	0.00	0.88	1.40	1.57	1.97	0.00
380	6.33	0.50	0.96	1.10	1.47	0.00	0.91	1.45	1.62	2.02	0.00
390	6.50	0.55	1.02	1.18	1.55	0.00	0.95	1.49	1.66	2.07	0.00
400	6.67	0.60	1.09	1.24	1.63	0.00	0.98	1.53	1.71	2.12	0.00
410	6.83	0.69	1.22	1.39	1.81	0.00	1.22	1.89	2.11	2.61	0.00
420	7.00	0.81	1.41	1.60	2.07	0.00	1.48	2.27	2.52	3.12	0.00
430	7.17	0.92	1.57	1.78	2.28	0.00	1.54	2.34	2.59	3.19	0.00
440	7.33	1.08	1.82	2.05	2.61	0.00	1.88	2.84	3.14	3.86	0.00
450	7.50	1.29	2.13	2.40	3.04	0.00	2.24	3.37	3.71	4.54	0.00
460	7.67	1.73	2.80	3.13	3.93	0.00	3.42	5.07	5.58	6.79	0.00
470	7.83	2.73	4.30	4.79	5.96	0.00	6.14	8.99	9.87	11.94	0.00
480	8.00	3.42	5.30	5.88	7.26	0.00	5.91	8.57	9.39	11.31	0.00
490	8.17	3.31	5.08	5.62	6.92	0.00	3.44	4.93	5.39	6.46	0.00
500	8.33	2.98	4.55	5.03	6.18	0.00	2.45	3.50	3.82	4.57	0.00
510	8.50	2.68	4.05	4.48	5.48	0.00	2.12	3.02	3.30	3.94	0.00
520	8.67	2.46	3.71	4.09	4.99	0.00	2.15	3.05	3.33	3.97	0.00

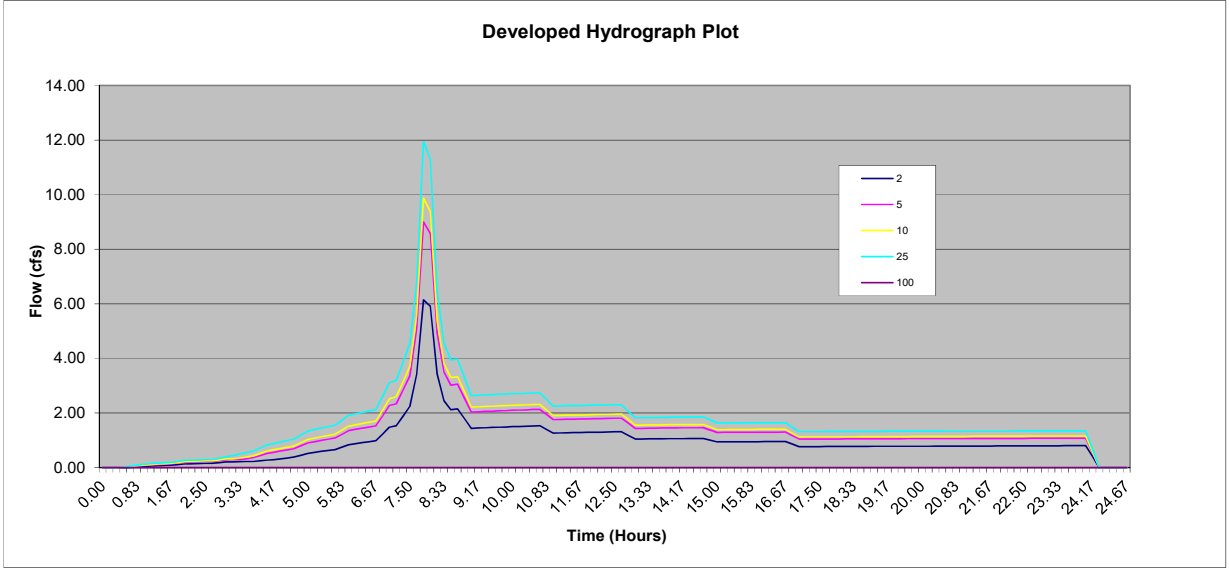
		Pre-Developed Hydrographs					Developed Hydrographs				
Year	=======>	2	5	10	25	100	2	5	10	25	100
Qpeak	cfs =>	3.42	5.30	5.88	7.26	0.00	6.14	8.99	9.87	11.94	0.00
Volume	cf =>	73,183	107,346	117,913	142,981	-	84,150	119,380	130,207	155,802	-
Tpeak	min =>	480	480	480	480	10	470	470	470	470	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17	7.83	7.83	7.83	7.83	0.17
Hydrograph Name=>		2	5	10	25	100	2	5	10	25	100
Time (min)	Time (hr)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)
530	8.83	2.22	3.33	3.66	4.46	0.00	1.80	2.55	2.78	3.31	0.00
540	9.00	1.96	2.92	3.21	3.91	0.00	1.44	2.04	2.22	2.64	0.00
550	9.17	1.78	2.63	2.90	3.51	0.00	1.45	2.05	2.23	2.65	0.00
560	9.33	1.65	2.43	2.67	3.23	0.00	1.46	2.06	2.24	2.66	0.00
570	9.50	1.56	2.29	2.52	3.04	0.00	1.47	2.07	2.25	2.67	0.00
580	9.67	1.50	2.20	2.41	2.90	0.00	1.48	2.08	2.26	2.68	0.00
590	9.83	1.46	2.13	2.34	2.81	0.00	1.49	2.09	2.27	2.70	0.00
600	10.00	1.44	2.09	2.29	2.75	0.00	1.50	2.10	2.28	2.71	0.00
610	10.17	1.42	2.06	2.25	2.71	0.00	1.51	2.11	2.29	2.71	0.00
620	10.33	1.42	2.04	2.24	2.68	0.00	1.52	2.12	2.30	2.72	0.00
630	10.50	1.41	2.04	2.22	2.67	0.00	1.53	2.13	2.31	2.73	0.00
640	10.67	1.42	2.03	2.22	2.66	0.00	1.53	2.14	2.32	2.74	0.00
650	10.83	1.38	1.98	2.16	2.59	0.00	1.40	1.95	2.11	2.50	0.00
660	11.00	1.32	1.89	2.07	2.47	0.00	1.27	1.76	1.91	2.26	0.00
670	11.17	1.28	1.83	2.00	2.39	0.00	1.27	1.77	1.91	2.26	0.00
680	11.33	1.26	1.79	1.95	2.33	0.00	1.28	1.77	1.92	2.27	0.00
690	11.50	1.24	1.76	1.92	2.29	0.00	1.28	1.78	1.92	2.27	0.00
700	11.67	1.23	1.74	1.90	2.26	0.00	1.29	1.78	1.93	2.28	0.00
710	11.83	1.22	1.73	1.89	2.25	0.00	1.29	1.79	1.93	2.28	0.00
720	12.00	1.22	1.73	1.88	2.24	0.00	1.30	1.79	1.94	2.29	0.00
730	12.17	1.22	1.72	1.88	2.23	0.00	1.30	1.80	1.94	2.29	0.00
740	12.33	1.22	1.72	1.88	2.23	0.00	1.31	1.80	1.95	2.30	0.00
750	12.50	1.22	1.72	1.88	2.23	0.00	1.31	1.80	1.95	2.30	0.00
760	12.67	1.23	1.73	1.88	2.23	0.00	1.31	1.81	1.96	2.31	0.00
770	12.83	1.19	1.68	1.83	2.17	0.00	1.18	1.62	1.76	2.07	0.00
780	13.00	1.13	1.59	1.73	2.06	0.00	1.05	1.44	1.56	1.83	0.00
790	13.17	1.09	1.53	1.67	1.98	0.00	1.05	1.44	1.56	1.83	0.00
800	13.33	1.06	1.49	1.62	1.92	0.00	1.05	1.44	1.56	1.84	0.00
810	13.50	1.04	1.46	1.59	1.88	0.00	1.05	1.45	1.56	1.84	0.00
820	13.67	1.03	1.44	1.57	1.86	0.00	1.06	1.45	1.57	1.84	0.00
830	13.83	1.02	1.43	1.55	1.84	0.00	1.06	1.45	1.57	1.84	0.00
840	14.00	1.02	1.42	1.54	1.83	0.00	1.06	1.45	1.57	1.85	0.00
850	14.17	1.01	1.42	1.54	1.82	0.00	1.06	1.46	1.57	1.85	0.00
860	14.33	1.01	1.41	1.53	1.81	0.00	1.07	1.46	1.58	1.85	0.00
870	14.50	1.01	1.41	1.53	1.81	0.00	1.07	1.46	1.58	1.85	0.00
880	14.67	1.01	1.41	1.53	1.81	0.00	1.07	1.46	1.58	1.86	0.00
890	14.83	1.00	1.39	1.50	1.78	0.00	1.01	1.38	1.49	1.74	0.00
900	15.00	0.97	1.35	1.46	1.72	0.00	0.94	1.29	1.39	1.63	0.00
910	15.17	0.95	1.32	1.43	1.69	0.00	0.94	1.29	1.39	1.63	0.00
920	15.33	0.93	1.30	1.41	1.66	0.00	0.95	1.29	1.39	1.63	0.00
930	15.50	0.92	1.28	1.39	1.64	0.00	0.95	1.29	1.40	1.64	0.00
940	15.67	0.92	1.27	1.38	1.63	0.00	0.95	1.29	1.40	1.64	0.00
950	15.83	0.91	1.27	1.37	1.62	0.00	0.95	1.30	1.40	1.64	0.00
960	16.00	0.91	1.26	1.37	1.62	0.00	0.95	1.30	1.40	1.64	0.00
970	16.17	0.91	1.26	1.37	1.61	0.00	0.95	1.30	1.40	1.64	0.00
980	16.33	0.91	1.26	1.37	1.61	0.00	0.96	1.30	1.40	1.64	0.00
990	16.50	0.91	1.26	1.37	1.61	0.00	0.96	1.30	1.41	1.65	0.00
1000	16.67	0.91	1.26	1.37	1.61	0.00	0.96	1.30	1.41	1.65	0.00
1010	16.83	0.89	1.23	1.33	1.56	0.00	0.86	1.17	1.27	1.48	0.00
1020	17.00	0.84	1.16	1.26	1.49	0.00	0.77	1.04	1.13	1.32	0.00
1030	17.17	0.81	1.12	1.21	1.43	0.00	0.77	1.05	1.13	1.32	0.00
1040	17.33	0.79	1.09	1.18	1.39	0.00	0.77	1.05	1.13	1.32	0.00
1050	17.50	0.78	1.07	1.16	1.36	0.00	0.77	1.05	1.13	1.32	0.00
1060	17.67	0.76	1.05	1.14	1.34	0.00	0.77	1.05	1.13	1.32	0.00
1070	17.83	0.76	1.04	1.13	1.33	0.00	0.77	1.05	1.13	1.32	0.00
1080	18.00	0.75	1.04	1.12	1.32	0.00	0.77	1.05	1.13	1.33	0.00
1090	18.17	0.75	1.03	1.12	1.31	0.00	0.78	1.05	1.13	1.33	0.00
1100	18.33	0.75	1.03	1.11	1.31	0.00	0.78	1.05	1.13	1.33	0.00
1110	18.50	0.75	1.03	1.11	1.31	0.00	0.78	1.05	1.14	1.33	0.00
1120	18.67	0.75	1.03	1.11	1.30	0.00	0.78	1.05	1.14	1.33	0.00
1130	18.83	0.75	1.03	1.11	1.30	0.00	0.78	1.05	1.14	1.33	0.00
1140	19.00	0.75	1.03	1.11	1.30	0.00	0.78	1.06	1.14	1.33	0.00
1150	19.17	0.75	1.03	1.11	1.30	0.00	0.78	1.06	1.14	1.33	0.00
1160	19.33	0.75	1.03	1.11	1.30	0.00	0.78	1.06	1.14	1.33	0.00
1170	19.50	0.75	1.03	1.11	1.30	0.00	0.78	1.06	1.14	1.33	0.00
1180	19.67	0.75	1.03	1.11	1.30	0.00	0.78	1.06	1.14	1.33	0.00
1190	19.83	0.75	1.03	1.11	1.31	0.00	0.78	1.06	1.14	1.33	0.00
1200	20.00	0.75	1.03	1.11	1.31	0.00	0.78	1.06	1.14	1.33	0.00
1210	20.17	0.75	1.03	1.11	1.31	0.00	0.79	1.06	1.14	1.34	0.00
1220	20.33	0.75	1.03	1.11	1.31	0.00	0.79	1.06	1.14	1.34	0.00
1230	20.50	0.75	1.03	1.12	1.31	0.00	0.79	1.06	1.15	1.34	0.00

		Pre-Developed Hydrographs					Developed Hydrographs				
Year ========>		**2**	**5**	**10**	**25**	**100**	**2**	**5**	**10**	**25**	**100**
Qpeak	cfs =>	**3.42**	**5.30**	**5.88**	**7.26**	**0.00**	**6.14**	**8.99**	**9.87**	**11.94**	**0.00**
Volume	cf =>	73,183	107,346	117,913	142,981	-	84,150	119,380	130,207	155,802	-
Tpeak	min =>	480	480	480	480	10	470	470	470	470	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17	7.83	7.83	7.83	7.83	0.17
Hydrograph Name=>		2	5	10	25	100	2	5	10	25	100
Time (min)	Time (hr)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)
1240	20.67	0.75	1.03	1.12	1.31	0.00	0.79	1.06	1.15	1.34	0.00
1250	20.83	0.76	1.03	1.12	1.31	0.00	0.79	1.06	1.15	1.34	0.00
1260	21.00	0.76	1.03	1.12	1.31	0.00	0.79	1.07	1.15	1.34	0.00
1270	21.17	0.76	1.04	1.12	1.31	0.00	0.79	1.07	1.15	1.34	0.00
1280	21.33	0.76	1.04	1.12	1.31	0.00	0.79	1.07	1.15	1.34	0.00
1290	21.50	0.76	1.04	1.12	1.31	0.00	0.79	1.07	1.15	1.34	0.00
1300	21.67	0.76	1.04	1.12	1.31	0.00	0.79	1.07	1.15	1.34	0.00
1310	21.83	0.76	1.04	1.12	1.32	0.00	0.79	1.07	1.15	1.34	0.00
1320	22.00	0.76	1.04	1.12	1.32	0.00	0.79	1.07	1.15	1.34	0.00
1330	22.17	0.76	1.04	1.12	1.32	0.00	0.79	1.07	1.15	1.34	0.00
1340	22.33	0.76	1.04	1.12	1.32	0.00	0.80	1.07	1.15	1.34	0.00
1350	22.50	0.76	1.04	1.13	1.32	0.00	0.80	1.07	1.15	1.35	0.00
1360	22.67	0.77	1.04	1.13	1.32	0.00	0.80	1.07	1.15	1.35	0.00
1370	22.83	0.77	1.04	1.13	1.32	0.00	0.80	1.07	1.16	1.35	0.00
1380	23.00	0.77	1.05	1.13	1.32	0.00	0.80	1.07	1.16	1.35	0.00
1390	23.17	0.77	1.05	1.13	1.32	0.00	0.80	1.07	1.16	1.35	0.00
1400	23.33	0.77	1.05	1.13	1.32	0.00	0.80	1.07	1.16	1.35	0.00
1410	23.50	0.77	1.05	1.13	1.32	0.00	0.80	1.08	1.16	1.35	0.00
1420	23.67	0.77	1.05	1.13	1.32	0.00	0.80	1.08	1.16	1.35	0.00
1430	23.83	0.77	1.05	1.13	1.33	0.00	0.80	1.08	1.16	1.35	0.00
1440	24.00	0.77	1.05	1.13	1.33	0.00	0.80	1.08	1.16	1.35	0.00
1450	24.17	0.66	0.90	0.97	1.14	0.00	0.40	0.54	0.58	0.68	0.00
1460	24.33	0.47	0.64	0.69	0.81	0.00	0.00	0.00	0.00	0.00	0.00
1470	24.50	0.34	0.46	0.50	0.58	0.00	0.00	0.00	0.00	0.00	0.00
1480	24.67	0.24	0.33	0.35	0.41	0.00	0.00	0.00	0.00	0.00	0.00
1490	24.67	0.17	0.23	0.25	0.30	0.00	0.00	0.00	0.00	0.00	0.00
1500	24.67	0.12	0.17	0.18	0.21	0.00	0.00	0.00	0.00	0.00	0.00

		Pre-Developed Hydrographs				
Year	=======>	2	5	10	25	100
Qpeak	cfs =>	3.42	5.30	5.88	7.26	0.00
Volume	cf =>	73,183	107,346	117,913	142,981	-
Tpeak	min =>	480	480	480	480	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17
Hydrograph Name=>		2	5	10	25	100
Time	Time	Hyd	Hyd	Hyd	Hyd	Hyd
(min)	(hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)

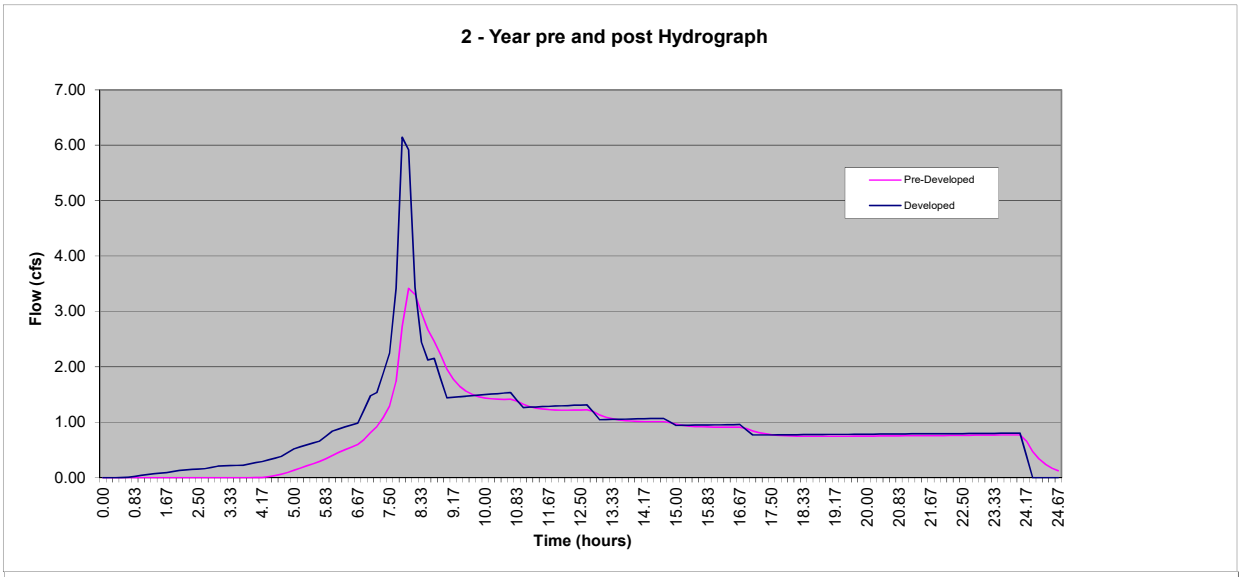
Developed Hydrographs				
2	5	10	25	100
6.14	8.99	9.87	11.94	0.00
84,150	119,380	130,207	155,802	-
470	470	470	470	10
7.83	7.83	7.83	7.83	0.17
2	5	10	25	100
Hyd	Hyd	Hyd	Hyd	Hyd
(cfs)	(cfs)	(cfs)	(cfs)	(cfs)

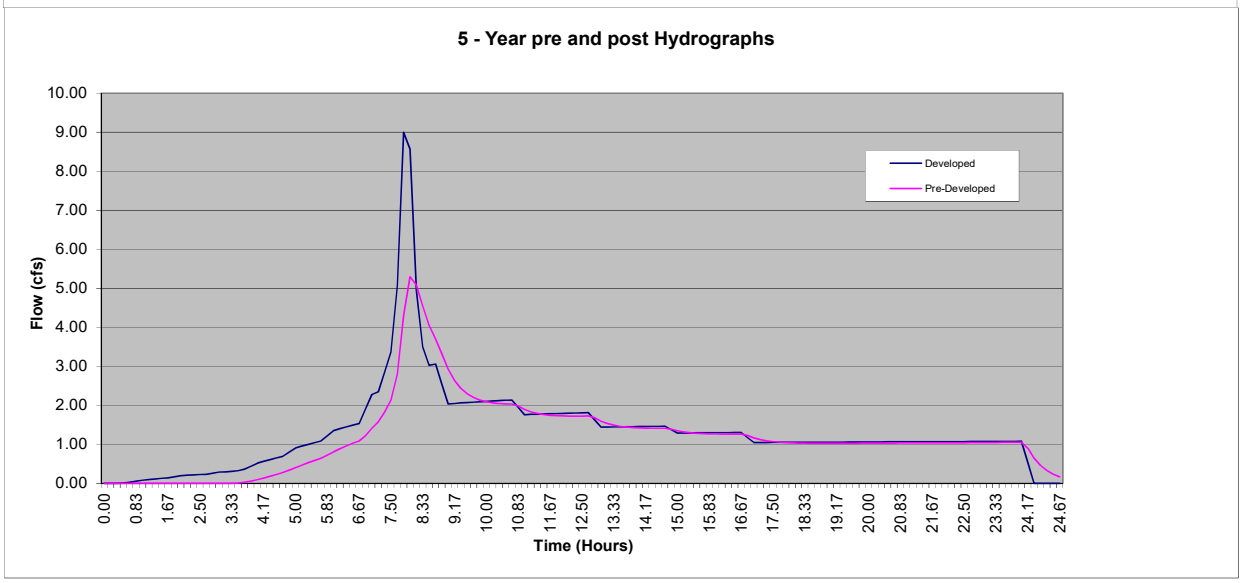




		Pre-Developed Hydrographs				
Year	=======>	2	5	10	25	100
Qpeak	cfs =>	3.42	5.30	5.88	7.26	0.00
Volume	cf =>	73,183	107,346	117,913	142,981	-
Tpeak	min =>	480	480	480	480	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17
Hydrograph Name=>		2	5	10	25	100
Time	Time	Hyd	Hyd	Hyd	Hyd	Hyd
(min)	(hr)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)

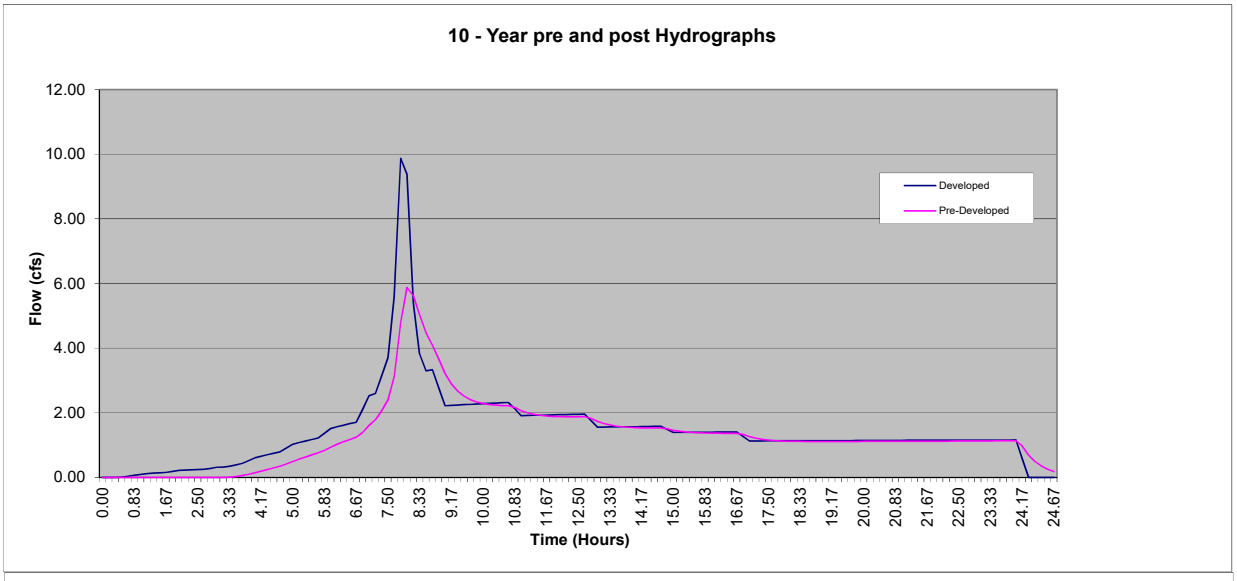
Developed Hydrographs				
2	5	10	25	100
6.14	8.99	9.87	11.94	0.00
84,150	119,380	130,207	155,802	-
470	470	470	470	10
7.83	7.83	7.83	7.83	0.17
2	5	10	25	100
Hyd	Hyd	Hyd	Hyd	Hyd
(cfs)	(cfs)	(cfs)	(cfs)	(cfs)

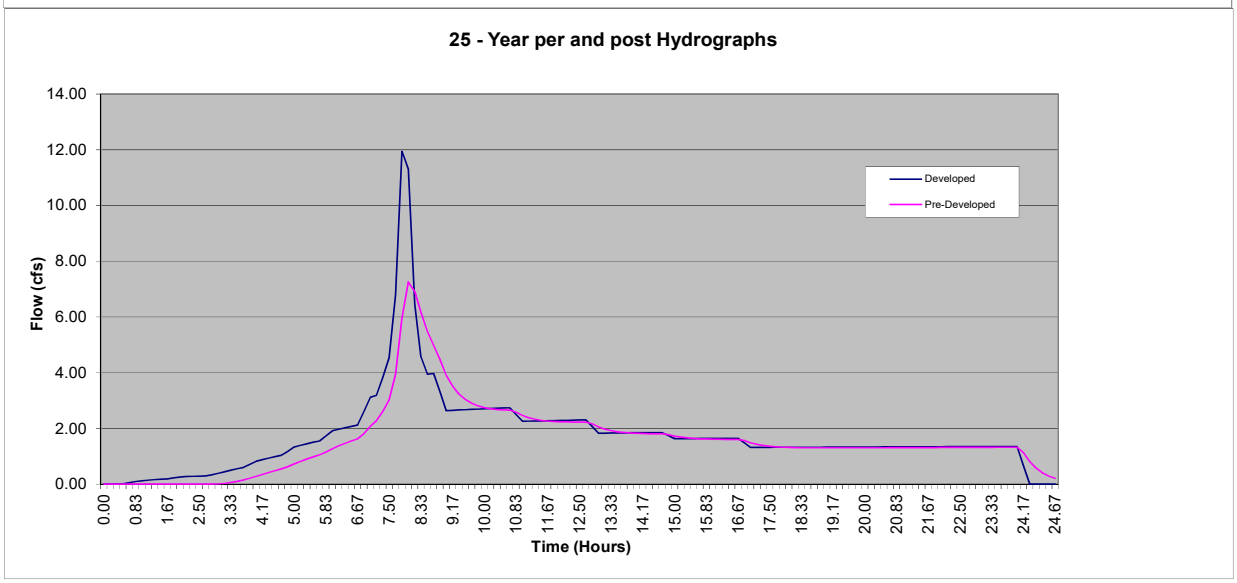




		Pre-Developed Hydrographs				
Year	=======>	2	5	10	25	100
Qpeak	cfs =>	3.42	5.30	5.88	7.26	0.00
Volume	cf =>	73,183	107,346	117,913	142,981	-
Tpeak	min =>	480	480	480	480	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17
Hydrograph Name=>		2	5	10	25	100
Time (min)	Time (hr)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)

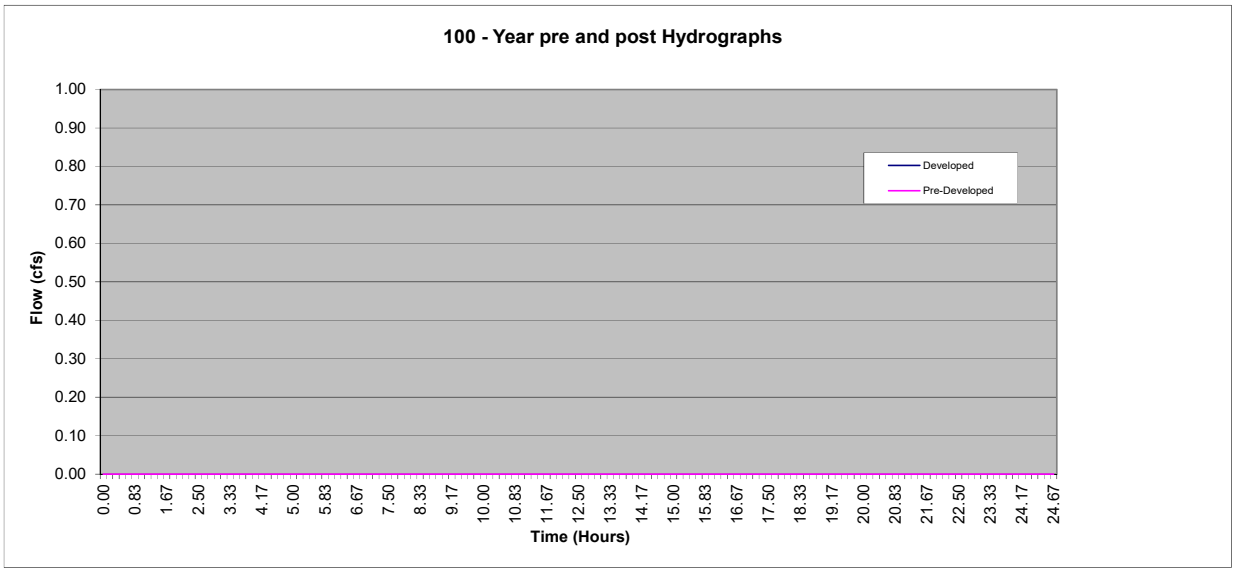
Developed Hydrographs				
2	5	10	25	100
6.14	8.99	9.87	11.94	0.00
84,150	119,380	130,207	155,802	-
470	470	470	470	10
7.83	7.83	7.83	7.83	0.17
2	5	10	25	100
Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)





		Pre-Developed Hydrographs				
Year	=======>	2	5	10	25	100
Qpeak	cfs =>	3.42	5.30	5.88	7.26	0.00
Volume	cf =>	73,183	107,346	117,913	142,981	-
Tpeak	min =>	480	480	480	480	10
Tpeak	hr =>	8.00	8.00	8.00	8.00	0.17
Hydrograph Name=>		2	5	10	25	100
Time (min)	Time (hr)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)

Developed Hydrographs				
2	5	10	25	100
6.14	8.99	9.87	11.94	0.00
84,150	119,380	130,207	155,802	-
470	470	470	470	10
7.83	7.83	7.83	7.83	0.17
2	5	10	25	100
Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)	Hyd (cfs)



Project Name:	**Bull Run Terrace**
Detention System Summary	
Job #	019-035
Date:	11/20/2019

Note: The detention system design is based on the King County Model "Facility Design Routine".

1) Detention Facility Design Input:

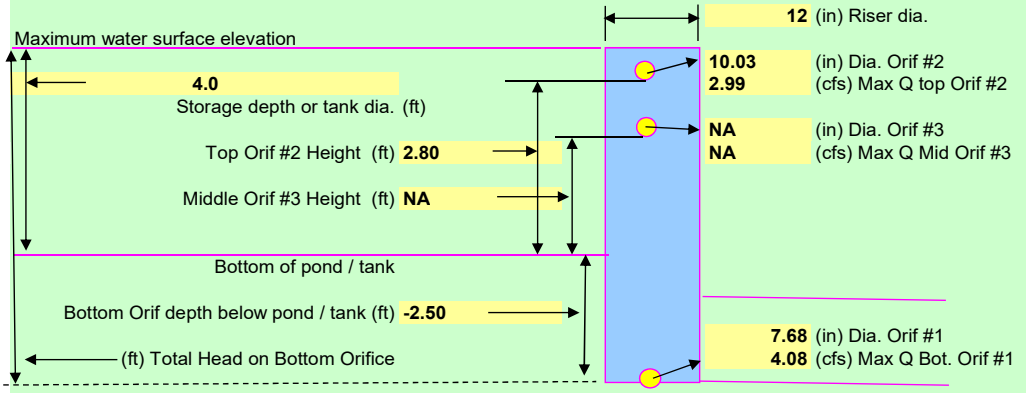
2) Type of facility:		USER	
3) Pond side slopes:	3	NA in USER mode	
4) Pond storage depth:	**4**	**ft (from bottom of pond to overflow)**	
5) Vertical permeability	0	min/in	
6) Number of orifices:	2		
7) Riser dia. =>	12	in	
8) Orifice coefficient	0.62	(typically 0.62)	
9) IE - bottom orifice:	-2.5	ft (distance below bottom of pond - Negative #)	
10) Max Q Bottom Orif. #1	4.08	cfs	
11) Top Orif #2 Height =	2.8	ft	
12) Max Q Mid Orif. #3	0.00	cfs	Orifice not being used
13) Mid Orif #3 Height =	0.90	ft	Orifice not being used

Detention Facility Design Results:

Performance year	Developed Inflow cfs	Pre-Developed Outflow cfs	**Actual Outflow cfs**	Peak Stage ft	Storage cf
100	0	0	**0**	0	-
25	11.94	7.26	**7.07**	4.00	12,323
10	9.87	5.88	**5.71**	3.27	9,696
5	8.99	5.30	**4.77**	2.94	8,562
2	6.14	3.42	**3.23**	1.57	4,252
			Required Storage ====		12,323

	Bottom Orif.	Middle Orif.	Top Orif.	Optional Weir Design
Total Q =	4.08	0.00	2.99	(for top orifice)
Head (ft) =	6.50	0.00	1.20	1.16 La (ft)
Dist. from bottom of pond (ft) =	-2.50	NA	2.80	132.65 < deg.
Orif. Dia. (in) =	7.68	0.00	10.03	Weir is an option

FLOW CONTROL STRUCTURE SCHEMATIC



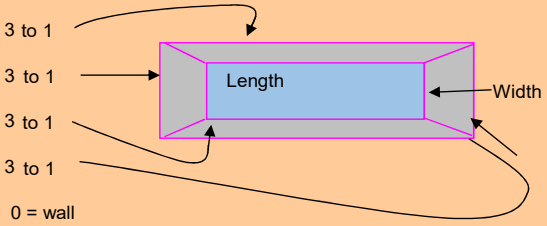
Project Name:	Bull Run Terrace
Detention Facility Type	
Job #	019-035
Date:	11/20/2019

Detention Facility Type:

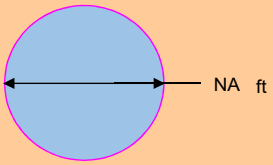
USER

L =	**NA ft**
W =	**40.0 ft**
D =	**4.0 ft**
Pond Area =	**NA sf**

DETENTION POND
NA



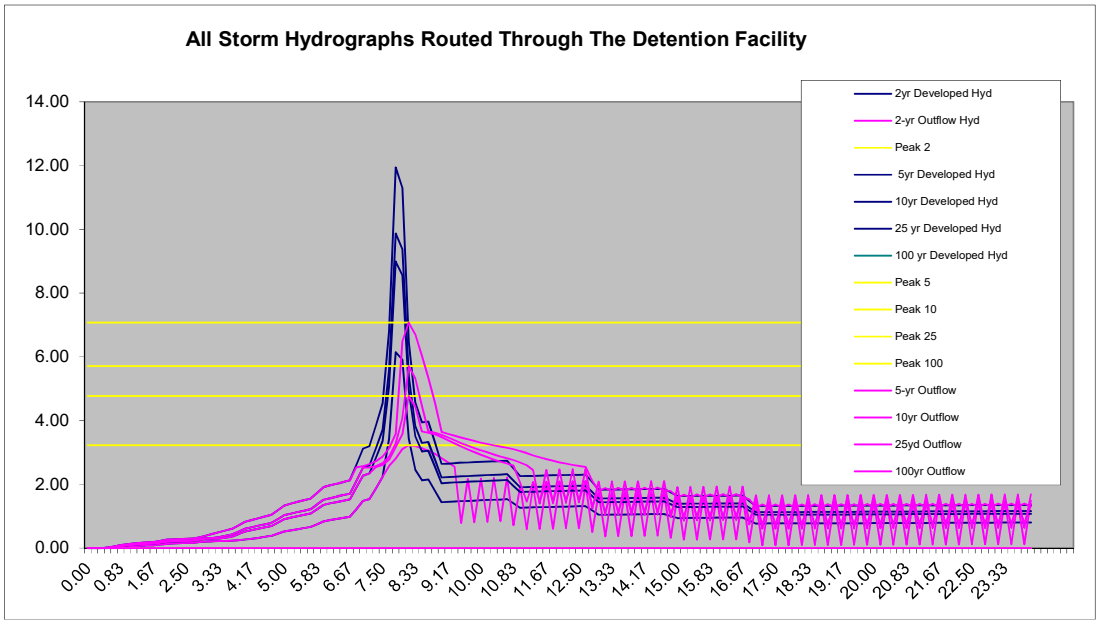
DETENTION TANK
NA

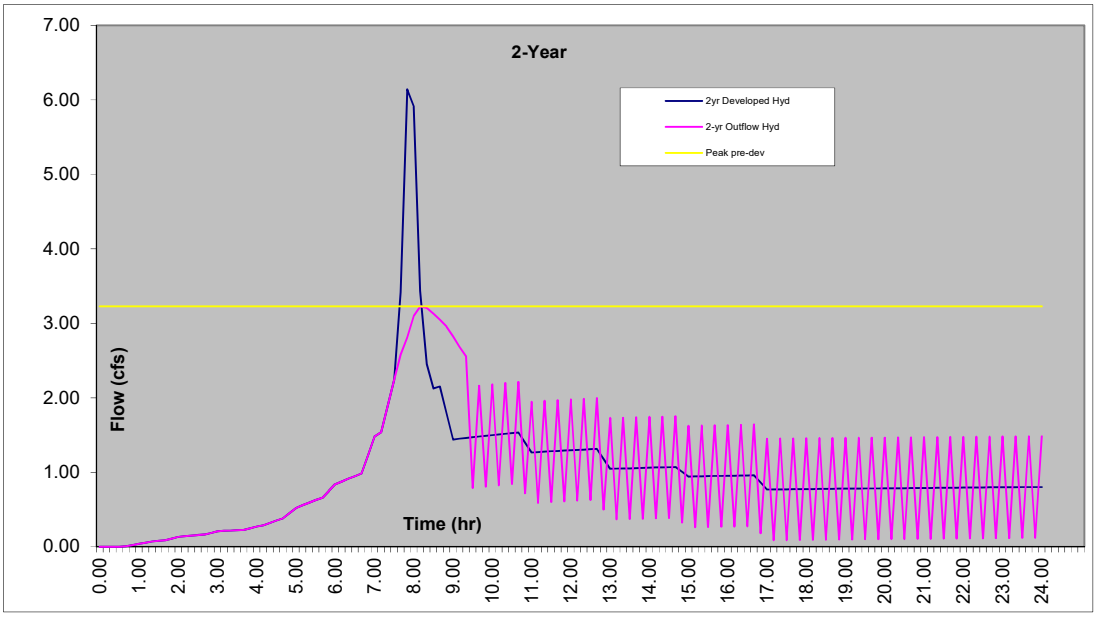


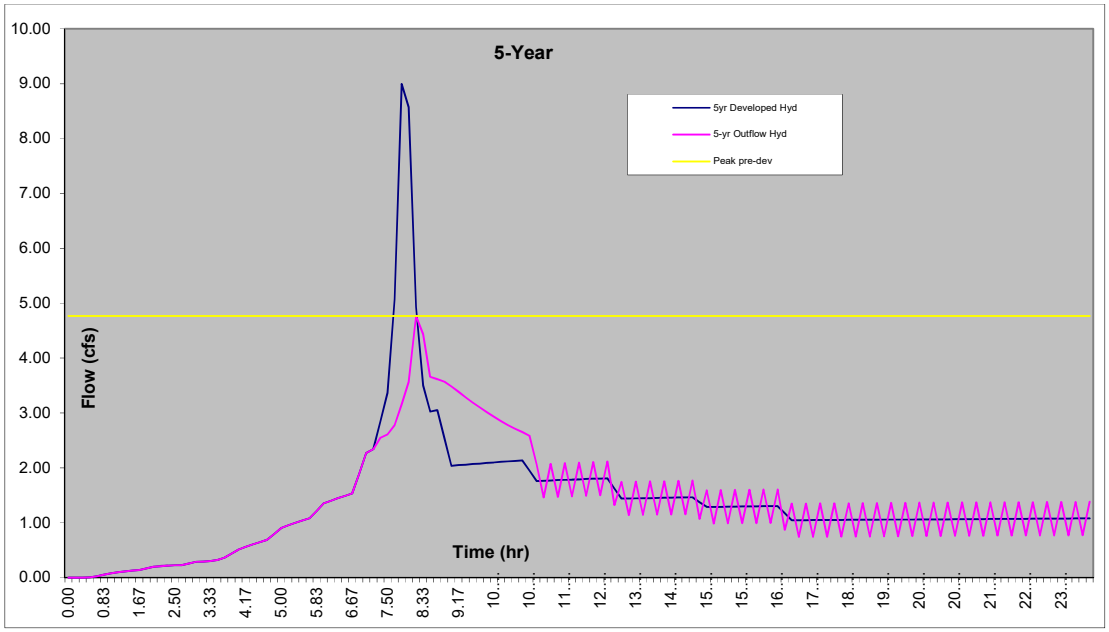
USER DEFINED POND

Pond Geometry

Stage (ft)	Area (sf)
0	2,443
1	2,750
2	3,070
3	3,405
4	3,754
5	4,000
6	4,500
7	5,000
8	5,500
9	6,000
10	6,500
11	7,000
12	7,500
13	8,000
14	8,500
15	9,000


All Storm Hydrographs Routed Through The Detention Facility
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00 0.83 1.67 2.50 3.33 4.17 5.00 5.83 6.67 7.50 8.33 9.17 10.00 10.83 11.67 12.50 13.33 14.17 15.00 15.83 16.67 17.50 18.33 19.17 20.00 20.83 21.67 22.50 23.33
2yr Developed Hyd
2-yr Outflow Hyd
Peak 2
5yr Developed Hyd
10yr Developed Hyd
25 yr Developed Hyd
100 yr Developed Hyd
Peak 5
Peak 10
Peak 25
Peak 100
5-yr Outflow
10yr Outflow
25yd Outflow
100yr Outflow


2-Year
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Flow (cfs)
Time (hr)
0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00 11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 19.00 20.00 21.00 22.00 23.00 24.00
2yr Developed Hyd
2-yr Outflow Hyd
Peak pre-dev


5-Year
5yr Developed Hyd
5-yr Outflow Hyd
Peak pre-dev
Flow (cfs)
Time (hr)
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
0.83
1.67
2.50
3.33
4.17
5.00
5.83
6.67
7.50
8.33
9.17
10
10
11
12
13
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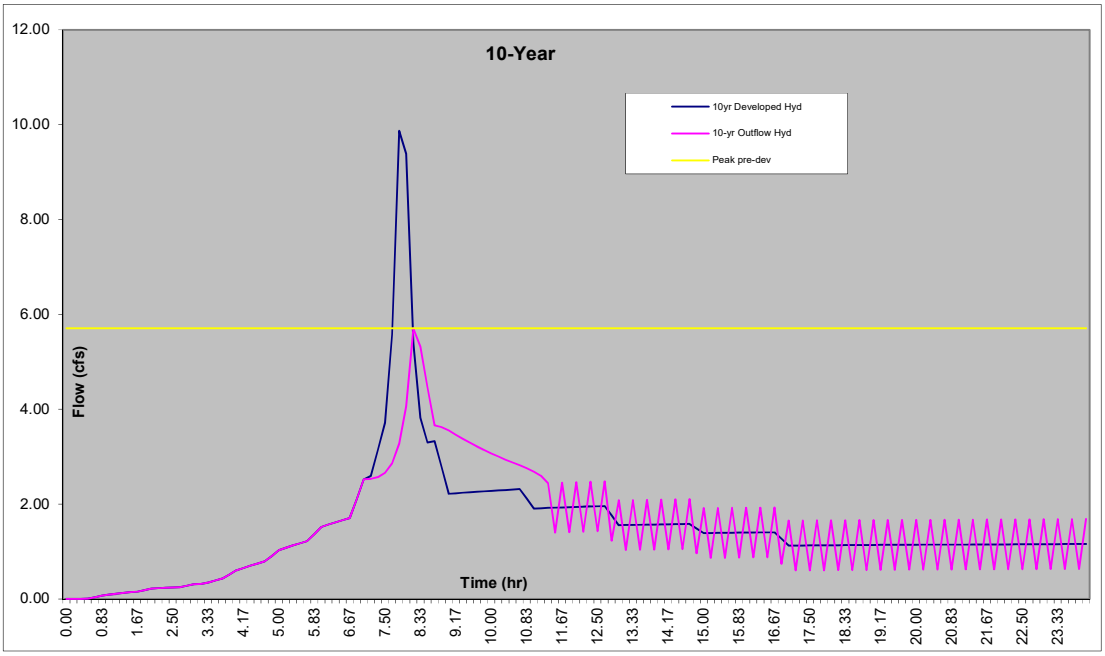
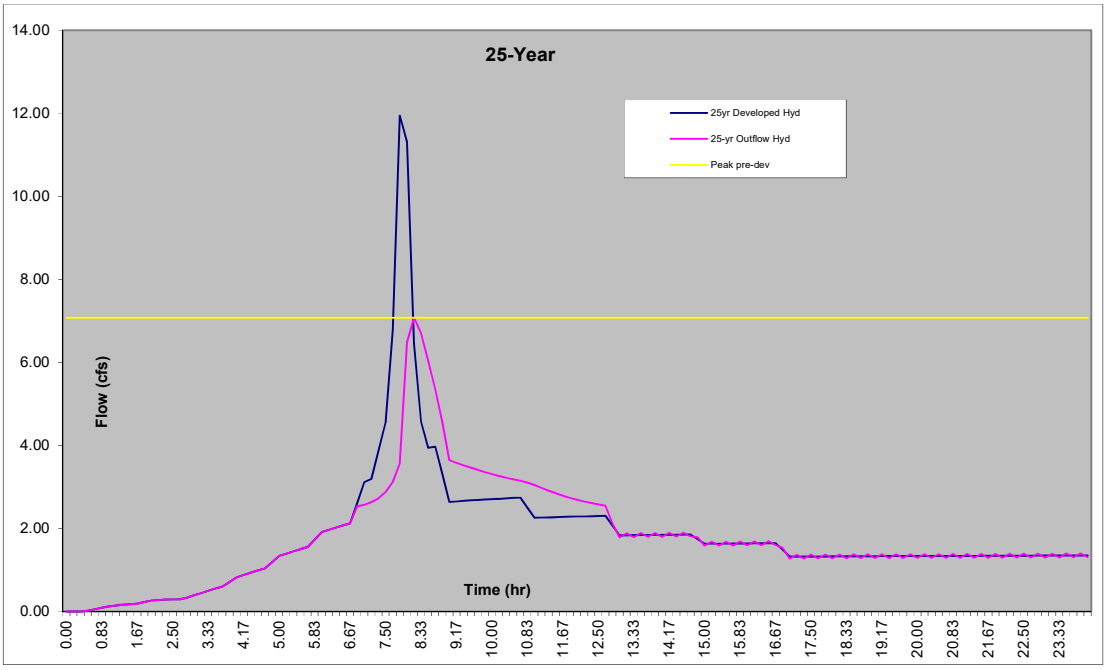
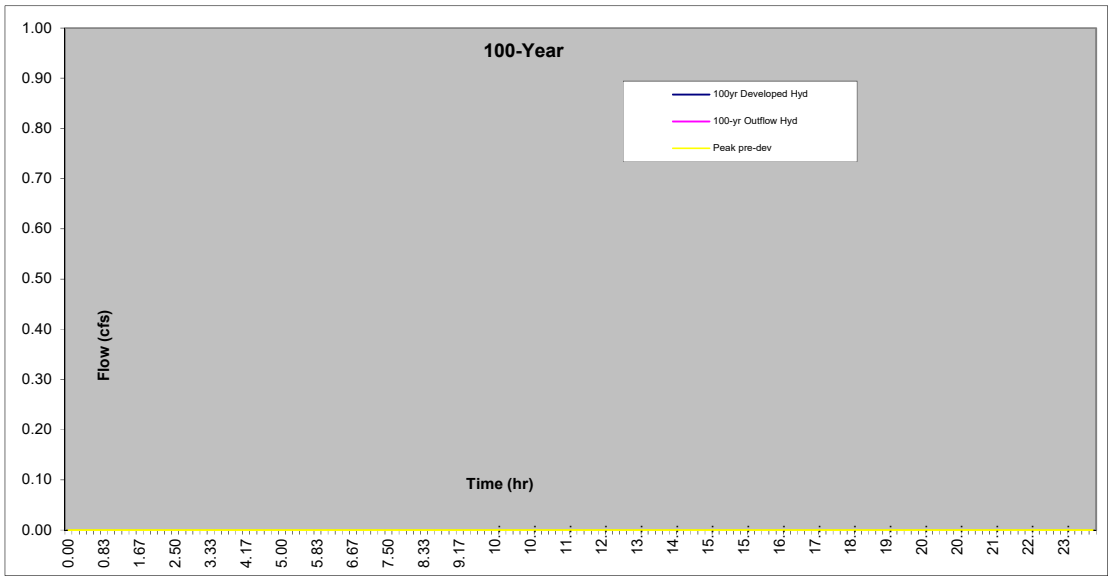
17
18
19
20
20
21
22
23

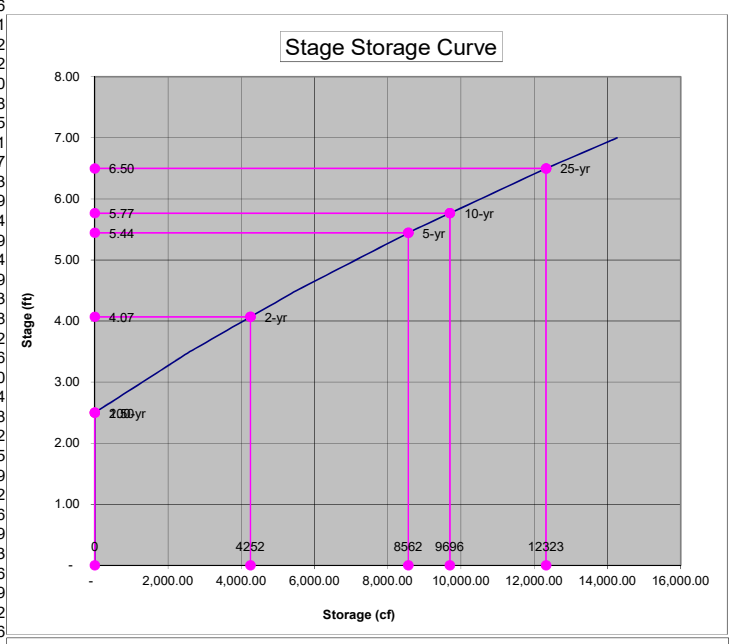

10-Year
10yr Developed Hyd
10-yr Outflow Hyd
Peak pre-dev
Flow (cfs)
Time (hr)
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
0.83
1.67
2.50
3.33
4.17
5.00
5.83
6.67
7.50
8.33
9.17
10.00
10.83
11.67
12.50
13.33
14.17
15.00
15.83
16.67
17.50
18.33
19.17
20.00
20.83
21.67
22.50
23.33

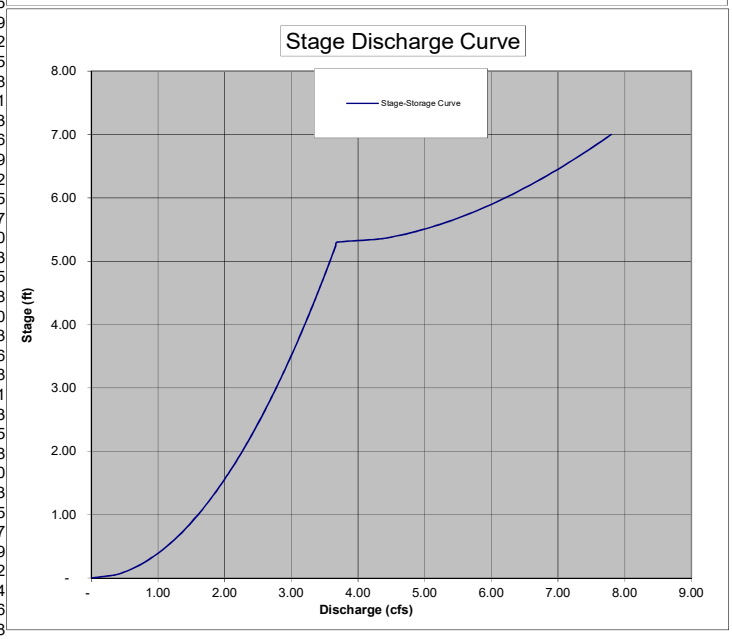

25-Year
25yr Developed Hyd
25-yr Outflow Hyd
Peak pre-dev
Flow (cfs)
Time (hr)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.00
0.83
1.67
2.50
3.33
4.17
5.00
5.83
6.67
7.50
8.33
9.17
10.00
10.83
11.67
12.50
13.33
14.17
15.00
15.83
16.67
17.50
18.33
19.17
20.00
20.83
21.67
22.50
23.33


100-Year
100yr Developed Hyd
100-yr Outflow Hyd
Peak pre-dev
Flow (cfs)
Time (hr)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00

Project Name: Bull Run Terrace
Stage Storage Summary
Job # 019-035
Date: 11/20/2019

Stage ft	Storage cf	Discharge cfs
-	-	-
0.05	-	0.36
0.10	-	0.51
0.15	-	0.62
0.20	-	0.72
0.25	-	0.80
0.30	-	0.88
0.35	-	0.95
0.40	-	1.01
0.45	-	1.07
0.50	-	1.13
0.55	-	1.19
0.60	-	1.24
0.65	-	1.29
0.70	-	1.34
0.75	-	1.39
0.80	-	1.43
0.85	-	1.48
0.90	-	1.52
0.95	-	1.56
1.00	-	1.60
1.05	-	1.64
1.10	-	1.68
1.15	-	1.72
1.20	-	1.75
1.25	-	1.79
1.30	-	1.82
1.35	-	1.86
1.40	-	1.89
1.45	-	1.93
1.50	-	1.96
1.55	-	1.99
1.60	-	2.02
1.65	-	2.06
1.70	-	2.09
1.75	-	2.12
1.80	-	2.15
1.85	-	2.18
1.90	-	2.21
1.95	-	2.23
2.00	-	2.26
2.05	-	2.29
2.10	-	2.32
2.15	-	2.35
2.20	-	2.37
2.25	-	2.40
2.30	-	2.43
2.35	-	2.45
2.40	-	2.48
2.45	-	2.50
2.50	-	2.53
2.55	129.83	2.56
2.60	259.65	2.58
2.65	389.48	2.61
2.70	519.30	2.63
2.75	649.13	2.65
2.80	778.95	2.68
2.85	908.78	2.70
2.90	1,038.60	2.73
2.95	1,168.43	2.75
3.00	1,298.25	2.77
3.05	1,428.08	2.79
3.10	1,557.90	2.82
3.15	1,687.73	2.84
3.20	1,817.55	2.86
3.25	1,947.38	2.88





Stage ft	Storage cf	Discharge cfs
3.30	2,077.20	2.91
3.35	2,207.03	2.93
3.40	2,336.85	2.95
3.45	2,466.68	2.97
3.50	2,596.50	2.99
3.55	2,742.00	3.02
3.60	2,887.50	3.04
3.65	3,033.00	3.06
3.70	3,178.50	3.08
3.75	3,324.00	3.10
3.80	3,469.50	3.12
3.85	3,615.00	3.14
3.90	3,760.50	3.16
3.95	3,906.00	3.18
4.00	4,051.50	3.20
4.05	4,197.00	3.22
4.10	4,342.50	3.24
4.15	4,488.00	3.26
4.20	4,633.50	3.28
4.25	4,779.00	3.30
4.30	4,924.50	3.32
4.35	5,070.00	3.34
4.40	5,215.50	3.36
4.45	5,361.00	3.38
4.50	5,506.50	3.39
4.55	5,668.38	3.41
4.60	5,830.25	3.43
4.65	5,992.13	3.45
4.70	6,154.00	3.47
4.75	6,315.88	3.49
4.80	6,477.75	3.51
4.85	6,639.63	3.52
4.90	6,801.50	3.54
4.95	6,963.38	3.56
5.00	7,125.25	3.58
5.05	7,287.13	3.60
5.10	7,449.00	3.61
5.15	7,610.88	3.63
5.20	7,772.75	3.65
5.25	7,934.63	3.67
5.30	8,096.50	3.68
5.35	8,258.38	4.31
5.40	8,420.25	4.58
5.45	8,582.13	4.79
5.50	8,744.00	4.97
5.55	8,922.98	5.14
5.60	9,101.95	5.28
5.65	9,280.93	5.42
5.70	9,459.90	5.55
5.75	9,638.88	5.67
5.80	9,817.85	5.79
5.85	9,996.83	5.90
5.90	10,175.80	6.00
5.95	10,354.78	6.11
6.00	10,533.75	6.21
6.05	10,712.73	6.30
6.10	10,891.70	6.40
6.15	11,070.68	6.49
6.20	11,249.65	6.58
6.25	11,428.63	6.66
6.30	11,607.60	6.75
6.35	11,786.58	6.83
6.40	11,965.55	6.91
6.45	12,144.53	6.99
6.50	12,323.50	7.07
6.55	12,517.35	7.15
6.60	12,711.20	7.23
6.65	12,905.05	7.30
6.70	13,098.90	7.38
6.75	13,292.75	7.45
6.80	13,486.60	7.52
6.85	13,680.45	7.59

Stage ft	Storage cf	Discharge cfs
6.90	13,874.30	7.66
6.95	14,068.15	7.73
7.00	14,262.00	7.80

Project Name: Bull Run Terrace
Rectangular, Sharp Crested Weir Calculations

Job # 019-035
Date: 11/20/2019

Weir Equation: $Q = C(L-0.2H)H^{3/2}$

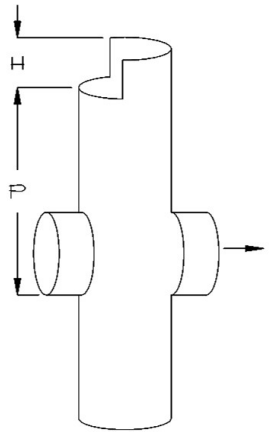
Q	= Flow over weir (cfs)
C	= 3.27 + 0.40 H/P (ft)
L	= Adjusted length of weir (La - 0.1H x 2) this is to account for side constraints
La	= Actual length of weir along pipes interior circumference (ft)
H	= Distance from bottom of weir to maximum head (ft)
P	= Distance from bottom of weir to outfall invert elevation (ft)
D	= Inside riser pipe diameter (in)
<	= Angle of opening for weir (maximum 180 degrees)

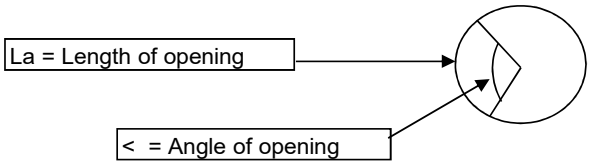
Given:

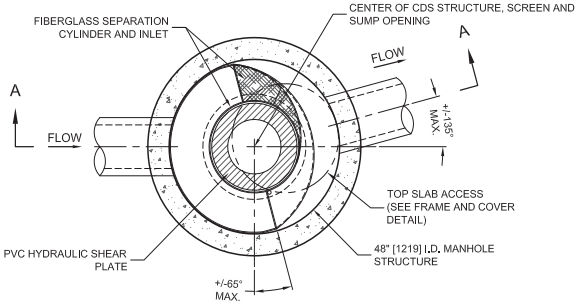
Q	2.99	cfs
H	1.20	ft
P	5.30	ft
D	12	in

Find:

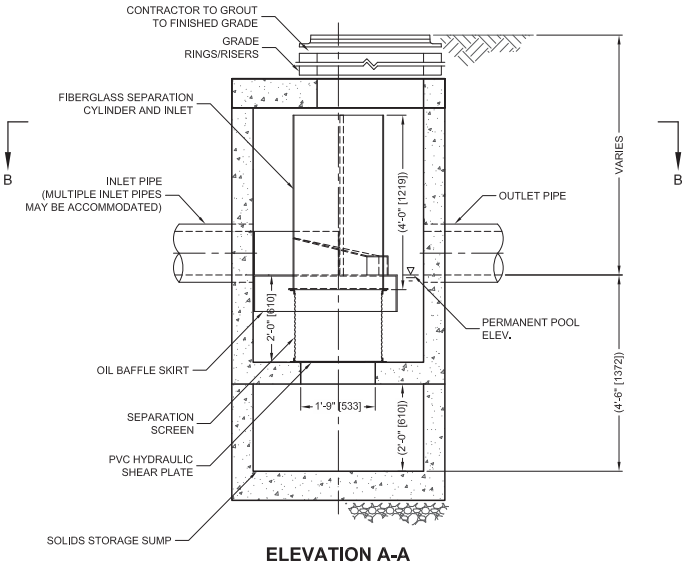
C	3.36	ft
L	0.92	ft
La	**1.16**	**ft**
<	**133**	**degrees**







PLAN VIEW B-B
N.T.S.



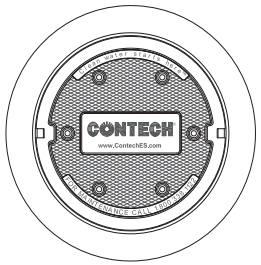
ELEVATION A-A
N.T.S.

CDS2015-4-C DESIGN NOTES

CDS2015-4-C RATED TREATMENT CAPACITY IS 0.7 CFS [19.8 L/s], OR PER LOCAL REGULATIONS. MAXIMUM HYDRAULIC INTERNAL BYPASS CAPACITY IS 10.0 CFS [283 L/s]. IF THE SITE CONDITIONS EXCEED 10.0 [283 L/s] CFS, AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.

THE STANDARD CDS2015-4-C CONFIGURATION IS SHOWN. ALTERNATE CONFIGURATIONS ARE AVAILABLE AND ARE LISTED BELOW. SOME CONFIGURATIONS MAY BE COMBINED TO SUIT SITE REQUIREMENTS.

CONFIGURATION DESCRIPTION
GRATED INLET ONLY (NO INLET PIPE)
GRATED INLET WITH INLET PIPE OR PIPES
CURB INLET ONLY (NO INLET PIPE)
CURB INLET WITH INLET PIPE OR PIPES
SEPARATE OIL BAFFLE (SINGLE INLET PIPE REQUIRED FOR THIS CONFIGURATION)
SEDIMENT WEIR FOR NJDEP / NJCAT CONFORMING UNITS



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID			
WATER QUALITY FLOW RATE (CFS OR L/s)			*
PEAK FLOW RATE (CFS OR L/s)			*
RETURN PERIOD OF PEAK FLOW (YRS)			*
SCREEN APERTURE (2400 OR 4700)			*
PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*
RIM ELEVATION			*
ANTI-FLOTATION BALLAST		WIDTH	HEIGHT
		*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET HS20 (AASHTO M 306) LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING PATENTS: 5,788,848; 6,649,048; 6,991,114; 7,186,755; 7,296,692; 7,297,266; 7,513,364; 7,753,213; 7,959,011; 8,557,104; 8,470,173; 8,673,157; 8,771,511; 8,801,926; 8,852,436; 9,032,681; 9,068,324; 9,095,792; 9,199,184; 9,266,045; 9,352,263; 9,352,264; 9,352,265; 9,352,266; 9,352,267; 9,352,268; 9,352,269; 9,352,270; 9,352,271; 9,352,272; 9,352,273; 9,352,274; 9,352,275; 9,352,276; 9,352,277; 9,352,278; 9,352,279; 9,352,280; 9,352,281; 9,352,282; 9,352,283; 9,352,284; 9,352,285; 9,352,286; 9,352,287; 9,352,288; 9,352,289; 9,352,290; 9,352,291; 9,352,292; 9,352,293; 9,352,294; 9,352,295; 9,352,296; 9,352,297; 9,352,298; 9,352,299; 9,352,300; 9,352,301; 9,352,302;

BULL RUN TERRACE SUBDIVISION
TRAFFIC IMPACT STUDY
(SEPTEMBER 2022 UPDATE)

SANDY, OREGON

PREPARED FOR:
Alex Reverman

PREPARED BY:
Michael Ard, PE
Ard Engineering

DATE:
September 29, 2022

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TABLE OF CONTENTS

Executive Summary 3

Project Description & Location 4

Existing Conditions 6

Site Trips 13

Future Conditions Analysis 17

Safety Analysis 22

Transportation Planning Rule Analysis 26

Conclusions 29

Appendix 30

EXECUTIVE SUMMARY

1. A property located on the south side of US Highway 26 opposite SE Vista Loop Drive in Sandy, Oregon is proposed for a subdivision which will support up to 192 apartment units and 8 duplex dwelling units, along with future commercial uses. The site will take access via an extension of Dubarko Road through the property, connecting the existing stub to Highway 26 opposite SE Vista Loop Drive.

2. Upon completion of residential development within the R-1, R-2, R-3 and C-3 zones, the subject property is projected to generate 94 new site trips during the morning peak hour, 115 trips during the evening peak hour, and 1,418 new daily site trips.

3. Based on the operational analysis, the study intersections currently operate acceptably and are projected to continue to operate acceptably under year 2024 background conditions without residential development of the subject property or connection of Dubarko Road to Highway 26.

4. All study intersections are projected to operate within capacity under year 2024 traffic conditions either with or without the addition of site trips from the proposed development. However, upon completion of the residential development within the proposed subdivision and the connection of Dubarko Road to Highway 26, it is projected that the intersection of Highway 26 at Dubarko Road will operate with very high delays for the northeast-bound Dubarko Road approach. Since vehicles exiting the site to the west can also travel west on Dubarko Road to Langensand Road prior to turning west on Highway 26, it is expected that some vehicles will divert and the actual delays will be lower than those reported.

5. Based on the crash data, the majority of the study intersections are currently operating acceptably with respect to safety. The intersection of Highway 211 at Dubarko Road has a high historical crash rate which recent ODOT safety improvements have not significantly reduced. It is recommended that the intersection be converted to all-way stop control. This improvement will also restore operation of the intersection to level of service D or better during the peak hours. No other safety improvements are recommended for the study area intersections at this time.

6. Based on the warrant analysis, a northwest-bound left-turn lane and a southeast-bound right-turn lane are projected to be warranted at the intersection of Highway 26 at Dubarko Road with completion of the Dubarko Road extension. No other turn lanes or traffic signals are recommended in conjunction with the proposed subdivision.

7. Intersection sight distance was evaluated for the new intersection of Highway 26 at Dubarko Road. The proposed intersection was found to have adequate sight distance in both directions.

8. Based on the transportation planning rule analysis for the proposed zone change, it is recommended that a trip cap of 340 PM net new peak hour trips be applied to the subject property as a condition of approval for the proposed zone change. No other mitigations are necessary or recommended in conjunction with the proposed zone change.

PROJECT DESCRIPTION & LOCATION

INTRODUCTION

A property located on the south side of US Highway 26 opposite SE Vista Loop Drive is proposed for development with up to 192 apartment units and 8 duplex dwelling units. The site will take access via an extension of Dubarko Road which will connect the existing stub (east of Meadow Avenue) to Highway 26 opposite SE Vista Loop Drive.

This report addresses the impacts of the proposed development on the surrounding street system. Based on discussions with the City of Sandy and ODOT staff, an operational and safety analysis was conducted for the proposed site access as well as the intersections of:

- Highway 26 at SE Ten Eyck Road;
- Highway 26 at SE Langensand Road;
- Highway 26 at SE Vista Loop Drive;
- Highway 211 at Dubarko Road; and
- Dubarko Road at SE Langensand Road.

The purpose of this analysis is to determine whether the surrounding transportation system is capable of safely and efficiently supporting the proposed use and to identify any necessary improvements and mitigations.

SITE LOCATION AND STUDY AREA DESCRIPTION

The project site has an area of approximately 16 acres, which is currently undeveloped. The property is surrounded by a mixture of residential development, agricultural uses and undeveloped forested land.

The proposed development will include an extension of Dubarko Road from its existing eastern terminus through the subject property to Highway 26 opposite SE Vista Loop Drive. The proposed development will take access via this newly extended segment of Dubarko Road.

US Highway 26 (Mt. Hood Highway) is classified by the Oregon Department of Transportation as a Statewide Highway and a Freight Route. It has two through lanes in each direction and added turn lanes at intersections. Between SE Langensand Road and SE Vista Loop Drive it has a center two-way left-turn lane. It has a posted speed limit of 25 mph at SE Ten Eyck Road, 40 mph at SE Langensand Road, and 55 mph at SE Vista Loop Drive. West of SE Ten Eyck Road the highway divides into a couplet, with westbound traffic traveling on Proctor Boulevard and eastbound traffic traveling on Pioneer Boulevard.

SE Ten Eyck Road has one through lane in each direction and is striped to prohibit passing in the site vicinity. It has a basic rule speed limit of 55 mph and is classified by the City of Sandy as a Minor Arterial.

SE Langensand Road is also classified by the City of Sandy as a Minor Arterial. It has a two-lane cross-section with one through lane in each direction and a posted speed limit of 25 mph. Partial sidewalks are in place on both sides of the roadway, and on-street parking is available where sufficient paved width is provided.

SE Vista Loop Drive is a narrow street without centerline striping and with a posted residential speed limit of 25 mph. It is classified by the City of Sandy as a collector roadway.

Oregon Highway 211 (Eagle Creek Sandy Highway) is classified by the Oregon Department of Transportation as a District Highway. It has a two-lane cross-section with one through lane in each direction and added turn lanes at major intersections. It has a posted speed limit of 45 mph in the vicinity of Dubarko Road.

Dubarko Road is classified by the City of Sandy as a Minor Arterial. It generally has a two-lane cross-section with some added turn lanes at major intersections and bike lanes on each side of the roadway. Partial sidewalks are in place on each side of the roadway adjacent to developed properties. It has a posted residential speed limit of 25 mph.

EXISTING CONDITIONS

The intersection of US Highway 26 at SE Ten Eyck Road/Wolf Drive is controlled by a traffic signal. The northbound and southbound approaches each have a single, shared lane for all turning movements. The westbound approach has a left-turn lane, two through lanes, and a short right-turn pocket. The eastbound approach has a left-turn lane, a dedicated through lane and a shared through/right lane. The northbound and southbound approaches operate with concurrent signal phasing. Protected phasing is provided for the eastbound and westbound left-turn movements. Bike lanes are provided along Highway 26 to the right of the through lanes.

The intersection of US Highway 26 at SE Langensand Road is a T- intersection controlled by a stop sign on the northbound Langensand Road approach. Through traffic traveling along Highway 26 does not stop. The northbound approach has a left-turn lane and a right-turn lane. The eastbound approach has two through lanes and a right-turn lane. The westbound approach has a left-turn lane and two through lanes. Bike lanes are provided along Highway 26 to the right of the through lanes.

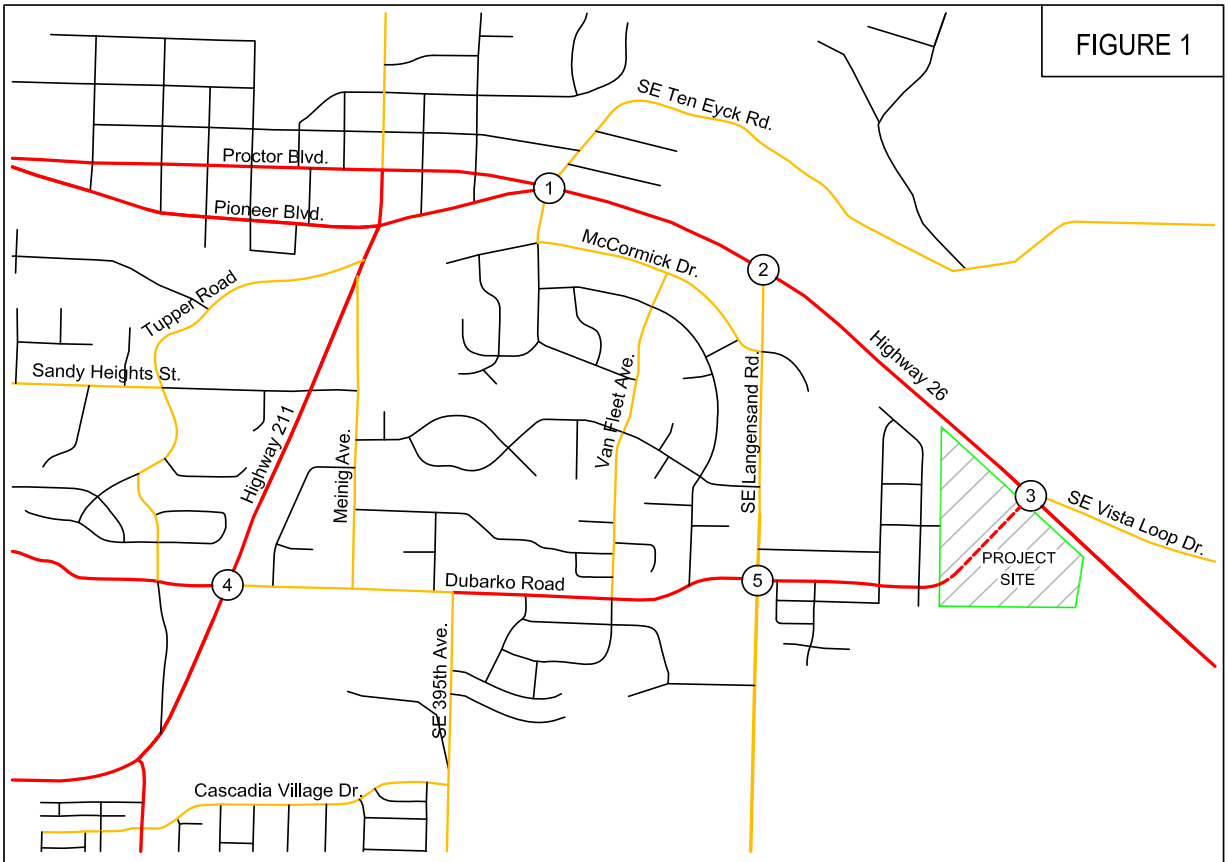
The intersection of US Highway 26 at SE Vista Loop Drive is currently a T- intersection controlled by a stop sign on the southwest-bound Vista Loop Drive approach. Through traffic traveling along Highway 26 does not stop. The southwest-bound approach has a single, shared lane for all turning movements. The southeast-bound approach has a left-turn lane and two through lanes. The northwest-bound approach has a dedicated through lane and a shared through/right lane. Bike lanes are provided along Highway 26 to the right of the through lanes.

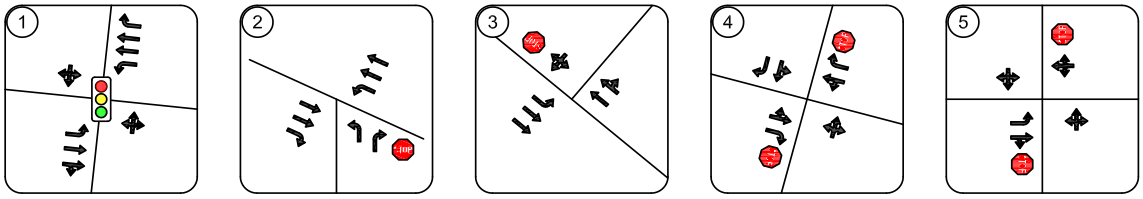
The intersection of Oregon Highway 211 at Dubarko Road is a four-way intersection controlled by stop signs on the eastbound and westbound Dubarko Road approaches. The southbound, eastbound and westbound approaches each have a shared through/left lane, a bike lane, and a dedicated right-turn lane. The northbound approach has a single, shared lane for all motorized turning movements and a bike lane.

The intersection of Dubarko Road at SE Langensand Road is a four-way intersection currently controlled by stop signs on the eastbound and westbound Dubarko Road approaches. Through traffic traveling along SE Langensand Road does not stop. The northbound and southbound approaches each have a single, shared lane for all turning movements. The westbound approach has a single, shared lane for all motor vehicle turning movements and a bike lane. The eastbound approach has a left-turn lane, a shared through/right lane and a bike lane.

A vicinity map displaying the project site, vicinity streets, and the study intersections including lane configurations is provided in Figure 1 on page 7.

FIGURE 1





LEGEND

- Study Intersection
- Traffic Signal
- Stop Sign

VICINITY MAP
Study Intersections
Lane Configurations and Traffic Control

PAGE 7

TRAFFIC COUNT DATA

Traffic counts were conducted at the study intersections on Tuesday March 19th, 2019 from 4:00 to 6:00 PM and on Wednesday March 20th, 2019 from 7:00 to 9:00 AM. Data was used from the highest-volume hour during each analysis period.

Since the count data was collected during a non-peak period of the year, the observed traffic volumes were adjusted to account for seasonal traffic variations in order to represent the 30th-highest hour design volumes.

US Highway 26 serves local and commuter traffic as well as trips to and from Mt. Hood and beyond. These trip types would be expected to exhibit very different seasonal variations in travel demands over the course of the year, since local and commuter traffic volumes are relatively stable regardless of season, while travel volumes to and from Mt. Hood vary significantly based on the season.

In order to determine the portion of traffic attributable to each of the two primary travel types, data from ODOT's 2017 Highway Volume Tables was utilized. Specifically, the data used was collected at ODOT's Automatic Count Data station 03-006, located 0.30 miles east of Camp Creek Road in Rhododendron, Oregon. This site is located on Highway 26 approximately 21 miles east of SE Vista Loop Drive. Although the distance to the ATR station means the data cannot be used directly, the ATR data provides useful information regarding the variation in traffic volumes traveling to Mt. Hood and beyond during the time of the count data collection as well as during the peak season of the year. Accordingly, this data allows determination of the likely portion of highway traffic that falls into each of the two seasonal variation categories ("commuter" and "recreational summer/winter"), as well as providing information regarding the most appropriate seasonal adjustment factor for the recreational summer/winter traffic.

Based on the data, 6,763 vehicles per day (approximately 676 per hour during the peak hour) travel along Highway 26 to and from Mt. Hood at the Rhododendron permanent count station location during the month of March. This volume represents 45.3 percent of the through traffic volumes measured on Highway 26 east of SE Vista Loop Drive. Accordingly, it is expected that no more than 45.3 percent of the trips traveling along Highway 26 in the project vicinity are traveling to and from destinations beyond the Rhododendron count station. Since the remaining 54.7 percent of through traffic volumes on the Highway 26 at the study intersections never reach Mt. Hood, it was assumed that these traffic volumes represent more typical commuter and local trips.

The ODOT data also showed that 11,738 vehicles were measured per day (approximately 1174 per hour during the peak hour) during the peak-season month of August at the ATR station near Rhododendron. This indicates that the seasonal recreational traffic volumes along the Highway 26 corridor increased by no more than 4,975 vehicles per day (11,738 vehicles per day in August - 6,763 vehicles per day in March). This equates to roughly 498 additional vehicles per hour during the peak hour of the peak recreational season. It is expected that the increased recreational traffic flows will be somewhat directional, with approximately 55% traveling westbound during the evening peak hour.

In order to seasonally adjust the local and commuter traffic volumes, the through traffic volumes were reduced by the amount of the assumed seasonal traffic (676 vehicles per hour during the evening peak hour, and a seasonal adjustment of 1.08 was applied to the remaining local and commuter traffic

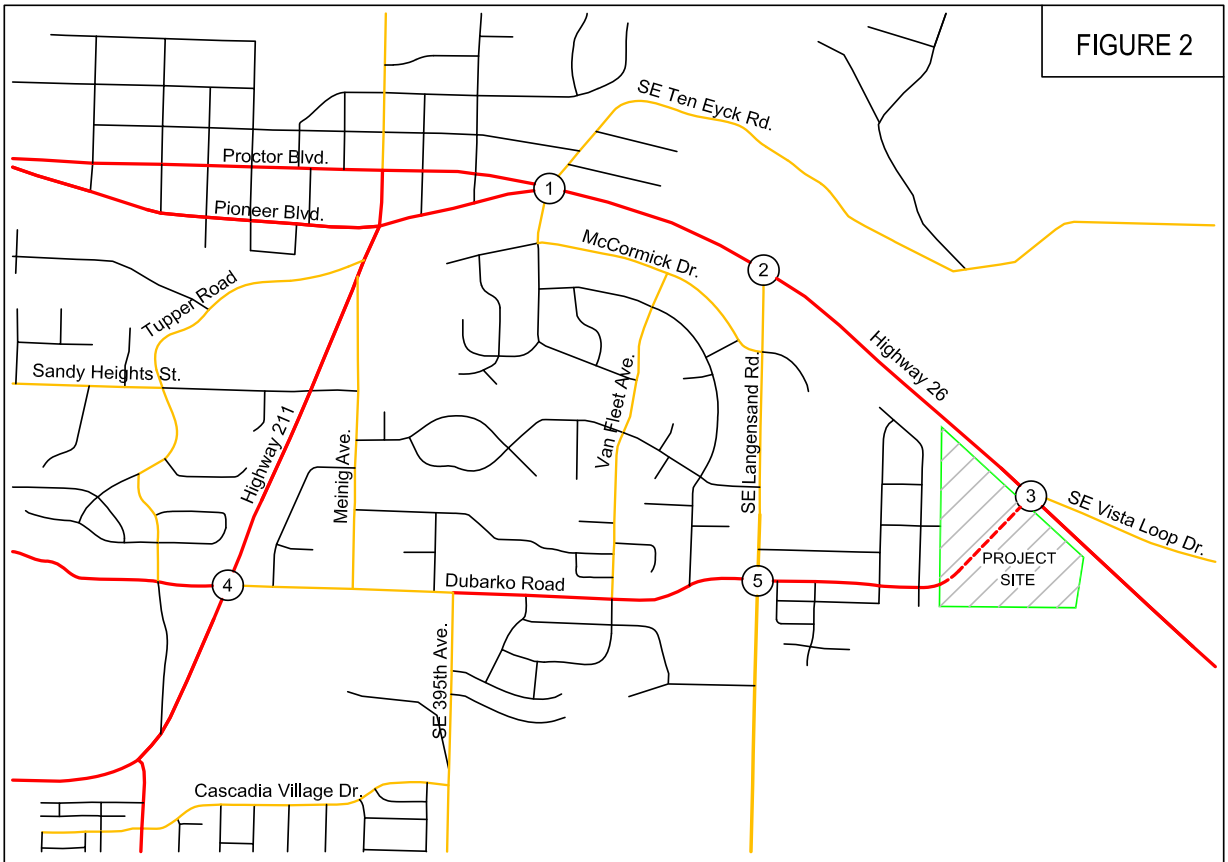
volumes. Following this adjustment, the 676 March recreational trips and the 498 peak-season through trips were added to determine the total peak-season traffic volumes. These calculated through traffic volumes represent the anticipated traffic levels for the intersections along Highway 26 during the 30th-highest hour in August. The morning peak hour traffic volumes along the highway were then increased by the same overall percentage as the evening peak hour volumes.

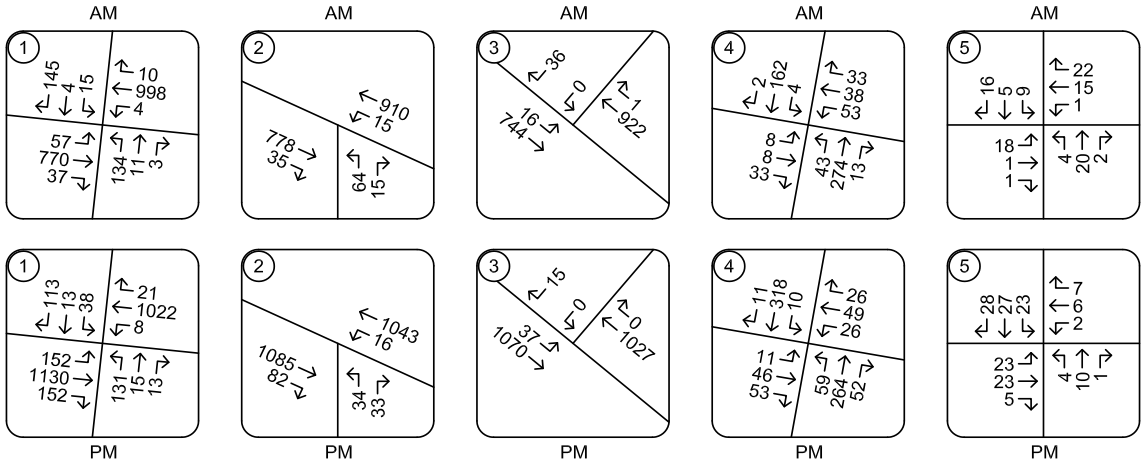
The observed traffic volumes along Highway 211 also had a seasonal adjustment of 1.08 applied to represent peak-season traffic volumes.

Following application of the seasonal adjustments, one year of growth was added to the year 2019 traffic count data in order to represent the expected year 2020 seasonal peak traffic conditions absent the impacts of the current COVID-19 pandemic. Based on data from ODOT's Future Volume Tables, the growth rate for traffic volumes on Highway 26 in the site vicinity was calculated to be 1.93 percent per year. The growth rate for traffic volumes on Highway 211 was calculated to be 3.16 percent per year. These growth rates were applied to the through traffic volumes on the highways. All other turning movements had a growth factor of 2 percent per year applied. The respective growth rates were applied over a period of one year to generate the year 2020 seasonal peak traffic volumes.

Figure 2 on page 10 shows the existing year 2020 30th-highest hour traffic volumes for the morning and evening peak hours at the study intersections.

FIGURE 2





TRAFFIC VOLUMES
2020 Existing 30th-Highest Hour (August) Conditions
Morning and Evening Peak Hours

PAGE 10

OPERATIONAL ANALYSIS

An operational analysis was conducted for the study intersections using Synchro 10 software, with outputs calculated based on the *HIGHWAY CAPACITY MANUAL, 6th Edition.* The analysis was conducted for the weekday morning and evening peak hours.

The purpose of the existing conditions analysis is to establish how the study area intersections operate currently and allow for calibration of the operational analysis if required.

The results of the operational analysis are reported based on delay, Level of Service (LOS), and volume-to-capacity ratio (v/c). Delays are reported in seconds. Level of service is reported as a letter grade and can range from A to F, with level of service A representing nearly free-flow conditions and level of service F representing high delays and severe congestion. A report of level of service D generally indicates moderately high but tolerable delays, and typically occurs prior to reaching intersection capacity. For unsignalized intersections, the v/c represents the portion of the available intersection capacity that is being utilized on the worst intersection approach. For signalized intersections, it indicates the portion of the overall intersection's capacity that is being used. A v/c ratio of 1.0 would indicate that the intersection is operating at capacity.

The Oregon Department of Transportation requires that the signalized intersection of Highway 26 at SE Ten Eyck Road operate with a v/c ratio of 0.85 or less during the peak hours. The intersections of Highway 26 at SE Langensand Road and Highway 26 at SE Vista Loop Drive are required to operate with a v/c ratio of 0.80 or less on the major-street approaches and a v/c ratio of 0.90 or less on the minor-street approaches.

Intersections operating under the jurisdiction of the City of Sandy are required to operate at level of service D or better. This operational standard applies to the intersection of Dubarko Road at Langensand Road.

A summary of the existing conditions operational analysis is provided in Table 1 on the following page. For the unsignalized intersections the reported delays and levels-of-service represent the approach lane which experiences the highest delays. The reported v/c ratios represent the highest ratio for the major-street and minor-street movements. For the signalized intersection of Highway 26 at SE Ten Eyck Road, the reported delays, levels-of-service and v/c ratios represent the operation of the overall intersection.

Based on the analysis, the study intersections are currently operating acceptably per the respective ODOT and City of Sandy standards. Detailed capacity analysis worksheets are provided in the technical appendix.

Table 1 - Operational Analysis Summary: Year 2020 30th-Highest Hour Conditions

Intersection	AM Peak Hour			PM Peak Hour		
	Delay	LOS	v/c*	Delay	LOS	v/c*
Highway 26 at Ten Eyck Road	23.4	C	0.62	26.2	C	0.70
Highway 26 at Langensand Road	54.8	F	0.28 / 0.50	88.9	F	0.35 / 0.47
Highway 26 at Vista Loop Drive	12.7	B	0.28 / 0.08	13.0	B	0.32 / 0.06
Highway 211 at Dubarko Road	18.3	C	0.22 / 0.27	25.7	D	0.24 / 0.32
Dubarko Road at Langensand Road	9.3	A	0.05	9.8	A	0.04

*(major street v/c) / (minor-street v/c) is shown for unsignalized ODOT intersections.

SITE TRIPS

Proposed Development

The proposed subdivision will support development of up to 200 dwelling units, including 8 duplex units and 192 multi-family dwellings. Some commercial development is also expected to occur within the C-3 zoned portion of the property prior to completion of development within the subject area. The exact nature of any future commercial use is unknown, but to assess potential impacts associated with some level of commercial activity and ensure that the analysis contains a realistic development scenario, a 5,000 square foot general office building was assumed to be included within the C-3 zone. To estimate the number of trips that will be generated by residential development within the proposed subdivision, trip rates from the *TRIP GENERATION MANUAL, 11th EDITION* were used. Data from land-use code 215, *Single-Family Attached Housing*, 220, *Multi-Family Housing*, and *565, Day Care Center* were used. The trip estimates are based on the number of dwelling units.

A summary of the trip generation calculations is provided in Table 2 below. Detailed trip generation worksheets are also included in the technical appendix.

Table 2 - Proposed Development Trip Generation Summary

	AM Peak Hour			PM Peak Hour			Daily
	In	Out	Total	In	Out	Total	Total
192 Apartment Units	20	62	82	65	38	103	1306
8 Duplex Units	1	3	4	3	2	5	58
5,000 sf General Office Building	7	1	8	1	6	7	54
Total Site Trips	28	66	94	69	46	115	1,418

Zone Change

In addition to evaluation of the increase in site trips expected upon completion of anticipated development within the proposed subdivision, trip generation calculations were prepared to examine the potential change in site trips based on the "reasonable worst-case development scenario" for the existing and proposed zoning. This second analysis was conducted to determine whether the proposed zone change would significantly affect any transportation facilities as defined by Oregon's Transportation Planning Rule.

After accounting for anticipated dedication of 2.232 acres of public right-of-way, the subject property is currently zoned with a mix of 6.628 acres of R-1, 4.439 acres of R-2 and 2.611 acres of C-3 zoning. Under the proposed subdivision plan, again 2.232 acres will be dedicated as public right-of-way, 0.906 acres will be zoned R-1, 1.233 acres will be zoned R-2, 6.504 acres will be zoned R-3, 3.280 acres will be zoned C-3, and 1.755 acres will be zoned POS (Parks & Open Space).

Trip generation for the R-1 zone was calculated assuming duplex residential development with 80 percent lot coverage and a minimum lot size of 5,000 square feet. For the R-2 zoning, trip generation was calculated assuming single-family residential development with 14 dwelling units per acre and 80

percent lot coverage. For the R-3 zoning, trip generation was calculated based on low-rise multi-family residential development with 20 dwelling units per acre and 100 percent lot coverage.

Under the C-3 (Village Commercial) zoning, the Sandy development code allows development with auto sales and repair facilities, convenience stores, restaurants (excluding drive-through facilities), grocery stores, athletic clubs, day care facilities, schools, banks (excluding drive-through facilities), medical clinics, offices, hotels, residential facilities, and manufacturing facilities that do not produce significant levels of noise or odor beyond the boundaries of the site. Since the highest trip generators have limited floor areas, and no more than one convenience store, one day care center and two fast food restaurants can reasonably be expected within a commercial site with a gross land area of less than five acres, the "reasonable worst case" development scenario includes a mix of these uses with the remainder of the site consisting of general retail uses (evaluated as a shopping center).

A summary of the trip generation calculations for the reasonable worst-case development scenarios based on allowable development levels under the existing and proposed City of Sandy zoning is provided in Table 3 below. Detailed trip generation calculations are also included in the technical appendix.

Table 3 - Zone Change Trip Generation Summary

	AM Peak Hour			PM Peak Hour			Daily
	In	Out	Total	In	Out	Total	Total
Existing R1, R2 and C3 Zoning							
6.628 Acres R-1 (92 Duplex Units)	13	29	42	29	22	51	650
4.439 Acres R-2 (50 Homes)	9	28	37	32	18	50	472
2.611 Acres C-3 (28,433 sf)							
Fast Food w/o Drive Thru (5,000 sf)	64	62	126	74	68	142	1732
-Pass-by Trips (43%)	-27	-27	-54	-31	-31	-62	-744
Day Care Center (5,000 sf)	30	25	55	27	29	56	238
Supermarket (18,433 sf)	41	29	70	85	85	170	1968
-Pass-by Trips (36%)	-13	-13	-26	-31	-31	-62	-708
Net Trips (Existing Zoning)	**117**	**133**	**250**	**185**	**160**	**345**	**3608**
Proposed Zoning							
0.906 Acres R-1 (12 Duplex Units)	2	4	6	4	3	7	86
1.233 Acres R-2 (14 Homes)	3	7	10	9	5	14	132
6.504 Acres R-3 (130 Apartments)	14	46	60	46	27	73	952
3.609 Acres C-3 (35,720 sf Retail)							
Fast Food w/o Drive Thru (5,000 sf)	64	62	126	74	68	142	1732
-Pass-by Trips (43%)	-27	-27	-54	-31	-31	-62	-744
Day Care Center (5,000 sf)	30	25	55	27	29	56	238
Supermarket (25,720 sf)	44	30	74	129	128	257	2838
-Pass-by Trips (36%)	-13	-13	-26	-46	-46	-92	-1022
1.755 Acres POS (Public Park)	0	0	0	0	0	0	2
Net Trips (Proposed Zoning)	**117**	**134**	**251**	**212**	**183**	**395**	**4214**
Net Change In Site Trips	**0**	**1**	**1**	**27**	**23**	**50**	**606**

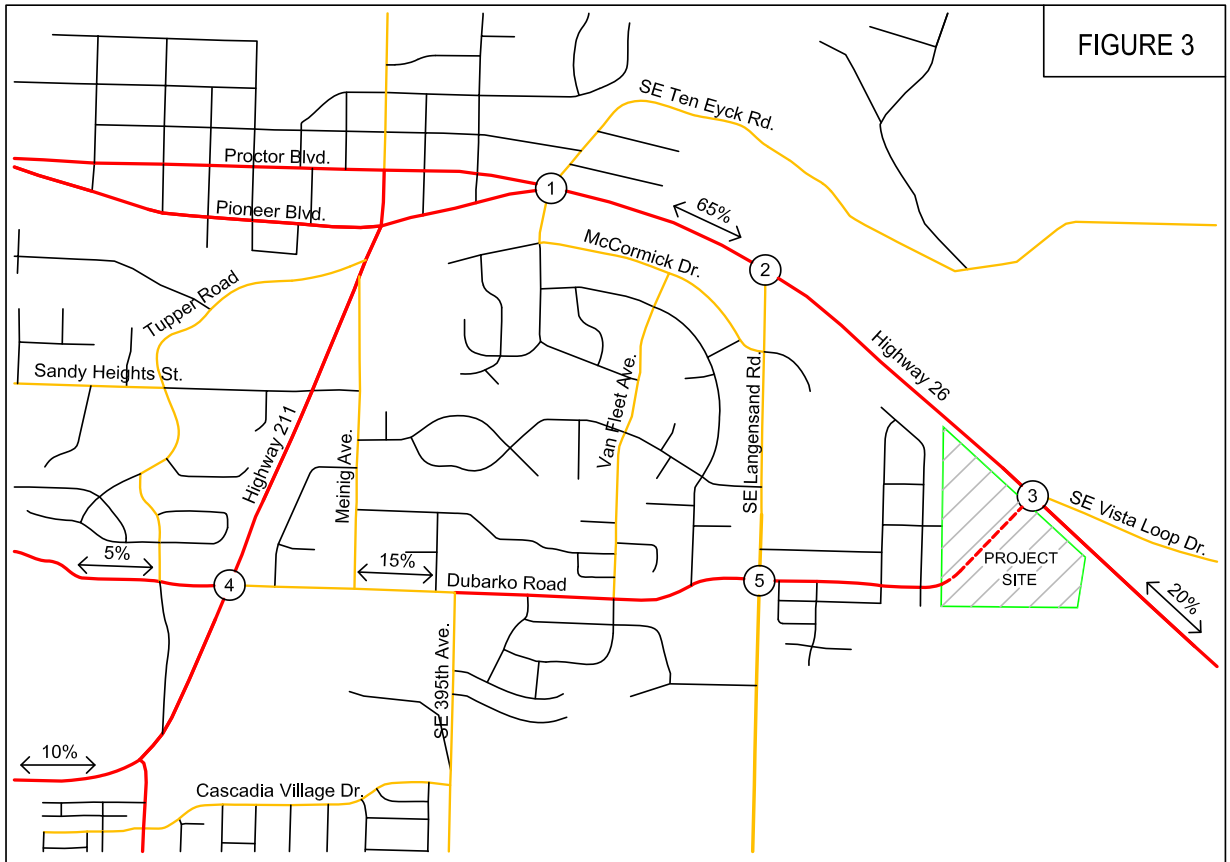
Based on the zone change analysis, the proposed zone change could result in a net increase of 1 site trip during the morning peak hour, a net increase of 50 trips during the evening peak hour, and a net increase of 606 daily trips. The zone change may therefore result in a significant increase in site traffic as measured at the planning horizon under the "reasonable worst case" development scenario. Accordingly, some form of mitigation is necessary to meet the requirements of Oregon's Transportation Planning Rule. A detailed analysis based on the requirements of Oregon's Transportation Planning Rule including a recommended condition of approval which is be sufficient to ensure that the zone change does not result in a significant effect is provided in the "Transportation Planning Rule Analysis" section found on page 26 of this report.

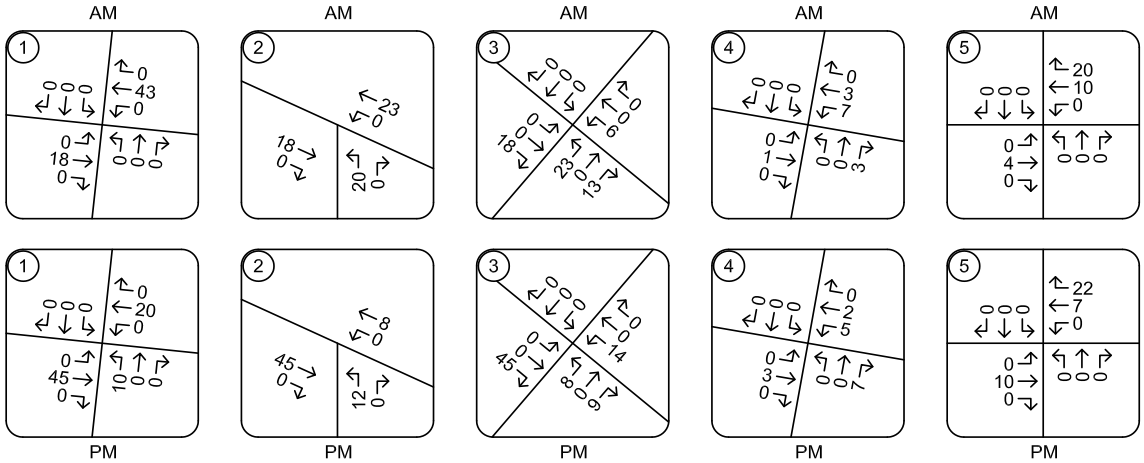
TRIP DISTRIBUTION

The directional distribution of site trips to and from the project site was estimated based the existing travel patterns in the site vicinity, as well as the locations of likely trip destinations and major transportation routes. Overall, 65 percent of the anticipated site trips are projected to travel to and from the northwest on Highway 26, 20 percent are projected to travel to and from the southeast on Highway 26, and the remaining 15 percent of site trips are projected to travel to and from the west on Dubarko Road.

The trip distribution percentages and trip assignment for residential development within the proposed subdivision are shown in Figure 3 on page 16.

FIGURE 3





TRAFFIC VOLUMES
Proposed Development - Primary Site Trips
Morning and Evening Peak Hours

PAGE 16

FUTURE CONDITIONS ANALYSIS

BACKGROUND VOLUMES

In order to determine the expected impact of site trips on the study area intersections, it is necessary to compare traffic conditions both with and without the addition of the projected traffic from the proposed development. This comparison is made for future traffic conditions at the time of project completion. It is anticipated that the proposed use will be completed and occupied within four years. Accordingly, the analysis was conducted for year 2024 traffic conditions.

Prior to adding the projected site trips to the study intersections, the existing traffic volumes were adjusted to account for background traffic growth over time. Based on data from ODOT's Future Volume Tables, the growth rate for traffic volumes on Highway 26 in the site vicinity was calculated to be 1.93 percent per year (linear). The growth rate for traffic volumes on Highway 211 was calculated to be 3.16 percent per year (linear). These growth rates were applied to the through traffic volumes on the highways. All other turning movements had a growth factor of 2 percent per year (exponential) applied.

In addition to the background growth, anticipated site trips from the "The Views" residential development were added to the background traffic volumes. The projected site trips for this residential development are shown in Figure 8 in the attached technical appendix.

Figure 4 on page 18 shows the projected year 2024 background traffic volumes at the study intersections during the morning and evening peak hours.

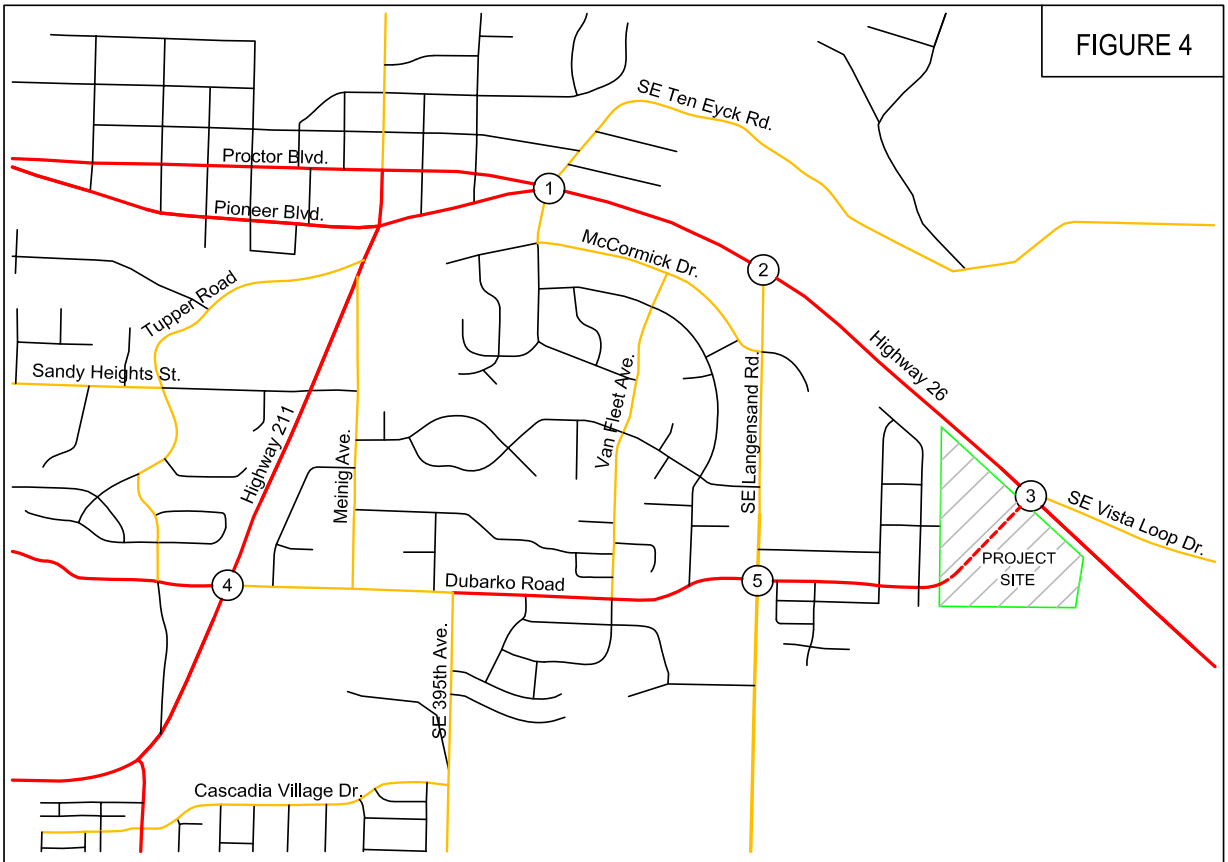
BACKGROUND VOLUMES PLUS SITE TRIPS

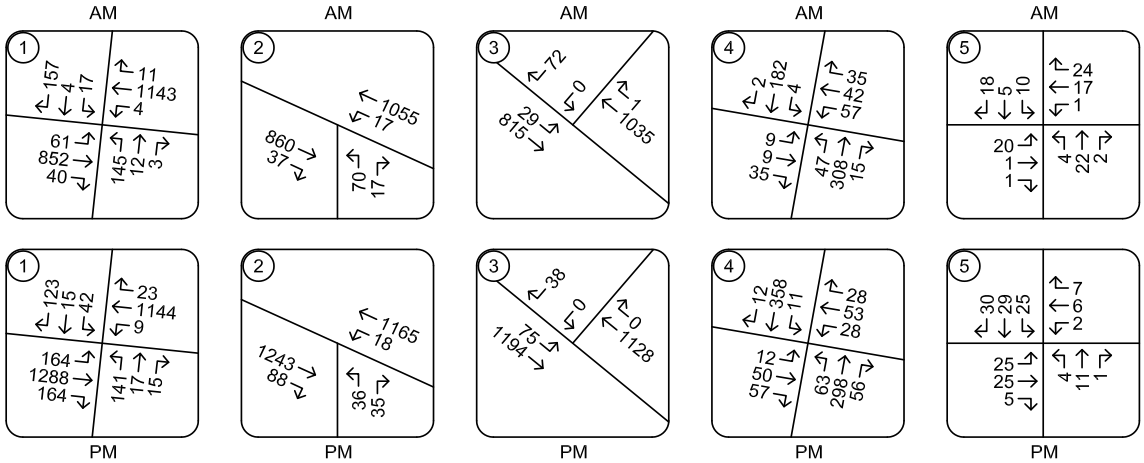
Peak hour trips calculated to be generated by the proposed development were added to the projected year 2024 background traffic volumes to obtain the year 2024 total traffic volumes following completion of the proposed residential development.

In addition to the addition of anticipated site trips, some existing traffic is expected to divert upon completion of the Dubarko Road connection to Highway 26. Drivers traveling between locations east of the city on Highway 26 and locations south of the city on Highway 211 will have an alternative travel route available that will serve as a shorter travel route and bypass some congestion within the City of Sandy. The new road connection will also serve as an alternative travel route for residents living in areas to the west of the subject property traveling to and from destinations to the east on Highway 26. A diagram showing the projected trip diversions associated with completion of the Dubarko Road connection to Highway 26 is provided as Figure 7 in the attached technical appendix.

Figure 5 on page 19 shows the projected year 2024 peak hour volumes including background growth, site trips from the proposed development, and diverted trips associated with the proposed connection of Dubarko Road to Highway 26 for the morning and evening peak hours.

FIGURE 4

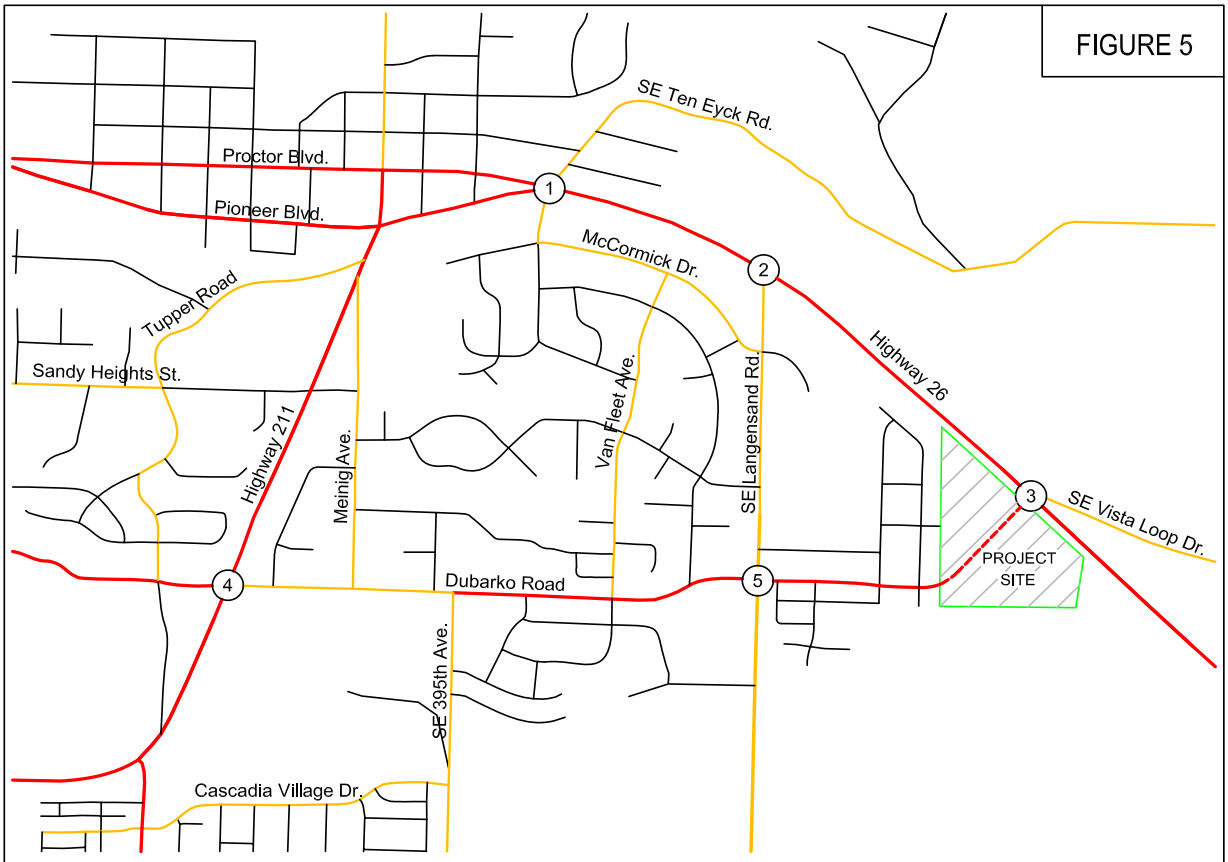


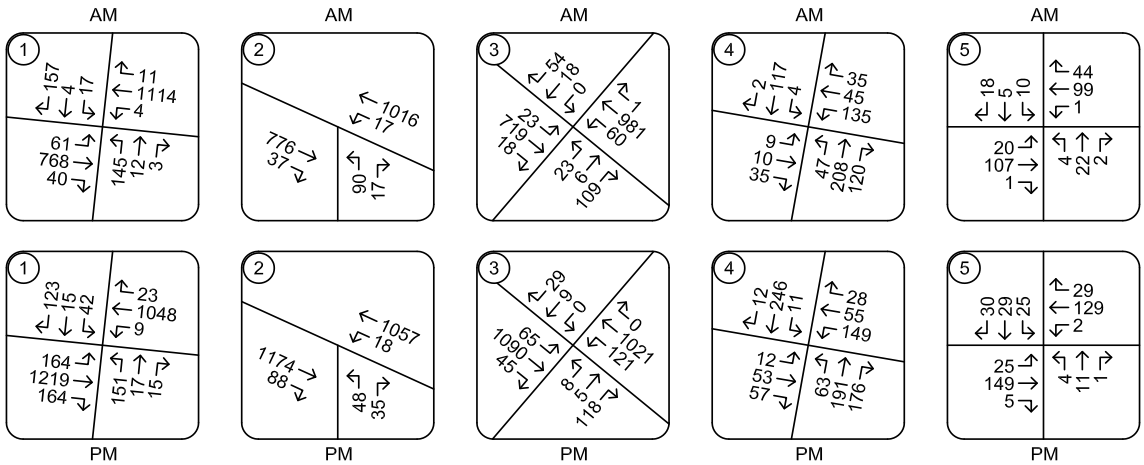


TRAFFIC VOLUMES
2024 Background Conditions
Morning and Evening Peak Hours

PAGE 18

FIGURE 5





TRAFFIC VOLUMES
2024 Background Plus Site Trips
Morning and Evening Peak Hours

PAGE 19

OPERATIONAL ANALYSIS

The operational analysis for future traffic conditions was again conducted using Synchro analysis software, with outputs based on the analysis methodologies contained in the *HIGHWAY CAPACITY MANUAL*. The analysis was prepared for the intersections' morning and evening peak hours.

The results of the operational analysis are summarized in Table 4 below. Detailed analysis worksheets are also included in the technical appendix.

Table 4 - Operational Analysis Summary: Year 2024 Future Conditions

Intersection	AM Peak Hour			PM Peak Hour		
	Delay	LOS	v/c*	Delay	LOS	v/c*
Highway 26 at Ten Eyck Road						
2024 Background Conditions	25.1	C	0.70	29.4	C	0.78
2024 Background plus Site	24.7	C	0.69	29.5	C	0.76
Highway 26 at Langensand Road						
2024 Background Conditions	95.4	F	0.33 / 0.70	169.9	F	0.41 / 0.72
2024 Background plus Site	93.8	F	0.32 / 0.77	168.0	F	0.39 / 0.80
Highway 26 at Vista Loop Drive						
2024 Background Conditions	14.4	B	0.33 / 0.17	14.3	B	0.38 / 0.09
2024 Background plus Site	140.9	F	0.31 / 0.58	533.0	F	0.34 / 0.89
Highway 211 at Dubarko Road						
2024 Background Conditions	21.2	C	0.33	32.9	D	0.41
2024 Background plus Site	23.3	C	0.51	74.7	F	0.89
2024 Background plus Site (AWSC)	18.0	C	0.64	29.9	D	0.79
Dubarko Road at Langensand Road						
2024 Background Conditions	9.4	A	0.05	9.9	A	0.04
2024 Background plus Site	10.5	B	0.20	11.3	B	0.23

*(major street v/c) / (minor-street v/c) is shown for unsignalized ODOT intersections.

Based on the results of the operational analysis, most study intersections are projected to operate acceptably through year 2024 either with or without the addition of site trips from the proposed development and the diversion of through trips between Highway 26 and Highway 211 onto Dubarko Road. The intersection of Highway 211 at Dubarko Road is projected to operate at level of service F during the evening peak hour; however, with conversion to all-way stop control the intersection is projected to operate at level of service D (meeting the city standard). Warrants for this treatment are discussed in more detail in the Safety analysis section of this report.

It should be noted that the intersections of Highway 26 at Ten Eyck Road and Highway 26 at Langensand Road operate slightly better with project completion than under background conditions. This is an expected result of the diversion of traffic onto Dubarko Road, which results in decreased through traffic volumes along Highway 26.

Although the intersection of Highway 26 at SE Vista Loop Drive is shown to operate acceptably during the morning and evening peak hours, the average delays for the northeast-bound left/through lane are projected to be 182 seconds during the morning peak hour and 533 seconds during the evening peak hour. These long delays indicate that the northeast-bound left/through lane is unlikely to accommodate any meaningful traffic volumes as vehicles are likely to divert to alternative (lower-delay) travel routes.

QUEUING ANALYSIS

In addition to the operational analysis, a queuing analysis was conducted to determine an appropriate storage length for a northwest-bound left-turn lane on Highway 26 at Dubarko Road.

The storage length provided for the northwest-bound left-turn lane on Highway 26 should be sufficient to accommodate the 95th percentile queue length for this movement. The 95th percentile queue is the length which is exceeded during five percent or less of the peak hour. Queue lengths in excess of the 95th percentile occur do not occur with sufficient frequency to allow for cost-effective design.

The queuing analysis was conducted for year 2024 background plus site trips conditions during the morning and evening peak hours. Based on the analysis, the projected 95th percentile queue lengths were 45 feet during the morning peak hour and 127 feet during the evening peak hour. Accordingly, it is recommended that if a new northwest-bound left turn lane is provided it should have a storage length of at least 130 feet.

SITE CIRCULATION CONSIDERATIONS

The proposed subdivision includes a new four-leg intersection on Dubarko Road. “Street A” will connect to Fawn Street to the north, providing for local-street connectivity within the development and extending connectivity for the existing residential homes west of the site. “Street B” will extend south from Dubarko Road stubbing at the property line to provide future connectivity to the south in conformance with the city’s Transportation System Plan.

It is anticipated that there may also be private access driveways on Dubarko Road within the subject property. Future access driveways should be located outside the standing queue for the intersection of Highway 26 at Dubarko Road or be restricted to right-in, right-out access only in order to ensure that they can operate safely and efficiently.

SAFETY ANALYSIS

CRASH DATA ANALYSIS

Using data obtained from the Oregon Department of Transportation, a review of the five most recent years of available crash history (from January 2016 through December 2020) was performed for the study intersections. The crash data was evaluated based on the number, type, and severity of collisions, as well as the intersection crash rate. Crash rates allow comparison of relative safety risks at intersections with different lane configurations, volumes, and traffic control devices by accounting for both the number of crashes that occur during the study period and the number of vehicles that traveled through the intersection during that period. Crash rates are calculated using the standard assumption that evening peak hour volumes are approximately 10 percent of the average daily traffic volume at an intersection. The crash rates were compared to statewide crash rates for similar intersection types in order to identify any locations with crash rates in excess of the 90th percentile.

The intersection of Highway 26 at SE Ten Eyck Road had nine reported collisions during the five-year analysis period. These included five rear-end collisions, three turning-movement collisions, and one angle collision. The crashes resulted in no serious injuries or fatalities and six reports of a "possible injury/complaint of pain". The crash rate for the intersection was calculated to be 0.18 crashes per million entering vehicles. This is well below the 90th percentile crash rate of 0.86 crashes per million entering vehicles for signalized, four-way urban intersections in Oregon.

The intersection of Highway 26 at SE Langensand Road had six reported collisions during the five-year analysis period. These included four turning-movement collisions, one backing collision and one pedestrian collision. The pedestrian collision occurred when a pedestrian walking along the south side of Highway 26 crossing Langensand Road was struck by a driver making an eastbound right turn from the highway onto Langensand Road. The collision resulted in a report of a "possible injury/complaint of pain" by the pedestrian. Overall, the crashes resulted in one non-incapacitating injury and four reports of a "possible injury/complaint of pain". The crash rate for the intersection was calculated to be 0.20 crashes per million entering vehicles. This is well below the 90th percentile crash rate of 0.29 crashes per million entering vehicles for stop-controlled, three-way urban intersections in Oregon.

The intersection of Highway 26 at SE Vista Loop Drive had two reported crashes during the five-year analysis period. Both were turning movement collisions that resulted in property damage only. The crash rate for the intersection was calculated to be 0.051 crashes per million entering vehicles. This is well below the 90th percentile crash rate of 0.475 crashes per million entering vehicles for stop-controlled, three-way rural intersections in Oregon.

The intersection of Highway 211 at Dubarko Road had 27 reported crashes during the five-year analysis period. These included 17 angle collisions, 3 turning-movement collisions, 3 rear-end collisions, 1 backing collision, 1 sideswipe-overtaking collision, 1 fixed-object collision, and 1 pedestrian collision. The crashes resulted in one incapacitating injury. There were 11 "non-incapacitating" injuries reported and 18 reports of a "possible injury/complaint of pain". The crash rate for the intersection was calculated to be 1.72 crashes per million entering vehicles. This is above the 90th percentile crash rate of 1.08 crashes per million entering vehicles for rural unsignalized four-way intersections in the state of Oregon. The Oregon Department of Transportation undertook safety improvements at this intersection, including re-alignment of the minor-street approaches to intersect

at a 90-degree angle and the addition of some striping along the major-street to increase driver awareness of speed. However, the crash data for subsequent years showed no significant improvement in the crash frequency at this intersection. An examination of the current intersection configuration revealed no significant apparent hazards and adequate sight distance from the minor-street approaches, allowing drivers approaching the highway to select safe gaps when turning onto or crossing the highway. As described in the Warrant Analysis section of this report below, the intersection currently meets all-way stop control warrants based on crash history and is projected to meet all-way stop control warrants based on vehicular volume under year 2024 conditions with completion of the Dubarko Road connection to Highway 26. Accordingly, it is recommended that the intersection be converted to all-way stop control. No other safety mitigations are recommended at this time.

The intersection of Dubarko Road at SE Langensand Road had one reported collision during the five-year analysis period. It was an angle collision that resulted in property damage only. The crash rate for the intersection was calculated to be 0.35 crashes per million entering vehicles. This is well below the 90th percentile crash rate of 0.408 crashes per million entering vehicles for stop-controlled, four-way urban intersections in Oregon.

Based on the crash data, the majority of the study intersections are currently operating acceptably with respect to safety. The intersection of Highway 211 at Dubarko Road has a high historical crash rate which recent safety improvements have not significantly improved. It is recommended that all-way stop control be considered for installation at this intersection. No other safety improvements are recommended for the study area intersections at this time.

TRAFFIC SIGNAL WARRANT ANALYSIS

Traffic signal warrants were examined for the unsignalized study intersections.

Based on the projected traffic volumes, traffic signal warrants are projected to be marginally met at for the intersection of Highway 211 at Dubarko Road under year 2024 30th-highest hour conditions with completion of the proposed development, the nearby "The Views" development, and completion of a full-movement connection between Highway 26 and Dubarko Road. Traffic signal warrants are not projected to be met for any of the other unsignalized study intersections for any of the analysis scenarios, and are not likely to be met under average traffic conditions.

An examination of the future turning movement volumes at the intersection of Highway 211 and Dubarko Road reveals that the proposed development will add 10 PM peak hour trips to the westbound side-street approach. This represents 5 percent of the future westbound traffic volume on Dubarko Road. In contrast, the connection of Dubarko Road as contemplated in the city's Transportation System Plan adds 116 PM peak hour trips to the westbound approach. This comparison demonstrates that the triggering event that causes signal warrants to be met under 30th-highest-hour conditions at this intersection upon project completion is not the Bull Run Terrace Development. Rather, it is the completion of the city's planned connection of Dubarko Road to Highway 26. Accordingly, a request to construct a traffic signal at this intersection would be disproportionate to the actual impacts of the proposed development. Since an alternative treatment is available which would not be disproportionate to the impact of the proposed development, installation of a traffic signal is not recommended at this time.

Since traffic volumes for Highway 211 at Dubarko Road are only projected to marginally meet signal warrants for 30th-highest hour conditions, all-way stop-control warrants were also examined for the intersection. Based on the analysis, all-way stop control warrants are currently met for Criterion B (crash history) and are projected to be met upon completion of the proposed development for Criterion C (minimum volumes). Accordingly, all-way stop control can be installed at this intersection. Upon installation of all-way stop control, the intersection would be projected to operate at level of service C during the morning peak hour, and level of service D during the evening peak hour. The maximum projected v/c ratio was determined to be 0.79 with implementation of all-way stop control.

Alternatively, consideration was given to installing a roundabout at the intersection of Highway 211 and Dubarko Road. Based on the operational analysis, installation of a roundabout would result in operation well within capacity and at level of service A. However, according to *Roundabouts: An Informational Guide*, published by the Federal Highway Administration, "It is generally not desirable to locate roundabouts in locations where grades through the intersection are greater than four percent. The installation of roundabouts on roadways with grades lower than three percent is generally not problematic." In this instance, Highway 211 has a constant grade of approximately 6 percent through its intersection with Dubarko Road. Accordingly, installation of a roundabout would not be recommended absent significant re-grading of the approach roadways. The potential for snow and ice at the intersection compound this concern.

TURN LANE WARRANT ANALYSIS

Turn lane warrants were also examined for the major-street approaches to the unsignalized study intersections. Left-turn lane warrants are intended to evaluate whether a meaningful safety benefit may be expected if the turning vehicles are provided with turn lane within the street, allowing left-turning drivers to move out of the through travel lane so that following vehicles may pass without conflicts.

The intersection of Highway 26 at Langensand Road already has left and right turn lanes in place.

The intersection of Highway 26 at Dubarko Road is projected to meet warrants for a northwest-bound left-turn lane and a southeast-bound right turn lane upon completion of the proposed development.

The intersection of Highway 211 at Dubarko Road currently meets warrants for a northbound left-turn lane and a northbound right-turn lane. However, the need for these turn lanes is not related to the proposed development. Further, the turn lane warrants would not be applicable and added lanes would not be needed if all-way stop control is installed at the intersection as recommended based on the safety analysis. Accordingly, no new turn lanes are recommended in conjunction with the proposed development.

The intersection of Dubarko Road at Langensand Road is not projected to meet turn lane warrants under any analysis scenarios. However, it was noted that the existing two-way stop control is currently oriented in a way that favors through traffic on Langensand Road. Upon completion of the Dubarko Road connection to Highway 26 the major street is projected to be Dubarko Road. Accordingly, consideration should be given to revising the traffic control at this intersection to remove the stop signs on the eastbound and westbound Dubarko Road approaches and install stop signs on the northbound and southbound Langensand Road approaches.

INTERSECTION SIGHT DISTANCE ANALYSIS

Intersection sight distance was evaluated for the proposed new Dubarko Road approach to Highway 26. The posted speed limit along Highway 26 is 55 mph. Using a design speed of 65 mph and designing for combination trucks, the minimum required intersection sight distance was calculated to be 1,195 feet in each direction.

The available intersection sight distances were measured from a position 14.5 feet behind the edge of the traveled way with a driver's eye height 3.5 feet above the driveway surface to an oncoming driver's eye height of 3.5 feet above the surface of the oncoming travel lane.

From the location of the proposed Dubarko Road approach to Highway 26, the available intersection sight distance was measured to be in excess of 1,200 feet in each direction. Since the available intersection sight distance is in excess of the minimum required, intersection sight distance was determined to be acceptable at this intersection. No sight distance mitigations are necessary or recommended.

TRANSPORTATION PLANNING RULE ANALYSIS

In order to allow the proposed zone change on the subject property, the City of Sandy must find that the requirements of Oregon's Transportation Planning Rule (OAR 660-012-0060) are met. This rule provides guidance regarding whether and how the potential transportation impacts of a plan amendment must be mitigated. The relevant portions of the Transportation Planning Rule are quoted below, along with responses specific to the proposed comprehensive plan amendment and zone change.

660-012-0060
Plan and Land Use Regulation Amendments

(1) If an amendment to a functional plan, an acknowledged comprehensive plan, or a land use regulation (including a zoning map) would significantly affect an existing or planned transportation facility, then the local government must put in place measures as provided in section (2) of this rule, unless the amendment is allowed under section (3), (9) or (10) of this rule. A plan or land use regulation amendment significantly affects a transportation facility if it would:

(a) Change the functional classification of an existing or planned transportation facility (exclusive of correction of map errors in an adopted plan);

No changes are proposed to the functional classification of existing or planned transportation facilities.

(b) Change standards implementing a functional classification system; or

No changes are proposed to the standards implementing the functional classification system.

(c) Result in any of the effects listed in paragraphs (A) through (C) of this subsection based on projected conditions measured at the end of the planning period identified in the adopted TSP. As part of evaluating projected conditions, the amount of traffic projected to be generated within the area of the amendment may be reduced if the amendment includes an enforceable, ongoing requirement that would demonstrably limit traffic generation, including, but not limited to, transportation demand management. This reduction may diminish or completely eliminate the significant effect of the amendment.

(A) Types or levels of travel or access that are inconsistent with the functional classification of an existing or planned transportation facility;

(B) Degrade the performance of an existing or planned transportation facility such that it would not meet the performance standards identified in the TSP or comprehensive plan; or

(C) Degrade the performance of an existing or planned transportation facility that is otherwise projected to not meet the performance standards identified in the TSP or comprehensive plan.

Under the reasonable worst case development scenario, the proposed zone change would result in no significant change in trips during the morning peak hour, a net increase of 50 trips during the evening peak hour, and an increase of 606 daily trips. This represents an increase of 14.5 percent during the evening peak hour and 16.8 percent in daily trips. It is anticipated that these increases may result in a significant effect as measured at the planning horizon. Accordingly, some form of mitigation is required in order to approve the zone change application. Acceptable mitigation measures are described in OAR 660-012-0060(2).

(2) If a local government determines that there would be a significant effect, then the local government must ensure that allowed land uses are consistent with the identified function, capacity, and performance standards of the facility measured at the end of the planning period identified in the adopted TSP through one or a combination of the remedies listed in (a) through (e) below, unless the amendment meets the balancing test in subsection (2)(e) of this section or qualifies for partial mitigation in section (11) of this rule. A local government using subsection (2)(e), section (3), section (10) or section (11) to approve an amendment recognizes that additional motor vehicle traffic congestion may result and that other facility providers would not be expected to provide additional capacity for motor vehicles in response to this congestion.

It is anticipated that the increases in trip generation resulting from the proposed zone change may result in a significant effect as measured at the planning horizon. Accordingly, some form of mitigation as described in OAR 660-012-0060(2) is required. In this instance, mitigation would be provided pursuant to sub-section (d), which reads:

(d) Providing other measures as a condition of development or through a development agreement or similar funding method, including, but not limited to, transportation system management measures or minor transportation improvements. Local governments shall, as part of the amendment, specify when measures or improvements provided pursuant to this subsection will be provided.

One mechanism to ensure that future development under the proposed zoning does not result in a significant impact on surrounding transportation facilities is to apply a trip cap to the subject property.

Under the existing zoning, the reasonable worst case development scenario was calculated to result in 250 net new morning peak hour trips, 345 net evening peak hour trips, and 3,608 net new daily trips. Since the operational analysis demonstrated that the evening peak hour was the critical design hour for all intersections, an appropriate trip cap can be created by limiting the number of net new PM peak hour trips to a level no greater than that allowed under the existing zoning. Accordingly, a trip cap of 345 net new PM peak hour site trips is sufficient to address the potential transportation impacts of the proposed zone change.

It should be noted that in the prior Bull Run Terrace Traffic Impact Study dated September 28, 2020, the trip generation numbers varied somewhat from the current analysis. This is primarily due to the fact that duplex development is now permitted within low-density residential zones (but was not permitted at the time of the prior report). In the prior study, a slightly lower trip cap of 340 PM peak hour trips was proposed. To maintain consistency with that report and the numerous materials in the record, it is recommended that the trip cap be maintained at 340 PM peak hour trips.

Based on the transportation planning rule analysis for the proposed zone change, it is recommended that a trip cap of 340 PM net new peak hour trips be applied to the subject property as a condition of approval for the proposed zone change. No other mitigations are necessary or recommended in conjunction with the proposed zone change.

CONCLUSIONS

All study intersections are projected to operate within capacity under year 2024 traffic conditions either with or without the addition of site trips from the proposed development. However, upon completion of development within the proposed subdivision and the connection of Dubarko Road to Highway 26, it is projected that the intersection of Highway 26 at Dubarko Road will operate with very high delays for the northeast-bound Dubarko Road approach. Since vehicles exiting the site to the west can also travel west on Dubarko Road to Langensand Road prior to turning west on Highway 26, it is expected that some vehicles will divert and the actual delays will be lower than those reported.

The intersection of Highway 211 at Dubarko Road is projected to operate at level of service F during the evening peak hour if it continues to operate under two-way stop control upon completion of the proposed development. Based on the crash and warrant analysis, it is recommended that the intersection be converted to all-way stop control. With this safety mitigation in place, the intersection is projected to operate within capacity and at level of service D or better during the peak hours, meeting the standards of the City of Sandy.

Based on the crash data, the majority of the study intersections are currently operating acceptably with respect to safety. The intersection of Highway 211 at Dubarko Road has a high historical crash rate which recent safety improvements have not significantly improved. Based on the analysis it was recommended that the intersection be converted to all-way stop control. No other safety improvements are recommended for the study area intersections at this time.

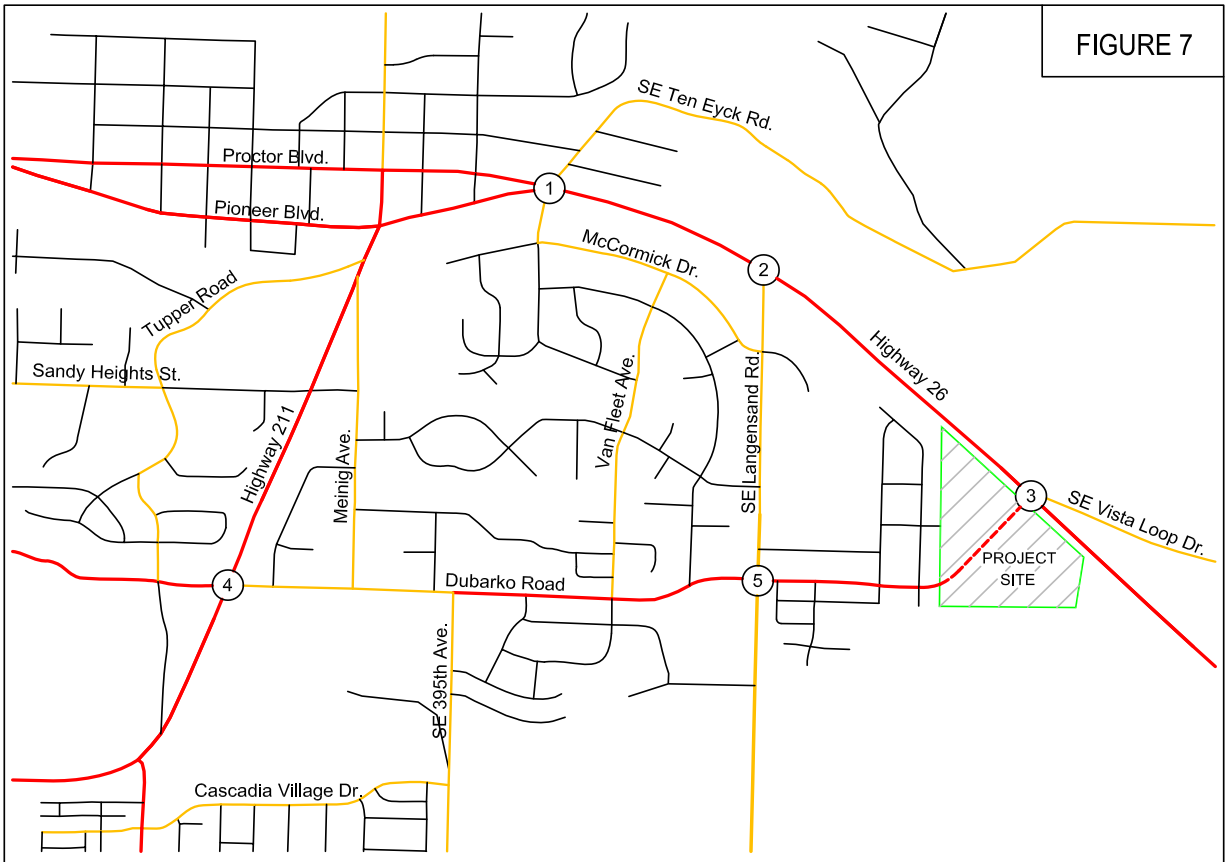
Based on the warrant analysis, a northwest-bound left-turn lane and a southeast-bound right-turn lane are projected to be warranted at the intersection of Highway 26 at Dubarko Road with completion of the Dubarko Road extension. No other turn lanes or traffic signals are recommended in conjunction with the proposed subdivision.

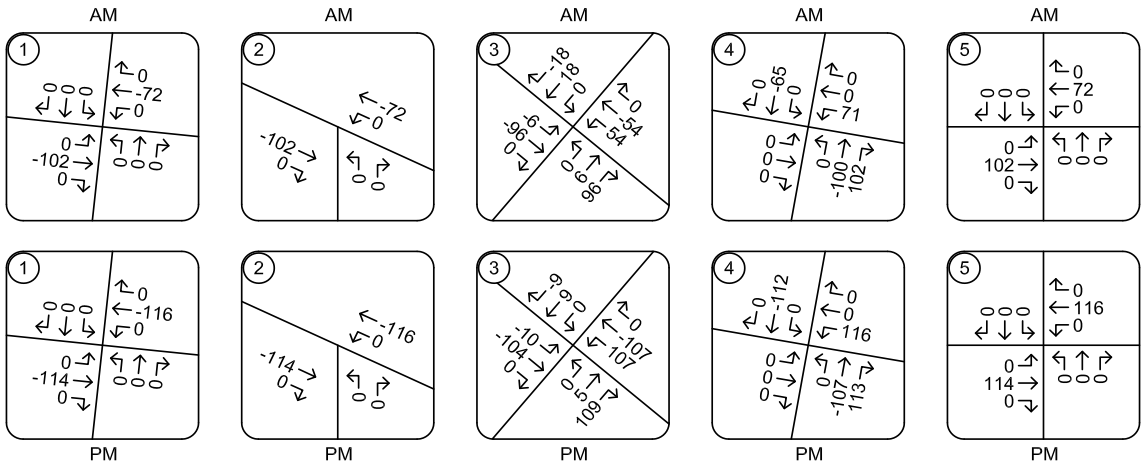
Intersection sight distance was evaluated for the new intersection of Highway 26 at Dubarko Road. The proposed intersection was found to have adequate sight distance in both directions.

A zone change is proposed for the subject property from the existing mix of R-1, R-2 and C-3 zoning to R-1, R-2, R-3, C-3 and POS zoning. It is recommended that the proposed zone change be approved with a condition of approval limiting the site to no more than 340 PM peak hour trips. With this condition of approval, the proposed zone change will not result in a significant effect on the transportation system and will meet the requirements of Oregon's Transportation Planning Rule.

APPENDIX

FIGURE 7

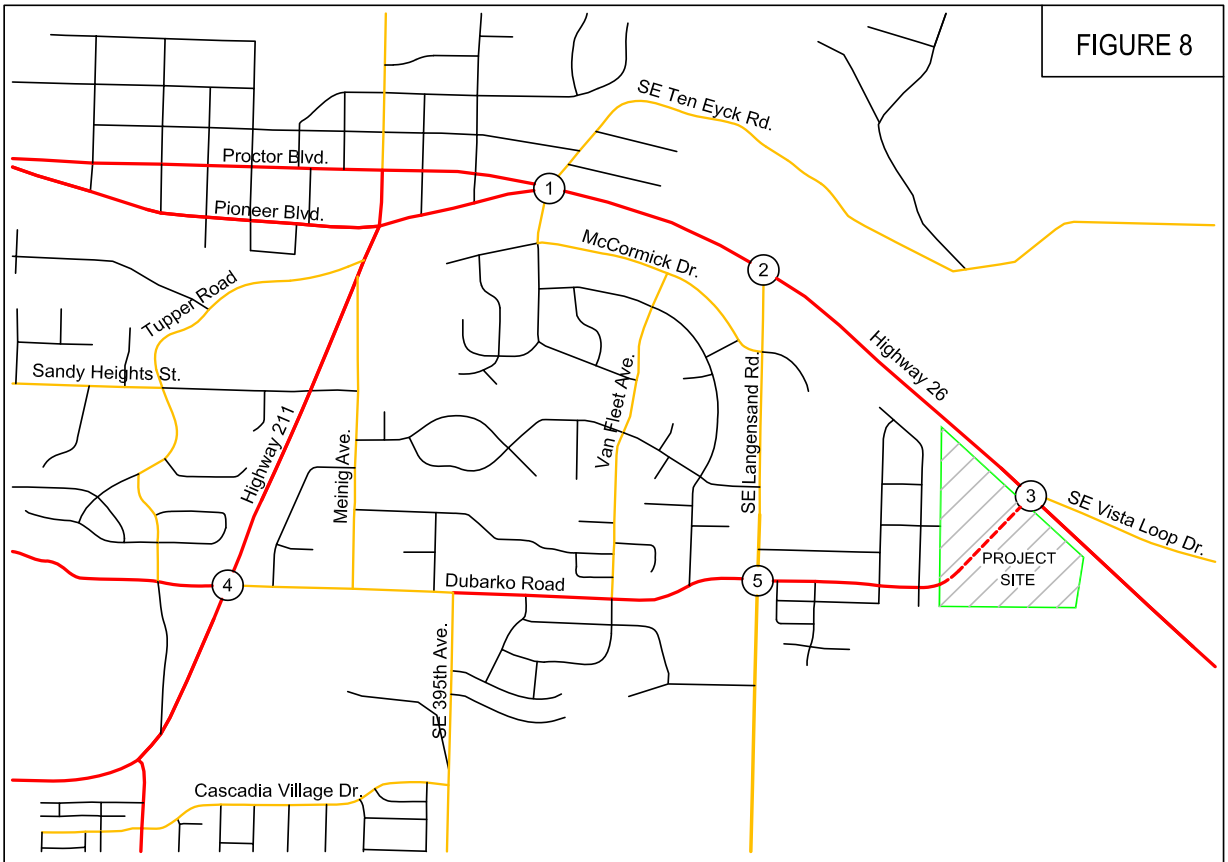


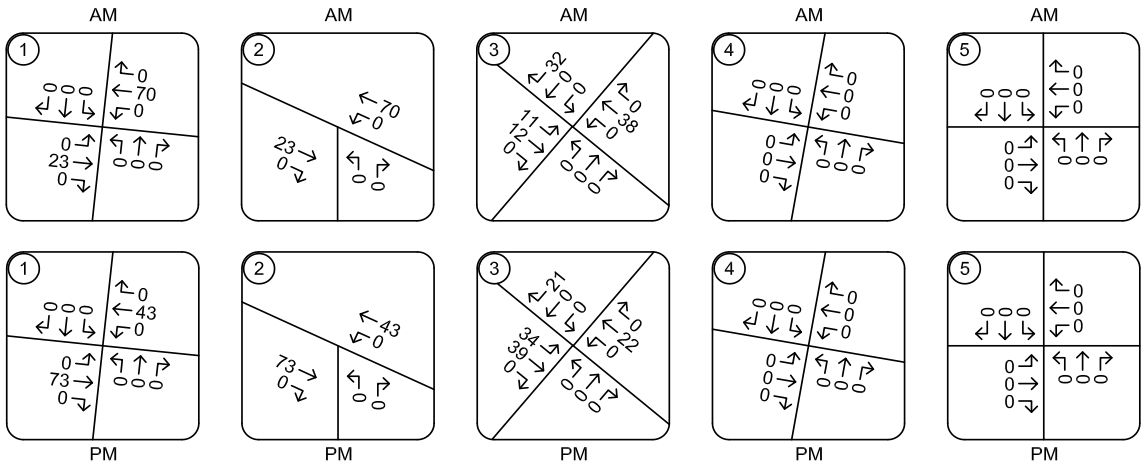


TRAFFIC VOLUMES
Diverted Trips Following Dubarko Connection to Hwy. 26
Morning and Evening Peak Hours

PAGE
APP1

FIGURE 8





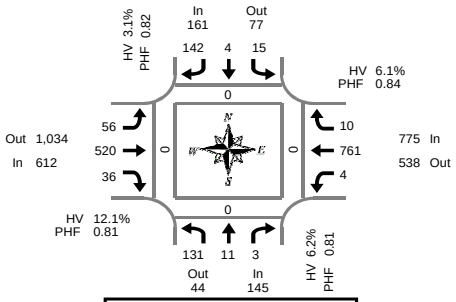
TRAFFIC VOLUMES
"The Views" Development - In-Process Site Trips
Morning and Evening Peak Hours

PAGE
APP2

Total Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
7:00 AM to 8:00 AM

SE Ten Eyck Rd & Hwy 26

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	16	0	0	0	0	0	17	0	5	26	2	0	0	74	0	0	140	0	0	0	0
7:05 AM	10	0	1	0	1	0	10	0	2	18	3	0	1	65	2	0	113	0	0	0	0
7:10 AM	17	1	0	0	2	0	11	0	7	36	2	0	2	74	1	0	153	0	0	0	0
7:15 AM	12	0	0	0	1	2	9	0	9	40	2	0	1	84	1	0	161	0	0	0	0
7:20 AM	15	0	0	0	3	0	11	0	3	40	1	0	0	68	0	0	141	0	0	0	0
7:25 AM	14	1	0	0	1	1	16	0	2	40	4	0	0	70	1	0	150	0	0	0	0
7:30 AM	7	1	1	0	0	0	16	0	8	43	2	0	0	67	0	0	145	0	0	0	0
7:35 AM	12	2	0	0	3	0	12	0	0	56	5	0	0	57	1	0	148	0	0	0	0
7:40 AM	8	2	0	0	0	0	11	0	4	59	3	0	0	53	0	0	140	0	0	0	0
7:45 AM	12	1	1	0	2	0	11	0	4	53	3	0	0	45	2	0	134	0	0	0	0
7:50 AM	4	2	0	0	1	0	10	0	9	47	4	0	0	62	0	0	139	0	0	0	0
7:55 AM	4	1	0	0	1	1	8	0	3	62	5	0	0	42	2	0	129	0	0	0	0
8:00 AM	5	0	1	0	2	1	13	0	2	46	2	0	0	41	0	0	113	0	0	0	0
8:05 AM	6	0	0	0	1	1	5	0	8	50	2	0	0	42	2	0	117	0	0	0	0
8:10 AM	3	0	0	0	2	1	10	0	5	45	4	0	0	53	1	0	124	0	0	0	1
8:15 AM	12	0	0	0	2	0	7	0	3	38	1	0	0	34	1	0	98	0	0	0	0
8:20 AM	6	2	0	0	2	0	9	0	5	38	1	0	1	49	0	0	113	0	0	0	0
8:25 AM	8	0	0	0	1	0	11	0	4	44	3	0	0	39	2	0	112	0	0	0	1
8:30 AM	5	0	0	0	2	1	10	0	4	66	2	0	0	47	0	0	137	1	0	0	0
8:35 AM	10	0	0	0	3	0	13	0	6	59	5	0	0	45	1	0	142	0	0	0	0
8:40 AM	7	0	0	0	5	1	15	0	10	62	3	0	1	43	1	0	148	0	0	0	0
8:45 AM	5	0	0	0	1	0	12	0	5	69	5	0	0	63	0	0	160	0	0	0	0
8:50 AM	9	2	0	0	3	0	12	0	7	56	8	0	1	46	1	0	145	0	0	0	0
8:55 AM	8	1	0	0	2	0	13	0	6	51	8	0	2	44	1	0	136	0	0	0	0
Total Survey	215	16	4	0	41	9	272	0	121	1,144	80	0	9	1,307	20	0	3,238	1	0	0	2

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	43	1	1	0	3	0	38	0	14	80	7	0	3	213	3	0	406	0	0	0	0
7:15 AM	41	1	0	0	5	3	36	0	14	120	7	0	1	222	2	0	452	0	0	0	0
7:30 AM	27	5	1	0	3	0	39	0	12	158	10	0	0	177	1	0	433	0	0	0	0
7:45 AM	20	4	1	0	4	1	29	0	16	162	12	0	0	149	4	0	402	0	0	0	0
8:00 AM	14	0	1	0	5	3	28	0	15	141	8	0	0	136	3	0	354	0	0	0	1
8:15 AM	26	2	0	0	5	0	27	0	12	120	5	0	1	122	3	0	323	0	0	0	1
8:30 AM	22	0	0	0	10	2	38	0	20	187	10	0	1	135	2	0	427	1	0	0	0
8:45 AM	22	3	0	0	6	0	37	0	18	176	21	0	3	153	2	0	441	0	0	0	0
Total Survey	215	16	4	0	41	9	272	0	121	1,144	80	0	9	1,307	20	0	3,238	1	0	0	2

Peak Hour Summary
7:00 AM to 8:00 AM

By Approach	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	145	44	189	0	161	77	238	0	612	1,034	1,646	0	775	538	1,313	0	1,693	0	0	0	0
%HV	6.2%				3.1%				12.1%				6.1%				8.0%				
PHF	0.81				0.82				0.81				0.84				0.93				

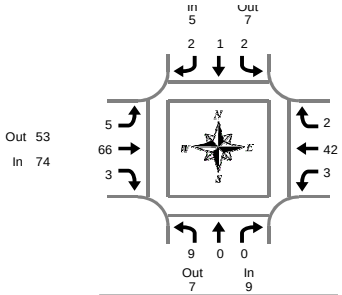
By Movement	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	131	11	3	145	15	4	142	161	56	520	36	612	4	761	10	775	1,693
%HV	6.9%	0.0%	0.0%	6.2%	13.3%	25.0%	1.4%	3.1%	8.9%	12.7%	8.3%	12.1%	75.0%	5.5%	20.0%	6.1%	8.0%
PHF	0.74	0.55	0.75	0.81	0.63	0.33	0.81	0.82	0.74	0.77	0.75	0.81	0.25	0.84	0.63	0.84	0.93

Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	131	11	3	0	15	4	142	0	56	520	36	0	4	761	10	0	1,693	0	0	0	0
7:15 AM	102	10	3	0	17	7	132	0	57	581	37	0	1	684	10	0	1,641	0	0	0	1
7:30 AM	87	11	3	0	17	4	123	0	55	581	35	0	1	584	11	0	1,512	0	0	0	2
7:45 AM	82	6	2	0	24	6	122	0	63	610	35	0	2	542	12	0	1,506	1	0	0	2
8:00 AM	84	5	1	0	26	5	130	0	65	624	44	0	5	546	10	0	1,545	1	0	0	2

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



SE Ten Eyck Rd & Hwy 26

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Peak Hour Summary
7:00 AM to 8:00 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	1	0	0	1	0	0	0	0	1	6	1	8	0	6	0	6	15
7:05 AM	0	0	0	0	0	0	0	0	0	5	0	5	0	5	0	5	10
7:10 AM	3	0	0	3	0	0	0	0	0	3	0	3	2	2	1	5	11
7:15 AM	1	0	0	1	0	1	0	1	2	6	0	8	1	1	0	2	12
7:20 AM	2	0	0	2	1	0	0	1	0	5	0	5	0	1	0	1	9
7:25 AM	0	0	0	0	0	0	0	0	0	6	1	7	0	1	0	1	8
7:30 AM	0	0	0	0	0	0	0	0	0	7	0	7	0	7	0	7	14
7:35 AM	0	0	0	0	1	0	0	1	0	7	0	7	0	6	0	6	14
7:40 AM	0	0	0	0	0	0	0	0	1	8	0	9	0	1	0	1	10
7:45 AM	0	0	0	0	0	0	1	1	0	6	0	6	0	4	0	4	11
7:50 AM	0	0	0	0	0	0	1	1	0	3	0	3	0	7	0	7	11
7:55 AM	2	0	0	2	0	0	0	0	1	4	1	6	0	1	1	2	10
8:00 AM	1	0	0	1	0	0	1	1	0	10	1	11	0	2	0	2	15
8:05 AM	0	0	0	0	1	0	1	2	0	9	0	9	0	7	1	8	19
8:10 AM	0	0	0	0	0	0	0	0	0	2	0	2	0	6	0	6	8
8:15 AM	0	0	0	0	0	0	0	0	0	4	0	4	0	3	0	3	7
8:20 AM	0	0	0	0	0	0	1	1	0	5	0	5	1	2	0	3	9
8:25 AM	0	0	0	0	0	0	0	0	0	6	1	7	0	3	0	3	10
8:30 AM	0	0	0	0	1	0	0	1	2	6	0	8	0	3	0	3	12
8:35 AM	0	0	0	0	0	0	0	0	1	5	0	6	0	8	0	8	14
8:40 AM	0	0	0	0	0	0	1	1	0	5	0	5	0	1	0	1	7
8:45 AM	0	0	0	0	0	0	0	0	0	9	0	9	0	3	0	3	12
8:50 AM	0	0	0	0	0	0	0	0	1	4	0	5	1	8	0	9	14
8:55 AM	0	0	0	0	0	0	3	3	0	0	2	2	0	3	0	3	8
Total Survey	10	0	0	10	4	1	9	14	9	131	7	147	5	91	3	99	270

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	4	0	0	4	0	0	0	0	1	14	1	16	2	13	1	16	36
7:15 AM	3	0	0	3	1	1	0	2	2	17	1	20	1	3	0	4	29
7:30 AM	0	0	0	0	1	0	0	1	1	22	0	23	0	14	0	14	38
7:45 AM	2	0	0	2	0	0	2	2	1	13	1	15	0	12	1	13	32
8:00 AM	1	0	0	1	1	0	2	3	0	21	1	22	0	15	1	16	42
8:15 AM	0	0	0	0	0	0	1	1	0	15	1	16	1	8	0	9	26
8:30 AM	0	0	0	0	1	0	1	2	3	16	0	19	0	12	0	12	33
8:45 AM	0	0	0	0	0	0	3	3	1	13	2	16	1	14	0	15	34
Total Survey	10	0	0	10	4	1	9	14	9	131	7	147	5	91	3	99	270

Heavy Vehicle Peak Hour Summary
7:00 AM to 8:00 AM

By Approach	Northbound SE Ten Eyck Rd			Southbound SE Ten Eyck Rd			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	9	7	16	5	7	12	74	53	127	47	68	115	135
PHF	0.38			0.63			0.80			0.73			0.89

By Movement	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	9	0	0	9	2	1	2	5	5	66	3	74	3	42	2	47	135
PHF	0.38	0.00	0.00	0.38	0.50	0.25	0.25	0.63	0.63	0.75	0.75	0.80	0.25	0.75	0.50	0.73	0.89

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

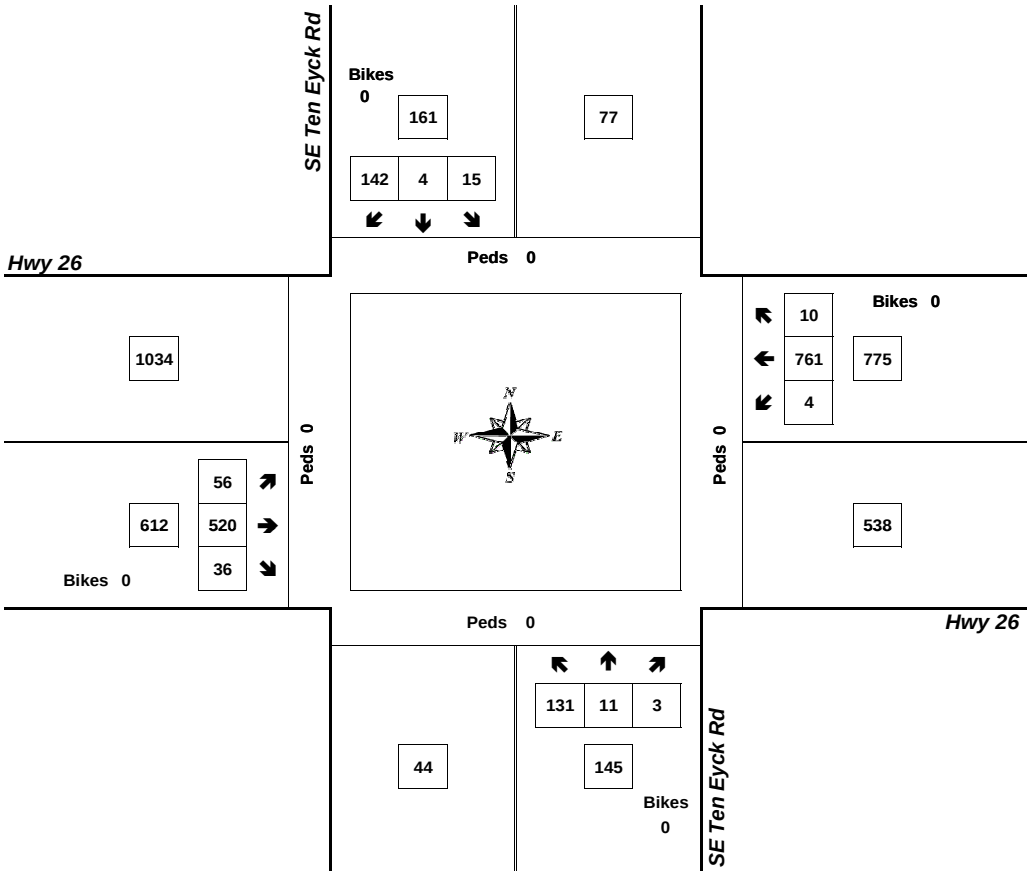
Interval Start Time	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	9	0	0	9	2	1	2	5	5	66	3	74	3	42	2	47	135
7:15 AM	6	0	0	6	3	1	4	8	4	73	3	80	1	44	2	47	141
7:30 AM	3	0	0	3	2	0	5	7	2	71	3	76	1	49	2	52	138
7:45 AM	3	0	0	3	2	0	6	8	4	65	3	72	1	47	2	50	133
8:00 AM	1	0	0	1	2	0	7	9	4	65	4	73	2	49	1	52	135

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SE Ten Eyck Rd & Hwy 26

7:00 AM to 8:00 AM
Wednesday, March 20, 2019

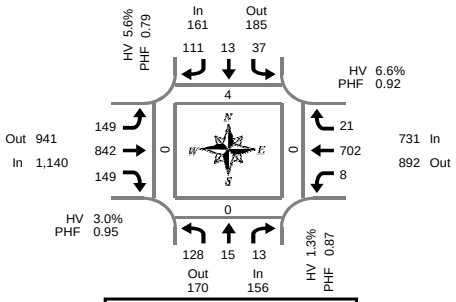


Approach	PHF	HV%	Volume
EB	0.81	12.1%	612
WB	0.84	6.1%	775
NB	0.81	6.2%	145
SB	0.82	3.1%	161
Intersection	0.93	8.0%	1,693

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



SE Ten Eyck Rd & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

Peak Hour Summary
4:10 PM to 5:10 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval	Pedestrians Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	4	0	2	0	4	3	11	0	8	58	12	0	1	49	2	0	154	0	1	0	0
4:05 PM	10	1	0	0	7	1	5	0	12	63	8	0	1	53	3	0	164	0	0	0	0
4:10 PM	7	2	3	0	1	0	17	0	12	76	11	0	0	65	1	0	195	0	0	0	0
4:15 PM	14	0	1	0	7	1	9	0	18	71	15	0	0	62	1	0	199	0	0	0	0
4:20 PM	9	0	1	0	4	1	11	0	9	75	10	0	0	62	7	0	189	0	0	0	0
4:25 PM	12	2	0	0	5	0	10	0	12	61	14	0	0	52	0	0	168	0	0	0	0
4:30 PM	11	1	4	0	3	2	12	0	17	87	16	1	1	58	1	0	213	0	0	0	0
4:35 PM	15	0	0	0	2	2	6	0	6	59	14	0	0	65	3	0	172	0	0	0	0
4:40 PM	7	1	1	0	3	0	7	0	7	54	9	0	1	57	0	0	147	1	0	0	0
4:45 PM	8	1	0	0	4	1	3	0	13	71	15	1	3	51	3	0	173	0	0	0	0
4:50 PM	13	2	1	0	1	1	6	0	19	74	8	0	0	56	0	0	181	0	0	0	0
4:55 PM	7	1	0	0	1	0	12	0	10	67	14	0	3	57	1	0	173	1	0	0	0
5:00 PM	13	3	1	0	2	2	14	0	12	81	12	0	0	49	1	0	190	2	0	0	0
5:05 PM	12	2	1	0	4	3	4	0	14	66	11	0	0	68	3	1	188	0	0	0	0
5:10 PM	8	0	0	0	6	2	10	0	13	60	12	0	0	68	2	0	181	2	0	0	0
5:15 PM	8	2	1	0	6	2	8	0	9	70	11	0	0	57	1	0	175	0	0	0	0
5:20 PM	8	1	1	1	1	4	10	0	15	73	10	0	0	43	1	0	167	0	1	0	0
5:25 PM	9	1	0	0	4	2	8	0	14	74	11	0	0	43	0	0	166	0	0	0	0
5:30 PM	5	0	1	0	4	0	5	0	15	64	10	0	0	44	0	0	148	1	0	0	0
5:35 PM	5	1	0	0	7	0	9	0	17	50	4	1	0	39	0	0	132	0	0	0	0
5:40 PM	4	0	0	0	2	1	5	0	11	56	7	0	0	30	1	0	117	2	0	0	2
5:45 PM	4	1	0	0	3	2	8	0	14	76	6	0	3	41	1	0	159	0	0	0	0
5:50 PM	7	1	0	0	0	1	6	0	14	69	8	0	0	42	0	0	148	0	0	0	0
5:55 PM	10	1	0	0	0	2	3	0	16	65	10	0	0	51	1	0	159	0	0	0	0
Total Survey	210	24	18	1	81	33	199	0	307	1,620	258	3	13	1,262	33	1	4,058	9	2	0	2

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval	Pedestrians Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	21	3	5	0	12	4	33	0	32	197	31	0	2	167	6	0	513	0	1	0	0
4:15 PM	35	2	2	0	16	2	30	0	39	207	39	0	0	176	8	0	556	0	0	0	0
4:30 PM	33	2	5	0	8	4	25	0	30	200	39	1	2	180	4	0	532	1	0	0	0
4:45 PM	28	4	1	0	6	2	21	0	42	212	37	1	6	164	4	0	527	1	0	0	0
5:00 PM	33	5	2	0	12	7	28	0	39	207	35	0	0	185	6	1	559	4	0	0	0
5:15 PM	25	4	2	1	11	8	26	0	38	217	32	0	0	143	2	0	508	0	1	0	0
5:30 PM	14	1	1	0	13	1	19	0	43	170	21	1	0	113	1	0	397	3	0	0	2
5:45 PM	21	3	0	0	3	5	17	0	44	210	24	0	3	134	2	0	466	0	0	0	0
Total Survey	210	24	18	1	81	33	199	0	307	1,620	258	3	13	1,262	33	1	4,058	9	2	0	2

Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	156	170	326	0	161	185	346	0	1,140	941	2,081	2	731	892	1,623	1	2,188	4	0	0	0
%HV	1.3%				5.6%				3.0%				6.6%				4.3%				
PHF	0.87				0.79				0.95				0.92				0.94				

By Movement	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	128	15	13	156	37	13	111	161	149	842	149	1,140	8	702	21	731	2,188
%HV	1.6%	0.0%	0.0%	1.3%	0.0%	0.0%	8.1%	5.6%	4.0%	3.0%	2.0%	3.0%	0.0%	6.7%	4.8%	6.6%	4.3%
PHF	0.84	0.63	0.65	0.87	0.58	0.65	0.75	0.79	0.89	0.94	0.85	0.95	0.33	0.93	0.58	0.92	0.94

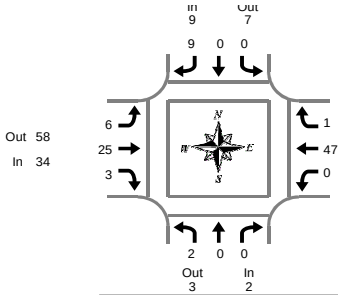
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval	Pedestrians Crosswalk			
Time	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	Total	North	South	East	West
4:00 PM	117	11	13	0	42	12	109	0	143	816	146	2	10	687	22	0	2,128	2	1	0	0
4:15 PM	129	13	10	0	42	15	104	0	150	826	150	2	8	705	22	1	2,174	6	0	0	0
4:30 PM	119	15	10	1	37	21	100	0	149	836	143	2	8	672	16	1	2,126	6	1	0	0
4:45 PM	100	14	6	1	42	18	94	0	162	806	125	2	6	605	13	1	1,991	8	1	0	2
5:00 PM	93	13	5	1	39	21	90	0	164	804	112	1	3	575	11	1	1,930	7	1	0	2

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



SE Ten Eyck Rd & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

Peak Hour Summary
4:10 PM to 5:10 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval
Time	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	Total
4:00 PM	0	0	0	0	0	0	0	0	0	4	0	4	0	10	1	11	15
4:05 PM	0	0	0	0	1	0	0	1	0	6	0	6	0	3	1	4	11
4:10 PM	0	0	0	0	0	0	0	0	0	2	0	2	0	8	0	8	10
4:15 PM	2	0	0	2	0	0	2	2	2	3	0	5	0	3	0	3	12
4:20 PM	0	0	0	0	0	0	2	2	1	3	0	4	0	5	1	6	12
4:25 PM	0	0	0	0	0	0	1	1	0	5	1	6	0	4	0	4	11
4:30 PM	0	0	0	0	0	0	2	2	1	0	0	1	0	3	0	3	6
4:35 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	5
4:40 PM	0	0	0	0	0	0	1	1	0	3	0	3	0	2	0	2	6
4:45 PM	0	0	0	0	0	0	0	0	1	1	0	2	0	4	0	4	6
4:50 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	7	7
4:55 PM	0	0	0	0	0	0	1	1	1	2	1	4	0	0	0	0	5
5:00 PM	0	0	0	0	0	0	0	0	0	4	1	5	0	1	0	1	6
5:05 PM	0	0	0	0	0	0	0	0	0	2	0	2	0	5	0	5	7
5:10 PM	0	0	0	0	0	0	0	0	1	3	0	4	0	4	0	4	8
5:15 PM	0	0	0	0	0	0	0	0	1	1	0	2	0	2	0	2	4
5:20 PM	0	0	0	0	0	0	0	0	0	1	0	1	0	5	0	5	6
5:25 PM	0	0	0	0	0	0	0	0	0	2	0	2	0	1	0	1	3
5:30 PM	0	0	0	0	0	0	0	0	0	3	1	4	0	3	0	3	7
5:35 PM	0	0	0	0	0	0	0	0	1	1	0	2	0	4	0	4	6
5:40 PM	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	2
5:45 PM	1	0	0	1	0	0	0	0	0	2	0	2	0	3	0	3	6
5:50 PM	1	0	0	1	0	0	0	0	0	1	1	2	0	4	0	4	7
5:55 PM	0	0	0	0	0	0	0	0	1	2	0	3	0	5	0	5	8
Total Survey	4	0	0	4	1	0	9	10	10	53	5	68	0	91	3	94	176

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval
Time	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	Total
4:00 PM	0	0	0	0	1	0	0	1	0	12	0	12	0	21	2	23	36
4:15 PM	2	0	0	2	0	0	5	5	3	11	1	15	0	12	1	13	35
4:30 PM	0	0	0	0	0	0	3	3	1	3	0	4	0	10	0	10	17
4:45 PM	0	0	0	0	0	0	1	1	2	3	1	6	0	11	0	11	18
5:00 PM	0	0	0	0	0	0	0	0	1	9	1	11	0	10	0	10	21
5:15 PM	0	0	0	0	0	0	0	0	1	4	0	5	0	8	0	8	13
5:30 PM	0	0	0	0	0	0	0	0	1	6	1	8	0	7	0	7	15
5:45 PM	2	0	0	2	0	0	0	0	1	5	1	7	0	12	0	12	21
Total Survey	4	0	0	4	1	0	9	10	10	53	5	68	0	91	3	94	176

Heavy Vehicle Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound SE Ten Eyck Rd			Southbound SE Ten Eyck Rd			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	2	3	5	9	7	16	34	58	92	48	25	73	93
PHF	0.25			0.45			0.57			0.71			0.66

By Movement	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	2	0	0	2	0	0	9	9	6	25	3	34	0	47	1	48	93
PHF	0.25	0.00	0.00	0.25	0.00	0.00	0.45	0.45	0.50	0.57	0.38	0.57	0.00	0.73	0.25	0.71	0.66

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

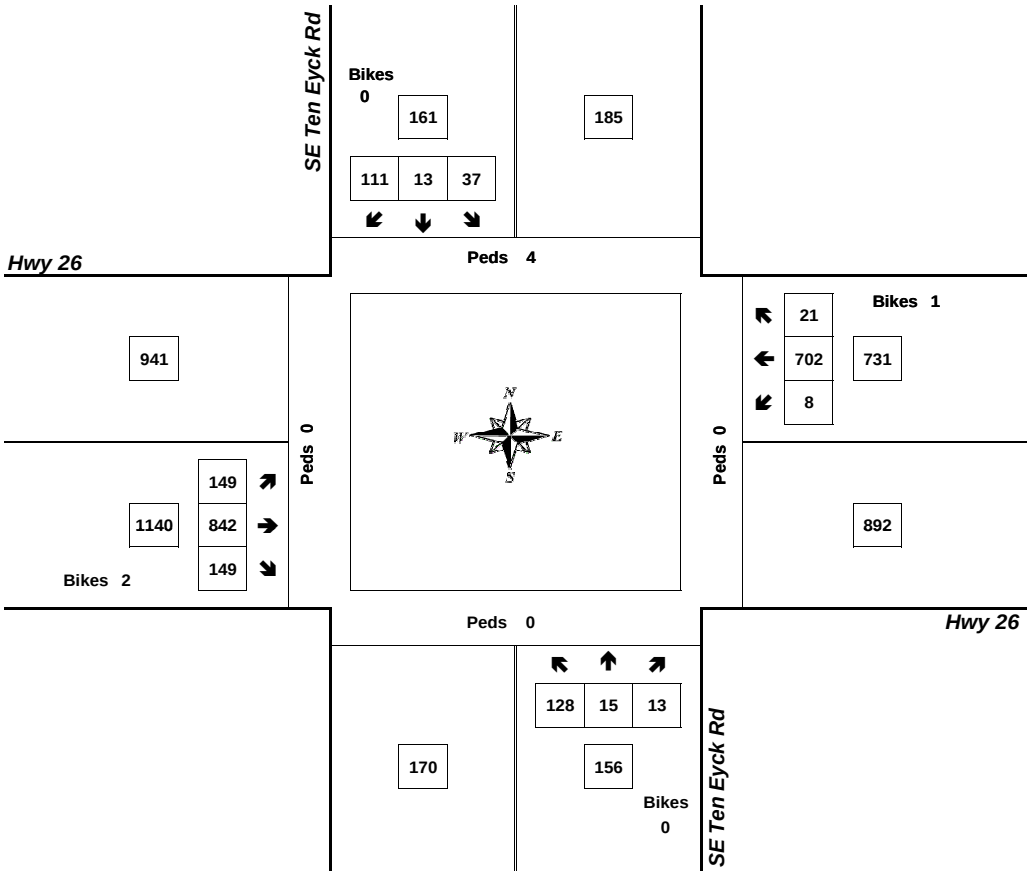
Interval Start	Northbound SE Ten Eyck Rd				Southbound SE Ten Eyck Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval
Time	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	Total
4:00 PM	2	0	0	2	1	0	9	10	6	29	2	37	0	54	3	57	106
4:15 PM	2	0	0	2	0	0	9	9	7	26	3	36	0	43	1	44	91
4:30 PM	0	0	0	0	0	0	4	4	5	19	2	26	0	39	0	39	69
4:45 PM	0	0	0	0	0	0	1	1	5	22	3	30	0	36	0	36	67
5:00 PM	2	0	0	2	0	0	0	0	4	24	3	31	0	37	0	37	70

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SE Ten Eyck Rd & Hwy 26

4:10 PM to 5:10 PM
Tuesday, March 19, 2019

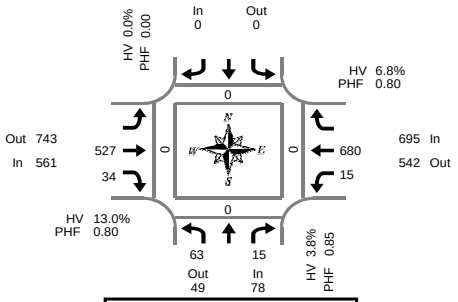


Approach	PHF	HV%	Volume
EB	0.95	3.0%	1,140
WB	0.92	6.6%	731
NB	0.87	1.3%	156
SB	0.79	5.6%	161
Intersection	0.94	4.3%	2,188

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



SE Langensand Rd & Hwy 26

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Peak Hour Summary
7:05 AM to 8:05 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
7:00 AM	4		0	0				0	25	1	0	2	62		0	94	0	0	0	0
7:05 AM	9		0	0				0	24	2	0	2	65		0	102	0	0	0	0
7:10 AM	3		0	0				0	22	2	0	0	74		0	101	0	0	0	0
7:15 AM	4		2	0				0	33	3	0	1	71		0	114	0	0	0	0
7:20 AM	9		2	0				0	52	1	0	0	71		0	135	0	0	0	0
7:25 AM	4		1	0				0	31	3	0	4	67		0	110	0	0	0	0
7:30 AM	5		2	0				0	39	5	0	0	60		0	111	0	0	0	0
7:35 AM	4		1	0				0	52	1	0	2	54		0	114	0	0	0	0
7:40 AM	8		0	0				0	56	3	0	2	41		0	110	0	0	0	0
7:45 AM	1		2	0				0	49	8	0	3	42		0	105	0	0	0	0
7:50 AM	4		2	0				0	56	2	0	1	52		0	117	0	0	0	0
7:55 AM	7		1	0				0	59	2	0	0	45		0	114	0	0	0	0
8:00 AM	5		2	0				0	54	2	0	0	38		0	101	0	0	0	0
8:05 AM	2		2	0				0	44	3	0	1	41		0	93	0	0	0	0
8:10 AM	2		2	0				0	41	1	0	0	49		0	95	0	0	0	0
8:15 AM	4		1	0				0	46	0	0	2	34		0	87	0	0	0	0
8:20 AM	2		1	0				0	40	3	0	0	42		0	88	0	0	0	0
8:25 AM	4		2	0				0	39	2	0	1	43		0	91	0	0	0	0
8:30 AM	5		4	0				0	53	1	0	2	37		0	102	0	0	0	0
8:35 AM	2		3	0				0	56	1	0	0	53		0	115	0	0	0	0
8:40 AM	1		2	0				0	53	8	0	1	47		0	112	0	0	0	0
8:45 AM	6		2	0				0	77	5	0	0	53		0	143	0	0	0	0
8:50 AM	4		4	0				0	52	2	0	5	60		0	127	0	0	0	0
8:55 AM	5		0	0				0	60	0	0	1	42		0	108	0	0	0	0
Total Survey	104		38	0				0	1,113	61	0	30	1,243		0	2,589	0	0	0	0

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
7:00 AM	16		0	0				0	71	5	0	4	201		0	297	0	0	0	0
7:15 AM	17		5	0				0	116	7	0	5	209		0	359	0	0	0	0
7:30 AM	17		3	0				0	147	9	0	4	155		0	335	0	0	0	0
7:45 AM	12		5	0				0	164	12	0	4	139		0	336	0	0	0	0
8:00 AM	9		6	0				0	139	6	0	1	128		0	289	0	0	0	0
8:15 AM	10		4	0				0	125	5	0	3	119		0	266	0	0	0	0
8:30 AM	8		9	0				0	162	10	0	3	137		0	329	0	0	0	0
8:45 AM	15		6	0				0	189	7	0	6	155		0	378	0	0	0	0
Total Survey	104		38	0				0	1,113	61	0	30	1,243		0	2,589	0	0	0	0

Peak Hour Summary
7:05 AM to 8:05 AM

By Approach	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	78	49	127	0	0	0	0	0	561	743	1,304	0	695	542	1,237	0	1,334	0	0	0	0
%HV	3.8%				0.0%				13.0%				6.8%				9.2%				
PHF	0.85				0.00				0.80				0.80				0.93				

By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L		R	Total				Total	T	R	Total		L	T		Total	
Volume	63		15	78				0	527	34	561		15	680		695	1,334
%HV	3.2%	NA	6.7%	3.8%	NA	NA	NA	0.0%	NA	13.1%	11.8%	13.0%	20.0%	6.5%	NA	6.8%	9.2%
PHF	0.88		0.75	0.85				0.00		0.78	0.65	0.80	0.54	0.79		0.80	0.93

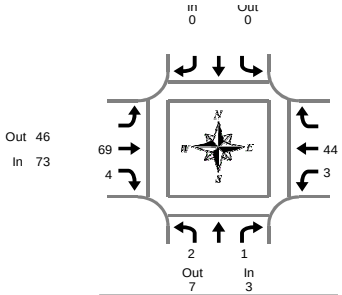
Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
7:00 AM	62		13	0				0	498	33	0	17	704		0	1,327	0	0	0	0
7:15 AM	55		19	0				0	566	34	0	14	631		0	1,319	0	0	0	0
7:30 AM	48		18	0				0	575	32	0	12	541		0	1,226	0	0	0	0
7:45 AM	39		24	0				0	590	33	0	11	523		0	1,220	0	0	0	0
8:00 AM	42		25	0				0	615	28	0	13	539		0	1,262	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
7:05 AM to 8:05 AM

SE Langensand Rd & Hwy 26

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
7:00 AM	0		0	0				0	6	1	7	0	6		6	13
7:05 AM	0		0	0				0	4	1	5	0	6		6	11
7:10 AM	0		0	0				0	2	0	2	0	3		3	5
7:15 AM	0		0	0				0	6	0	6	0	3		3	9
7:20 AM	0		0	0				0	7	0	7	0	0		0	7
7:25 AM	0		0	0				0	5	1	6	1	2		3	9
7:30 AM	0		0	0				0	6	0	6	0	6		6	12
7:35 AM	0		0	0				0	5	0	5	1	7		8	13
7:40 AM	1		0	1				0	7	0	7	0	2		2	10
7:45 AM	0		0	0				0	11	1	12	1	3		4	16
7:50 AM	0		1	1				0	4	1	5	0	5		5	11
7:55 AM	1		0	1				0	3	0	3	0	5		5	9
8:00 AM	0		0	0				0	9	0	9	0	2		2	11
8:05 AM	1		0	1				0	11	1	12	0	7		7	20
8:10 AM	0		0	0				0	2	0	2	0	5		5	7
8:15 AM	0		0	0				0	3	0	3	0	4		4	7
8:20 AM	0		0	0				0	4	1	5	0	2		2	7
8:25 AM	0		1	1				0	4	1	5	0	3		3	9
8:30 AM	0		2	2				0	9	0	9	1	3		4	15
8:35 AM	1		1	2				0	5	0	5	0	6		6	13
8:40 AM	0		0	0				0	5	0	5	0	3		3	8
8:45 AM	0		0	0				0	7	0	7	0	1		1	8
8:50 AM	0		0	0				0	3	0	3	0	9		9	12
8:55 AM	0		0	0				0	4	0	4	0	4		4	8
Total Survey	4		5	9				0	132	8	140	4	97		101	250

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
7:00 AM	0		0	0				0	12	2	14	0	15		15	29
7:15 AM	0		0	0				0	18	1	19	1	5		6	25
7:30 AM	1		0	1				0	18	0	18	1	15		16	35
7:45 AM	1		1	2				0	18	2	20	1	13		14	36
8:00 AM	1		0	1				0	22	1	23	0	14		14	38
8:15 AM	0		1	1				0	11	2	13	0	9		9	23
8:30 AM	1		3	4				0	19	0	19	1	12		13	36
8:45 AM	0		0	0				0	14	0	14	0	14		14	28
Total Survey	4		5	9				0	132	8	140	4	97		101	250

Heavy Vehicle Peak Hour Summary
7:05 AM to 8:05 AM

By Approach	Northbound SE Langensand Rd			Southbound SE Langensand Rd			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	3	7	10	0	0	0	73	46	119	47	70	117	123
PHF	0.38			0.00			0.76			0.69			0.79

By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L		R	Total				Total	T	R	Total	L	T		Total	
Volume	2		1	3				0	69	4	73	3	44		47	123
PHF	0.50		0.25	0.38				0.00	0.75	0.50	0.76	0.38	0.73		0.69	0.79

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

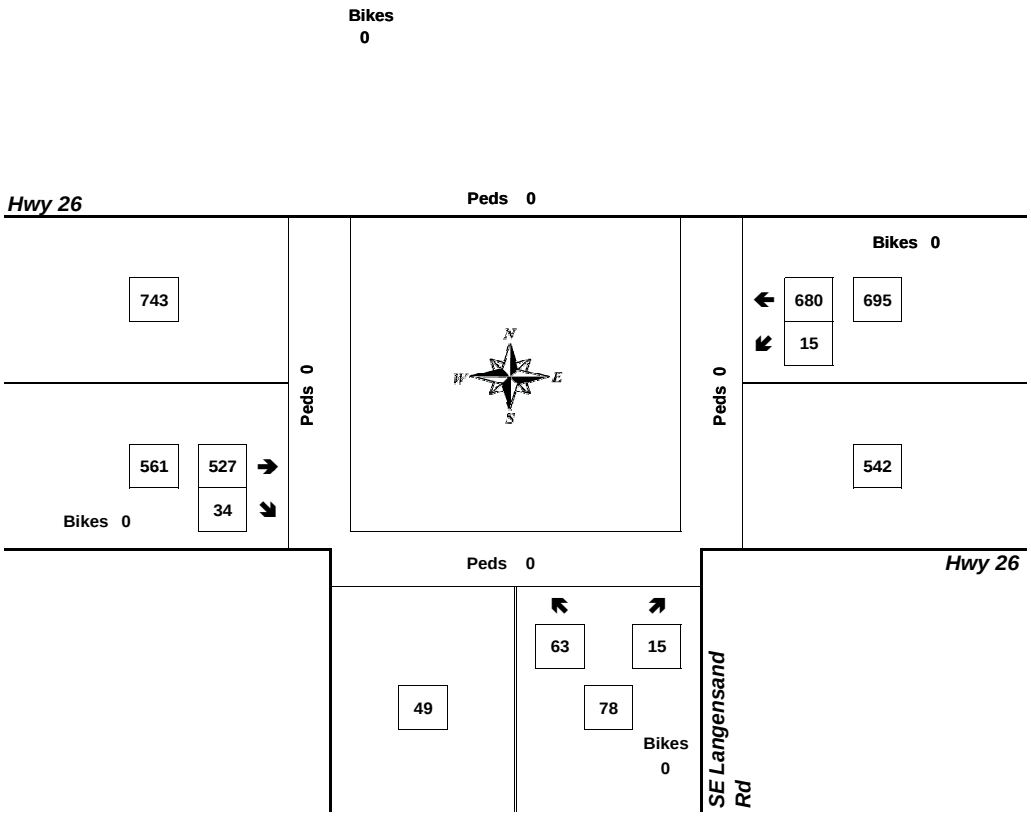
Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
7:00 AM	2		1	3				0	66	5	71	3	48		51	125
7:15 AM	3		1	4				0	76	4	80	3	47		50	134
7:30 AM	3		2	5				0	69	5	74	2	51		53	132
7:45 AM	3		5	8				0	70	5	75	2	48		50	133
8:00 AM	2		4	6				0	66	3	69	1	49		50	125

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SE Langensand Rd & Hwy 26

7:05 AM to 8:05 AM
Wednesday, March 20, 2019

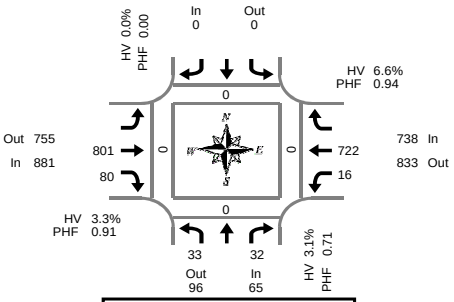


Approach	PHF	HV%	Volume
EB	0.80	13.0%	561
WB	0.80	6.8%	695
NB	0.85	3.8%	78
SB	0.00	0.0%	0
Intersection	0.93	9.2%	1,334

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:10 PM to 5:10 PM

SE Langensand Rd & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	2		4	0				0	62	9	0	5	50		0	132	0	0	0	0
4:05 PM	1		2	0				0	69	6	0	3	52		0	133	0	0	0	0
4:10 PM	1		3	0				0	61	3	0	1	74		0	143	0	0	0	0
4:15 PM	6		1	0				0	76	5	0	1	50		0	139	0	0	0	0
4:20 PM	5		5	0				0	79	9	0	1	70		0	169	0	0	0	0
4:25 PM	6		0	1				0	58	8	0	1	49		0	122	0	0	0	0
4:30 PM	0		3	0				0	75	12	0	1	56		0	147	0	0	0	0
4:35 PM	2		5	0				0	61	7	0	1	64		0	140	0	0	0	0
4:40 PM	0		1	0				0	59	1	0	1	55		0	117	0	0	0	0
4:45 PM	1		1	0				0	64	3	0	2	63		0	134	0	0	0	0
4:50 PM	6		5	0				0	62	6	0	0	54		0	133	0	0	0	0
4:55 PM	3		0	0				0	72	5	0	2	56		0	138	0	0	0	0
5:00 PM	1		5	0				0	62	10	0	1	55		0	134	0	0	0	0
5:05 PM	2		3	0				0	72	11	0	4	76		0	168	0	0	0	0
5:10 PM	2		3	0				0	58	14	0	1	65		0	143	0	0	0	0
5:15 PM	1		2	0				0	51	8	0	2	59		0	123	0	0	0	0
5:20 PM	2		4	0				0	78	7	0	2	43		0	136	0	0	0	0
5:25 PM	3		1	0				0	71	5	0	1	42		0	123	0	0	0	0
5:30 PM	2		2	0				0	67	7	0	3	38		0	119	0	0	0	0
5:35 PM	1		1	0				0	60	5	0	1	38		0	106	0	0	0	0
5:40 PM	0		4	0				0	49	7	0	0	34		0	94	0	0	0	0
5:45 PM	2		1	0				0	69	7	0	1	45		0	125	0	0	0	0
5:50 PM	0		3	0				0	60	4	0	0	43		0	110	0	0	0	0
5:55 PM	4		1	0				0	65	8	0	3	52		0	133	0	0	0	0
Total Survey	53		60	1				0	1,560	167	0	38	1,283		0	3,161	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	4		9	0				0	192	18	0	9	176		0	408	0	0	0	0
4:15 PM	17		6	1				0	213	22	0	3	169		0	430	0	0	0	0
4:30 PM	2		9	0				0	195	20	0	3	175		0	404	0	0	0	0
4:45 PM	10		6	0				0	198	14	0	4	173		0	405	0	0	0	0
5:00 PM	5		11	0				0	192	35	0	6	196		0	445	0	0	0	0
5:15 PM	6		7	0				0	200	20	0	5	144		0	382	0	0	0	0
5:30 PM	3		7	0				0	176	19	0	4	110		0	319	0	0	0	0
5:45 PM	6		5	0				0	194	19	0	4	140		0	368	0	0	0	0
Total Survey	53		60	1				0	1,560	167	0	38	1,283		0	3,161	0	0	0	0

Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	65	96	161	1	0	0	0	0	881	755	1,636	0	738	833	1,571	0	1,684	0	0	0	0
%HV	3.1%				0.0%				3.3%				6.6%				4.8%				
PHF	0.71				0.00				0.91				0.94				0.93				

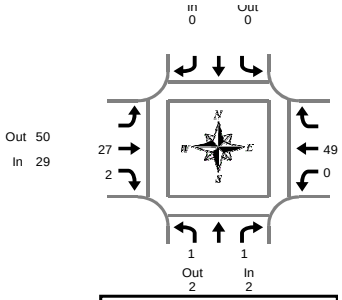
By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L		R	Total				Total		T	R	Total	L	T		Total	
Volume	33		32	65				0		801	80	881	16	722		738	1,684
%HV	3.0%	NA	3.1%	3.1%	NA	NA	NA	0.0%	NA	3.4%	2.5%	3.3%	0.0%	6.8%	NA	6.6%	4.8%
PHF	0.49		0.80	0.71				0.00		0.93	0.69	0.91	0.57	0.93		0.94	0.93

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	33		30	1				0	798	74	0	19	693		0	1,647	0	0	0	0
4:15 PM	34		32	1				0	798	91	0	16	713		0	1,684	0	0	0	0
4:30 PM	23		33	0				0	785	89	0	18	688		0	1,636	0	0	0	0
4:45 PM	24		31	0				0	766	88	0	19	623		0	1,551	0	0	0	0
5:00 PM	20		30	0				0	762	93	0	19	590		0	1,514	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



SE Langensand Rd & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

Peak Hour Summary
4:10 PM to 5:10 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
4:00 PM	0		0	0				0	3	0	3	0	11		11	14
4:05 PM	0		0	0				0	8	0	8	0	5		5	13
4:10 PM	0		0	0				0	2	0	2	0	7		7	9
4:15 PM	0		0	0				0	5	0	5	0	4		4	9
4:20 PM	1		0	1				0	4	1	5	0	4		4	10
4:25 PM	0		0	0				0	3	0	3	0	5		5	8
4:30 PM	0		1	1				0	1	1	2	0	3		3	6
4:35 PM	0		0	0				0	1	0	1	0	4		4	5
4:40 PM	0		0	0				0	2	0	2	0	3		3	5
4:45 PM	0		0	0				0	1	0	1	0	4		4	5
4:50 PM	0		0	0				0	2	0	2	0	6		6	8
4:55 PM	0		0	0				0	1	0	1	0	2		2	3
5:00 PM	0		0	0				0	3	0	3	0	1		1	4
5:05 PM	0		0	0				0	2	0	2	0	6		6	8
5:10 PM	0		0	0				0	0	1	1	0	4		4	5
5:15 PM	0		0	0				0	2	0	2	0	3		3	5
5:20 PM	0		0	0				0	0	0	0	0	5		5	5
5:25 PM	0		0	0				0	1	0	1	0	1		1	2
5:30 PM	0		0	0				0	4	0	4	0	2		2	6
5:35 PM	0		0	0				0	0	0	0	1	2		3	3
5:40 PM	0		0	0				0	1	0	1	0	3		3	4
5:45 PM	0		0	0				0	4	0	4	0	3		3	7
5:50 PM	0		0	0				0	1	0	1	0	2		2	3
5:55 PM	0		0	0				0	2	0	2	0	7		7	9
Total Survey	1		1	2				0	53	3	56	1	97		98	156

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
4:00 PM	0		0	0				0	13	0	13	0	23		23	36
4:15 PM	1		0	1				0	12	1	13	0	13		13	27
4:30 PM	0		1	1				0	4	1	5	0	10		10	16
4:45 PM	0		0	0				0	4	0	4	0	12		12	16
5:00 PM	0		0	0				0	5	1	6	0	11		11	17
5:15 PM	0		0	0				0	3	0	3	0	9		9	12
5:30 PM	0		0	0				0	5	0	5	1	7		8	13
5:45 PM	0		0	0				0	7	0	7	0	12		12	19
Total Survey	1		1	2				0	53	3	56	1	97		98	156

Heavy Vehicle Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound SE Langensand Rd			Southbound SE Langensand Rd			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	2	2	4	0	0	0	29	50	79	49	28	77	80
PHF	0.25			0.00			0.56			0.82			0.71

By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L		R	Total				Total	T	R	Total	L	T		Total	
Volume	1		1	2				0	27	2	29	0	49		49	80
PHF	0.25		0.25	0.25				0.00	0.56	0.25	0.56	0.00	0.82		0.82	0.71

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
4:00 PM	1		1	2				0	33	2	35	0	58		58	95
4:15 PM	1		1	2				0	25	3	28	0	46		46	76
4:30 PM	0		1	1				0	16	2	18	0	42		42	61
4:45 PM	0		0	0				0	17	1	18	1	39		40	58
5:00 PM	0		0	0				0	20	1	21	1	39		40	61

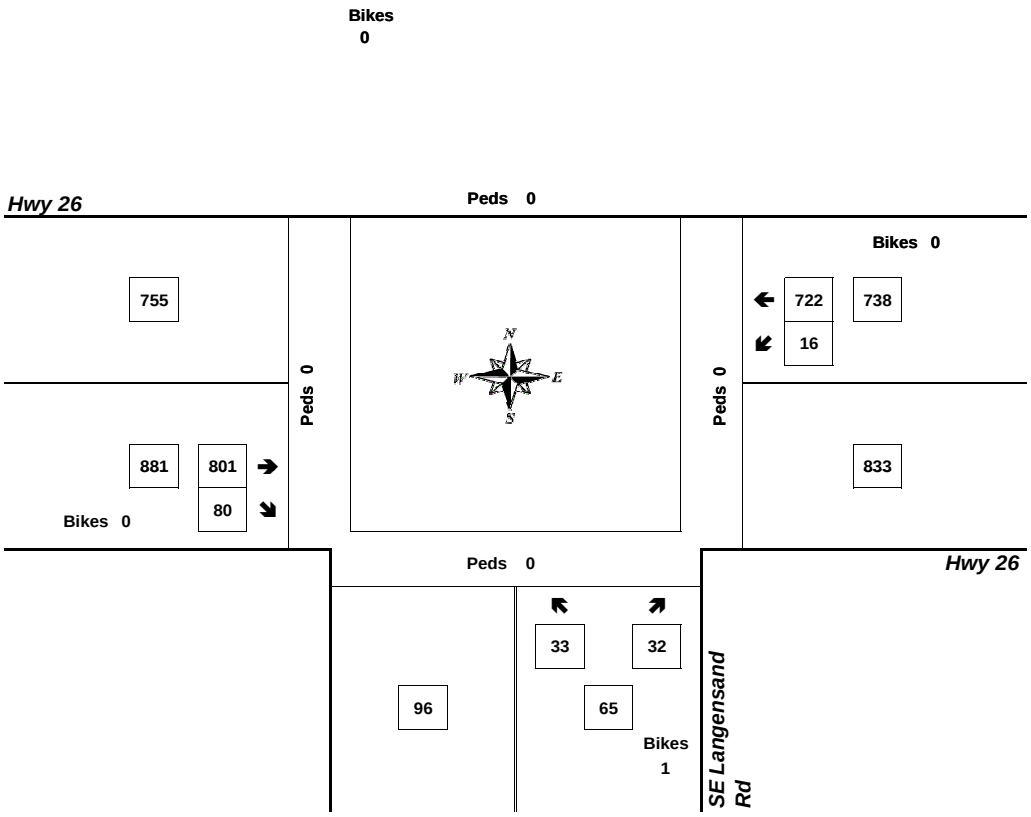
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

SE Langensand Rd & Hwy 26

4:10 PM to 5:10 PM
Tuesday, March 19, 2019

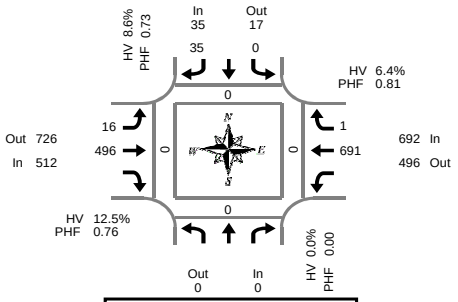


Approach	PHF	HV%	Volume
EB	0.91	3.3%	881
WB	0.94	6.6%	738
NB	0.71	3.1%	65
SB	0.00	0.0%	0
Intersection	0.93	4.8%	1,684

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



SE Vista Loop Dr & Hwy 26

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Peak Hour Summary
7:00 AM to 8:00 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
7:00 AM				0	0		6	0	1	25		0		68	0	0	100	0	0	0	0
7:05 AM				0	0		2	0	0	25		0		54	0	0	81	0	0	0	0
7:10 AM				0	0		4	0	1	24		0		80	0	0	109	0	0	0	0
7:15 AM				0	0		2	0	2	32		0		71	0	0	107	0	0	0	0
7:20 AM				0	0		2	0	2	51		0		63	0	0	118	0	0	0	0
7:25 AM				0	0		4	0	1	31		0		62	0	0	98	0	0	0	0
7:30 AM				0	0		1	0	2	46		0		62	1	0	112	0	0	0	0
7:35 AM				0	0		4	0	0	43		0		49	0	0	96	0	0	0	0
7:40 AM				0	0		4	0	3	54		0		45	0	0	106	0	0	0	0
7:45 AM				0	0		4	0	0	54		0		44	0	0	102	0	0	0	0
7:50 AM				0	0		0	0	2	53		0		57	0	0	112	0	0	0	0
7:55 AM				0	0		2	0	2	58		0		36	0	0	98	0	0	0	0
8:00 AM				0	0		3	0	1	52		0		31	0	0	87	0	0	0	0
8:05 AM				0	0		2	0	3	44		0		40	0	0	89	0	0	0	0
8:10 AM				0	1		1	0	0	42		0		50	0	0	94	0	0	0	0
8:15 AM				0	0		0	0	1	46		0		32	0	0	79	0	0	0	0
8:20 AM				0	0		1	0	2	38		0		46	0	0	87	0	0	0	0
8:25 AM				0	0		0	0	3	39		0		42	0	0	84	0	0	0	0
8:30 AM				0	0		2	0	0	61		0		42	0	0	105	0	0	0	0
8:35 AM				0	0		0	0	0	56		0		44	0	0	100	0	0	0	0
8:40 AM				0	1		2	0	0	64		0		52	0	0	119	0	0	0	0
8:45 AM				0	0		1	0	0	66		0		56	0	0	123	0	0	0	0
8:50 AM				0	0		0	0	2	56		0		49	0	0	107	0	0	0	0
8:55 AM				0	0		2	0	2	61		0		42	0	0	107	0	0	0	0
Total Survey				0	2		49	0	30	1,121		0		1,217	1	0	2,420	0	0	0	0

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
7:00 AM				0	0		12	0	2	74		0		202	0	0	290	0	0	0	0
7:15 AM				0	0		8	0	5	114		0		196	0	0	323	0	0	0	0
7:30 AM				0	0		9	0	5	143		0		156	1	0	314	0	0	0	0
7:45 AM				0	0		6	0	4	165		0		137	0	0	312	0	0	0	0
8:00 AM				0	1		6	0	4	138		0		121	0	0	270	0	0	0	0
8:15 AM				0	0		1	0	6	123		0		120	0	0	250	0	0	0	0
8:30 AM				0	1		4	0	0	181		0		138	0	0	324	0	0	0	0
8:45 AM				0	0		3	0	4	183		0		147	0	0	337	0	0	0	0
Total Survey				0	2		49	0	30	1,121		0		1,217	1	0	2,420	0	0	0	0

Peak Hour Summary
7:00 AM to 8:00 AM

By Approach	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	0	0	0	35	17	52	0	512	726	1,238	0	692	496	1,188	0	1,239	0	0	0	0
%HV	0.0%				8.6%				12.5%				6.4%				9.0%				
PHF	0.00				0.73				0.76				0.81				0.93				

By Movement	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26			Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	0		35	35	16	496		512		691	1	692	1,239
%HV	NA	NA	NA	0.0%	0.0%	NA	8.6%	8.6%	6.3%	12.7%	NA	12.5%	NA	6.4%	0.0%	6.4%	9.0%
PHF				0.00	0.00		0.73	0.73	0.80	0.75		0.76		0.81	0.25	0.81	0.93

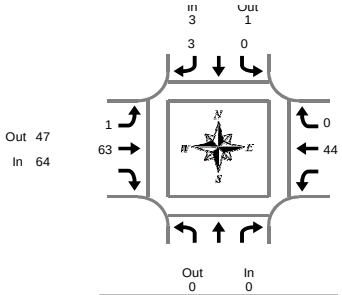
Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
7:00 AM				0	0		35	0	16	496		0		691	1	0	1,239	0	0	0	0
7:15 AM				0	1		29	0	18	560		0		610	1	0	1,219	0	0	0	0
7:30 AM				0	1		22	0	19	569		0		534	1	0	1,146	0	0	0	0
7:45 AM				0	2		17	0	14	607		0		516	0	0	1,156	0	0	0	0
8:00 AM				0	2		14	0	14	625		0		526	0	0	1,181	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



SE Vista Loop Dr & Hwy 26

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Peak Hour Summary
7:00 AM to 8:00 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
7:00 AM				0	0		0	0	0	6		6		4	0	4	10
7:05 AM				0	0		0	0	0	4		4		5	0	5	9
7:10 AM				0	0		1	1	0	2		2		3	0	3	6
7:15 AM				0	0		0	0	0	3		3		2	0	2	5
7:20 AM				0	0		0	0	0	7		7		1	0	1	8
7:25 AM				0	0		0	0	0	5		5		3	0	3	8
7:30 AM				0	0		0	0	0	8		8		6	0	6	14
7:35 AM				0	0		1	1	0	4		4		5	0	5	10
7:40 AM				0	0		1	1	1	9		10		3	0	3	14
7:45 AM				0	0		0	0	0	7		7		3	0	3	10
7:50 AM				0	0		0	0	0	5		5		8	0	8	13
7:55 AM				0	0		0	0	0	3		3		1	0	1	4
8:00 AM				0	0		0	0	1	8		9		3	0	3	12
8:05 AM				0	0		1	1	1	10		11		5	0	5	17
8:10 AM				0	0		1	1	0	3		3		6	0	6	10
8:15 AM				0	0		0	0	0	4		4		3	0	3	7
8:20 AM				0	0		0	0	1	4		5		2	0	2	7
8:25 AM				0	0		0	0	1	5		6		3	0	3	9
8:30 AM				0	0		0	0	0	11		11		4	0	4	15
8:35 AM				0	0		0	0	0	5		5		8	0	8	13
8:40 AM				0	1		0	1	0	7		7		3	0	3	11
8:45 AM				0	0		0	0	0	8		8		4	0	4	12
8:50 AM				0	0		0	0	1	5		6		6	0	6	12
8:55 AM				0	0		0	0	0	1		1		3	0	3	4
Total Survey				0	1		5	6	6	134		140		94	0	94	240

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
7:00 AM				0	0		1	1	0	12		12		12	0	12	25
7:15 AM				0	0		0	0	0	15		15		6	0	6	21
7:30 AM				0	0		2	2	1	21		22		14	0	14	38
7:45 AM				0	0		0	0	0	15		15		12	0	12	27
8:00 AM				0	0		2	2	2	21		23		14	0	14	39
8:15 AM				0	0		0	0	2	13		15		8	0	8	23
8:30 AM				0	1		0	1	0	23		23		15	0	15	39
8:45 AM				0	0		0	0	1	14		15		13	0	13	28
Total Survey				0	1		5	6	6	134		140		94	0	94	240

Heavy Vehicle Peak Hour Summary
7:00 AM to 8:00 AM

By Approach	Northbound SE Vista Loop Dr			Southbound SE Vista Loop Dr			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	0	0	0	3	1	4	64	47	111	44	63	107	111
PHF	0.00			0.38			0.73			0.79			0.73

By Movement	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	0		3	3	1	63		64		44	0	44	111
PHF				0.00	0.00		0.38	0.38	0.25	0.75		0.73		0.79	0.00	0.79	0.73

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

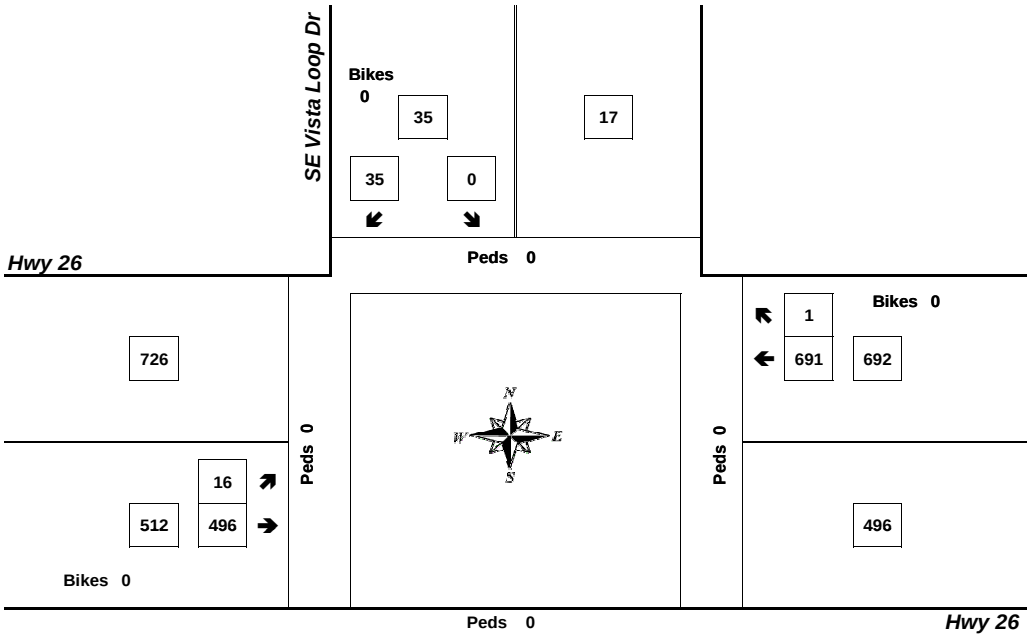
Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
7:00 AM				0	0		3	3	1	63		64		44	0	44	111
7:15 AM				0	0		4	4	3	72		75		46	0	46	125
7:30 AM				0	0		4	4	5	70		75		48	0	48	127
7:45 AM				0	1		2	3	4	72		76		49	0	49	128
8:00 AM				0	1		2	3	5	71		76		50	0	50	129

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SE Vista Loop Dr & Hwy 26

7:00 AM to 8:00 AM
Wednesday, March 20, 2019



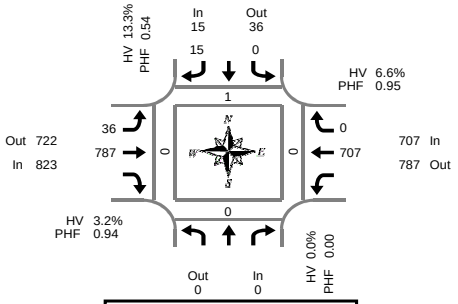
Bikes 0

Approach	PHF	HV%	Volume
EB	0.76	12.5%	512
WB	0.81	6.4%	692
NB	0.00	0.0%	0
SB	0.73	8.6%	35
Intersection	0.93	9.0%	1,239

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

SE Vista Loop Dr & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
4:00 PM				0	0		2	0	1	53		0		55	0	0	111	0	0	0	0
4:05 PM				0	1		0	0	2	65		0		60	0	0	128	0	0	0	0
4:10 PM				0	0		3	0	5	61		0		62	0	0	131	0	0	0	0
4:15 PM				0	0		1	0	7	68		0		53	0	0	129	0	0	0	0
4:20 PM				0	0		3	0	2	86		0		68	0	0	159	0	0	0	0
4:25 PM				0	0		2	0	1	50		0		44	0	0	97	0	0	0	0
4:30 PM				0	0		2	0	3	76		1		63	0	0	144	0	0	0	0
4:35 PM				0	0		1	0	4	69		0		54	0	0	128	0	0	0	0
4:40 PM				0	0		0	0	2	51		1		68	0	0	121	1	0	0	0
4:45 PM				0	0		1	1	1	59		0		59	0	0	120	0	0	0	0
4:50 PM				0	0		0	0	2	70		0		59	0	0	131	0	0	0	0
4:55 PM				0	0		1	0	4	64		0		58	0	0	127	0	0	0	0
5:00 PM				0	0		2	0	3	69		0		54	0	0	128	0	0	0	0
5:05 PM				0	0		1	0	3	64		0		58	0	0	126	0	0	0	0
5:10 PM				0	0		1	0	4	61		0		69	0	0	135	0	0	0	0
5:15 PM				0	0		0	0	0	57		0		44	0	0	101	0	0	0	0
5:20 PM				0	0		0	0	1	73		0		39	0	0	113	0	0	0	0
5:25 PM				0	0		4	0	2	61		0		41	0	0	108	0	0	0	0
5:30 PM				0	0		2	0	4	76		0		39	0	0	121	0	0	0	0
5:35 PM				0	0		0	0	1	56		0		39	0	0	96	0	0	0	0
5:40 PM				0	0		3	0	0	62		0		29	0	0	94	0	0	0	0
5:45 PM				0	0		1	0	0	79		0		46	0	0	126	0	0	0	0
5:50 PM				0	0		0	0	1	60		0		45	0	0	106	0	0	0	0
5:55 PM				0	0		2	0	3	70		0		42	0	0	117	0	0	0	0
Total Survey				0	1		32	1	56	1,560		2		1,248	0	0	2,897	1	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
4:00 PM				0	1		5	0	8	179		0		177	0	0	370	0	0	0	0
4:15 PM				0	0		6	0	10	204		0		165	0	0	385	0	0	0	0
4:30 PM				0	0		3	0	9	196		2		185	0	0	393	1	0	0	0
4:45 PM				0	0		2	1	7	193		0		176	0	0	378	0	0	0	0
5:00 PM				0	0		4	0	10	194		0		181	0	0	389	0	0	0	0
5:15 PM				0	0		4	0	3	191		0		124	0	0	322	0	0	0	0
5:30 PM				0	0		5	0	5	194		0		107	0	0	311	0	0	0	0
5:45 PM				0	0		3	0	4	209		0		133	0	0	349	0	0	0	0
Total Survey				0	1		32	1	56	1,560		2		1,248	0	0	2,897	1	0	0	0

Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	0	0	0	0	15	36	51	1	823	722	1,545	2	707	787	1,494	0	1,545	1	0	0	0
%HV	0.0%				13.3%				3.2%				6.6%				4.9%				
PHF	0.00				0.54				0.94				0.95				0.97				

By Movement	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	0		15	15	36	787		823		707	0	707	1,545
%HV	NA	NA	NA	0.0%	0.0%	NA	13.3%	13.3%	0.0%	3.3%	NA	3.2%	NA	6.6%	0.0%	6.6%	4.9%
PHF				0.00	0.00		0.54	0.54	0.90	0.93		0.94		0.95	0.00	0.95	0.97

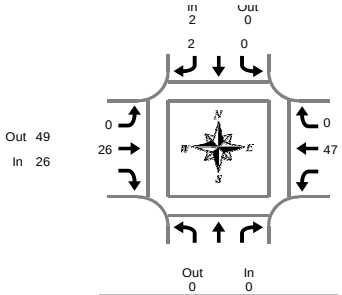
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
				Bikes	L		R	Bikes	L	T		Bikes		T	R	Bikes		North	South	East	West
4:00 PM				0	1		16	1	34	772		2		703	0	0	1,526	1	0	0	0
4:15 PM				0	0		15	1	36	787		2		707	0	0	1,545	1	0	0	0
4:30 PM				0	0		13	1	29	774		2		666	0	0	1,482	1	0	0	0
4:45 PM				0	0		15	1	25	772		0		588	0	0	1,400	0	0	0	0
5:00 PM				0	0		16	0	22	788		0		545	0	0	1,371	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:15 PM to 5:15 PM

SE Vista Loop Dr & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
4:00 PM				0	0		1	1	0	2		2		10	0	10	13
4:05 PM				0	1		0	1	1	6		7		2	0	2	10
4:10 PM				0	0		1	1	1	2		3		7	0	7	11
4:15 PM				0	0		0	0	0	3		3		3	0	3	6
4:20 PM				0	0		1	1	0	6		6		4	0	4	11
4:25 PM				0	0		1	1	0	3		3		3	0	3	7
4:30 PM				0	0		0	0	0	1		1		1	0	1	2
4:35 PM				0	0		0	0	0	0		0		5	0	5	5
4:40 PM				0	0		0	0	0	3		3		3	0	3	6
4:45 PM				0	0		0	0	0	1		1		3	0	3	4
4:50 PM				0	0		0	0	0	2		2		8	0	8	10
4:55 PM				0	0		0	0	0	1		1		1	0	1	2
5:00 PM				0	0		0	0	0	4		4		4	0	4	8
5:05 PM				0	0		0	0	0	1		1		8	0	8	9
5:10 PM				0	0		0	0	0	1		1		4	0	4	5
5:15 PM				0	0		0	0	0	2		2		1	0	1	3
5:20 PM				0	0		0	0	0	0		0		5	0	5	5
5:25 PM				0	0		0	0	0	0		0		1	0	1	1
5:30 PM				0	0		0	0	0	2		2		2	0	2	4
5:35 PM				0	0		0	0	0	0		0		4	0	4	4
5:40 PM				0	0		0	0	0	2		2		2	0	2	4
5:45 PM				0	0		0	0	0	2		2		1	0	1	3
5:50 PM				0	0		0	0	0	0		0		2	0	2	2
5:55 PM				0	0		0	0	0	2		2		3	0	3	5
Total Survey				0	1		4	5	2	46		48		87	0	87	140

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
4:00 PM				0	1		2	3	2	10		12		19	0	19	34
4:15 PM				0	0		2	2	0	12		12		10	0	10	24
4:30 PM				0	0		0	0	0	4		4		9	0	9	13
4:45 PM				0	0		0	0	0	4		4		12	0	12	16
5:00 PM				0	0		0	0	0	6		6		16	0	16	22
5:15 PM				0	0		0	0	0	2		2		7	0	7	9
5:30 PM				0	0		0	0	0	4		4		8	0	8	12
5:45 PM				0	0		0	0	0	4		4		6	0	6	10
Total Survey				0	1		4	5	2	46		48		87	0	87	140

Heavy Vehicle Peak Hour Summary
4:15 PM to 5:15 PM

By Approach	Northbound SE Vista Loop Dr			Southbound SE Vista Loop Dr			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	0	0	0	2	0	2	26	49	75	47	26	73	75
PHF	0.00			0.25			0.54			0.73			0.78

By Movement	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Total
				Total	L		R	Total	L	T		Total		T	R	Total	
Volume				0	0		2	2	0	26		26		47	0	47	75
PHF				0.00	0.00		0.25	0.25	0.00	0.54		0.54		0.73	0.00	0.73	0.78

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

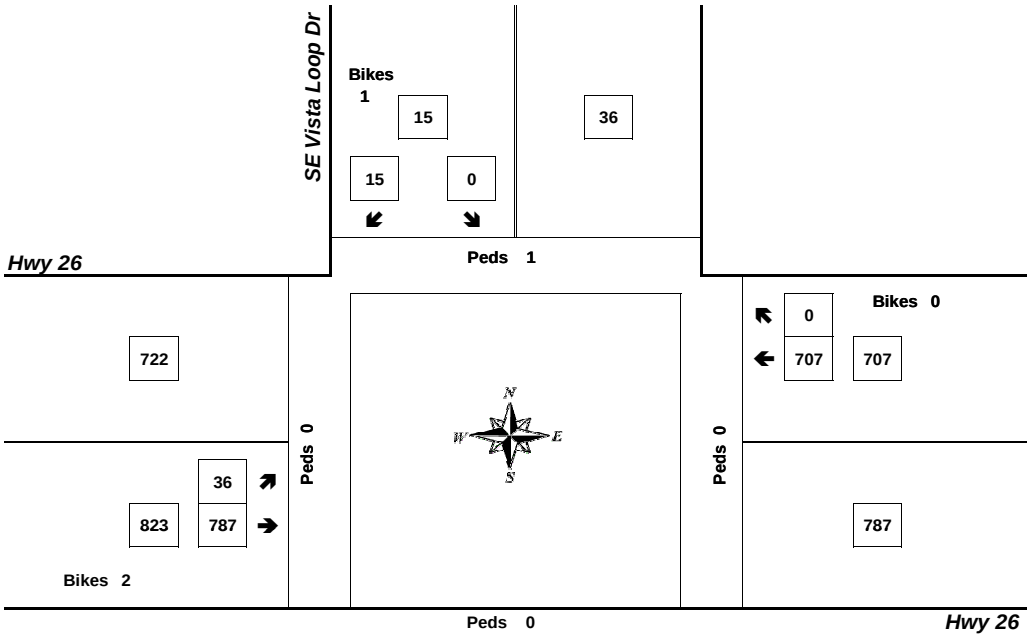
Interval Start Time	Northbound SE Vista Loop Dr				Southbound SE Vista Loop Dr				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
				Total	L		R	Total	L	T		Total		T	R	Total	
4:00 PM				0	1		4	5	2	30		32		50	0	50	87
4:15 PM				0	0		2	2	0	26		26		47	0	47	75
4:30 PM				0	0		0	0	0	16		16		44	0	44	60
4:45 PM				0	0		0	0	0	16		16		43	0	43	59
5:00 PM				0	0		0	0	0	16		16		37	0	37	53

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SE Vista Loop Dr & Hwy 26

4:15 PM to 5:15 PM
Tuesday, March 19, 2019



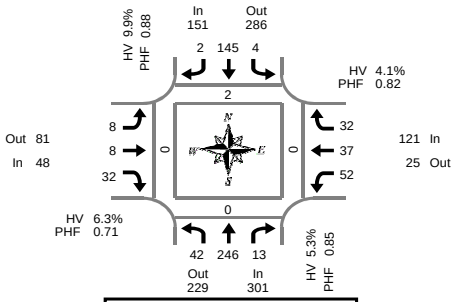
Bikes 0

Approach	PHF	HV%	Volume
EB	0.94	3.2%	823
WB	0.95	6.6%	707
NB	0.00	0.0%	0
SB	0.54	13.3%	15
Intersection	0.97	4.9%	1,545

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
7:05 AM to 8:05 AM

Hwy 211 & Dubarko Rd

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	2	18	1	0	0	8	0	0	0	0	0	0	4	5	0	0	38	0	1	0	0
7:05 AM	3	20	1	0	0	12	0	0	0	0	0	0	3	1	5	0	45	0	0	0	0
7:10 AM	5	23	0	0	0	12	0	0	2	2	4	0	4	3	9	0	64	0	0	0	0
7:15 AM	5	32	0	0	0	9	0	0	1	0	2	0	4	2	2	0	57	1	0	0	0
7:20 AM	8	13	0	0	2	13	1	0	0	0	2	0	5	3	5	0	52	0	0	0	0
7:25 AM	1	23	2	0	0	13	0	0	1	1	5	0	4	3	3	0	56	0	0	0	0
7:30 AM	3	17	0	0	1	12	0	0	0	0	3	0	4	9	1	0	50	1	0	0	0
7:35 AM	2	23	0	0	0	17	0	0	0	0	7	0	6	5	1	0	61	0	0	0	0
7:40 AM	2	23	1	0	0	6	1	0	1	2	4	0	6	4	1	0	51	0	0	0	0
7:45 AM	4	20	3	0	0	14	0	0	0	1	0	0	3	1	0	0	46	0	0	0	0
7:50 AM	5	15	3	0	0	10	0	0	1	1	1	0	5	4	2	0	47	0	0	0	0
7:55 AM	1	21	2	0	1	15	0	0	1	0	3	0	3	1	1	0	49	0	0	0	0
8:00 AM	3	16	1	0	0	12	0	0	1	1	1	0	5	1	2	0	43	0	0	0	0
8:05 AM	2	15	0	0	0	7	0	0	1	1	2	0	4	0	3	0	35	1	0	0	0
8:10 AM	2	19	1	0	1	8	0	0	3	1	2	0	3	4	1	0	45	0	0	0	0
8:15 AM	3	27	1	0	0	8	0	0	0	0	1	0	1	3	2	0	46	0	0	0	0
8:20 AM	0	19	0	0	0	10	0	0	0	1	0	0	1	3	0	0	34	0	0	0	0
8:25 AM	6	8	1	0	0	8	0	0	0	1	1	0	1	1	2	0	29	0	0	0	0
8:30 AM	3	27	2	0	0	10	0	0	0	1	1	0	2	2	5	0	53	0	0	0	0
8:35 AM	1	14	0	0	0	16	0	0	0	1	0	0	2	2	0	0	36	0	0	0	0
8:40 AM	0	19	1	0	0	15	0	0	0	1	1	0	1	3	1	0	42	0	0	0	0
8:45 AM	1	21	1	0	0	15	1	0	0	2	3	0	1	2	4	0	51	0	0	0	0
8:50 AM	0	21	0	0	0	9	0	0	0	2	0	0	3	3	2	0	40	0	0	0	0
8:55 AM	4	20	1	0	1	10	0	0	1	3	2	0	3	3	3	0	51	0	0	0	0
Total Survey	66	474	22	0	6	269	3	0	13	22	45	0	78	68	55	0	1,121	3	1	0	0

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	10	61	2	0	0	32	0	0	2	2	4	0	11	9	14	0	147	0	1	0	0
7:15 AM	14	68	2	0	2	35	1	0	2	1	9	0	13	8	10	0	165	1	0	0	0
7:30 AM	7	63	1	0	1	35	1	0	1	2	14	0	16	18	3	0	162	1	0	0	0
7:45 AM	10	56	8	0	1	39	0	0	2	2	4	0	11	6	3	0	142	0	0	0	0
8:00 AM	7	50	2	0	1	27	0	0	5	3	5	0	12	5	6	0	123	1	0	0	0
8:15 AM	9	54	2	0	0	26	0	0	0	2	2	0	3	7	4	0	109	0	0	0	0
8:30 AM	4	60	3	0	0	41	0	0	0	3	2	0	5	7	6	0	131	0	0	0	0
8:45 AM	5	62	2	0	1	34	1	0	1	7	5	0	7	8	9	0	142	0	0	0	0
Total Survey	66	474	22	0	6	269	3	0	13	22	45	0	78	68	55	0	1,121	3	1	0	0

Peak Hour Summary
7:05 AM to 8:05 AM

By Approach	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	301	229	530	0	151	286	437	0	48	81	129	0	121	25	146	0	621	2	0	0	0
%HV	5.3%				9.9%				6.3%				4.1%				6.3%				
PHF	0.85				0.88				0.71				0.82				0.90				

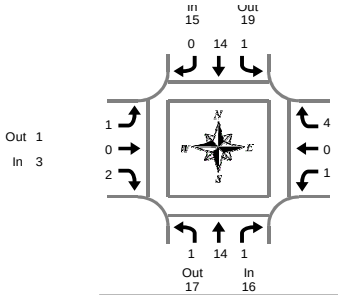
By Movement	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	42	246	13	301	4	145	2	151	8	8	32	48	52	37	32	121	621
%HV	2.4%	5.7%	7.7%	5.3%	25.0%	9.7%	0.0%	9.9%	12.5%	0.0%	6.3%	6.3%	1.9%	0.0%	12.5%	4.1%	6.3%
PHF	0.58	0.82	0.41	0.85	0.33	0.86	0.50	0.88	0.67	0.50	0.53	0.71	0.81	0.51	0.50	0.82	0.90

Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	41	248	13	0	4	141	2	0	7	7	31	0	51	41	30	0	616	2	1	0	0
7:15 AM	38	237	13	0	5	136	2	0	10	8	32	0	52	37	22	0	592	3	0	0	0
7:30 AM	33	223	13	0	3	127	1	0	8	9	25	0	42	36	16	0	536	2	0	0	0
7:45 AM	30	220	15	0	2	133	0	0	7	10	13	0	31	25	19	0	505	1	0	0	0
8:00 AM	25	226	9	0	2	128	1	0	6	15	14	0	27	27	25	0	505	1	0	0	0

Heavy Vehicle Summary

Clay Carney
(503) 833-2740



Peak Hour Summary
7:05 AM to 8:05 AM

Hwy 211 & Dubarko Rd

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
7:05 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
7:10 AM	0	1	0	1	0	0	0	0	0	0	1	1	0	0	1	1	3
7:15 AM	0	1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	2
7:20 AM	0	0	0	0	1	1	0	2	0	0	0	0	1	0	0	1	3
7:25 AM	0	0	0	0	0	0	0	0	1	0	0	1	0	0	2	2	3
7:30 AM	0	1	0	1	0	2	0	2	0	0	0	0	0	0	0	0	3
7:35 AM	0	1	0	1	0	2	0	2	0	0	0	0	0	0	0	0	3
7:40 AM	0	3	1	4	0	0	0	0	0	0	0	0	0	0	1	1	5
7:45 AM	0	0	0	0	0	3	0	3	0	0	0	0	0	0	0	0	3
7:50 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:55 AM	1	0	0	1	0	3	0	3	0	0	0	0	0	0	0	0	4
8:00 AM	0	6	0	6	0	2	0	2	0	0	0	0	0	0	0	0	8
8:05 AM	0	0	0	0	0	3	0	3	0	0	0	0	1	0	0	1	4
8:10 AM	0	2	0	2	0	0	0	0	0	0	0	0	1	1	0	2	4
8:15 AM	1	2	0	3	0	1	0	1	0	0	0	0	0	0	0	0	4
8:20 AM	0	2	0	2	0	2	0	2	0	1	0	1	0	0	0	0	5
8:25 AM	0	2	0	2	0	1	0	1	0	0	0	0	0	0	0	0	3
8:30 AM	0	3	0	3	0	2	0	2	0	0	0	0	0	0	0	0	5
8:35 AM	0	3	0	3	0	4	0	4	0	0	0	0	0	0	0	0	7
8:40 AM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
8:45 AM	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
8:50 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
8:55 AM	0	0	0	0	0	2	0	2	0	0	0	0	0	1	0	1	3
Total Survey	2	31	1	34	1	31	0	32	1	1	2	4	3	3	4	10	80

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	0	2	0	2	0	1	0	1	0	0	1	1	0	1	1	2	6
7:15 AM	0	1	0	1	1	1	0	2	1	0	1	2	1	0	2	3	8
7:30 AM	0	5	1	6	0	4	0	4	0	0	0	0	0	0	1	1	11
7:45 AM	1	0	0	1	0	6	0	6	0	0	0	0	0	0	0	0	7
8:00 AM	0	8	0	8	0	5	0	5	0	0	0	0	2	1	0	3	16
8:15 AM	1	6	0	7	0	4	0	4	0	1	0	1	0	0	0	0	12
8:30 AM	0	7	0	7	0	7	0	7	0	0	0	0	0	0	0	0	14
8:45 AM	0	2	0	2	0	3	0	3	0	0	0	0	0	1	0	1	6
Total Survey	2	31	1	34	1	31	0	32	1	1	2	4	3	3	4	10	80

Heavy Vehicle Peak Hour Summary
7:05 AM to 8:05 AM

By Approach	Northbound Hwy 211			Southbound Hwy 211			Eastbound Dubarko Rd			Westbound Dubarko Rd			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	16	17	33	15	19	34	3	1	4	5	2	7	39
PHF	0.57			0.63			0.38			0.42			0.81

By Movement	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	1	14	1	16	1	14	0	15	1	0	2	3	1	0	4	5	39
PHF	0.25	0.58	0.25	0.57	0.25	0.58	0.00	0.63	0.25	0.00	0.25	0.38	0.25	0.00	0.50	0.42	0.81

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

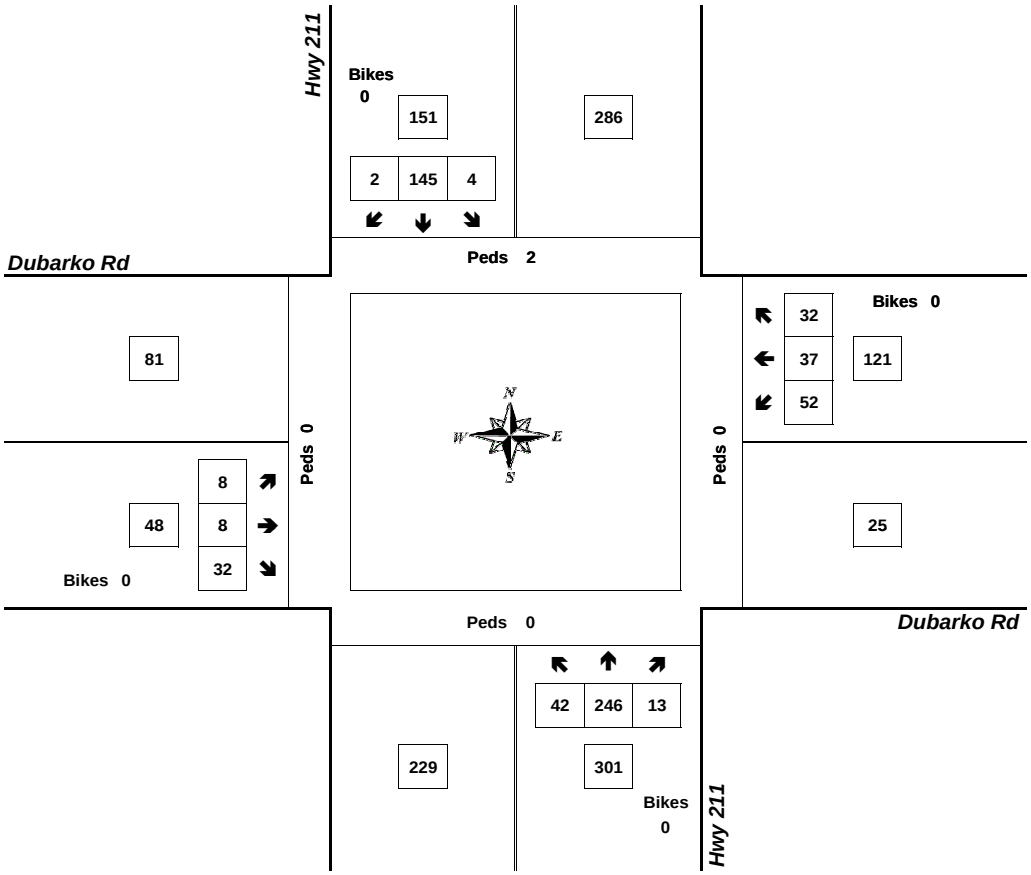
Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
7:00 AM	1	8	1	10	1	12	0	13	1	0	2	3	1	1	4	6	32
7:15 AM	1	14	1	16	1	16	0	17	1	0	1	2	3	1	3	7	42
7:30 AM	2	19	1	22	0	19	0	19	0	1	0	1	2	1	1	4	46
7:45 AM	2	21	0	23	0	22	0	22	0	1	0	1	2	1	0	3	49
8:00 AM	1	23	0	24	0	19	0	19	0	1	0	1	2	2	0	4	48

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

Hwy 211 & Dubarko Rd

7:05 AM to 8:05 AM
Wednesday, March 20, 2019

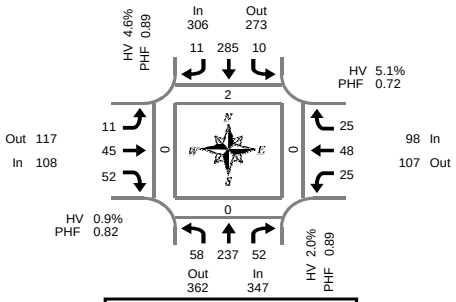


Approach	PHF	HV%	Volume
EB	0.71	6.3%	48
WB	0.82	4.1%	121
NB	0.85	5.3%	301
SB	0.88	9.9%	151
Intersection	0.90	6.3%	621

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:05 PM to 5:05 PM

Hwy 211 & Dubarko Rd

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	4	14	0	0	2	25	1	0	0	3	3	0	2	3	3	0	60	0	0	1	0
4:05 PM	4	28	3	0	1	31	0	0	1	7	6	0	2	6	2	0	91	0	0	0	0
4:10 PM	10	17	2	0	1	19	0	0	0	4	3	0	3	4	3	0	66	0	0	0	0
4:15 PM	4	20	6	0	2	20	1	0	2	7	3	1	1	5	1	0	72	0	0	0	0
4:20 PM	6	12	1	0	1	14	1	0	2	3	4	0	5	7	4	0	60	1	0	0	0
4:25 PM	5	16	4	0	1	21	1	0	3	3	4	0	2	4	1	0	65	0	0	0	0
4:30 PM	4	22	3	0	0	19	3	0	1	2	2	0	5	5	1	0	67	1	0	0	0
4:35 PM	2	23	7	0	0	29	1	0	1	2	1	0	0	1	3	0	70	0	0	0	0
4:40 PM	2	17	4	0	0	22	0	0	0	2	1	0	1	3	3	0	55	0	0	0	0
4:45 PM	10	23	7	0	2	29	1	0	0	6	8	0	3	2	0	0	91	0	0	0	0
4:50 PM	3	22	6	0	1	19	1	0	1	0	4	0	1	1	2	0	61	0	0	0	0
4:55 PM	4	20	3	0	0	20	2	0	0	6	2	0	1	6	1	0	65	0	0	0	0
5:00 PM	4	17	6	0	1	42	0	0	0	3	14	0	1	4	4	0	96	0	0	0	0
5:05 PM	2	24	5	0	0	20	0	0	0	4	5	0	1	2	3	0	66	0	0	0	0
5:10 PM	8	24	4	0	1	13	1	0	1	8	2	0	2	1	3	0	68	0	0	0	0
5:15 PM	4	13	4	0	1	19	1	0	0	4	3	0	5	3	0	0	57	0	0	0	0
5:20 PM	1	19	6	0	1	29	1	0	1	2	2	0	1	4	0	0	67	0	0	0	0
5:25 PM	5	14	6	0	0	17	1	0	1	3	9	0	2	4	3	0	65	0	0	0	0
5:30 PM	5	19	6	0	0	19	1	0	1	5	5	0	0	2	3	0	66	0	0	0	0
5:35 PM	5	15	1	0	2	24	0	0	1	5	6	0	1	2	1	0	63	0	0	0	0
5:40 PM	5	19	7	0	0	29	1	0	0	8	3	0	1	2	0	1	75	0	0	0	0
5:45 PM	4	15	8	0	0	16	1	0	0	7	3	0	3	0	0	0	57	0	0	0	0
5:50 PM	4	13	2	0	0	20	3	0	2	5	3	0	0	5	3	0	60	0	0	0	0
5:55 PM	5	13	2	0	1	18	0	0	0	2	3	0	2	1	1	0	48	0	0	0	0
Total Survey	110	439	103	0	18	534	22	0	18	101	99	1	45	77	45	1	1,611	2	0	1	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	18	59	5	0	4	75	1	0	1	14	12	0	7	13	8	0	217	0	0	1	0
4:15 PM	15	48	11	0	4	55	3	0	7	13	11	1	8	16	6	0	197	1	0	0	0
4:30 PM	8	62	14	0	0	70	4	0	2	6	4	0	6	9	7	0	192	1	0	0	0
4:45 PM	17	65	16	0	3	68	4	0	1	12	14	0	5	9	3	0	217	0	0	0	0
5:00 PM	14	65	15	0	2	75	1	0	1	15	21	0	4	7	10	0	230	0	0	0	0
5:15 PM	10	46	16	0	2	65	3	0	2	9	14	0	8	11	3	0	189	0	0	0	0
5:30 PM	15	53	14	0	2	72	2	0	2	18	14	0	2	6	4	1	204	0	0	0	0
5:45 PM	13	41	12	0	1	54	4	0	2	14	9	0	5	6	4	0	165	0	0	0	0
Total Survey	110	439	103	0	18	534	22	0	18	101	99	1	45	77	45	1	1,611	2	0	1	0

Peak Hour Summary
4:05 PM to 5:05 PM

By Approach	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	347	362	709	0	306	273	579	0	108	117	225	1	98	107	205	0	859	2	0	0	0
%HV	2.0%				4.6%				0.9%				5.1%				3.1%				
PHF	0.89				0.89				0.82				0.72				0.94				

By Movement	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	58	237	52	347	10	285	11	306	11	45	52	108	25	48	25	98	859
%HV	3.4%	1.7%	1.9%	2.0%	0.0%	4.9%	0.0%	4.6%	0.0%	0.0%	1.9%	0.9%	4.0%	2.1%	12.0%	5.1%	3.1%
PHF	0.73	0.91	0.72	0.89	0.63	0.88	0.55	0.89	0.39	0.63	0.65	0.82	0.52	0.75	0.78	0.72	0.94

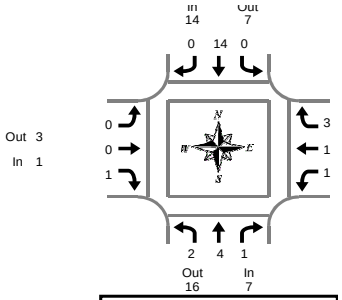
Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
4:00 PM	58	234	46	0	11	268	12	0	11	45	41	1	26	47	24	0	823	2	0	1	0
4:15 PM	54	240	56	0	9	268	12	0	11	46	50	1	23	41	26	0	836	2	0	0	0
4:30 PM	49	238	61	0	7	278	12	0	6	42	53	0	23	36	23	0	828	1	0	0	0
4:45 PM	56	229	61	0	9	280	10	0	6	54	63	0	19	33	20	1	840	0	0	0	0
5:00 PM	52	205	57	0	7	266	10	0	7	56	58	0	19	30	21	1	788	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740



Peak Hour Summary
4:05 PM to 5:05 PM

Hwy 211 & Dubarko Rd

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	0	1	0	1	0	4	0	4	0	0	1	1	1	0	0	1	7
4:05 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
4:10 PM	2	0	0	2	0	0	0	0	0	0	0	0	0	0	1	1	3
4:15 PM	0	1	0	1	0	4	0	4	0	0	0	0	0	0	0	0	5
4:20 PM	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	2	2
4:25 PM	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	2
4:30 PM	0	0	0	0	0	2	0	2	0	0	0	0	0	0	1	1	3
4:35 PM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	1	1	3
4:40 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
4:45 PM	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1
4:50 PM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
4:55 PM	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	2
5:00 PM	0	1	0	1	0	2	0	2	0	0	0	0	0	0	0	0	3
5:05 PM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5:10 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
5:15 PM	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5:20 PM	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5:25 PM	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:35 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
5:40 PM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5:50 PM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
5:55 PM	0	0	0	0	0	2	0	2	0	0	1	1	1	0	0	1	4
Total Survey	3	9	2	14	0	23	0	23	0	0	3	3	3	1	3	7	47

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	2	1	0	3	0	5	0	5	0	0	1	1	1	0	1	2	11
4:15 PM	0	1	0	1	0	6	0	6	0	0	0	0	1	1	0	2	9
4:30 PM	0	1	0	1	0	4	0	4	0	0	0	0	0	0	2	2	7
4:45 PM	0	1	1	2	0	1	0	1	0	0	1	1	0	0	0	0	4
5:00 PM	0	2	0	2	0	3	0	3	0	0	0	0	0	0	0	0	5
5:15 PM	1	2	1	4	0	0	0	0	0	0	0	0	0	0	0	0	4
5:30 PM	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	2
5:45 PM	0	0	0	0	0	3	0	3	0	0	1	1	1	0	0	1	5
Total Survey	3	9	2	14	0	23	0	23	0	0	3	3	3	1	3	7	47

Heavy Vehicle Peak Hour Summary
4:05 PM to 5:05 PM

By Approach	Northbound Hwy 211			Southbound Hwy 211			Eastbound Dubarko Rd			Westbound Dubarko Rd			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	7	16	23	14	7	21	1	3	4	5	1	6	27
PHF	0.58			0.58			0.25			0.42			0.68

By Movement	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	2	4	1	7	0	14	0	14	0	0	1	1	1	1	3	5	27
PHF	0.25	0.50	0.25	0.58	0.00	0.58	0.00	0.58	0.00	0.00	0.25	0.25	0.25	0.25	0.38	0.42	0.68

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

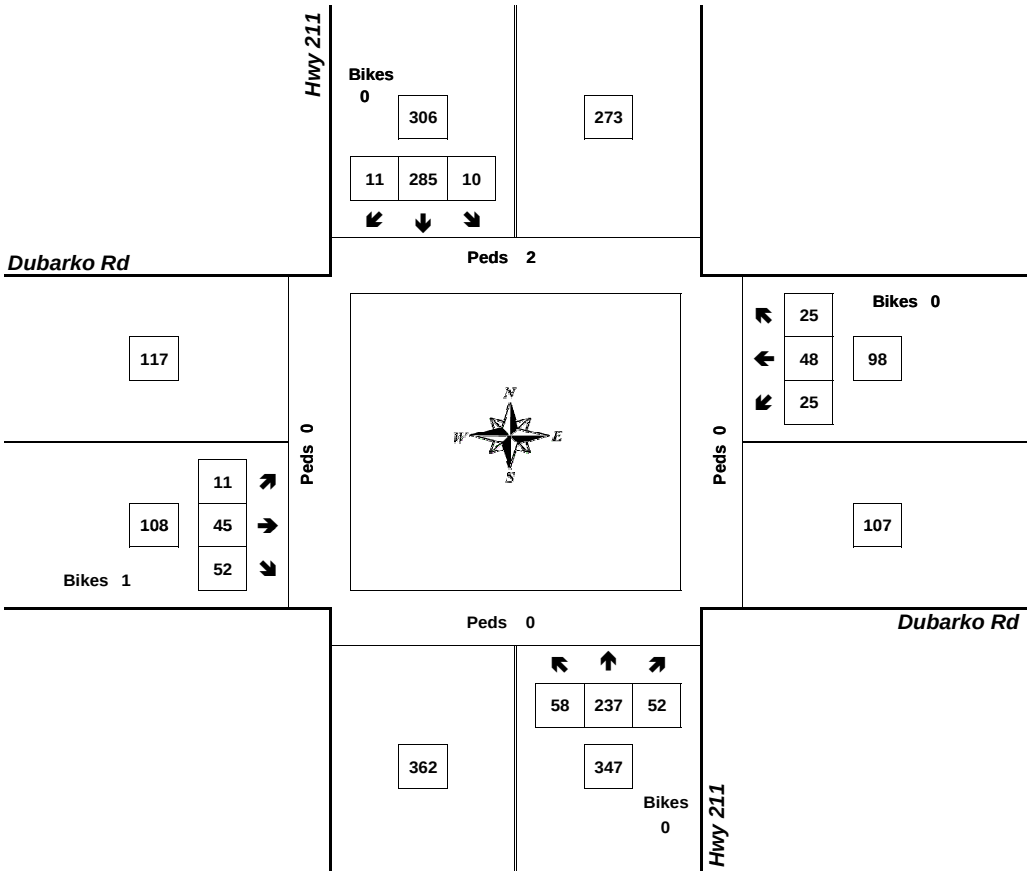
Interval Start Time	Northbound Hwy 211				Southbound Hwy 211				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
4:00 PM	2	4	1	7	0	16	0	16	0	0	2	2	2	1	3	6	31
4:15 PM	0	5	1	6	0	14	0	14	0	0	1	1	1	1	2	4	25
4:30 PM	1	6	2	9	0	8	0	8	0	0	1	1	0	0	2	2	20
4:45 PM	1	6	2	9	0	5	0	5	0	0	1	1	0	0	0	0	15
5:00 PM	1	5	1	7	0	7	0	7	0	0	1	1	1	0	0	1	16

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

Hwy 211 & Dubarko Rd

4:05 PM to 5:05 PM
Tuesday, March 19, 2019

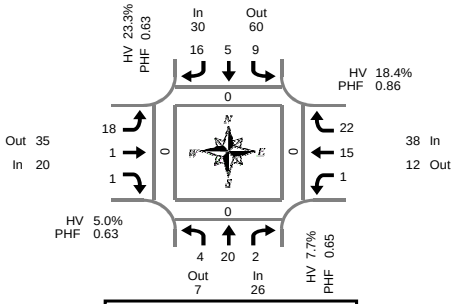


Approach	PHF	HV%	Volume
EB	0.82	0.9%	108
WB	0.72	5.1%	98
NB	0.89	2.0%	347
SB	0.89	4.6%	306
Intersection	0.94	3.1%	859

Count Period: 4:00 PM to 6:00 PM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
7:05 AM to 8:05 AM

SE Langensand Rd & Dubarko Rd

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	1	1	0	0	0	1	1	0	0	0	0	0	0	2	0	0	6	0	0	0	0
7:05 AM	2	1	0	0	1	0	3	0	1	1	0	0	0	2	3	0	14	0	0	0	0
7:10 AM	0	0	0	0	1	0	0	0	1	0	0	0	0	1	2	0	5	0	0	0	0
7:15 AM	0	2	1	0	0	1	1	0	2	0	0	0	0	0	1	0	8	0	0	0	0
7:20 AM	0	0	0	0	0	0	0	0	3	0	0	0	1	3	2	0	9	0	0	0	0
7:25 AM	0	0	0	0	2	2	3	0	1	0	0	0	0	1	2	0	11	0	0	0	0
7:30 AM	0	6	0	0	0	0	3	0	0	0	0	0	0	1	1	0	11	0	0	0	0
7:35 AM	1	2	0	0	0	0	0	0	0	0	1	0	0	2	0	0	6	0	0	0	0
7:40 AM	0	0	1	0	2	1	3	0	0	0	0	0	0	2	2	0	11	0	0	0	0
7:45 AM	0	1	0	0	2	0	1	0	2	0	0	0	0	0	3	0	9	0	0	0	0
7:50 AM	1	1	0	0	1	0	2	0	3	0	0	0	0	1	3	0	12	0	0	0	0
7:55 AM	0	4	0	0	0	0	0	0	3	0	0	0	0	0	2	0	9	0	0	0	0
8:00 AM	0	3	0	0	0	1	0	0	2	0	0	0	0	2	1	0	9	0	0	0	0
8:05 AM	0	1	0	0	0	1	1	0	3	0	0	0	0	3	1	0	10	0	0	0	0
8:10 AM	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	3	1	0	0	0
8:15 AM	0	2	0	0	0	0	1	0	3	0	0	0	0	1	1	0	8	0	0	0	0
8:20 AM	1	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	5	0	0	0	0
8:25 AM	1	0	0	0	0	1	1	0	3	0	1	0	0	0	1	0	8	0	0	1	0
8:30 AM	0	0	0	0	0	0	0	0	2	2	0	0	1	2	1	0	8	0	0	0	0
8:35 AM	1	0	0	0	1	0	0	0	1	1	1	0	1	2	0	0	8	0	0	0	0
8:40 AM	1	1	0	0	0	3	2	0	1	0	0	0	0	1	0	0	9	0	0	0	0
8:45 AM	1	3	0	0	0	1	2	0	3	0	2	0	1	2	1	0	16	0	0	0	0
8:50 AM	1	4	1	0	0	1	2	0	2	0	0	0	0	1	3	0	15	0	0	0	0
8:55 AM	1	2	1	0	0	0	1	0	1	0	0	0	0	2	1	0	9	0	0	0	0
Total Survey	12	35	4	0	11	14	29	0	38	5	5	0	4	31	31	0	219	1	0	1	0

15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	3	2	0	0	2	1	4	0	2	1	0	0	0	5	5	0	25	0	0	0	0
7:15 AM	0	2	1	0	2	3	4	0	6	0	0	0	1	4	5	0	28	0	0	0	0
7:30 AM	1	8	1	0	2	1	6	0	0	0	1	0	0	5	3	0	28	0	0	0	0
7:45 AM	1	6	0	0	3	0	3	0	8	0	0	0	0	1	8	0	30	0	0	0	0
8:00 AM	0	5	0	0	1	2	2	0	5	0	0	0	0	5	2	0	22	1	0	0	0
8:15 AM	2	2	0	0	0	2	3	0	7	1	1	0	0	1	2	0	21	0	0	1	0
8:30 AM	2	1	0	0	1	3	2	0	4	3	1	0	2	5	1	0	25	0	0	0	0
8:45 AM	3	9	2	0	0	2	5	0	6	0	2	0	1	5	5	0	40	0	0	0	0
Total Survey	12	35	4	0	11	14	29	0	38	5	5	0	4	31	31	0	219	1	0	1	0

Peak Hour Summary
7:05 AM to 8:05 AM

By Approach	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	26	7	33	0	30	60	90	0	20	35	55	0	38	12	50	0	114	0	0	0	0
%HV	7.7%				23.3%				5.0%				18.4%				14.9%				
PHF	0.65				0.63				0.63				0.86				0.89				

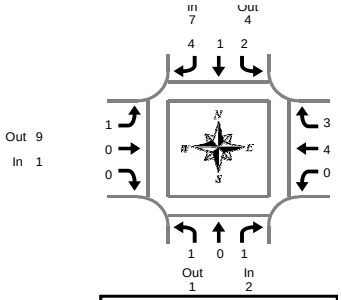
By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	4	20	2	26	9	5	16	30	18	1	1	20	1	15	22	38	114
%HV	25.0%	0.0%	50.0%	7.7%	22.2%	20.0%	25.0%	23.3%	5.6%	0.0%	0.0%	5.0%	0.0%	26.7%	13.6%	18.4%	14.9%
PHF	0.50	0.63	0.50	0.65	0.45	0.42	0.67	0.63	0.56	0.25	0.25	0.63	0.25	0.75	0.69	0.86	0.89

Rolling Hour Summary
7:00 AM to 9:00 AM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval Total	Pedestrians Crosswalk			
	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes	L	T	R	Bikes		North	South	East	West
7:00 AM	5	18	2	0	9	5	17	0	16	1	1	0	1	15	21	0	111	0	0	0	0
7:15 AM	2	21	2	0	8	6	15	0	19	0	1	0	1	15	18	0	108	1	0	0	0
7:30 AM	4	21	1	0	6	5	14	0	20	1	2	0	0	12	15	0	101	1	0	1	0
7:45 AM	5	14	0	0	5	7	10	0	24	4	2	0	2	12	13	0	98	1	0	1	0
8:00 AM	7	17	2	0	2	9	12	0	22	4	4	0	3	16	10	0	108	1	0	1	0

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
7:05 AM to 8:05 AM

SE Langensand Rd & Dubarko Rd

Wednesday, March 20, 2019
7:00 AM to 9:00 AM

Heavy Vehicle 5-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval
Time	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	Total
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:05 AM	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	2
7:10 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
7:15 AM	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1
7:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	2
7:25 AM	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	2
7:30 AM	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1
7:35 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:40 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	1	0	1	2	0	0	0	0	0	0	0	0	2
7:50 AM	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1	2	4
7:55 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	2
8:05 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
8:10 AM	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:20 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:25 AM	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
8:35 AM	1	0	0	1	0	0	0	0	1	0	0	1	1	0	0	1	3
8:40 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:50 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8:55 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Survey	2	1	1	4	2	1	5	8	3	0	0	3	2	4	3	9	24

Heavy Vehicle 15-Minute Interval Summary
7:00 AM to 9:00 AM

Interval Start	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval
Time	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	Total
7:00 AM	1	0	0	1	0	0	1	1	0	0	0	0	0	0	1	1	3
7:15 AM	0	0	1	1	0	0	1	1	0	0	0	0	0	3	0	3	5
7:30 AM	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1
7:45 AM	0	0	0	0	2	0	1	3	1	0	0	1	0	1	1	2	6
8:00 AM	0	1	0	1	0	1	1	2	0	0	0	0	0	0	1	1	4
8:15 AM	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
8:30 AM	1	0	0	1	0	0	0	0	1	0	0	1	2	0	0	2	4
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Survey	2	1	1	4	2	1	5	8	3	0	0	3	2	4	3	9	24

Heavy Vehicle Peak Hour Summary
7:05 AM to 8:05 AM

By Approach	Northbound SE Langensand Rd			Southbound SE Langensand Rd			Eastbound Dubarko Rd			Westbound Dubarko Rd			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	2	1	3	7	4	11	1	9	10	7	3	10	17
PHF	0.25			0.58			0.25			0.58			0.71

By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Total
	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	
Volume	1	0	1	2	2	1	4	7	1	0	0	1	0	4	3	7	17
PHF	0.25	0.00	0.25	0.25	0.25	0.25	0.50	0.58	0.25	0.00	0.00	0.25	0.00	0.33	0.38	0.58	0.71

Heavy Vehicle Rolling Hour Summary
7:00 AM to 9:00 AM

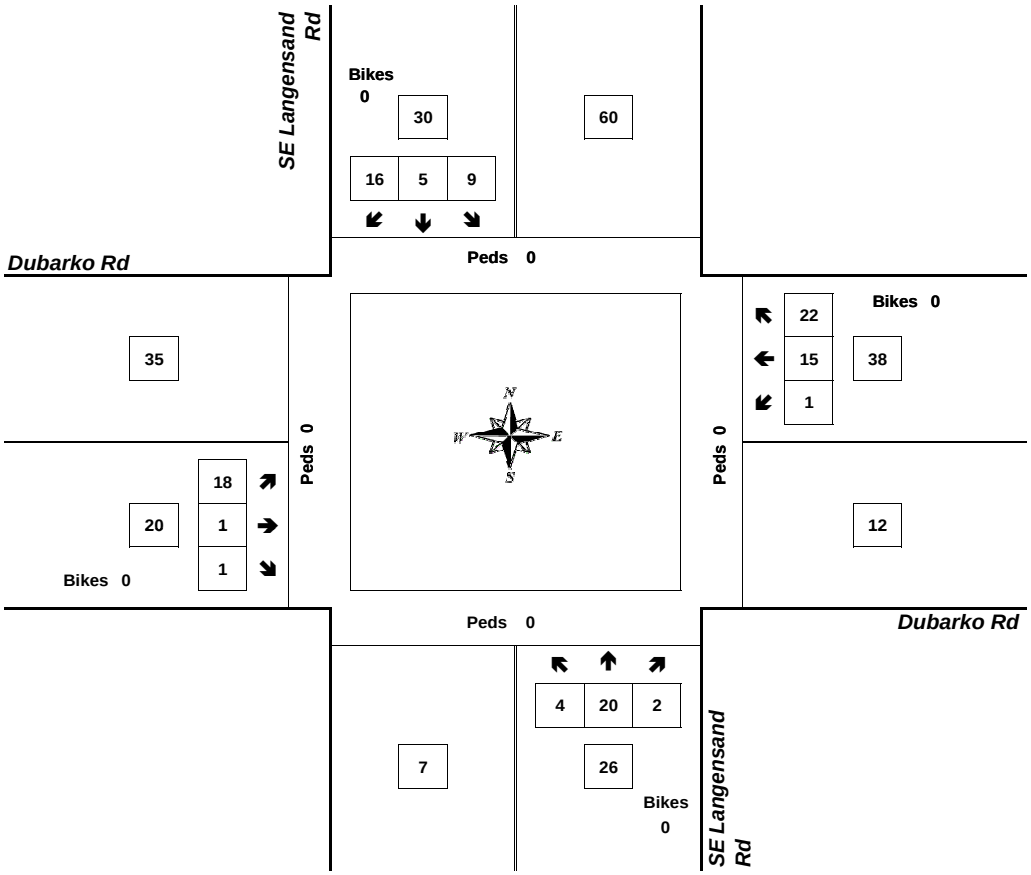
Interval Start	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Dubarko Rd				Westbound Dubarko Rd				Interval
Time	L	T	R	Total	L	T	R	Total	L	T	R	Total	L	T	R	Total	Total
7:00 AM	1	0	1	2	2	0	4	6	1	0	0	1	0	4	2	6	15
7:15 AM	0	1	1	2	2	1	4	7	1	0	0	1	0	4	2	6	16
7:30 AM	0	1	0	1	2	1	3	6	2	0	0	2	0	1	2	3	12
7:45 AM	1	1	0	2	2	1	2	5	3	0	0	3	2	1	2	5	15
8:00 AM	1	1	0	2	0	1	1	2	2	0	0	2	2	0	1	3	9

Peak Hour Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740

SE Langensand Rd & Dubarko Rd

7:05 AM to 8:05 AM
Wednesday, March 20, 2019

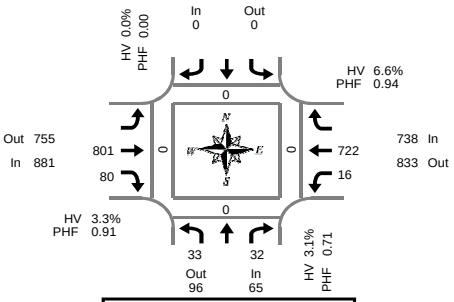


Approach	PHF	HV%	Volume
EB	0.63	5.0%	20
WB	0.86	18.4%	38
NB	0.65	7.7%	26
SB	0.63	23.3%	30
Intersection	0.89	14.9%	114

Count Period: 7:00 AM to 9:00 AM

Total Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



Peak Hour Summary
4:10 PM to 5:10 PM

SE Langensand Rd & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	2		4	0				0	62	9	0	5	50		0	132	0	0	0	0
4:05 PM	1		2	0				0	69	6	0	3	52		0	133	0	0	0	0
4:10 PM	1		3	0				0	61	3	0	1	74		0	143	0	0	0	0
4:15 PM	6		1	0				0	76	5	0	1	50		0	139	0	0	0	0
4:20 PM	5		5	0				0	79	9	0	1	70		0	169	0	0	0	0
4:25 PM	6		0	1				0	58	8	0	1	49		0	122	0	0	0	0
4:30 PM	0		3	0				0	75	12	0	1	56		0	147	0	0	0	0
4:35 PM	2		5	0				0	61	7	0	1	64		0	140	0	0	0	0
4:40 PM	0		1	0				0	59	1	0	1	55		0	117	0	0	0	0
4:45 PM	1		1	0				0	64	3	0	2	63		0	134	0	0	0	0
4:50 PM	6		5	0				0	62	6	0	0	54		0	133	0	0	0	0
4:55 PM	3		0	0				0	72	5	0	2	56		0	138	0	0	0	0
5:00 PM	1		5	0				0	62	10	0	1	55		0	134	0	0	0	0
5:05 PM	2		3	0				0	72	11	0	4	76		0	168	0	0	0	0
5:10 PM	2		3	0				0	58	14	0	1	65		0	143	0	0	0	0
5:15 PM	1		2	0				0	51	8	0	2	59		0	123	0	0	0	0
5:20 PM	2		4	0				0	78	7	0	2	43		0	136	0	0	0	0
5:25 PM	3		1	0				0	71	5	0	1	42		0	123	0	0	0	0
5:30 PM	2		2	0				0	67	7	0	3	38		0	119	0	0	0	0
5:35 PM	1		1	0				0	60	5	0	1	38		0	106	0	0	0	0
5:40 PM	0		4	0				0	49	7	0	0	34		0	94	0	0	0	0
5:45 PM	2		1	0				0	69	7	0	1	45		0	125	0	0	0	0
5:50 PM	0		3	0				0	60	4	0	0	43		0	110	0	0	0	0
5:55 PM	4		1	0				0	65	8	0	3	52		0	133	0	0	0	0
Total Survey	53		60	1				0	1,560	167	0	38	1,283		0	3,161	0	0	0	0

15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	4		9	0				0	192	18	0	9	176		0	408	0	0	0	0
4:15 PM	17		6	1				0	213	22	0	3	169		0	430	0	0	0	0
4:30 PM	2		9	0				0	195	20	0	3	175		0	404	0	0	0	0
4:45 PM	10		6	0				0	198	14	0	4	173		0	405	0	0	0	0
5:00 PM	5		11	0				0	192	35	0	6	196		0	445	0	0	0	0
5:15 PM	6		7	0				0	200	20	0	5	144		0	382	0	0	0	0
5:30 PM	3		7	0				0	176	19	0	4	110		0	319	0	0	0	0
5:45 PM	6		5	0				0	194	19	0	4	140		0	368	0	0	0	0
Total Survey	53		60	1				0	1,560	167	0	38	1,283		0	3,161	0	0	0	0

Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total	Pedestrians Crosswalk			
	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes	In	Out	Total	Bikes		North	South	East	West
Volume	65	96	161	1	0	0	0	0	881	755	1,636	0	738	833	1,571	0	1,684	0	0	0	0
%HV	3.1%				0.0%				3.3%				6.6%				4.8%				
PHF	0.71				0.00				0.91				0.94				0.93				

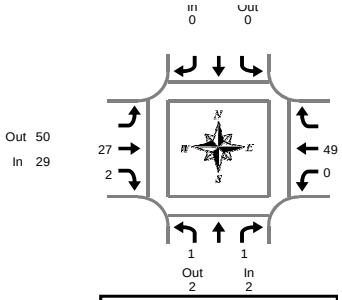
By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L		R	Total				Total	T	R	Total	L	T		Total		
Volume	33		32	65				0	801	80	881	16	722		738		1,684
%HV	3.0%	NA	3.1%	3.1%	NA	NA	NA	0.0%	NA	3.4%	2.5%	3.3%	0.0%	6.8%	NA	6.6%	4.8%
PHF	0.49		0.80	0.71				0.00		0.93	0.69	0.91	0.57	0.93		0.94	0.93

Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total	Pedestrians Crosswalk			
	L		R	Bikes				Bikes	T	R	Bikes	L	T		Bikes		North	South	East	West
4:00 PM	33		30	1				0	798	74	0	19	693		0	1,647	0	0	0	0
4:15 PM	34		32	1				0	798	91	0	16	713		0	1,684	0	0	0	0
4:30 PM	23		33	0				0	785	89	0	18	688		0	1,636	0	0	0	0
4:45 PM	24		31	0				0	766	88	0	19	623		0	1,551	0	0	0	0
5:00 PM	20		30	0				0	762	93	0	19	590		0	1,514	0	0	0	0

Heavy Vehicle Summary

All Traffic Data Services Inc.
Clay Carney
(503) 833-2740



SE Langensand Rd & Hwy 26

Tuesday, March 19, 2019
4:00 PM to 6:00 PM

Peak Hour Summary
4:10 PM to 5:10 PM

Heavy Vehicle 5-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
4:00 PM	0		0	0				0	3	0	3	0	11		11	14
4:05 PM	0		0	0				0	8	0	8	0	5		5	13
4:10 PM	0		0	0				0	2	0	2	0	7		7	9
4:15 PM	0		0	0				0	5	0	5	0	4		4	9
4:20 PM	1		0	1				0	4	1	5	0	4		4	10
4:25 PM	0		0	0				0	3	0	3	0	5		5	8
4:30 PM	0		1	1				0	1	1	2	0	3		3	6
4:35 PM	0		0	0				0	1	0	1	0	4		4	5
4:40 PM	0		0	0				0	2	0	2	0	3		3	5
4:45 PM	0		0	0				0	1	0	1	0	4		4	5
4:50 PM	0		0	0				0	2	0	2	0	6		6	8
4:55 PM	0		0	0				0	1	0	1	0	2		2	3
5:00 PM	0		0	0				0	3	0	3	0	1		1	4
5:05 PM	0		0	0				0	2	0	2	0	6		6	8
5:10 PM	0		0	0				0	0	1	1	0	4		4	5
5:15 PM	0		0	0				0	2	0	2	0	3		3	5
5:20 PM	0		0	0				0	0	0	0	0	5		5	5
5:25 PM	0		0	0				0	1	0	1	0	1		1	2
5:30 PM	0		0	0				0	4	0	4	0	2		2	6
5:35 PM	0		0	0				0	0	0	0	1	2		3	3
5:40 PM	0		0	0				0	1	0	1	0	3		3	4
5:45 PM	0		0	0				0	4	0	4	0	3		3	7
5:50 PM	0		0	0				0	1	0	1	0	2		2	3
5:55 PM	0		0	0				0	2	0	2	0	7		7	9
Total Survey	1		1	2				0	53	3	56	1	97		98	156

Heavy Vehicle 15-Minute Interval Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
4:00 PM	0		0	0				0	13	0	13	0	23		23	36
4:15 PM	1		0	1				0	12	1	13	0	13		13	27
4:30 PM	0		1	1				0	4	1	5	0	10		10	16
4:45 PM	0		0	0				0	4	0	4	0	12		12	16
5:00 PM	0		0	0				0	5	1	6	0	11		11	17
5:15 PM	0		0	0				0	3	0	3	0	9		9	12
5:30 PM	0		0	0				0	5	0	5	1	7		8	13
5:45 PM	0		0	0				0	7	0	7	0	12		12	19
Total Survey	1		1	2				0	53	3	56	1	97		98	156

Heavy Vehicle Peak Hour Summary
4:10 PM to 5:10 PM

By Approach	Northbound SE Langensand Rd			Southbound SE Langensand Rd			Eastbound Hwy 26			Westbound Hwy 26			Total
	In	Out	Total	In	Out	Total	In	Out	Total	In	Out	Total	
Volume	2	2	4	0	0	0	29	50	79	49	28	77	80
PHF	0.25			0.00			0.56			0.82			0.71

By Movement	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Total
	L		R	Total				Total	T	R	Total	L	T		Total	
Volume	1		1	2				0	27	2	29	0	49		49	80
PHF	0.25		0.25	0.25				0.00	0.56	0.25	0.56	0.00	0.82		0.82	0.71

Heavy Vehicle Rolling Hour Summary
4:00 PM to 6:00 PM

Interval Start Time	Northbound SE Langensand Rd				Southbound SE Langensand Rd				Eastbound Hwy 26				Westbound Hwy 26				Interval Total
	L		R	Total				Total	T	R	Total	L	T		Total	
4:00 PM	1		1	2				0	33	2	35	0	58		58	95
4:15 PM	1		1	2				0	25	3	28	0	46		46	76
4:30 PM	0		1	1				0	16	2	18	0	42		42	61
4:45 PM	0		0	0				0	17	1	18	1	39		40	58
5:00 PM	0		0	0				0	20	1	21	1	39		40	61

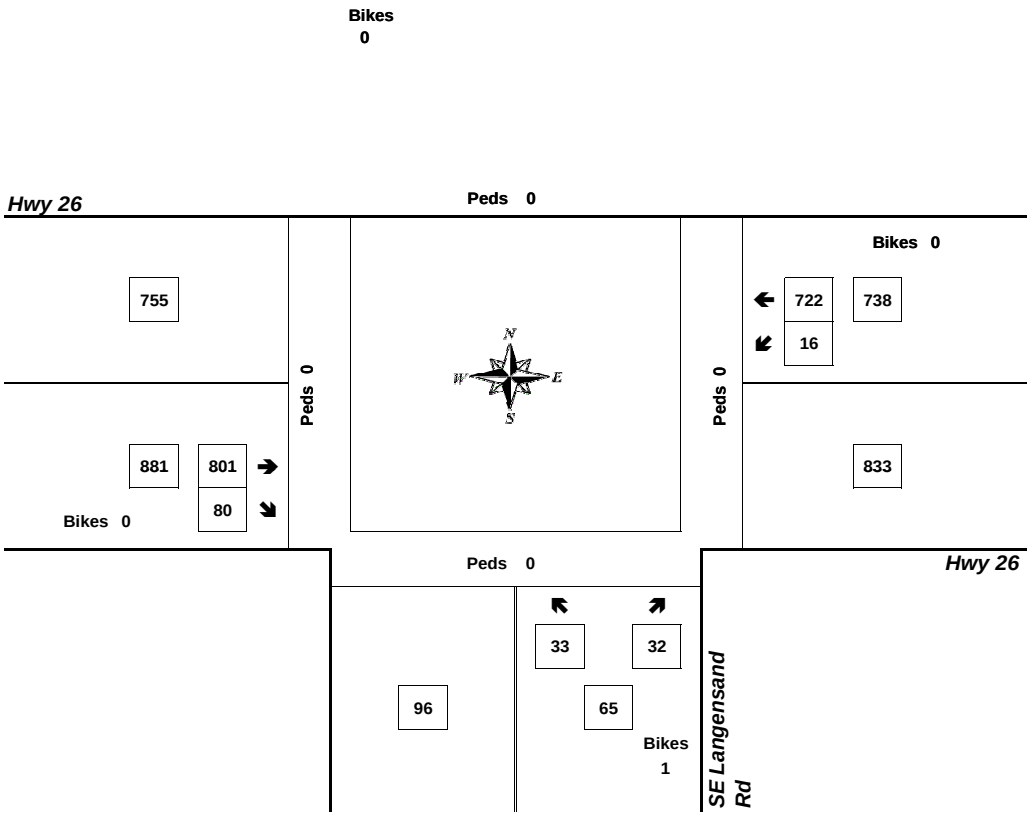
Peak Hour Summary

All Traffic Data Services Inc.

Clay Carney
(503) 833-2740

SE Langensand Rd & Hwy 26

4:10 PM to 5:10 PM
Tuesday, March 19, 2019



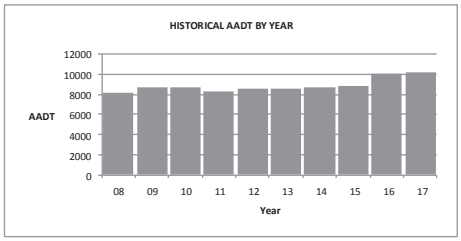
Approach	PHF	HV%	Volume
EB	0.91	3.3%	881
WB	0.94	6.6%	738
NB	0.71	3.1%	65
SB	0.00	0.0%	0
Intersection	0.93	4.8%	1,684

Count Period: 4:00 PM to 6:00 PM

Location:	US26; MP 46.38; MT. HOOD HIGHWAY NO. 26; 0.30 mile east of Camp Creek Rd (USFS 28)	Site Name:	Rhododendron (03-006)
		Installed:	August, 1995

HISTORICAL TRAFFIC DATA

		Percent of AADT				
Year	AADT	Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2008	8162	233	22.9	20.1	19.1	18.2
2009	8737	197	22.3	19.6	18.4	17.8
2010	8714	207	21.6	19.8	18.9	18.5
2011	8330	214	24.7	20.0	18.6	18.1
2012	8480	227	24.0	21.0	20.2	19.4
2013	8527	213	23.4	21.1	20.3	19.1
2014	8652	216	23.2	21.1	20.3	19.2
2015	8861	242	21.4	20.3	19.4	18.7
2016	10071	208	22.9	19.6	18.8	17.9
2017	10223	200	19.9	19.1	18.1	17.5



2017 TRAFFIC DATA

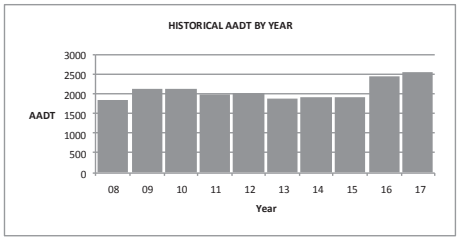
	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	6744	66	9080	89
February	6533	64	9496	93
March	6763	66	9337	91
April	6166	60	8675	85
May	7675	75	9598	94
June	8568	84	10695	105
July	11291	110	13874	136
August	11738	115	13623	133
September	11300	111	12734	125
October	6589	64	8087	79
November	5493	54	7313	72
December	8753	86	10161	99

For Vehicle Classification data near your project, please go to the following web page: https://www.oregon.gov/ODOT/Data/Documents/TVT_2017.xlsx

Location:	OR35; MP 57.79; MT. HOOD HIGHWAY NO. 26; 0.02 mile east of Warm Springs Highway No. 53 (US26)	Site Name:	Mt. Hood Meadows (03-007)
		Installed:	September, 1995

HISTORICAL TRAFFIC DATA

		Percent of AADT				
Year	AADT	Max Day	Max Hour	10TH Hour	20TH Hour	30TH Hour
2008	1854	398	56.8	44.2	39.9	36.1
2009	2130	***	***	***	***	***
2010	2145	374	49.2	39.5	34.8	33.2
2011	1976	476	79.2	49.1	45.0	39.1
2012	2023	452	65.4	43.4	40.3	37.7
2013	1868	427	68.1	48.7	42.0	37.1
2014	1908	400	60.0	41.9	37.4	33.6
2015	1931	393	50.4	38.6	34.4	32.6
2016	2455	366	55.9	38.3	33.1	31.2
2017	2565	340	52.1	37.7	32.5	31.3



2017 TRAFFIC DATA

	Average Weekday Traffic	Percent of AADT	Average Daily Traffic	Percent of AADT
January	2449	95	3616	141
February	1978	77	3362	131
March	1781	69	2833	110
April	1116	44	2050	80
May	1202	47	1609	63
June	1794	70	2070	81
July	2405	94	2837	111
August	2302	90	2614	102
September	3956	154	3993	156
October	1387	54	1614	63
November	768	30	1156	45
December	2499	97	2966	116

For Vehicle Classification data near your project, please go to the following web page: https://www.oregon.gov/ODOT/Data/Documents/TVT_2017.xlsx

HWY	MP	DIR	HS	Location	2014	2015	2016	2036	RSQ
026	22.72	1		0.02 mile northwest of S.E. 362nd Drive, west city limits of Sandy		29500		41400	MODEL
026	23.85	1		0.02 mile west of Bluff Road		30100		42600	MODEL
026	23.89	1		0.02 mile east of Bluff Road		15100		21600	MODEL
026	24.02	1		0.02 mile west of Beers Avenue		15100		21600	MODEL
026	24.35	1		0.05 mile west of Eagle Creek-Sandy Highway (OR211)		14800		21600	MODEL
026	24.42	1		0.02 mile east of Eagle Creek-Sandy Highway (OR211)		12000		17100	MODEL
026	24.59	1		0.02 mile west of Ten Eyck Road		11200		16000	MODEL
026	23.89	2	W	0.02 mile east of Bluff Road		15200		21300	MODEL
026	24.04	2	W	0.02 mile west of Beers Avenue		15200		21300	MODEL
026	24.36	2	W	0.05 mile west of Eagle Creek-Sandy Highway (OR211)		14500		20700	MODEL
026	24.40	2	W	0.02 mile east of Eagle Creek-Sandy Highway (OR211)		12100		16900	MODEL
026	24.61	2	W	0.02 mile west of Ten Eyck Road		11700		16400	MODEL
026	25.10	1		0.02 mile west of Langensand Road		18000		25400	MODEL
026	25.66	1		0.10 mile east of Vista Loop Drive		19700		27600	MODEL

HWY	MP	DIR	HS	Location	2014	2015	2016	2036	RSQ
172	-0.13	1		0.10 mile east of Clackamas Highway (OR224)			5600	8800	MODEL
172	1.45	1		0.10 mile southwest of Judd Road			5800	9100	MODEL
172	1.65	1		0.10 mile northeast of Judd Road			6200	9600	MODEL
172	3.65	1		0.05 mile west of 362nd Drive			7600	11600	MODEL
172	3.75	1		0.05 mile east of 362nd Drive			5300	7900	MODEL
172	5.07	1		0.10 mile west of Bornstedt Road			4200	6900	MODEL
172	5.29	1		0.10 mile south of Dubarko Road			6500	10700	MODEL
172	5.50	1		0.11 mile north of Dubarko Road			5700	9200	MODEL
172	5.83	1		0.05 mile south of Mt. Hood Highway (US26-Eastbound)			5700	9200	MODEL
172	5.92	1		0.02 mile south of Mt. Hood Highway (US26-Westbound)			5000	8100	MODEL

HCM Signalized Intersection Capacity Analysis
1: Wolf Drive/Ten Eyck Road & Highway 26 07/08/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	57	770	37	4	998	10	134	11	3	15	4	145
Future Volume (vph)	57	770	37	4	998	10	134	11	3	15	4	145
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00			0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			1.00	
Satd. Flow (prot)	1484	2949		1568	3137	1403		1575			1489	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.55			0.97	
Satd. Flow (perm)	1484	2949		1568	3137	1403		911			1450	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	61	819	39	4	1062	11	143	12	3	16	4	154
RTOR Reduction (vph)	0	3	0	0	0	5	0	1	0	0	107	0
Lane Group Flow (vph)	61	855	0	4	1062	6	0	157	0	0	67	0
Heavy Vehicles (%)	12%	12%	12%	6%	6%	6%	6%	6%	6%	3%	3%	3%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases						6	4			8		
Actuated Green, G (s)	8.4	68.9		1.1	61.6	61.6		36.5			36.5	
Effective Green, g (s)	8.4	68.9		1.1	61.6	61.6		36.5			36.5	
Actuated g/C Ratio	0.07	0.57		0.01	0.51	0.51		0.30			0.30	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	103	1693		14	1610	720		277			441	
v/s Ratio Prot	c0.04	0.29		0.00	c0.34							
v/s Ratio Perm						0.00		c0.17			0.05	
v/c Ratio	0.59	0.51		0.29	0.66	0.01		0.57			0.15	
Uniform Delay, d1	54.1	15.3		59.1	21.5	14.3		35.1			30.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	8.8	1.1		10.9	2.1	0.0		8.2			0.2	
Delay (s)	63.0	16.4		70.0	23.6	14.3		43.3			30.6	
Level of Service	E	B		E	C	B		D			C	
Approach Delay (s)		19.5			23.7			43.3			30.6	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	68.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Signalized Intersection Summary
1: Wolf Drive/Ten Eyck Road & Highway 26 07/08/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	57	770	37	4	998	10	134	11	3	15	4	145
Future Volume (veh/h)	57	770	37	4	998	10	134	11	3	15	4	145
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1586	1586	1586	1668	1668	1668	1668	1668	1668	1709	1709	1709
Adj Flow Rate, veh/h	61	819	39	4	1062	11	143	12	3	16	4	154
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	12	12	12	6	6	6	6	6	6	3	3	3
Cap, veh/h	75	1693	81	8	1692	755	326	25	6	55	29	396
Arrive On Green	0.05	0.58	0.58	0.01	0.53	0.53	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1511	2929	139	1589	3169	1414	884	84	19	75	95	1303
Grp Volume(v), veh/h	61	421	437	4	1062	11	158	0	0	174	0	0
Grp Sat Flow(s),veh/h/ln	1511	1507	1561	1589	1585	1414	986	0	0	1472	0	0
Q Serve(g_s), s	4.8	19.7	19.7	0.3	28.2	0.4	7.8	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	4.8	19.7	19.7	0.3	28.2	0.4	19.0	0.0	0.0	11.2	0.0	0.0
Prop In Lane	1.00		0.09	1.00		1.00	0.91		0.02	0.09		0.89
Lane Grp Cap(c), veh/h	75	871	903	8	1692	755	357	0	0	480	0	0
V/C Ratio(X)	0.82	0.48	0.48	0.48	0.63	0.01	0.44	0.00	0.00	0.36	0.00	0.00
Avail Cap(c_a), veh/h	146	871	903	73	1692	755	357	0	0	480	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	56.5	14.8	14.8	59.5	19.6	13.1	36.7	0.0	0.0	32.9	0.0	0.0
Incr Delay (d2), s/veh	18.7	1.9	1.9	38.0	1.8	0.0	3.9	0.0	0.0	0.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	7.1	7.4	0.2	10.7	0.2	4.4	0.0	0.0	4.1	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	75.2	16.7	16.7	97.5	21.4	13.2	40.6	0.0	0.0	33.4	0.0	0.0
LnGrp LOS	E	B	B	F	C	B	D	A	A	C	A	A
Approach Vol, veh/h		919			1077			158			174	
Approach Delay, s/veh		20.6			21.6			40.6			33.4	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.1	73.9		41.0	10.4	68.6		41.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.5	64.5		36.5	11.6	58.4		36.5				
Max Q Clear Time (g_c+I1), s	2.3	21.7		21.0	6.8	30.2		13.2				
Green Ext Time (p_c), s	0.0	7.1		0.8	0.0	9.6		1.1				

Intersection Summary	
HCM 6th Ctrl Delay	23.4
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	2.1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	778	35	15	910	64	15
Future Vol, veh/h	778	35	15	910	64	15
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	160	215	-	120	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	13	13	7	7	4	4
Mvmt Flow	828	37	16	968	68	16

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	865	0	1344	414
Stage 1	-	-	-	-	828	-
Stage 2	-	-	-	-	516	-
Critical Hdwy	-	-	4.24	-	6.88	6.98
Critical Hdwy Stg 1	-	-	-	-	5.88	-
Critical Hdwy Stg 2	-	-	-	-	5.88	-
Follow-up Hdwy	-	-	2.27	-	3.54	3.34
Pot Cap-1 Maneuver	-	-	743	-	140	582
Stage 1	-	-	-	-	384	-
Stage 2	-	-	-	-	558	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	743	-	137	582
Mov Cap-2 Maneuver	-	-	-	-	137	-
Stage 1	-	-	-	-	384	-
Stage 2	-	-	-	-	546	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	46.6
HCM LOS			E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	137	582	-	-	743	-
HCM Lane V/C Ratio	0.497	0.027	-	-	0.021	-
HCM Control Delay (s)	54.8	11.4	-	-	10	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	2.3	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.4

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	16	744	922	1	0	36
Future Vol, veh/h	16	744	922	1	0	36
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	220	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	13	13	6	6	9	9
Mvmt Flow	17	791	981	1	0	38

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	982	0	-	0	1412	491
Stage 1	-	-	-	-	982	-
Stage 2	-	-	-	-	430	-
Critical Hdwy	4.36	-	-	-	6.98	7.08
Critical Hdwy Stg 1	-	-	-	-	5.98	-
Critical Hdwy Stg 2	-	-	-	-	5.98	-
Follow-up Hdwy	2.33	-	-	-	3.59	3.39
Pot Cap-1 Maneuver	636	-	-	-	121	505
Stage 1	-	-	-	-	308	-
Stage 2	-	-	-	-	604	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	636	-	-	-	118	505
Mov Cap-2 Maneuver	-	-	-	-	118	-
Stage 1	-	-	-	-	300	-
Stage 2	-	-	-	-	604	-

Approach	SE	NW	SW
HCM Control Delay, s	0.2	0	12.7
HCM LOS			B

Minor Lane/Major Mvmt	NWT	NWR	SEL	SET	SWLn1
Capacity (veh/h)	-	-	636	-	505
HCM Lane V/C Ratio	-	-	0.027	-	0.076
HCM Control Delay (s)	-	-	10.8	-	12.7
HCM Lane LOS	-	-	B	-	B
HCM 95th %tile Q(veh)	-	-	0.1	-	0.2

Intersection	
Int Delay, s/veh	4.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱		↔			↰	↱
Traffic Vol, veh/h	8	8	33	53	38	33	43	274	13	4	162	2
Future Vol, veh/h	8	8	33	53	38	33	43	274	13	4	162	2
Conflicting Peds, #/hr	2	0	0	0	0	2	0	0	0	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	90	-	-	125	-	-	-	-	-	330
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	9	9	37	59	42	37	48	304	14	4	180	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	639	606	182	621	601	315	184	0	0	320	0	0
Stage 1	190	190	-	409	409	-	-	-	-	-	-	-
Stage 2	449	416	-	212	192	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.15	6.55	6.25	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.545	4.045	3.345	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	390	413	863	395	410	718	1391	-	-	1223	-	-
Stage 1	814	745	-	613	591	-	-	-	-	-	-	-
Stage 2	591	594	-	783	736	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	326	392	861	358	390	715	1388	-	-	1221	-	-
Mov Cap-2 Maneuver	326	392	-	358	390	-	-	-	-	-	-	-
Stage 1	778	741	-	586	565	-	-	-	-	-	-	-
Stage 2	496	568	-	738	732	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.4	16.2	1	0.2
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1388	-	-	356	861	371	715	1221	-	-
HCM Lane V/C Ratio	0.034	-	-	0.05	0.043	0.273	0.051	0.004	-	-
HCM Control Delay (s)	7.7	0	-	15.6	9.4	18.3	10.3	8	0	-
HCM Lane LOS	A	A	-	C	A	C	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	1.1	0.2	0	-	-

Intersection	
Int Delay, s/veh	5.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	1	1	1	15	22	4	20	2	9	5	16
Future Vol, veh/h	18	1	1	1	15	22	4	20	2	9	5	16
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	5	5	5	18	18	18	8	8	8	23	23	23
Mvmt Flow	20	1	1	1	17	25	4	22	2	10	6	18

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	87	67	15	67	75	23	24	0	0	24	0	0
Stage 1	35	35	-	31	31	-	-	-	-	-	-	-
Stage 2	52	32	-	36	44	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.28	6.68	6.38	4.18	-	-	4.33	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.28	5.68	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.28	5.68	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.662	4.162	3.462	2.272	-	-	2.407	-	-
Pot Cap-1 Maneuver	891	818	1056	888	786	1009	1553	-	-	1465	-	-
Stage 1	973	860	-	946	839	-	-	-	-	-	-	-
Stage 2	953	862	-	940	828	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	848	810	1056	879	778	1009	1553	-	-	1465	-	-
Mov Cap-2 Maneuver	848	810	-	879	778	-	-	-	-	-	-	-
Stage 1	970	854	-	943	836	-	-	-	-	-	-	-
Stage 2	908	859	-	931	822	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	9.2	1.1	2.2
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1553	-	-	848	917	900	1465	-	-
HCM Lane V/C Ratio	0.003	-	-	0.024	0.002	0.047	0.007	-	-
HCM Control Delay (s)	7.3	0	-	9.3	8.9	9.2	7.5	0	-
HCM Lane LOS	A	A	-	A	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0.1	0	-	-

HCM Signalized Intersection Capacity Analysis
1: Wolf Drive/Ten Eyck Road & Highway 26 07/08/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	152	1130	152	8	1022	21	131	15	13	38	13	113
Future Volume (vph)	152	1130	152	8	1022	21	131	15	13	38	13	113
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97		1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.99			0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.99	
Satd. Flow (prot)	1614	3163		1554	3107	1343		1646			1460	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.57			0.91	
Satd. Flow (perm)	1614	3163		1554	3107	1343		980			1339	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	160	1189	160	8	1076	22	138	16	14	40	14	119
RTOR Reduction (vph)	0	8	0	0	0	11	0	3	0	0	66	0
Lane Group Flow (vph)	160	1341	0	8	1076	11	0	165	0	0	107	0
Confl. Peds. (#/hr)						4						4
Confl. Bikes (#/hr)			2			1						
Heavy Vehicles (%)	3%	3%	3%	7%	7%	7%	1%	1%	1%	6%	6%	6%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases						6	4			8		
Actuated Green, G (s)	16.2	74.0		1.0	58.8	58.8		31.5			31.5	
Effective Green, g (s)	16.2	74.0		1.0	58.8	58.8		31.5			31.5	
Actuated g/C Ratio	0.13	0.62		0.01	0.49	0.49		0.26			0.26	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	217	1950		12	1522	658		257			351	
v/s Ratio Prot	c0.10	c0.42		0.01	0.35							
v/s Ratio Perm						0.01		c0.17			0.08	
v/c Ratio	0.74	0.69		0.67	0.71	0.02		0.64			0.30	
Uniform Delay, d1	49.9	15.3		59.3	23.9	15.7		39.3			35.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	12.3	2.0		89.5	2.8	0.0		11.7			0.5	
Delay (s)	62.1	17.3		148.8	26.7	15.8		51.0			36.0	
Level of Service	E	B		F	C	B		D			D	
Approach Delay (s)		22.1			27.3			51.0			36.0	
Approach LOS		C			C			D			D	

Intersection Summary				
HCM 2000 Control Delay	26.5	HCM 2000 Level of Service	C	
HCM 2000 Volume to Capacity ratio	0.70			
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5	
Intersection Capacity Utilization	79.3%	ICU Level of Service	D	
Analysis Period (min)	15			
c Critical Lane Group				

HCM 6th Signalized Intersection Summary
1: Wolf Drive/Ten Eyck Road & Highway 26

07/08/2020

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	152	1130	152	8	1022	21	131	15	13	38	13	113
Future Volume (veh/h)	152	1130	152	8	1022	21	131	15	13	38	13	113
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1709	1709	1709	1654	1654	1654	1736	1736	1736	1668	1668	1668
Adj Flow Rate, veh/h	160	1189	160	8	1076	22	138	16	14	40	14	119
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	7	7	7	1	1	1	6	6	6
Cap, veh/h	186	1765	237	15	1605	698	285	32	24	108	50	267
Arrive On Green	0.11	0.62	0.62	0.01	0.51	0.51	0.26	0.26	0.26	0.26	0.26	0.26
Sat Flow, veh/h	1628	2869	385	1576	3143	1368	876	123	91	270	191	1016
Grp Volume(v), veh/h	160	671	678	8	1076	22	168	0	0	173	0	0
Grp Sat Flow(s),veh/h/ln	1628	1624	1630	1576	1572	1368	1090	0	0	1477	0	0
Q Serve(g_s), s	11.6	32.5	32.9	0.6	30.6	1.0	6.8	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	11.6	32.5	32.9	0.6	30.6	1.0	18.1	0.0	0.0	11.3	0.0	0.0
Prop In Lane	1.00		0.24	1.00		1.00	0.82		0.08	0.23		0.69
Lane Grp Cap(c), veh/h	186	999	1003	15	1605	698	341	0	0	425	0	0
V/C Ratio(X)	0.86	0.67	0.68	0.52	0.67	0.03	0.49	0.00	0.00	0.41	0.00	0.00
Avail Cap(c_a), veh/h	264	999	1003	67	1605	698	341	0	0	425	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	52.2	15.1	15.2	59.1	21.8	14.6	39.9	0.0	0.0	36.9	0.0	0.0
Incr Delay (d2), s/veh	17.6	3.6	3.7	24.7	2.2	0.1	5.0	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.7	12.6	12.8	0.3	11.7	0.3	4.9	0.0	0.0	4.4	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.8	18.7	18.9	83.8	24.1	14.7	44.9	0.0	0.0	37.5	0.0	0.0
LnGrp LOS	E	B	B	F	C	B	D	A	A	D	A	A
Approach Vol, veh/h		1509			1106			168			173	
Approach Delay, s/veh		24.2			24.3			44.9			37.5	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.7	78.3		36.0	18.2	65.8		36.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.1	69.9		31.5	19.5	55.5		31.5				
Max Q Clear Time (g_c+I1), s	2.6	34.9		20.1	13.6	32.6		13.3				
Green Ext Time (p_c), s	0.0	13.4		0.7	0.2	9.0		1.0				

Intersection Summary	
HCM 6th Ctrl Delay	26.2
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	1.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1085	82	16	1043	34	33
Future Vol, veh/h	1085	82	16	1043	34	33
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	160	215	-	120	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	3	7	7	3	3
Mvmt Flow	1142	86	17	1098	36	35

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1228	0	1725	571
Stage 1	-	-	-	-	1142	-
Stage 2	-	-	-	-	583	-
Critical Hdwy	-	-	4.24	-	6.86	6.96
Critical Hdwy Stg 1	-	-	-	-	5.86	-
Critical Hdwy Stg 2	-	-	-	-	5.86	-
Follow-up Hdwy	-	-	2.27	-	3.53	3.33
Pot Cap-1 Maneuver	-	-	536	-	79	461
Stage 1	-	-	-	-	264	-
Stage 2	-	-	-	-	518	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	536	-	76	461
Mov Cap-2 Maneuver	-	-	-	-	76	-
Stage 1	-	-	-	-	264	-
Stage 2	-	-	-	-	501	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	51.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	76	461	-	-	536	-
HCM Lane V/C Ratio	0.471	0.075	-	-	0.031	-
HCM Control Delay (s)	88.9	13.4	-	-	11.9	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	1.9	0.2	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.3

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	37	1070	1027	0	0	15
Future Vol, veh/h	37	1070	1027	0	0	15
Conflicting Peds, #/hr	0	0	0	1	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	220	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	3	3	7	7	13	13
Mvmt Flow	38	1103	1059	0	0	15

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1060	0	-	0	1688	532
Stage 1	-	-	-	-	1060	-
Stage 2	-	-	-	-	628	-
Critical Hdwy	4.16	-	-	-	7.06	7.16
Critical Hdwy Stg 1	-	-	-	-	6.06	-
Critical Hdwy Stg 2	-	-	-	-	6.06	-
Follow-up Hdwy	2.23	-	-	-	3.63	3.43
Pot Cap-1 Maneuver	647	-	-	-	75	464
Stage 1	-	-	-	-	271	-
Stage 2	-	-	-	-	465	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	646	-	-	-	70	463
Mov Cap-2 Maneuver	-	-	-	-	70	-
Stage 1	-	-	-	-	255	-
Stage 2	-	-	-	-	465	-

Approach	SE	NW	SW
HCM Control Delay, s	0.4	0	13
HCM LOS			B

Minor Lane/Major Mvmt	NWT	NWR	SEL	SET	SWLn1
Capacity (veh/h)	-	-	646	-	463
HCM Lane V/C Ratio	-	-	0.059	-	0.033
HCM Control Delay (s)	-	-	10.9	-	13
HCM Lane LOS	-	-	B	-	B
HCM 95th %tile Q(veh)	-	-	0.2	-	0.1

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	11	46	53	26	49	26	59	264	52	10	318	11
Future Vol, veh/h	11	46	53	26	49	26	59	264	52	10	318	11
Conflicting Peds, #/hr	2	0	0	0	0	2	0	0	0	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	90	-	-	125	-	-	-	-	-	330
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	12	49	56	28	52	28	63	281	55	11	338	12

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	839	826	340	856	811	313	352	0	0	338	0	0
Stage 1	362	362	-	437	437	-	-	-	-	-	-	-
Stage 2	477	464	-	419	374	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.15	6.55	6.25	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.545	4.045	3.345	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	286	308	705	275	310	720	1207	-	-	1205	-	-
Stage 1	659	627	-	592	574	-	-	-	-	-	-	-
Stage 2	571	565	-	606	612	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	223	284	704	207	286	717	1205	-	-	1203	-	-
Mov Cap-2 Maneuver	223	284	-	207	286	-	-	-	-	-	-	-
Stage 1	615	619	-	552	536	-	-	-	-	-	-	-
Stage 2	462	527	-	508	604	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16.6	21.7	1.3	0.2
HCM LOS	C	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1205	-	-	270	704	253	717	1203	-	-
HCM Lane V/C Ratio	0.052	-	-	0.225	0.08	0.315	0.039	0.009	-	-
HCM Control Delay (s)	8.2	0	-	22.2	10.6	25.7	10.2	8	0	-
HCM Lane LOS	A	A	-	C	B	D	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	0.8	0.3	1.3	0.1	0	-	-

Intersection	
Int Delay, s/veh	5.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	23	23	5	2	6	7	4	10	1	23	27	28
Future Vol, veh/h	23	23	5	2	6	7	4	10	1	23	27	28
Conflicting Peds, #/hr	2	0	1	3	0	4	1	0	3	4	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	7	7	7	3	3	3
Mvmt Flow	25	25	5	2	7	8	4	11	1	25	30	31

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	129	122	51	138	137	20	63	0	0	16	0	0
Stage 1	98	98	-	24	24	-	-	-	-	-	-	-
Stage 2	31	24	-	114	113	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.17	-	-	4.13	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.263	-	-	2.227	-	-
Pot Cap-1 Maneuver	844	768	1017	833	754	1058	1508	-	-	1595	-	-
Stage 1	908	814	-	994	875	-	-	-	-	-	-	-
Stage 2	986	875	-	891	802	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	815	749	1012	791	735	1050	1505	-	-	1589	-	-
Mov Cap-2 Maneuver	815	749	-	791	735	-	-	-	-	-	-	-
Stage 1	903	799	-	987	869	-	-	-	-	-	-	-
Stage 2	965	869	-	842	788	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.7	9.2	2	2.2
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1505	-	-	815	785	864	1589	-	-
HCM Lane V/C Ratio	0.003	-	-	0.031	0.039	0.019	0.016	-	-
HCM Control Delay (s)	7.4	0	-	9.6	9.8	9.2	7.3	0	-
HCM Lane LOS	A	A	-	A	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	0	-	-

Trip Generation Calculation Worksheet

Land Use Description: Multi-Family Housing (Low-Rise*)
ITE Land Use Code: 220
Independent Variable: Dwelling Units
Quantity: 192 Dwelling Units
Setting: General Urban/Suburban and Rural (Not Close to Rail Transit)

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Equation: T = 0.31(X) + 22.85
Directional Distribution: 24% Entering 76% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Equation: T = 0.43(X) + 20.55
Directional Distribution: 63% Entering 37% Exiting

Total Weekday Traffic
Trip Equation: T = 6.41(X) + 75.31
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

192 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	20	62	82
PM Peak Hour	65	38	103
Weekday	653	653	1306

*"Low-Rise" applies to buildings with 2-3 floors.

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Single-Family Attached Housing
ITE Land Use Code: 215
Independent Variable: Dwelling Units
Quantity: 8 Dwelling Units
Setting: General Urban/Suburban and Rural

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.48 trips per dwelling unit
Directional Distribution: 31% Entering 69% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.57 trips per dwelling unit
Directional Distribution: 57% Entering 43% Exiting

Total Weekday Traffic
Trip Rate: 7.2 trips per dwelling unit
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

8 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	1	3	4
PM Peak Hour	3	2	5
Weekday	29	29	58

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: General Office Building
ITE Land Use Code: 710
Independent Variable: Gross Floor Area
Quantity: 5.000 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 1.52 trips per ksf
Directional Distribution: 86% Entering 14% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 1.44 trips per ksf
Directional Distribution: 16% Entering 84% Exiting

Total Weekday Traffic
Trip Rate: 10.84 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

5.000 ksf General Office Building

	Entering	Exiting	Total
AM Peak Hour	7	1	8
PM Peak Hour	1	6	7
Weekday	27	27	54

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Single-Family Attached Housing
ITE Land Use Code: 215
Independent Variable: Dwelling Units
Quantity: 92 Dwelling Units
Setting: General Urban/Suburban and Rural

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Equation: T = 0.52(X) - 5.70
Directional Distribution: 31% Entering 69% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Equation: T = 0.60(X) - 3.93
Directional Distribution: 57% Entering 43% Exiting

Total Weekday Traffic
Trip Equation: T = 7.62(X) - 50.48
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

92 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	13	29	42
PM Peak Hour	29	22	51
Weekday	325	325	650

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Single-Family Detached Housing
ITE Land Use Code: 210
Independent Variable: Dwelling Units
Quantity: 50 Dwelling Units

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.74 trips per dwelling unit
Directional Distribution: 25% Entering 75% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.99 trips per dwelling unit
Directional Distribution: 63% Entering 37% Exiting

Total Weekday Traffic
Trip Rate: 9.44 trips per dwelling unit
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

50 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	9	28	37
PM Peak Hour	32	18	50
Weekday	236	236	472

Data Source: *Trip Generation Manual, 10th Edition* , Institute of Transportation Engineers, 2017

Trip Generation Calculation Worksheet

Land Use Description: Fast-Food Restaurant without Drive-Through
ITE Land Use Code: 933
Independent Variable: Gross Floor Area
Quantity: 5.000 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 25.10 trips per ksf
Directional Distribution: 51% Entering 49% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 28.34 trips per ksf
Directional Distribution: 52% Entering 48% Exiting

Total Weekday Traffic
Trip Rate: 346.23 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

5.0 ksf Fast-Food Restaurant w/o Drive Thru

	Entering	Exiting	Total
AM Peak Hour	64	62	126
PM Peak Hour	74	68	142
Weekday	866	866	1732

Data Source: *Trip Generation Manual, 10th Edition* , Institute of Transportation Engineers, 2017

Trip Generation Calculation Worksheet

Land Use Description: Day Care Center
ITE Land Use Code: 565
Independent Variable: Gross Floor Area
Quantity: 5.00 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 11.00 trips per ksf
Directional Distribution: 54% Entering 46% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 11.12 trips per ksf
Directional Distribution: 49% Entering 51% Exiting

Total Weekday Traffic
Trip Rate: 47.62 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

5.00 ksf Day Care Center

	Entering	Exiting	Total
AM Peak Hour	30	25	55
PM Peak Hour	27	29	56
Weekday	119	119	238

Data Source: *Trip Generation Manual, 10th Edition* , Institute of Transportation Engineers, 2017

Trip Generation Calculation Worksheet

Land Use Description: Supermarket
ITE Land Use Code: 850
Independent Variable: Gross Floor Area
Quantity: 18.433 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 3.82 trips per ksf
Directional Distribution: 58% Entering 42% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 9.24 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Total Weekday Traffic
Trip Rate: 106.78 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

18.433 ksf Supermarket

	Entering	Exiting	Total
AM Peak Hour	41	29	70
PM Peak Hour	85	85	170
Weekday	984	984	1968

Data Source: *Trip Generation Manual, 10th Edition* , Institute of Transportation Engineers, 2017

Trip Generation Calculation Worksheet

Land Use Description: Single-Family Attached Housing
ITE Land Use Code: 215
Independent Variable: Dwelling Units
Quantity: 12 Dwelling Units
Setting: General Urban/Suburban and Rural

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.48 trips per dwelling unit
Directional Distribution: 31% Entering 69% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.57 trips per dwelling unit
Directional Distribution: 57% Entering 43% Exiting

Total Weekday Traffic
Trip Rate: 7.2 trips per dwelling unit
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

12 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	2	4	6
PM Peak Hour	4	3	7
Weekday	43	43	86

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Single-Family Detached Housing
ITE Land Use Code: 210
Independent Variable: Dwelling Units
Quantity: 14 Dwelling Units

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.74 trips per dwelling unit
Directional Distribution: 25% Entering 75% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.99 trips per dwelling unit
Directional Distribution: 63% Entering 37% Exiting

Total Weekday Traffic
Trip Rate: 9.44 trips per dwelling unit
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

14 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	3	7	10
PM Peak Hour	9	5	14
Weekday	66	66	132

Data Source: *Trip Generation Manual, 10th Edition* , Institute of Transportation Engineers, 2017

Trip Generation Calculation Worksheet

Land Use Description: Multi-Family Housing (Low-Rise)
ITE Land Use Code: 220
Independent Variable: Dwelling Units
Quantity: 130 Dwelling Units

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.46 trips per dwelling unit
Directional Distribution: 23% Entering 77% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.56 trips per dwelling unit
Directional Distribution: 63% Entering 37% Exiting

Total Weekday Traffic
Trip Rate: 7.32 trips per dwelling unit
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

130 Dwelling Units

	Entering	Exiting	Total
AM Peak Hour	14	46	60
PM Peak Hour	46	27	73
Weekday	476	476	952

Data Source: *Trip Generation Manual, 10th Edition* , Institute of Transportation Engineers, 2017

Trip Generation Calculation Worksheet

Land Use Description: Supermarket
ITE Land Use Code: 850
Independent Variable: Gross Floor Area
Quantity: 25.720 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 2.86 trips per ksf
Directional Distribution: 59% Entering 41% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Equation: Ln(T) = 0.81 Ln(X) + 2.92
Directional Distribution: 50% Entering 50% Exiting

Total Weekday Traffic
Trip Rate: T = 89.39(X) + 539.33
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

25.720 ksf Supermarket

	Entering	Exiting	Total
AM Peak Hour	44	30	74
PM Peak Hour	129	128	257
Weekday	1419	1419	2838

Data Source: Trip Generation Manual, 11th Edition, Institute of Transportation Engineers, 2021

Trip Generation Calculation Worksheet

Land Use Description: Public Park
ITE Land Use Code: 411
Independent Variable: Acres
Quantity: 1.755 Acres

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.02 trips per acre
Directional Distribution: 59% Entering 41% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.11 trips per acre
Directional Distribution: 55% Entering 45% Exiting

Total Weekday Traffic
Trip Rate: 0.78 trips per acre
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

1.755 Acre Park

	Entering	Exiting	Total
AM Peak Hour	0	0	0
PM Peak Hour	0	0	0
Weekday	1	1	2

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

HCM Signalized Intersection Capacity Analysis
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	852	40	4	1143	11	145	12	3	17	4	157
Future Volume (vph)	61	852	40	4	1143	11	145	12	3	17	4	157
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00			0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			1.00	
Satd. Flow (prot)	1484	2949		1568	3137	1403		1576			1489	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.53			0.97	
Satd. Flow (perm)	1484	2949		1568	3137	1403		879			1445	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	65	906	43	4	1216	12	154	13	3	18	4	167
RTOR Reduction (vph)	0	3	0	0	0	6	0	1	0	0	95	0
Lane Group Flow (vph)	65	946	0	4	1216	6	0	169	0	0	94	0
Heavy Vehicles (%)	12%	12%	12%	6%	6%	6%	6%	6%	6%	3%	3%	3%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases						6	4			8		
Actuated Green, G (s)	8.1	69.0		1.0	61.9	61.9		36.5			36.5	
Effective Green, g (s)	8.1	69.0		1.0	61.9	61.9		36.5			36.5	
Actuated g/C Ratio	0.07	0.58		0.01	0.52	0.52		0.30			0.30	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	100	1695		13	1618	723		267			439	
v/s Ratio Prot	c0.04	0.32		0.00	c0.39							
v/s Ratio Perm						0.00		c0.19			0.07	
v/c Ratio	0.65	0.56		0.31	0.75	0.01		0.63			0.21	
Uniform Delay, d1	54.6	16.0		59.2	23.0	14.1		36.0			31.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	14.1	1.3		13.0	3.3	0.0		11.0			0.2	
Delay (s)	68.7	17.3		72.2	26.2	14.1		46.9			31.3	
Level of Service	E	B		E	C	B		D			C	
Approach Delay (s)		20.6			26.3			46.9			31.3	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	25.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Signalized Intersection Summary
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	61	852	40	4	1143	11	145	12	3	17	4	157
Future Volume (veh/h)	61	852	40	4	1143	11	145	12	3	17	4	157
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1586	1586	1586	1668	1668	1668	1668	1668	1668	1709	1709	1709
Adj Flow Rate, veh/h	65	906	43	4	1216	12	154	13	3	18	4	167
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	12	12	12	6	6	6	6	6	6	3	3	3
Cap, veh/h	80	1693	80	8	1682	750	316	25	5	57	28	401
Arrive On Green	0.05	0.58	0.58	0.01	0.53	0.53	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1511	2929	139	1589	3169	1414	850	81	17	81	93	1318
Grp Volume(v), veh/h	65	466	483	4	1216	12	170	0	0	189	0	0
Grp Sat Flow(s),veh/h/ln	1511	1507	1561	1589	1585	1414	948	0	0	1492	0	0
Q Serve(g_s), s	5.1	22.7	22.7	0.3	35.1	0.5	9.2	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	5.1	22.7	22.7	0.3	35.1	0.5	21.5	0.0	0.0	12.3	0.0	0.0
Prop In Lane	1.00		0.09	1.00		1.00	0.91		0.02	0.10		0.88
Lane Grp Cap(c), veh/h	80	871	903	8	1682	750	345	0	0	487	0	0
V/C Ratio(X)	0.82	0.54	0.54	0.48	0.72	0.02	0.49	0.00	0.00	0.39	0.00	0.00
Avail Cap(c_a), veh/h	132	871	903	68	1682	750	345	0	0	487	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	56.3	15.5	15.5	59.5	21.4	13.3	37.9	0.0	0.0	33.3	0.0	0.0
Incr Delay (d2), s/veh	17.9	2.4	2.3	38.0	2.7	0.0	4.9	0.0	0.0	0.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	8.3	8.6	0.2	13.5	0.2	4.9	0.0	0.0	4.5	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.1	17.8	17.7	97.5	24.2	13.4	42.8	0.0	0.0	33.8	0.0	0.0
LnGrp LOS	E	B	B	F	C	B	D	A	A	C	A	A
Approach Vol, veh/h		1014			1232			170			189	
Approach Delay, s/veh		21.4			24.3			42.8			33.8	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.1	73.9		41.0	10.8	68.2		41.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.1	64.9		36.5	10.5	59.5		36.5				
Max Q Clear Time (g_c+I1), s	2.3	24.7		23.5	7.1	37.1		14.3				
Green Ext Time (p_c), s	0.0	8.1		0.8	0.0	10.3		1.2				

Intersection Summary												
HCM 6th Ctrl Delay			25.1									
HCM 6th LOS			C									

Intersection	
Int Delay, s/veh	3.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	860	37	17	1055	70	17
Future Vol, veh/h	860	37	17	1055	70	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	160	215	-	120	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	13	13	7	7	4	4
Mvmt Flow	915	39	18	1122	74	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	954	0	1512	458
Stage 1	-	-	-	-	915	-
Stage 2	-	-	-	-	597	-
Critical Hdwy	-	-	4.24	-	6.88	6.98
Critical Hdwy Stg 1	-	-	-	-	5.88	-
Critical Hdwy Stg 2	-	-	-	-	5.88	-
Follow-up Hdwy	-	-	2.27	-	3.54	3.34
Pot Cap-1 Maneuver	-	-	686	-	109	544
Stage 1	-	-	-	-	346	-
Stage 2	-	-	-	-	507	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	686	-	106	544
Mov Cap-2 Maneuver	-	-	-	-	106	-
Stage 1	-	-	-	-	346	-
Stage 2	-	-	-	-	494	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	79.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	106	544	-	-	686	-
HCM Lane V/C Ratio	0.703	0.033	-	-	0.026	-
HCM Control Delay (s)	95.4	11.8	-	-	10.4	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	3.7	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.7

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	29	815	1035	1	0	72
Future Vol, veh/h	29	815	1035	1	0	72
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	220	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	13	13	6	6	9	9
Mvmt Flow	31	867	1101	1	0	77

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1102	0	-	0	1598	551
Stage 1	-	-	-	-	1102	-
Stage 2	-	-	-	-	496	-
Critical Hdwy	4.36	-	-	-	6.98	7.08
Critical Hdwy Stg 1	-	-	-	-	5.98	-
Critical Hdwy Stg 2	-	-	-	-	5.98	-
Follow-up Hdwy	2.33	-	-	-	3.59	3.39
Pot Cap-1 Maneuver	569	-	-	-	90	461
Stage 1	-	-	-	-	265	-
Stage 2	-	-	-	-	558	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	569	-	-	-	85	461
Mov Cap-2 Maneuver	-	-	-	-	85	-
Stage 1	-	-	-	-	251	-
Stage 2	-	-	-	-	558	-

Approach	SE	NW	SW
HCM Control Delay, s	0.4	0	14.4
HCM LOS			B

Minor Lane/Major Mvmt	NWT	NWR	SEL	SET	SWLn1
Capacity (veh/h)	-	-	569	-	461
HCM Lane V/C Ratio	-	-	0.054	-	0.166
HCM Control Delay (s)	-	-	11.7	-	14.4
HCM Lane LOS	-	-	B	-	B
HCM 95th %tile Q(veh)	-	-	0.2	-	0.6

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	9	35	57	42	35	47	308	15	4	182	2
Future Vol, veh/h	9	9	35	57	42	35	47	308	15	4	182	2
Conflicting Peds, #/hr	2	0	0	0	0	2	0	0	0	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	90	-	-	125	-	-	-	-	-	330
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	10	10	39	63	47	39	52	342	17	4	202	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	712	677	204	693	671	355	206	0	0	361	0	0
Stage 1	212	212	-	457	457	-	-	-	-	-	-	-
Stage 2	500	465	-	236	214	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.15	6.55	6.25	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.545	4.045	3.345	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	349	376	839	354	374	682	1365	-	-	1181	-	-
Stage 1	792	729	-	578	563	-	-	-	-	-	-	-
Stage 2	555	565	-	760	720	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	283	355	837	317	353	679	1362	-	-	1179	-	-
Mov Cap-2 Maneuver	283	355	-	317	353	-	-	-	-	-	-	-
Stage 1	752	725	-	549	535	-	-	-	-	-	-	-
Stage 2	454	537	-	712	716	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	12.1	18.4	1	0.2
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1362	-	-	315	837	331	679	1179	-	-
HCM Lane V/C Ratio	0.038	-	-	0.063	0.046	0.332	0.057	0.004	-	-
HCM Control Delay (s)	7.7	0	-	17.2	9.5	21.2	10.6	8.1	0	-
HCM Lane LOS	A	A	-	C	A	C	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	1.4	0.2	0	-	-

Intersection	
Int Delay, s/veh	5.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	1	1	1	17	24	4	22	2	10	5	18
Future Vol, veh/h	20	1	1	1	17	24	4	22	2	10	5	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	5	5	5	18	18	18	8	8	8	23	23	23
Mvmt Flow	22	1	1	1	19	27	4	25	2	11	6	20

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	95	73	16	73	82	26	26	0	0	27	0	0
Stage 1	38	38	-	34	34	-	-	-	-	-	-	-
Stage 2	57	35	-	39	48	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.28	6.68	6.38	4.18	-	-	4.33	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.28	5.68	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.28	5.68	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.662	4.162	3.462	2.272	-	-	2.407	-	-
Pot Cap-1 Maneuver	881	812	1055	880	779	1006	1550	-	-	1461	-	-
Stage 1	970	857	-	943	836	-	-	-	-	-	-	-
Stage 2	947	860	-	937	824	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	834	803	1055	871	770	1006	1550	-	-	1461	-	-
Mov Cap-2 Maneuver	834	803	-	871	770	-	-	-	-	-	-	-
Stage 1	967	850	-	940	833	-	-	-	-	-	-	-
Stage 2	898	857	-	927	817	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.4	9.3	1	2.3
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1550	-	-	834	912	892	1461	-	-
HCM Lane V/C Ratio	0.003	-	-	0.027	0.002	0.053	0.008	-	-
HCM Control Delay (s)	7.3	0	-	9.4	9	9.3	7.5	0	-
HCM Lane LOS	A	A	-	A	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0.2	0	-	-

HCM Signalized Intersection Capacity Analysis
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	164	1288	164	9	1144	23	141	17	15	42	15	123
Future Volume (vph)	164	1288	164	9	1144	23	141	17	15	42	15	123
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97		1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.99			0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.99	
Satd. Flow (prot)	1614	3166		1554	3107	1343		1645			1462	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.55			0.90	
Satd. Flow (perm)	1614	3166		1554	3107	1343		949			1334	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	1356	173	9	1204	24	148	18	16	44	16	129
RTOR Reduction (vph)	0	8	0	0	0	12	0	3	0	0	64	0
Lane Group Flow (vph)	173	1521	0	9	1204	12	0	179	0	0	125	0
Confl. Peds. (#/hr)						4						4
Confl. Bikes (#/hr)			2			1						
Heavy Vehicles (%)	3%	3%	3%	7%	7%	7%	1%	1%	1%	6%	6%	6%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases						6	4			8		
Actuated Green, G (s)	16.5	74.0		1.0	58.5	58.5		31.5			31.5	
Effective Green, g (s)	16.5	74.0		1.0	58.5	58.5		31.5			31.5	
Actuated g/C Ratio	0.14	0.62		0.01	0.49	0.49		0.26			0.26	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	221	1952		12	1514	654		249			350	
v/s Ratio Prot	c0.11	c0.48		0.01	0.39							
v/s Ratio Perm						0.01		c0.19			0.09	
v/c Ratio	0.78	0.78		0.75	0.80	0.02		0.72			0.36	
Uniform Delay, d1	50.0	17.0		59.4	25.7	15.9		40.2			36.0	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	16.4	3.2		128.3	4.4	0.1		16.4			0.6	
Delay (s)	66.4	20.1		187.6	30.1	15.9		56.6			36.6	
Level of Service	E	C		F	C	B		E			D	
Approach Delay (s)		24.8			31.0			56.6			36.6	
Approach LOS		C			C			E			D	

Intersection Summary			
HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	86.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Signalized Intersection Summary
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	164	1288	164	9	1144	23	141	17	15	42	15	123
Future Volume (veh/h)	164	1288	164	9	1144	23	141	17	15	42	15	123
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1709	1709	1709	1654	1654	1654	1736	1736	1736	1668	1668	1668
Adj Flow Rate, veh/h	173	1356	173	9	1204	24	148	18	16	44	16	129
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	7	7	7	1	1	1	6	6	6
Cap, veh/h	199	1776	225	17	1581	688	274	33	24	109	52	267
Arrive On Green	0.12	0.61	0.61	0.01	0.50	0.50	0.26	0.26	0.26	0.26	0.26	0.26
Sat Flow, veh/h	1628	2892	366	1576	3143	1368	838	125	93	276	197	1017
Grp Volume(v), veh/h	173	757	772	9	1204	24	182	0	0	189	0	0
Grp Sat Flow(s),veh/h/ln	1628	1624	1634	1576	1572	1368	1055	0	0	1491	0	0
Q Serve(g_s), s	12.5	40.4	41.5	0.7	37.0	1.1	8.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	12.5	40.4	41.5	0.7	37.0	1.1	20.5	0.0	0.0	12.5	0.0	0.0
Prop In Lane	1.00		0.22	1.00		1.00	0.81		0.09	0.23		0.68
Lane Grp Cap(c), veh/h	199	997	1003	17	1581	688	331	0	0	428	0	0
V/C Ratio(X)	0.87	0.76	0.77	0.53	0.76	0.03	0.55	0.00	0.00	0.44	0.00	0.00
Avail Cap(c_a), veh/h	251	997	1003	66	1581	688	331	0	0	428	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	51.7	16.7	16.9	59.0	24.0	15.1	41.0	0.0	0.0	37.3	0.0	0.0
Incr Delay (d2), s/veh	22.6	5.4	5.7	23.1	3.5	0.1	6.4	0.0	0.0	0.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	15.9	16.5	0.4	14.4	0.4	5.5	0.0	0.0	4.8	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.3	22.1	22.6	82.2	27.5	15.2	47.4	0.0	0.0	38.0	0.0	0.0
LnGrp LOS	E	C	C	F	C	B	D	A	A	D	A	A
Approach Vol, veh/h		1702			1237			182			189	
Approach Delay, s/veh		27.7			27.7			47.4			38.0	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.8	78.2		36.0	19.1	64.9		36.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.0	70.0		31.5	18.5	56.5		31.5				
Max Q Clear Time (g_c+I1), s	2.7	43.5		22.5	14.5	39.0		14.5				
Green Ext Time (p_c), s	0.0	14.1		0.7	0.2	8.9		1.0				

Intersection Summary			
HCM 6th Ctrl Delay		29.4	
HCM 6th LOS		C	

Intersection	
Int Delay, s/veh	2.7

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1243	88	18	1165	36	35
Future Vol, veh/h	1243	88	18	1165	36	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	160	215	-	120	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	3	7	7	3	3
Mvmt Flow	1308	93	19	1226	38	37

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1401	0	1959	654
Stage 1	-	-	-	-	1308	-
Stage 2	-	-	-	-	651	-
Critical Hdwy	-	-	4.24	-	6.86	6.96
Critical Hdwy Stg 1	-	-	-	-	5.86	-
Critical Hdwy Stg 2	-	-	-	-	5.86	-
Follow-up Hdwy	-	-	2.27	-	3.53	3.33
Pot Cap-1 Maneuver	-	-	459	-	55	407
Stage 1	-	-	-	-	215	-
Stage 2	-	-	-	-	478	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	459	-	53	407
Mov Cap-2 Maneuver	-	-	-	-	53	-
Stage 1	-	-	-	-	215	-
Stage 2	-	-	-	-	458	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	93.4
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	53	407	-	-	459	-
HCM Lane V/C Ratio	0.715	0.091	-	-	0.041	-
HCM Control Delay (s)	169.9	14.7	-	-	13.2	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	2.9	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	0.6

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Traffic Vol, veh/h	75	1194	1128	0	0	38
Future Vol, veh/h	75	1194	1128	0	0	38
Conflicting Peds, #/hr	0	0	0	1	0	1
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	220	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	97	97	97	97	97	97
Heavy Vehicles, %	3	3	7	7	13	13
Mvmt Flow	77	1231	1163	0	0	39

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1164	0	-	0	1934	584
Stage 1	-	-	-	-	1164	-
Stage 2	-	-	-	-	770	-
Critical Hdwy	4.16	-	-	-	7.06	7.16
Critical Hdwy Stg 1	-	-	-	-	6.06	-
Critical Hdwy Stg 2	-	-	-	-	6.06	-
Follow-up Hdwy	2.23	-	-	-	3.63	3.43
Pot Cap-1 Maneuver	590	-	-	-	51	428
Stage 1	-	-	-	-	237	-
Stage 2	-	-	-	-	390	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	589	-	-	-	44	427
Mov Cap-2 Maneuver	-	-	-	-	44	-
Stage 1	-	-	-	-	206	-
Stage 2	-	-	-	-	390	-

Approach	SE	NW	SW
HCM Control Delay, s	0.7	0	14.3
HCM LOS			B

Minor Lane/Major Mvmt	NWT	NWR	SEL	SET	SWLn1
Capacity (veh/h)	-	-	589	-	427
HCM Lane V/C Ratio	-	-	0.131	-	0.092
HCM Control Delay (s)	-	-	12	-	14.3
HCM Lane LOS	-	-	B	-	B
HCM 95th %tile Q(veh)	-	-	0.5	-	0.3

Intersection	
Int Delay, s/veh	5.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	50	57	28	53	28	63	298	56	11	358	12
Future Vol, veh/h	12	50	57	28	53	28	63	298	56	11	358	12
Conflicting Peds, #/hr	2	0	0	0	0	2	0	0	0	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	90	-	-	125	-	-	-	-	-	330
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	13	53	61	30	56	30	67	317	60	12	381	13

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	933	920	383	952	903	351	396	0	0	379	0	0
Stage 1	407	407	-	483	483	-	-	-	-	-	-	-
Stage 2	526	513	-	469	420	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.15	6.55	6.25	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.545	4.045	3.345	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	247	272	667	236	274	686	1163	-	-	1163	-	-
Stage 1	623	599	-	559	548	-	-	-	-	-	-	-
Stage 2	537	538	-	569	584	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	182	248	666	167	249	683	1161	-	-	1161	-	-
Mov Cap-2 Maneuver	182	248	-	167	249	-	-	-	-	-	-	-
Stage 1	576	590	-	517	506	-	-	-	-	-	-	-
Stage 2	422	497	-	464	575	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	19.1	27.1	1.3	0.2
HCM LOS	C	D		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1161	-	-	232	666	213	683	1161	-	-
HCM Lane V/C Ratio	0.058	-	-	0.284	0.091	0.405	0.044	0.01	-	-
HCM Control Delay (s)	8.3	0	-	26.6	10.9	32.9	10.5	8.1	0	-
HCM Lane LOS	A	A	-	D	B	D	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	1.1	0.3	1.8	0.1	0	-	-

Intersection	
Int Delay, s/veh	5.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	25	5	2	6	7	4	11	1	25	29	30
Future Vol, veh/h	25	25	5	2	6	7	4	11	1	25	29	30
Conflicting Peds, #/hr	2	0	1	3	0	4	1	0	3	4	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	7	7	7	3	3	3
Mvmt Flow	27	27	5	2	7	8	4	12	1	27	32	33

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	137	130	54	147	146	21	67	0	0	17	0	0
Stage 1	105	105	-	25	25	-	-	-	-	-	-	-
Stage 2	32	25	-	122	121	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.17	-	-	4.13	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.263	-	-	2.227	-	-
Pot Cap-1 Maneuver	834	761	1013	821	745	1056	1503	-	-	1594	-	-
Stage 1	901	808	-	993	874	-	-	-	-	-	-	-
Stage 2	984	874	-	882	796	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	805	740	1008	776	725	1048	1500	-	-	1588	-	-
Mov Cap-2 Maneuver	805	740	-	776	725	-	-	-	-	-	-	-
Stage 1	896	792	-	986	868	-	-	-	-	-	-	-
Stage 2	963	868	-	829	780	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.8	9.3	1.9	2.2
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1500	-	-	805	774	856	1588	-	-
HCM Lane V/C Ratio	0.003	-	-	0.034	0.043	0.019	0.017	-	-
HCM Control Delay (s)	7.4	0	-	9.6	9.9	9.3	7.3	0	-
HCM Lane LOS	A	A	-	A	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0.1	0.1	-	-

HCM Signalized Intersection Capacity Analysis
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	61	768	40	4	1114	11	145	12	3	17	4	157
Future Volume (vph)	61	768	40	4	1114	11	145	12	3	17	4	157
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00			0.88	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			1.00	
Satd. Flow (prot)	1484	2946		1568	3137	1403		1576			1489	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.53			0.97	
Satd. Flow (perm)	1484	2946		1568	3137	1403		879			1445	
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	65	817	43	4	1185	12	154	13	3	18	4	167
RTOR Reduction (vph)	0	3	0	0	0	6	0	1	0	0	107	0
Lane Group Flow (vph)	65	857	0	4	1185	6	0	169	0	0	82	0
Heavy Vehicles (%)	12%	12%	12%	6%	6%	6%	6%	6%	6%	3%	3%	3%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases						6	4			8		
Actuated Green, G (s)	8.5	69.0		1.0	61.5	61.5		36.5			36.5	
Effective Green, g (s)	8.5	69.0		1.0	61.5	61.5		36.5			36.5	
Actuated g/C Ratio	0.07	0.58		0.01	0.51	0.51		0.30			0.30	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	105	1693		13	1607	719		267			439	
v/s Ratio Prot	c0.04	0.29		0.00	c0.38							
v/s Ratio Perm						0.00		c0.19			0.06	
v/c Ratio	0.62	0.51		0.31	0.74	0.01		0.63			0.19	
Uniform Delay, d1	54.2	15.3		59.2	22.9	14.3		36.0			30.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	10.4	1.1		13.0	3.1	0.0		11.0			0.2	
Delay (s)	64.6	16.4		72.2	26.0	14.3		46.9			31.0	
Level of Service	E	B		E	C	B		D			C	
Approach Delay (s)		19.8			26.0			46.9			31.0	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	25.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Signalized Intersection Summary
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	61	768	40	4	1114	11	145	12	3	17	4	157
Future Volume (veh/h)	61	768	40	4	1114	11	145	12	3	17	4	157
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1586	1586	1586	1668	1668	1668	1668	1668	1668	1709	1709	1709
Adj Flow Rate, veh/h	65	817	43	4	1185	12	154	13	3	18	4	167
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	12	12	12	6	6	6	6	6	6	3	3	3
Cap, veh/h	80	1684	89	8	1682	750	316	25	5	57	28	401
Arrive On Green	0.05	0.58	0.58	0.01	0.53	0.53	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	1511	2912	153	1589	3169	1414	850	81	17	81	93	1318
Grp Volume(v), veh/h	65	423	437	4	1185	12	170	0	0	189	0	0
Grp Sat Flow(s),veh/h/ln	1511	1507	1559	1589	1585	1414	948	0	0	1492	0	0
Q Serve(g_s), s	5.1	19.7	19.7	0.3	33.6	0.5	9.2	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	5.1	19.7	19.7	0.3	33.6	0.5	21.5	0.0	0.0	12.3	0.0	0.0
Prop In Lane	1.00		0.10	1.00		1.00	0.91		0.02	0.10		0.88
Lane Grp Cap(c), veh/h	80	871	901	8	1682	750	345	0	0	487	0	0
V/C Ratio(X)	0.82	0.49	0.49	0.48	0.70	0.02	0.49	0.00	0.00	0.39	0.00	0.00
Avail Cap(c_a), veh/h	145	871	901	68	1682	750	345	0	0	487	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	56.3	14.8	14.8	59.5	21.1	13.3	37.9	0.0	0.0	33.3	0.0	0.0
Incr Delay (d2), s/veh	17.8	1.9	1.9	38.0	2.5	0.0	4.9	0.0	0.0	0.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.4	7.2	7.4	0.2	12.9	0.2	4.9	0.0	0.0	4.5	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	74.0	16.8	16.7	97.5	23.6	13.4	42.8	0.0	0.0	33.8	0.0	0.0
LnGrp LOS	E	B	B	F	C	B	D	A	A	C	A	A
Approach Vol, veh/h		925			1201			170			189	
Approach Delay, s/veh		20.8			23.8			42.8			33.8	
Approach LOS		C			C			D			C	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.1	73.9		41.0	10.8	68.2		41.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.1	64.9		36.5	11.5	58.5		36.5				
Max Q Clear Time (g_c+I1), s	2.3	21.7		23.5	7.1	35.6		14.3				
Green Ext Time (p_c), s	0.0	7.1		0.8	0.0	10.1		1.2				

Intersection Summary			
HCM 6th Ctrl Delay		24.7	
HCM 6th LOS		C	

Intersection	
Int Delay, s/veh	4.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	776	37	17	1016	90	17
Future Vol, veh/h	776	37	17	1016	90	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	160	215	-	120	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	13	13	7	7	4	4
Mvmt Flow	826	39	18	1081	96	18

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	865	0	1403	413
Stage 1	-	-	-	-	826	-
Stage 2	-	-	-	-	577	-
Critical Hdwy	-	-	4.24	-	6.88	6.98
Critical Hdwy Stg 1	-	-	-	-	5.88	-
Critical Hdwy Stg 2	-	-	-	-	5.88	-
Follow-up Hdwy	-	-	2.27	-	3.54	3.34
Pot Cap-1 Maneuver	-	-	743	-	128	583
Stage 1	-	-	-	-	385	-
Stage 2	-	-	-	-	519	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	743	-	125	583
Mov Cap-2 Maneuver	-	-	-	-	125	-
Stage 1	-	-	-	-	385	-
Stage 2	-	-	-	-	507	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	80.7
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	125	583	-	-	743	-
HCM Lane V/C Ratio	0.766	0.031	-	-	0.024	-
HCM Control Delay (s)	93.8	11.4	-	-	10	-
HCM Lane LOS	F	B	-	-	A	-
HCM 95th %tile Q(veh)	4.4	0.1	-	-	0.1	-

Intersection	
Int Delay, s/veh	4.7

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	23	719	18	60	981	1	23	6	109	0	18	54
Future Vol, veh/h	23	719	18	60	981	1	23	6	109	0	18	54
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	220	-	-	200	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	13	13	2	2	6	6	2	2	2	9	2	9
Mvmt Flow	24	757	19	63	1033	1	24	6	115	0	19	57

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1034	0	0	776	0	0	1467	1975	388	1590	1984	517
Stage 1	-	-	-	-	-	-	815	815	-	1160	1160	-
Stage 2	-	-	-	-	-	-	652	1160	-	430	824	-
Critical Hdwy	4.36	-	-	4.14	-	-	7.54	6.54	6.94	7.68	6.54	7.08
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.68	5.54	-
Follow-up Hdwy	2.33	-	-	2.22	-	-	3.52	4.02	3.32	3.59	4.02	3.39
Pot Cap-1 Maneuver	606	-	-	836	-	-	89	61	611	67	61	485
Stage 1	-	-	-	-	-	-	338	389	-	197	268	-
Stage 2	-	-	-	-	-	-	423	268	-	555	385	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	606	-	-	836	-	-	53	54	611	45	54	485
Mov Cap-2 Maneuver	-	-	-	-	-	-	53	54	-	45	54	-
Stage 1	-	-	-	-	-	-	324	373	-	189	248	-
Stage 2	-	-	-	-	-	-	319	248	-	426	370	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	0.3	0.6	39.2	45.4
HCM LOS			E	E

Minor Lane/Major Mvmt	NELn1	NELn2	NWL	NWT	NWR	SEL	SET	SER	SWLn1
Capacity (veh/h)	53	611	836	-	-	606	-	-	162
HCM Lane V/C Ratio	0.576	0.188	0.076	-	-	0.04	-	-	0.468
HCM Control Delay (s)	140.9	12.2	9.7	-	-	11.2	-	-	45.4
HCM Lane LOS	F	B	A	-	-	B	-	-	E
HCM 95th %tile Q(veh)	2.3	0.7	0.2	-	-	0.1	-	-	2.2

Intersection	
Int Delay, s/veh	7.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		↰	↱		↔			↰	↱
Traffic Vol, veh/h	9	10	35	135	45	35	47	208	120	4	117	2
Future Vol, veh/h	9	10	35	135	45	35	47	208	120	4	117	2
Conflicting Peds, #/hr	2	0	0	0	0	2	0	0	0	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	90	-	-	125	-	-	-	-	-	330
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	90	90	90	90	90	90	90	90	90	90	90	90
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	10	11	39	150	50	39	52	231	133	4	130	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	588	610	132	568	546	302	134	0	0	366	0	0
Stage 1	140	140	-	404	404	-	-	-	-	-	-	-
Stage 2	448	470	-	164	142	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.15	6.55	6.25	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.545	4.045	3.345	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	422	411	920	429	441	731	1451	-	-	1176	-	-
Stage 1	865	783	-	617	594	-	-	-	-	-	-	-
Stage 2	592	562	-	831	774	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	348	389	918	386	417	728	1448	-	-	1174	-	-
Mov Cap-2 Maneuver	348	389	-	386	417	-	-	-	-	-	-	-
Stage 1	823	778	-	587	565	-	-	-	-	-	-	-
Stage 2	486	535	-	781	769	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.3	21.2	0.9	0.3
HCM LOS	B	C		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1448	-	-	368	918	393	728	1174	-	-
HCM Lane V/C Ratio	0.036	-	-	0.057	0.042	0.509	0.053	0.004	-	-
HCM Control Delay (s)	7.6	0	-	15.4	9.1	23.3	10.2	8.1	0	-
HCM Lane LOS	A	A	-	C	A	C	B	A	A	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	2.8	0.2	0	-	-

Intersection	
Int Delay, s/veh	8.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	20	107	1	1	99	44	4	22	2	10	5	18
Future Vol, veh/h	20	107	1	1	99	44	4	22	2	10	5	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	89	89	89	89	89	89	89	89	89
Heavy Vehicles, %	5	5	5	18	18	18	8	8	8	23	23	23
Mvmt Flow	22	120	1	1	111	49	4	25	2	11	6	20

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	152	73	16	133	82	26	26	0	0	27	0	0
Stage 1	38	38	-	34	34	-	-	-	-	-	-	-
Stage 2	114	35	-	99	48	-	-	-	-	-	-	-
Critical Hdwy	7.15	6.55	6.25	7.28	6.68	6.38	4.18	-	-	4.33	-	-
Critical Hdwy Stg 1	6.15	5.55	-	6.28	5.68	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.15	5.55	-	6.28	5.68	-	-	-	-	-	-	-
Follow-up Hdwy	3.545	4.045	3.345	3.662	4.162	3.462	2.272	-	-	2.407	-	-
Pot Cap-1 Maneuver	808	812	1055	803	779	1006	1550	-	-	1461	-	-
Stage 1	970	857	-	943	836	-	-	-	-	-	-	-
Stage 2	884	860	-	869	824	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	678	803	1055	704	770	1006	1550	-	-	1461	-	-
Mov Cap-2 Maneuver	678	803	-	704	770	-	-	-	-	-	-	-
Stage 1	967	850	-	940	833	-	-	-	-	-	-	-
Stage 2	726	857	-	739	817	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.3	10.4	1	2.3
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1550	-	-	678	805	829	1461	-	-
HCM Lane V/C Ratio	0.003	-	-	0.033	0.151	0.195	0.008	-	-
HCM Control Delay (s)	7.3	0	-	10.5	10.3	10.4	7.5	0	-
HCM Lane LOS	A	A	-	B	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.5	0.7	0	-	-

HCM Signalized Intersection Capacity Analysis
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	164	1219	164	8	1058	23	151	17	15	42	15	123
Future Volume (vph)	164	1219	164	8	1058	23	151	17	15	42	15	123
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Total Lost time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.97		1.00			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Frt	1.00	0.98		1.00	1.00	0.85		0.99			0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96			0.99	
Satd. Flow (prot)	1614	3163		1554	3107	1343		1646			1462	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.56			0.90	
Satd. Flow (perm)	1614	3163		1554	3107	1343		962			1331	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	173	1283	173	8	1114	24	159	18	16	44	16	129
RTOR Reduction (vph)	0	8	0	0	0	13	0	3	0	0	64	0
Lane Group Flow (vph)	173	1448	0	8	1114	11	0	190	0	0	125	0
Confl. Peds. (#/hr)						4						4
Confl. Bikes (#/hr)			2			1						
Heavy Vehicles (%)	3%	3%	3%	7%	7%	7%	1%	1%	1%	6%	6%	6%
Turn Type	Prot	NA		Prot	NA	Perm	Perm	NA		Perm	NA	
Protected Phases	5	2		1	6			4			8	
Permitted Phases						6	4			8		
Actuated Green, G (s)	16.8	72.0		1.0	56.2	56.2		33.5			33.5	
Effective Green, g (s)	16.8	72.0		1.0	56.2	56.2		33.5			33.5	
Actuated g/C Ratio	0.14	0.60		0.01	0.47	0.47		0.28			0.28	
Clearance Time (s)	4.5	4.5		4.5	4.5	4.5		4.5			4.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	225	1897		12	1455	628		268			371	
v/s Ratio Prot	c0.11	c0.46		0.01	0.36							
v/s Ratio Perm						0.01		c0.20			0.09	
v/c Ratio	0.77	0.76		0.67	0.77	0.02		0.71			0.34	
Uniform Delay, d1	49.7	17.7		59.3	26.4	17.1		38.9			34.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00			1.00	
Incremental Delay, d2	14.6	3.0		89.5	3.9	0.1		14.7			0.5	
Delay (s)	64.3	20.7		148.8	30.3	17.2		53.6			34.9	
Level of Service	E	C		F	C	B		D			C	
Approach Delay (s)		25.3			30.9			53.6			34.9	
Approach LOS		C			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	29.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM 6th Signalized Intersection Summary
1: Wolf Drive/Ten Eyck Road & Highway 26 09/29/2022

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	164	1219	164	8	1058	23	151	17	15	42	15	123
Future Volume (veh/h)	164	1219	164	8	1058	23	151	17	15	42	15	123
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1709	1709	1709	1654	1654	1654	1736	1736	1736	1668	1668	1668
Adj Flow Rate, veh/h	173	1283	173	8	1114	24	159	18	16	44	16	129
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	3	3	3	7	7	7	1	1	1	6	6	6
Cap, veh/h	199	1717	230	15	1528	665	295	33	25	115	54	284
Arrive On Green	0.12	0.60	0.60	0.01	0.49	0.49	0.28	0.28	0.28	0.28	0.28	0.28
Sat Flow, veh/h	1628	2869	384	1576	3143	1367	861	118	88	280	193	1017
Grp Volume(v), veh/h	173	722	734	8	1114	24	193	0	0	189	0	0
Grp Sat Flow(s),veh/h/ln	1628	1624	1630	1576	1572	1367	1067	0	0	1491	0	0
Q Serve(g_s), s	12.5	38.6	39.4	0.6	33.9	1.1	9.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	12.5	38.6	39.4	0.6	33.9	1.1	21.2	0.0	0.0	12.2	0.0	0.0
Prop In Lane	1.00		0.24	1.00		1.00	0.82		0.08	0.23		0.68
Lane Grp Cap(c), veh/h	199	972	976	15	1528	665	353	0	0	453	0	0
V/C Ratio(X)	0.87	0.74	0.75	0.52	0.73	0.04	0.55	0.00	0.00	0.42	0.00	0.00
Avail Cap(c_a), veh/h	264	972	976	67	1528	665	353	0	0	453	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	51.7	17.4	17.6	59.1	24.5	16.1	39.6	0.0	0.0	35.7	0.0	0.0
Incr Delay (d2), s/veh	20.4	5.1	5.3	24.7	3.1	0.1	6.0	0.0	0.0	0.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.3	15.3	15.7	0.3	13.1	0.4	5.7	0.0	0.0	4.7	0.0	0.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	72.1	22.6	22.9	83.8	27.6	16.2	45.6	0.0	0.0	36.3	0.0	0.0
LnGrp LOS	E	C	C	F	C	B	D	A	A	D	A	A
Approach Vol, veh/h		1629			1146			193			189	
Approach Delay, s/veh		28.0			27.8			45.6			36.3	
Approach LOS		C			C			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	5.7	76.3		38.0	19.2	62.8		38.0				
Change Period (Y+Rc), s	4.5	4.5		4.5	4.5	4.5		4.5				
Max Green Setting (Gmax), s	5.1	67.9		33.5	19.5	53.5		33.5				
Max Q Clear Time (g_c+I1), s	2.6	41.4		23.2	14.5	35.9		14.2				
Green Ext Time (p_c), s	0.0	13.2		0.8	0.2	8.2		1.1				

Intersection Summary	
HCM 6th Ctrl Delay	29.5
HCM 6th LOS	C

Intersection	
Int Delay, s/veh	3.6

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Vol, veh/h	1174	88	18	1079	48	35
Future Vol, veh/h	1174	88	18	1079	48	35
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	160	215	-	120	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	3	3	7	7	3	3
Mvmt Flow	1236	93	19	1136	51	37

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1329	0	1842	618
Stage 1	-	-	-	-	1236	-
Stage 2	-	-	-	-	606	-
Critical Hdwy	-	-	4.24	-	6.86	6.96
Critical Hdwy Stg 1	-	-	-	-	5.86	-
Critical Hdwy Stg 2	-	-	-	-	5.86	-
Follow-up Hdwy	-	-	2.27	-	3.53	3.33
Pot Cap-1 Maneuver	-	-	490	-	66	430
Stage 1	-	-	-	-	235	-
Stage 2	-	-	-	-	504	-
Platoon blocked, %	-	-		-		
Mov Cap-1 Maneuver	-	-	490	-	63	430
Mov Cap-2 Maneuver	-	-	-	-	63	-
Stage 1	-	-	-	-	235	-
Stage 2	-	-	-	-	484	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	103.1
HCM LOS			F

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	63	430	-	-	490	-
HCM Lane V/C Ratio	0.802	0.086	-	-	0.039	-
HCM Control Delay (s)	168	14.2	-	-	12.6	-
HCM Lane LOS	F	B	-	-	B	-
HCM 95th %tile Q(veh)	3.6	0.3	-	-	0.1	-

Intersection	
Int Delay, s/veh	6.3

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Vol, veh/h	65	1090	45	121	1021	0	8	5	118	0	9	29
Future Vol, veh/h	65	1090	45	121	1021	0	8	5	118	0	9	29
Conflicting Peds, #/hr	0	0	0	0	0	1	0	0	0	0	0	1
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	220	-	-	200	-	-	-	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	97	97	97	97	97	97	97	97	97	97	97	97
Heavy Vehicles, %	3	3	2	2	7	7	2	2	2	13	2	13
Mvmt Flow	67	1124	46	125	1053	0	8	5	122	0	9	30

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1054	0	0	1170	0	0	2063	2585	585	2003	2608	529
Stage 1	-	-	-	-	-	-	1281	1281	-	1304	1304	-
Stage 2	-	-	-	-	-	-	782	1304	-	699	1304	-
Critical Hdwy	4.16	-	-	4.14	-	-	7.54	6.54	6.94	7.76	6.54	7.16
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	5.54	-	6.76	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	5.54	-	6.76	5.54	-
Follow-up Hdwy	2.23	-	-	2.22	-	-	3.52	4.02	3.32	3.63	4.02	3.43
Pot Cap-1 Maneuver	650	-	-	593	-	-	32	25	454	31	24	467
Stage 1	-	-	-	-	-	-	175	235	-	154	229	-
Stage 2	-	-	-	-	-	-	353	229	-	372	229	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	649	-	-	593	-	-	14	18	454	14	17	466
Mov Cap-2 Maneuver	-	-	-	-	-	-	14	18	-	14	17	-
Stage 1	-	-	-	-	-	-	157	211	-	138	180	-
Stage 2	-	-	-	-	-	-	247	180	-	238	205	-

Approach	SE	NW	NE	SW
HCM Control Delay, s	0.6	1.3	67.1	126
HCM LOS			F	F

Minor Lane/Major Mvmt	NELn1	NELn2	NWL	NWT	NWR	SEL	SET	SER	SWLn1
Capacity (veh/h)	15	454	593	-	-	649	-	-	64
HCM Lane V/C Ratio	0.893	0.268	0.21	-	-	0.103	-	-	0.612
HCM Control Delay (s)	$ 532.6	15.8	12.7	-	-	11.2	-	-	126
HCM Lane LOS	F	C	B	-	-	B	-	-	F
HCM 95th %tile Q(veh)	2.1	1.1	0.8	-	-	0.3	-	-	2.6

Intersection	
Int Delay, s/veh	17.2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	53	57	149	55	28	63	191	176	11	246	12
Future Vol, veh/h	12	53	57	149	55	28	63	191	176	11	246	12
Conflicting Peds, #/hr	2	0	0	0	0	2	0	0	0	2	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	90	-	-	125	-	-	-	-	-	330
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	94	94	94	94	94	94	94	94	94	94
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	13	56	61	159	59	30	67	203	187	12	262	13

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	765	814	264	784	734	301	277	0	0	392	0	0
Stage 1	288	288	-	433	433	-	-	-	-	-	-	-
Stage 2	477	526	-	351	301	-	-	-	-	-	-	-
Critical Hdwy	7.11	6.51	6.21	7.15	6.55	6.25	4.12	-	-	4.15	-	-
Critical Hdwy Stg 1	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.11	5.51	-	6.15	5.55	-	-	-	-	-	-	-
Follow-up Hdwy	3.509	4.009	3.309	3.545	4.045	3.345	2.218	-	-	2.245	-	-
Pot Cap-1 Maneuver	321	313	777	307	344	732	1286	-	-	1150	-	-
Stage 1	722	675	-	595	577	-	-	-	-	-	-	-
Stage 2	571	530	-	659	660	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	247	287	776	226	315	729	1284	-	-	1148	-	-
Mov Cap-2 Maneuver	247	287	-	226	315	-	-	-	-	-	-	-
Stage 1	671	666	-	553	537	-	-	-	-	-	-	-
Stage 2	454	493	-	549	651	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	16.4	66.9	1.2	0.3
HCM LOS	C	F		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	WBLn2	SBL	SBT	SBR
Capacity (veh/h)	1284	-	-	279	776	245	729	1148	-	-
HCM Lane V/C Ratio	0.052	-	-	0.248	0.078	0.886	0.041	0.01	-	-
HCM Control Delay (s)	8	0	-	22.1	10	74.7	10.1	8.2	0	-
HCM Lane LOS	A	A	-	C	B	F	B	A	A	-
HCM 95th %tile Q(veh)	0.2	-	-	1	0.3	7.4	0.1	0	-	-

Intersection	
Int Delay, s/veh	9.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	149	5	2	129	29	4	11	1	25	29	30
Future Vol, veh/h	25	149	5	2	129	29	4	11	1	25	29	30
Conflicting Peds, #/hr	2	0	1	3	0	4	1	0	3	4	0	2
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	115	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	2	2	2	2	2	2	7	7	7	3	3	3
Mvmt Flow	27	164	5	2	142	32	4	12	1	27	32	33

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	217	130	54	215	146	21	67	0	0	17	0	0
Stage 1	105	105	-	25	25	-	-	-	-	-	-	-
Stage 2	112	25	-	190	121	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.17	-	-	4.13	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.263	-	-	2.227	-	-
Pot Cap-1 Maneuver	739	761	1013	742	745	1056	1503	-	-	1594	-	-
Stage 1	901	808	-	993	874	-	-	-	-	-	-	-
Stage 2	893	874	-	812	796	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	596	740	1008	599	725	1048	1500	-	-	1588	-	-
Mov Cap-2 Maneuver	596	740	-	599	725	-	-	-	-	-	-	-
Stage 1	896	792	-	986	868	-	-	-	-	-	-	-
Stage 2	720	868	-	627	780	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.2	11.1	1.9	2.2
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	EBLn2	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1500	-	-	596	746	766	1588	-	-
HCM Lane V/C Ratio	0.003	-	-	0.046	0.227	0.23	0.017	-	-
HCM Control Delay (s)	7.4	0	-	11.3	11.2	11.1	7.3	0	-
HCM Lane LOS	A	A	-	B	B	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.9	0.9	0.1	-	-

Intersection	
Intersection Delay, s/veh	14.7
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	10	35	135	45	35	47	208	120	4	117	2
Future Vol, veh/h	9	10	35	135	45	35	47	208	120	4	117	2
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	10	11	39	150	50	39	52	231	133	4	130	2
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	9.3	12.6	18	10.7
HCM LOS	A	B	C	B

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	13%	47%	0%	75%	0%	3%	0%
Vol Thru, %	55%	53%	0%	25%	0%	97%	0%
Vol Right, %	32%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	375	19	35	180	35	121	2
LT Vol	47	9	0	135	0	4	0
Through Vol	208	10	0	45	0	117	0
RT Vol	120	0	35	0	35	0	2
Lane Flow Rate	417	21	39	200	39	134	2
Geometry Grp	6	7	7	7	7	7	7
Degree of Util (X)	0.642	0.04	0.063	0.37	0.06	0.229	0.003
Departure Headway (Hd)	5.547	6.828	5.872	6.664	5.572	6.125	5.398
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	650	524	609	540	642	586	662
Service Time	3.576	4.577	3.621	4.402	3.31	3.862	3.136
HCM Lane V/C Ratio	0.642	0.04	0.064	0.37	0.061	0.229	0.003
HCM Control Delay	18	9.9	9	13.3	8.7	10.7	8.2
HCM Lane LOS	C	A	A	B	A	B	A
HCM 95th-tile Q	4.6	0.1	0.2	1.7	0.2	0.9	0

Intersection	
Intersection Delay, s/veh	21.2
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	12	53	57	149	55	28	63	191	176	11	246	12
Future Vol, veh/h	12	53	57	149	55	28	63	191	176	11	246	12
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles, %	1	1	1	5	5	5	2	2	2	5	5	5
Mvmt Flow	13	56	61	159	59	30	67	203	187	12	262	13
Number of Lanes	0	1	1	0	1	1	0	1	0	0	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	1	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	2	2	2
HCM Control Delay	11.2	15.9	29.9	16.4
HCM LOS	B	C	D	C

Lane	NBLn1	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	15%	18%	0%	73%	0%	4%	0%
Vol Thru, %	44%	82%	0%	27%	0%	96%	0%
Vol Right, %	41%	0%	100%	0%	100%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	430	65	57	204	28	257	12
LT Vol	63	12	0	149	0	11	0
Through Vol	191	53	0	55	0	246	0
RT Vol	176	0	57	0	28	0	12
Lane Flow Rate	457	69	61	217	30	273	13
Geometry Grp	6	7	7	7	7	7	7
Degree of Util (X)	0.8	0.147	0.115	0.46	0.054	0.517	0.022
Departure Headway (Hd)	6.298	7.672	6.855	7.638	6.544	6.81	6.074
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	576	467	522	471	547	530	589
Service Time	4.332	5.427	4.61	5.383	4.289	4.55	3.813
HCM Lane V/C Ratio	0.793	0.148	0.117	0.461	0.055	0.515	0.022
HCM Control Delay	29.9	11.8	10.5	16.8	9.7	16.7	9
HCM Lane LOS	D	B	B	C	A	C	A
HCM 95th-tile Q	7.8	0.5	0.4	2.4	0.2	2.9	0.1

Intersection: 1: Wolf Drive/Ten Eyck Road & Highway 26

Movement	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	TR	L	T	T	R	LTR	LTR
Maximum Queue (ft)	189	366	327	79	586	496	88	225	192
Average Queue (ft)	71	208	154	6	343	298	6	104	70
95th Queue (ft)	158	333	278	43	486	437	40	191	138
Link Distance (ft)		538	538		613	613		315	380
Upstream Blk Time (%)					0	0			
Queuing Penalty (veh)					0	0			
Storage Bay Dist (ft)	165			120			70		
Storage Blk Time (%)	0	11			34	31	0		
Queuing Penalty (veh)	1	7			1	4	0		

Intersection: 2: Langensand Road & Highway 26

Movement	EB	EB	WB	NB	NB
Directions Served	T	R	L	L	R
Maximum Queue (ft)	8	8	47	145	833
Average Queue (ft)	0	0	12	136	507
95th Queue (ft)	6	8	39	168	1023
Link Distance (ft)	701				876
Upstream Blk Time (%)					19
Queuing Penalty (veh)					0
Storage Bay Dist (ft)		160	215	120	
Storage Blk Time (%)				87	3
Queuing Penalty (veh)				15	3

Intersection: 3: Dubarko Road/Vista Loop Drive & Highway 26

Movement	SE	SE	NW	NE	NE	SW
Directions Served	L	TR	L	LT	R	LTR
Maximum Queue (ft)	75	9	59	155	92	366
Average Queue (ft)	18	0	21	66	43	152
95th Queue (ft)	54	6	45	156	72	428
Link Distance (ft)		1133		752	752	575
Upstream Blk Time (%)						5
Queuing Penalty (veh)						0
Storage Bay Dist (ft)	220		200			
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 4: Highway 211 & Dubarko Road

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	R	LTR	LT	R
Maximum Queue (ft)	38	48	114	70	166	80	17
Average Queue (ft)	16	22	48	25	73	33	1
95th Queue (ft)	42	50	85	54	132	60	9
Link Distance (ft)	645		745		654	862	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		90		125			330
Storage Blk Time (%)			0				
Queuing Penalty (veh)			0				

Intersection: 5: Langensand Road & Dubarko Road

Movement	EB	EB	WB	NB	SB
Directions Served	L	TR	LTR	LTR	LTR
Maximum Queue (ft)	41	80	106	10	14
Average Queue (ft)	15	42	55	0	0
95th Queue (ft)	44	65	89	6	7
Link Distance (ft)		604	851	716	706
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)	115				
Storage Blk Time (%)					
Queuing Penalty (veh)					

Network Summary

Network wide Queuing Penalty: 30

Intersection: 1: Wolf Drive/Ten Eyck Road & Highway 26

Movement	EB	EB	EB	WB	WB	WB	WB	NB	SB
Directions Served	L	T	TR	L	T	T	R	LTR	LTR
Maximum Queue (ft)	190	551	527	77	519	448	92	227	209
Average Queue (ft)	152	347	303	9	349	294	10	112	89
95th Queue (ft)	226	521	485	46	476	415	52	192	176
Link Distance (ft)		538	538		613	613		315	380
Upstream Blk Time (%)		2	1		0				
Queuing Penalty (veh)		0	0		0				
Storage Bay Dist (ft)	165			120			70		
Storage Blk Time (%)	12	16			38	35	0		
Queuing Penalty (veh)	74	26			3	8	0		

Intersection: 2: Langensand Road & Highway 26

Movement	EB	WB	NB	NB
Directions Served	R	L	L	R
Maximum Queue (ft)	5	60	145	703
Average Queue (ft)	0	15	129	381
95th Queue (ft)	4	47	174	822
Link Distance (ft)				876
Upstream Blk Time (%)				2
Queuing Penalty (veh)				0
Storage Bay Dist (ft)	160	215	120	
Storage Blk Time (%)			84	1
Queuing Penalty (veh)			29	0

Intersection: 3: Dubarko Road/Vista Loop Drive & Highway 26

Movement	SE	SE	SE	NW	NW	NE	NE	SW
Directions Served	L	T	TR	L	T	LT	R	LTR
Maximum Queue (ft)	99	13	25	153	64	143	158	323
Average Queue (ft)	31	1	1	63	3	55	57	110
95th Queue (ft)	70	7	12	127	33	134	106	317
Link Distance (ft)		1135	1135		800	615	615	575
Upstream Blk Time (%)								0
Queuing Penalty (veh)								0
Storage Bay Dist (ft)	220			200				
Storage Blk Time (%)				0				
Queuing Penalty (veh)				0				

Intersection: 4: Highway 211 & Dubarko Road

Movement	EB	EB	WB	WB	NB	SB	SB
Directions Served	LT	R	LT	R	LTR	LT	R
Maximum Queue (ft)	60	67	120	74	251	160	42
Average Queue (ft)	33	32	60	22	100	69	6
95th Queue (ft)	58	59	103	56	193	125	24
Link Distance (ft)	645		745		654	862	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)		90		125			330
Storage Blk Time (%)		0	0				
Queuing Penalty (veh)		0	0				

Intersection: 5: Langensand Road & Dubarko Road

Movement	EB	EB	WB	SB
Directions Served	L	TR	LTR	LTR
Maximum Queue (ft)	39	95	95	39
Average Queue (ft)	22	45	48	3
95th Queue (ft)	49	70	77	20
Link Distance (ft)		604	851	706
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	115			
Storage Blk Time (%)		0		
Queuing Penalty (veh)		0		

Network Summary

Network wide Queuing Penalty: 142

SER# / INVEST / RD DPT / UNLOC?	S P E D	A L C	D M R G S	J N V	S H L	W O R K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT EVENT	CAUSE
03911	N	N	N				10/27/2018	17	PROCTOR BLVD	INTER	5-LEG	N	N	UNK	S-1STOP	01	NONE 0	STRGHT									29
NONE							SA	0	SE TEN EYCK RD	NE		TRF SIGNAL	N	UNK	REAR		PRVTE	NE-SW								000	00
N							5P			06	0		N	DUSK	INJ		PSNGR CAR		01	DRVR	NONE	70	M	OR-Y		026	000	29
N							45 23 49.25	-122 15 19.74																OR<25				
																02	NONE 0	STOP										
																	PRVTE	NE-SW								011	00	
																	PSNGR CAR		01	DRVR	INJC	55	F	OR-Y		000	000	00
																								OR<25				
03089	N	N	N				09/03/2018	14	PROCTOR BLVD	INTER	5-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT									29
NONE							MO		SE TEN EYCK RD	SE		TRF SIGNAL	N	DRY	REAR		UNKN	SE-NW								000	00
N							3P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	00	F	UNK		026	000	29
N							45 23 49.25	-122 15 19.75	002600200S00															UNK				
																02	NONE 0	STOP										
																	PRVTE	SE-NW								011	00	
																	PSNGR CAR		01	DRVR	INJC	25	F	OR-Y		000	000	00
																								OR>25				
03213	N	N	N				09/17/2019	14	PROCTOR BLVD	INTER	5-LEG	N	N	CLR	S-1STOP	01	NONE 0	STRGHT									29
NONE							TU		SE TEN EYCK RD	SE		TRF SIGNAL	N	DRY	REAR		PRVTE	SE-NW								000	00
N							3P			06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	41	F	OTH-Y		026	000	29
N							45 23 49.26	-122 15 19.69	002600200S00															N-RES				
																02	NONE 0	STOP										
																	PRVTE	SE-NW								011	00	
																	PSNGR CAR		01	DRVR	INJC	48	F	OR-Y		000	000	00
																								OR<25				
																02	NONE 0	STOP										
																	PRVTE	SE-NW								011	00	
																	PSNGR CAR		02	PSNG	INJC	50	M			000	000	00
05173	N	N	N				11/08/2016	14	PROCTOR BLVD	INTER	5-LEG	N	N	CLR	ANGL-OTH	01	NONE 9	U-TURN									06
NONE							TU		SE TEN EYCK RD	W		TRF SIGNAL	N	DRY	TURN		N/A	W -W								000	00
N							5P			05	0		N	DUSK	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 49.25	-122 15 19.74	002600200S00		(02)													UNK				
																02	NONE 9	TURN-R										
																	N/A	NE-W								000	00	
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																								UNK				
04335	N	N	N				11/06/2018	14	PROCTOR BLVD	INTER	5-LEG	N	N	CLR	ANGL-OTH	01	NONE 9	STRGHT									02
NONE							TU		SE TEN EYCK RD	CN		TRF SIGNAL	N	DRY	TURN		N/A	SE-NW								000	00
N							2P			01	0		N	DAY	PDO		SEMI TOW		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 49.25	-122 15 19.72	002600200S00															UNK				

Disclaimer: The information contained in this report is compiled from individual driver and police crash reports submitted to the Oregon Department of Transportation as required in ORS 811.720. The Crash Analysis and Reporting Unit is committed to providing the highest quality crash data to customers. However, because submittal of crash report forms is the responsibility of the individual driver, the Crash Analysis and Reporting Unit can not guarantee that all qualifying crashes are represented nor can assurances be made that all details pertaining to a single crash are accurate. Note: Legislative changes to DMV's vehicle crash reporting requirement, effective 01/01/2004, may result in fewer property damage only crashes being eligible for inclusion in the Statewide Crash Data File.

SER# / INVEST / RD DPT / UNLOC?	S P E D	A L C	R U G S	J I N V	S C H L	W O R K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT EVENT	CAUSE
																02	NONE 9	TURN-R									
																	N/A	NE-NW								015	00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																								UNK				
00825	N	N	N		N	N	03/03/2020	14	PROCTOR BLVD	INTER	5-LEG	N	N	UNK	ANGL-OTH	01	NONE 0	STRGHT										04
CITY							TU		SE TEN EYCK RD	CN		TRF SIGNAL	N	WET	ANGL		PRVTE	NE-SW								000	00
N							10A			01	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	53	F	OR-Y		000	000	00
N							45 23 49.26	-122 15 19.75	002600200S00															OR<25				
																02	NONE 0	STRGHT									
																	PRVTE	SE-NW								000	00
																	PSNGR CAR		01	DRVR	NONE	64	M	OR-Y		020	000	04
																								OR>25				

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SER# / INVEST RD DPT UNLOC?	S P E D	A L C	R U G S	J I N V	S C H L	W O R K	DATE DAY TIME LAT	CLASS DIST FROM LONG	CITY STREET FIRST STREET SECOND STREET LRS	RD CHAR DIRECT LOCTN	INT-TYPE (MEDIAN) LEGS (#LANES)	INT-REL TRAF- CONTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH COLL SVRTY	SPCL USE TRLR QTY OWNER V# TYPE	MOVE FROM TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE

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SER# / INVEST RD DPT UNLOC?	S P E D	A L C	R U G S	J I N V	S C H L	W O R K	DATE DAY TIME LAT	CLASS DIST FROM LONG	CITY STREET FIRST STREET SECOND STREET LRS	RD CHAR DIRECT LOCTN	INT-TYPE (MEDIAN) LEGS (#LANES)	INT-REL TRAF- CONTL	OFFRD RNDBT DRVWY	WTHR SURF LIGHT	CRASH COLL SVRTY	SPCL USE TRLR QTY OWNER V# TYPE	MOVE FROM TO	PRTC P# TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT EVENT	CAUSE

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OREGON.. DEPARTMENT OF TRANSPORTATION - TRANSPORTATION DEVELOPMENT DIVISION
TRANSPORTATION DATA SECTION - CRASH ANAYLYSIS AND REPORTING UNIT
URBAN NON-SYSTEM CRASH LISTING

WOLF DR at PIONEER BLVD, City of Sandy, Clackamas County, 01/01/2016 to 12/31/2020

1 - 3 of 3 Crash records shown.

SER# / INVEST / RD DPT / UNLOC?	S P E D	A L C	D R U G S	M J I N V	S C H L	W O R K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	P#	PRTC / TYPE	INJ / SVRTY	A G E	S E X	LICNS / RES	PED / LOC	ERROR	ACT	EVENT	CAUSE
00635	N	N	N				02/17/2020	17	PIONEER BLVD	INTER	5-LEG	N	N	CLR	S-1STOP	01	NONE 9	STRGHT											29
NONE							MO	0	WOLF DR	S		TRF SIGNAL	N	DRY	REAR		N/A	S -N									000		00
N							2P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00
N							45 23 49.25	-122 15 19.77																UNK					
																02	NONE 9	STOP											
																	N/A	S -N									012		00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00
																								UNK					
03463	N	N	N		N	N	12/21/2020	14	PIONEER BLVD	INTER	5-LEG	N	N	CLR	S-1STOP	01	NONE 9	STRGHT											27,29
CITY							MO		WOLF DR	W		TRF SIGNAL	N	DRY	REAR		N/A	W -E									000		00
N							10A			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00
N							45 23 49.25	-122 15 19.74	002600100S00															UNK					
																02	NONE 9	STOP											
																	N/A	W -E									011		00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00
																								UNK					
00512	N	N	N		N	N	02/07/2017	14	PIONEER BLVD	INTER	5-LEG	N	N	RAIN	ANGL-OTH	01	NONE 0	TURN-L											04
CITY							TU		WOLF DR	CN		TRF SIGNAL	N	WET	TURN		PRVTE	S -W									000		00
N							4P			04	0		N	DUSK	INJ		PSNGR CAR		01	DRVR	INJC	55	F	OR-Y		000	000		00
N							45 23 49.25	-122 15 19.74	002600100S00															OR<25					
																02	NONE 0	STRGHT											
																	PRVTE	W -E									000		00
																	PSNGR CAR		01	DRVR	NONE	63	M	OR-Y		020	000		04
																								OR>25					

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SER# / INVEST / RD DPT / UNLOC?	S P E D	A L C	D R G S	M J N V	S I H L	W C O K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / TYPE / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
05355	N	N	N				11/18/2016	14	LANGENSAND RD	INTER	3-LEG	N	N	RAIN	PED	01	NONE 0	TURN-R										19,02
CITY							FR		MT HOOD HY	S		UNKNOWN	N	WET	PED		PRVTE	S -SE								015		00
N							6P			06	0		N	DUSK	INJ		PSNGR CAR		01	DRVR	NONE	59	M	OR-Y		029	000		02
N							45 23 44.19	-122 15 .03	002600100S00									OR>25										
																		- STRGHT	01	PED	INJC	34	M		I XWK?	000	034		19
																		SE NW										
05056	N	N	N				12/01/2017	14	LANGENSAND RD	INTER	3-LEG	N	N	RAIN	ANGL-STP	01	NONE 0	TURN-R										08
NONE							FR		MT HOOD HY	S		STOP SIGN	N	WET	TURN		PRVTE	NW-S								000		00
N							9P			06	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	27	F	OR-Y		001	000		08
N							45 23 44.19	-122 15 .03	002600100S00									OR<25										
																02	NONE 0	STOP										
																	PRVTE	S -N									012		00
																	PSNGR CAR		01	DRVR	INJC	27	F	OR-Y		000	000		00
																		OR<25										
																02	NONE 0	STOP										
																	PRVTE	S -N									012		00
																	PSNGR CAR		02	PSNG	INJC	25	M			000	000		00
01431	N	N	N				04/14/2017	14	LANGENSAND RD	INTER	3-LEG	N	N	CLR	O-1STOP	01	NONE 9	BACK										10
NONE							FR		MT HOOD HY	S		STOP SIGN	N	DRY	BACK		N/A	N -S								000		00
N							3P			06	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00
N							45 23 44.19	-122 15 .03	002600100S00									UNK										
																02	NONE 9	STOP										
																	N/A	S -N									012		00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000		00
																		UNK										
04571	N	N	Y		N	N	10/05/2016	14	LANGENSAND RD	INTER	3-LEG	N	N	RAIN	ANGL-OTH	01	NONE 0	TURN-L									013	02,08
CITY							WE		MT HOOD HY	CN		STOP SIGN	N	WET	TURN		PRVTE	S -W								015		00
N							6P			04	0		N	DUSK	INJ		PSNGR CAR		01	DRVR	NONE	21	M	OR-Y		028	000		02
N							45 23 44.19	-122 15 .03	002600100S00									OR<25										
																02	NONE 0	STRGHT										
																	PRVTE	W -E									000	013	00
																	PSNGR CAR		01	DRVR	NONE	37	M	OR-Y		000	000		00
																		OR>25										
																03	NONE 0	STRGHT										
																	PRVTE	E -W									022		00
																	PSNGR CAR		01	DRVR	INJB	61	M	OR-Y		000	000		00
																		OR<25										

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																03	NONE 0	STRGHT										
																	PRVTE	E -W									022	00
																	PSNGR CAR		02	PSNG	INJC	59	F			000	000	00
03612	N	N	N		N	N	10/16/2019	14	LANGENSAND RD	INTER	3-LEG	N	N	RAIN	ANGL-OTH	01	NONE 9	TURN-L											02
CITY							WE		MT HOOD HY	CN		STOP SIGN	N	WET	TURN		N/A	S -NW								015	00
N							2P			02	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 44.19	-122 15 .03	002600100S00															UNK				
																02	NONE 9	STRGHT										
																	N/A	SE-NW									000	00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																								UNK				
04040	N	N	N				11/14/2019	14	LANGENSAND RD	INTER	3-LEG	N	N	CLR	ANGL-OTH	01	NONE 9	STRGHT											02
NONE							TH		MT HOOD HY	CN		STOP SIGN	N	DRY	TURN		N/A	E -W								000	00
N							8A			02	0		N	DAWN	PDO		SEMI TOW		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 44.2	-122 15 .04	002600100S00															UNK				
																02	NONE 9	TURN-L										
																	N/A	S -W									015	00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																								UNK				

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03785	N	N	N				10/28/2019	14	MT HOOD HY	INTER	3-LEG	N	N	CLR	ANGL-OTH	01	NONE 9	TURN-L									02
NONE							MO		VISTA LP DR	CN		STOP SIGN	N	DRY	TURN		N/A	NE-SE								015	00
N							7A			01	1		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 8.77	-122 14 3.1	002600100S00															UNK				
																02	NONE 9	STRGHT										
																	N/A	NW-SE								000	00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																								UNK				
01564	N	N	N				05/12/2019	14	MT HOOD HY	INTER	3-LEG	N	N	CLR	ANGL-OTH	01	NONE 9	TURN-L									02
NONE							SU		VISTA LP DR	CN		STOP SIGN	N	DRY	TURN		N/A	NE-SE								015	00
N							8A			02	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 29.77	-122 14 35.28	002600100S00															UNK				
																02	NONE 9	STRGHT										
																	N/A	SE-NW								000	00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																								UNK				

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CITY OF SANDY, CLACKAMAS COUNTY

DUBARKO RD at EAGLE CRK-SANDY HY, City of Sandy, Clackamas County, 01/01/2016 to 12/31/2020

1 - 4 of 27 Crash records shown.

SER# / INVEST / RD DPT / UNLOC?	S P E D C	A L G S	M R U N H	J I N V	S C H L	W O R K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	SPCL USE / TRLR QTY / OWNER	V#	TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT EVENT	CAUSE
02296	N	N	N		N	N	07/06/2019	16	DUBARKO RD	INTER	CROSS	N	N	CLR	S-1STOP	NONE 9	01	NONE	STRGHT										27,29,32
CITY							SA		EAGLE CRK-SANDY HY	N		NONE	N	DRY	REAR	N/A			NE-SW								000	00
N							11A			06	0		N	DAY	PDO	PSNGR CAR				01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 22.65	-122 15 48.74	017200100S00																UNK				
																	02	NONE	STOP										
																N/A			NE-SW									011	00
																PSNGR CAR				01	DRVR	NONE	00	Unk	UNK		000	000	00
																									UNK				
01165	N	N	N				03/10/2016	16	DUBARKO RD	INTER	CROSS	N	N	CLR	O-1STOP	NONE 0	01	NONE	BACK										10
NONE							TH		EAGLE CRK-SANDY HY	E		STOP SIGN	N	DRY	BACK	PRVTE			W -E								000	00
N							6P			06	0		N	DAY	INJ	PSNGR CAR				01	DRVR	NONE	22	M	OR-Y		011	000	10
N							45 23 22.76	-122 15 48.39	017200100S00																OR<25				
																	02	NONE	STOP										
																PRVTE			E -W									012	00
																PSNGR CAR				01	DRVR	INJC	26	F	OR-Y		000	000	00
																									OR<25				
04008	N	N	N		N	N	11/02/2018	16	DUBARKO RD	INTER	CROSS	N	N	CLD	PED	NONE 0	01	NONE	STRGHT										02
CITY							FR		EAGLE CRK-SANDY HY	E		STOP SIGN	N	WET	PED	PRVTE			E -W								000	00
N							7P			06	0		N	DLIT	INJ	PSNGR CAR				01	DRVR	NONE	74	M	OR-Y		029	000	02
N							45 23 22.54	-122 15 48.5	017200100S00																OR<25				
																			-										
																			STRGHT	01	PED	INJC	36	M		I XWK?	000	034	00
																			N S										
01095	N	N	N		N	N	03/04/2016	16	DUBARKO RD	INTER	CROSS	N	N	CLD	S-1STOP	NONE 0	01	NONE	STRGHT										27,07,32
CITY							FR		EAGLE CRK-SANDY HY	SW		STOP SIGN	N	DRY	SS-O	PRVTE			NE-SW								000	00
N							4P			06	0		N	DAY	INJ	PSNGR CAR				01	DRVR	NONE	30	M	OR-Y		016,043,052	010	27,07,32
N							45 23 22.76	-122 15 48.39	017200100S00																OR<25				
																	01	NONE	STRGHT										
																PRVTE			NE-SW									000	00
																PSNGR CAR				02	PSNG	NO<5	01	F			000	000	00
																	02	NONE	STOP										
																PRVTE			NE-SW									012	00
																PSNGR CAR				01	DRVR	NONE	18	F	OR-Y		000	000	00
																									OR<25				
																	03	NONE	STRGHT										
																PRVTE			SW-NE									000	00
																PSNGR CAR				01	DRVR	INJB	26	M	OR-Y		000	000	00
																									OR<25				

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SER# / INVEST / RD DPT / UNLOC?	S P E D C	D A L G S	M R J S V	W I N H L	S C O R K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / TYPE / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
00763	N	N	N	N	N	02/17/2016	16	DUBARKO RD	INTER	CROSS	N	N	RAIN	S-1STOP	01	NONE 9	STRGHT										07
CITY				WE				EAGLE CRK-SANDY HY	SW		NONE	N	WET	REAR		N/A	S -N								000		00
N				5P					06	0		N	DLIT	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
N				45 23 22.76		-122 15 48.39		017200100S00															UNK				
															02	NONE 9	STOP										
																N/A	S -N								012		00
																PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
																							UNK				
01324	N	N	N	N	N	04/19/2018	16	DUBARKO RD	INTER	CROSS	N	N	CLR	S-1STOP	01	NONE 0	STRGHT										29
CITY				TH				EAGLE CRK-SANDY HY	SW		UNKNOWN	N	DRY	REAR		PRVTE	SW-NE								000		00
N				6P					06	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	19	M	OR-Y	026	000		29
N				45 23 22.55		-122 15 48.5		017200100S00															OR<25				
															02	NONE 0	STOP										
																PRVTE	SW-NE								012		00
																PSNGR CAR		01	DRVR	INJC	21	F	OR-Y	000	000		00
																							OR<25				
															02	NONE 0	STOP										
																PRVTE	SW-NE								012		00
																PSNGR CAR		02	PSNG	INJC	18	M		000	000		00
02483	N	N	N	N	N	09/09/2020	16	DUBARKO RD	INTER	CROSS	N	Y	CLD	FIX OBJ	01	NONE 9	STRGHT									043	10
CITY				WE	0			EAGLE CRK-SANDY HY	SW		NONE	N	DRY	FIX		N/A	NE-SW								000		00
N				4P					05	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
N				45 23 22.54		-122 15 48.5																	UNK				
03589	N	N	N	N	N	08/05/2016	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										02
CITY				FR				EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	E -W								015		00
N				6P					01	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	77	M	OTH-Y	028	000		02
N				45 23 22.76		-122 15 48.39		017200100S00															N-RES				
															02	NONE 0	STRGHT										
																PRVTE	N -S								000		00
																PSNGR CAR		01	DRVR	NONE	40	M	OR-Y	000	000		00
																							OR<25				
03967	N	N	N	N	N	08/30/2016	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										02
CITY				TU				EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	W -E								015		00
N				12P					04	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJC	61	F	OTH-Y	028	000		02
N				45 23 22.76		-122 15 48.39		017200100S00															N-RES				
															01	NONE 0	STRGHT										
																PRVTE	W -E								015		00
																PSNGR CAR		02	PSNG	INJC	06	F		000	000		00

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SER# / INVEST / RD DPT / UNLOC?	S P E D	D A L C	M R G S	J U N V	S I H L	W C O K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
																02	NONE 0 PRVTE PSNGR CAR	STRGHT S -N	01	DRVR	INJB	53	F	OR-Y OR<25		000	000		00 00
02427	N	N	N				05/31/2016 TU 11A 45 23 22.76 -122 15 48.39	16 EAGLE CRK-SANDY HY 017200100S00	DUBARKO RD EAGLE CRK-SANDY HY	INTER CN 03	CROSS 0	N STOP SIGN	N N	CLR UNK DAY	ANGL-OTH ANGL PDO	01	NONE 9 N/A PSNGR CAR	STRGHT W -E	01	DRVR	NONE	00	Unk	UNK UNK		000	000		03,32 00 00
																02	NONE 9 N/A PSNGR CAR	STRGHT N -S	01	DRVR	NONE	00	Unk	UNK UNK		000	000		00 00
02031	N	N	N	N	N		05/06/2016 FR 4P 45 23 22.76 -122 15 48.39	16 EAGLE CRK-SANDY HY 017200100S00	DUBARKO RD EAGLE CRK-SANDY HY 01	INTER CN 0	CROSS STOP SIGN	N N	N N	CLR DRY DAY	ANGL-OTH ANGL PDO	01	NONE 9 N/A PSNGR CAR	STRGHT N -S	01	DRVR	NONE	00	Unk	UNK UNK		000	000		02 00 00
																02	NONE 9 N/A PSNGR CAR	STRGHT E -W	01	DRVR	NONE	00	Unk	UNK UNK		000	000		00 00
00805	N	N	N	N	N		03/01/2017 WE 3P 45 23 22.76 -122 15 48.39	16 EAGLE CRK-SANDY HY 017200100S00	DUBARKO RD EAGLE CRK-SANDY HY 04	INTER CN 0	CROSS STOP SIGN	N N	N N	CLD DRY DAY	ANGL-OTH ANGL INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT W -E	01	DRVR	INJC	17	F	OR-Y OR<25		028	015 000	082,013 082	02 00 02
																02	NONE 0 PRVTE PSNGR CAR	STRGHT S -N	01	DRVR	INJC	43	M	OR-Y OR<25		000	000 000	013	00 00
																03	NONE 0 PRVTE PSNGR CAR	STOP E -W	01	DRVR	INJB	27	F	OR-Y OR<25		000	022 000		00 00
00846	N	N	N	N	N		03/04/2017 SA 6P 45 23 22.76 -122 15 48.39	16 EAGLE CRK-SANDY HY 017200100S00	DUBARKO RD EAGLE CRK-SANDY HY 04	INTER CN 0	CROSS STOP SIGN	N N	N N	RAIN WET DLIT	ANGL-OTH ANGL INJ	01	NONE 0 PRVTE PSNGR CAR	STRGHT W -E	01	DRVR	NONE	21	M	OR-Y OR<25		028	015 000		02 00 02
																02	NONE 0 PRVTE PSNGR CAR	STRGHT N -S	01	DRVR	INJC	21	F	OR-Y OR<25		000	000 000		00 00

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SER# / INVEST / RD DPT / UNLOC?	S P E D C	A L G S	R U I N V	J C H L	S O R K	W	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
02225	N	N	N				06/07/2017	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										02
CITY							WE		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	S -N								000		00
N							4P			04	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJB	40	M	OR-Y	000	000		00
N							45 23 22.76	-122 15 48.39	017200100S00															OR<25				
																02	NONE 0	STRGHT										
																	PRVTE	W -E								015		00
																	PSNGR CAR		01	DRVR	INJC	38	M	OR-Y	028	000		02
																								OR<25				
02958	N	N	N		N	N	07/21/2017	16	DUBARKO RD	INTER	CROSS	N	N	CLR	O-1 L-TURN	01	NONE 0	TURN-L										02
CITY							FR		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	TURN		PRVTE	S -W								000		00
N							8P			01	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	28	M	OR-Y	028	000		02
N							45 23 22.76	-122 15 48.39	017200100S00															OR<25				
																02	NONE 0	STRGHT										
																	PRVTE	N -S								000		00
																	PSNGR CAR		01	DRVR	INJB	29	F	OR-Y	000	000		00
																								OR<25				
00647	N	N	N		N	N	02/18/2017	16	DUBARKO RD	INTER	CROSS	N	N	RAIN	ANGL-OTH	01	NONE 9	STRGHT										03
CITY							SA		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	WET	ANGL		N/A	W -E								000		00
N							7P			03	0		N	DLIT	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
N							45 23 22.76	-122 15 48.39	017200100S00															UNK				
																02	NONE 9	STRGHT										
																	N/A	N -S								000		00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
																								UNK				
03467	N	N	N		N	N	08/23/2017	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 9	STRGHT										02
CITY							WE		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		N/A	NE-SW								000		00
N							8A			01	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
N							45 23 22.76	-122 15 48.39	017200100S00															UNK				
																02	NONE 9	STRGHT										
																	N/A	E -W								015		00
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000		00
																								UNK				
03265	N	N	N				09/14/2018	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	TURN-L									082	02
CITY							FR		EAGLE CRK-SANDY HY	CN		FLASHBCN-R	N	DRY	TURN		PRVTE	W -N								015		00
N							9P			03	0		N	DARK	INJ		PSNGR CAR		01	DRVR	NONE	38	M	OR-Y	028	000	082	02
N							45 23 22.52	-122 15 48.53	017200100S00															OR<25				
																01	NONE 0	TURN-L										
																	PRVTE	W -N								015		00
																	PSNGR CAR		01	PSNG	INJC	35	F		000	000		00

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SER# / INVEST / RD DPT / UNLOC?	S P E D	D A L C	M R G S	J U N V	S I H L	W C O K	DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES	PED LOC	ERROR	ACT	EVENT	CAUSE
																01	NONE 0 PRVTE PSNGR CAR	TURN-L W -N									015	00
																			02	PSNG	NONE	02	F			000	000		00
																02	NONE 0 PRVTE PSNGR CAR	STRGHT N -S									000	00
																			01	DRVR	NONE	62	M	OR-Y OR<25		000	000		00
03281	N	N	N	N	N		09/23/2019	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT											02
CITY							MO		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	NE-SW								000		00
N N							7A 45 23 22.59	-122 15 48.49	017200100S00	02	0		N	DAWN	INJ		PSNGR CAR		01	DRVR	NONE	31	M	OR-Y OR<25		000	000		00
																02	NONE 0 PRVTE PSNGR CAR	STRGHT E -W									015	00
																			01	DRVR	INJC	17	F	OR-Y OR<25		028	000		02
																02	NONE 0 PRVTE PSNGR CAR	STRGHT E -W									015	00
																			02	PSNG	INJA	12	F			000	000		00
00075	N	N	N	N	N		01/08/2019	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										013	27,02
CITY							TU		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	N -S								000		00
N N							4P 45 23 22.54	-122 15 48.5	017200100S00	03	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	INJB	52	M	OR-Y OR<25		000	000		00
																02	NONE 0 PRVTE PSNGR CAR	STRGHT E -W									015	013 00
																			01	DRVR	INJC	16	F	OR-Y OR<25		028	000		27,02
																03	NONE 0 PRVTE PSNGR CAR	STOP W -E									022	00
																			01	DRVR	NONE	21	M	OR-Y OR<25		000	000		00
00908	N	N	N				03/14/2019	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT											02
NO RPT							TH		EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	S -N								000		00
N N							2P 45 23 22.76	-122 15 48.39	017200100S00	04	0		N	DAY	INJ		SEMI TOW		01	DRVR	INJC	58	M	OR-Y OR<25		000	000		00
																02	NONE 0 PRVTE PSNGR CAR	STRGHT W -E									015	00
																			01	DRVR	INJB	19	M	OR-Y OR<25		028	000		02
																02	NONE 0 PRVTE PSNGR CAR	STRGHT W -E									015	00
																			02	PSNG	INJB	18	F			000	000		00

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01291	N	N	N	N	N	N	04/22/2019	16	DUBARKO RD	INTER	CROSS	N	N	CLD	ANGL-OTH	01	NONE 0	STRGHT										02
CITY				MO					EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	S -N									000	00
N				5P						04	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJB	36	M	OR-Y		000	000	00
N				45 23 22.54			-122 15 48.5		017200100S00															OR<25				
																02	NONE 0	STRGHT									015	00
																	PRVTE	W -E										
																	PSNGR CAR		01	DRVR	NONE	37	M	OR-Y	028		000	02
																								OR<25				
03399	N	N	N	N	N	N	10/03/2019	16	DUBARKO RD	INTER	CROSS	N	N	RAIN	ANGL-OTH	01	NONE	STRGHT										02
CITY				TH					EAGLE CRK-SANDY HY	CN		STOP SIGN	N	WET	ANGL		PRVTE	N -S									000	00
N				7P						03	2		N	DLIT	INJ		PSNGR CAR		01	DRVR	INJB	48	F	OR-Y		000	000	00
N				45 23 22.78			-122 15 48.4		017200100S00															OR<25				
																02	NONE	STRGHT									015	00
																	PRVTE	W -E										
																	PSNGR CAR		01	DRVR	NONE	19	M	OTH-Y	028		000	02
																								N-RES				
04270	N	N	N				11/29/2019	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										02
CITY				FR					EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		PRVTE	N -S									000	00
N				5P						01	0		N	DLIT	INJ		PSNGR CAR		01	DRVR	NONE	49	F	OR-Y		000	000	00
N				45 23 22.55			-122 15 48.51		017200100S00															OR<25				
																02	NONE 0	STRGHT									015	00
																	PRVTE	E -W										
																	PSNGR CAR		01	DRVR	INJC	59	F	OR-Y	028		000	02
																								OR<25				
01493	N	N	N	N	N	N	06/13/2020	16	DUBARKO RD	INTER	CROSS	N	N	RAIN	ANGL-OTH	01	NONE 0	STRGHT										27,02
CITY				SA					EAGLE CRK-SANDY HY	CN		STOP SIGN	N	WET	ANGL		PRVTE	S -N									000	00
N				4P						04	0		N	DAY	INJ		PSNGR CAR		01	DRVR	NONE	82	F	OR-Y		000	000	00
N				45 23 22.54			-122 15 48.5		017200100S00															OR<25				
																02	NONE 0	STRGHT									015	00
																	PRVTE	W -E										
																	PSNGR CAR		01	DRVR	NONE	21	M	OR-Y	028		038	27,02
																								OR<25				
																02	NONE 0	STRGHT									015	00
																	PRVTE	W -E										
																	PSNGR CAR		02	PSNG	INJC	25	M		000		000	00
02738	N	N	N	N	N	N	10/10/2020	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 0	STRGHT										03
CITY				SA					EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	TURN		PRVTE	S -N									000	00
N				3P						02	0		N	DAY	INJ		PSNGR CAR		01	DRVR	INJB	61	M	OR-Y		000	000	00
N				45 23 22.58			-122 15 48.5		017200100S00															OR<25				

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																02	NONE 0	TURN-L										
																	PRVTE	E -S									000	00
																	PSNGR CAR		01	DRVR	INJC	19	M	OR-Y OR>25		021	000	03
02936	N	N	N		N	N	11/01/2020	16	DUBARKO RD	INTER	CROSS	N	N	CLR	ANGL-OTH	01	NONE 9	STRGHT										084	02
CITY							SU	0	EAGLE CRK-SANDY HY	CN		STOP SIGN	N	DRY	ANGL		N/A	SW-NE									000	00
N							1P			04	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
N							45 23 22.55	-122 15 48.51										UNK										
																02	NONE 9	STRGHT									015	00
																	N/A	W -E										
																	PSNGR CAR		01	DRVR	NONE	00	Unk	UNK		000	000	00
																		UNK										

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CITY OF SANDY, CLACKAMAS COUNTY

DUBARKO RD at LANGENSAND RD, City of Sandy, Clackamas County, 01/01/2016 to 12/31/2020

1 - 1 of 1 Crash records shown.

SER# / INVEST / RD DPT / UNLOC?	S P E D C	A L G S	R U I N V	J C H L	S O R K	W DATE / DAY / TIME / LAT	CLASS / DIST / FROM / LONG	CITY STREET / FIRST STREET / SECOND STREET / LRS	RD CHAR / DIRECT / LOCTN	INT-TYPE (MEDIAN) / LEGS / (#LANES)	INT-REL / TRAF- / CONTL	OFFRD / RNDBT / DRVWY	WTHR / SURF / LIGHT	CRASH / COLL / SVRTY	V#	SPCL USE / TRLR QTY / OWNER / TYPE	MOVE / FROM / TO	P#	PRTC TYPE	INJ SVRTY	A G E	S E X	LICNS RES / UNK	PED LOC	ERROR	ACT EVENT	CAUSE
00720	N	N	N	N	N	02/24/2020	16	DUBARKO RD	INTER	CROSS	N	N	CLD	ANGL-OTH	01	NONE 9	STRGHT									02
CITY			MO			0	LANGENSAND RD	CN		STOP SIGN	N	DRY	ANGL		N/A	W -E								015	00
N			3P					03	0		N	DAY	PDO		PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000	00
N			45 23 23.89 -122 14 59.94																			UNK			
															02	NONE 9	STRGHT									
																N/A	N -S								000	00
																PSNGR CAR		01	DRVR	NONE	00	Unk	UNK	000	000	00
																							UNK			

Disclaimer: The information contained in this report is compiled from individual driver and police crash reports submitted to the Oregon Department of Transportation as required in ORS 811.720. The Crash Analysis and Reporting Unit is committed to providing the highest quality crash data to customers. However, because submittal of crash report forms is the responsibility of the individual driver, the Crash Analysis and Reporting Unit can not guarantee that all qualifying crashes are represented nor can assurances be made that all details pertaining to a single crash are accurate. Note: Legislative changes to DMV's vehicle crash reporting requirement, effective 01/01/2004, may result in fewer property damage only crashes being eligible for inclusion in the Statewide Crash Data File.

Preliminary Traffic Signal Warrant Analysis

Project Name: Dubarko Road Development
Intersection: Highway 26 at Langensand Road
Scenario: 2024 Background Plus Site Trips
Number of Major Street Lanes: 2 PM Peak Hour Volume 2359 (sum of both approaches)
Number of Minor Street Lanes 1 PM Peak Hour Volume 70 (highest-volume approach)[a]
Posted or 85th percentile speed > 40 mph: Yes
Isolated Population Less than 10,000: No

Warrant 1, Eight-Hour Vehicular Volume

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

Warrant Anaylsis Calculations	8th Highest Hour[b]	Minimum Volume	Warrant Satisfied?
Condition A - Minimum Vehicular Volume			
Major Street Volume	1333	420	
Minor Street Volume	40	105	**No**
Condition B - Interruption of Continuous Traffic			
Major Street Volume	1333	630	
Minor Street Volume	40	53	**No**
Combination Warrant[c]			
Major Street Volume	1333	504	
Minor Street Volume	40	84	**No**

[a] Minor-Street right turn volumes are reduced to account for the impact of right-turns on red.
[b] Eighth-highest hour volumes are calculated as 5.65 percent of the expected daily traffic volume.
[c] This warrant should be used only after adequate trial of other alternatives has failed to solve traffic problems.

Preliminary Traffic Signal Warrant Analysis

Project Name: Dubarko Road Development
Intersection: Highway 26 at Dubarko Road
Scenario: 2024 Background Plus Site Trips
Number of Major Street Lanes: 2
Number of Minor Street Lanes 1
Posted or 85th percentile speed > 40 mph: Yes
Isolated Population Less than 10,000: No

PM Peak Hour Volume 2342 (sum of both approaches)
PM Peak Hour Volume 30 (highest-volume approach)[a]
(Without delay diversions)

Warrant 1, Eight-Hour Vehicular Volume

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

Warrant Anaylsis Calculations	8th Highest Hour[b]	Minimum Volume	Warrant Satisfied?
Condition A - Minimum Vehicular Volume			
Major Street Volume	1323	420	
Minor Street Volume	17	105	**No**
Condition B - Interruption of Continuous Traffic			
Major Street Volume	1323	630	
Minor Street Volume	17	53	**No**
Combination Warrant[c]			
Major Street Volume	1323	504	
Minor Street Volume	17	84	**No**

[a] Minor-Street right turn volumes are reduced to account for the impact of right-turns on red.
[b] Eighth-highest hour volumes are calculated as 5.65 percent of the expected daily traffic volume.
[c] This warrant should be used only after adequate trial of other alternatives has failed to solve traffic problems.

Preliminary Traffic Signal Warrant Analysis

Project Name: Dubarko Road Development
Intersection: Highway 211 at Dubarko Road
Scenario: 2024 Background Plus Site Trips (30th-Highest Hour)
Number of Major Street Lanes: 1 PM Peak Hour Volume 699 (sum of both approaches)
Number of Minor Street Lanes 1 PM Peak Hour Volume 204 (highest-volume approach)[a]
Posted or 85th percentile speed > 40 mph: Yes
Isolated Population Less than 10,000: No

Warrant 1, Eight-Hour Vehicular Volume

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

Warrant Anaylsis Calculations	8th Highest Hour[b]	Minimum Volume	Warrant Satisfied?
Condition A - Minimum Vehicular Volume			
Major Street Volume	395	350	
Minor Street Volume	115	105	**Yes**
Condition B - Interruption of Continuous Traffic			
Major Street Volume	395	525	
Minor Street Volume	115	53	**No**
Combination Warrant[c]			
Major Street Volume	395	420	
Minor Street Volume	115	84	**No**

[a] Minor-Street right turn volumes are reduced to account for the impact of right-turns on red.
[b] Eighth-highest hour volumes are calculated as 5.65 percent of the expected daily traffic volume.
[c] This warrant should be used only after adequate trial of other alternatives has failed to solve traffic problems.

Preliminary Traffic Signal Warrant Analysis

Project Name: Dubarko Road Development
Intersection: Dubarko Road at Langensand Road
Scenario: 2024 Background Plus Site Trips

Number of Major Street Lanes: 1 — PM Peak Hour Volume 317 (sum of both approaches)
Number of Minor Street Lanes 1 — PM Peak Hour Volume 76 (highest-volume approach)[a]
Posted or 85th percentile speed > 40 mph: No
Isolated Population Less than 10,000: No

Warrant 1, Eight-Hour Vehicular Volume

Condition A - Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B - Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on minor street (total of both approaches)			
Major Street	Minor Street	100%	80%	70%	56%	100%	80%	70%	56%
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

Warrant Anaylsis Calculations	8th Highest Hour[b]	Minimum Volume	Warrant Satisfied?
Condition A - Minimum Vehicular Volume			
Major Street Volume	179	500	
Minor Street Volume	43	150	**No**
Condition B - Interruption of Continuous Traffic			
Major Street Volume	179	750	
Minor Street Volume	43	75	**No**
Combination Warrant[c]			
Major Street Volume	179	600	
Minor Street Volume	43	120	**No**

[a] Minor-Street right turn volumes are reduced to account for the impact of right-turns on red.
[b] Eighth-highest hour volumes are calculated as 5.65 percent of the expected daily traffic volume.
[c] This warrant should be used only after adequate trial of other alternatives has failed to solve traffic problems.

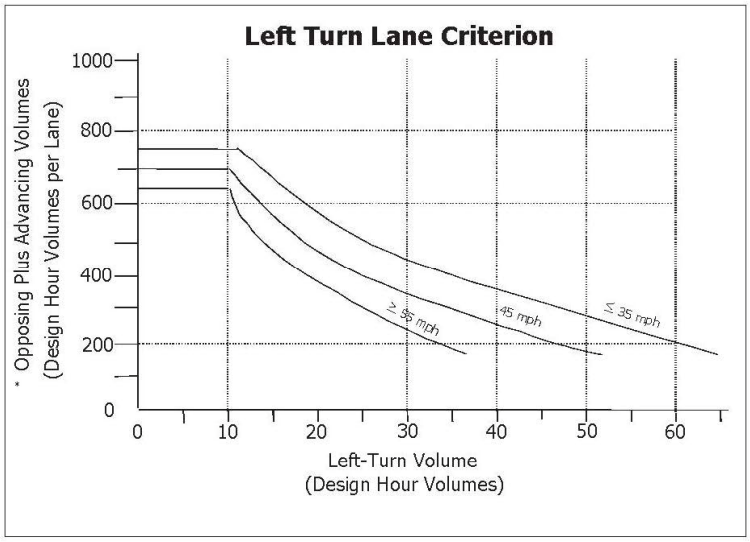
Left-Turn Lane Warrant Analysis (ODOT Methodology)

Project Name: Bull Run Terrace Subdivision
Approach: Highway 26 WB at Dubarko Road
Scenario: 2024 Background plus Site Trips

Number of Advancing Lanes: 2
Number of Opposing Lanes: 2
Major-Street Design Speed: 55 mph

	AM Volume	PM Volume
Advancing Volume for Design Hour:	1042	1142
Opposing Volume for Design Hour:	760	1200
Design Hour Volume Per Lane:	901	1171
Number of Left Turns per Hour:	60	121
Left-turn lane warrants satisfied?	**YES**	**YES**

Exhibit 7-1 Left Turn Lane Criterion (TTI)



*(Advancing Volume/Number of Advancing Through Lanes) + (Opposing Volume/Number of Opposing Through Lanes)

Right-Turn Lane Warrant Analysis (ODOT Methodology)

Project Name: Bull Run Terrace Subdivision
Approach: Highway 26 Eastbound at Dubarko Road
Scenario: 2024 Background Plus Site Trips

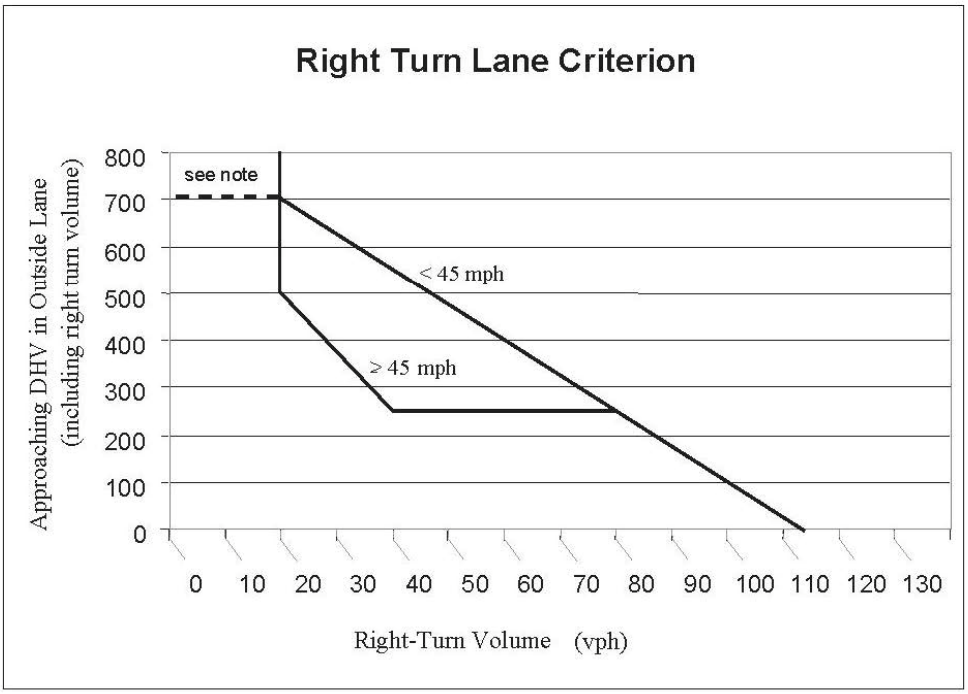
Major-Street Design Speed: 55 mph

	AM Volume	PM Volume
Number of Right Turns per Hour:	18	45
Approaching DVH in Outside Lane:	376	590
Calculated Turn Volume Threshold:	30	20
Right Turn Volume Exceeds Threshold?	**NO**	**YES**

Criterion 1: Vehicular Volume

The vehicular volume criterion is intended for application where the volume of intersecting traffic is the principal reason for considering installation of a right turn lane. The vehicular volume criteria are determined using the curve in Exhibit 7-2.

Exhibit 7-2 Right Turn Lane Criterion



Note: If there is no right turn lane, a shoulder needs to be provided. If this intersection is in a rural area and is a connection to a public street, a right turn lane is needed.

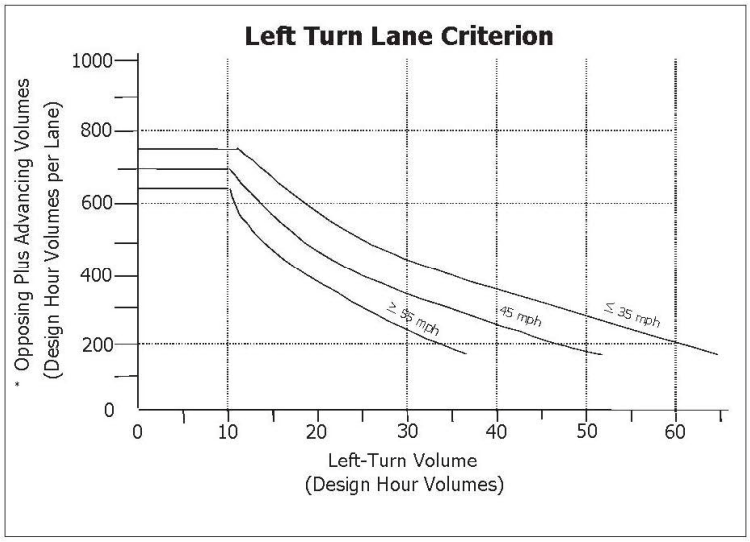
Left-Turn Lane Warrant Analysis (ODOT Methodology)

Project Name: Bull Run Terrace Subdivision
Approach: Highway 211 NB at Dubarko Road
Scenario: 2024 Background plus Site Trips

Number of Advancing Lanes: 1
Number of Opposing Lanes: 1
Major-Street Design Speed: 45 mph

	AM Volume	PM Volume
Advancing Volume for Design Hour:	375	430
Opposing Volume for Design Hour:	121	257
Design Hour Volume Per Lane:	496	687
Number of Left Turns per Hour:	47	63
Left-turn lane warrants satisfied?	**YES**	**YES**

Exhibit 7-1 Left Turn Lane Criterion (TTI)



*(Advancing Volume/Number of Advancing Through Lanes) + (Opposing Volume/Number of Opposing Through Lanes)

Right-Turn Lane Warrant Analysis (ODOT Methodology)

Project Name: Bull Run Terrace Subdivision
Approach: Highway 211 Northbound at Dubarko Road
Scenario: 2020 Existing Conditions

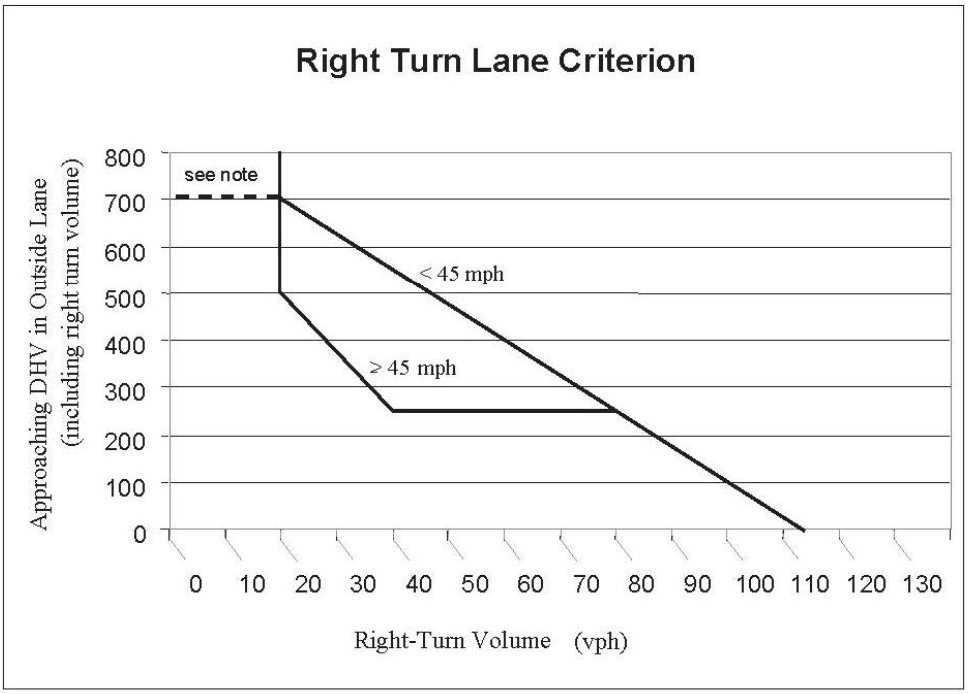
Major-Street Design Speed: 45 mph

	AM Volume	PM Volume
Number of Right Turns per Hour:	13	52
Approaching DVH in Outside Lane:	321	366
Calculated Turn Volume Threshold:	34	31
Right Turn Volume Exceeds Threshold?	**NO**	**YES**

Criterion 1: Vehicular Volume

The vehicular volume criterion is intended for application where the volume of intersecting traffic is the principal reason for considering installation of a right turn lane. The vehicular volume criteria are determined using the curve in Exhibit 7-2.

Exhibit 7-2 Right Turn Lane Criterion



Note: If there is no right turn lane, a shoulder needs to be provided. If this intersection is in a rural area and is a connection to a public street, a right turn lane is needed.

EXHIBIT F

TERAGAN & ASSOCIATES, INC.
ARBORICULTURAL CONSULTANTS

MEMORANDUM

DATE: December 14, 2019

TO: Alex Reverman (Roll Tide Corporation)

FROM: Todd Prager, RCA #597, ISA Board Certified Master Arborist

RE: Tree Plan for the Dubarko Road Subdivision and Condominiums

Summary

This report includes tree removal, preservation, and protection recommendations for the proposed Dubarko Road Subdivision and Condominiums in Sandy, Oregon.

Background

Roll Tide Corporation is proposing to construct a four lot subdivision and 216 unit condominium complex with parking, street access, sidewalks, utilities, and open space at the east end of Dubarko Road in Sandy, Oregon. An existing conditions map of the site and trees is provided in Attachment 1. The proposed site plan with the proposed tree removal and retention is provided in Attachment 2. A detail of the grove of trees to be retained along Highway 26 is provided in Attachment 3.

The assignment requested of our firm for this project was to:

- Assess the existing grove of trees along Highway 26;
- Identify the trees to be removed and retained in the grove;
- Identify trees that are in good condition within the park tract within the northwest portion of the site; and
- Provide tree protection recommendations for the trees to be retained in the grove and park.

Tree Assessment

On September 12 and December 11, 2019 I completed the inventory of existing trees in the grove and park.

The complete inventory data for each tree is provided in Attachment 4 and includes the tree number, common name, scientific name, trunk diameter (DBH), crown

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Email: todd@teragan.com • Website: teragan.com

radius, health condition, structural condition, pertinent comments, and whether it is an onsite 11-inch DBH or greater tree in good condition to be retained.[1]

The tree numbers in the inventory in Attachment 4 correspond to the tree numbers on the plans in Attachments 1 through 3.

Note that since the site is 15.91 acres, Section 17.102.50 requires 48 trees over 11-inch DBH that are in good condition to be retained. My assignment was to identify at least 48 trees in the grove that meet this criteria. While I assessed 97 trees total in the grove and park, I found 59 that were over 11-inch DBH and in good condition.

Tree Removal and Retention

This section of the report includes tree removal and retention recommendations based on the proposed site plan.

Tree Removal

The standard tree protection requirements in the City of Sandy Code range from at least 10 feet from the trunks of retained trees (SDC 17.102.50.B.1) to five feet beyond the driplines (SDC 17.92.10.D) unless otherwise approved by the Planning Director.

A typical alternative minimum protection zone allows encroachments no closer than a radius from a tree of .5 feet per inch of DBH as long as no more than 25 percent of the critical root protection zone area (estimated at one foot radius per inch of DBH) is impacted. Figure 1 illustrates this concept.

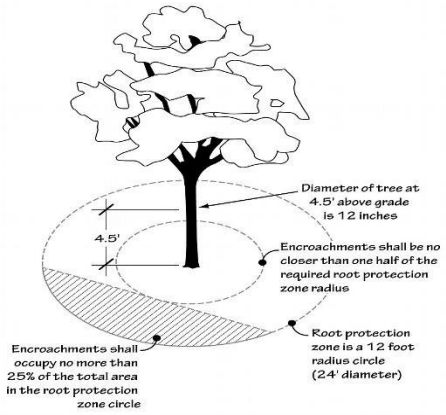

Figure 1: Alterative minimum protection zone

Using the criteria described above, while considering the tree conditions and their locations relative to grading, paving, construction, and other site improvements, 21 of the assessed trees at the edges of the grove and park are proposed for removal.

Note that the grove is comprised of relatively young trees that are competing for space, water, nutrients, and light. The grove could benefit from selective thinning of trees to improve the growth of the more dominant trees that are presently in good condition. Also, invasive understory and vine species such as Himalayan blackberry (*Rubus armeniacus*) and English ivy (*Hedera helix*) should be removed to improve the condition of the understory and prevent vine growth on the retained trees. At a minimum, the trees in the grove that are in good condition will be retained while other trees may be marked for selective removal to improve the overall health of the grove. The invasive understory species may also be removed to improve the health of the grove.

[1] Section 17.102.50 of the City of Sandy Code requires three onsite trees over 11-inch DBH that are in good condition to be retained.

Tree Retention

Fifty-nine (59) trees within the grove and park that are in good condition and over 11-inch DBH are proposed to be retained. Tree preservation has been maximized to the extent practicable with trees removed only as necessary for building construction, parking lot construction, street construction, and improvements to Highway 26. Note that trees 15584.1 and 15644 are in poor or very poor health and/or structural condition, along the new edges of the grove, and proposed for removal for safety purposes.

Section 17.102.50.A of the City of Sandy Code includes five criteria for tree retention with development. The five criteria followed by my findings in *italics* are listed below:

1. At least three trees 11 inches DBH or greater are to be retained for every one-acre of contiguous ownership.

Finding: The site is 15.91 acres in size so 48 trees over 11-inch DBH in good condition are required to be retained. The proposed preservation includes 59 trees over 11-inch DBH in good condition within the grove along Highway 26 and park tract to be retained. This criterion is met.

2. Retained trees can be located anywhere on the site at the landowner's discretion before the harvest begins. Clusters of trees are encouraged.

Finding: The retained trees are clustered within the grove of trees along Highway 26. Clusters of trees will also be retained within the park tract. This criterion is met.

3. Trees proposed for retention shall be healthy and likely to grow to maturity, and be located to minimize the potential for blow-down following the harvest.

Finding: All of the trees subject to this standard are in good health condition and likely to grow to maturity. Future selective thinning of the grove is recommended to improve the availability of space, water, nutrients, and light for the retained trees. Also, invasive understory and vine species such as Himalayan blackberry and English ivy should be removed to improve the condition of the understory and prevent vine growth on the retained trees.

Trees along portions of the southwest, east, and north sides of the grove are proposed for removal for construction. It will be important to reassess and monitor the trees along the newly exposed edges following site clearing and periodically during construction and after high wind events to ensure they do not pose a high risk. Since the bulk of the grove will be retained, I anticipate that the overall grove will remain viable. However, selective thinning of trees within the grove should be delayed until the changes in wind dynamics from edge tree removal is more thoroughly assessed. Retaining more of the interior trees will help to protect the overall integrity of grove from blow-down during the near term. It will also be very

important to protect the root zones of the trees in the grove and park tract from construction impacts with tree protection fencing and other measures to further minimize the risk of blow-down. Tree protection measures are further described in the next section of this report.

Since the bulk of the grove will be retained and measures to monitor and protect the trees in the grove and park tract will be implemented, this criterion is met.

4. If possible, at least two of the required trees per acre must be of conifer species.

Finding: All 59 trees over 11-inch DBH and in good condition are conifer species. This criterion is met.

5. Trees within the required protected setback areas may be counted towards the tree retention standard if they meet these requirements.

Finding: The trees that are over 11-inch DBH and in good condition that are within the conservation easement along Highway 26 will be counted towards the tree retention standards. This criterion is met.

Tree Protection Recommendations

The standard tree protection requirements in the City of Sandy Code range from at least 10 feet from the trunks of retained trees (SDC 17.102.50.B.1) to five feet beyond the driplines (SDC 17.92.10.D) unless otherwise approved by the Planning Director.

A typical alternative minimum protection zone allows encroachments no closer than a radius from a tree of .5 feet per inch of DBH as long as no more than 25 percent of the critical root protection zone area (estimated at one foot radius per inch of DBH) is impacted. Figure 1 illustrates this concept.

The reason for using this alternative is because it allows the tree protection zone to better relate to the size of the tree and its root zone. For example, a 10 foot tree protection setback would not be adequate for a 36-inch DBH tree which should have a minimum setback of at least 18 feet. Also, driplines can be highly variable based on species growth habits and onsite conditions such as the presence of adjacent trees or past pruning.

The critical root zone radii of 1 foot per inch of DBH is shown for the trees to be retained along the edges of the grove and park on the plan sheets in Attachments 2 and 3. The trees to be retained can be adequately protected by placing tree protection fencing as shown in Attachments 2 and 3. The tree protection fencing will protect at least 75 percent of their critical roots zones and avoid any encroachments closer than a radius of .5 feet per inch of DBH to a tree to be retained. No grading, stockpiling, storage, disposal, or any other construction related activity shall occur in the tree protection zones unless specifically reviewed and approved by the project arborist.

The following additional protection measures shall apply to the trees at the site:

- *Tree Protection Fencing*: Establish tree protection fencing in the locations shown in Attachments 2 and 3. Required fencing shall be a minimum of six feet tall supported with metal posts placed no farther than ten feet apart installed flush with the initial undisturbed grade.
- *Directional Felling*: Fell the trees to be removed away from the trees to be retained so they do not contact or otherwise damage the trunks or branches of the trees to be retained. No vehicles or heavy equipment shall be permitted within the tree protection zones during tree removal operations.
- *Stump Removal*: The stumps of the trees to be removed from within the tree protection zones shall either be retained in place or stump ground to protect the root systems of the trees to be retained.
- *Retaining Wall on North Side of Grove*: A low retaining wall is recommended on the north side of the grove of trees along Highway 26 to eliminate grading in the tree protection zone to better protect the root systems of the trees at the northern edge of the grove.
- *Protect Tree Crowns*: Care will need to be taken to not contact or otherwise damage the crowns of the trees that may extend into the construction area.
- *Monitoring of New Grove Edges*: Trees along portions of the southwest, east, and north sides of the grove are proposed for removal for construction. It will be important to reassess and monitor the trees along the newly exposed edges following site clearing and periodically during construction and after high wind events to ensure they do not pose a high risk. This monitoring should occur for the next two to three storm seasons following site clearing.
- *Selective Thinning of Grove Trees*: Selective thinning of the grove is recommended to improve the availability of space, water, nutrients, and light for the retained trees. Also, invasive understory and vine species such as Himalayan blackberry and English ivy should be removed to improve the condition of the understory and prevent vine growth on the retained trees.

  Any thinning of trees within the grove should be delayed until the changes in wind dynamics from edge tree removal is more thoroughly assessed. Retaining more of the interior trees will help to protect the overall integrity of the grove from blow-down during the near term. After, site adaptations of the trees are better understood in the following two to three storm seasons following disturbance, the project arborist may prescribe a selective thinning treatment.

Additional tree protection recommendations for the trees to be retained are provided in Attachment 5.

Conclusion

Fifty-nine (59) trees over 11-inch DBH in good condition are proposed to be retained within the grove of trees along Highway 26 and park tract at the northeast portion of the site. The required tree retention for the 15.91 acre site is 48 trees.

While the grove of trees will have areas of disturbance along the edges, I anticipate that the overall grove will remain viable. It will be important to reassess and monitor the trees along the newly exposed edges following site clearing and periodically during construction and after high wind events to ensure they do not pose a high risk.

Once the grove is stabilized, I recommend selective thinning of trees to improve the availability of space, water, nutrients, and light for the retained trees. Also, invasive understory and vine species such as Himalayan blackberry and English ivy should be removed to improve the condition of the understory and prevent vine growth on the retained trees.

Please contact me if you have questions, concerns, or need any additional information.

Sincerely,

Todd Prager

Todd Prager
ASCA Registered Consulting Arborist #597
ISA Board Certified Master Arborist, WE-6723B
ISA Qualified Tree Risk Assessor
AICP, American Planning Association

Attachments:
Attachment 1 - Existing Site Conditions with Existing Trees
Attachment 2 - Site Plan with Trees Removal and Retention
Attachment 3 - Grove Detail with Tree Removal and Protection
Attachment 4 - Tree Inventory
Attachment 5 - Tree Protection Recommendations
Attachment 6 - Assumptions and Limiting Conditions

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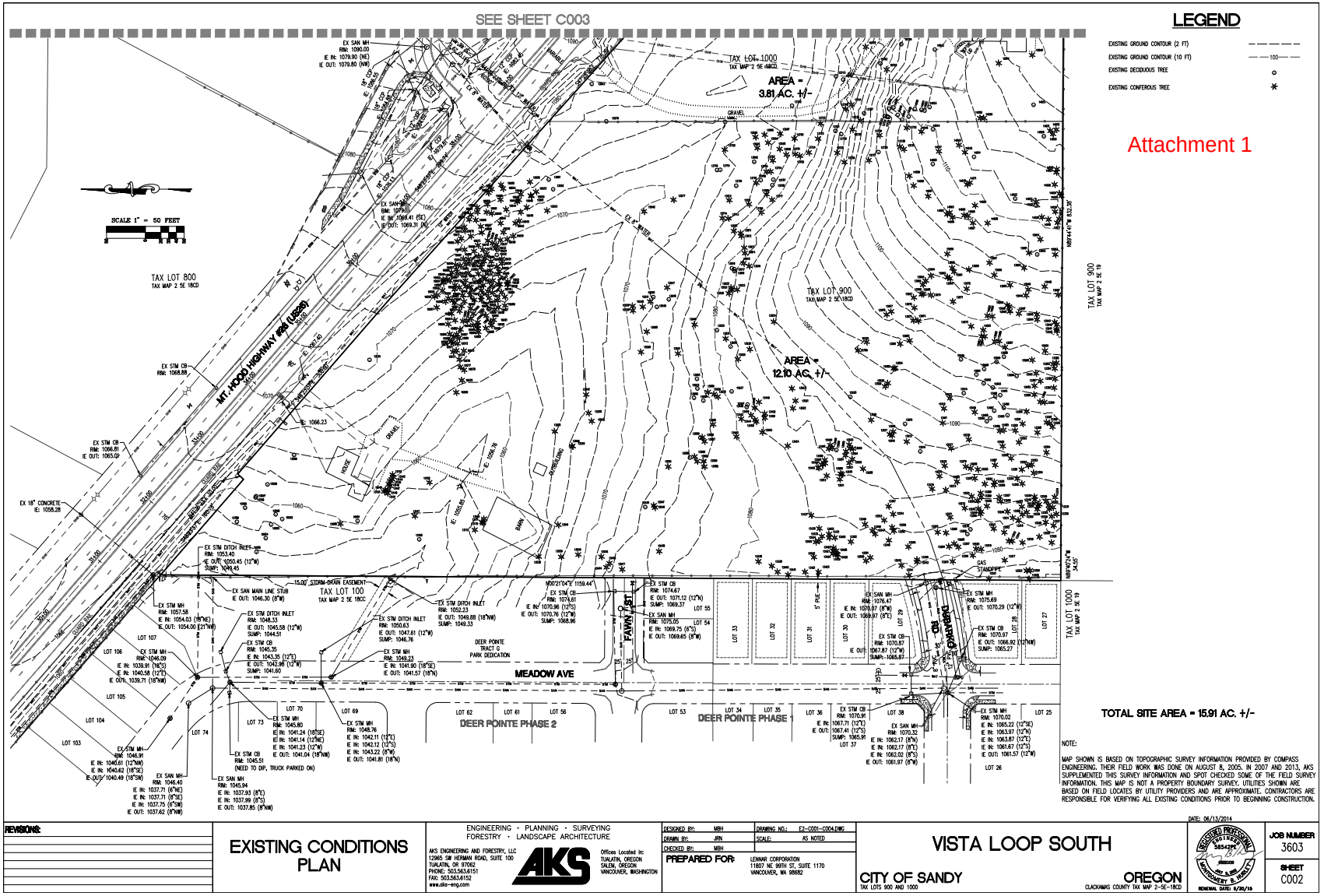
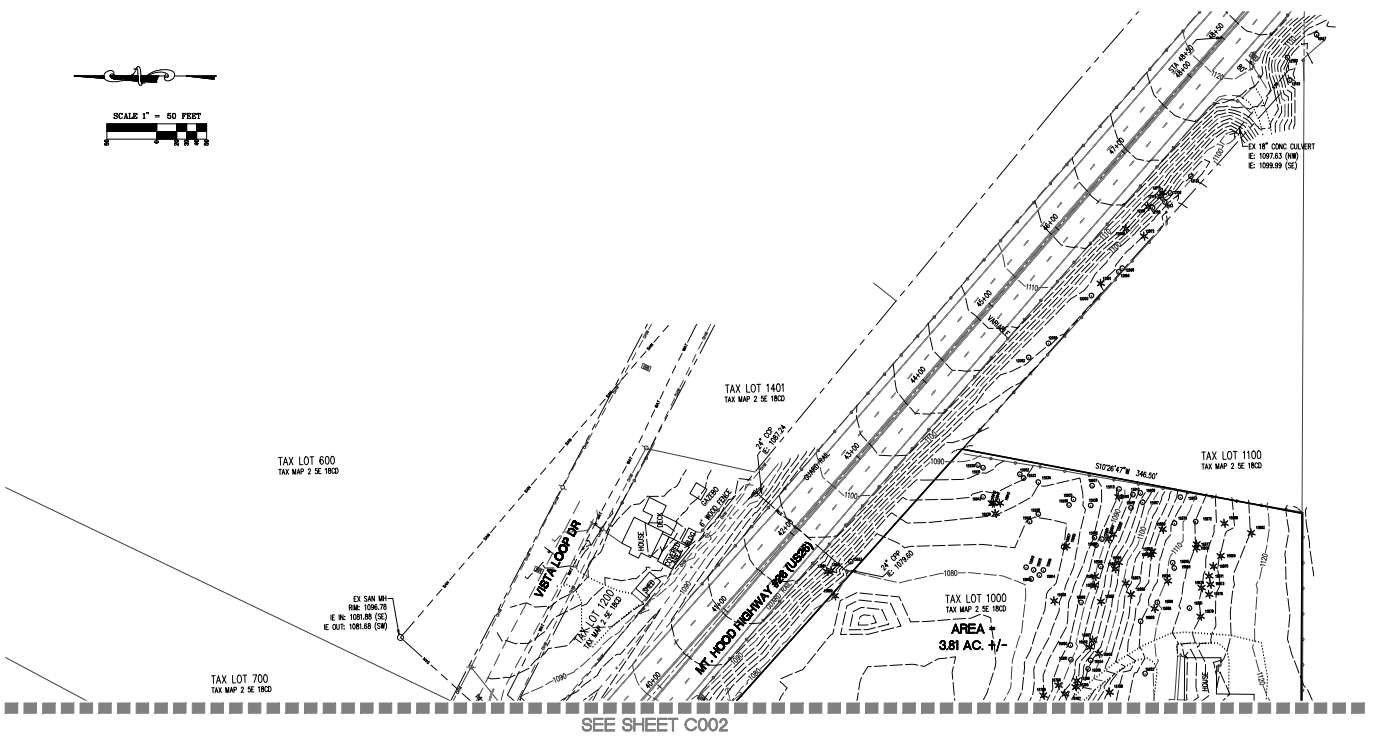

SEE SHEET C003
LEGEND
EXISTING GROUND CONTOUR (2 FT)
EXISTING GROUND CONTOUR (10 FT)
EXISTING DECIDUOUS TREE
EXISTING CONIFEROUS TREE
Attachment 1
SCALE 1" = 50 FEET
TAX LOT 800
TAX MAP 2 5E 18CD
TAX LOT 1000
TAX MAP 2 5E 18CD
AREA = 3.81 AC. +/-
AREA = 12.10 AC. +/-
TAX LOT 900
TAX MAP 2 5E 18CD
TAX LOT 900
TAX MAP 2 5E 19
TAX LOT 100
TAX MAP 2 5E 18CC
TAX LOT 1000
TAX MAP 2 5E 19
MT. HOOD HIGHWAY #26 (US26)
MEADOW AVE
FAWN ST
DUBARKO RD
DEER POINTE PHASE 2
DEER POINTE PHASE 1
DEER POINTE TRACT G PARK DEDICATION
15.00' STORM DRAIN EASEMENT
TOTAL SITE AREA = 15.91 AC. +/-
NOTE:
MAP SHOWN IS BASED ON TOPOGRAPHIC SURVEY INFORMATION PROVIDED BY COMPASS ENGINEERING. THEIR FIELD WORK WAS DONE ON AUGUST 8, 2005. IN 2007 AND 2013, AKS SUPPLEMENTED THIS SURVEY INFORMATION AND SPOT CHECKED SOME OF THE FIELD SURVEY INFORMATION. THIS MAP IS NOT A PROPERTY BOUNDARY SURVEY. UTILITIES SHOWN ARE BASED ON FIELD LOCATES BY UTILITY PROVIDERS AND ARE APPROXIMATE. CONTRACTORS ARE RESPONSIBLE FOR VERIFYING ALL EXISTING CONDITIONS PRIOR TO BEGINNING CONSTRUCTION.
DATE: 06/13/2014
REVISIONS:
EXISTING CONDITIONS PLAN
ENGINEERING · PLANNING · SURVEYING
FORESTRY · LANDSCAPE ARCHITECTURE
AKS ENGINEERING AND FORESTRY, LLC
12965 SW HERMAN ROAD, SUITE 100
TUALATIN, OR 97062
PHONE: 503.563.6151
FAX: 503.563.6152
www.aks-eng.com
AKS
Offices Located In:
TUALATIN, OREGON
SALEM, OREGON
VANCOUVER, WASHINGTON
DESIGNED BY: MBH
DRAWN BY: JRN
CHECKED BY: MBH
DRAWING NO.: E2-C001-C004.DWG
SCALE: AS NOTED
PREPARED FOR: LENNAR CORPORATION
11807 NE 99TH ST, SUITE 1170
VANCOUVER, WA 98682
VISTA LOOP SOUTH
CITY OF SANDY
TAX LOTS 900 AND 1000
OREGON
CLACKAMAS COUNTY TAX MAP 2-5E-18CD
REGISTERED PROFESSIONAL ENGINEER
58542PE
OREGON
MONTGOMERY B. HURLEY
RENEWAL DATE: 6/30/15
JOB NUMBER
3603
SHEET
C002

Attachment 1



TOTAL SITE AREA = 15.91 AC. +/-

NOTE:

MAP SHOWN IS BASED ON TOPOGRAPHIC SURVEY INFORMATION PROVIDED BY COMPASS ENGINEERING. THEIR FIELD WORK WAS DONE ON AUGUST 8, 2005. IN 2007 AND 2013, AKS SUPPLEMENTED THIS SURVEY INFORMATION AND SPOT CHECKED SOME OF THE FIELD SURVEY INFORMATION. THIS MAP IS NOT A PROPERTY BOUNDARY SURVEY. UTILITIES SHOWN ARE BASED ON FIELD LOCATES BY UTILITY PROVIDERS AND ARE APPROXIMATE. CONTRACTORS ARE RESPONSIBLE FOR VERIFYING ALL EXISTING CONDITIONS PRIOR TO BEGINNING CONSTRUCTION.

DATE: 06/13/2014

REVISIONS:

EXISTING CONDITIONS PLAN

ENGINEERING · PLANNING · SURVEYING
FORESTRY · LANDSCAPE ARCHITECTURE

AKS ENGINEERING AND FORESTRY, LLC
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TUALATIN, OREGON
SALEM, OREGON
VANCOUVER, WASHINGTON

DESIGNED BY:	MBH	DRAWING NO.:	E2-C001-C004.DWG
DRAWN BY:	JRN	SCALE:	AS NOTED
CHECKED BY:	MBH		

PREPARED FOR: LENNAR CORPORATION
11807 NE 99TH ST, SUITE 1170
VANCOUVER, WA 98682

VISTA LOOP SOUTH

CITY OF SANDY
TAX LOTS 900 AND 1000

OREGON
CLACKAMAS COUNTY TAX MAP 2-5E-18CD

REGISTERED PROFESSIONAL ENGINEER
58542PE
OREGON
JULY 9, 2015
MONTGOMERY B. HURLEY
RENEWAL DATE: 6/30/15

JOB NUMBER
3603

SHEET
C003

Attachment 1

TREE NUMBER	SPECIES	DBH (IN
12052	MAPLE	17,19
12055	MAPLE	38
12060	MAPLE	29
12061	CEDAR	26
12066	UNKNOWN DECID.	5
12068	UNKNOWN DECID.	13
12069	DOUGLAS FIR	27
12072	CEDAR	17
12101	DOUGLAS FIR	19
12102	MAPLE	7
12113	MAPLE	14,28
12114	DOUGLAS FIR	22
12115	DOUGLAS FIR	25
12116	MAPLE	12
12122	MAPLE	7,8,15
12167	MAPLE	5,6
12193	UNKNOWN DECID.	12
12197	MAPLE	9
13095	BIG LEAF MAPLE	20
13096	PEAR	12
13097	PEAR	10
13098	FILBERT	8
13134	BIG LEAF MAPLE	32
13142	DOUGLAS FIR	19
13143	DOUGLAS FIR	10
13144	DOUGLAS FIR	36
13145	DOUGLAS FIR	12
13146	DOUGLAS FIR	21
13147	DOUGLAS FIR	13
13148	DOUGLAS FIR	21
13149	DOUGLAS FIR	15
13150	DOUGLAS FIR	19
13151	DOUGLAS FIR	23
13152	DOUGLAS FIR	35
13157	PINE	18
13158	APPLE	22
13169	DOUGLAS FIR	20
13170	DOUGLAS FIR	15
13171	CEDAR	20
13172	CEDAR	29,28
13208	DOUGLAS FIR	22
13209	DOUGLAS FIR	17
13210	DOUGLAS FIR	44
13263	CEDAR	24
13264	CEDAR	10
13265	CEDAR	15
13266	CEDAR	24
13267	DOUGLAS FIR	21
13268	DOUGLAS FIR	17
13269	ALDER	8
13270	ALDER	10
13271	CEDAR	12
13272	CEDAR	12
13273	CEDAR	19
13274	CEDAR	19
13275	DOUGLAS FIR	24
13276	CEDAR	11
13277	CEDAR	36
13278	CEDAR	48
13279	CEDAR	18
13280	DOUGLAS FIR	22
13281	DOUGLAS FIR	16
13282	DOUGLAS FIR	17
13283	CEDAR	32
13284	DOUGLAS FIR	15
13285	DOUGLAS FIR	20
13286	DOUGLAS FIR	20
13287	DOUGLAS FIR	17
13288	CEDAR	12
13289	CEDAR	12
13290	CEDAR	13
13291	CEDAR	40
13292	CEDAR	37
13293	CEDAR	9
13294	CEDAR	6
13295	CEDAR	13
13296	CEDAR	13
13297	CEDAR	13
13298	CEDAR	16
13299	CEDAR	37
13300	SPRUCE	12
13301	CEDAR	8
13302	CEDAR	8
13303	CEDAR	13
13304	DOUGLAS FIR	18
13305	DOUGLAS FIR	12
13306	CEDAR	17
13307	DOUGLAS FIR	27
13308	CEDAR	12
13309	CEDAR	8
13310	CEDAR	8
13311	CEDAR	31
13312	CEDAR	32
13313	CEDAR	13
13314	CEDAR	37
13315	DOUGLAS FIR	13
13316	DOUGLAS FIR	26
13317	DOUGLAS FIR	14
13318	DOUGLAS FIR	28
13319	DOUGLAS FIR	16
13320	CEDAR	13
13321	DOUGLAS FIR	15
13322	CEDAR	40
13323	CEDAR	30
13324	DOUGLAS FIR	16
13325	CEDAR	46
13326	DOUGLAS FIR	26
13327	DOUGLAS FIR	25
13328	CEDAR	11

TREE NUMBER	SPECIES	DBH (IN)
13329	CEDAR	16
13330	CEDAR	19
13331	CEDAR	12
13332	CEDAR	8
13333	DOUGLAS FIR	13
13334	CEDAR	10
13335	CEDAR	11
13336	CEDAR	10
13337	CEDAR	13
13338	CEDAR	11
13339	CEDAR	14
13340	DOUGLAS FIR	15
13341	DOUGLAS FIR	26
13342	DOUGLAS FIR	13
13343	DOUGLAS FIR	12
13344	DOUGLAS FIR	17
13345	DOUGLAS FIR	27
13346	DOUGLAS FIR	32
13347	DOUGLAS FIR	21
13348	DOUGLAS FIR	12
13349	DOUGLAS FIR	16
13350	DOUGLAS FIR	31
13351	DOUGLAS FIR	11
13352	DOUGLAS FIR	26
13353	DOUGLAS FIR	19
13354	DOUGLAS FIR	24
13355	DOUGLAS FIR	18
13356	DOUGLAS FIR	12
13357	DOUGLAS FIR	13
13382	DOUGLAS FIR	12
13383	DOUGLAS FIR	14
13384	DOUGLAS FIR	14
13385	DOUGLAS FIR	8
13386	DOUGLAS FIR	18
13387	DOUGLAS FIR	18
13388	DOUGLAS FIR	16
13390	DOUGLAS FIR	26
13391	DOUGLAS FIR	24
13392	DOUGLAS FIR	28
13393	DOUGLAS FIR	28
13394	DOUGLAS FIR	12
13395	DOUGLAS FIR	8
13396	DOUGLAS FIR	16
13397	DOUGLAS FIR	14
13398	DOUGLAS FIR	14
13399	DOUGLAS FIR	8
13430	DOUGLAS FIR	9
13431	CEDAR	19
13432	CEDAR	38
13433	CEDAR	12
13434	CEDAR	26
13435	ALDER	10
13436	ALDER	6
13437	ALDER	6
13438	ALDER	6
13439	ALDER	6
13410	DOUGLAS FIR	39
13411	CEDAR	26
13412	CEDAR	26
13413	DOUGLAS FIR	29
13414	ALDER	10
13415	ALDER	10
13416	ALDER	6
13421	DOUGLAS FIR	29
13422	DOUGLAS FIR	13
13423	DOUGLAS FIR	36
13424	DOUGLAS FIR	24
13425	DOUGLAS FIR	22
13426	DOUGLAS FIR	17
13427	DOUGLAS FIR	8
13428	DOUGLAS FIR	8
13429	DOUGLAS FIR	8
13430	DOUGLAS FIR	11
13431	DOUGLAS FIR	22
13432	DOUGLAS FIR	22
13433	DOUGLAS FIR	22
13434	CEDAR	14
13435	CEDAR	22
13436	DOUGLAS FIR	24
13437	DOUGLAS FIR	14
13438	DOUGLAS FIR	40
13439	HOLLY	9
13440	DOUGLAS FIR	32
13441	DOUGLAS FIR	12
13442	CEDAR	32
13443	DOUGLAS FIR	29
13444	DOUGLAS FIR	17
13445	DOUGLAS FIR	8
13446	ALDER	6
13447	ALDER	8
13448	CEDAR	12
13449	DOUGLAS FIR	17
13450	CEDAR	9
13451	DOUGLAS FIR	29
13452	CEDAR	8
13453	DOUGLAS FIR	27
13454	DOUGLAS FIR	19
13455	DOUGLAS FIR	30
13474	DOUGLAS FIR	13
13475	DOUGLAS FIR	16
13476	DOUGLAS FIR	26
13477	DOUGLAS FIR	48
13478	DOUGLAS FIR	48
13493	DOUGLAS FIR	16
13494	DOUGLAS FIR	19
13495	BIG LEAF MAPLE	12
13496	DOUGLAS FIR	12
13497	DOUGLAS FIR	19
13498	DOUGLAS FIR	24

TREE NUMBER	SPECIES	DBH (IN)
13499	DOUGLAS FIR	15
13500	ALDER	9
13501	CEDAR	13
13502	DOUGLAS FIR	22
13503	CEDAR	9
13504	DOUGLAS FIR	13
13505	DOUGLAS FIR	10
13506	CEDAR	8
13507	CEDAR	16
13508	CEDAR	18
13509	CEDAR	17
13510	DOUGLAS FIR	10
13511	DOUGLAS FIR	30
13512	CEDAR	16
13513	CEDAR	17
13514	ALDER	14
13515	ALDER	8
13516	DOUGLAS FIR	22
13517	CEDAR	13
13518	CEDAR	25
13519	CEDAR	35
13520	ALDER	34
13521	DOUGLAS FIR	36
13522	DOUGLAS FIR	8
13523	DOUGLAS FIR	18
13524	DOUGLAS FIR	17
13525	CEDAR	9
13526	CEDAR	16
13538	CEDAR	17
13539	DOUGLAS FIR	11
13540	CEDAR	26,32
13541	CEDAR	17
13542	DOUGLAS FIR	15
13543	DOUGLAS FIR	35
13544	DOUGLAS FIR	18
13545	FRUIT	36
13546	DOUGLAS FIR	11
13547	DOUGLAS FIR	11
13581	DOUGLAS FIR	30
13582	DOUGLAS FIR	39
13583	DOUGLAS FIR	14
13584	DOUGLAS FIR	17
13585	DOUGLAS FIR	17
13586	HOLLY	10
13587	CEDAR	12
13588	CEDAR	12
13589	ALDER	12
13599	DOUGLAS FIR	14
13600	DOUGLAS FIR	25
13601	DOUGLAS FIR	25
13602	ALDER	15
13603	ALDER	13
13634	ALDER	12
13635	ALDER	12
13636	DOUGLAS FIR	23
13610	DOUGLAS FIR	17
13611	CEDAR	10
13612	CEDAR	10
13613	CEDAR	25
13614	CEDAR	25
13615	DOUGLAS FIR	39
13616	DOUGLAS FIR	19
13617	ALDER	8
13618	ALDER	6
13619	DOUGLAS FIR	14
13620	CEDAR	39
13621	DOUGLAS FIR	10
13622	DOUGLAS FIR	34
13623	DOUGLAS FIR	5
13624	DOUGLAS FIR	34
13625	DOUGLAS FIR	34
13626	DOUGLAS FIR	35
13627	ALDER	13
13628	DOUGLAS FIR	34
13629	DOUGLAS FIR	19
13630	HOLLY	8
13631	DOUGLAS FIR	30
13632	ALDER	11
13646	DOUGLAS FIR	32
13647	DOUGLAS FIR	32
13648	HOLLY	8
13649	HOLLY	9
13650	HOLLY	7
13651	ALDER	9
13652	HOLLY	10
13653	DOUGLAS FIR	6
13676	APPLE	17
13677	DOUGLAS FIR	30
13684	BIG LEAF MAPLE	12
13692	CHERRY	8
13693	CEDAR	40
13694	CEDAR	30
13695	DOUGLAS FIR	15
13696	DOUGLAS FIR	32
13697	CEDAR	16
13698	CEDAR	14
13699	CEDAR	16
13730	CEDAR	30
13731	CEDAR	14
13732	CEDAR	15
13733	CEDAR	17
13734	CEDAR	12
13735	CEDAR	15
13736	ALDER	14
13737	ALDER	6
13738	ALDER	6
13739	CEDAR	15
13710	CEDAR	34
13711	CEDAR	30

TREE NUMBER	SPECIES	DBH (IN)
11712	CEDAR	46
11713	CEDAR	25
11714	DOUGLAS FIR	17
11715	ALDER	24
11716	DOUGLAS FIR	36
11717	DOUGLAS FIR	12
11718	BIG LEAF MAPLE	42
11719	BIG LEAF MAPLE	6
11720	CEDAR	12
11721	BIG LEAF MAPLE	18
11722	DOUGLAS FIR	17
11723	CEDAR	15
11724	CEDAR	17
11725	DOUGLAS FIR	18
11726	DOUGLAS FIR	34
11727	DOUGLAS FIR	19
11728	FRUIT	36
11729	DOUGLAS FIR	36
11730	DOUGLAS FIR	22
11731	DOUGLAS FIR	34
11732	DOUGLAS FIR	22
11733	ALDER	13
11734	ALDER	14
11735	ALDER	10
11736	DOUGLAS FIR	15
11737	ALDER	12
11738	DOUGLAS FIR	12
11739	BIG LEAF MAPLE	20
11740	CEDAR	18
11741	DOUGLAS FIR	33
11742	BIG LEAF MAPLE	16
11743	ALDER	9
11744	ALDER	8
11796	PEAR	8
11738	PEAR	9
11739	PEAR	8
11843	BIG LEAF MAPLE	12
11880	DOUGLAS FIR	24,24
11881	DOUGLAS FIR	18
11882	DOUGLAS FIR	18,16
11933	BIG LEAF MAPLE	12,16
11940	DOUGLAS FIR	17
11941	DOUGLAS FIR	23
11942	DOUGLAS FIR	14
11943	DOUGLAS FIR	31
11944	DOUGLAS FIR	17
11945	DOUGLAS FIR	6
11946	DOUGLAS FIR	12
11947	DOUGLAS FIR	35
11948	DOUGLAS FIR	9
11949	DOUGLAS FIR	18
11950	DOUGLAS FIR	16
11951	DOUGLAS FIR	20
11952	BIG LEAF MAPLE	24
11953	DOUGLAS FIR	21
11954	DOUGLAS FIR	20
11955	DOUGLAS FIR	40
11956	DOUGLAS FIR	28
11957	DOUGLAS FIR	28
11958	DOUGLAS FIR	20
11959	DOUGLAS FIR	36
11960	CEDAR	6
11961	CEDAR	6
11962	DOUGLAS FIR	24
11963	DOUGLAS FIR	22
11964	DOUGLAS FIR	28
11965	DOUGLAS FIR	28
11966	DOUGLAS FIR	14
11967	DOUGLAS FIR	30
11968	DOUGLAS FIR	8
11969	DOUGLAS FIR	8
11970	DOUGLAS FIR	26
11971	DOUGLAS FIR	16
11972	DOUGLAS FIR	30
11973	DOUGLAS FIR	22
11974	DOUGLAS FIR	18
11975	DOUGLAS FIR	24
11976	CEDAR	10
11977	DOUGLAS FIR	30
11978	DOUGLAS FIR	24
11979	ALDER	12
11990	DOUGLAS FIR	24
11991	DOUGLAS FIR	18
11992	DOUGLAS FIR	18
11993	DOUGLAS FIR	24
11994	DOUGLAS FIR	32
11995	ALDER	16
11996	DOUGLAS FIR	28
11997	DOUGLAS FIR	28
11998	ALDER	8
11999	ALDER	6
11990	ALDER	8
11991	ALDER	8
11992	ALDER	8
11993	ALDER	8
11994	ALDER	8
11995	DOUGLAS FIR	30
11996	DOUGLAS FIR	6
11997	DOUGLAS FIR	28
11998	DOUGLAS FIR	18
11999	DOUGLAS FIR	18
11000	DOUGLAS FIR	16
11001	DOUGLAS FIR	28
11002	DOUGLAS FIR	28
11003	DOUGLAS FIR	6
11016	DOUGLAS FIR	6
11017	DOUGLAS FIR	24
11018	DOUGLAS FIR	26
11019	DOUGLAS FIR	28

TREE NUMBER	SPECIES	DBH(IN)
14020	CEDAR	8
14021	BIG LEAF MAPLE	25
14022	DOUGLAS FIR	6
14023	BIG LEAF MAPLE	8
14024	DOUGLAS FIR	14
14025	DOUGLAS FIR	32
14026	DOUGLAS FIR	42
14027	DOUGLAS FIR	24
14028	DOUGLAS FIR	32
14029	BIG LEAF MAPLE	24
14030	DOUGLAS FIR	26
14031	DOUGLAS FIR	18
14032	DOUGLAS FIR	24
14033	BIG LEAF MAPLE	16
14041	BIG LEAF MAPLE	28
14042	DOUGLAS FIR	6
14043	DOUGLAS FIR	32
14044	ALDER	8
14045	DOUGLAS FIR	28
14046	BIG LEAF MAPLE	16
14047	ALDER	14
14048	ALDER	8
14049	ALDER	12
14050	ALDER	6
14051	ALDER	8
14052	ALDER	8
14053	ALDER	8
14055	DOUGLAS FIR	18
14056	DOUGLAS FIR	20
14057	DOUGLAS FIR	12
14058	ALDER	14
14059	DOUGLAS FIR	18
14060	DOUGLAS FIR	39
14061	DOUGLAS FIR	39
14062	DOUGLAS FIR	24
14063	DOUGLAS FIR	20
14064	DOUGLAS FIR	16
14065	DOUGLAS FIR	20
14066	DOUGLAS FIR	22
14067	DOUGLAS FIR	12
14068	DOUGLAS FIR	24
14069	DOUGLAS FIR	14
14070	DOUGLAS FIR	22
14071	DOUGLAS FIR	36
14550	DOUGLAS FIR	28
15501	BIG LEAF MAPLE	18
15502	HAZELNUT	6
15503	HAZELNUT	6
15504	HAZELNUT	6
15505	HAZELNUT	6
15538	DOUGLAS FIR	6
15539	DOUGLAS FIR	15
15540	DOUGLAS FIR	24
15541	DOUGLAS FIR	20
15542	CEDAR	15
15543	DOUGLAS FIR	6
15544	DOUGLAS FIR	6
15545	DOUGLAS FIR	8
15546	DOUGLAS FIR	10
15547	DOUGLAS FIR	6
15548	DOUGLAS FIR	6
15549	DOUGLAS FIR	6
15550	DOUGLAS FIR	6
15551	DOUGLAS FIR	10
15552	DOUGLAS FIR	15
15553	DOUGLAS FIR	10
15554	DOUGLAS FIR	10
15555	DOUGLAS FIR	21
15556	DOUGLAS FIR	10
15557	DOUGLAS FIR	15
15558	DOUGLAS FIR	10
15559	DOUGLAS FIR	8
15560	DOUGLAS FIR	8
15561	DOUGLAS FIR	8
15562	DOUGLAS FIR	16
15563	DOUGLAS FIR	8
15564	DOUGLAS FIR	10
15565	DOUGLAS FIR	8
15566	DOUGLAS FIR	15
15567	DOUGLAS FIR	12
15568	DOUGLAS FIR	6
15569	DOUGLAS FIR	10
15570	DOUGLAS FIR	10
15571	DOUGLAS FIR	6
15572	DOUGLAS FIR	10
15573	DOUGLAS FIR	15
15574	DOUGLAS FIR	6
15575	DOUGLAS FIR	12
15576	DOUGLAS FIR	15
15577	DOUGLAS FIR	10
15578	DOUGLAS FIR	15
15579	DOUGLAS FIR	24
15580	DOUGLAS FIR	30
15581	DOUGLAS FIR	6
15582	DOUGLAS FIR	8
15583	DOUGLAS FIR	8
15584	DOUGLAS FIR	10
15585	DOUGLAS FIR	6
15586	DOUGLAS FIR	6
15587	DOUGLAS FIR	6
15588	DOUGLAS FIR	8
15589	DOUGLAS FIR	12
15590	DOUGLAS FIR	10
15591	DOUGLAS FIR	10
15592	DOUGLAS FIR	6
15593	DOUGLAS FIR	12
15594	DOUGLAS FIR	8
15595	DOUGLAS FIR	10
15596	DOUGLAS FIR	6

TREE NUMBER	SPECIES	DBH (IN
15597	DOUGLAS FIR	6
15598	DOUGLAS FIR	12
15599	DOUGLAS FIR	12
15600	DOUGLAS FIR	6
15601	DOUGLAS FIR	14
15602	DOUGLAS FIR	6
15603	ALDER	6
15604	ALDER	8
15605	ALDER	8
15606	DOUGLAS FIR	12
15607	DOUGLAS FIR	10
15608	DOUGLAS FIR	18
15609	DOUGLAS FIR	17
15610	DOUGLAS FIR	12
15611	DOUGLAS FIR	8
15612	DOUGLAS FIR	8
15613	DOUGLAS FIR	10
15614	DOUGLAS FIR	6
15615	DOUGLAS FIR	10
15616	DOUGLAS FIR	6
15617	DOUGLAS FIR	6
15618	DOUGLAS FIR	8
15619	DOUGLAS FIR	12
15620	DOUGLAS FIR	15
15621	DOUGLAS FIR	12
15622	DOUGLAS FIR	6
15623	DOUGLAS FIR	6
15624	DOUGLAS FIR	6
15625	DOUGLAS FIR	8
15626	DOUGLAS FIR	10
15627	ALDER	6
15628	DOUGLAS FIR	8
15629	DOUGLAS FIR	8
15630	DOUGLAS FIR	12
15631	DOUGLAS FIR	13
15632	DOUGLAS FIR	10
15633	DOUGLAS FIR	8
15634	ALDER	8
15635	DOUGLAS FIR	6
15636	DOUGLAS FIR	8
15637	DOUGLAS FIR	10
15638	DOUGLAS FIR	15
15639	DOUGLAS FIR	10
15640	DOUGLAS FIR	10
15641	DOUGLAS FIR	12
15642	DOUGLAS FIR	12
15643	DOUGLAS FIR	10
15644	DOUGLAS FIR	12
15645	DOUGLAS FIR	12
15646	DOUGLAS FIR	10
15647	DOUGLAS FIR	10
15648	DOUGLAS FIR	10
15649	DOUGLAS FIR	12
15650	DOUGLAS FIR	12
15651	DOUGLAS FIR	18
15652	DOUGLAS FIR	24
15653	DOUGLAS FIR	12
15654	DOUGLAS FIR	15
15655	DOUGLAS FIR	16
15656	DOUGLAS FIR	14
15657	DOUGLAS FIR	18
15658	DOUGLAS FIR	15
15659	DOUGLAS FIR	18
15660	DOUGLAS FIR	15
15661	DOUGLAS FIR	8
15662	DOUGLAS FIR	6
15663	DOUGLAS FIR	12
15664	DOUGLAS FIR	12
15665	DOUGLAS FIR	15
15666	DOUGLAS FIR	10
15667	DOUGLAS FIR	10
15668	DOUGLAS FIR	10
15669	DOUGLAS FIR	10
15670	DOUGLAS FIR	8
15671	DOUGLAS FIR	8
15672	DOUGLAS FIR	10
15673	DOUGLAS FIR	10
15674	DOUGLAS FIR	10
15675	DOUGLAS FIR	8
15676	DOUGLAS FIR	6
15677	DOUGLAS FIR	8
15678	DOUGLAS FIR	8
15679	DOUGLAS FIR	10
15680	DOUGLAS FIR	8
15681	DOUGLAS FIR	11
15682	DOUGLAS FIR	12
15683	DOUGLAS FIR	6
15684	DOUGLAS FIR	6
15685	DOUGLAS FIR	6
15686	DOUGLAS FIR	17
15687	DOUGLAS FIR	11
15688	DOUGLAS FIR	15
15689	DOUGLAS FIR	9
15690	DOUGLAS FIR	12
15691	DOUGLAS FIR	6
15692	DOUGLAS FIR	9
15693	DOUGLAS FIR	6
15694	DOUGLAS FIR	6
15695	DOUGLAS FIR	6
15696	DOUGLAS FIR	6
15697	DOUGLAS FIR	6
15698	DOUGLAS FIR	6
15699	DOUGLAS FIR	6
15730	ALDER	6
15739	PINE	18
15710	DOUGLAS FIR	32
15740	ALDER	12
15738	UNKNOWN DECID.	9
15739	BIG LEAF MAPLE	12

TREE NUMBER	SPECIES	DBH (IN)
15762	ALDER	12
15763	UNKNOWN DECID.	10
15765	CEDAR	12
15766	UNKNOWN DECID.	8
15767	DOUGLAS FIR	17
15768	CEDAR	24
15769	DOUGLAS FIR	14
15770	DOUGLAS FIR	25
15802	ELM	8
15841	UNKNOWN DECID.	8
15842	BIG LEAF MAPLE	48
15849	CEDAR	17
15862	CEDAR	12
15868	CEDAR	16
15869	PINE	11
15870	PINE	23
15871	PINE	17
15872	BIG LEAF MAPLE	16
15873	DOUGLAS FIR	20
15874	PINE	12
15875	DOUGLAS FIR	22
15876	DOUGLAS FIR	24
15877	DOUGLAS FIR	16
15878	CEDAR	17
15879	ALDER	17
15880	DOUGLAS FIR	18
15881	BIRCH	15
15882	DOUGLAS FIR	20
15883	DOUGLAS FIR	24
15884	PINE	23
15885	DOUGLAS FIR	18
15886	UNKNOWN DECID.	13
15887	DOUGLAS FIR	25
15888	ALDER	13
15889	DOUGLAS FIR	16
15890	DOUGLAS FIR	36
15891	HOLLY	8
15892	ALDER	13
15893	ALDER	19
15894	DOUGLAS FIR	24
15895	ALDER	19
15896	BIG LEAF MAPLE	16
15897	DOUGLAS FIR	36
15898	DOUGLAS FIR	33
15899	DOUGLAS FIR	30
15900	DOUGLAS FIR	10
15901	BIG LEAF MAPLE	10
15902	BIG LEAF MAPLE	31
15903	BIG LEAF MAPLE	14
15904	BIG LEAF MAPLE	23
15905	CEDAR	10
15907	BIG LEAF MAPLE	17
15908	BIG LEAF MAPLE	20
15909	UNKNOWN DECID.	17
15910	BIG LEAF MAPLE	14,15
15911	ALDER	19
15912	ALDER	18
15913	BIG LEAF MAPLE	9,11,19,16
15914	ALDER	8
15915	CEDAR	17
15916	ALDER	16
15918	ALDER	22
15919	ALDER	36
15920	ALDER	10
15921	ALDER	11
15930	BIG LEAF MAPLE	22
15931	BIG LEAF MAPLE	24
15932	BIG LEAF MAPLE	27
15933	BIG LEAF MAPLE	24
15934	BIG LEAF MAPLE	19
15935	BIG LEAF MAPLE	30
15936	BIG LEAF MAPLE	19
15937	ALDER	17
15938	BIG LEAF MAPLE	19
15939	UNKNOWN DECID.	12
15940	UNKNOWN DECID.	12
15941	UNKNOWN DECID.	12
15942	UNKNOWN DECID.	12
15943	ALDER	14
15950	ALDER	16
15951	BIG LEAF MAPLE	20
15952	DOUGLAS FIR	12
15953	DOUGLAS FIR	18
15954	ALDER	10
15955	ALDER	11
15956	DOUGLAS FIR	17
15957	CHERRY	8

REVISIONS:

EXISTING CONDITIONS TREE TABLE

ENGINEERING • PLANNING • SURVEYING
FORESTRY • LANDSCAPE ARCHITECTURE

AKS ENGINEERING AND FORESTRY, LLC
12965 SW HERMAN ROAD, SUITE 100
TUALATIN, OR 97062
PHONE: 503.563.6151
FAX: 503.563.6152
www.aks-eng.com

Offices Located In:
TUALATIN, OREGON
SALEM, OREGON
VANCOUVER, WASHINGTON

DESIGNED BY: MBH
DRAWN BY: JRN
CHECKED BY: MBH

DRAWING NO.: E2-C001-C004.DWG
SCALE: AS NOTED

PREPARED FOR:
LENNAR CORPORATION
11807 NE 99TH ST, SUITE 1170
VANCOUVER, WA 98682

VISTA LOOP SOUTH

CITY OF SANDY
TAX LOTS 900 AND 1000

OREGON
CLACKAMAS COUNTY TAX MAP 2-5E-18CD

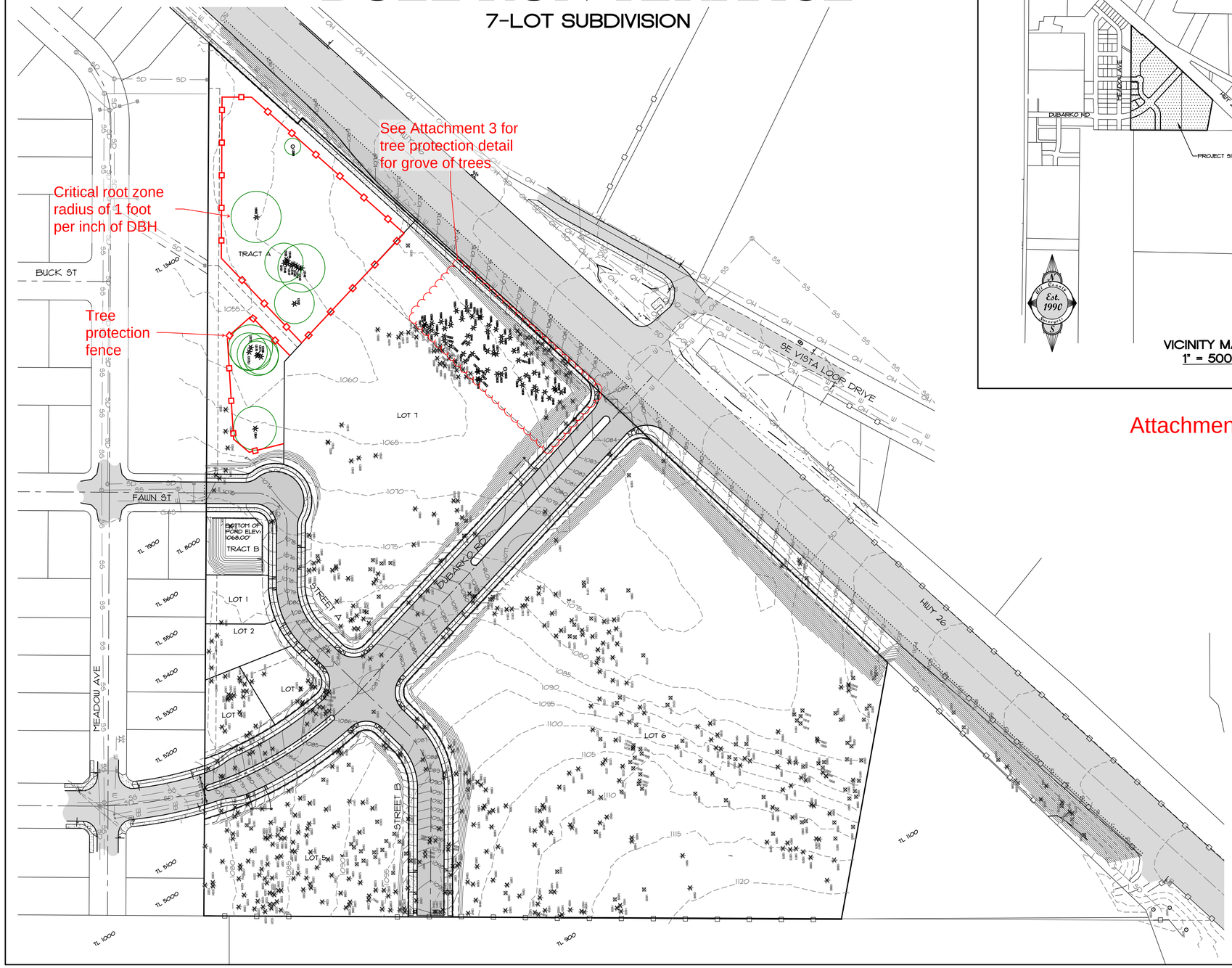
DATE: 06/13/2014
RENEWAL DATE: 6/30/15

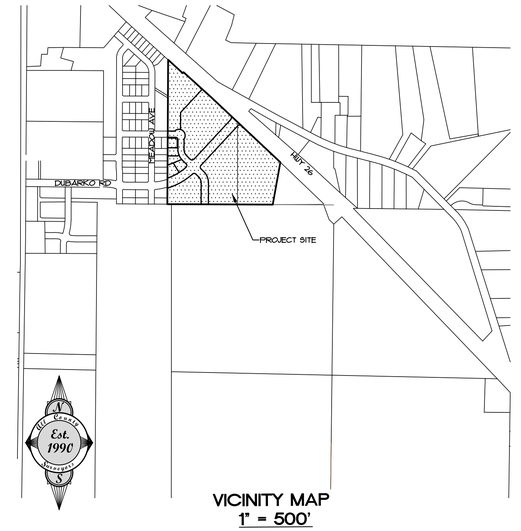
JOB NUMBER 3603

SHEET C004

BULL RUN TERRACE

7-LOT SUBDIVISION





VICINITY MAP
1" = 500'

Attachment 2

SHEET	1	OF	1

DATE	NO.	REVISION	BY
-	-	-	-

DESIGNED: CTH
DRAWN: CTH
CHECKED: RLM
APPROVED: RLM

REGISTERED PROFESSIONAL ENGINEER
RAY L. MOORE
RENEWAL DATE: 12/31/2020

SCALE: VERT: N/A HORIZ: 1"=60'
DATE: 07/26/2018
FILE: 19-035-Planning.dwg

LEGAL		
SECTION	TWP.	RANGE
18	2S	5E

PROJECT: BULL RUN TERRACE SUBDIVISION

TREE RETENTION EXHIBIT

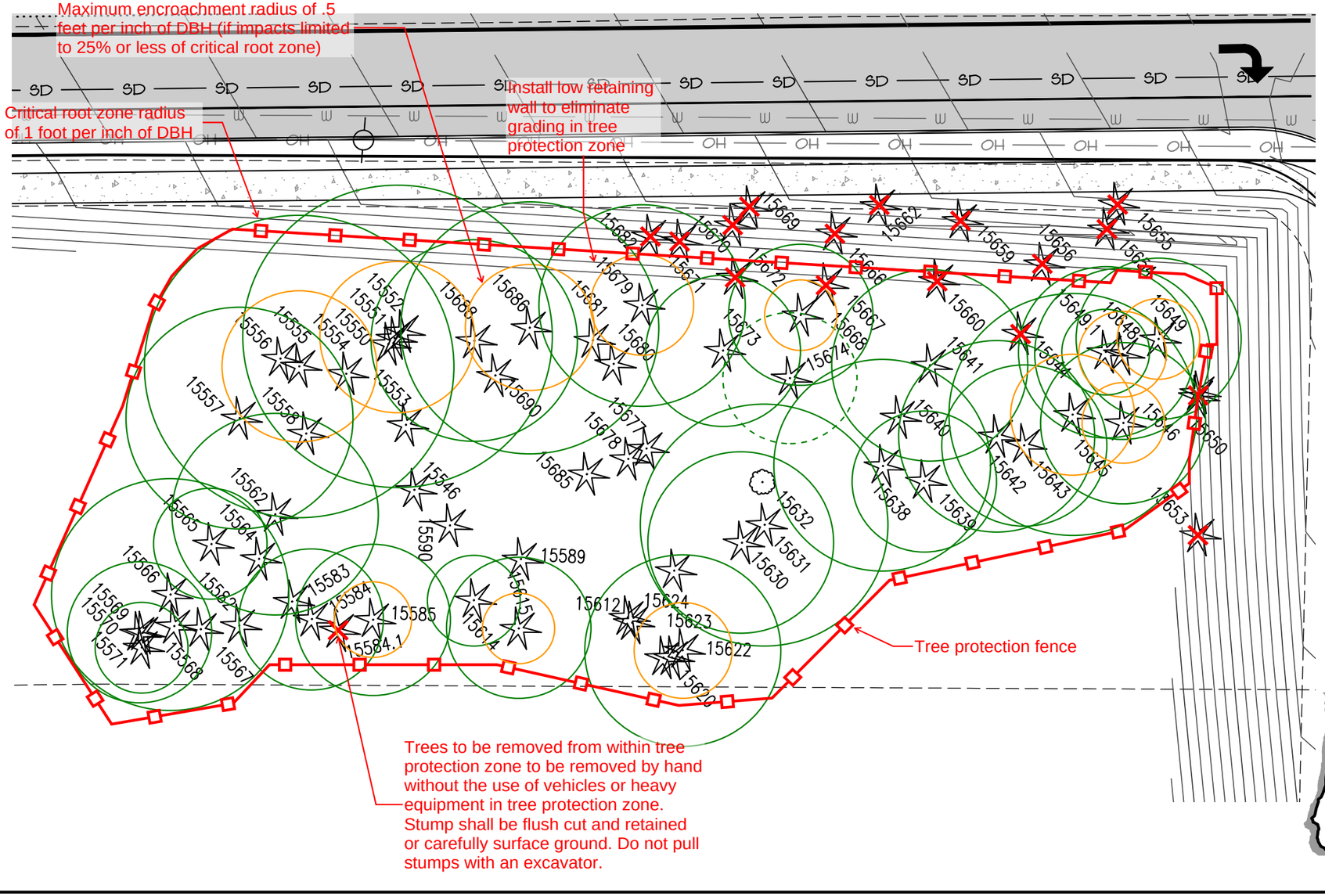
LOCATION: 40808 & 41010 HWY 26, SANDY, OR 97055

Surveyors & Planners, Inc.
Surveying, Planning and Civil Engineering
P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
Fax: (503) 668-4730

DATE OF PLOT 12/13/2019

CLIENT: ROLL TIDE PROPERTIES CORPORATION
PO BOX 703
CORNELIUS, OR 97113

GROVE DETAIL



SCALE : 1" = 20'

0' 10' 20' 40'

Attachment 3

All County Surveyors & Planners, Inc.
Surveying, Planning
and Civil Engineering
P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
Fax: (503) 668-4730
Subject to General Conditions 2006 ©

19-035-Planning.dwg
DATE OF PLOT: 9/10/19

Attachment 4

Tree No	Common Name	Scientific Name	DBH[1]	C-Rad[2]	Condition[3]	Structure[3]	Comments	Treatment	Onsite Trees >11" DBH in Good Cond. to be Retained
13096	Douglas-fir	*Pseudotsuga menziesii*	11	10	good	good		retain	x
13134	bigleaf maple	*Acer macrophyllum*	55	38	good	fair	open grown, multiple leaders at 10', cable constricting lower trunk	remove	
13142	Douglas-fir	*Pseudotsuga menziesii*	32	28	fair	fair	one sided, codominant at 5' with included bark, 70% girdled at lower trunk	retain	
13143	Douglas-fir	*Pseudotsuga menziesii*	13	13	fair	poor	overtopped by adjacent trees, poor trunk taper	retain	
13144	Douglas-fir	*Pseudotsuga menziesii*	34	23	good	fair	multiple leaders at 5' with included bark, one sided, west 10" leader dead	retain	x
13145	Douglas-fir	*Pseudotsuga menziesii*	14	5	fair	poor	overtopped by adjacent trees, poor trunk taper	retain	
13146	Douglas-fir	*Pseudotsuga menziesii*	26	23	good	fair	one sided	retain	x
13147	Douglas-fir	*Pseudotsuga menziesii*	15	19	good	fair	one sided, marginal trunk taper	retain	x
13148	Douglas-fir	*Pseudotsuga menziesii*	25	24	good	fair	one sided	retain	x
13149	Douglas-fir	*Pseudotsuga menziesii*	17	20	poor	poor	overtopped by adjacent trees, one sided, suppressed	retain	
13150	Douglas-fir	*Pseudotsuga menziesii*	22	30	good	fair	one sided	retain	x
13151	Douglas-fir	*Pseudotsuga menziesii*	24,12	25	good	fair	one sided, codominant at ground level	retain	x
13152	Douglas-fir	*Pseudotsuga menziesii*	37	26	good	fair	open grown, multiple leaders at 25'	retain	x
13169	Douglas-fir	*Pseudotsuga menziesii*	24	24	good	fair	one sided	retain	x
13170	Douglas-fir	*Pseudotsuga menziesii*	19	20	good	fair	one sided	retain	x
13171	western redcedar	*Thuja plicata*	28	20	good	fair	moderately one sided	retain	x
13172	western redcedar	*Thuja plicata*	30	17	good	fair	one sided, pressed against trees 13172.1	retain	x
13172.1	Douglas-fir	*Pseudotsuga menziesii*	25	21	good	fair	one sided, pressed against trees 13172	retain	x
13538	western redcedar	*Thuja plicata*	39	24	good	fair	codominant at 6' with included bark	remove	
13539	Douglas-fir	*Pseudotsuga menziesii*	32	23	good	fair	moderately one sided	remove	
13540	western redcedar	*Thuja plicata*	37,33	29	good	fair	codominant at 3' with included bark	remove	
13541	western redcedar	*Thuja plicata*	29	21	good	good		retain	x
13653	Douglas-fir	*Pseudotsuga menziesii*	11	15	fair	fair	thin crown, large wound at lower trunk	remove	
15500	Douglas-fir	*Pseudotsuga menziesii*	34	21	good	good		retain	x
15546	Douglas-fir	*Pseudotsuga menziesii*	15	15	good	poor	25% live crown ratio, poor trunk taper	retain	x
15550	Douglas-fir	*Pseudotsuga menziesii*	6	0	very poor	very poor	dead	retain	
15551	Douglas-fir	*Pseudotsuga menziesii*	30	15	good	fair	codominant at 1', west stem has 33% live crown ratio	retain	x
15552	n/a	n/a	n/a	n/a	n/a	n/a	same as tree 15551	n/a	n/a
15553	Douglas-fir	*Pseudotsuga menziesii*	13	15	good	poor	25% live crown ratio, poor trunk taper	retain	x
15554	Douglas-fir	*Pseudotsuga menziesii*	11	10	fair	poor	poor trunk taper, suppressed	retain	
15555	Douglas-fir	*Pseudotsuga menziesii*	30	25	good	fair	moderately one sided	retain	x

Teragan Associates, Inc.
3145 Westview Circle • Lake Oswego, OR 97034
Phone: 971.295.4835 • Fax: 503.697.1976
Email: todd@teragan.com • Website: teragan.com

Attachment 4

Tree No	Common Name	Scientific Name	DBH[1]	C-Rad[2]	Condition[3]	Structure[3]	Comments	Treatment	Onsite Trees >11" DBH in Good Cond. to be Retained
15556	Douglas-fir	*Pseudotsuga menziesii*	12	10	poor	poor	overtopped by adjacent trees, suppressed	retain	
15557	grand fir	*Abies grandis*	22	20	good	fair	one sided, codominant at 30' with included bark	retain	x
15558	Douglas-fir	*Pseudotsuga menziesii*	12	15	good	poor	33% live crown ratio, poor trunk taper	retain	x
15562	Douglas-fir	*Pseudotsuga menziesii*	20	15	good	fair	40% live crown ratio, marginal trunk taper	retain	x
15564	Douglas-fir	*Pseudotsuga menziesii*	14	15	good	poor	marginal trunk taper, 33% live crown ratio	retain	x
15565	Douglas-fir	*Pseudotsuga menziesii*	11	15	fair	fair	one sided, marginal trunk taper, 5" codominant dead stem at 3'	retain	
15566	Douglas-fir	*Pseudotsuga menziesii*	23	20	good	fair	one sided	retain	x
15567	Douglas-fir	*Pseudotsuga menziesii*	17	15	good	fair	marginal trunk taper, 40% live crown ratio	retain	x
15568	Douglas-fir	*Pseudotsuga menziesii*	7	0	very poor	very poor	dead	retain	
15569	Douglas-fir	*Pseudotsuga menziesii*	11	8	fair	poor	poor trunk taper	retain	
15570	Douglas-fir	*Pseudotsuga menziesii*	14	15	fair	fair	one sided, overtopped by adjacent trees	retain	
15571	Douglas-fir	*Pseudotsuga menziesii*	9	5	fair	poor	poor trunk taper, suppressed	retain	
15582	Douglas-fir	*Pseudotsuga menziesii*	10	5	fair	poor	poor trunk taper, suppressed	retain	
15583	Douglas-fir	*Pseudotsuga menziesii*	13	15	good	poor	poor trunk taper, 25% live crown ratio	retain	x
15584	Douglas-fir	*Pseudotsuga menziesii*	14	15	good	fair	marginal trunk taper, 40% live crown ratio	retain	x
15584.1	Douglas-fir	*Pseudotsuga menziesii*	8	0	very poor	very poor	dead	remove	
15585	Douglas-fir	*Pseudotsuga menziesii*	15	20	good	poor	35% live crown ratio, poor trunk taper	retain	x
15589	Douglas-fir	*Pseudotsuga menziesii*	18	20	good	poor	33% live crown ratio, marginal trunk taper	retain	x
15590	Douglas-fir	*Pseudotsuga menziesii*	13	15	good	poor	35% live crown ratio, poor trunk taper	retain	x
15612	Douglas-fir	*Pseudotsuga menziesii*	9	0	very poor	very poor	dead	retain	
15614	Douglas-fir	*Pseudotsuga menziesii*	9	10	fair	poor	25% live crown ratio, poor trunk taper	retain	
15615	Douglas-fir	*Pseudotsuga menziesii*	14	15	good	poor	25% live crown ratio, poor trunk taper	retain	x
15619	Douglas-fir	*Pseudotsuga menziesii*	20,16	20	good	fair	codominant at ground level with included bark, marginal trunk taper	retain	x
15620	n/a	n/a	n/a	n/a	n/a	n/a	same as tree 15619	n/a	n/a
15621	n/a	n/a	n/a	n/a	n/a	n/a	duplicate tree point?	n/a	n/a
15622	Douglas-fir	*Pseudotsuga menziesii*	19	20	good	fair	one sided, bowed trunk, marginal trunk taper	retain	x
15623	Douglas-fir	*Pseudotsuga menziesii*	8	10	good	poor	one sided, poor trunk taper	retain	
15624	Douglas-fir	*Pseudotsuga menziesii*	9	0	very poor	very poor	dead	retain	
15630	Douglas-fir	*Pseudotsuga menziesii*	18	20	good	fair	one sided	retain	x
15631	Douglas-fir	*Pseudotsuga menziesii*	24	20	good	fair	one sided	retain	x
15632	Douglas-fir	*Pseudotsuga menziesii*	13	15	good	poor	40% live crown ratio, poor trunk taper	retain	x
15638	Douglas-fir	*Pseudotsuga menziesii*	21	20	good	fair	one sided	retain	x
15639	Douglas-fir	*Pseudotsuga menziesii*	14	15	good	fair	one sided, marginal trunk taper, bowed trunk	retain	x

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Attachment 4

Tree No	Common Name	Scientific Name	DBH[1]	C-Rad[2]	Condition[3]	Structure[3]	Comments	Treatment	Onsite Trees >11" DBH in Good Cond. to be Retained
15640	Douglas-fir	*Pseudotsuga menziesii*	15	15	good	fair	one sided, 70% live crown ratio, marginal trunk taper	retain	x
15641	Douglas-fir	*Pseudotsuga menziesii*	19	20	good	fair	40% live crown ratio, marginal trunk taper	retain	x
15642	Douglas-fir	*Pseudotsuga menziesii*	19	15	good	fair	moderately one sided, marginal trunk taper, 50% live crown ratio	retain	x
15643	Douglas-fir	*Pseudotsuga menziesii*	16	15	good	fair	one sided	retain	x
15644	Douglas-fir	*Pseudotsuga menziesii*	17	20	good	poor	33% live crown ratio, marginal trunk taper	remove	
15645	Douglas-fir	*Pseudotsuga menziesii*	24	25	good	fair	one sided	retain	x
15646	Douglas-fir	*Pseudotsuga menziesii*	16	15	good	fair	one sided	retain	x
15648	Douglas-fir	*Pseudotsuga menziesii*	17	15	good	fair	one sided, 60% live crown ratio, marginal trunk taper	retain	x
15649	Douglas-fir	*Pseudotsuga menziesii*	16	20	good	fair	one sided, marginal trunk taper	retain	x
15649.1	Douglas-fir	*Pseudotsuga menziesii*	17	20	good	fair	moderately one sided, marginal trunk taper	retain	x
15650	Douglas-fir	*Pseudotsuga menziesii*	23,16	25	good	fair	codominant at ground level, north stem has poor trunk taper	remove	
15651	n/a	n/a	n/a	n/a	n/a	n/a	same as tree 15650	n/a	n/a
15654	Douglas-fir	*Pseudotsuga menziesii*	21	20	good	fair	one sided, codominant at 12' with included bark	remove	
15655	Douglas-fir	*Pseudotsuga menziesii*	24	25	good	fair	one sided	remove	
15656	Douglas-fir	*Pseudotsuga menziesii*	16	15	good	fair	marginal trunk taper, 40% live crown ratio	remove	
15659	Douglas-fir	*Pseudotsuga menziesii*	21	20	good	fair	moderately one sided, 6" dead codominant stem at base of trunk	remove	
15660	Douglas-fir	*Pseudotsuga menziesii*	19	20	good	fair	35% live crown ratio, marginal trunk taper, dead 8" codominant stem at 15'	remove	
15662	Douglas-fir	*Pseudotsuga menziesii*	8	0	very poor	very poor	dead	remove	
15666	Douglas-fir	*Pseudotsuga menziesii*	13	15	good	fair	marginal trunk taper, 35% live crown ratio	remove	
15667	Douglas-fir	*Pseudotsuga menziesii*	16	15	good	fair	40% live crown ratio, marginal trunk taper	remove	
15668	Douglas-fir	*Pseudotsuga menziesii*	14	15	good	fair	40% live crown ratio, marginal trunk taper	retain	x
15669	Douglas-fir	*Pseudotsuga menziesii*	15	15	good	fair	one sided, overtopped by adjacent trees	remove	
15670	Douglas-fir	*Pseudotsuga menziesii*	23	20	good	fair	moderately one sided	remove	
15671	Douglas-fir	*Pseudotsuga menziesii*	10	10	good	poor	one sided, poor trunk taper	remove	
15672	Douglas-fir	*Pseudotsuga menziesii*	15	20	good	poor	33% live crown ratio, marginal trunk taper	remove	
15673	Douglas-fir	*Pseudotsuga menziesii*	15	15	good	fair	35% live crown ration, marginal trunk taper	retain	x
15674	Douglas-fir	*Pseudotsuga menziesii*	13	10	good	poor	25% live crown ratio, poor trunk taper	retain	x
15677	Douglas-fir	*Pseudotsuga menziesii*	13	10	good	poor	25% live crown ratio, poor trunk taper	retain	x
15678	Douglas-fir	*Pseudotsuga menziesii*	14	10	good	poor	33% live crown ratio, poor trunk taper	retain	x

Teragan Associates, Inc.
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Email: todd@teragan.com • Website: teragan.com

Attachment 4

Tree No	Common Name	Scientific Name	DBH[1]	C-Rad[2]	Condition[3]	Structure[3]	Comments	Treatment	Onsite Trees >11" DBH in Good Cond. to be Retained
15679	Douglas-fir	*Pseudotsuga menziesii*	16,12	20	good	fair	codominant at ground level with included bark, south stem has marginal trunk taper with 25% live crown ratio	retain	x
15680	Douglas-fir	*Pseudotsuga menziesii*	11	10	good	poor	25% live crown ratio, poor trunk taper	retain	x
15681	Douglas-fir	*Pseudotsuga menziesii*	14	10	good	poor	poor trunk taper, 20% live crown ratio	retain	x
15682	Douglas-fir	*Pseudotsuga menziesii*	26	20	good	fair	one sided	remove	
15685	Douglas-fir	*Pseudotsuga menziesii*	22	20	good	fair	moderately one sided	retain	x
15686	Douglas-fir	*Pseudotsuga menziesii*	25	25	good	fair	one sided	retain	x
15688	Douglas-fir	*Pseudotsuga menziesii*	20	20	good	fair	marginal trunk taper, 50% live crown ratio	retain	x
15690	Douglas-fir	*Pseudotsuga menziesii*	16	20	good	poor	33% live crown ratio, poor trunk taper	retain	x

[1]**DBH** is the trunk diameter in inches measured in accordance with International Society of Arboriculture standards.

[2]**C-Rad** is the approximate crown radius in feet.

[2]**Condition** and **Structure** ratings range from very poor, poor, fair, to good.

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Attachment 5
Additional Tree Protection Recommendations

The following recommendations meet or exceed City of Sandy Code requirements:

Before Construction Begins

1. Notify all contractors of tree protection procedures. For successful tree protection on a construction site, all contractors must know and understand the goals of tree protection.
    a. Hold a tree protection meeting with all contractors to explain the goals of tree protection.
    c. Have all contractors sign memoranda of understanding regarding the goals of tree protection. The memoranda should include a penalty for violating the tree protection plan. The penalty should equal the resulting fines issued by the local jurisdiction plus the appraised value of the tree(s) within the violated tree protection zone per the current Trunk Formula Method as outline in the current edition of the ***Guide for Plant Appraisal*** by the Council of Tree & Landscape Appraisers. The penalty should be paid to the owner of the property.
2. Fencing
    a. Trees to remain in the grove should be protected by installation of tree protection fencing as shown in Attachments 2 and 3.
    b. The fencing should be put in place before the ground is cleared in order to protect the trees and the soil around the trees from disturbances.
    c. Fencing should be established by the project arborist based on the needs of the trees to be protected and to facilitate construction.
    d. Fencing should consist of 6-foot high steel fencing on concrete blocks or 6-foot metal fencing secured to the ground with 8-foot metal posts placed no farther than ten feet apart to prevent it from being moved by contractors, sagging, or falling down.
    e. Fencing should remain in the position that is established by the project arborist and not be moved without approval from the project arborist until final project approval.
3. Signage
    a. All tree protection fencing should have signage as follows so that all contractors understand the purpose of the fencing:

> **TREE PROTECTION ZONE**
>
> **DO NOT REMOVE OR ADJUST THE APPROVED LOCATION OF THIS TREE PROTECTION FENCING.**
>
> Please contact the project arborist if alterations to the approved location of the tree protection fencing are necessary.
>
> Todd Prager, Project Arborist - 971-295-4835

    b. Signage should be placed every 75-feet or less.

Teragan & Associates, Inc.
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During Construction

1. Protection Guidelines Within the Tree Protection Zones:
    a. No new buildings; grade change or cut and fill, during or after construction; new impervious surfaces; or utility or drainage field placement should be allowed within the tree protection zones.
    b. No traffic should be allowed within the tree protection zones. This includes but is not limited to vehicle, heavy equipment, or even repeated foot traffic.
    c. No storage of materials including but not limiting to soil, construction material, or waste from the site should be permitted within the tree protection zones. Waste includes but is not limited to concrete wash out, gasoline, diesel, paint, cleaner, thinners, etc.
    d. Construction trailers should not to be parked/placed within the tree protection zones.
    e. No vehicles should be allowed to park within the tree protection zones.
    f. No other activities should be allowed that will cause soil compaction within the tree protection zones.
2. The trees should be protected from any cutting, skinning or breaking of branches, trunks or woody roots.
3. The project arborist should be notified prior to the cutting of woody roots from trees that are to be retained to evaluate and oversee the proper cutting of roots with sharp cutting tools. Cut roots should be immediately covered with soil or mulch to prevent them from drying out.
4. Trees that have roots cut should be provided supplemental water during the summer months.
5. Any necessary passage of utilities through the tree protection zones should be by means of tunneling under woody roots by hand digging or boring with oversight by the project arborist.
6. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

After Construction

1. Carefully landscape the areas within the tree protection zones. Do not allow trenching for irrigation or other utilities within the tree protection zones.
2. Carefully plant new plants within the tree protection zones. Avoid cutting the woody roots of trees that are retained.
3. Do not install permanent irrigation within the tree protection zones unless it is drip irrigation to support a specific planting or the irrigation is approved by the project arborist.
4. Provide adequate drainage within the tree protection zones and do not alter soil hydrology significantly from existing conditions for the trees to be retained.
5. Provide for the ongoing inspection and treatment of insect and disease populations that are capable of damaging the retained trees and plants.
6. The retained trees may need to be fertilized if recommended by the project arborist.
7. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

Attachment 6
Assumptions and Limiting Conditions

1. Any legal description provided to the consultant is assumed to be correct. The site plans and other information provided by Roll Tide Corporation and their consultants was the basis of the information provided in this report.
2. It is assumed that this property is not in violation of any codes, statutes, ordinances, or other governmental regulations.
3. The consultant is not responsible for information gathered from others involved in various activities pertaining to this project. Care has been taken to obtain information from reliable sources.
4. Loss or alteration of any part of this delivered report invalidates the entire report.
5. Drawings and information contained in this report may not be to scale and are intended to be used as display points of reference only.
6. The consultant's role is only to make recommendations. Inaction on the part of those receiving the report is not the responsibility of the consultant.
7. The purpose of this report is to:
   - Assess the existing grove of trees along Highway 26;
   - Identify the trees to be removed and retained in the grove;
   - Identify trees that are in good condition within the park tract within the northwest portion of the site; and
   - Provide tree protection recommendations for the trees to be retained in the grove.

TERAGAN & ASSOCIATES, INC.
ARBORICULTURAL CONSULTANTS

MEMORANDUM

DATE: September 15, 2020

TO: Alex Reverman (Roll Tide Corporation)

FROM: Todd Prager, RCA #597, ISA Board Certified Master Arborist

RE: Additional Tree Preservation at the Dubarko Road Subdivision and Condominiums

Summary

This report includes recommendations for preserving additional trees along the west property line at the proposed Dubarko Road Subdivision and Condominiums in Sandy, Oregon.

Background

Teragan & Associates prepared an arborist report dated December 14, 2019 with a tree assessment, preservation, removal, and protection recommendations for the Dubarko Road Subdivision and Condominiums project.

Roll Tide Corporation has requested my review and recommendations regarding the preservation of additional trees along the west property line of the site.

Tree Assessment

On September 15, 2020, I assessed the additional trees along the west property line of the site. Attachment 1 is a site plan with the tree locations and Attachment 2 is a summary of my assessment data for each tree.

Of the six trees that I assessed, all but one (tree 13438) can be retained and protected according to the recommendations in the next section of this report.

Teragan & Associates, Inc.
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Phone: 971.295.4835 • Fax: 503.697.1976
Email: todd@teragan.com • Website: teragan.com

Tree Protection Recommendations

The standard tree protection requirements in the City of Sandy Code range from at least 10 feet from the trunks of retained trees (SDC 17.102.50.B.1) to five feet beyond the driplines (SDC 17.92.10.D) unless otherwise approved by the Planning Director.

A typical alternative minimum protection zone allows encroachments no closer than a radius from a tree of .5 feet per inch of DBH as long as no more than 25 percent of the critical root protection zone area (estimated at one foot radius per inch of DBH) is impacted. Figure 1 illustrates this concept.

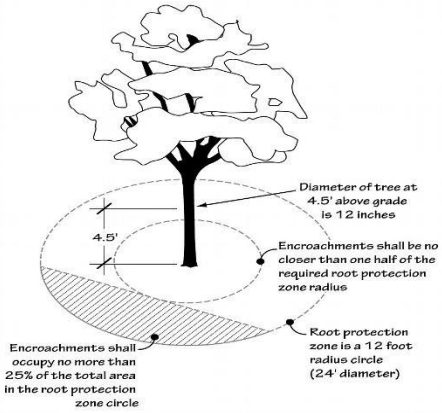

Figure 1: Alterative minimum protection zone

The critical root zone radii of 1 foot per inch of DBH and typical minimum construction setback of .5 feet per inch of DBH is shown for the trees to be retained along the west property line in Attachment 1. The trees to be retained will have at least 75 percent of their critical roots zones radii protected from construction. However, trees 13421 and 13423 will have encroachments for construction of the driveway for lot 4 closer than a radius of .5 feet per inch of DBH from their trunks.

Even with the driveway construction, the trees along the west property line can be retained and protected as follows:

- *Tree Protection Fencing*: Establish tree protection fencing in the locations shown in Attachment 1. Required fencing shall be a minimum of six feet tall supported with metal posts placed no farther than ten feet apart installed flush with the initial undisturbed grade.
- *Directional Felling*: Fell the trees to be removed away from the trees to be retained so they do not contact or otherwise damage the trunks or branches of the trees to be retained. No vehicles or heavy equipment shall be permitted within the tree protection zones during tree removal operations.
- *Stump Removal*: The stump of the tree 13438 shall be stump ground to protect the root systems of the trees to be retained.
- *Curb/Pavement Construction*: Construction of the new curb/paving in the tree protection zone of trees 13421 and 13423 shall occur under project arborist supervision. Use extruded curbs and a modified pavement profile as shown in Figure 1 for new pavement in the tree protection zones.

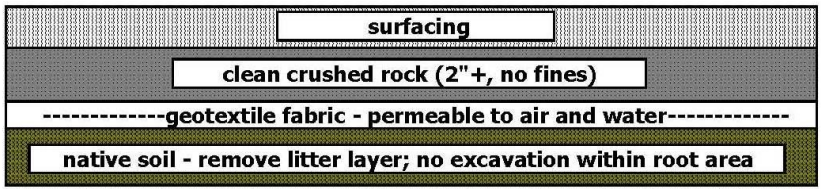

Figure 1. Sample profile for areas within tree protection zones. Depth of rock is dependent on grading.

The additional tree protection recommendations from my December 14, 2019 report are provided in Attachment 3.

Conclusion

Five of the six additional trees along the west property line of the site can be retained and protected according to the recommendations in this report.

Please contact me if you have questions, concerns, or need any additional information.

Sincerely,

Todd Prager

Todd Prager
ASCA Registered Consulting Arborist #597
ISA Board Certified Master Arborist, WE-6723B
ISA Qualified Tree Risk Assessor
AICP, American Planning Association

Attachments: Attachment 1 - Site Plan with Additional Tree Removal and Retention
Attachment 2 - Additional Tree Inventory
Attachment 3 - Tree Protection Recommendations
Attachment 4 - Assumptions and Limiting Conditions

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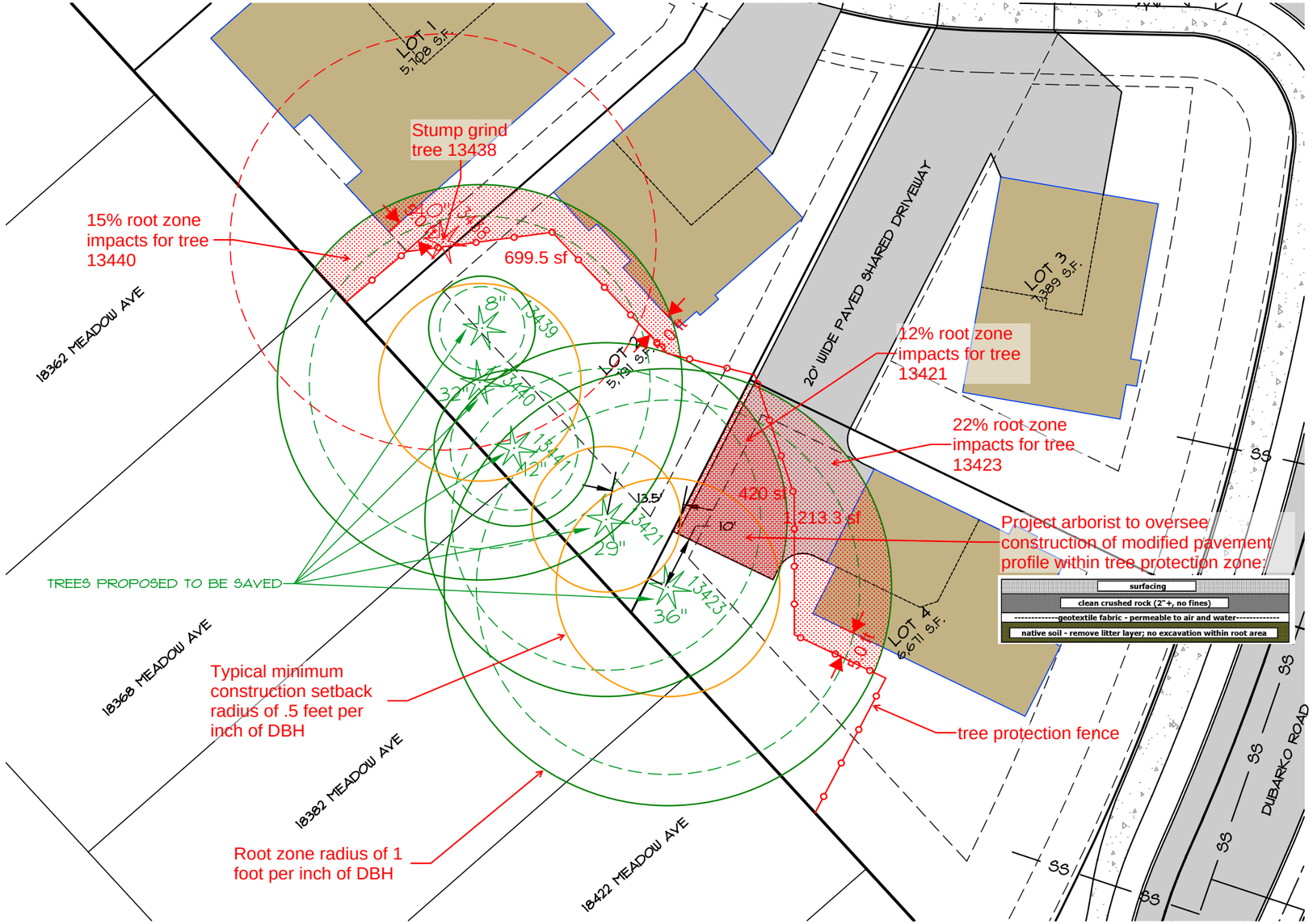
BULLRUN TERRACE

TREES ON WEST SIDE OF PROPERTY



All County Surveyors Est. 1990

SCALE : 1" = 20'

0' 10' 20' 40'

Attachment 1

All County Surveyors & Planners, Inc.
Surveying, Planning
and Civil Engineering
P.O. Box 955 Sandy, OR 97055
Phone: (503) 668-3151
Fax: (503) 668-4730
Subject to General Conditions 2006 ©

19-035-Planning.dwg
DATE OF PLOT: 9/03/20

Attachment 2

Tree No	Common Name	Scientific Name	DBH[1]	C-Rad[2]	Condition[3]	Structure[3]	Comments	Treatment
13421	Douglas-fir	*Pseudotsuga menziesii*	34	20	good	fair	swelling at lower trunk, previously lost top with new top at 15'	retain
13423	Douglas-fir	*Pseudotsuga menziesii*	42	20	good	fair	moderately one sided	retain
13438	Douglas-fir	*Pseudotsuga menziesii*	46	20	good	fair	moderately one sided	remove
13439	Douglas-fir	*Pseudotsuga menziesii*	10	10	good	fair	overtopped by adjacent trees, one sided	retain
13440	Douglas-fir	*Pseudotsuga menziesii*	38	20	good	fair	moderately one sided	retain
13441	Douglas-fir	*Pseudotsuga menziesii*	15	15	fair	fair	overtopped by adjacent trees, marginal trunk taper, small Porodaedalea conks at lower trunk	retain

[1]**DBH** is the trunk diameter in inches measured in accordance with International Society of Arboriculture standards.

[2]**C-Rad** is the approximate crown radius in feet.

[2]**Condition** and **Structure** ratings range from very poor, poor, fair, to good.

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Attachment 3
Additional Tree Protection Recommendations

The following recommendations meet or exceed City of Sandy Code requirements:

Before Construction Begins

1. Notify all contractors of tree protection procedures. For successful tree protection on a construction site, all contractors must know and understand the goals of tree protection.
    a. Hold a tree protection meeting with all contractors to explain the goals of tree protection.
    c. Have all contractors sign memoranda of understanding regarding the goals of tree protection. The memoranda should include a penalty for violating the tree protection plan. The penalty should equal the resulting fines issued by the local jurisdiction plus the appraised value of the tree(s) within the violated tree protection zone per the current Trunk Formula Method as outline in the current edition of the ***Guide for Plant Appraisal*** by the Council of Tree & Landscape Appraisers. The penalty should be paid to the owner of the property.
2. Fencing
    a. Trees to remain in the grove should be protected by installation of tree protection fencing as shown in Attachment 1.
    b. The fencing should be put in place before the ground is cleared in order to protect the trees and the soil around the trees from disturbances.
    c. Fencing should be established by the project arborist based on the needs of the trees to be protected and to facilitate construction.
    d. Fencing should consist of 6-foot high steel fencing on concrete blocks or 6-foot metal fencing secured to the ground with 8-foot metal posts placed no farther than ten feet apart to prevent it from being moved by contractors, sagging, or falling down.
    e. Fencing should remain in the position that is established by the project arborist and not be moved without approval from the project arborist until final project approval.
3. Signage
    a. All tree protection fencing should have signage as follows so that all contractors understand the purpose of the fencing:

> **TREE PROTECTION ZONE**
>
> **DO NOT REMOVE OR ADJUST THE APPROVED LOCATION OF THIS TREE PROTECTION FENCING.**
>
> Please contact the project arborist if alterations to the approved location of the tree protection fencing are necessary.
>
> Todd Prager, Project Arborist - 971-295-4835

    b. Signage should be placed every 75-feet or less.

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During Construction

1. Protection Guidelines Within the Tree Protection Zones:
    a. No new buildings; grade change or cut and fill, during or after construction; new impervious surfaces; or utility or drainage field placement should be allowed within the tree protection zones.
    b. No traffic should be allowed within the tree protection zones. This includes but is not limited to vehicle, heavy equipment, or even repeated foot traffic.
    c. No storage of materials including but not limiting to soil, construction material, or waste from the site should be permitted within the tree protection zones. Waste includes but is not limited to concrete wash out, gasoline, diesel, paint, cleaner, thinners, etc.
    d. Construction trailers should not to be parked/placed within the tree protection zones.
    e. No vehicles should be allowed to park within the tree protection zones.
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2. The trees should be protected from any cutting, skinning or breaking of branches, trunks or woody roots.
3. The project arborist should be notified prior to the cutting of woody roots from trees that are to be retained to evaluate and oversee the proper cutting of roots with sharp cutting tools. Cut roots should be immediately covered with soil or mulch to prevent them from drying out.
4. Trees that have roots cut should be provided supplemental water during the summer months.
5. Any necessary passage of utilities through the tree protection zones should be by means of tunneling under woody roots by hand digging or boring with oversight by the project arborist.
6. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

After Construction

1. Carefully landscape the areas within the tree protection zones. Do not allow trenching for irrigation or other utilities within the tree protection zones.
2. Carefully plant new plants within the tree protection zones. Avoid cutting the woody roots of trees that are retained.
3. Do not install permanent irrigation within the tree protection zones unless it is drip irrigation to support a specific planting or the irrigation is approved by the project arborist.
4. Provide adequate drainage within the tree protection zones and do not alter soil hydrology significantly from existing conditions for the trees to be retained.
5. Provide for the ongoing inspection and treatment of insect and disease populations that are capable of damaging the retained trees and plants.
6. The retained trees may need to be fertilized if recommended by the project arborist.
7. Any deviation from the recommendations in this section should receive prior approval from the project arborist.

Attachment 4
Assumptions and Limiting Conditions

1. Any legal description provided to the consultant is assumed to be correct. The site plans and other information provided by Roll Tide Corporation and their consultants was the basis of the information provided in this report.
2. It is assumed that this property is not in violation of any codes, statutes, ordinances, or other governmental regulations.
3. The consultant is not responsible for information gathered from others involved in various activities pertaining to this project. Care has been taken to obtain information from reliable sources.
4. Loss or alteration of any part of this delivered report invalidates the entire report.
5. Drawings and information contained in this report may not be to scale and are intended to be used as display points of reference only.
6. The consultant's role is only to make recommendations. Inaction on the part of those receiving the report is not the responsibility of the consultant.
7. The purpose of this report is to review and provide recommendations regarding the preservation of additional trees along the west property line of the site.

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Phone: 971.295.4835 • Fax: 503.697.1976
Email: todd@teragan.com • Website: teragan.com

EXHIBIT G

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
- Investigation
- Design
- Construction Support

August 16, 2005

Project No. 05-9266

Cascade Communities, Inc.
13535 SE 145th Avenue
Clackamas, OR 97015

Attention: Don Oakley (Fax 503-658-4544)

RE: **GEOTECHNICAL AND SLOPE STABILITY INVESTIGATION**
VISTA LOOP NORTH AND VISTA LOOP SOUTH SUBDIVISIONS
SANDY, OREGON

This report presents the results of our geotechnical and slope stability investigation of the proposed Vista Loop Planned Development in the City of Sandy, Clackamas County, Oregon. The purpose of our investigation was to evaluate subsurface conditions and slope stability at the site, and provide geotechnical recommendations for site development and construction. Our work was performed in accordance with GeoPacific Engineering, Inc.'s (GeoPacific) proposal letter No. P2463, dated May 4, 2005. The scope of our work included extensive investigation of Vista Loop North with particular attention to slopes on northern portion of the site. On Vista Loop South, the scope of our work was limited to a localized several acre area where slopes exceed 15% grade.

1.0 PROJECT INFORMATION

Location:	The subject property is approximately 25.14 acres located in the City of Sandy, Clackamas County, Oregon (Figure 1).
Owner/ Developer:	Cascade Communities, Inc. 13535 SE 145th Avenue, Clackamas, OR 97015
Civil Engineer:	Don Oakley, P.E. 13535 SE 145th Avenue, Clackamas, OR 97015
Jurisdictional Agency:	City of Sandy, Oregon

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The subject property includes approximately 25.14 acres that is divided by Highway 26 and is located in the City of Sandy, Clackamas County, Oregon (Figure 1). Vista Loop North, which is bordered on the south by the street right of way for Highway 26, consists of approximately 9.14 acres. Vista Loop South, which is bordered by Highway 26 on the north, consists of approximately 15.57 acres. These proposed residential developments are situated on the margin of an upland

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Fax (503) 598-8705

plateau with Vista Loop North at the top of an approximately 300 foot high slope that forms the southern portion of the Cedar Creek drainage. Slopes on the upland plateau portion of the site generally incline to the west at about 5% to 15% grade. Slopes on the northern portion of Vista Loop North are moderately steep inclining at 40% to 70% grade. An old logging road is present at the top of this slope. Vegetation consists of low grasses, brush, and young to mature trees.

The proposed subdivision layout and grading plan for Vista Loop North and Vista Loop South are shown in Figure 2 and Figure 4, respectively. On Figure 2, the plan also shows conservation easement limits which set the northerly extend of building foundations on Lots 6 through 16. We presume that underground utilities will generally be constructed at depths of less than 10 feet.

3.0 SITE GEOLOGY

The subject property lies on the far eastern margin of the Willamette Valley/Puget Sound physiographic province, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. Underlying the site vicinity is the Plio-Pleistocene age (about 2 million years ago) Springwater Formation, a broad fluvial/alluvial fan deposit of outwash sediment derived from the Cascade Range (Schlicker and Finlayson, 1979). Regionally, the Springwater Formation consists of fluvial conglomerate, volcaniclastic sandstone, siltstone and debris flows. The conglomerate typically consists of deeply weathered to decomposed, well-rounded pebbles to cobbles of basalt, andesite and dacite with a sand matrix composed of feldspathic and volcanic lithics. Siltstone units typically consist of quartzofeldspathic silt, volcanic ash and clay. The estimated thickness of the Springwater Formation in the site vicinity based on mapped thicknesses exposed in the Sandy River drainage is 150 to 200 hundred feet.

Underlying the Springwater Formation is the Pliocene age (3 to 5 million years ago) Troutdale Formation, which is informally divided into an upper and lower member (Schlicker and Finlayson, 1979). The upper member consists primarily of indurated sandstone and conglomerate with localized clay seams. In the site vicinity, the estimated thickness of the upper member is 100 to 150 feet. The lower member, also known as the Sandy River Mudstone, consists of moderately-well indurated siltstone, claystone, very-fine-grained sandstone and some volcanic lapilli tuff layers with a total estimated thickness of about 725 feet. In the site vicinity, these strata are generally horizontally bedded with maximum dip angles on the order of 2 degrees (Schlicker and Finlayson, 1979).

4.0 SUBSURFACE CONDITIONS

In order to characterize subsurface conditions on the subject property, GeoPacific conducted a two phase program of subsurface exploration. The first phase consisted of 12 test pits excavated to depths of 8 to 12 feet with an 8-ton trackhoe. The second phase consisted of drilling 3 exploratory borings with a track-mounted drill rig to depths of 51.5 and 61.5 feet below the ground surface, using mud-rotary drilling techniques. Exploration locations shown in Figure 2 were located in the field by pacing distances from apparent property corners and other site features, and as such should be considered approximate.

The following section presents generalized discussions of soil, rock and groundwater conditions anticipated on site based on subsurface explorations performed for the project. Each of the geologic deposits encountered is discussed separately below. For additional details regarding conditions at specific exploration locations, refer to the attached test pit and boring logs.

Project No. 05-9266
Vista Loop

4.1 Soil

Fill: A localized fill wedge is present on the outboard edge of the existing logging road which skirts the top of the moderately steep slope on the northern portion of the site (see Figure 3). This fill consists of organic silt and clayey silt soil that is poorly compacted. In test pits (TP-4, TP-5, & TP-7), the fill ranges between 2 and 5 feet thick.

Topsoil: Over most of the site, the ground surface is directly underlain by topsoil consisting of dark brown, organic SILT (OL) with common fine roots in grassland areas and many roots in forested areas. The observed thickness of topsoil generally varies from about 12 to 18 inches.

Native Soil Horizon/Colluvium: On the gently sloping portions of the site, the topsoil is underlain by a native soil horizon, while on the more steeply sloping portions the topsoil is underlain by colluvial soil. The native soil horizon generally consists of brown to red-brown, clayey SILT (ML) derived from in-place weathering and mineral decomposition. In general, this soil horizon has a stiff to very-stiff consistency. Pocket penetrometer measurements indicate an approximate unconfined compressive strength of 1.5 to greater than 3.0 tons/ft^2. The thickness of this layer ranges between 2 and 3 feet. Colluvial soil underlying the topsoil in sloping areas is derived from weathering, mineral decomposition, erosion and soil creep. The colluvial soil consists of brown to red-brown, clayey SILT (ML) to sandy SILT (ML) with fragments of weathered volcanic rocks and cobbles. In general, the consistency of the colluvial soil ranges from stiff with loose pockets to very-stiff. Pocket penetrometer measurements indicate approximate unconfined compressive strengths of 0.5 to 3.5 tons/ft^2. In test pits, the thickness of colluvial soil ranges between 2.5 and 4 feet.

Residual Soil: Underlying the native and colluvial soil is residual soil derived from in-place decomposition of the Springwater Formation. The residual soil consists of red-brown, clayey SILT (ML), sandy SILT (ML), and silty CLAY (CL) with some sand and weathered rock fragments. In general, this soil horizon has a stiff to very-stiff consistency. Pocket penetrometer measurements indicate an approximate unconfined compressive strength of 1.5 to 3.0 tons/ft^2. In test pits, the thickness of this layer ranges from about 3 feet to greater than 7 feet thick, while in some sloping areas, the residual soil is absent.

Springwater Formation: Underlying the above soil units is the Springwater Formation. In test pits, the Springwater Formation consists of multi-colored, sandy SILT (ML) with clay and abundant weathered volcanic lithics and decomposed rounded cobbles. The consistency is generally medium-stiff to very-stiff but is variable depending on the original sediment mineralogy and degree of weathering and decomposition. In borings, Standard Penetration Test (SPT) N-values generally range between N=5 and N=greater than 50 consistent with a medium-stiff to hard consistency. Springwater Formation extends below the maximum depth explored of 60 feet below the ground surface.

4.2 Soil Moisture and Groundwater

In May of 2005, near surface soil moisture conditions observed in test pits generally ranged from damp to moist. Minor groundwater seepage was observed in test pits TP-1 and TP-3 at a depth of 7 feet below the ground surface.

Seasonal springs are common in the Springwater Formation and tend to occur in localized areas in a variety of topographic settings. No springs or geomorphic evidence of seasonal springs was observed during our reconnaissance of the site. However, we anticipate that minor seasonal perching of infiltrating surface water and localized groundwater seepage may be encountered in cuts and in shallow excavations during the wet weather season. Because mud-rotary drilling techniques do not permit measurement of groundwater, the exploratory borings provided no information regarding groundwater conditions.

5.0 SLOPE STABILITY

For the purpose of evaluating slope stability, we: (1) performed a review of published geologic literature, (2) performed a series of field reconnaissance traverses of the subject property and adjacent areas, (3) conducted a program of subsurface exploration, (4) constructed geologic cross sections and slope stability models, and (5) performed a quantitative analyses of slope stability.

5.1 Regional Landslide Hazard Mapping

Regional slope instability mapping identifies the slopes on the northern margin of the site as a moderate to high relative slope hazard zone based primarily on slope gradient (Hofmeister et al., 2003). Regional geologic hazard mapping of the westward projection of these slopes identifies numerous "landslide topography" features (Schlicker and Finlayson, 1979). Common slope instability in this area is attributed to weak horizons in the Troutdale Formation underlying the lower portion of the slope and erosional oversteeping of slopes by stream undercutting. The mapped "landslide topography" closest to the subject site lies approximately 2,000 feet to the west. Based on our review of 1:24,000 scale topographic mapping, there appears to be a possible landslide feature expressed as benched topography located approximately 500 feet east of the site (see Figure 1).

These mapped hazard zone designations are general in nature based largely on prevailing slopes, and are intended to indicate the need for site-specific geotechnical investigation such as this report.

5.2 Slope Geomorphology and Subsurface Soil Structure

We performed a series of slope reconnaissance traverses of the moderately steep slope on the northern margin the subject site and adjacent property. This north-facing slope is approximately 300 feet high and extends to the bottom of the Cedar Creek drainage, a small tributary to the Sandy River (See Figure 1). Based on review of the site topographic survey (see Figure 2) and clinometer measurements collected during our reconnaissance traverses, the upper portion of this slope inclines at 40% to 70% grade and includes both concave and slightly convex slope geometries. In contrast the lower portion of the slope, inclines at grades of less than 40% with a concave geometry becoming more gentle towards the toe of the slope at Cedar Creek. Figure 3 presents a slope profile constructed using hand-held clinometer and cloth tape techniques.

Based on observations made during our reconnaissance traverses, slope geomorphology on and directly below the site is generally smooth and uniform consistent with relatively stable slope conditions. No geomorphic evidence of significant slope movement, such as benches, closed depressions, scarps, ground cracks, etc., was observed during our reconnaissance.

Project No. 05-9266
Vista Loop

Subsurface soil conditions were evaluated in three exploratory borings drilled along the top of slope on the northern margin of the site. Soil samples were collected and standard penetration tests (SPTs) of soil strength were performed on 5 foot intervals. Logs of the borings are presented in Appendix A. The borings indicate that the Springwater Formation underlying the upper portion of the slope generally consists of highly tuffaceous, clayey silt with varying amounts of highly weathered volcanic lithics and decomposed cobbles. Due to the high degree of weathering and decomposition, the consistency of the Springwater Formation is variable, ranging between medium-stiff and hard. Standard penetration tests of soil strength indicate that Springwater Formation within 35 feet of the ground surface is generally medium-stiff to stiff with SPT N-values of between N=5 and N=12. These N-values are considered to be consistent with low to moderate strength and low to moderate resistance to slope instability. In contrast, standard penetration tests indicate that the Springwater Formation at depths of 35 to 60 feet is generally stiff to hard with SPT N-values of N=13 to N= greater than 50 for 1 inch of penetration. These N-values are considered to be consistent with moderate strength and moderate resistance to slope instability.

5.3 Slope Stability – Lower Slope

We performed a qualitative geologic evaluation of the potential for deep seated slope instability in the Troutdale Formation underlying the lower portion of the slope that extends beyond the northern limits of the subject site. Regionally, the lower section of the Troutdale Formation has a relatively high susceptibility to slope instability due to the presence of weak bedding plane layers and a low internal strength. Because reported bedding planes in the Troutdale Formation generally incline gently to the west at approximate dips of 2 to 3 degrees (Schlicker and Finlayson, 1979), weak bedding planes are unlikely to provide potential failure planes slope movement. Regional distribution patterns indicate that slope failures in the lower section of the Troutdale Formation are triggered more by oversteepening of slopes due to undercutting by stream erosion.

In our assessment, the presence of Troutdale Formation underlying the lower portion of the slope beyond the northern boundary of the subject property does not appear to present a significant instability hazard on the subject site, because: (1) the lower slope inclines at relatively gentle grades (about 10% to 40% grade), (2) the slope is not significantly undercut by Cedar Creek, (3) the Troutdale Formation is somewhat buttressed by deposition of colluvial and alluvial sediments at the toe the slope, and (4) we observed no geomorphic evidence of prior, deep-seated slope instability on the lower slope directly below the subject site.

5.4 Slope Stability Modeling and Quantitative Stability Analysis – Upper Slope

Our slope profile and relevant subsurface data was compiled and used to construct a representative geologic cross section of the slope geometry on and adjacent to the northern portion of the site (Figure 3). A quantitative slope model was then constructed and stability analyses performed to evaluate local slope stability under future conditions with the proposed development cuts at the top of slope. Our analysis presumes that a substantial cut is made at the top of the slope as shown in the project grading plan (Figure 2).

The slope was modeled as a multi-layered system with each layer being an isotropic medium. For the stability evaluation, the most critical circular failure surface was found by analyzing 100 potential failure surfaces. Shear strength parameters used in the model were selected based on correlations

Project No. 05-9266
Vista Loop

with field SPT N-value measurements and our local experience with similar soil and geologic conditions. The parameters assumed in the slope stability calculations are summarized in Table 1.

Table 1 - Summary of Assumed Soil Strength Parameters

Geologic Unit	Moist Unit Weight (pcf)	Friction Angle	Cohesion (psf)
Weathered Springwater Fm.	125	33°	300
Springwater Fm.	130	36°	500
Troutdale Formation	125	32°	250

Slope stability analyses were performed using the SLOPE/W computer program developed by Geo-Slope International of Calgary, Canada. This numerical analysis program utilizes a two-dimensional limiting equilibrium method to calculate the factor of safety of a potential slip surface and incorporates search routines to identify the most critical potential failure surfaces for the cases analyzed. Factors of safety were calculated using Spencer's method of slices. Potential seismic forces were also incorporated into the analysis using a pseudostatic approach. The pseudostatic analysis used a horizontal ground acceleration of 0.1 g, which is approximately 50 percent of our maximum estimated acceleration for a design seismic event (10 percent probability of exceedence in 50 years). Due to the inherent conservatism of the pseudostatic methodology, it is standard engineering practice to utilize one-half to two-thirds of the expected horizontal accelerations in pseudostatic slope stability calculations.

Results of the slope stability factor of safety calculations are presented in Table 2. Graphic plots of the slope model and analysis output are presented in Appendix B.

Table 2 - Summary of Slope Stability Analysis Results

Cross Section	Slope Conditions	Factor of Safety (Static Conditions)	Factor of Safety (Pseudostatic Conditions)
A-A'	Preliminary Plan Finish Grade	1.46	-
A-A'	Preliminary Plan Finish Grade	-	1.19

Our slope stability analysis indicates that a factor of safety of 1.46 is achieved under post development, static conditions with a finish grade setback from the top of the slope of 40 feet (see Appendix B). Pseudostatic stability calculations indicate that the factor of safety under seismic loading during the maximum probable event is 1.1. Potential failure surfaces closer than 40 feet to the top of slope (finish grade) will have reduced factors-of-safety.

In our opinion, the factors of safety presented in Table 2 against slope instability for both static and pseudostatic conditions are adequate for conventional foundation construction that maintains a minimum 40 foot horizontal setback from the top of the moderately-steep slope on the northern margin of Vista Loop North (Lots 6 through 16). Structures located closer than 40 feet horizontal from the top of slope will need to be evaluated individually and will likely require deepened

foundations and/or soil anchors. For the purpose of determining setbacks from the top of slope, "top of slope" refers to the top of slope resulting after the project grading cuts shown on Figure 2 are made.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Our geotechnical investigation indicates that the proposed residential development is geotechnically feasible provided that the site is developed and constructed in accordance with our recommendations. The potential for damaging deep-seated slope instability is considered to be low for conventional house foundations that maintain a minimum setback of 40 feet from the top of the moderately-steep slope on the northern portion of Vista Loop North. Houses on Vista Loop North Lots 6 through 16 that are situated closer than 40 feet from the top of the slope will likely require deep foundations such as drilled piers or driven piles and soil anchors.

Appendix C contains an itemized checklist of soil testing and inspection procedures that are recommended to help guide the project to completion.

6.1 Slope Stability

The northern margin of Vista Loop North is situated at the top of a moderately-steep, 300-foot-high, north-facing slope. In our opinion, the primary slope instability hazard is the potential for localized slope failure on the steeper upper portion of the slope where grades incline up to 70%. Quantitative slope stability modeling and analysis indicates that at distances of less than 40 feet from the top of the slope, the upper slope has a factor of safety against movement of less than 1.46. We recommend that houses supported on conventional shallow foundations maintain a minimum setback of 40 feet from the top of the moderately-steep slope on the northern portion of the property. Houses on Vista Loop North Lots 6 through 16 situated closer than 40 feet from the top of the slope will likely require deep foundations such as drilled piers or driven piles and soil anchors. These foundations will need to be evaluated and designed individually. For maintaining slope stability, stormwater runoff from the development should not be allowed to flow onto the moderately-steep slopes on the northern margin of the development.

Slope gradients on Vista Loop South are generally gentle except for a localized approximately 20 foot high slope inclining at about 35% to 50% grade on the east-central portion of the site (Figure 4). Exploratory test pits indicate that this slope is underlain by relatively competent soils that have a moderate to high resistance to instability on moderate slopes. The preliminary grading plan specifies that 8 feet of structural fill will be placed at the toe of this slope. In our opinion, the potential for damaging slope instability on this slope is low and no special mitigating measures are necessary for slope stability.

6.2 Site Preparation

All areas to be graded should first be cleared of debris, trees, stumps, vegetation, etc., and all debris from clearing should be removed from the site. Organic-rich topsoil should then be stripped. We anticipate that an average stripping depth of 8 to 10 inches will be necessary to remove organic-rich

topsoil. Localized deeper stripping, or tilling and root-picking, to depths of 12 to 24 inches may be necessary to remove thick topsoil and abundant roots around trees. The final depth of stripping removal will be determined on the basis of a site inspection after the initial stripping has been performed. Stripped topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by GeoPacific.

Once stripping is approved, the area should be aerated, and/or ripped or tilled to a depth of 8 inches, moisture conditioned, and compacted in-place prior to the placement of engineered fill or crushed aggregate base for pavement (dry weather only). Exposed subgrade soils should be evaluated by the geotechnical engineer. For large areas, this evaluation is normally performed by proof-rolling the exposed subgrade with a fully loaded scraper or dump truck. For smaller areas where access is restricted, the subgrade should be evaluated by probing the soil with a steel probe.

Old fill, subsurface structures, etc, in future structural areas should be demolished, removed from the site, and the excavations backfilled with fill compacted to engineered fill specifications. We anticipate that some old fill may be present on Vista Loop North in the vicinity of Lots 49 through 58.

6.4 Rough Grading

Grading for the proposed development should be performed as engineered grading in accordance with Appendix Chapter 33 of the 1997 Uniform Building Code (UBC) with the exceptions and additions noted herein. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to its arrival on site.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 95% of the maximum dry density determined by Standard Proctor AASHTO T-99 or equivalent. Field density testing should conform to ASTM D2922 and D3017, or D1556. Engineered fill should be observed and tested by GeoPacific. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more testing. Because the standard of practice is to perform testing on an on-call basis, we recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency.

Earthwork is usually performed in the summer months, generally mid-June to mid-October, when warm dry weather is available for proper moisture conditioning of soils. Earthwork performed during the wet-weather season will probably require expensive measures such as cement treatment or imported granular material to compact fill to the recommended engineering specifications.

The preliminary grading plan for Vista Loop South specifies an approximately 10 foot thick fill in the bottom of a broad drainage swale extending through the site (Figure 4). We anticipate that soft soils and shallow groundwater may be present in the drainage bottom such that subgrade stabilization measures may be necessary to construct structural fills for lots and streets. We recommend that this area be evaluated in construction prior to fill placement. Recommended subgrade stabilization measures may include imported rock stabilization layers, subdrains, drying out ("baking") of exposed subgrade during hot weather conditions, etc.

6.5 Landscaping Fill

Landscaping fill not supporting structures may consist of organic soils (such as topsoil strippings) that are free of large woody debris and/or other deleterious material. To limit settlement and shifting, landscaping fill should be compacted to a firm, unyielding state as determined by GeoPacific (typically 90% of standard proctor AASHTO T-99 or equivalent).

6.6 Erosion Control Considerations

Due to the presence of gentle to moderate slope gradients, we consider the potential for adverse erosion during construction to be moderate. Erosion at the site during construction can be minimized by implementing the project erosion control plan specified by the civil engineer, which typically includes the use of straw bales, bio-bags, and silt fences. Where used, these erosion control devices should be in place and remain in place throughout site preparation and construction.

Areas of exposed soil requiring immediate and/or temporary protection against exposure should be covered with either mulch or erosion control netting/blankets. Areas of exposed soil requiring permanent stabilization should be seeded with an approved grass seed mixture, or hydroseeded with an approved seed-mulch-fertilizer mixture. Cut and fill slopes should be seeded or planted as soon as possible after construction, so that vegetation has time to become established before the onset of the next wet-weather season.

6.7 Excavating Conditions and Temporary Excavations

Based on subsurface test pit exploration, we anticipate that the planned excavation depths will generally be achievable with conventional heavy equipment. Some boulders may be encountered, particularly in deeper excavations. All temporary cuts in excess of 4 feet in height should be sloped in accordance with U.S. Occupational Safety and Heath Administration (OSHA) regulations (29 CFR Part 1926), or be shored. At the time of our exploration, native soils at the site were generally classified as Type A and Type B Soil. Temporary excavation side slope inclinations as steep as ¾:1 (Type A) and 1H:1V (Type B) may be assumed for planning purposes. This cut slope inclination is applicable to excavations above the water table only. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions.

Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

6.8 Utilities

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321. We recommend that structural trench backfill be compacted to at least 95% of the maximum dry density determined by Standard Proctor AASHTO T-99 or equivalent. Initial backfill lift thickness for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying

flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

Adequate density testing should be performed during construction to verify that the recommended relative compaction is achieved. Typically, one density test is taken for every 4 vertical feet of backfill on each 200-lineal-foot section of trench. Franchise utility trenches are generally not compacted unless they are located near a structural area. Trench spoils spread over lots should be kept to a minimum.

6.9 Pavement Construction

It is our understanding that the project will incorporate the standard City pavement section for dry weather construction consisting of 2.5 inches of asphaltic concrete over 8 inches of crushed aggregate (1 ½"-0 or ¾"-0) compacted to at least 95% of AASHTO T-180 or equivalent. For the purpose of evaluating native soil strength for support of pavement, we performed Portable Dynamic Cone Penetrometer (PDCP) field tests which approximate the California Bearing Ratio (CBR) of in-situ soils (see Appendix A). Using a CBR of 10 for in-situ, native soil at damp to dry moisture conditions, and empirical correlations between CBR and resilient modulus (M_r), in-situ native soil strength is considered adequate for support of the standard pavement section assuming a light duty traffic index of 4.0 and a design life of 20 years.

Areas of yielding, native soil subgrade should be tilled to a minimum depth of 12 to 24 inches, aerated, and recompacted in-place to at least 95% of the maximum dry density obtained by AASHTO T-99 or equivalent. GeoPacific recommends that subgrade strength be verified visually by proof-rolling directly on soil subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas which rut, pump, or weave by more than ¼ inch on soil and 1/8 inch on base course should be stabilized prior to paving. Generally, one subgrade, one base course, and one asphalt compaction test is performed for every 100 to 200 linear feet of paving.

If pavement areas are to be constructed during wet weather, GeoPacific should review the subgrade and proposed construction methods immediately prior to the placement of base course so that specific recommendations can be provided. Wet-weather pavement construction is likely to require soil amendment, or woven geotextile fabric and a minimum additional 6 inches of crushed aggregate base.

6.10 Anticipated House Foundations

The majority of the subject site to within 40 feet of the top of slope on Vista Ridge North is suitable for shallow foundations bearing on stiff, native soil and/or engineered fill. Foundation design, construction, and setback requirements should conform to the applicable code at the time of permitting. For protection against frost heave, spread footings should be embedded at a minimum depth of 18 inches below exterior grade. The recommended minimum widths for continuous footings supporting wood-framed walls without masonry are presented in Table 3. Minimum reinforcement consisting of three horizontal No. 4 bars, two in the footing and one in the stem wall, is

recommended. Actual footing widths, sizing, and reinforcement should be determined by the house designer, architect- or engineer-of-record.

Table 3 - Recommended Minimum Width of Continuous Spread Footings

Number of Stories	Minimum Width of Continuous Spread Footings
1-Story	12 inches
2-Story	15 inches
3-Story	18 inches

The recommended allowable soil bearing pressure is 1,500 lbs/ft^2 for footings on stiff, native soil and engineered fill. A maximum chimney and column load of 35 kips is recommended for the site. For heavier loads, GeoPacific should be consulted. The coefficient of friction between on-site soil and poured-in-place concrete may be taken as 0.40 (no factor of safety included). The maximum anticipated total and differential footing movements (generally from soil expansion and/or settlement) are 1 inch and ¾ inch over a span of 20 feet, respectively. Excavations near structural footings should not extend within a 1H:1V plane projected downward from the bottom edge of footings.

Footing excavations should penetrate through topsoil and any loose soil to stiff subgrade that is suitable for bearing support. All footing excavations should be trimmed neat, and all loose or softened soil should be removed from the excavation bottom prior to placing reinforcing steel bars. Due to the moisture sensitivity of on-site native soils, foundations constructed during the wet weather season may require overexcavation of footings and backfill with compacted, crushed aggregate.

6.11 House Foundations Incorporating Retaining Walls

Lateral soil pressures recommended by GeoPacific for design of permanent retaining structures with adequate drainage can be calculated using the equivalent fluid unit weights provided in Table 4. The effect of surcharges or live loads on lateral pressures has not been included. The recommended values assume that adequate drainage measures are incorporated, and that no hydrostatic pressures develop behind the walls. The unit weights in Table 4 are for backfill consisting of free-draining granular material such as crushed aggregate; on-site soils are not recommended for use as retaining wall backfill. Wall backfill should be compacted to at least 95% of the maximum dry density determined by ASTM D698 or equivalent.

The average allowable bearing pressure for retaining walls may be taken as 2,000 lbs/ft^2 with a maximum allowable toe pressure of 2,500 lbs/ft^2. The coefficient of friction between native soil or engineered granular fill and poured-in-place concrete may be taken as 0.45 (no factor of safety added).

Subdrains should be installed behind all retaining walls to prevent the build-up of adverse hydrostatic pressure. We recommend that subdrains consist of ADS Highway Grade (or equivalent), perforated, plastic pipe enveloped in a minimum of 3 ft^3 per lineal foot of 2" - ½", open-graded gravel (drain rock) wrapped with geofabric filter (Amoco 4545, Trevia 1120, or equivalent). A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet.

Project No. 05-9266
Vista Loop

Table 4 - Recommended Equivalent Fluid Lateral Earth Pressures

Type	Unrestrained Wall		Restrained Wall	
	Level Profile	2H:1V Upslope	Level Profile	2H:1V Upslope
Active Pressure ($lbs/ft^2/ft$)	32	46	-	-
At-Rest Pressure ($lbs/ft^2/ft$)	-	-	50	65
Passive Pressure * ($lbs/ft^2/ft$)	280	280	250	250

* Passive pressure values are allowable and include a factor of safety of 1.5. For passive pressure calculations, the upper 6 inches of embedment should be ignored.

For concrete retaining walls in living spaces, waterproofing and a geocomposite wall drain such as Tuff-N-Dry and Warm-N-Dry or CONTECH C-DRAIN 11K, or equivalent are recommended to minimize the potential for interior moisture problems.

6.12 Footing Subdrains, Roof Drains, and Drainage

Footing subdrains constructed as standard practice should consist of a minimum 3-inch diameter ADS Highway Grade (or equivalent), perforated, plastic pipe enveloped in a minimum of 1 ft^3 per lineal foot of 2"- ½", open, graded gravel (drain rock) wrapped with geofabric filter (Amoco 4545, Trevia 1120, or equivalent). Subdrains should be connected to the storm drain system or daylight to a suitable outfall location. A minimum 0.5% fall should be maintained throughout all subdrains and non-perforated pipe outlets. Footing subdrains are normally installed for mitigating detrimental effects of water on foundations only, and are not intended for elimination of all potential sources of water beneath the house or within crawl spaces.

Additional subdrains such as cut-off trenches or blanket drains may be necessary to facilitate drainage of springs encountered during construction. If springs are encountered during construction, GeoPacific Engineering should be contacted to make site-specific recommendations.

Surface water drainage should be directed away from structures. In no case should roof drains be connected to footing drains.

6.13 Seismic Design

The subject site is located in a region of moderate seismic risk, and moderate levels of earthquake shaking should be anticipated during the design life of the proposed structures and improvements. Probabilistic assessments of the seismic shaking hazard in Oregon predict that in the next 50 years bedrock underlying the subject site has a 10% probability of experiencing a peak ground acceleration (PGA) of 0.18 g, a 5% probability of experiencing a PGA of 0.22 g, and a 2% probability of experiencing a PGA of 0.34 g (Geomatrix, 1995).

Seismic design requirements for single-family homes are included in the Oregon One- and Two-Family Dwelling Specialty Code, which specifies the site location as being in Seismic Design Category D_1. Structures not governed by the One- and Two- Family Dwelling Specialty Code should be designed to resist earthquake loading in accordance with the methodology described in section 1615 of the State of Oregon 2004 Structural Specialty Code (OSSC) Amendments to the 2003 International Building Code (IBC). The maximum considered earthquake ground motion for short period and 1.0 second period spectral response may be determined from map Figures 1615(1) and 1615(2) of the State of Oregon 2004 Structural Specialty Code (OSSC) or the 2003 National Earthquake Hazard Reduction Program (NEHRP) "Recommended Provisions for Seismic Regulations for New Buildings and Other Structures" published by the Building Seismic Safety Council. We recommend Site Class D be used for design per the OSSC, Table 1615.1.1. Using this information, the structural engineer can select the appropriate site coefficient values (F_a and F_v) from Tables 1615.1.2(1) and 1615.1.2(2) of the 2003 IBC to determine the maximum considered earthquake spectral response acceleration for design of the project.

In our opinion, the potential for liquefaction or liquefaction-related ground failure at the subject site is very low, and no special mitigating measures are recommended against liquefaction.

7.0 UNCERTAINTY AND LIMITATIONS

We have prepared this report for the developer and designers, for use on this project only. The report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

We recommend that GeoPacific perform sufficient geotechnical monitoring, testing and consultation during construction to confirm that the conditions encountered are consistent with those indicated by explorations, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated. The checklist attached to this report (Appendix C) outlines the minimum recommended geotechnical observations and testing for the project.

Within the limitations of scope, schedule and budget, GeoPacific attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, express or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

Project No. 05-9266
Vista Loop

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

CERTIFIED OREGON PAUL A. CRENNA E1766 ENGINEERING GEOLOGIST

Paul A. Crenna, C.E.G.
Engineering Geologist

REGISTERED PROFESSIONAL ENGINEER 14743 OREGON JAN. 23, 1990 JAMES D. IMBRIE Exp. 6-30-07

James D. Imbrie, P.E., C.E.G
Geotechnical Engineer

8.0 REFERENCES CITED

Geomatrix Consultants, 1995, Seismic Design Mapping, State of Oregon: unpublished report prepared for Oregon Department of Transportation, Personal Services Contract 11688, January 1995.

Hofmeister, R.J., Hasenberg, C.S., Madin, I.P, and Wang, Y., 2003, Relative earthquake and landslide hazards in Clackamas County: Oregon Department of Geology and Mineral Industries Open File Report O-03-09, map scale 1:100,000.

Schlicker, H.G. and Finlayson, C.T., 1979, Geology and Geologic Hazards of northwestern Clackamas County, Oregon: Oregon Department of Geology and Mineral Industries, Bulletin No. 99, 79 p., scale 1:24,000.

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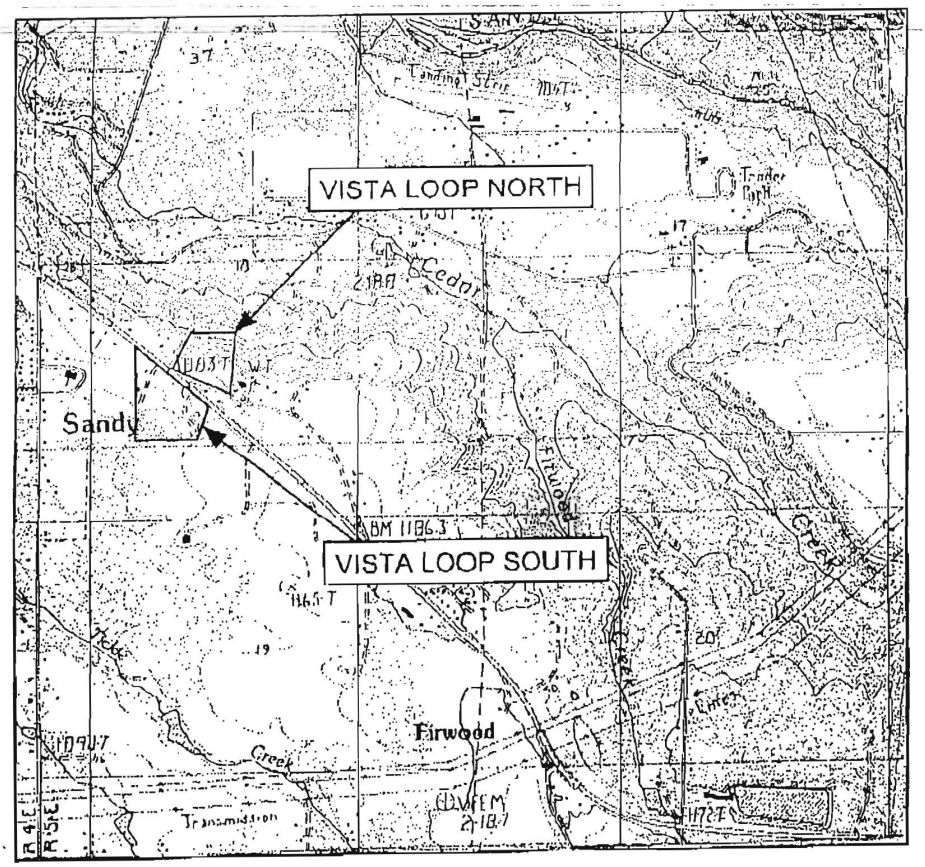
VICINITY MAP

NORTH



Legend

Approximate Scale 1 in = 2,000 ft

Date: 8/16/05
Drawn by: PAC

Base map: U.S. Geological Survey 7.5 minute Topographic Map Series, Bull Run Quadrangle, 1985

Project: Vista Loop Sandy, Oregon	Project No. 05-9266	FIGURE 1

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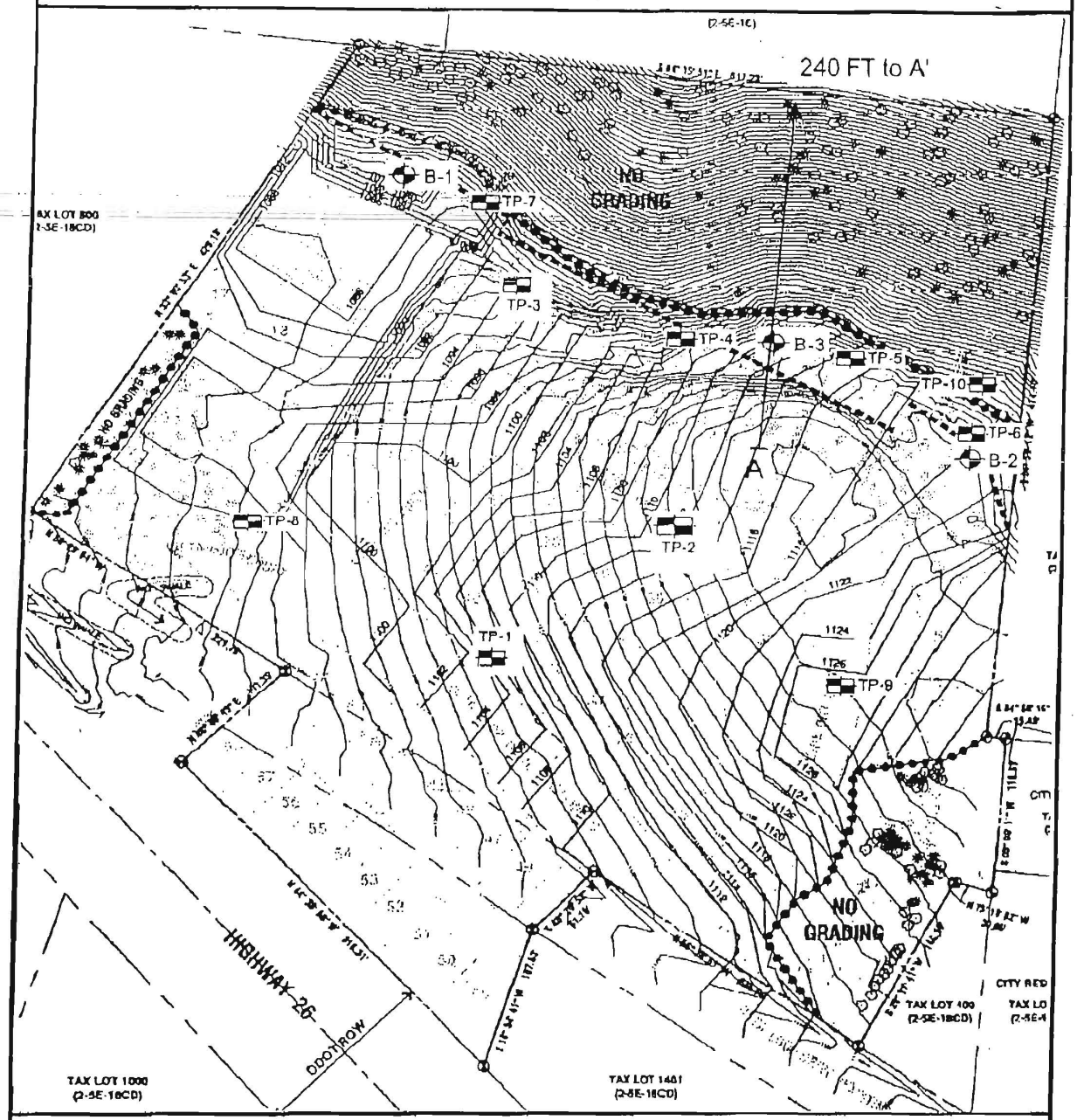
VISTA LOOP NORTH GRADING PLAN WITH EXPLORATIONS



Legend

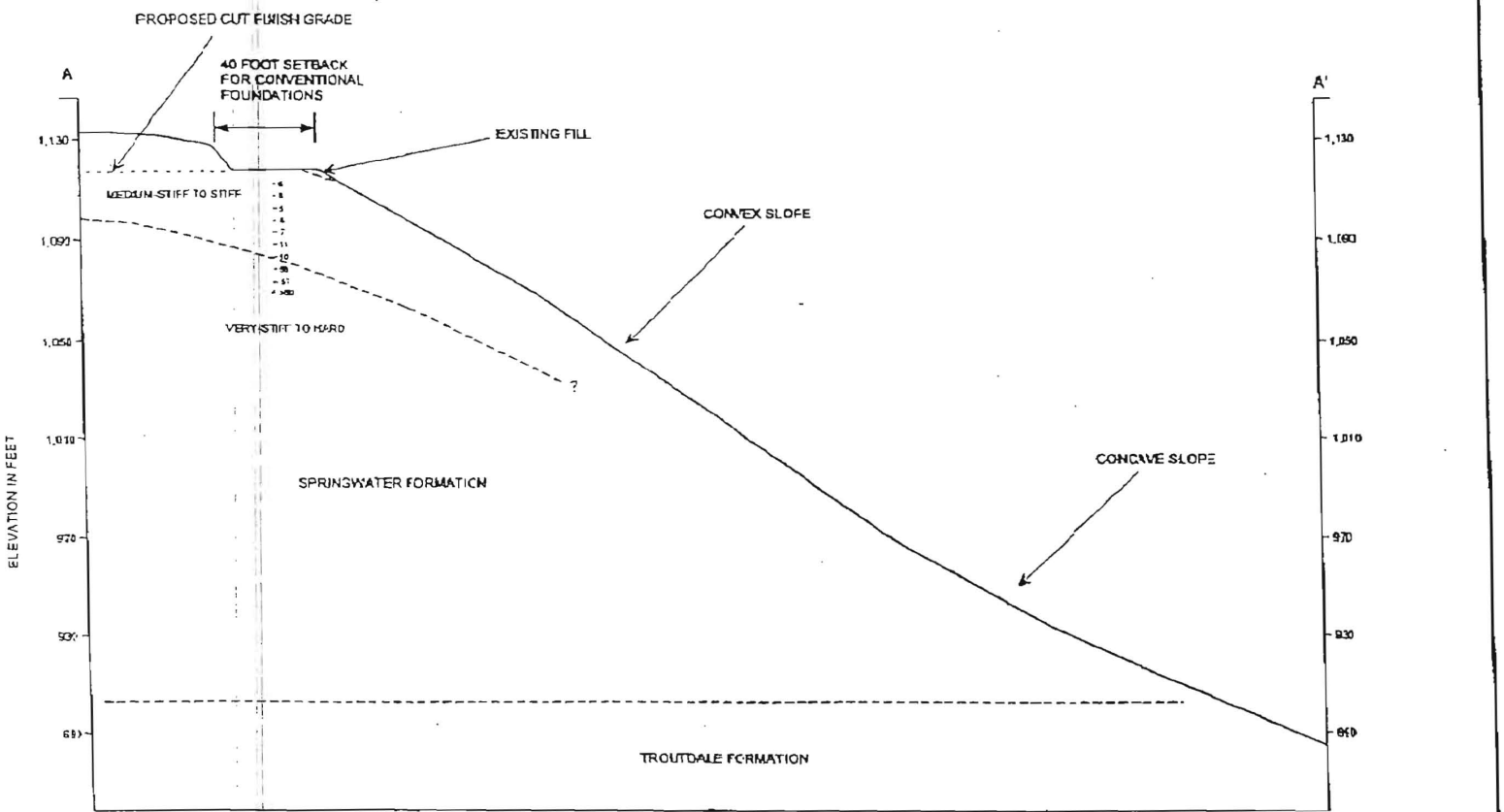
TP-2 EXPLORATORY TEST PIT

B-2 EXPLORATORY BORING

APPROXIMATE SCALE 1 IN = 100 FT

Date: 8/16/05
Drawn by: PAC

Project: Vista Loop Sandy, Oregon	Project No. 05-9266	FIGURE 2



NOTES: (1) SLOPE PROFILE WAS CONSTRUCTED USING HAND-HELD CLINOMETER MEASUREMENTS SOLELY FOR USE IN THIS REPORT AND SHOULD NOT BE CONSIDERED ACCURATE FOR OTHER USES.

(2) LOCATION OF ALL GEOTECHNICAL INFORMATION IS APPROXIMATE

APPROXIMATE SCALE

0 40 80 FEET

1" IN = 40 FT

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GEOLOGIC CROSS SECTION

Project: Vista Loop North Sandy Oregon	Project No. 05-5266	Drawn By: PAC	FIGURE 3

GeoPacific Engineering, Inc.
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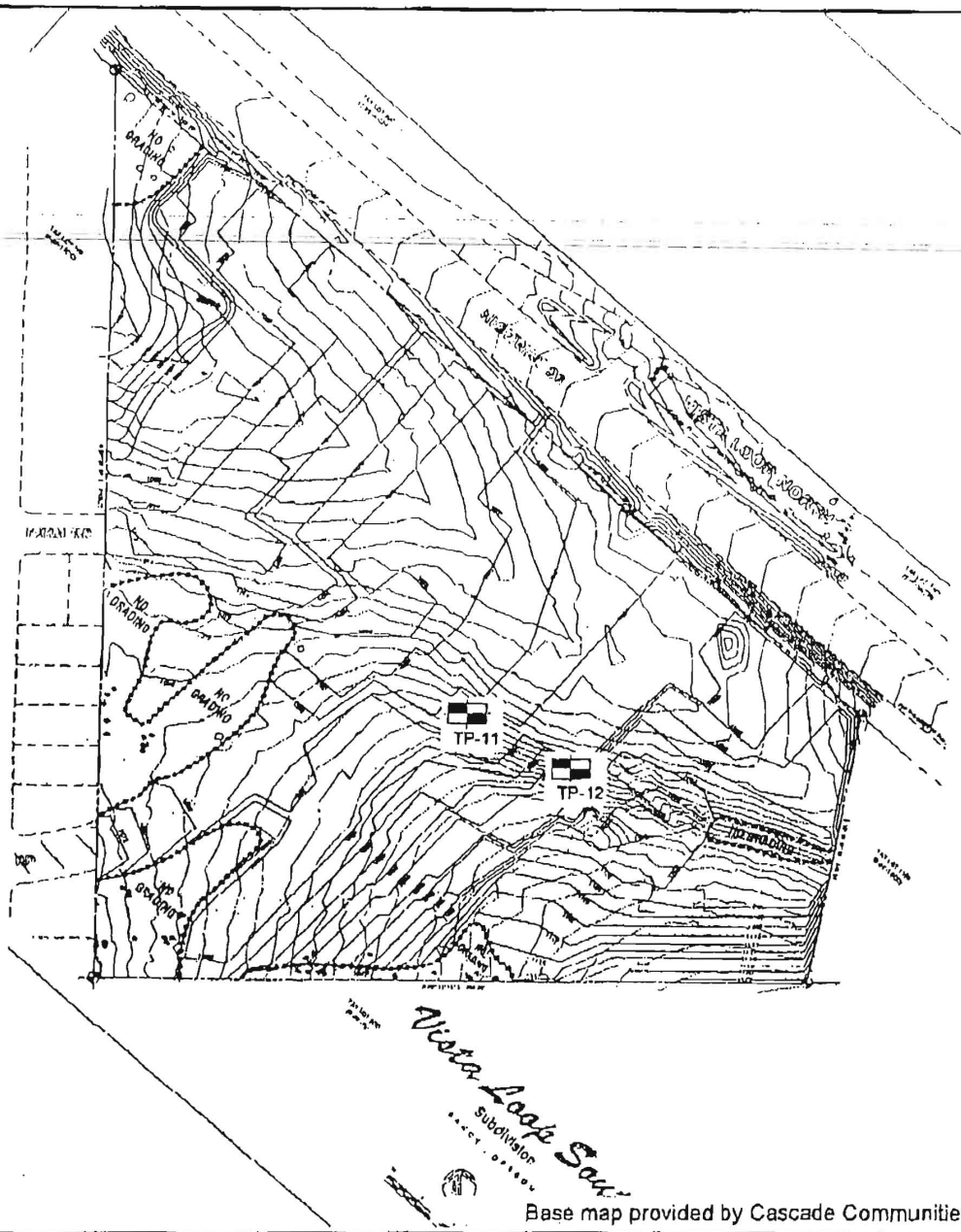
VISTA LOOP SOUTH GRADING PLAN WITH EXPLORATIONS



Base map provided by Cascade Communities, Inc.

Legend

TP-2 EXPLORATORY TEST PIT

APPROXIMATE SCALE 1 IN = 200 FT

Date: 8/15/05
Drawn by: PAC

Project: Vista Loop Sandy, Oregon	Project No. 05-9266	FIGURE 4

Project No. 05-9266
Vista Loop

APPENDIX A

FIELD EXPLORATIONS, SAMPLING, LABORATORY AND FIELD TESTING

On May 18, 2005, twelve exploratory test pits were excavated on the subject property to depths of 8 to 12 feet. On May 31 and June 1 of 2005, three exploratory borings were advanced to depths of 51.5 to 61.5 feet. The approximate exploration locations are shown on Figure 2. A GeoPacific Engineering Geologist evaluated and logged the explorations with regard to soil type, moisture content, relative strength, groundwater content, etc. and collected representative samples. Logs of the explorations are presented in this Appendix. The borings were drilled with track-mounted drill-rigs operated by Geotechnical Explorations, Inc. of Tualatin, Oregon. Standard penetration tests were performed on 5-foot intervals using a standard 2-inch O.D., split-spoon sampler driven with a 140 pound auto-hammer. The test pits were excavated with a 16,000 lbs. trackhoe operated by Dan Fisher Excavating of Banks, Oregon using a 30-inch-wide bucket. All excavations were backfilled immediately after completion of logging and sampling. At the completion of the test pit logging, the test pits were backfilled with the excavated spoils and tamped with the backhoe bucket. This backfill should not be expected to behave as compacted structural fill and some minor settling of the ground surface may occur.

Classification, Moisture Content, and Unit Weights

Soil samples were evaluated, described, and classified in accordance with the Unified Soil Classification System. Rock hardness was characterized using a modified version of the Oregon Department of Transportation (ODOT) Soil and Rock Classification Manual (Table A2). All natural moisture samples were collected in plastic bags, and tested in accordance with the methods outlined in ASTM D2216. Moisture content is expressed as a percentage of the mass of water lost during oven drying to the dry weight of soil.

Moisture-Density Relationship

A Standard Proctor compaction test was performed on one bulk sample from the site to determine the moisture-density relationship of native soils. The test was conducted in accordance with AASHTO T-99. The results obtained may be compared with field densities for the purpose of evaluating relative compaction of fill and native soils. The test results are summarized in Table B1.

Table B1 - Proctor Test Results (AASHTO T-99)

Material Description	Maximum Dry Density (lbs/ft^3)	Optimum Moisture Content
Clayey SILT (ML)	88.0	30.8%

Portable Dynamic Cone Penetrometer Tests

Field tests were conducted with a Portable Dynamic Cone Penetrometer (PDPC) to determine the strength parameters of the native soil for support of pavement.

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TEST PIT LOG

Project: Vista Loop North
Sandy, Oregon

Project No. 05-9266

Test Pit No. **TP-1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark brown, organic SILT (OL), many roots and organics (Topsoil)
1	1.5					Stiff to very stiff, clayey SILT (ML), brown to red-brown, few roots, moist (Native Soil Horizon)
2	2.5					
3	3.0					
4	3.0					Very-stiff, clayey SILT (ML), red-brown, includes sand below 8 feet, damp to moist (Residual Soil)
5						
6						
7						Minor groundwater seepage at 7 feet
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: Minor groundwater seepage encountered at 7 feet
13						
14						
15						
16						
17						

LEGEND

Peg Sample (100 to 1,800 g) · Bucket Sample (5 Gal. Bucket) · Shelby Tube Sample · Seepage · Water Bearing Zone · Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

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TEST PIT LOG

Project: Vista Loop North Sandy, Oregon	Project No. 05-9266	Test Pit No. TP-2

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5					Dark brown, organic SILT (OL), many roots (Topsoil)
2	1.5					Stiff, clayey SILT (ML), red-brown, moist (Native Soil)
3	3.0					
4	3.5					Very-stiff, clayey SILT (ML) to silty CLAY (CL), red-brown with localized gray and orange mottling, damp to moist (Residual Soil)
5						
6						
7						
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: No seepage or groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-0445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North Sandy, Oregon	Project No. 05-0266	Test Pit No. TP-3

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark brown, organic SILT (OL), many roots (Topsoil)
1	0.5					
2	1.5					Stiff to very stiff with localized loose pockets, clayey SILT (ML), brown to red-brown, moist (Colluvial soil)
3	3.0					
4	2.5					
5						Very-stiff, clayey SILT (ML) to lean CLAY (CL), red-brown with localized orange and gray mottling, damp to moist (Residual Soil)
6						
7						Minor groundwater seepage at 7 feet
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: Minor groundwater seepage encountered at 7 feet.
13						
14						
15						
16						
17						

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering Inc
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North
Sandy, Oregon

Project No. 05-9266

Test Pit No. TP-4

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1–4						Variable consistency with loose pockets, mixed organic SILT (OL) and clayey SILT (ML), dark brown to red-brown (Poorly Compacted Fill)
5–7	1.5					Stiff to very-stiff, clayey SILT (ML) to silty CLAY (CL), red-brown, moist (Residual Soil)
8–11						Stiff to very-stiff, sandy SILT (ML), multi-colored light yellow-brown, red, brown, orange, gray and black, highly tuffaceous with relict volcanic lithics, moist (Springwater Formation)
12						Test Pit Terminated at 12 feet
13–17						Note: No seepage or groundwater encountered.

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8706

TEST PIT LOG

Project: Vista Loop North
Sandy, Oregon

Project No. 05-9266

Test Pit No. TP-5

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Variable consistency with loose pockets, mixed organic SILT (OL) and clayey SILT (ML), dark brown to red-brown (Poorly Compacted Fill)
2						
3						Stiff, clayey SILT (ML), red-brown, contains abundant fragments of decomposed volcanic lithics, moist (Colluival Soil)
4						
5	1.5					
6						Stiff to very-stiff, sandy SILT (ML) with clay, multi-colored light yellow-brown, red, brown, orange, gray and black, highly tuffaceous, includes abundant relict volcanic lithics, moist (Springwater Formation)
7						
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: No seepage or groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering Inc
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 590-0445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North, Sandy, Oregon	Project No. 05-9266	Test Pit No. TP-6

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark brown, organic SILT (OL), many roots (Topsoil)
1						
2	1.0					Stiff with loose pockets, clayey SILT (ML) with fragments of decomposed volcanic lithics, red-brown, brown and yellow-brown, moist (Colluvial Soil)
3	0.5					
4	1.0					
5	3.0					
6						Stiff to very-stiff, sandy SILT (ML) with clay and weathered volcanic lithics including cobbles, light gray-brown, yellow-brown, orange, gray and black, highly tuffaceous, moist (Springwater Formation)
7						
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: No seepage or groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crerina
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North, Sandy, Oregon	Project No. 05-9266	Test Pit No. TP-7

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1–4						Medium-stiff with loose pockets, mixed organic SILT (OL) and clayey SILT (ML), dark brown and red-brown, damp to moist (Fill)
5–7						Stiff, clayey SILT (ML), red-brown, moist (Residual Soil)
8–9						Stiff to very-stiff, sandy SILT (ML) with abundant weathered volcanic lithics, light yellow-brown, brown, red-brown, and gray, moist (Springwater Formation)
10–17						Test Pit Terminated at 10 feet Note: No seepage or groundwater encountered.

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North
Sandy, Oregon

Project No. 05-9266

Test Pit No. TP-8

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.5					
2	3.0					Stiff to very-stiff, sandy SILT (ML) with clay, red-brown, moist (Residual Soil)
3	3.5					
4	3.5					
5						
6						
7						
8						Test Pit Terminated at 8 feet
9						
10						Note: No seepage or groundwater encountered.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: D. Cronna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North Sandy, Oregon	Project No. 05-9266	Test Pit No. **TP-9**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark brown, organic SILT (OL), many roots (Topsoil)
1						
2	3.0					Very-stiff, clayey SILT (ML), red-brown, moist (Native Soil)
3	3.0					
4	3.5					
5						Very-stiff, clayey SILT (ML) to silty CLAY (CL), red-brown, damp to moist (Residual Soil)
6						
7						
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: No seepage or groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North
Sandy, Oregon

Project No. 05-9266

Test Pit No. TP-10

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Dark brown, organic SILT (OL), many roots (Topsoil)
2	2.0					Stiff to very-stiff, clayey SILT (ML), red-brown, includes few weathered volcanic lithics and roots, moist (Colluvial Soil)
3	2.5					
4	3.0					
5						Very-stiff, sandy SILT (ML) with clay and abundant weathered volcanic lithics, includes few cobbles, red-brown, gray, light brown, and yellow-brown, highly tuffaceous, damp to moist (Residual Soil)
6						
7						
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: No seepage or groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-0445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North
Sandy, Oregon

Project No. 05-9266

Test Pit No. TP-11

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
						Dark brown, organic SILT (OL), many roots (Topsoil)
1	1.5					Stiff to very-stiff, clayey SILT (ML), brown to red-brown, damp to moist (Native Soil)
2	3.0					
3	3.0					
4	3.0					Very-stiff, clayey SILT (ML), red-brown, damp to moist (Residual Soil)
5						
6						
7						
8						Test Pit Terminated at 8 feet
9						
10						Note: No seepage or groundwater encountered.
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample

Shelby Tube Sample

Seepage

Water Bearing Zone

Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-0445 Fax: (503) 598-8705

TEST PIT LOG

Project: Vista Loop North, Sandy, Oregon	Project No. 05-8266	Test Pit No. TP-12

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Dark brown, organic SILT (OL), many roots (Topsoil)
2	3.0					Very-stiff, clayey SILT (ML), brown to red-brown, damp to moist (Colluvial Soil)
3	3.5					
4	3.5					
5						Very-stiff, clayey SILT (ML), red-brown with gray mottling below 8 feet, damp (Residual Soil)
6						
7						
8						
9						
10						Test Pit Terminated at 10 feet
11						
12						Note: No seepage or groundwater encountered.
13						
14						
15						
16						
17						

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 5/18/05
Logged By: P. Cronne
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

BORING LOG

Project: Vista Loop North
Sandy, Oregon

Job No. 05-9266

Boring No. B-1

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
5		5				Medium-stiff, clayey SILT (ML) and organic SILT (OL), red-brown and dark brown (Fill and Topsoil)
10		21				Medium-stiff to very-stiff, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, highly tuffaceous, red-brown, brown, gray and black, moist (Springwater Formation)
15		6				
20		2/ 50 for 5"				
25		6				Medium-stiff to very-stiff, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, highly tuffaceous, red-brown, brown, gray and black, moist (Springwater Formation)
30		8				
35						

LEGEND

100 to 1,000 g Bag Sample | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table | Water Bearing Zone

Date Drilled: 5/31/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax. (503) 598-8705

BORING LOG

Project: Vista Loop North
Sandy, Oregon

Job No. 05-9266

Boring No. B-1

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
		7				
40		13				Stiff to hard, sandy SILT (ML), brown to gray, includes volcanic lithics, damp (Springwater Formation)
45		23				
50		50 for 3"				
55		75				Hard, gravelly SILT (ML) with sand and volcanic lithics, indurated, highly tuffaceous, damp (Springwater Formation)
60		50 for 1"				
						Boring Terminated at 61.5 feet
65						Note: No groundwater observations possible due to use of mud-rotary drilling technique.
70						

LEGEND

Bag Sample (100 to 1,000 g) | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table | Water Bearing Zone

Date Drilled: 5/31/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering, Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

BORING LOG

Project: Vista Loop North
Sandy, Oregon

Job No. 05-0266

Boring No. B-2

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
5		0				Soft, clayey SILT (ML), some sand, red-brown, highly tuffaceous, moist (Residual Soil)
10		5				Medium-stiff to stiff, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, red-brown, brown to yellow-brown and gray, highly tuffaceous, moist (Springwater Formation)
15		6				
20		12				
25		9				
30		8				Medium-stiff to stiff, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, red-brown, brown to yellow-brown and gray, highly tuffaceous, moist (Springwater Formation)
35						

LEGEND

100 to 1,000 g — Bag Sample; Split-Spoon; Shelby Tube Sample; Static Water Table at Drilling; Static Water Table; Water Bearing Zone

Date Drilled: 5/31/05
Logged By: D. Crenna
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

BORING LOG

Project: Vista Loop North
Sandy, Oregon

Job No. 05-9266

Boring No. B-2

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
40		9				Stiff to hard, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, red-brown, brown to yellow-brown and gray, highly tuffaceous, moist (Springwater Formation)
45		49				
50		16				
55		19				Boring Terminated at 51.5 feet Note: No groundwater observations possible due to use of mud-rotary drilling technique.
60						
65						
70						

LEGEND

100 to 1,000 g Bag Sample | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table | Water Bearing Zone

Date Drilled: 5/31/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-0445 Fax: (503) 598-8705

BORING LOG

Project: Vista Loop North
Sandy, Oregon

Job No. 05-9266

Boring No. B-3

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
5		6				Medium-stiff, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, red-brown, brown, gray and black, highly tuffaceous, moist (Springwater Formation)
10		5				
15		5				
20		8				Medium-stiff to stiff, sandy SILT (ML) with clay and abundant fragments of weathered volcanic lithics, gray, red-brown and brown, highly tuffaceous, moist (Springwater Formation)
25		7				
30		11				
35						

LEGEND

Bag Sample (100 lb / 1,000 g) | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table | Water Bearing Zone

Date Drilled: 6/1/05
Logged By: P. Crenna
Surface Elevation:

GeoPacific Engineering Inc.
7312 SW Durham Road
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 598-8705

BORING LOG

Project: Vista Loop North
Sandy, Oregon

Job No. 05-9266

Boring No. **B-3**

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
40		10				Stiff to hard, sandy SILT (ML) with clay pods and abundant fragments of weathered volcanic lithics, gray, brown, buff and light green-brown, highly tuffaceous, moist (Springwater Formation)
		35				
45		57				
50		16/ 50 for 5"				
						Boring Terminated at 51.5 feet
55						Note: No groundwater observations possible due to use of mud-rotary drilling technique.
60						
65						
70						

LEGEND

Bag Sample (100 to 1,000 g) | Split-Spoon | Shelby Tube Sample | Static Water Table at Drilling | Static Water Table | Water Bearing Zone

Date Drilled: 6/1/05
Logged By: P. Crenna
Surface Elevation:

Project No. 05-9266
Vista Loop

APPENDIX B

SLOPE STABILITY QUANTITATIVE MODELING ANALYSIS

GRAPHIC PLOTS AND OUTPUT RESULTS

08/16/2005 11:31 5035987 5 GEOPACIFIC ENG PAGE 40
1.460
Vista Ridge Section A-A'
40-foot horizontal building setback
Material #: 1 Description: Colluvium/Weathered Bedrock Wt: 125 Cohesion: 300 Phi: 33
Material #: 2 Description: Springwater Formation Wt: 130 Cohesion: 500 Phi: 36
Material #: 3 Description: Troutdale Formation Wt: 125 Cohesion: 250 Phi: 32
Material #: 4 Description: Buttress Fill Wt: 125 Cohesion: 200 Phi: 30
Static Factor of Safety: 1.460
Elevation (feet)
Distance (feet)

08/16/2005 11:31 5035988795 GEOPACIFIC ENG PAGE 41
1.190
Vista Ridge Section A-A'
40-foot horizontal building setback
Material #: 1 Description: Colluvium/Weathered Bedrock Wt: 125 Cohesion: 300 Phi: 33
Material #: 2 Description: Springwater Formation Wt: 130 Cohesion: 500 Phi: 36
Material #: 3 Description: Troutdale Formation Wt: 125 Cohesion: 250 Phi: 32
Material #: 4 Description: Buttress Fill Wt: 125 Cohesion: 200 Phi: 30
Pseudostatic Factor of Safety: 1.190
Elevation (feet)
Distance (feet)

Project No. 05-9286
Vista Loop

APPENDIX C

CHECKLIST OF RECOMMENDED SOIL TESTIING & INSPECTIONS

Item No.	Procedure	Timing	By Whom	Done
1	Pre-construction meeting	Prior to beginning site work	Contractor, Developer, Civil and Geotechnical Engineers	
2	Stripping, aeration, and root-picking operations	During stripping	Soil Technician	
3	Compaction testing of engineered fill (96% of Standard Proctor)	During filling, tested every 2 vertical feet per lot	Soil Technician	
4	Compaction testing of trench backfill (95% of Standard Proctor)	During backfilling, tested every 4 vertical feet for every 200 lineal feet	Soil Technician	
5	Street subgrade compaction (95% of Standard Proctor)	Prior to base course every 200 lineal feet	Soil Technician	
6	Base course compaction (95% of Modified Proctor)	Prior to paving, tested every 200 lineal feet	Soil Technician	
7	AC Compaction (91% (bottom lift) / 92% (top lift) of Rice)	During paving, tested every 200 lineal feet	Soil Technician	
8	Final Geotechnical Engineer's certification	Completion of project	Geotechnical Engineer	

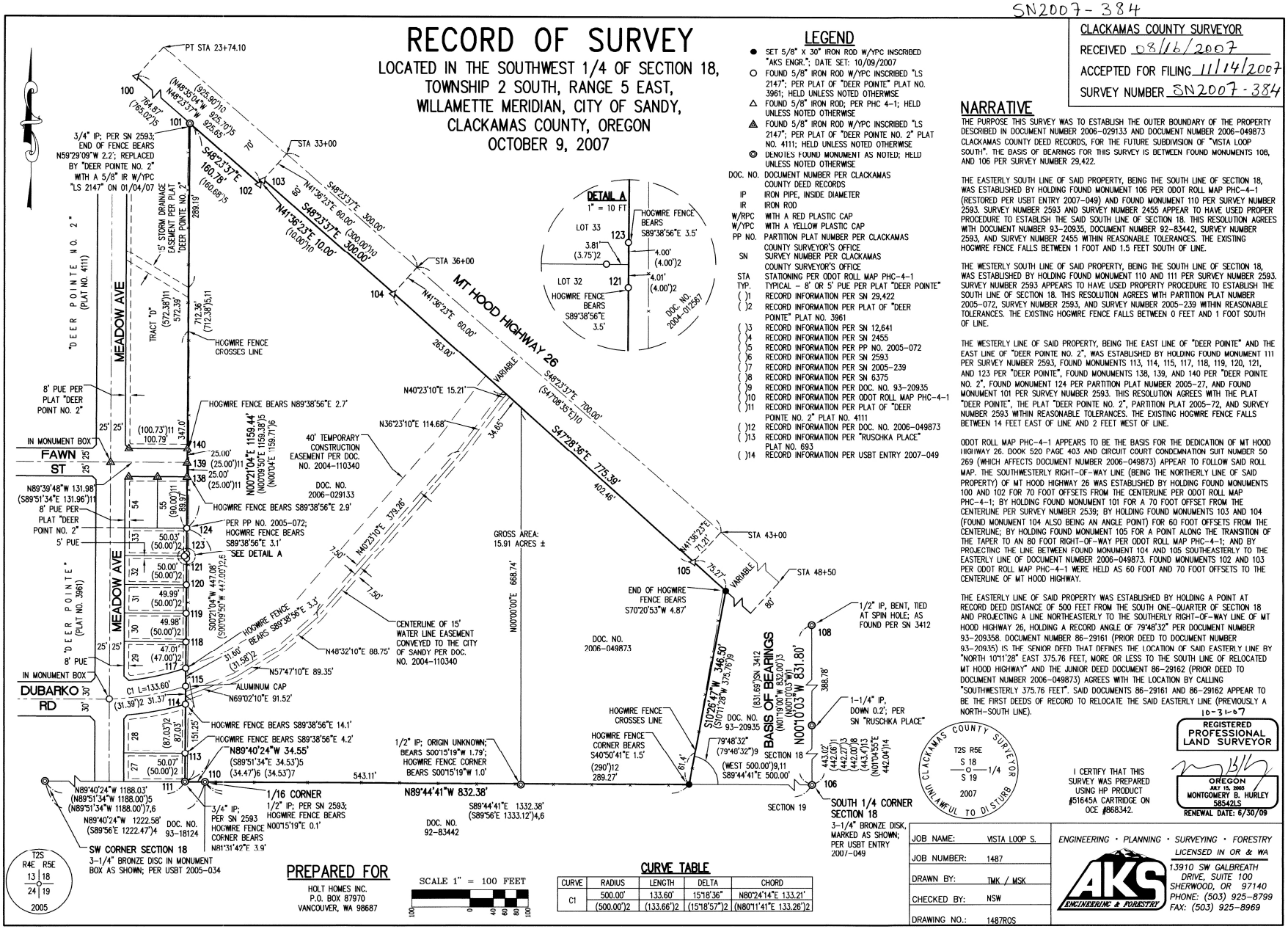
SN2007-384

RECORD OF SURVEY

LOCATED IN THE SOUTHWEST 1/4 OF SECTION 18, TOWNSHIP 2 SOUTH, RANGE 5 EAST, WILLAMETTE MERIDIAN, CITY OF SANDY, CLACKAMAS COUNTY, OREGON

OCTOBER 9, 2007

CLACKAMAS COUNTY SURVEYOR
RECEIVED 08/16/2007
ACCEPTED FOR FILING 11/14/2007
SURVEY NUMBER SN2007-384



LEGEND

- ● SET 5/8" X 30" IRON ROD W/YPC INSCRIBED "AKS ENGR."; DATE SET: 10/09/2007
- ○ FOUND 5/8" IRON ROD W/YPC INSCRIBED "LS 2147"; PER PLAT OF "DEER POINTE" PLAT NO. 3961; HELD UNLESS NOTED OTHERWISE
- △ FOUND 5/8" IRON ROD; PER PHC 4-1; HELD UNLESS NOTED OTHERWISE
- ◬ FOUND 5/8" IRON ROD W/YPC INSCRIBED "LS 2147"; PER PLAT OF "DEER POINTE NO. 2" PLAT NO. 4111; HELD UNLESS NOTED OTHERWISE
- ◎ DENOTES FOUND MONUMENT AS NOTED; HELD UNLESS NOTED OTHERWISE

DOC. NO.	DOCUMENT NUMBER PER CLACKAMAS COUNTY DEED RECORDS
IP	IRON PIPE, INSIDE DIAMETER
IR	IRON ROD
W/RPC	WITH A RED PLASTIC CAP
W/YPC	WITH A YELLOW PLASTIC CAP
PP NO.	PARTITION PLAT NUMBER PER CLACKAMAS COUNTY SURVEYOR'S OFFICE
SN	SURVEY NUMBER PER CLACKAMAS COUNTY SURVEYOR'S OFFICE
STA	STATIONING PER ODOT ROLL MAP PHC-4-1
TYP.	TYPICAL – 8' OR 5' PUE PER PLAT "DEER POINTE"
( )1	RECORD INFORMATION PER SN 29,422
( )2	RECORD INFORMATION PER PLAT OF "DEER POINTE" PLAT NO. 3961
( )3	RECORD INFORMATION PER SN 12,641
( )4	RECORD INFORMATION PER SN 2455
( )5	RECORD INFORMATION PER PP NO. 2005-072
( )6	RECORD INFORMATION PER SN 2593
( )7	RECORD INFORMATION PER SN 2005-239
( )8	RECORD INFORMATION PER SN 6375
( )9	RECORD INFORMATION PER DOC. NO. 93-20935
( )10	RECORD INFORMATION PER ODOT ROLL MAP PHC-4-1
( )11	RECORD INFORMATION PER PLAT OF "DEER POINTE NO. 2" PLAT NO. 4111
( )12	RECORD INFORMATION PER DOC. NO. 2006-049873
( )13	RECORD INFORMATION PER "RUSCHKA PLACE" PLAT NO. 693
( )14	RECORD INFORMATION PER USBT ENTRY 2007-049

NARRATIVE

THE PURPOSE THIS SURVEY WAS TO ESTABLISH THE OUTER BOUNDARY OF THE PROPERTY DESCRIBED IN DOCUMENT NUMBER 2006-029133 AND DOCUMENT NUMBER 2006-049873 CLACKAMAS COUNTY DEED RECORDS, FOR THE FUTURE SUBDIVISION OF "VISTA LOOP SOUTH". THE BASIS OF BEARINGS FOR THIS SURVEY IS BETWEEN FOUND MONUMENTS 108, AND 106 PER SURVEY NUMBER 29,422.

THE EASTERLY SOUTH LINE OF SAID PROPERTY, BEING THE SOUTH LINE OF SECTION 18, WAS ESTABLISHED BY HOLDING FOUND MONUMENT 106 PER ODOT ROLL MAP PHC-4-1 (RESTORED PER USBT ENTRY 2007-049) AND FOUND MONUMENT 110 PER SURVEY NUMBER 2593. SURVEY NUMBER 2593 AND SURVEY NUMBER 2455 APPEAR TO HAVE USED PROPER PROCEDURE TO ESTABLISH THE SAID SOUTH LINE OF SECTION 18. THIS RESOLUTION AGREES WITH DOCUMENT NUMBER 93-20935, DOCUMENT NUMBER 92-83442, SURVEY NUMBER 2593, AND SURVEY NUMBER 2455 WITHIN REASONABLE TOLERANCES. THE EXISTING HOGWIRE FENCE FALLS BETWEEN 1 FOOT AND 1.5 FEET SOUTH OF LINE.

THE WESTERLY SOUTH LINE OF SAID PROPERTY, BEING THE SOUTH LINE OF SECTION 18, WAS ESTABLISHED BY HOLDING FOUND MONUMENT 110 AND 111 PER SURVEY NUMBER 2593. SURVEY NUMBER 2593 APPEARS TO HAVE USED PROPERTY PROCEDURE TO ESTABLISH THE SOUTH LINE OF SECTION 18. THIS RESOLUTION AGREES WITH PARTITION PLAT NUMBER 2005-072, SURVEY NUMBER 2593, AND SURVEY NUMBER 2005-239 WITHIN REASONABLE TOLERANCES. THE EXISTING HOGWIRE FENCE FALLS BETWEEN 0 FEET AND 1 FOOT SOUTH OF LINE.

THE WESTERLY LINE OF SAID PROPERTY, BEING THE EAST LINE OF "DEER POINTE" AND THE EAST LINE OF "DEER POINTE NO. 2", WAS ESTABLISHED BY HOLDING FOUND MONUMENT 111 PER SURVEY NUMBER 2593, FOUND MONUMENTS 113, 114, 115, 117, 118, 119, 120, 121, AND 123 PER "DEER POINTE", FOUND MONUMENTS 138, 139, AND 140 PER "DEER POINTE NO. 2", FOUND MONUMENT 124 PER PARTITION PLAT NUMBER 2005-27, AND FOUND MONUMENT 101 PER SURVEY NUMBER 2593. THIS RESOLUTION AGREES WITH THE PLAT "DEER POINTE", THE PLAT "DEER POINTE NO. 2", PARTITION PLAT 2005-72, AND SURVEY NUMBER 2593 WITHIN REASONABLE TOLERANCES. THE EXISTING HOGWIRE FENCE FALLS BETWEEN 14 FEET EAST OF LINE AND 2 FEET WEST OF LINE.

ODOT ROLL MAP PHC-4-1 APPEARS TO BE THE BASIS FOR THE DEDICATION OF MT HOOD HIGHWAY 26. BOOK 520 PAGE 403 AND CIRCUIT COURT CONDEMNATION SUIT NUMBER 50 269 (WHICH AFFECTS DOCUMENT NUMBER 2006-049873) APPEAR TO FOLLOW SAID ROLL MAP. THE SOUTHWESTERLY RIGHT-OF-WAY LINE (BEING THE NORTHERLY LINE OF SAID PROPERTY) OF MT HOOD HIGHWAY 26 WAS ESTABLISHED BY HOLDING FOUND MONUMENTS 100 AND 102 FOR 70 FOOT OFFSETS FROM THE CENTERLINE PER ODOT ROLL MAP PHC-4-1; BY HOLDING FOUND MONUMENT 101 FOR A 70 FOOT OFFSET FROM THE CENTERLINE PER SURVEY NUMBER 2539; BY HOLDING FOUND MONUMENTS 103 AND 104 (FOUND MONUMENT 104 ALSO BEING AN ANGLE POINT) FOR 60 FOOT OFFSETS FROM THE CENTERLINE; BY HOLDING FOUND MONUMENT 105 FOR A POINT ALONG THE TRANSITION OF THE TAPER TO AN 80 FOOT RIGHT-OF-WAY PER ODOT ROLL MAP PHC-4-1; AND BY PROJECTING THE LINE BETWEEN FOUND MONUMENT 104 AND 105 SOUTHEASTERLY TO THE EASTERLY LINE OF DOCUMENT NUMBER 2006-049873. FOUND MONUMENTS 102 AND 103 PER ODOT ROLL MAP PHC-4-1 WERE HELD AS 60 FOOT AND 70 FOOT OFFSETS TO THE CENTERLINE OF MT HOOD HIGHWAY.

THE EASTERLY LINE OF SAID PROPERTY WAS ESTABLISHED BY HOLDING A POINT AT RECORD DEED DISTANCE OF 500 FEET FROM THE SOUTH ONE-QUARTER OF SECTION 18 AND PROJECTING A LINE NORTHEASTERLY TO THE SOUTHERLY RIGHT-OF-WAY LINE OF MT HOOD HIGHWAY 26, HOLDING A RECORD ANGLE OF 79°48'32" PER DOCUMENT NUMBER 93-209358. DOCUMENT NUMBER 86-29161 (PRIOR DEED TO DOCUMENT NUMBER 93-20935) IS THE SENIOR DEED THAT DEFINES THE LOCATION OF SAID EASTERLY LINE BY "NORTH 10°11'28" EAST 375.76 FEET, MORE OR LESS TO THE SOUTH LINE OF RELOCATED MT HOOD HIGHWAY" AND THE JUNIOR DEED DOCUMENT 86-29162 (PRIOR DEED TO DOCUMENT NUMBER 2006-049873) AGREES WITH THE LOCATION BY CALLING "SOUTHWESTERLY 375.76 FEET". SAID DOCUMENTS 86-29161 AND 86-29162 APPEAR TO BE THE FIRST DEEDS OF RECORD TO RELOCATE THE SAID EASTERLY LINE (PREVIOUSLY A NORTH-SOUTH LINE).

10-31-07

REGISTERED PROFESSIONAL LAND SURVEYOR

I CERTIFY THAT THIS SURVEY WAS PREPARED USING HP PRODUCT #51645A CARTRIDGE ON OCE #668342.

OREGON JULY 19, 2003 MONTGOMERY B. HURLEY 58542LS
RENEWAL DATE: 6/30/09

PREPARED FOR

HOLT HOMES INC.
P.O. BOX 87970
VANCOUVER, WA 98687

SCALE 1" = 100 FEET

100 0 40 60 80 100

CURVE TABLE

CURVE	RADIUS	LENGTH	DELTA	CHORD
C1	500.00'	133.60'	15°18'36"	N80°24'14"E 133.21'
	(500.00')2	(133.66')2	(15°18'57")2	(N80°11'41"E 133.26')2

JOB NAME:	VISTA LOOP S.
JOB NUMBER:	1487
DRAWN BY:	TMK / MSK
CHECKED BY:	NSW
DRAWING NO.:	1487ROS

ENGINEERING • PLANNING • SURVEYING • FORESTRY
LICENSED IN OR & WA
AKS ENGINEERING & FORESTRY
13910 SW GALBREATH DRIVE, SUITE 100
SHERWOOD, OR 97140
PHONE: (503) 925-8799
FAX: (503) 925-8969

May 3, 2019 **EXHIBIT H**

Carey Sheldon
PO Box 883
Fairview, OR 97024

RE: Dubarko Road Subdivision – Wetland Determination

Carey:

This letter provides findings of a wetlands determination conducted by Environmental Science & Assessment, LLC (ES&A) at 40808 & 41010 Highway 26 in Sandy, Oregon (TL# 25E18CD00900 & TL#25E18CD01000) to evaluate the existing conditions. The 16.12-acre site is located directly east of a subdivision near Dubarko Road and Meadows Avenue and south of Highway 26 in the east end of Sandy, Oregon (Figure 1; Attachment A). The parcel boundaries and base topographic survey were provided by All County Surveyors and Planners, Inc.

A 6-lot subdivision and 216-unit condominium complex site is planned for the project. The project developer contracted ES&A to determine the presence of jurisdictional resources on site and determine the presence or absence of potential stream or wetland within the site.

METHODOLOGY

Potential wetland areas on the parcel were evaluated using the methodology provided in the Army Corps of Engineers *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region*, (U.S. Army Corps of Engineers, 2010). This methodology defines criteria for hydrology, soils, and vegetation to identify wetland areas.

Two levels of investigation were used to evaluate the presence or absence of Sensitive Areas. The first level included a review of existing and available background data. The second level consisted of an on-site field investigation.

Reviewed background data included the following information:

- Aerial Photography (Google Earth, 2018)
- City of Sandy Local Wetland Inventory (Sri/Shapiro AGCO Inc., 1997)
- USFWS National Wetland Inventory (NWI) (USFWS, 2019)
- Natural Resource Conservation Service (NRCS) Soil Survey of Clackamas County, Oregon (Web Soil Survey, 2019)
- Topography (Metro Data Resource Center's MetroMap, 2018)

The lots within site are currently undeveloped, but a small structure was located on TL 1000 in 2012 based on the available 2012 aerial photos (Figure 2). The only evidence of water or wetland resources on site is an intermittent stream mapped on the City of Sandy Local Wetland Inventory (LWI) extending east to west through the site. The USFWS NWI does not map wetland or waters within the site (Figure 3) and the NRCS soil survey does not map hydric soils on site (Figure 4).

ES&A wetland scientist, Jack Dalton, conducted the site assessment on March 23, 2019, with a preliminary site visit on June 8, 2018. Three (3) wetland determination data plots were established to document existing conditions on-site (Figure 5). The data sheets are included in Appendix C of this report. Data plot locations were mapped in the field using a hand-held resource grade GPS unit and transferred to a base topographic survey provided by All County Surveyors and Planners, Inc. (Attachment A).

EXISTING CONDITIONS

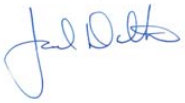
The 16.12-acre site located at 40808 & 41010 Highway 26, Sandy, Oregon (TL# 25E18CD00900 & TL#25E18CD01000) is bordered by Highway 26 to the north and a neighborhood to the west. Agricultural land is located east of the site and a single-family residence is located on the lot directly east (Figure 1). A stub for Dubarko Road and a second road stub for Fawn Street are located along the west site boundary (Figure 2).

The investigation found no water feature at the mapped location in the middle of the site. While there is a narrow linear depression extending roughly east to west through the site, no defined channel bed or bank is present, as documented by site data plot locations (Figure 5). No evidence of ponding was observed in the lowest points in the west end of the site and no evidence of seasonal surface water flow was observed in the area of the mapped stream. The plant community is primarily a weedy cleared field dominated by Himalayan blackberry (*Rubus armeniacus*, FAC) and pasture grasses. The tree groves on site are primarily Douglas fit (*Pseudotsuga menziesii*, FACU) with small clusters of western red-cedar (*Thuja plicata*, FAC). No wetland vegetation is present on site. Soils sampled at the three data plots all lacked hydric soil indicators and showed no evidence of sub-surface saturation, high seasonal groundwater, saturation or other hydrology indicators. Photos documenting the existing conditions and plant community are provided in Attachment B. Detailed plant and soil data is provided in Attachment C.

It is my conclusion that the intermittent stream feature mapped on the LWI mapping is not longer accurate and no stream feature or wetland is currently present on site. Any historic drainage that may have extended through the site has is no longer present and was altered by past land use or a change in the surrounding basin hydrology up slope of site. There is no evidence of any surface water entering the site from the east and no evidence of wetland or seasonal ponded water features was observed in the lowest topographic point of site where wetland or were most likely to be located.

If you have any questions about the findings presented in this letter, I would be happy to discuss the determination findings further.

Sincerely,

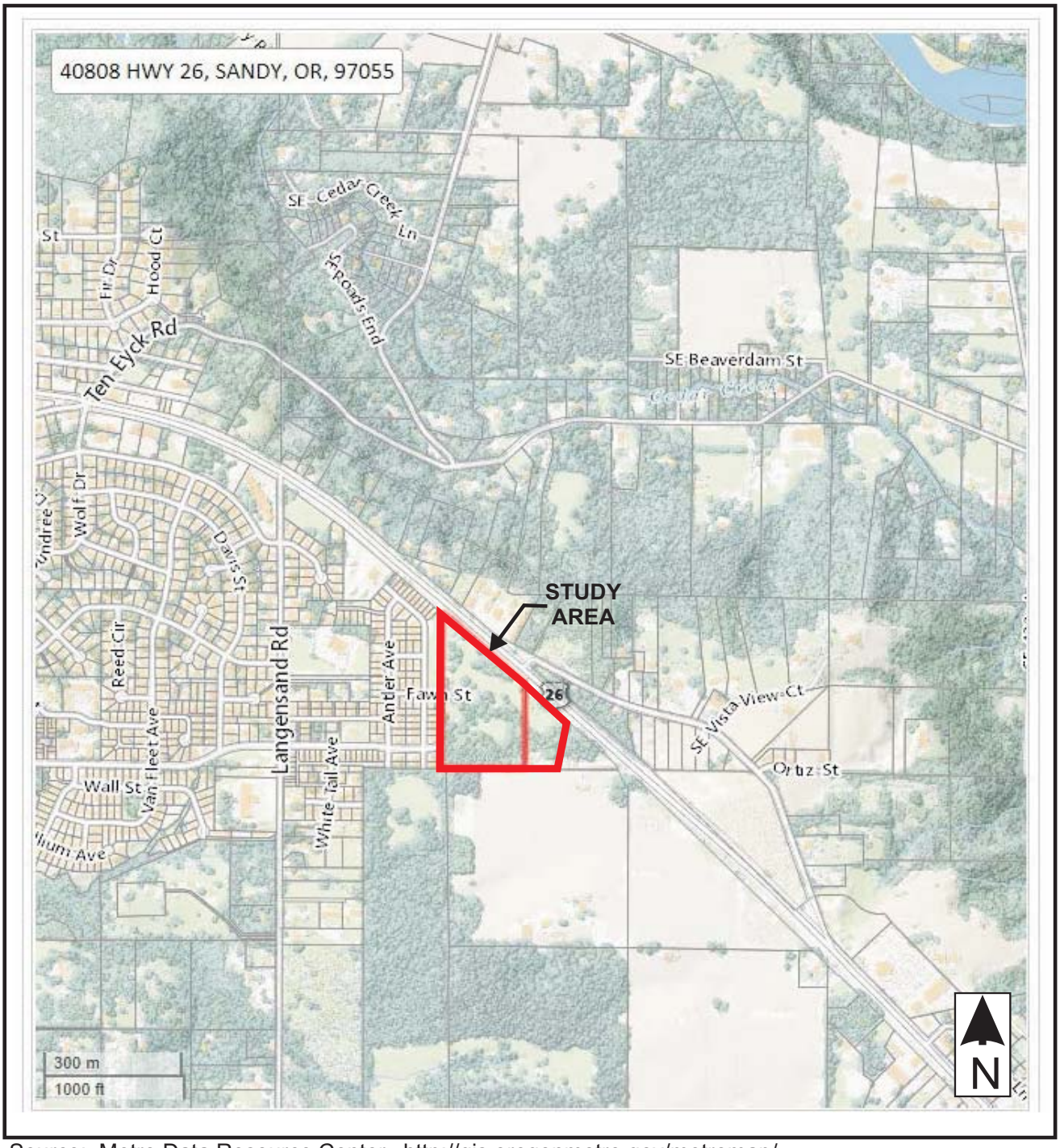


Jack Dalton
Environmental Science & Assessment, LLC

Cc: Alex Reverman (via email)
Ray Moore (via email)

Attachments
A – Figures
B – Site Photos
C - Wetland Determination Data

ATTACHMENT A: FIGURES



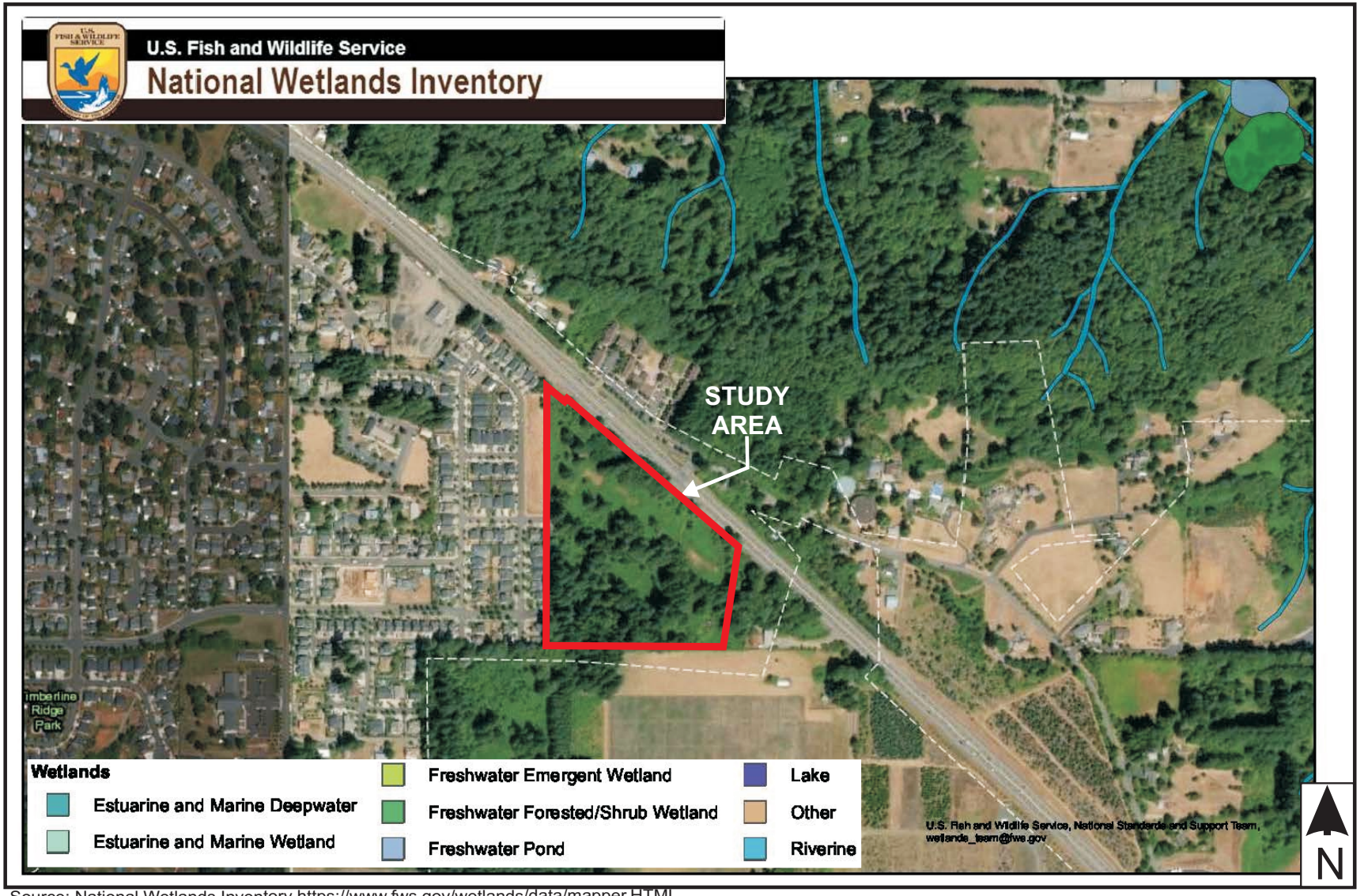
Source: Metro Data Resource Center. http://gis.oregonmetro.gov/metromap/

Environmental Science & Assessment, LLC	Vicinity Map Dubarko Road Subdivision Sandy, Oregon	Figure 1 Approx. Scale: 1in. = 100 ft.

Source: Google Earth

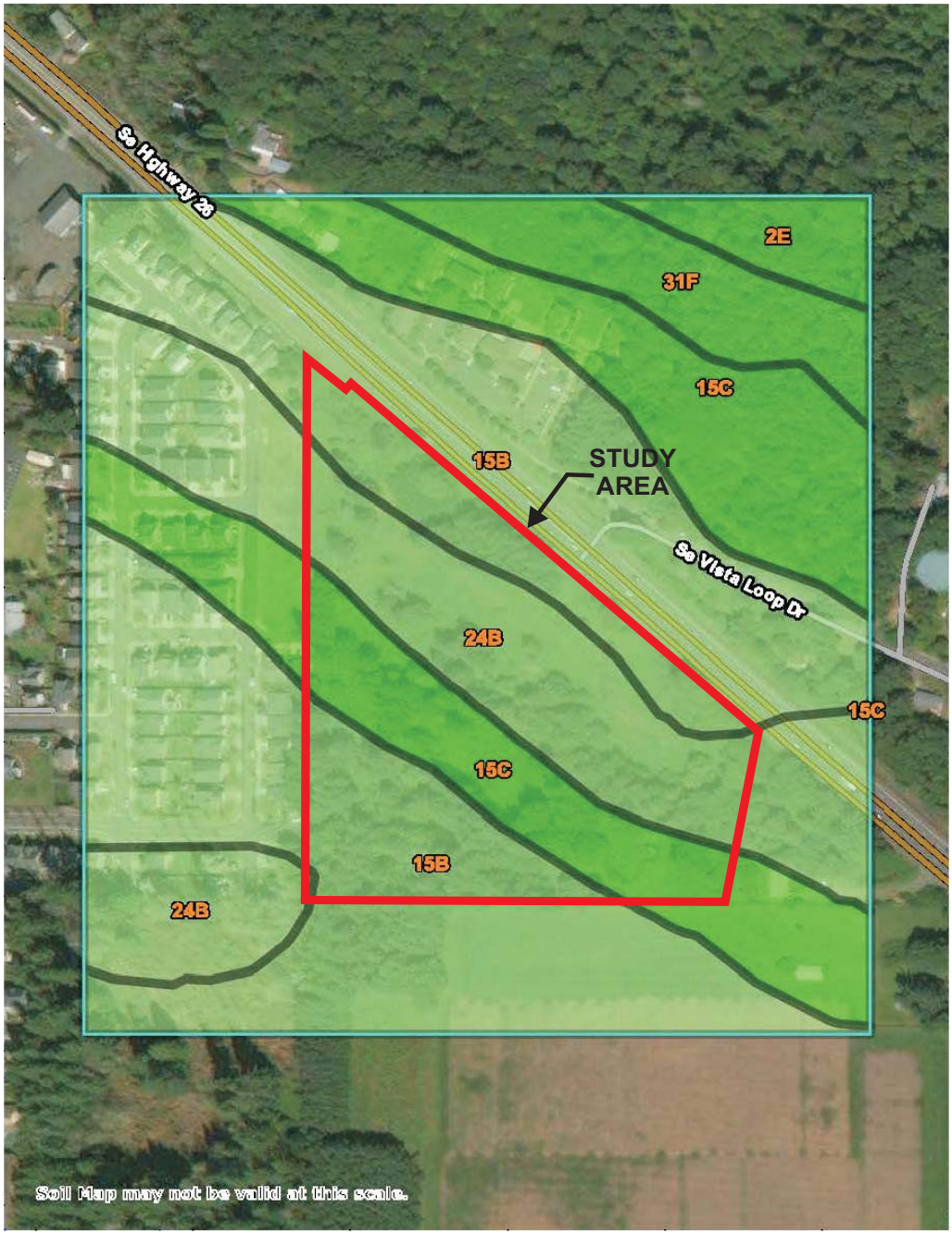
Image Date: 9/3/2018

Environmental Science & Assessment, LLC	Aerial Photograph Dubarko Road Subdivision Sandy, Oregon	Approx. Scale: 1in. = 345ft.	Figure 2



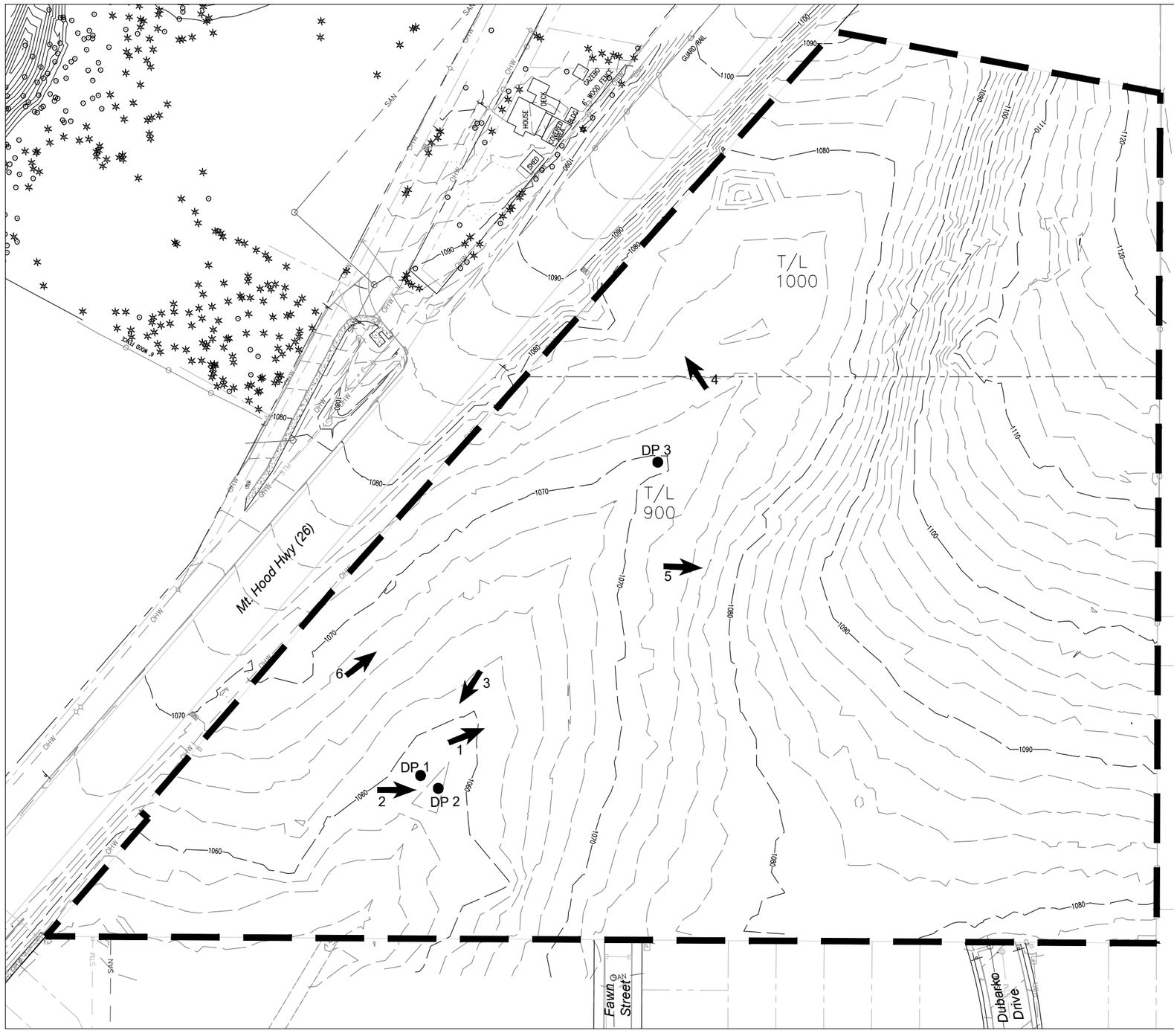
Source: National Wetlands Inventory https://www.fws.gov/wetlands/data/mapper.HTML

Environmental Science & Assessment, LLC	NWI Map Dubarko Road Subdivision Sandy, Oregon	Not to Scale	Figure 3



Source: NRCS Web Soil Survey https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

Environmental Science & Assessment, LLC	NRCS Soil Map Dubarko Road Subdivision Sandy, Oregon	Figure 4 Not to Scale



Environmental Science & Assessment, LLC

107 SE Washington St., Suite 249
Portland, OR 97214
Phone: 503.478.0424
www.esapdx.com

Existing Conditions Map
Dubarko Road Subdivision
40808, 41010 HWY 26
Sandy, Oregon

Base Map Source:	All County Surveyors & Planners, Inc.
Modified By:	KR
Date:	4/19
Job:	18042
Rev:	00/00

Figure 5

ATTACHMENT B: SITE PHOTOS

Photo 1: View SE of low point in the middle of the site.

Photo 2: View S by DP-1 and DP-2. Shallow swale with no offsite connection.

Photo 3: View NW of the middle of the site.

Photo 4: View NE of overgrown blackberry area.

Photo 5: View S of Doug fir forest in SW corner.

Photo 6: View NE of doug fir grove at N end.

ATTACHMENT C: WETLAND DETERMINATION DATA SHEETS

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Dubarko Road Subdivision City/County: Sandy/Clackamas Sampling Date: 3/28/19

Applicant/Owner: Roll Tide Properties Corp State: OR Sampling Point: DP-1

Investigator(s): Jack Dalton Section, Township, Range: S18 T2S R5E

Landform (hillslope, terrace, etc.): Local relief (concave, convex, none): none Slope (%):

Subregion (LRR): A-Northwest Forests and Coasts Lat: 45.392061° Long: -122.244803° Datum: N/A

Soil Map Unit Name: Cottrell silty clay loam (24B) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No (If no, explain in Remarks.)

Are Vegetation , Soil , or Hydrology significantly disturbed? Are "Normal Circumstances" present? Yes X No

Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes	No X
Hydric Soil Present?	Yes	No X
Wetland Hydrology Present?	Yes	No X

Is the Sampled Area within a Wetland? Yes No X

Remarks: Data point taken at grassy, flat area in the lower topo in west end.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' diameter)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size:)			
1. Rubus armeniacus	25	yes	FAC
2.			
3.			
4.			
5.			
	25 = Total Cover		
Herb Stratum (Plot size:)			
1. Schedonorus arundinaceus	50	yes	FAC
2. Agrostis sp.	20	yes	UPL
3. Dactylis glomerata	20	yes	FACU
4. Poa sp.	10		FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size:)			
1.			
2.			
	= Total Cover		

% Bare Ground in Herb Stratum

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	60	x 3 =	180
FACU species	45	x 4 =	180
UPL species	20	x 5 =	100
Column Totals:	125 (A)		460 (B)

Prevalence Index = B/A = 3.6

Hydrophytic Vegetation Indicators:

- 1 - Rapid Test for Hydrophytic Vegetation
- 2 - Dominance Test is >50%
- 3 - Prevalence Index is ≤3.0[1]
- 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- 5 - Wetland Non-Vascular Plants[1]
- Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes No X

Remarks:

SOIL

Sampling Point: DP-1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	7.5 YR 3/2	100			C	M	silt loam	no redox
12-16	7.5YR 4/4	99	7.5YR 4/6	1	C	M	silt loam	
16-20	7.5YR 3/4	99	7.5YR 4/6	1	C	M	silt clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation/O.R. or evidence of surface flow.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Dubarko Road Subdivision City/County: Sandy/Clackamas Sampling Date: 3/28/19

Applicant/Owner: Roll Tide Properties Corp State: OR Sampling Point: DP-2

Investigator(s): Jack Dalton Section, Township, Range: S18 T2S R5E

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): none Slope (%): _____

Subregion (LRR): A-Northwest Forests and Coasts Lat: 45.392061° Long: -122.244803° Datum: N/A

Soil Map Unit Name: Cottrell silty clay loam (24B) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: Data point taken at low point in linear swale in the west end - no evidence of wetland hydrology.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' diameter)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. Rubus armeniacus	50	yes	FAC
2.			
3.			
4.			
5.			
	50 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Schedonorus arundinaceus	50	yes	FAC
2. Agrostis sp.	30	yes	UPL
3. Holcus lanatus	15		FAC
4. Galium aparine	5		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species _____	x 1 = _____
FACW species _____	x 2 = _____
FAC species 115	x 3 = 345
FACU species 5	x 4 = 20
UPL species 30	x 5 = 150
Column Totals: 150 (A)	515 (B)

Prevalence Index = B/A = 3.43

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ✓ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: Veg meets dominance test, but fails prevalence index test - marginal FAC dominated community that lacks FACW or OBL veg.

SOIL

Sampling Point: DP-2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-9	7.5 YR 3/2	100			C	M	silt loam	no redox, 10% pebbles
9-12	7.5YR 3/2	99	7.5YR 3/4	1	C	M	silt loam	
12-16	7.5YR 4/4	80	7.5YR 3/2	18	C	M		
			7.5YR 3/4	2	C	M		
16-20	7.5YR 4/4	90	7.5YR 4/6	10	C	M		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
- ___ Salt Crust (B11)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)
- ___ Raised Ant Mounds (D6) (**LRR A**)
- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? Yes _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: No saturation, O.R. or evidence of surface flow.

WETLAND DETERMINATION DATA FORM – Western Mountains, Valleys, and Coast Region

Project/Site: Dubarko Road Subdivision City/County: Sandy/Clackamas Sampling Date: 3/28/19

Applicant/Owner: Roll Tide Properties Corp State: OR Sampling Point: DP-3

Investigator(s): Jack Dalton Section, Township, Range: S18 T2S R5E

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): A-Northwest Forests and Coasts Lat: 45.392061° Long: -122.244803° Datum: N/A

Soil Map Unit Name: Cottrell silty clay loam (24B) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks: Data point taken up linear depression in middle of site - no wetland hydrology evident.

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 30' diameter)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1. Rubus armeniacus	50	yes	FAC
2.			
3.			
4.			
5.			
	50 = Total Cover		
Herb Stratum (Plot size: _____)			
1. Holcus lanatus	35	yes	FAC
2. Anthoxanthum odoratum	30	yes	FACU
3. Agrostis sp.	30	yes	UPL
4. Schedonorus arundinaceus	5		FAC
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		
% Bare Ground in Herb Stratum _____			

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	_____	x 1 =	_____
FACW species	_____	x 2 =	_____
FAC species	40	x 3 =	120
FACU species	80	x 4 =	320
UPL species	30	x 5 =	150
Column Totals:	150 (A)		590 (B)

Prevalence Index = B/A = 3.9

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- ___ 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ 5 - Wetland Non-Vascular Plants[1]
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: Marginal degraded plant community - lacks FACW or greater plants.

SOIL

Sampling Point: DP-3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	7.5 YR 3/3	100			C	M	silt loam	no redox,
10-13	7.5YR 4/3	98	10YR 3/6	2	C	M		
13-15	10YR 4/4	95	7.5YR 4/6	5	C	M		
15-20	10YR 4/3	80	7.5YR 4/6	10	C	M		
			10YR 4/4	10				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1) (**except MLRA 1**)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10)
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Water-Stained Leaves (B9) (**except MLRA 1, 2, 4A, and 4B**)
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- ___ Stunted or Stressed Plants (D1) (**LRR A**)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water-Stained Leaves (B9) (**MLRA 1, 2, 4A, and 4B**)
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- ___ Frost-Heave Hummocks (D7)

Field Observations:

Surface Water Present? Yes _____ No ✓ Depth (inches): _____

Water Table Present? Yes _____ No ✓ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No ✓ Depth (inches): _____

Wetland Hydrology Present? **Yes** _____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: faint O.R. at 13"

OFFSITE WETLAND DETERMINATION REPORT **BATCH**
OREGON DEPARTMENT OF STATE LANDS **WD#:** 2019-0386
775 Summer Street NE, Suite 100, Salem OR 97301-1279 Phone: (503) 986-5200

At your request, an offsite wetland determination has been conducted on the property described below.

County: Clackamas City: Sandy

Agent Name & Address: Tracy Brown, Tracy Brown Planning Consultants, LLC, 17075 Fir Dr., Sandy, OR 97055

Township: 2S Range: 5E Section: 18 Q/Q: CD Tax Lot(s): 900, 1000

Project Name: Site Evaluation

Site Address/Location: 40808 and 41010 Highway 26, Sandy, OR

☐ The National Wetlands Inventory or Local Wetlands Inventory shows a wetland on the property.

☐ The county soil survey shows hydric (wet) soils on the property. Hydric soils indicate that there may be wetlands.

☒ It is unlikely that there are jurisdictional wetlands or waterways on the property based upon a review of wetlands maps, the county soil survey and other information. An onsite investigation by a qualified professional is the only way to be certain that there are no wetlands.

☐ There may be wetlands/waterways on the property that are subject to the state Removal-Fill Law.

- ☒ A state permit is required for ≥ 50 cubic yards of fill, removal, or ground alteration in the wetlands or waterways.
- ☐ A state permit may be required for any amount of fill, removal, or other ground alteration in the Essential Salmonid Habitat and hydrologically associated wetlands.

☐ A state permit will be/will not be required for project because/if .

☐ The proposed parcel division may create a lot that is largely wetland and thus create future development problems.

☐ A wetland delineation by a qualified wetland consultant is recommended prior to site development. The wetland delineation report should be submitted to DSL for review and approval.

☐ A permit may be required by the Army Corps of Engineers: (503) 808-4373

Note: This report is for the state Removal-Fill Law only. City or County permits may be required for the proposed activity.

Comments: Based on a review of the available information, there are no jurisdictional wetlands or waters on the property.

Determination by: _____ Date: 7/03/19

☐ This jurisdictional determination is valid for five years from the above date, unless new information necessitates a revision. Circumstances under which the Department may change a determination and procedures for renewal of an expired determination are found in OAR 141-090-0045 (available on our web site or upon request). The applicant, landowner, or agent may submit a request for reconsideration of this determination in writing within six months from the above date.

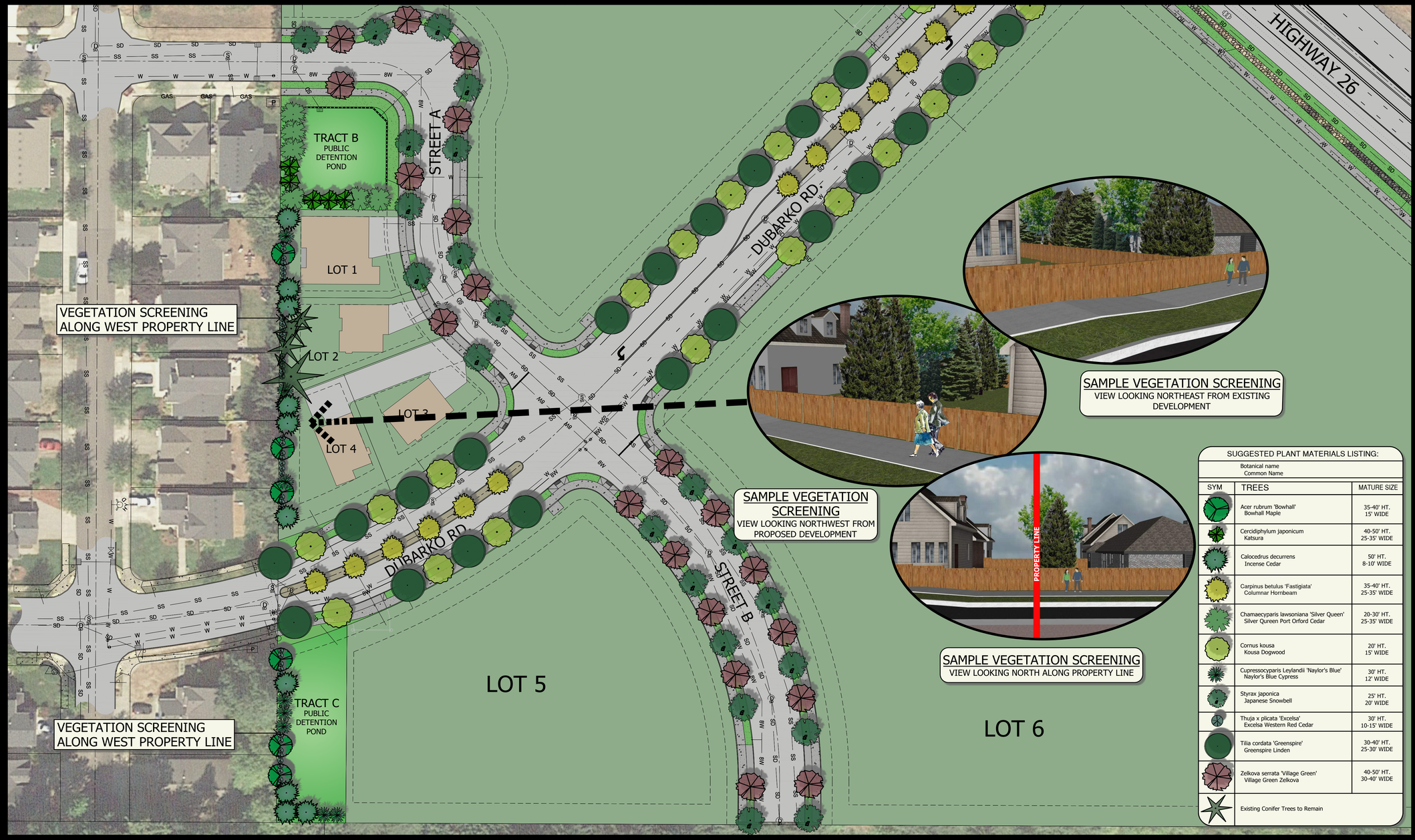
☒ **This is a preliminary jurisdictional determination and is advisory only.**

Copy To: ☐ Other ☒ Enclosures: email: tbrownplan@gmail.com
☐ City of Sandy

FOR OFFICE USE ONLY

Entire Lot(s) Checked? ☒ Yes ☐ No **Waters Present** ☐ Yes ☒ No ☐ Maybe **Request Received:** 6/27/2019
LWI Area: Sandy **LWI Code:** N/A **Latitude:** 45.390763 **Longitude:** -122.244278 **Related DSL File #** N/A
Has Wetlands? ☐Y ☒N ☐Unk **ESH?** ☐Y ☒N **Wild & Scenic?** ☐Y ☒N **State Scenic?** ☐Y ☒N **Coast Zone?** ☐Y ☒N ☐Unk
Adjacent Waterbody: N/A **NWI Quad:** Sandy ☒ Scanned ☒ Mailings Completed ☒ Data Entry Completed

proj# 78454



SUGGESTED PLANT MATERIALS LISTING:

SYM	Botanical name / Common Name	MATURE SIZE
	TREES	
	Acer rubrum 'Bowhall' Bowhall Maple	35-40' HT. 15' WIDE
	Cercidiphylum japonicum Katsura	40-50' HT. 25-35' WIDE
	Calocedrus decurrens Incense Cedar	50' HT. 8-10' WIDE
	Carpinus betulus 'Fastigiata' Columnar Hornbeam	35-40' HT. 25-35' WIDE
	Chamaecyparis lawsoniana 'Silver Queen' Silver Qureen Port Orford Cedar	20-30' HT. 25-35' WIDE
	Cornus kousa Kousa Dogwood	20' HT. 15' WIDE
	Cupressocyparis Leylandii 'Naylor's Blue' Naylor's Blue Cypress	30' HT. 12' WIDE
	Styrax japonica Japanese Snowbell	25' HT. 20' WIDE
	Thuja x plicata 'Excelsa' Excelsa Western Red Cedar	30' HT. 10-15' WIDE
	Tilia cordata 'Greenspire' Greenspire Linden	30-40' HT. 25-30' WIDE
	Zelkova serrata 'Village Green' Village Green Zelkova	40-50' HT. 30-40' WIDE
	Existing Conifer Trees to Remain	

BULLRUN TERRACE

ROLL TIDE PROPERTIES CORPORATION

40808 & 41010 HIGHWAY 26, SANDY, OR 97055

ALL COUNTY SURVEYORS AND PLANNERS, INC. CIVIL ENGINEER | **MEARS DESIGN GROUP** LANDSCAPE ARCHITECT

SEPTEMBER 2020
ALL RIGHTS RESERVED BY ALL FIRMS

EXHIBIT I

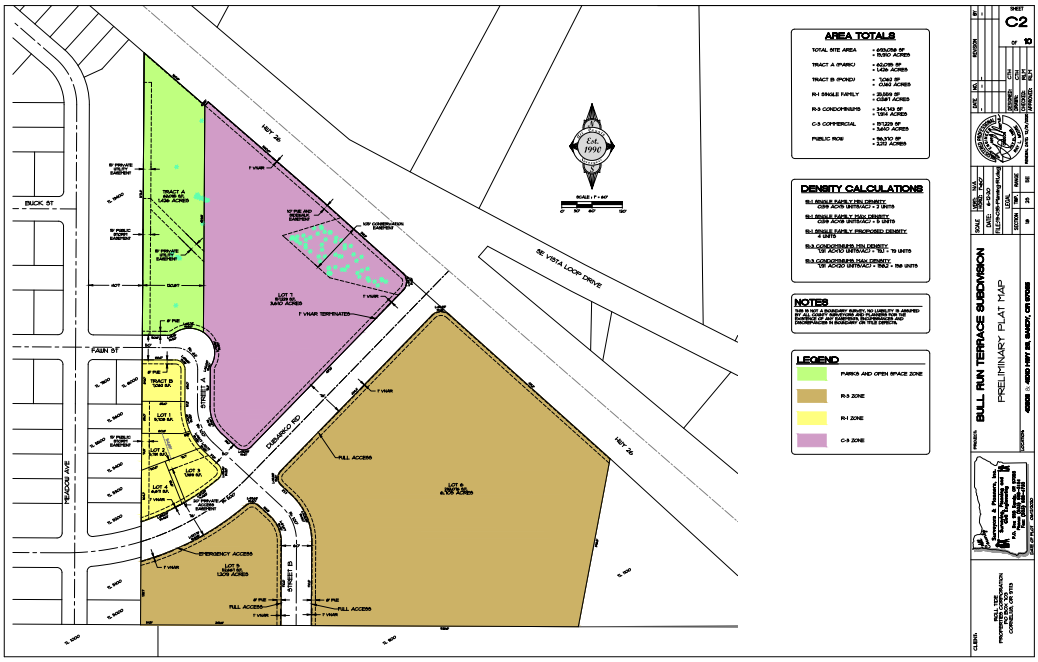
L1- SCREENING CONCEPT PLAN

SCALE: 1" = 30'-0"

30' 15' 0' 30' 60'

EXHIBIT J

JOHNSON ECONOMICS



PUBLIC NEED ANALYSIS FOR ROLLTIDE PROPERTY

RESIDENTIAL LANDS
CITY OF SANDY

JULY, 2020

621 SW ALDER, SUITE 605, PORTLAND, OR 97205 503/295-7832

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TABLE OF CONTENTS

INTRODUCTION 1
RESIDENTIAL LAND NEEDS 3
SITE SUITABILITY FOR PROPOSED USES 5
CONCLUSIONS REGARDING THE PROPOSED ZONE CHANGE 5

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INTRODUCTION

Johnson Economics was asked to prepare an assessment of the public need for residential as well as commercial uses in the City of Sandy. This work is in support of a comprehensive plan and zone change application for a 15.91-acre site located south of Highway 26 at the future intersection with Dubarko Road.

LOCATION OF SUBJECT SITE

SOURCE: Clackamas Maps

Current zoning on the site include 2.84 acres of C-3 (Village Commercial), 8.05 acres designated R-1 (Low Density Residential), and 5.01 acres designated R-2 (Medium Density Residential). The proposed change in zoning would increase the C-3 zoned area to 3.61 acres, reduce the R-1 zoned property to 0.59 acres, and rezone 7.91 acres to R-3 (High Density Residential). In addition, 1.43 acres would be set aside as POS (Parks and Open Space), 2.21 would be right of way, and 0.16 would be a public stormwater tract. The change in designation would allow for up to 158 rental apartment units on the R-3 property, while reducing density in the R-1 and R-2 tracts from a current max of 101 units to a max of 5 units. The net impact assuming development at maximum allowed density would increase residential capacity on the site by 62 units, with a shift from low- and medium-density product to rental apartments. The commercial/employment capacity on the site would be increased by roughly 1.5 net acres.

Area Comparison of Existing to Proposed Zoning

	Existing (gross acres)	Existing (net acres)*	Proposed (net acres)
C-3, Village Commercial	2.84	2.13	3.61
R-1, Low Density Residential	8.05	6.04 (48 units max.)	0.59 (5 units max.)
R-2, Medium Density Residential	5.01	3.76 (53 units max.)	0.00
R-3, High Density Residential	0.00	0.00	7.91 (158 units max.)
POS, Parks and Open Space	0.00	0.00	1.43
Rights of Way	0.00	3.98	2.21
Public Tracts (stormwater tract)	0.00	0.00	0.16
Total Area	15.91	15.91	15.91

**** - Net acres assumes 25% reduction for public roads***

This analysis addresses the public need for the requested change. In addition, the analysis will discuss whether the proposed change on the property represents an appropriate zoning boundary modification and the degree to which the development represents a sound, stable, and desirable development proposal. Following is a brief summary of the designations from the City of Sandy's Development Code:

> Sandy's C3 zone *"The Village Commercial (C-3) district is primarily oriented to serve residents of the village and the immediately surrounding residential area. The Village Commercial area is intended to help form the core of the villages. Allowing a mixture of residential uses beside and/or above commercial uses will help create a mixed-use environment which integrates uses harmoniously and increases the intensity of activity in the area. The orientation of the uses should integrate pedestrian access and provide linkages to adjacent residential areas, plazas and/or parks, and amenities."*
>
> The "*High Density Residential (R-3) district is intended for high density residential development at 10 to 20 dwelling units per net acre. Intended uses are apartments, row houses, and townhouses, duplexes, single-family planned developments, and manufactured home parks including existing developed areas and areas suitable for development at this density.*
>
> *High density residential areas are generally located immediately adjacent to village commercial centers or the Central Business District. Commercial development, including home businesses and limited neighborhood retail, is considered appropriate in high density residential developed in conjunction with villages or immediately north of the Central Business District. High density residential areas are generally located nearby Village Commercial Centers, the Central Business District and/or public facilities such as schools or parks. The HDR Plan designation encompasses one zoning district designation."*

The proposed R3 zoning allows a range of multi-family residential uses, including duplexes, townhomes, and residential facilities. The minimum allowed residential density is 10 units per acre with a maximum of 20 units per acre. The predominant use on the site is likely to be common wall multi-family and/or rental apartments.

This analysis relies on employment data provided by the US Census, assessment of developed and vacant land provided by Metro's RLIS, the City of Sandy Urbanization Study (2015), and Portland State University's Population Research Center's population estimates. This analysis supports the following findings:

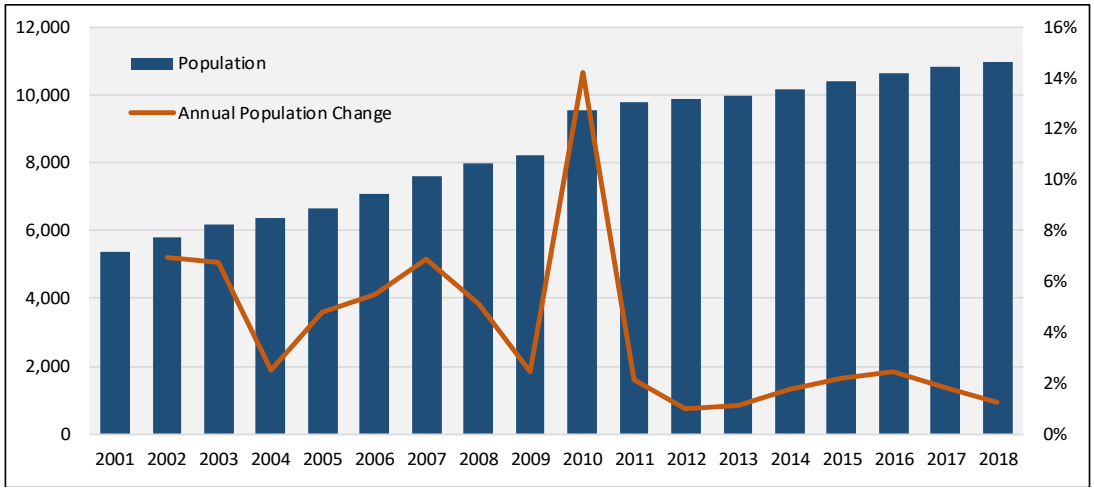
- The change in use would provide capacity for additional housing options, which may alleviate local housing affordability issues while providing increased demographic support for the proximate commercial concentrations in central Sandy.
- The entitlement change would be expected to bring the property into active urban use and be supportive of the City's planning policies.

Residential Land Needs

Population

Portland State University's Population Research Center provides intercensal population estimates for the State of Oregon, which are considered to be more accurate than Census Bureau estimates. The Center estimates that in 2001 Sandy's population was 5,380 and grew to 10,990 by 2018. This represents an increase of 104% since 2001 and an average growth rate of 4.3% over this same period. However, much of this growth took place before 2011. From 2011 through 2018 average annual growth was only 1.7%. Portland State University's population forecast programs most recent forecast for the Sandy UGB projected average annual growth of 2.7% through 2040.

Historical Population, Sandy (2001-2018) [1]

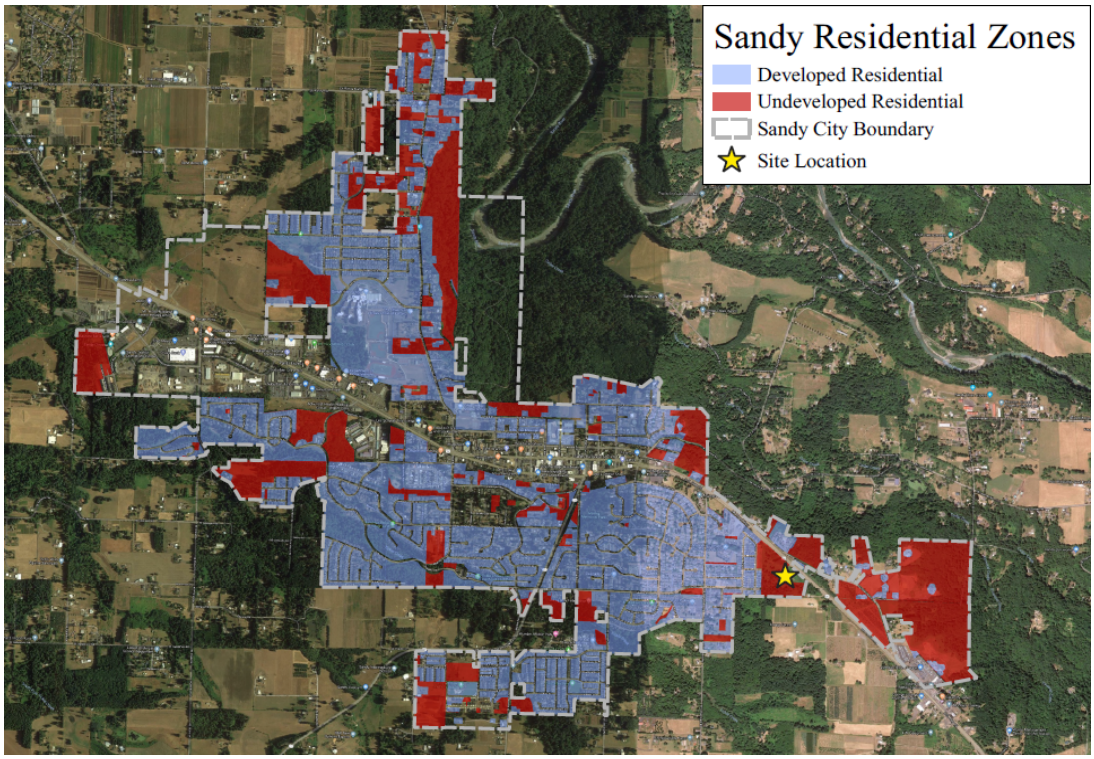


Population and Housing

As mentioned earlier, Portland State University's Center estimates that in 2001 Sandy's population was 5,380 and grew to 10,990 by 2018. This represents an increase of 104% since 2001 and an average growth rate of 4.7% over this same period. For the purposes of this study, assuming that levels of residential density in Sandy remain constant, the demand for residential land will likely follow the city's forecasted population within the UGB of 2.7%. According to Metro's RLIS, Sandy currently has 865.7 acres of residentially zoned, developed land. Projecting 20

[1] Portland State University Population Research Center

years forward to 2038, the city will likely need an additional 609.2 acres to meet a total need of 1,474.9 acres of residential land. Currently, the city has a total of 1,295.6 acres of land zoned for residential uses. This amount of land is 178.6 acres short of the projected need by 2038 based on historic development patterns.



SUMMARY OF RESIDENTIAL ZONED LAND SUPPLY, CITY OF SANDY[2]

Zone	Developed		Undeveloped		% Developed	
	Parcels	Acres	Parcels	Acres	Parcels	Acres
R1	74	137.5	30	39.4	71.2%	77.7%
R2	76	194.1	31	71.4	71.0%	73.1%
R3	58	125.8	29	53.0	66.7%	70.4%
SFR	114	408.3	53	266.9	68.3%	60.5%
Total Residential	322	865.7	143	430.6	69.2%	**66.8%**

The City has developed just over 70% of its land for multifamily and 66.8% for residential more broadly. While additional capacity is expected to be available through redevelopment, this is inherently more difficult and typically more expensive to deliver. Increasing the City's multifamily residential land inventory would increase local capacity for residential products that can meet a broad range of price points. Affordability of housing has become a major

2 Metro, RLIS system

concern during the recent expansion cycle and provision of higher density housing options is seen as a major tool in addressing affordability concerns.

Site Suitability for Proposed Uses

The subject site does not have any significant physical development constraints and enjoys visibility from Highway 26. The proposed use pattern will place a public park and the low density residential uses on the western edge of the property, providing a buffer between more intensive uses on the remainder of the site and the R-3 zoned property to the east and south. The proposed development pattern allows for a relatively efficient utilization of the site, with an efficiency of 84% (net developable area divided by total area, excluding park dedication). This is significantly higher than would be achievable with the current zoning designation, and supports more efficient land utilization.

Clustering residential density along Highway 26 and at the future intersection with Dubarko will provide excellent access to the residents, including to the commercial development on the site and the extensive commercial options in the city's downtown core (roughly a mile and a half west and three minutes away) as well as larger format retailers to the west of downtown. The intersection of Dubarko and Highway 26 is expected to collect the bulk of traffic from commercial and multi-family development on the site.

Conclusions Regarding the Proposed Zone Change

The proposed zone change is responsive to the City's projected need for additional residential capacity. Lennar Corporation, who previously controlled the site, spent a decade and significant investment trying to generate a viable development program for the site. The cost of the connection to Highway 26 and the infrastructure investment requirements in the village overlay were too great to be offset by the value of the underlying property. While technically capable of supporting development, these economic constraints make the site effectively undevelopable under the current zoning designation.

A key criteria in the City of Sandy is the degree to which the development represents a sound, stable, and desirable development proposal. Increasing the allowed residential density as proposed will provide the ability of the site to support necessary infrastructure investments to open up development. Under the current zoning the economic constraints outlined preclude a "sound, stable" development program for the site.

Allowing the proposed change in zoning will accelerate the development of the property while better addressing the City of Sandy's land use needs and public policy objectives. Dubarko's connection to Highway 26 can't be completed unless this site is developed, which has a significant impact on the City's broader street system. In addition, development of the site will provide more tax revenue as well as providing needed park space. The proposed use will also provide a "middle housing" product in the market that will address the local need for more low-cost housing choices.

Deer Point Neighborhood Park

Deer Point is an existing, undeveloped 1.41-acre park located on the east side of Sandy, just south of Highway 26 and Sandy Vista apartments. The long, narrow, gently sloping parcel is bounded by neighborhood streets on two sides, Highway 26 on a third, and fields with clusters of mature trees to the east. The concept provides standard neighborhood park amenities including an accessible looped path, playground, multi-use field, picnic shelters and tables, and a sport court with the option to expand east into the undeveloped parcel identified as NP 7, Deer Point Expansion on **Figure 8**.

Figure 11
Deer Point Neighborhood Park Concept

SANDY PARKS AND RECREATION

EXHIBIT L

38348 Pioneer Blvd.,
Sandy, OR 97055
503-668-5569

To: City of Sandy, Mayor, and City Council

Date: October 27th, 2022

From: Don Robertson, Parks & Trails Advisory Board Chair

Subject: Bull Run Terrace Reconsidered

Attachments: None

I am sending this communication on behalf of the Parks & Trails Advisory Board.

We understand that the Council will be reviewing this project during a public hearing on November 21st, 2022.

The applicant, Roll Tide Properties Corp, is now proposing to dedicate 1.755 acres for the eventual construction of Deer Pointe Park and zone this land as Parks and Open Space (POS).

We find the new proposal to be consistent with our two previous positions:

1. This new proposal supports the previous recommendation of Parkland dedication. As stated in a previous staff report (dated August 30, 2021) "It is the hope of the board that the city and the developer can reach an agreement that includes land dedication that is adjacent to the existing city owned property in the Deer Pointe neighborhood. This would allow the development of a true neighborhood park in an underserved area of the community."

2. It meets the objectives as listed in the 2022 Parks and Trails Master Plan.

The Parks Board requests that the applicant shall work with the City of Sandy to create a mutually agreed upon engineer estimate for the Deer Pointe parkland improvements. The final engineer's estimate shall be used as the basis for an agreement to calculate Park SDC credits for the applicant.

Parkland improvements should be based on the concept found in the 2022 Parks and Trails Master Plan; including public meeting(s) to solicit neighborhood input. If the applicant and City agree to the applicant/developer completing parkland improvements, the park improvements shall be completed prior to final plat approval or as otherwise established in a development agreement.

Thank you for your consideration of this matter.

Sincerely,

Don Robertson, Parks & Trails Advisory Board Chair

Staff Contact:
Rochelle Anderholm-Parsch
503-489-2157
randerholmparsch@ci.sandy.or.us

SANDY AREA METRO

EXHIBIT M

Sandy Transit
16610 Champion Way
Sandy, OR 97055

Memorandum

Date: October 28, 2022

To: Kelly O'Neill, Planning Director; Emily Meharg, Senior Planner, Marisol Martinez, Permit Technician I

From: Andi Howell, Transit Director

Re: Transit Request Bull Run Terrace Development

Per review of the Bull Run Terrace Development Proposal, the Transit Department is requesting a pull out stop on Highway 26 after the intersection of Dubarko to serve Eastbound transit services along Highway 26 (within Lot 6) as well as a 2 complimentary transit stops to support a future, in-town circulator service. These complementary stops would be located: 1. at the intersection of Dubarko Rd and Street B in Lot 6; 2. Dubarko Rd and Street A in Lot 3 (or lot 1 if preferrable). The complimentary stops should provide a transit pad and bench.

Support for these requests can be found on pages 35,36 of the Transit master Plan (TMP), the identification of two new roads as described in the 2011 Transportation System Plan. The plan discusses long term future plans of a circulator that will allow transit to serve Dubarko Road, Vista Loop and Proctor Blvd.

Pg. 35,36 TMP also illustrates the importance of recognizing possible future development and the importance of planning for transit service that provides transportation Eastbound as well as Westbound along Highway 26.

Pg. 45-47 of the TMP, referring to the City's Comprehensive Plan as envisioning village area designation as having "housing, retail shops, public uses, a village green or park, and, potentially, a transit stop." Development proposals, such as this one, with high density and village development should provide transit access along highway 26 to support useful and high ridership transit.

Please contact the Transit Department for specific location, amenity information and pad engineering specifications at 503-489-0925 or ahowell@ci.sandy.or.us.

Andi Howell

Transit Director

EXHIBIT N

SANDY FIRE DISTRICT NO. 72
Fire Prevention Division

E-mail Memorandum

To: Marisol Martinez

From: Gary Boyles

Date: October 24, 2022

Re: City Council Reconsideration of Bull Run Terrace Subdivision

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This review is not intended to be a comprehensive analysis of all applicable code sections, nor shall this review nullify code requirements that are determined necessary during building permit review. Review and comments are based upon the current version of the Oregon Fire Code (OFC) as adopted by the Oregon Office of State Fire Marshal. The scope of this review is typically limited to fire apparatus access and water supply, although the applicant shall comply with all applicable OFC requirements. When buildings are completely protected with an approved automatic fire sprinkler system, the requirements for fire apparatus access and water supply may be modified as approved by the fire code official. References, unless otherwise specified, include provisions found in the Metro Code Committee's Fire Code Applications Guide, OFC Chapter 5 and Appendices B, C and D.

COMMENTS:

General

1. All future construction activities shall comply with the applicable Oregon Fire Code and the Fire Code Application Guide. Construction documents detailing compliance with fire apparatus access and fire protection water supply requirements shall be provided to the Sandy Fire District for review and approval concurrently with building permit submittal.

2. Where fire apparatus access roads or a water supply for fire protection are required to be installed, such protection shall be installed and made serviceable prior to and during the time of construction except where approved alternative methods of protection are provided.

Fire Apparatus Access

FIRE APPARATUS ACCESS ROAD (as defined by the OFC). A road that provides fire apparatus access from a fire station to a facility, building or portion thereof. This is a general term inclusive of all other terms such as *fire lane*, public street, private street, parking lot lane and access roadway.

1. Dead-end streets in excess of 150 ft., resulting from a phased project, are to be provided with an approved temporary turnaround. (Street B).

2. Not less than two approved means of fire apparatus access will be required for multiple-family residential projects having more than 100 dwelling units.

   Exception: Projects having up to 200 dwelling units will be approved with only one means of fire apparatus access where all buildings, including nonresidential occupancies, are equipped throughout with an approved automatic sprinkler system installed in accordance with OFC Section 903.3.1.1 or 903.3.1.2.

   If more than 200 dwelling units, not less than two approved means of fire apparatus access will be required.

3. Commercial and industrial buildings exceeding three stories or 30 feet in height shall have not fewer than two means of fire apparatus access for each building.

4. Commercial and industrial buildings having a gross building area of more than 62,000 square feet (124,000 square feet if equipped throughout with an approved automatic sprinkler systems) shall be provided with two separated and approved fire apparatus access roads.

5. Where two access roads are required, they shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.

6. Fire apparatus access roadway grades shall not exceed 10 percent. Intersections and turnarounds shall be as level as possible and have a maximum of 5 percent grade with the exception of crowning for water run-off.

7. Fire apparatus access roads shall have an unobstructed driving surface width of not less than 20 feet (26 feet adjacent to a fire hydrant, exclusive of shoulders) and an unobstructed vertical clearance of 13 feet 6 inches.

8. When the vertical distance between the grade plane and a building's highest roof surface exceeds 30 feet, approved aerial fire apparatus access roads shall be provided. For purposes of this requirement, the highest roof surface shall be determined by measurements to the eave of a pitched roof, the intersection of the roof to the exterior wall, or the top of parapet walls, whichever is greater. If buildings are more than 30 feet in height, as measured above, the following requirements apply:

    a. Aerial fire apparatus access roads shall be provided and have a minimum unobstructed width of 26 feet, exclusive of shoulders or parking, in the immediate vicinity of the building or portion thereof that will accommodate aerial operations.
    b. The aerial fire apparatus access road shall be located not less than 15 feet nor greater than 30 feet from the building and shall be positioned parallel to one entire side of the building.
    c. The side of the building on which the aerial fire apparatus access road is positioned shall be approved by the fire code official.
    d. Overhead utility and power lines shall not be located within the aerial fire apparatus access road or between the aerial fire apparatus access road and the building.

9. The inside turning radius and outside turning radius for fire apparatus access roads shall be not less than 28 feet and 48 feet respectively, measured from the same center point.

10. Streets and roads shall be identified with approved signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles.

<u>Firefighting Water Supplies</u>

1. The minimum available fire-flow and flow duration for commercial and industrial buildings shall be as specified in OFC Appendix B. In no case shall the resulting fire-flow be less than 1,500 gpm at 20 psi residual.

2. The minimum available fire flow for one- and two-family dwellings served by a municipal water supply shall be 1,000 gpm at 20 psi residual provided the fire area of the dwelling(s) does not exceed 3,600 square feet. For dwellings that exceed 3,600 square feet, the required fire-flow shall be determined in accordance with OFC Appendix B, Table B105.1(2).

3. For one- and two-family dwellings served by a municipal water system, all portions of the dwellings shall be located within 600 feet from a fire hydrant on a fire apparatus

access road, as measured in an approved route that is approved by the fire code official.

4. For commercial and industrial buildings served by a municipal water system where a portion of the building is more than 400 feet from a fire hydrant on a fire apparatus access road (600 feet for buildings equipped throughout with an approved automatic sprinkler system), as measured in an approved route around the exterior of the building, on-site fire hydrants and mains shall be provided.

5. If applicable, fire department connections (FDC) shall be remote from the structure they serve and located within 100 feet of a fire hydrant. All FDC's shall be permanently labeled with appropriate address in which it serves and shall be accessible and visible from the fire apparatus access road.

6. Prior to the start of combustible construction, required fire hydrants shall be operational and accessible.

7. Fire hydrants installed within the Sandy Fire District shall comply with the following requirements:
    a. Flow requirements and location of fire hydrants will be reviewed and approved by Sandy Fire upon building permit submittal.
    b. Each new fire hydrant installed shall be ordered in an OSHA safety red finish and have a 4-inch non-threaded metal faced hydrant connection with cap installed on the steamer port (4 ½-inch NST x 4-inch Storz Adaptor). If a new building, structure, or dwelling is already served by an existing hydrant, the existing hydrant shall also be OSHA safety red and have a 4-inch non-threaded metal faced hydrant connection with cap installed.

8. The minimum number and distribution of fire hydrants shall be in accordance with City of Sandy requirements and OFC Appendix C.

NOTE:

Sandy Fire District comments may not be all inclusive based on information provided. A more detailed review may be needed for future development to proceed.

Please do not hesitate to contact Fire Marshal Gary Boyles at 503-891-7042 or fmboyles.sandyfire@gmail.com should you have any questions or concerns.

EXHIBIT O

October 27, 2022

CURRAN-McLEOD, INC.
CONSULTING ENGINEERS
6655 S.W. HAMPTON STREET, SUITE 210
PORTLAND, OREGON 97223

Mr. Kelly O'Neill
City of Sandy
39250 Pioneer Blvd.
Sandy, OR 97055

RE: CITY OF SANDY
BULL RUN TERRACE SUBDIVISION RECONSIDERATION
PRELIMINARY REVIEW 22-038 CPA/ZC/SAP/SUB/TREE

Dear Kelly:

We have reviewed the revised submittal for the Bull Run Terrace subdivision and have the following comments related to the public improvements:

1. The Preliminary Storm Drainage and Calculations report is acceptable; however, an upstream and downstream capacity analysis needs to be included in the report and the design modified as needed.

2. The developer will need to secure ODOT approval of all highway frontage and intersection improvements. The developer needs to also review the conclusions contained in the ARD Engineering September 28, 2020, Traffic Impact Study with the City to determine which conclusions are applicable to the revised submittal. Truck turning movements should be addressed for the intersection with the highway.

3. Street A is acceptable as a local with 28 foot width and 5 foot sidewalks. Street A will have parking allowed on both sides.

4. Street B is acceptable as a collector with 36 foot width and 6 foot sidewalks. No parking is permitted on a collector street less than 40 feet wide. Note the minimum street width for a collector street without parking is 32 feet.

5. Dubarko Road is classified by the City Transportation System Plan as a minor arterial which requires a minimum of 40 foot width and 6 foot sidewalks. Actual width on the preliminary plans is 43 or 44 feet with 5 or 6 foot sidewalks and includes a raised median in areas. One concern with the median is the paved width for access from the Highway is only 16 feet, which is less than the width required by the fire department access standards. No parking will be allowed on Dubarko Road.

6. The developer needs to coordinate with the City to review the Traffic Impact Study recommendations and how those are incorporated into the design.

PHONE: (503) 684-3478 E-MAIL: cmi@curran-mcleod.com FAX: (503) 624-8247

7. All public improvements must comply with the requirements of the public works department.

Let me know if you have questions.

Very truly yours,

CURRAN-McLEOD, INC.

Curt McLeod, PE

SANDY
WHERE INNOVATION MEETS ELEVATION

39250 Pioneer Blvd
Sandy, OR 97055
503-668-5533

EXHIBIT P

Memorandum

To: Kelly O'Neill Jr, Development Services Director

From: AJ Thorne, Assistant Public Works Director

RE: Bull Run Terrace Review

Date: 10/28/2022

Kelly,

See Public Works comments below:

WATER:

Existing line must be replaced with a line of the same size within city depth requirements.

An 18 inch water line must be extended through the project area connecting the existing 18" line to the 12 inch line up at HWY 26. This line will be high flow, low pressure and used as a fire line.

SANITARY SEWER:

Sewer connections will be permitted as proposed.

STORM:

All site runoff (including new runoff from the widened surfaces of US 26) shall be detained such that post-development runoff does not exceed the pre-development runoff rate for the 2, 5, 10 and 25 year storm events. Stormwater quality treatment shall be provided for all site drainage per the standards in the City of Portland Stormwater Management Manual (COP SWMM).

TRANSPORTATION:

The proposed street and utility plan depicts Dubarko Rd. between its current eastern terminus and proposed Street A with a 76 ft. wide right-of-way consisting of a 0.5 ft. monumentation strip, a six-foot sidewalk, a five-foot planter strip, a 0.5 ft. curb, a five-foot bike lane, a 17-foot travel lane and half of an 8 ft. median for a total half section equaling 38 feet and a full section equaling 76 feet. The standard section for an arterial street in the TSP consists of 11-foot travel lanes with 5-foot bike lanes. It is not clear why the proposed travel lanes are so wide.

The portion of Dubarko Rd. between Street A west to the west boundary of the development should be used to provide a transition from the proposed three lane section with median to a two lane section with median to match the existing section. The proposed 17-foot wide travel lanes will be confusing to motorists.

The applicant shall submit a revised cross-section for this portion of Dubarko Rd. with the public improvement plans for the project for City Engineer review and approval.

The traffic analysis makes several references to a right-in/right-out intersection at Dubarko Rd. and US 26. These references are in the context of analysis of the performance of other study intersections examined in the TIS and not a proposal to construct a right-in/right-out intersection at this location.

The adopted Transportation System Plan (TSP) does not contemplate a right-in/right-out intersection at US 26 and Dubarko Rd. The intersection of US 26 and Dubarko Rd. shall be constructed as a full-access intersection in compliance with the TSP.

The alignment of Street B and Dubarko Rd. does not provide the minimum 100 ft. of tangent alignment (as measured from the curb line on Dubarko extended) on Street B as required by section 17.84.50 H.5.a of the Sandy Municipal Code (SMC). The alignment of this intersection shall be revised to provide the minimum 100 ft. tangent section to comply with the Code.

The applicant shall provide a 40 ft. x 40 ft. right-of-way dedication or permanent traffic signal easement at the northeast corner of lot 7 to accommodate a future traffic signal.

The widening of Dubarko Rd. to accommodate the section recommended in the TSP is eligible for Transportation System Development Charge credits. The difference in cost between the required minor arterial improvements and a standard local street section is eligible for credits. Estimated costs shall be submitted to City and reviewed and approved by the City Engineer. The City and the Applicant shall enter into an agreement defining the eligible improvements and estimated costs prior to plat approval. SDC credits shall be based on final audited costs.

Any ODOT-required improvements on and adjacent to the US 26 frontage of the site are not included in the City's TSP or capital plans and as such are not eligible for SDC credits or reimbursement.

DKS 720 SW WASHINGTON STREET, SUITE 500, PORTLAND, OR 97205 • 503.243.3500 • DKSASSOCIATES.COM

EXHIBIT Q

DATE: Oct 31, 2022

REQUEST: Bull Run Terrace Subdivision, Transportation Review

FILE NO: 19-050 CPA/ZC/SAP/SUB/TREE

REVIEWER: Dock Rosenthal, PE, DKS Associates

DKS Associates has reviewed the traffic impact analysis[1] and site plan for the Bull Run Terrace subdivision. The proposed zone change would reduce the amount of R-1 and R-2 zoned property, increase the amount of C-3 zoned property and add R-3 zoned property. The proposed development application would construct 192 apartment dwelling units, eight (8) duplex dwelling units and a 5,000 square foot general office. The project site is located south of US 26 near Dubarko Road on the east side of Sandy and will connect to the transportation system via an extension of Dubarko Road through the property.

The general comments and listing of recommended conditions of approval are based on a review of the impact study and site plan.

DEVELOPMENT TRANSPORTATION IMPACT REVIEW

Key comments and issues related to the proposed development's transportation impact analysis include:

Existing

- Study Intersections
  - US 26 at SE Ten Eyck Road
  - US 26 at SE Langensand Road
  - US 26 at SE Vista Loop Drive (Dubarko Road future connection)
  - US 211 at Dubarko Road
  - Dubarko Road at SE Langensand Road

[1] Bull Run Terrace Subdivision Traffic Impact Study, Ard Engineering, September 29, 2022.

- Existing traffic volumes on US 26 were seasonally adjusted but the methodology applied deviates from ODOT's Analysis Procedures Manual (APM). Updating the TIA with the appropriate AMP methodology is not anticipated to change the finding and recommendations. The APM methodology should be followed in future TIAs.
- All study intersections operate at an acceptable volume to capacity ratios during the 2021 AM and PM peak hours.
- Crash data from January 2016 to December 2020 was analyzed, the intersection of Dubarko Road and Highway 211 was found to have a high crash rate.

Future (2024) Background Condition

- A growth rate of 1.93 percent per year was applied to the existing 2019 volumes to account for background growth for highway volumes on US 26. An annual growth rate of 3.16 percent per year was applied to the existing 2019 volumes on Highway 211. A rate of 2 percent per year was applied for other (non-highway) movements.
- Both study intersections operate at an acceptable volume to capacity ratios during the 2024 AM and PM peak hours

Future (2024) With Project Condition

- ITE Trip Generation Code 215 single-family housing, 220 multi-family housing, and 565 daycare center were used for the trip generation estimate.
- The proposed project would result in additional vehicle trips: 94 (28 in/66 out) AM peak hour vehicle trips, 115 (69 in/46 out) PM peak hour vehicle trips and 1418 weekday trips.
- 2024 Total Traffic Conditions - All study intersections would operate at an acceptable volume to capacity ratios and LOS (level of service) standards with the addition of vehicle trips from the proposed project except for the intersection of Highway 211 and Dubarko Road in the PM peak hour which operates at LOS F. The City’s standard is LOS D.
- All-way stop control warrants were met at the Highway 211 and Dubarko Road intersection based on crash history criteria. Conversion of the intersection to all-way stop control would improve operations to LOS C in the AM peak hour and LOS D in the PM peak hour.
- Signal warrants were met at the intersection of Highway 211 and Dubarko Road. A signal is not recommended by the applicant as a condition of approval due to the low proportion of vehicles from the development contributing to the total volume.
- Installation of a roundabout at the Highway 211 and Dubarko Road intersection would improve operations to LOS A during the AM and PM peak hours. Roundabout control is not recommended by the applicant due to the 6% grade on Highway 211 at Dubarko Road which exceeds the FHA guidelines of 4% or less.
- Turn warrants were met at the intersection of US 26 and Dubarko Road. A northbound left turn lane and southbound right turn lane are warranted.
- Intersection sight distance requirements are met at the Dubarko Road extension at US 26. Stopping sight distance was not evaluated.

Mitigation

1. The TPR (Transportation Planning Rule) analysis for the zone change recommended applying a 340 PM peak trip cap to ensure adequate operation of the future transportation system.

2. The Dubarko Road and Highway 211 intersection is recommended to be converted to an all-way stop controlled intersection to mitigate existing safety issues. The city does not support

this intersection control change due to concerns with vehicles on Dubarko Road stopping on the grade during icy weather conditions.

3. A northbound left turn lane is warranted for US 26 to the future Dubarko Road Extension.
4. A southbound right turn lane is warranted for US 26 to the future Dubarko Road Extension.

SANDY TRANSPORTATION SYSTEM PLAN

The 2011 Sandy Transportation System Plan identifies the following improvements:

- Highway 211 and Dubarko Road (Project M9) – Construct a traffic signal, northbound right turn lane, southbound left turn lane and northbound left turn lane
- US 26 and Dubarko Road (Project M20) – Extend Dubarko Road to US 26 opposite Vista Loop Drive (West)

These project should be incorporate into the conditions of approval.

RECOMMENDED CONDITIONS OF APPROVAL

The following conditions of approval are recommended based on a review of the traffic impact study and site plan:

1. A trip cap of 340 PM peak hour trips shall be applied to the development to ensure adequate operation of the future transportation system. The applicant shall conduct a trip generation survey for the proposed development between six and twelve months after full buildout of the development and submit the findings to the city to confirm the trip cap has not been exceeded. If the development exceeds the trip cap, the city will reassess the need for additional transportation mitigations, proportionate share fees and Transportation System Development Charges for the application.
2. The development shall contribute Transportation System Development Charges toward citywide impacts.
3. Applicant shall contribute a proportional share fee of $268,351 towards constructing future capacity improvements at the Highway 211/Dubarko Road intersection. The cost per PM peak hour trip is $15,785. The development adds 17 PM peak hour trips.
4. The applicant shall construct the extension of Dubarko Road to US 26 per City street standards. The new US 26 and Dubarko Road intersection shall operate with full access and provide a northbound left turn lane with 150-feet of vehicle storage at the.
5. Stopping sight distance shall be verified at the intersection of US 26 and the Dubarko Road extension in the final engineering/construction stages.
6. Minimum sight distance requirements shall be met at all site driveways. Sight distances should be verified in the final engineering/construction stages of development.
7. Trips included in the summary trip generation table on page 13 do not match the values in the appendix. The analysis shall be updated as needed, this may include discussion of pass-by or diverted trip assumptions.

EXHIBIT R

DKS

720 SW WASHINGTON STREET, SUITE 500, PORTLAND, OR 97205 • 503.243.3500 • DKSASSOCIATES.COM

TECHNICAL MEMORANDUM

DATE: October 27, 2022

TO: Kelly O'Neill | City of Sandy

FROM: Reah Flisakowski | DKS

SUBJECT: Highway 211/Dubarko Road Proportionate Share Funding Plan

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This memorandum summarizes the development of a proportionate share funding plan to construct improvements at the Highway 211/Dubarko Road intersection. Additional vehicle capacity will be needed at the intersection to adequately accommodate the anticipated growth from multiple developments in the eastern portion of the city.

A proportionate share funding plan was established to allow the City to collect financial contributions from multiple developments. The fees will fund specific capacity improvement that are needed to mitigate a traffic operation deficiency that is triggered by the impact of new trips from nearby growth. All developments will be conditioned to contribute financially to the improvements based on the number of trips their development adds to the location. A transportation study conducted by a development applicant will be required to estimate the number of new trips that would be added to the location by the proposed development.

PROPOSED IMPROVEMENTS

The need for future improvements at this intersection was identified in the adopted 2011 Sandy Transportation System Plan. The TSP project details are summarized in Table 1.

TABLE 1: SUMMARY OF LONG-TERM IMPROVEMENT PROJECTS

PLAN	IMPROVEMENT	PROJECT COST ESTIMATE
SANDY TRANSPORTATION SYSTEM PLAN	**Highway 211/Dubarko Road –** Construct a traffic signal, northbound right turn lane, southbound left turn lane, and northbound left turn lane	$10,150,000

PROPORTIONATE SHARE FEE CALCULATION

The proportionate share fee is based on the cost of capacity improvements at the Highway 211/Dubarko Road intersection needed to mitigate future growth impacts and the number of new trips that can be adequately accommodated with the additional capacity. The fee estimate applies the following formula:

$$Cost\ per\ Trip = \frac{Improvement\ Cost\ Attributable\ to\ Development}{Net\ Growth\ in\ Trips\ Accommodated}$$

A summary of the proportionate share fee calculation is provided in Table 3. Recent traffic count data[1] was used to establish current volumes at the intersection. Future year 2029 volumes were obtained from the 2011 TSP. The city will require all new development to pay $15,785 per PM peak hour trip their development generates through the intersection towards capacity improvements that are triggered by future traffic growth. The project cost estimate, future volumes and the fee calculation will be updated with information provided in future adopted TSP Updates.

TABLE 3: PROPORTIONATE SHARE FEE ANALYSIS RESULTS

PROPORTIONATE SHARE METHOD	SHORT-TERM (5 YEARS)
PROPOSED IMPROVEMENT	Traffic signal + turn lanes
PROJECT COST	$10,150,000
YEAR 2020 ENTERING VOLUME	907
YEAR 2029 ENTERING VOLUME	1,550
NET GROWTH IN TRIPS ACCOMMODATED	643
COST FOR DEVELOPMENT	$15,785 per PM peak hour trip

NOTE: VOLUMES REPRESENT PM PEAK HOUR

[1] All Traffic Data intersection count, conducted Thursday, October 22, 2020.

Oregon
Kate Brown, Governor

Department of Transportation
Region 1 Headquarters
123 NW Flanders Street
Portland, Oregon 97209
(503) 731.8200
FAX (503) 731.8259

EXHIBIT S

11/2//22 ODOT #10566

ODOT Updated Response

Project Name: Bull Run Terrace Subdivision Reconsideration	**Applicant:** ARD Engineering
Jurisdiction: City of Sandy	**Jurisdiction Case #:** 22-038CPA/ZC/SAP/SUB/TREE
Site Address: No Situs: US 26 and Dubarko Road, Sandy, OR	**State Highway:** US 26

The site of this proposed land use action is adjacent to US 26. ODOT has permitting authority for this facility and an interest in ensuring that this proposed land use is compatible with its safe and efficient operation. **Please direct the applicant to the District Contact indicated below to determine permit requirements and obtain application information.**

COMMENTS/FINDINGS

The applicant proposes to subdivide the property in such a way to develop 192 multi-family dwellings, 8 duplexes and some commercial development. The proposed development requires amendments to the Comprehensive Plan Map and Zoning Map.

EXISTING ZONING DISTRICT DESIGNATION: Low-Density Residential (R-1), Medium-Density Residential (R-2), and Village Commercial (C-3)
PROPOSED ZONING DISTRICT DESIGNATION: Low-Density Residential (R-1), Medium-Density Residential (R-2), High-Density Residential (R-3), Village Commercial (C-3), and Parks and Open Space (POS)

Traffic Impact Study and Transportation Planning Rule (TPR) Findings

ODOT has reviewed the September 2022 Update Traffic Impact Study (TIS) for the Bull Run Terrace Subdivision prepared by ARD Engineering. The analysis shows that operations at ODOT intersections are expected to marginally improve primarily due to diversion from US 26 to Dubarko Rd. The new street connection will implement the city's TSP and improve street connectivity in the vicinity of the highway.

The TPR analysis doesn't include the correct mobility standards from the Oregon Highway Plan (OHP) and the "future" year analysis is for 2024. OHP Action 1F2 requires that the planning horizon in the adopted TSP or 15 years from the proposed date of amendment adoption, whichever is greater be used for the analysis. The trip generation comparison between the existing and proposed zoning shows the proposed trip generation, which is shown to increase PM Peak Hour trips by 50. ODOT has determined that this level of increased trips would not have a significant effect on State highway facilities.

US 26 and Dubarko Rd Intersection

The proposed subdivision includes a new public road connection of Durbako Rd to US 26 consistent with the City of Sandy Transportation System Plan. The location for the proposed public road connection is access controlled. ODOT has acquired and owns access rights along the subject property's frontage. Therefore, in order to construct the new public road connection to US 26, the City is required to apply for and obtain a "Grant of Access" for the public approach (OAR 731-051-2020). As part of the application process, the City must address the criteria outlined in the rule including provide the following information:

1. Traffic Impact analysis for 20 years from the year of construction
2. Demonstrate a committed funding source for the US 26 improvements
3. Demonstrate a benefit to the highway (OAR 731-051-4030)
4. 100% Construction Plans for highway improvements

For information on the Grant of Access process, please contact Tony Rikli, P.E. at Anthony.RIKLI@odot.oregon.gov.

*Note: It may take **6 months to a year** to process a Grant of Access.*

The subdivision relies on the new Dubarko Rd connection to US 26 for access to the transportation system. Therefore, the subdivision should be conditioned to obtain the Grant of Access including the ODOT Permit to Occupy or Perform Operations upon a State Highway prior to the recording of the plat and the issuance of Building Permits. All improvements that are conditioned as part of the Grant of Access must be constructed and accepted by ODOT prior to the City issuing approval for Occupancy.

All alterations within the State highway right of way are subject to the ODOT Highway Design Manual (HDM) standards. Alterations along the State highway but outside of ODOT right-of-way may also be subject to ODOT review pending its potential impact to safe operation of the highway. If proposed alterations deviate from ODOT standards a Design Exception Request must be prepared by a licensed engineer for review by ODOT Technical Services. Preparation of a Design Exception request does not guarantee its ultimate approval. Until more detailed plans have been reviewed, ODOT cannot make a determination whether design elements will require a Design Exception.

Note: Design Exception Requests may take up to 3 months to process.

All ODOT permits and approvals must reach 100% plans before the District Contact will sign-off on a local jurisdiction building permit, or other necessary requirement prior to construction.

ODOT RECOMMENDED SUBDIVISION CONDITIONS OF APPROVAL

☒ The Dubarko Rd public road connection to US 26 shall be constructed. A Grant of Access (OAR 731-051-2020) shall be obtained from ODOT for the new public road connection to US 26 prior to recording the plan for the subdivision. Prior to issuance of Building Permits, the Grant of Access including the ODOT Permit to Occupy or Perform Operations Upon a State Highway for all improvements highway improvement shall be obtained. All improvements that are conditioned as part of the Grant of Access must be constructed and accepted by ODOT prior to the City issuing approval for Occupancy.

*Note: It may take **6 months to a year** to process a Grant of Access.*

☒ Curb, sidewalk, cross walk ramps, bikeways and road widening along the US 26 frontage shall constructed as necessary to be consistent with local, ODOT and ADA standards. ODOT Permit to Occupy or Perform Operations Upon a State Highway for all improvements highway improvement shall be obtained.

Please send a copy of the Notice of Decision including conditions of approval to:

ODOT Region 1 Planning
Development Review
123 NW Flanders St
Portland, OR 97209

ODOT_R1_DevRev@odot.state.or.us

Development Review Planner: Marah Danielson	503.731.8258, marah.b.danielson@odot.state.or.us
Traffic Contact: Avi Tayar, P.E.	503.731.8221 Abraham.tayar@odot.state.or.us
District Contact: Robbie Cox	D2CAP@odot.oregon.gov
Region Access Management Engineer: Tony Rikli, P.E	Anthony.RIKLI@odot.oregon.gov

EXHIBIT T

Rebecca Markham <rmarkham@ci.sandy.or.us>

Bull Run Development

Gary Roche <groche51@gmail.com>
To: planning@cityofsandy.com

Fri, Oct 21, 2022 at 1:09 PM

File # 22-038 CPA/ZC/SAP/SUB/TREE

Comments regarding this proposed development:

1. There needs to be a signal at Hwy 26 and Debarko Rd. This will be a dangerous intersection with the majority of cars leaving Bull Run turning left across two lanes. Cars and trucks routinely travel 45-50 mph on this section of Hwy 26.

2. Fawn St is a narrow street with children playing in the street daily. Traffic should be directed toward Debarko Rd.

3. High density housing and commercial too close to single family homes.

4. Proposal states C-3 lot will be a mix of both residential and commercial. Why is a lot zoned commercial allowed to have residential?

Thank you
Gary and Val Roche
Deer Pointe

EXHIBIT U

RECEIVED
OCT 21 2022
CITY OF SANDY

COMMENT SHEET for File No. 22-038 CPA/ZC/SAP/SUB/TREE:

We oppose any development that includes high density housing R-3 and this is almost half of the latest proposal. Such a huge increase in housing in our neighborhood would have a huge negative impact.

David & Nancy Allan 503-826-0282
Your Name Phone Number

18417 Meadow Ave, Sandy, OR 97055
Address

APPLICABLE CRITERIA: Sandy Municipal Code: 17.12 Procedures for Decision Making; 17.18 Processing Applications; 17.20 Public Hearings; 17.22 Notices; 17.24 Comprehensive Plan Amendment Procedures; 17.26 Zoning District Amendments; 17.30 Zoning District Amendments; 17.32 Parks and Open Space (POS); 17.36 Low Density Residential (R-1); 17.38 Medium Density Residential (R-2); 17.40 High Density Residential (R-3); 17.46 Village Commercial (C-3); 17.54 Specific Area Plan Overlay; 17.80 Additional Setbacks on Collector and Arterial Streets; 17.82 Special Setbacks on Transit Streets; 17.84 Improvements Required with Development; 17.86 Parkland and Open Space; 17.92 Landscaping and Screening; 17.98 Parking, Loading, and Access Requirements; 17.100 Land Division; 17.102 Urban Forestry; 15.30 Dark Sky; and, 15.44 Erosion Control Regulations.

EXHIBIT V

COMMENT SHEET for File No. 22-038 CPA/ZC/SAP/SUB/TREE:

RECEIVED
NOV 14 2022
City of Sandy

Bull Run Terrace

We are pleased that city planning will have Debarco intersect with Hwy 26. Lot #1 should be commecial and no residenctial, as the east end has no neighborhood services, the ability to walk or ride for Local needs, would make the more Livable. Not to mention safer!

Dave Carter — 503 534 6123
Your Name — Phone Number

41248 SE Vista Loop Dr 97055
Address

APPLICABLE CRITERIA: Sandy Municipal Code: 17.12 Procedures for Decision Making; 17.18 Processing Applications; 17.20 Public Hearings; 17.22 Notices; 17.24 Comprehensive Plan Amendment Procedures; 17.26 Zoning District Amendments; 17.30 Zoning District Amendments; 17.32 Parks and Open Space (POS); 17.36 Low Density Residential (R-1); 17.38 Medium Density Residential (R-2); 17.40 High Density Residential (R-3); 17.46 Village Commercial (C-3); 17.54 Specific Area Plan Overlay; 17.80 Additional Setbacks on Collector and Arterial Streets; 17.82 Special Setbacks on Transit Streets; 17.84 Improvements Required with Development; 17.86 Parkland and Open Space; 17.92 Landscaping and Screening; 17.98 Parking, Loading, and Access Requirements; 17.100 Land Division; 17.102 Urban Forestry; 15.30 Dark Sky; and, 15.44 Erosion Control Regulations.

SANDY
WHERE INNOVATION MEETS ELEVATION

39250 Pioneer Blvd
Sandy, OR 97055
503-668-5533

Exhibit W

MEMORANDUM FOR PUBLIC HEARING

DATE: November 17, 2022

SUBJECT: Bull Run Terrace Reconsideration condition modifications

TO: Mayor Pulliam and City Councilors

FROM: Kelly O'Neill Jr.

After publication of the staff report on November 14, 2022, and additional discussions with City Attorney Soper, we have proposed modifications to three findings and two conditions as detailed in track changes below and reflected in both the conditions and findings as revised in the revised staff report and Attachment C for Ordinance No. 2022-27. **Bold blue underline** signifies additions and ~~red strikethrough~~ signifies deletions.

Finding 27. Goal 12.
Finding 92.
Condition B.
The applicant shall dedicate the proposed 1.755 acres of parkland to the City through a dedication deed process, separate from the subdivision plat process. Prior to dedication, the applicant shall provide a Phase I Environmental Assessment for Tract A. This dedication shall occur within 180 days after approval of Ordinance No. 2022-27.

Finding 56.
Condition G. 7.
The subject property shall be subject to a trip cap of 340 PM net new peak hour trips. **Each application for development of a lot within the subject property shall include a report from a licensed traffic engineer stating the number of net new PM peak hour trips expected to be generated by the proposed development, and this number of trips will be deducted from the total trip cap of 340 net new PM peak hour trips upon approval of the application. No development application will be approved that would cause the total net new PM peak hour trips to exceed said cap unless the applicant agrees to pay additional proportionate share fees for the intersection of Highway 211 and Dubarko Road, in an amount determined by the City based on the number of trips in excess of the cap.** ~~The applicant shall conduct a trip generation survey for the proposed development between six and twelve months after full buildout of the development and submit the findings to the City to confirm the trip cap has not been exceeded. If the development exceeds the trip cap, the City will reassess the need for additional transportation mitigations, proportionate share fees, and Transportation System Development Charges for the application.~~

Exhibit X

ARD ENGINEERING
21370 SW Langer Farms Pkwy
Suite 142, Sherwood, OR 97140

Technical Memorandum

To: Dave Vandehey, Roll Tide Properties Corporation

From: Michael Ard, PE

Date: November 21, 2022

Re: **Deer Meadows Subdivision – DKS Associates Review Comment Responses**

Following submittal of the Bull Run Terrace Subdivision Traffic Impact Study (September 2022 Update), we have received review comments from DKS Associates as the city's on-call transportation engineer. This memorandum is written in response to review comments dated October 31, 2022 by Dock Rosenthal PE and October 27, 2022 by Reah Flisakowski, PE.

The transportation review memo (Exhibit Q) by Dock Rosenthal, PE largely summarized the report, but included a few references to concerns that merit additional discussion.

1) *"Existing traffic volumes on US 26 were seasonally adjusted but the methodology applied deviates from ODOT's Analysis Procedures Manual (APM). Updating the TIA with appropriate APM methodology is not anticipated to change the finding and recommendations. The APM methodology should be followed in future TIAs."*

The seasonal adjustment methodology used in this report was consistent with the methodology used in prior traffic impact studies prepared for development in the City of Sandy over the last 5 years. The methodology was previously reviewed and approved for multiple traffic studies by John Replinger, PE (the city's prior on-call consultant) and by ODOT staff. However, we are happy to work with DKS Associates staff to come to agreement regarding how seasonal adjustments will be made on future reports.

2) *"Intersection sight distance requirements are met at the Dubarko Road extension at US 26. Stopping sight distance was not evaluated."*

Intersection sight distance requirements are generally in excess of stopping sight distance requirements. In this instance, the required intersection sight distance was calculated to be 1,195 feet in each direction in order to account for large trucks that would be expected to use the intersection and a design speed of 65 mph. In contrast, the required stopping sight distance for a 65-mph design speed is just 645 feet in each direction (slightly more than half what is required for intersection sight distance). We do not anticipate any difficulty in achieving stopping sight distance requirements in addition to intersection sight distance requirements, and this appears to be largely a matter of ensuring technical completeness rather than pointing at a potential design flaw.

3) *"The Dubarko Road and Highway 211 intersection is recommended to be converted to an all-way stop controlled intersection to mitigate existing safety issues. The city does not support this intersection control change due to concerns with vehicles on Dubarko Road stopping on the grade during icy weather conditions."*

The recommendation for installation of all-way stop control was made both to reduce the current high crash rates at the intersection and ensure the intersection meets the operational performance standards established by the City of Sandy.

Although installation of a traffic signal is also warranted and may also adequately address the operational and safety concerns, the cost of signalization (and lane additions) contemplated in the city's current TSP is several orders of magnitude higher than installation of stop signs, with an estimated cost of about $10 million. It is unclear when a traffic signal can be funded at this intersection, and failure to implement mitigation will mean continued operation with the existing safety deficiencies.

Notably, the city's concerns with stopping under icy conditions would likely be worsened by installation of a traffic signal since southbound vehicles traveling down the hill approaching a stop sign know that they will need to stop (and we can install permanent stop signs at the stop bar, "stop ahead' signs in advance, and even rumble strips and speed feedback signs to ensure that drivers are aware of their speed and the need to stop. In contrast, drivers approaching a traffic signal will often see a green display and not be sure whether they will need to stop prior to entering the intersection. As such, initial speeds prior to braking would be likely to be higher with signalization, and the required rate of braking on the hill would be increased.

Based on these considerations, it remains our recommendation that the intersection be converted to all-way stop control.

4) *"Trips included in the summary trip generation table on page 13 do not match the values in the appendix. The analysis shall be updated as needed, this may include discussion of pass-by or diverted trip assumptions."*

The reported values in the table were confirmed to precisely match the values in the appendix. It is likely that this comment arose due to the fact that the trip generation calculations in the technical appendix included more than one page for the same land use categories, albeit with different sizes. These differences were intentional (e.g., the maximum size for a Supermarket under the existing zoning was 18,433 sf, while the maximum size under the proposed zoning increased to 25,720 sf.) No revisions to the trip generation calculations are needed to address this review comment.

The Dubarko Road Proportionate Share Funding Plan memo (Exhibit R) by Reah Flisakowski, PE utilized information from the City's 2011 Transportation System Plan to calculate a proportionate share contribution payable toward planned improvements at the intersection of Highway 211 and Dubarko Road. However, the analysis contains several problematic assumptions and conclusions.

First, the analysis takes for granted that installation of the improvements contemplated in 2011 will be necessary under year 2029 traffic conditions. However, the need for these improvements was predicated on outdated traffic volume projections and the assumption that the intersection would operate under the jurisdiction of the Oregon Department of Transportation (i.e., needing to meet ODOT rather than City of Sandy performance standards and subject to ODOT approval of any installed traffic control devices). These assumptions are no longer applicable at this location.

Regarding traffic volumes, the memo outlines that the year 2020 entering traffic volumes totaled 907 vehicles. Under year 2029 it was projected that there would be 1,550 entering vehicles. This represents a 70 percent growth in volumes in just 9 years. This equates to a linear growth rate of 7.77 percent per year, which is more than double ODOT's projections of 3.16 percent per year growth on this highway. It is therefore unlikely that the intersection will experience those design volumes under year 2029 traffic conditions. It is also likely that re-analysis with more reasonable traffic volumes would lead to a finding that improvements with lesser costs would be sufficient for the actual projected traffic volumes. Installation of a traffic signal without lane additions, for instance, would have project costs in the range of $500,000, about 5 percent of the $10 million cost projected in the memo. Further, installation of all-way stop control would address the immediate concern and would have negligible construction costs.

Second, the analysis accounts for growth between 2020 and 2029, but ignores that the TSP was created in 2011. If the city intended to fund installation of these improvements based on contributions from new development, per-trip fees should have been assessed for all projects dating back to when this project was anticipated. Since this was not done, application of the suggested fee of $268,345 for the 17 trips this project will generate at the intersection represents a significant deviation from past practice and unequal treatment with respect to this developer and this project as compared to other (and prior) development within the City of Sandy.

Installation of all-way stop control is expected to address the immediate concerns regarding safety and operation of the intersection and was projected to result in using only 79 percent of intersection capacity, providing some ability to accommodate growth prior to construction of further intersection improvements. Further, installation of stop signs on the Highway 211 approaches does not result in greater overall risks even under ice and snow conditions than installation of a traffic signal. Based on these factors, the request for payment of $268,345 may not be a reasonable condition of approval.

Finally, the proportionate share calculation is subject to the constitutional standards for exactions as expressed in *Nollan v. California Coastal Com*., 483 U.S. 825, 836–37 (1987) and *Dolan v. City of Tigard*, 512 U.S. 374, 391-395 (1994). *Dolan* is particularly relevant here, because it requires any exactions to be "roughly proportional" to the impacts which the exactions are intended to offset. Given that DKS's proportionate share calculation relies on flawed assumptions, the City has likely not carried its burden to demonstrate the rough proportionality of that required contribution to the actual traffic impacts likely to be created by the project.

If you have any questions regarding these comment responses, please feel free to contact me at (503)537-8511 at any time.

EXHIBIT Y

Rebecca Markham <rmarkham@ci.sandy.or.us>

File No. 22-038 CPA/ZC/SUB/SAP/TREE (Bull Run Terrace); Applicant's Response to Updated Condition B

Stephenson, Garrett H. <GStephenson@schwabe.com> Mon, Nov 21, 2022 at 3:36 PM
To: "Kelly O'Neill Jr." <koneill@ci.sandy.or.us>, Planning <planning@ci.sandy.or.us>
Cc: Jeff Aprati <japrati@ci.sandy.or.us>, Josh Soper <josh@gov-law.com>, Dave Vandehey <dave.vandehey@rolltideproperties.com>, Tracy Brown <tbrownplan@gmail.com>

Kelly:

As you know, this office represents Roll Tide Properties Corp. I understand that you and Dave Vandehey had a good discussion this morning about Condition B. To be on the safe side, I wanted to register a protective objection against a certain component of that condition, which requires dedication of the parkland within 180 days and not as part of the subdivision plat. Among the primary reasons for this, as I explain below, is the ongoing sewer moratorium that could significantly impact our development timing, and we think that this condition should be revised to reflect this.

Please place this email into the record on the above-referenced casefile and place it before the Council.

The Applicant objects to the last sentence of revised Condition B (which we received only last Thursday afternoon), which provides as follows:

> "The applicant shall dedicate the proposed 1.755 acres of parkland to the City through a dedication deed process, separate from the subdivision plat process. Prior to dedication, the applicant shall provide a Phase I Environmental Assessment for Tract A. This dedication shall occur within 180 days after approval of Ordinance No. 2022-27."

The parkland dedication is required under SDC 17.86. SDC 17.86.10.A. provides as follows:

> "The required parkland shall be dedicated as a condition of approval for the following:
>
> 1. Single-family and duplex building permits;
>
> 2. Tentative plat for a subdivision or partition;
>
> 3. Design review for a multi-family development or manufactured home park;
>
> 4. Design review for a multi-family development accessory to commercial or industrial development; and,
>
> 5. Replat or amendment of any site plan for multi-family development or manufactured home park where dedication has not previously been made or where the density of the development involved will be increased."

The Code requires parkland dedication only in connection with residential development, and plainly does not support a requirement to dedicate land as a condition of a plan amendment/zone change and in a manner unrelated to the timing of completion of the final plat or other "residential development."

The proposed requirement also raises practical problems. First, the City has imposed a six-month sewer connection moratorium. Res. 2022-024. Financing for the Bull Run Terrace project is unlikely to be available until the moratorium has expired, as neither investors nor banks will typically lend on a project that cannot connect to sewer when the financial commitments are made.

Second, depending on market conditions, it may take more than 180 days for the Applicant to achieve the financing necessary to make the project work. If the project cannot be financed within the 180-day period set forth in the condition, the dedication will not occur. Thus, the 180-day deadline serves to put the project at unnecessary timing risk and as a consequence, put the City's desired parkland at the same unnecessary risk.

If the City Council wishes to impose a specific timeframe not associated with the subdivision itself during which parkland dedication must occur, the Applicant requests that Condition B be revised as follows:

> "The applicant shall dedicate the proposed 1.755 acres of parkland to the City through a dedication deed process, separate from the subdivision plat process. Prior to dedication, the applicant shall provide a Phase I Environmental Assessment for Tract A. This dedication shall occur within 180 days after approval of Ordinance No. 2022-27 or within 180 days after the termination of any development moratoria, whichever occurs last."

Finally, tying the parkland dedication to an arbitrary timeframe after the effective date of the zone change likely violates the 5th Amendment of the US Constitution. Requiring a landowner to dedicate its private property rights or pay money for public improvements in exchange for development approval is a compensable taking unless there is an "essential nexus" between the condition and the government interest. *Nollan v. California Coastal Com.*, 483 U.S. 825, 836–37 (1987). Additionally, such exactions must be "roughly proportional" to the expected impacts caused by the proposed development. *Dolan v. City of Tigard*, 512 U.S. 374, 391-395 (1994) (emphasis added). The City carries the burden of proof to demonstrate that the proposed public improvements have the required nexus, and must make an "individualized determination" of rough proportionality and "some effort to quantify" a project's impacts to support its conclusions. *Dolan*, 512 U.S. at 391.

As written, Condition B turns on the plan amendment/zone change proposal and is "separate from the subdivision plat process." The plan amendment/zone change itself does not allow the proposed development; the subdivision plat and subsequent design reviews are required for constructions of any residential units. Rather, the plan amendment/zone change is a *predicate* for future development. As a result, the City is unable to find that a requirement to dedicate and improve the parkland within six months of the plan amendment/zone change has an "essential nexus" or is "roughly proportional" to the plan amendment/zone change itself, which if divorced from the residential development proposed in the application, causes no physical impacts whatsoever.

Obviously, this constitutional issue arises only if the final plat is not recorded, but I am required under ORS 197.796(b) and ORS 197.797(5)(c) to raise the issue. For this reason, the Applicant accepts this condition to the extent it must do so under ORS 197.796(1), but also reserves its rights to the remedies under that statute.

Best regards,

Garrett

Garrett H. Stephenson

Shareholder

Direct: 503-796-2893

Mobile: 503-320-3715

gstephenson@schwabe.com

Schwabe Williamson & Wyatt

Please visit our COVID-19 Resource page

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EXHIBIT Z

from: **'RaynRoo Ruehrdanz' via Planning** <planning@ci.sandy.or.us>
Date: Mon, Nov 21, 2022, 5:10 PM
Subject: Bull Run Terrace Rebuttal
To: planning@ci.sandy.or.us <planning@ci.sandy.or.us>

Dear Planning Commission, City Planning Staff, and City Councilors:

I have lived in the Deer Pointe neighborhood for the past 11 years. I moved to the City of Sandy because of its small town feel and the lower population compared to many other cities in the Urban Growth Boundary. We, as a community, have seen more and more cars and homeless people moving into the area. The traffic in this area has gotten severely worse over the last few years. There are times when you have to wait several minutes just to get onto 26. This is not acceptable and is only going to get worse when you add in more neighborhoods like the proposed one at the Bull Run Terrace Subdivision. You all need to think about the ramifications on the residents that currently live here and not the ones that will be moving here. I have no problem with the city growing, but make sure it is done correctly. Please make sure that the builders will adhere to the original plans and not build any apartment complexes. I have no problems with single family dwellings or low density housing.

Also, when we built here, we were told that the park across the street was going to be doubled in size. There was a plan to have a walking path, basketball courts, and a playground in the park. The new plans by the builders don't have a park at all and have houses built there instead. With every other neighborhood in the area, there is a park in the middle of it for the kids and families to use. The original plans should still be intact and not be replaced by more houses.

I don't understand why the citizens of the City of Sandy have to argue against building new subdivision housing areas. The amount of traffic that is going to be in the neighborhood of Deer Pointe is going to be at dangerous levels. The cars in the neighborhoods across the city are already packing the side streets to get away from Highway 26. With the new proposal of Deer Meadows it is going to be a problem with no outlet to Highway 26. All the houses in that neighborhood will have to all go through Deer Pointe. This is going to increase the traffic to an already congested neighborhood. There is no outlet on Dubarko because of the expense that the builders will have to incur. There has to be other outlets out of the neighborhood. Please take in consideration the citizens and their concerns and not just focus on the money that will be coming into the city.

Scott Ruehrdanz
40498 Fawn Street
Sandy, Oregon
715-703-0839

Sent from Mail for Windows

Staff Report

Meeting Date:	December 5, 2022
From	Greg Brewster, IT/SandyNet Director
SUBJECT:	SandyNet CBX IGA Amendment

DECISION TO BE MADE:
Whether to approve the proposed changes to the existing SandyNet and CBX Kiwanis IGA from September, 2019.

PURPOSE / OBJECTIVE:
The purpose of the proposed IGA amendments is to bring existing agreements up to date with lessons learned from the Pilot Project, to allow SandyNet to participate in new rural expansion with CBX, and to increase SandyNet revenue.

BACKGROUND / CONTEXT:
In 2019, Sandy City Council approved an IGA between the City of Sandy ("City") and Clackamas Broadband eXchange ("CBX") to build out and operate a pilot project, serving fiber broadband to forest service roads 29, 31, 35, 35a, 35b. Within the IGA SandyNet operates the ISP service and CBX builds out and maintains the fiber line to the house as well as the distribution and fiber backbone. The original service area passed 149 homes, and to date, 48 of those homes have active connections. Current speeds and prices are 300Mbps up/down for $64.95 a month and 1000Mbps (Gigabit) up/down for $84.95. Revenue is split between the City and CBX, where Sandy receives $24 a month for each 300Mbps connection and $34 a month for each 1000Mbps connection. The IGA provides a partnership where the County is able to build out and provide high speed internet to rural areas of the Clackamas County without operating as an internet service provider. For the City, we are able to expand SandyNet to collect additional revenue at very little cost.

Since the execution of the IGA and the deployment of the fiber service, the following challenges and were identified and resolved:

- The standard pipeline for processing SandyNet service requests was modified to handle the dispatch of CBX to construct and test serviceability before SandyNet scheduled and performed the indoor installation. SandyNet's customer tracking system was modified to include a separate project procedure, preventing orders from being lost. Finally, additional communication was required to the customer to reduce appointment no-shows as well as several smaller modifications to standard procedures, such as weather tracking and pre-configuration of equipment due to poor cell service.

- Troubleshooting existing connections was previously an unknown. Prior to the IGA, SandyNet did not deeply analyze specific information that was generated by our fiber systems. To prevent unnecessary truck rolls, SandyNet translated new information to us to help determine modem disconnects/arrivals as well as clustering the units on a map to pinpoint an outage to help determine cause. The result was the ability to predict a power outage, fiber breaks or a one-off customer specific event. SandyNet was then able to dispatch a tech from either party to resolve the issue. Since 2019, SandyNet has dispatched three truck rolls for non-installation customer related issues and dispatched between five to eight trucks rolls to CBX for them to fix broken fiber drops or repairs. On two occasions, the fiber mainline up the mountain failed due to severe weather, once in 2020 and most recently in early November 2022. Both instances were not related to the pilot project and CBX was responsible for restoring service.
- Finally, billing and reporting requirements are now a clearly defined process, making sure funds are accurately split between the two departments. Billing system modification allows these funds to be automatically split between CBX's share and the City's, preventing comprehensive manual auditing. Introduction of ARPA fund requirements may require additional reports to the United States Department of Treasury, which is covered in the proposed modification to the IGA.

KEY CONSIDERATIONS / ANALYSIS:

Since the implementation of the pilot project, new opportunities with CBX have been identified, mostly from the availability of the American Rescue Plan Act (ARPA) funding. Clackamas County has received several million dollars in ARPA funds, and many have been allocated to CBX to build out underserved areas. Analysis by Clackamas County identified that areas north, south, and east of Sandy are the most underserved in the County. CBX is set to begin construction in several areas, all within five miles of Sandy city limits, most notably a patch of roughly 28 houses, between the intersection of Hudson/Lusted Road and Dodge Park, and Colorado Road and Gunderson Road for an estimated potential of 250 homes. Given the proximity to Sandy and the success of the existing pilot project, there is a mutual desire to amend the existing IGA, rather than propose a new one for the new opportunities. Staff has prepared the following changes to bring the proposed and existing partnership projects under the same IGA.

The following changes are proposed:

- Remove the term pilot project from the IGA
- Modify the speed for the 300Mbps package, changing it to 500Mbps to match SandyNet existing service offerings
- Adjust the revenue received for the city for now the 500Mbps package, now collecting $40 instead of the existing $24 and modifying the 1000Mbps package to collect $60 instead of the existing $34
- Add language that requires the City comply with 31 CFR 35.6(w)(2)(i)
- Add language that requires the City and County to agree on reporting requirements before engaging in any new projects
- Removed existing location section, defining the previous pilot project

Considerations for the following proposed changes:

Moving the 300Mbps speed tier to 500Mbps has negligible impact on the overall performance of the network. Additionally, migrating all existing speed accounts from 300 to 500Mbps will bring each offered tier in line with SandyNet's existing tiers.

The proposed increases in revenue share to the city are brought on by the CBX cost model. Since CBX's capital costs are covered under ARPA, CBX desires to modify the existing pilot project revenue shares, bringing them in line with future ARPA revenue requirements. The impact is increased revenue for the city, with no additional responsibilities other than those modified in the proposed IGA changes.

The 31 CFR language was provided by the State and Local Fiscal Recovery Funds (SLFRF) final rule, which requires a provider to offer at a minimum broadband speed of 100/20Mbps (up/down) to customers, which both the existing and proposed tier changes exceed. Additionally, the ISP (City) must be enrolled in the FCC's Affordability Connectivity Program (ACP), which the City already participates in as of October 17th, 2022. The code language is attached to this staff report. Finally, ARPA reporting requirements must be provided to CBX from the ISP. To minimize burden to the City, both parties must agree on metrics I.e., speed benchmarks, latency, number of active customers, ACP statistics before engaging in any new project.

The location section was removed to prevent rigidity within the IGA, allowing for the City to participate in other future deployments, should they be in the interest of the City. Review of the IGA and its amendments by the City Attorney, has confirmed that the language in Section 2 allows the City to only engage in new projects that it desires.

RECOMMENDATION:
Staff respectfully requests that Council review and approve the proposed changes to the 2019 SandyNet CBX IGA. Staff is also prepared to make adjustments and bring the proposed changes at a later meeting to allow for council discussion.

BUDGETARY IMPACT:
The approval of the IGA amendment would yield an additional $16 a month for each 500Mbps customer and $26 a month for each 1000Mbps, resulting in an increase in revenue of 66% and 76% respectively from the existing customers within the pilot project area. Should the IGA take effect in January 2023, an additional $3,968 in revenue from the existing customer base would be received for the 2022-2023 fiscal year.

Assuming a 50% take rate for the new expansion projects targeted by CBX, SandyNet could realize an additional $67,000 in revenue per year for providing these ISP services with little cost to the City.

LIST OF ATTACHMENTS/EXHIBITS:

- SandyNet / CBX Kiwanis IGA
- 31 CFR language

INTERGOVERNMENTAL AGREEMENT
BETWEEN CLACKAMAS COUNTY
AND THE CITY OF SANDY

THIS AGREEMENT ("Agreement") is entered into and by and between Clackamas County ("County"), a political subdivision of the State of Oregon, and the City of Sandy ("City"), a political subdivision of the State of Oregon, pursuant to ORS Chapter 190 (Cooperation of Governmental Units), collectively referred to as the "Parties" and each a "Party."

RECITALS

WHEREAS, authority is conferred under ORS Chapter 190 to local governments to enter into agreements for the performance of any and all functions and activities that a party to the agreement, its officers or agencies have authority to perform; and

WHEREAS, the parties desire to partner for a fiber-to-the-x project whereby the City will serve as the Internet Service Provider ("ISP") and the County will construct the necessary infrastructure and provide the dark fiber connections to the City's customers (the "Project"); and

NOW, THEREFORE**,** in consideration of the mutual promises set forth below and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby agree as follows:

1. **Term.** This Agreement shall be effective upon execution by both Parties, and shall continue for a term of five (5) year from the date of execution. This Agreement shall automatically renew for an additional one (1) year term each year thereafter unless otherwise terminated by the parties but not to exceed a maximum of 10 years from date executed.

2. **Rights and Obligations of the County.**

   A. Upon written request from the City, County shall construct the necessary infrastructure and install a dark fiber connection to the property owners who have agreed to have the City serve as an ISP as part of the Project ("Infrastructure Construction"). Infrastructure Construction shall be performed by County in its sole discretion. The County is and will remain the owner of any infrastructure and dark fiber installed as part of the Infrastructure Construction. Prior to County performing the Infrastructure Construction, the County will consult with the City to ensure that the specifications of the infrastructure and fiber are compatible with City's system. Prior to the County performing the Infrastructure Construction, the City shall ensure the following construction and installation requirements are satisfied at each property:

      a. The City has secured all easements, leases, licenses, authorizations, or other agreements from property owner to allow County to use existing pathways to, into and within each site to the demarcation point for service, and to otherwise perform the Infrastructure Construction.

      b. A path acceptable to the County is provided for the fiber optic cable from the point of entry into the site to the termination panel or CSP (Customer Splice Point) and into the home demarcation that complies with all applicable building, electrical, fire and related codes.

      c. The County and its employees, agents, lessees, officers and its authorized vendors, upon reasonable notice, have reasonable ingress and egress into and out of the properties and buildings in connection with the provision of service.

B. Following construction of such infrastructure, and throughout the term of this Agreement, County shall maintain and repair, as necessary, all County-owned infrastructure necessary to provide service to each customer receiving service pursuant to this Agreement. County shall have the sole discretion to determine how to maintain said infrastructure and make the required repairs, provided that the repair is sufficient to restore service at a level equal to or better than the level that existed prior to the damage necessitating the repair, and (2) the repair is completed promptly.

C. Subject to the availability of funds, as determined by the County in its sole administrative discretion, the County will provide all funds for the expansion of the fiber network to serve the property owners involved in the Project including, but not limited to, the expansion of the backbone fiber, and all drops or laterals. The County will also contribute up to $15,000.00 for purchase of new ISP equipment necessary to provide service to the property owners. This ISP equipment shall be procured and managed solely by the City. In procuring the ISP equipment, the City shall comply with all local, state, or federal law, including the Oregon Public Contracting Code, applicable to the procurement of goods and services. Upon termination of this agreement, title and ownership to all ISP equipment purchased by the City with County funds will be conveyed to County and will be removed from the City's network at the City's expense.

3. **Rights and Obligations of City.**

A. If County performs the Infrastructure Construction necessary to serve a property owner as requested by the City, the City will provide ISP services to the property owner pursuant to those terms and conditions as may be mutually agreed to between the City and the property owner. County will have no involvement or interest in, and will not be a party to, any such agreement entered into by and between City and the property owner.

B. In serving as an ISP, City shall provide all commercially reasonable ISP services including, but not limited to, IP addresses, billings, and general customer service. Customer service will be available Monday through Friday from 9 am to 5 pm, excluding federal holidays. City will not impose any data caps on the amount of data used by the customer. City will not be able to slow or restrict use in any way based on the amount of data used by each customer, unless in the event of an emergency.

C.

D. As of the date of this Agreement, City will provide the ISP services to property owners at a cost of $64.95 per month per customer for a symmetrical 500 Mg service or $84.95 per month per customer for a symmetrical 1 Gig service. Of this fee, $40.00 will be withheld by the City for each 500 Mbps customer and $60.00 for each Gig customer. The remainder of the funds received from each customer for the ISP services will be sent to County. Cost does not include any fees or taxes that may be imposed on City or County, which may be added to the customer's cost.

E. City shall abide by United States Department of Treasury Final Rule for SLFRF General Broadband investment sections 31 CFR 35.6(e)(2)(i)[1]

F. If reporting of any type or any frequency is required for City or County funding, grants, or organization specific processes, each party agrees to reasonably cooperate to assist the other party in meetings its reporting needs, and the parties shall endeavor to define and agree in writing to reporting parameters and frequency of occurrence.

[1] United States Department of Treasury, 31 CFR 35.6(e)(2)(i), https://www.ecfr.gov/current/title-31/subtitle-A/part-35/subpart-A/section-35.6, accessed on 11/27/2022

G. Rate increases shall occur no more than once per calendar year and only as be mutually agreed upon by both parties and via a written amendment to this agreement. Rate increases that are due to a government-imposed fee or tax are exempt from the requirements of this section.

4. **Representations and Warranties**.

A. *City representations and warranties*: City represents and warrants to County that City has the power and authority to enter into and perform this Agreement, and this Agreement, when executed and delivered, shall be a valid and binding obligation of City enforceable in accordance with its terms.

B. *County Representations and Warranties*: County represents and warrants to City has the power and authority to enter into and perform this Agreement, and this Agreement, when executed and delivered, shall be a valid and binding obligation of County enforceable in accordance with its terms.

C. The warranties set forth in this section are in addition to, and not in lieu of, any other warranties provided.

5. **Termination**.

A. The County and City, by mutual written agreement, may terminate this Agreement at any time. Either Party may terminate for convenience upon providing one hundred twenty (120) days' written notice to the other Party.

B. Either the County or City may terminate this Agreement in the event of a breach of the Agreement by the other. Prior to such termination however, the Party seeking the termination shall give the other Party written notice of the breach and of the Party's intent to terminate. If the breaching Party has not entirely cured the breach within fifteen (15) days of deemed or actual receipt of the notice, or other time as may be agreed between the parties in writing, then the Party giving notice may terminate the Agreement at any time thereafter by giving written notice of termination stating the effective date of the termination. If the default is of such a nature that it cannot be completely remedied within such fifteen (15) day period, this provision shall be complied with if the breaching Party begins correction of the default within the fifteen (15) day period and thereafter proceeds with reasonable diligence and in good faith to effect the remedy as soon as practicable. The Party giving notice shall not be required to give more than one (1) notice for a similar default in any twelve (12) month period.

C. The County or City shall not be deemed to have waived any breach of this Agreement by the other Party except by an express waiver in writing. An express written waiver as to one breach shall not be deemed a waiver of any other breach not expressly identified, even though the other breach is of the same nature as that waived.

D. Either Party may terminate this Agreement in the event the Party fails to receive expenditure authority sufficient to allow that Party, in the exercise of its reasonable administrative discretion, to continue to perform under this Agreement, or if federal or state laws, regulations or guidelines are modified or interpreted in such a way that performance under this Agreement is prohibited or a Party is prohibited from paying for such work from the planned funding source.

E. Any termination of this Agreement shall not prejudice any rights or obligations accrued to the Parties prior to termination.

6. **Indemnification**.

   A. Subject to the limits of the Oregon Constitution and the Oregon Tort Claims Act or successor statute, the County agrees to indemnify, save harmless and defend City, its officers, elected officials, agents and employees from and against all costs, losses, damages, claims or actions and all expenses incidental to the investigation and defense thereof arising out of or based upon damages or injuries to persons or property caused by the negligent or willful acts of the County or its officers, elected officials, owners, employees, agents, or its subcontractors or anyone over which the County has a right to control.

   B. Subject to the limits of the Oregon Constitution and the Oregon Tort Claims Act or successor statute, City agrees to indemnify, save harmless and defend the County, its officers, elected officials, agents and employees from and against all costs, losses, damages, claims or actions and all expenses incidental to the investigation and defense thereof arising out of or based upon damages or injuries to persons or property caused by the negligent or willful acts of City or its officers, elected officials, owners, employees, agents, or its subcontractors or anyone over which City has a right to control.

7. **Insurance.** The Parties agree to maintain insurance levels sufficient to cover the obligations agreed to in this Agreement.

8. **Party Contacts**

   A. Duke Dexter or his designee will act as liaison for the County.

   Contact Information:

   Duke Dexter
   121 Library Court
   Oregon City, Oregon 97045
   ddexter@clackamas.us
   Fax: 503-655-8255

   Greg Brewster or his designee will act as liaison for City.

   Contact Information:

   Greg Brewster
   39250 SE Pioneer Blvd
   Sandy, Oregon 97055
   gbrewster@ci.sandy.or.us
   503-489-0937

   B. Either Party may change the Party contact information, or the invoice or payment addresses by giving prior written notice thereof to the other Party at its then current notice address.
   C. Any notice required to be provided under this Agreement shall be provided to the Party Contact at the address specified herein. Notices shall be made by personal service, in which case they are effective on the date of service, or by certified mail, in which case they are effective on the date of delivery, or if delivery is refused, upon the date of delivery refusal.

9. **General Provisions**

A. **Oregon Law and Forum.** This Agreement, and all rights, obligations, and disputes arising out of it will be governed by and construed in accordance with the laws of the State of Oregon without giving effect to the conflict of law provisions thereof. Any claim between County and City that arises from or relates to this Agreement shall be brought and conducted solely and exclusively within the Circuit Court of Clackamas County for the State of Oregon; provided, however, if a claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by either Party of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. City, by execution of this Agreement, hereby consents to the in personam jurisdiction of the courts referenced in this section.

B. **Compliance with Applicable Law**. Both Parties shall comply with all applicable local, state and federal ordinances, statutes, laws and regulations. All provisions of law required to be part of this Agreement, whether listed or otherwise, are hereby integrated and adopted herein. Failure to comply with such obligations is a material breach of this Agreement.

C. **Non-Exclusive Rights and Remedies**. Except as otherwise expressly provided herein, the rights and remedies expressly afforded under the provisions of this Agreement shall not be deemed exclusive, and shall be in addition to and cumulative with any and all rights and remedies otherwise available at law or in equity. The exercise by either Party of any one or more of such remedies shall not preclude the exercise by it, at the same or different times, of any other remedies for the same default or breach, or for any other default or breach, by the other Party.

D. **Access to Records**. The Parties shall retain, maintain, and keep accessible all records relevant to this Agreement ("Records") for a minimum of six (6) years, following Agreement termination or full performance or any longer period as may be required by applicable law, or until the conclusion of an audit, controversy or litigation arising out of or related to this Agreement, whichever is later. The Parties shall maintain all financial records in accordance with generally accepted accounting principles. All other Records shall be maintained to the extent necessary to clearly reflect actions taken. During this record retention period each Party shall permit the other Parties' authorized representatives' access to the Records at reasonable times and places for purposes of examining and copying.

E. **Debt Limitation.** This Agreement is expressly subject to the debt limitation of Oregon counties set forth in Article XI, Section 10, of the Oregon Constitution, and any debt limitations contained in any City or County charter, and is contingent upon funds being appropriated therefore. Any provisions herein which would conflict with law are deemed inoperative to that extent.

F. **Severability.** If any provision of this Agreement is found to be unconstitutional, illegal or unenforceable, this Agreement nevertheless shall remain in full force and effect and the offending provision shall be stricken. The Court or other authorized body finding such provision unconstitutional, illegal or unenforceable shall construe this Agreement without such provision to give effect to the maximum extent possible the intentions of the Parties.

G. **Integration, Amendment and Waiver.** Except as otherwise set forth herein, this Agreement constitutes the entire agreement between the Parties regarding its subject matter. There are no understandings, agreements, or representations, oral or written, not specified herein regarding this Agreement. No waiver, consent, modification or change of terms of this Agreement shall bind either Party unless in writing and signed by both Parties and all necessary approvals have been obtained. Such waiver, consent, modification or change, if made, shall be effective only in the specific instance and for the specific purpose given. The failure of either Party to enforce any provision of this Agreement shall not constitute a waiver by such Party of that or any other provision.

H. **Interpretation**. The titles of the sections of this Agreement are inserted for convenience of reference only and shall be disregarded in construing or interpreting any of its provisions.

I. **Independent Contractor**. Each of the Parties hereto shall be deemed an independent contractor for purposes of this Agreement. No representative, agent, employee or contractor of one Party shall be deemed to be a representative, agent, employee or contractor of the other Party for any purpose, except to the extent specifically provided herein. Nothing herein is intended, nor shall it be construed, to create between the Parties any relationship of principal and agent, partnership, joint venture or any similar relationship, and each Party hereby specifically disclaims any such relationship.

J. **No Third-Party Beneficiary.** City and County are the only parties to this Agreement and are the only parties entitled to enforce its terms. Nothing in this Agreement gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly or otherwise, to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of the terms of this Agreement.

K. **Assignment**. Neither Party shall assign or transfer any of its interest in this Agreement, by operation of law or otherwise, without obtaining prior written approval from the other Party, which shall be granted or denied in that Party's sole and absolute discretion. One Party's consent to any assignment shall not relieve the other Party of any of its duties or obligations under this Agreement.

L. **Counterparts**. This Contract may be executed in several counterparts (electronic or otherwise), each of which shall be an original, all of which shall constitute the same instrument.

M. **Survival.** The provisions of Sections 5, 7, and 10 shall survive the termination of this Agreement.

N. **Necessary Acts.** Each Party shall execute and deliver to the others all such further instruments and documents as may be reasonably necessary to carry out this Agreement.

O. **Successors in Interest.** The provisions of this Agreement shall be binding upon and shall inure to the benefit of the parties hereto, and their respective authorized successors and assigns.

P. **Force Majeure.** Neither City nor County shall be held responsible for delay or default caused by events outside of City's or County's reasonable control including, but not limited to, fire, terrorism, riot, acts of God, or war.

Q. **Confidentiality**. The Parties and their employees or agents may, in the course of this Agreement, be exposed to or acquire material identified as confidential information. Such information shall be deemed confidential information of the Party identifying it as such ("Confidential Information"). The Parties agree to hold Confidential Information in strict confidence, using at least the same degree of care that each Party uses in maintaining the confidentiality of its own confidential information, and not to copy, reproduce, sell, assign, license, market, transfer or otherwise dispose of, give, or disclose Confidential Information to third parties or use Confidential Information for any purpose unless specifically authorized in writing under this Agreement or required by law.

[Signatures on Following Page]

IN WITNESS HEREOF, the Parties have executed this Agreement by the date set forth opposite their names below.

Clackamas County	**City of Sandy**
_____	_____
Chair, Board of County Commissioners	By: Its:
_____	_____
Date	Date
_____	
Recording Secretary	

(2) ***Broadband investments*** -

(i) ***General.*** Broadband infrastructure if the following conditions are met:

(A) The broadband infrastructure is designed to provide service to households and businesses with an identified need, as determined by the recipient, for such infrastructure;

(B) The broadband infrastructure is designed to, upon completion:

(*1*) Reliably meet or exceed symmetrical 100 Mbps download speed and upload speeds; or

(*2*) In cases where it is not practicable, because of the excessive cost of the project or geography or topography of the area to be served by the project, to provide service reliably meeting or exceeding symmetrical 100 Mbps download speed and upload speeds:

(*i*) Reliably meet or exceed 100 Mbps download speed and between at least 20 Mbps and 100 Mbps upload speed; and

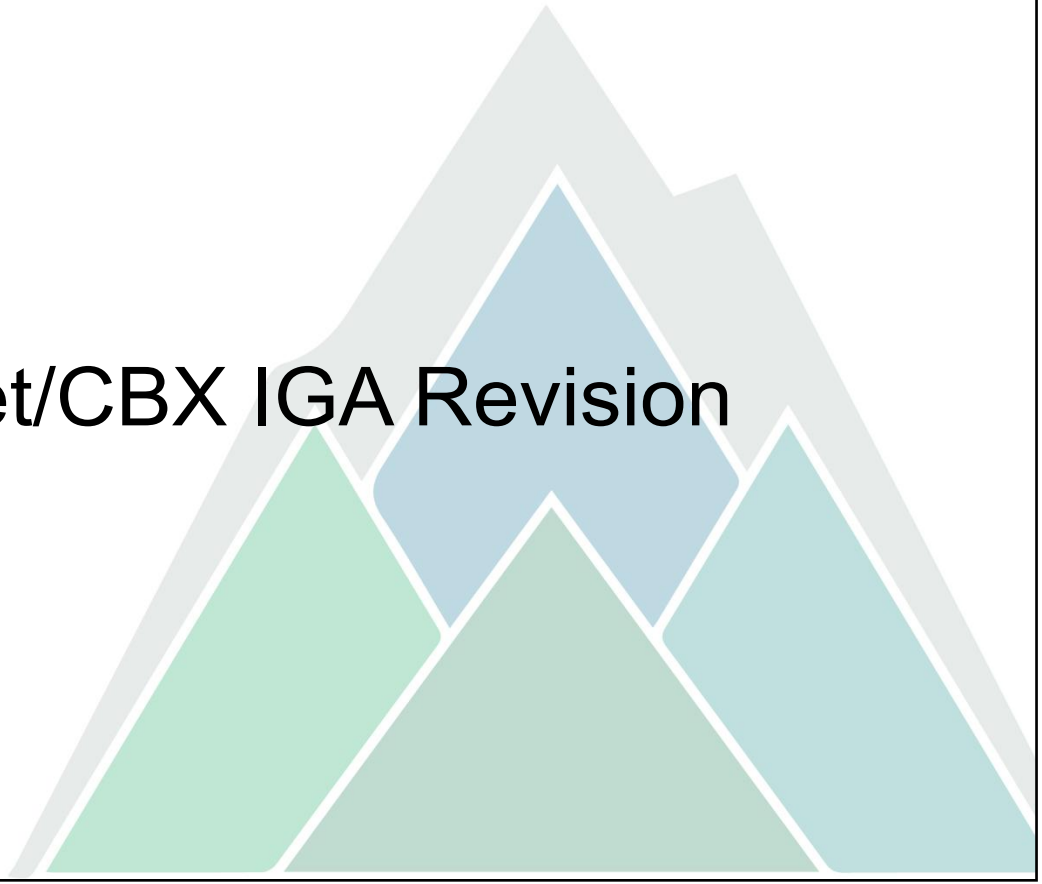
(*ii*) Be scalable to a minimum of 100 Mbps download speed and 100 Mbps upload speed; and

(C) The service provider for a completed broadband infrastructure investment project that provides service to households is required, for as long as the SLFRF-funded broadband infrastructure is in use, by the recipient to:

(*1*) Participate in the Federal Communications Commission's Affordable Connectivity Program (ACP) through the lifetime of the ACP; or

(*2*) Otherwise provide access to a broad-based affordability program to low-income consumers in the proposed service area of the broadband infrastructure that provides benefits to households commensurate with those provided under the ACP through the lifetime of the ACP.

SandyNet/CBX IGA Revision



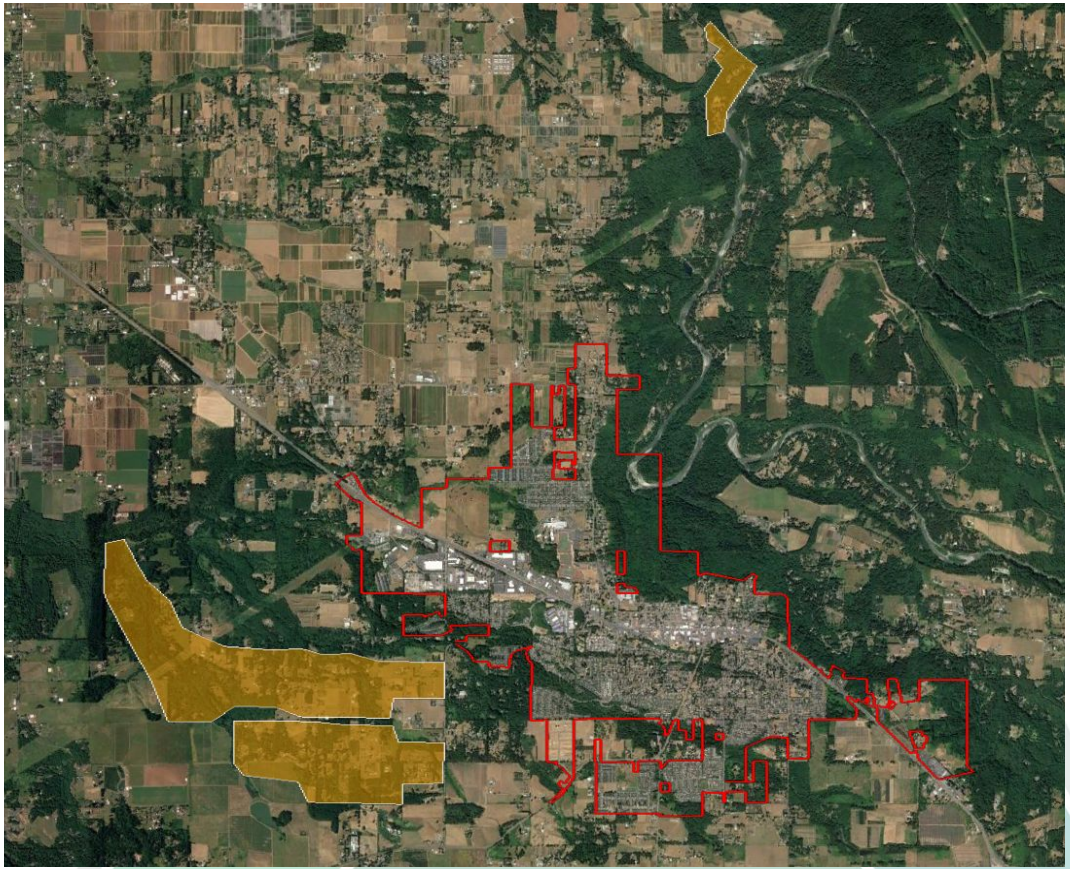
2019 IGA Highlights

- **Pilot** project between Rhododendron and Government Camp, serving 139 homes.
- Two speed tiers offered
  - 300Mbps for $64.95, city keeps $24 a month
  - 1000Mbps for $84.95, city keeps $34 a month
- No requirements for reporting
- To date, has about 35% take rate
- Low number of city truck rolls for troubleshooting

Key Amendment Considerations

- Speed increase for the 300Mbps tier to change to 500Mbps
- City revenue adjustments
  - $40 a month for 500Mbps
  - $60 a month for 1000Mbps
- Revenue ratio adjustments are due to CBX price model changes from usage of ARPA funds
- Extra revenue to city covers ARPA reporting requirements from modems
- Adjustment for three new service territories, near Sandy (next slide)
- New territories are within 2 miles of city limits

Proposed Areas

- Lusted Rd
- Colorado Rd
- Gunderson Rd

~250 Potential homes served