Appendix B: Forecasting Methodology and Data

The Transpo Group

MEMORANDUM

Date:	September 24, 2007	**TG:**	06301.01
To:	Anne Sylvester, Parametrix		
From:	Brent Turley, PE, Tranpso Larry Toedtli, PE, Transpo		
cc:	Eric Shimizu, PE, PTOE, Transpo		
Subject:	2007 Model Documentation – Methods of Forecasting Traffic Volumes for the Woodland Transportation Strategic Infrastructure Plan		

The purpose of this memorandum is to document the assumptions and methodologies for forecasting future 2025 traffic volumes for the Woodland Transportation Strategic Infrastructure Plan. This forecast process utilized the travel demand model previously developed for the City of Woodland 2005 Transportation Plan Update (see *Model Documentation*, Transpo, July 2005). This memo outlines the land use changes, model structure changes, and the resulting traffic volume forecasts.

Land Use Assumptions

As part of the Woodland Transportation Strategic Infrastructure planning process, 2005 land use growth assumptions were reviewed and updated to be consistent with current information. This review was made by the Cowliz-Wahkiakum Council of Governments (CWCOG) and discussed in the attached July 25, 2007 memorandum, *City of Woodland Population Estimates & UGA Growth*. Based on this information, two land use scenarios were developed for use in the Strategic Infrastructure Plan.

CWCOG Findings on Population Growth Rates

Based on recent information, CWCOG staff reviewed population growth and development patterns in and surrounding the Woodland Urban Growth Area (UGA). They concluded that growth may be higher than anticipated in the 2005 Woodland Comprehensive Plan. The 2005 Comprehensive Plan is based on an annual population growth rate of 3.5 percent. This growth rate is lower than the 4.5 percent annual growth rate between 1990 and 2000. Table 1 summarizes the population growth through 2025 based on the two growth rates.

Table 1. Population Projections By Year

Growth Rate Source	Growth Rate	2007 Population	2025 Population
2005 Comprehensive Plan	3.5%	4,960	9,087
Historical Trends (1990 to 2000)	4.5%	4,960	10,954
Difference:			***+1,867***

Source: CWCOG, July 25, 2007

The CWCOG memo indicates that the higher growth rate would most likely result in additional residential units located south and west of the City's current UGA boundary. Based on the current average of 2.67 persons per dwelling unit, as identified by CWCOG staff, the additional 1,867 persons would translate into 699 more dwelling units compared to the assumptions used in the 2005 Comprehensive Plan.

Land Use Scenarios

Based on the two growth rates, two land use scenarios were used in forecasting 2025 traffic volumes for use in the Transportation Strategic Infrastructure Plan. The first scenario, entitled "Comp Plan," is based on the 2005 Comprehensive Plan land use as documented in the 2005 Model Documentation. The second scenario, "Comp Plan Plus," adds 699 residential dwelling units to the original land use forecasts and assumes they are located south and west of the city as shown in Attachment 1. For modeling purposes, these additional units were added to the land use already assumed for Transportation Analysis Zone (TAZ) number 408 (see Attachment 2). Attachment 1 also shows the original land use growth assumptions for each general area of the city.

Travel Demand Model Changes

In addition to the land use assumption updates, the travel demand model was updated to incorporate the latest version of the VISUM software. To ensure that the software changes did not adversely affect the model setup, the 2004 model calibration was re-validated as part of this project. These updates were carried forward into an updated 2025 city model used to forecast future traffic volumes.

VISUM Travel Model Changes -Trip Distribution

The City of Woodland travel demand model was developed in the VISUM software for the 2005 Comprehensive Plan. At that time, the "trip distribution" portion of the traditional four-step model had not yet been incorporated into the main software platform. Instead, trip distribution was calculated in a separate Excel-based program utility. The original trip distribution deterrence parameters (or friction factors) were calibrated to the methodology used in this utility.

The latest version of VISUM (Version 9.52-11) incorporates the trip distribution process directly in the model software. This updated software provides much more flexibility in applying the trip distribution processes. However, this increased flexibility also resulted in subtle changes to the distribution methodology such that the previous model results are difficult to exactly duplicate.

Table 2 outlines the original and updated trip distribution deterrence parameters. All but the Freeway Related trip purpose had the same deterrence parameters (see table footnote for "a" value explanation). The previously established parameters for Freeway Related trips did not replicate the desired existing travel patterns with the revised software. Therefore, the parameters for Freeways Related trips were adjusted to more closely replicate the previous model results.

Table 2. Trip Distribution Deterrence Parameters[1]

	Original Woodland Model			Updated Woodland Model		
Trip Purpose	**a**	**b**	**c**	**a[2]**	**b**	**c**
Home-Based Work	1	0.05	0.001	-1	0.05	0.001
Home-Based Other	1	0.05	0.001	-1	0.05	0.001
Non-Home Based	3	0.05	0.020	-3	0.05	0.020
Freeway Related	1	0.00	0.000	-1	1.00	1.000

1. These parameters relate to the TModel equation as found in the VISUM software.
2. In the previous VISUM version, the TModel equation assumed "a" would be negative so the input parameter needed to be positive. The current VISUM version generalizes the equation so that the "a" parameter should be coded as a negative to represent the same original equation.

Updated Validation and Calibration

With the changes in the trip distribution parameters, the base year model validation and calibration were reviewed and checked. This process focused on the screen line calibration and the link volume regression analysis.

The revised screen line results are shown in Table 3. All screen line percent differences were within the allowed error and were only marginally different. Regression analysis was performed to estimate R-squared, or the "goodness of fit," of the model link volumes compared to associated counts. If R-squared was 1.00, then the model volumes would match counts exactly. The revised model volumes had an R-squared of 0.96, which is the same as the original model. Therefore, the changes to the software and parameters did not affect the model setup and the calibration results indicate that the model is well established for preparing forecasts for the Transportation Strategic Infrastructure Plan.

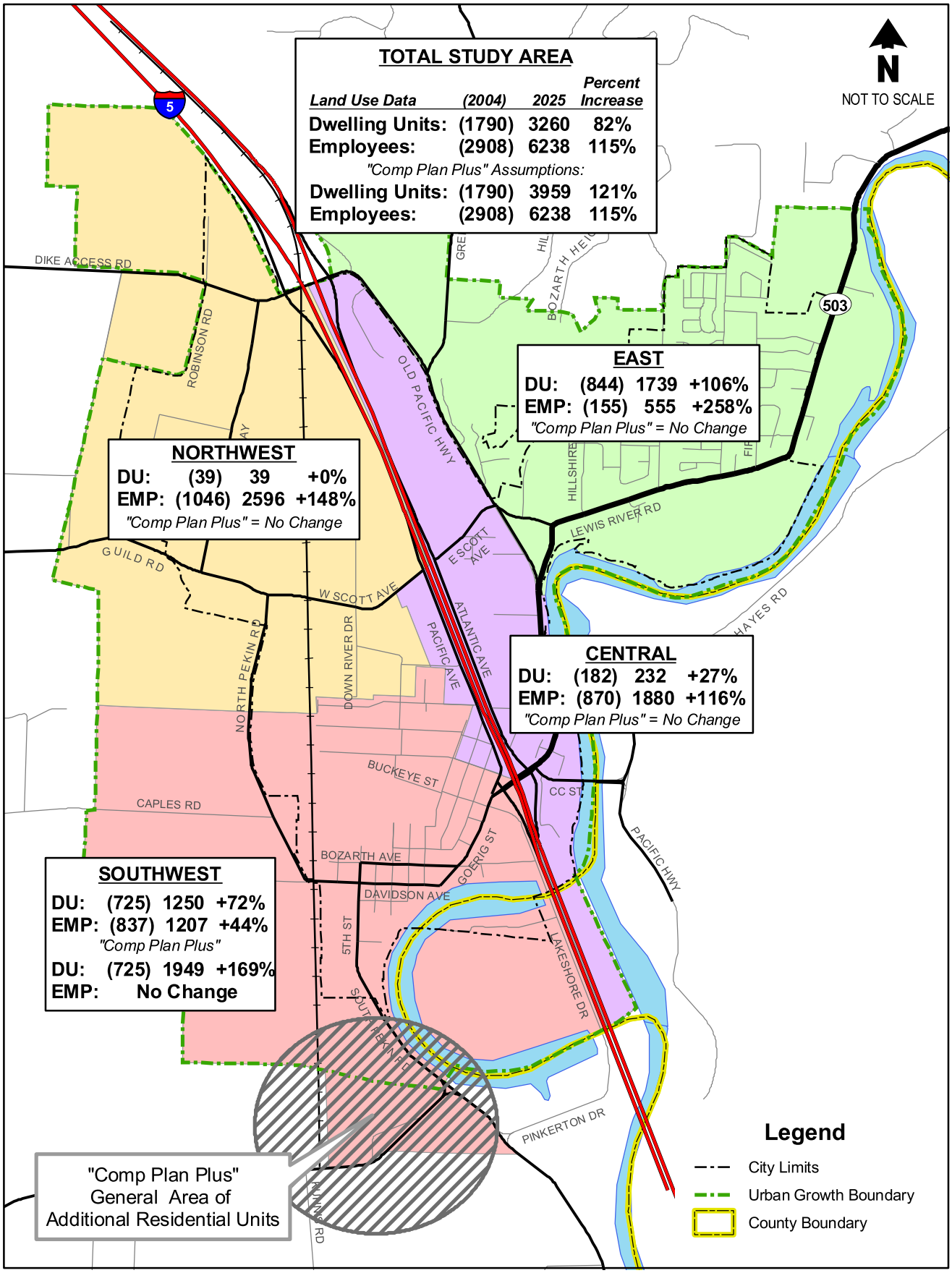
Table 3. Screen Line Calibration Summary

#	Screenline Location	Traffic Counts		Model Volumes		Percent Difference[2]		
	North-South	**SB[1]**	**NB**	**SB**	**NB**	**SB**	**NB**	**Allowed**
1	Parallel to Scott Ave[3]	3,000	3,005	2963	2966	-1%	-1%	19%
	East-West	**WB[1]**	**EB**	**WB**	**EB**	**WB**	**EB**	**Allowed**
2	I-5 Bridges	930	980	1199	1025	29%	5%	29%
3	SR 502 west of Hillsdale	405	695	461	785	14%	13%	36%

1. Direction of traffic: Southbound; Northbound; Westbound; Eastbound
2. Maximum desirable error obtained from the highway Traffic Data fro Urbanized Area Project planning and Design report (NHCRP 255)
3. Removing SB and NB mainline I-5 volumes would increase the percent difference to 4% and -5%, respectively.

Traffic Volume Results

The revised 2025 Woodland travel demand model was used to develop traffic volume forecasts. Two traffic volumes scenarios were developed based on the Comp Plan and Comp Plan Plus land use scenarios. The study intersections and resulting 2025 volumes are shown in Attachments 3 and 4. These turning movement volumes are not "raw" 2025 model volumes, but represent the 2025 model traffic volumes adjusted to reflect the differences in calibration, consistent with the original Comprehensive Plan forecasting process.



Attachment 1

Land Use by District

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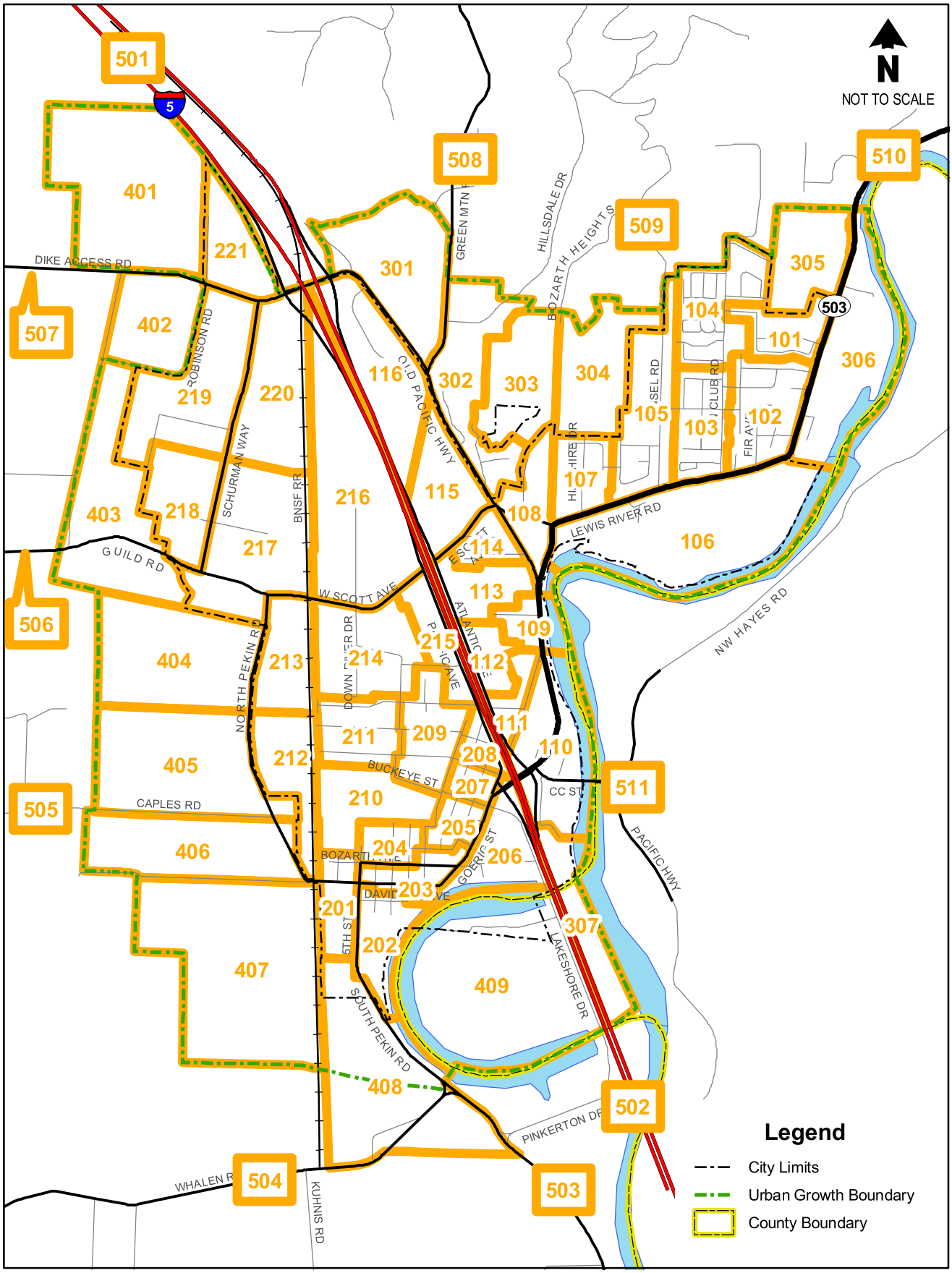
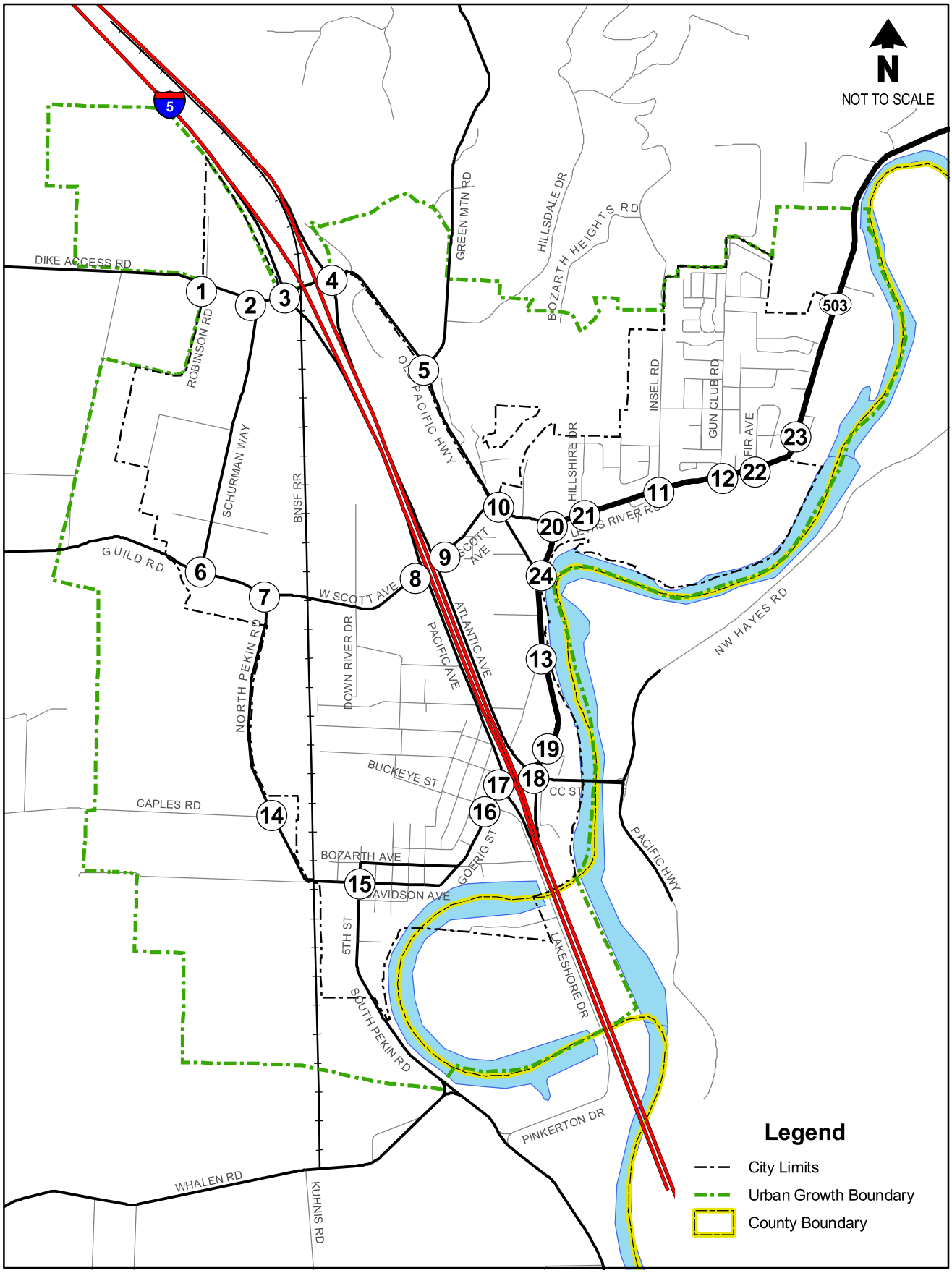


Attachment 2

Model Transportation Analsyis Zones

Parametrix

The Transpo Group



Attachment 3

Study Intersections

2025 COMP PLAN	2025 COMP PLAN PLUS
1 Robinson Rd Dike Access Rd 5 250 185 80 70 10 10 5	1 Robinson Rd Dike Access Rd 5 255 185 80 70 10 10 5
2 Schurman Way Dike Access Rd 325 210 20 140 55 385	2 Schurman Way Dike Access Rd 305 210 45 135 55 390
3 I-5 SB Ramps Dike Access Rd 5 85 245 415 265 295 165	3 I-5 SB Ramps Dike Access Rd 5 80 240 410 265 285 175
4 I-5 NB Ramps Dike Access Rd 155 120 505 275 160 110	4 I-5 NB Ramps Dike Access Rd 150 120 465 280 160 115
5 Green Mtn Rd Old Pacific Hwy 470 105 75 180 165 235	5 Green Mtn Rd Old Pacific Hwy 460 105 75 185 165 230
6 Schurman Way Guide Rd 35 90 50 210 80 60	6 Schurman Way Guide Rd 30 125 50 225 85 65

2025 COMP PLAN	2025 COMP PLAN PLUS
7 North Pekin Rd West Scott Ave 135 160 50 45 95 15	7 North Pekin Rd West Scott Ave 130 165 95 50 105 20
8 SB I-5 Off-Ramp / Pacific Ave West Scott Ave 475 60 175 145	8 SB I-5 Off-Ramp / Pacific Ave West Scott Ave 480 55 170 150
9 NB I-5 On-Ramp / Pacific Ave East Scott Ave 70 280 245 290	9 NB I-5 On-Ramp / Pacific Ave East Scott Ave 70 285 250 290
10 Old Pacific Hwy East Scott Ave 335 160 275 65 155 80 60 40 10 15 315	10 Old Pacific Hwy East Scott Ave 335 160 265 65 150 75 60 40 10 15 325
11 Insel Rd Lewis River Rd (SR 503) 60 5 115 5 895 565	11 Insel Rd Lewis River Rd (SR 503) 65 5 115 5 905 585
12 Gun Club Rd Lewis River Rd (SR 503) 120 5 220 5 800 450	12 Gun Club Rd Lewis River Rd (SR 503) 125 5 220 5 805 465

Attachment 4A

2025 PM Peak Hour Traffic Volumes

Woodland Transportation Strategic Infrastructure Plan

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2025 COMP PLAN	2025 COMP PLAN PLUS
(13) N Goerig St (SOUTH INT) Lewis River Rd (SR 503) 840 80 245 15 5 995	(13) N Goerig St (SOUTH INT) Lewis River Rd (SR 503) 900 80 250 15 5 1,020
(14) North Pekin Rd Caples Rd 95 20 15 40 45 85	(14) North Pekin Rd Caples Rd 150 15 15 45 45 100
(15) 5th St Davidson Ave 20 15 5 5 150 100 35 205 35 115 15	(15) 5th St Davidson Ave 50 15 5 5 145 90 95 445 55 200 25
(16) Goerig St Buckeye St / Lakeshore Dr 480 115 135 100 110 10 15 10 10 5 610	(16) Goerig St Buckeye St / Lakeshore Dr 700 110 135 100 110 10 10 10 10 5 685
(17) I-5 SB On-ramp / Pacific Ave Lewis River Rd (SR 503) 270 115 455 65 360 545 615 210 610	(17) I-5 SB On-ramp / Pacific Ave Lewis River Rd (SR 503) 270 115 440 70 355 610 805 210 610
(18) I-5 NB Off-ramp / Atlantic Ave Lewis River Rd (SR 503) 405 30 320 145 680 765 410 580 325	(18) I-5 NB Off-ramp / Atlantic Ave Lewis River Rd (SR 503) 440 30 335 140 720 855 475 580 330

2025 COMP PLAN	2025 COMP PLAN PLUS
(19) CC St Lewis River Rd (SR 503) 985 695 310 115 210 90	(19) CC St Lewis River Rd (SR 503) 1,025 780 310 115 215 85
(20) SR 503 East Scott Ave 480 190 365 5 5 865	(20) SR 503 East Scott Ave 515 180 355 5 5 880
(21) Hillshire Dr Lewis River Rd (SR 503) 45 5 75 10 1,080 580	(21) Hillshire Dr Lewis River Rd (SR 503) 50 5 75 5 1,090 600
(22) Fir Ave Lewis River Rd (SR 503) 10 25 720 480	(22) Fir Ave Lewis River Rd (SR 503) 10 25 725 490
(23) Lewis River Rd (SR 503) Evergreen Lane 475 5 5 5 5 720	(23) Lewis River Rd (SR 503) Evergreen Lane 485 5 5 5 5 725
(24) N Goerig St (NORTH INT) Lewis River Rd (SR 503) 475 10 10 380 330 855	(24) N Goerig St (NORTH INT) Lewis River Rd (SR 503) 510 10 10 405 340 875

Attachment 4B

2025 PM Peak Hour Traffic Volumes

Woodland Transportation Strategic Infrastructure Plan

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Appendix C: Signal Warrant Calculation Worksheets

Warrants Summary

Information			
Analyst	DTCL	Intersection	
Agency/Co	The Transpo Group	Jurisdiction	Woodland, WA
Date Performed	5/19/2008	Units	U.S. Customary
Project ID	Future (2025) PM Peak Hour	Time Period Analyzed	
East/West Street	E Scott Ave	North/South Street	Lewis River Rd
File Name	2 E Scott and Lewis River	Major Street	East-West

Project Description *Future (2025) PM Peak Hour*

General				Roadway Network	
Major Street Speed (mph)	35	☐	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	0	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	1	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	0	0	0	0	0	0	0	1	0	0	1	0
Lane usage		LR						LT			TR	
Vehicle Volume Averages (vph)	258	0	3	0	0	0	3	679	0	0	397	138
Peds (ped/h) / Gaps (gaps/h)	--	/	--	--	/	--	--	/	--	--	/	--
Delay (s/veh) / (veh-hr)	--	/	--	--	/	--	--	/	--	--	/	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Pedestrian Volumes (Four hours --or-- one hour) --and--	☐
4 B. Gaps Same Period (Four hours --or-- one hour)	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐

7 C. 80% Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐

Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐

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Warrants Summary

Information			
Analyst	DTCL	Intersection	
Agency/Co	The Transpo Group	Jurisdiction	Woodland, WA
Date Performed	5/19/2008	Units	U.S. Customary
Project ID	Future (2025) PM Peak Hour	Time Period Analyzed	
East/West Street	N Goerig St	North/South Street	Lewis River Rd
File Name	1 N Goerig and Lewis River	Major Street	East-West

Project Description *Future (2025) PM Peak Hour*

General				Roadway Network	
Major Street Speed (mph)	35	☐	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	0	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	1	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	0	0	0	0	0	0	0	1	0	0	1	0
Lane usage		LR						LT			TR	
Vehicle Volume Averages (vph)	7	0	312	0	0	0	262	675	0	0	393	7
Peds (ped/h) / Gaps (gaps/h)	--	/	--	--	/	--	--	/	--	--	/	--
Delay (s/veh) / (veh-hr)	--	/	--	--	/	--	--	/	--	--	/	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Pedestrian Volumes (Four hours --or-- one hour) --and--	☐
4 B. Gaps Same Period (Four hours --or-- one hour)	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐

7 C. 80% Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐

Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐

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