APPENDIX C

Future Conditions Technical Memorandum

Woodland
Transportation Infrastructure
Strategic Plan

Future Conditions Technical Memorandum

Prepared for

Cowlitz-Wahkiakum Council of Governments
Administration Annex
207 N. 4th Avenue
Kelso, WA 98626

Prepared by

Parametrix
700 NE Multnomah, Suite 1000
Portland, OR 97232-4110
503-233-2400
www.parametrix.com

In Association with

The Transpo Group
11730 118th Avenue NE, Suite 600
Kirkland, WA 98034

November, 2007 | 274-2398-006

CITATION

Parametrix. 2007. Future Conditions Technical Memorandum.
Prepared by Parametrix, Portland, Oregon. November, 2007.

TABLE OF CONTENTS

1. INTRODUCTION 1-1
1.1 PURPOSE AND CONTEXT 1-1
1.2 REPORT CONTENT AND ORGANIZATION 1-1
1.3 SUMMARY OF KEY FINDINGS 1-1

2. DEVELOPMENT OF FUTURE BASELINE TRAFFIC VOLUMES 2-1
2.1 TRAVEL DEMAND MODEL DEVELOPMENT 2-1
2.1.1 2004 Comprehensive Plan Land Use/Socio-Economic Data 2-2
2.1.2 Updated Land Use Assumptions 2-5
2.1.3 Transportation Network 2-5
2.1.4 Transportation Modeling Software 2-6

3. BASELINE TRAFFIC VOLUMES AND CONDITIONS 3-1
3.1 INTRODUCTION 3-1
3.2 2025 PEAK HOUR TRAFFIC VOLUMES 3-1
3.3 2025 PEAK HOUR TRAFFIC OPERATIONS ANALYSIS 3-1
3.3.1 Intersection Level of Service (LOS) Criteria 3-1
3.3.2 Intersection Level of Service Standards 3-2
3.4 2025 TRAFFIC OPERATIONS ANALYSIS RESULTS 3-5
3.4.1 Summary of 2025 Baseline Intersection Operations 3-5
3.4.2 Summary of 2025 Traffic Queuing Analysis 3-8
3.5 SUMMARY OF IMPROVEMENT NEEDS AND DEFICIENCIES 3-9
3.5.1 Signal Warrant Analysis 3-9
3.5.2 Left Turn Lane Warrant Analysis 3-9
3.6 POTENTIAL IMPROVEMENT OPTIONS 3-10

APPENDICES

APPENDIX A Forecasting Methodology and Data

APPENDIX B 2025 Intersection Operations Analysis Worksheets for Comp Plan Scenario

APPENDIX C 2025 Intersection Operations Analysis Worksheets for Comp Plan Plus Scenario

APPENDIX D Warrant Analysis Worksheets

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

Table 2-1. 2004 and 2025 Forecasts for Housing Land Use Data 2-2
Table 2-2. 2004 and 2025 Forecasts for Employment Land Use Data 2-5
Table 2-3. Population Projections by Year 2-5
Table 3-1. Level of Service Criteria for Signalized Intersections..... 3-2
Table 3-2. Level of Service Criteria for Unsignalized Intersections 3-2
Table 3-3. 2007 and 2025 PM Peak Hour Intersection Traffic Operation Summary 3-6
Table 3-4. 2025 PM Peak Hour Traffic Queues at Key Intersections 3-8
Table 3-5. 2025 Left Turn Lane Warrant Analysis..... 3-10

LIST OF FIGURES

Figure 1-1. Woodland Study Area 1-3
Figure 2-1. Woodland Study Area, Growth Assumptions by District 2-3
Figure 3-1. Woodland Study Area Intersections..... 3-3
Figure 3-2. 2025 PM Peak Hour Intersection Turning Movements..... 3-4

ACRONYMS

CWCOG	Cowlitz-Wahkiakum Council of Governments
DU	Dwelling Unit (e.g., house or apartment)
FHWA	Federal Highway Administration
GMA	Growth Management Act
HCM	Highway Capacity Manual
HSS	Highways of Statewide Significance
LOS	Level of Service
MUTCD	Manual of Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program (of the Transportation Research Board)
SR	State Route
TAZ	Transportation Analysis Zone
TDM	Transportation Demand Management
TSP	Transportation System Plan
TISP	(Woodland) Transportation Infrastructure Strategic Plan
UGA	Urban Growth Area
V/C	Volume/Capacity (ratio)
VISUM	Travel demand modeling software used for the Woodland TISP
WSDOT	Washington State Department of Transportation

1. INTRODUCTION

1.1 PURPOSE AND CONTEXT

The primary purpose of the Woodland Transportation Infrastructure Strategic Plan is to build upon the foundation provided by the Woodland Transportation Plan by identifying improvement recommendations for the I-5 interchanges, and refining other appropriate improvement recommendations, particularly to serve the Woodland Industrial/Port area. This study will be developed using a collaborative process and will culminate in a strategic infrastructure plan that addresses growing freeway and community traffic demand, increases arterial system connectivity, and provides enhanced and safer access to growing industrial and residential portions of the city, particularly along SR 503.

This report is one of several leading to the development of a strategic transportation plan. The report was prepared to assess likely impacts of growth on the existing transportation system within the citywide study area. The analysis of future conditions builds on the baseline existing transportation system analysis as documented in the "Existing Conditions Technical Memorandum", August 2007. It includes a discussion of travel forecasts for the planning horizon year of 2025, and an analysis of future transportation system deficiencies and improvement opportunities. The future conditions analysis and the public vision for the community as defined through an on-going public involvement process will form the basis for the development of long term transportation strategies.

1.2 REPORT CONTENT AND ORGANIZATION

This report is divided into three chapters, the first of which is this Introduction.

Chapter 2 documents the community growth assumptions that form the foundation for traffic volume forecasts. The chapter includes a brief discussion of the traffic forecasting process including development of a community travel demand model and its inherent assumptions about the transportation system. This model was used to develop 2025 PM peak hour traffic volumes for two scenarios. One scenario is based on the existing adopted Woodland Comprehensive Land Use Plan that assumes a 3.5 percent annual population growth rate in the study area (referred to as the Comp Plan scenario). The other scenario is based on a slightly higher population growth rate (4.5 percent per year) to reflect more recent trends in community growth (referred to as the Comp Plan Plus scenario). Nothing in the analysis of a higher annualized population growth rate should be assumed to supersede or anticipate a pending update to the City's Comprehensive Land Use Plan that will be undertaken over the next few years.

Chapter 3 presents future (2025) PM peak hour traffic volumes for key study area intersections, identifies traffic operational analysis results that define future roadway system needs and deficiencies, and suggests a potential range of improvement options. Improvement options will be further developed and discussed in the Alternatives Technical Memorandum and will also include ideas suggested through project advisory committee discussions, and meetings with the general public.

1.3 SUMMARY OF KEY FINDINGS

This section provides a short summary of the key findings and conclusions with respect to the future study area transportation system. The study area street system is shown in Figure 1-1.

1.3.1 Findings from the Technical Analysis

Significant growth in traffic congestion is anticipated in the Woodland study area by the planning horizon year of 2025. As noted above, two land use growth scenarios were evaluated. One represents development expectations based on the existing 2005 Comprehensive (Comp) Land Use Plan which would add approximately 4,100 more residents by 2025 in comparison with 2007 estimates. The second scenario (Comp Plan Plus) would add nearly 6,000 more residents over today's levels with a concentration of this additional residential development assumed to occur in the southwestern portion of the City.

With either the Comp Plan or Comp Plan Plus land development scenarios, it is anticipated that traffic volumes will grow substantially and that many intersection in the study area will operate with unacceptably long delays. Failing intersections would include:

- I-5 southbound ramps/Pacific Avenue at SR 503
- I-5 northbound ramps/Atlantic Avenue at SR 503
- SR 503 at CC Street
- SR 503 at Goerig Street (both westerly and easterly intersections)
- SR 503 at E. Scott Avenue
- I-5 southbound ramps at Dike Road
- I-5 northbound ramps at Dike Road
- Old Pacific Highway at Green Mountain Road
- Old Pacific Highway at E. Scott Avenue
- Davidson Avenue at 5th Street
- Buckeye Street at Goerig Street

Within the vicinity of the I-5 interchange at SR 503 signalized traffic operations are affected by vehicles spilling back from one intersection to another. Traffic queues are expected to be lengthy and impact the entire interchange area from approximately Buckeye Street on the west to beyond CC Street on the east.

For unsignalized intersections, traffic operational failures affect primarily the stop-controlled side streets where long delays and lengthy queues would be experienced. Traffic queues on the I-5 off-ramps to Dike Road are expected to exceed 700 feet on the southbound ramp and to be nearly 500 feet in length on the northbound ramp.

Traffic signal and left turn lane warrants were evaluated at each of the adversely affected intersections with the following results:

- Signal warrants would be met at the intersections of:
  - SR 503 and E. Scott Avenue
  - I-5 northbound and southbound ramps at Dike Road
  - Old Pacific Highway at Green Mountain Road and at E. Scott Avenue
  - Buckeye Street at Goerig Street
  - Davidson Street at 5th Street (for the Comp Plan Plus scenario only)
- Left turn lane warrants were also evaluated using WSDOT methodology. Warrants would be met at the following intersections along SR 503:
  - Hillshire Drive
  - Insel Road
  - Gun Club Road
  - Fir Avenue

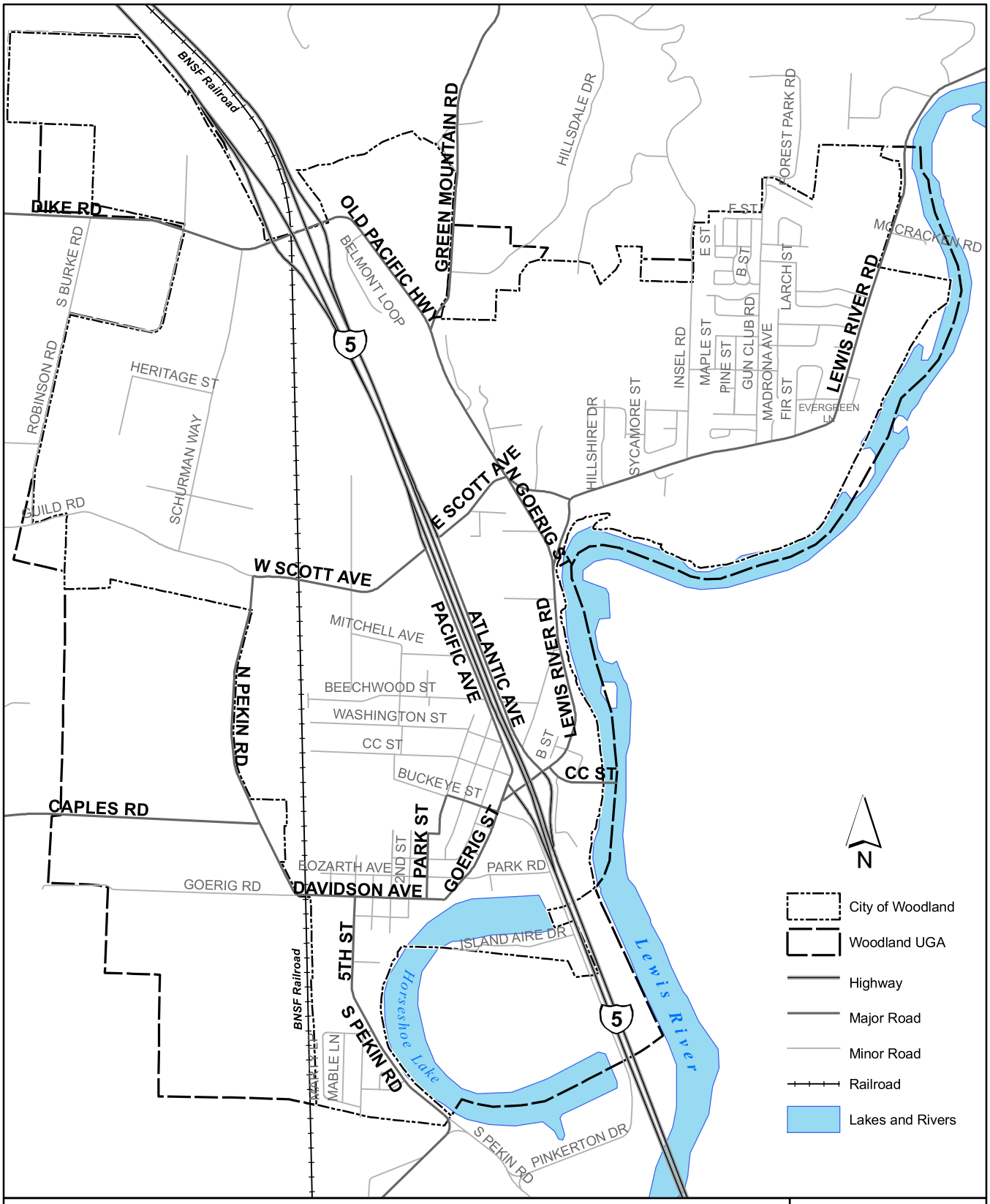


Figure 1-1: Woodland Study Area

Parametrix

The Transpo Group

Woodland Transportation Strategic Infrastructure Plan

Analysis by C. Hainey; Analysis Date: July 2007; Plot Date: October 2007; File Name: 1-1_StudyArea.mxd

This page intentionally left blank.

- Evergreen Lane

A wide range of potential improvement options will be identified and considered to address existing and future safety and intersection operational problems. The development and evaluation of improvement options will be the subject of the next technical memorandum.

1.3.2 Summary of Public Input about Needs and Deficiencies

The public comments received focused primarily on recommended transportation improvements and concerns over the existing transportation system. Some of the most often cited comments included:

1.3.2.1 General Comments

1. Take care of SR 503, either widening or adding turn pockets and improve multi-modal transportation facilities in the corridor.
2. Alleviate congestion near I-5 Exits 21 and 22 by providing an alternate east/west crossing.
3. Address delays caused by railroad crossings. Options included constructing under or overpasses at crossings.

The following is a summary of public comments received that relate to specific transportation facilities or issues.

Lewis River Road/SR 503

- Widen SR 503 to include pocket turn lanes
- Install stop lights at Insel Road, Gun Club Road, and Scott Avenue
- Widen SR 503 to have bus pull out/turn out lanes for the school buses, especially needed between 7:00am – 9:00am and 2:30pm – 5:00pm
- Widen SR 503 to three lanes (two lanes and a turn lane) within the entire Woodland city limits so that you don't create a bottleneck going from 3 lanes to 2 and then back to 3 lanes.
- Construct sidewalks along the high accident segment of SR 503
- Widen SR 503 to five lanes or construct an SR 503 bypass
- Improve signage on SR 503 at Scott Avenue directing motorists to I-5 from Old Pacific Highway rather than always going to the main interchange at Exit 21
- Make Goerig/Pacific at SR 503 a T-intersection
- Turning out of the Woodland Commerce Center is currently very difficult because of its location close to the bridge over Lewis River
- There are big access issues along Treatment Plant Road
- Pumping station on Lewis River Road may be in the way of any future widening
- Build flyover from Millard Street to I-5 southbound
- Build a new road from Cherry Blossom to Old Pacific Highway so vehicles can bypass the SR 503 / Old Pacific Highway intersection

Scott Avenue

- Davis Sales located near Scott Avenue and Pacific Avenue is concerned that the flyway of a Scott Road overpass will cut off both of their access points to Pacific Avenue unless they are granted access to Pacific Avenue via the old Wimpy's restaurant site property
- An underpass should be considered at Scott but would likely not work because of the water table and flooding issues

- Putting an overpass at Scott Avenue will help east-west connectivity if a railroad overpass at Scott is also installed, otherwise cars will back up on the overpass. However, this could be addressed if an alternative route from Scott via Downriver Drive, Mitchell Avenue, Columbia Street to Pacific Avenue is established and improvements to that route are made
    - This overpass would improve emergency safety, provide improved access to the grocery store and attract more shoppers to downtown businesses
- Build an I-5 overpass north of Scott Avenue, that would connect Old Pacific Highway on the east side to Down River Drive on the west side. This option avoids blocking business access, particularly Davis Sales, to Pacific Avenue on the west side
- Construct a four-way stop at Pacific and Scott and straighten the intersection to form right angles
- If you widen Exits 21 and 22 similar to the intersections at I-5 and 99th or 78th Streets, then you may not need to add a Scott Road overpass
- Install signage to direct motorists to I-5 from Scott to avoid routing them south through a heavily congested area
- Clogging occurs every winter in the State's storm easements under the apartments near Scott and SR 503
- Improve dangerous turns from Scott Avenue to SR 503 eastbound
- Install signal at Scott and SR 503

Dike Access Road

- Widen the exit and add more lanes, because currently it is too narrow. If additional industrial development and the building a new high school occurs, the existing road and interchange will not be able to handle the congestion caused by an increase in truck traffic or school buses
- Make it wider and similar in design to the I-5 Exit at 99th Street or 78th Street
- Address the huge railroad bottleneck issue here, especially if the 3rd Rail comes through
- Need to address flooding issue, perhaps raise the freeway between Exit 21 and 22
- Regardless of changes, there needs to be better signage for people to know where they are going when they get on or off Exit 22
- The Port is concerned that mixed use developments along Dike Road, north of Guild Road, will slow Port traffic
- There is a potential for altered Port activities and increased Port facilities to increase industrial traffic on Dike Road to I-5
- Flooding at the Dike Road interchange is a problem
- Construct a bypass connecting Dike Road or Old Pacific Highway with SR 503 in the northeast corner of Woodland. Also connect this new bypass to a new overpass near Scott Avenue

Railroad Crossings

- Build an overpass over the railroad at Scott Avenue
- Build an overpass over the railroad at Davidson Avenue
- Realign Davidson Avenue to reduce the sharp turn just west of the tracks
- Rather than having the 3rd Rail come down the existing BNSF alignment, have the 3rd rail spur off towards the port and port property
- Cowlitz County should consider railroad improvements just as Clark County has
- Build an overpass over the railroad at Whalen Road
- An underground aquifer runs east/west near Scott Avenue and would be a problem when considering tunneling under railroad tracks

Other Traffic and Community Improvements

- Raise I-5 between Exit 21 and Exit 22. Raising the freeway will allow east-west connectivity to be re-established under it and would also allow the Fleetwood trucks to access the freeway in Woodland rather than having to drive down to La Center or Ridgefield for access because of the current height restrictions
- Extend Downriver Drive to include an overpass over the railroad tracks. Connect Downriver Drive directly to Dike Access Road, or connect Downriver Drive to Dike Access Road via Schurman Way
- It is not currently identified as a high industrial truck traffic area, but Pekin Road is heavily traveled by industrial truck traffic
- Extend Schurman Way to Goerig Road to help establish more north-south connectivity
- At the intersection of Davidson Avenue, N Pekin Road, Goerig Road, and the BNSF Railroad, it is very dangerous because semi-trucks are interacting with speeding cars, and many people overshoot the turn. Recommend you install a stop sign or light at Pekin where it meets Davidson/Goerig
- Implement some safety measures at the corner of Caples Road and Pekin Road because it is very dangerous for semi-trucks to turn since the speed limit is 35mph and most people drive 50mph on that stretch of road
- Build new road connecting Insel and Old Pacific Highway
- Extend Pacific and Atlantic north connecting near Dike Road
- Extend Robinson Road east to Shurman Way
- Consider extending Howard Way rather than Shurman Way to the south
- Construct new road on right-of-way currently owned by the City east of the Railroad between Davidson and Beechwod to alleviate school traffic
- Make Pekin Road and Goerig/Davidson a T-intersection
- Make turn at Buckeye Goerig/Davidson a T-intersection
- Southwest section bordered by Caples and Pekin, just outside the City limits, is the most likely location of future growth
- Consider purchasing right-of-way west of Woodland to be used for future roadways
- Extend Pinkerton Road west to serve future developments southwest of the city, and funnel the traffic from these new developments around Downtown Woodland via Lakeshore Drive or a new I-5 Interchange south of SR 503
- The failing level of service at Buckeye and Goerig may be caused by commercial truck turning movements
- Consider realigning Shurman Way southern extension to match property boundary lines as much as possible
- Project staff should coordinate this project with utility companies (gas, PUD, phone, BNSF, cable and city facilities) which may be upgrading their facilities
- Consider a ferry to St. Helens
- Involve the local diking district to evaluate runoff and flooding impacts
- Construct more parks in town and consider locating a park south of SR 503 near Insel
- Transportation system needs to prepare for more growth east of the Woodland City Limits.
- Consider creating new interchanges in Woodland area from north of Dike Road to south of SR 503. At minimum new on/off ramps should be looked at
- Work with Railroad to raise rail line and also raise Dike Road to reduce flooding
- Consider a new SR 503 bypass from a new interchange south of the city limits, east along Lewis River, connecting with SR 503 east of the city limits.
- Construct a walking path along Horseshoe Lake

2. DEVELOPMENT OF FUTURE BASELINE TRAFFIC VOLUMES

This chapter documents the development of future baseline (2025) PM peak hour traffic volumes that provide the basis for an assessment of longer term transportation system needs and deficiencies in the Woodland study area. Included in the chapter is a discussion of the traffic forecasting process, a summary of future population and employment growth expectations, and a discussion of the street network assumptions inherent in the future baseline scenario.

As noted in Chapter 1, traffic forecasts for the study area were developed to compare and assess the anticipated roadway system improvement needs associated with two land development scenarios. The first (referred to as the Comp Plan scenario) is based on the existing adopted Woodland Comprehensive Land Use Plan which assumes an annualized population growth rate of 3.5 percent per year. The second land development scenario reflects more recent experience in community growth and assumes that population will grow by 4.5 per year from 2007 through the planning horizon year of 2025. The purpose of this second scenario is to test a "what if" condition which asks the question – "What would be the transportation impacts and infrastructure requirements if the current trends in land development and population growth were to continue through the entire planning period?"

As noted previously, the second scenario (referred to as Comp Plan Plus) is not intended to supersede or second guess the demographic analysis and land use recommendations that will result from the pending update to the City's Comprehensive Plan. Rather, the analysis of this scenario is intended to inform and provide some direction to understanding the infrastructure implications of potential land use decisions. Additionally, analysis of the second scenario, offers insight into the ability of improvement recommendations to meet a range of potential community growth expectations.

2.1 TRAVEL DEMAND MODEL DEVELOPMENT

A multi-step process was undertaken to prepare future year traffic volume forecasts. This process relied on the travel demand model developed and maintained for the Woodland urban growth area by the Cowlitz-Wahkiakum Council of Governments (CWCOG). The future planning horizon year was assumed to be 2025, consistent with regional transportation planning activities currently underway within the region.

The City's travel demand model was initially constructed in 1995 to support the development of the original GMA-based City of Woodland Comprehensive Plan. It was used to evaluate the needed transportation system to support the anticipated land use targets documented in that Plan. Since 1995, several elements of the model have been updated to support both the 2004 Transportation Plan update and the Woodland Transportation Infrastructure Strategic Plan (TISP). The updated elements to support the Transportation Plan are more fully documented in a report entitled *"Travel Demand Model Documentation, City of Woodland, 2004 Transportation Plan"*, the Transpo Group, dated July 2005. Model updates to support the TISP are described in the memorandum entitled "2007 Model Documentation – Methods of Forecasting Traffic Volumes for the Woodland Transportation Strategic Infrastructure Plan", the Transpo Group, dated September 24, 2007. This memorandum is included in Appendix A in its entirety. Excerpts from these documents are presented below.

2.1.1 2004 Comprehensive Plan Land Use/Socio-Economic Data

Land use and socio-economic data provide the foundation for estimating the likely traffic volume growth associated with community development activities over time. This data was input into the travel demand model for each Transportation Analysis Zone (TAZ) within the study area. A TAZ represents a specific geographic area that contains relatively homogeneous land uses. A map of TAZs is included in Appendix A. Based on the nature and type of growth assumptions in each TAZ, future travel demand forecasts can be produced. Most of this forecasted traffic will travel to other TAZs within the study area using the roadway system and replicating patterns of traffic that can be observed in the field (e.g., travel from a residential area to an employment area). Some trips are also assumed to leave the study area to other destination (such as the Longview/Kelso area and/or Clark County).

Existing and forecasted future land use data for the Woodland study area were originally prepared by City staff according to a series of land use categories (e.g., single and multi-family housing types and various categories of employment). Tables 2-1 and 2-2 summarize the existing and future forecasted land use data by study area district (see Figure 2-1). These districts provide a concise summary of existing and potential future land use patterns within the study area.

Land use data for 2004 reflects existing conditions at the time the model was developed. The East City district is comprised of largely residential uses east of I-5. The Central City district includes mostly retail areas along I-5. The Northwest City district is dominated by industrial areas west of I-5. The southwest City district encompasses the traditional urban core of Woodland representing a mix and land uses.

As shown in Table 2-1, the number of residential dwelling units (e.g., houses or apartments) in 2025 is forecasted to be 82 percent higher than conditions in 2004. The largest increase is anticipated in the East City district where dwelling units (DUs) are expected to more than double. The southwest City District will also see a significant (72 percent) increase in dwelling units. Based on these forecasts, a majority (53 percent) of Woodland residents will live in the East City district by 2025.

Table 2-1. 2004 and 2025 Forecasts for Housing Land Use Data

	Number of Dwelling Units			Weighting by District		
Study Area District	**2004**	**2025**	**Percent Increase**	**2004**	**2025**	**Change in Weighting**
1. East City	844	1,739	106%	47%	53%	+ 6%
2. Southwest City	725	1,250	72%	41%	38%	- 3%
3. Central City	182	232	27%	10%	7%	- 3%
4. Northwest City	39	39	0%	2%	2%	0%
Total	**1,790**	**3,260**	**82%**	**100%**	**100%**	

Note: Data provided by City of Woodland. Refer to Figure 2-1 for district location.

As shown in Table 2-2, Woodland employment is forecasted to more than double by 2025. While the largest percent increase in employment is in the East City district, employment in that district remains less than 10 percent of the City's total employment. The bulk of the employment growth will be in the Northwest City district with a 148 percent increase. The Southwest City district would also see an increase in employment, but overall employment activity is expected to shift to other areas of the city.

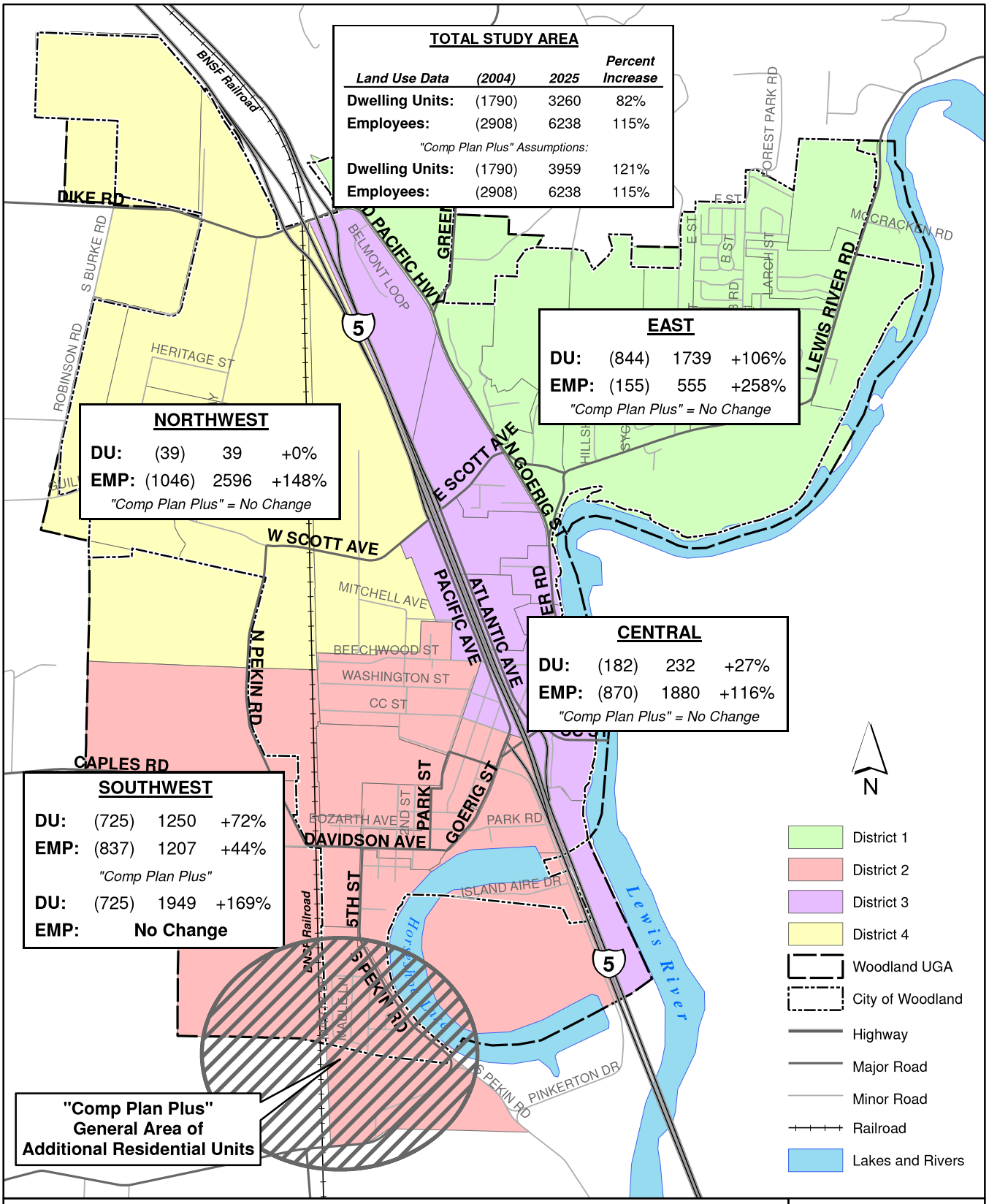


Figure 2-1: Woodland Study Area, Growth Assumptions by District

Parametrix

The Transpo Group

Woodland Transportation Strategic Infrastructure Plan

Analysis by C. Hainey; Analysis Date: Oct. 2007; Plot Date: July 2007; File Name: 2-1_GrowthAssumptions.mxd

This page intentionally left blank.

Table 2-2. 2004 and 2025 Forecasts for Employment Land Use Data

	Number of Employees			Weighting by District		
Study Area District	**2004**	**2025**	**Percent Increase**	**2004**	**2025**	**Change in Weighting**
1. East City	155	555	258%	5%	9%	+ 4%
2. Southwest City	837	1,207	44%	29%	19%	- 10%
3. Central City	870	1,880	116%	30%	30%	0%
4. Northwest City	1,046	2,596	148%	36%	42%	+ 6%
Total	**2,908**	**6,238**	**115%**	**100%**	**100%**	

Note: Data provided by City of Woodland. Refer to Figure 2-1 for district location.

2.1.2 Updated Land Use Assumptions

As part of the Woodland transportation infrastructure strategic planning process, 2005 land use growth assumptions were reviewed and updated to be consistent with current 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 2-3 summarizes the population growth through 2025 based on the two growth rates.

Table 2-3. 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: City of Woodland Population Estimates & UGA Growth Memorandum, CWCOG, July 25, 2007

The CWCOG 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 in the Woodland study area as compared to the assumptions used in the 2005 Comprehensive Plan.

Based on the two growth rates, two land use scenarios were used in forecasting 2025 traffic volumes for use in the Transportation Infrastructure Strategic Plan. The first scenario, entitled "Comp Plan," is based on the 2005 Comprehensive Plan land use as summarized below. 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. Growth in dwelling units and employment within the Woodland study area for both scenarios is illustrated in Figure 2-1.

2.1.3 Transportation Network

The Woodland travel demand model used for the 2005 Transportation Plan also includes assumptions about the existing transportation system including such factors as the location and connections available with the existing street and highway system, lane capacity, speeds and a variety of other factors. For the baseline 2025 mode, existing roadway and intersection capacity parameters were adjusted to reflect likely improvements that would occur before the

2025 planning horizon year. For example, capacity for SR 503 was increased to reflect the planned widening from I-5 to the east city limits. Capacity for the Old Pacific Highway from Dike Access Road to E. Scott Avenue was also increased to reflect roadway improvements such as turn lanes to provide access to adjacent properties expected to develop during the planning period. In addition, intersection capacity parameters were adjusted at the intersections of I-5 ramps with Dike Road and SR 503, Buckeye Street at Goerig Street, SR 503 at CC Street, SR 503 at Goerig Street, Old Pacific Highway at E. Scott Avenue, and Old Pacific Highway at Green Mountain Road. All other capacity parameters remained constant with those that exist today.

No changes were made to this baseline network for the Woodland Transportation Infrastructure Strategic Plan. The development and evaluation of improvement alternatives will rely on this baseline transportation network as a starting point. For each alternative, appropriate changes will be made in the model network to reflect the unique characteristics of the alternative. These changes could include new connections, changes to existing roadway capacity and/or speed parameters, or other modifications.

2.1.4 Transportation Modeling Software

In addition to the land use assumption updates, the travel demand model used in the Woodland TISP was updated to incorporate the latest version of the VISUM software. To ensure that the software changes did not adversely affect the model set-up, 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.

The City of Woodland travel demand model was developed in the VISUM software for the 2005 Comprehensive Plan. At that time trip distribution was calculated in an Excel-based program utility. The latest version of VISUM (Version 9.52-11) incorporates the trip distribution process directly in the model software. This updated software provides results in subtle changes to the distribution methodology. A comparison of the parameters is documented in Appendix A. The previously established parameters for freeway-related trips did not replicate the desired existing travel patterns with the revised software. Therefore, the parameters for freeway-related trips were adjusted to more closely replicate the previous model results. The travel demand model assumes only vehicles trips are made and there are no reductions made for TDM activities or alternative mode choices.

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 Appendix A. Therefore, the changes to the software and parameters did not affect the model set-up and the calibration results indicate that the model is well established for preparing forecasts for the Transportation Infrastructure Strategic Plan.

3. BASELINE TRAFFIC VOLUMES AND CONDITIONS

3.1 INTRODUCTION

This chapter includes a discussion of future 2025 traffic volumes developed using the land development assumptions and forecasting process described in Chapter 2. This chapter also includes an evaluation of the anticipated impact of community growth on the existing transportation system within the citywide study area. The analysis of future conditions will build on the existing transportation system results presented in the *"Woodland TISP Existing Conditions Technical Memorandum"*, dated August 2007. The analysis will identify deficiencies expected to occur in the baseline transportation network as a result of the forecasted 2025 land use, population and employment growth. These transportation system needs and deficiencies, combined with the public vision will form the basis for the development of alternative strategies to improve the transportation system. A more detailed discussion of these strategies and their analysis results will be the subject of a future Technical Memorandum.

3.2 2025 PEAK HOUR TRAFFIC VOLUMES

As noted in Chapter 2, the updated 2025 Woodland travel demand model was used to forecast intersection turning movement traffic volumes for the weekday PM peak hour in the planning horizon year. 2025 projected PM peak hour turning movement traffic volumes based on the Comp Plan scenario are presented in Figure 3-1. Turning movement volumes based on the Comp Plan Plus scenario are shown in Figure 3-2. Traffic volumes were rounded to the nearest five vehicles because weekday volumes fluctuate day-to-day. Typically, turning movement projections of less than seven are rounded to five. The turning movement volumes are not "raw" 2025 model volumes, but represent the 2025 model traffic volumes adjusted to reflect intersection level data calibration that was conducted using the procedures articulated in NCHRP Report 255[1].

3.3 2025 PEAK HOUR TRAFFIC OPERATIONS ANALYSIS

The traffic operations analysis provides a quantitative method for evaluating and comparing existing and future transportation alternatives. Traffic operations were evaluated based upon the LOS (level of service) methodologies of the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2000). The HCM is a nationally recognized and locally accepted method of measuring traffic flow and congestion. Criteria range from LOS A, indicating free-flow conditions with minimal vehicle delays, to LOS F, indicating extreme congestion with significant vehicle delays.

3.3.1 Intersection Level of Service (LOS) Criteria

Signalized intersection LOS is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically,

---

[1] NCHRP Report 255 entitled "Highway Traffic Data for Urbanized Area Project Planning and Design" was published in 1982 by the Transportation Research Board's National Cooperative Highway Research Program. It is an authoritative reference on the post-processing of travel demand model data output to develop future intersection level turning movement forecasts.

LOS criteria are stated in terms of average delay per vehicle during a specified time period (for example, the PM peak hour). Vehicle delay is a complex measure based on many variables, including signal phasing (i.e., progression of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. Table 3-1 shows LOS criteria for signalized intersections, as described in HCM.

Table 3-1. Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (sec/veh)	General Description (Signalized Intersections)
A	≤10	Free Flow
B	>10 - 20	Stable Flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	>80	Forced flow (jammed)

Source: Transportation Research Board, *2000 Highway Capacity Manual: Special Report 209*.

Unsignalized intersection LOS criteria can be further reduced into two intersection types: all-way stop-controlled and two-way stop-controlled. All-way, stop-controlled intersection LOS is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection. Two-way, stop-controlled intersection LOS is defined in terms of the average vehicle delay of an individual movement(s). This is because the performance of a two-way, stop-controlled intersection is more closely reflected in terms of its individual movements, rather than its performance overall. For this reason, LOS for a two-way, stop-controlled intersection is defined in terms of its individual movements. With this in mind, total average vehicle delay (i.e., average delay of all movements) for a two-way, stop-controlled intersection should be viewed with discretion. Table 3-2 shows LOS criteria for unsignalized intersections (both all-way and two-way, stop-controlled).

Table 3-2. Level of Service Criteria for Unsignalized Intersections

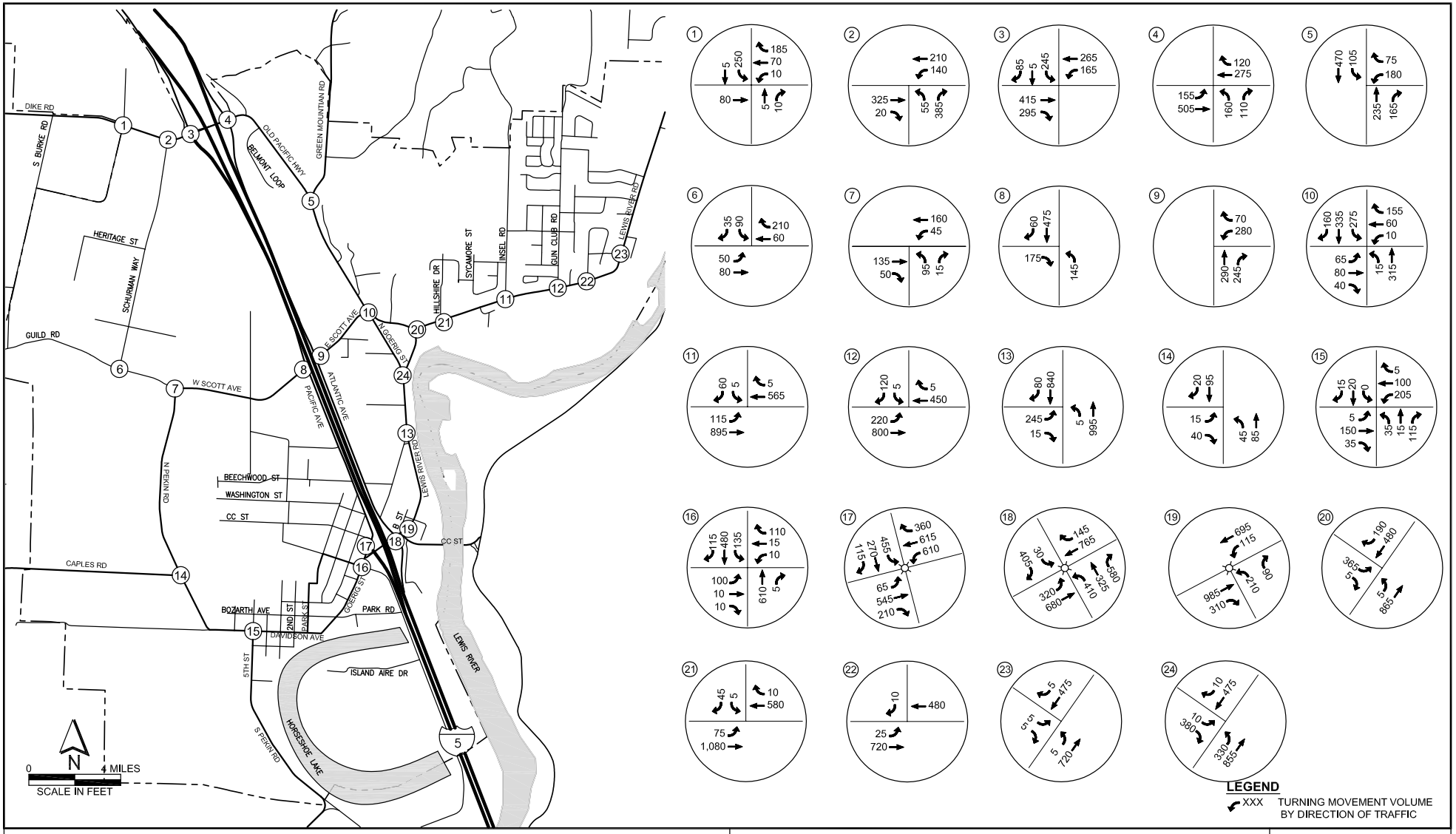
Level of Service	Average Control Delay (sec/vehicle)
A	0 – 10
B	>10 – 15
C	>15 – 25
D	>25 – 35
E	>35 – 50
F	>50

Source: Transportation Research Board, *2000 Highway Capacity Manual: Special Report 209*.

3.3.2 Intersection Level of Service Standards

The Level of Service (LOS) standard is measured using methodologies identified in HCM. The level of service standard is LOS D or better on state highways, major arterials, and minor arterials. Acceptable levels of traffic on collectors and local streets are established through street design standards.

Pursuant to the requirements of Washington's Growth Management Act (GMA) requirements, CWCOG established levels of service standards for state highways within Cowlitz County. LOS C was established as the standard for Highways of Statewide



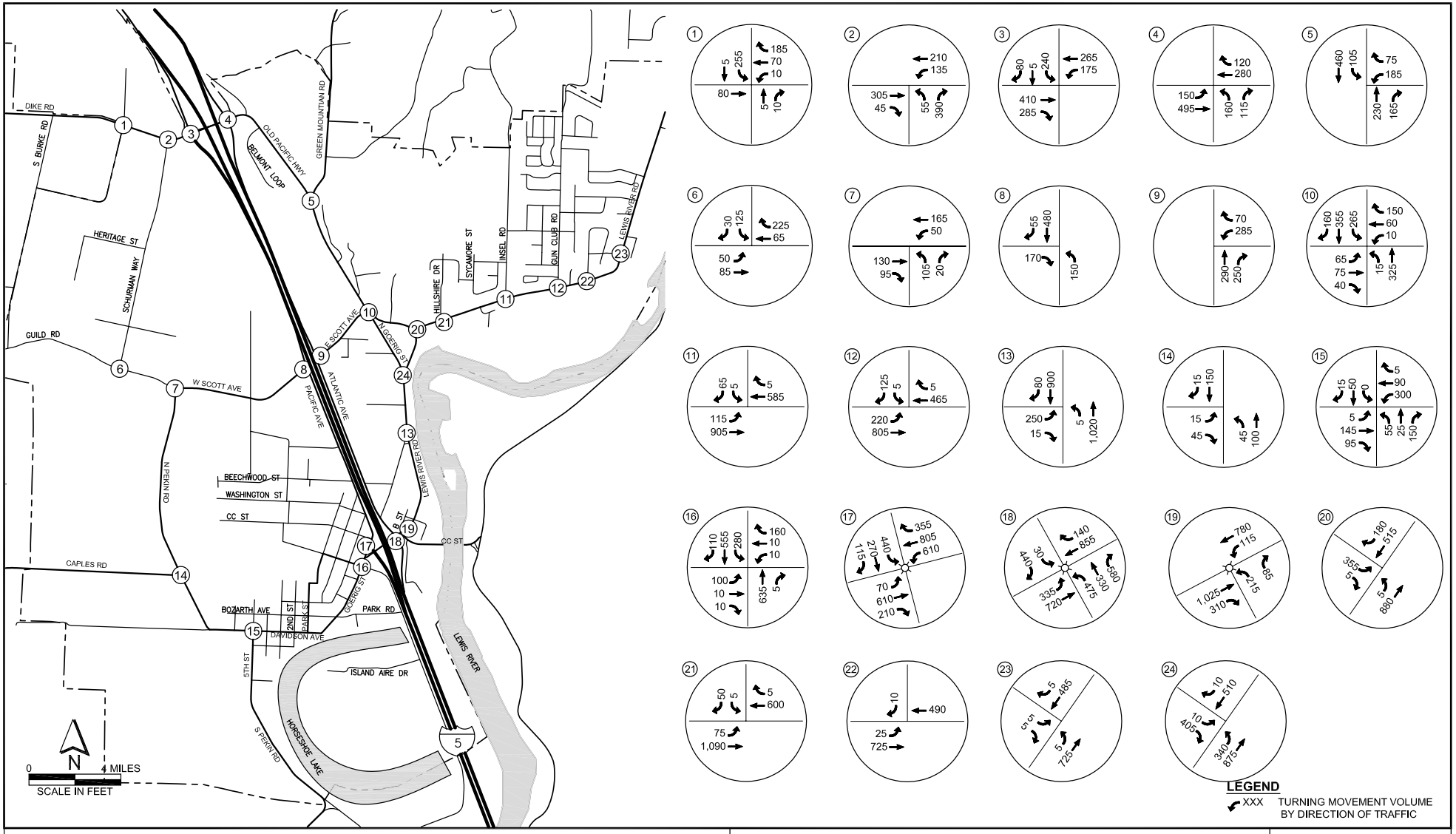
DATE: Oct 09, 2007 FILE: PO2398006F-16

Figure 3-1
Comprehensive Plan 2025 Intersection Turning Movement Volumes

Woodland Transportation Strategic Infrastructure Plan

Parametrix

The Transpo Group



DATE: Mar 24, 2008 FILE: PO2398006F-17

Figure 3-2
Comprehensive Plan Plus 2025 Intersection Turning Movement Volumes

Woodland Transportation Strategic Infrastructure Plan

Parametrix

The Transpo Group

Significance (HSS) in rural areas. For non-HSS facilities, CWCOG established LOS D for urban areas and LOS C for rural areas. Therefore, the city's LOS D standard would be consistent for SR 503 within the Urban Growth Area (UGA), with a LOS C standard outside the UGA. As the study area for the Woodland Transportation Infrastructure Strategic Plan is located within the City and the UGA; the LOS D standard applies.

3.4 2025 TRAFFIC OPERATIONS ANALYSIS RESULTS

Traffic operations analysis for the Woodland Transportation Infrastructure Strategic Plan focuses on key intersections located throughout the city. These intersections were also evaluated for the Woodland Transportation System Plan adopted in 2005 and in the *"Woodland TISP Existing Conditions Technical Memorandum"* using traffic volumes that has been updated to 2007. The analysis of future weekday PM peak hour traffic operations was conducted using a Synchro traffic simulation model developed specifically for the study area intersections. The model utilizes existing roadway channelization and intersection configurations to represent the future baseline scenarios without improvements.

3.4.1 Summary of 2025 Baseline Intersection Operations

Table 3-3 compares the existing (2007) and 2025 traffic operations at the key study area intersections for the two population scenarios: Comp Plan and Comp Plan Plus. Data in these tables includes LOS results, average delay per vehicle, volume-to-capacity (v/c) ratios, and worst movements at the study intersections. Detailed level of service worksheets for the Comp Plan Scenario are presented in Appendix B. Worksheets for the Comp Plan Plus Scenario are included in Appendix C.

3.4.1.1 Comprehensive Plan Growth Scenario

As noted in the table, all of the intersections currently meet the City's LOS D standard during the weekday PM peak hour with the exception of the intersections of SR 503 with Goerig Street (easterly location) and E Scott Avenue, and Buckeye Street at Goreig Street. The intersection of SR 503 and Goerig Street currently operates at LOS E during the weekday PM peak hour, while the intersection of SR 503 with E Scott Avenue operations at LOS F during the same time period. Improvements are planned at both of these intersections as part of the SR 503 widening and channelization project outlined in the City's recently adopted Transportation System Plan (TSP). The intersection of Buckeye Street with Goerig Street was also identified for improvement in the TSP.

In 2025 the table shows, all of the intersections along SR 503 east of E. Scott Avenue would meet the City's LOS D standard during the weekday PM peak hour. Intersections along SR 503 that are expected to fail would include the northbound I-5 ramp/Atlantic Avenue, CC Street, both the easterly and westerly intersections of Goerig Street, and E. Scott Avenue. Traffic operations at the intersection of SR 503 with N Goerig Street would degrade from LOS E in 2007 to LOS F by 2025 for the weekday PM peak hour. The intersection of SR 503 with E Scott Avenue would continue to operate at LOS F during the weekday PM peak hour in 2025. Other intersections that are expected to fail during the 2025 PM peak hour would include: the Dike Road intersections with I-5, Old Pacific Highway at Green Mountain Road, E. Scott Avenue at Old Pacific Highway, and Buckeye Street at Goerig Street.

Table 3-3. 2007 and 2025 PM Peak Hour Intersection Traffic Operation Summary

			Existing (2007)			Future (2025) Comp Plan			Future (2025) Comp Plan Plus		
No.	**Signalized Intersections**		**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**
17	I-5 SB On-Ramp @ SR 503 (Lewis River Rd)		17.3	0.62	B	54.8	0.99	D	**60.0**	**>1.00**	**E**
18	I-5 NB Off-Ramp @ SR 503 (Lewis River Rd)		51.3	0.71	D	**>80.0**	**>1.00**	**F**	**>80.0**	**>1.00**	**F**
19	SR 503 (Lewis River Road) @ CC Street		20.3	0.56	C	**77.0**	**0.80**	**E**	**>80.0**	**0.85**	**F**
	Unsignalized Intersections	**Critical Movement**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**
13	SR 503 (Lewis River Rd) @ Goerig Street (westerly)	EB	NA	NA	NA	**>50.0**	**>1.00**	**F**	**>50.0**	**>1.00**	**F**
24	SR 503 (Lewis River Rd) @ Goerig Street (easterly)	EB	**48.9**	**0.52**	**E**	**96.6**	**1.07**	**F**	**138.5**	**>1.00**	**F**
20	SR 503 (Lewis River Rd) @ E Scott Avenue	EB	**55.2**	**0.69**	**F**	**>50.0**	**>1.00**	**F**	**>50**	**>1.00**	**F**
21	SR 503 (Lewis River Rd) @ Hillshire Drive	SB	13.7	0.09	B	20.4	0.19	C	21.6	0.22	C
11	SR 503 (Lewis River Rd) @ Insel Rd	SB	13.5	0.09	B	18.6	0.21	C	19.9	0.24	C
12	SR 503 (Lewis River Rd) @ Gun Club Road	SB	12.2	0.19	B	15.8	0.28	C	16.2	0.30	C
22	SR 503 (Lewis River Rd) @ Fir Ave	SB	10.3	0.02	B	11.6	0.02	B	11.5	0.02	B
23	SR 503 (Lewis River Rd) @ Evergreen Lane	EB	13.2	0.02	B	14.9	0.03	B	18.4	0.04	C
1	Dike Access Road @ Robinson Way	NB	8.8	0.01	A	10.1	0.02	B	10.1	0.02	B
		SB	0.0	0.00	A	14.8	0.43	B	15.0	0.44	B
2	Dike Access Road @ Schurman Way	NB	9.9	0.28	A	22.7	0.23	C	22.0	0.22	C
3	I-5 SB Ramps @ Dike Access Road	SB	14.7	0.32	B	**>50.0**	**>1.00**	**F**	**>50.0**	**>1.00**	**F**
4	I-5 NB Ramps @ Dike Access Road	NB	11.8	0.14	B	**>50.0**	**>1.00**	**F**	**>50.0**	**>1.00**	**F**

Table 3-3. 2007 and 2025 PM Peak Hour Intersection Traffic Operations Summary Continued

		Existing (2007)				Future (2025) Comp Plan			Future (2025) Comp Plan Plus		
No.	**Unsignalized Intersections**	**Critical Movement**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**	**Control Delay (secs./vehicle)**	**V/C Ratio**	**LOS**
5	Old Pacific Hwy @ Green Mountain Road	WB	11.1	0.09	B	**>50.0**	**>1.00**	**F**	**>50.0**	**>1.00**	F
6	Schurman Way @ Guild Road	SBL	9.9	0.07	A	12.8	0.18	B	13.8	0.25	B
7	W Scott Avenue @ N Pekin Road	NB	10.1	0.09	B	13.0	0.21	B	13.8	0.25	B
8	W Scott Avenue @ Pacific Avenue	EB	11.1	0.12	B	16.0	0.37	C	15.9	0.36	C
9	E Scott Avenue @ Atlantic Avenue	WBL	10.3	0.07	B	14.9	0.46	B	15.0	0.47	C
10	E Scott Avenue @ Old Pacific Highway	SB	9.4	0.30	A	**63.3**	**>1.00**	**F**	**61.4**	**>1.00**	**F**
14	Caples Road @ N Pekin Road	EB	9.0	0.03	A	9.8	0.07	A	10.2	0.09	B
15	Davidson Avenue @ 5th Street	NB	10.3	0.14	B	16.1	0.36	C	**>51.4**	**0.81**	**F**
		SB	10.6	0.05	B	15.2	0.10	C	30.2	0.33	D
16	Buckeye Street @ Goerig Street	EB	**>50.0**	**0.98**	**F**	**>50.0**	**>1.00**	**F**	**>50.0**	**>1.00**	**F**
		WB	18.4	0.30	C	**>50.0**	**>1.00**	**F**	**>50.0**	**>1.00**	**F**

Note: LOS means level of service, V/C means volume-to-capacity ratio, NB means northbound direction of approach to an intersection, SB means southbound, EB means eastbound, and WB means westbound.

3.4.1.2 Comprehensive Plan Plus Scenario

The location of the proposed added residential development that was assumed as part of the Comprehensive Plan Plus scenario would result in modest impacts at most intersections throughout the city. A major exception would be at the intersection of Davidson Avenue with 5th Street where 2025 PM peak hour level of Service C conditions are anticipated with the Comp Plan scenario. This would drop to LOS F with the Comp Plan Plus scenario for the northbound movement. Additionally, the failing intersections of Buckeye Street at Goerig Street, and the I-5 interchange area along SR 503 would experience increased congestion resulting in higher delays and worse operating performance than under the Comp Plan scenario. This finding is not indicated by the information presented in Table 3-3 which cuts off the quantitative assessment at the LOS F threshold. Numbers beyond this threshold are theoretically improbable, and under actual conditions traffic congestion typically results in a spread of the peak hour over a longer period of time. Some diversion of traffic onto less congested streets and the foregoing of peak hour trips may also occur.

3.4.2 Summary of 2025 Traffic Queuing Analysis

The assessment of 2025 PM peak hour intersection operations also included an assessment of potential traffic back-ups (or queues) that could be anticipated with either the Comp Plan or Comp Plan Plus scenarios. The evaluation of traffic queuing impacts is important because it provides an indication of how intersections that are located in close proximity of each other may interact under future traffic conditions. Traffic queuing analysis results are presented in Table 3-4.

Table 3-4. 2025 PM Peak Hour Traffic Queues at Key Intersections

Intersection	Existing Vehicle Storage	Future (2025) Comp Plan		Future (2025) Comp Plan Plus	
		Movement	Queue Length (ft)	Movement	Queue Length (ft)
SR 503 (Lewis River Rd) @ I-5 SB On-Ramp/Pacific Avenue	150 ft	EB Left	90 ft	EB Left	140 ft
	300 ft	EB Thru	**360 ft (1)**	EB Thru	**420 ft (1)**
	400 ft	WB Left	**690 ft (1)**	WB Left	**690 ft. (1)**
	420 ft	WB Thru	**450 ft (1)**	WB Thru	**670 ft (1)**
	100 ft	SB Left	**540 ft (1)**	SB Left	**540 ft (1)**
	(3)	SB Thru	260 ft	SB Thru	260 ft
SR 503 (Lewis River Rd) @ I-5 NB Off-Ramp/ Atlantic Avenue	200 ft	EB Left	**530 ft (1)**	EB Left	**560 ft (1)**
	400 ft	EB Thru	**410 ft (1)**	EB Thru	**450 ft (1)**
	150 ft	WB Thru	N/A (2)	WB Thru	NA (2)
	50 ft	SB Left	40 ft	SB Left	40 ft
	(3)	SB Right	410 ft	SB Right	480 ft
	1200 ft	NB Thru/Left	1,090 ft (1)	NB Thru/Left	**1,200 ft (1)**
	250 ft	NB Right	**460 ft (1)**	NB Right	**500 ft. (1)**
SR 503 (Lewis River Road) @ CC Street	50 ft	EB Thru	N/A (2)	EB Thru	N/A (2)
	100 ft	WB Left	**200 ft (1)**	WB Left	**200 ft (1)**
	(3)	WB Thru	460 ft	WB Thru	520 ft
	120 ft	NB Left	**230 ft (1)**	NB Left	**245 ft (1)**
	(3)	NB Right	40 ft	NB Right	40 ft
Dike Access Road @ I-5 SB Ramps		SB All	780 ft	SB All	760 ft
Dike Access Road @ I-5 NB Ramps		NB All	490 ft	NB All	490 ft

(1) Exceeds available vehicle storage space as indicated by **bold** shading.
(2) Metered by signal at adjacent intersection.
(3) Through lane with storage in excess of 1,000 feet.

As noted in the table, nearly all movements at the intersections along SR 503 in the vicinity of the I-5 interchange would exceed available storage space for vehicle queuing. This indicates that traffic frequently backs up from one intersection into the next, impacting traffic operations for the area as a whole. Consequently, when improvements are considered for this location, they must accommodate the movement of vehicles through the entire interchange area and not rely on satisfying demand at a single location.

3.5 SUMMARY OF IMPROVEMENT NEEDS AND DEFICIENCIES

The following paragraphs summarize the intersection needs and deficiencies as described in detail above. This discussion begins to point analysis in the direction of identifying potential improvements that would address and accommodate expected traffic demand during the 2025 PM peak hour time period for both the Comp Plan and Comp Plan Plus scenarios. Included in this discussion is an assessment of traffic signal warrants which would need to be met to consider this type of intersection improvement. Also included is a discussion of left turn lane warrants to identify potential locations where this improvement may be appropriate for further consideration.

3.5.1 Signal Warrant Analysis

The Federal Highway Administration's Manual of Uniform Traffic Control Devices (MUTCD) peak hour, four and eight hour volume signal warrants were evaluated at several key intersections. Appendix D contains the worksheets for this analysis. The following intersections meet multiple signal warrants under both 2025 scenarios except Davidson Ave/5th Street which would meet signal warrants only for the Comp Plan Plus scenario.

- SR 503/Goerig Street (west)
- SR 503/Goerig Stret (east)
- SR 503/E Scott Avenue
- Dike Access Road/I-5 SB Ramps
- Dike Access Road/I-5 NB Ramps
- Green Mountain Road/Old Pacific Hwy
- E Scott Avenue/Old Pacific Hwy
- Buckeye Street/Goerig Street
- Davidson Avenue/5th Street (2025 Comp Plan Plus only)

At some of the intersections a roundabout should be considered as a safer alternative to a signalization of the intersection. Turn lane improvements may be needed in addition to signalization.

3.5.2 Left Turn Lane Warrant Analysis

The need for a left-turn lane and/or a two-way left-turn lane at unsignalized intersections was evaluated based on WSDOT's Figure 910-8a *Left-Turn Storage Guidelines (Two-Lane Unsignalized)* from the *Design Manual, May 2007*. Table 3-5 summarizes the results of the left-turn lane warrant analysis.

Table 3-5. 2025 Left Turn Lane Warrant Analysis

Unsignalized Intersections	Direction	Meets Left-Turn Lane Recommended by WSDOT?
SR 503 (Lewis River Rd) @ Hillshire Drive	EB	Yes
SR 503 (Lewis River Rd) @ Insel Road	EB	Yes
SR 503 (Lewis River Rd) @ Gun Club Road	EB	Yes
SR 503 (Lewis River Rd) @ Fir Avenue	EB	Yes
SR 503 (Lewis River Rd) @ Evergreen Lane	EB	No

Note: EB means eastbound travel direction.

As shown in Table 3-5, all locations along SR 503 would meet WSDOT's standards for left-turn lanes except at Evergreen Lane.

3.6 POTENTIAL IMPROVEMENT OPTIONS

The analysis of existing and future traffic operations shows that as community growth and development occurs in Woodland, improvements to and expansions of the existing transportation system will be necessary to accommodate the anticipated growth in congestion. Identified needs include:

- Increasing capacity on the street network;
- Developing alternative routes to move traffic across and through town;
- Providing access to new developments, reducing conflicts between adjacent land uses and rail
- Protecting the function of existing facilities,
- Improve and expand the existing walkway and bikeway network;
- Meeting the growing and changing public transportation needs.

Strategies to accommodate growth and to provide a safe, convenient, and economic transportation system will need to be developed consistent with the community vision. The following are some of the topics that should be explored further for potential improvements opportunities.

- Street standards
- Access management
- New roadway connections or extensions
- Roadway and intersection capacity improvements
- Roadway safety improvements
- Options for alternative modal transportation

Woodland is projected to grow significantly during the next twenty years and a piecemeal approach to transportation system planning will not result in the integrated network that is needed. It is essential that Woodland develop transportation strategies that provide transportation options for all residents, optimizes investments in existing facilities, and coordinates with the County and WSDOT systems.