

**KITTELSON & ASSOCIATES, INC.****TRANSPORTATION ENGINEERING / PLANNING**

610 SW Alder Street, Suite 700, Portland, OR 97205 P 503.228.5230 F 503.273.8169

**MEMORANDUM**

---

Date:	November 8, 2016	Project #: 20495
To:	Curleigh Carothers, P.E.; City of Camas	
cc:	Ralph Emerson, CLB Washington Option Solutions, LLC Kurt Stonex, P.E., Mike Odren, Stacey Hickman; Olson Engineering	
From:	Chris Brehmer, P.E., Kelly Laustsen; Kittelson & Associates, Inc.	
Project:	Green Mountain Phase 2	
Subject:	Transportation Compliance Letter	

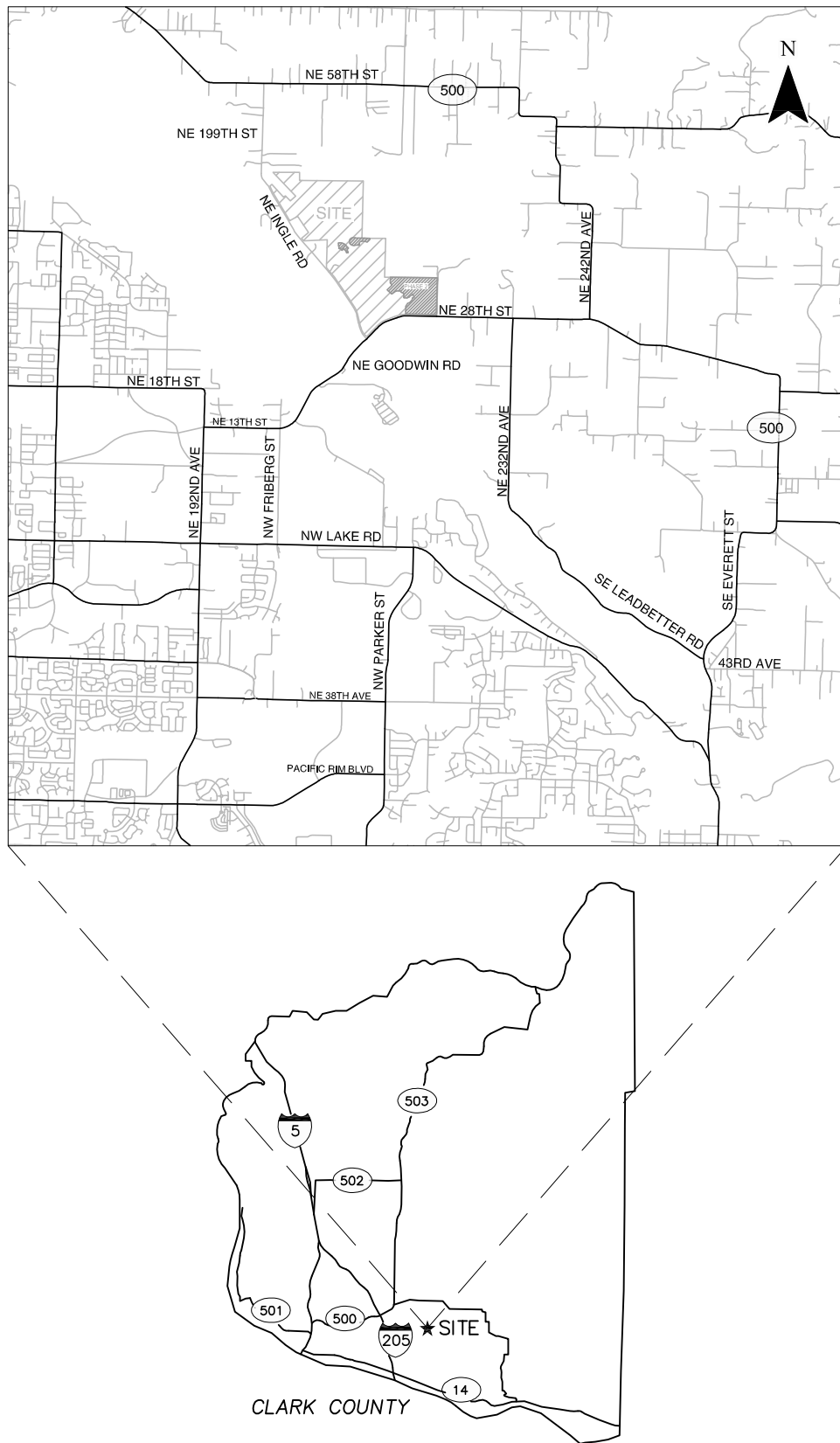
---

This memorandum provides a transportation compliance letter to support Phase 2 of the proposed Green Mountain Master Plan development to be located at the northeast corner of NE Ingle Road and NE Goodwin Road in Camas, Washington. The contents of this memorandum are based on the recommendations provided in the *Green Mountain Master Plan Transportation Impact Analysis (TIA)*, prepared by Kittelson & Associates, Inc. and dated June 2014 (provided in *Appendix A*). The intent of this memorandum is to document the trip generation of Phase 2 and ensure that the mitigation measures provided in the Masterplan TIA are applied at the appropriate phase of development.

**BACKGROUND**

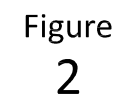
The TIA for the Green Mountain Master Plan developed in 2014 provided a near- and long-term analysis for full buildout of the Green Mountain site, including 283-acres of mixed-use development. The master plan includes eight phases of the development, the first of which is currently underway.

Figure 1 illustrates the site vicinity and location of the Master Plan site. A mix of residential and commercial uses is planned in accordance with the zoning. Development of Phase 2 of the site is currently proposed, with the site plan shown in Figure 2. Phase 2 includes development of 230 residential units with an additional access via NE 28<sup>th</sup> Street.



Site Vicinity  
Camas, Washington

Figure  
1



## SCOPE OF THE REPORT

This analysis identifies the transportation-related impacts associated with Phase 2 of the proposed Green Mountain Master Plan development and was prepared in accordance with the recommendations outlined in the Master Plan TIA. It documents the following:

- The number of site-generated trips (daily, weekday a.m. peak hour, weekday p.m. peak hour) estimated with Phase 2.
- The number of site-generated trips (daily, weekday a.m. peak hour, weekday p.m. peak hour) previously debited by approved site development applications on the master plan site.
- An accounting of the number of site-generated trips (daily, weekday a.m. peak hour, weekday p.m. peak hour) remaining assuming approval of the Phase 2 subdivision application.
- Evaluation of outstanding mitigation needs (as appropriate consistent with the Master Plan recommendations) involving:
  - Need for an eastbound right-turn lane at NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500)
  - NE Ingle Road/NE Goodwin Road intersection operations
  - Assessment of proportionate share contribution at NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street intersection
- On-site access and circulation.
- Conclusions and recommendations.

## ANALYSIS METHODOLOGY

As with the Master Plan TIA, all level of service analyses described in this report were performed in accordance with the procedures stated in the *2000 Highway Capacity Manual* (Reference 1). A description of level of service and the criteria by which they are determined is presented in *Appendix B*. *Appendix B* also indicates how level of service is measured and what is generally considered the acceptable range of level of service.

To ensure that this analysis was based on a reasonable worst-case scenario, the peak 15 minute flow rate during the peak hour analysis periods was used in the evaluation of all intersection levels of service. For this reason, the analysis reflects conditions that are only likely to occur for 15 minutes out of each average peak hour. Traffic conditions during other weekday hours and throughout the weekend will likely be better than those described in this report.

## CURRENT PROPOSED DEVELOPMENT PLAN

Phase 2 consists of 230 single-family detached homes and is expected to be completed by 2018. Phase 2 is primarily located in the southeast portion of the overall site, with access anticipated on NE 28<sup>th</sup> Street via a neighborhood circulator. As part of Phase 2, two pods adjacent to and northwest of Phase 1 will also be constructed. Phase 2 will be connected to Phase 1 via the extension of N. Boxwood Street, as shown in the site plan in Figure 1. The proposed master plan anticipates two public street neighborhood circulator connections to NE Goodwin Road serving the site in conjunction with two public street neighborhood circulator connections along NE 28<sup>th</sup> Street.

### Trip Generation

Trip generation estimates for the proposed development were generated based on information provided in the standard reference manual *Trip Generation, 9<sup>th</sup> Edition* published by the Institute of Transportation Engineers (ITE – Reference 2). Table 1 summarizes the daily, weekday a.m., and weekday p.m. peak-hour trips for the Phase 2 assumed development. All daily trips have been rounded to the nearest ten and all peak hour trips have been rounded to the nearest five trips.

Table 1: Trip Generation Estimate – Phase 2

Land Use	ITE Code	Size	Daily	Weekday AM Peak Hour			Weekday PM Peak Hour		
				Total	In	Out	Total	In	Out
Single-Family Detached Housing	210	230 units	2,190	175	45	130	230	145	85

Table 2 summarizes the overall master plan trip generation and then deducts for the Phase 1<sup>1</sup> and Phase 2 trips to summarize the number of net new trips that will remain vested.

---

<sup>1</sup> While approved for 215 units, Phase 1 now consists of 201 units. The updated trip totals are shown in Table 2 with the full trip generation provided in *Appendix C*.

Table 2: Master Plan Trip Generation and Build-out Debiting (Includes Phase 1 and Phase 2)

Land Use	ITE Code	Size	Daily	Weekday AM Peak Hour			Weekday PM Peak Hour		
				Total	In	Out	Total	In	Out
Apartment	220	536 units	3,570	275	55	220	330	215	115
Single-Family Detached Housing	210	764 units	7,270	575	145	430	765	480	285
Total Residential (1,300 units)			10,840	850	200	650	1,095	695	400
Internalization (6% Daily,54% PM)			630	0	0	0	60	30	30
Shopping Center	820	90,000 square feet	6,340	145	90	55	560	270	290
Internalization (10% Daily, 11% PM)			630	0	0	0	60	30	30
Pass-By Trips (34%)			1,940	50	25	25	170	85	85
Total Vested Trips			17,180	995	290	705	1,655	965	690
Less Internalization			1,260	0	0	0	120	60	60
Less Pass-by trips			1,940	50	25	25	170	85	85
Vested Net New Trips for Full Build-out			13,980	945	265	680	1,365	820	545
Deduct for Net New Trips for Phase 1			1,915	150	40	110	200	125	75
Deduct for Net New Trips for Phase 2			2,190	175	45	130	230	145	85
Remaining Trips			9,885	620	180	440	935	550	385

As seen in Table 2, after accounting for Phase 1 and Phase 2; 9,885 daily; 620 weekday a.m. peak hour; and 935 weekday p.m. peak hour trips remain in the master plan approval.

## Trip Distribution and Assignment

The distribution of site-generated trips onto the study area roadway system was estimated utilizing the trip distribution provided in the Master Plan TIA. The majority of trips are anticipated to use the new access on NE Goodwin Road, while a small portion of trips may utilize the neighborhood circulator access on NE Ingle Road developed with Phase 1. *Appendix D* illustrates the trip assignment.

## EVALUATION OF OUTSTANDING MITIGATION NEEDS

The Master Plan TIA included recommended mitigations for intersections not meeting standards under background and/or total traffic conditions. As part of each phase's transportation compliance letter, it recommended evaluation of the following:

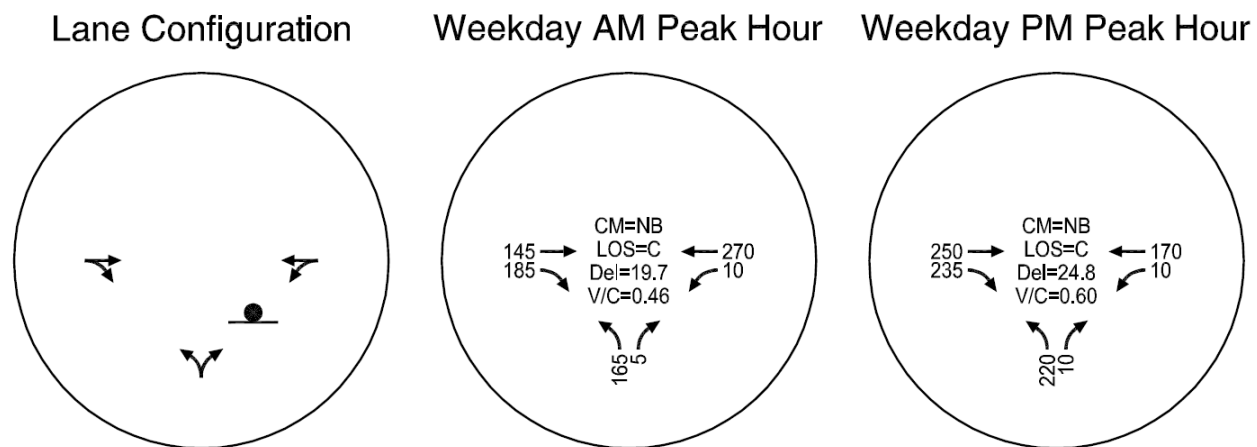
- Need for an eastbound right-turn lane at NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500)
- NE Ingle Road/NE Goodwin Road operations (including traffic signal warrant analysis)
- Assessment of proportionate share contribution at NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street

Updated traffic counts were collected in October 2016 at NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street and NE Ingle Road/NE Goodwin Road to inform an updated operations analysis. The count sheets are provided in *Appendix E*. The results are discussed below.

## NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500)

The Master Plan TIA recommended that future subdivision applications provide an updated assessment as to the potential need for providing a right-turn taper or lane at NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500), considering both the need for a right-turn taper or lane and delay with the northbound left-turn. Year 2018 total traffic conditions were analyzed using the same approach from the Master Plan TIA, accounting for in-process developments (details are provided in *Appendix F*), Green Mountain Phase 1, and Green Mountain Phase 2. The lane configuration and projected operations under 2018 total traffic conditions are shown in Exhibit 1. *Appendix G* contains the 2018 total traffic conditions traffic operations worksheets.

### Exhibit 1: NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500) Total Traffic Lane Configuration and Operations



As seen in the exhibit, the minor street northbound left-turn at the intersection of NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500) is projected to satisfy WSDOT standards during the weekday a.m. and p.m. peak hours. The intersection is projected to operate at a volume-to-capacity (v/c) ratio of 0.46 and LOS C during the a.m. peak hour and v/c ratio of 0.60 and LOS C during the p.m. peak hour. It therefore complies with WSDOT's LOS requirement (LOS C) for non-HSS facilities in rural areas.

Roadways under Washington State jurisdiction are subject to the turn lane guidelines contained in the *WSDOT Design Manual* (Reference 3). Traffic volumes at the intersection of NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500) meet WSDOT's guidelines for an eastbound right-turn lane on NE 58<sup>th</sup> Street under existing conditions and all future scenarios during both the weekday a.m. and p.m. peak hour (consistent with findings from the Master Plan TIA). Construction of a right-turn lane could require right-of-way acquisition and will likely impact one or more private driveways along NE 58<sup>th</sup> Street (depending on the length of the deceleration lane constructed).

The table below assesses volumes at the intersection for various horizon year scenarios and the impact of the proposed development.

Table 3: NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500) Eastbound Right-Turn Lane Assessment

Scenario	Eastbound Right-Turn (EBRT) Volume	Meets Guideline?	Development-Added EBRT Trips	Impact of Development
2016 Existing Traffic – AM Peak	156	Yes	-	-
2016 Existing Traffic – PM Peak	161	Yes	-	-
2018 Background Traffic – AM Peak	178	Yes	8 (Phase 1)	4%
2018 Background Traffic – PM Peak	206	Yes	25 (Phase 1)	12%
2018 Total Traffic – AM Peak	187	Yes	9 (Phase 2)	5%
2018 Total Traffic – PM Peak	235	Yes	29 (Phase 2)	12%

The findings in Table 3 are consistent with those presented in the June 2014 TIA. Given that no homes are yet occupied at the development site and no material changes relative to the proposed development plan have occurred since approval of the TIA, no right-turn improvements are recommended in conjunction with Phase 2. Consistent with the master plan approval conditions, future subdivision applications should continue to assess the potential need for providing a right-turn taper or lane at the intersection.

### NE Ingle Road/NE Goodwin Road

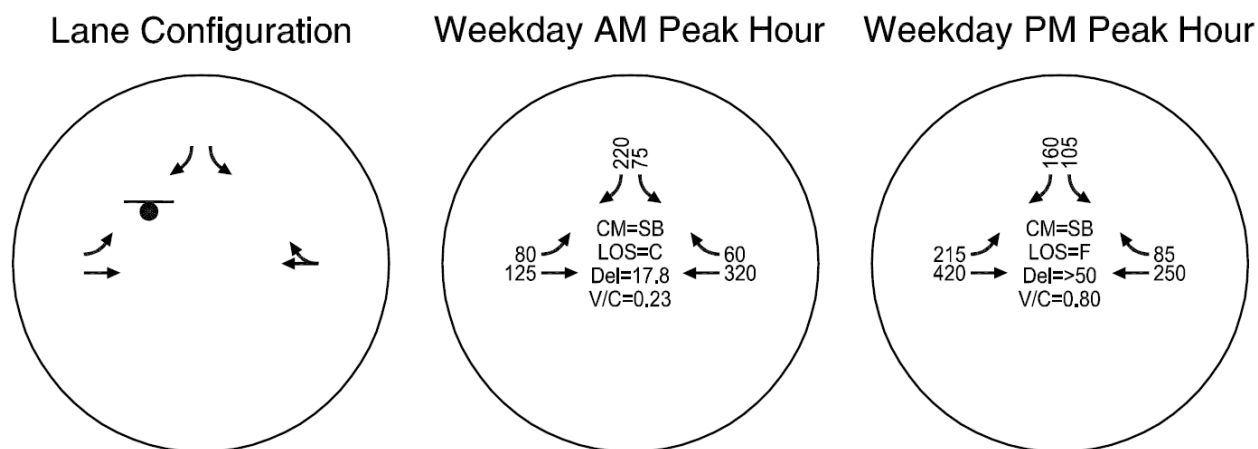
In the Master Plan TIA, the intersection of NE Ingle Road/NE Goodwin Road was projected to not meet City of Camas intersection operating standards in the 2029 background conditions during the weekday p.m. peak hour and the 2029 total traffic conditions during both the weekday a.m. and p.m. peak hours. Therefore, the following series of mitigations were recommended in conjunction with the proposed development:

- Construct an eastbound left-turn lane on NE Goodwin Road at NE Ingle Road with the first Phase 1 trip (*currently under construction*).
- Construct a westbound right-turn lane on NE Goodwin Road at NE Ingle Road with the 203<sup>rd</sup> Phase 1 trip (prior to occupancy of 203<sup>rd</sup> single family home on site). The right-turn lane should provide at least 100 feet of storage. (*Phase 1 was reduced to 201 homes, so construction of the westbound right-turn lane has not yet occurred*).
- Construct a three-lane roadway section (with center two-way left-turn lane) on NE Goodwin Road along the site frontage in conjunction with standard frontage improvements as adjacent development occurs (*applicable to Phase 2 development*).
- Upon completion of Phase 1 site development (including construction of the eastbound left-turn lane on NE Goodwin Road at NE Ingle Road with Phase 1), the developer shall monitor the need for installation of a traffic signal with each future subdivision application at the intersection and construct a traffic signal when the intersection no longer satisfies City of Camas performance standard (LOS "D" and v/c of 0.90 or better) *and* the intersection volumes meet traffic signal warrants (subject to direction from the City of Camas) (*discussion provided below*).



Operations of the intersection as a stop-controlled intersection are provided in Exhibit 2 assuming Phase 1 and 2 site development as well as approved background traffic. *Appendix G* contains the 2018 total traffic conditions traffic operations worksheets.

## Exhibit 2: NE Ingle Road/NE Goodwin Road 2018 Total Traffic Lane Configuration and Operations



As seen in Exhibit 2, the southbound left-turn at NE Ingle/NE Goodwin Road is projected to operate at a LOS F during the weekday p.m. peak hour with buildout of Phase 2 but operates under capacity with a v/c ratio of 0.80. Installation of a westbound right-turn lane (previously recommended with development of the 203<sup>rd</sup> home) is recommended with Phase 2 site development and will improve intersection operations compared to those reported in Exhibit 2. Further, to meet City of Camas standards, provision of a center two-way left-turn lane is recommended on NE Goodwin Road east of NE Ingle Road to accommodate two stage southbound left-turns. Operations with these mitigations are shown in Table 4. *Appendix H* contains the supporting traffic operations worksheets.

Table 4: NE Ingle Road/NE Goodwin Road 2018 Total Traffic Operations

Scenario	Weekday AM Peak Hour		Weekday PM Peak Hour	
	Delay	v/c	Delay	v/c
Current Intersection Configuration (refer to Exhibit 2)	17.8 (LOS C)	0.23	87.9 (LOS F)	0.80
Provision of a westbound right-turn lane	17.1 (LOS C)	0.22	75.1 (LOS F)	0.74
Provision of a TWLTL on NE Goodwin Road	12.5 (LOS B)	0.15	25.8 (LOS D)	0.41

Note: Operations shown are for the critical movement (southbound left-turn)  
TWLTL = Two-way left-turn lane

Recognizing that the intersection satisfies City of Camas performance standards with these recommended mitigations, installation of a traffic signal is not recommended with Phase 2 development. Per the Master Plan conditions of approval, the developer shall monitor the need for installation of a traffic signal with future subdivision applications.

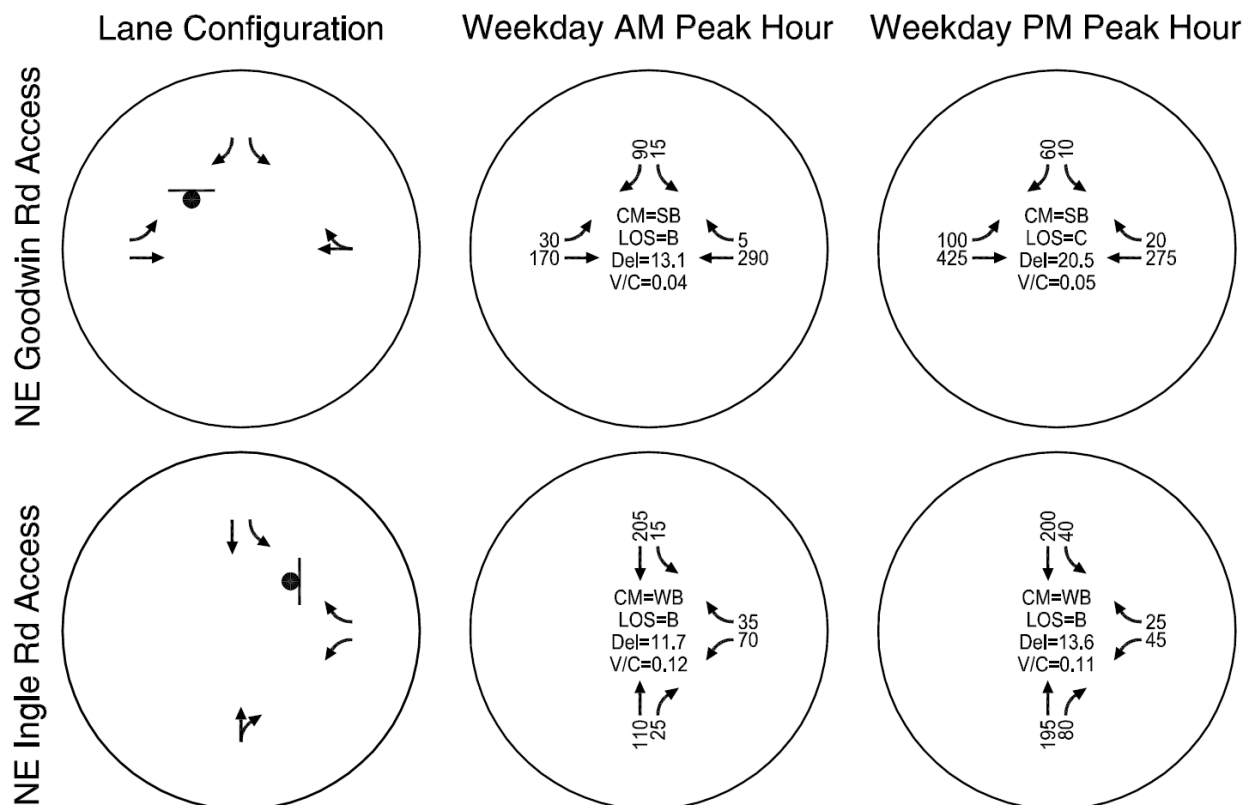
## NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street

The Master Plan TIA identified a proposed proportionate cost sharing methodology to fund future construction of a northbound right-turn lane and a westbound right-turn lane on NE 13<sup>th</sup> Avenue at NE 192<sup>nd</sup> Avenue, provided in *Appendix I*. Under this methodology, each weekday p.m. peak hour trip would be assessed a fee of \$319. Based on the Phase 2 trip assignment (refer to *Appendix D*), Phase 2 adds 103 trips to the intersection of NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street and therefore should be responsible for contributing \$32,857 towards future improvements at the intersection.

## ON-SITE CIRCULATION AND OPERATIONS

As seen in Figure 2, Phase 2 is located in the southeast portion of the overall site, with access anticipated on NE 28<sup>th</sup> Street (NE Goodwin Road) via a neighborhood circulator. Phase 2 will be connected to Phase 1 via the extension of N. Boxwood Street, as shown in the site plan in Figure 1. Therefore, some trips were assumed to utilize the neighborhood circulator access on NE Ingle Road developed with Phase 1. The proposed lane configuration for the access on NE 28<sup>th</sup> Street (NE Goodwin Road) and weekday a.m. and p.m. peak hour operations are shown in Exhibit 3. The operations for the access on NE Ingle Road developed with Phase 1 are also shown. *Appendix J* contains the traffic operations worksheets for the Phase 2 access operations.

**Exhibit 3: Site Accesses – 2018 Total Traffic Lane Configuration and Operations**



As seen in the exhibit, both accesses are projected to operate acceptably during both the weekday a.m. and p.m. peak hours. Anticipated queueing is provided in Table 4.

Table 5: Site Access Queueing – 2018 Total Traffic Conditions

Location	Movement	95 <sup>th</sup> Percentile Queue	
		Weekday AM Peak Hour	Weekday PM Peak Hour
NE Goodwin Road/ Site Access	Eastbound left-turn	25	25
	Westbound right-turn	<25	<25
	Southbound left-turn	25	25
	Southbound right-turn	25	25
NE Ingle Road/ Site Access	Westbound left-turn	25	25
	Westbound right-turn	25	25
	Southbound left-turn	25	25

As seen in table three, 95<sup>th</sup> percentile queues are anticipated to be one vehicle or less.

On-site landscaping, signage and any above-ground utilities should be provided appropriately to ensure that adequate sight distance is provided and maintained.

## FINDINGS AND RECOMMENDATIONS

Based on the results of the transportation impact analysis, Phase 2 of the Green Mountain Master Plan can be developed while maintaining acceptable levels of service and safety at the study intersections without any required off-site mitigations. The primary findings and recommendations of this study are summarized below.

### Trip Generation

- Phase 2 includes 230 single family homes and is estimated to generate 2,190 daily trips, 175 net new a.m. peak hour trips, and 230 net new p.m. peak hour trips.
- After accounting for Phase 1 and Phase 2; 9,885 daily; 620 weekday a.m. peak hour; and 935 weekday p.m. peak hour trips remain in the master plan approval.

### NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500)

- Consistent with prior analysis, the intersection of NE 199<sup>th</sup> Avenue/NE 58<sup>th</sup> Street (SR 500) continues to satisfy WSDOT's guidelines for a right-turn lane on the eastbound approach under existing conditions and all future scenarios during both the weekday a.m. and p.m. peak hours.
  - Given the lack of crash history related to eastbound right-turns and the relatively small impact of Phase 2 (nine eastbound right-turn trips during the weekday a.m.

peak hour, 29 eastbound right-turn trips during the weekday p.m. peak hour), no improvements are recommended in conjunction with Phase 2.

- In the future, the provision of a right-turn taper or lane could be considered if suggested by the crash history at the intersection or intersection operations.

### NE Ingle Road/NE Goodwin Road

- The southbound left-turn at NE Ingle/NE Goodwin Road is projected to operate at a LOS F and below capacity with buildout of Phase 2.
- Construction of a westbound right-turn lane on NE Goodwin Road at NE Ingle Road with at least 100 feet of storage and provision of a two-way left-turn lane on NE Goodwin Road east of NE Ingle Road are recommended with Phase 2 development. With these mitigations in place, the intersection satisfies City of Camas operating standards.

### NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street

- Phase 2 is forecast to add 103 weekday p.m. peak hour trips to the intersection of NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street. This equates to a proportionate cost share of \$32,857 (\$391 per trip) based on the proposed methodology presented in the Master Plan TIA.

### Recommendations

- The following should be provided in conjunction with site development:
  - Construction of a three-lane roadway section (with center two-way left-turn lane) on NE Goodwin Road along the site frontage in conjunction with standard frontage improvements.
  - Construction of a westbound right-turn lane on NE Goodwin Road at NE Ingle Road with at least 100 feet of storage and provision of a two-way left-turn lane on NE Goodwin Road east of NE Ingle Road.
  - Contribution of \$32,857 towards future improvements at NE 192<sup>nd</sup> Avenue/NE 13<sup>th</sup> Street.
  - On-site and off-site landscaping and any above ground utilities at the site-access driveways and internal roadways should be provided appropriately to ensure that adequate sight-distance is maintained.

We trust this letter adequately addresses the traffic impacts associated with the proposed Green Mountain Master Plan Phase 2 site development. Please contact us if you have any questions or comments regarding the contents of this report or the analysis performed.

## REFERENCES

1. Transportation Research Board 2000. Highway Capacity Manual. 2000.
2. Institute of Transportation Engineers. *Trip Generation Manual*, 9<sup>th</sup> Edition. 2012.
3. Washington State Department of Transportation. *Design Manual*. July 2013.

