City of Lacey
Transportation Systems Analysis and Alternatives Evaluation

Assumptions Document for:
Traffic Operations & Model Forecasting Methodology

Prepared by:
Shea, Carr & Jewell, Inc. and Parametrix

Updated – May 1, 2008

TABLE OF CONTENTS

Stakeholder Acceptance

The undersigned parties concur with the assumptions for the *City of Lacey Transportation Systems Analysis and Alternatives Evaluation* presented in this document

WSDOT - Headquarters Traffic

Signature

Title

Date

FHWA

Signature

Area Engineer

Title

Date

WSDOT – Olympic Region Traffic

Signature

Title

Date

Note: Participation on the Stakeholders Committee and/or signing of this document does not constitute approval of the *Transportation Systems Analysis and Alternatives Evaluation* Report.

1. Introduction and Project Description

The City of Lacey is in the early stages of preparing a study that will involve a detailed evaluation of the arterial and highway network and future traffic demand in the north Lacey area. Current traffic levels on both the local and interstate systems have grown significantly over the past ten years and this growth trend is expected to continue in both the Lacey and Thurston County regions. Preliminary travel forecasts indicate that several of the primary arterials (Marvin Road, Martin Way, and Carpenter Road) will experience increases in traffic levels by more than 50% by 2015 and up to 100% increase on selected roadway segments by 2030. The projected traffic levels are also expected to affect the interstate system as well; forecasts from the regional travel demand model predict a 40-50% increase in freeway segments and a 70-80% increase in ramp volumes for several of the interchange junctions serving the Lacey area.

This growth has been anticipated for some time, and the City has invested significant resources in developing the local transportation infrastructure to help accommodate this growth. Specific examples include:

- Widening Marvin Road to a four-lane boulevard between I-5 and Willamette Parkway including the installation of two multi-lane roundabout intersections
- Constructing Britton Parkway, a new east-west arterial between Marvin Road and Carpenter Road
- Rebuilding and widening the Marvin Road/Interstate 5 diamond interchange with a future Phase 2 to convert the diamond configuration to a "single point urban interchange" (SPUI)

Each of these projects was completed in the early 2000s and is expected to reach the design-year traffic levels within the next 5 to 6 years. The City is planning to improve several other arterials and intersections to help alleviate the current traffic conditions and near-term growth patterns. However, even with these other local improvements, it is expected that traffic flow and access to the interstate system will be constrained to unacceptable service levels. These operational conditions will be summarized and identified in this study and the results will enable the City of Lacey and project stakeholders to assess options and opportunities to improve the transportation system through the Lacey urban area.

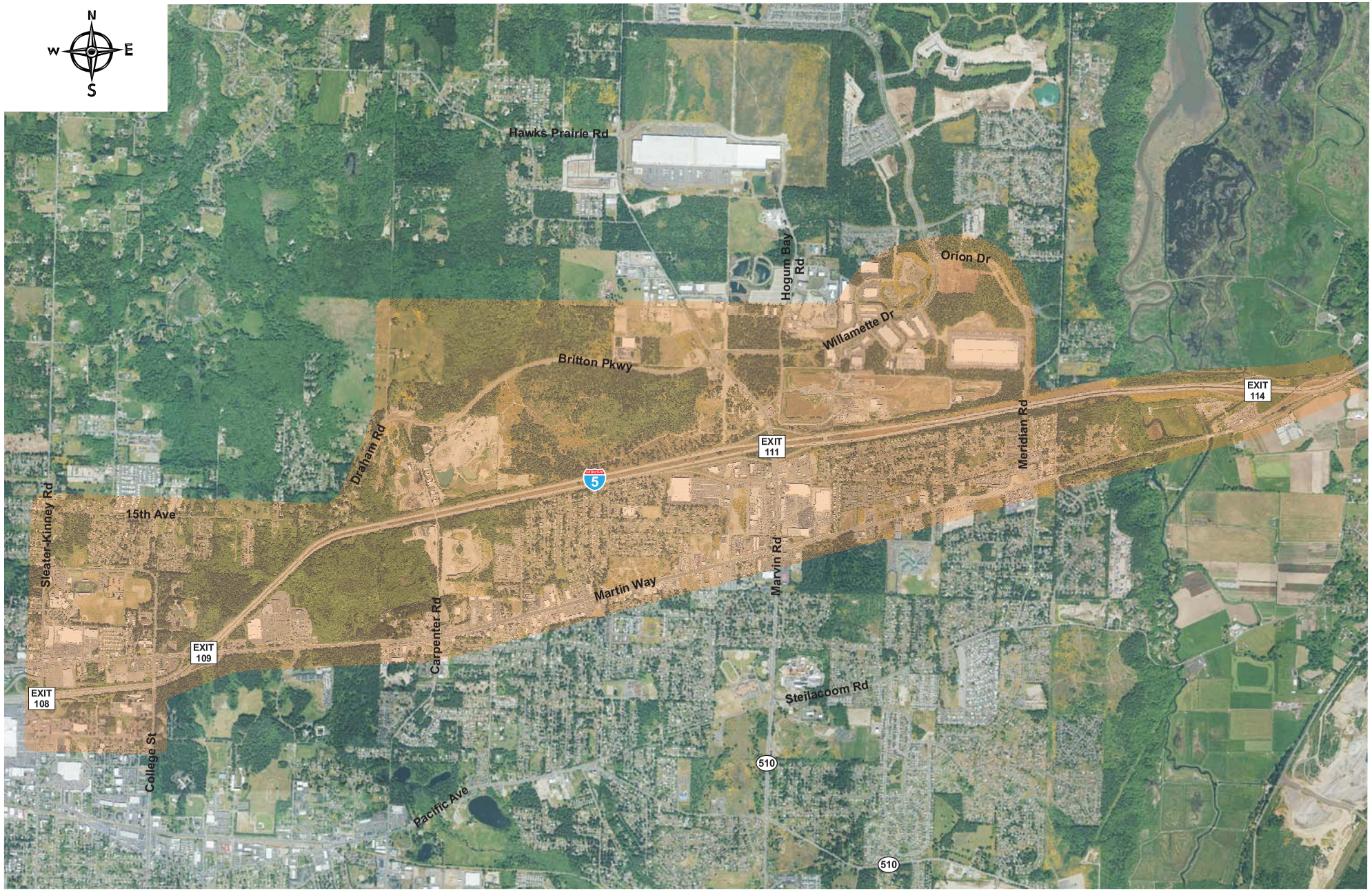
This study will also refine the Thurston Regional Planning Council (TRPC) travel demand model for the Lacey area. The enhanced traffic model will be used to predict the future traffic conditions expected to use the local and interstate systems. These future-year forecasts will be used to assess and analyze the adequacy of the existing interstate facilities and future arterial street system, including each interchange junction.

The following sections of this Traffic Analysis Assumptions Document will define and confirm the study area, and document concurrence on model forecast methodology and analytical parameters.

2. Project Study Area

The study area pictured below will include the I-5 corridor from the Sleater-Kinney Road interchange (Exit 108) to the Martin Way-Nisqually interchange (Exit 114). The study area will also include primary surface street and intersections between Sleater-Kinney Road and Marvin Road as well as corridors north and south of Interstate 5.

Figure 1 highlights the study area as approved by the project stakeholders.



SHEA CARR JEWELL Inc

Study Area

Figure 1

Study Area

Transportation Systems Analysis and Alternatives Evaluation

3. Evaluation Process/Modeling

3.1 Analysis Horizon Years

For this study, the team will evaluate base year 2007 conditions and estimated conditions for the 2013 and 2030 horizon years. The 2013 horizon corresponds with the six-year Transportation Improvement Program horizon. This year was selected as being a reasonable implementation year for potential improvements based on corridor priorities and assumed funding availability.

The design year 2030 is consistent with the regional strategic planning horizon and environmental documentation. It is approximately 20 years past the year of opening and is the forecast year evaluated by the TRPC for the current Regional Transportation Plan (RTP), adopted in June 2007.

3.2 Evaluation Process

This study will evaluate the existing roadway network in the study area to identify existing deficiencies. The future year scenarios will initially be evaluated under "baseline" conditions. The baseline roadway network will include the roadway improvements identified in the 2030 RTP for areas outside of the Lacey UGA, but only projects on the current 6-Year Transportation Improvement Program (6-yr TIP) will be included in the baseline network for roadways within the City of Lacey UGA.

Roadway and intersection deficiencies will be categorized as those facilities that are currently operating or are projected to operate below the adopted level of service (LOS) standard. WSDOT has set a LOS threshold of D for Interstate-5. The LOS for City transportation facilities is LOS D, with the exception of the Martin Way corridor intersections which have a LOS E threshold. In addition, the City has adopted specific ordinances addressing the limitation of expanding their arterial network beyond five travel lanes in width. The City's ordinance does not dictate that improvements need to be made on the Interstate to accommodate local traffic. For those intersections or highway segments already operating below the applicable LOS threshold, the time delay associated with the pre-development LOS will be used rather than the applicable deficiency level. Both the LOS criteria and the specific roadway width condition will be considered when evaluating various system alternatives.

If roadway deficiencies are identified, additional facility improvements will be considered incrementally. The following describes the building block approach to the operational analysis that will be used to identify potential roadway improvements to accommodate area traffic growth:

- Identify existing 2007 conditions
- Evaluate future year "baseline" conditions – Includes all improvements identified in the current RTP outside of Lacey and only the Lacey 6-yr TIP transportation projects within the Lacey UGA
- Consider additional network improvements to City of Lacey surface streets (projects could be taken from the City of Lacey Comprehensive Transportation Plan or new projects not identified on a current plan)

Once we have exhausted all reasonable alternatives and improvements to the city street network, we will proceed with the following scenarios:

- Evaluate improvements to existing Interstate 5 access points
- Explore potential new access points to Interstate 5

3.3 Surface Street Intersection Operations Analysis

Synchro 7.0 software was selected to analyze the operations of signalized surface street and ramp terminal intersections operations. The *Highway Capacity* software (HCS) will be used to analyze all unsignalized intersections, including ramp terminals. The current version of the SIDRA software package was selected to analyze roundabout controlled intersections in the study area. SimTraffic will be used for queuing and turn lane spillover analysis. Study intersections selected by the project team and listed below will be analyzed during the AM and PM single peak hours only.

The following local network intersections will be evaluated in this report:

- Martin Way/Sleater-Kinney Rd
- Martin Way/College Street
- Martin Way/Carpenter Rd
- Martin Way/Marvin Rd
- Martin Way/Meridian Road
- 15th Avenue NE/Sleater-Kinney Rd
- 15th Avenue NE/College Street (Future Intersection)
- Draham Rd/Carpenter Rd
- Britton Pkwy/Carpenter Rd
- Britton Pkwy/Marvin Rd
- Hogum Bay Rd/Marvin Rd
- 3rd Avenue SE/College Street
- 6th Avenue SE/Sleater-Kinney Rd
- Orion Drive /Willamette Drive
- Willamette Drive/Hogum Bay Road
- Quinault Drive/Marvin Road
- Main Street/Marvin Road (Future Intersection)
- Orion Drive/Meridian Road

Analysis results are based on the criteria as defined by the 2000 HCM. Results will be summarized into LOS tables. Average intersection delay, intersection LOS, intersection volume/capacity (v/c) ratio, and 95th percentile queuing (compared to actual/effective storage) will be used as performance measures. LOS and queuing results will be taken from Synchro HCM output tables and from SIDRA outputs including intersection and movement summaries.

Year 2007 existing conditions analysis will be based on traffic volumes collected in the study area since 2005. Peak hour factors and heavy vehicle percentages used in the analysis will reflect the conditions of each approach as observed during the turning movement count. Heavy vehicle percentages will be increased by 2.0 percent for intersections in the Hawks Prairie area north of Interstate 5 for the 2030 design year (i.e., an intersection experiencing 4.0 percent heavy vehicles in 2007 and 2013 would be assumed to experience 6.0 percent heavy vehicles in 2030). Specifically the truck percentage increase will be included at following intersections:

- Britton Parkway/Marvin Road
- Main Street/Marvin Road
- Hogum Bay Road/Marvin Road
- Interstate 5 SB Ramps/Marvin Road
- Interstate 5 NB Ramps/Marvin Road
- Willamette Drive/Hogum Bay Road
- Orion Drive/Willamette Drive

When analyzing a signalized improvement to an unsignalized intersection, assumptions for pedestrian crossing time will be made based on pedestrian walking speed and crossing distances from conceptual drawings. If concept drawings do not exist, assumptions will be made based on lane width and number of lanes.

3.4 Freeway Operations Analysis

The HCS will be used to analyze all unsignalized ramp terminals and will be used to validate the merge/diverge connections on all ramps. Vehicle speed and density will be used as performance measures for the HCS analysis.

In addition to the local network intersections listed above, the following interchange junctions will be included in the report:

Exit 108 – Sleater-Kinney Rd Interchange
- I-5 SB Ramps/Sleater-Kinney Rd
- I-5 NB Off-Ramps

Exit 109 – Martin Way Interchange
- I-5 SB Ramps/Martin Way
- I-5 NB Ramps/Martin Way

Exit 111 – Marvin Road Interchange
- I-5 SB Ramps/Marvin Road
- I-5 NB Ramps/Marvin Road
- Quinault Dr/Marvin Road
- Quinault Dr/Galaxy Way

Exit 114 – Martin Way - Nisqually Interchange
- I-5 SB On-Ramp/Nisqually Cut-Off Rd
- I-5 NB Off-Ramp/Nisqually Cut-Off Rd
- I-5 NB On-Ramp/SB Off-Ramp/Martin Way/Nisqually Cut-Off Rd

The project will require a simulation model capable of analyzing freeway and intersection to intersection geometry, including weaving sections and multiple vehicle classes. VISSIM was selected for the simulation of the preferred alternative because it meets these needs while also providing animation graphics.

Operational modeling of the freeway corridor will be conducted over two one-hour peak periods using the VISSIM software. The existing peak one-hour volumes generally fall into the 7:30 - 8:30 AM and 4:30 - 5:30 PM time periods. All traffic analysis will be reported for the AM and PM single peak hours only. The study area will include the I-5 corridor between Sleater-Kinney Road and Martin Way at Nisqually.

The FHWA report "Guidelines for Applying Traffic Microsimulation Modeling Software" will be used to develop and calibrate the VISSIM model. HCS calculations will also be included in the traffic operations section of the study. VISSIM microsimulation results will not be directly interpreted into HCS LOS tables or used as a primary analysis tool. It is important to note that VISSIM will only be used as a secondary analysis tool to validate and illustrate the HCS analysis findings. All results will be based on the AM and PM peak hours.

3.5 Travel Forecast Methodology

For this study, the most current regional Emme/2 model from TRPC will be used as the basis for preparing 2013 and 2030 traffic forecasts for the study roadways and intersection. Enhancements to the regional model will be implemented to better reflect new development and traffic circulation trends for the Hawks Prairie Area.

Planned Roadway Improvements

The 2030 "baseline" scenario will include all transportation improvements built into the 2030 TRPC model for the areas outside the Lacey UGA. Within the Lacey UGA only improvements on the current City of Lacey 6-yr TIP will be included in the baseline scenario modeled network.

Gateway Area Enhancements

The 2030 model has been enhanced to include additional detail representing the land-use and roadway plan for the Lacey Gateway Towncenter area generally bounded by Interstate 5, Britton Parkway, Carpenter Road and Marvin Road. Ten Traffic Analysis Zones (TAZ's) have been added to the 2030 model to represent the Lacey Gateway Towncenter. Population and employment estimates from the currently proposed Lacey Gateway Towncenter Master Plan have been built into the model, replacing the previous population and employment estimates for the TAZ's in that specific area.

The "backbone" roadway network for the Lacey Gateway Towncenter area has also been built into the enhanced 2030 model. The additional roadway network includes the new east-west "Main Street" roadway, and three north-south roadways between Main Street and Britton Parkway.

Freeway Segment Enhancements

In addition to the localized surface street improvements, the travel forecasts will be developed assuming an additional capacity lane on I-5 is in place between Nisqually and Sleater-Kinney. Because the local and highway system will be constrained by the 2030 forecast, travel demand flow and trip assignments will be significantly altered from normal driver tendencies. The widening of I-5 through the study area will allow the traffic model to distribute regional and local traffic in a more predictable manner. Therefore, the additional capacity lanes provide a means to assess the sensitivity of this improvement and to define a more realistic travel forecast and future-year model volumes.

3.6 Travel Forecasts

The resulting enhanced model will be used to generate 2030 baseline traffic volumes. It is anticipated that model "post-processing" will be utilized to account for localized discrepancies between existing "ground counts" and model-generated volumes. The recommended method will be to add the "model growth increment" (the difference between the 2007 and 2030 model volumes) to the existing ground count traffic volumes.

As traffic volumes increase, peaking behavior diminishes because a smaller proportion of motorists drive during the peak fifteen minute period. To reflect this, the peak hour factor (PHF) used for each successive horizon year will be increased. The PHF observed in ground counts will be used for the 2007 conditions with a minimum PHF of 0.75 used. In 2013, signalized intersections will have a minimum

PHF of 0.92 and unsignalized intersections will have a minimum PHF of 0.85. In 2030, all signalized intersections will use a PHF equal to 0.95 and unsignalized intersections a PHF equal to 0.92.

4. Summary

This assumptions document identifies specific criteria, processes and technical methodologies in establishing the baseline traffic conditions and future traffic levels for the north Lacey area. All future results, analyses and recommendations will be predicated on the underlying assumptions described in this document. All members of the Stakeholders Committee will accept this document as a guide and reference as the study progresses through the various stages of project development.

Appendix C

TECHNICAL MEMORANDUM: 2007 AND 2030 BASELINE ANALYSIS

The technical appendices are included as published at their time. In some instances subsequent analyses refined the results of the published material. Any such refinements are reflected in the subsequent materials, but the published material is unchanged.

SHEA CARR JEWELL Inc.

TECHNICAL MEMORANDUM

TO: LTSAAE Stakeholders

FROM: Perry Shea, P.E., Principal

DATE: February 29, 2008

REGARDING: Lacey Transportation Systems Analysis and Alternatives Evaluation – 2007 & 2030 Baseline Analysis
SC&J #0805.04

ENCLOSURES: Traffic Volume Calculation Worksheets

I. Introduction and purpose

The City of Lacey is in the process of preparing the *Lacey Transportation Systems Analysis and Alternatives Evaluation (LTSAAE)* that will involve a detailed evaluation of the arterial and highway network and future traffic demand in the north Lacey area. This Technical Memorandum identifies and describes the existing roadway and intersection operations at all key locations within the study area. Predicted conditions for the "baseline" 2030 horizon have also been prepared to determine which facilities may require improvements to accommodate future traffic loading.

This study is being conducted in accordance with the guidelines and methodologies outlined in the *Assumptions Document for Traffic Operations & Model Forecasting Methodology.* Subsequent analysis will include screening various improvement strategies to identify a preferred program of roadway and intersection improvements.

This information has been prepared for Stakeholder review in advance of the LTSAAE meeting on March 4, 2008.

II. Traffic Volume Projections

Existing AM and PM turning movement counts were collected for the study intersections over 2006 and 2007. The average 2006 AM and PM mid-week peak hour traffic volumes on the I-5 mainline were provided by WSDOT Traffic Data Office for ADC R060 (permanent traffic recorder located between Marvin Road and Martin Way.) Counts collected in 2006 were increased by 4% to represent 2007 base year conditions. These traffic volume counts were used for the existing year analysis and as the basis for preparing the 2030 traffic volume projections.

The traffic volume projections used in this analysis were prepared using the regional Emme/2 transportation demand model. The model, prepared by Thurston Regional Planning Council (TRPC), has been most recently calibrated to represent 2005 traffic conditions. The base year model has subsequently been updated by TRPC to represent a 2007 (end of 2006) horizon by adding new households and employment in the area to the 2005 land-use.

Model Enhancements

TRPC has prepared a 2030 model scenario that includes the regionally adopted household and employment projections for the region. The 2030 scenario also includes all roadway improvements identified in the current Thurston County Regional Transportation Plan (RTP). For this analysis, the 2030 model has been enhanced to include additional detail specific to the Lacey area. The enhancements primarily involve the addition of traffic analysis zones in the Hawks Prairie Business District (located generally between I-5 and Britton Parkway, and Marvin Road and Carpenter Road – also known as the "Lacey Gateway Towncenter"). Also, additional household and employment have been added in areas where specific development proposals exceed the 2030 land-use projections built into the current TRPC model.

Model Network Modifications

As noted, the 2030 TRPC model includes all regional roadway and intersection improvements in the current adopted RTP. This applies to the areas outside of the LTSAAE study. Within the study area only the following improvements have been included in the 2030 "baseline" roadway network:

- Widening Carpenter Road from 2 to 4 lanes – Britton Parkway to Pacific Avenue
- Constructing College Street Extension (1 lane each direction) from 6th Ave NE to 15th Ave NE
- Constructing Interim Martin Way Interchange improvements. This project involves widening Martin Way at the I-5 ramp terminals to increase left-turn storage for the high left-turn operation onto the on-ramps.
- Widening Britton Parkway from 2 to 4 lanes – Marvin Road to Carpenter Road
- Constructing roadway grid in Hawks Prairie Business District. Basic network will include:
    - A new east-west roadway (Main Street) connecting Marvin Road and Carpenter Road between I-5 and Britton Parkway
    - Three new north-south roadways connecting Main Street and Britton Parkway
- Construction of Phase 2 of the Marvin Road Interchange, a Single Point Urban Interchange

In addition to the localized surface street improvements, the travel forecasts will be developed assuming an additional capacity lane on I-5 is in place between Nisqually and Sleater-Kinney. Because the local and highway system will be constrained by the 2030 forecast, travel demand flow and trip assignments will be significantly altered from normal driver tendencies. The additional capacity lanes on I-5 through

the study area will allow the traffic model to distribute regional and local traffic in a more predictable manner. Therefore, the additional capacity lanes provide a means to assess the sensitivity of this improvement and to define a more realistic travel forecast and future-year model volumes. This process and baseline assumption was presented at previous stakeholder meetings and endorsed by the committee for analysis purposes.

Model Post-Processing

While the model is calibrated to replicate existing travel patterns, traffic volumes on individual roadways may vary somewhat from existing traffic counts. To account for this variance, the transportation model traffic volume assignments were "post-processed" to align them with existing "ground counts." Specifically, the traffic volume growth predicted by the transportation model was added to the actual 2007 traffic volumes to prepare the 2030 AM and PM peak hour traffic volumes used in the analysis. The Traffic Volume Projection worksheets are provided as an attachment.

III. Operational Analysis Methodology

The acknowledged source for determining overall capacity for roadways and intersections is the current edition of the Highway Capacity Manual (HCM). Signalized and stop-sign controlled intersection analysis was performed using the Synchro software package. The software provides an analysis based on the methods of the 2000 Highway Capacity Manual. The Sidra software methodology was used to analyze the operation of the modern roundabouts.

Queuing was evaluated using the Simtraffic microsimulation program. A total of three simulations were run for each scenario. The 95th percentile queue results were averaged for each group of simulations.

Intersections were analyzed for existing and 2030 baseline conditions. As defined in this study, the 2030 baseline roadway and intersection conditions reflect the intersection and roadway improvements described in the previous section, including the Interstate 5 mainline widening.

Level of Service calculations for intersections determine the amount of "control delay" (in seconds) that drivers will experience while proceeding through an intersection. Control delay includes all deceleration delay, stopped delay and acceleration delay caused by the traffic control device. The Level of Service is directly related to the amount of delay experienced.

For intersections under minor street stop sign control, the LOS of the most difficult movement (typically the minor street left-turn) represents the intersection Level of Service. **Table 1** below shows the Level of Service criteria for unsignalized intersections.

Table 1. Level of Service Criteria for Stop Sign-Controlled Intersections

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

The *Highway Capacity Manual* (*HCM*) also presents capacity analysis results in terms of LOS for signalized intersections. The *HCM* bases the LOS criteria in terms of overall average delay a vehicle may experience at the intersection during the analysis period. Intersections under modern roundabout control are also assessed based on overall intersection delay. LOS delay criteria for signalized and modern roundabout-controlled intersections are shown in **Table 2** below.

Table 2. Level of Service Criteria for Signalized and Modern Roundabout Intersections

Level of Service	Average Control Delay (seconds/vehicle)
A	≤ 10
B	> 10 – 20
C	> 20 – 35
D	> 35 – 55
E	> 55 – 80
F	> 80

IV. Intersection Analysis Results

The existing 2007 and projected 2030 intersection analysis results are presented in the following sections. The operational analysis includes interaction between all major roadways and intersections within the study area. However, for presentation purposes the study area has been broken into five groups representing the influence areas of Interstate 5 interchanges and main north-south corridors.

Following is a brief description of the existing and predicted operation of the intersections within each of the five intersection groupings. The intersection control type for each location is noted on the Level of Service summary tables. Intersection analysis worksheets and Simtraffic queue evaluation summaries will be provided at the TSAAE stakeholder meeting on March 4.

Sleater-Kinney Road – College Street Corridors

This area includes the Sleater-Kinney Road interchange (Exit 108) and Martin Way interchange (Exit 109). It also includes the Martin Way/College Street intersection which is one of the busiest intersections in Thurston County. Currently the following are notable congestion points within the area:

- The Sleater-Kinney Road/Martin Way intersection operates near capacity during the evening peak hour
- The southbound I-5 on-ramp from Sleater Kinney Road occasionally backs up to 6th Avenue SE during the evening peak hour
- The Martin Way/College Street intersection and Martin Way interchange ramp junctions generate queues that impact upstream intersections. Eastbound and westbound left-turn queues on Martin Way between the ramp terminals frequently exceed the available storage capacity
- Eastbound queuing on Martin Way at College Street occasionally extends to the upstream traffic signal at Kasey Keller Drive
- Queuing on the SB off-ramp occasionally backs to the Interstate 5 mainline

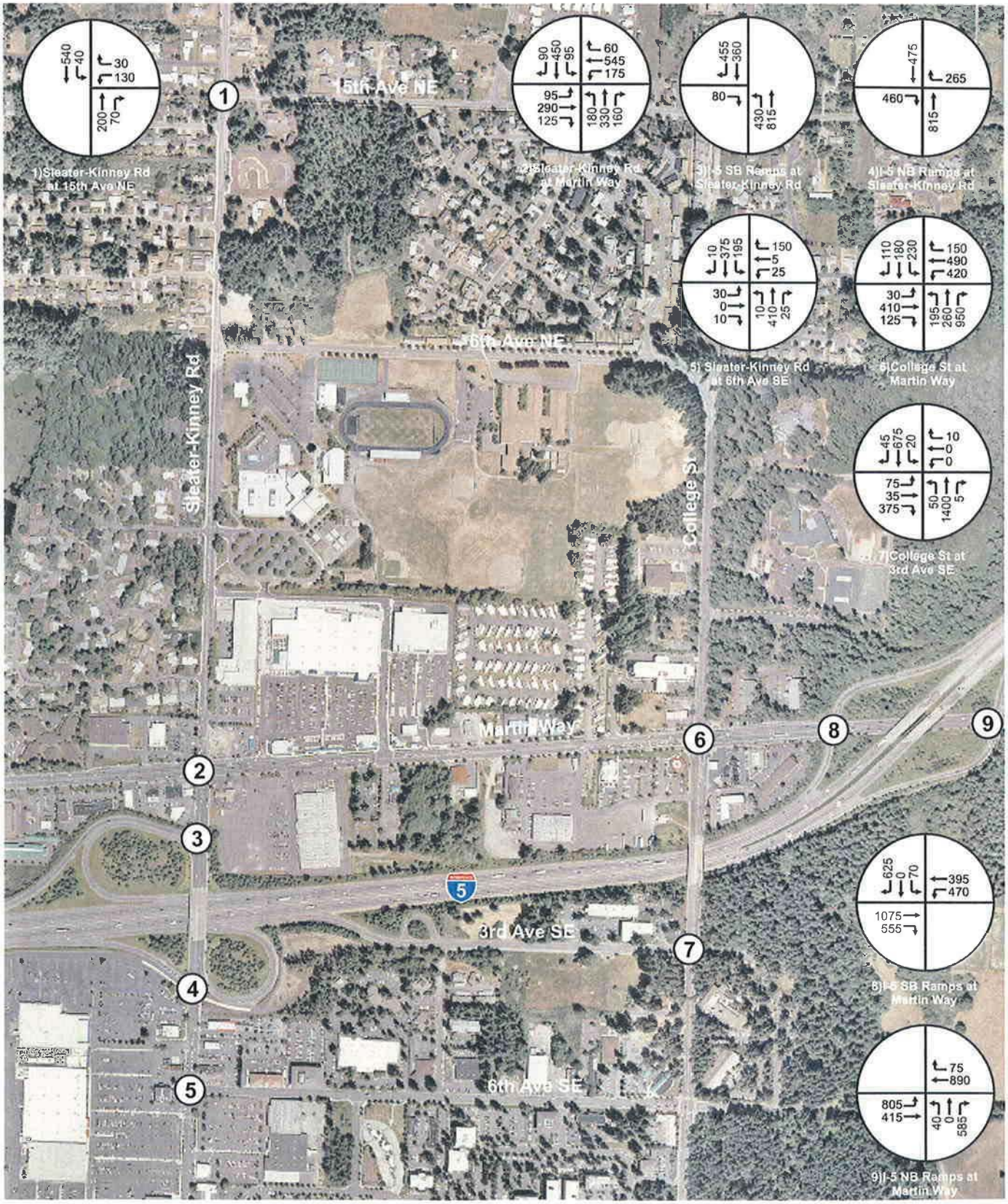
The 2030 analysis includes the extension of College Street to 15th Avenue NE creating a new 'tee' intersection. The analysis also includes additional left-turn lane capacity on Martin Way at the NB and SB ramp terminals.

With the increase in traffic expected by the 2030 horizon, the operation of the Martin Way interchange and Martin Way/Sleater Kinney Road intersection degrade to the point that it affects the flow of most of the other intersections within the area.

Table 3 Level of Service Summary - Sleater Kinney Road/College Street Corridors

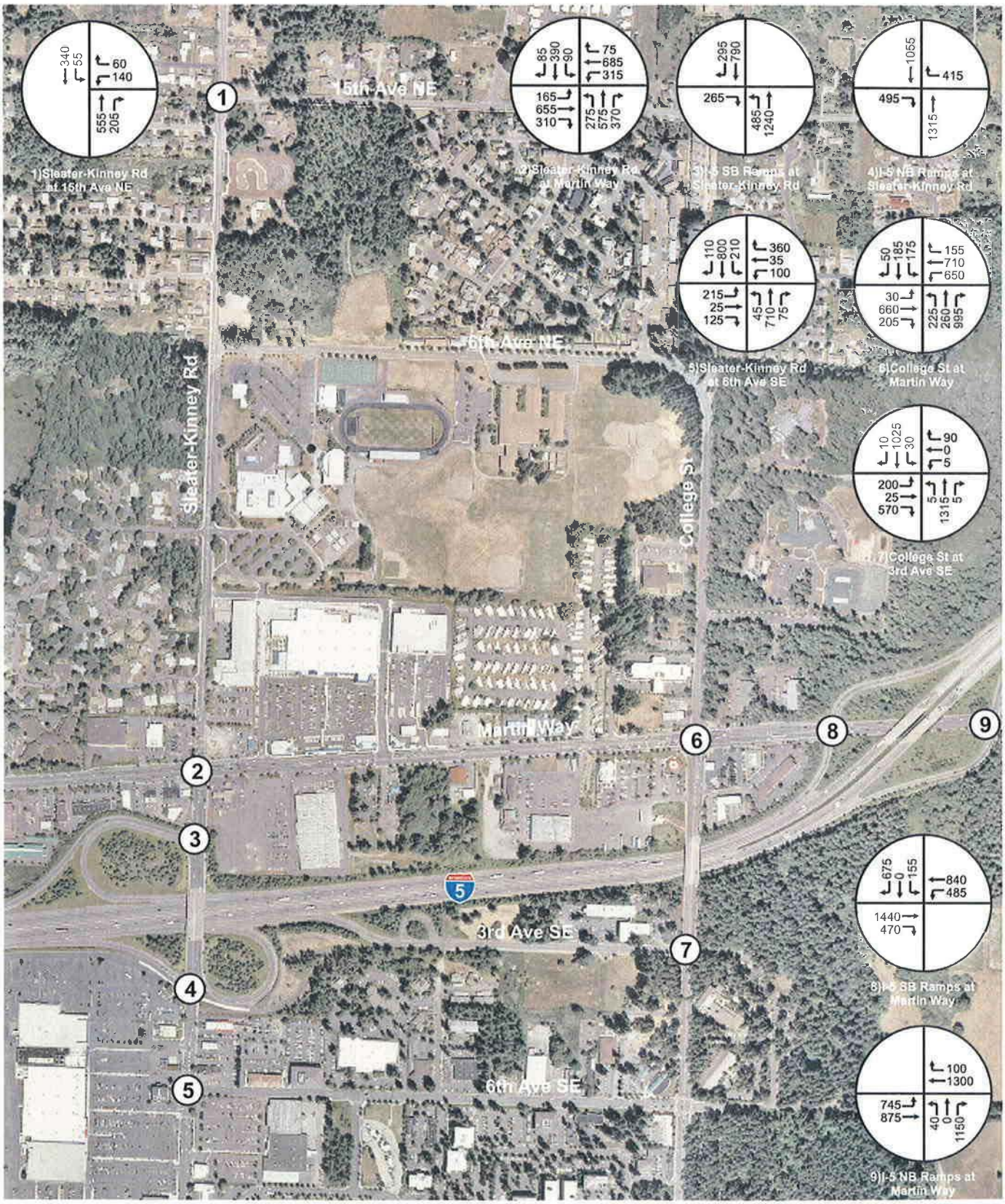
Intersection	Control Type	Existing AM Peak Hour		2030 Baseline AM Peak Hour		Existing PM Peak Hour		2030 Baseline PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Sleater-Kinney Rd at 15th Ave	Stop	E	46.2	B	12.9	F	85.6	F	660.5
Sleater-Kinney Rd at Martin Way	Signal	D	49.1	F	83.4	E	59.9	F	124.1
I-5 SB Ramps at Sleater-Kinney Rd	Stop	A	9.7	B	11.7	C	16.2	D	28.2
I-5 NB Ramps at Sleater-Kinney Rd	Stop	D	31.4	D	31.3	F	138.4	D	32.5
Sleater-Kinney Rd at 6th Ave SE	Signal	C	27.5	F	191.6	D	50.1	E	60.9
College St at Martin Way	Signal	D	37.3	F	86.4	C	27.6	F	83.8
College St at 3rd Ave SE	Signal	B	16.5	C	20.4	D	42.3	C	34.7
I-5 SB Ramps at Martin Way	Signal	C	30.3	F	89.0*	D	41.6	F	112.3*
I-5 NB Ramps at Martin Way	Signal	D	47.9	B	16.4*	C	27.0	C	30.7*
15th Ave/College St (new intersection)	Stop	N/A		F	>999	N/A		F	>999

* Includes adding EB and WB left-turn lane storage on Martin Way for traffic entering the freeway



Sleater-Kinney Road and College Street Corridors
Intersection AM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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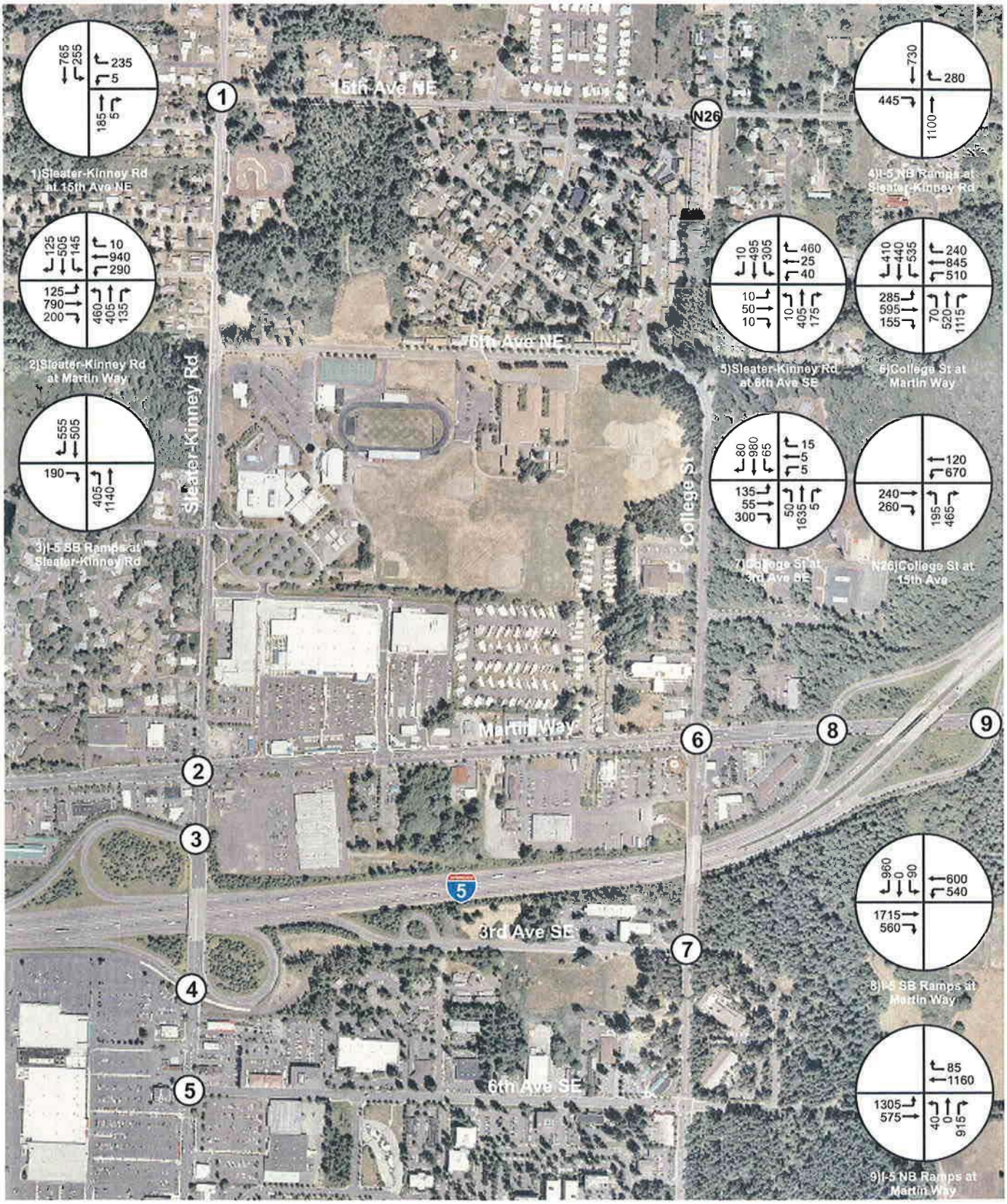
Sleater-Kinney Road and College Street Corridors
Intersection PM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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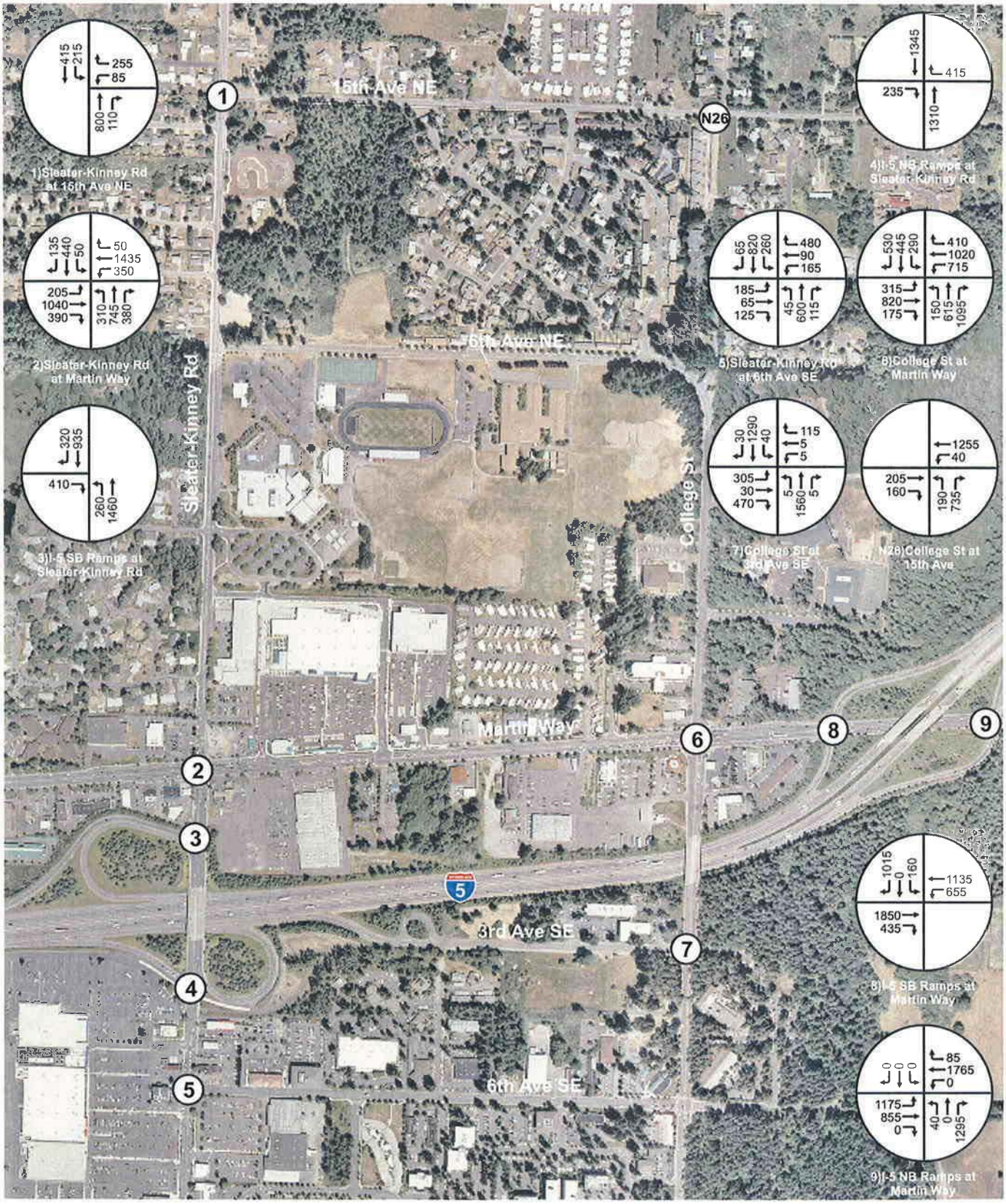
Sleater-Kinney Road and College Street Corridors
Intersection AM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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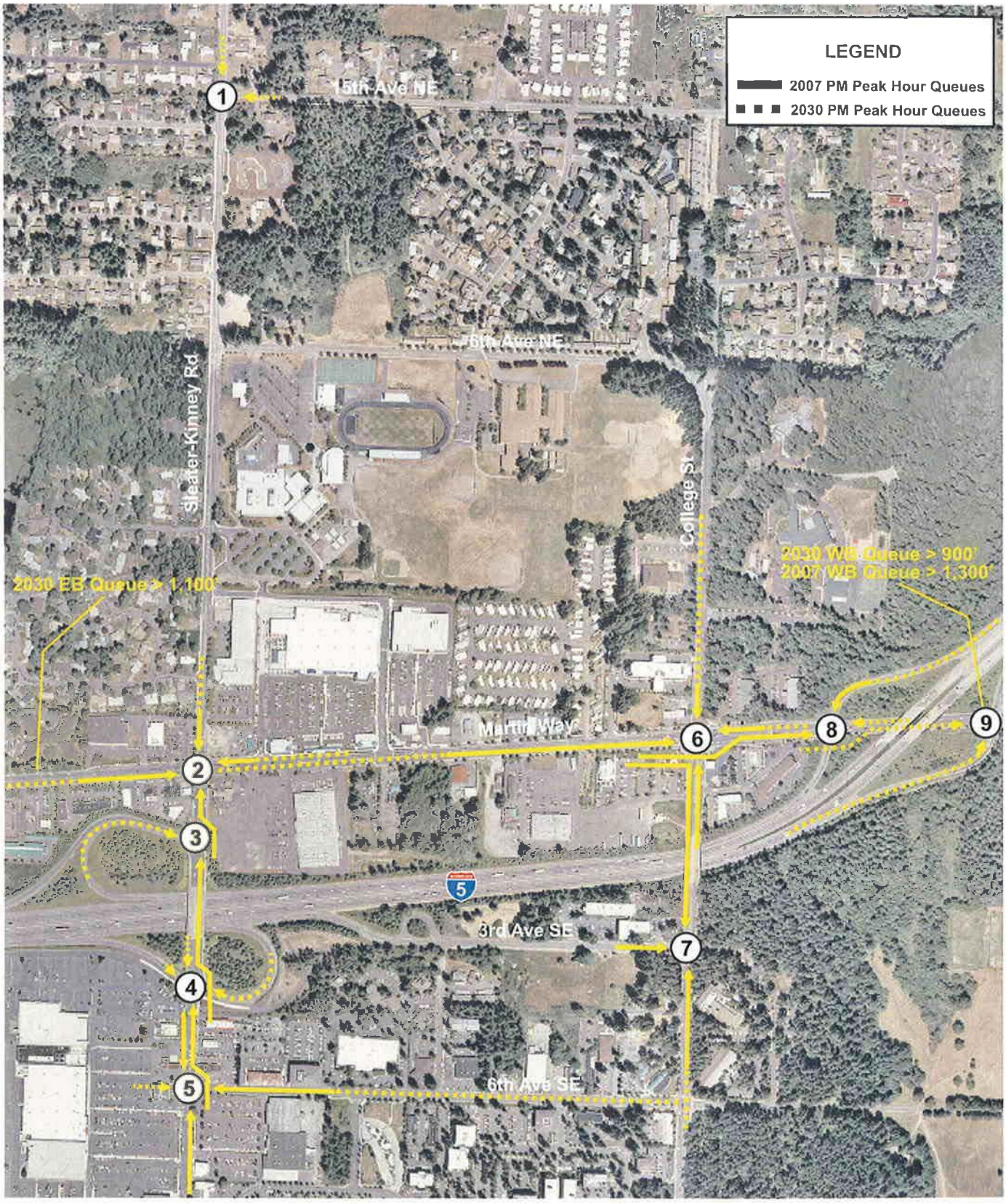
Sleater-Kinney Road and College Street Corridors
Intersection PM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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Sleater-Kinney Road and College Street Corridors
Road Segments Significantly Impacted
By PM Peak Hour Queuing

Transportation Systems Analysis and Alternatives Evaluation

Carpenter Road Corridor

This area includes the study intersections along Carpenter Road between Martin Way and Britton Parkway. Under current conditions, each intersection operates acceptably during the morning and evening peak hours.

In the 2030 scenario Carpenter Road has been assumed to be widened to a 5-lane roadway between Pacific Avenue (south of the study area) to Britton Parkway. Also Britton Parkway has been widened to 2 lanes in each direction.

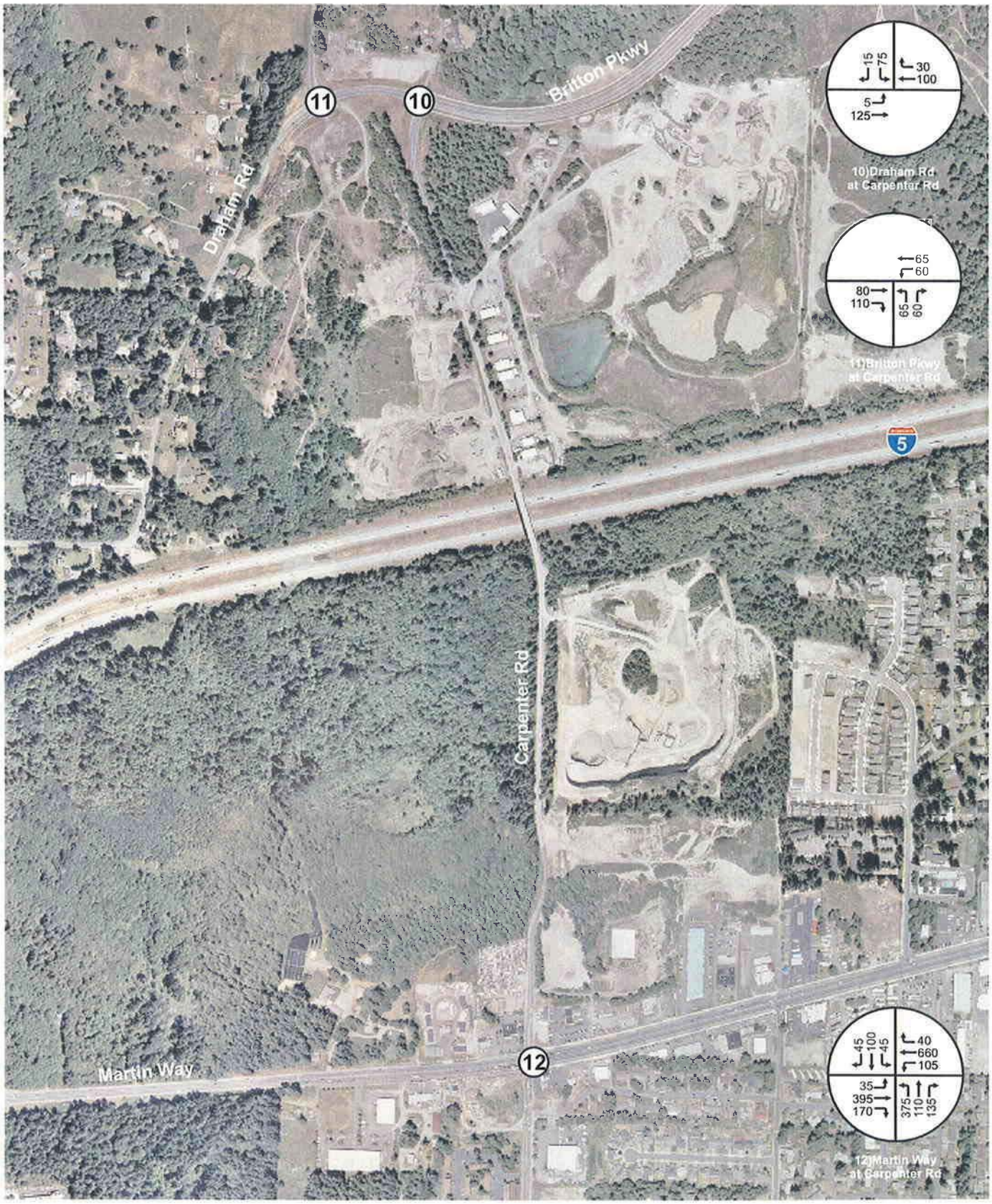
The Martin Way/Carpenter Road intersection reflects planned improvements that involve implementing dual left-turn lane operation for eastbound and westbound movements on Martin Way. The project also includes widening the northbound and southbound approaches of Carpenter Road to include two through lanes and exclusive left-turn lanes.

In the 2030 horizon significant traffic growth is anticipated for Carpenter Road between Martin Way and Britton Parkway. Evening PM peak hour flows are projected to increase from 430 vph (total both directions) to 3,640 vph. Much of the new traffic will use the new Main Street/Carpenter Road intersection to access the Lacey Gateway Towncenter area.

The increased traffic loadings will result in a poor LOS and operation at the Martin Way/Carpenter Road intersection in both the AM and PM peak hours. Eastbound queuing at this intersection would occasionally extend several thousand feet toward the Martin Way interchange. In addition the increase in traffic will result in the need for intersection upgrades at Britton Parkway/Carpenter Road and Draham Rd/Carpenter Road intersections.

Table 4. Level of Service Summary – Carpenter Road Corridor

Intersection	Control Type	Existing AM Peak Hour		2030 Baseline AM Peak Hour		Existing PM Peak Hour		2030 Baseline PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Carpenter Rd at Draham Rd	Stop	B	11.0	F	724.8	B	13.0	F	>999
Carpenter Rd at Britton Pkwy	Stop	B	10.9	F	>999	B	13.0	F	>999
Carpenter Rd at Martin Way	Signal	C	33.0	F	144.0	D	38.2	F	111.0



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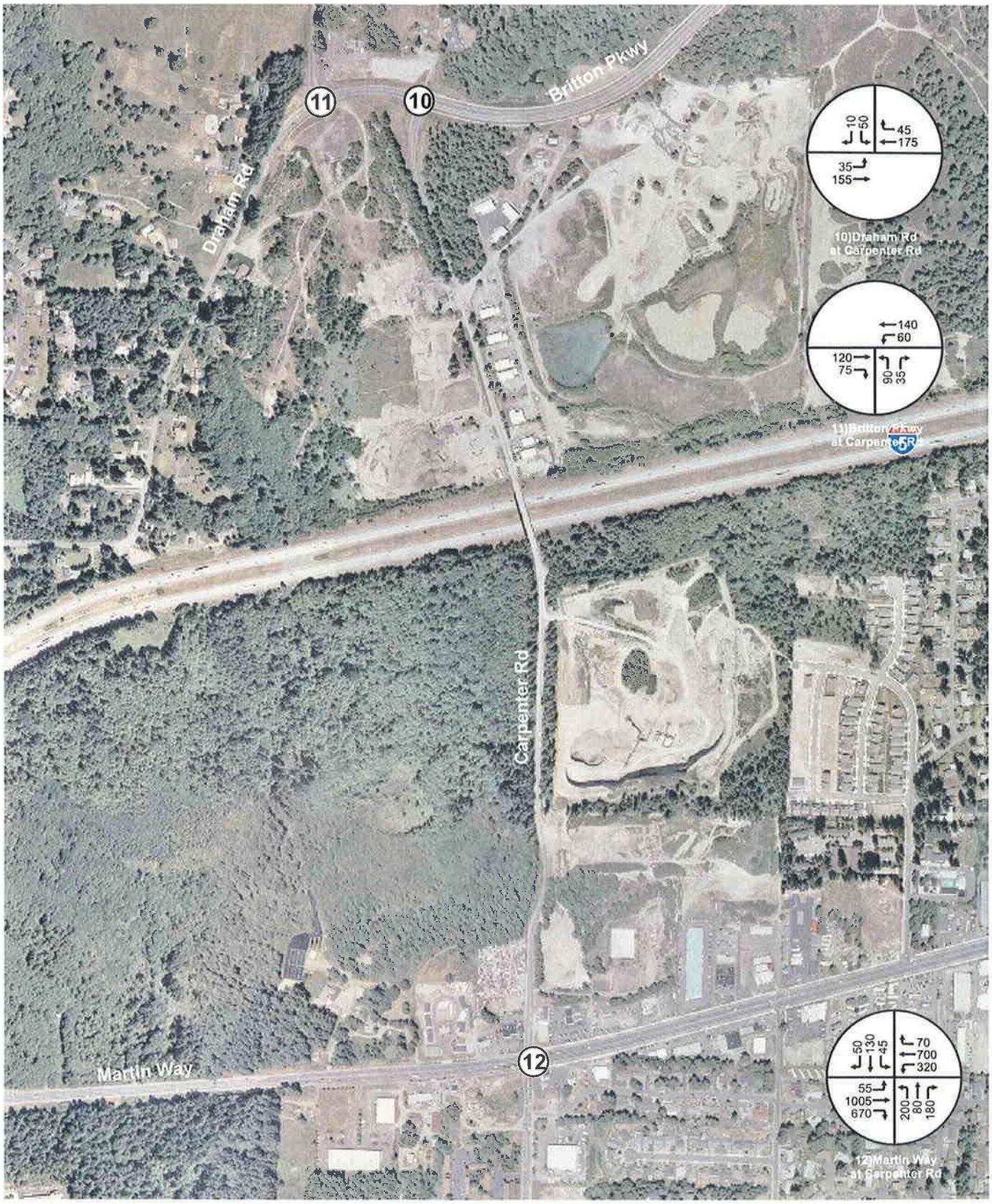
Carpenter Road Corridor
Intersection AM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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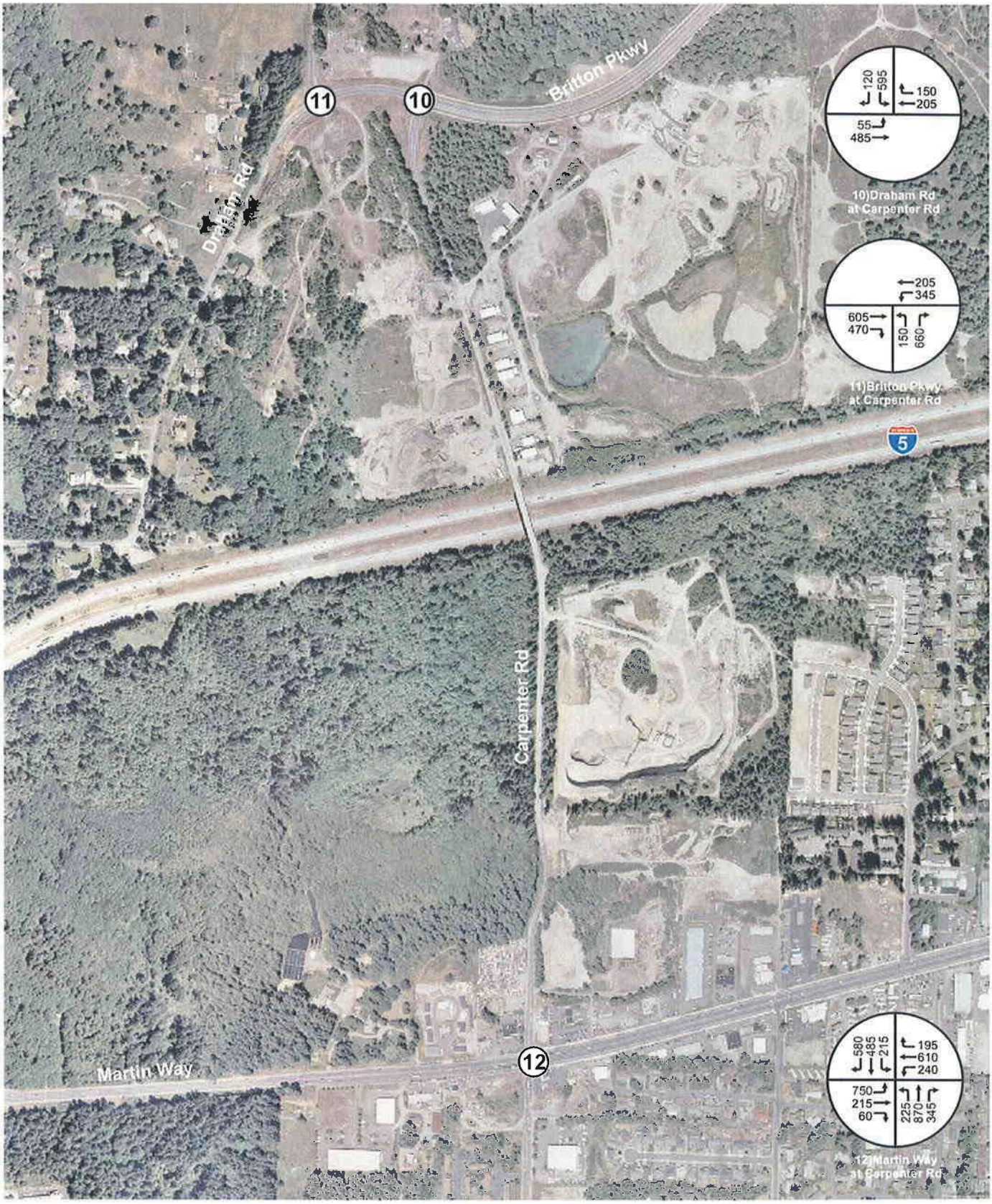
Carpenter Road Corridor
Intersection PM Peak Hour - 2007 Volumes

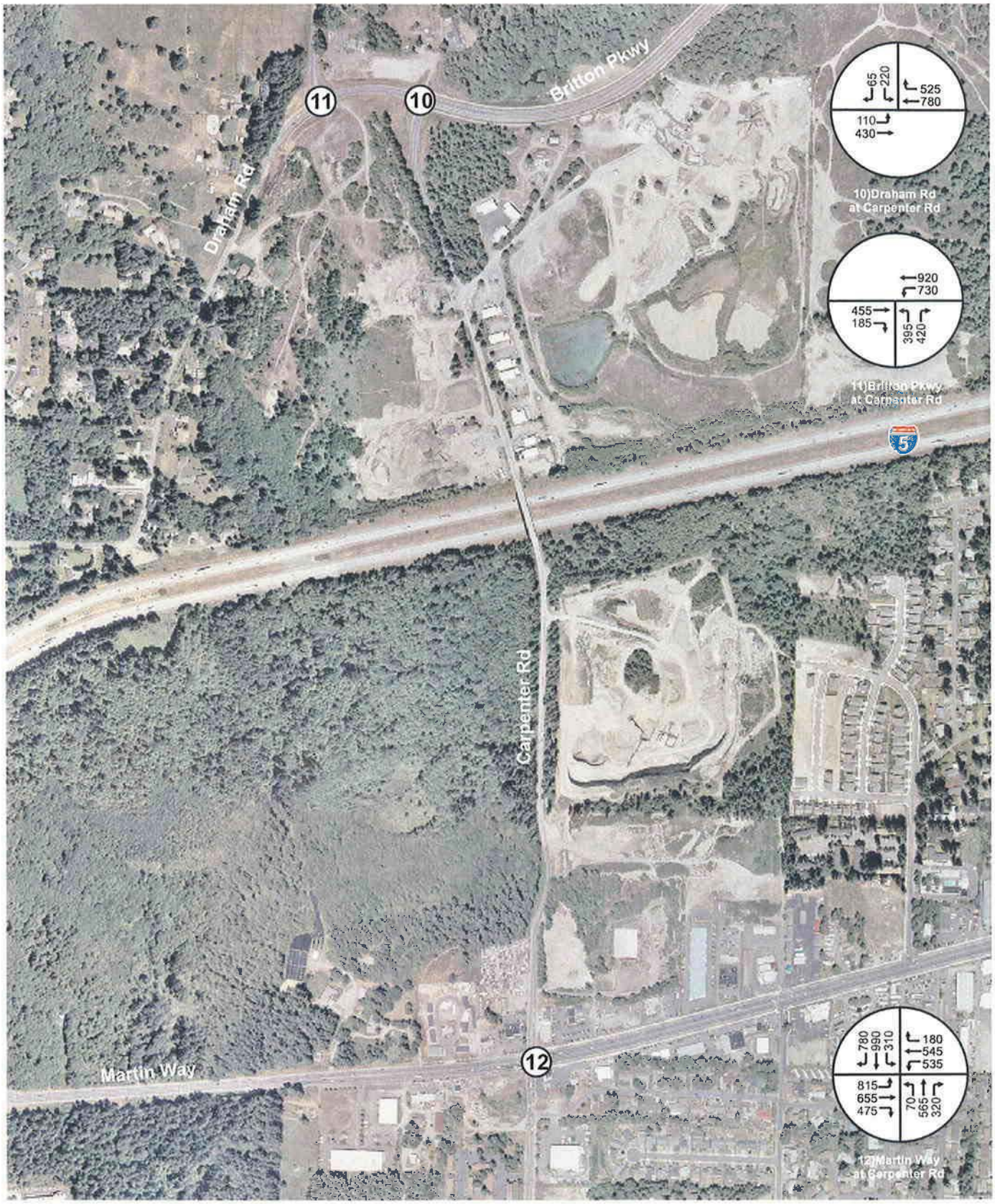
Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL INC.

Carpenter Road Corridor
Intersection AM Peak Hour - 2030 Volumes

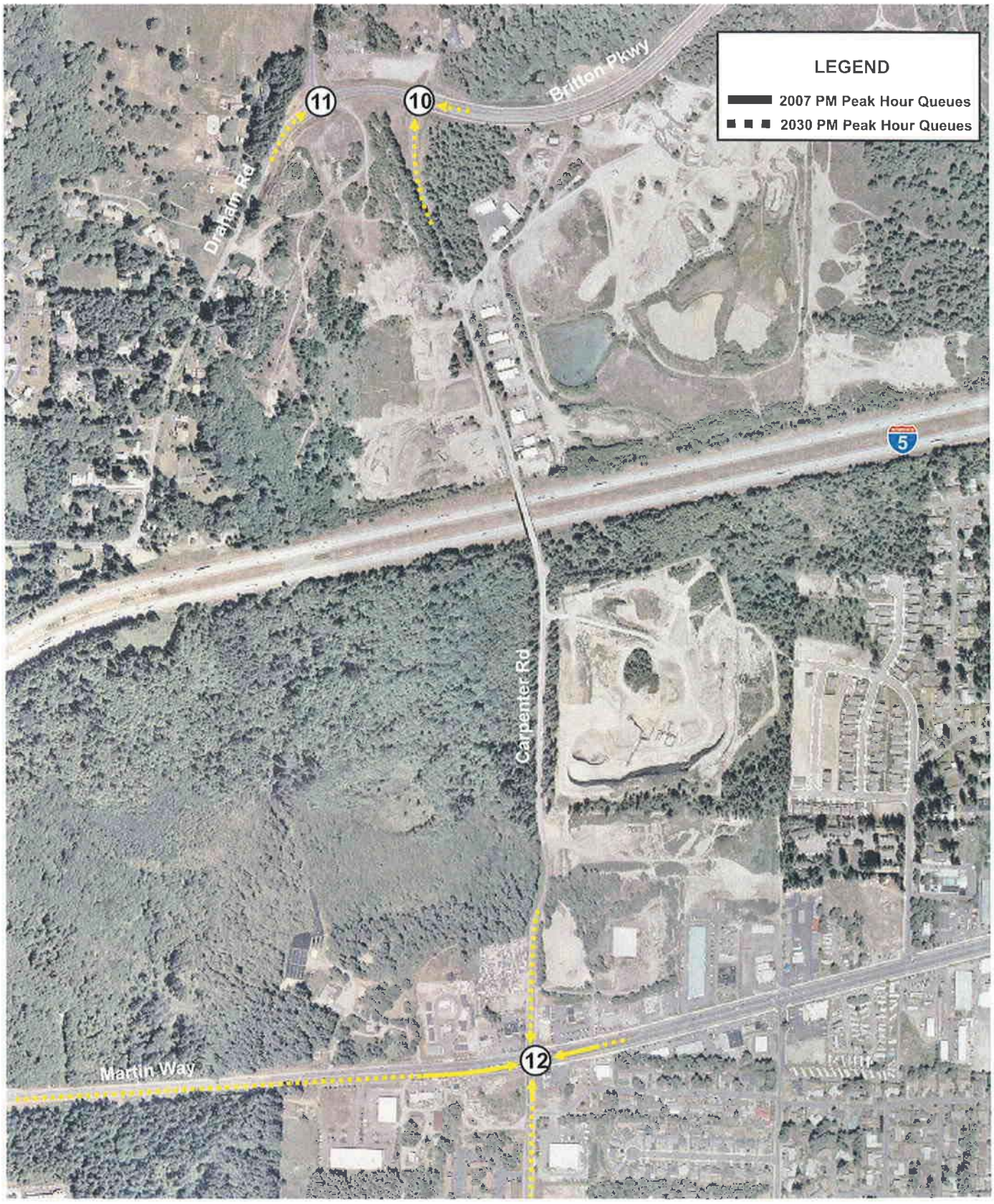
Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL

Carpenter Road Corridor
Intersection PM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL Inc.

Carpenter Road Corridor
Road Segments Significantly Impacted
By PM Peak Hour Queuing

Transportation Systems Analysis and Alternatives Evaluation

Marvin Road Corridor

This area includes the Marvin Road interchange (Exit 111) which serves as the main gateway into the Hawks Prairie area of North Lacey. Under current conditions, the intersections and roadways function acceptably during the morning and evening peak periods.

The 2030 analysis includes conversion of the Marvin Road interchange to a Single Point Urban Interchange. The 2030 scenario also includes the addition of the Main Street/Marvin Road intersection functioning as a three-leg Modern RAB with two circulating lanes.

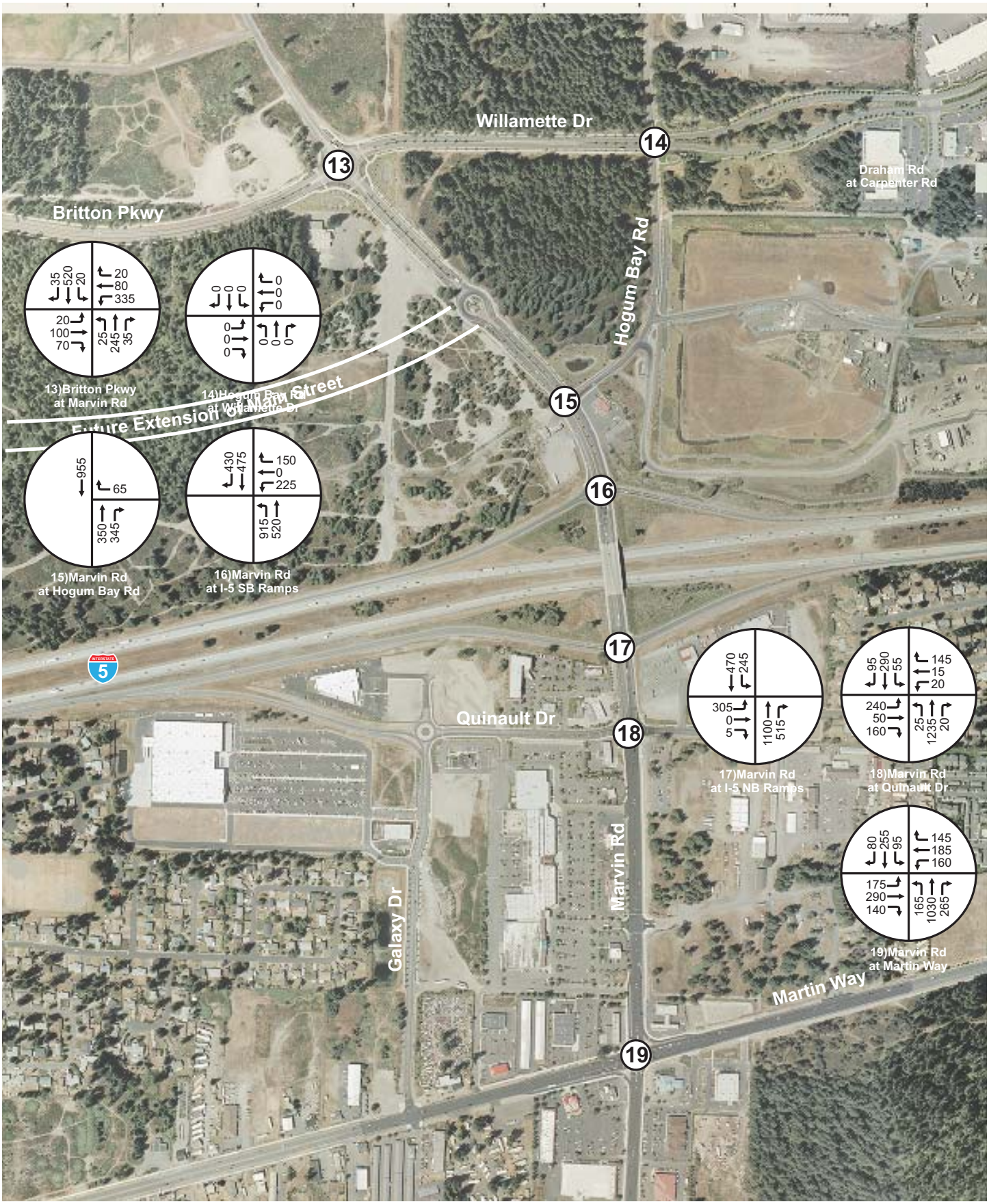
Traffic flows are predicted to increase significantly on the roadways north of Interstate 5 and at the Marvin Road interchange. Currently, between Interstate 5 and Hogum Bay Road, Marvin Road serves approximately 2,000 vehicles during the evening peak hour (total of NB and SB movements). For the 2030 scenario, that volume is projected to increase to 6,500 PM peak hour vehicles.

Based on the projected traffic flows, the Single Point Urban Interchange would not function acceptably during the morning or evening peak periods. Also, each of the signalized and modern RAB intersections would be over capacity along the Marvin Road corridor.

Table 5. Level of Service Summary – Marvin Road Corridor

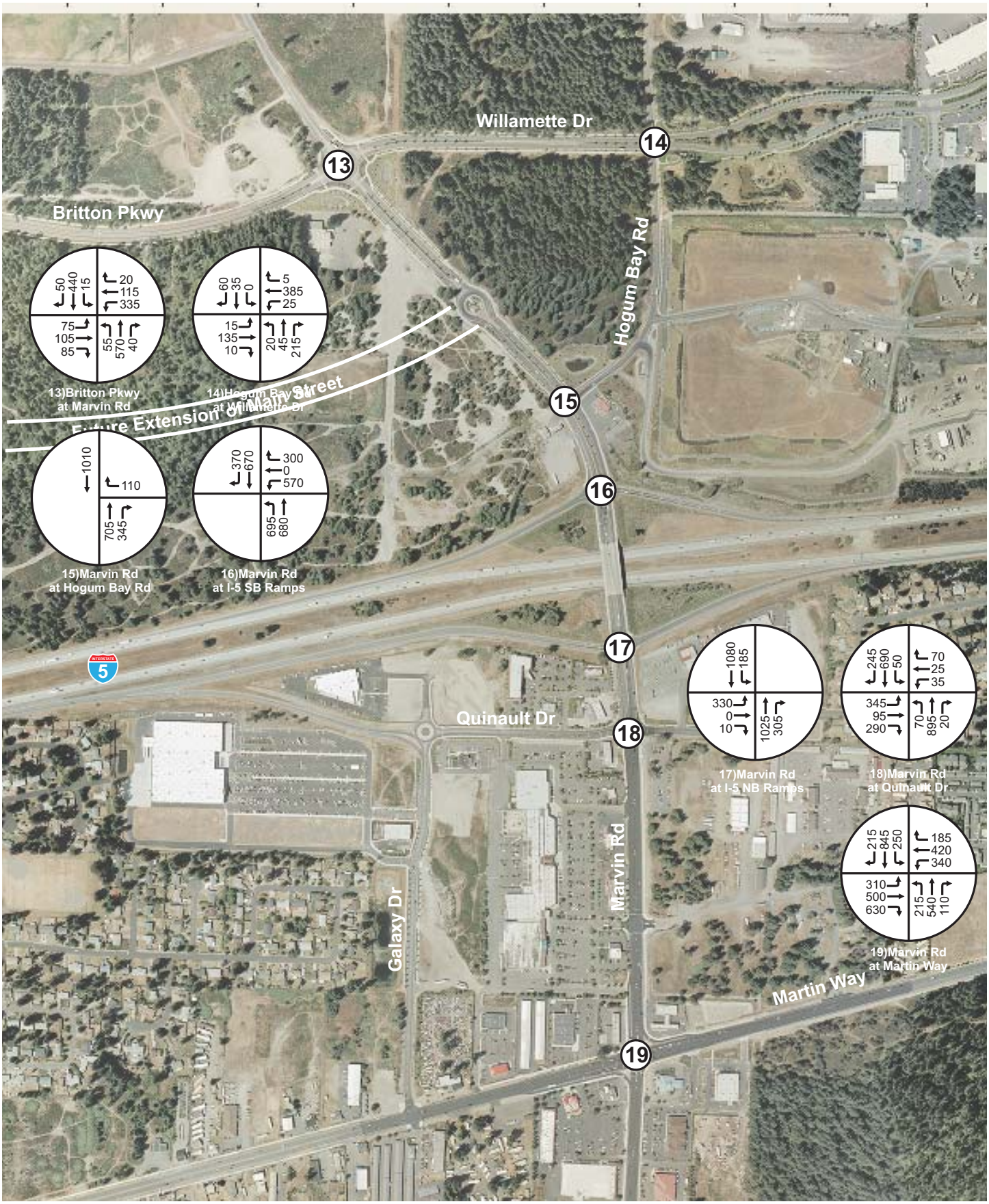
Intersection	Control Type	Existing AM Peak Hour		2030 Baseline AM Peak Hour		Existing PM Peak Hour		2030 Baseline PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Marvin Rd at Britton Pkwy	Modern RAB	A	8.6	F	167.6	A	9.1	F	192.8
Willamette Dr at Hogum Bay Rd	Stop	Turning movement counts pending				C	16.1	F	>999
Marvin Rd at Hogum Bay Rd	Stop	B	11.4	D	34.0	B	11.7	F	53.5
I-5 SB Ramps at Marvin Rd	Signal	C	20.9	F*	80.5*	C	27.0	F*	103.4*
I-5 NB Ramps at Marvin Rd	Signal	B	14.5			B	15.7		
Marvin Rd at Quinault Dr	Signal	C	20.8	F	129.9	C	23.2	E	66.2
Marvin Rd at Martin Way	Signal	D	36.4	E	75.5	E	56.0	F	112.9
Marvin Rd at Main Street (new intersection)	Modern RAB	N/A				N/A			

* With conversion to Single Point Urban Interchange



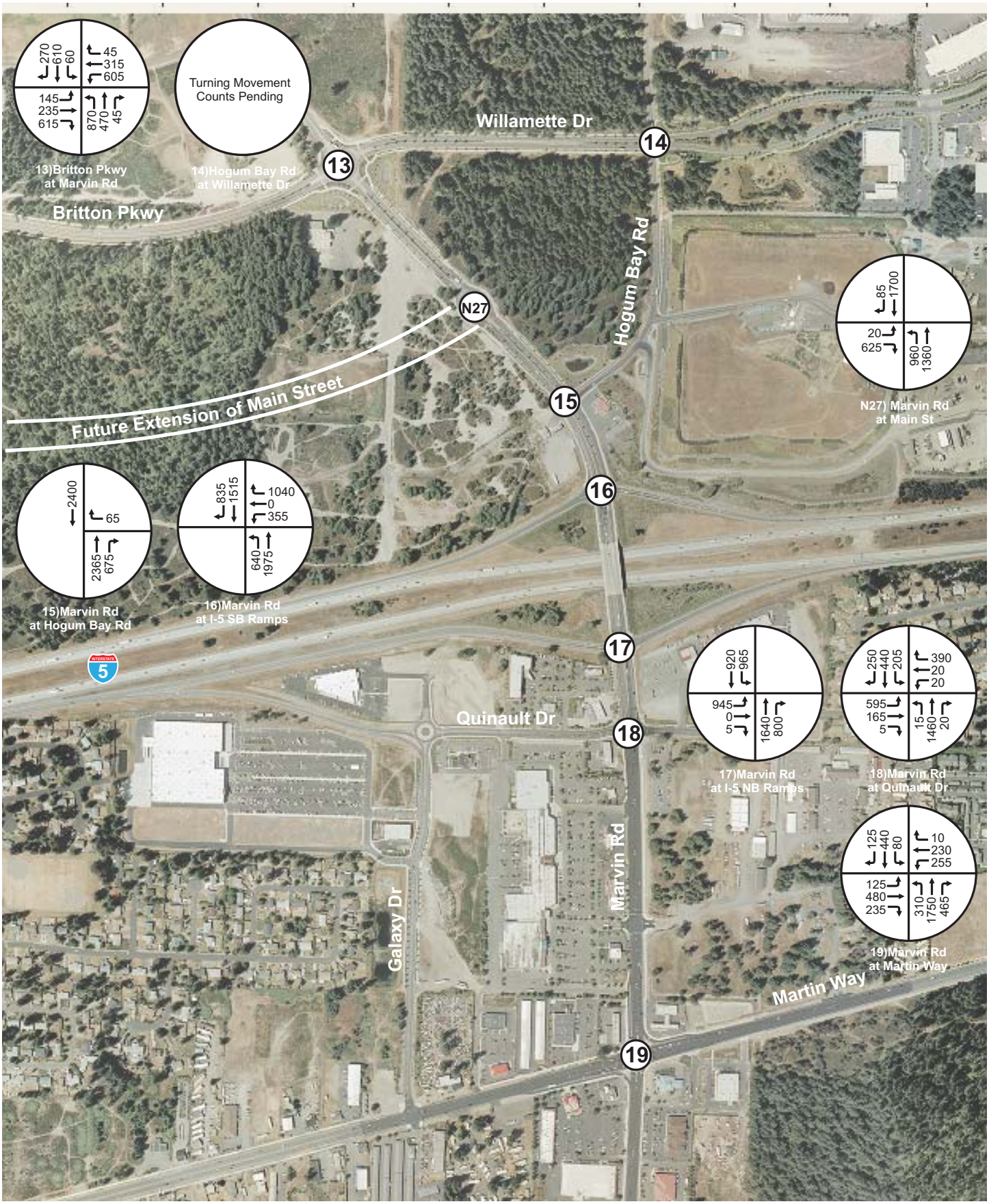
Marvin Road Corridor
Intersection AM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation



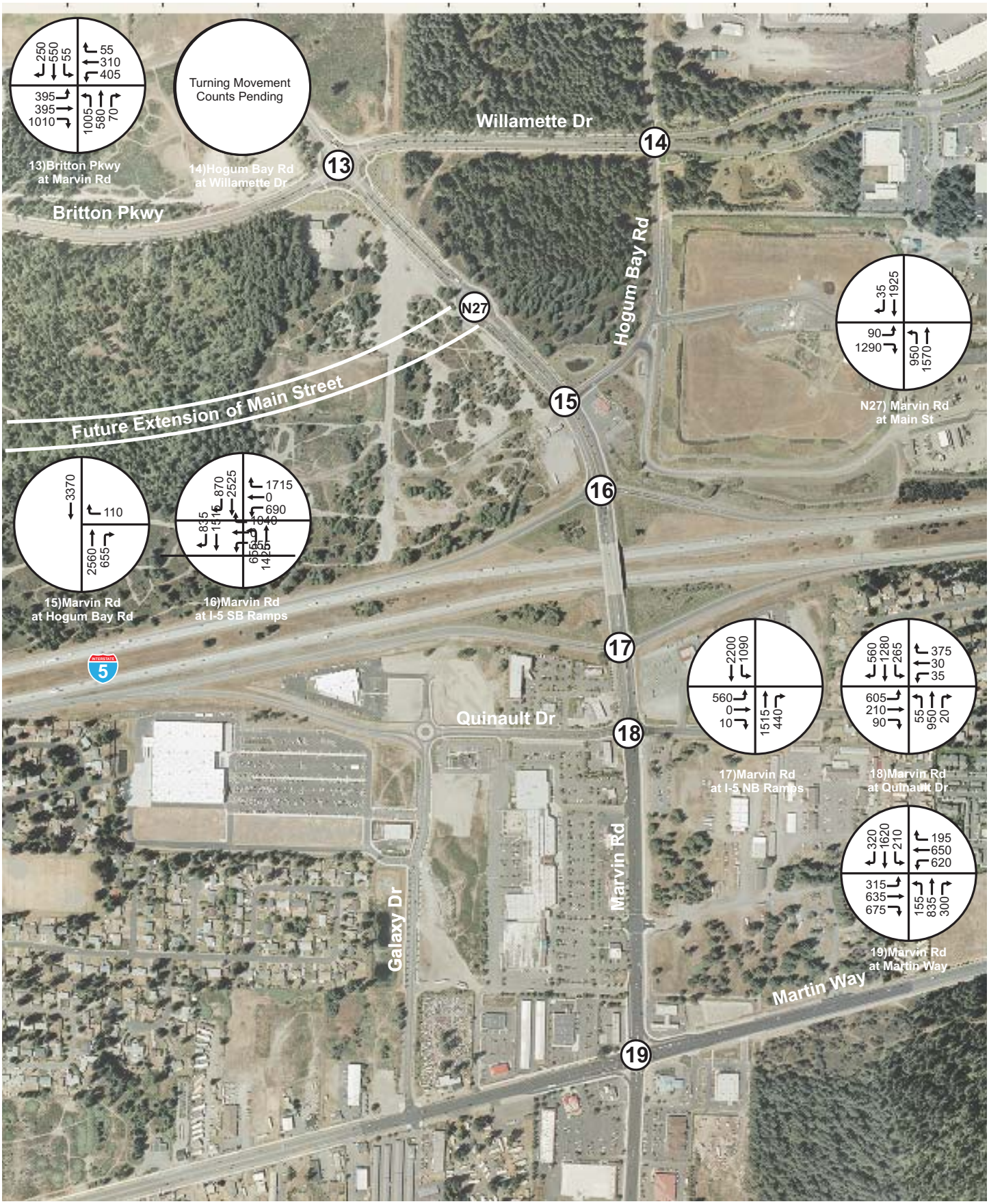
Marvin Road Corridor
Intersection PM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation



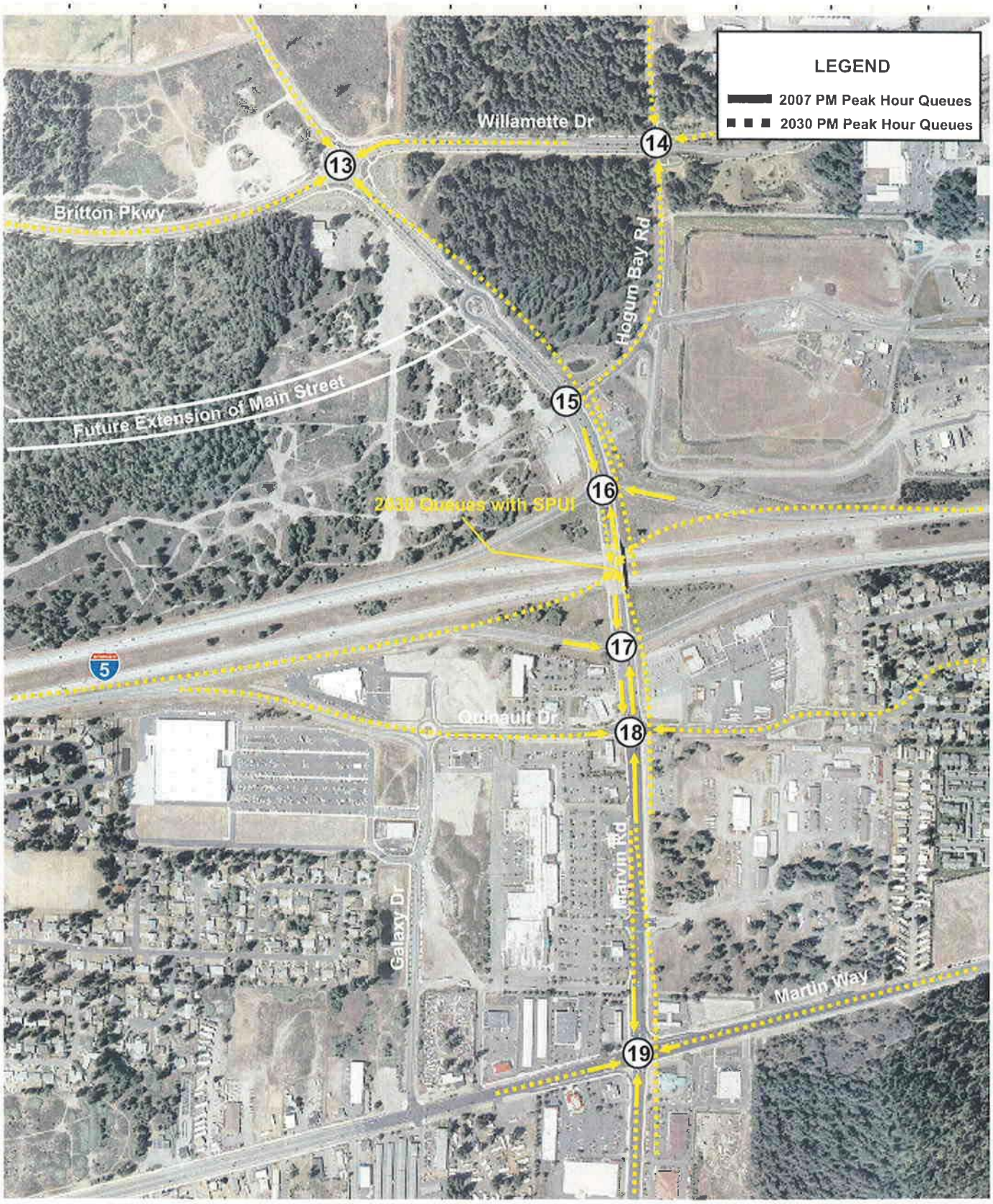
Marvin Road Corridor
Intersection AM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation



Marvin Road Corridor
Intersection PM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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Marvin Road Corridor
Road Segments Significantly Impacted
By PM Peak Hour Queuing

Transportation Systems Analysis and Alternatives Evaluation

Meridian Road Corridor

This area is based around the Orion Drive – Meridian Road route between Martin Way and Willamette Drive. This serves as a secondary outlet for traffic north of Interstate 5 within the Hawks Prairie area. Intersections along this corridor were recently included in the study and traffic data is incomplete at this time.

Table 6. Level of Service Summary – Meridian Road Corridor

Intersection	Control Type	Existing AM Peak Hour		2030 Baseline AM Peak Hour		Existing PM Peak Hour		2030 Baseline PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Willamette Dr at Orion Dr	Stop	Turning movement counts pending				B	13.1	F	244.1
Meridian Rd at Orion Dr	Modern RAB	Turning movement counts pending							
Meridian Rd at Martin Way	Signal	Turning movement counts pending				C	29.5	E	79.4

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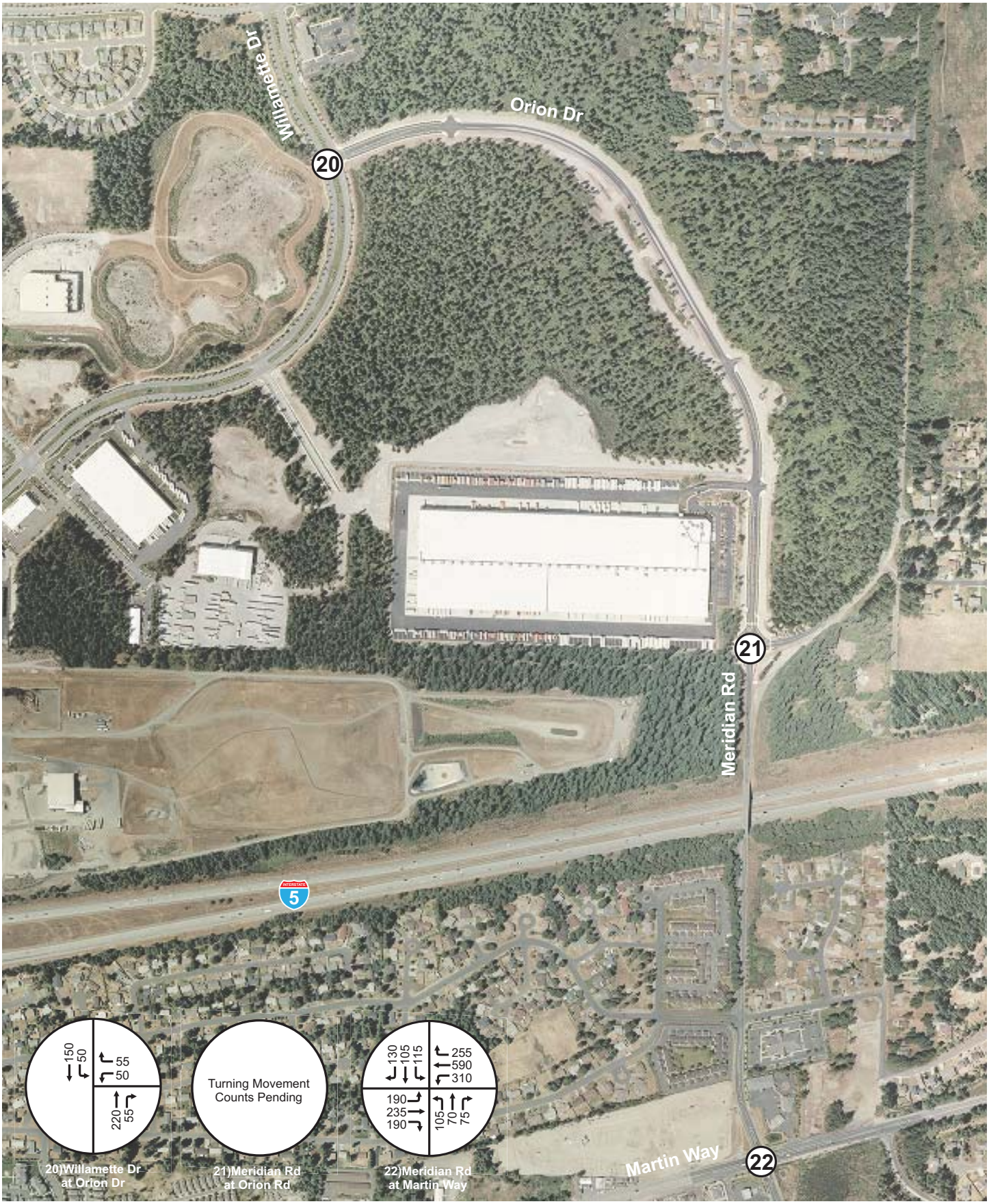
Meridian Road Corridor
Intersection AM Peak Hour Volumes - 2007

Transportation Systems Analysis and Alternatives Evaluation



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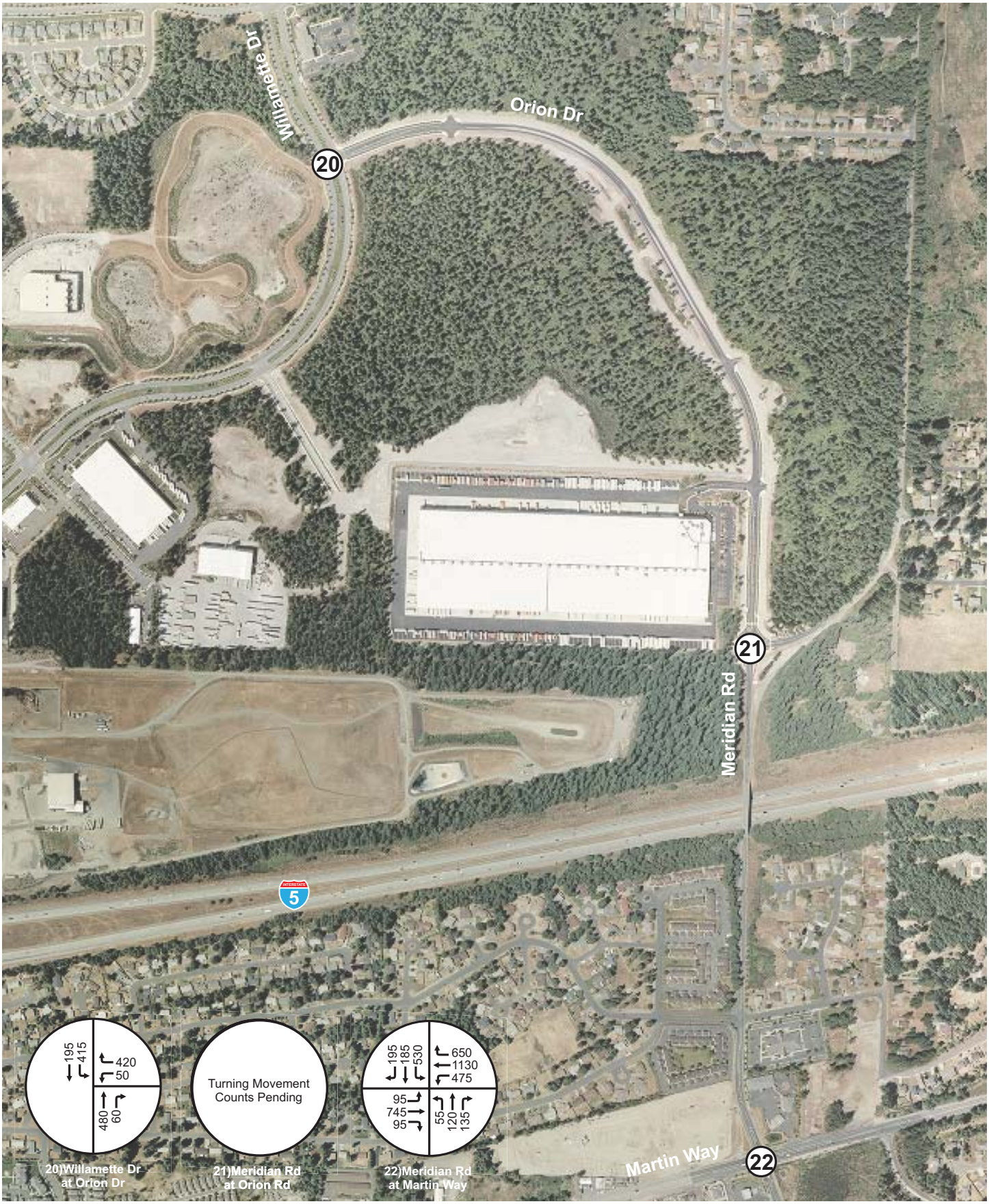
Meridian Road Corridor
Intersection PM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL Inc

Meridian Road Corridor
Intersection AM Peak Hour Volumes - 2030

Transportation Systems Analysis and Alternatives Evaluation



Meridian Road Corridor
Intersection PM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL Inc.

Meridian Road Corridor
Road Segments Significantly Impacted
By PM Peak Hour Queuing

Transportation Systems Analysis and Alternatives Evaluation

Nisqually Interchange

This area includes the Nisqually Interchange (Exit 114) at the eastern terminus of Martin Way. The intersections currently operate at acceptable levels during the AM and PM peak hours. Under the 2030 scenarios, the signalized intersection at the I-5 NB On Ramp/SB Off Ramp at Martin Way will degrade to a LOS F condition during both the AM and PM periods. This would be caused by the significant increase in traffic using the Interstate 5 ramps to/from the north.

Table 7. Level of Service Summary – Nisqually Interchange

Intersection	Control Type	Existing AM Peak Hour		2030 Baseline AM Peak Hour		Existing PM Peak Hour		2030 Baseline PM Peak Hour	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Nisqually Cut-Off Rd/I-5 SB On Ramp	Stop	A	n/a	A	n/a	A	n/a	A	n/a
Nisqually Cut-Off Rd/I-5 NB Off Ramp	Stop	A	8.8	A	8.9	A	9.4	A	9.1
I-5 NB On Ramp/SB Off Ramp at Nisqually Cut-Off Rd/Martin Way	Signal	C	23.8	F	216.9	D	39.1	F	199.2

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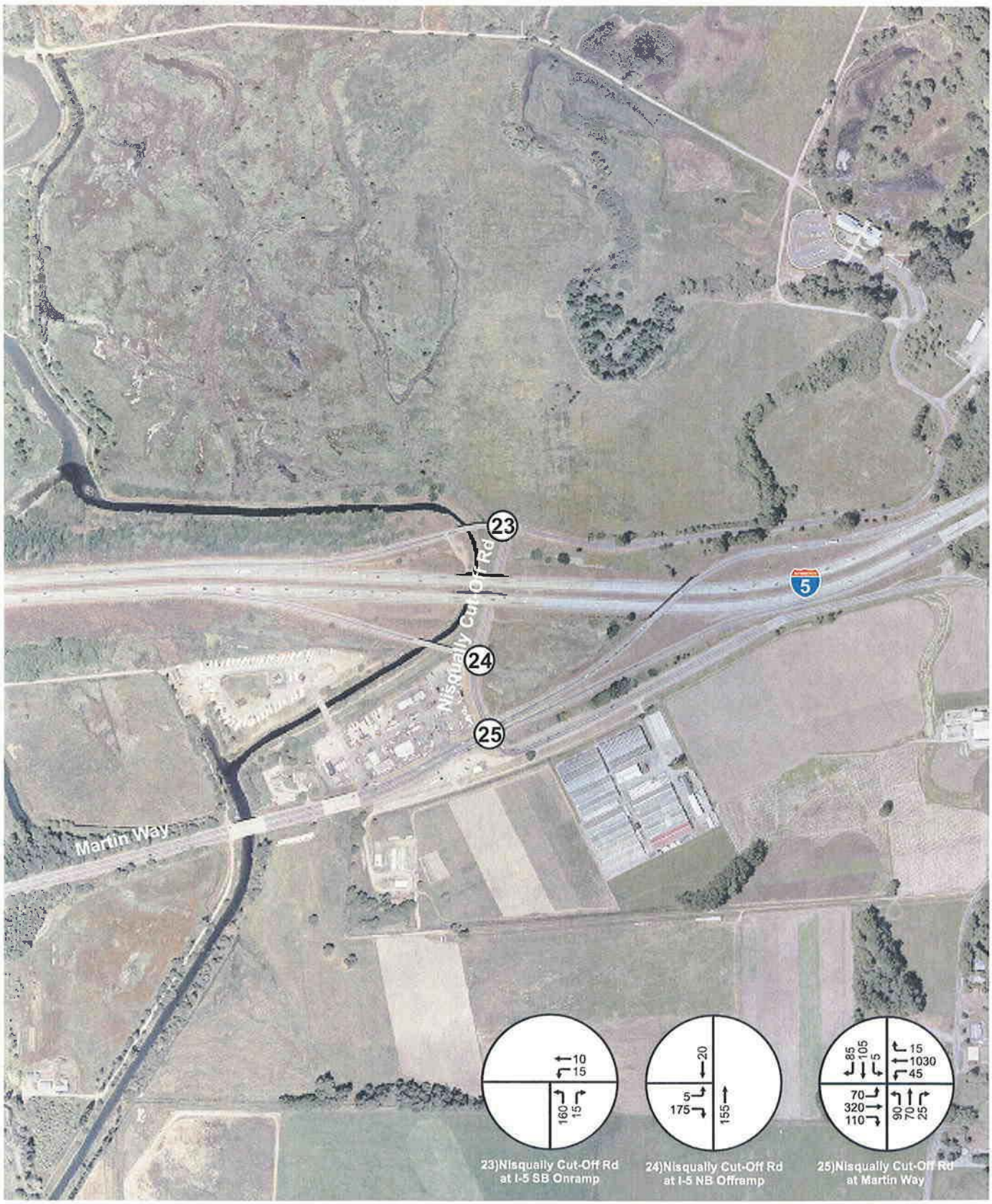
Nisqually Cut-Off Corridor
Intersection AM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation



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Nisqually Cut-Off Corridor
Intersection PM Peak Hour - 2007 Volumes

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL Inc.

Nisqually Cut-Off Corridor
Intersection AM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL Inc.

Nisqually Cut-Off Corridor
Intersection PM Peak Hour - 2030 Volumes

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL Inc.

Nisqually Cut-Off Corridor
Road Segments Significantly Impacted
By PM Peak Hour Queuing

Transportation Systems Analysis and Alternatives Evaluation

V. Freeway mainline and ramp analysis results

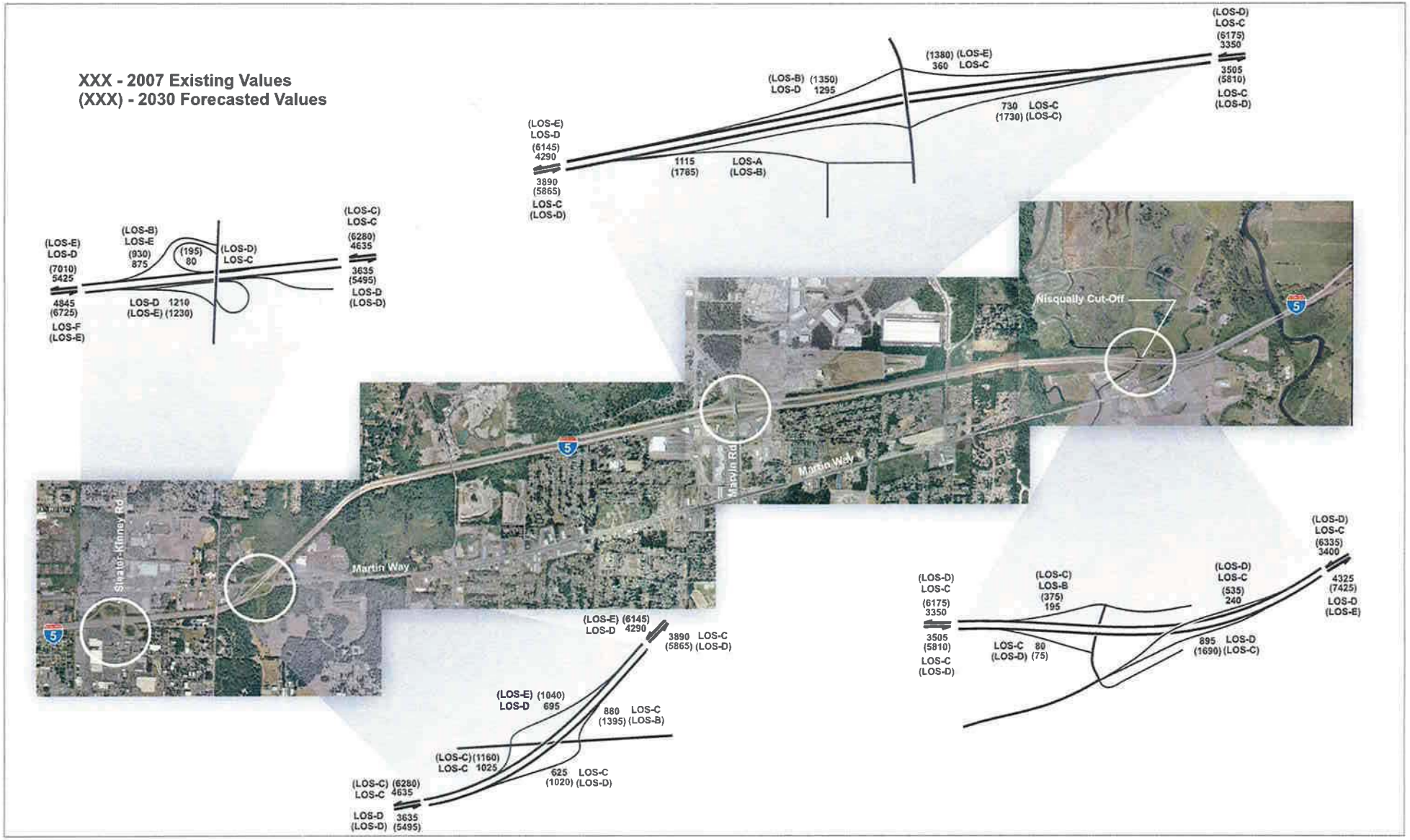
The mainline Interstate 5 segments and interchange ramps merge and diverge areas were analyzed using the methodologies outlined in sections 24 and 25 of the Highway Capacity Manual. The results are presented in terms of Level of Service and are based on the density of vehicles using the facilities. The analysis is provided for AM and PM peak hour conditions for the existing 2007 and projected 2030 scenarios.

The 2030 freeway segment and ramp analysis includes an additional mainline capacity lane between Sleater Kinney Road and the Nisqually River Bridge. In some instances this has resulted in lower overall vehicle densities at the merge and diverge points and an improvement in the projected ramp operation. The existing 2007 and projected 2030 freeway mainline and ramp merge/diverge volumes and levels of service are shown on the following figures.

VI. Conclusion

The City of Lacey is in the process of preparing the *Lacey Transportation Systems Analysis and Alternatives Evaluation (LTSAAE)* that will involve a detailed evaluation of the arterial and highway network and future traffic demand in the north Lacey area. Subsequent analysis will include screening various improvement strategies to identify a preferred program of roadway and intersection improvements.

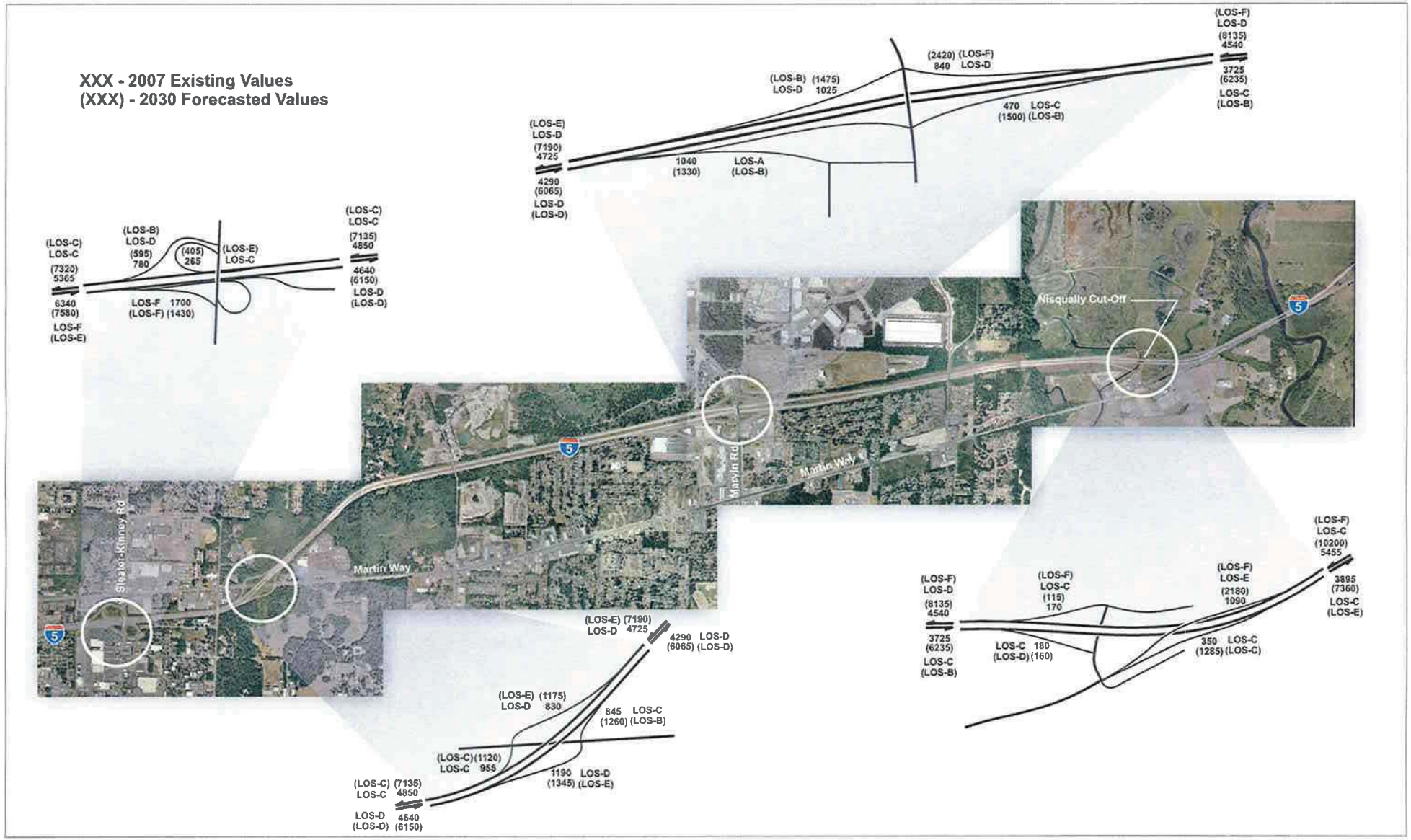
This information has been prepared for Stakeholder review in advance of the LTSAAE meeting on March 4, 2008. Technical appendices supporting the traffic volume projections and facilities analysis will be provided at that time.



SHEA CARR JEWELL

I-5 Mainline and Ramp AM Peak Hour Volumes
and Level of Service

Transportation
Systems Analysis
and Alternatives
Evaluation



SHEA CARR JEWELL

I-5 Mainline and Ramp PM Peak Hour Volumes
and Level of Service

Transportation Systems Analysis and Alternatives Evaluation

Appendix D

TECHNICAL MEMORANDUM: 2030 SURFACE STREET IMPROVEMENT SCENARIO TESTING

The technical appendices are included as published at their time. In some instances subsequent analyses refined the results of the published material. Any such refinements are reflected in the subsequent materials, but the published material is unchanged.

TECHNICAL MEMORANDUM

TO:	LTSAAE Stakeholders
FROM:	Perry Shea, P.E., Principal
DATE:	March 26, 2008
REGARDING:	Lacey Transportation Systems Analysis and Alternatives Evaluation – 2030 Surface Street Improvement Scenario Testing SC&J #0805.04
ENCLOSURES:	2030 "Raw" Model Volume Plots; Traffic Volume Calculation Worksheets; Traffic Volume Comparison Plots

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I. Introduction

The City of Lacey is in the process of preparing the *Lacey Transportation Systems Analysis and Alternatives Evaluation (LTSAAE.)* Previous analysis described existing roadway and intersection operations at all key locations within the study area. Predicted conditions for the "baseline" 2030 horizon were also prepared, and many future deficiencies were identified on facilities in the study area. Notable deficiencies included the Martin Way corridor between Sleater-Kinney Road and the Martin Way/Interstate 5 interchange and Marvin Road from Martin Way to Britton Parkway.

The stakeholder team was tasked with identifying potential surface street improvements that could help alleviate the predicted congestion along those corridors and the rest of the study area. An extensive list of roadway and intersection improvements was proposed by the stakeholder group that has been taken forward for analysis.

Shea, Carr & Jewell has prepared traffic volume comparisons for the study area with and without the proposed surface street improvements. This memorandum describes the results of the surface street improvement scenario testing.

This information has been prepared for Stakeholder review in advance of the LTSAAE meeting on March 31, 2008.

II. Surface Street Improvement Alternatives

The stakeholder group identified approximately 15 improvements for potential analysis. The full list of proposed improvements is provided below. The proposed improvements were screened and grouped into three packages to be built into the transportation demand model.

Lacey TSAAE - Surface Street Improvement Scenario Testing

Potential Improvement Identified by Stakeholder Group	Add to next model scenarios?	Package
1. Mullen Road Extension – Ruddell Rd to College Street (at 37th Ave)	Already in 2030 model	N/A
2. 6th Avenue Extension – College Street to Desmond Drive	No (1)	N/A
3. Bowker Street Extension – 7th Avenue to Desmond Drive	Yes	A
4. Hoh Street Extension – Martin Way to Steilacoom Rd	Yes	A
5. Interstate 5 Over-Crossings		
a. Kinwood Rd Extension – Martin Way to Main Street	a. No (2)	N/A
b. Mid-point crossing in vicinity of Stillwell, Whisler and Horne Streets – Martin Way to Main Street	b. Yes	C
c. Mid-point non-motorized crossing in vicinity of Stillwell, Whisler and Horne Streets – Martin Way to Main Street	c. Yes	A
6. Meridian Road Upgrades (increase capacity and structure to accommodate increased truck traffic) – Martin Way to Willamette Drive	Yes	A
7. Draham Rd NE/15th Ave NE widen to four lanes – Carpenter Road to Sleater-Kinney Rd	Yes	A
8. 15th Avenue Extension – from Sleater-Kinney Rd to Lilly Road	Yes	B
9. College Street Extension Extension – from 15th Ave NE to future 26th Avenue Connector	Yes	B
10. 26th Avenue Connector – from Marvin Road to Sleater Kinney Road	Yes	B
11. 31st Avenue Extension – from Hogum Bay Road to Marvin Road in vicinity of future 26th Avenue Connector	Yes	B
12. Hogum Bay Road Upgrades (increase structural and geometric capability of roadway to accommodate truck traffic) – Marvin Road to Hawks Prairie Road	Yes	A
a. May include optional slip-ramp access from I-5 SB off-ramp directly to Hogum Bay Road	a. Yes	A
13. NE Lacey (Hawks Prairie) Interconnecting Roadways – commercial collector grid between Hogum Bay Road and Carpenter Road north of I-5	Yes	A

(1) Per negotiations between Saint Martins University and the City of Lacey this item will be removed from Lacey Transportation Plan

(2) This project functionally similar to 5c, which has been included in "A" package of improvements

The three alternative improvement packages are listed below:

Alternative A

- Bowker Street Extension – from 7th Avenue to Desmond Drive
- Hoh Street Extension – from Martin Way to Steilacoom Road
- Non-motorized Interstate 5 over-crossing in vicinity of Stillwell, Whisler and Horne Streets – from Martin Way to Main Street
- Meridian Road Upgrades (increase capacity and structure to accommodate increased truck traffic) – from Martin Way to Willamette Drive
- Draham Rd NE/15th Ave NE widen to four lanes – Carpenter Road to Sleater-Kinney Road
- Hogum Bay Road Upgrades (increase structural and geometric capability of roadway to accommodate truck traffic) – Marvin Road to Hawks Prairie Road
- Construct slip ramp access from I-5 SB off-ramp directly to Hogum Bay Road
- NE Lacey (Hawks Prairie) Interconnecting Roadways – commercial collector grid between Hogum Bay Road and Carpenter Road north of I-5

Alternative B

- 15th Avenue Extension – from Sleater-Kinney Road to Lilly Road
- College Street Extension Extension – from 15th Avenue NE to future 26th Avenue Connector
- 26th Avenue Connector – from Marvin Road to Sleater-Kinney Road
- 31st Avenue Extension – from Hogum Bay Road to Marvin Road in vicinity of future 26th Avenue Connector

Alternative C

This scenario has been added for comparative purposes; however, in the initial screening process it was determined that disruption to an existing neighborhood may prohibit implementation.

- Vehicular Interstate 5 over-crossing in vicinity of Stillwell, Whisler and Horne Streets – Martin Way to Main Street

III. Traffic Volume Projections

Traffic Modeling Methodology

The traffic volume projections for Alternatives A, B and C were prepared using the same methodology used for the "baseline" 2030 traffic assignments. The improvement packages were incrementally added to the 2030 baseline model scenario. Each alternative builds on the previous alternative. That is, the roadway and intersection improvements in Alternative A were added to the baseline and model assignments were prepared. Then Alternative B was added and additional assignments were prepared. Then Alternative C was added creating a third batch of model assignments.

Post-Processed Traffic Volume Assignments

The transportation model traffic volume output was post-processed to align the analysis volumes with existing "ground counts." Specifically, the traffic volume growth predicted by the transportation model was added to the actual 2007 traffic volumes to prepare the 2030 PM peak hour traffic volumes shown in this memorandum. The Traffic Volume Projection worksheets are provided as an attachment.

We have provided the post-processed traffic analysis volumes for Baseline, Alternative A, and Alternative B for selected locations on the **Figures 1** through **5**. The "raw" (not post-processed) PM peak traffic volume model plots for the baseline 2030 scenario and Alternatives A, B and C are also attached.

Figure 1
Sleater-Kinney Road Corridor
Projected 2030 PM Peak Hour
Directional Traffic Volumes

Figure 2
Carpenter Road Corridor
Projected 2030 PM Peak Hour
Directional Traffic Volumes

Transportation Systems Analysis and Alternatives Evaluation

Figure 3
Marvin Road Corridor
Projected 2030 PM Peak Hour
Directional Traffic Volumes

Transportation Systems Analysis and Alternatives Evaluation

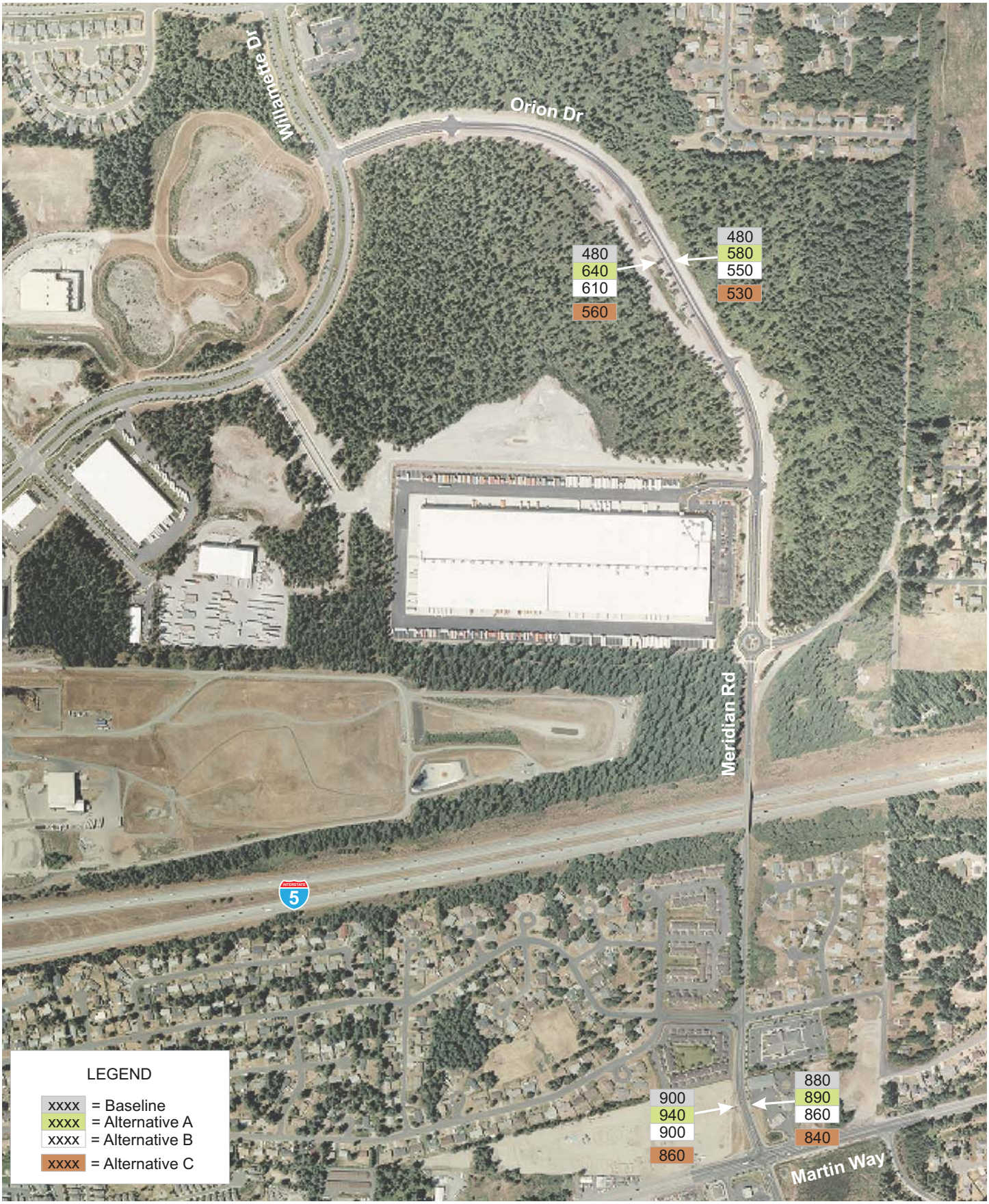


Figure 4
Meridian Road Corridor
Projected 2030 PM Peak Hour
Directional Traffic Volumes

Transportation Systems Analysis and Alternatives Evaluation

Figure 5
Nisqually Road Corridor
Projected 2030 PM Peak Hour
Directional Traffic Volumes

Transportation Systems Analysis and Alternatives Evaluation

III. Traffic Volume Comparison

As would be expected, adding the network improvement packages changes travel patterns within the study area causing significant shifts in traffic flows on some roadways. The attached graphics depict the change (increase or decrease) in projected 2030 PM peak hour traffic volumes within the study area between the Baseline and Alternative A, the Baseline and Alternative B and the Baseline and Alternative C.

The following is a discussion of some of the more notable changes for each of the Alternatives.

2030 Alternative A

Bowker Street Extension – from 7th Avenue to Desmond Drive
This new roadway would draw approximately 150 PM peak hour trips, improving local access but not providing a significant regional benefit.

Hoh Street Extension – from Martin Way to Steilacoom Road
This new roadway would draw approximately 400 vehicles during the 2030 PM peak hour. This would improve local access and provide some benefit to the congested Marvin Road corridor south of Martin Way.

Non-motorized Interstate 5 over-crossing in vicinity of Stillwell, Whisler and Horne Streets – from Martin Way to Main Street
This non-motorized connection would improve multi-modal access between the neighborhood south of I-5 and the Hawks Prairie area north of I-5. It would not be expected to have a significant effect on vehicular traffic.

Meridian Road Upgrades (increase capacity and structure to accommodate increased truck traffic) – from Martin Way to Willamette Drive
This could improve the safety and functionality of Meridian Road/Orion Drive but would not attract a significant amount of new traffic to Meridian Road.

Draham Rd NE/15th Avenue NE widen to four lanes – Carpenter Road to Sleater-Kinney Road
This improvement would be expected to create a significant increase in traffic (approximately 1200 vehicles in the 2030 PM peak hour) on 15th Avenue/Draham Road. This would reduce congestion on Carpenter Road and would increase traffic flows on Sleater-Kinney Road north of Martin Way.

Hogum Bay Road Upgrades (increase structural and geometric capability of roadway to accommodate truck traffic) – Marvin Road to Hawks Prairie Road
This could improve the safety and functionality of Hogum Bay Road; however, the capacity upgrade would not be expected to significantly affect traffic flows on Hogum Bay Road.

Construct slip ramp access from I-5 SB off-ramp directly to Hogum Bay Road
The slip ramp would attract approximately 600 vehicles in the PM peak hour. This would result in a corresponding reduction in traffic on Marvin Road between I-5 and Hogum Bay Road. Demand modeling indicates that some vehicles en route from southbound Interstate 5 to Britton Parkway would use the Hogum Bay slip ramp to avoid a congested Marvin Road.

NE Lacey (Hawks Prairie) Interconnecting Roadways – commercial collector grid between Hogum Bay Road and Carpenter Road north of I-5
These roadways would provide local access to properties in the area and improved access between Hogum Bay Road, Marvin Road and Carpenter Road. It is not expected that these new roadway connections would significantly affect traffic flows south of Interstate 5.

Network Traffic Volume Changes
The roadway and intersection improvements in Alternative A would result in significant shifts in localized traffic volumes with improvement in overall congestion levels. Traffic volumes at the "pinch-points" identified in the baseline analysis would experience marginal benefit. Traffic on Marvin Road in the vicinity of Interstate 5 would be reduced by only 1%. Traffic on Martin Way in the vicinity of the I-5 interchange would be reduced by only 6%. Carpenter Road in the vicinity of Martin Way would experience the most benefit with a 12% reduction in traffic volumes. Freeway traffic volumes in the study area would remain almost unchanged.

2030 Alternative B

The results summarized below describe some of the differences in projected 2030 PM peak hour traffic volumes between Alternative B and Alternative A. (Note that Alternative B includes the Alternative A improvements.)

15th Avenue Extension – from Sleater-Kinney Road to Lilly Road
This new roadway connection would attract approximately 1000 PM peak hour trips by the 2030 horizon. This would result in a decrease in traffic on Sleater-Kinney Road between Martin Way and 15th Avenue NE with traffic flows on this section of Sleater-Kinney Road adjusting back to 2030 baseline volumes.

College Street Extension Extension – from 15th Ave NE to future 26th Avenue Connector

This new roadway would be expected to attract approximately 350 PM peak hour trips in the 2030 horizon. It would not be expected to result in a significant change in traffic volumes on the other section of the College Street Extension (between 6th Avenue NE and 15th Avenue NE.)

26th Avenue Connector – from Marvin Road to Sleater-Kinney Road

This new roadway would draw approximately 1200 vehicles during the PM peak hour. It would also increase traffic flows on 26th Avenue west of Sleater-Kinney Road by approximately 400 vph.

31st Avenue Extension – from Hogum Bay Road to Marvin Road in vicinity of future 26th Avenue Connector

This new roadway would provide improved local access and would attract approximately 1000 vehicles during the PM peak hour.

Network Traffic Volume Changes

The roadway and intersection improvements in Alternative B would result in additional shifts in localized traffic volumes. Marginal reduction in traffic volumes would be experienced at the "pinch-points." Traffic on Marvin Road in the vicinity of Interstate 5 would be reduced by only 2%. Traffic on Martin Way in the vicinity of the I-5 interchange would be reduced by 8%. Carpenter Road in the vicinity of Martin Way would experience the most benefit with a 14% reduction in traffic volume. Freeway traffic volumes in the study area would remain almost unchanged.

2030 Alternative C

Vehicular Interstate 5 over-crossing in vicinity of Stillwell, Whisler and Horne Streets – Martin Way to Main Street

This new roadway would attract approximately 1300 vehicles during the PM peak hour. It would result in a reduction of approximately 400 vehicles on Carpenter Road north of Martin Way and a reduction of approximately 350 vehicles on Marvin Road north of Interstate 5.

Network Traffic Volume Changes

Alternative C would result in minimal changes (beyond Alternative B) network-wide. The traffic shift from this Alternative would occur mostly on Marvin Road and Carpenter Road, between Martin Way and Britton Parkway. Traffic volumes on Marvin Road in the vicinity of I-5 would be reduced by 9% compared to baseline. Traffic volumes on Carpenter Road would be reduced by 26%. Traffic volumes on Martin Way west of Carpenter Road would be increased by over 10%.

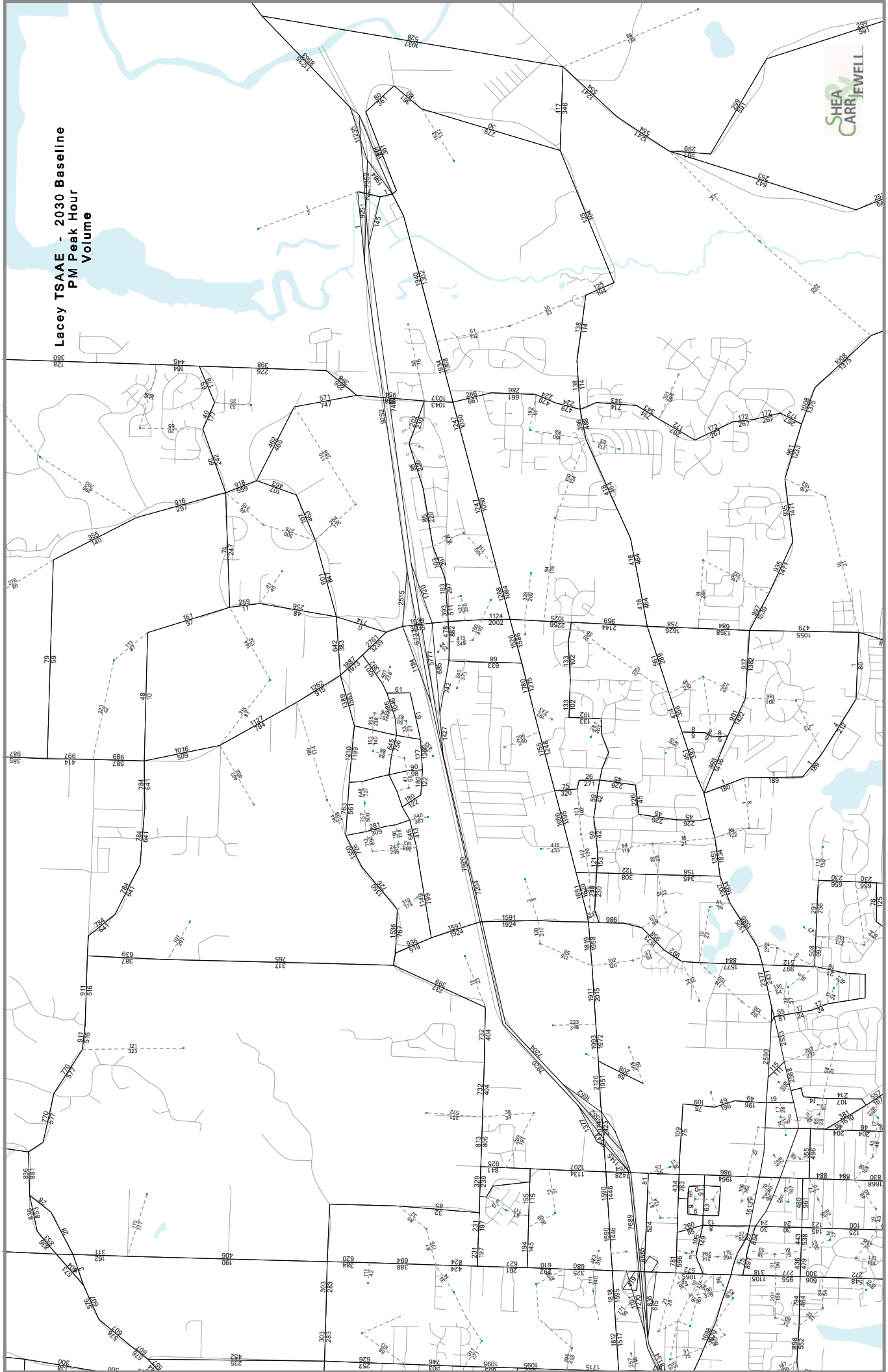
IV. Conclusions

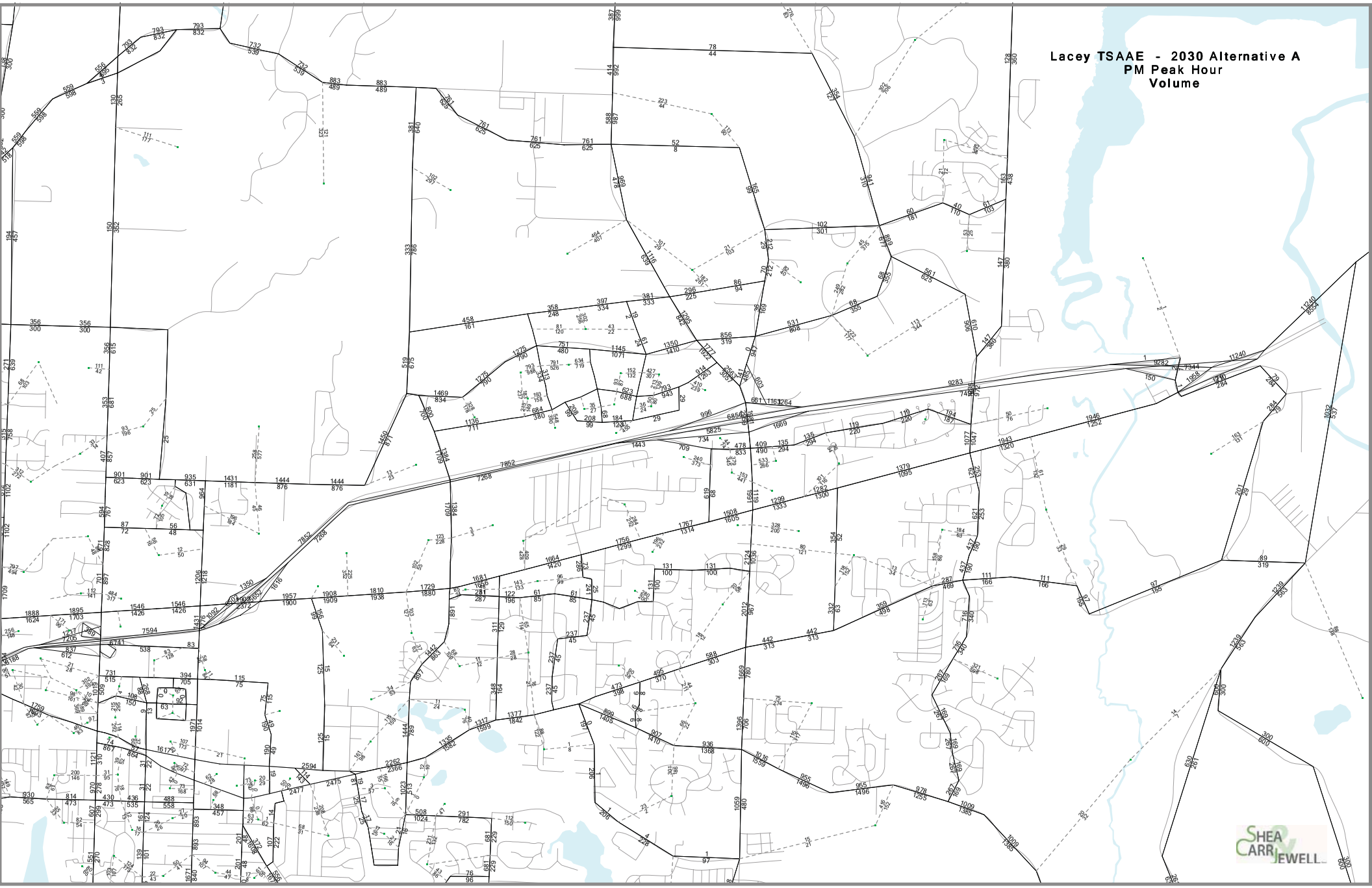
We have analyzed the Lacey TSAAE study area for projected 2030 conditions with a series of potential surface street improvements. The proposed intersection and roadway projects each provide circulation benefits within their own localized area. Some of the improvements also provide significant regional benefit resulting in lower overall congestion levels.

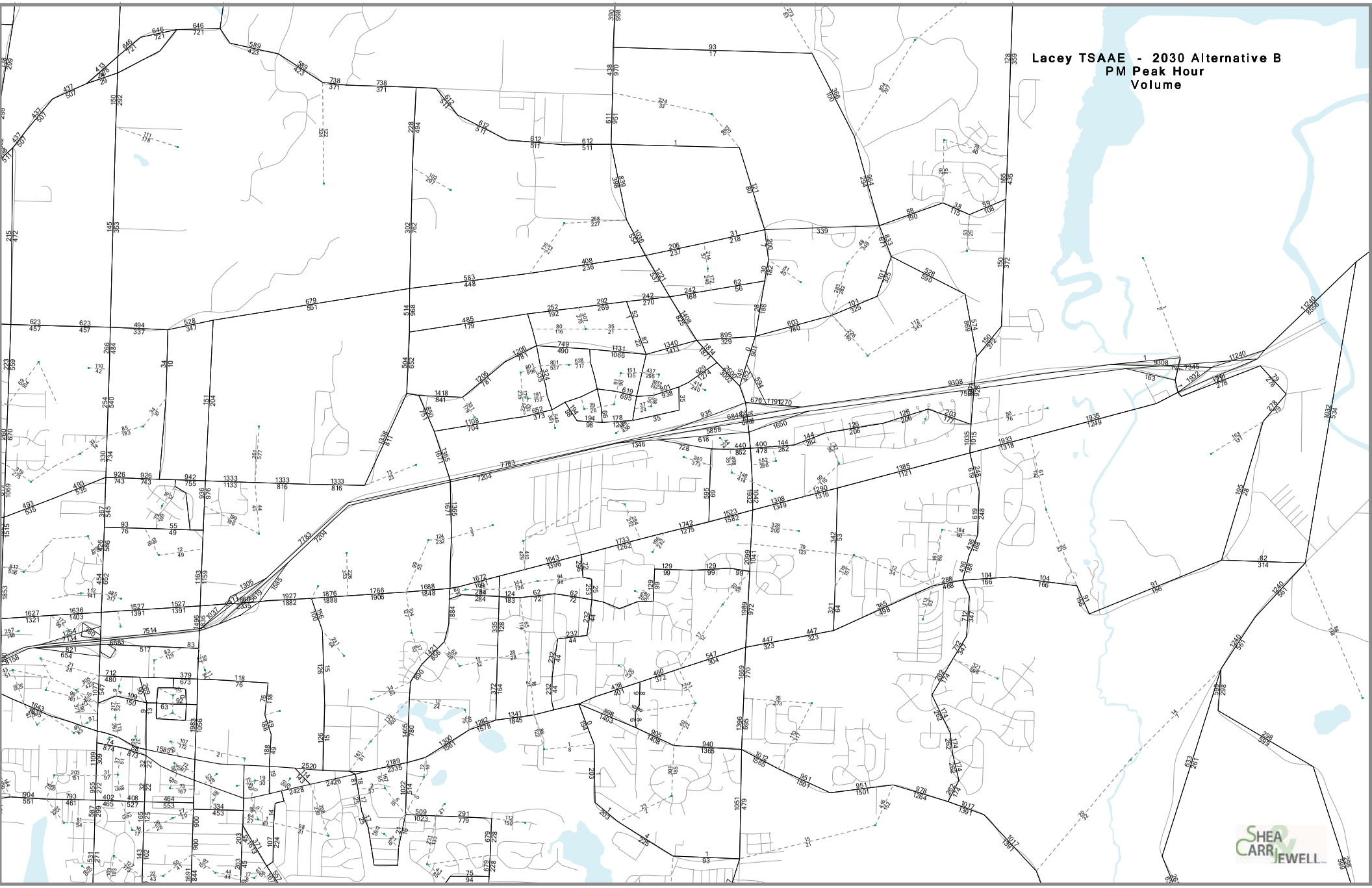
Alternative A improves the regional circulation by providing additional local access connections, and enhancing east-west mobility north of Interstate 5. The critical Martin Way/Interstate 5 and Marvin Road/Interstate 5 interchanges receive only marginal benefit. Under Alternative A, additional improvements would be required to accommodate future traffic loadings in the area.

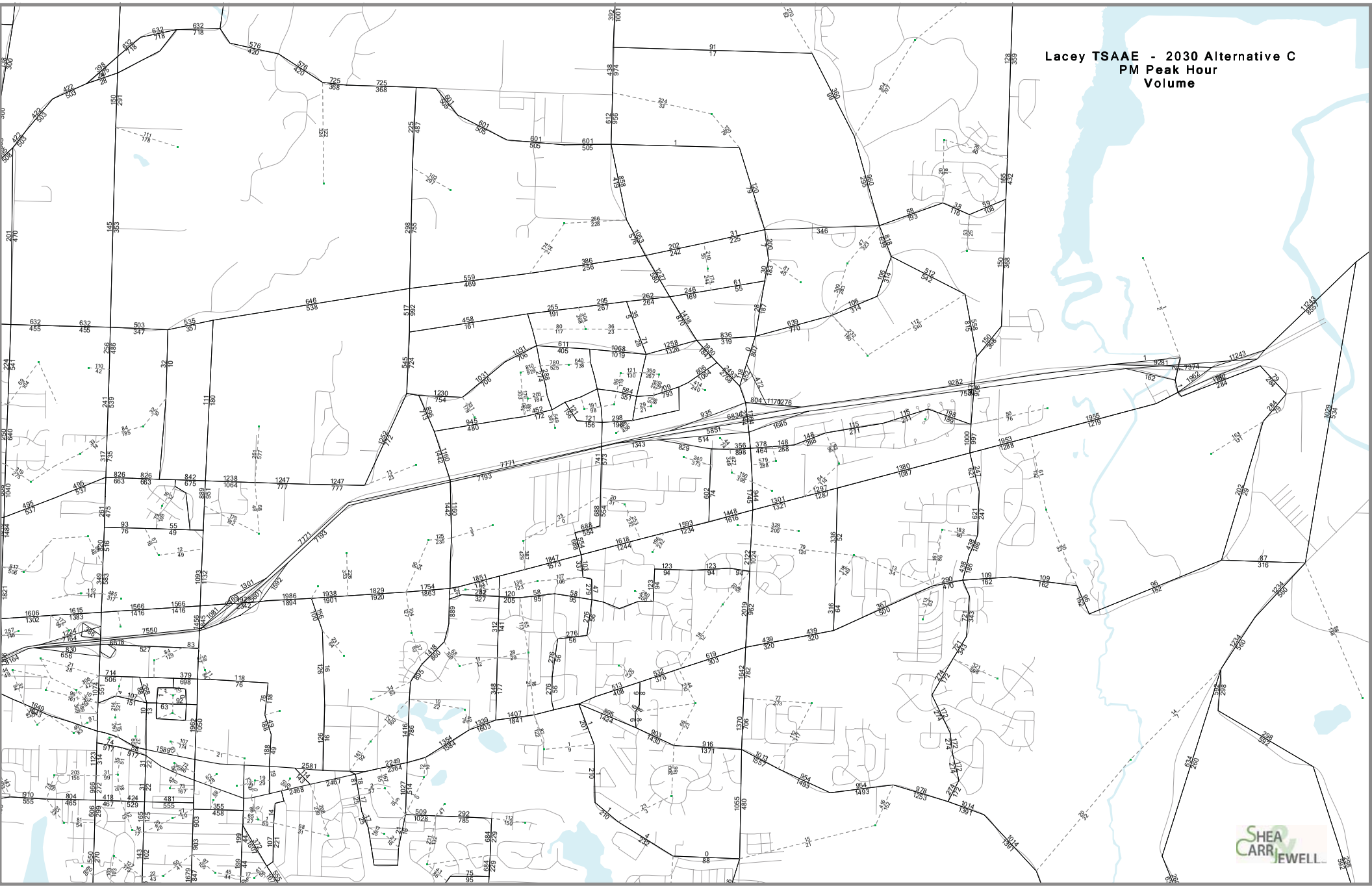
Alternative B significantly improves traffic circulation within the Hawks Prairie area and enhances the east-west connections presented in Alternative A. However, as with Alternative A, the critical Martin Way/Interstate 5 and Marvin Road/Interstate 5 interchanges receive only marginal benefit. Under Alternative B, additional improvements would be required to accommodate future traffic loadings in the area.

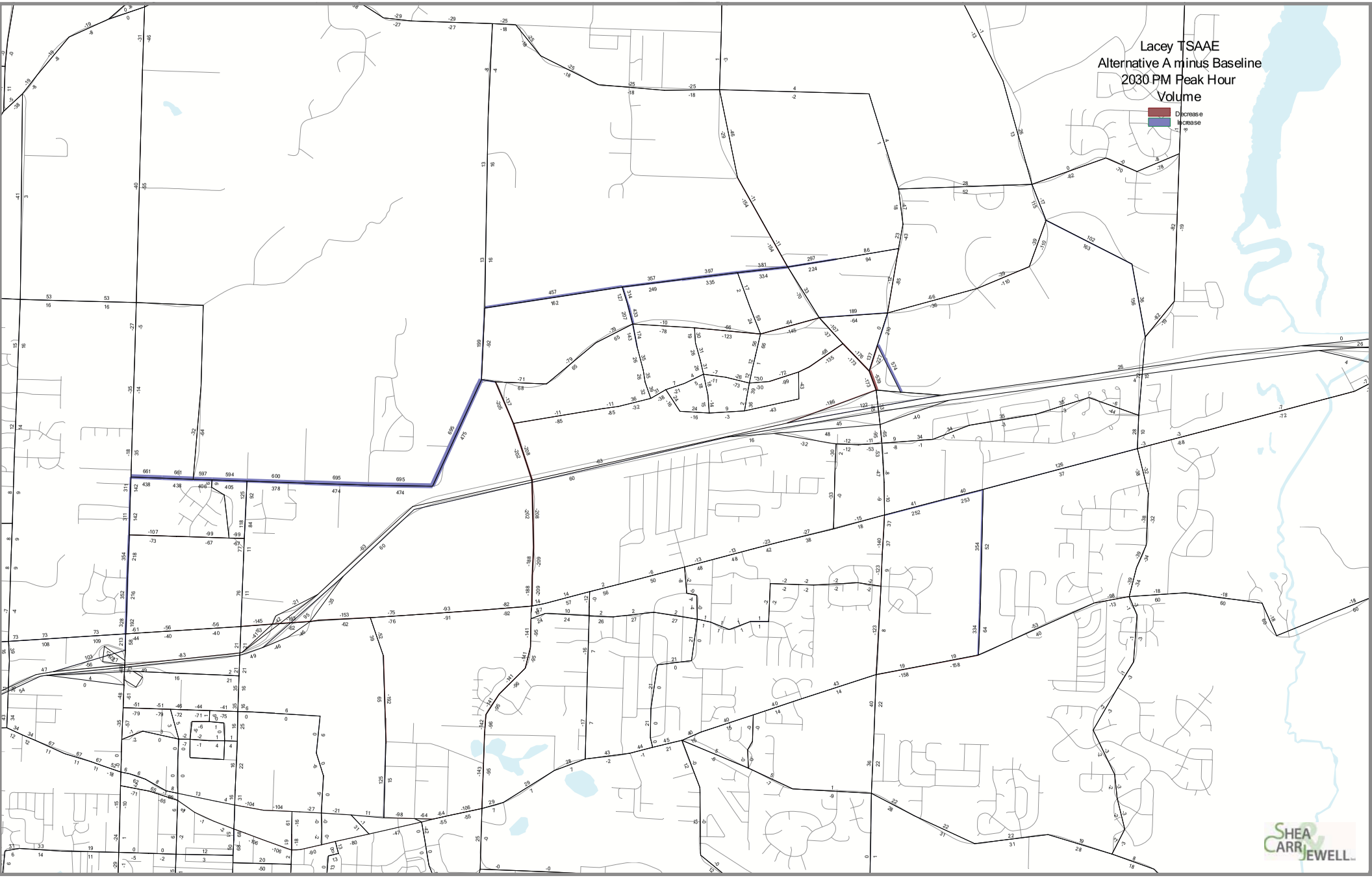
Alternative C provides an additional reduction in traffic flows on Carpenter Road and Marvin Road. The reduction in traffic on Marvin Road could provide improvement to the function of the Marvin Road/Interstate 5 interchange. However, the traffic flows at the Martin Way/Interstate 5 interchange would remain within 6% of baseline conditions. Under Alternative C additional improvements would be required to accommodate future traffic loadings in the area.

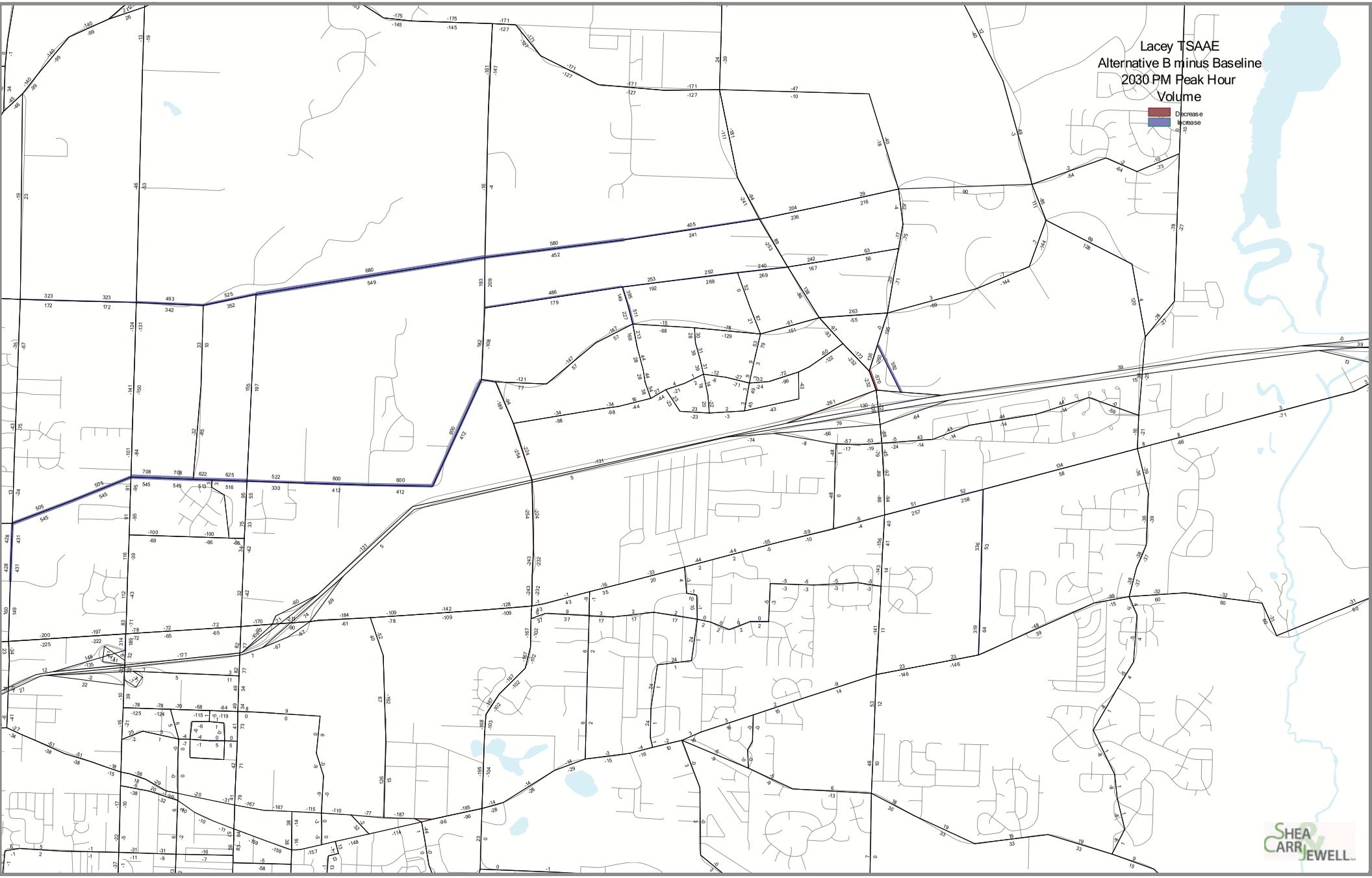

Lacey TSAAE - 2030 Baseline
PM Peak Hour
Volume
SHEA CARR JEWELL


Lacey TSAAE - 2030 Alternative A
PM Peak Hour
Volume
SHEA CARR JEWELL


Lacey TSAAE - 2030 Alternative B
PM Peak Hour
Volume
SHEA CARR JEWELL


Lacey TSAAE - 2030 Alternative C
PM Peak Hour
Volume
SHEA CARR JEWELL


Lacey TSAAE
Alternative A minus Baseline
2030 PM Peak Hour
Volume
Decrease
Increase
SHEA CARR JEWELL


Lacey TSAAE
Alternative B minus Baseline
2030 PM Peak Hour
Volume
Decrease
Increase
SHEA CARR JEWELL

Appendix E

PRELIMINARY LAYOUT OF EXISTING INTERCHANGE SCENARIOS

The technical appendices are included as published at their time. In some instances subsequent analyses refined the results of the published material. Any such refinements are reflected in the subsequent materials, but the published material is unchanged.

Sleater Kinney Road Interchange

Option #1

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

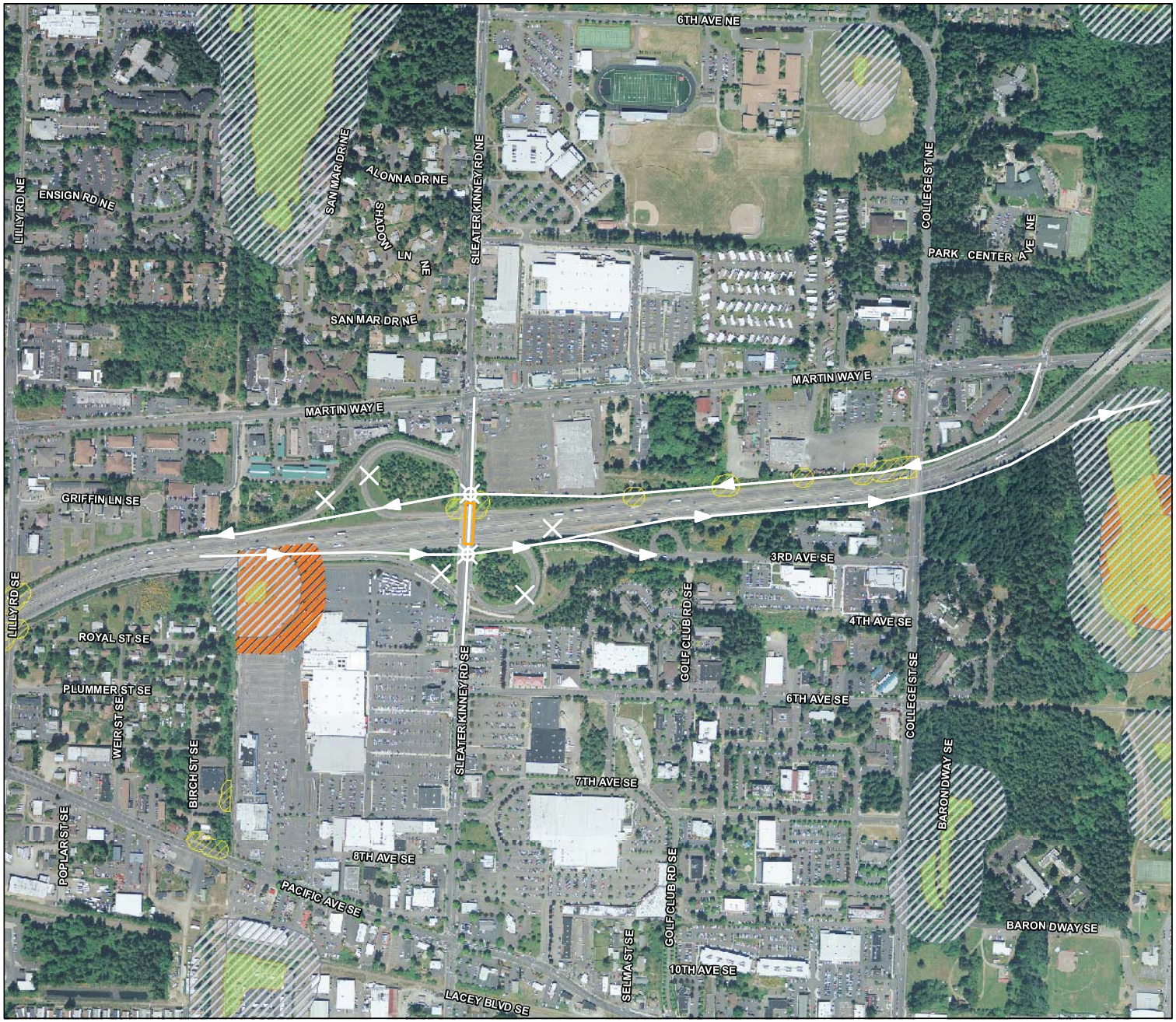
  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N
W E
S

Feet
0 250 500 1,000

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.



Sleater Kinney Road Interchange

Option #2

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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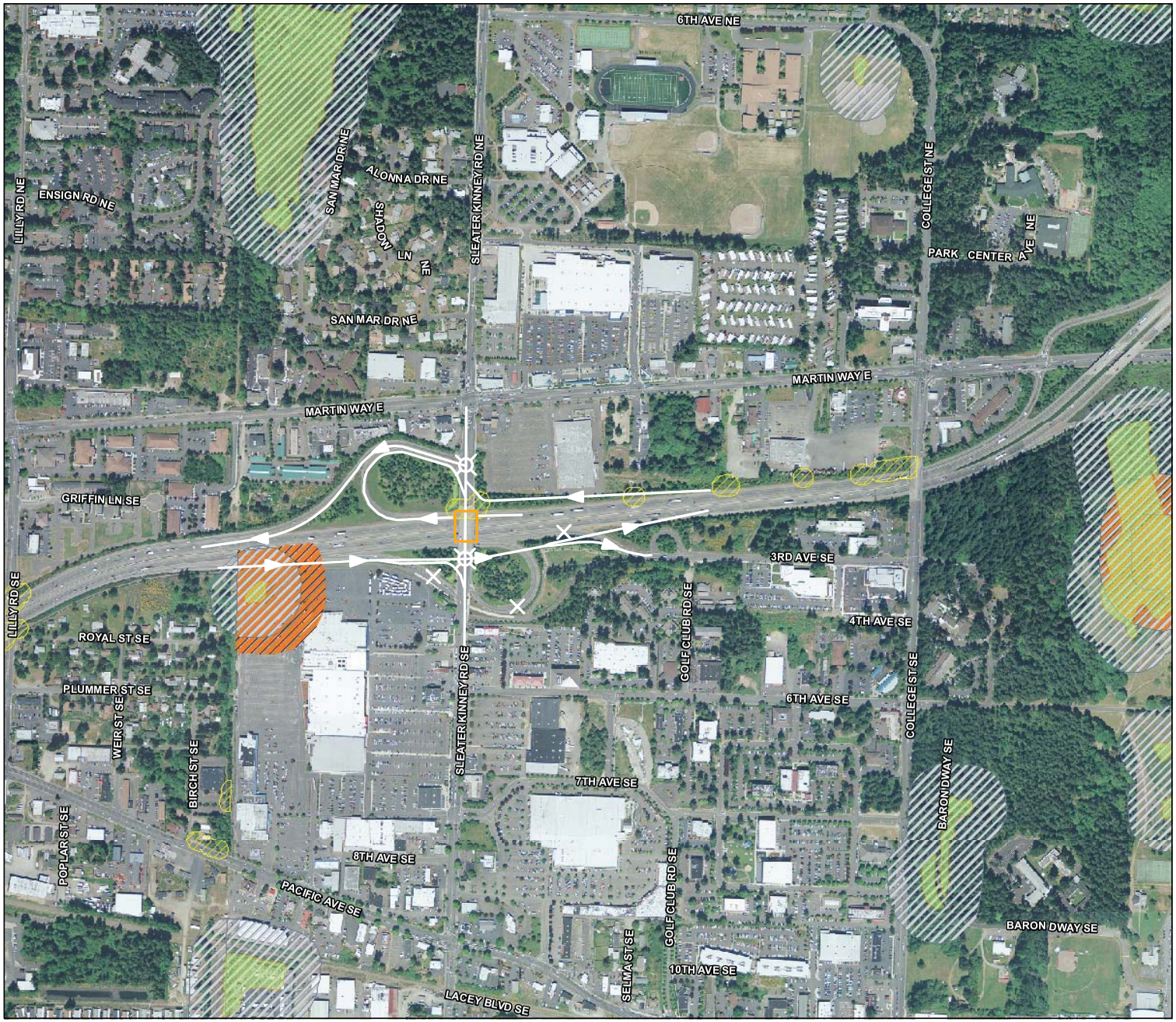

Sleater Kinney Road Interchange

Option #2A

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N W E S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

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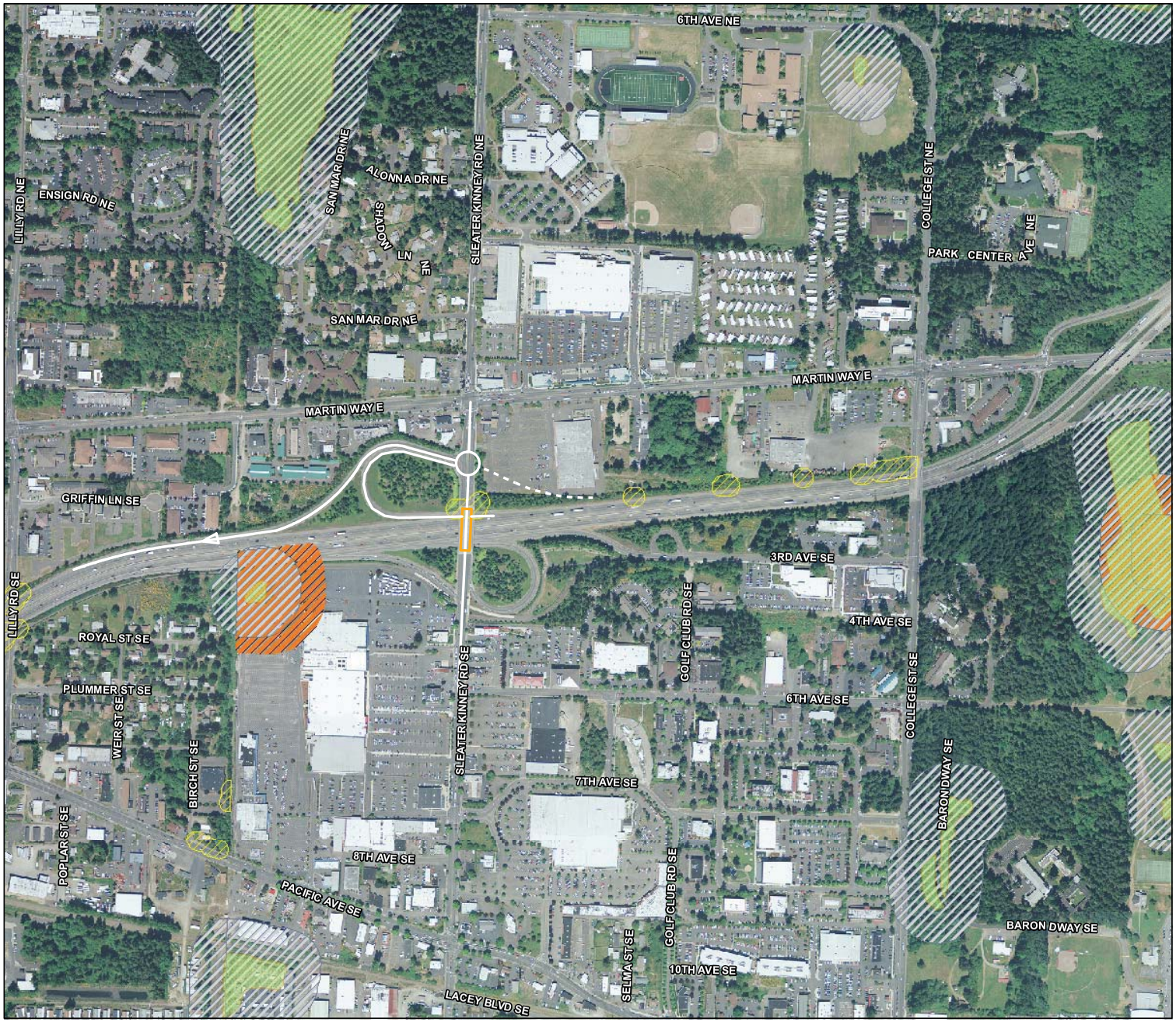

Sleater Kinney Road Interchange

Option #2B

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N W E S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

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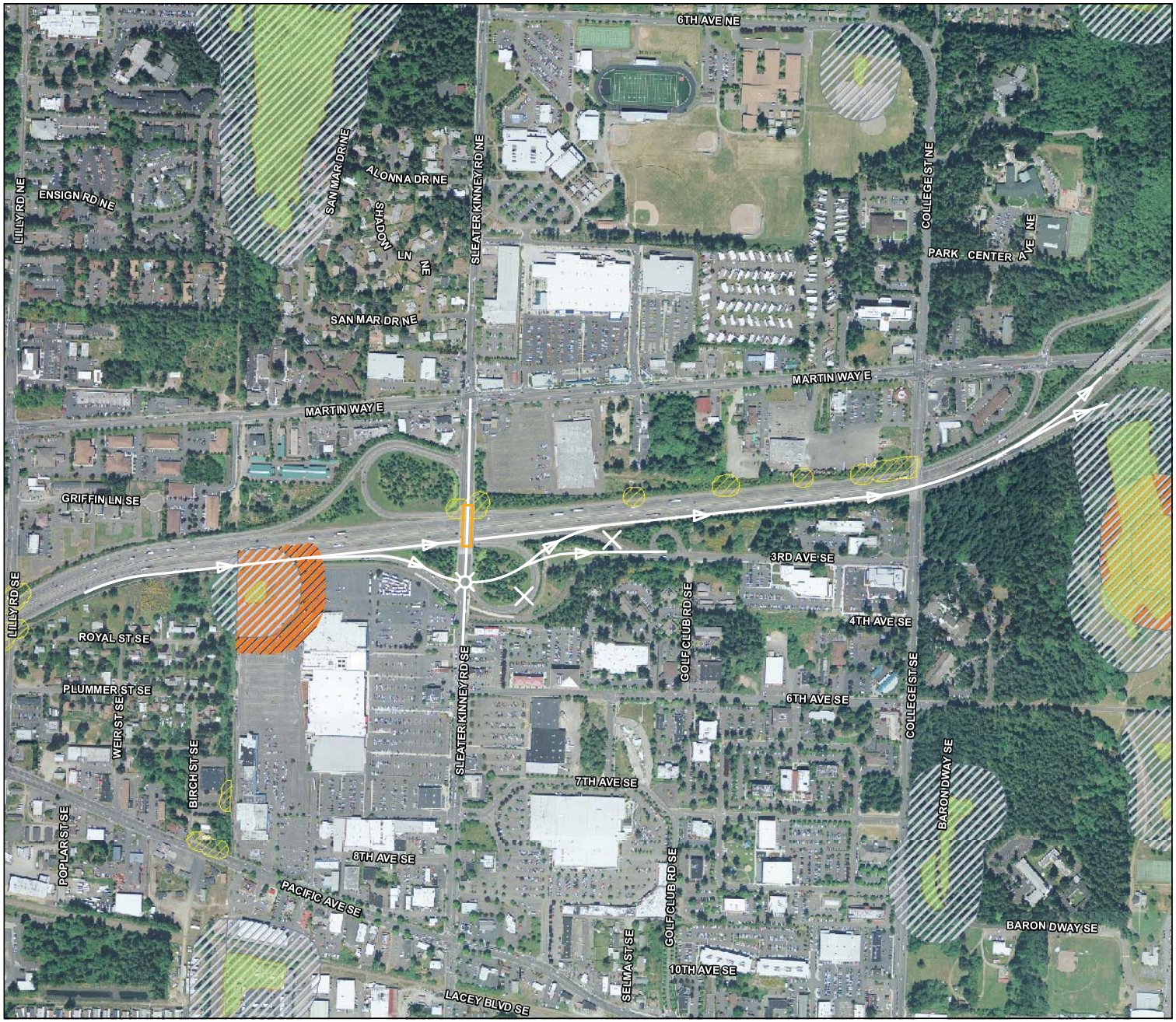

Sleater Kinney Road Interchange

Option #2C

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Sleater Kinney Road Interchange

Option #3

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N W E S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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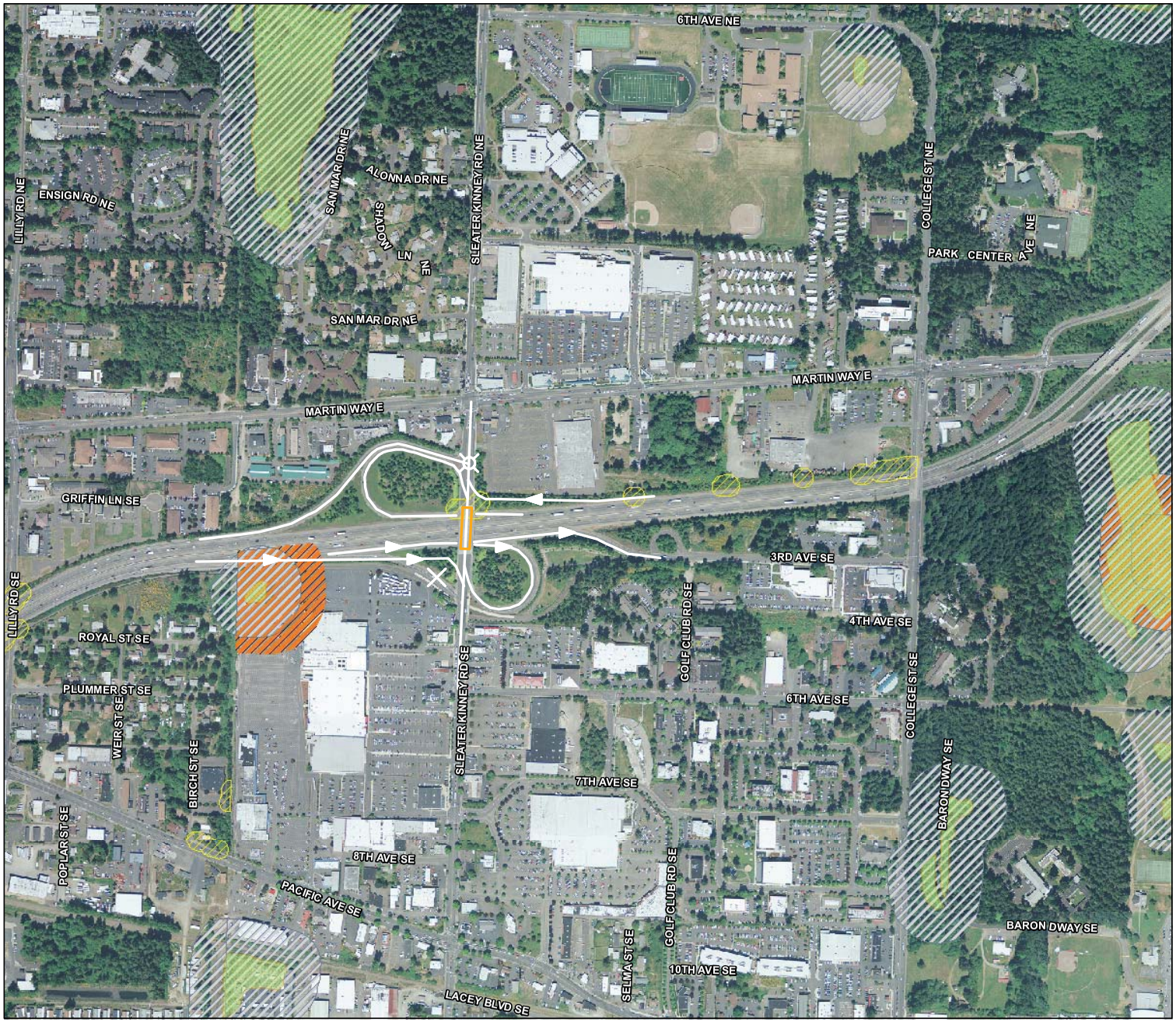

Sleater Kinney Road Interchange

Option #4

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N W E S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Martin Way Interchange

Option #5

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N W E S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

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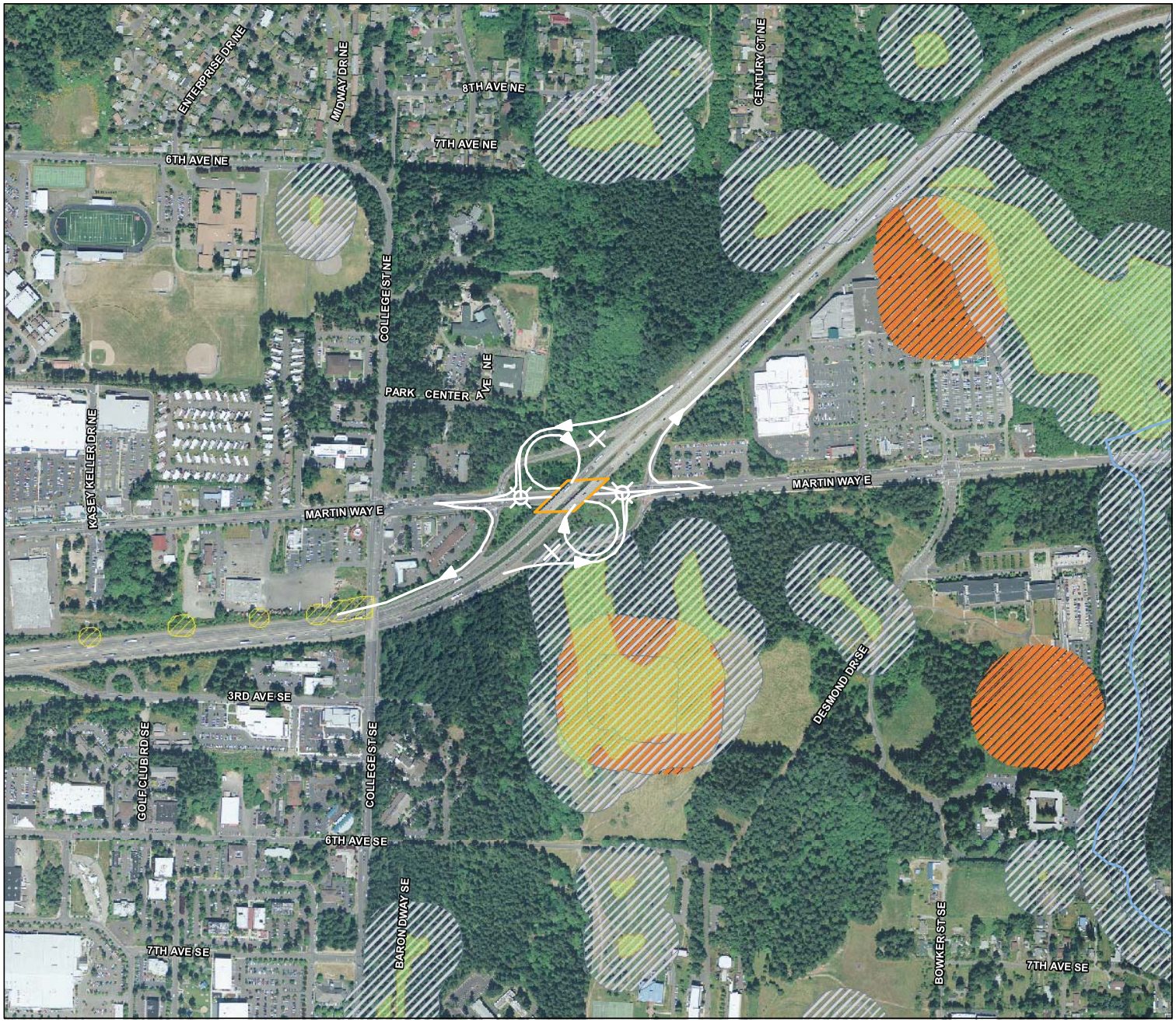


Martin Way Interchange

Option #5A

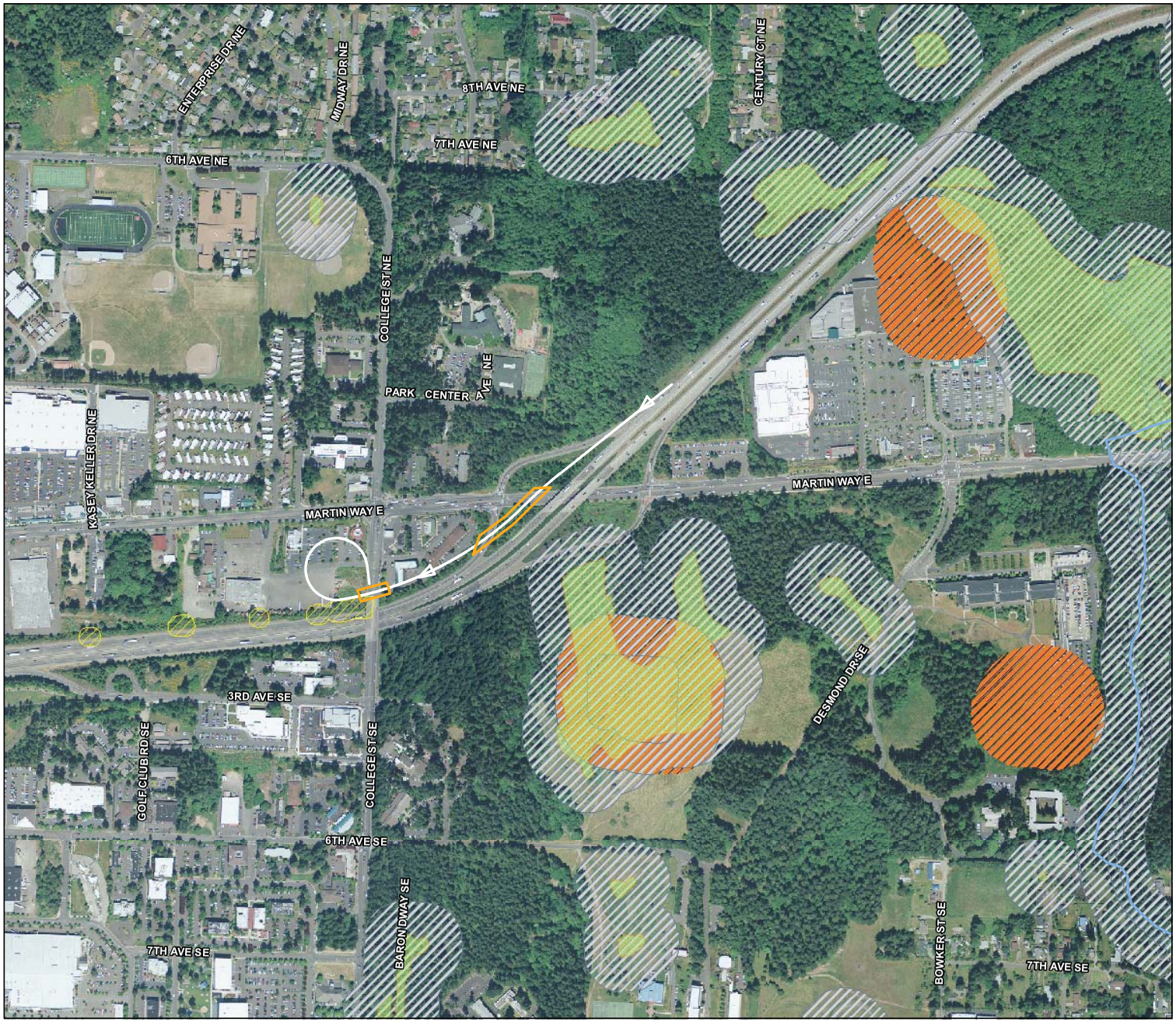
- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
S

Feet
0 250 500 1,000

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Martin Way Interchange

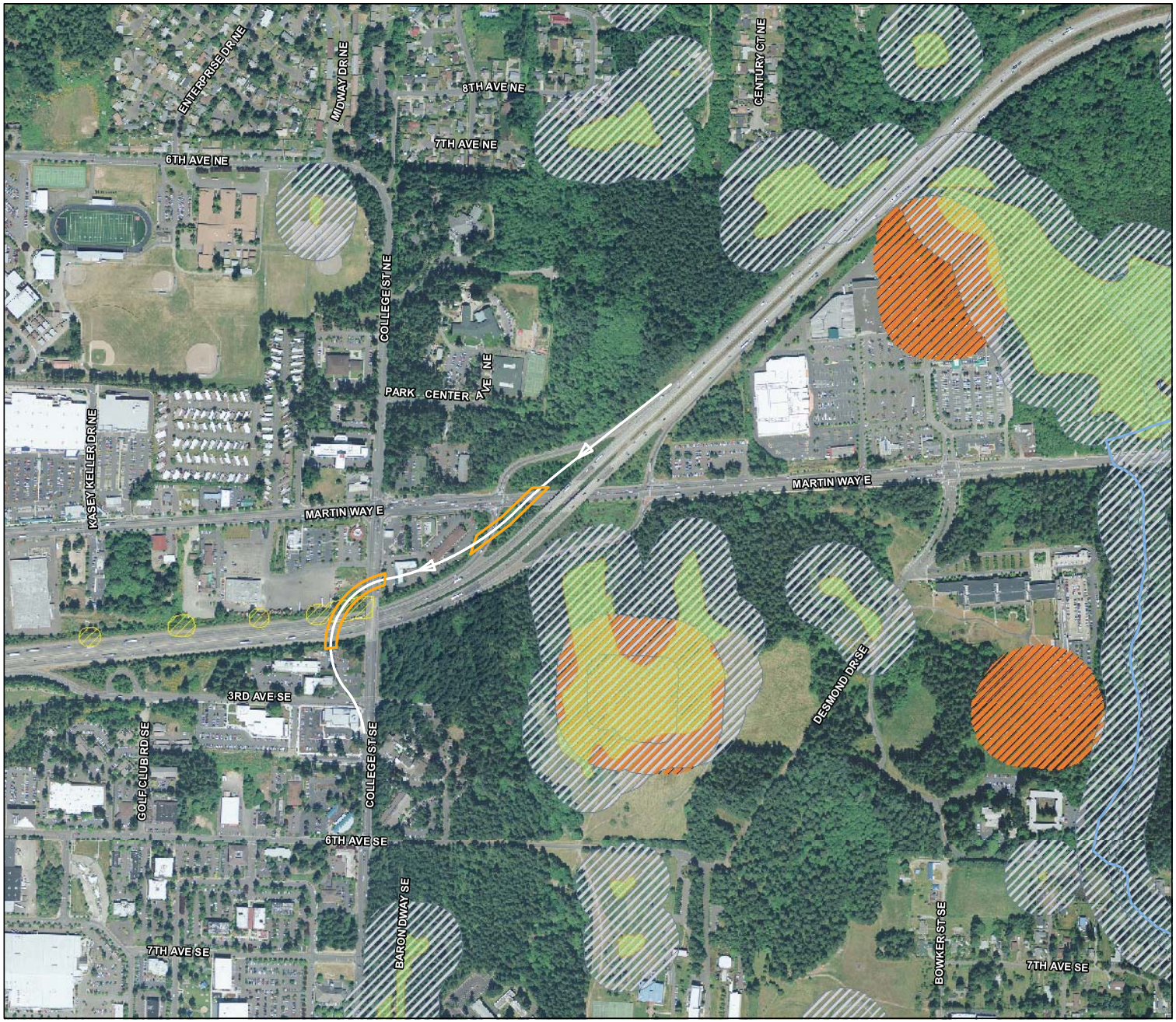
Option #5B

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
S

Feet
0 250 500 1,000

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Martin Way Interchange

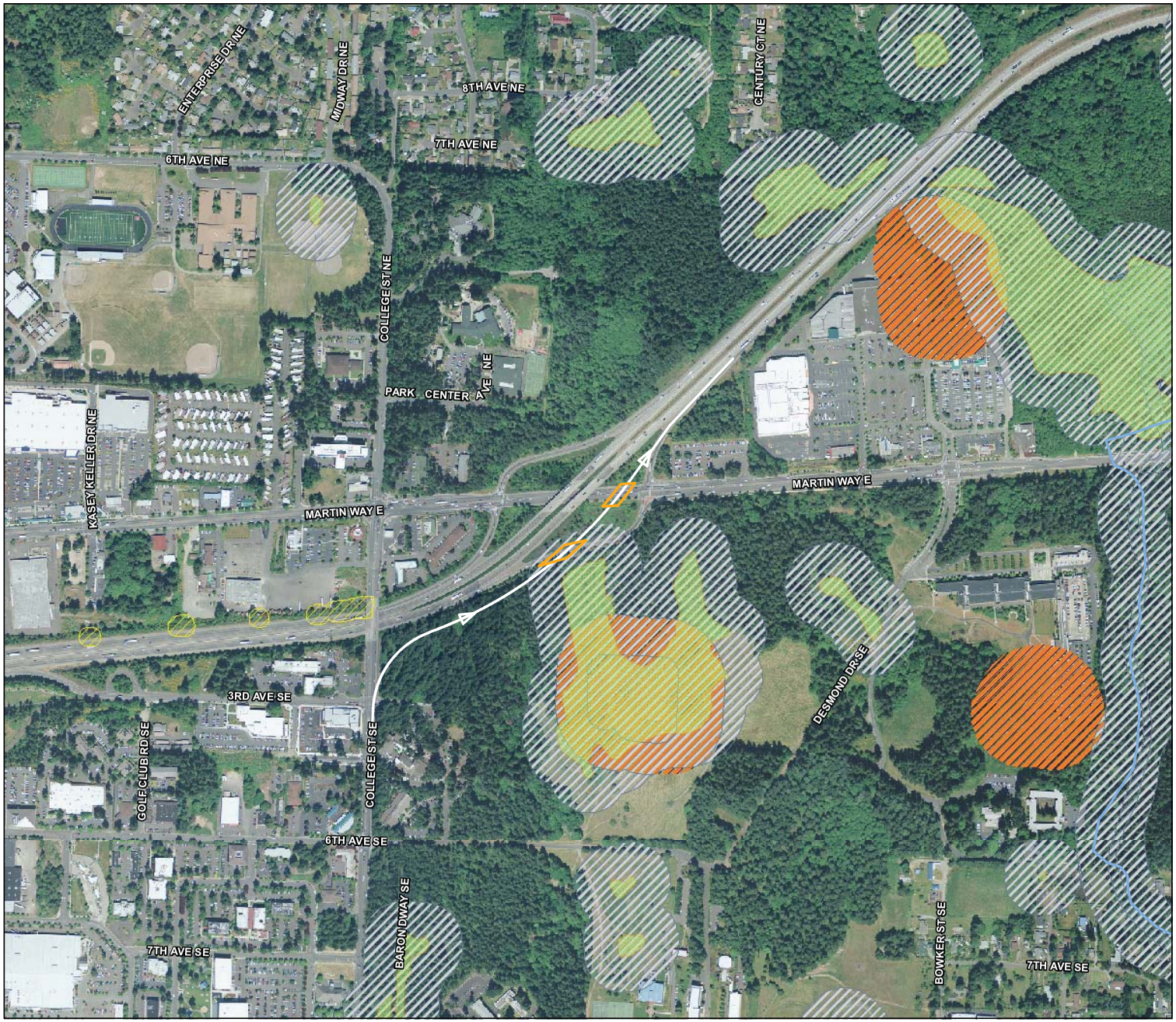
Option #5C

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
File: P:\Transportation\LaceyInterchangeStudy\Maps_Images\LaceyStudyArea_critical_martinway.mxd

Martin Way Interchange

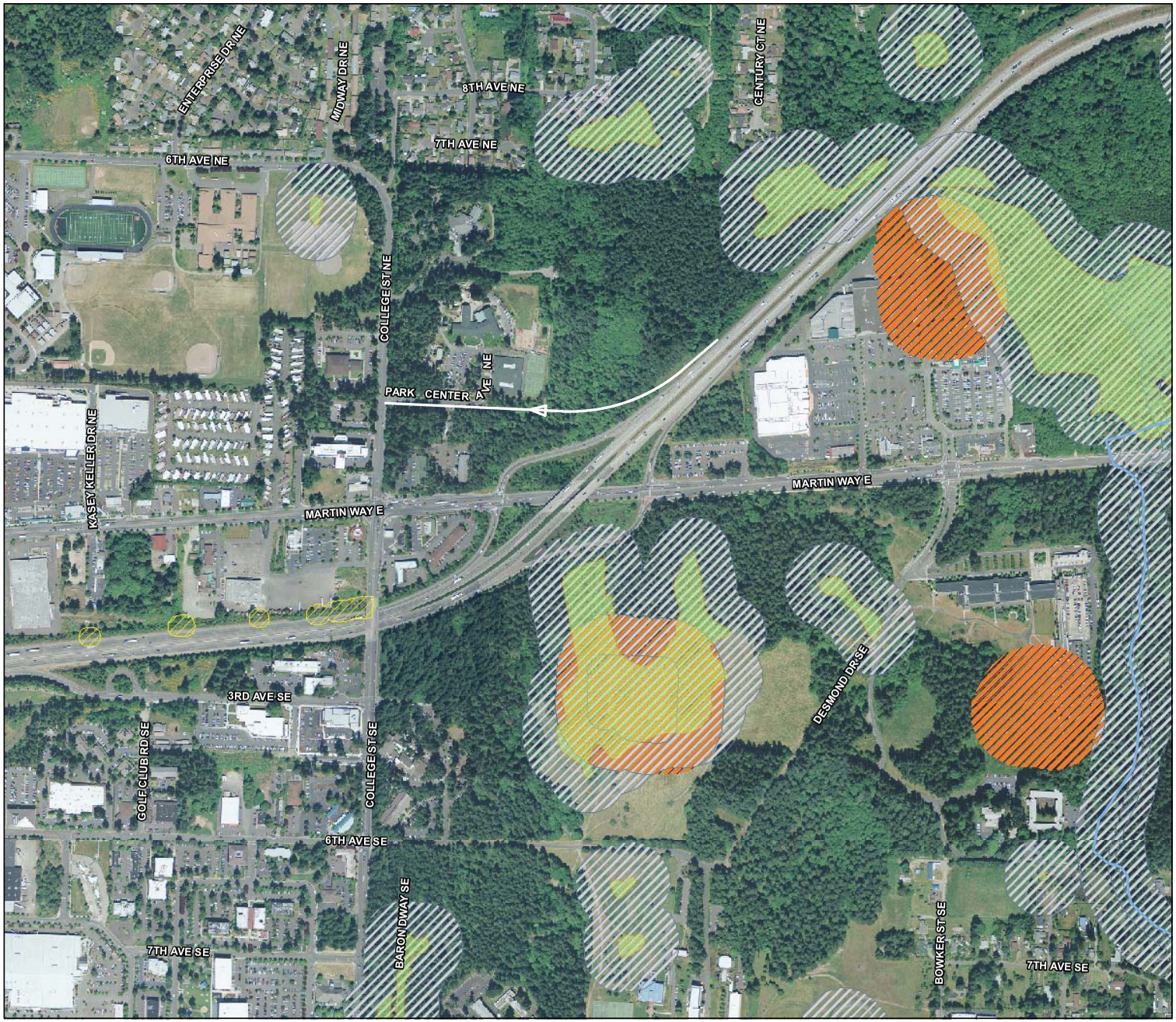
Option #5D

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
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Feet
0 250 500 1,000

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Martin Way Interchange

Option #6

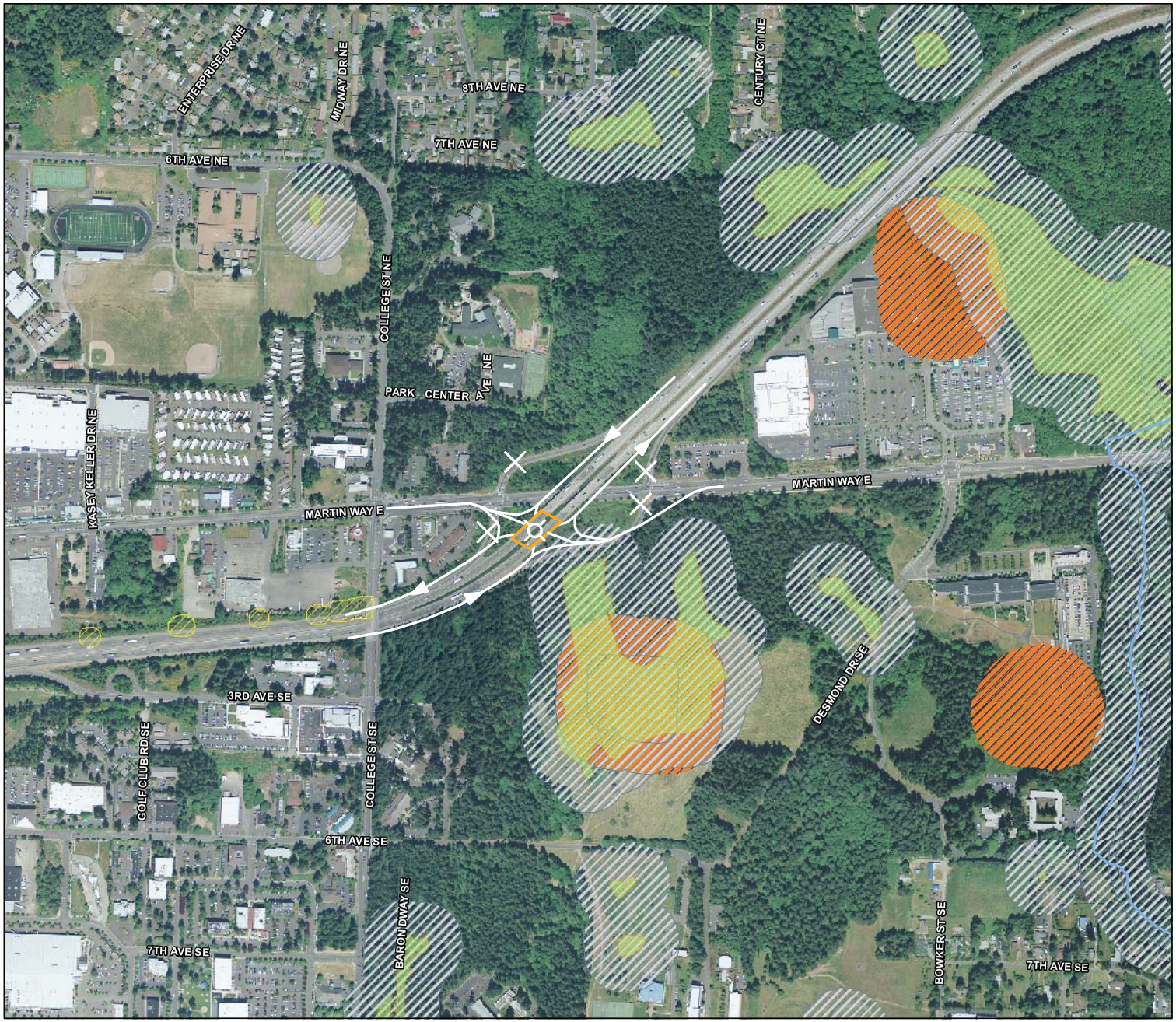
- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
S

Feet
0 250 500 1,000

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Martin Way Interchange

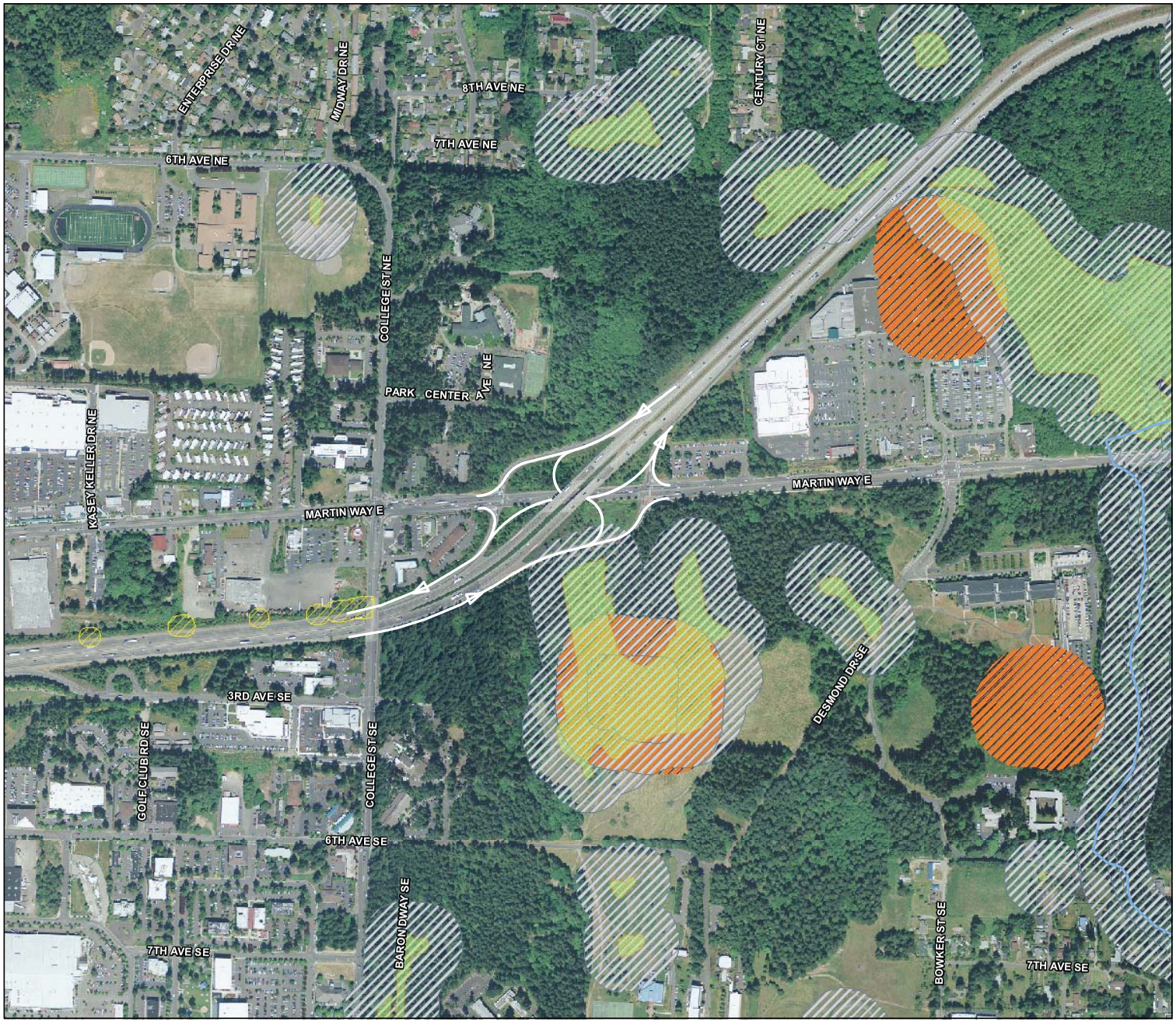
Option #6A

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
S

Feet
0 250 500 1,000

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Marvin Road Interchange

Option #10

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

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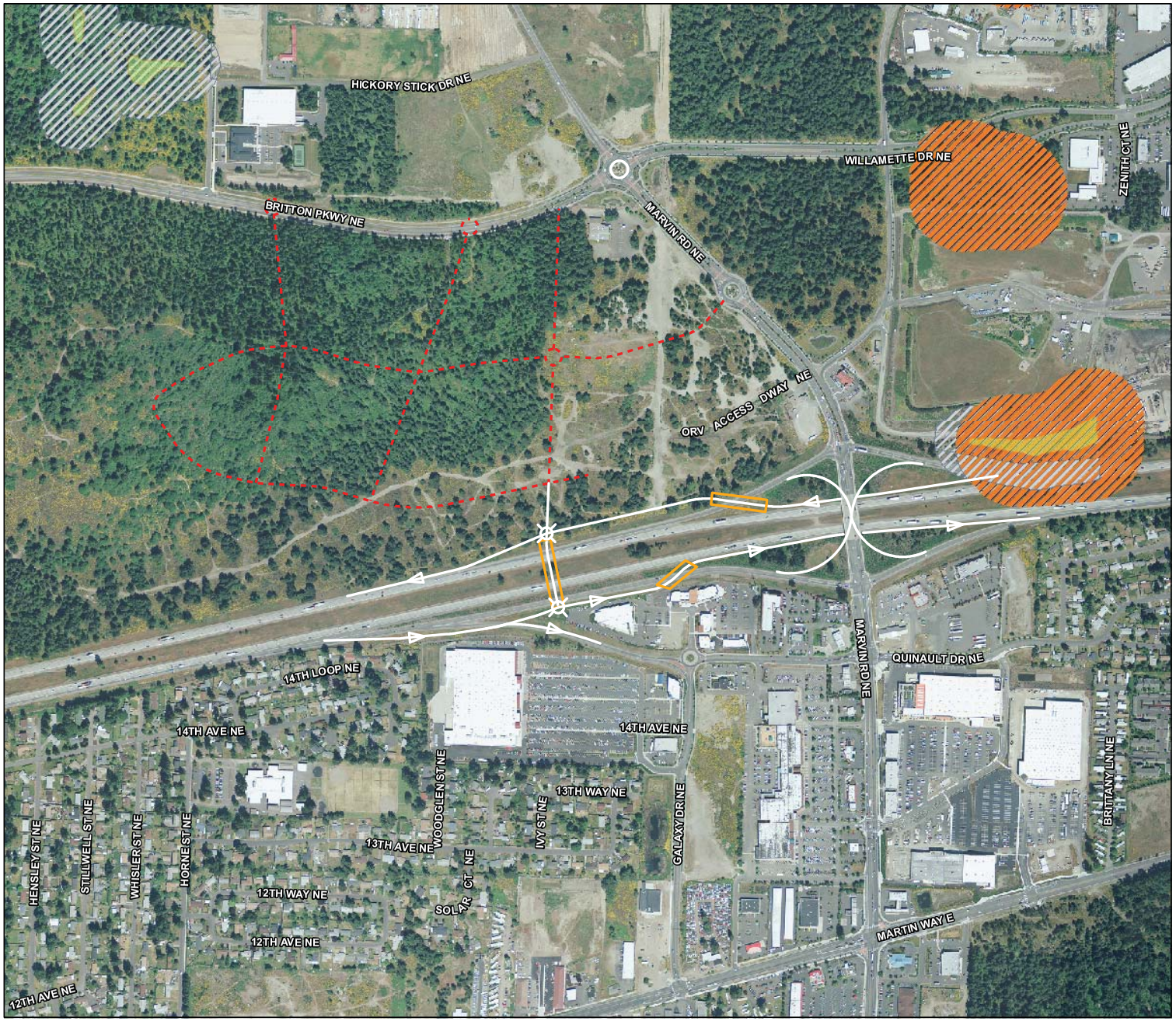


Marvin Road Interchange

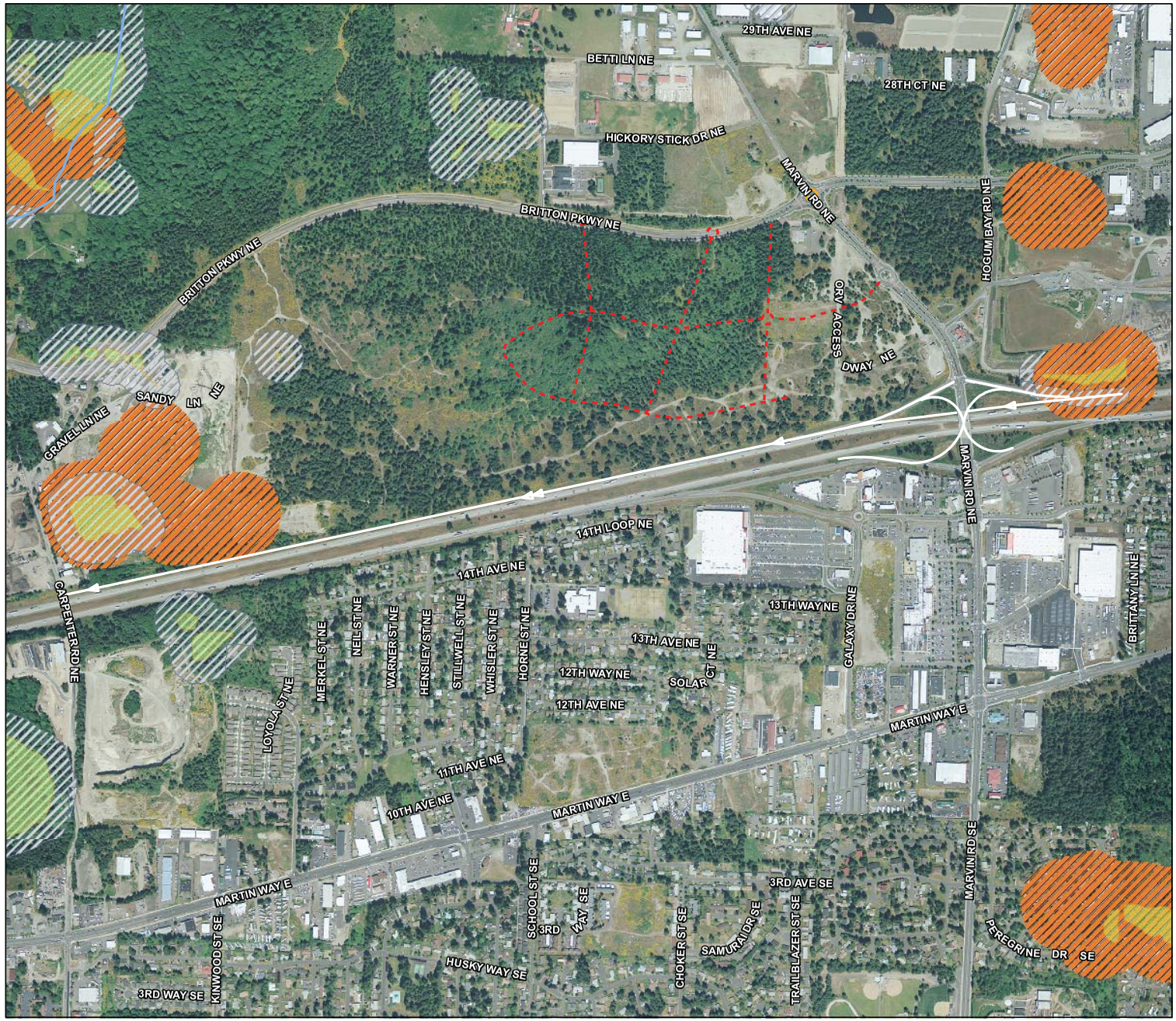
Option #10A

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines
- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N W E S

0 500 1,000 2,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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Marvin Road Interchange

Option #11

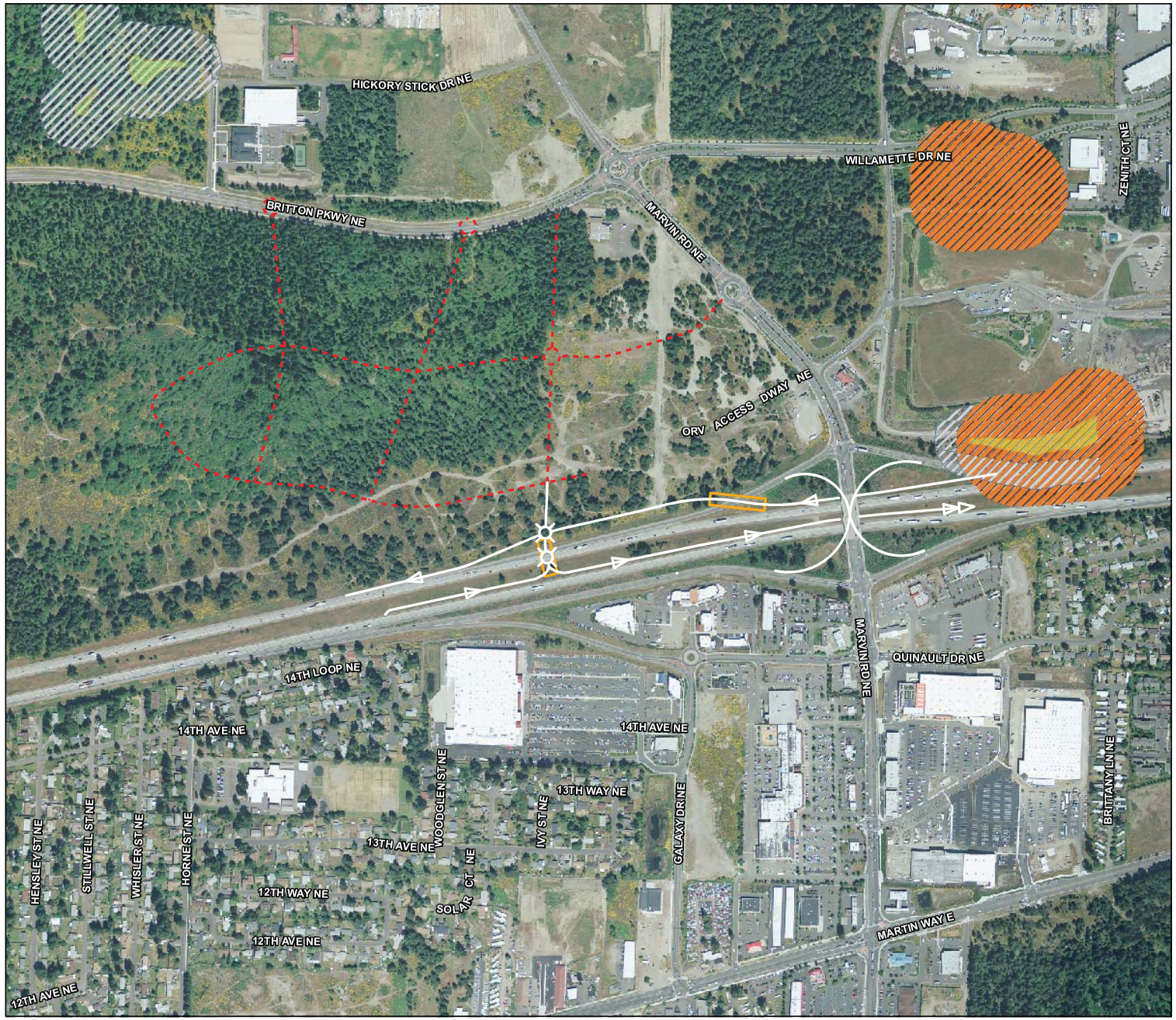
- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain



N
W E
S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
File: P:\Transportation\LaceyInterchangeStudy\Maps_Images\LaceyStudyArea_critical_marvinroad.mxd

Marvin Road Interchange

Option #12

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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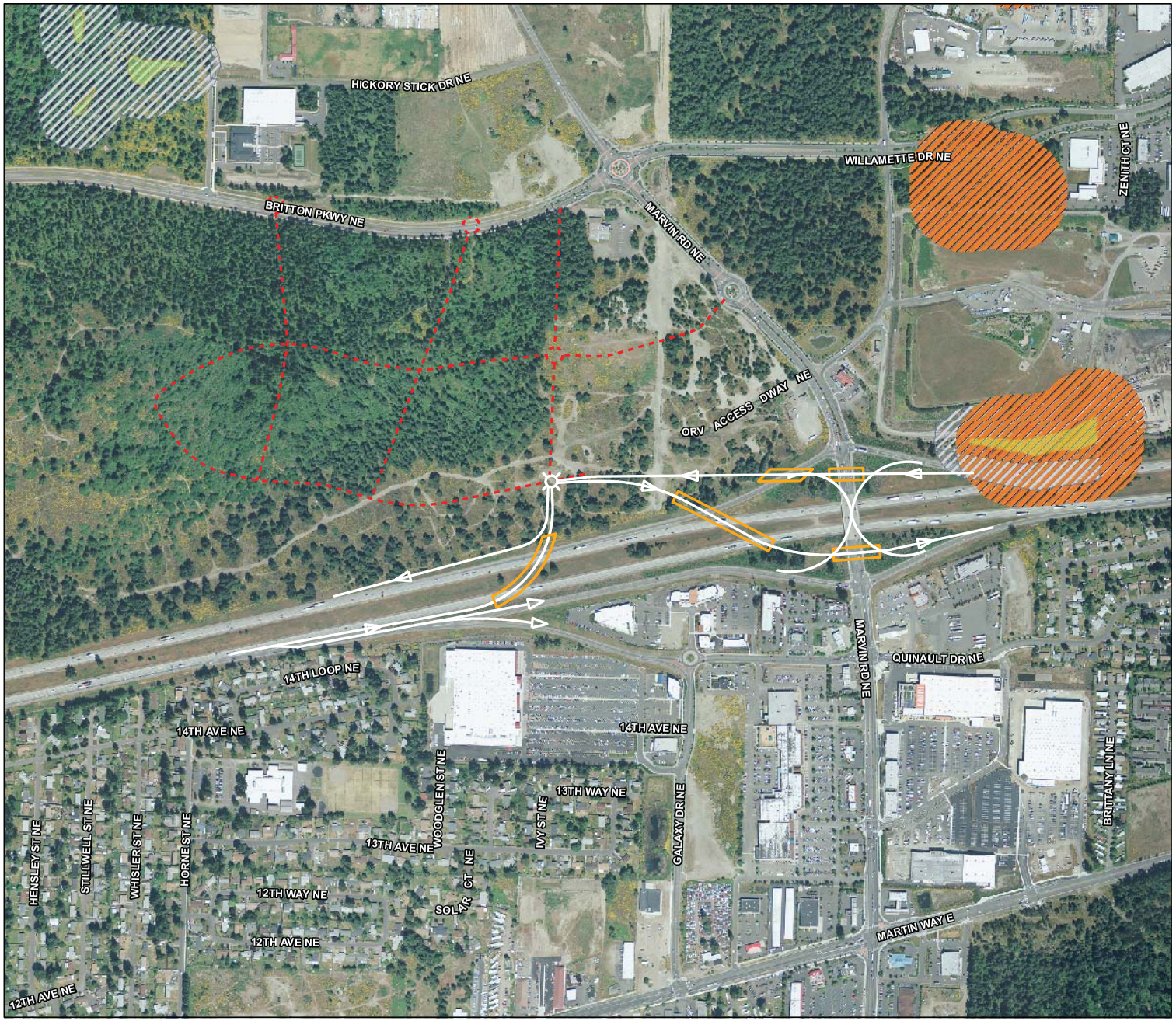

Marvin Road Interchange

Option #13

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N W E S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
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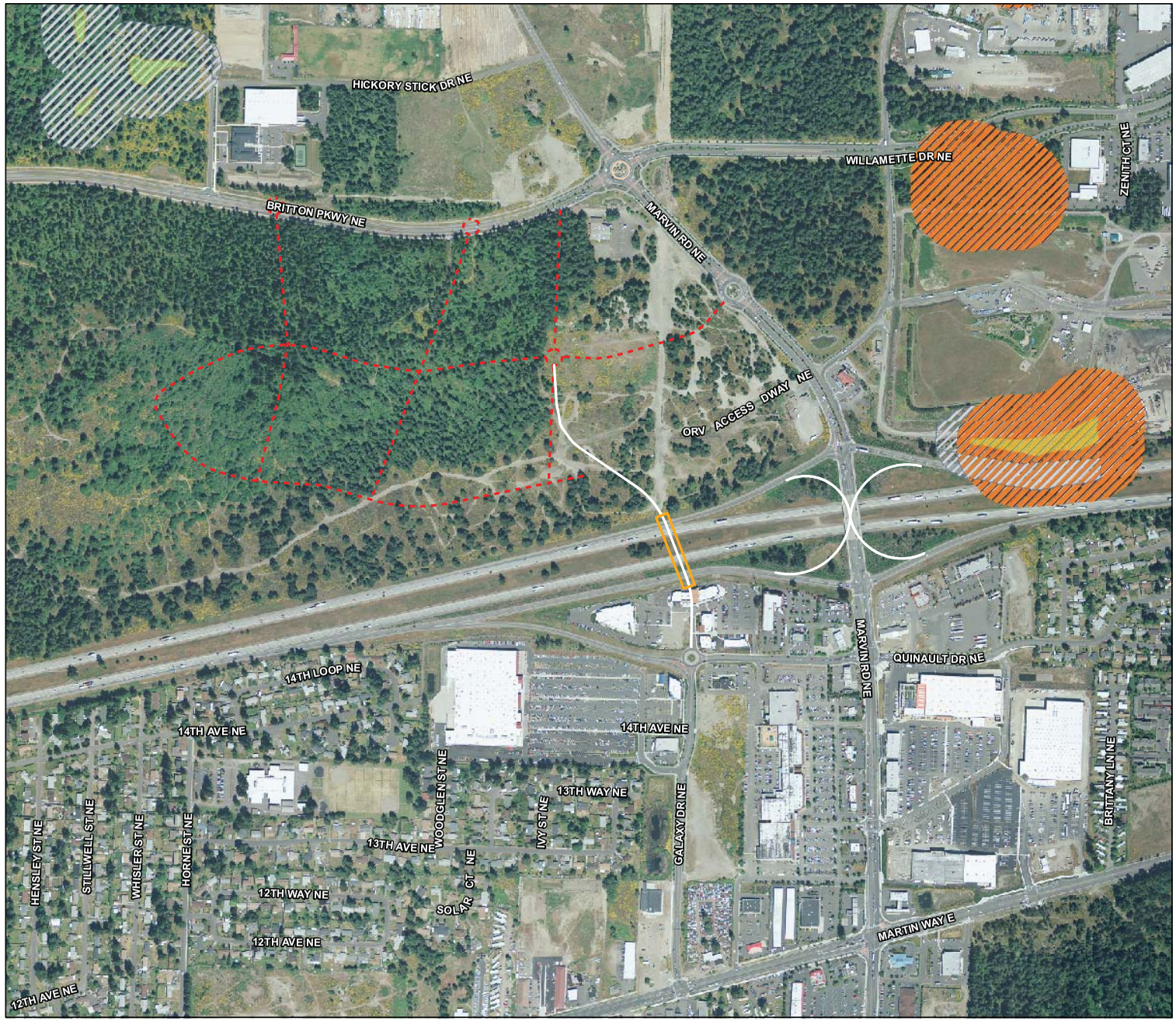


Marvin Road Interchange

Option #14

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

N
W E
S

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
File: P:\Transportation\LaceyInterchangeStudy\Maps_Images\LaceyStudyArea_critical_marvinroad.mxd

Marvin Road Interchange

Option #14A

- Remove Ramp
- Signalized Intersection
- Proposed Roadway
- Bridge
- Proposed Local Street Network

Critical Area Indicators *

- Ponds, Lakes and Streams
- Buffers of Critical Areas Including:

  Streams, Wetlands, Ponds, Lakes, Shorelines

- Steep Slopes
- High Ground Water
- Oak and Prairie Grass
- Wetlands
- Flood Plain

0 250 500 1,000 Feet

* Areas identified are considered to be indicators that Critical Areas may be present based on each jurisdictions criteria. On-site verification is required to confirm presence or absence of Critical Areas.

Printing Date: September 18, 2008
File: P:\Transportation\LaceyInterchangeStudy\Maps_Images\LaceyStudyArea_critical_marvinroad.mxd

Appendix F

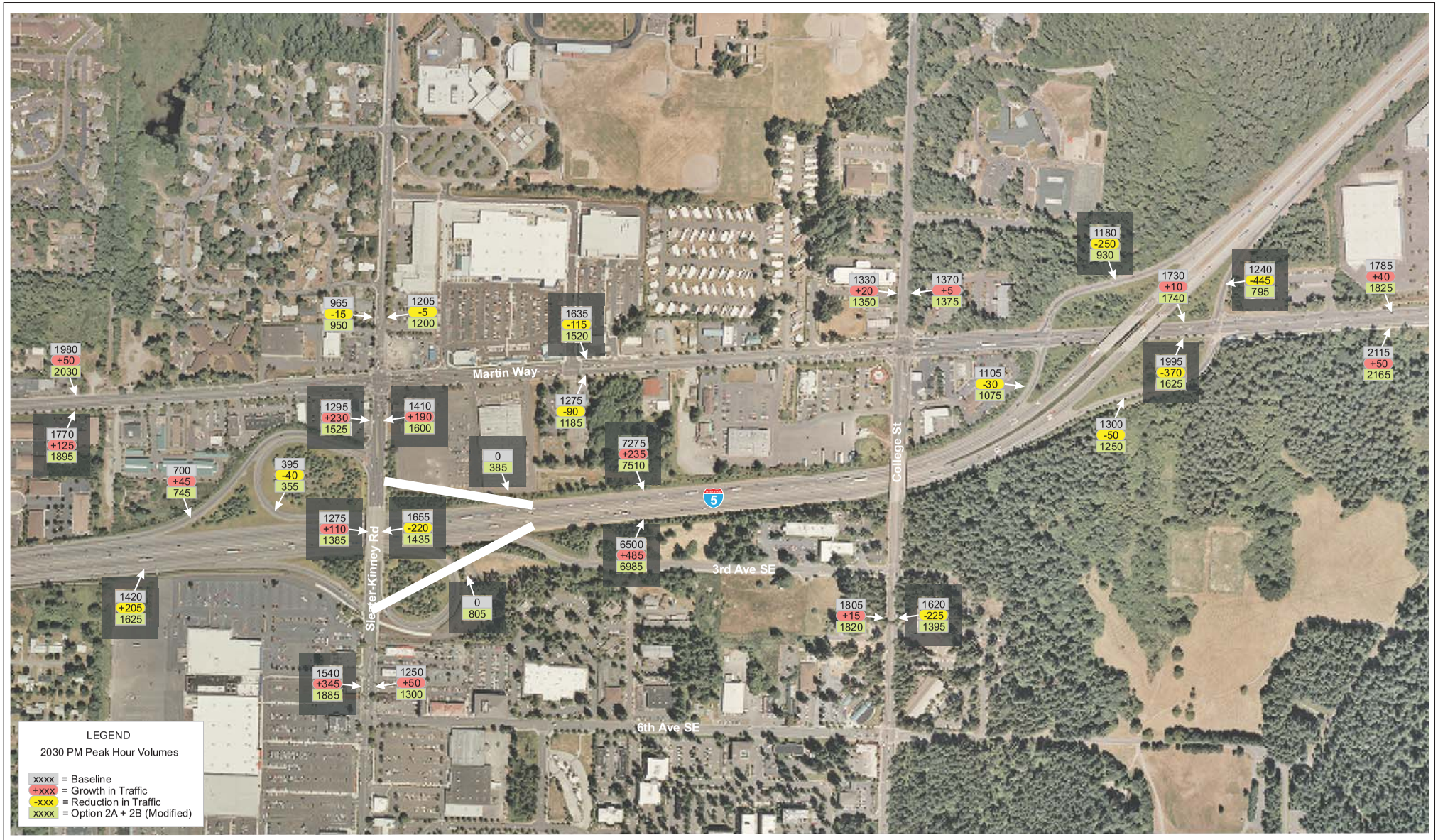
EXISTING INTERCHANGE LINK VOLUME COMPARISONS

The technical appendices are included as published at their time. In some instances subsequent analyses refined the results of the published material. Any such refinements are reflected in the subsequent materials, but the published material is unchanged.

SHEA CARR JEWELL

Option 2A (Modified) - Add a SB I-5 to NB Sleater Kinney Rd off-ramp

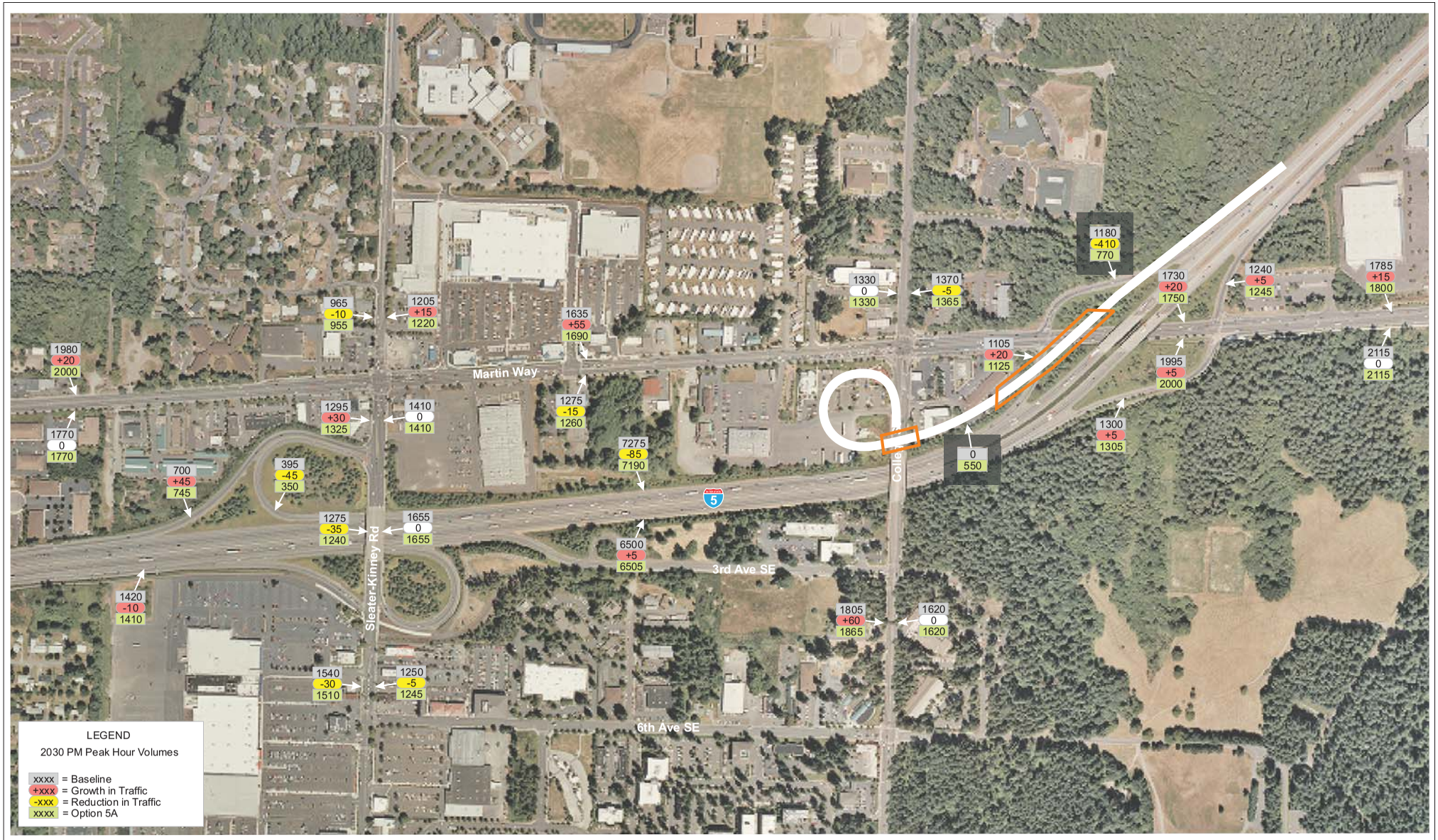
Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL

Option 2A & 2B (Modified) - Option 2A (Modified) plus a Sleater-Kinney Rd to NB I-5 on-ramp

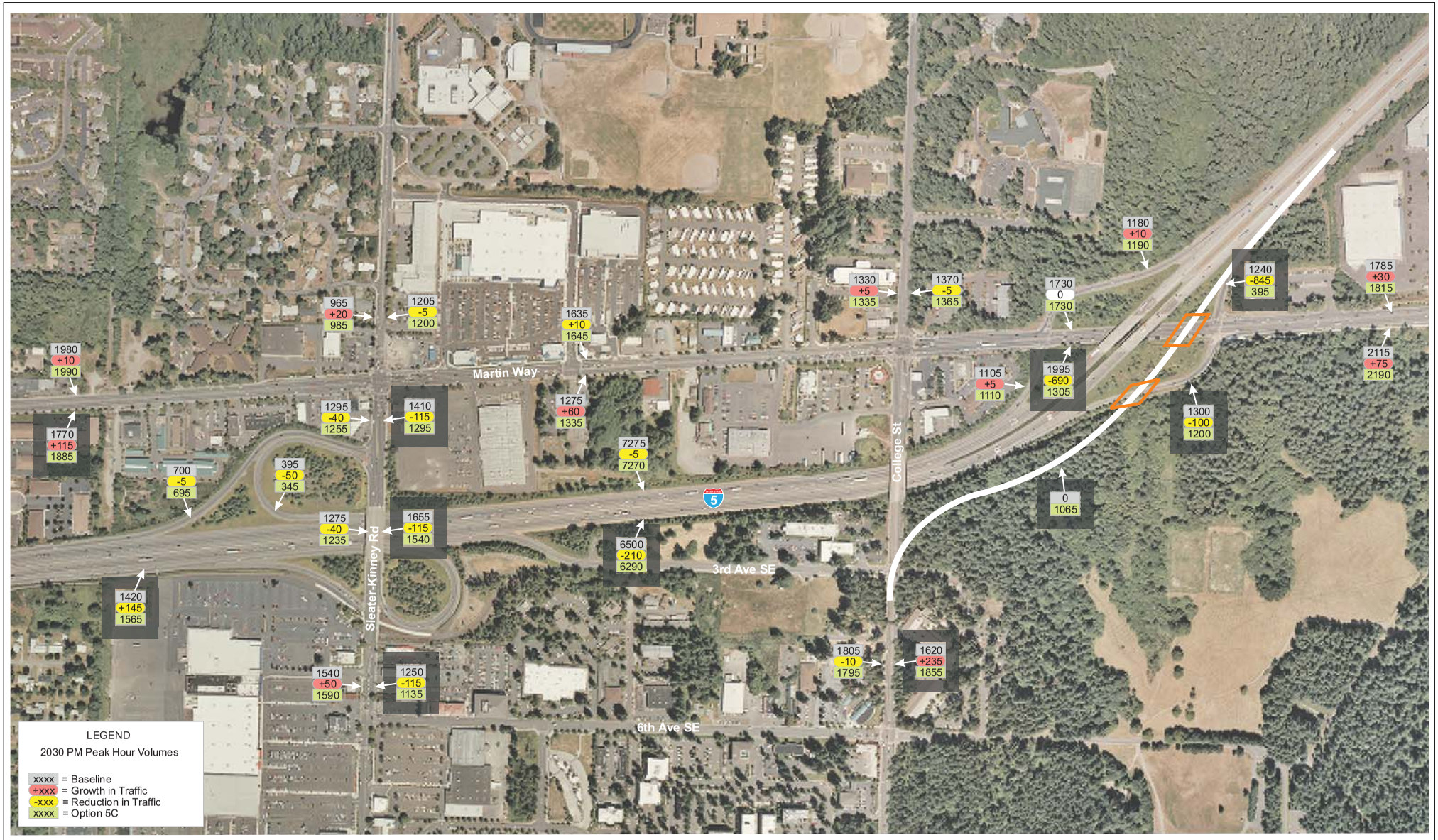
Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL

Option 5A - Add a SB I-5 to SB College St flyover off-ramp

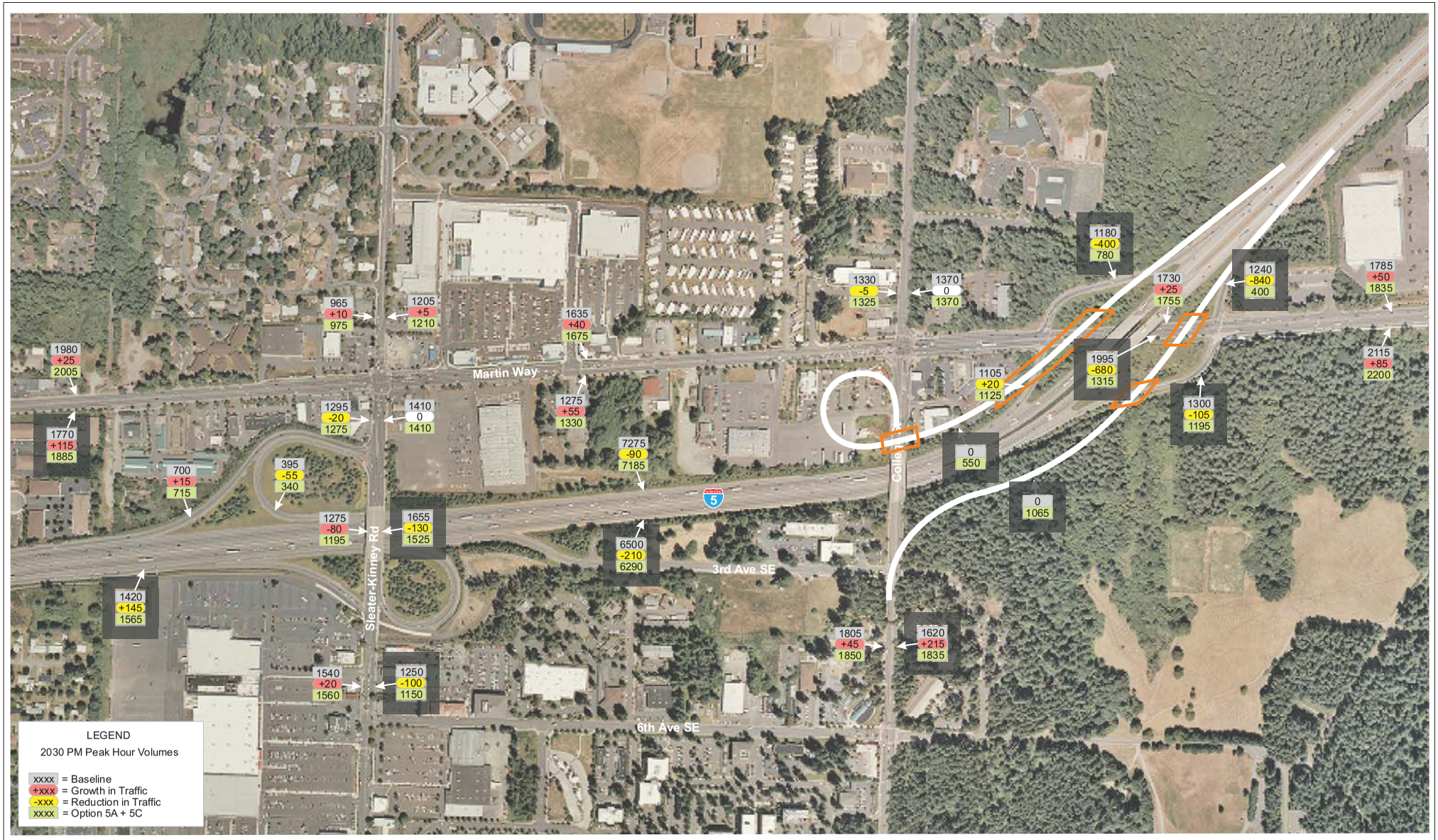
Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL

Option 5C - Add a NB College St to NB I-5 flyover on-ramp

Transportation Systems Analysis and Alternatives Evaluation



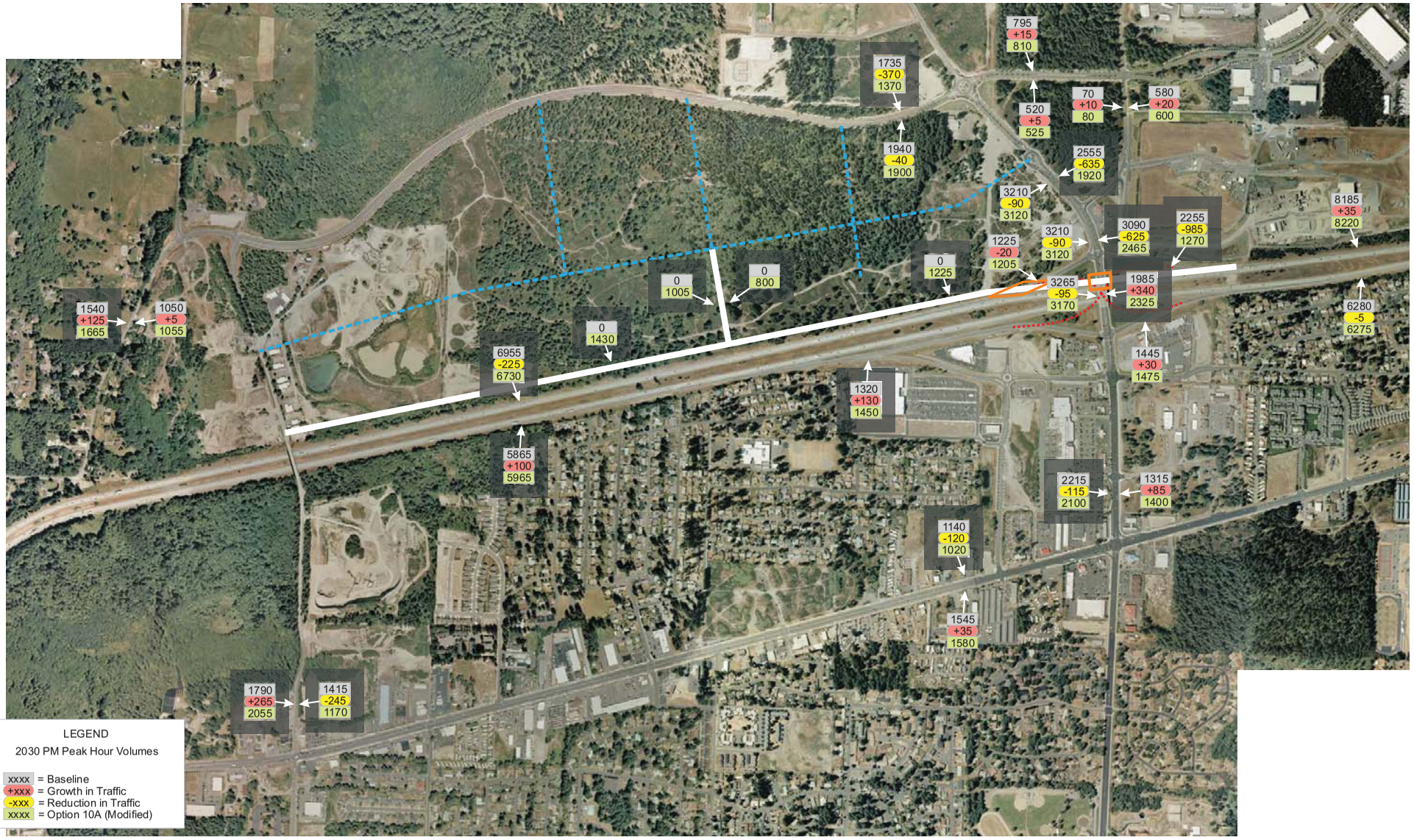
Option 5A plus Option 5C

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL

Option 10A - SB CD to Carpenter Rd

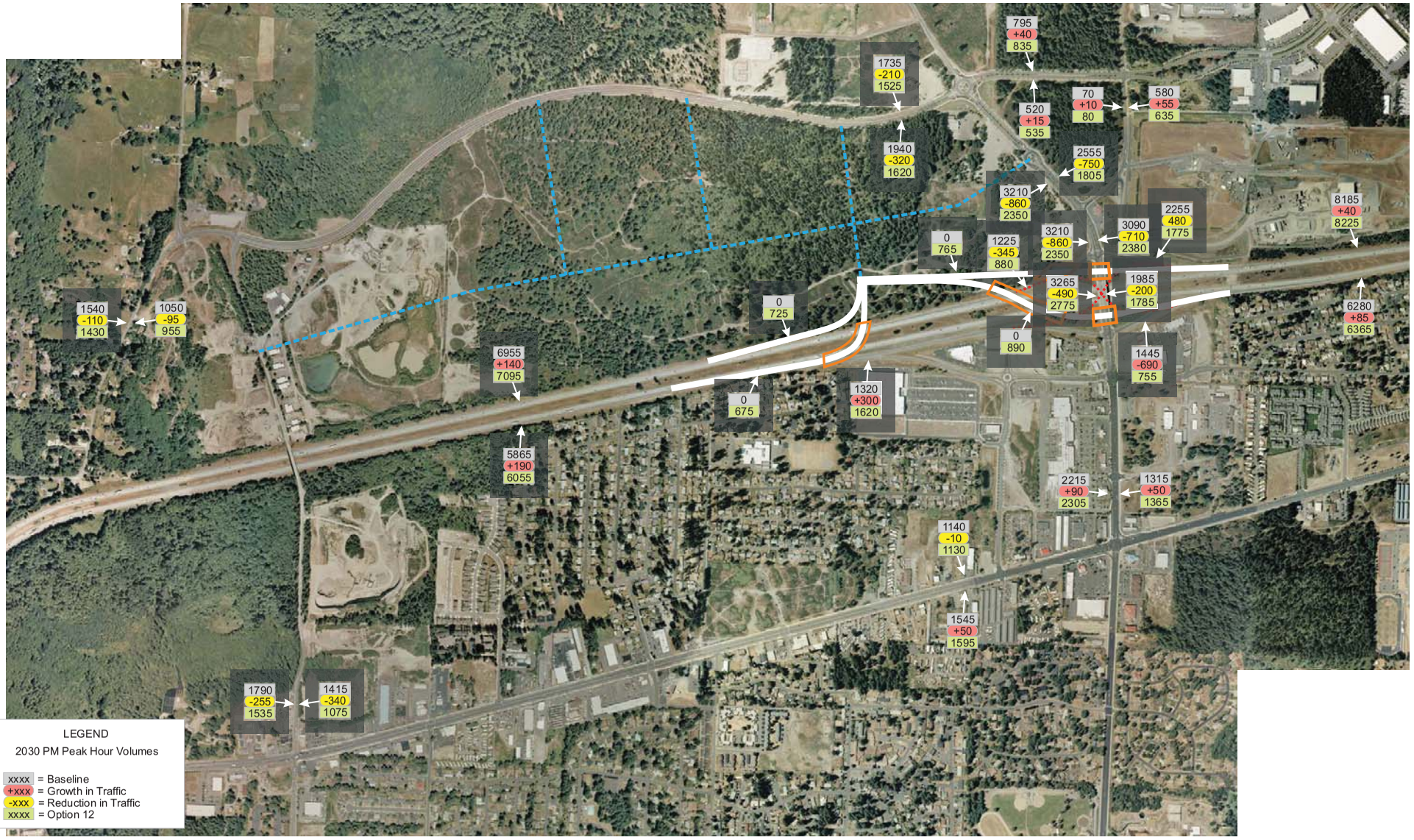
Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL

Option 10A (Modified) - Option 10A with access to Lacey Gateway Town Center

Transportation Systems Analysis and Alternatives Evaluation



Option 12 - NB off/on flyover ramps

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL

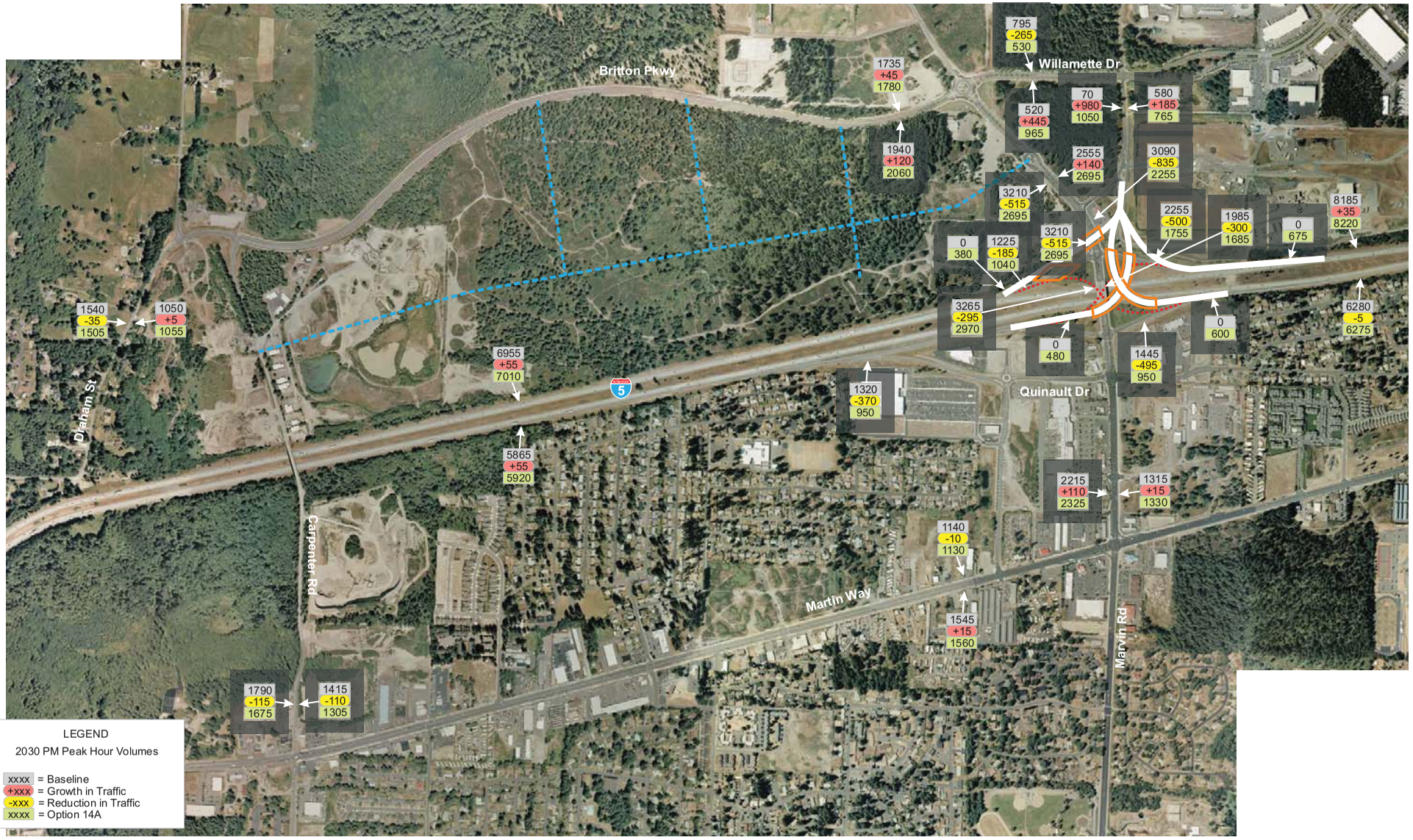
Option 13 - New over-crossing; Galaxy Drive Extension

Transportation Systems Analysis and Alternatives Evaluation

SHEA CARR JEWELL

Option 14 - Direct SB off-ramp to Hogum Bay Rd

Transportation Systems Analysis and Alternatives Evaluation



SHEA CARR JEWELL

Option 14A - Flyover ramps to Hogum Bay Rd

Transportation Systems Analysis and Alternatives Evaluation