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TECHNICAL MEMORANDUM

DATE: May 1, 2015

TO: Jeff Peters, P.E., City of Richland

CC:

FROM: Spencer Montgomery, Transportation Planner
Vijay Kornala, P.E., P.T.O.E.
Ben Hoppe, P.E.
Rick Door, P.E.

SUBJECT: George Washington Way/I-182 Access Study

This memorandum will provide background information associated with George Washington Way immediately north of I-182, document studies performed to date to support additional questions, and summarize accident history and traffic operations under existing and future No-Build conditions as well as two alternative improvement scenarios. It also documents design features for ramps to/from George Washington Way at the I-182/SR 240 Interchange.

The intent of this memo is to demonstrate that improvements are needed, and that there will be no significant impacts to the I-182 mainline under either of the two alternatives, such that no Interchange Justification Report (IJR) would be required, consistent with Note (3) of Exhibit 550-1 of the WSDOT Design Manual. Additionally, the City of Richland seeks reasonable assurance from the Federal Highway Administration (FHWA) and the Washington State Department of Transportation (WSDOT) to allow the City to proceed with a more detailed alternatives analysis and comparison including right-of-way impacts, environmental impacts and public involvement and to ensure that the improvements identified in either alternative may move forward with a reasonable assurance of ultimate approval for construction.

Introduction and Background

George Washington Way (GWW) in the city of Richland, Washington is a major north-south principal arterial roadway. Due to the barrier created by the Yakima River and I-182, GWW provides one of two routes into the city from the south, along with SR 240, and is second only to SR 240 in the amount of traffic it serves in the City. The City has other significant projects underway that will improve the local roadway system and add a third access corridor from the south in the form of an additional crossing of the Yakima River that would connect the southern portions of Richland to SR 240 north of I-182 and also connect to the downtown area.

In 2013 J-U-B Engineers completed a study for the City of Richland for the George Washington Way/Columbia Point Drive (GWW/CPD) intersection. The intersection previously had included

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northbound and southbound permissive left-turn movements in the traffic signal cycle. In response to a high number of accidents at the intersection the City eliminated the permissive left-turns and as a result there are significant queues on GWW, especially southbound during the PM peak hour. Hence the study was performed to identify improvements that would address the capacity deficiencies.

Long range forecasts were prepared for the year 2032 and several alternatives were developed to address capacity needs at the intersection. Eighteen alternatives were developed with nine of the alternatives being evaluated for future traffic operations using Synchro modeling software. Three of the nine alternatives were evaluated, along with the No-Build, using VISSIM traffic microsimulation software. The two most promising alternatives involve the following geometric changes (see attached exhibits for existing and the improvement alternatives):

- Traditional Improvements (Alternative 2): add a second left turn lane northbound and southbound, add an additional thru lane southbound and exclusive right turn lane southbound, separate the shared thru/left turn lane for both the eastbound and westbound approaches by constructing an additional lane so that the split phased signal timing can be eliminated. This alternative widens the intersection from 8 lanes to 10 lanes across.
- Separate T Intersections (Alternative 3): this alternative would create a new intersection south of existing Columbia Point Drive on the west side of GWW (removing the existing Aaron Drive leg of the intersection). This alternative improves the green time allocated to the southbound movement by separating the east-west legs and allowing those movements to operate concurrently.

The Separate T Intersection Alternative would be placed in the limited access area of the SR 240/I-182 Interchange. Meetings were previously held with WSDOT and FHWA representatives and it was determined that additional analysis would be necessary to determine the impacts to the interchange and any mitigation if necessary. A brief summary of other additional analysis and research performed as part of this study effort includes the following:

- More detailed investigation was performed to determine if additional modeling needed to be performed. This included examination of the following three issues:

  1. The origin-destination of the traffic from westbound I-182, to determine the percent of traffic that is completing the weave, to merge into the northbound left-turn lane at the GWW/CPD intersection.
  2. The origin-destination of the southbound GWW traffic to determine the percentage of traffic going eastbound or westbound on I-182 and the percentage of traffic continuing southbound on GWW.
  3. The impact of pedestrians crossing at the intersection of GWW/CPD on the Alternative Concepts.

  For each of the first two issues it was determined that the model is conservative in all cases. In other words: the amount of traffic making the weave from westbound I-182 to the northbound

left at Columbia Point Drive is higher in the model than observed in the field; the amount of traffic destined for I-182 from GWW southbound in the model is higher than observed in the field for the Separate T Alternative (which would reduce the reported queues because of better lane utilization).

Regarding the third issue, if pedestrians were added to the VISSIM model, the Traditional Improvements Alternative would need to be re-evaluated to accommodate the pedestrian crossing since the required time to cross would be 35 seconds and the signal cycle only allows for 19 seconds. However, the Separate T Alternative requires only 29 seconds for pedestrians to cross and 35 seconds are available in the cycle for pedestrians to cross.

- A memorandum was prepared that summarized research performed regarding the use of innovative techniques to eliminate conflicting travel movements from congested intersections. Several examples in the research demonstrated the benefits of considering relocating left turns from heavily congested intersections. It is clear from the research that many jurisdictions are benefitting from non-traditional intersection designs.

- A memorandum was prepared that evaluated the previous 20 year forecasts and the growth rates used. Traffic counts were collected at the intersection of George Washington Way/Columbia Point Drive in February 2015 and compared with the original study counts collected in May 2012. Seasonal factors were also considered. The result of the analysis determined that in nearly every case (except the westbound CPD through movement) the traffic volumes projected (for 2015) using the previous growth rate exceed the adjusted counts from 2015. The conclusion was that the traffic volumes previously forecast still adequately represent 20 years of growth from today at the intersection, and in actuality could represent a longer time period under No-Build conditions. This evaluation recommends that the 2032 forecast traffic volumes previously prepared adequately represent long range design year 2040 traffic volumes.

Collision History

For the 2013 George Washington Way/Columbia Point Drive Study collision records were researched during the 5 year period of 2006 – 2010 with 136 total collisions. The number of collisions at the intersection was 30 – 35 per year from 2006 – 2008 when permissive left turns were allowed. The collisions went down to less than 20 in 2009 – 10 after the permissive phase of the signal cycle was eliminated. Nearly two-thirds of the collisions types were those that would typically be associated with congestion, including 29.6% being same direction one stopped – rear end, 26.2% opposite direction one left turn one straight and 9.2% same direction both moving – rear end.

A more recent examination of collisions from 2012 – 2014 at the GWW/CPD intersection as well as collisions on the four I-182 ramps to/from GWW is provided in Tables 1 – 3 below which show the collisions by year, collision severity and collision types (four other ramps serve the interchange as well but are not included in the tables below since they are unaffected by the GWW/CPD intersection). As

shown in the tables, significantly more collisions occur at the GWW/CPD intersection than occur on the ramps to/from the interchange to GWW. Fortunately, there have been no fatalities or serious injury collisions in the study area and only 6 of the 82 collisions have resulted in evident injuries. In fact, only 9 collisions have occurred on the two on-ramps and the westbound to northbound off-ramp in the three years, with 5 of those involving a single vehicle with a fixed object and the other 4 being rear-end collisions. Meanwhile, 16 additional collisions have occurred on the SR 240 ramp which serves as an extension of GWW. The most common collision type at the intersection of GWW/CPD and the immediate north-south ramp serving the intersection is by far rear-end, amounting to 2/3 of the collisions. It is important to note that the number of left turning collisions has reduced to just one with the elimination of the permissive phase of the signal.

Table 1. Summary of Collisions by Year

Location	2012	2013	2014	Total
George Washington Way/ Columbia Point Drive	17	20	20	57
I-182 LX00495 & SR 240 (NB/SB SR 240 ramp)	5	5	6	16
I-182 R1 00540 (WB I-182 to NB GWW)	0	1	2	3
I-182 S1 00440 SB GWW to WB I-182	1	1	2	4
I-182 Q2 00567 (n/I-182) SB GWW to EB I-182	2	0	0	2
TOTAL	**25**	**27**	**30**	**82**

Table 2. Summary of Collisions by Severity

Location	Serious	Evident	Possible	None	Total
George Washington Way/ Columbia Point Drive	0	5	22	30	57
I-182 LX00495 & SR 240 (NB/SB SR 240 ramp)	0	1	5	10	16
I-182 R1 00540 (WB I-182 to NB GWW)	0	0	2	1	3
I-182 S1 00440 SB GWW to WB I-182	0	0	2	2	4
I-182 Q2 00567 (n/I-182) SB GWW to EB I-182	0	0	1	1	2
TOTAL	**0**	**6**	**32**	**44**	**82**

Table 3. Summary of Collisions by First Collision Type/Object Struck

Location	Same direction one stopped- rear end	Same direction both moving - rear end	Opposite direction one left turn one straight	Entering at angle	Same direction - sideswipe	Bike/Ped	Fixed Object, ditch, embankment, guardrail, etc.	All others	TOTAL
George Washington Way/ Columbia Point Drive	26	10	1	9	3	2	5	1	57
I-182 LX00495 & SR 240 (NB/SB SR 240 ramp)	5	6	0	0	2	0	3	0	16
I-182 R1 00540 (WB I-182 to NB GWW)	1	0	0	0	0	0	2	0	3
I-182 S1 00440 (SB GWW to WB I-182)	1	2	0	0	0	0	1	0	4
I-182 Q2 00567 (n/I-182) (SB GWW to EB I-182)	0	0	0	0	0	0	2	0	2
TOTAL	33	18	1	9	5	2	13	1	82

Traffic Operations

Prior to completing the microsimulation for each of the alternatives, a calibrated model of existing conditions was prepared. To simulate the existing conditions, the VISSIM model was constructed using an aerial photograph of the roadway network as the background. The number of lanes, location of lane additions, lane drops, speed limits and other roadway geometry were input in the model to reflect the field conditions. The existing AM and PM VISSIM models were calibrated to reflect the field measurements for existing queue lengths and delay.

The traffic volumes and queue lengths were collected from the traffic count videos and used to calibrate the base model following the FHWA Traffic Analysis Toolbox Volume III: *Guidelines for Applying Traffic Microsimulation Modeling Software*. The calibrated existing 2012 AM and PM peak hour VISSIM models meet the calibration and validation criteria. The calibrated VISSIM models accurately represent the field-measured traffic conditions with respect to the traffic delay and queue lengths. The improvement Alternatives selected for 2032 traffic conditions were analyzed using the calibrated VISSIM model.

A summary of the results of the AM peak hour analysis including delay and queue lengths for all intersections associated with each alternative, including the No-Build Alternative, are shown in Table 4, with the PM results summarized in Table 5. The results of the analysis were used to prepare videos that could be used to observe both traffic operations and queueing.

As shown in the tables, the AM conditions are not expected to degrade substantially and will provide Level of Service (LOS) "C" in the No-Build condition. However, the No-Build Condition during the PM peak hour shows LOS "F" with 107 seconds of average vehicle delay with queues extending back more than one-quarter mile in the southbound direction. The PM peak condition for Alternative 2 with Traditional Improvements in the form of additional lanes achieves overall intersection LOS of "D" with 37 seconds of average vehicle delay. Alternative 3 with the Separate T Intersections has LOS "B" at each of the two intersections with average vehicle delay of 19 and 14 seconds.

An observation was made that the LOS "D" and "B" reported at the GWW/CPD intersection likely does not fully represent the two alternatives because some vehicles in the Separate T Intersection Alternative would have to stop at both intersections which could amount to as much as 33 seconds of average vehicle delay, much closer to the average delay associated with the Traditional Improvements. When looking at the southbound through movement for the two alternatives the delay would be 31 seconds of average vehicle delay for the Traditional Improvements and 26 seconds for the Separate T Intersections when combined.

To provide a more accurate comparison of the two alternatives a travel time comparison was performed using the results from the VISSIM model, checking the travel times from north of Comstock Street to south of the new southern intersection included in the Separate T alternative. The results of this analysis are included in Table 6. As shown in the table the average travel times are substantially lower for either of the alternatives than for the No-Build scenario, and although there are slight differences in the travel times depending upon the destination of the trip and the scenario examined, the percentage reduction in travel time for both scenarios are very similar and are approximately 40% of the travel time of the No-Build Scenario.

As mentioned earlier, the new intersection associated with the Separate T intersections alternative would place a new intersection closer to I-182. Concern was expressed regarding having northbound queues back up into the interchange, especially since the Separate T intersection is 500' closer to the interchange, and the fact that westbound I-182 traffic destined to make a northbound left-turn onto the new west leg of the T intersection could have a shorter distance to weave to that lane. The attached graphic shows the relationship of the queue lengths and the associated available weaving distance between the Existing, No-Build and the two alternatives. As shown, because the traffic operations is improved over the No-Build scenario, the minimum weaving length available increases from 425' for the No-Build to 632' for Traditional Improvements and 564' for the Separate T Intersection Alternative, an improvement of 140' over the no-Build.

Table 4. 2040 AM Level of Service and Queue Comparison of Alternatives

for Detailed Traffic Operations Analysis

AM PEAK

Alternative		0				1				2			
Description		2012 Existing				2040 No-Build				2040 Traditional Improvements (Adding 1 NBL, 1SBL,1 SBT, 1SBR, 1 EBL, 1 WBT)			
MOEs		Volume	Delay (sec)	95% Q (ft)	LOS	Volume	Delay (sec)	95% Q (ft)	LOS	Volume	Delay (sec)	95% Q (ft)	LOS
Movement	NBL	126	41.9	109	D	140	42.8	115	D	140	68	111	E
	NBT	1914	21	285	C	2240	27.6	497	C	2240	14.6	301	B
	NBR	232	3.9	0	A	260	6.6	0	A	260	7.1	0	A
	SBL	100	39.9	89	D	110	42	97	D	110	64.4	72	E
	SBT	970	17.2	139	B	1090	18.8	165	B	1090	9.9	116	A
	SBR	12	14.8	138	B	13	13.7	164	B	13	2.9	0	A
	EBL	20	54.7	118	D	20	58.1	109	E	20	92.2	148	F
	EBT	36	50.7	118	D	40	51.9	109	D	40	95.3	148	F
	EBR	108	10	0	A	120	9.6	0	A	120	17	0	B
	WBL	159	41.4	90	D	190	42.9	139	D	190	66.3	145	E
	WBT	23	41.4	90	D	30	44.9	139	D	30	56	48	E
	WBR	88	5.6	0	A	110	7.4	0	A	110	4.5	0	A
	Overall		**21**		**C**		**25.1**		**C**		**19**		**B**

Alternative		3							
Description		2040 Separate T-Intersections							
		GW Way/Columbia Point				GWW/New "T" at Shelterbelt			
MOEs		Volume	Delay (sec)	95% Q (ft)	LOS	Volume	Delay (sec)	95% Q (ft)	LOS
Movement	NBL	-	-	-	-	140	55.4	78	E
	NBT	2260	9.2	242	A	2500	5.2	97	A
	NBR	300	3.3	22	A	-	-	-	-
	SBL	110	52	65	D	-	-	-	-
	SBT	1103	3.9	69	A	1280	5.1	70	A
	SBR	-	-	-	-	43	2.6	0	A
	EBL	-	-	-	-	60	67.3	123	E
	EBT	-	-	-	-	-	-	-	-
	EBR	-	-	-	-	120	43.6	123	D
	WBL	220	50.1	129	D	-	-	-	-
	WBT	-	-	-	-	-	-	-	-
	WBR	110	6.7	0	A	-	-	-	-
	Overall		**10.6**		**B**		**8.8**		**A**

Table 5. 2040 PM Level of Service and Queue Comparison of Alternatives

for Detailed Traffic Operations Analysis

PM PEAK

Alternative		0				1				2			
Description		2012 Existing				2040 No-Build				2040 Traditional Improvements (Adding 1 NBL, 1SBL,1 SBT, 1SBR, 1 EBL, 1 WBT)			
MOEs		Volume	Delay (sec)	95% Q (ft)	LOS	Volume	Delay (sec)	95% Q (ft)	LOS	Volume	Delay (sec)	95% Q (ft)	LOS
Movement	NBL	248	104.1	528	F	280	144.7	843	F	280	76.3	193	E
	NBT	1348	30.2	304	C	1570	35.5	410	D	1570	29.5	351	C
	NBR	279	3.2	0	A	310	6.5	0	A	310	8.7	0	A
	SBL	174	115.5	174	F	190	143.3	1011	F	190	51.2	114	D
	SBT	2447	113.7	1335	F	2740	124.2	1335	F	2740	30.7	1256	C
	SBR	34	107.9	1334	F	40	107.5	1334	F	40	19.2	0	B
	EBL	32	115.5	199	F	40	138.5	658	F	40	61.9	138	E
	EBT	76	105.1	199	F	80	121.2	658	F	80	84.7	138	F
	EBR	307	69.1	700	E	340	60.2	707	E	340	55.7	603	E
	WBL	400	86	483	F	490	339	1183	F	490	67.3	383	E
	WBT	55	87.9	483	F	70	343.7	1183	F	70	57.5	90	E
	WBR	89	6	0	A	110	198.6	35	F	110	4.0	0	A
	Overall		**77.8**		**E**		**107.3**		**F**		**36.9**		**D**

Alternative		3							
Description		2040 Separate T-Intersections							
		GW Way/Columbia Point				GWW/New "T" at Shelterbelt			
MOEs		Volume	Delay (sec)	95% Q (ft)	LOS	Volume	Delay (sec)	95% Q (ft)	LOS
Movement	NBL	-	-	-	-	280	59.6	151	E
	NBT	1610	14.6	209	B	1880	5.7	84	A
	NBR	390	6.3	29	A	-	-	-	-
	SBL	190	53.2	101	D	-	-	-	-
	SBT	2780	14.5	1314	B	3230	11.4	290	B
	SBR	-	-	-	-	110	3.6	0	A
	EBL	-	-	-	-	120	65	154	E
	EBT	-	-	-	-	-	-	-	-
	EBR	-	-	-	-	340	38.8	161	D
	WBL	560	54.8	341	D	-	-	-	-
	WBT	-	-	-	-	-	-	-	-
	WBR	110	5.6	0	A	-	-	-	-
	Overall		**19**		**B**		**14.3**		**B**

Table 6. 2032 PM Peak Hour Travel Time Comparison (seconds)

Direction	No-Build	Traditional Improvements		Separate T Intersections	
		Travel Time	% of No-Build	Travel Time	% of No-Build
Northbound	116.2	113.7	98%	99.8	86%
Southbound to SR 240	301.7	118.1	39%	115.8	38%
Southbound to I-182 Eastbound	309.5	138.9	45%	142.8	46%
Southbound to I-182 Westbound	312.1	139.5	45%	143.8	46%

Additional Considerations

Following the completion of the 2013 GWW/CPD Intersection Study, the City of Richland staff, consultant team and WSDOT staff met to review the alternatives and challenges associated with the potential improvements identified. Multiple issues were discussed and concerns were expressed regarding pedestrians at the intersection and their impacts on traffic operations. Also, given the accident history in the vicinity of George Washington Way north of I-182, high speeds and weaving concerns, along with the inclusion of a new intersection closer to I-182 in one of the alternatives, there was some discussion about modifications to some of the ramps.

Modifications to the I-182 westbound off-ramps to northbound GWW were evaluated to reduce the speed limit to 35 MPH as well as to increase the distance between the ramp merge and the northbound left turn on GWW. It was determined that an additional 525' could be added to the weave length, nearly double the distance shown in the previous graphic depicting the minimum available weaving length of 564' for the Separate T Intersection alternative. This modified ramp can be achieved while still meeting WSDOT standards for deceleration length and is shown in the exhibit Acceleration/Deceleration requirements.

Modifications are also shown in the Exhibit that demonstrate that 35 MPH curves can also be achieved for the southbound direction of GWW. These modifications would still meet the length requirements to allow traffic adequate distance to accelerate up to Interstate speed. By incorporating these ramp modifications the nature the facility would give a more urban feel, and it may be feasible to turn back to the City of Richland a portion of the State Highway, from the new intersection north to Columbia Point Drive. This would allow the two alternatives to be considered through a more comprehensive alternatives analysis process that will consider other factors beyond traffic operations. These other considerations may include right-of-way impacts to adjacent properties, environmental issues, cost, public involvement, etc.

Another enhancement shown in the Exhibit includes a pedestrian underpass of George Washington Way south of Columbia Point Drive. It should be noted that the pedestrian underpass, as well as the ramp modifications, could be incorporated with either the Separate T Intersection alternative or the Traditional Improvements alternative.

In conclusion, potential improvements identified with either the Traditional Improvements in the form of roadway widening and adding additional lanes or through the creation of Separate T Intersection to improve capacity will pose no impacts to the I-182 mainline. The tables and exhibits included in this memorandum show the following:

- Either alternative will improve LOS and significantly reduce delay.
- Both alternatives reduce queue lengths below the future No-Build condition
- Both alternatives provide improved weaving distances for the westbound I-182 to the northbound left turn from George Washington Way at Columbia Point Drive.
- Either alternative will provide adequate acceleration/deceleration lengths.

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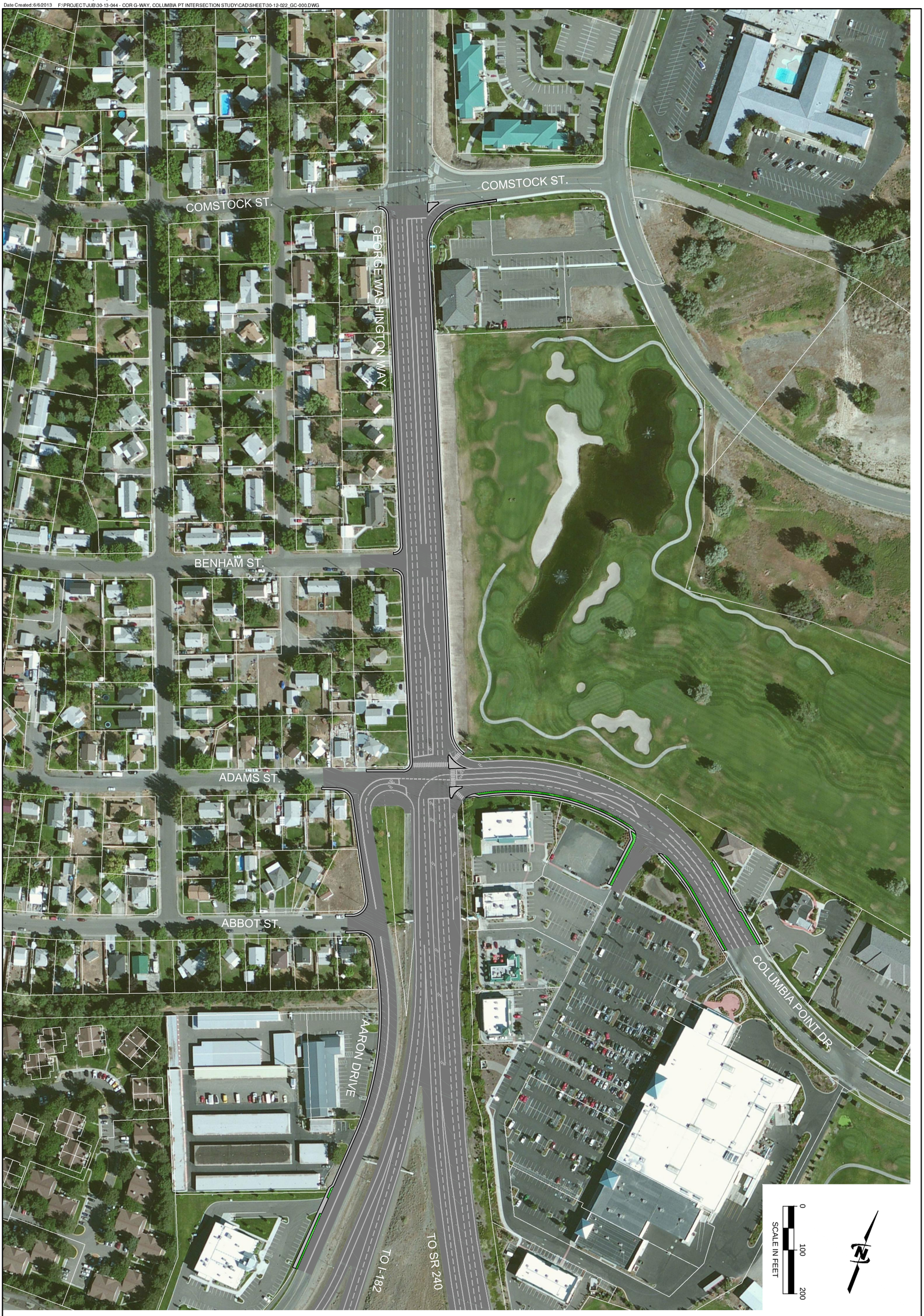

FIGURE 2

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EXISTING LANE CONFIGURATION

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FIGURE 5

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DESIGN BY: XW
CHECKED BY: LLL
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ALTERNATIVE 2
TRADITIONAL INTERSECTION IMPROVEMENTS

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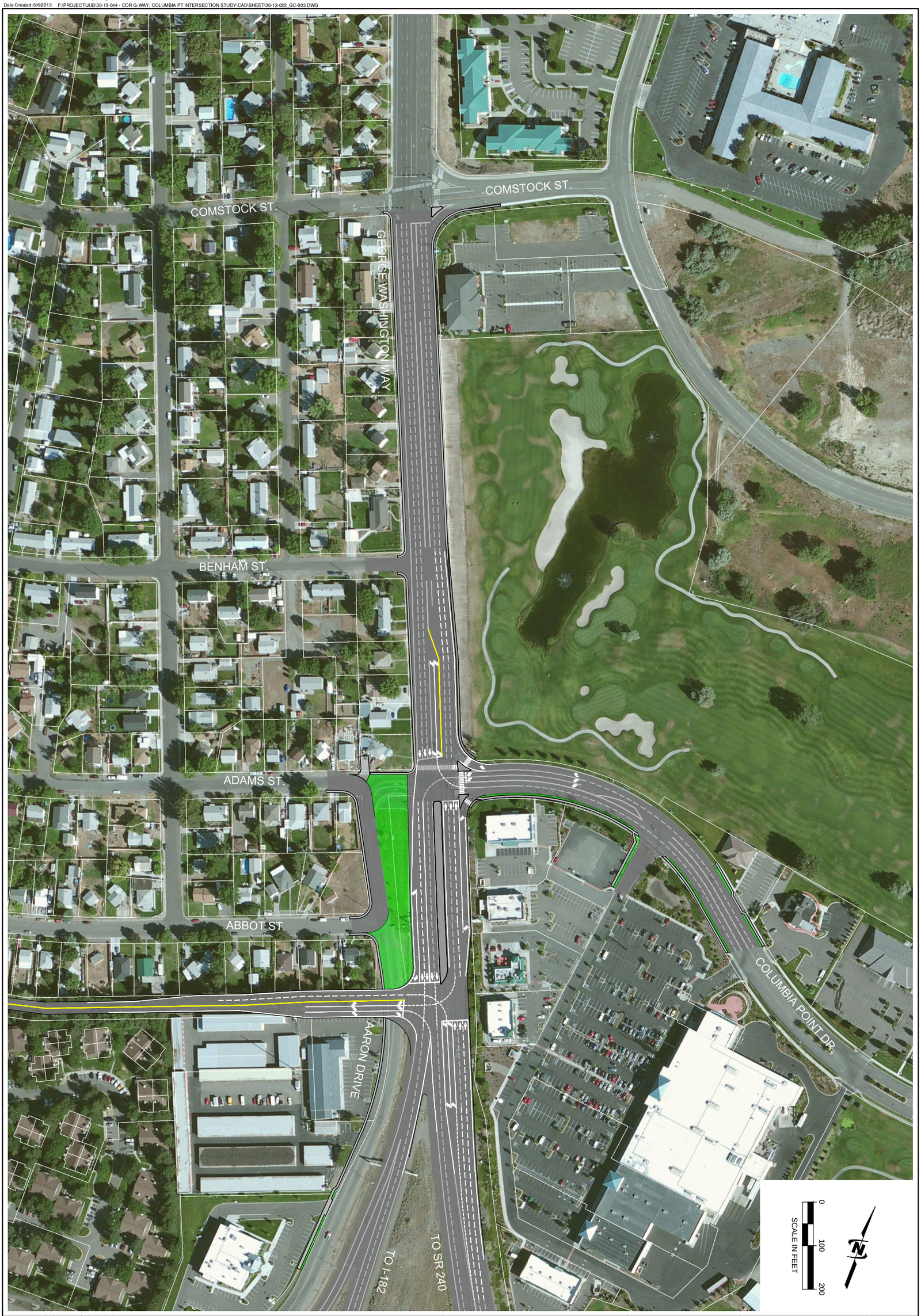

FIGURE 6

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ALTERNATIVE 3
SEPARATE-T INTERSECTIONS

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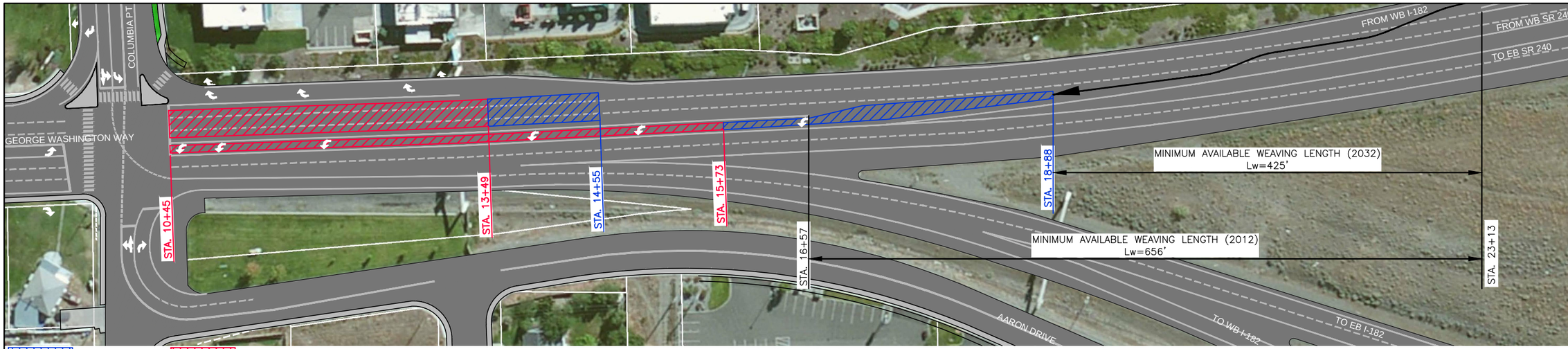
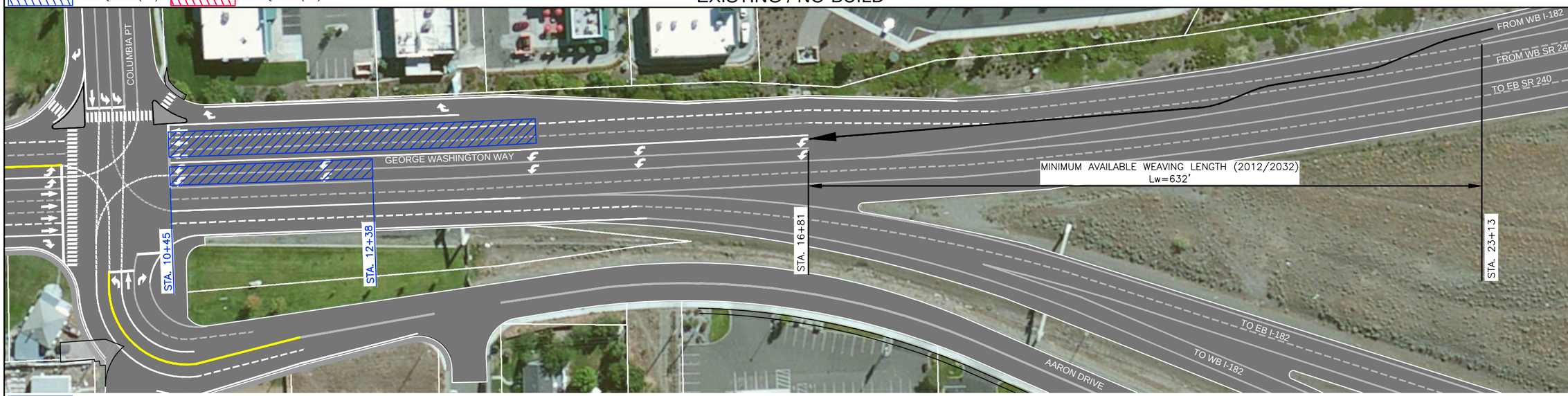


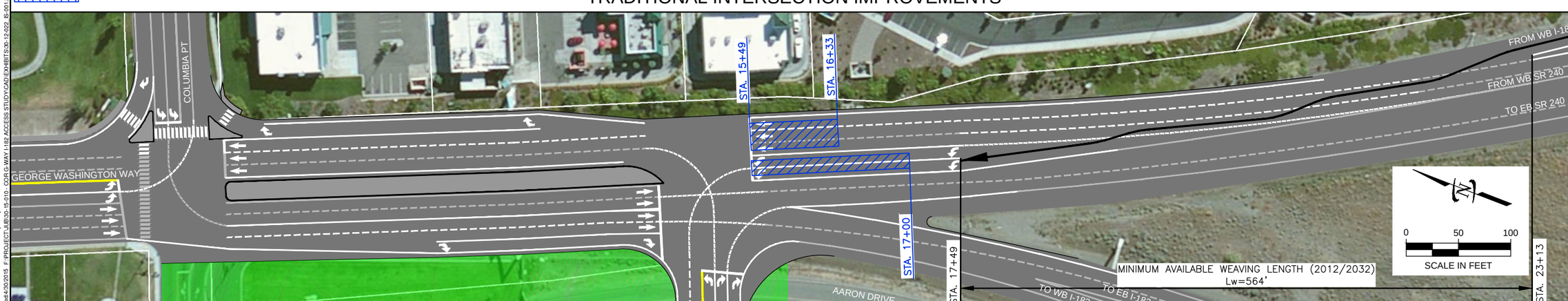
2032 QUEUE (PM) 2012 QUEUE (PM)

EXISTING / NO-BUILD



2032 QUEUE (PM)

TRADITIONAL INTERSECTION IMPROVEMENTS



2032 QUEUE (PM)

SEPARATE T INTERSECTIONS

Plot Date:4/30/2015 9:59 AM Plotted By: Mary M. Wilkinson
Date Created:4/30/2015 F:\PROJECT\JUB\30-15-010 - COR G-WAY I-182 ACCESS STUDY\CAD\EXHIBITS\30-12-022_IS-001.DWG

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PRELIMINARY PLANS

NOT FOR CONSTRUCTION

REUSE OF DRAWINGS

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NO.	DESCRIPTION	BY	APR.	DATE

REVISION

GEORGE WASHINGTON WAY I-182 ACCESS STUDY
RICHLAND, WA

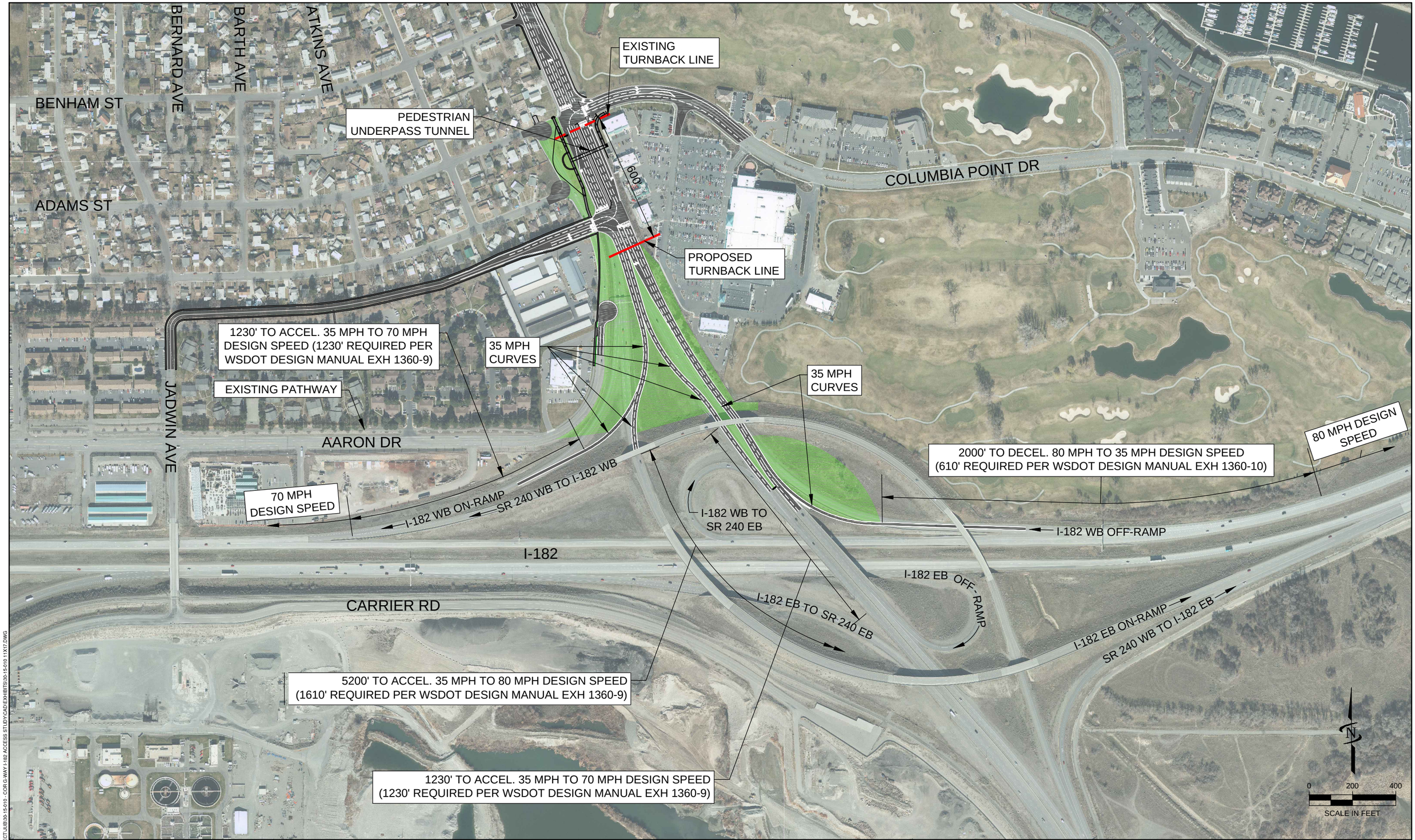
WEAVING AND QUEUE ANALYSIS

FILE : 30-12-022_IS-001
JUB PROJ. # : 30-12-022
DRAWN BY: MMW
DESIGN BY: BBH
CHECKED BY:

ONE INCH
AT FULL SIZE, IF NOT ONE INCH, SCALE ACCORDINGLY

LAST UPDATED: 4/30/2015

FIG. I/S-1



GEORGE WASHINGTON WAY / I-182 ACCESS STUDY
ACCELERATION / DECELERATION REQUIREMENTS

J-U-B ENGINEERS, INC.

Plot Date:4/29/2015 2:27 PM, Plotted By: Mary M. Wilkinson
Date Created:4/29/2015 F:\PROJECT\JUB\30-15-010 - COR G WAY I-182 ACCESS STUDY\CAD\EXHIBITS\30-15-010 11X17.DWG