



City of Bellingham

Meridian Street Roundabouts Feasibility Study

Bellingham, WA

December 2019

PREPARED BY

ReidMiddleton

City of Bellingham
Meridian Street Roundabouts Feasibility Report
December 2019

The engineering material and data contained in this report were prepared under the supervision and direction of the undersigned, whose seal as registered professional engineer is affixed below.



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EXECUTIVE SUMMARY

The two closely spaced intersections at Meridian/Birchwood and Meridian/Squalicum are critical nodes in several major transportation routes for the movement of people, emergency responders, industrial freight, and commercial goods between the following locations:

- Bellingham's commercial, industrial, and residential Waterfront District
- Birchwood Neighborhood commercial center and residential area
- Fountain District Urban Village commercial center and residential area
- Saint Joseph's Hospital and medical offices
- King Mountain Neighborhood (Via Orchard Drive)
- Irongate industrial area (Via Orchard Drive)
- Meridian-Bakerview commercial area north of Interstate 5
- U.S.-Canadian border crossings on Interstate 5 and State Route 539 (Guide-Meridian).

Increased vehicular capacity at these intersections is needed to accommodate the level of growth and development that the City is planning for in the Bellingham Comprehensive Plan. Over 5,000,000 square feet of commercial, industrial, and residential growth is planned for the Waterfront District. Approximately 500,000 square feet of new medical offices and patient care is planned for Saint Joseph's Hospital. Several hundred thousand square feet of mixed-use commercial and residential development is planned for the Fountain District Urban Village. Many vacant parcels await commercial and residential development in the Meridian-Bakerview commercial area north and east of Interstate 5.

Since 2006, the City of Bellingham has been working to study the feasibility, develop plans, secure funding, and obtains permits to construct the Orchard Drive Extension in 2020 between Birchwood Avenue and James Street in the heart of Bellingham's 25th and newest residential neighborhood. This area was annexed to the City in 2009 and is expected to develop with over 3,000 homes over time. This has been a critical component of Bellingham's strategy to both plan for and accommodate growth while also providing a new, grade-separated crossing beneath Interstate 5. This new connection would relieve existing traffic congestion at the I-5/Meridian and I-5/Sunset interchanges, which are the only other route options from King Mountain into downtown Bellingham.

While the Orchard Drive extension would provide a much-needed connection, it would also introduce new traffic impacts to the Meridian/Birchwood and Meridian/Squalicum intersections. Replacing the existing traffic signals at these intersection with a multimodal roundabout has the potential to increase long-term intersection capacity for passenger and freight vehicles and to improve safety and comfort for all people using the multimodal transportation system. However, there are many significant challenges and risks to reconstructing these intersections and the purpose of this feasibility study was to examine all of these variables, test some possible alternative solutions, weigh the pros and cons of each alternative, and to make a recommendation as to how best to proceed forward. Importantly, there is no funding currently identified for right-of-way acquisition, engineering, design, or construction, but the recommendations from this study lay out a basic strategy and next steps for Bellingham to follow in order to seek funding for scalable transportation improvement of these intersections over time.

BACKGROUND

The following background provides a glimpse of the attention that these intersections have received from the City over the past 15 years.

In **2006**, Bellingham adopted the Orchard Drive Extension as an important new transportation project needed to accommodate the 20-year growth planned for in the Comprehensive Plan. This new grade-separated crossing of Interstate 5 would provide a multimodal transportation connection from James Street in the north-central Urban Growth Area (UGA), passing beneath Interstate 5, to Birchwood Avenue, Meridian Street, and the Bellingham urban core.

In **2006**, Bellingham also adopted a new Institutional Master Plan for Saint Joseph's Hospital, which called for hundreds of thousands of additional square feet of medical offices, surgery facilities, patient care, and a cancer center. The Orchard Drive Extension beneath Interstate 5 would provide a much faster and more direct route for emergency responders carrying patients from the northcentral UGA to a new backdoor to the hospital without having to deal with delays due to traffic congestion at the I-5 interchanges at Meridian and Sunset, which offered the only other routes to the hospital.

In **2007**, understanding that a new Orchard Drive Extension would provide major mobility benefits, but would also increase traffic congestion and delay at the Meridian/Birchwood and Meridian/Squalicum intersections, Bellingham Public Works issued a Request for Qualifications (RFQ), hired consultants, and began studying alternatives to improve the intersections. In 2008, the "Great Recession" negatively affected the national, state, and local economies and the intersection alternatives analysis was shelved.

In **2009**, approximately 1,000 acres of the northcentral UGA was annexed into the City of Bellingham and, through a lengthy public planning process in 2010, became the King Mountain Neighborhood, Bellingham's 25th planned neighborhood. The zoning approved for the King Mountain Neighborhood will allow over 3,000 new homes to be constructed over time, which will bring increased vehicle traffic, as well as the need to provide sidewalks, bikeways, and transit routes for the people who live in this area. During the same time period, the City adopted the Fountain District Urban Village Master Plan, which calls for higher urban densities in mixed-use, multi-story buildings in a relatively compact area focused along the Meridian Street corridor with transitions from higher densities to the surrounding residential neighborhoods.

In **2013**, the City adopted the Waterfront District Master Plan, which calls for significant redevelopment of the former 200-acre Georgia-Pacific pulp mill property, purchased by the Port of Bellingham in 2001, with up to 6 million square feet of commercial, industrial, marine shipping, institutional (WWU), and residential development over time.

In **2013**, Bellingham Public Works had secured a federal grant for \$1.25 million for the preliminary engineering, design, and right-of-way (ROW) acquisition of the Orchard Drive Extension. This worked has progressed steadily since the funding became available to the City and a significant amount of private land has been purchased to be used as public ROW for the new multimodal transportation route, but the final ROW acquisition has been delayed and is

awaiting the resolution of negotiations with individual property owners on each end of the project.

In **2014-2015**, the City rehabilitated and resurfaced the Bay-Chestnut Bridge, which allowed the removal of weight restrictions and re-established the major freight trucking route between the marine shipping terminal on south Cornwall Avenue to Chestnut, Roeder, Squalicum, Meridian, and Interstate 5.

In **2015**, the Washington legislature approved a \$15 billion “Connecting Washington” gas tax revenue funding package for major transportation projects throughout the state. Bellingham was fortunate to have the Orchard Drive Extension identified for \$10 million in the State 2017-2018 and 2019-2020 biennial budgets.

Due to the economic recession of 2008, the change from rural, suburban, and industrial areas to higher urban densities began very slowly, but with each passing year the pace of development, and change, has increased in throughout Bellingham. As development continues, the need to identify a feasible alternative to improving the multimodal transportation connections through and traffic operations at the Meridian/Birchwood and Meridian/Squalicum intersections has also grown in importance.

In **2018**, Bellingham Public Works issued an RFQ and hired Reid Middleton consultants to take a fresh look at the alternatives analysis for the Meridian/Birchwood and Meridian/Squalicum intersections.

In early **November 2019**, Washington voters approved Initiative 976, which proposed to cap vehicle registration fees at \$30 per vehicle. The day after the election, Washington Governor Jay Inslee issued a statement acknowledging the passage of I-976 and announcing that hundreds of millions of dollars will be removed from the Washington State Department of Transportation (WSDOT) budget in the coming years as a result.

On **November 27, 2019**, WSDOT published a list of major transportation projects whose funding has been delayed by at least 6 months until the repercussions of I-976 are better understood with the very real possibility that all project funding will have to be permanently eliminated. Bellingham’s Orchard Drive Extension is on this WSDOT list and at the time that this feasibility study report is being published (December 2019), it is uncertain whether Bellingham will have funding to construct the Orchard Drive Extension in 2020, as originally planned, or in the post I-976 future.

In **December 2019**, Reid Middleton concluded this multi-agency roundabout feasibility study with a recommended alternative for Alternative 3 strategically broken into phases 1 and 2 for both funding and construction purposes. Importantly, this Alternative 3 provides significant transportation benefit whether the Orchard Drive Extension is ultimately constructed or not. Assuming the City can obtain ownership of right-of-way claimed to be owned by BNSF, Alternative 3 also provides the best at-grade crossing option for the regional multiuse trail to cross the roundabout into Cornwall Park.

INTRODUCTION

This report summarizes the analysis performed for the Meridian Street intersections with Squalicum Way and Birchwood Avenue. The study includes evaluation of existing conditions, future no-build conditions, and analysis of conceptual design alternatives for the intersections. The alternatives analysis includes advantages and disadvantages of each alternative, preliminary analysis of probable costs, and assessment of multimodal and safety impacts related to each alternative. A conceptual layout of the preferred alternative is included, along with the challenges and risks associated with the proposed alternative.

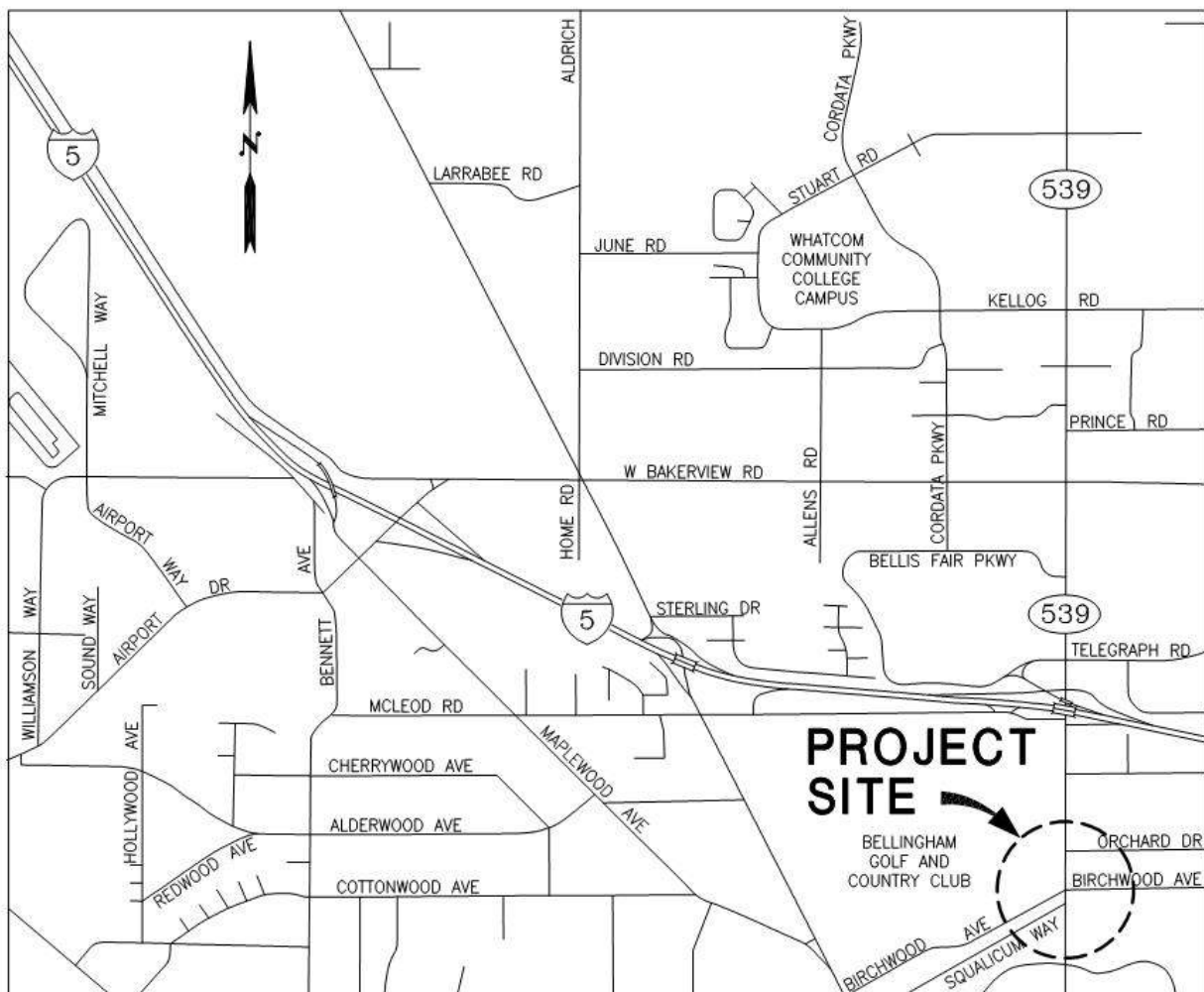


Figure 1. Vicinity Map

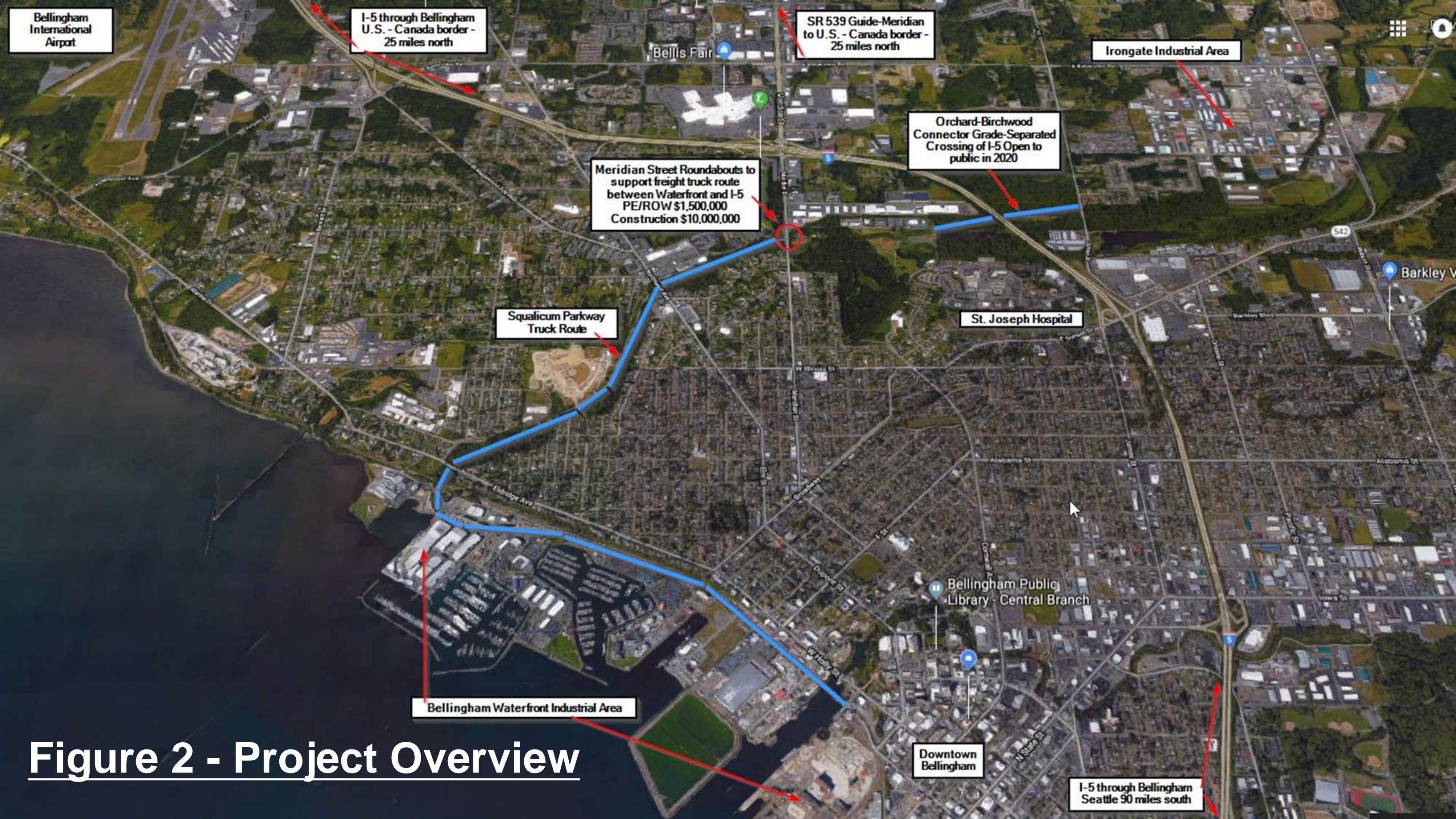


Figure 2 - Project Overview

Project #17: Meridian Street Roundabouts (Meridian/Squalicum & Meridian/Birchwood)

PROJECT NARRATIVE: These two closely spaced intersections are a critical freight route and multimodal transportation link between the industrial Bellingham Waterfront and U.S.-Canadian border crossings connected by Interstate 5 and Guide-Meridian (SR 539). When the Orchard-Birchwood extension is completed in 2020, vehicle traffic volume, as well as pedestrian and bicycle demand, will increase and these intersections will become increasingly congested. Pedestrian and Bicycle Master Plans call for sidewalks and Parks plans call for a multiuse trail on the former railroad bed. WTA has indicated that Meridian is a candidate for future high-frequency GO Line service.

MULTIMODAL TRANSPORTATION BENEFITS: Tier 2 sidewalks, Tier 3 bicycle lanes, turn lanes, increased access, safety, sight distance, and efficiency. WTA Routes 4 and 15 currently provide transit service, with future consideration for high-frequency transit on Meridian Street (SR 539).

PROJECT STATUS: Feasibility Study 2019. Unfunded. State and federal grants, as well as public-private funding partnerships will be sought.

No.	PROJECT DESCRIPTION	FUNDING SOURCE	Cost Estimates (000's) 2019 Dollars							PROJECT TOTALS	
			Previous Budget	FUNDED				UNFUNDED			
			2020	2021	2022	2023	2024	2025			
17	Meridian Street Roundabouts (Squalicum & Birchwood) (2019 Feasibility Study)	Street	160				Feasibility Study 2019				
		Unknown					10,000				
		Subtotal	160					10,000		10,160	

TRANSPORTATION IMPACT FEES COLLECTED

Yes, for local funds

RIGHT-OF-WAY ACQUISITION NECESSARY

Yes: Intersection corners and railroad ROW



Figure 3. Project Summary

EXISTING CONDITIONS

Traffic Signal Operations

The existing signal operation of these two closely-spaced intersections is inefficient due to the split side street signal phases. This causes significant delay to traffic, creating a bottleneck effect for the flow of traffic on Meridian Street. This condition is exacerbated by the heavy flow of truck traffic that uses Squalicum Way as the designated truck route to and from the City's waterfront industrial area.

Traffic counts were collected between 7-9 AM and between 4-6 PM. The AM peak hour occurred between 7:45 and 8:45 AM and the PM peak hour occurred between 4:45 and 5:45 PM. The combined demand at both intersections was approximately 1,800 vehicles during the morning and 2,400 vehicles during the evening. The percentage of freight vehicles (defined as FHWA vehicles classes 4, 6 and above) was 3.6% during the morning and 1.4% during the evening. There was limited bicyclist and pedestrian activity during either peak hour with a total volume of approximately 10 users via each mode during each peak hour. This is consistent with pedestrian and bicycle count data collected at the Meridian/Birchwood intersection annually during the last week of September as part of Bellingham's volunteer-based pedestrian and bicycle counts in partnership with WSDOT and Cascade Bicycle Club (2010-2019).

Table 1. Bike & Pedestrian Volumes.

Bellingham Volunteer-Based Annual Count of People Walking and People Riding Bicycles (Last Week in September)											
Intersection	Time	People Riding Bicycles Through the Intersection									
Count Location	2 hours	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Meridian/Birchwood	7-9 am	28	54	26	36	23	28	33	No Data	10	17
Meridian/Birchwood	4-6 pm	35	47	53	42	54	60	52	31	23	28
Intersection	Time	People Walking Through the Intersection									
Count Location	2 hours	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Meridian/Birchwood	7-9 am	14	27	24	18	17	10	23	No Data	17	20
Meridian/Birchwood	4-6 pm	23	35	24	20	34	25	21	24	25	29

The following existing traffic conditions were observations were during the PM peak hour:

- Tractor-trailers make a wide right turn from southbound Meridian Street onto westbound Squalicum Way, often blocking both southbound lanes on Meridian Street. They also make a wide left turn eastbound from Squalicum Way onto northbound Meridian Street, blocking both northbound lanes.
- Transit buses in the area were typically shorter, approximately 40' in length.
- Pedestrian and bicycle activity in the area was generally low.
- The largest queues observed on Birchwood Avenue and Squalicum Way were around 15-20 vehicles in length. Southbound queues on Meridian Street extended as far north as Orchard Drive (approximately 25 vehicles). Northbound queues on Meridian street extended as far south as Maplewood Avenue (approximately 20 vehicles).
- All queued vehicles typically cleared the intersection during each signal phase.
- Queuing did not extend to the I-5 ramp intersections, and queues were contained within the available left turn storage lengths.



Figure 4. Existing Peak Hour Traffic Volumes.

Existing conditions were modeled using VISSIM (see Appendix A). The results of the analysis are shown in Table 2. The results indicate that significant delay occurs for vehicles traveling south along Meridian Street. The overall level of service for the intersection is LOS D with average delays per vehicle of 41 seconds.

Table 2. Existing Peak Hour Traffic Volumes.

Approach	Demand (veh)	Percent Served	Delay (s/veh)	LOS	Maximum Queue (veh)
Meridian St – Northbound	608	100%	49	D	16
Meridian St – Southbound	814	100%	36	D	18
Birchwood Ave – Eastbound	264	99%	47	D	10
Birchwood Ave – Westbound	434	100%	30	C	15
Squalicum Way – Eastbound	260	100%	45	D	13
Cornwall Park - Westbound	10	100%	36	C	2
<i>Intersection Total</i>	<i>2,390</i>	<i>100%</i>	<i>41</i>	<i>D</i>	<i>-</i>

Source: Fehr & Peers.

PUBLIC OUTREACH

An open house for the Meridian Street Roundabouts Feasibility Study was conducted on the evening of June 24, 2019 at the A Life Church located at 3220 Meridian Street, immediately south of the Meridian/Squalicum intersection. Comments received included conversations with attendees, comment cards from open house participants and email correspondence for some community members that were unable to attend. The following list gives a summary of the comments received.

- Bike lanes and pedestrian facilities are needed in this area. Lack of facilities and a safe environment for cyclists may limit users.
- Multiple commenters indicated that bike lanes should be included in the chosen alternative.
- One local resident indicated the existing traffic light provides gaps in traffic along Meridian to allow vehicles to turn from E. Maplewood Ave.
- One commenter asked if bicycle volumes had been considered in the analysis.

Copies of the public notice, mailing area, comment forms, and the written comments received are included in Appendix C.



ALTERNATIVES ANALYSIS

Traffic Analysis

PM peak hour traffic analysis was conducted to evaluate operational improvements at the Squalicum Way and Birchwood Avenue intersections along Meridian Street. The operation analysis covered Existing, Future No-Build, and Future Build conditions for the study area.

Traffic forecasts for future year 2040 conditions were prepared using the latest version of the Whatcom County regional travel demand model maintained by Whatcom Council of Governments (WCOG). The model includes a 2016 base year and a 2036 future year. Before developing the forecasts, the base year model volumes at the study intersections were compared with the collected intersection counts to determine if a post-processing adjustment to the model volumes would be required to account for any differences between 2016 base year and 2019 count year. The model volumes were within 10% of the count volumes during both the AM and PM peak hours so no adjustments were necessary.

The future year intersection forecasts were prepared by adding the 20-year growth from the traffic model to the 2019 demand volumes. Overall, the model forecasts approximately 35% growth in vehicle trips and 50% growth in freight trips at the study intersections. These growth estimates are consistent with the forecasted population and employment growth within the City of Bellingham. The forecasts also account for additional traffic volume on Birchwood Ave from the Orchard Dr extension project.

The future year demand volumes were coded into the microsimulation model and minor signal timing adjustments were included to optimize the intersection operations. The analysis results for the 2040 PM peak hour are summarized in Table 3. Overall, all approaches except the park driveway operate with LOS F conditions and the maximum queue lengths are between 25 and 60 vehicles during the peak hour. It should be noted that traffic queues spilling south from Meridian/Birchwood can block access to the northern Cornwall Park driveway at Meridian/Squalicum. Detailed results are included as an attachment.

Table 3. Future Peak Hour Traffic Volumes (No Build Condition)

Approach	Demand (veh)	Percent Served	Delay (s/veh)	LOS	Maximum Queue (veh)
Meridian St – Northbound	742	102%	76	E	23
Meridian St – Southbound	1,127	99%	107	F	46
Birchwood Ave – Eastbound	444	98%	128	F	34
Birchwood Ave – Westbound	565	100%	> 150	F	56
Squalicum Way – Eastbound	361	94%	> 150	F	38
Cornwall Park - Westbound	20	98%	53	D	3
<i>Intersection Total</i>	<i>3,259</i>	<i>99%</i>	<i>125</i>	<i>F</i>	<i>-</i>

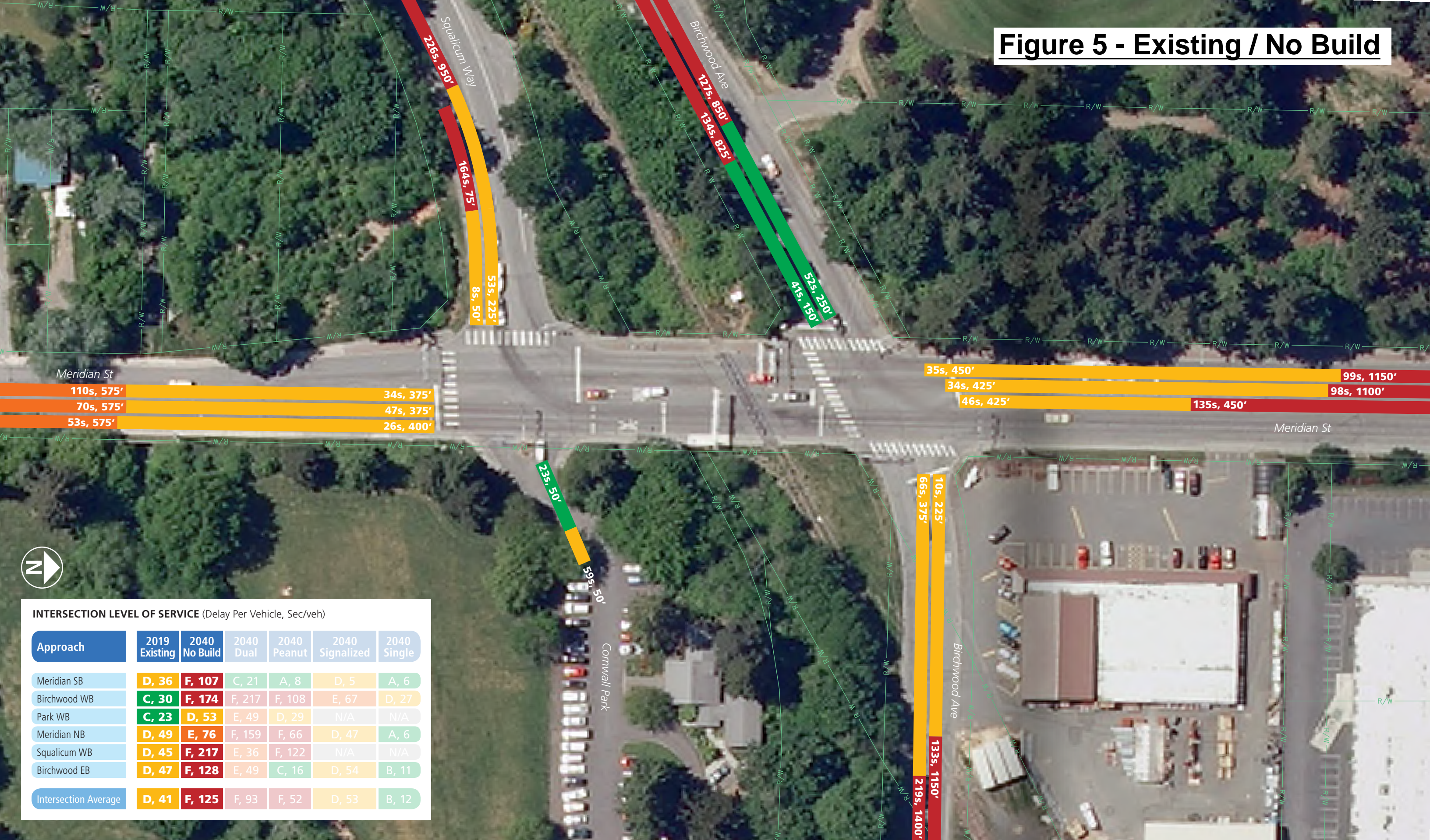
Source: Fehr & Peers.

Conceptual Alternatives

Three future scenarios were considered for the alternatives analysis. Conceptual plans for the future alternatives are shown in Figures 5 through 9. Each alternative includes the traffic analysis information for future operations projected in the year 2040. A summary of those alternatives is as follows:

- Future No Build: Maintain existing configuration (no change to intersections).
- Build Alternative 1: Dual Roundabouts to match existing intersection locations.
- Build Alternative 2: Peanut Roundabout.
- Build Alternative 3, Phase 1: Merge Birchwood and Squalicum arterial streets west of intersections; eliminate Meridian/Squalicum intersection; continue to operate Meridian/Birchwood with a traffic signal until a roundabout can be constructed.
- Build Alternative 3, Phase 2: Convert Meridian/Birchwood traffic signal to a multimodal roundabout.

Figure 5 - Existing / No Build



INTERSECTION LEVEL OF SERVICE (Delay Per Vehicle, Sec/veh)

Approach	2019 Existing	2040 No Build	2040 Dual	2040 Peanut	2040 Signalized	2040 Single
Meridian SB	D, 36	F, 107	C, 21	A, 8	D, 5	A, 6
Birchwood WB	C, 30	F, 174	F, 217	F, 108	E, 67	D, 27
Park WB	C, 23	D, 53	E, 49	D, 29	N/A	N/A
Meridian NB	D, 49	E, 76	F, 159	F, 66	D, 47	A, 6
Squalicum WB	D, 45	F, 217	E, 36	F, 122	N/A	N/A
Birchwood EB	D, 47	F, 128	E, 49	C, 16	D, 54	B, 11
Intersection Average	D, 41	F, 125	F, 93	F, 52	D, 53	B, 12



Figure 6 - Dual Roundabouts

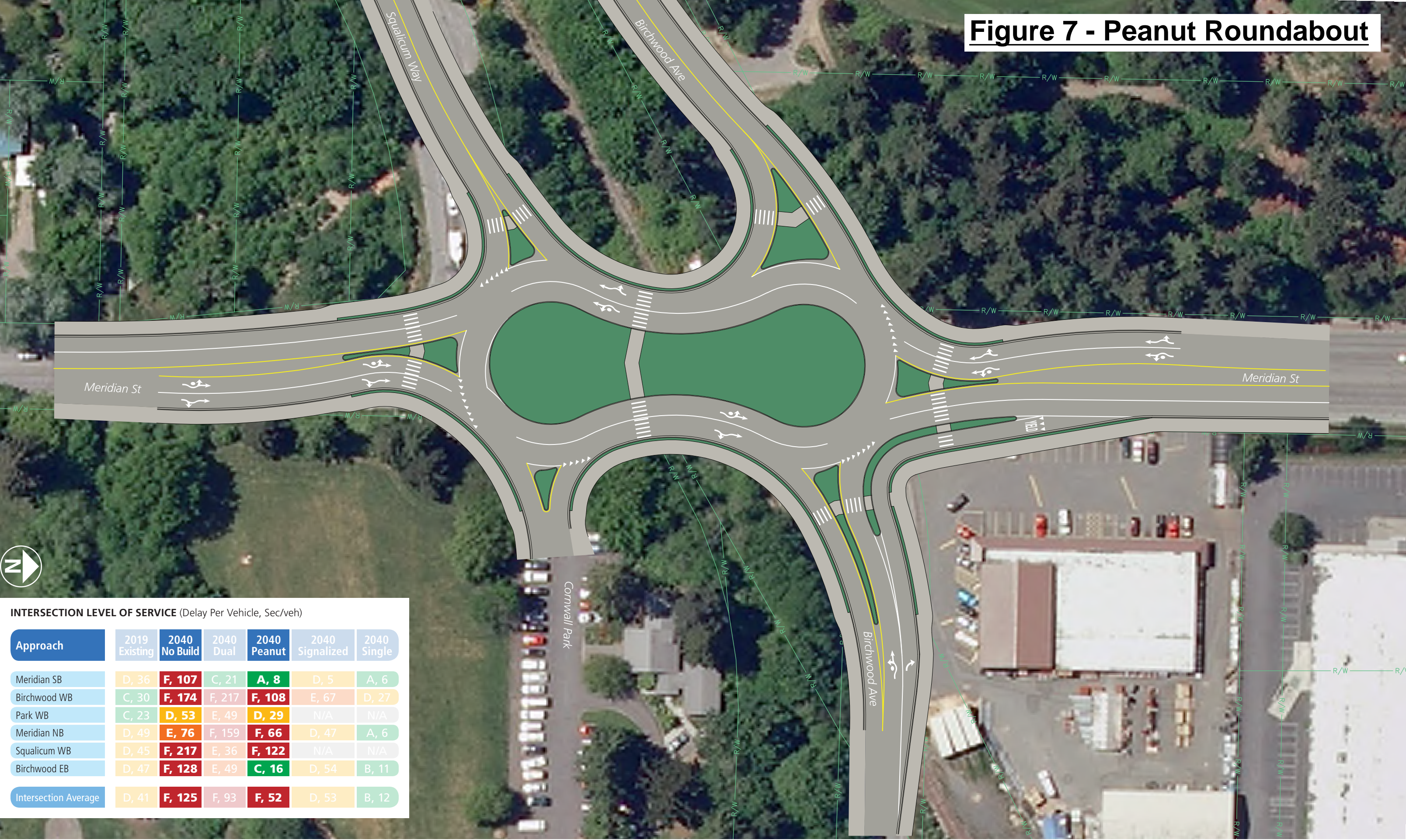


INTERSECTION LEVEL OF SERVICE (Delay Per Vehicle, Sec/veh)

Approach	2019 Existing	2040 No Build	2040 Dual	2040 Peanut	2040 Signalized	2040 Single
Meridian SB	D, 36	F, 107	C, 21	A, 8	D, 5	A, 6
Birchwood WB	C, 30	F, 174	F, 217	F, 108	E, 67	D, 27
Park WB	C, 23	D, 53	E, 49	D, 29	N/A	N/A
Meridian NB	D, 49	E, 76	F, 159	F, 66	D, 47	A, 6
Squalicum WB	D, 45	F, 217	E, 36	F, 122	N/A	N/A
Birchwood EB	D, 47	F, 128	E, 49	C, 16	D, 54	B, 11
Intersection Average	D, 41	F, 125	F, 93	F, 52	D, 53	B, 12



Figure 7 - Peanut Roundabout

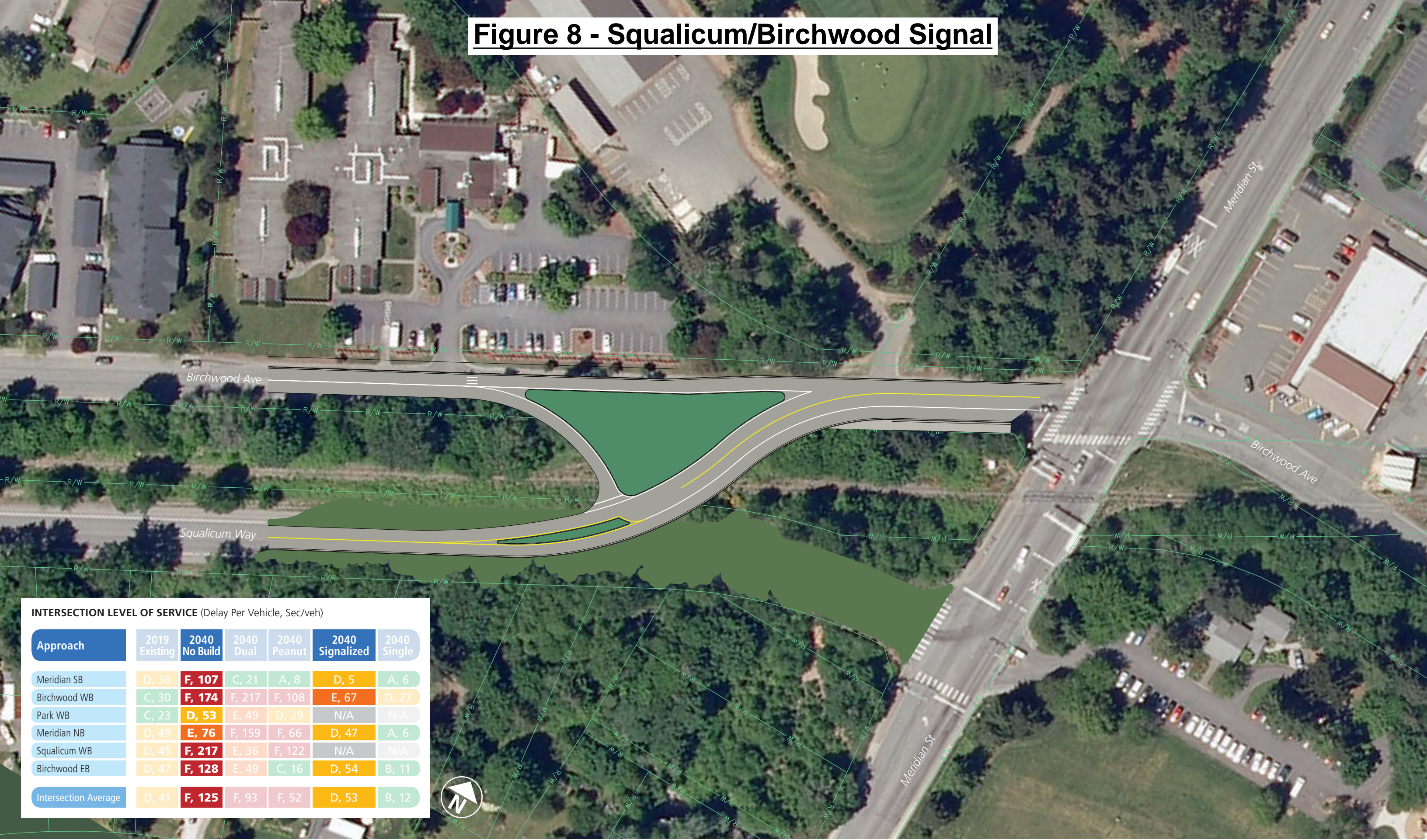


INTERSECTION LEVEL OF SERVICE (Delay Per Vehicle, Sec/veh)

Approach	2019 Existing	2040 No Build	2040 Dual	2040 Peanut	2040 Signalized	2040 Single
Meridian SB	D, 36	F, 107	C, 21	A, 8	D, 5	A, 6
Birchwood WB	C, 30	F, 174	F, 217	F, 108	E, 67	D, 27
Park WB	C, 23	D, 53	E, 49	D, 29	N/A	N/A
Meridian NB	D, 49	E, 76	F, 159	F, 66	D, 47	A, 6
Squalicum WB	D, 45	F, 217	E, 36	F, 122	N/A	N/A
Birchwood EB	D, 47	F, 128	E, 49	C, 16	D, 54	B, 11
Intersection Average	D, 41	F, 125	F, 93	F, 52	D, 53	B, 12



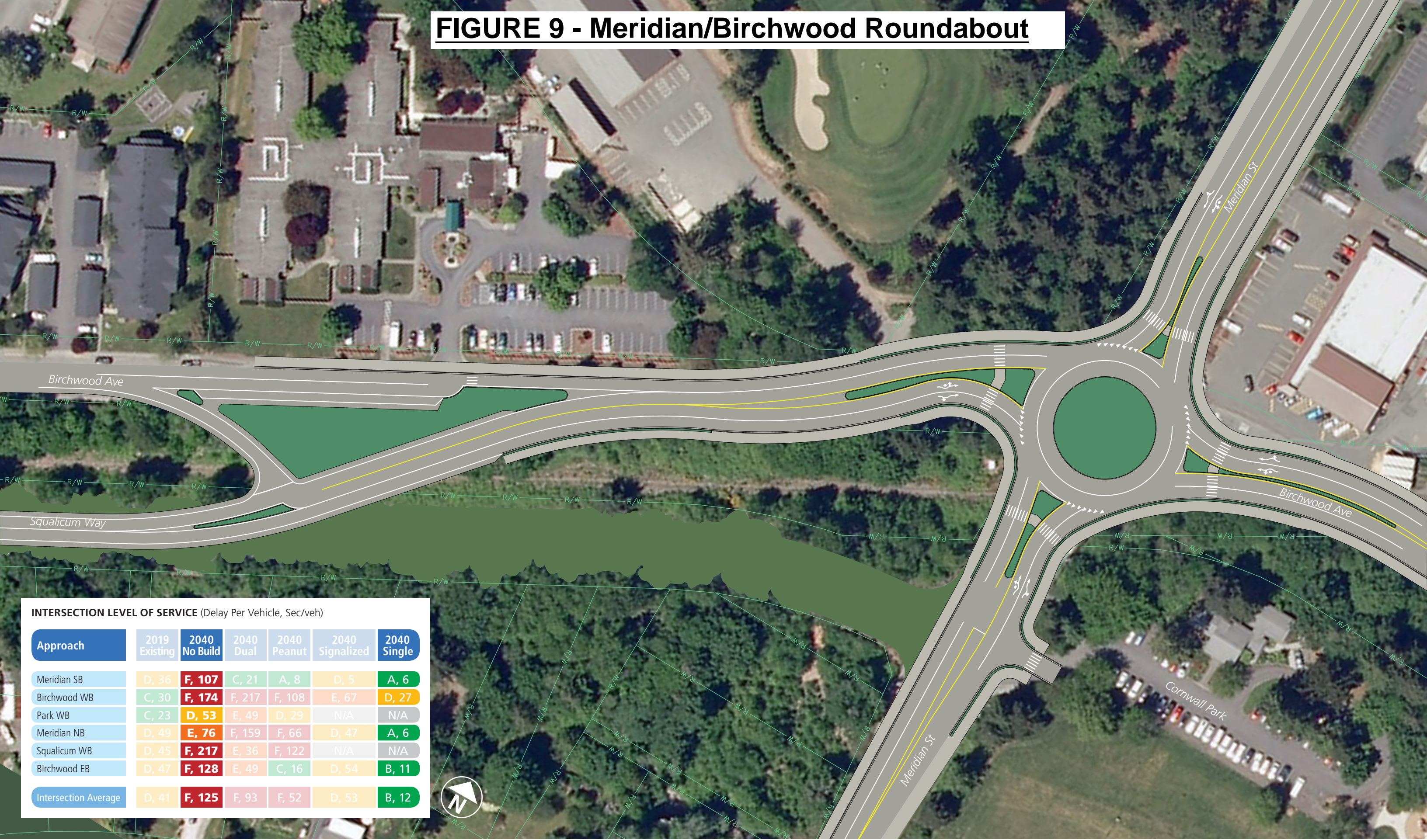
Figure 8 - Squalicum/Birchwood Signal



INTERSECTION LEVEL OF SERVICE (Delay Per Vehicle, Sec/veh)						
Approach	2019 Existing	2040 No Build	2040 Dual	2040 Peanut	2040 Signalized	2040 Single
Meridian SB	D, 36	F, 107	C, 21	A, 8	D, 5	A, 6
Birchwood WB	C, 30	F, 174	F, 217	F, 108	E, 67	D, 27
Park WB	C, 23	D, 53	E, 49	D, 29	N/A	N/A
Meridian NB	D, 49	E, 76	F, 159	F, 66	D, 47	A, 6
Squalicum WB	D, 45	F, 217	E, 36	F, 122	N/A	N/A
Birchwood EB	D, 47	F, 128	E, 49	C, 16	D, 54	B, 11
Intersection Average	D, 41	F, 125	F, 93	F, 52	D, 53	B, 12



FIGURE 9 - Meridian/Birchwood Roundabout



INTERSECTION LEVEL OF SERVICE (Delay Per Vehicle, Sec/veh)						
Approach	2019 Existing	2040 No Build	2040 Dual	2040 Peanut	2040 Signalized	2040 Single
Meridian SB	D, 36	F, 107	C, 21	A, 8	D, 5	A, 6
Birchwood WB	C, 30	F, 174	F, 217	F, 108	E, 67	D, 27
Park WB	C, 23	D, 53	E, 49	D, 29	N/A	N/A
Meridian NB	D, 49	E, 76	F, 159	F, 66	D, 47	A, 6
Squalicum WB	D, 45	F, 217	E, 36	F, 122	N/A	N/A
Birchwood EB	D, 47	F, 128	E, 49	C, 16	D, 54	B, 11
Intersection Average	D, 41	F, 125	F, 93	F, 52	D, 53	B, 12



Additional Considerations

Several other factors have been considered in addition to the traffic operations at the intersection. Table 5 provides a summary of various criteria for each alternative. These criteria were used to select the preferred alternative for the project.

TRAFFIC SAFETY

Each alternative has been evaluated for safety of vehicles and other multimodal users.

RIGHT-OF-WAY

All of the future build alternatives require additional area outside of the existing City Right-of-Way. These areas have been evaluated for square footage required, current use, potential loss of parking, points of property ingress/egress, and overall impacts to adjacent properties.

STORMWATER IMPACTS

A preliminary determination of new impervious surfacing was calculated for each alternative. The evaluation also includes potential impacts to Tributary W and the existing culvert crossing Meridian Street.

MULTIMODAL IMPACTS

A discussion of bicycle and pedestrian facilities has been included and WTA played an integral role in the multi-agency project team for the alternatives analysis.

ENVIRONMENTAL IMPACTS

A summary of impacts to critical areas is provided for each alternative. Project elements include potential impacts to the culverts for Tributary W, floodplain mitigation, stream buffer impacts, and possible habitat restoration.

ANTICIPATED COSTS

A preliminary cost estimate has been developed for each alternative.

TABLE 5 - Alternatives Analysis				
Future No Build (2040)	Alternative 1 – Dual RAB	Alternative 2 - Peanut	Alternative 3A – Squalicum/Birchwood Signal	Alternative 3B – Meridian/Birchwood RAB
Traffic Operations				
LOS F Significant queues during PM Peak. Nearly all legs of the intersections at LOS F. The exception is NB Meridian which degrades to a LOS E. Total Avg Delay of 125 sec/veh.	LOS F Improved overall operations as compared to the No-Build scenario, but degraded operations for WB Birchwood and NB Meridian. Improved LOS for SB and EB movements, but at the expense of the WB and NB. Total Avg Delay of 93 sec/veh.	LOS F Improved overall operations as compared to the No-Build scenario as well as the Dual RAB option. Compared to the Dual RAB option there is improvement for SB Meridian and EB Birchwood, but at the expense of Squalicum operations. Total Avg Delay of 52 sec/veh.	LOS D The elimination of Squalicum and its incoming traffic significantly improves the overall operations of the signalized intersection. The operations degrade by the year 2040 but provide improved functionality in the interim and significant improvement compared to the No-Build scenario. Total Avg Delay of 53 sec/veh.	LOS B The elimination of Squalicum and its incoming traffic significantly improves the overall operations of the intersection. There are still delays for WB Birchwood, resulting in LOS D for that leg of the intersection (PM Peak Hour), but the operations are still better than any other option and only slightly worse than the existing conditions. Total Avg Delay of 12 sec/veh.
Traffic Safety				
Signalized operations with higher volumes likely to result in increased rear-end crashes.	Reduced speeds throughout the intersections may reduce the severity of crashes. Minimal storage between roundabouts may cause traffic to back up into adjacent RAB and further impact operations and related safety. Long rolling queues for NB Meridian may block access at E Maplewood intersection.	Reduced number of conflict points and vehicle speeds through intersection may reduce both the number of crashes and crash severity.	Removal of intersection of Meridian and Squalicum reduces conflict points along Meridian. Reduced congestion. New connection between Squalicum and Birchwood requires slopes from 5% - 10%along the roadway.	Reduced number of conflict points and vehicle speeds through intersection may reduce both the number of crashes and crash severity.
Right-of-Way				
None	28,000 SF Minimal impact to adjacent properties. Partial acquisitions do not significantly impact the remaining use of each property. Assumed that loss of parking can be mitigated by replacing lost parking on site. \$175,000	45,000 SF Increased footprint for peanut/hourglass configuration. Partial acquisitions do not significantly impact the remaining use of each property. Assumed that loss of parking can be mitigated by replacing lost parking on site. \$270,000	None* *Assumed BNSF R/W acquired as part of regional trail project. \$0*	37,000 SF The west connection to combine Squalicum and Birchwood requires BNSF agreement for abandoned rail corridor. This option cannot be constructed without acquiring significant R/W from railroad and assumes the City is successful acquiring R/W from BNSF for trail alignment. \$230,000

Future No Build (2040)	Alternative 1 – Dual RAB	Alternative 2 - Peanut	Alternative 3A – Combined Squalicum/Birchwood	Alternative 3B – Meridian/Birchwood RAB
Stormwater Impacts				
None	18,500 SF New Impervious Increase in impervious surfacing will require stormwater mitigation. Likely stormwater treatment and flow control required. May require extension/replacement of culvert for Tributary W.	29,000 SF New Impervious Increase in impervious surfacing will require stormwater mitigation. Likely stormwater treatment and flow control required. Will require replacement of culvert for Tributary W. May require replacement of culvert crossing Squalicum Way as well.	11,000 SF New Impervious Increase in impervious surfacing will require stormwater mitigation. Likely stormwater treatment and flow control required. No impact Tributary W.	21,900 SF New Impervious** Increase in impervious surfacing will require stormwater mitigation. Likely stormwater treatment and flow control required. **Impervious Area calculations do not include west connection for combining Squalicum/Birchwood. Minimal impact to culverts for Tributary W.
Multimodal Impacts				
None	RRFB or speed tables recommended to alert drivers of pedestrians. Trail crossing and pedestrian crossing between RABs but within close proximity of Squalicum RAB could be problematic. Slowdowns for NB transit operations due to congestion and delays for the NB Meridian movement.	RRFB or speed tables recommended to alert drivers of pedestrians. Trail crossing and pedestrian crossing between intersections provides large pedestrian refuge. Requires portion of Cornwall Park to be used for travel lanes.	Simplified pedestrian crossings prior to intersection. Regional trail crossing could be added near existing Squalicum alignment—in line with park access and further away from intersection. Abandoned Squalicum Way alignment could be used for large amenity zone.	RRFB or speed tables recommended to alert drivers of pedestrians. Simplified pedestrian crossings prior to intersection. Regional trail crossing connection to Cornwall Park.
Environmental Impacts				
None Partial barrier for fish passage for Tributary W remains.	Potential minor impacts to critical areas require mitigation- ~0.2 acres buffer enhancement. Mitigation required for fill within floodplain. Extension or replacement of Tributary W culvert required. This alternative appears to have the least amount of impact to the stream buffer and floodplain.	Potential minor impacts to critical area require mitigation- ~0.4 acres buffer enhancement. Mitigation required for fill within floodplain. Replacement of Tributary W culvert required. This alternative appears to have the most amount of impact to the stream buffer and floodplain.	Potential minor impacts to critical area require mitigation. Mitigation required for fill within floodplain. Additional fill for west connection located outside of flood plain for Tributary W. Abandoned Squalicum Way alignment could be used for habitat restoration- mitigation this project (buffer enhancement and floodplain cut) and potentially other projects.	Potential minor impacts to critical area require mitigation- ~0.4 acres buffer enhancement. Mitigation required for fill within floodplain. Replacement of Tributary W culvert may not be required. Abandoned Squalicum Way alignment could be used for habitat restoration- mitigation this project (buffer enhancement and floodplain cut) and potentially other projects.
Construction Costs				
None	\$5,500,000 - \$7,500,000	\$6,500,000 - \$8,500,000	\$2,800,000 - \$3,700,000	\$6,300,000 - \$8,200,000

RECOMMENDED ALTERNATIVE

The full implementation of Build Alternative 3 to construct a dual-lane roundabout at the intersection of Birchwood Avenue and Meridian Street is the preferred option. This option functions significantly better than the other alternatives. The elimination of the Meridian/Squalicum intersection requires Squalicum Way to be connected to Birchwood Avenue west of Meridian Street. Due to the extreme challenges and costs associated with right-of-way acquisition, environmental impacts, mitigation, and construction costs of this alternative, the ultimate buildout of this configuration will be broken into phases to be realistic for funding and construction purposes. This alternative is shown in Figure 10 and further described below. Schematic plans and additional design information is included in Appendix E.

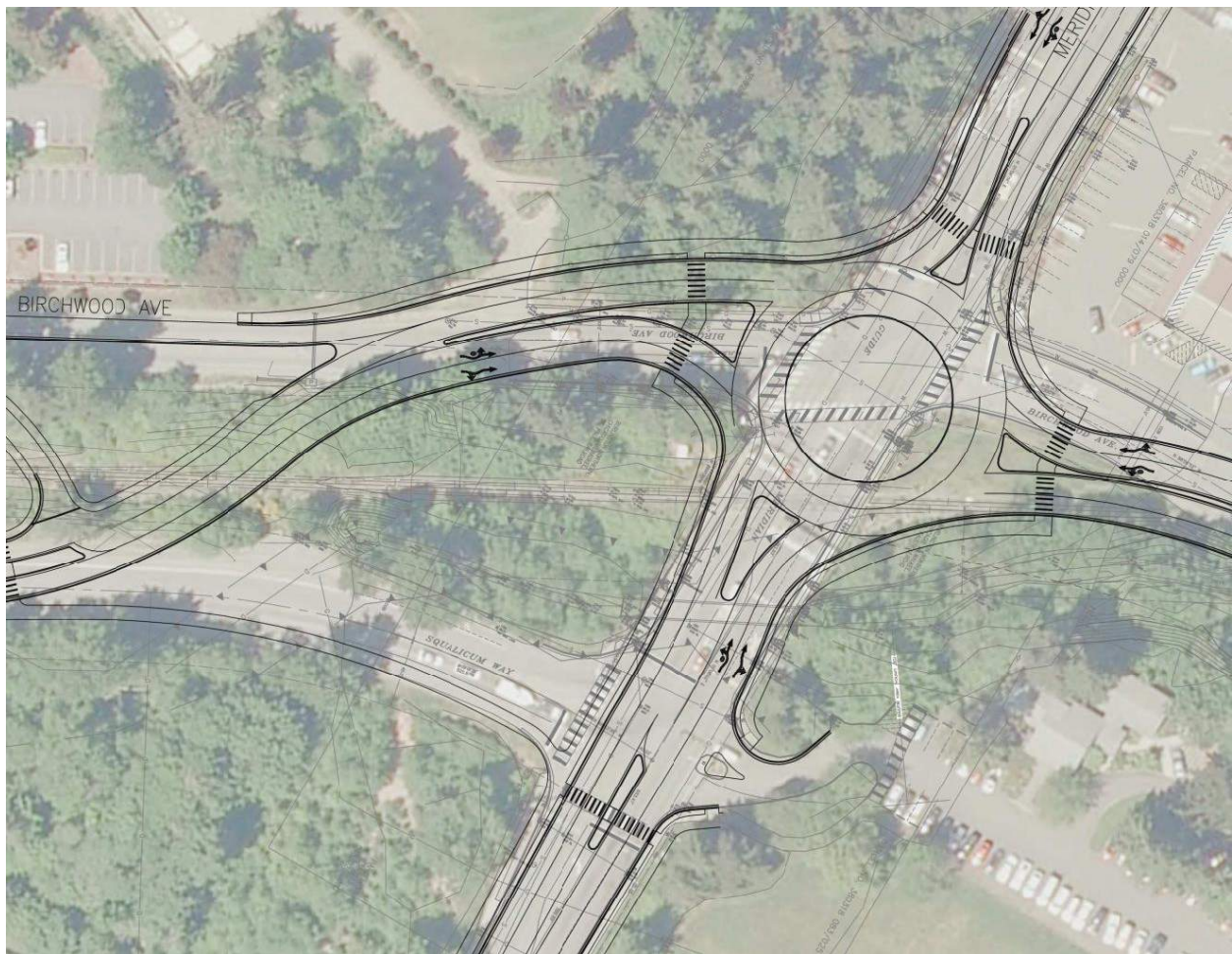


Figure 10. Preferred Alternative – Ultimate Buildout

Anticipated Benefits

The primary benefit of the combined Squalicum/Birchwood alternative is the reduced delays for vehicles trying to travel through the corridor. Constructing one roundabout instead of two provides significant improvement for all legs of the Meridian/Birchwood intersection. The average intersection delay of 12.0 seconds/vehicle in the PM peak hour of the design year is

markedly better than the 125.0 seconds/vehicle delay of the projected No-Build alternative, and improves upon the existing average intersection delay of 41.0 seconds/vehicle.

Combining Squalicum Way and Birchwood Avenue also allows for improved operation of the existing signalized intersection at Birchwood. The simplified signal phasing offers congestion relief by eliminating delays related to the split phase side street operations. The Squalicum/Birchwood connection could be constructed without the need to immediately construct the roundabout at Meridian Street. This offers potential phased construction based on available funding.

The inherent safety of roundabouts related to reduced speeds and conflict points, coupled with improved operations of the intersection provides the following ancillary benefits:

- Safer means of ingress / egress to abutting properties
- Potential increase in land values and tax revenue
- Promote redevelopment of properties throughout the corridor and neighborhood
- Sustain and improve regional economic development
- Provide increased vehicular, pedestrian and bicycle user safety
- Opportunity to vacate a portion of Squalicum Way and repurpose the area

This feasibility study recommends that the two signalized intersections at Meridian/Squalicum and Meridian/Birchwood be reconstructed in phases to provide a multimodal roundabout at Meridian/Birchwood.

- Phase 1 would join the Birchwood and Squalicum arterials together west of the Meridian/Birchwood intersection and then decommission the Meridian/Squalicum traffic signal. The unused segment of Squalicum Way between Meridian Street and the new intersection of Birchwood-Squalicum would be removed.
- Phase 2 would reconstruct the Meridian/Birchwood signalized intersection into a multimodal roundabout. The regional trail crossing at the south leg of the roundabout would be constructed to provide a connection to Cornwall Park.

Challenges and Risks

There is no defined timeline for either Phase 1 or Phase 2 of the Meridian Street Roundabout project. Significant physical space challenges, environmental constraints, and considerable construction costs means there will be multiple steps that must be completed before funding can be sought for the recommended transportation improvements. Several of the challenges associated with the project are summarized below.

RIGHT OF WAY

In order to provide the operational benefits of a single multi-lane roundabout, the connection for Squalicum Way and Birchwood Avenue must be constructed. This new connection of Squalicum Way and Birchwood Avenue requires the acquisition of the BNSF railroad Right-of-Way. Whereas other alternatives would require portions of the Right-of-Way that could be acquired from BNSF, Alternative 3 is not viable unless the City is successful in their efforts to acquire the abandoned rail R/W for the Bay to Baker Trail.

BNSF Railroad Right-of-Way

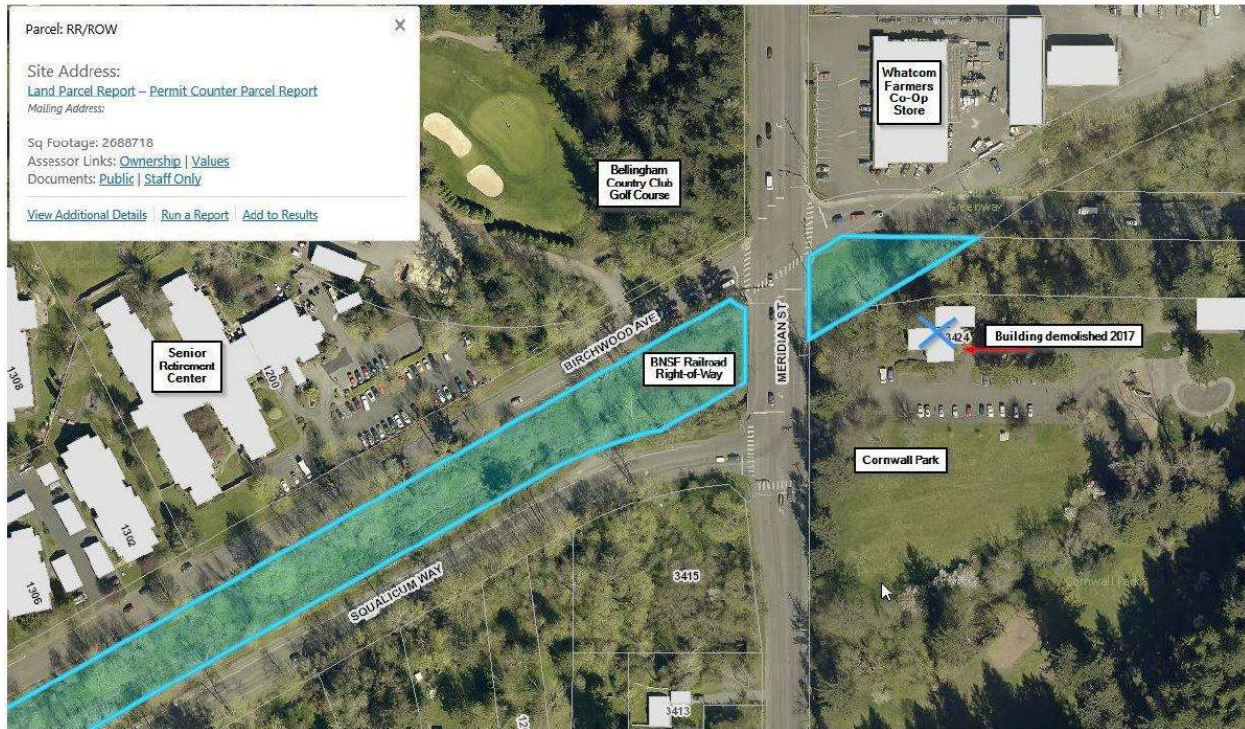


Figure 11. BNSF Right-of-Way

Neither Phase 1 or Phase 2 is possible without City ownership of the strip of land (pictured above) between Birchwood Avenue and Squalicum Parkway that is claimed to be owned by Burlington Northern Santa Fe (BNSF) Railroad. The Bellingham Parks Department has long viewed this strip of land as a critical link in a regional trail system known locally by various names such as: Bay to Baker Trail, Squalicum Creek Trail, Coast Millenium Trail, and the Nooksack Loop Trail. In the summer of 2018, the City and BNSF had nearly reached an agreement for transfer of ownership of this Right-of-Way, but BNSF abruptly and inexplicably withdrew and ended negotiations with the City. As of December 2019, the City of Bellingham Attorney's Office is actively pursuing legal strategies to acquire the Right-of-Way.

CORNWALL PARK LAND OWNERSHIP

In addition to the need to acquire Right-of-Way from BNSF, there may be legal implications associated with using the northwesternmost corner of Cornwall Park to accommodate the footprint of a multimodal roundabout. Cornwall Park was gifted to the City of Bellingham in 1909 by the Cornwall family for the exclusive purpose of providing recreational enjoyment for the citizens of Bellingham in perpetuity. If this condition is not maintained, then ownership of the land could theoretically revert to the heirs of the family that donated the land to the City. Bellingham Parks and the City Attorney's Office must obtain approval of the heirs for the land to be used for anything other than park use.

From a transportation planning, multiuse trail, and park access perspective, a case can be made that using a small slice of Cornwall Park property for the construction of a multimodal roundabout at Meridian/Birchwood will provide additional benefit to the park, as follows:

- A regional trail planned from Bellingham Bay to the eastern city limits (see below) will cross the south leg of the roundabout in a marked ADA-compliant crosswalk directly into Cornwall Park;
- The decommissioning of the Meridian/Squalicum traffic signal and reconstruction of the northern Cornwall Park driveway; and
- Enhanced mobility, safety, and access to Cornwall Park for more people in the future.

The Bellingham Public Works and Parks Departments will continue to seek a resolution to this issue, but at this time, it remains to be seen if using a small sliver of Cornwall Park land for a roundabout will be allowed.

ENVIRONMENTAL IMPACTS AND MITIGATION NEEDS

As with all of the alternatives that were considered it is expected that mitigation will be required for the Squalicum/Birchwood connection and Meridian/Birchwood roundabout. The project will trigger requirements for stormwater treatment and flow control as well as mitigation for impacts to environmental features. The surrounding area includes streams, wetlands, buffers, steep slopes, and other critical areas in the immediate vicinity of the intersection (see graphics below). Fish passage improvements as well as maintenance of flood storage and flow to the existing culvert crossing for Tributary W beneath Meridian Street is also anticipated. All of these impacts and mitigation requirements have been included in the cost estimates for the project.

Environmental Issues, Challenges, & Opportunities Surrounding Intersections

Critical Areas & Natural Features

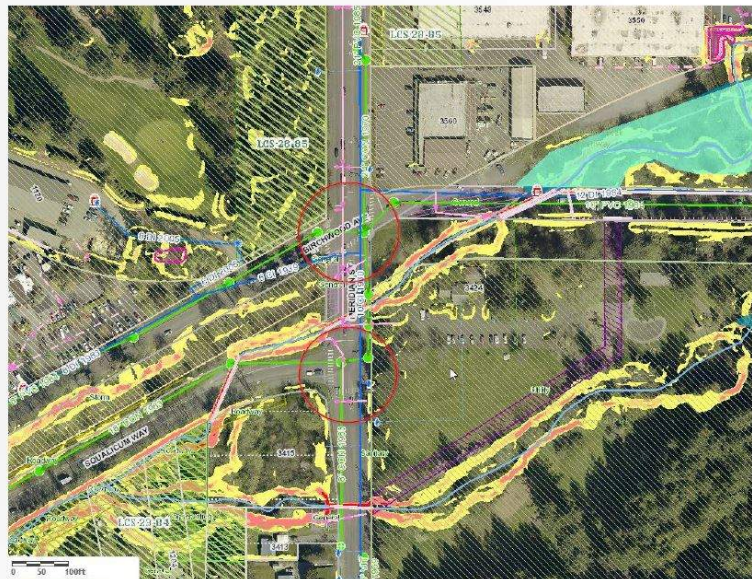
- Wetlands & Buffers
- Streams & Buffers
- Steep Slopes
- Forest & Habitat

Probable impacts to all of the above

- Mitigation sequencing documentation
- How to minimize impacts
- Alternatives analyzed
- Cost to mitigate unavoidable impacts

Preferred Alternative(s) Balances:

- Accommodating Planned Growth
- Multimodal Transportation Needs
- Environmental Protection
- Improvement Costs & Funding Capability



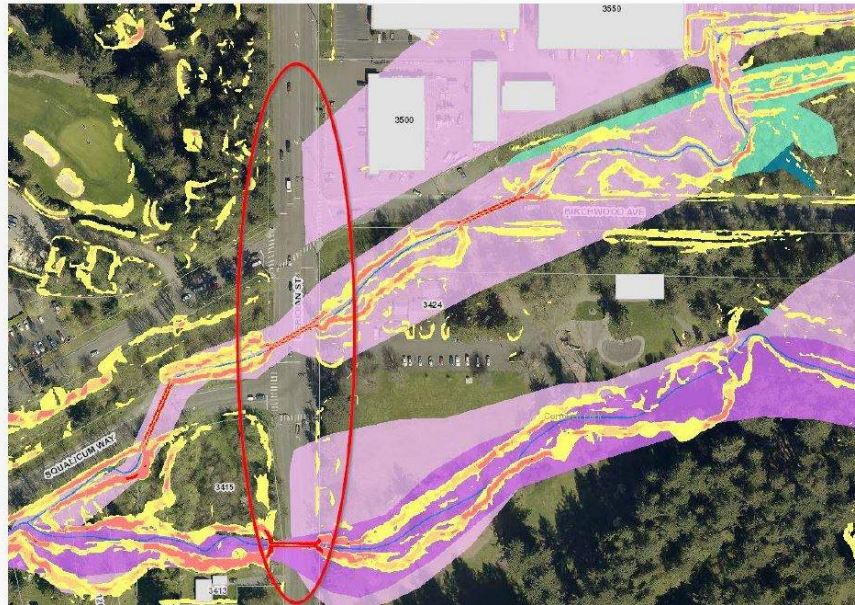
TRIBUTARY W

This side channel of Squalicum Creek is not a fish-bearing stream, but is considered to provide needed overflow capacity for flood stages of Squalicum Creek. Tributary W flows parallel to Birchwood Avenue and then flows southwest through culverts underneath both Birchwood Avenue and Meridian Street. During roundabout construction the Meridian Street culvert will need to be replaced, but it remains to be seen what level of mitigation may ultimately be required

due to environmental, storm water, and flood regulations in place when the roundabout seeks permits for construction.

Recreational & Environmental Issues

- Cornwall Park abuts both intersections
- Vehicle entrance to Cornwall Park is 4th leg of Meridian/Squalicum intersection
- Possibility of removal/replacement with Birchwood vehicle entrance
- BNSF Railroad Right-of-Way thru middle of two intersections; Needed for Bay to Baker Trail connection to Squalicum Creek Trail
- Squalicum Creek and Tributary W both cross Meridian thru/near intersections
- Flood zone, wetlands
- Critical Areas impact and mitigation
- Salmon and riparian habitat restoration
- Feasibility Study to Determine Preferred Alternative(s) to Pursue



The preferred alternative includes the potential to mitigate for project impacts within the abandoned portion of Squalicum Way. This area could be used to mitigate critical area impacts (both buffer impact and floodplain fill) associated with the roadway project and future parks trail as well. During future project planning there is potential to increase efficiency and reduce costs associated with mitigation by considering all potential impacts for the upcoming work in the project vicinity.

The preferred alternative could include improvements to the stream corridor by removing the section of roadway which is currently fragmenting habitat between the two streams (Squalicum Creek and Tributary W). Daylighting a portion of Tributary W and allowing for enhancement to riparian buffers in the project vicinity are possibilities with the reconfiguration of Squalicum Way. These potential improvements may also balance the floodplain cut/fill and compensate for impacts to the regulated floodplain, thus avoiding additional floodplain mitigation.

Project Funding

Once the Right-of-Way issues described above have been addressed and the necessary land is owned by the City, then funding can be pursued. The total combined cost of preliminary engineering, design, permitting, and construction for Phases 1 and 2 is estimated to be between \$10 million and \$12 million (2020 dollars). This does not include the cost to construct the regional trail connection. No single grant funding source can cover the total cost of this complex project. As a result, the project must be constructed in separate, sequential stages and leverage multiple funding sources to complete the overall project.

- Phase 1 is estimated to cost in the range of \$3-4 million (2020 dollars) and must be completed prior to Phase 2.
- Phase 2 is estimated to cost in the range of \$7-8 million (2020 dollars).

FUNDING PARTNERSHIPS

For each phase, the City will need to create a local public-private funding partnership while also seeking state and federal grant funding. Local funding partners might include:

- City of Bellingham (Multimodal Transportation, Parks, Trails, Natural Resources)
- Port of Bellingham (Shipping, Freight, Economic Development)
- Whatcom Transportation Authority (Public Transit)
- PeaceHealth (St. Joseph's Hospital)
- WSDOT (Interstate 5 and SR 539 – Guide-Meridian)
- Surrounding businesses and other interests

FUNDING SOURCES

If current grant funding programs remain available in the future, then possible grant funding sources could include:

- Surface Transportation Block Grant (STBG) federal funds – administered by WCOG
- Highway Safety Improvement Program (HSIP) federal funds – administered by WSDOT
- Freight Mobility Safety Improvement Board (FMSIB) – federal funds administered by WSDOT
- Urban Arterial Program (UAP) - state funds from WA Transportation Improvement Board (TIB)
- Community Economic Revitalization Board (CERB) – state funds administered by WA Commerce