FEHR PEERS

Memorandum

Date: November 8, 2021

To: Christopher Patano, EHDD

From: Michael Adamson and Nicholas Harris, Fehr & Peers

Subject: Si View Aquatic Center Preferred Site Traffic Analysis

SE19-0651

This memorandum serves to update the traffic analysis for the Si View Aquatic Center Feasibility Study that was submitted to EHDD/Patano Studios in August 2019. The original analysis considered two potential sites for the Si View Aquatic Center: one in Snoqualmie on Stone Quarry Road and one in North Bend at Torguson Park. This analysis considers a third site that has emerged as the preferred location for the Aquatic Center, at a site on the east side of SE Orchard Drive from from Si View Park.

Project Description

The Si View Aquatic Center will have approximately 46,800 square feet (sf) of gross floor area at full build out and is anticipated to open in 2022. The preferred site will be located on the northeast corner of the pedestrian crossing on SE Orchard Drive at approximately SE 5th Street. The project is planned to be constructed in two phases. This analysis considers phase one build out only (approximately 22,700 sf), including a recreational pool and multipurpose room. **Figure 1** shows the draft site plan, which includes two access points, one at SE Orchard Drive and one at SE Cedar Falls Way.

Traffic growth was analyzed at multiple study intersections for the weekday PM peak commute hour, which occurs from 4:30 to 5:30 PM. Since this time period experiences the heaviest traffic demand on a typical weekday, it is used to determine what improvements are necessary to accommodate new development. The study area for the proposed Si View Aquatic Center at the Si View Park site includes the following study intersections:

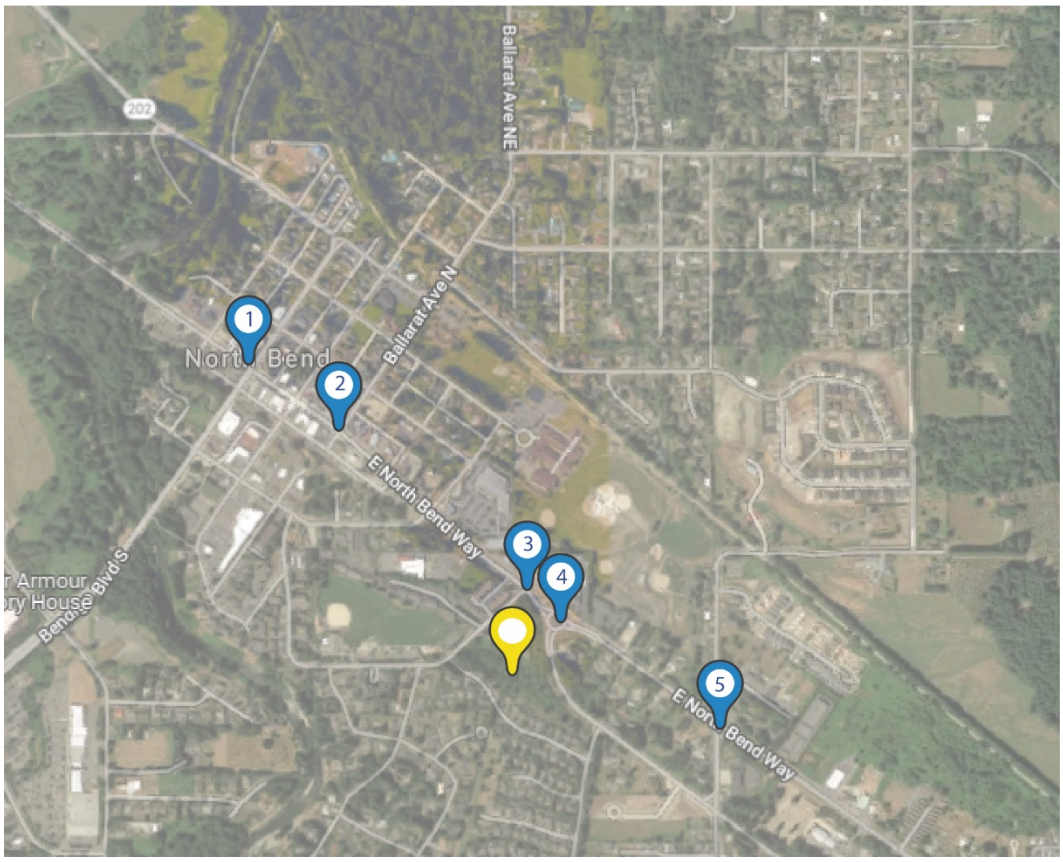
- Bendigo Boulevard / North Bend Way (Signalized)
- Ballarat Avenue / North Bend Way (Side-Street Stop-Controlled)
- Orchard Drive / North Bend Way (Side-Street Stop-Controlled)

- SE Cedar Falls Way / North Bend Way (Roundabout)
- Maloney Grove Avenue SE / North Bend Way (Two-Way Stop-Controlled)

The study area for the North Bend site is shown in **Figure 2**. In addition to driveway access points at SE Orchard Drive and SE Cedar Falls Way, North Bend Way, Bendigo Boulevard, Ballarat Avenue, and Maloney Grove Avenue SE are key roadways that will serve trips to and from the proposed aquatics center. Land uses adjacent to the proposed site include Si View Park to the west, and residential housing to the north, south and east.

Figure 1 – Si View Park Location Draft Site Plan

Figure 2 – Project Study Area for Si View Park Site in North Bend



Analysis Methodology

This section discusses the methods and assumptions used to evaluate the proposal's potential impacts on roadway segments and intersections in the study area.

Intersection Analysis

The operations of roadway facilities are described with the term *level of service*. Level of service (LOS) is a qualitative description of traffic flow based on factors including speed, travel time, delay, and freedom to maneuver. The six levels are defined from LOS A, the best operating conditions, to LOS F, the worst operating conditions. LOS E represents "at-capacity" operations. When traffic volumes exceed the capacity, stop-and-go conditions result, and operations are designated as LOS F.

To evaluate how study intersections are performing, the Highway Capacity Manual, 6th Edition (HCM) (Transportation Research Board, 2016), methodology was applied using the Trafficware Synchro 10 software package to calculate vehicle delay and LOS. **Table 1** summarizes the relationship between the average control delay per vehicle and LOS, described above, for signalized intersections and unsignalized intersections. Per HCM 6th Edition methodology, LOS at signalized and all-way-stop control intersections is determined using the average delay experienced by all vehicles at the intersection. For side-street stop-controlled intersections, the delay experience by vehicles at the highest-delay approach is considered.

SIDRA software and methodology consistent with HCM 6th Edition guidelines and Fehr & Peers best practices for the analysis of roundabouts was utilized to analyze the roundabout at SE Cedar Falls Way and North Bend Way.

Table 1 – HCM Intersection LOS Criteria

Level of Service		Description	Signalized Intersection Delay (seconds/vehicle)	Unsignalized Intersection Delay (seconds/vehicle)
	A	Free-flowing Conditions	≤ 10	0-10
	B	Stable Flow (slight delays)	>10-20	>10-15
	C	Stable Flow (acceptable delays)	>20-35	>15-25
	D	Approaching Unstable Flow (tolerable delay)	>35-55	>25-35
	E	Unstable Flow (intolerable delay)	>55-80	>35-50
	F	Forced Flow (congested and queues fail to clear)	>80	>50

Source: 6th Edition Highway Capacity Manual (HCM), 2016.

Existing (2021) Conditions

The existing conditions analysis considered how pertinent intersections and roadways operate during the PM peak hour as of Fall 2021. This analysis provides a baseline for how transportation facilities in the area are operating with current traffic volumes and roadway configurations.

Existing Roadway Facilities

Regional Roadways

- **Bendigo Boulevard N (State Route 202)**: Bendigo Boulevard is a state highway identified as a Major Arterial Roadway in North Bend's most recent Transportation Element. This roadway commences at the I-90 interchange in North Bend and continues until Woodinville. The roadway runs northeast-southwest through North Bend until it reaches E 4th Street, at which point it runs northwest-southeast through Snoqualmie. The state highway is a two-lane facility through North Bend and Snoqualmie.

Local Roadways

- **E North Bend Way**: E North Bend Way is identified as a Major Arterial Roadway in the North Bend Transportation Element. In the study area, it is a two-lane facility between Maloney Grove Avenue SE and SE Cedar Falls Way and alternates between a two- and three-lane facility between SE Cedar Falls Way and Bendigo Boulevard N.
- **Ballarat Avenue N**: Ballarat Avenue N is identified as a Minor Arterial Roadway in the North Bend Transportation Element. In the study area, it is a two-lane facility that runs from the E North Bend Way to NE 12th Street.
- **SE Cedar Falls Way**: SE Cedar Falls Way is identified as a Minor Arterial Roadway in the North Bend Transportation Element. In the study area, it is a two-lane facility that runs from E North Bend Way to SE 136th Street.
- **Maloney Grove Avenue SE**: Maloney Grove Avenue SE is identified as a Collector Roadway in the North Bend Transportation Element. In the study area, it is a two-lane facility that runs from E North Bend Way to SE 10th Street.

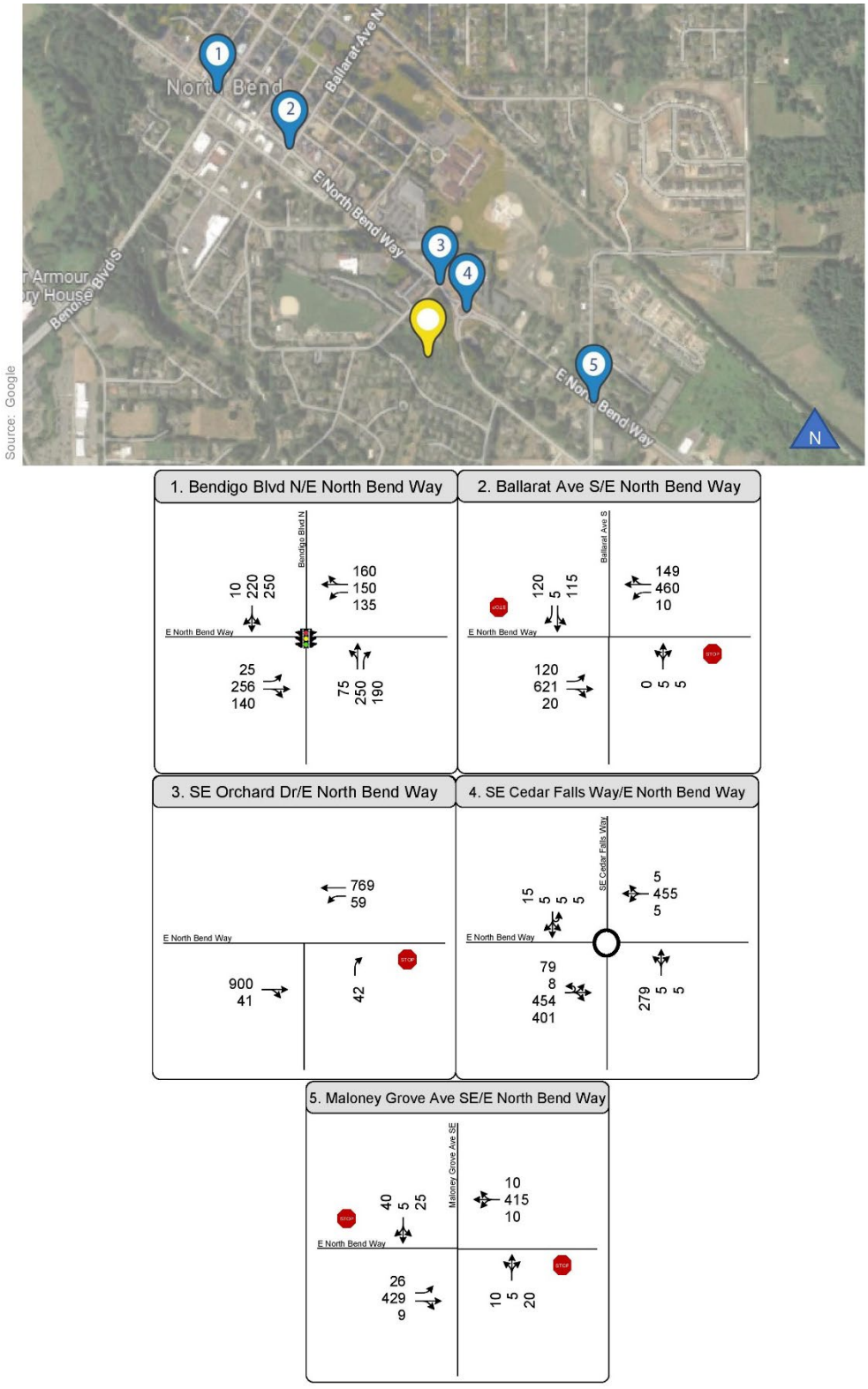
Traffic Volumes and Lane Configurations

Analysis of existing conditions was completed using traffic counts originally collected on Thursday, June 13th, 2019 during the evening peak period (4:00-6:00 PM). The intersection of SE Orchard Drive / E North Bend Way was the exception to this, as it was not analyzed as part of the

previous Torguson Park site analysis. Counts were collected at this intersection on Tuesday, October 19th, 2021. The 2019 counts were grown to 2021 conditions based on the 2% growth rate defined for North Bend as part of the 2019 analysis. This growth rate was developed based on previous traffic studies performed in North Bend. The 2021 forecasted volumes were then balanced against the SE Orchard Drive / E North Bend Way counts where necessary to provide consistency with the more recent data.

Based on the traffic volumes, it was determined that the evening peak hour for both study areas occurs from 4:30-5:30 PM. Existing (2021) peak hour volumes and lane configurations for the study intersections are summarized in **Figure 3** for the Si View Park site.

Figure 3 – Existing (2021) Traffic Volumes



Performance Criteria

The Transportation Element of North Bend's 2015 Comprehensive Plan defined an LOS D or better standard for all signalized intersections and LOS E or better standard for all unsignalized intersections.

Existing (2021) Intersection Operations

Existing traffic volumes, lane configurations, and signal timings were used to calculated delay and LOS at the study intersections for existing PM peak hour conditions. **Table 2** summarizes the results of the existing conditions assessment for the Si View Park site.

As can be seen from the table, Ballarat Avenue S / E North Bend Way is the only intersection operating at a deficient LOS. To address this deficiency, the City of North Bend is planning to build a traffic signal at the Ballarat Avenue S/E North Bend Way intersection by 2027, as identified in their six-year Transportation Improvement Program.[1]

It should also be noted that the delay at SE Cedar Falls Way / E North Bend Way decreased between the 2019 analysis and this 2021 updated analysis. This is due to a decrease in volumes between SE Orchard Drive / E North Bend Way and SE Cedar Falls Way / E North Bend Way, as observed in the 2021 counts collected at SE Orchard Drive / E North Bend Way. This difference in delay carries into the future analyses. Considering the traffic disruptions caused by the COVID-19 pandemic and subsequent changes in travel behavior, a small decrease in volume at this location was determined to be reasonable.

[1] City of North Bend Draft 6-Year Transportation Improvement Program (TIP) 2022-2027

Table 2 – Intersection LOS Si View Park Site – Existing Year (2021) Conditions

ID	Intersection	Control[1]	Existing Conditions	
			Delay[2]	LOS[3]
1	Bendigo Boulevard N / E North Bend Way	Signal	50	D
2	Ballarat Avenue S / E North Bend Way	SSSC	**284 (SBTL)**	**F**
3	SE Orchard Drive / E North Bend Way	SSSC	21 (NB)	C
4	SE Cedar Falls Way / E North Bend Way	Roundabout	12	B
5	Maloney Grove Ave SE / E North Bend Way	SSSC	18 (SB)	C

Notes:

1. SSSC = Side-Street Stop-Controlled
2. Whole intersection weighted average control delay expressed in seconds per vehicle. For stop-controlled intersections, worst movement delay reported, with worst movement in parentheses. NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound.
3. LOS = Level of Service. **Bold** represents an LOS deficiency.

Source: Fehr & Peers, 2021.

Future Conditions Analysis

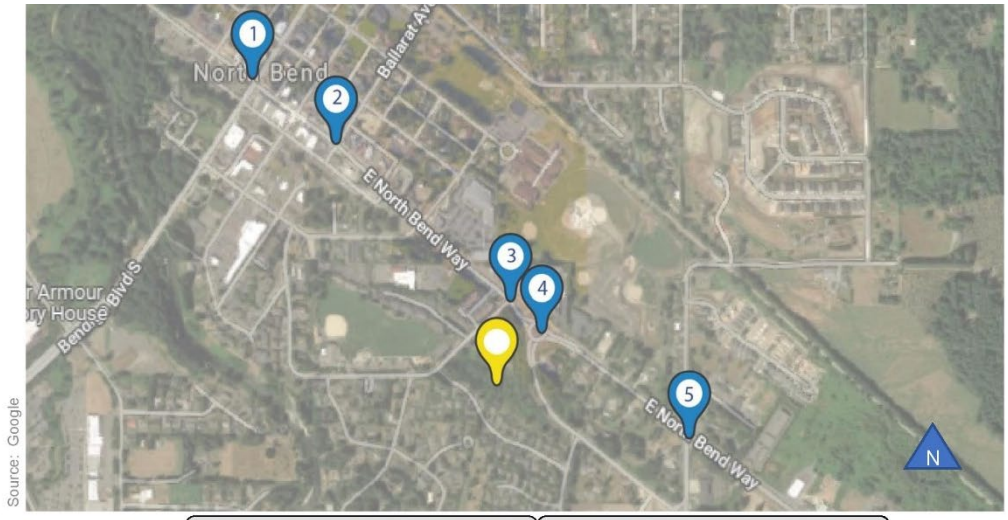
The following sections describe the future conditions analysis for the opening year (2024) with and without the proposed Si View Aquatic Center at the proposed Si View Park site, as well as methodology for modeling traffic generated by the proposal.

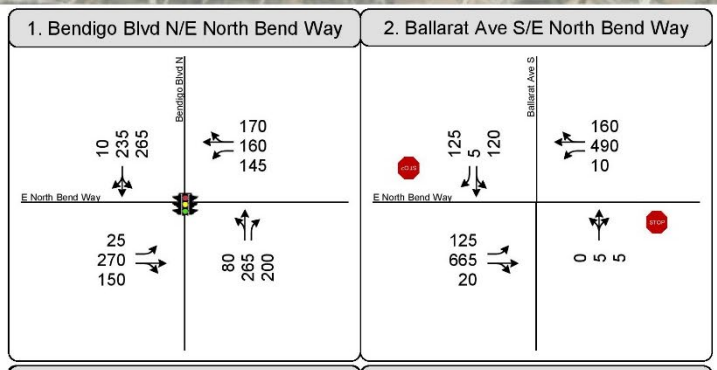
Opening Year (2024) Baseline Conditions

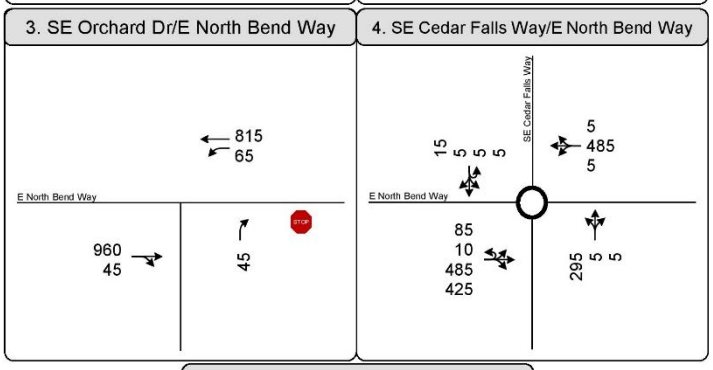
Growth Assumptions

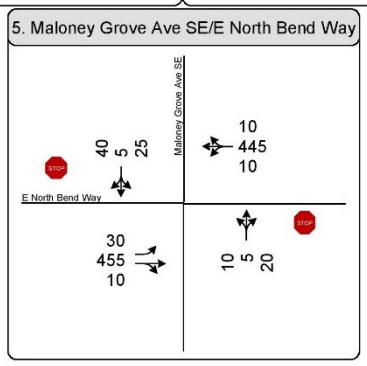
In the previous 2019 analysis, the opening year was assumed to be 2022. As part of this updated analysis, opening year has shifted to 2024. To calculate 2024 traffic volumes, the previously noted annual growth rate of 2% was used to forecast background traffic growth at the study intersections. Estimated turning movements counts for 2024 are shown in **Figure 4**.

Figure 4 – Future (2024) Estimated Background Traffic Volumes









Traffic Conditions

Applying the same methodology as the existing conditions analysis, the study intersections were evaluated for expected 2024 LOS operations without the Aquatic Center project to determine the future baseline conditions. **Table 3** summarizes the results of this analysis.

As can be seen from the table, both the Bendigo Boulevard N / E North Bend Way and Ballarat Avenue S / E North Bend Way intersections are anticipated to operate at a deficient LOS in the future baseline conditions. As previously noted, the City plans to implement a signal at Ballarat Avenue S / E North Bend Way by 2027. The City's TIP also outlines the following improvements to Bendigo Boulevard between E 3rd Street and E North Bend Way:

- Due to traffic congestion at North Bend Way/Bendigo Boulevard intersection, better queuing configurations for through and turning movements will be developed. Work will consist of restriping and resigning the corridor and creating time-restricted parking areas related to peak traffic hours.

These improvements to Bendigo Boulevard would positively impact operations at the intersection of Bendigo Boulevard N / E North Bend Way, and are planned to be completed by 2025.[2]

Table 3 – Intersection LOS Si View Park Site – Future (2024) Baseline Conditions

ID	Intersection	Control[1]	Future Conditions	
			Delay[2]	LOS[3]
1	Bendigo Boulevard N / E North Bend Way	Signal	**58**	**E**
2	Ballarat Avenue S / E North Bend Way	SSSC	**421 (SBTL)**	**F**
3	SE Orchard Drive / E North Bend Way	SSSC	23 (NB)	C
4	SE Cedar Falls Way / E North Bend Way	Roundabout	14	B
5	Maloney Grove Ave SE / E North Bend Way	SSSC	20 (SB)	C

Notes:
1. SSSC = Side-Street Stop-Controlled
2. Whole intersection weighted average control delay expressed in seconds per vehicle. For stop-controlled intersections, worst movement delay reported, with worst movement in parentheses. NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound.
3. LOS = Level of Service. **Bold** represents an LOS deficiency.

Source: Fehr & Peers, 2021.

[2] City of North Bend Draft 6-Year Transportation Improvement Program (TIP) 2022-2027

Opening Year (2024) Plus Project Analysis

Trip Generation

The next step was evaluating traffic conditions in 2024 with the Aquatic Center in place at the Si View Park Site. To add the Aquatic Center trips to the opening year analysis, the trip generation to and from the proposed Si View Aquatic Center was estimated using the anticipated schedule of activities for the center amenities. Consistent with trip generation methodologies used in other studies for recreational and aquatic centers, swimmer count for the lap pool was based on the number of swim lanes, while swimmer count for the recreational pool was based on the water surface area of the pool. A similar floor area assumption was applied to the classroom and weight room. In each case, a vehicle occupancy of 3.5 was assumed for trip generation. This higher vehicle occupancy assumption is related to swim teams and family drop-offs that tend to occur in these types of facilities. Based on these assumptions, the total number of inbound/outbound vehicles were estimated for the weekday evening peak hour (4:30-5:30 PM) for the roadways adjacent to the aquatic center.

As stated in the project description, the Si View Park site assumes phase one build out (approximately 22,700 sf), just as the previously analyzed Torguson Park site. As such, it was assumed that the Si View Park site would have the same trip generation as this previously analyzed site. The results of this previously calculated trip generation are summarized in **Table 4**.

Table 4 – Trip Generation for Si View Park site

Element	Size	Water Surface Size (sf)[1]	Rate	PM Peak Hour Trips		
				Total	Enter	Exit
Recreational Pool Natatorium	11900 sf	5171	20 sf/person	74	35	39
Classroom (Multipurpose Room)	1600 sf	-	15 sf/person	30	14	16
Total	**17,400**	**-**	**-**	**104**	**49**	**55**

Notes:
1. sf = square feet

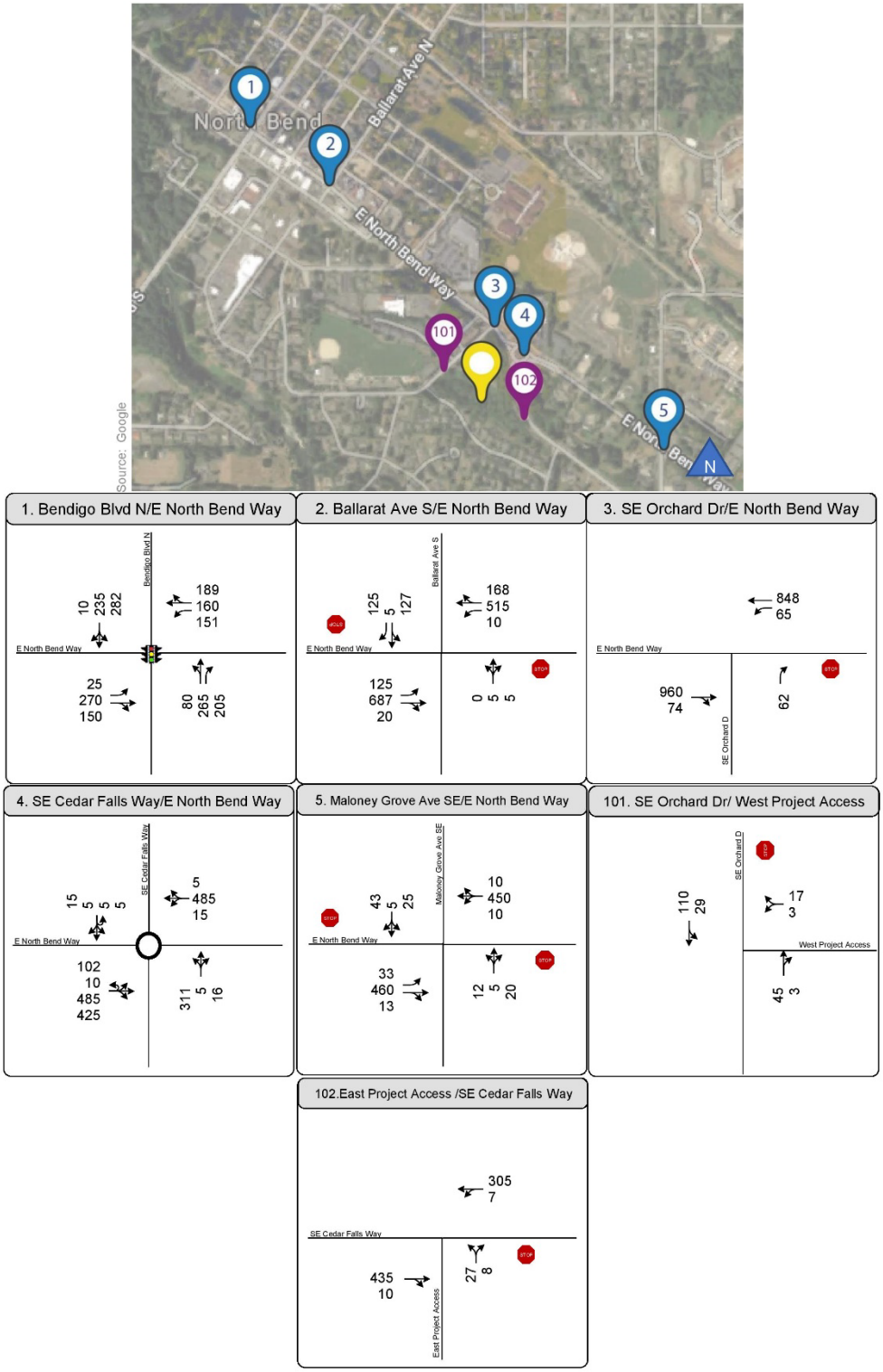
Source: Fehr & Peers, 2019.

Trip Distribution

Vehicle trip distribution patterns to/from the Si View Park site were determined based on the previous trip distribution developed for the Torguson Park site. However, this trip distribution was updated to reflect the fact that the Si View Park site will have multiple accesses. **Figure 5** shows the trip distribution patterns anticipated for the Si View Park site. Based on these trip distribution patterns, project trips were assigned to the roadway network. The anticipated future (2024) plus project volumes are shown in **Figure 6**.

Figure 5 – Trip Distribution Patterns for the Si View Park Site

Figure 6 – Future (2024) Traffic Volumes with Project Traffic



Traffic Conditions

Again, the study intersections were evaluated for expected LOS operations, this time under future (2024) plus project conditions.

The LOS results for the plus project analysis are summarized in **Table 5**. Similar to no project conditions, the Bendigo Boulevard N / E North Bend Way and Ballarat Avenue S/E North Bend Way intersections are anticipated to operate at LOS E and LOS F, respectively. It should be noted that these LOS deficiencies exist under baseline conditions and are not a direct result of project traffic. The proportional share of Aquatic Center traffic at these two intersections under plus project conditions is a small fraction of total volume, as follows:

- 2% of the total entering volume at Bendigo Boulevard N / E North Bend Way
- 3% of the total entering volume at Ballarat Avenue N / E North Bend Way

Table 5 – Intersection LOS Si View Park Site – Future (2024) Plus Project Conditions

ID	Intersection	Control[1]	Future Conditions	
			Delay[2]	LOS[3]
1	Bendigo Boulevard N / E North Bend Way	Signal	**61**	**E**
2	Ballarat Avenue S / E North Bend Way	SSSC	**527 (SBTL)**	**F**
3	SE Orchard Drive / E North Bend Way	SSSC	25 (NB)	C
4	SE Cedar Falls Way / E North Bend Way	Roundabout	15	B
5	Maloney Grove Ave SE / E North Bend Way	SSSC	20 (SB)	C
101	West Project Access / SE Orchard Drive	SSSC	9 (WB)	A
102	East Project Access / SE Cedar Falls Way	SSSC	16 (NB)	C

Notes:
1. SSSC = Side-Street Stop-Controlled
2. Whole intersection weighted average control delay expressed in seconds per vehicle. For stop-controlled intersections, worst movement delay reported, with worst movement in parentheses. NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound.
3. LOS = Level of Service. **Bold** represents an LOS deficiency.

Source: Fehr & Peers, 2021.

Conditions with Mitigations

As mitigations are already planned at both deficient intersections, it is important to assess how traffic conditions will shift with these mitigations in place. As previously noted, the City plans to implement a signal at Ballarat Avenue S / E North Bend Way by 2027, as well as implement restriping and reconfiguration improvements to Bendigo Boulevard N from E 3rd Street to E North Bend Way by 2025. For the purposes of this analysis, it was assumed that these reconfiguration improvements would include reconfiguring the north and south legs of Bendigo Boulevard N / E North Bend Way to allow the removal of split phasing at the signal. With the implementation of these mitigations, it is anticipated that the LOS under plus project conditions will improve for these intersections as follows:

- Bendigo Boulevard N / E North Bend Way would improve to LOS C with 25 seconds of delay
- Ballarat Avenue S / E North Bend Way would improve to LOS B with 15 seconds of delay

Conclusions

A summary of intersection LOS for existing (2021), opening year (2024) baseline and opening year (2024) plus project conditions is provided in **Table 6**. Under opening year (2024) baseline conditions, the intersections of Bendigo Boulevard N / E North Bend Way and Ballarat Avenue S / E North Bend Way are anticipated to operate at a deficient level of service. The 2022-2027 TIP identifies projects for both locations: a signal at Ballarat Avenue S / E North Bend Way and roadway reconfiguration on Bendigo Boulevard N just north of E North Bend Way. It is recommended that the City of North Bend consider removing the split phasing currently in place for the NB and SB approaches to the Bendigo Boulevard N / E North Bend Way as part of this reconfiguration project. With the signal and removal of split phasing in place, both intersections are anticipated to operate at an acceptable LOS.

These LOS deficiencies would occur with or without the proposed Si View Aquatic Center. It is not anticipated that the construction of the Aquatic Center at the proposed Si View Park site would lead to any additional LOS deficiencies.

Table 6 – Intersection LOS Summary Tables for the Si View Park Site

Summary of Level of Service Results – Si View Park Site								
Intersection		**Intersection Control[1]**	**Existing Conditions**		**Future Baseline Conditions**		**Future Plus Project Conditions**	
			Delay[2]	**LOS[3]**	**Delay[2]**	**LOS[3]**	**Delay[2]**	**LOS[3]**
1	Bendigo Boulevard N / E North Bend Way	Signal	50	D	**58[4]**	**E**	**61[4]**	**E**
2	Ballarat Avenue S / E North Bend Way	SSSC	**284 (SBTL)[4]**	**F**	**421 (SBTL)[4]**	**F**	**527 (SBTL)[4]**	**F**
3	SE Orchard Drive / E North Bend Way	SSSC	21 (NB)	C	23 (NB)	C	25 (NB)	C
4	SE Cedar Falls Way / E North Bend Way	Roundabout	12	B	14	B	15	B
5	Maloney Grove Ave SE / E North Bend Way	SSSC	18 (SB)	C	20 (SB)	C	20 (SB)	C
101	West Project Access / SE Orchard Drive	SSSC	-	-	-	-	9 (WB)	A
102	East Project Access / SE Cedar Falls Way	SSSC	-	-	-	-	16 (NB)	C

Notes:

1. SSSC = Side-Street Stop-Controlled
2. Whole intersection weighted average control delay expressed in seconds per vehicle. For stop-controlled intersections, worst movement delay reported, with worst movement in parentheses. NB – Northbound, SB – Southbound, EB – Eastbound, WB – Westbound.
3. LOS = Level of Service. **Bold** represents an LOS deficiency.
4. Deficiency fully mitigated by implementation of project on the 2022-2027 TIP.

Source: Fehr & Peers, 2021.