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## CITY OF KELOWNA

# MEMORANDUM

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**Date:** May 29, 2017  
**File No.:** Z16-0077

**To:** Community Planning (AC)

**From:** Development Engineering Manager (SM)

**Subject:** 1187 Sunset Drive **REVISED COMMENTS** Mixed Use Development

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Development Engineering Department have the following comments and requirements associated with this application. The road and utility upgrading requirements outlined in this report will be a requirement of this development. The Development Engineering Technologist for this project is Jason Angus.

### General

- a) Where there is a possibility of a high water table or surcharging of storm drains during major storm events, non-basement buildings may be required. This must be determined by the engineer and detailed on the Lot Grading Plan required in the drainage section.
- b) Provide easements as may be required.
- c) *The rezoning triggered a traffic impact assessment. 'Bunt & Associates Engineering Ltd' submitted a report dated May 17<sup>th</sup> 2017. The main conclusion was due to high southbound delays at the intersection of Sunset Drive and Water Street, this intersection currently warrants an intersection upgrade. A signalized intersection was recommended, which can be coordinated with the adjacent signal at Ellis Street and Clement Avenue. The applicant has agreed to pay for the intersection improvement subject to registering a latecomer agreement on all future benefiting properties.*

### 1. Domestic Water and Fire Protection

- (a) The existing lot is currently not serviced with a water service. The developer's consulting mechanical engineer will determine the domestic and fire protection requirements of this proposed development and establish hydrant requirements and service needs.
- (b) A water meter is mandatory for this development and must be installed inside the buildings on the water service inlet as required by the City Plumbing Regulation and Water Regulation bylaws. The developer or building contractor must purchase the meter from the City at the time of application for a building permit from the Inspection Services Department, and prepare the meter setter at his cost. Boulevard landscaping, complete with underground irrigation system, must be integrated with the on-site irrigation system.



2. Sanitary Sewer

- (a) The developer's consulting mechanical engineer will determine the requirements of this proposed development and establish the required size and preferred location of the new service. Only one service will be permitted for this development. The applicant, at his cost, will arrange for the removal of all existing small diameter services and the installation of a new larger service.
- (b) A downstream flow analysis check is required by a consulting civil engineer to determine the impact of additional flow contributions on the existing pipe system. If it is determined that upgrades to the existing facilities must be made, additional bonding will be required.

3. Storm Drainage

- (a) The developer must engage a consulting civil engineer to provide a storm water management plan for the site, which meets the requirements of the Subdivision, Development and Servicing Bylaw No. 7900. The storm water management plan must also include provision of lot grading plan, minimum basement elevation (MBE), if applicable, and provision of a storm drainage service for the development and / or recommendations for onsite drainage containment and disposal systems.
- (b) On site storm drainage systems and overflow service for the site will be reviewed and approved by Engineering when a site servicing design is submitted.
- (c) There is a possibility of a high water table or surcharging of storm drains during major storm events. This should be considered in the design of the onsite system.

4. Road Improvements

- (a) Sunset Drive fronting this development site is urbanized complete with existing curb & gutter, sidewalk, boulevard and trees. The condition of this infrastructure must be maintained through the construction process. A tree covenant will be required for proper care of the trees during construction. If the proposed accesses require tree removal, compensation will be triggered to the City's tree reserve fund.
- (b) Ellis Street is classified as an arterial road and must be upgraded to current urban standards along the full frontage of this proposed development, including curb and gutter if it is in a deteriorated state, a new separate sidewalk complete with landscaped boulevard and street trees and pavement removal and replacement, traffic signal upgrades/re-location, street lighting and re-location or adjustment of utility appurtenances if required to accommodate the upgrading construction.
- (c) Water Street is classified as an arterial road and must be upgraded to current urban standards along the full frontage of this proposed development, including curb and gutter if it is in a deteriorated state, replacement for the existing curb let-downs, a new separate sidewalk complete with landscaped boulevard and street trees and pavement removal and replacement, street lighting and re-location or adjustment of utility appurtenances if required to accommodate the upgrading construction.

- (d) Landscaped boulevards, complete with underground irrigation design drawings as per bylaw, is required on Ellis Street & Water Street.

5. Electric Power and Telecommunication Services

- a) The electrical services to this development must be installed in an underground duct system, and the building must be connected by an underground service. It is the developer's responsibility to make a servicing application with the respective electric power, telephone and cable transmission companies to arrange for these services which would be at the applicant's cost.
- b) Make servicing applications to the respective Power and Telecommunication utility companies. The utility companies are required to obtain the City's approval before commencing construction.
- c) Re-locate existing poles and underground utilities, where necessary.

6. Engineering

- a) Provide all necessary Statutory Rights-of-Way for any utility corridors required, including those on proposed or existing City Lands.
- b) If any road dedication affects lands encumbered by a Utility right-of-way (such as Terasen, etc.) please obtain the approval of the utility prior to application for final subdivision approval. Any works required by the utility as a consequence of the road dedication must be incorporated in the construction drawings submitted to the City's Development Manager.
- c) Road and utility construction design, construction supervision, and quality control supervision of all off-site and site services including on-site ground recharge drainage collection and disposal systems, must be performed by an approved consulting civil engineer. Designs must be submitted to the city engineering department for review and marked "issued for construction" by the city engineer before construction may begin.

7. Design and Construction

- (a) Design, construction supervision and inspection of all off-site civil works and site servicing must be performed by a Consulting Civil Engineer and all such work is subject to the approval of the City Engineer. Drawings must conform to City standards and requirements.
- (b) Engineering drawing submissions are to be in accordance with the City's "Engineering Drawing Submission Requirements" Policy. Please note the number of sets and drawings required for submissions.
- (c) Quality Control and Assurance Plans must be provided in accordance with the Subdivision, Development & Servicing Bylaw No. 7900 (refer to Part 5 and Schedule 3).
- (d) A "Consulting Engineering Confirmation Letter" (City document 'C') must be completed prior to submission of any designs.
- (e) Before any construction related to the requirements of this subdivision application commences, design drawings prepared by a professional engineer must be submitted to the City's Works & Utilities Department. The design drawings must first be "Issued for Construction" by the City Engineer. On examination of design

drawings, it may be determined that rights-of-way are required for current or future needs.

## 8. Servicing Agreements for Works and Services

- (a) A Servicing Agreement is required for all works and services on City lands in accordance with the Subdivision, Development & Servicing Bylaw No. 7900. The applicant's Engineer, prior to preparation of Servicing Agreements, must provide adequate drawings and estimates for the required works. The Servicing Agreement must be in the form as described in Schedule 2 of the bylaw.
- (b) Part 3, "Security for Works and Services", of the Bylaw, describes the Bonding and Insurance requirements of the Owner. The liability limit is not to be less than \$5,000,000 and the City is to be named on the insurance policy as an additional insured.

## 9. Geotechnical Report

As a requirement of this application the owner must provide a geotechnical report prepared by a Professional Engineer qualified in the field of hydro-geotechnical survey to address the following:

- (a) Area ground water characteristics.
- (b) Site suitability for development, unstable soils, etc.
- (c) Drill and / or excavate test holes on the site and install piezometers if necessary. Log test hole data to identify soil characteristics, identify areas of fill if any. Identify unacceptable fill material, analyse soil sulphate content, Identify unsuitable underlying soils such as peat, etc. and make recommendations for remediation if necessary.
- (d) List extraordinary requirements that may be required to accommodate construction of roads and underground utilities as well as building foundation designs.
- (e) Additional geotechnical survey may be necessary for building foundations, etc.

## 12. Development Permit and Site Related Issues


### Access and Manoeuvrability

- (i) *Sunset Dr Access; The sidewalk must be continuous and maintained across the access point to reinforce the "pedestrian first" atmosphere that the downtown area is striving for. All movements and pick-up/drop-offs must be done on-site and not within the City ROW. The design will also impact on-street parking and will also eliminate boulevard trees. The approved movements will be determined by the TIA.*
- (ii) *Ellis Street Access; The sidewalk must be continuous and maintained across the access point to reinforce the "pedestrian first" atmosphere that the downtown area is striving for. All movements and pick-up/drop-offs must be done on-site and not within the City ROW. The design will also*



*impact on-street parking No access will be permitted on Ellis Street as per bylaw. The approved movements will be determined by the TIA.*

- (ii) A MSU standard size vehicle must be able to manoeuvre onto and off the site without requiring a reverse movement onto public roadways. If the development plan intends to accommodate larger vehicles movements should also be illustrated on the site plan. Indicate on the site plan, the locations of the garbage and recycle bins.
- (iii) Perimeter access must comply with the BC Building Code. Fire Truck access designs and proposed hydrant locations will be reviewed by the Fire Protection Officer.

*for*   
Steve Muenz, P. Eng.  
Development Engineering Manager  
SS

<b>ATTACHMENT</b>		<b>A</b>
This forms part of application		
# Z16-0077		
Planner Initials	AC	 City of <b>Kelowna</b> COMMUNITY PLANNING

ISSUED FOR: RE-ZONING

DATE: APRIL 10, 2017

CLIENT



North American Development Group  
302 Lakeshore Rd  
Kelowna, BC V1W 3S9  
T: 250-575-0550



Kerkhoff Construction Ltd.  
202-45389 Luckakuck Way  
Chilliwack, BC V2R 3V1  
T: 604-824-4122 F: 604-824-4171  
info@kerkhoff.ca



Sheet List		
Sheet Number	Sheet Revision Number	Sheet Name
A0.00		COVER PAGE
A0.01		PROJECT INFORMATION
A0.02		CONTEXT PLAN
A0.03		CONTEXT RENDERINGS
A0.04		ZONING
A0.05		SURVEY
A0.06		SITE PLAN
A1.01		LEVEL 1 FLOOR PLAN
A1.02		LEVEL 2 FLOOR PLAN
A1.03		LEVEL 3 FLOOR PLAN
A1.05		TOWER UNIT PLANS
A2.01		WEST ELEVATION
A3.01		RENDERINGS
A3.02		PROJECT INSPIRATIONS

ARCHITECT



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[www.kasian.com](http://www.kasian.com)



**Kasian Architecture  
Interior Design  
and Planning Ltd**

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CONSULTANT

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PROJECT
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ONE WATER STREET

1187 Sunset Drive  
Kelowna, British Columbia, Canada

DRAWING TITLE
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COVER PAGE

DRAWING ISSUE
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PROJECT NO. 190104	PLOT DATE 2017/04/10	DRAWN Author
	SCALE AS NOTED	REVIEWED Checker
DRAWING NO. A0.00		REVISION 1

## PROJECT INFORMATION

PROJECT ADDRESS: 1187 SUNSET DRIVE, KELOWNA  
LEGAL ADDRESS: LOT 1, DISTRICT LOT 130, OYD  
PLAN KAP76304

PROPOSED ZONING: C7

PROPOSED USES: APARTMENT / RETAIL / LIVE-WORK

PROPOSED HEIGHT: SOUTH TOWER - 35 STOREYS / 116.15m  
NORTH TOWER - 27 STOREYS / 92.15m

SITE COVERAGE: GROUND FLOOR BUILDING FOOTPRINT = 8,306.36m<sup>2</sup>  
BUILDING FOOTPRINT + DRIVEWAYS = 9,390.76m<sup>2</sup>

SITE FOOTPRINT: = 11,490.00m<sup>2</sup>

SITE COVERAGE = 72.3%

SITE COVERAGE (INCL. DRIVEWAYS) = 81.73%

### South Tower Area Matrix

Level	Unit # and Area (sf)															Total # of Units	Studio	1 Bed	1 Bed + Den	Jr 2 Bed	2 Bed	2 Bed + Den	3 Bed
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15								
35	3395.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
34	1914.8	1990.8	1909.4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3
33	1914.8	1990.8	1909.4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3
32	1914.8	1990.8	1909.4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3
31	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
30	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
29	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
28	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
27	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
26	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
25	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
24	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
23	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
22	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
21	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
20	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
19	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
18	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
17	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
16	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
15	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
14	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
13	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
12	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
11	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1
10	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-
9	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-
8	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-
7	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-
6	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-
5	338.5	1175.2	1164	1136.2	1343	1132.1	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
4	338.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1	-	-	-	-	-	5
<b>Totals</b>																<b>214</b>	<b>7</b>	<b>10</b>	<b>52</b>	<b>26</b>	<b>62</b>	<b>21</b>	<b>36</b>

### North Tower Area Matrix

Level	Unit # and Area (sf)															Total # of Units	Studio	1 Bed	1 Bed + Den	Jr 2 Bed	2 Bed	2 Bed + Den	3 Bed	3 Bed Townhouse
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15									
27	3395.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-
26	1914.8	1990.8	1909.4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3	-
25	1914.8	1990.8	1909.4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3	-
24	1914.8	1990.8	1909.4	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	3	-
23	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
22	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
21	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
20	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
19	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
18	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
17	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
16	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
15	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
14	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
13	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
12	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
11	806.9	856.9	1046.3	576.2	593.5	879.4	1154.9	-	-	-	-	-	-	-	-	7	-	2	1	2	1	1	1	-
10	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-	-
9	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-	-
8	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-	-
7	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-	-
6	465.9	462.1	788.7	316.7	745.1	573.4	592.3	698.6	464.5	740.8	-	-	-	-	-	10	1	2	2	1	4	-	-	-
5	338.5	1175.2	1164	1136.2	1343	1132.1	1187.8	1196	1271.6	1260.2	1196	1187.8	-	-	-	1	1	-	-	-	-	-	-	-
4	338.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12	1	-	-	-	-	-	-	6
<b>Totals</b>																<b>164</b>	<b>7</b>	<b>10</b>	<b>36</b>	<b>18</b>	<b>46</b>	<b>13</b>	<b>28</b>	<b>6</b>

## Parking

City Required Residential Parking: 1 Stall per unit  
City Required Visitor Parking: 1 Stall per 7 units (included in City requirement above)  
Parking Requirement by Owner: 1.4 Stalls per unit  
Commercial Parking: 1.3 Stalls per 100m<sup>2</sup>  
Residential Bicycle Parking: 0.5/dwelling unit - Class 1; 0.1/dwelling unit - Class 2  
Commercial Bicycle Parking: 0.2/100m<sup>2</sup> - Class 1; 0.6/100m<sup>2</sup> - Class 2  
Restaurant Bicycle Parking: 0.1/100m<sup>2</sup> - Class 1

### Parking Requirement

	North Tower	South Tower	Live/Work Units	Total Units / Area	Factor	Parking Required
# of Units	164	214	10	388	1	388
Commercial Space (m <sup>2</sup> )				1330.96	1.3/100m <sup>2</sup>	17
<b>Total</b>						<b>405</b>

### Bicycle Parking Requirement



SITE CONTEXT \_VIEW FROM EAST



SITE CONTEXT \_VIEW FROM SOUTH



SITE CONTEXT \_VIEW FROM WEST



## CONTEXT PLAN



CURRENT ZONING



Kasian Architecture  
Interior Design  
and Planning Ltd

1011 Ninth Avenue SE, Suite 450  
Calgary, AB Canada T2G 0H7  
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[www.kasian.com](http://www.kasian.com)

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	PROJECT
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ONE WATER STREET

1187 Sunset Drive  
Kelowna, British Columbia, Canada

DRAWING TITLE

## CONTEXT PLAN

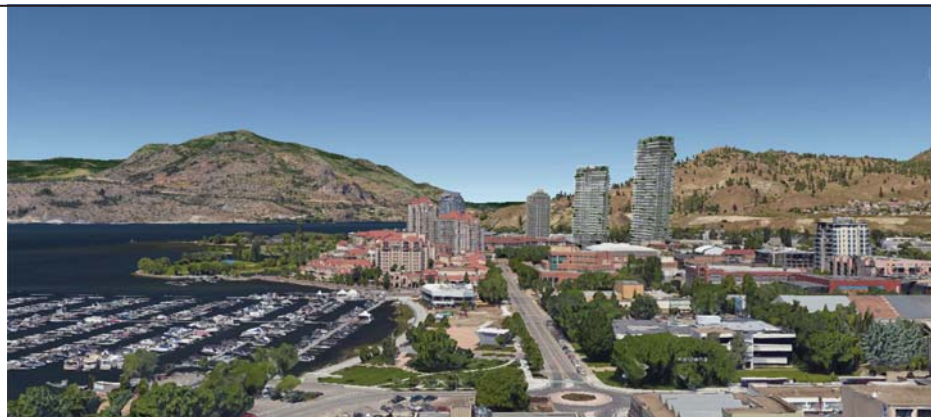
DRAWING ISSUE

PROJECT NO.  190104	PLOT DATE 2017/04/10	DRAWN Auth
	SCALE	REVIEWED Check
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## RENDERING KEYPLAN



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ONE WATER STREET

1187 Sunset Drive  
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## CONTEXT RENDERINGS

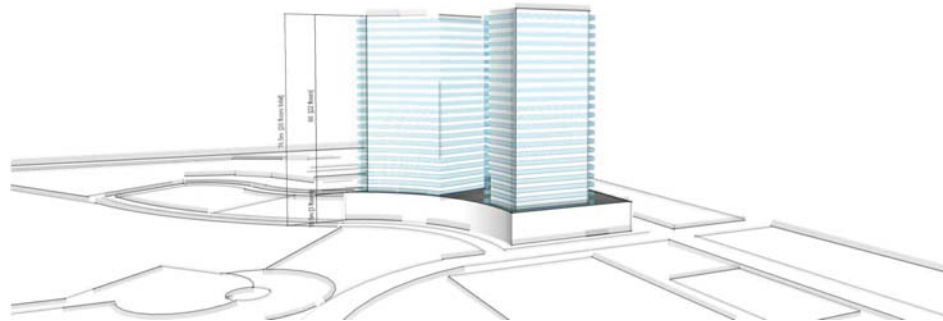
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max far w/ bonusing: 1.68  
max height 15m = 3 floors  
max site coverage 75%

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1187 Sunset Drive  
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## ZONING

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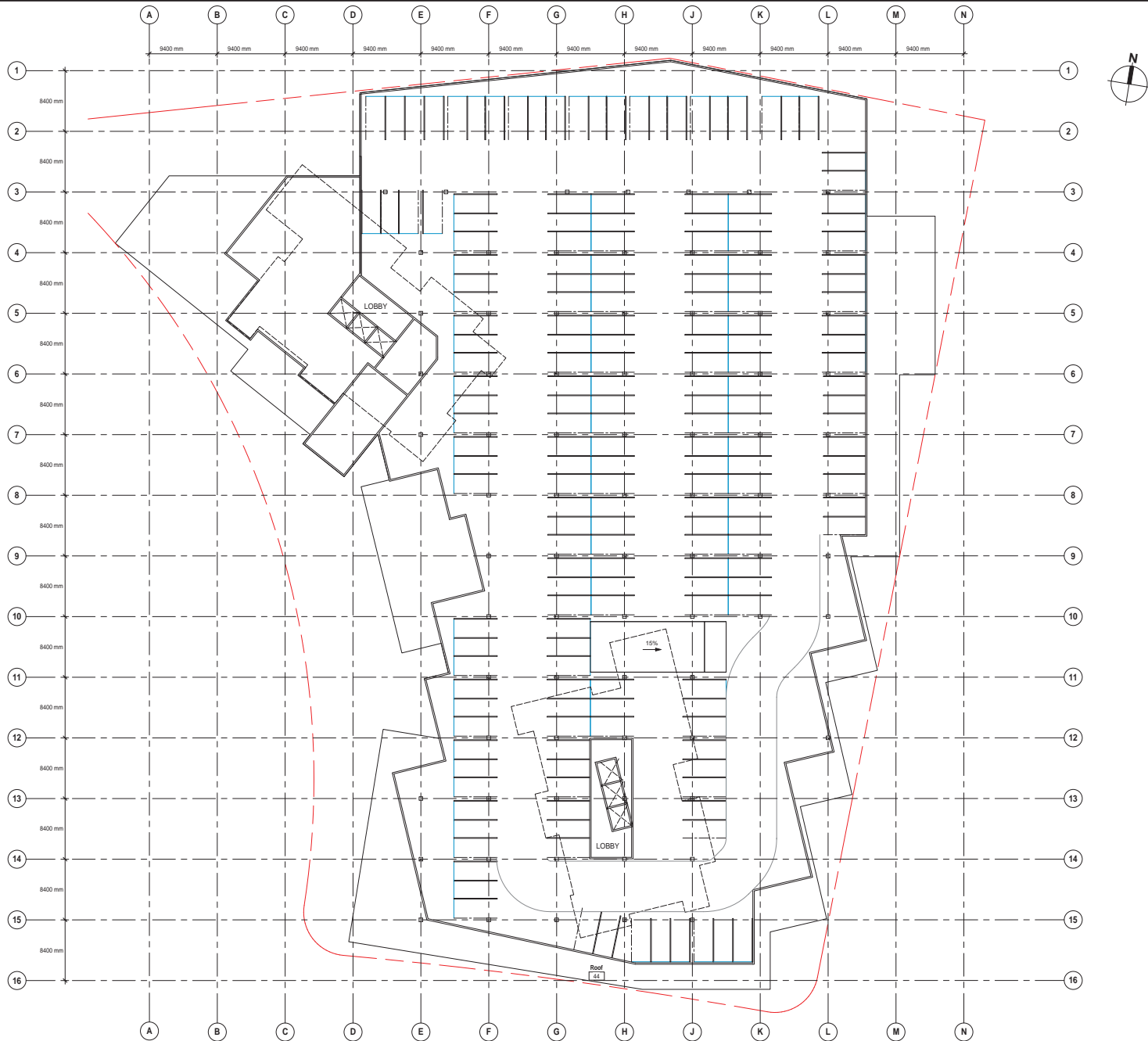












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PROJECT

**ONE WATER STREET**

1187 Sunset Drive  
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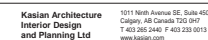
**LEVEL 3 FLOOR PLAN**

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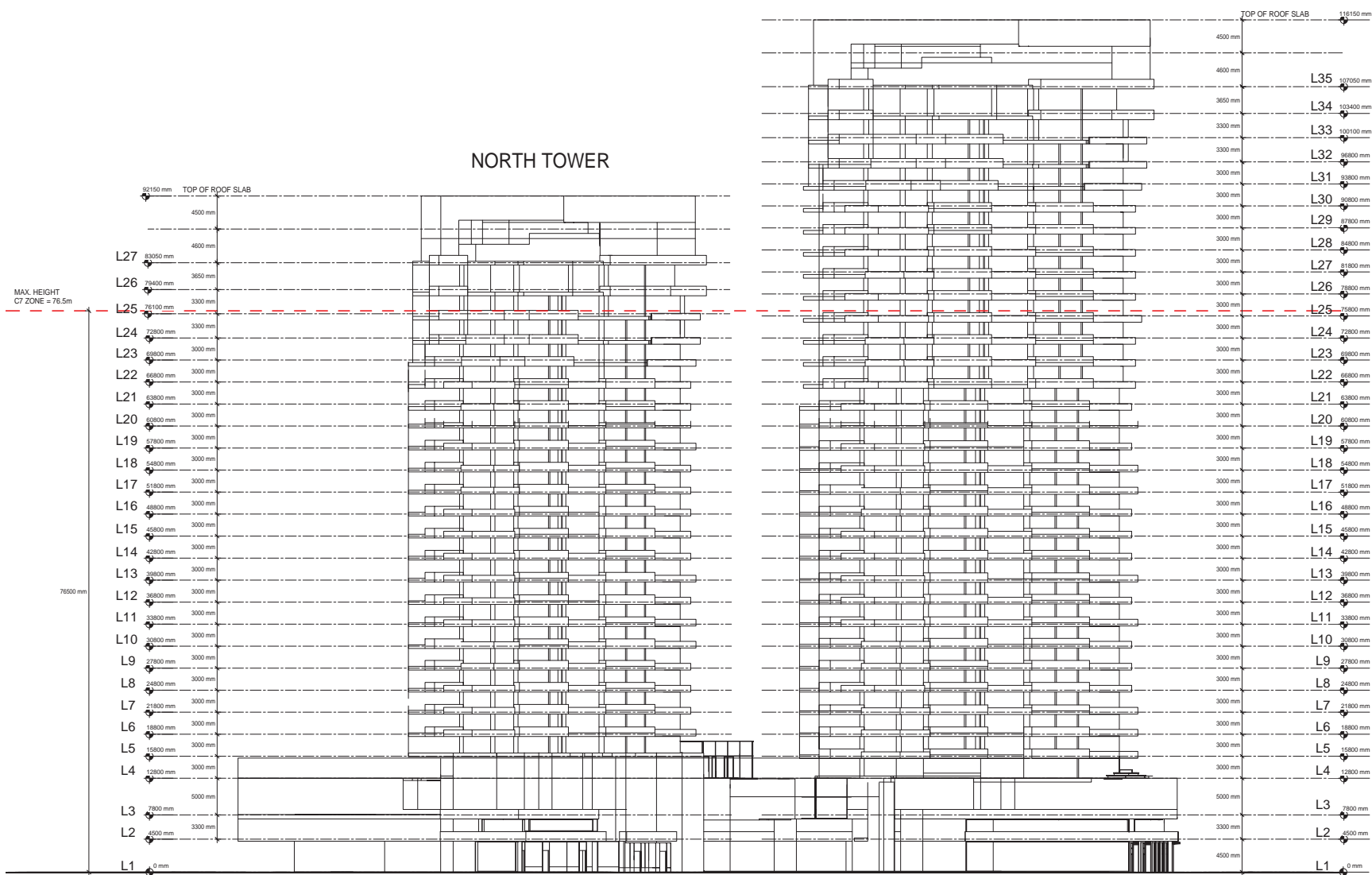
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1 LEVEL 3  
A1.03 SCALE: 1 : 250





## NORTH TOWER



WEST ELEVATION  
SCALE: 1:250

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PROJECT

ONE WATER STREET

1187 Sunset Drive  
Kelowna, British Columbia, Canada

WEST ELEVATION

PROBATION, 1993-94

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PROJECT

ONE WATER STREET

1187 Sunset Drive  
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## RENDERINGS

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**LIFESTYLE** \_INDOOR / OUTDOOR

LIFESTYLE \_FOOD CULTURE



**LIFESTYLE \_OKANAGAN MODERN**



LIFESTYLE \_LAKE LIFE



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PROJECT	
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ONE WATER STREET

1187 Sunset Drive  
Kelowna, British Columbia, Canada

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## PROJECT INSPIRATIONS

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<b>ATTACHMENT</b>		<b>B</b>
This forms part of application		
# Z16-0077		
Planner Initials	AC	 City of <b>Kelowna</b> COMMUNITY PLANNING

# 1187 Sunset Drive Mixed Use Development Transportation Impact Assessment Final Report

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Prepared for: North American Development Group

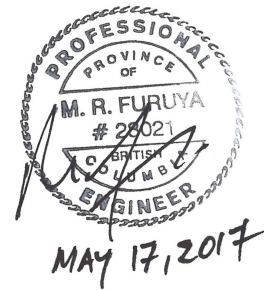
Date: May 17, 2017

Prepared by: Bunt & Associates Engineering (Alberta) Ltd.

Project No.: 1498-02

## CORPORATE AUTHORIZATION

This document entitled "*1187 Sunset Drive Mixed Use Development - Transportation Impact Assessment*" was prepared by Bunt & Associates for the benefit of the client to whom it is addressed. The information and data in the report reflects Bunt & Associates best professional judgement in light of the knowledge and information available to Bunt & Associates at the time of preparation. Except as required by law, this report and the information and the data contained are to be treated as confidential and may be used and relied upon only by the client, its officers, and employees. Any use which a third party makes of this report, or any reliance on or decisions based on it, are the responsibilities of such third parties. Bunt & Associates accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.



---

Responsible Engineer

## TABLE OF CONTENTS

1. INTRODUCTION .....	1
1.1 SCOPE OF WORK .....	1
2. EXISTING CONDITIONS .....	2
2.1 SITE LOCATION AND CONTEXT .....	2
2.2 STREET NETWORK .....	5
2.3 EXISTING TRAFFIC VOLUMES .....	5
2.4 EXISTING INTERSECTION CAPACITY ANALYSIS .....	8
2.5 WALKING .....	12
2.6 CYCLISTS .....	12
2.7 TRANSIT .....	13
3. DEVELOPMENT PLAN .....	16
3.1 LAND USE .....	16
3.2 VEHICLE ACCESS .....	16
3.3 TRIP GENERATION .....	17
3.4 TRIP DISTRIBUTION & ASSIGNMENT .....	19
3.4.1 Distribution .....	19
3.4.2 Assignment .....	19
4. FUTURE TRAFFIC CONDITIONS .....	24
4.1 BACKGROUND OPERATIONS .....	24
4.2 POST DEVELOPMENT OPERATIONS .....	29
4.2.1 Northbound Left Turns Permitted at the Ellis Street Access .....	29
4.2.2 Northbound Left Turn Restricted at Ellis Street Access .....	34
4.2.3 Northbound Left Turn at Ellis Street Site Access Summary .....	37
5. PARKING & LOADING .....	39
5.1 VEHICLE PARKING .....	39
5.2 BICYCLE PARKING .....	39
5.3 LOADING REQUIREMENT .....	40
5.4 VEHICLE CIRCULATION .....	40
6. CONCLUSION & SUMMARY .....	44

## APPENDIX A Scope Correspondence

## APPENDIX B Existing Signal Timing Plans

## APPENDIX C Traffic Counts

## APPENDIX D Synchro &amp; Sidra Outputs

## APPENDIX E TAC Signal Warrant

## APPENDIX F NCHRP Internal Capture

## APPENDIX G 1190 Richter Street (RCMP Headquarters) TIA

## APPENDIX H Background Development Site Trips

## EXHIBITS

Exhibit 2.1	Site Context.....	3
Exhibit 2.2	Site Plan.....	4
Exhibit 2.3	Existing Lane Configurations & Traffic Control.....	6
Exhibit 2.4	Existing Balanced Traffic Volumes.....	7
Exhibit 2.5	Active Transportation Network.....	15
Exhibit 3.1	Proposed Lane Configurations & Traffic Control.....	21
Exhibit 3.2	Development Site Trips.....	22
Exhibit 3.3	Development Site Trips with Restricted Northbound Left Turn at Ellis Street Access .....	23
Exhibit 4.1	Background 2020 Traffic Volumes .....	25
Exhibit 4.2	Background 2030 Traffic Volumes .....	26
Exhibit 4.3	Post Development 2020 Traffic Volumes.....	30
Exhibit 4.4	Post Development 2030 Traffic Volumes.....	31
Exhibit 4.5	Post Development 2030 Traffic Volumes with Restricted Northbound Left Turn at Ellis Street Access .....	35
Exhibit 5.1	Vehicle Turning Analysis – External Loading.....	41
Exhibit 5.2	Vehicle Turning Analysis – Internal Loading .....	42
Exhibit 5.3	Vehicle Turning Analysis – Passenger Vehicle On-site Manoeuvring .....	43



## TABLES

Table 2.1: Intersection Level of Service Thresholds .....	8
Table 2.2: Existing Operations .....	9
Table 2.3: Sunset Drive & Water Street / Clement Avenue Mitigated Operations .....	10
Table 2.4: Existing Pedestrian Volumes.....	12
Table 2.5: Existing Cyclist Volumes.....	13
Table 2.6: Bus Transit Service .....	14
Table 3.1: Proposed Land Use Densities.....	16
Table 3.2: Development Site Trip Generation .....	18
Table 3.3: Vehicle Trip Distribution.....	19
Table 4.1: Background 2020 .....	27
Table 4.2: Background 2030 Operations .....	28
Table 4.3: Post Development 2020 Operations.....	32
Table 4.4: Post Development 2030 Operations.....	33
Table 4.5: Post Development 2030 Operations with Restricted NBL at Ellis Street Access .....	36
Table 5.1: Bylaw Required Vehicle Parking .....	39
Table 5.2: Bylaw Required Bicycle Parking .....	40

## FIGURES

Figure 4.1: Driveway Design .....	38
Figure 4.2: Driveway Design 2 .....	38

## 1. INTRODUCTION

North American Development Group (NADG) is proposing a mixed-use commercial and residential development at the northeast corner of Sunset Drive and Water Street/Clement Avenue. Bunt & Associates (Bunt) has been retained to prepare a Transportation Impact Assessment for this proposed development. Bunt recently completed a TIA in 2014 for a similar proposed development located at 1000 Manhattan Drive, which is approximately 500 metres northwest of the proposed study site, and this study summarized the current transportation operations and highlighted future mitigation measures that were likely to be required. This study is therefore intended as an “update” to the previous TIA, and it considers a similar study area but with a different development site.

The proposed develop will include approximately 17,083 ft<sup>2</sup> of retail area, 9 live work townhomes and 397 residential condo units. The retail area will be primarily located along Clement and Sunset Avenue, while the townhomes will be on Ellis Street. The residential condo units will be located in two towers, one on the south edge of the site and one on the northwest corner.

This study follows the general form and content of the previous Bunt TIA as agreed by the City of Kelowna Transportation staff with a couple of amendments. A summarized version of the scope is shown below, while the detailed scope and correspondence attached in **Appendix A**.

### 1.1 Scope of Work

The scope of work for this study was confirmed to include the following:

- Determine expected site generated traffic volumes for the proposed uses at Opening Day based on ITE data. Assign expected site generated traffic volumes to the road network based on the distributions used in the previous TIA.
- Complete capacity analysis for Existing, Opening Day and Opening Day + 10 year Background and Post Development horizons during the weekday AM and PM peak hours at the following intersections:
  - Sunset Drive & Water Street / Clement Avenue
  - Ellis Street & Clement Avenue
  - All site accesses
- Review active transportation for a 400m radius around the site.
- Review the site plan, accesses, loading bays and site circulation.
- Determine the bylaw parking requirements and adequacy of the proposed parking supply.

## 2. EXISTING CONDITIONS

### 2.1 Site Location and Context

The site is located just north of downtown Kelowna and is currently zoned as C4. It is proposed to be re-zoned to C7 through the redevelopment. The site is bounded by Clement Avenue to the south, Sunset Drive to the west, Ellis Street to the east and lot 1147 Sunset Drive to the north which is currently being developed with a residential tower.

The proposed development is to consist of a podium with approximately 17,100 ft<sup>2</sup> of retail, 9 live/work townhomes, and two mid-rise towers with 397 condo units. The two towers will rest on a three level above ground podium with internal parking and external commercial on the west, south and east sides.

Vehicular access to the development will be provided from two separate locations, with one access on Sunset Drive and one access on Ellis Street, and the development will be accessible to pedestrians on the west, east and south frontages.

In the surrounding neighbourhood there are a number of varying uses. Directly south of the site is the Prospera Place Arena, which shares a block with some light industrial and retail uses. Directly west of the site is a surface level parking lot, and to the north on Sunset Drive are a number of hotels and vacation rental developments. East of the site is primarily a light industrial area with some restaurants and entertainment uses.

The study area and adjacent external road network is illustrated in **Exhibit 2.1**, and the site plan is illustrated in **Exhibit 2.2**.



Base Map Source: Google Maps

## Exhibit 2.1 Site Context







Base Map Source: Kasian Architecture Interior Design and Planning Ltd.

## Exhibit 2.2 Site Plan



## 2.2 Street Network

This section outlines the study area street network, and describes roadway function, design characteristics and intersection controls. The studied intersections are illustrated in **Exhibit 2.3** and summarized below:

- Sunset Drive and Water Street/Clement Avenue (southbound stop control on Sunset Drive)
- Clement Avenue and Ellis Street (traffic signal control)

Sunset Drive is classified as a major collector road, and connects Water Street/Clement Avenue in the south to Manhattan Drive, then continuing two blocks further north as Guy Street. There is pay parallel parking (two hour maximum duration of stay) available on both sides of Sunset Drive fronting the proposed development. The road surface is approximately 11m wide. Along the east side of Sunset Drive there is a 3.5m wide continuous sidewalk and the sidewalk along the west side of Sunset Drive is approximately 1.5m wide.

Water Street, west of Sunset Drive, has one lane of travel in the westbound direction and is 10m wide at its narrowest point. In the eastbound direction to Ellis Street, Water Street becomes Clement Avenue, an arterial road, with a four-lane cross-section (including storage lanes) and on-street parking on south side block face, being 23m at its widest point. The road is classified as a two lane arterial west of Sunset Drive and a four lane arterial east of Sunset Drive. On the northern edge of Water Street / Clement Avenue there is a wide, continuous sidewalk (approximately 2.5m), while the southern edge borders Prospera Place, which has a wide public realm area for pedestrians.

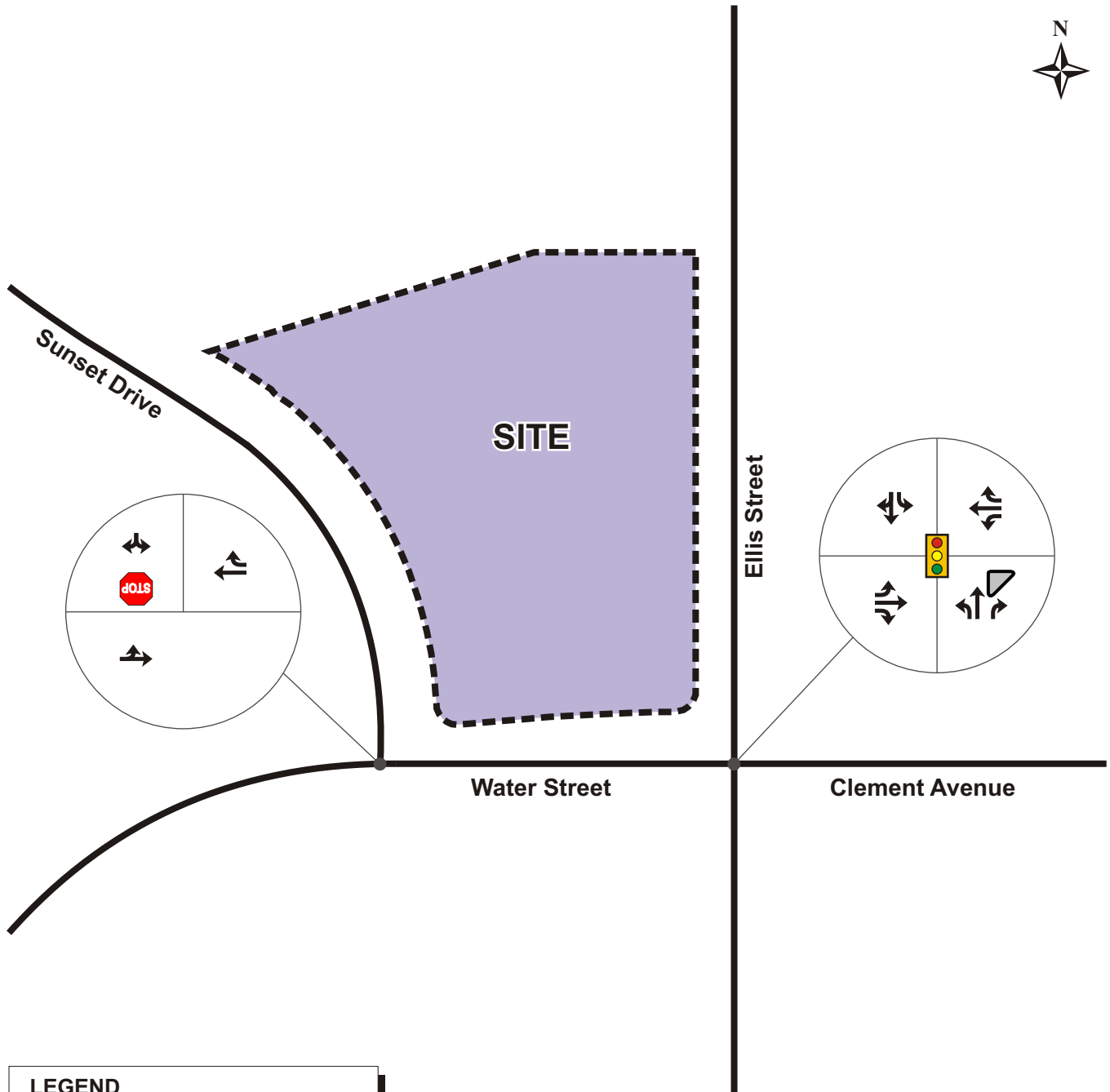
Ellis Street is an arterial road, with one lane of travel in either direction (not including turning storage bays), and north of Clement Avenue there is unrestricted on-street parking. A continuous sidewalk is provided on the both sides of Clement Avenue near the study site.

## 2.3 Existing Traffic Volumes

Traffic volumes were obtained from the City of Kelowna for the study intersections. Bunt balanced the through volumes between the intersections based on comments from the City and conducted the analysis using these updated volumes. The adjusted turning movement volumes are summarized in **Exhibit 2.4**, and the original data that Bunt received from the City is located in **Appendix C**.

The pedestrian and bicycle volumes that were used in the following sections were from previous counts and are noted below. The raw data for these counts is also attached in Appendix C.

- Sunset Drive & Water Street / Clement Avenue – Tuesday/Wednesday May 13<sup>th</sup>-14<sup>th</sup>, 2014 (Bunt)
- Ellis Street & Clement Avenue – Wednesday July 11<sup>th</sup>, 2012 (City of Kelowna)



#### LEGEND



Lane Configuration



Signalized Intersection



Stop Controlled

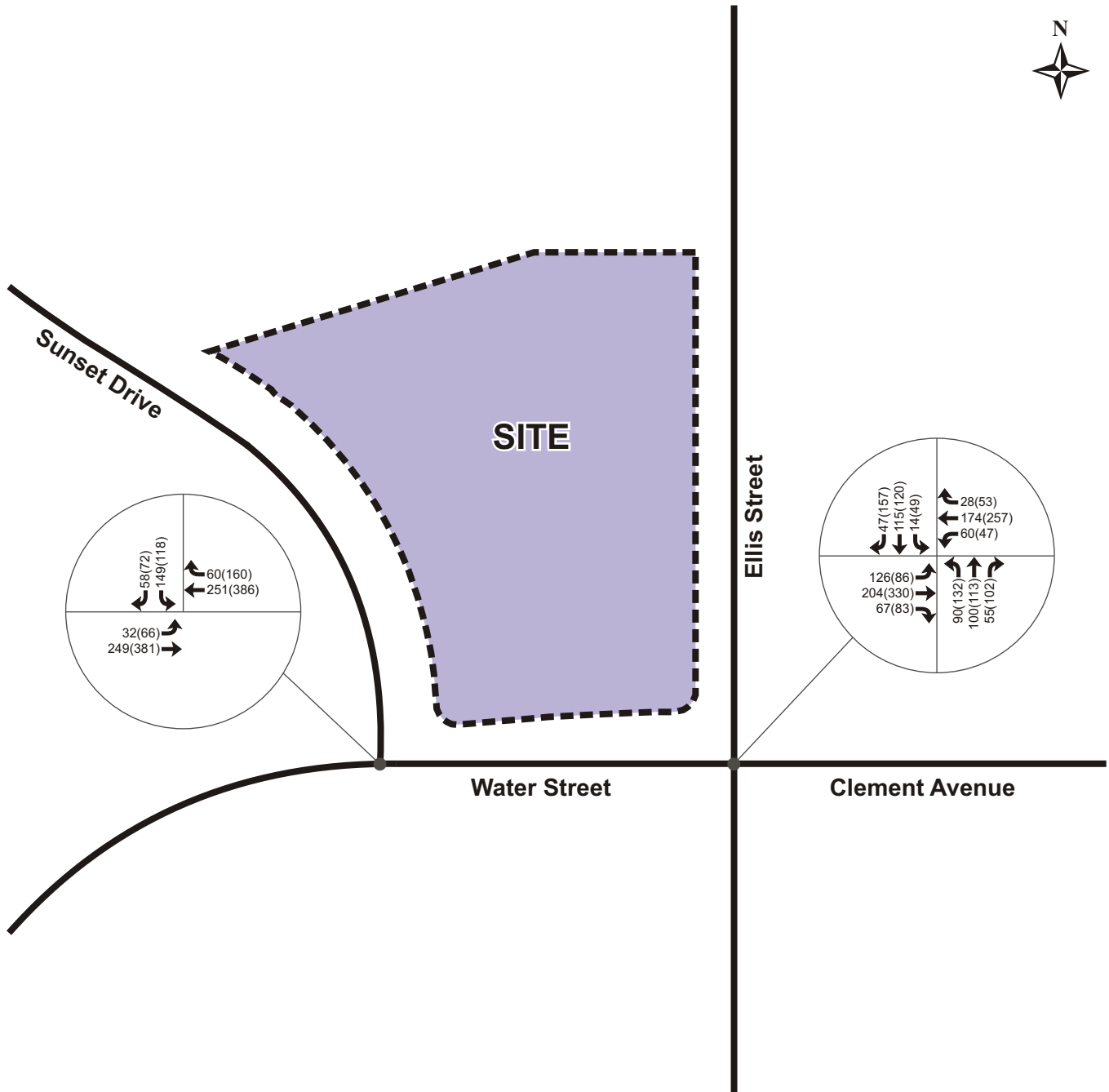


Right Turn Channelization

#### Exhibit 2.3

### Existing Lane Configurations & Traffic Control





**LEGEND**

↶ ↷ ↸ Vehicle Volumes

XX AM Peak Hour

(ZZ) PM Peak Hour

**Exhibit 2.4**  
**Existing Balanced Traffic Volumes**





## 2.4 Existing Intersection Capacity Analysis

All study network intersections were assessed based on the methods outlined in the Highway Capacity Manual (HCM), using the Synchro 9.0 analysis software. The traffic operations were assessed using the performance criteria (as calculated by the software) of Level of Service (LOS), volume-to-capacity (v/c) ratio and delay.

The LOS rating is based on average vehicle delay and ranges from “A” to “F” based on the quality of operation at the intersection. A LOS “A” represents optimal, minimal delay conditions while a LOS “F” represents an over-capacity condition with considerable congestion and/or delay. Delay is calculated in seconds and is based on the average movement/intersection delay per vehicle. **Table 2.1** below summarizes the LOS thresholds for both the signalized and unsignalized intersections.

**Table 2.1: Intersection Level of Service Thresholds**

Level of Service	Average Control Delay per Vehicle (Seconds)	
	Signalized	Unsignalized
A	$\leq 10$	$\leq 10$
B	$> 10$ and $\leq 20$	$> 10$ and $\leq 15$
C	$> 20$ and $\leq 35$	$> 15$ and $\leq 25$
D	$> 35$ and $\leq 55$	$> 25$ and $\leq 35$
E	$> 55$ and $\leq 80$	$> 35$ and $\leq 50$
F	$> 80$	$> 50$

The volume to capacity (v/c) ratio of an intersection represents the ratio between the demand volume and the available capacity. A v/c ratio less than 0.85 indicates that there is generally sufficient capacity to accommodate demand. A v/c value between 0.85 and 0.95 indicates an intersection is approaching practical capacity; a v/c ratio over 0.95 indicates that traffic demands are close to exceeding the available capacity, resulting in saturated conditions.

The performance thresholds that were used to trigger consideration of roadway or traffic control improvements to support roadway or traffic control improvements employed in this study are listed below:

### Signalized Intersections:

- Overall intersection Level of Service must not be worse than LOS D;
- Overall intersection v/c ratio should not exceed 0.85;
- Individual movement Level of Service must not be worse than LOS E; and,
- Individual movement v/c ratio should not exceed 0.90.

**Unsignalized Intersections:**

- Individual movement Level of Service should be LOS D or better, unless the volume is very low in which case LOS E can be considered acceptable.

**Table 2.2** presents the current operation of the study intersections, and the detailed Synchro summaries for the existing intersections are provided in **Appendix D**.

Note that the Synchro laning was modeled to reflect driver behavior, as some lanes are wide enough to accommodate more than one movement. At the Sunset Drive / Clement Avenue intersection, the westbound leg was modeled with the separate through and right lane because right turning vehicles have the space to perform this movement despite a formal lane not being marked.

**Table 2.2: Existing Operations**

Intersection	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Sunset Drive & Water Street / Clement Avenue (SB Stop)	EB	1	0.03	A	1	1	0.08	A	2	2
	WB	1	0.16	A	0	0	0.25	A	0	0
	SB	1	0.47	C	19	19	0.70	E	41	37
	Int. Summary		-	A	5	-	-	B	7	-
Ellis Street & Clement Avenue (Signalized)	EBL	1	0.30	B	10	14	0.23	B	11	13
	EBT	1	0.31	A	9	19	0.52	B	13	42
	EBR	1	0.12	A	3	4	0.15	A	3	6
	WBL	1	0.15	A	9	7	0.14	A	10	8
	WBT	1	0.26	A	9	17	0.40	B	11	32
	WBR	1	0.05	A	3	3	0.10	A	4	5
	NBL	1	0.18	A	10	11	0.40	B	15	22
	NBT	1	0.13	A	9	12	0.19	B	11	17
	NBR	1	0.08	A	4	5	0.19	A	4	7
	SBL	1	0.03	A	8	3	0.12	B	11	9
	SBTR	1	0.21	A	8	15	0.46	A	9	26
	Int. Summary		-	A	8	-	-	B	10	-

The southbound movement at the intersection of Sunset Drive and Water Street is currently operating with a LOS E and moderately high delay during the PM peak hour. The northbound left turn at the intersection of Ellis Street and Clement Avenue is exceeding its' storage length of 20m by 2m. This is a small amount, and represents less than one vehicle. No changes are recommended for this northbound left movement at this time. The remaining movements and study area intersections are currently operating within acceptable capacity parameters and no other intersection improvements are required to accommodate existing volumes. Mitigation measures for the Sunset Drive & Water Street intersection are discussed below.

To mitigate the existing operational issue for the southbound movement at the intersection of Sunset Drive and Water Street, a number of intersection configuration upgrades have been considered, and these are listed below.

- Separated southbound left and right turn lanes
- Separated southbound left and right turn lanes, and three-way stop control
- Roundabout with shared southbound right and left laning
- Traffic signal control with shared southbound right and left laning

The performance results for the alternative traffic control types for the Sunset Drive / Water Street intersection are summarized in **Table 2.3**. The values displayed are from Synchro analysis, although Sidra traffic analysis software was used to assess the roundabout performance. The detail analysis outputs are attached in Appendix D.

**Table 2.3: Sunset Drive & Water Street / Clement Avenue Mitigated Operations**

Mitigated Intersection Type	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Separated SB Lanes	EB	1	0.03	A	1	1	0.08	A	2	2
	WB	1	0.16	A	0	0	0.25	A	0	0
	SBL	1	0.38	C	19	13	0.57	E	40	24
	SBR	1	0.09	B	10	2	0.13	B	13	4
	<i>Int. Summary</i>		-	A	5	-	-	A	6	-
Three Way Stop Control	EB	1	0.47	B	13	-	0.79	D	27	-
	WB	1	0.43	B	12	-	0.69	C	20	-
	SBL	1	0.30	B	11	-	0.27	B	12	-
	SBR	1	0.10	A	8	-	0.14	A	9	-
	<i>Int. Summary</i>		-	B	12	-	-	C	20	-
Roundabout	WB	1	0.32	A	7	12	0.58	B	11	31
	SB	1	0.27	A	7	8	0.29	A	8	9
	EB	1	0.33	A	7	11	0.50	A	10	22
	<i>Int. Summary</i>		0.33	A	7	-	0.58	A	10	-
Signalization	EB	1	0.28	A	8	38	0.46	A	10	68
	WB	1	0.23	A	7	32	0.35	A	7	48
	SB	1	0.58	C	24	32	0.56	C	22	27
	<i>Int. Summary</i>		-	B	11	-	-	A	10	-

The separate southbound movement option has a failing level of service and moderately high delay, while the eastbound movement for the three-way stop control option is near the performance threshold of 0.85 at 0.79. The other two intersections are well within the performance thresholds, and given the background growth anticipated in the area including the new RCMP building and 1147-1157 Sunset Drive, only the roundabout and signalization options are anticipated to be able to accommodate the forecasted vehicle demand.

Both the roundabout and traffic signal options would provide adequate capacity to accommodate the existing balanced volumes. Note that both of these options would require the relocation of the Route #2 bus stop from its current location directly south of Sunset Drive on the south side of Clement Avenue.

Signalization of the intersection is considered to be the more appropriate choice for this location over the roundabout for the following reasons:

- There are no other roundabouts on Water Street and a signal would maintain consistency with the nearby intersections.
- The adjacent Prospera Place is likely to cause surges of traffic before and after major events, and a signal will be more able to accommodate these high vehicle volumes
- Signals are typically preferred for applications where there are frequent pedestrians. Given the ground-oriented retail proposed for the site, and the pedestrian nature of the area, a signal would be more appropriate for accommodating pedestrians. Additionally, high pedestrian volumes before and after major events at Prospera Place would significantly reduce the capacity of a roundabout as pedestrians would have the un-restricted right to cross traffic flows.
- A roundabout would require a larger footprint than is currently available at this location.

For these reasons a signal is recommended to be installed at this location, and due to its' close proximity to the intersection of Ellis Street and Clement Avenue, it is recommended that these two intersections are coordinated.

A TAC signal warrant analysis was also conducted at the intersection in question, and the detail results are shown in **Appendix E**. The existing volumes do not currently warrant a traffic signal based on the TAC warrant analysis, with the intersection achieving a score of 72 points (50 vehicle and 22 pedestrian) with 100 points generally required to warrant a signal. Nevertheless a signal is still warranted from a traffic operations perspective, and is recommended to mitigate the existing operational issues.



## 2.5 Walking

The existing pedestrian network near the study site is shown in **Exhibit 2.5**. The site is generally well connected to downtown Kelowna due to close proximity and sidewalks along most streets. The intersection of Sunset Drive with Water Street currently has a pedestrian crossing on only the eastbound leg, although crossings are permitted on the southbound leg. It is recommended that a crossing be added on the westbound leg of the intersection. This will improve pedestrian access to the site from the south and the plaza surrounding Propsera Place. There are marked pedestrian crossings with push buttons at all legs at the intersection of Clement Avenue and Ellis Street, and these are illustrated in Exhibit 2.5.

The cumulative (includes all four legs) peak hour pedestrian volumes at the study area intersections are summarized in **Table 2.4**.

**Table 2.4: Existing Pedestrian Volumes**

Intersection	AM Peak Hour	PM Peak Hour
Sunset Drive/Clement Avenue	20	48
Ellis Street/ Clement Avenue	19	45

Sidewalks are located along most of the streets near the study site, but there are some areas east of the site where sidewalks are still missing. Marked pedestrian crossings are also missing at many of the intersections east of the site.

## 2.6 Cyclists

The existing cycling network in the vicinity of the proposed development is illustrated in Exhibit 2.5.

As indicated, the proposed development site is moderately well connected to the existing cycling network through both the Recreation Avenue bike route north of the site, and the Cawston Avenue bicycle path to the south. Although there are not any sharrows (a street marking typically placed in the centre of the vehicle travel lane to indicate that a cyclist may use the full lane) or other cycling facilities on Sunset Drive, its' wide cross-section it is still generally considered an attractive route for cyclists. Sunset Drive then connects to the Water Street bike lanes to the south, which feed to the Abbot Street separated bike lane and the Cawston Avenue Pathway, which is the primary east-west bike route in the area.

The City has recently added cycle tracks on Ethel Street between Cawston and Bernard Avenues, and plans on adding bicycle lanes on Ellis Street in the near future.

Existing cycling volumes (total from all four legs) for the study area intersections are illustrated in **Table 2.5**.

**Table 2.5: Existing Cyclist Volumes**

Intersection	AM Peak Hour	PM Peak Hour
Sunset Drive/Clement Avenue	12	17
Ellis Street/Clement Avenue	17	20

For the traffic analysis portion of this study, a minimum value of 5 bicycle trips was used for each movement. Due to the imminent addition of the Ellis Street cycle tracks, 20 bph were assumed for each direction on Ellis Street. These values were used for the existing analysis, and were grown by 2% annually for the future horizons.

## 2.7 Transit

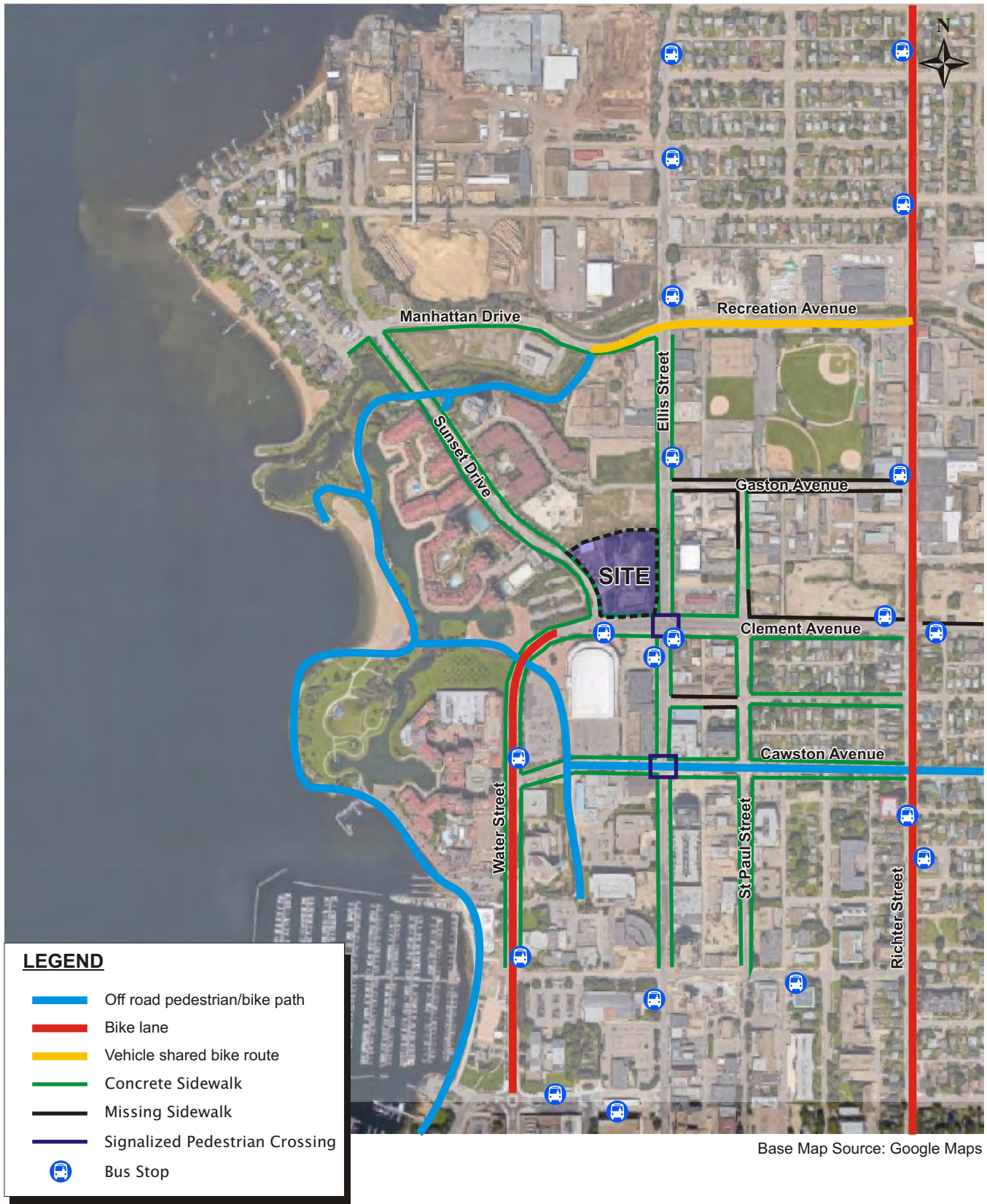
The site is located close the northbound bus stop for the Route 2 shuttle, which is located directly south of the site on Clement Avenue, and the bus Route 5 with stops near the intersection of Clement Avenue and Ellis Street. The Route 2 shuttle travels from the nearby stop northbound, and does a loop to/from the Queensway Exchange, while the Route 5 travels from the Queensway Exchange south to the Mission Recreation Park.

The existing Queensway Exchange is a significant destination and transfer point in downtown Kelowna, and is located approximately 800m south of the site, or approximately a 10-minute walk away. **Table 2.6** summarizes the bus transit routes near the study site and at the Queensway Exchange. The exchange is also the terminus for the RapidBus service implemented as Phase I of the RapidBus project.

**Table 2.6: Bus Transit Service**

Type	Bus Route	Destination	Duration	AM Peak Frequency	PM Peak Frequency	SAT Frequency
Adjacent Route	2	Queensland Exchange / Cambridge Avenue	15	35	25	30
	5	Mission Recreation Exchange	25	30	30	30
Routes available through transfer at Queensway Exchange	1	Okanagan College / Mission Recreation Exchange	25	15	15	30
	6	University of British Columbia Okanagan	35	NA	55	NA
	7	Orchard Park Mall	35	18	15	30
	9	Orchard Park Mall	20	NA	NA	NA
	10	Fitzpatrick & Findlay Rd	45	15	15	30
	11	Craig Rd & McCurdy Rd	40	15	15	30
	97	Westbank Exchange and University of British Columbia Okanagan	50	15	15	30

As illustrated in Table 2.6, the site is well connected to a variety of other bus services through the Queensway transit exchange, which is accessible via a 10-minute walk or a transfer from Route 2. However, given the existing 30-minute frequency of Route 3 during peak activity periods, transit is not anticipated to be a substantial mode of travel to and from the site with the current transit scheduling.



**Exhibit 2.5**  
**Active Transportation Network**





### 3. DEVELOPMENT PLAN

#### 3.1 Land Use

The proposed development uses and densities are summarized in **Table 3.1**.

**Table 3.1: Proposed Land Use Densities**

Land Use	Density
Commercial	10,034 ft <sup>2</sup>
Restaurant	7,048 ft <sup>2</sup>
Residential - Townhouse	9 units
Residential - Condo	397 units
<b>Total</b>	<b>733,116 ft<sup>2</sup></b>

#### 3.2 Vehicle Access

The proposed lane configurations and traffic control for the development site accesses and the study network are shown in **Exhibit 3.1**. As shown, there are two vehicle access points to the site, a full movement access on Sunset Drive and a partial movement access on Ellis Street. Each site access is described in detail below:

##### **Access on Sunset Drive**

Located on the north end of the site and spaced approximately 115m from Clement Avenue, this access meets the City of Kelowna and TAC access spacing requirements from Clement Avenue. This access is proposed to be a full movement access, with both inbound and outbound left and right turns permitted.

##### **Access on Ellis Street**

This access is approximately 115m away from Clement Avenue and also meets the City of Kelowna and TAC access spacing requirements. However, the City bylaw also states that residential driveway accesses are not permitted on arterial streets. Despite this, the City has indicated their tentative approval of a right in / right out access at this location.

The client also seeks to have the northbound left turn movement allowed at the Ellis Street access as well, as a significant portion of future site traffic is anticipated to come from the south and east directions on Clement Avenue and Ellis Street. To better understand the impacts of permitting or restricting the northbound left turn movement at this access, the City has requested that a sensitivity analysis be conducted.



This sensitivity analysis is included in **Section 4.2**. The Post Development analysis with the northbound left turn *permitted* is shown for the 2020 and 2030 horizon years in **Section 4.2.1**, and Post Development analysis with the northbound left turn *restricted* has been shown for the 2030 horizon in **Section 4.2.2**. **Section 4.2.3** summarizes the differences between the two analyses and highlights the pros and cons of each.

### 3.3 Trip Generation

Traffic generation estimates for the proposed development were based on trip rates reported in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 9<sup>th</sup> Edition. Trip rates and the subsequent trips generation for the AM and PM peak hour periods is presented in **Table 3.2**

ITE trip generation data is predominately based on suburban locations which are typically considered more car dependent than would be the case for the proposed development located within walking/cycling distance to the downtown Kelowna area and near to higher density residential land uses. Although the proposed site location has access to transit, and significant cycling and pedestrian connections, for a conservative estimate the reported ITE trip rates were used as a base with discounts applied as described below. The City of Kelowna has approved the site trip generation methodology.

Table 3.2: Development Site Trip Generation

Use	Quantity (ft² or units)	Source	Peak Hour	Total Trip Rate (per 1000 ft² or unit)	# Trips In	# Trips Out	Total Trips
Commercial	10,034	ITE 820	AM	0.96	6	4	10
			PM	3.71	18	19	37
Restaurant	7,048	ITE 931	AM	0.81	4	2	6
			PM	7.49	35	17	53
Residential – Live/Work	9 units	ITE 230	AM	0.44	1	3	4
			PM	0.52	3	2	5
Residential - Condo	397 units	ITE 230	AM	0.44	30	145	175
			PM	0.52	138	68	206
Sub Total				AM	40	154	194
				PM	195	106	301
Internal Capture Reduction (NCHRP 684 procedure)				AM	4	2	6
				PM	26	26	52
10% Active Transportation Reduction				AM	4	15	19
				PM	17	8	25
Total				AM	33	136	169
				PM	152	72	224

Internal capture for the development was based on the National Cooperative Highway Research Program (NCHRP) Report 684: Enhancing Internal Trip Capture Estimate for Mixed Use Developments. The methodology takes into account the different land uses and calculates individual internal capture reductions for each use during the peak hour periods. The sum of the individual internal capture reductions are shown in Table 4.1 for simplicity, and the detailed calculations for can be found in **Appendix F**.

A 10% active transportation reduction was applied to all the site trips to take account for the site's proximity to transit and the downtown, and was based on mode share data from the Central Okanagan – Regional Active Transportation Master Plan, which states that the overall active transportation mode share is 15%. The typical ITE rate is 5%, and so the difference of 10% was applied as a reduction. This is considered to be a conservative estimate, as the site is centrally located and likely to have a higher transit and active mode share than a typical site in Kelowna.

## 3.4 Trip Distribution & Assignment

### 3.4.1 Distribution

Based on a conversation with City staff on May 2<sup>nd</sup>, 2014, and confirmed on April 11, 2017, it is anticipated that the majority of site generated vehicle trips will be to and from the south. The traffic distribution and assignment patterns for the development were based on this, as well as existing traffic patterns. The AM and PM trip distributions are shown in **Table 3.3**.

**Table 3.3: Vehicle Trip Distribution**

Direction	AM Peak Hour		PM Peak Hour	
	In	Out	In	Out
To/from the south on Ellis Street	55%	55%	40%	50%
To/from the north on Ellis Street	10%	10%	10%	10%
To/from the west on Water Street	10%	10%	10%	15%
To/from the east on Clement Avenue	25%	25%	40%	25%
To/from the north on Sunset Drive	0%	0%	0%	0%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### 3.4.2 Assignment

#### **With the Northbound Left Turn Movement at the Ellis Street Access Permitted**

Vehicles were distributed to the site accesses based on the anticipated commercial / residential site access distribution and the convenience of using each access. 50% of all commercial trips and all residential trips to/from Water Street were assigned to use the access on Sunset Drive. A percentage of 50% was used for the commercial trips because the commercial/retail component will be focused on the southwest corner of the site and is likely to attract people to the Sunset Drive access, even if they approach the development from the south or east.

The overall access assignment to the Sunset Drive access ranged between 11 – 28% of the total site trips, and varied for inbound/outbound movements based on the time of day, and the proportional differences between commercial and residential trips. **Exhibit 3.2** shows the development site trips on the study network with some site trips assigned to the northbound left turn movement at the Ellis Street access.

**With the Northbound Left Turn Movement at the Ellis Street Access Restricted**

As noted earlier, the City of Kelowna has asked that the northbound left turn movement from Ellis Street into the site access be restricted. Site trip assignment for this scenario was conducted in an identical manner to the scenario with the northbound left permitted (as described above), except for the following:

- Northbound through site vehicles at the intersection of Ellis Street and Clement Avenue have been rerouted to turn northbound left and use the Sunset Drive access.
- Westbound right turning site vehicles at the intersection of Ellis Street and Clement Avenue have been rerouted to westbound through to use the Sunset Drive access.
- The Eastbound left turning vehicles at Ellis Street and Clement Avenue have instead been assigned to turn eastbound left at the intersection of Sunset Drive and Water Street, and then routed to the Sunset Drive access.

**Exhibit 3.3** shows the development site trips for the scenario with the northbound left turn movement banned, based on the above changes.

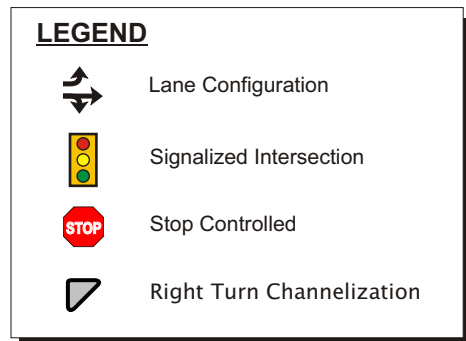
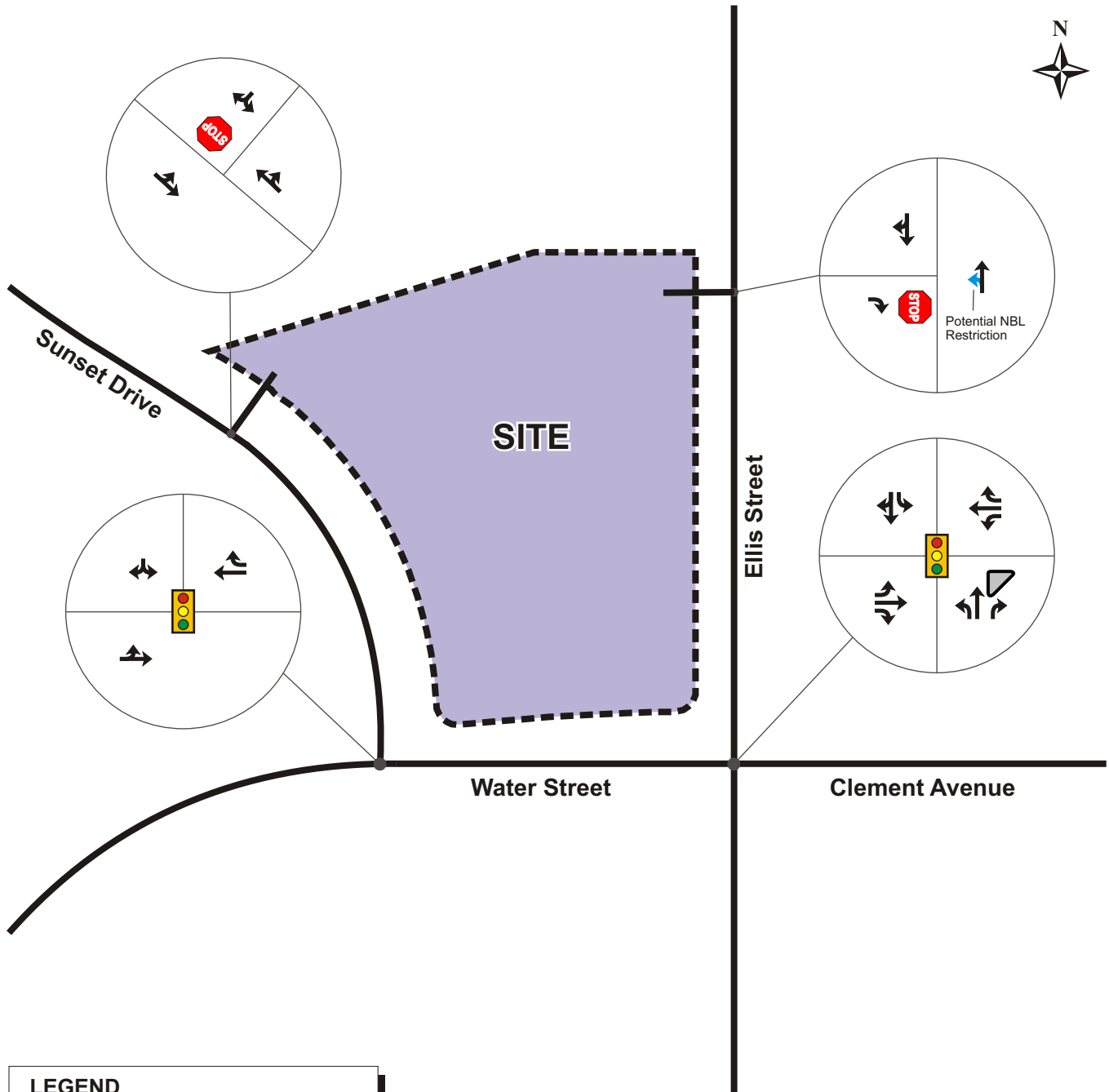
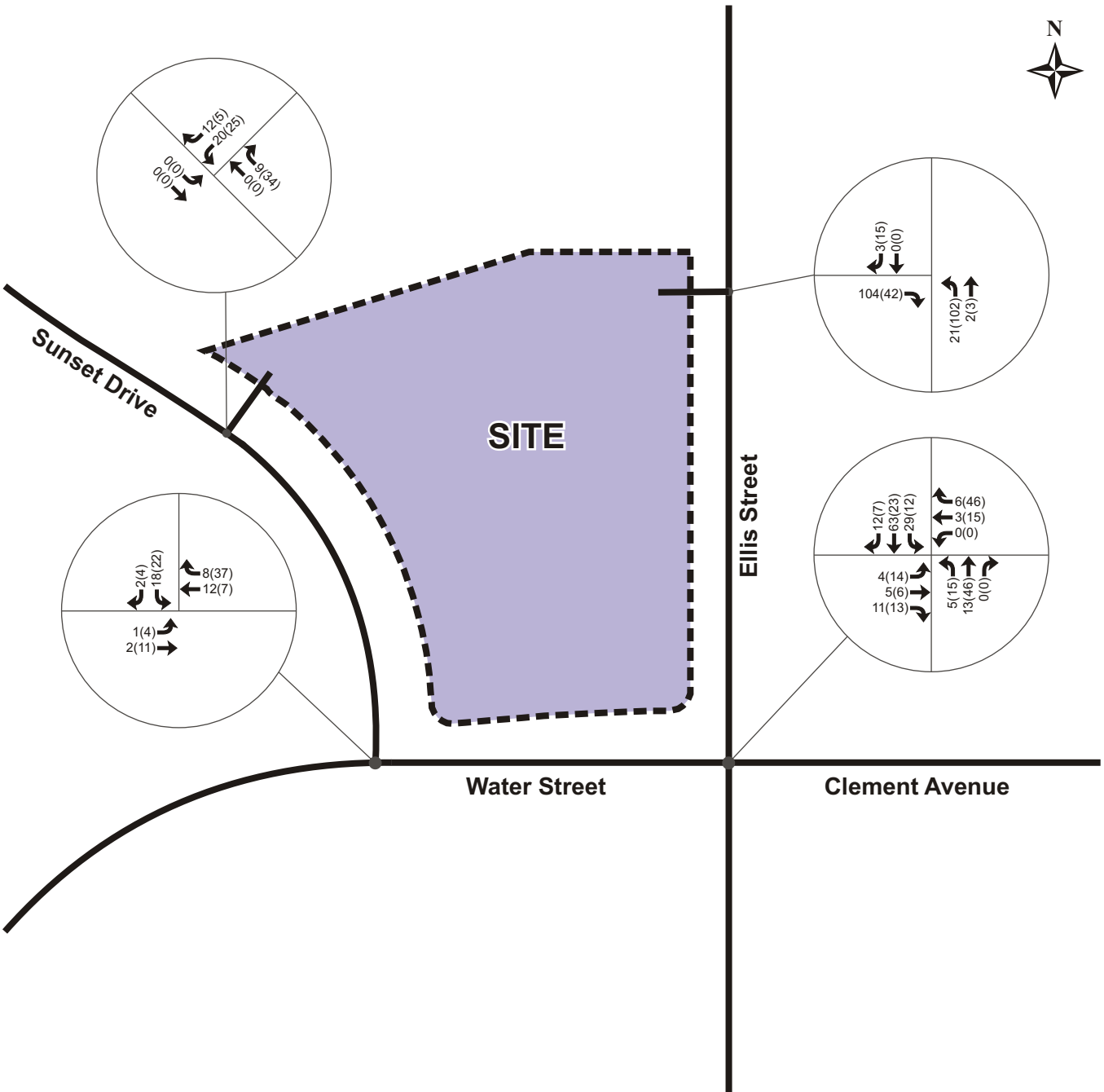


Exhibit 3.1

## Proposed Lane Configurations & Traffic Control







**LEGEND**

↶ ↷ ↸ Vehicle Volumes

XX AM Peak Hour

(ZZ) PM Peak Hour

**Exhibit 3.2**  
**Development Site Trips**



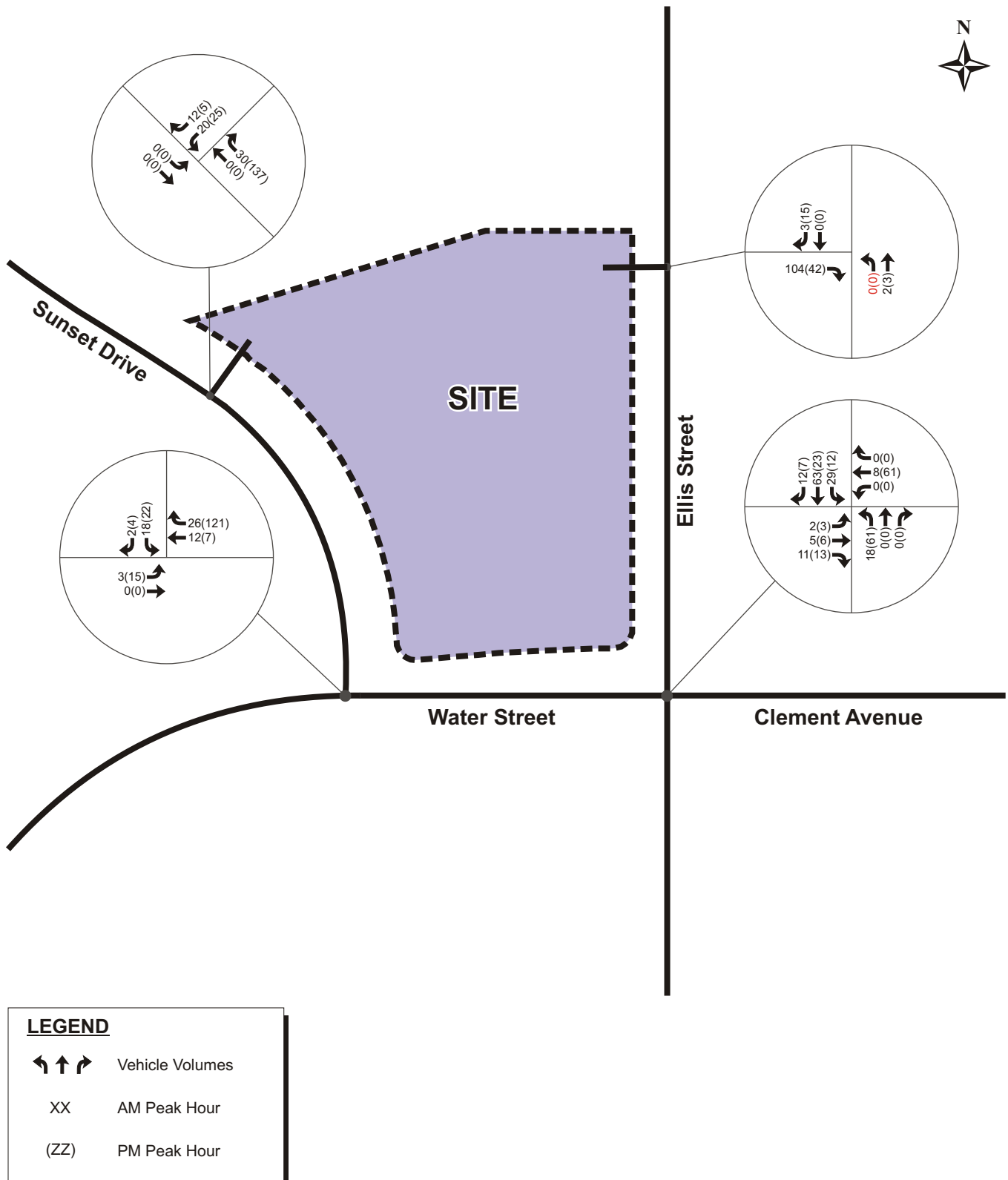


Exhibit 3.3

## Development Site Trips with Restricted Northbound Left Turn at Ellis Street Access



## 4. FUTURE TRAFFIC CONDITIONS

To develop the future Background Traffic volumes, the existing volumes were grown at an annual growth rate of 2% (as requested by the City of Kelowna), and pedestrian and cycling trips were also increased at this growth rate. The mitigation measures recommended in Section 2.0 were also carried through to the future analysis (Background and Post Development), and the updated network was used as a base for following analysis.

In addition, background traffic was added for the nearby approved developments of 1147-1157 Sunset Drive (93 residential units) and 1190 Richter Street (new RCMP headquarters). Trip generation and distribution for the 1147-1157 Sunset Drive development was calculated in a similar manner to the trip generation and distribution for the study site, and the site was forecasted to generate a total of 37 AM trips (6 In, 31 Out) and 44 PM trips (29 In, 14 Out).

Trips for the soon to be completed RCMP development were taken from the TIA for the site, which was completed in March 2013 by EBA. The trip generation for the 2018 EBA horizon were used for the 2020 horizon, while the 2035 horizon was used for the 2030 horizon in this study. This report has been included in **Appendix G** for reference.

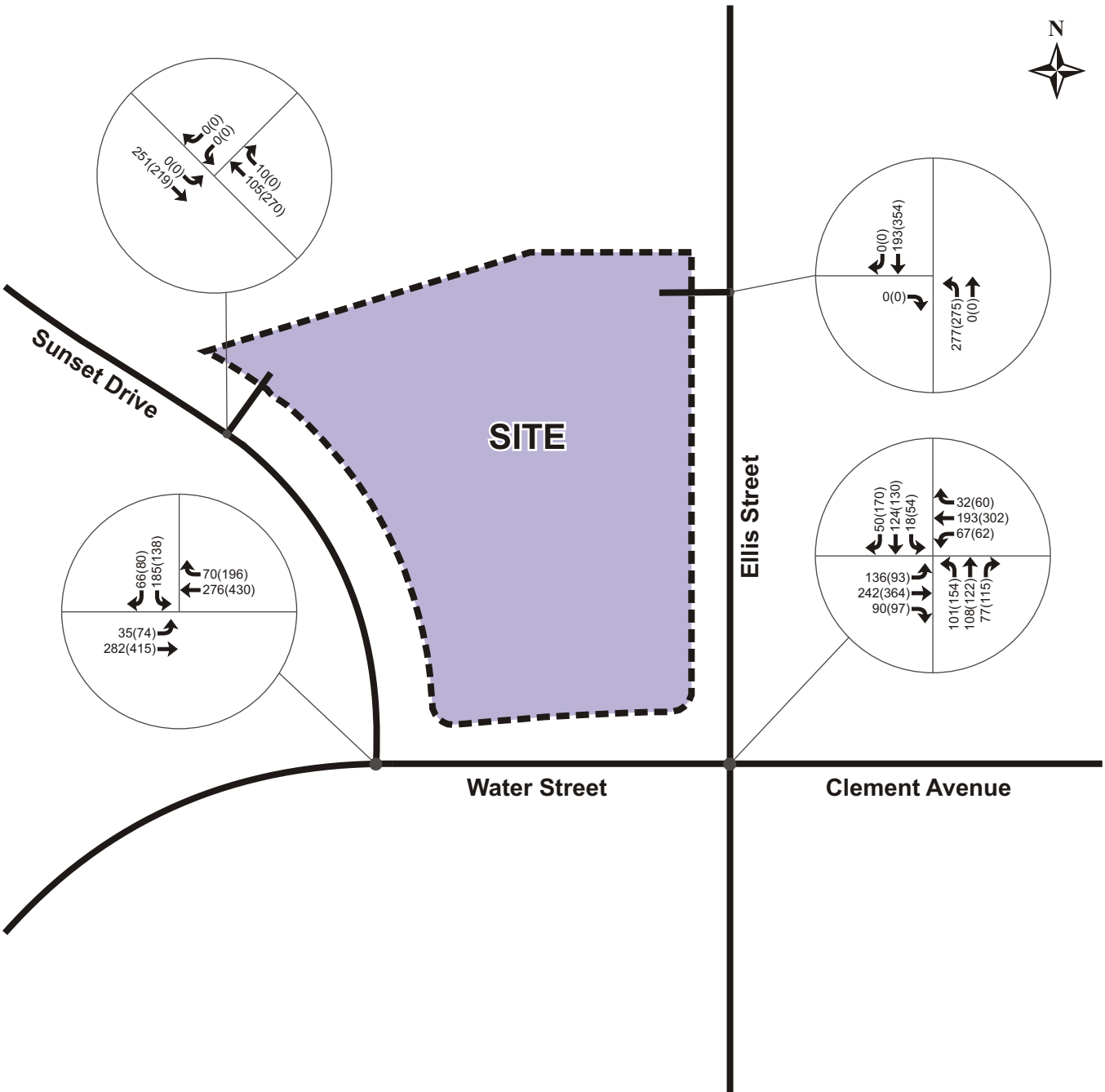
The combined background trips for both of these sites were added together and are shown on the study area intersections in **Appendix H.1 & H.2**. These trips were then added to the grown background traffic volumes for each horizon year to come up with the 2020 and 2030 Background Volumes (Exhibit 2.4 + 2% annual growth + Appendix H.1 or H.2).

It is noted that the 2% blanket growth rate likely includes a portion of the two approved developments, and therefore there is some inherent conservativeness in the resulting 2020 and 2030 Background Traffic volumes.

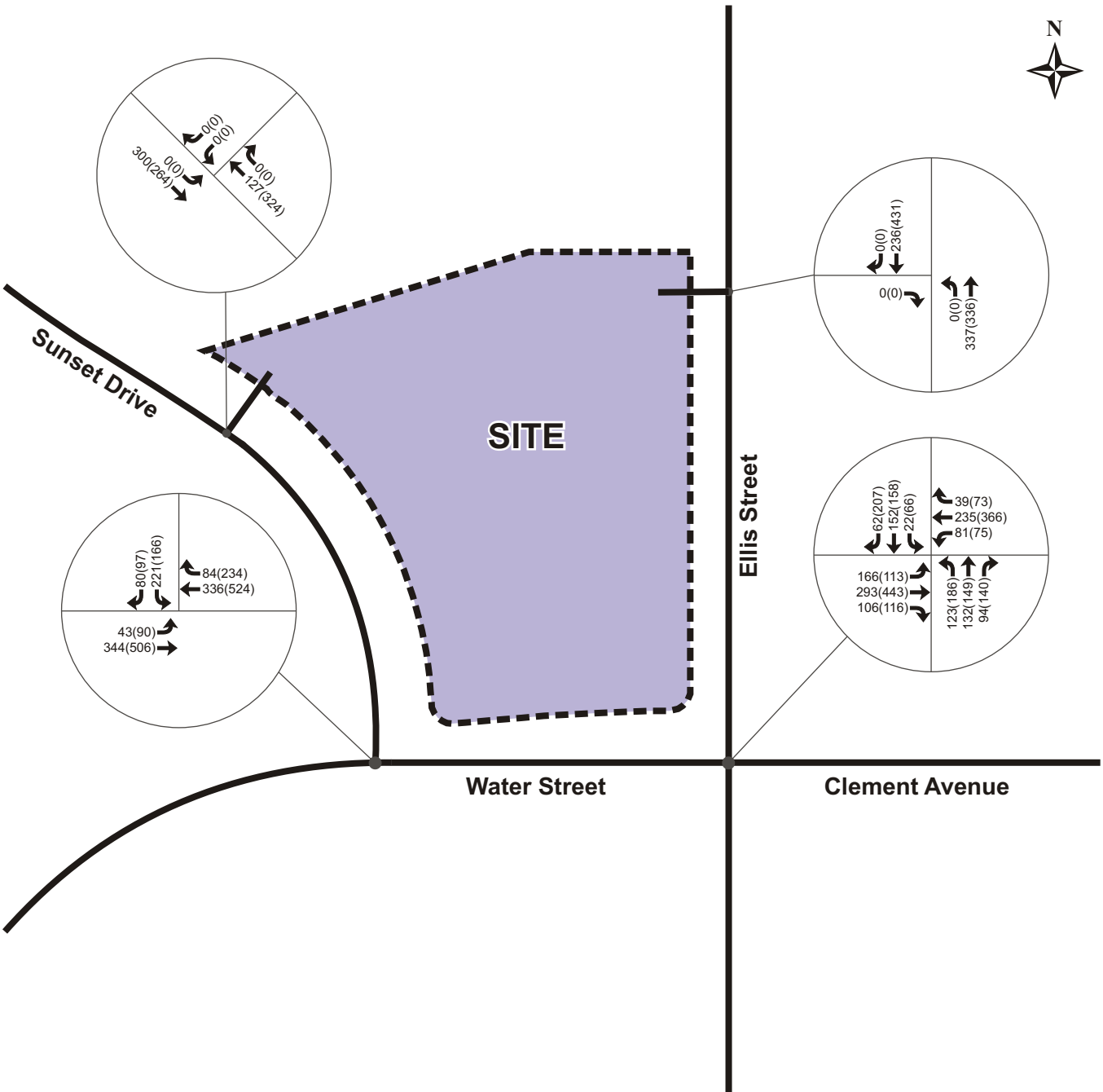
Finally, it is also acknowledged that while a signal was recommended for the intersection of Sunset Drive & Water Street based on the existing volumes, the current southbound stop controlled configuration could suffice for a number of years without the proposed development. However, the addition of the proposed development necessitates the upgrading of this intersection, and development should be considered a contributing factor to the requirement of a signal even though it has been assumed for the future Background and Post Development horizons.

### 4.1 Background Operations

Traffic volumes for the Background 2020 (estimated Opening Day) and Background 2030 (Opening Day plus 10 year) horizons are summarized in **Exhibit 4.1 and 4.2**. As noted above, these were based on the existing balanced traffic volumes, grown by 2% annually and include additional traffic from the nearby approved developments. The intersection capacity analysis for these Background horizons are summarized in **Table 4.1 and 4.2**.



**Exhibit 4.1**  
**Background 2020 Traffic Volumes**



**Exhibit 4.2**  
**Background 2030 Traffic Volumes**



Table 4.1: Background 2020

Intersection	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Sunset Drive & Water Street / Clement Avenue (Signalized)	EB	1	0.31	A	8	42	0.48	A	10	74
	WB	1	0.26	A	7	32	0.37	A	6	47
	SB	1	0.67	C	30	45	0.68	C	35	45
	Int. Summary		-	B	13	-	-	B	12	-
Ellis Street & Clement Avenue (Signalized)	EBL	1	0.22	A	10	16	0.21	B	12	17
	EBT	1	0.24	A	9	25	0.42	B	14	66
	EBR	1	0.11	A	4	4	0.13	A	2	2
	WBL	1	0.11	A	9	11	0.16	B	15	15
	WBT	1	0.19	A	9	26	0.35	B	15	57
	WBR	1	0.04	A	0	0	0.08	A	1	1
	NBL	1	0.35	C	20	19	0.51	C	21	24
	NBT		0.25	C	22	25	0.23	C	21	25
	NBR	1	0.19	A	6	8	0.23	A	5	10
	SBL	1	0.06	B	16	6	0.15	B	15	10
	SBTR	1	0.55	C	28	34	0.76	C	32	54
	Int. Summary		-	B	13	-	-	C	17	-

At the Ellis Street and Clement Avenue intersection the northbound left turn queue increased to approximately 40m due to the increase in background traffic, and a separate phase for the northbound and southbound left turn movements was implemented to reduce the northbound queue. With these mitigation measures, the northbound left turn queue is still exceeding the storage length, but only by 4m or approximately 1 vehicles.

The remaining movements are all within the capacity thresholds.

Table 4.2: Background 2030 Operations

Intersection	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Sunset Drive & Water Street / Clement Avenue (Signalized)	EB	1	0.41	B	10	54	0.64	B	13	106
	WB	1	0.33	B	13	57	0.47	A	7	57
	SB	1	0.74	C	32	55	0.75	D	38	56
	Int. Summary		-	B	17	-	-	B	14	-
Ellis Street & Clement Avenue (Signalized)	EBL	1	0.30	A	9	23	0.31	B	13	17
	EBT	1	0.31	A	9	36	0.53	B	15	74
	EBR	1	0.13	A	2	4	0.16	A	2	2
	WBL	1	0.16	B	11	15	0.25	B	18	20
	WBT	1	0.25	B	11	35	0.44	B	17	71
	WBR	1	0.05	A	1	1	0.10	A	4	8
	NBL	1	0.41	B	19	21	0.75	C	34	32
	NBT		0.30	C	22	28	0.28	C	22	30
	NBR	1	0.22	A	6	10	0.27	A	5	11
	SBL	1	0.06	B	14	6	0.16	B	14	12
	SBTR	1	0.62	C	29	40	0.81	C	34	67
	Int. Summary		-	B	13	-	-	B	19	-

At the Ellis Street and Clement Avenue intersection the northbound left turn 95<sup>th</sup> percentile queue now exceeds the available storage in the AM peak hour, and exceeds the storage by 12 metres (approximately 2 vehicles) in the PM peak hour. For reference the 50<sup>th</sup> percentile queue for the northbound left turn is at 20 metres in the PM peak hour.

There may be an opportunity to increase the northbound left storage to approximately 45 metres, which would fit the anticipated queues. This would however require a realignment of the centre line, and potentially the removal of parking spaces on the east side of Ellis Street to achieve the entrance taper. It is recommended that queues are monitored for this movement, and that the possibility of increasing the storage length is reviewed if queues are observed to routinely exceed the available storage.

The eastbound through movement at this intersection has a reported 95<sup>th</sup> percentile queue of 74 metres, which would extend back into the intersection of Sunset Drive / Water Street as there is only 70 metres of space between the two intersections. While this is not ideal, coordinating the intersections will help to ensure that sufficient green bands are provided for the both the eastbound and westbound through movements during the peak hours (which will help limit spill back between the intersections). The 74-metre queue (approximately 9 vehicles) will be able to clear in one cycle, and the queue is only anticipated to reach 74 metres once or twice during the PM peak hour.

If and when the eastbound through queue does extend into the Sunset Drive / Water Street intersection, there is no northbound movement at this intersection to be blocked, and the southbound left turning vehicles will be able to wait until the queue clears before entering the intersection. It should be noted that the roundabout would not be advantageous over the signal in this scenario, as the eastbound queue would back up through the roundabout and block the south movements just the same.

Finally, widening the eastbound through movement to two lanes is considered unfeasible, as a second lane would not line up with the downstream side of Ellis Street, and widening the road would be counterintuitive to the active transportation goals outlined in Kelowna On the Move: Pedestrian and Bicycle Master Plan, especially given the close proximity of the study area to downtown. It is therefore recommended that the eastbound through movement be coordinated as best possible, and the operation of the intersections be monitored regularly to ensure sufficient operation.

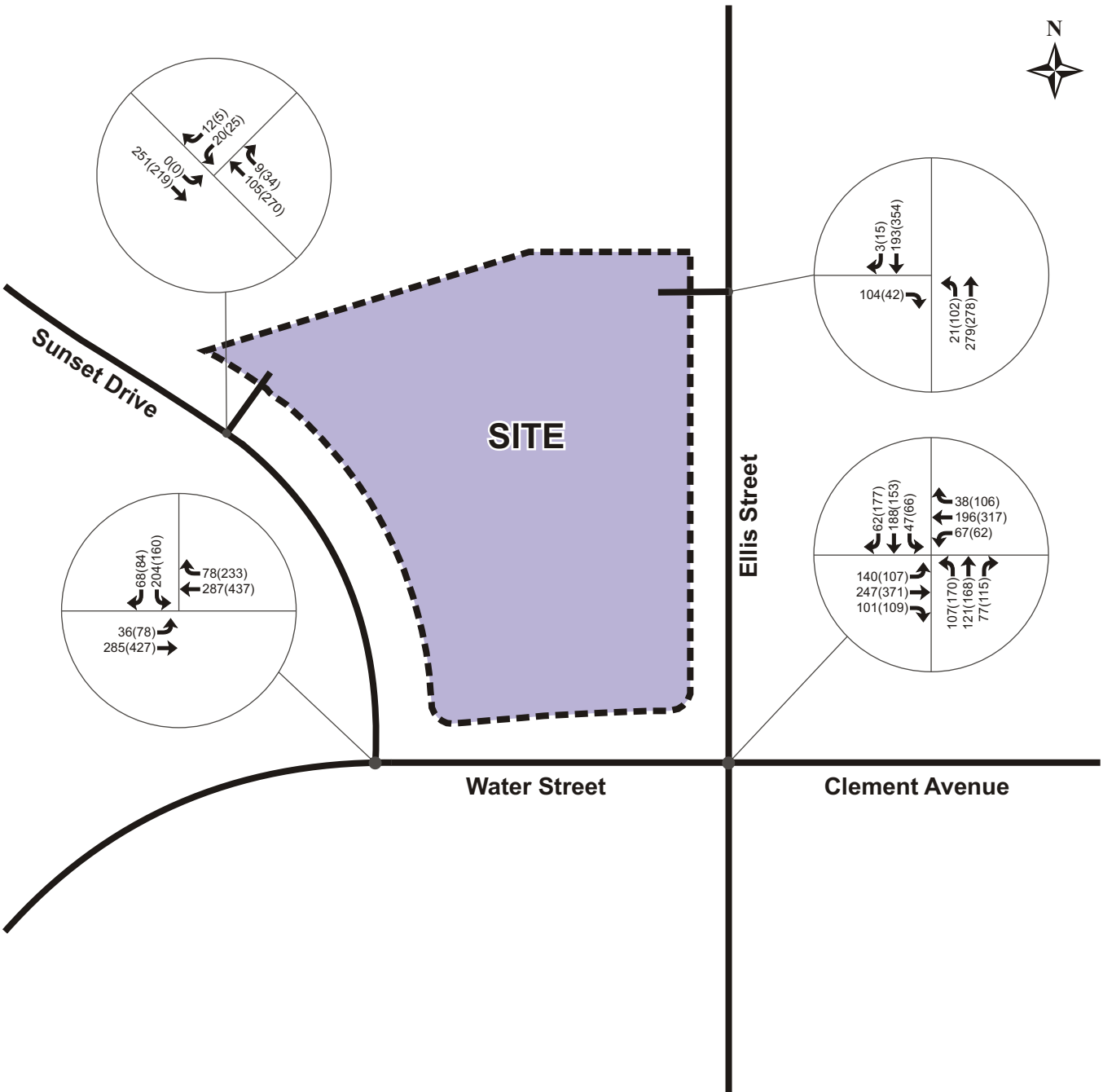
## 4.2 Post Development Operations

As noted earlier, analysis for the Post Development horizons has been split into two different sections, one with the northbound left turn at the Ellis Street site access permitted (4.2.1), and one with it banned (4.2.2). Section 4.2.3 compares the two scenarios, and describes the pros and cons of each.

For all Post Development scenarios, the traffic volumes shown are the result of the addition of the future total Background Volumes (Exhibits 4.1 and 4.2) plus the forecasted site traffic (Exhibits 3.2 and 3.3).

### 4.2.1 Northbound Left Turns Permitted at the Ellis Street Access

Post Development traffic volumes with the northbound left turn permitted for Opening Day (est. 2020) and the Opening Day plus 10 year horizon (2030) are shown in **Exhibits 4.3 and 4.4**. The Intersection capacity analysis for these horizons is shown in **Tables 4.3 and 4.4**.



**LEGEND**

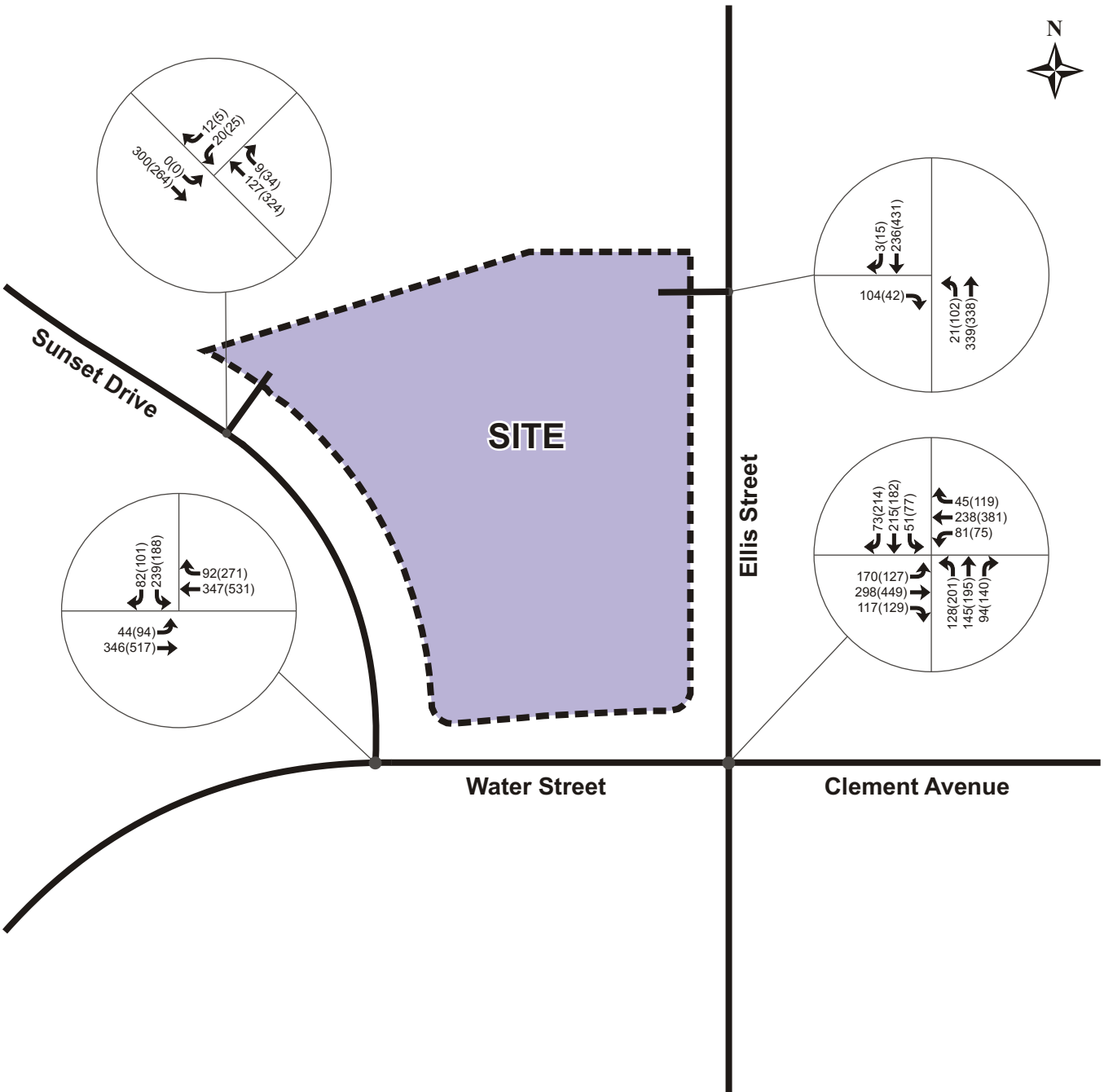
↔ ↑ ↔ Vehicle Volumes

XX AM Peak Hour

(ZZ) PM Peak Hour

**Exhibit 4.3**  
**Post Development 2020 Traffic Volumes**





**Exhibit 4.4**  
**Post Development 2030 Traffic Volumes**



Table 4.3: Post Development 2020 Operations

Intersection	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Sunset Drive & Water Street / Clement Avenue (Signalized)	EB	1	0.32	A	9	43	0.51	B	10	72
	WB	1	0.27	A	8	32	0.38	A	6	43
	SB	1	0.70	C	31	49	0.74	D	39	54
	Int. Summary		-	B	14	-	-	B	13	-
Ellis Street & Clement Avenue (Signalized)	EBL	1	0.25	B	11	19	0.26	B	13	22
	EBT	1	0.27	B	11	30	0.44	B	16	71
	EBR	1	0.13	A	4	6	0.15	A	3	4
	WBL	1	0.13	B	12	13	0.17	B	15	15
	WBT	1	0.22	B	12	31	0.37	B	16	58
	WBR	1	0.05	A	1	1	0.14	A	4	9
	NBL	1	0.36	B	17	17	0.62	C	25	28
	NBT		0.28	C	22	25	0.33	C	23	35
	NBR	1	0.18	A	5	7	0.24	A	5	10
	SBL	1	0.13	B	14	9	0.18	B	15	12
	SBTR	1	0.66	C	30	46	0.79	D	35	63
	Int. Summary		-	B	15	-	-	B	18	-
Sunset Drive Access (WB Stop Control)	WB	1	0.05	B	11	1	0.07	B	13	2
	NB	1	0.00	A	0	0	0.00	A	0	0
	SB	1	0.07	A	0	0	0.19	A	0	0
	Int. Summary		-	A	1	-	-	A	1	-
Ellis Street Access (EB Stop Control)	EB	1	0.14	B	10	4	0.07	B	11	2
	NB	1	0.02	A	1	0	0.10	A	3	3
	SB	1	0.13	A	0	0	0.24	A	0	0
	Int. Summary		-	-	-	-	-	A	2	-

At the intersection of Ellis Street and Clement Avenue, the eastbound and northbound left turn 95<sup>th</sup> percentile queues are anticipated to exceed the available storage. As noted in the previous section, the eastbound through queue is anticipated to be manageable with the coordination of the two intersections. The northbound left queue will exceed the 20-metre storage by 8 metres (approximately 1 vehicle), which is only 4 metres more than the background scenario. It is recommended that the northbound left turn queue be monitored, and the option to increase the storage length be reviewed if the queues materialize.

Both of the site accesses are anticipated to operate well within the performance thresholds. The southbound 95<sup>th</sup> percentile queues at both of the signalized intersections on Clement Avenue do not extend back to either of the site access, and the accesses are anticipated to have little if any impact on the performance of the signalized intersections on Clement Avenue.

**Table 4.4: Post Development 2030 Operations**

Intersection	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Sunset Drive & Water Street / Clement Avenue (Signalized)	EB	1	0.42	B	11	54	0.68	B	15	106
	WB	1	0.34	A	8	37	0.48	B	10	63
	SB	1	0.76	C	33	60	0.81	D	43	69
	Int. Summary		-	B	16	-	-	B	17	-
Ellis Street & Clement Avenue (Signalized)	EBL	1	0.33	B	13	33	0.40	B	19	22
	EBT	1	0.33	B	13	47	0.57	C	21	81
	EBR	1	0.15	A	4	6	0.19	A	4	6
	WBL	1	0.17	B	13	17	0.29	B	20	20
	WBT	1	0.27	B	13	39	0.49	B	19	74
	WBR	1	0.06	A	1	2	0.17	A	4	10
	NBL	1	0.48	B	20	19	0.75	C	32	36
	NBT		0.32	C	22	28	0.34	C	21	38
	NBR	1	0.22	A	6	9	0.25	A	4	11
	SBL	1	0.13	B	13	9	0.19	B	13	13
	SBTR	1	0.70	C	30	51	0.84	D	37	79
	Int. Summary		-	B	16	-	-	C	21	-
Sunset Drive Access (WB Stop Control)	WB	1	0.06	B	11	1	0.08	B	15	2
	NB	1	0.00	A	0	0	0.00	A	0	0
	SB	1	0.09	A	0	0	0.23	A	0	0
	Int. Summary		-	A	1	-	-	A	1	-
Ellis Street Access (EB Stop Control)	EB	1	0.15	B	11	4	0.08	B	12	2
	NB	1	0.02	A	1	0	0.11	A	3	3
	SB	1	0.15	A	0	0	0.28	A	0	0
	Int. Summary		-	A	2	-	-	A	2	-

The eastbound through movement 95<sup>th</sup> percentile queue at the intersection of Ellis Street and Clement Avenue is 81 metres, and continues to exceed the available distance between the two intersections of 70 metres. There is little opportunity to improve this movement as additional lanes cannot be provided without widening the road, and widening the road in this area, especially west of Sunset Drive on Water Street is not anticipated to be desired by the City. It is therefore recommended that the coordination at this location be closely monitored when implemented to ensure that the two intersections operate efficiently. The northbound left turn movement 95<sup>th</sup> percentile queue at the same intersection continues to exceed the available storage, and monitoring the queue is still the recommended course of action.

The operation at both of the site access are again within performance thresholds, and southbound queuing from the two signalized intersections will not reach back to the site accesses which are both offset over 100 metres from Clement Avenue. SimTraffic observations also show that the proposed site accesses are effectively outside of the signal's functional areas, and do not have an impact on their operations.

#### **4.2.2 Northbound Left Turn Restricted at Ellis Street Access**

As noted earlier, the City of Kelowna has asked that the northbound left turn from Ellis Street into the site access be restricted. A sensitivity analysis has been conducted for the 2030 Post Development horizon where the northbound left turn movement into the Ellis Street access is restricted. The total volumes for this scenario are shown in **Exhibit 4.5**, and the analysis results are presented in **Table 4.5**.

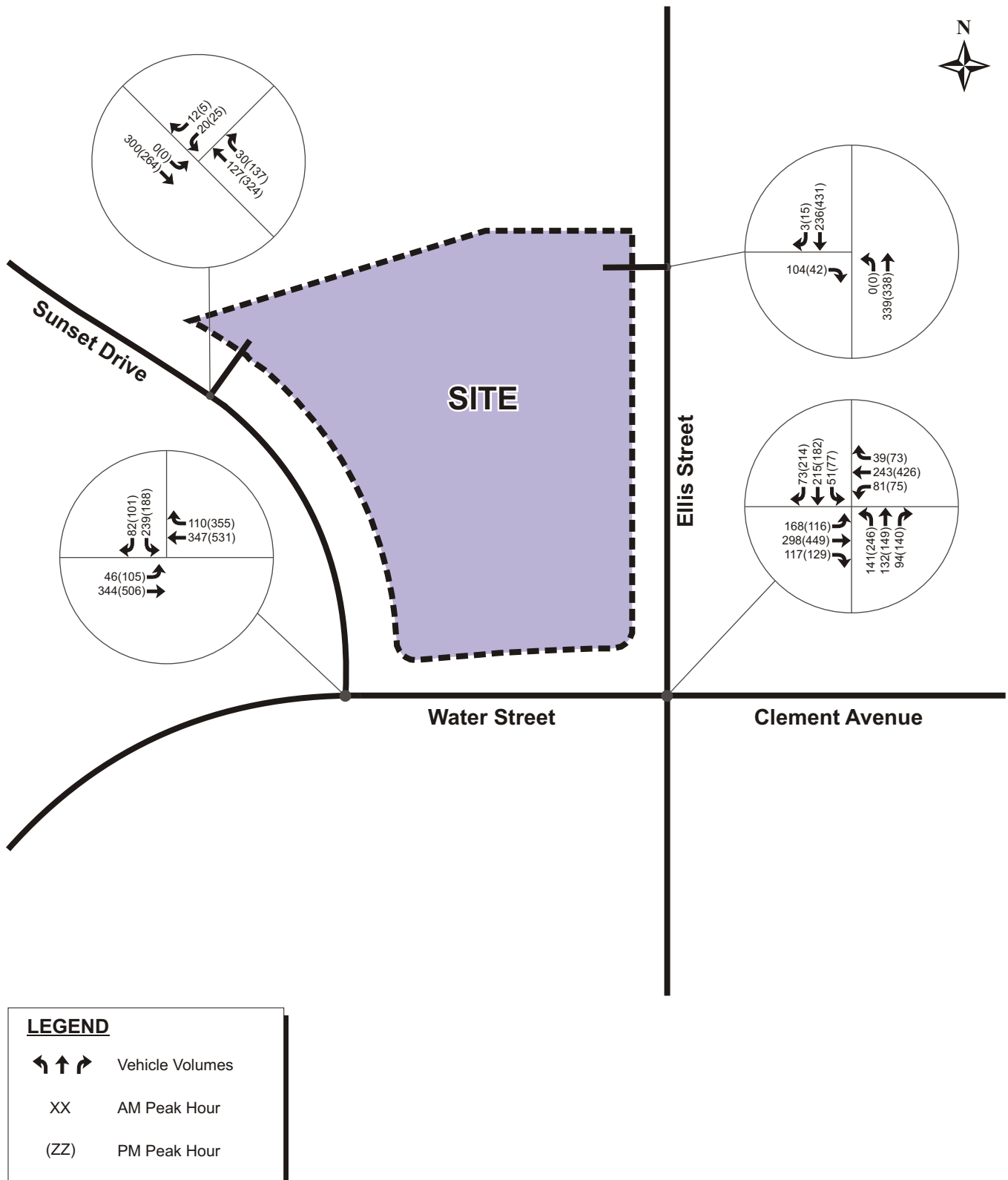


Exhibit 4.5

## Post Development 2030 Traffic Volumes with Restricted Northbound Left Turn at Ellis Street Access



Table 4.5: Post Development 2030 Operations with Restricted NBL at Ellis Street Access

Intersection	Movement & # of Lanes		AM Peak Hour				PM Peak Hour			
			v/c	LOS	Delay	Queue	v/c	LOS	Delay	Queue
Sunset Drive & Water Street / Clement Avenue (Signalized)	EB	1	0.42	B	11	54	0.72	B	16	113
	WB	1	0.34	A	8	38	0.48	A	8	53
	SB	1	0.76	C	33	60	0.81	D	43	69
	Int. Summary		-	B	15	-	-	B	17	-
Ellis Street & Clement Avenue (Signalized)	EBL	1	0.34	B	14	32	0.46	C	22	20
	EBT	1	0.35	B	13	47	0.60	C	20	86
	EBR	1	0.16	A	4	6	0.19	A	5	5
	WBL	1	0.18	B	13	17	0.32	C	22	21
	WBT	1	0.28	B	13	40	0.57	C	22	87
	WBR	1	0.05	A	1	1	0.11	A	1	3
	NBL	1	0.50	C	20	21	0.80	C	34	50
	NBT	1	0.27	C	21	25	0.24	B	19	29
	NBR	1	0.20	A	5	9	0.24	A	4	11
	SBL	1	0.12	B	13	9	0.18	B	13	13
	SBTR	1	0.70	C	30	51	0.85	D	39	83
	Int. Summary		-	B	16	-	-	C	23	-
Sunset Drive Access (WB Stop Control)	WB	1	0.06	B	11	1	0.08	C	15	2
	NB	1	0.00	A	0	0	0.01	A	0	0
	SB	1	0.10	A	0	0	0.29	A	0	0
	Int. Summary		-	A	1	-	-	A	1	-
Ellis Street Access (EB Stop Control)	EB	1	0.15	B	11	4	0.08	B	12	2
	NB	1	0.00	A	0	0	0.00	A	0	0
	SB	1	0.15	A	0	0	0.28	A	0	0
	Int. Summary		-	A	2	-	-	A	1	-

The intersection of Sunset Drive and Water Street operates approximately the same as the previous scenario. The operation at the intersection of Ellis Street and Clement Avenue has worsened slightly, with longer eastbound through and northbound left turning 95<sup>th</sup> percentile queues (81 to 86 metres and 36 to 50 metres accordingly). Operational performance at the site accesses is relatively unchanged.



#### 4.2.3 Northbound Left Turn at Ellis Street Site Access Summary

Based on the analysis presented above, and a general review of the proposed site access locations, the following points are noted in regards to the proposed northbound left turn restriction at the Ellis Street site access:

- Site accesses on arterial streets in Kelowna are generally restricted.
- The northbound left turn movement at the Ellis Street site access will generally have the highest impact on Ellis Street traffic operations compared to the eastbound right out and southbound right in movements (the eastbound left turn movement out of the site will be restricted).
- Permitting the northbound left turn at the Ellis Street access will increase the number conflicting vehicle / cyclist movements if / when a cycling route is established on Ellis Street.
- The loading bays for the proposed development are located near the Sunset Drive access, and so the northbound left turn movement at Ellis Street is not required from a loading access perspective.
- The majority of the site traffic (75-80%) is forecasted to come from the south or east (via Ellis Street and Clement Avenue), and the Ellis Street access would be the most direct route to the site parking from these directions.
- Restricting the northbound left turn movement would add more site traffic to:
  - The northbound left turn movement at the intersection of Ellis Street and Clement Avenue, and will result in a 95<sup>th</sup> percentile queue that is more than double the available storage (50 vs. 20 metres).
  - Sunset Drive, which is located near the Kelowna Waterfront and is intended to be lower volume road than Ellis Street (collector vs. arterial).
  - The intersection of Sunset Drive & Water Street, which has a moderate amount of available capacity.
- The increase in traffic to the northbound left and westbound through movements at the intersection of Ellis Street and Clement Avenue results in marginally worse operations at the intersection.
- The more circuitous routing for inbound traffic with the northbound left turn banned results in more potential pedestrian conflict points due to the inbound vehicles having to travel through more intersections.
- Operational observations in SimTraffic show that the northbound left turn traffic at the Ellis Street site access generally does not impede the northbound through traffic on Ellis Street, and does not cause northbound through traffic to back up to Clement Avenue. A separate northbound left turn lane is not required from a traffic operations perspective.
- The northbound left turn restriction into the site access may be difficult to enforce without physical barriers.

Permitting or restricting the northbound left turn movement into the proposed site access on Ellis Street has pros and cons. Based on the analysis conducted in this study and points noted above, Bunt considers it to be more beneficial for the surrounding street network and the site in general if the northbound left turn movement is permitted at the Ellis Street site access. This is because allowing the northbound left turn movement will work from a traffic operations perspective, will result in less circuitous inbound vehicle routing, and less traffic at the study intersections.

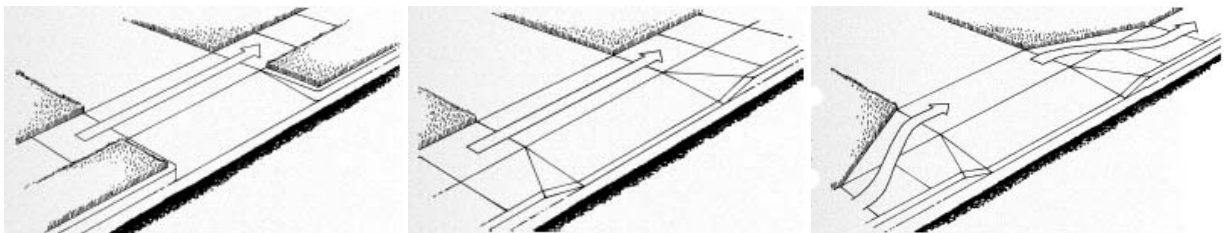
It is noted thought that the design of the Ellis Street site access will be an important consideration, especially with the planned addition of a bicycle route on Ellis Street. It is recommend that the driveway be designed to slow down inbound drivers and visually alert all users of the potential vehicle to pedestrian/cyclist conflicts through the use of grade changes and visual queues such as texture or colour. **Figures 4.1 and 4.2** show examples of driveway designs that prioritize pedestrians and cyclists and help to alert all road users of the potential conflicts.

**Figure 4.1: Driveway Design**



Source: NACTO Sidewalks

**Figure 4.2: Driveway Design 2**



Source: Designing Walkable Urban Thoroughfares (ITE & Congress of New Urbanism)

There may also be non-traffic related reasons and justifications for retaining or restricting this movement, but those are outside of the scope of this study.

## 5. PARKING & LOADING

### 5.1 Vehicle Parking

The study site is currently zoned as C4, and a C7 zoning is being sought as part of the application. The proposed parking supply was compared with the City of Kelowna's bylaw requirement to determine if the proposed supply meets the parking bylaw, and this comparison is shown in **Table 5.1**.

**Table 5.1: Bylaw Required Vehicle Parking**

Uses	Density (GFA m² or units)	Bylaw Requirement			Proposed
		Parking Ratio	Min. Stalls	Max Stalls	
Commercial	1,905 m²	1.30 stalls/ 100 m²	21	26	Allocation currently un- specified
Residential – Live Work	9 units	1 stall/unit (1/7 of these spaces to be classified as visitor parking)	9	11	
Residential - Condos	397 units		397	496	
Total			427	533	569

The bylaw motor vehicle parking requirement is between 427 and 533 stalls, and the proposed bylaw parking amount of 569 exceeds the parking requirement by 36 stalls. The maximum bylaw parking supply is based on the City of Kelowna's objectives for Transportation Demand Management (TDM), and the policy specifies that the maximum number of parking spaces for each use is 125% the minimum number. A bylaw parking relaxation may be required to allow for the additional 36 spaces.

1/7 or 88 of the residential stalls provided will be classified as visitor parking spaces.

### 5.2 Bicycle Parking

The bicycle parking provided on-site will include Class I Long Term and Class II Short Term parking. **Table 5.2** summarizes the bylaw required bicycle parking compared to the proposed amount.

**Table 5.2: Bylaw Required Bicycle Parking**

Use	Bylaw Required		Proposed	
	Class I	Class II	Class I	Class II
Commercial	2	6	Allocation currently un-specified	Allocation currently un-specified
Restaurant	1	0		
Residential – Live Work	5	1		
Residential - Condos	198	40		
<b>Total</b>	<b>206</b>	<b>47</b>	<b>218</b>	<b>49</b>

The development is proposing to slightly exceed the bicycle parking requirements for both Class I and Class II bicycle parking. The Class I bicycle parking spaces will be located on the ground floor level within the podium, and are shown on the site plan in Exhibit 2.2. The storage areas are relatively close to the podium access points and tower elevators, and a separate storage room is provided for each tower and the commercial uses.

### 5.3 Loading Requirement

Loading spaces are required for the commercial component of the development at a rate of 1 space per 1900 m<sup>2</sup>, and at a rate of 1 space per 2800 m<sup>2</sup> for the restaurant component. No spaces are required for the residential uses. Based on the size of the commercial and restaurant uses, the loading requirement for the proposed development is 0.7 loading bays. The development is proposing to meet the loading bylaw by providing 1 full sized loading bay (3.0 x 9.5 metres), and two additional loading bays for smaller vehicles. The full sized loading bay is located off of the Sunset Drive access, just before the parkade entrance. One of the smaller loading bays will be located to the east of the larger loading bay, while the other one is located inside the parkade on the south end. The locations of the loading bays are shown in Exhibit 2.2.

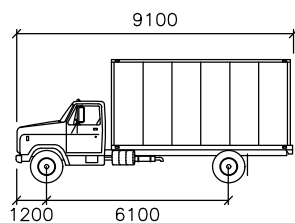
### 5.4 Vehicle Circulation

**Exhibits 5.1 and 5.2** show the swept paths for loading truck access to the loading bays and general manoeuvring within the parkade. The full sized loading bay is accessible by an SU9 truck, while the two smaller loading bays are accessible by smaller deliver van.

A high-level review of the underground parking area is shown in **Exhibit 5.3**, which demonstrates that the parkade and the parking stalls are generally accessible by a mid-sized passenger car (2017 Ford Fusion).



## DESIGN VEHICLE



SU9	mm
Width	: 2600
Track	: 2600
Lock to Lock Time	: 6.0
Steering Angle	: 31.5

AREA TO BE DRIVEABLE

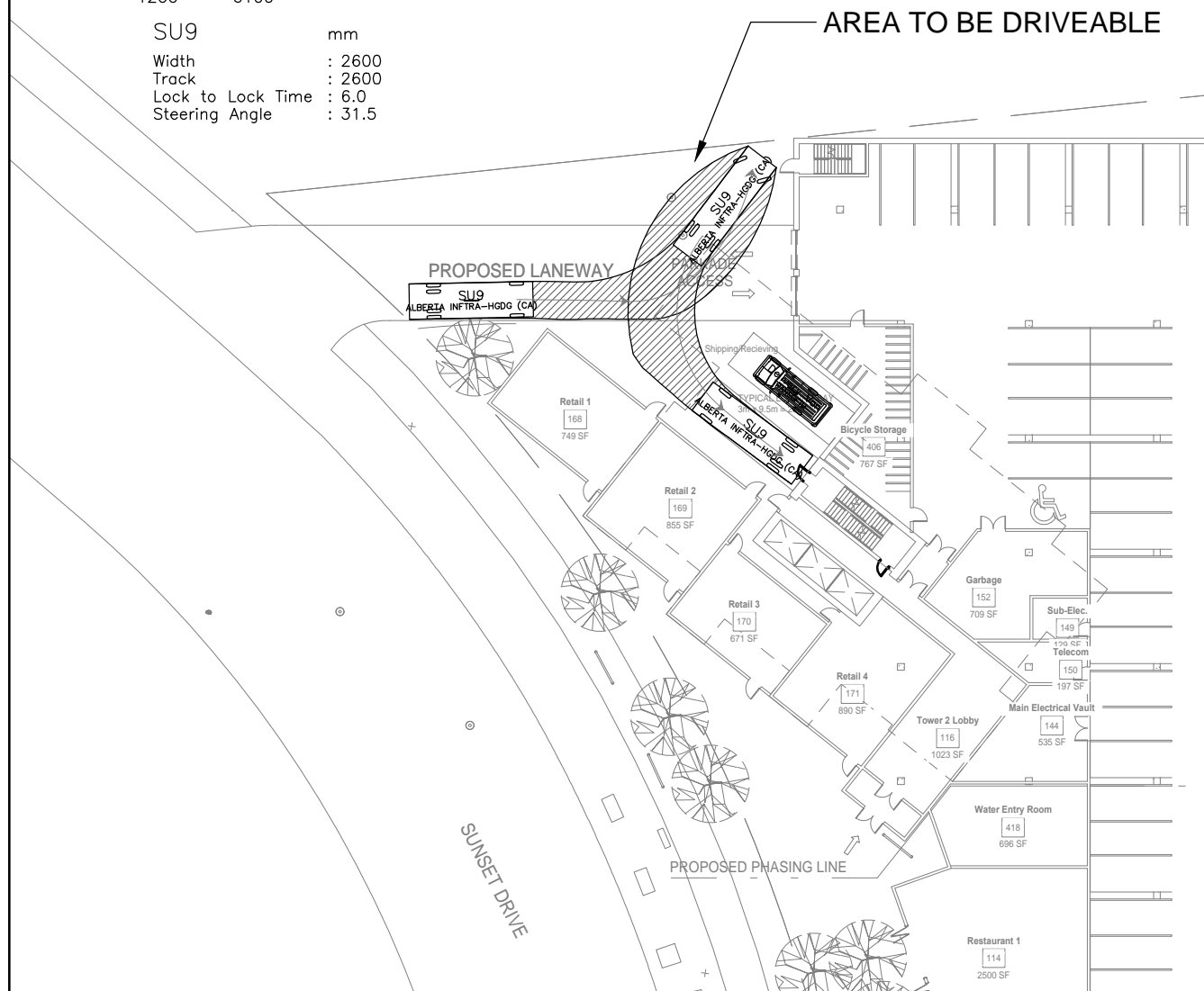


EXHIBIT 5.1

## Vehicle Turning Analysis - External Loading





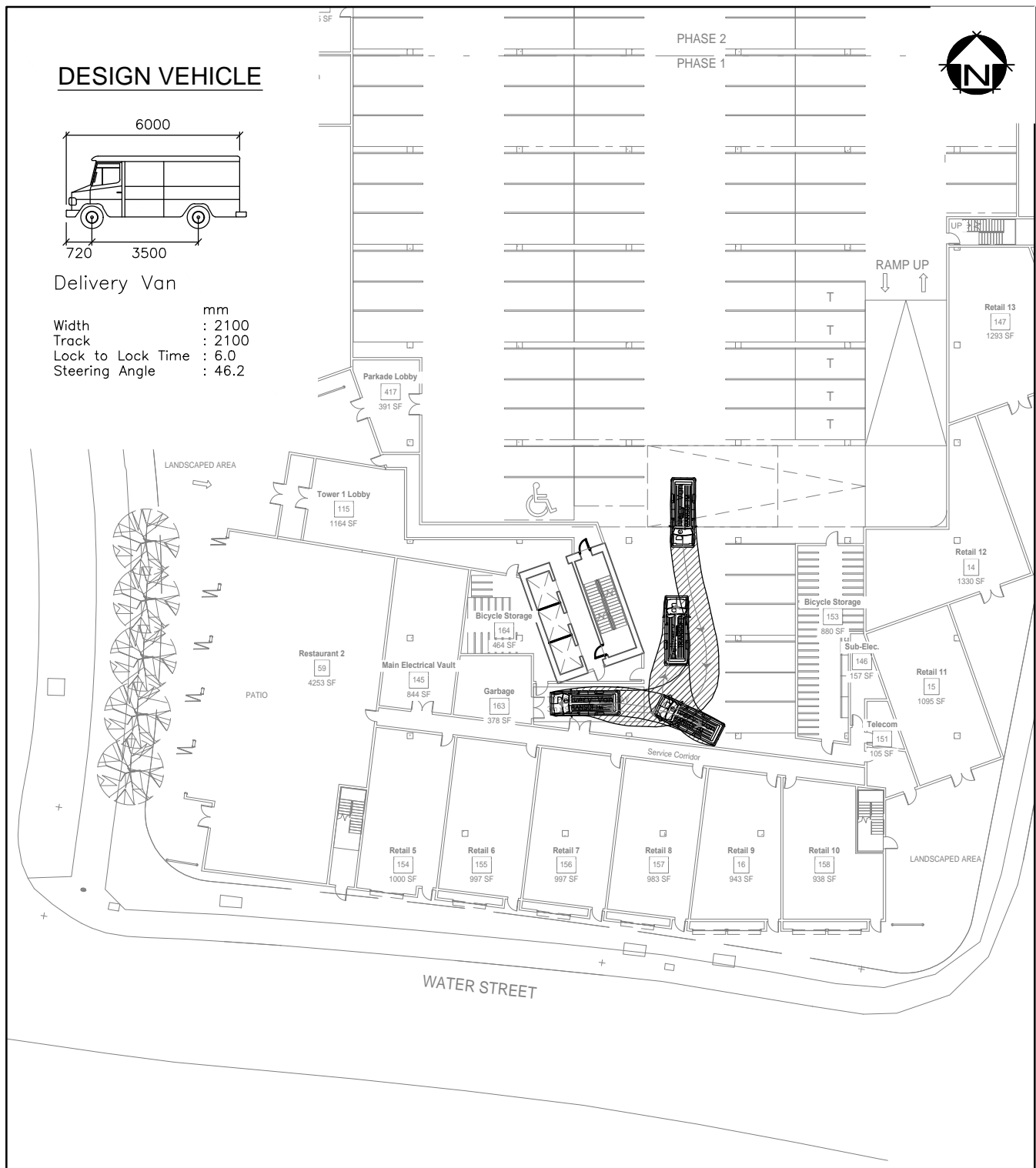
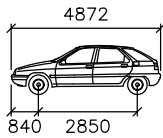


EXHIBIT 5.2

## Vehicle Turning Analysis - Internal Loading

## DESIGN VEHICLE



2017 Ford Fusion

Width : 2121  
Track : 1592  
Lock to Lock Time : 6.0  
Steering Angle : 40.0

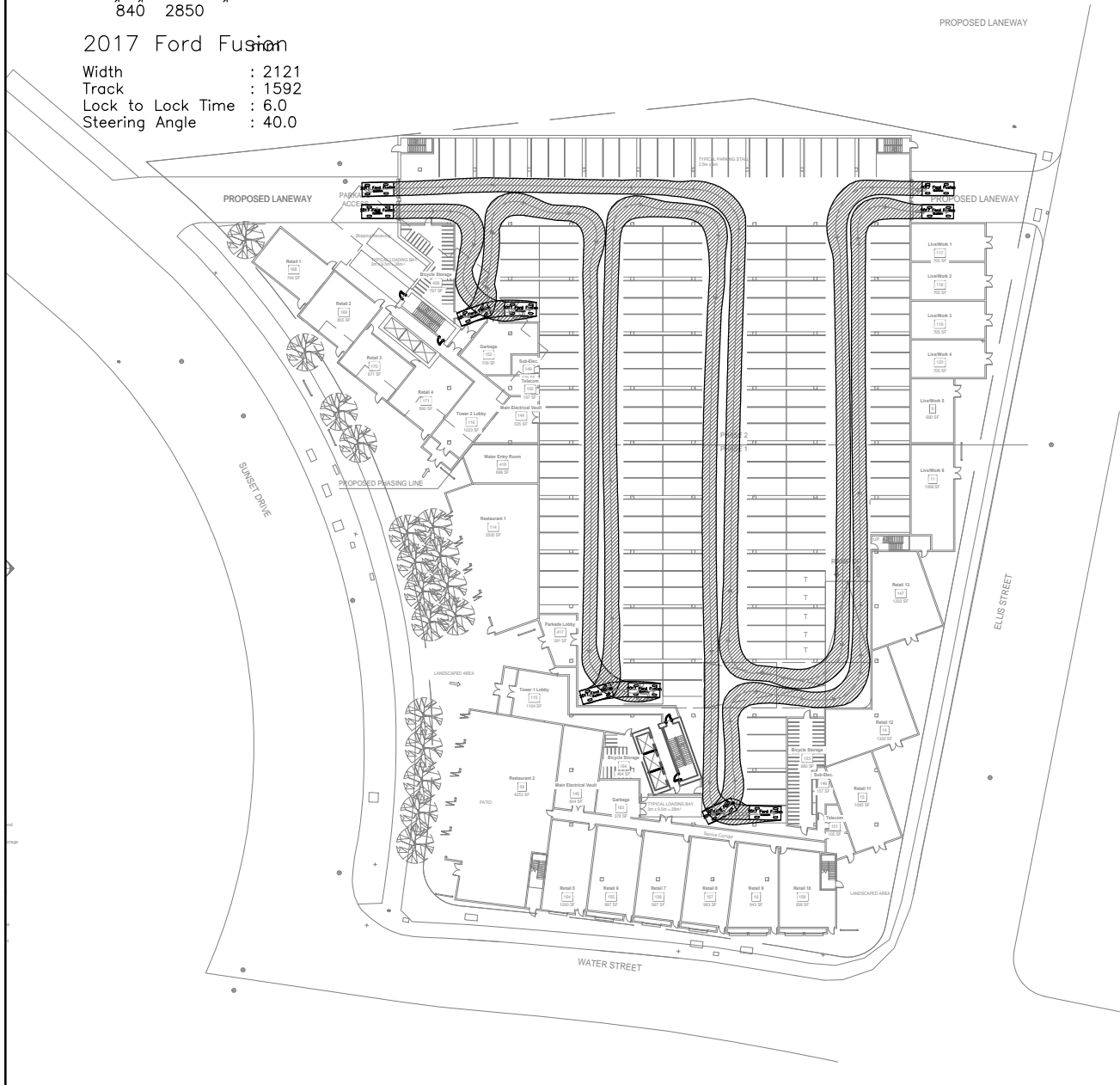


EXHIBIT 5.3

## Vehicle Turning Analysis - Passenger Vehicle On-site Maneuvering



## 6. CONCLUSION & SUMMARY

North American Development Group is proposing to rezone a currently vacant site located at the north end of downtown Kelowna and build a mixed-use commercial and residential development. The site is proposed to consist of approximately 10,000 ft<sup>2</sup> ground oriented commercial, 7,050 ft<sup>2</sup> of restaurant and 6 live/work town homes within a three storey podium. Two mid-rise towers above the podium will accommodate an additional 397 residential units. Access to the site is proposed to be provided off of Sunset Drive and Ellis Street, and the a review of the transportation impact of the development was conducted and is summarized below:

- The site is generally well connected to downtown and the waterfront, and the proposed ground level retail will help to activate the adjacent streets and further encourage walking near the site.
- The site is generally well connected to the bicycle network in Kelowna, and the development is proposing to provide moderate surpluses of both Class I and Class II bicycle parking spaces, which will help facilitate and encourage future residents and employees to cycle to the site. Ellis Street is also slated to receive bicycle lanes in the near future, which will further improve cycling in the area.
- The Queensland Transit Exchange is located within walking distance, and there are two bus routes that pass by the site, however the frequencies of these routes are quite low. Transit is anticipated to be a feasible mode of transportation to and from the site, but is not anticipated to account for a large percentage of future trips.
- The existing vehicle transportation network was reviewed, and high southbound delays at the intersection of Sunset Drive and Water Street currently warrant an intersection upgrade. A signalized intersection is recommended, which can be coordinated with the adjacent signal at Ellis Street and Clement Avenue.
- Future Background and Post Development traffic analyses were conducted for the 2020 and 2030 horizon years, and the future site traffic was estimated and distributed to the study intersections. The future background traffic volumes are noted to be inherently conservative due to the use of a 2% blanket growth rate and the simultaneous addition of site trips for adjacent approved developments.
- In both the future Background and Post Development scenarios, queuing between the two signalized intersections was noted, and northbound and southbound left turn phases were recommended at the intersection of Ellis Street and Clement Avenue. The option of extending the northbound left turn storage bay at this intersection was also noted, but as this would likely require the removal of some on-street parking spaces, it is recommended that that queues be monitored at this time.
- The option of restricting the northbound left turn movement at the Ellis Street site access was reviewed, and it was concluded that maintaining the northbound left turn movement would be more beneficial for the site and the surrounding study network.
- The vehicle parking and loading bylaw requirements were calculated for the proposed uses, and the proposed development exceeds the bylaw maximum for parking supply and meets the loading bylaw requirement.
- On-site circulation and access to the loading bays has been initially reviewed, and all loading bays and parking spaces that were tested are accessible.

# APPENDIX A

## Scope Correspondence

**Subject:** RE: 1187 Sunset Dr. Development

**Date:** Tuesday, 11 April, 2017 11:01:20 AM Mountain Daylight Time

**From:** Sergio Sartori

**To:** Lynn Machacek

**CC:** James Kay, Chad Williams, Ryan Roycroft

Hi Lynn,

Please see Chad's email below and proceed as directed.

Thanks,  
Sergio

---

**From:** Chad Williams

**Sent:** Tuesday, April 11, 2017 8:54 AM

**To:** Sergio Sartori <SSartori@kelowna.ca>

**Cc:** James Kay <JKay@kelowna.ca>; Gordon Foy <GFoy@kelowna.ca>

**Subject:** RE: 1187 Sunset Dr. Development

Thank you for getting this to us.

We have reviewed the provided information and have some minor comments as seen below.

**Traffic Distribution**

- 1) All NB trips from the site should use Sunset Dr as there is no left out on to Ellis,
- 2) Ellis (North), PM IN should also be around 10%. The additional 10% can be distributed based on the comment below,
- 3) Based on the Regional Household Travel Survey Data SB and EB trips are approximately split equally. Almost all these EB trips are via Clement. Water St distribution look appropriate, so please reallocate some trips from Ellis to Clement to align with this data.

**Sensitivity analysis**

- 4) For the proposed sensitivity analysis please clearly provide assumed changes in traffic volumes and where these are being redistributed to and a clear comparison of the results.
- 5) Please take note of other public impacts such as loss of parking, conflicts with pedestrians and cyclists, arterial/truck route operation etc.

**Background Traffic Balancing**

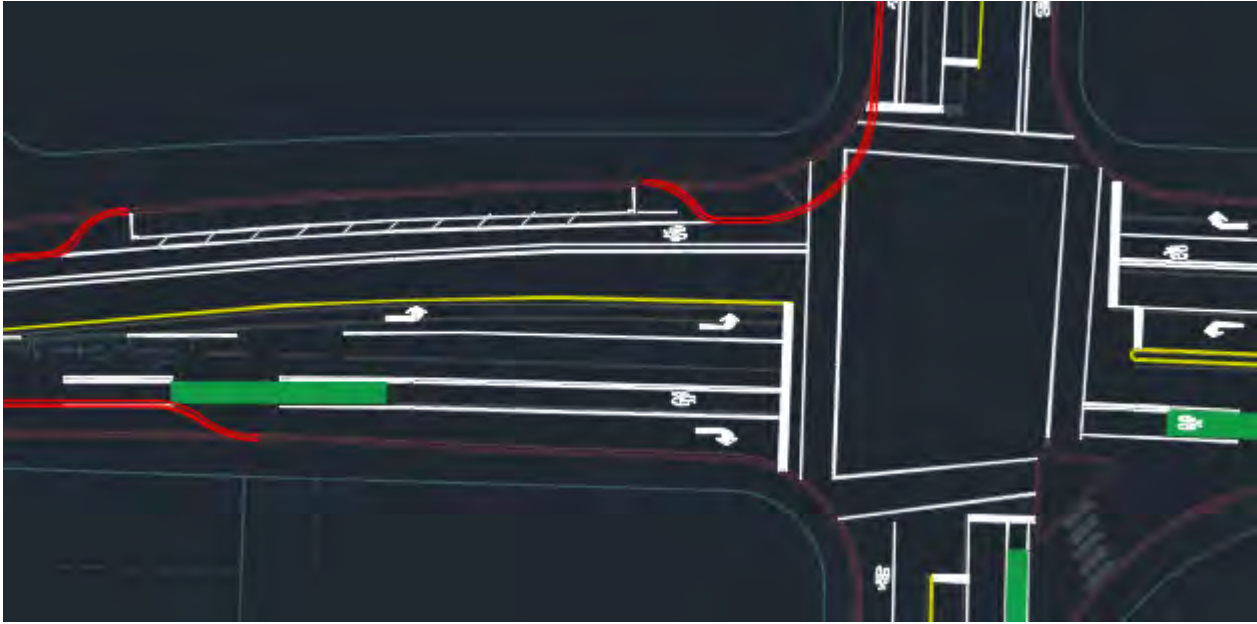
- 6) EB traffic volumes, at Water/Sunset, have been substantial factored up (AM - 132%) to accommodate lane balancing. We understand that this is to align with the background traffic counts provided by the City, however a more balanced approach maybe to have the volumes meet somewhere in the middle
- 7) Note if there is available time in the process, it would be ideal to complete new traffic counts to resolve this discrepancy. The original counts where provided by the city due to the construction that was taking place last year, as the project is complete and the development process has been delayed this should be considered.

If anyone has any questions, please let us know. Once these edits have been accommodated the consultant may proceed.

On another note, we would like to see the developer install curb extensions along the Water St frontage. We



have developed a concept sketch of this design as seen below.



Thank you,

**Chad Williams, EIT**

Transportation Planning Engineer | City of Kelowna

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**From:** Sergio Sartori

**Sent:** Friday, April 07, 2017 11:05 AM

**To:** Chad Williams <[CWilliams@kelowna.ca](mailto:CWilliams@kelowna.ca)>

**Cc:** James Kay <[JKay@kelowna.ca](mailto:JKay@kelowna.ca)>; Gordon Foy <[GFoy@kelowna.ca](mailto:GFoy@kelowna.ca)>

**Subject:** FW: 1187 Sunset Dr. Development

Hi Chad,

For your review and comments if any.

Thanks,  
Sergio

---

**From:** Lynn Machacek [<mailto:LMachacek@bunteng.com>]

**Sent:** Friday, April 07, 2017 8:33 AM

**To:** Sergio Sartori <[SSartori@kelowna.ca](mailto:SSartori@kelowna.ca)>

**Cc:** James Kay <[JKay@kelowna.ca](mailto:JKay@kelowna.ca)>

**Subject:** Re: 1187 Sunset Dr. Development

Hi Sergio,

Please find our proposed trip generation, distribution and assignment attached. Both are generally consistent with what was proposed for the 1000 Manhattan Drive. In regards to traffic balancing assumptions, we have balanced up the existing counts along Clement Avenue as discussed with transportation earlier in the process (see attached).

Please review and provide any comments before we begin with our post development analysis.

Thanks,

**Lynn Machacek**, EIT | Transportation Analyst

[Bunt & Associates Engineering Ltd.](#)

Suite 400 – 11012 Macleod Trail SE, Calgary, AB Canada T2J 6A5

p 403 252 3343 Ext 7586 f 403 252 3323 | [www.bunteng.com](http://www.bunteng.com)

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**From:** Lynn Machacek <[lmachacek@bunteng.com](mailto:lmachacek@bunteng.com)>

**Date:** Thursday, 6 April, 2017 3:54 PM

**To:** Sergio Sartori <[SSartori@kelowna.ca](mailto:SSartori@kelowna.ca)>

**Cc:** James Kay <[JKay@kelowna.ca](mailto:JKay@kelowna.ca)>

**Subject:** Re: 1187 Sunset Dr. Development

Hi Sergio,

Thanks for the response. This scope is acceptable to us, and we will resume our TIA study shortly. One thing to note is that we plan on conducting a sensitivity analysis within the TIA to explore the impacts of either allowing or not allowing the northbound left turn into the site from Ellis Street. This is to address the comment highlighted in [blue](#) below.

As an FYI, we will be updating our trip generation and distribution assumptions in the next day or two, and will send them to you for review before we proceed with the post development analysis.

In the mean time, can you please provide me with the details (uses and areas) of any major developments currently approved in the area, including the new RCMP building. This will be added to the background traffic. If available, please provided the TIAs for these development, as this will enable us maintain consistency between our analysis and any trip generation and distribution assumption for previous analyses.

Thanks,

**Lynn Machacek**, EIT | Transportation Analyst

[Bunt & Associates Engineering Ltd.](#)

Suite 400 – 11012 Macleod Trail SE, Calgary, AB Canada T2J 6A5

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**From:** Sergio Sartori <[SSartori@kelowna.ca](mailto:SSartori@kelowna.ca)>

**Date:** Wednesday, 5 April, 2017 9:35 AM

**To:** Lynn Machacek <[lmachacek@bunteng.com](mailto:lmachacek@bunteng.com)>

**Cc:** James Kay <[JKay@kelowna.ca](mailto:JKay@kelowna.ca)>

**Subject:** FW: 1187 Sunset Dr. Development

Hi Lynn,

Please see Transportation comments in the email below.

Thanks,

Sergio

---

**From:** Chad Williams

**Sent:** Wednesday, April 05, 2017 7:59 AM

**To:** Sergio Sartori <[SSartori@kelowna.ca](mailto:SSartori@kelowna.ca)>

**Cc:** Gordon Foy <[GFoy@kelowna.ca](mailto:GFoy@kelowna.ca)>; Ryan Roycroft <[RRoycroft@kelowna.ca](mailto:RRoycroft@kelowna.ca)>; James Kay <[JKay@kelowna.ca](mailto:JKay@kelowna.ca)>; Ryan Smith <[rsmith@kelowna.ca](mailto:rsmith@kelowna.ca)>

**Subject:** RE: 1187 Sunset Dr. Development

Hello Sergio,

We wanted to provide the feedback, that the consultant had requested, now that the new Site Plan has been provided.

The City will allow the TIS to proceed for 1187 Sunset Dr if the same general assumptions, methodologies and level of analysis as was used for the 1000 Manhattan Drive TIS are used. Any deviation from standard procedures should be justified in the report.

The scope for the current TIS can be modified to include the intersections of Water/Sunset and Clement/Ellis, as well as site circulation and access. Review of active transportation should be completed for a 400m network radius despite the reduced scope for intersection analysis.

Traffic capacity analysis for existing, opening day and opening day + 10 year (background & post development) analysis using a background annual growth rate of 2%.

The Traffic counts as previously provided can be used. Any lane balancing or adjustments must be justified in the report.

Planning to identify any major developments currently approved in the area including RCMP building to be added to background traffic.

Please make sure that all assumptions for trip generation, distribution, trip reductions, traffic balancing, and assignment are submitted to the City for approval prior to commencing detailed work. This will prevent work having to be revisited later in the process.

The TIS report will present analysis for each scenario in a table presenting delay, LOS and 95 percentile queue.

Site Plan – We appreciated the developer addressing some of transportation's original comments in the new site plan, such as pedestrian connectivity between Sunset and Ellis. We anticipate this lane to be built with CPTED standards with a pedestrian facility and easement to preserve this long term connection. [With this proposed site layout, the developer also shows an access at Ellis, this access will be R/O restricted unless the TIS process finds that the NBL is required for the operation of the development and a left turn lane will be required to reduce conflicts along this truck route.](#)

There may be an opportunity to expand the pedestrian space along Water St with Curb extensions as part of the frontage improvements.

The streetscaping along Ellis is lacking and 1.8 m sidewalk should be provided on PL to allow for BLVD and trees.

Site plan comments are subject to review of the finalized design.

If there are any questions we would be happy to discuss.

Thank you,

**Chad Williams, EIT**

Transportation Planning Engineer | City of Kelowna

---

**From:** Sergio Sartori

**Sent:** Wednesday, March 08, 2017 8:10 AM

**To:** 'Lynn Machacek' <[lmachacek@bunteng.com](mailto:lmachacek@bunteng.com)>

**Cc:** Chad Williams <[CWilliams@kelowna.ca](mailto:CWilliams@kelowna.ca)>

**Subject:** RE: 1187 Sunset Dr. Development

Hi Lynn,

Do you have an updated site plan? Transportation would like to have the site plan so they can comment on your bullet points.

Thanks,  
Sergio

---

**From:** Lynn Machacek [<mailto:lmachacek@bunteng.com>]  
**Sent:** Friday, February 17, 2017 10:29 AM  
**To:** Sergio Sartori <[SSartori@kelowna.ca](mailto:SSartori@kelowna.ca)>  
**Cc:** Chad Williams <[CWilliams@kelowna.ca](mailto:CWilliams@kelowna.ca)>; Mike Furuya <[mfuruya@bunteng.com](mailto:mfuruya@bunteng.com)>  
**Subject:** Re: 1187 Sunset Dr. Development

Hi Sergio,

As I am sure you are aware, we are having a bit of a re-start on our 1187 Sunset Drive project, and I would like to get the ball rolling again in terms of our TIA. It is my understanding that at this point we are proposing the following:

~400 residential units  
~15,000 sf of commercial

Likely two site accesses, with one on Sunset Drive, and one on Ellis Street. The site plan is still in the works, but this is what I am expecting thus far.

There were also a couple of outstanding items pertaining to the previous TIA scope that had yet to be confirmed. To simplify things, I have pared down the previous email and **propose the following scope:**

- ? Follow the same general assumptions, methodologies and level of analysis as used for the 1000 Manhattan Drive TIS.
- ? Utilize City traffic counts for the background volumes (these have already been received)
- ? City to provide Bunt with information on approved developments in the area to be included in the future background
- ? Analyze the intersection of Water/Sunset and Clement/Ellis as well as the proposed site accesses (one on Sunset Drive and one on Ellis Street)
- ? Traffic capacity analysis for existing, opening day and opening day + 10 year (background & post development) analysis using a background annual growth rate of 2%.
- ? Review site circulation
- ? Review the active transportation network within a 400m radius of the site
- ? Parking Review - If parking bylaws are met, then only a brief summary of the bylaw parking requirements and proposed parking supply will be provided. If parking bylaw relaxations are requested, then a more detailed parking review will be provided.

Can you please confirm / comment on the items above. Once the scope is confirmed, we will provide our proposed trip generation, distribution and assignment for review before completing our analysis.

Thanks,

**Lynn Machacek**, EIT | Transportation Analyst  
**Bunt & Associates Engineering (AB) Ltd.**  
Suite 400 – 11012 Macleod Trail SE, Calgary, AB Canada T2J 6A5  
p 403 252 3343 Ext 7586 f 403 252 3323 | [www.bunteng.com](http://www.bunteng.com)

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**From:** Sergio Sartori <[SSartori@kelowna.ca](mailto:SSartori@kelowna.ca)>  
**Date:** Monday, 5 December, 2016 10:17 AM  
**To:** Lynn Machacek <[lmachacek@bunteng.com](mailto:lmachacek@bunteng.com)>  
**Subject:** FW: 1187 Sunset Dr. Development

Hi Lynn,

Please see Chad's email below in response to your Nov 22, 2016 email.

Thanks,

**Sergio Sartori,**  
Development Engineering | City of Kelowna  
250 469-8589 [ssartori@kelowna.ca](mailto:ssartori@kelowna.ca)

---

**From:** Chad Williams  
**Sent:** Thursday, December 01, 2016 10:43 PM  
**To:** Sergio Sartori <[ssartori@kelowna.ca](mailto:ssartori@kelowna.ca)>  
**Cc:** Mahesh Tripathi <[mtripathi@kelowna.ca](mailto:mtripathi@kelowna.ca)>; Rafael Villarreal Pacheco <[RVillarreal@kelowna.ca](mailto:RVillarreal@kelowna.ca)>  
**Subject:** Fwd: 1187 Sunset Dr. Development

Hello Sergio,

The TIS for 1187 Sunset can be based on the study for 1000 Manhattan Drive and utilize the same general assumptions, methodologies and level of analysis. Any deviation from standard procedures should be justified in the report.

The scope for the current TIS can be modified to include the intersections of Water/Sunset and Clement/Ellis, as well as site circulation and access. Review of active transportation should be completed for a 400m network radius despite the reduced scope for intersection analysis.

Vehicular site access is only permitted from Sunset Drive, and should be moved further north from the current location. Public access should be provided along the north side of the property from Ellis St to Sunset Dr.

The City has conducted traffic counts at these intersections and provided background traffic volumes - in the attached spreadsheet- to keep the process moving with construction beginning the area and the end of counting season for the Winter.

Please make sure that all assumptions for trip generation, distribution, trip reductions, traffic balancing, and assignment are submitted to the City for approval prior to commencing detailed work. This will prevent work having to be revisited later in the process.

Has the option of presenting the developer with the requirements for the previous TIA and some site specific requirements, in Lieu of a TIS, been considered? Due to the similarities in location and scale of the development it would seem reasonable to apply the current requirement as well as some additional requirements to ensure City policy is being followed for this specific site.

Please let me know if you have any questions. Please forward TIS comments to the developer if that is the intended approach.

Thank you,

**Chad Williams, EIT**  
Transportation Planning Engineer  
Transportation Engineering  
250-469-8568 | [CWilliams@kelowna.ca](mailto:CWilliams@kelowna.ca)





# APPENDIX B

## Existing Signal Timing Plans

# Clement Ave & Ellis St

## City of Kelowna

### Signal Timings - Development

PEDESTRIAN CLEARANCE	Distance in meters	Pedestrian Walking Speed (m/s)	Ped Xing Time (sec)	CALL
Estimated distance across East Leg	25.4	1.2	17.8	18
Estimated distance across West Leg	29.2	1.2	20.9	21
Estimated distance across North Leg	21.0	1.2	14.1	15
Estimated distance across South Leg	18.4	1.2	11.9	12

Phase	Direction
1	SB Left
2	NB
3	WB Left
4	EB
5	NB Left
6	SB
7	EB Left
8	WB

Data Entered by:	Sylvie Laporte
Date of Data Entry:	06-Jul-11
Time of Implementation:	12:00
Date of Implementation:	24-Jul-11
Implemented by:	BB

#### WALK

- All walk times have been set at 8 seconds

#### Minimum Green

- All Minimum Greens are set to 10 Seconds for Throughs and 7 Seconds for Left Turns

#### Veh. Extension

- All Vehicle Extensions are set to 3.0 seconds for through movements and 2.5 seconds left turn movements

#### Veh. Maximums

- All Vehicle Maximums are to be determined using HCS to identify best splits for each period  
- AM Peak is to be MAX 1, PM Peak is to be MAX 2, MAX 3 is to be used where deemed necessary

#### VEHICLE CLEARANCE TIMES

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8
(w) Cross Street Width (m)	0	18	0	21	0	18	0	21
(v) Approach Speed (Km/h)	50	50	50	50	50	50	50	50
(L) Assumed Vehicle Length (m)	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
(t) Driver Perception Time (s)	1	1	1	1	1	1	1	1
(a) Average Deceleration (m/s <sup>2</sup> )	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
(g) Acceleration due to gravity (m/s <sup>2</sup> )	9.81	9.81	9.81	9.81	9.81	9.81	9.81	9.81
(G) Grade of approach (%)	0%	0%	0%	0%	0%	0%	0%	0%
Yellow Interval	0.0	3.4	0.0	3.4	0.0	3.4	0.0	3.4
Red Clearance Interval	0.0	1.9	0.0	2.1	0.0	1.9	0.0	2.1
	LTurn		LTurn		LTurn		LTurn	

### Signal Timings - Base Timings

Intersection : Clement Ave & Ellis St

RING	1	2	3	4	-	-	-	-
Phase	-	-	-	-	5	6	7	8
Direction	-	NB	-	EB	-	SB	-	WB
MIN GRN	-	10	-	10	-	10	-	10
Bike MIN GRN	-	-	-	-	-	-	-	-
Cond. Serv.	-	-	-	-	-	-	-	-
WALK	-	8	-	8	-	8	-	8
PED CLR	-	18	-	12	-	21	-	15
VEH EXT.	-	3	-	3	-	3	-	3
ALT VEH EXT.	-	-	-	-	-	-	-	-
MAX EXT.	-	5	-	5	-	5	-	5
MAX 1	-	20	-	25	-	20	-	25
MAX 2	-	-	-	-	-	-	-	-
MAX 3	-	30	-	30	-	30	-	30
DET. Fail MAX	-	20	-	20	-	20	-	20
YELLOW INTERVAL	-	3.4	-	3.4	-	3.4	-	3.4
RED CLR INTERVAL	-	1.9	-	2.1	-	1.9	-	2.1
RED REVERT	-	-	-	-	-	-	-	-
Min GRN Ped/Clear		31.3		25.5		34.3		28.5

Phases in Use	-	X	-	X	-	X	-	X
Recall	-	X	-	-	-	X	-	-

change phase 2 recall to max recall if it must match phase 6

Split Times (sec)	1	2**	3	4	5	6**	7	8	Cycle Length	Offset to **
AM (plan 10)										
NOON (plan 20)										
PM (plan 30)										
Special (plan 40)										

#### COMMENTS:

Camera's are installed; timings to be installed once SB stop bars is in place

- 1) measured crosswalk length; timing adjustment required for the walk & don't walk
- 2) re-instate max time before loops were removed
2. Pedestrian clearance and intergreen clearance times as per City of Kelowna standards

# APPENDIX C

## Traffic Counts

## AM Background Traffic Data

Sunset Dr				Ellis St			
159				176			
91				293			
58				48			
0				115			
101				14			
302	32		58	302	319	166	28
	169	2016	244			270	179
201	0	<b>662</b>	0	270	524	89	<b>1214</b>
						60	339
0				93			
0				100			
0				55			
0				263			
				248			

## PM Background Traffic Data

Sunset Dr				Ellis St			
164				351			
200				270			
72				182			
0				120			
93				49			
395	66		134	458	632	104	53
	300	2016	324			400	298
366	0	<b>964</b>	0	393	604	100	<b>1406</b>
						47	550
0				153			
0				113			
0				102			
0				267			
				367			

# APPENDIX D

Synchro & Sidra Outputs



12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	32	249	251	60	149	58
Future Volume (vph)	32	249	251	60	149	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt				0.850	0.962	
Flt Protected		0.994			0.965	
Satd. Flow (prot)	0	1872	1883	1601	1748	0
Flt Permitted		0.994			0.965	
Satd. Flow (perm)	0	1872	1883	1601	1748	0
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	10			10	10	10
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	271	273	65	162	63
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	306	273	65	225	0
Sign Control		Free	Free		Stop	
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization 50.6%	ICU Level of Service A					
Analysis Period (min) 15						

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing

	EBL	EBT	WBT	WBR	SBL	SBR
Movement						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (veh/h)	32	249	251	60	149	58
Future Volume (Veh/h)	32	249	251	60	149	58
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	271	273	65	162	63
Pedestrians		10	10		10	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			87			
pX, platoon unblocked	1.00				1.00	1.00
vC, conflicting volume	348				634	293
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	345				631	289
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				62	91
cM capacity (veh/h)	1200				423	735
Direction, Lane #	EB 1	WB 1	WB 2	SB 1		
Volume Total	306	273	65	225		
Volume Left	35	0	0	162		
Volume Right	0	0	65	63		
cSH	1200	1700	1700	480		
Volume to Capacity	0.03	0.16	0.04	0.47		
Queue Length 95th (m)	0.7	0.0	0.0	18.7		
Control Delay (s)	1.2	0.0	0.0	18.9		
Lane LOS	A			C		
Approach Delay (s)	1.2	0.0		18.9		
Approach LOS				C		
<b>Intersection Summary</b>						
Average Delay			5.3			
Intersection Capacity Utilization			50.6%		ICU Level of Service	A
Analysis Period (min)			15			

13: Ellis St & Clement Ave  
5/11/2017












AM Peak Hour  
Existing

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	126	204	67	60	174	28	90	100	55	14	115	47
Future Volume (vph)	126	204	67	60	174	28	90	100	55	14	115	47
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.96	0.99		0.96	0.99		0.96	0.99		0.99
Frt			0.850			0.850			0.850		0.957	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1782	0
Fit Permitted	0.639			0.620			0.646			0.687		
Satd. Flow (perm)	1190	1883	1535	1154	1883	1539	1206	1883	1537	1280	1782	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			73			39			60		43	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			454.1	
Travel Time (s)		6.5			13.6			15.4			34.1	
Confl. Peds. (#/hr)	10		10	10		10	10		10	10		10
Confl. Bikes (#/hr)			5			5			10			10
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	137	222	73	65	189	30	98	109	60	15	125	51
Shared Lane Traffic (%)												
Lane Group Flow (vph)	137	222	73	65	189	30	98	109	60	15	176	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2		6		
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	34.3	34.3	34.3	34.3	34.3	
Total Split (s)	29.0	29.0	29.0	29.0	29.0	29.0	36.0	36.0	36.0	36.0	36.0	
Total Split (%)	44.6%	44.6%	44.6%	44.6%	44.6%	44.6%	55.4%	55.4%	55.4%	55.4%	55.4%	
Maximum Green (s)	23.5	23.5	23.5	23.5	23.5	23.5	30.7	30.7	30.7	30.7	30.7	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	1.9	1.9	1.9	1.9	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3	5.3	5.3	5.3	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0	18.0	18.0	18.0	21.0	21.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	
Act Effct Green (s)	11.4	11.4	11.4	11.4	11.4	11.4	13.7	13.7	13.7	13.7	13.7	
Actuated g/C Ratio	0.38	0.38	0.38	0.38	0.38	0.38	0.46	0.46	0.46	0.46	0.46	
v/c Ratio	0.30	0.31	0.12	0.15	0.26	0.05	0.18	0.13	0.08	0.03	0.21	

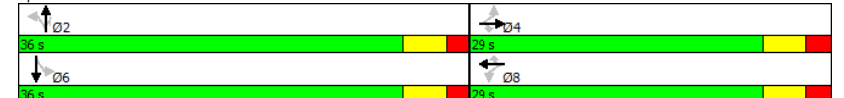
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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
Existing

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	10.3	9.3	3.2	8.6	9.0	3.1	9.6	8.8	3.6	8.3	7.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	10.3	9.3	3.2	8.6	9.0	3.1	9.6	8.8	3.6	8.3	7.5	
LOS	B	A	A	A	A	A	A	A	A	A	A	
Approach Delay		8.6			8.3			7.9			7.6	
Approach LOS		A			A			A			A	
Queue Length 50th (m)	4.9	7.9	0.0	2.2	6.6	0.0	3.3	3.6	0.0	0.5	4.5	
Queue Length 95th (m)	14.0	19.4	4.4	7.4	16.6	2.5	11.4	11.5	4.5	2.9	14.8	
Internal Link Dist (m)		63.2			156.9			180.7			430.1	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	926	1465	1211	898	1465	1206	1152	1799	1471	1223	1704	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.15	0.15	0.06	0.07	0.13	0.02	0.09	0.06	0.04	0.01	0.10	
Intersection Summary												
Area Type:	Other											
Cycle Length: 65												
Actuated Cycle Length: 29.9												
Natural Cycle: 65												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.31												
Intersection Signal Delay: 8.2						Intersection LOS: A						
Intersection Capacity Utilization 60.5%						ICU Level of Service B						
Analysis Period (min) 15												

Splits and Phases: 13: Ellis St & Clement Ave



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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Existing

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	66	381	386	160	118	72
Future Volume (vph)	66	381	386	160	118	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt				0.850	0.949	
Flt Protected		0.993			0.970	
Satd. Flow (prot)	0	1870	1883	1601	1734	0
Flt Permitted		0.993			0.970	
Satd. Flow (perm)	0	1870	1883	1601	1734	0
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	22			22	28	20
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	414	420	174	128	78
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	486	420	174	206	0
Sign Control		Free	Free		Stop	
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization 66.5%	ICU Level of Service C					
Analysis Period (min) 15						

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Existing

	EBL	EBT	WBT	WBR	SBL	SBR
Movement						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (veh/h)	66	381	386	160	118	72
Future Volume (Veh/h)	66	381	386	160	118	72
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	414	420	174	128	78
Pedestrians		20	28		22	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			87			
pX, platoon unblocked	0.97				0.97	0.97
vC, conflicting volume	616				1028	462
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	588				1013	429
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				44	87
cM capacity (veh/h)	939				227	585
Direction, Lane #	EB 1	WB 1	WB 2	SB 1		
Volume Total	486	420	174	206		
Volume Left	72	0	0	128		
Volume Right	0	0	174	78		
cSH	939	1700	1700	295		
Volume to Capacity	0.08	0.25	0.10	0.70		
Queue Length 95th (m)	1.9	0.0	0.0	36.7		
Control Delay (s)	2.1	0.0	0.0	41.1		
Lane LOS	A			E		
Approach Delay (s)	2.1	0.0		41.1		
Approach LOS				E		
<b>Intersection Summary</b>						
Average Delay			7.4			
Intersection Capacity Utilization		66.5%		ICU Level of Service		C
Analysis Period (min)		15				

13: Ellis St & Clement Ave  
5/11/2017













PM Peak Hour  
Existing

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	86	330	83	47	257	53	132	113	102	49	120	157
Future Volume (vph)	86	330	83	47	257	53	132	113	102	49	120	157
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.95	0.99		0.96	0.99		0.95	0.99	0.97	
Frt			0.850			0.850			0.850		0.915	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1671	0
Fit Permitted	0.588			0.532			0.577			0.678		
Satd. Flow (perm)	1097	1883	1526	990	1883	1539	1074	1883	1524	1264	1671	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			90			58			111		134	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			454.1	
Travel Time (s)		6.5			13.6			15.4			34.1	
Confl. Peds. (#/hr)	10		14	14		10	16		10	10		16
Confl. Bikes (#/hr)			5			5			20			20
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	93	359	90	51	279	58	143	123	111	53	130	171
Shared Lane Traffic (%)												
Lane Group Flow (vph)	93	359	90	51	279	58	143	123	111	53	301	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		4			8			2		6		
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	2	2	2	6	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	34.3	34.3	34.3	34.3	34.3	
Total Split (s)	30.1	30.1	30.1	30.1	30.1	30.1	34.9	34.9	34.9	34.9	34.9	
Total Split (%)	46.3%	46.3%	46.3%	46.3%	46.3%	46.3%	53.7%	53.7%	53.7%	53.7%	53.7%	
Maximum Green (s)	24.6	24.6	24.6	24.6	24.6	24.6	29.6	29.6	29.6	29.6	29.6	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	1.9	1.9	1.9	1.9	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	5.3	5.3	5.3	5.3	5.3	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	None	None	None	None	None	None	Min	Min	Min	Min	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0	18.0	18.0	18.0	21.0	21.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0	
Act Effct Green (s)	13.9	13.9	13.9	13.9	13.9	13.9	12.8	12.8	12.8	12.8	12.8	
Actuated g/C Ratio	0.36	0.36	0.36	0.36	0.36	0.36	0.34	0.34	0.34	0.34	0.34	
v/c Ratio	0.23	0.52	0.15	0.14	0.40	0.10	0.40	0.19	0.19	0.12	0.46	

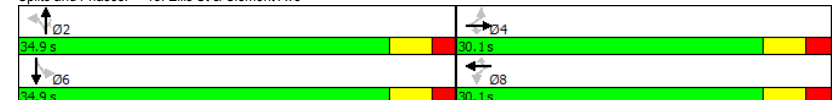
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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
Existing

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	10.6	12.9	3.4	9.7	11.3	3.7	14.5	10.8	3.8	10.7	8.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	10.6	12.9	3.4	9.7	11.3	3.7	14.5	10.8	3.8	10.7	8.8	
LOS	B	B	A	A	B	A	B	B	A	B	A	
Approach Delay		10.9			10.0			10.2			9.1	
Approach LOS		B			A			B			A	
Queue Length 50th (m)	3.3	14.2	0.0	1.7	10.5	0.0	6.0	4.8	0.0	2.0	6.7	
Queue Length 95th (m)	13.0	41.6	6.0	8.1	31.7	4.9	21.5	16.5	7.4	9.0	26.2	
Internal Link Dist (m)		63.2			156.9			180.7			430.1	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	742	1274	1061	669	1274	1060	874	1533	1261	1029	1385	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.13	0.28	0.08	0.08	0.22	0.05	0.16	0.08	0.09	0.05	0.22	
Intersection Summary												
Area Type:		Other										
Cycle Length: 65												
Actuated Cycle Length: 38.1												
Natural Cycle: 65												
Control Type: Actuated-Uncoordinated												
Maximum v/c Ratio: 0.52												
Intersection Signal Delay: 10.1					Intersection LOS: B							
Intersection Capacity Utilization 71.9%					ICU Level of Service C							
Analysis Period (min) 15												

Splits and Phases: 13: Ellis St & Clement Ave



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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing Mitigated - Three Way Stop

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	32	249	251	60	149	58
Future Volume (vph)	32	249	251	60	149	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	1
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt				0.850		0.850
Flt Protected		0.994			0.950	
Satd. Flow (prot)	0	1872	1883	1601	1789	1601
Flt Permitted		0.994			0.950	
Satd. Flow (perm)	0	1872	1883	1601	1789	1601
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	10			10	10	10
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	271	273	65	162	63
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	306	273	65	162	63
Sign Control		Stop	Stop		Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization	47.8%
Analysis Period (min)	15
	ICU Level of Service A

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing Mitigated - Three Way Stop

	EBL	EBT	WBT	WBR	SBL	SBR
Movement						
Lane Configurations		↔	↔	↔	↔	↔
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	32	249	251	60	149	58
Future Volume (vph)	32	249	251	60	149	58
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	271	273	65	162	63
Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2	
Volume Total (vph)	306	273	65	162	63	
Volume Left (vph)	35	0	0	162	0	
Volume Right (vph)	0	0	65	0	63	
Hadj (s)	0.06	0.03	-0.67	0.53	-0.67	
Departure Headway (s)	5.5	5.6	4.9	6.7	5.5	
Degree Utilization, x	0.47	0.43	0.09	0.30	0.10	
Capacity (veh/h)	627	616	697	495	605	
Control Delay (s)	13.3	11.6	7.2	11.4	7.9	
Approach Delay (s)	13.3	10.7		10.4		
Approach LOS	B	B		B		
Intersection Summary						
Delay			11.6			
Level of Service			B			
Intersection Capacity Utilization			47.8%	ICU Level of Service		A
Analysis Period (min)			15			

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing Mitigated - Signalized

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	←	←	←	←
Traffic Volume (vph)	32	249	251	60	149	58
Future Volume (vph)	32	249	251	60	149	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.96	0.98	
Frt				0.850	0.962	
Flt Protected		0.994			0.965	
Satd. Flow (prot)	0	1872	1883	1601	1730	0
Flt Permitted		0.947			0.965	
Satd. Flow (perm)	0	1782	1883	1540	1712	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				62	35	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	10			10	10	10
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	271	273	65	162	63
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	306	273	65	225	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	35.0	35.0	35.0	35.0	30.0	
Total Split (%)	53.8%	53.8%	53.8%	53.8%	46.2%	
Maximum Green (s)	29.5	29.5	29.5	29.5	24.5	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		40.3	40.3	40.3	13.7	
Actuated g/C Ratio		0.62	0.62	0.62	0.21	
v/c Ratio		0.28	0.23	0.07	0.58	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing Mitigated - Signalized

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		7.9	6.3	2.3	24.3	
Queue Delay		0.0	0.4	0.0	0.0	
Total Delay		7.9	6.7	2.3	24.3	
LOS		A	A	A	C	
Approach Delay		7.9	5.9		24.3	
Approach LOS		A	A		C	
Queue Length 50th (m)		13.9	4.8	0.0	20.9	
Queue Length 95th (m)		37.6	32.3	6.4	31.8	
Internal Link Dist (m)		298.7	63.2		216.0	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1106	1168	979	667	
Starvation Cap Reductn		0	489	0	0	
Spillback Cap Reductn		0	0	0	0	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.28	0.40	0.07	0.34	

Intersection Summary

Area Type: Other

Cycle Length: 65

Actuated Cycle Length: 65

Offset: 24 (37%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.58

Intersection Signal Delay: 11.3

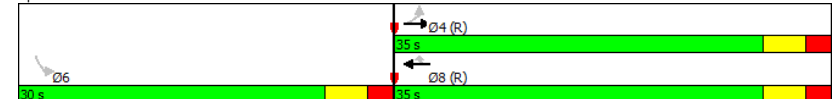
Intersection LOS: B

Intersection Capacity Utilization 61.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



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Synchro 9 Report LM



12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing Mitigated - Separated SB

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	32	249	251	60	149	58
Future Volume (vph)	32	249	251	60	149	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	1
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt				0.850		0.850
Flt Protected		0.994			0.950	
Satd. Flow (prot)	0	1872	1883	1601	1789	1601
Flt Permitted		0.994			0.950	
Satd. Flow (perm)	0	1872	1883	1601	1789	1601
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	10			10	10	10
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	35	271	273	65	162	63
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	306	273	65	162	63
Sign Control		Free	Free		Stop	

#### Intersection Summary

Area Type: Other  
Control Type: Unsignalized  
Intersection Capacity Utilization 47.8%  
Analysis Period (min) 15

ICU Level of Service A

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Existing Mitigated - Separated SB

	EBL	EBT	WBT	WBR	SBL	SBR
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (veh/h)	32	249	251	60	149	58
Future Volume (Veh/h)	32	249	251	60	149	58
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	35	271	273	65	162	63
Pedestrians		10	10		10	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		1	1		1	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			87			
pX, platoon unblocked	0.99				0.99	0.99
vC, conflicting volume	348				634	293
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	338				627	283
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				62	91
cM capacity (veh/h)	1200				424	737

Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2
Volume Total	306	273	65	162	63
Volume Left	35	0	0	162	0
Volume Right	0	0	65	0	63
cSH	1200	1700	1700	424	737
Volume to Capacity	0.03	0.16	0.04	0.38	0.09
Queue Length 95th (m)	0.7	0.0	0.0	13.4	2.1
Control Delay (s)	1.2	0.0	0.0	18.7	10.3
Lane LOS	A			C	B
Approach Delay (s)	1.2	0.0		16.3	
Approach LOS				C	

#### Intersection Summary

Average Delay 4.6  
Intersection Capacity Utilization 47.8%  
Analysis Period (min) 15

ICU Level of Service

A

## MOVEMENT SUMMARY

Site: Existing AM Mitigated

Sunset Drive & Water Street / Clement Avenue  
Roundabout

Movement Performance - Vehicles										
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Average Speed km/h
East: Clement Avenue										
6	T	273	2.0	0.316	6.5	LOS A	1.5	11.5	0.16	21.0
16	R	65	2.0	0.316	6.5	LOS A	1.5	11.5	0.16	19.9
Approach		338	2.0	0.316	6.5	LOS A	1.5	11.5	0.16	20.8
North: Sunset Drive										
7	L	162	2.0	0.268	7.2	LOS A	1.1	8.4	0.43	20.5
14	R	63	2.0	0.268	7.2	LOS A	1.1	8.4	0.43	18.9
Approach		225	2.0	0.268	7.2	LOS A	1.1	8.4	0.43	20.1
West: Water Street										
5	L	35	2.0	0.325	7.3	LOS A	1.5	11.3	0.36	20.6
2	T	271	2.0	0.325	7.3	LOS A	1.5	11.3	0.36	20.3
Approach		305	2.0	0.325	7.3	LOS A	1.5	11.3	0.36	20.3
All Vehicles		868	2.0	0.325	7.0	LOS A	1.5	11.5	0.30	20.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Model used. Geometric Delay not included.

Processed: Thursday, May 11, 2017 10:01:09 AM  
SIDRA INTERSECTION 5.1.13.2093  
Project: \\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\Existing Mitigated\Existing - Mitigated Roundabout.sip  
8000533, BUNT & ASSOCIATES ENGINEERING (AB) LTD, SINGLE

SIDRA  
INTERSECTION

12: Water St/Clement Ave & Sunset Dr

5/11/2017

PM Peak Hour

Existing Mitigated - Three Way Stop

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↖	↗	↖	↗	↗
Traffic Volume (vph)	66	381	386	160	118	72
Future Volume (vph)	66	381	386	160	118	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	1
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt			0.850		0.850	
Flt Protected		0.993			0.950	
Satd. Flow (prot)	0	1870	1883	1601	1789	1601
Flt Permitted		0.993			0.950	
Satd. Flow (perm)	0	1870	1883	1601	1789	1601
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	22			22	28	20
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	414	420	174	128	78
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	486	420	174	128	78
Sign Control		Stop	Stop		Stop	

Intersection Summary	
Area Type:	Other
Control Type:	Unsignalized
Intersection Capacity Utilization 63.9%	ICU Level of Service B
Analysis Period (min) 15	

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Existing Mitigated - Three Way Stop

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔	↔	↔	↔
Sign Control		Stop	Stop		Stop	
Traffic Volume (vph)	66	381	386	160	118	72
Future Volume (vph)	66	381	386	160	118	72
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	414	420	174	128	78
Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2	
Volume Total (vph)	486	420	174	128	78	
Volume Left (vph)	72	0	0	128	0	
Volume Right (vph)	0	0	174	0	78	
Had <sub>j</sub> (s)	0.06	0.03	-0.67	0.53	-0.67	
Departure Headway (s)	5.8	5.9	5.2	7.7	6.5	
Degree Utilization, x	0.79	0.69	0.25	0.27	0.14	
Capacity (veh/h)	486	595	673	427	520	
Control Delay (s)	26.9	19.8	8.7	12.3	9.3	
Approach Delay (s)	26.9	16.5		11.2		
Approach LOS	D	C		B		
<b>Intersection Summary</b>						
Delay		19.6				
Level of Service		C				
Intersection Capacity Utilization		63.9%		ICU Level of Service	B	
Analysis Period (min)		15				

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12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Existing Mitigated - Signalization

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	66	381	386	160	118	72
Future Volume (vph)	66	381	386	160	118	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.95	0.96	
Frt				0.850	0.949	
Flt Protected		0.993			0.970	
Satd. Flow (prot)	0	1870	1883	1601	1699	0
Flt Permitted		0.890			0.970	
Satd. Flow (perm)	0	1672	1883	1514	1657	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				113	52	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Conf. Peds. (#/hr)	22			22	28	20
Conf. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	414	420	174	128	78
<b>Shared Lane Traffic (%)</b>						
Lane Group Flow (vph)	0	486	420	174	206	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
<b>Switch Phase</b>						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	36.5	36.5	36.5	36.5	28.5	
Total Split (%)	56.2%	56.2%	56.2%	56.2%	43.8%	
Maximum Green (s)	31.0	31.0	31.0	31.0	23.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
<b>Lead/Lag</b>						
<b>Lead-Lag Optimize?</b>						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		41.3	41.3	41.3	12.7	
Actuated g/C Ratio		0.64	0.64	0.64	0.20	
v/c Ratio		0.46	0.35	0.17	0.56	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

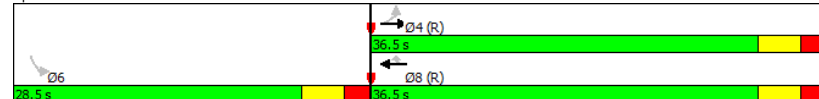
PM Peak Hour  
Existing Mitigated - Signalization

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay	9.6	6.5	2.3	22.1		
Queue Delay	0.0	0.6	0.0	0.0		
Total Delay	9.6	7.1	2.3	22.1		
LOS	A	A	A	C		
Approach Delay	9.6	5.7		22.1		
Approach LOS	A	A		C		
Queue Length 50th (m)	24.0	16.1	0.0	17.0		
Queue Length 95th (m)	67.8	48.0	11.8	27.2		
Internal Link Dist (m)	298.7	63.2		216.0		
Turn Bay Length (m)			12.0			
Base Capacity (vph)	1061	1195	1002	619		
Starvation Cap Reductn	0	413	0	0		
Spillback Cap Reductn	0	0	0	0		
Storage Cap Reductn	0	0	0	0		
Reduced v/c Ratio	0.46	0.54	0.17	0.33		

Intersection Summary

Area Type:	Other
Cycle Length: 65	
Actuated Cycle Length: 65	
Offset: 25 (38%), Referenced to phase 4:EBTL and 8:WBT, Start of Green	
Natural Cycle: 60	
Control Type: Actuated-Coordinated	
Maximum v/c Ratio: 0.56	
Intersection Signal Delay: 9.8	Intersection LOS: A
Intersection Capacity Utilization 73.1%	ICU Level of Service D
Analysis Period (min) 15	

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Existing Mitigated - Separated SB

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	66	381	386	160	118	72
Future Volume (vph)	66	381	386	160	118	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	1
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt				0.850		0.850
Frt Protected		0.993			0.950	
Satd. Flow (prot)	0	1870	1883	1601	1789	1601
Frt Permitted		0.993			0.950	
Satd. Flow (perm)	0	1870	1883	1601	1789	1601
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	22			22	28	20
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	72	414	420	174	128	78
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	486	420	174	128	78
Sign Control		Free	Free		Stop	

Intersection Summary

Area Type:	Other
Control Type: Unsignalized	
Intersection Capacity Utilization 63.9%	ICU Level of Service B
Analysis Period (min) 15	

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Existing Mitigated - Separated SB

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↩	↩	↩	↩	↩
Traffic Volume (veh/h)	66	381	386	160	118	72
Future Volume (Veh/h)	66	381	386	160	118	72
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	72	414	420	174	128	78
Pedestrians		20	28		22	
Lane Width (m)		3.7	3.7		3.7	
Walking Speed (m/s)		1.2	1.2		1.2	
Percent Blockage		2	2		2	
Right turn flare (veh)						
Median type		None	None			
Median storage (veh)						
Upstream signal (m)			87			
pX, platoon unblocked	0.96				0.96	0.96
vC, conflicting volume	616				1028	462
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	577				1007	417
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	92				43	87
cM capacity (veh/h)	936				226	588
Direction, Lane #	EB 1	WB 1	WB 2	SB 1	SB 2	
Volume Total	486	420	174	128	78	
Volume Left	72	0	0	128	0	
Volume Right	0	0	174	0	78	
cSH	936	1700	1700	226	588	
Volume to Capacity	0.08	0.25	0.10	0.57	0.13	
Queue Length 95th (m)	1.9	0.0	0.0	23.7	3.5	
Control Delay (s)	2.2	0.0	0.0	39.9	12.1	
Lane LOS	A			E	B	
Approach Delay (s)	2.2	0.0		29.4		
Approach LOS				D		
Intersection Summary						
Average Delay			5.5			
Intersection Capacity Utilization		63.9%		ICU Level of Service		B
Analysis Period (min)		15				

## MOVEMENT SUMMARY

Site: Existing PM Mitigated

Sunset Drive & Water Street / Clement Avenue  
Roundabout

Movement Performance - Vehicles										
Mov. ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh
East: Clement Avenue										
6	T	420	2.0	0.576	11.0	LOS B	4.0	30.9	0.35	0.19
16	R	174	2.0	0.576	11.0	LOS B	4.0	30.9	0.35	0.19
Approach		593	2.0	0.576	11.0	LOS B	4.0	30.9	0.35	0.19
North: Sunset Drive										
7	L	128	2.0	0.286	8.4	LOS A	1.1	8.6	0.53	0.66
14	R	78	2.0	0.286	8.4	LOS A	1.1	8.6	0.53	0.50
Approach		207	2.0	0.286	8.4	LOS A	1.1	8.6	0.53	0.60
West: Water Street										
5	L	72	2.0	0.500	9.8	LOS A	2.9	22.2	0.41	0.50
2	T	414	2.0	0.500	9.8	LOS A	2.9	22.2	0.41	0.27
Approach		486	2.0	0.500	9.8	LOS A	2.9	22.2	0.41	0.30
All Vehicles		1286	2.0	0.576	10.2	LOS B	4.0	30.9	0.40	0.30

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Model used. Geometric Delay not included.

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**SIDRA**  
**INTERSECTION**

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Background 2020

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	35	282	276	70	185	66
Future Volume (vph)	35	282	276	70	185	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.96	0.98	
Frt				0.850	0.964	
Flt Protected		0.995			0.964	
Satd. Flow (prot)	0	1874	1883	1601	1731	0
Flt Permitted		0.944			0.964	
Satd. Flow (perm)	0	1776	1883	1537	1710	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				68	28	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	11			11	11	11
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	307	300	76	201	72
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	345	300	76	273	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	41.0	41.0	41.0	41.0	29.0	
Total Split (%)	58.6%	58.6%	58.6%	58.6%	41.4%	
Maximum Green (s)	35.5	35.5	35.5	35.5	23.5	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		43.3	43.3	43.3	15.7	
Actuated g/C Ratio		0.62	0.62	0.62	0.22	
v/c Ratio		0.31	0.26	0.08	0.67	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Background 2020

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Control Delay		8.4	6.6	2.5	29.8	
Queue Delay		0.0	0.4	0.0	0.0	
Total Delay		8.4	7.0	2.5	29.8	
LOS		A	A	A	C	
Approach Delay		8.4	6.1		29.8	
Approach LOS		A	A		C	
Queue Length 50th (m)		18.5	15.0	0.0	29.4	
Queue Length 95th (m)		42.1	32.4	5.4	44.7	
Internal Link Dist (m)		298.7	63.2		216.0	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1098	1164	976	592	
Starvation Cap Reductn		0	466	0	0	
Spillback Cap Reductn		0	0	0	0	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.31	0.43	0.08	0.46	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 26 (37%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.67

Intersection Signal Delay: 13.4

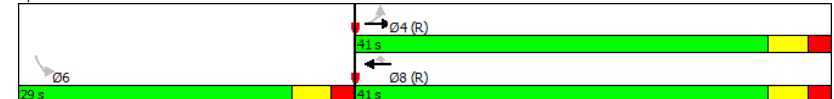
Intersection LOS: B

Intersection Capacity Utilization 65.7%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



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Synchro 9 Report LM



13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
Background 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	→	↱	↰	→	↱	↰	→	↱	↰	→	↱
Traffic Volume (vph)	136	242	90	67	193	32	101	108	77	18	124	50
Future Volume (vph)	136	242	90	67	193	32	101	108	77	18	124	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.96	0.99		0.96	0.99		0.95	0.99		0.99
Frt			0.850			0.850			0.850		0.957	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1779	0
Fit Permitted	0.626			0.596			0.493			0.682		
Satd. Flow (perm)	1164	1883	1531	1108	1883	1535	918	1883	1527	1268	1779	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			98			90			94		33	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			454.1	
Travel Time (s)		6.5			13.6			15.4			34.1	
Confl. Peds. (#/hr)	11		11	11		11	11		11	11		11
Confl. Bikes (#/hr)			5			5			11			11
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	148	263	98	73	210	35	110	117	84	20	135	54
Shared Lane Traffic (%)												
Lane Group Flow (vph)	148	263	98	73	210	35	110	117	84	20	189	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	NA
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	31.0	31.0	31.0	31.0	31.0	31.0	8.0	31.0	31.0	8.0	31.0	
Total Split (%)	44.3%	44.3%	44.3%	44.3%	44.3%	44.3%	11.4%	44.3%	44.3%	11.4%	44.3%	
Maximum Green (s)	25.5	25.5	25.5	25.5	25.5	25.5	4.5	25.7	25.7	4.5	25.7	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	40.4	40.4	40.4	40.4	40.4	40.4	19.9	17.2	17.2	17.8	12.4	
Actuated g/C Ratio	0.58	0.58	0.58	0.58	0.58	0.58	0.28	0.25	0.25	0.25	0.18	
v/c Ratio	0.22	0.24	0.11	0.11	0.19	0.04	0.35	0.25	0.19	0.06	0.55	

\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\3 -Background 2f  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
Background 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	9.7	9.3	3.7	9.0	8.8	0.1	20.2	22.0	5.7	15.6	27.5	
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	9.7	9.7	3.7	9.0	8.8	0.1	20.2	22.0	5.7	15.6	27.5	
LOS	A	A	A	A	A	A	C	C	A	B	C	
Approach Delay		8.6			7.9			17.0			26.3	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	8.6	15.3	1.1	4.0	12.2	0.0	10.5	11.7	0.0	1.8	18.9	
Queue Length 95th (m)	15.8	24.6	4.4	11.4	26.0	0.3	19.0	25.1	8.3	5.5	33.9	
Internal Link Dist (m)		63.2			156.9			180.7			430.1	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	672	1087	925	639	1087	924	316	691	620	355	674	
Starvation Cap Reductn	0	427	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.22	0.40	0.11	0.11	0.19	0.04	0.35	0.17	0.14	0.06	0.28	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 40 (57%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 13.1

Intersection LOS: B

Intersection Capacity Utilization 63.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 13: Ellis St & Clement Ave



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\3 -Background 2f  
Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Background 2020

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	←	←	←	←
Traffic Volume (vph)	74	415	430	196	138	80
Future Volume (vph)	74	415	430	196	138	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.94	0.94	
Frt				0.850	0.950	
Flt Protected		0.993			0.969	
Satd. Flow (prot)	0	1870	1883	1601	1693	0
Flt Permitted		0.873			0.969	
Satd. Flow (perm)	0	1640	1883	1498	1637	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				123	37	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	24			24	30	22
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	80	451	467	213	150	87
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	531	467	213	237	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	51.0	51.0	51.0	51.0	29.0	
Total Split (%)	63.8%	63.8%	63.8%	63.8%	36.3%	
Maximum Green (s)	45.5	45.5	45.5	45.5	23.5	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		53.5	53.5	53.5	15.5	
Actuated g/C Ratio		0.67	0.67	0.67	0.19	
v/c Ratio		0.48	0.37	0.20	0.68	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Background 2020

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		9.5	6.0	2.3	34.5	
Queue Delay		0.1	0.7	0.3	0.0	
Total Delay		9.6	6.7	2.7	34.5	
LOS		A	A	A	C	
Approach Delay		9.6	5.4		34.5	
Approach LOS		A	A		C	
Queue Length 50th (m)		33.7	20.4	0.0	28.5	
Queue Length 95th (m)		73.5	47.3	6.3	45.1	
Internal Link Dist (m)		298.7	63.2		216.0	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1096	1258	1042	507	
Starvation Cap Reductn		0	458	433	0	
Spillback Cap Reductn		54	0	0	1	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.51	0.58	0.35	0.47	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 65 (81%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay: 11.7

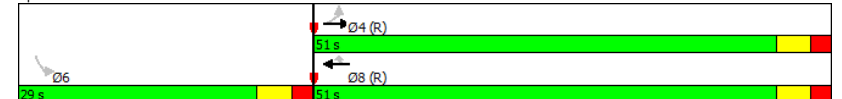
Intersection LOS: B

Intersection Capacity Utilization 78.7%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\3 -Background 2f  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
Background 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	93	364	97	62	302	60	154	122	115	54	130	170
Future Volume (vph)	93	364	97	62	302	60	154	122	115	54	130	170
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.95	0.99		0.96	0.99		0.94	0.99	0.96	
Frt			0.850			0.850			0.850		0.915	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1653	0
Fit Permitted	0.507			0.443			0.271			0.672		
Satd. Flow (perm)	945	1883	1515	823	1883	1532	503	1883	1506	1247	1653	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			127			127			125		86	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			454.1	
Travel Time (s)		6.5			13.6			15.4			34.1	
Confl. Peds. (#/hr)	11		15	15		11	17		11	11		17
Confl. Bikes (#/hr)			5			5			22			22
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	101	396	105	67	328	65	167	133	125	59	141	185
Shared Lane Traffic (%)												
Lane Group Flow (vph)	101	396	105	67	328	65	167	133	125	59	326	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	37.4	37.4	37.4	37.4	37.4	37.4	12.0	34.6	34.6	8.0	30.6	
Total Split (%)	46.8%	46.8%	46.8%	46.8%	46.8%	46.8%	15.0%	43.3%	43.3%	10.0%	38.3%	
Maximum Green (s)	31.9	31.9	31.9	31.9	31.9	31.9	8.5	29.3	29.3	4.5	25.3	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	39.8	39.8	39.8	39.8	39.8	39.8	31.2	24.6	24.6	23.9	17.6	
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.39	0.31	0.31	0.30	0.22	
v/c Ratio	0.21	0.42	0.13	0.16	0.35	0.08	0.51	0.23	0.23	0.15	0.76	

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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
Background 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	12.1	13.9	1.7	14.9	15.1	0.5	20.6	21.2	4.8	14.5	32.3	
Queue Delay	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	12.1	14.7	1.7	14.9	15.1	0.5	20.6	21.2	4.8	14.5	32.3	
LOS	B	B	A	B	B	A	C	C	A	B	C	
Approach Delay		12.0			13.0			16.1			29.5	
Approach LOS		B			B			B			C	
Queue Length 50th (m)	8.2	44.0	0.8	5.3	28.9	0.0	16.6	15.9	0.0	5.5	34.3	
Queue Length 95th (m)	17.3	66.1	1.8	15.2	56.5	1.1	24.4	25.2	9.9	10.4	54.2	
Internal Link Dist (m)		63.2			156.9			180.7			430.1	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	470	936	817	409	936	826	332	689	630	402	581	
Starvation Cap Reductn	0	263	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.21	0.59	0.13	0.16	0.35	0.08	0.50	0.19	0.20	0.15	0.56	

#### Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 16.8

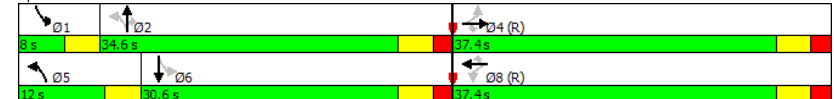
Intersection LOS: B

Intersection Capacity Utilization 72.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 13: Ellis St & Clement Ave



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\3 -Background 2f  
Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Background 2030

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	←	←	←	←
Traffic Volume (vph)	43	344	336	84	221	80
Future Volume (vph)	43	344	336	84	221	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.96	0.97	
Frt				0.850	0.964	
Flt Protected		0.994			0.965	
Satd. Flow (prot)	0	1872	1883	1601	1730	0
Flt Permitted		0.930			0.965	
Satd. Flow (perm)	0	1749	1883	1530	1705	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				68	28	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	13			13	13	13
Confl. Bikes (#/hr)				7		7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	374	365	91	240	87
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	421	365	91	327	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	41.5	41.5	41.5	41.5	28.5	
Total Split (%)	59.3%	59.3%	59.3%	59.3%	40.7%	
Maximum Green (s)	36.0	36.0	36.0	36.0	23.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		41.6	41.6	41.6	17.4	
Actuated g/C Ratio		0.59	0.59	0.59	0.25	
v/c Ratio		0.41	0.33	0.10	0.74	

\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
Background 2030

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		10.1	12.8	5.7	31.8	
Queue Delay		0.0	0.6	0.0	0.0	
Total Delay		10.1	13.4	5.7	31.8	
LOS		B	B	A	C	
Approach Delay		10.1	11.8		31.8	
Approach LOS		B	B		C	
Queue Length 50th (m)		26.5	23.2	0.6	35.7	
Queue Length 95th (m)		53.6	56.5	7.5	55.0	
Internal Link Dist (m)		298.7	63.2		216.0	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1039	1119	937	579	
Starvation Cap Reductn		0	418	0	0	
Spillback Cap Reductn		0	0	0	0	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.41	0.52	0.10	0.56	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 16.7

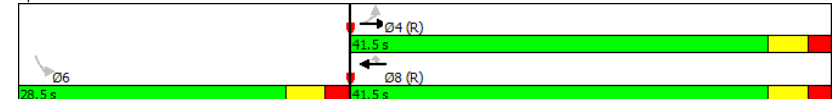
Intersection LOS: B

Intersection Capacity Utilization 71.5%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
Background 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	166	293	106	81	235	39	123	132	94	22	152	62
Future Volume (vph)	166	293	106	81	235	39	123	132	94	22	152	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.95	0.99		0.95	0.99		0.95	0.99		0.99
Frt			0.850			0.850			0.850		0.957	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1776	0
Fit Permitted	0.600			0.540			0.427			0.666		
Satd. Flow (perm)	1115	1883	1522	1004	1883	1527	794	1883	1520	1236	1776	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			115			90			102		32	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			454.1	
Travel Time (s)		6.5			13.6			15.4			34.1	
Confl. Peds. (#/hr)	13		13	13		13	13		13	13		13
Confl. Bikes (#/hr)		7			7				13			13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	180	318	115	88	255	42	134	143	102	24	165	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	180	318	115	88	255	42	134	143	102	24	232	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	31.0	31.0	31.0	31.0	31.0	31.0	9.0	31.0	31.0	8.0	30.0	
Total Split (%)	44.3%	44.3%	44.3%	44.3%	44.3%	44.3%	12.9%	44.3%	44.3%	11.4%	42.9%	
Maximum Green (s)	25.5	25.5	25.5	25.5	25.5	25.5	5.5	25.7	25.7	4.5	24.7	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	38.2	38.2	38.2	38.2	38.2	38.2	21.8	17.8	17.8	19.2	13.8	
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.55	0.55	0.31	0.25	0.25	0.27	0.20	
v/c Ratio	0.30	0.31	0.13	0.16	0.25	0.05	0.41	0.30	0.22	0.06	0.62	

\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
Background 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	8.8	8.1	1.6	11.2	10.8	0.7	19.4	22.2	6.2	13.8	29.0	
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	8.8	8.5	1.6	11.2	10.8	0.7	19.4	22.2	6.2	13.8	29.0	
LOS	A	A	A	B	B	A	B	C	A	B	C	
Approach Delay		7.3			9.8			16.9			27.5	
Approach LOS		A			A			B			C	
Queue Length 50th (m)	11.7	21.2	1.3	5.5	16.9	0.0	12.2	13.6	0.0	2.1	24.2	
Queue Length 95th (m)	23.1	35.9	m4.2	15.0	35.0	1.1	20.5	27.6	9.6	5.6	40.3	
Internal Link Dist (m)		63.2			156.9			180.7			430.1	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	609	1028	883	548	1028	875	325	691	622	373	647	
Starvation Cap Reductn	0	332	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	53	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.30	0.46	0.13	0.16	0.26	0.05	0.41	0.21	0.16	0.06	0.36	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.62

Intersection Signal Delay: 13.3

Intersection LOS: B

Intersection Capacity Utilization 67.3%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 13: Ellis St & Clement Ave



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Background 2030

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	↑	↑	↑	↑
Traffic Volume (vph)	90	506	524	234	166	97
Future Volume (vph)	90	506	524	234	166	97
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.93	0.93	
Frt				0.850	0.950	
Flt Protected		0.992			0.969	
Satd. Flow (prot)	0	1868	1883	1601	1687	0
Flt Permitted		0.838			0.969	
Satd. Flow (perm)	0	1574	1883	1483	1619	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				122	37	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		240.0	
Travel Time (s)		24.2	6.5		18.0	
Confl. Peds. (#/hr)	29			29	37	26
Confl. Bikes (#/hr)				7		7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	98	550	570	254	180	105
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	648	570	254	285	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	51.5	51.5	51.5	51.5	28.5	
Total Split (%)	64.4%	64.4%	64.4%	64.4%	35.6%	
Maximum Green (s)	46.0	46.0	46.0	46.0	23.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		51.7	51.7	51.7	17.3	
Actuated g/C Ratio		0.65	0.65	0.65	0.22	
v/c Ratio		0.64	0.47	0.25	0.75	

\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
Background 2030

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		13.4	7.3	2.8	37.7	
Queue Delay		0.5	0.9	0.4	0.0	
Total Delay		13.9	8.2	3.1	37.7	
LOS		B	A	A	D	
Approach Delay		13.9	6.6		37.7	
Approach LOS		B	A		D	
Queue Length 50th (m)		52.8	37.5	0.3	35.2	
Queue Length 95th (m)		105.6	57.3	m10.8	55.8	
Internal Link Dist (m)		298.7	63.2		216.0	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1017	1216	1001	491	
Starvation Cap Reductn		0	363	371	0	
Spillback Cap Reductn		108	0	0	2	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.71	0.67	0.40	0.58	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 64 (80%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.75

Intersection Signal Delay: 14.3

Intersection LOS: B

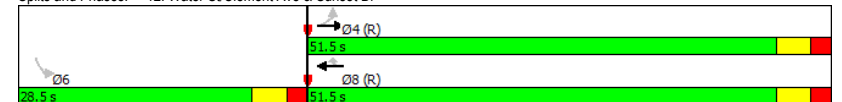
Intersection Capacity Utilization 90.8%

ICU Level of Service E

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM



13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
Background 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	113	443	116	75	366	73	186	149	140	66	158	207
Future Volume (vph)	113	443	116	75	366	73	186	149	140	66	158	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.94	0.99		0.95	0.99		0.93	0.98		0.95
Frt			0.850			0.850			0.850		0.915	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1645	0
Fit Permitted	0.438			0.361			0.218			0.654		
Satd. Flow (perm)	816	1883	1502	671	1883	1523	404	1883	1496	1211	1645	0
Right Turn on Red			Yes			Yes			Yes		Yes	
Satd. Flow (RTOR)			126			79			152		90	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			454.1	
Travel Time (s)		6.5			13.6			15.4			34.1	
Confl. Peds. (#/hr)	13		18	18		13	21		13	13		21
Confl. Bikes (#/hr)		7			7			26			26	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	123	482	126	82	398	79	202	162	152	72	172	225
Shared Lane Traffic (%)												
Lane Group Flow (vph)	123	482	126	82	398	79	202	162	152	72	397	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	10.0	35.0	35.0	8.0	33.0	
Total Split (%)	46.3%	46.3%	46.3%	46.3%	46.3%	46.3%	12.5%	43.8%	43.8%	10.0%	41.3%	
Maximum Green (s)	31.5	31.5	31.5	31.5	31.5	31.5	6.5	29.7	29.7	4.5	27.7	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	38.6	38.6	38.6	38.6	38.6	38.6	31.2	24.2	24.2	26.9	20.6	
Actuated g/C Ratio	0.48	0.48	0.48	0.48	0.48	0.48	0.39	0.30	0.30	0.34	0.26	
v/c Ratio	0.31	0.53	0.16	0.25	0.44	0.10	0.75	0.28	0.27	0.16	0.81	

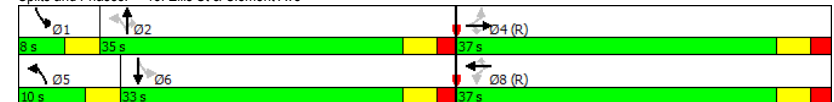
\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
Background 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	12.9	14.6	1.8	17.5	17.1	4.3	33.7	21.9	4.6	13.8	34.0	
Queue Delay	0.0	1.6	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.4	
Total Delay	12.9	16.2	1.8	17.5	17.1	4.3	34.7	21.9	4.6	13.8	34.4	
LOS	B	B	A	B	B	A	C	C	A	B	C	
Approach Delay		13.1			15.3			21.8			31.2	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	9.5	51.1	0.6	7.1	38.3	0.0	19.8	19.0	0.0	6.5	43.7	
Queue Length 95th (m)	m17.4	74.4	m1.8	19.5	70.9	7.6	#32.0	29.7	10.8	11.8	67.0	
Internal Link Dist (m)		63.2			156.9			180.7			430.1	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	393	907	789	323	907	775	270	699	650	440	628	
Starvation Cap Reductn	0	251	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	9	0	0	0	39	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.31	0.73	0.16	0.25	0.44	0.10	0.77	0.23	0.23	0.16	0.67	
Intersection Summary												
Area Type:	Other											
Cycle Length:	80											
Actuated Cycle Length:	80											
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green, Master Intersection											
Natural Cycle:	70											
Control Type:	Actuated-Coordinated											
Maximum v/c Ratio:	0.81											
Intersection Signal Delay:	19.4											
Intersection Capacity Utilization	81.0%											
Analysis Period (min)	15											
#	95th percentile volume exceeds capacity, queue may be longer.											
	Queue shown is maximum after two cycles.											
m	Volume for 95th percentile queue is metered by upstream signal.											

Splits and Phases: 13: Ellis St & Clement Ave



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\4 - Background 2  
Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
PD 2020

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	←	←	←	←
Traffic Volume (vph)	36	285	287	78	204	68
Future Volume (vph)	36	285	287	78	204	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.96	0.98	
Frt				0.850	0.966	
Flt Protected		0.994			0.964	
Satd. Flow (prot)	0	1872	1883	1601	1736	0
Flt Permitted		0.941			0.964	
Satd. Flow (perm)	0	1770	1883	1537	1714	0
Right Turn on Red				Yes	Yes	
Satd. Flow (RTOR)				73	26	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		120.1	
Travel Time (s)		24.2	6.5		9.0	
Confl. Peds. (#/hr)	11			11	11	11
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	39	310	312	85	222	74
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	349	312	85	296	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	41.0	41.0	41.0	41.0	29.0	
Total Split (%)	58.6%	58.6%	58.6%	58.6%	41.4%	
Maximum Green (s)	35.5	35.5	35.5	35.5	23.5	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		42.6	42.6	42.6	16.4	
Actuated g/C Ratio		0.61	0.61	0.61	0.23	
v/c Ratio		0.32	0.27	0.09	0.70	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
PD 2020

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		8.8	7.7	3.5	30.8	
Queue Delay		0.0	0.4	0.0	0.0	
Total Delay		8.8	8.1	3.5	30.8	
LOS		A	A	A	C	
Approach Delay		8.8	7.2		30.8	
Approach LOS		A	A		C	
Queue Length 50th (m)		19.7	19.1	0.8	32.5	
Queue Length 95th (m)		42.7	31.9	6.3	49.2	
Internal Link Dist (m)		298.7	63.2		96.1	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1076	1144	962	592	
Starvation Cap Reductn		0	426	0	0	
Spillback Cap Reductn		0	0	0	0	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.32	0.43	0.09	0.50	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 62 (89%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 14.4

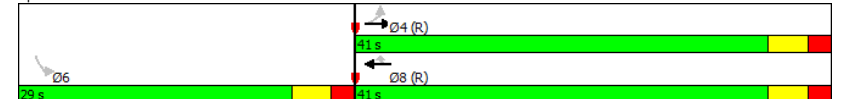
Intersection LOS: B

Intersection Capacity Utilization 66.7%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
PD 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	→	↱	↰	→	↱	↰	→	↱	↰	→	↱
Traffic Volume (vph)	140	247	101	67	196	38	107	121	77	47	188	62
Future Volume (vph)	140	247	101	67	196	38	107	121	77	47	188	62
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.96	0.99		0.96	0.99		0.96	0.99		0.99
Frt			0.850			0.850			0.850		0.963	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1796	0
Fit Permitted	0.625			0.585			0.391			0.673		
Satd. Flow (perm)	1163	1883	1531	1088	1883	1535	729	1883	1537	1251	1796	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			110			90			94		26	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			121.6	
Travel Time (s)		6.5			13.6			15.4			9.1	
Confl. Peds. (#/hr)	11		11	11		11	11		11	11		11
Confl. Bikes (#/hr)			5			5			5			5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	152	268	110	73	213	41	116	132	84	51	271	67
Shared Lane Traffic (%)												
Lane Group Flow (vph)	152	268	110	73	213	41	116	132	84	51	271	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	NA
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	30.7	30.7	30.7	30.7	30.7	30.7	9.0	31.3	31.3	8.0	30.3	
Total Split (%)	43.9%	43.9%	43.9%	43.9%	43.9%	43.9%	12.9%	44.7%	44.7%	11.4%	43.3%	
Maximum Green (s)	25.2	25.2	25.2	25.2	25.2	25.2	5.5	26.0	26.0	4.5	25.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	36.8	36.8	36.8	36.8	36.8	36.8	22.7	17.6	17.6	20.6	15.2	
Actuated g/C Ratio	0.53	0.53	0.53	0.53	0.53	0.53	0.32	0.25	0.25	0.29	0.22	
v/c Ratio	0.25	0.27	0.13	0.13	0.22	0.05	0.36	0.28	0.18	0.13	0.66	

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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
PD 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	11.2	10.7	3.7	11.8	11.5	0.6	17.2	21.7	5.1	13.6	30.1	
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	11.2	11.0	3.7	11.8	11.5	0.6	17.2	21.7	5.1	13.6	30.1	
LOS	B	B	A	B	B	A	B	C	A	B	C	
Approach Delay		9.6			10.2			15.9			27.5	
Approach LOS		A			B			B			C	
Queue Length 50th (m)	10.7	18.8	1.6	4.8	14.6	0.0	10.0	14.4	0.0	4.2	29.5	
Queue Length 95th (m)	19.0	29.6	5.5	13.4	31.1	1.1	17.1	24.6	7.4	9.0	46.4	
Internal Link Dist (m)		63.2			156.9			180.7			97.6	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	611	990	857	572	990	850	319	699	629	402	658	
Starvation Cap Reductn	0	341	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.25	0.41	0.13	0.13	0.22	0.05	0.36	0.19	0.13	0.13	0.41	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green, Master Intersection

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.66

Intersection Signal Delay: 14.9

Intersection LOS: B

Intersection Capacity Utilization 66.4%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 13: Ellis St & Clement Ave



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Synchro 9 Report LM










14: Sunset Dr & Sunset Drive Access  
5/11/2017

AM Peak Hour  
PD 2020

Lane Group	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations	W			W	W	
Traffic Volume (vph)	20	12	5	251	105	9
Future Volume (vph)	20	12	5	251	105	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.950				0.989	
Flt Protected	0.970			0.999		
Satd. Flow (prot)	1736	0	0	1882	1863	0
Flt Permitted	0.970			0.999		
Satd. Flow (perm)	1736	0	0	1882	1863	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	81.8			110.1	120.1	
Travel Time (s)	14.7			8.3	9.0	
Confl. Peds. (#/hr)			11			11
Confl. Bikes (#/hr)		5				5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	13	5	273	114	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	35	0	0	278	124	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	27.2%			ICU Level of Service A		
Analysis Period (min)	15					




14: Sunset Dr & Sunset Drive Access  
5/11/2017

AM Peak Hour  
PD 2020

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	20	12	5	251	105	9
Future Volume (Veh/h)	20	12	5	251	105	9
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	13	5	273	114	10
Pedestrians	11					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)					120	
pX, platoon unblocked						
vC, conflicting volume	413	130	135			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	413	130	135			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	100			
cM capacity (veh/h)	588	911	1436			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	35	278	124			
Volume Left	22	5	0			
Volume Right	13	0	10			
cSH	677	1436	1700			
Volume to Capacity	0.05	0.00	0.07			
Queue Length 95th (m)	1.2	0.1	0.0			
Control Delay (s)	10.6	0.2	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.6	0.2	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay	1.0					
Intersection Capacity Utilization	27.2%					
Analysis Period (min)	15					
				ICU Level of Service		
				A		

15: Ellis St & Ellis Street Access  
5/11/2017

AM Peak Hour  
PD 2020

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	104	21	279	193	5
Future Volume (vph)	0	104	21	279	193	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.865			0.997	
Flt Protected				0.996		
Satd. Flow (prot)	0	1629	0	1876	1878	0
Flt Permitted				0.996		
Satd. Flow (perm)	0	1629	0	1876	1878	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	61.0			121.6	332.5	
Travel Time (s)	4.6			9.1	24.9	
Confl. Peds. (#/hr)			11			11
Confl. Bikes (#/hr)		5				5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	113	23	303	210	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	113	0	326	215	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	33.9%			ICU Level of Service A		
Analysis Period (min)	15					

15: Ellis St & Ellis Street Access  
5/11/2017

AM Peak Hour  
PD 2020

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	104	21	279	193	5
Future Volume (Veh/h)	0	104	21	279	193	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	113	23	303	210	5
Pedestrians	11					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				122		
pX, platoon unblocked	0.94					
vC, conflicting volume	572	224	226			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	517	224	226			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	86	98			
cM capacity (veh/h)	476	808	1330			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	113	326	215			
Volume Left	0	23	0			
Volume Right	113	0	5			
cSH	808	1330	1700			
Volume to Capacity	0.14	0.02	0.13			
Queue Length 95th (m)	3.7	0.4	0.0			
Control Delay (s)	10.2	0.7	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.2	0.7	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		2.1				
Intersection Capacity Utilization		33.9%		ICU Level of Service	A	
Analysis Period (min)		15				

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
PD 2020

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	↑	↑	↑	↑
Traffic Volume (vph)	78	427	437	233	160	84
Future Volume (vph)	78	427	437	233	160	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.94	0.94	
Frt				0.850	0.954	
Flt Protected		0.992			0.968	
Satd. Flow (prot)	0	1868	1883	1601	1699	0
Flt Permitted		0.866			0.968	
Satd. Flow (perm)	0	1626	1883	1499	1635	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				155	32	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		121.3	
Travel Time (s)		24.2	6.5		9.1	
Confl. Peds. (#/hr)	24			24	30	22
Confl. Bikes (#/hr)				5		5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	85	464	475	253	174	91
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	549	475	253	265	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	26.5	
Total Split (s)	53.5	53.5	53.5	53.5	26.5	
Total Split (%)	66.9%	66.9%	66.9%	66.9%	33.1%	
Maximum Green (s)	48.0	48.0	48.0	48.0	21.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	13.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		52.7	52.7	52.7	16.3	
Actuated g/C Ratio		0.66	0.66	0.66	0.20	
v/c Ratio		0.51	0.38	0.24	0.74	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
PD 2020

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		10.0	6.1	2.2	38.6	
Queue Delay		0.1	0.8	0.4	0.0	
Total Delay		10.1	6.9	2.7	38.6	
LOS		B	A	A	D	
Approach Delay		10.1	5.4		38.6	
Approach LOS		B	A		D	
Queue Length 50th (m)		38.2	25.3	0.0	33.1	
Queue Length 95th (m)		72.2	43.4	9.5	54.2	
Internal Link Dist (m)		298.7	63.2		97.3	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1071	1241	1041	452	
Starvation Cap Reductn		0	457	409	0	
Spillback Cap Reductn		64	0	0	1	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.55	0.61	0.40	0.59	

Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 63 (79%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.74

Intersection Signal Delay: 12.8

Intersection LOS: B

Intersection Capacity Utilization 79.7%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



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Synchro 9 Report LM



13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
PD 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	107	371	109	62	317	106	170	168	115	66	153	177
Traffic Volume (vph)	107	371	109	62	317	106	170	168	115	66	153	177
Future Volume (vph)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Ideal Flow (vphpl)	45.0	45.0	45.0	26.0	70.0	20.0	0.0	50.0	0.0	50.0	0.0	0.0
Storage Length (m)	1	1	1	1	1	1	1	1	1	1	1	0
Storage Lanes	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Taper Length (m)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Util. Factor	0.99	0.95	0.99	0.96	0.99	0.94	0.99	0.94	0.99	0.96	0.96	0.96
Ped Bike Factor	0.99	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850	0.850
Frt	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950	0.950
Fit Protected	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1666	0
Satd. Flow (prot)	0.492	0.437	0.437	0.437	0.437	0.437	0.437	0.437	0.437	0.437	0.437	0.437
Fit Permitted	917	1883	1515	812	1883	1532	437	1883	1505	1193	1666	0
Satd. Flow (perm)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Right Turn on Red	118	118	118	118	118	118	118	118	118	118	118	118
Satd. Flow (RTOR)	48	48	48	48	48	48	48	48	48	48	48	48
Link Speed (k/h)	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2	87.2
Link Distance (m)	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Travel Time (s)	11	15	15	11	17	11	17	11	11	11	17	17
Confl. Peds. (#/hr)	5	5	5	5	5	5	5	5	5	5	5	5
Confl. Bikes (#/hr)	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Peak Hour Factor	116	403	118	67	345	115	185	183	125	72	358	0
Adj. Flow (vph)	Shared Lane Traffic (%)	116	403	118	67	345	115	185	183	125	72	358
Lane Group Flow (vph)	Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA
Turn Type	Protected Phases	4	4	4	8	8	8	2	2	2	6	6
Protected Phases	Permitted Phases	4	4	4	8	8	8	2	2	2	6	6
Permitted Phases	Detector Phase	4	4	4	8	8	8	2	2	2	6	6
Detector Phase	Switch Phase	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Switch Phase	Minimum Initial (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3
Minimum Initial (s)	Minimum Split (s)	38.7	38.7	38.7	38.7	38.7	38.7	11.0	33.3	33.3	8.0	30.3
Minimum Split (s)	Total Split (%)	48.4%	48.4%	48.4%	48.4%	48.4%	48.4%	13.8%	41.6%	41.6%	10.0%	37.9%
Total Split (%)	Maximum Green (s)	33.2	33.2	33.2	33.2	33.2	33.2	7.5	28.0	28.0	4.5	25.0
Maximum Green (s)	Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4
Yellow Time (s)	All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9
All-Red Time (s)	Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lost Time Adjust (s)	Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3
Total Lost Time (s)	Lead/Lag	Lead	Lag	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead/Lag	Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lead-Lag Optimize?	Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Vehicle Extension (s)	Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max
Recall Mode	Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Walk Time (s)	Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0	17.0	17.0	17.0	17.0	17.0
Flash Dont Walk (s)	Pedestrian Calls (#/hr)	0	0	0	0	0	0	0	0	0	0	0
Pedestrian Calls (#/hr)	Act Effct Green (s)	39.3	39.3	39.3	39.3	39.3	39.3	31.3	23.5	23.5	25.2	18.9
Act Effct Green (s)	Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49	0.49	0.39	0.29	0.29	0.32	0.24
Actuated g/C Ratio	v/c Ratio	0.26	0.44	0.15	0.17	0.37	0.14	0.62	0.33	0.24	0.18	0.79
v/c Ratio												

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13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
PD 2020

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	13.3	14.8	2.8	14.9	15.5	3.5	24.9	23.3	5.0	14.7	35.2	35.2
Queue Delay	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.3	15.6	2.8	14.9	15.5	3.5	24.9	23.3	5.0	14.7	35.2	35.2
LOS	B	B	A	B	B	A	C	C	A	B	D	D
Approach Delay	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8
Approach LOS	B	B	B	B	B	B	B	B	B	B	B	B
Queue Length 50th (m)	10.2	46.7	1.0	5.4	31.4	0.0	18.2	22.1	0.0	6.6	40.2	40.2
Queue Length 95th (m)	m21.6	71.2	m4.2	14.7	57.9	8.7	27.8	34.6	10.2	12.4	63.4	63.4
Internal Link Dist (m)	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2
Turn Bay Length (m)	45.0	45.0	26.0	70.0	20.0	50.0	0.0	50.0	0.0	50.0	0.0	0.0
Base Capacity (vph)	450	925	804	399	925	811	297	659	608	408	572	572
Starvation Cap Reductn	0	268	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.61	0.15	0.17	0.37	0.14	0.62	0.28	0.21	0.18	0.63	0.63

#### Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.79

Intersection Signal Delay: 18.2

Intersection LOS: B

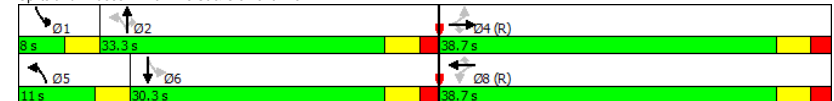
Intersection Capacity Utilization 74.4%

ICU Level of Service D

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.




Splits and Phases: 13: Ellis St & Clement Ave



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14: Sunset Dr & Sunset Drive Access  
5/11/2017

PM Peak Hour  
PD 2020

Lane Group	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (vph)	25	5	5	219	270	34
Future Volume (vph)	25	5	5	219	270	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.979				0.985	
Flt Protected	0.960			0.999		
Satd. Flow (prot)	1770	0	0	1882	1855	0
Flt Permitted	0.960			0.999		
Satd. Flow (perm)	1770	0	0	1882	1855	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	81.8			110.1	121.3	
Travel Time (s)	14.7			8.3	9.1	
Confl. Peds. (#/hr)			30			30
Confl. Bikes (#/hr)		5				5
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	5	5	238	293	37
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	0	0	243	330	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	26.6%			ICU Level of Service A		
Analysis Period (min)	15					

14: Sunset Dr & Sunset Drive Access  
5/11/2017

PM Peak Hour  
PD 2020

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	25	5	5	219	270	34
Future Volume (Veh/h)	25	5	5	219	270	34
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	5	5	238	293	37
Pedestrians	30					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	3					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)					121	
pX, platoon unblocked						
vC, conflicting volume	590	342	360			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	590	342	360			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	94	99	100			
cM capacity (veh/h)	456	683	1168			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	32	243	330			
Volume Left	27	5	0			
Volume Right	5	0	37			
cSH	481	1168	1700			
Volume to Capacity	0.07	0.00	0.19			
Queue Length 95th (m)	1.6	0.1	0.0			
Control Delay (s)	13.0	0.2	0.0			
Lane LOS	B	A				
Approach Delay (s)	13.0	0.2	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay	0.8					
Intersection Capacity Utilization	26.6%					
Analysis Period (min)	15					
				ICU Level of Service		
				A		

15: Ellis St & Ellis Street Access  
5/11/2017

PM Peak Hour  
PD 2020

	EBL	EBR	NBL	NBT	SBT	SBR
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	42	102	278	354	15
Future Volume (vph)	0	42	102	278	354	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.865			0.995	
Flt Protected				0.987		
Satd. Flow (prot)	0	1629	0	1859	1874	0
Flt Permitted				0.987		
Satd. Flow (perm)	0	1629	0	1859	1874	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	65.2			121.6	332.5	
Travel Time (s)	11.7			9.1	24.9	
Confl. Peds. (#/hr)			17			17
Confl. Bikes (#/hr)		5				22
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	46	111	302	385	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	46	0	413	401	0
Sign Control	Stop			Free	Free	
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	46.5%					
Analysis Period (min)	15					
	ICU Level of Service A					

15: Ellis St & Ellis Street Access  
5/11/2017

PM Peak Hour  
PD 2020

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	42	102	278	354	15
Future Volume (Veh/h)	0	42	102	278	354	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	46	111	302	385	16
Pedestrians	17					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				122		
pX, platoon unblocked	0.92					
vC, conflicting volume	934	410	418			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	887	410	418			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	93	90			
cM capacity (veh/h)	258	632	1124			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	46	413	401			
Volume Left	0	111	0			
Volume Right	46	0	16			
cSH	632	1124	1700			
Volume to Capacity	0.07	0.10	0.24			
Queue Length 95th (m)	1.8	2.5	0.0			
Control Delay (s)	11.1	3.0	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.1	3.0	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		2.1				
Intersection Capacity Utilization		46.5%		ICU Level of Service	A	
Analysis Period (min)		15				

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
PD 2030

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Lane Configurations		↔	↔	↔	↔	↔
Traffic Volume (vph)	44	346	347	92	239	82
Future Volume (vph)	44	346	347	92	239	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.96	0.97	
Frt				0.850	0.966	
Fit Protected		0.994			0.964	
Satd. Flow (prot)	0	1872	1883	1601	1733	0
Fit Permitted		0.927			0.964	
Satd. Flow (perm)	0	1744	1883	1530	1707	0
Right Turn on Red				Yes	Yes	
Satd. Flow (RTOR)				72	26	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		121.2	
Travel Time (s)		24.2	6.5		9.1	
Confl. Peds. (#/hr)	13			13	13	13
Confl. Bikes (#/hr)				7		7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	48	376	377	100	260	89
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	424	377	100	349	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	41.5	41.5	41.5	41.5	28.5	
Total Split (%)	59.3%	59.3%	59.3%	59.3%	40.7%	
Maximum Green (s)	36.0	36.0	36.0	36.0	23.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		40.9	40.9	40.9	18.1	
Actuated g/C Ratio		0.58	0.58	0.58	0.26	
v/c Ratio		0.42	0.34	0.11	0.76	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
PD 2030

	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group						
Control Delay		10.6	8.0	3.1	32.8	
Queue Delay		0.0	0.4	0.0	0.0	
Total Delay		10.6	8.4	3.1	32.8	
LOS		B	A	A	C	
Approach Delay		10.6	7.3		32.8	
Approach LOS		B	A		C	
Queue Length 50th (m)		28.0	23.9	2.4	38.6	
Queue Length 95th (m)		54.2	37.0	6.2	59.7	
Internal Link Dist (m)		298.7	63.2		97.2	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1019	1101	924	578	
Starvation Cap Reductn		0	342	0	0	
Spillback Cap Reductn		16	0	0	0	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.42	0.50	0.11	0.60	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 59 (84%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 15.5

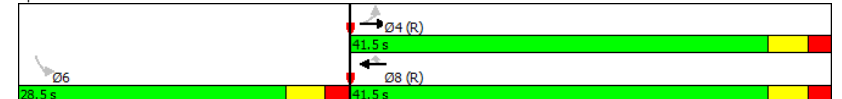
Intersection LOS: B

Intersection Capacity Utilization 72.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
PD 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	170	298	117	81	238	45	128	145	94	51	215	73
Future Volume (vph)	170	298	117	81	238	45	128	145	94	51	215	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.95	0.99		0.95	0.99		0.95	0.99		0.99
Frt			0.850			0.850			0.850		0.962	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1789	0
Fit Permitted	0.592			0.528			0.362			0.657		
Satd. Flow (perm)	1100	1883	1522	982	1883	1527	674	1883	1519	1219	1789	0
Right Turn on Red			Yes			Yes			Yes		Yes	
Satd. Flow (RTOR)			127			90			102		27	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			121.6	
Travel Time (s)		6.5			13.6			15.4			9.1	
Confl. Peds. (#/hr)	13		13	13		13	13		13	13		13
Confl. Bikes (#/hr)		7			7				13			13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	185	324	127	88	259	49	139	158	102	55	234	79
Shared Lane Traffic (%)												
Lane Group Flow (vph)	185	324	127	88	259	49	139	158	102	55	313	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	NA
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	31.6	31.6	31.6	31.6	31.6	31.6	8.0	30.4	30.4	8.0	30.4	
Total Split (%)	45.1%	45.1%	45.1%	45.1%	45.1%	45.1%	11.4%	43.4%	43.4%	11.4%	43.4%	
Maximum Green (s)	26.1	26.1	26.1	26.1	26.1	26.1	4.5	25.1	25.1	4.5	25.1	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	36.1	36.1	36.1	36.1	36.1	36.1	22.8	18.3	18.3	22.1	16.7	
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.52	0.33	0.26	0.26	0.32	0.24	
v/c Ratio	0.33	0.33	0.15	0.17	0.27	0.06	0.48	0.32	0.22	0.13	0.70	

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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
PD 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	13.2	12.1	3.7	13.2	12.6	1.3	19.7	21.6	5.5	12.9	30.1	
Queue Delay	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	13.2	12.5	3.7	13.2	12.6	1.3	19.7	21.6	5.5	12.9	30.1	
LOS	B	B	A	B	B	A	B	C	A	B	C	
Approach Delay		11.0			11.3			16.8			27.5	
Approach LOS		B			B			B			C	
Queue Length 50th (m)	12.0	21.1	1.8	6.0	18.7	0.0	11.9	17.2	0.0	4.5	34.2	
Queue Length 95th (m)	m32.6	47.0	m5.6	16.8	39.4	2.3	18.9	27.5	8.9	8.9	51.0	
Internal Link Dist (m)		63.2			156.9			180.7			97.6	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	567	970	846	505	970	830	291	675	610	421	658	
Starvation Cap Reductn	0	286	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.33	0.47	0.15	0.17	0.27	0.06	0.48	0.23	0.17	0.13	0.48	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Green, Master Intersection

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 15.7

Intersection LOS: B

Intersection Capacity Utilization 70.4%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.




Splits and Phases: 13: Ellis St & Clement Ave



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Synchro 9 Report LM










14: Sunset Dr & Sunset Drive Access  
5/11/2017

AM Peak Hour  
PD 2030

Lane Group	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (vph)	20	12	5	300	127	9
Future Volume (vph)	20	12	5	300	127	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.950				0.991	
Flt Protected	0.970			0.999		
Satd. Flow (prot)	1736	0	0	1882	1866	0
Flt Permitted	0.970			0.999		
Satd. Flow (perm)	1736	0	0	1882	1866	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	81.8			110.1	121.2	
Travel Time (s)	14.7			8.3	9.1	
Confl. Peds. (#/hr)			13			13
Confl. Bikes (#/hr)		7				7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	13	5	326	138	10
Shared Lane Traffic (%)						
Lane Group Flow (vph)	35	0	0	331	148	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	29.8%			ICU Level of Service A		
Analysis Period (min)	15					




14: Sunset Dr & Sunset Drive Access  
5/11/2017

AM Peak Hour  
PD 2030

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (veh/h)	20	12	5	300	127	9
Future Volume (Veh/h)	20	12	5	300	127	9
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	13	5	326	138	10
Pedestrians	13					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)					121	
pX, platoon unblocked						
vC, conflicting volume	492	156	161			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	492	156	161			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	100			
cM capacity (veh/h)	528	880	1402			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	35	331	148			
Volume Left	22	5	0			
Volume Right	13	0	10			
cSH	620	1402	1700			
Volume to Capacity	0.06	0.00	0.09			
Queue Length 95th (m)	1.4	0.1	0.0			
Control Delay (s)	11.2	0.1	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.2	0.1	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay	0.9					
Intersection Capacity Utilization	29.8%					
Analysis Period (min)	15					
ICU Level of Service A						

15: Ellis St & Ellis Street Access  
5/11/2017

AM Peak Hour  
PD 2030

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	104	21	339	236	5
Future Volume (vph)	0	104	21	339	236	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.865			0.997	
Flt Protected				0.997		
Satd. Flow (prot)	0	1629	0	1878	1878	0
Flt Permitted				0.997		
Satd. Flow (perm)	0	1629	0	1878	1878	0
Link Speed (k/h)	48			48	48	
Link Distance (m)	65.2			121.6	332.5	
Travel Time (s)	4.9			9.1	24.9	
Confl. Peds. (#/hr)			13			13
Confl. Bikes (#/hr)		13				13
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	113	23	368	257	5
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	113	0	391	262	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	38.4%			ICU Level of Service A		
Analysis Period (min)	15					

15: Ellis St & Ellis Street Access  
5/11/2017

AM Peak Hour  
PD 2030

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	104	21	339	236	5
Future Volume (Veh/h)	0	104	21	339	236	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	113	23	368	257	5
Pedestrians	13					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				122		
pX, platoon unblocked	0.91					
vC, conflicting volume	686	272	275			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	606	272	275			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	85	98			
cM capacity (veh/h)	407	758	1274			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	113	391	262			
Volume Left	0	23	0			
Volume Right	113	0	5			
cSH	758	1274	1700			
Volume to Capacity	0.15	0.02	0.15			
Queue Length 95th (m)	4.0	0.4	0.0			
Control Delay (s)	10.6	0.6	0.0			
Lane LOS	B	A				
Approach Delay (s)	10.6	0.6	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		1.9				
Intersection Capacity Utilization		38.4%		ICU Level of Service	A	
Analysis Period (min)		15				



12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
PD 2030

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	↑	↑	↑	↑
Traffic Volume (vph)	94	517	531	271	188	101
Future Volume (vph)	94	517	531	271	188	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.93	0.93	
Frt				0.850	0.953	
Flt Protected		0.992			0.969	
Satd. Flow (prot)	0	1868	1883	1601	1692	0
Flt Permitted		0.813			0.969	
Satd. Flow (perm)	0	1527	1883	1483	1614	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				148	33	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		121.0	
Travel Time (s)		24.2	6.5		9.1	
Confl. Peds. (#/hr)	29			29	37	26
Confl. Bikes (#/hr)				7		7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	102	562	577	295	204	110
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	664	577	295	314	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	26.5	
Total Split (s)	53.5	53.5	53.5	53.5	26.5	
Total Split (%)	66.9%	66.9%	66.9%	66.9%	33.1%	
Maximum Green (s)	48.0	48.0	48.0	48.0	21.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	13.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		51.0	51.0	51.0	18.0	
Actuated g/C Ratio		0.64	0.64	0.64	0.22	
v/c Ratio		0.68	0.48	0.30	0.81	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
PD 2030

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		14.8	9.5	3.9	42.6	
Queue Delay		0.2	0.9	0.5	3.3	
Total Delay		15.0	10.5	4.4	45.9	
LOS		B	B	A	D	
Approach Delay		15.0	8.4		45.9	
Approach LOS		B	A		D	
Queue Length 50th (m)		60.8	38.3	8.0	39.7	
Queue Length 95th (m)		106.2	62.7	m15.4	#68.7	
Internal Link Dist (m)		298.7	63.2		97.0	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		973	1200	999	448	
Starvation Cap Reductn		0	355	356	0	
Spillback Cap Reductn		36	0	0	66	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.71	0.68	0.46	0.82	

#### Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 3 (4%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 17.1

Intersection LOS: B

Intersection Capacity Utilization 91.6%

ICU Level of Service F

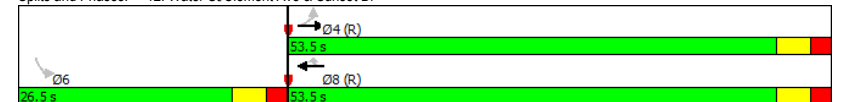
Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidral6 - PD 2030\PD 2  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
PD 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑	↱	↰	↑	↱	↰	↑	↱	↰	↑	↱
Traffic Volume (vph)	127	449	129	75	381	119	201	195	140	77	182	214
Future Volume (vph)	127	449	129	75	381	119	201	195	140	77	182	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.94	0.99		0.95	0.99		0.93	0.98		0.96
Frt			0.850			0.850			0.850		0.919	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1655	0
Fit Permitted	0.406			0.334			0.195			0.625		
Satd. Flow (perm)	757	1883	1502	621	1883	1523	362	1883	1496	1159	1655	0
Right Turn on Red			Yes			Yes			Yes		Yes	
Satd. Flow (RTOR)			140			129			152		79	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			121.6	
Travel Time (s)		6.5			13.6			15.4			9.1	
Confl. Peds. (#/hr)	13		18	18		13	21		13	13		21
Confl. Bikes (#/hr)		7			7			26			26	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	138	488	140	82	414	129	218	212	152	84	198	233
Shared Lane Traffic (%)												
Lane Group Flow (vph)	138	488	140	82	414	129	218	212	152	84	431	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	37.0	37.0	37.0	37.0	37.0	37.0	11.0	35.0	35.0	8.0	32.0	
Total Split (%)	46.3%	46.3%	46.3%	46.3%	46.3%	46.3%	13.8%	43.8%	43.8%	10.0%	40.0%	
Maximum Green (s)	31.5	31.5	31.5	31.5	31.5	31.5	7.5	29.7	29.7	4.5	26.7	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	36.2	36.2	36.2	36.2	36.2	36.2	34.4	26.6	26.6	28.3	22.0	
Actuated g/C Ratio	0.45	0.45	0.45	0.45	0.45	0.45	0.43	0.33	0.33	0.35	0.28	
v/c Ratio	0.40	0.57	0.19	0.29	0.49	0.17	0.75	0.34	0.25	0.19	0.84	

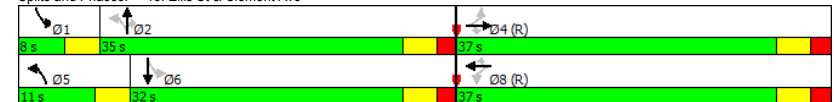
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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
PD 2030

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	18.7	17.9	4.1	19.8	19.2	3.8	32.0	21.3	4.3	13.2	37.0	
Queue Delay	0.0	2.6	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.1	
Total Delay	18.7	20.5	4.1	19.8	19.5	3.8	32.0	21.3	4.3	13.2	37.1	
LOS	B	C	A	B	B	A	C	C	A	B	D	
Approach Delay		17.2			16.3			20.9			33.2	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	11.1	40.3	0.8	7.8	43.6	0.0	20.0	24.2	0.0	7.1	49.8	
Queue Length 95th (m)	m21.9	80.5	m5.6	20.0	74.4	9.6	#36.2	38.3	10.8	13.4	78.7	
Internal Link Dist (m)		63.2			156.9			180.7			97.6	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	342	851	755	280	851	758	289	699	650	446	604	
Starvation Cap Reductn	0	241	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	105	0	0	0	0	0	4	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.40	0.80	0.19	0.29	0.55	0.17	0.75	0.30	0.23	0.19	0.72	
Intersection Summary												
Area Type:	Other											
Cycle Length:	80											
Actuated Cycle Length:	80											
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green											
Natural Cycle:	70											
Control Type:	Actuated-Coordinated											
Maximum v/c Ratio:	0.84											
Intersection Signal Delay:	21.1											
Intersection Capacity Utilization:	83.8%											
Analysis Period (min):	15											
#	95th percentile volume exceeds capacity, queue may be longer.											
	Queue shown is maximum after two cycles.											
m	Volume for 95th percentile queue is metered by upstream signal.											

Splits and Phases: 13: Ellis St & Clement Ave



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Synchro 9 Report LM

14: Sunset Dr & Sunset Drive Access  
5/11/2017

PM Peak Hour  
PD 2030

	WBL	WBR	SEL	SET	NWT	NWR
Lane Group	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations	WBL	WBR	SEL	SET	NWT	NWR
Traffic Volume (vph)	25	5	5	264	324	34
Future Volume (vph)	25	5	5	264	324	34
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.979				0.987	
Flt Protected	0.960			0.999		
Satd. Flow (prot)	1770	0	0	1882	1859	0
Flt Permitted	0.960			0.999		
Satd. Flow (perm)	1770	0	0	1882	1859	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	81.8			110.1	121.0	
Travel Time (s)	14.7			8.3	9.1	
Confl. Peds. (#/hr)			37			37
Confl. Bikes (#/hr)		7				7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	5	5	287	352	37
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	0	0	292	389	0
Sign Control	Stop			Free	Free	
<b>Intersection Summary</b>						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	29.4%					
Analysis Period (min)	15					




14: Sunset Dr & Sunset Drive Access  
5/11/2017

PM Peak Hour  
PD 2030

	WBL	WBR	SEL	SET	NWT	NWR
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations	WBL	WBR	SEL	SET	NWT	NWR
Traffic Volume (veh/h)	25	5	5	264	324	34
Future Volume (Veh/h)	25	5	5	264	324	34
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	5	5	287	352	37
Pedestrians						
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	3					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)					121	
pX, platoon unblocked						
vC, conflicting volume	704	408	426			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	704	408	426			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	93	99	100			
cM capacity (veh/h)	388	623	1097			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	32	292	389			
Volume Left	27	5	0			
Volume Right	5	0	37			
cSH	413	1097	1700			
Volume to Capacity	0.08	0.00	0.23			
Queue Length 95th (m)	1.9	0.1	0.0			
Control Delay (s)	14.5	0.2	0.0			
Lane LOS	B	A				
Approach Delay (s)	14.5	0.2	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay			0.7			
Intersection Capacity Utilization			29.4%		ICU Level of Service	A
Analysis Period (min)			15			

15: Ellis St & Ellis Street Site Access  
5/11/2017

PM Peak Hour  
PD 2030

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	42	102	338	431	15
Future Volume (vph)	0	42	102	338	431	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.865			0.996	
Flt Protected				0.989		
Satd. Flow (prot)	0	1629	0	1863	1876	0
Flt Permitted				0.989		
Satd. Flow (perm)	0	1629	0	1863	1876	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	65.5			121.6	332.5	
Travel Time (s)	11.8			9.1	24.9	
Confl. Peds. (#/hr)			21			21
Confl. Bikes (#/hr)		7				26
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	46	111	367	468	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	46	0	478	484	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	53.8%			ICU Level of Service A		
Analysis Period (min)	15					

15: Ellis St & Ellis Street Site Access  
5/11/2017

PM Peak Hour  
PD 2030

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	42	102	338	431	15
Future Volume (Veh/h)	0	42	102	338	431	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	46	111	367	468	16
Pedestrians	21					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	2					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				122		
pX, platoon unblocked	0.90					
vC, conflicting volume	1086	497	505			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1038	497	505			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	92	89			
cM capacity (veh/h)	201	563	1041			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	46	478	484			
Volume Left	0	111	0			
Volume Right	46	0	16			
cSH	563	1041	1700			
Volume to Capacity	0.08	0.11	0.28			
Queue Length 95th (m)	2.0	2.7	0.0			
Control Delay (s)	12.0	3.0	0.0			
Lane LOS	B	A				
Approach Delay (s)	12.0	3.0	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		2.0				
Intersection Capacity Utilization		53.8%		ICU Level of Service	A	
Analysis Period (min)		15				

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	←	←	←	←
Traffic Volume (vph)	46	344	347	110	239	82
Future Volume (vph)	46	344	347	110	239	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.96	0.97	
Frt				0.850	0.966	
Flt Protected		0.994			0.964	
Satd. Flow (prot)	0	1872	1883	1601	1733	0
Flt Permitted		0.923			0.964	
Satd. Flow (perm)	0	1736	1883	1530	1707	0
Right Turn on Red				Yes	Yes	
Satd. Flow (RTOR)				87	26	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		121.2	
Travel Time (s)		24.2	6.5		9.1	
Confl. Peds. (#/hr)	13			13	13	13
Confl. Bikes (#/hr)				7		7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	374	377	120	260	89
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	424	377	120	349	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	28.5	
Total Split (s)	41.5	41.5	41.5	41.5	28.5	
Total Split (%)	59.3%	59.3%	59.3%	59.3%	40.7%	
Maximum Green (s)	36.0	36.0	36.0	36.0	23.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	15.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		40.9	40.9	40.9	18.1	
Actuated g/C Ratio		0.58	0.58	0.58	0.26	
v/c Ratio		0.42	0.34	0.13	0.76	

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Synchro 9 Report LM

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay		10.6	7.9	3.1	32.8	
Queue Delay		0.0	0.5	0.0	0.0	
Total Delay		10.6	8.4	3.1	32.8	
LOS		B	A	A	C	
Approach Delay		10.6	7.1		32.8	
Approach LOS		B	A		C	
Queue Length 50th (m)		28.0	24.6	3.0	38.6	
Queue Length 95th (m)		54.3	37.8	7.1	59.7	
Internal Link Dist (m)		298.7	63.2		97.2	
Turn Bay Length (m)				12.0		
Base Capacity (vph)		1015	1101	931	578	
Starvation Cap Reductn		0	348	0	0	
Spillback Cap Reductn		14	0	0	0	
Storage Cap Reductn		0	0	0	0	
Reduced v/c Ratio		0.42	0.50	0.13	0.60	

Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 59 (84%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 60

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay: 15.3

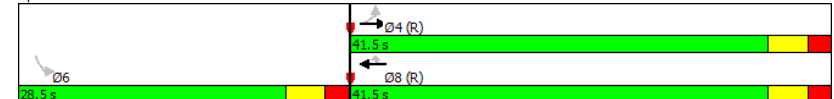
Intersection LOS: B

Intersection Capacity Utilization 72.4%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	→	↱	↰	→	↱	↰	→	↱	↰	→	↱
Traffic Volume (vph)	168	298	117	81	243	39	141	132	94	51	215	73
Future Volume (vph)	168	298	117	81	243	39	141	132	94	51	215	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.95	0.99		0.95	0.99		0.95	0.99		0.99
Frt			0.850			0.850			0.850		0.962	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1789	0
Fit Permitted	0.581			0.520			0.357			0.666		
Satd. Flow (perm)	1080	1883	1522	967	1883	1527	665	1883	1519	1236	1789	0
Right Turn on Red			Yes			Yes			Yes		Yes	
Satd. Flow (RTOR)			127			90			102		27	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			121.6	
Travel Time (s)		6.5			13.6			15.4			9.1	
Confl. Peds. (#/hr)	13		13	13		13	13		13	13		13
Confl. Bikes (#/hr)		7			7			13			13	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	183	324	127	88	264	42	153	143	102	55	234	79
Shared Lane Traffic (%)												
Lane Group Flow (vph)	183	324	127	88	264	42	153	143	102	55	313	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	31.6	31.6	31.6	31.6	31.6	31.6	8.0	30.4	30.4	8.0	30.4	
Total Split (%)	45.1%	45.1%	45.1%	45.1%	45.1%	45.1%	11.4%	43.4%	43.4%	11.4%	43.4%	
Maximum Green (s)	26.1	26.1	26.1	26.1	26.1	26.1	4.5	25.1	25.1	4.5	25.1	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	34.5	34.5	34.5	34.5	34.5	34.5	24.4	19.9	19.9	23.0	16.7	
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49	0.49	0.35	0.28	0.28	0.33	0.24	
v/c Ratio	0.34	0.35	0.16	0.18	0.28	0.05	0.50	0.27	0.20	0.12	0.70	

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Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	13.7	12.6	3.8	13.3	12.9	0.8	20.1	20.6	5.3	12.8	30.1	
Queue Delay	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	13.7	13.1	3.8	13.3	12.9	0.8	20.1	20.6	5.3	12.8	30.1	
LOS	B	B	A	B	B	A	C	C	A	B	C	
Approach Delay		11.4			11.7			16.5			27.5	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	11.9	21.1	1.8	6.0	19.2	0.0	13.2	15.4	0.0	4.5	34.2	
Queue Length 95th (m)	m32.3	47.0	m5.7	16.9	40.2	1.2	20.5	25.4	8.9	8.9	51.0	
Internal Link Dist (m)		63.2			156.9			180.7			97.6	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	532	927	814	476	927	797	304	675	610	441	658	
Starvation Cap Reductn	0	286	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.34	0.51	0.16	0.18	0.28	0.05	0.50	0.21	0.17	0.12	0.48	

#### Intersection Summary

Area Type: Other

Cycle Length: 70

Actuated Cycle Length: 70

Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green, Master Intersection

Natural Cycle: 70

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 15.9

Intersection LOS: B

Intersection Capacity Utilization 71.0%

ICU Level of Service C

Analysis Period (min) 15

m Volume for 95th percentile queue is metered by upstream signal.










Splits and Phases: 13: Ellis St & Clement Ave



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




14: Sunset Dr & Sunset Drive Access  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

						
Lane Group	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (vph)	20	12	5	300	127	30
Future Volume (vph)	20	12	5	300	127	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.950				0.974	
Flt Protected	0.970			0.999		
Satd. Flow (prot)	1736	0	0	1882	1834	0
Flt Permitted	0.970			0.999		
Satd. Flow (perm)	1736	0	0	1882	1834	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	81.8			110.1	121.2	
Travel Time (s)	14.7			8.3	9.1	
Confl. Peds. (#/hr)			13			13
Confl. Bikes (#/hr)		7				7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	22	13	5	326	138	33
Shared Lane Traffic (%)						
Lane Group Flow (vph)	35	0	0	331	171	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	29.8%			ICU Level of Service A		
Analysis Period (min)	15					

14: Sunset Dr & Sunset Drive Access  
5/11/2017







AM Peak Hour  
PD 2030 No NBL at Ellis Access

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations	 			 	 	
Traffic Volume (veh/h)	20	12	5	300	127	30
Future Volume (Veh/h)	20	12	5	300	127	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	13	5	326	138	33
Pedestrians	13					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)					121	
pX, platoon unblocked						
vC, conflicting volume	504	168	184			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	504	168	184			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	100			
cM capacity (veh/h)	520	867	1375			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	35	331	171			
Volume Left	22	5	0			
Volume Right	13	0	33			
cSH	611	1375	1700			
Volume to Capacity	0.06	0.00	0.10			
Queue Length 95th (m)	1.4	0.1	0.0			
Control Delay (s)	11.3	0.1	0.0			
Lane LOS	B	A				
Approach Delay (s)	11.3	0.1	0.0			
Approach LOS	B					
Intersection Summary						
Average Delay	0.8					
Intersection Capacity Utilization	29.8%					
Analysis Period (min)	15					
				ICU Level of Service		
				A		



15: Ellis St & Ellis Street Access  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

							
Lane Group	EBL	EBR	NBL	NBT	SBT	SBR	
Lane Configurations							
Traffic Volume (vph)	0	104	0	339	236	5	
Future Volume (vph)	0	104	0	339	236	5	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	
Ped Bike Factor							
Frt	0.865			0.997			
Flt Protected							
Satd. Flow (prot)	0	1629	0	1883	1878	0	
Flt Permitted							
Satd. Flow (perm)	0	1629	0	1883	1878	0	
Link Speed (k/h)	48			48	48		
Link Distance (m)	65.2			121.6	332.5		
Travel Time (s)	4.9			9.1	24.9		
Confl. Peds. (#/hr)			13			13	
Confl. Bikes (#/hr)		13				13	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Adj. Flow (vph)	0	113	0	368	257	5	
Shared Lane Traffic (%)							
Lane Group Flow (vph)	0	113	0	368	262	0	
Sign Control	Stop			Free	Free		
Intersection Summary							
Area Type:	Other						
Control Type: Unsignalized							
Intersection Capacity Utilization 26.1%				ICU Level of Service A			
Analysis Period (min) 15							

15: Ellis St & Ellis Street Access  
5/11/2017

AM Peak Hour  
PD 2030 No NBL at Ellis Access

	EBL	EBR	NBL	NBT	SBT	SBR
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	104	0	339	236	5
Future Volume (Veh/h)	0	104	0	339	236	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	113	0	368	257	5
Pedestrians	13					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	1					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				122		
pX, platoon unblocked	0.92					
vC, conflicting volume	640	272	275			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	565	272	275			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	85	100			
cM capacity (veh/h)	442	758	1274			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	113	368	262			
Volume Left	0	0	0			
Volume Right	113	0	5			
cSH	758	1274	1700			
Volume to Capacity	0.15	0.00	0.15			
Queue Length 95th (m)	4.0	0.0	0.0			
Control Delay (s)	10.6	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	10.6	0.0	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		1.6				
Intersection Capacity Utilization		26.1%		ICU Level of Service	A	
Analysis Period (min)		15				

12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		←	↑	→	↓	↘
Traffic Volume (vph)	105	506	531	355	188	101
Future Volume (vph)	105	506	531	355	188	101
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (m)	12.0			12.0	0.0	0.0
Storage Lanes	0			1	1	0
Taper Length (m)	2.5				2.5	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00		0.93	0.93	
Frt				0.850	0.953	
Flt Protected		0.991			0.969	
Satd. Flow (prot)	0	1866	1883	1601	1692	0
Flt Permitted		0.775			0.969	
Satd. Flow (perm)	0	1455	1883	1483	1614	0
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				194	33	
Link Speed (k/h)		48	48		48	
Link Distance (m)		322.7	87.2		121.0	
Travel Time (s)		24.2	6.5		9.1	
Confl. Peds. (#/hr)	29			29	37	26
Confl. Bikes (#/hr)				7		7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	114	550	577	386	204	110
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	664	577	386	314	0
Turn Type	Perm	NA	NA	Perm	Perm	
Protected Phases		4	8			
Permitted Phases	4			8	6	
Detector Phase	4	4	8	8	6	
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	
Minimum Split (s)	28.5	28.5	28.5	28.5	26.5	
Total Split (s)	53.5	53.5	53.5	53.5	26.5	
Total Split (%)	66.9%	66.9%	66.9%	66.9%	33.1%	
Maximum Green (s)	48.0	48.0	48.0	48.0	21.0	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	
Lost Time Adjust (s)		0.0	0.0	0.0	0.0	
Total Lost Time (s)		5.5	5.5	5.5	5.5	
Lead/Lag						
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	
Flash Dont Walk (s)	15.0	15.0	15.0	15.0	13.0	
Pedestrian Calls (#/hr)	10	10	10	10	10	
Act Effct Green (s)		51.0	51.0	51.0	18.0	
Actuated g/C Ratio		0.64	0.64	0.64	0.22	
v/c Ratio		0.72	0.48	0.38	0.81	

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12: Water St/Clement Ave & Sunset Dr  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Control Delay	16.3	8.4	3.8	42.6		
Queue Delay	0.3	1.3	0.6	4.9		
Total Delay	16.6	9.7	4.4	47.4		
LOS	B	A	A	D		
Approach Delay	16.6	7.6		47.4		
Approach LOS	B	A		D		
Queue Length 50th (m)	63.3	31.1	9.5	39.7		
Queue Length 95th (m)	113.4	m53.1	m17.6	#68.7		
Internal Link Dist (m)	298.7	63.2		97.0		
Turn Bay Length (m)			12.0			
Base Capacity (vph)	927	1200	1015	448		
Starvation Cap Reductn	0	397	322	0		
Spillback Cap Reductn	35	0	0	80		
Storage Cap Reductn	0	0	0	0		
Reduced v/c Ratio	0.74	0.72	0.56	0.85		

#### Intersection Summary

Area Type: Other

Cycle Length: 80

Actuated Cycle Length: 80

Offset: 3 (4%), Referenced to phase 4:EBTL and 8:WBT, Start of Green

Natural Cycle: 75

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 17.1

Intersection LOS: B

Intersection Capacity Utilization 91.6%

ICU Level of Service F

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Water St/Clement Ave & Sunset Dr



\\SERVERCAL3\Project Files\1498 North American Development\02 1187 Sunset Drive Mixed Use Dev Kelowna\A\Synchro & Sidra\7 - PD 2030 No NBL at Ellis Access  
Synchro 9 Report LM

13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔	↔
Traffic Volume (vph)	116	449	129	75	426	73	246	149	140	77	182	214
Future Volume (vph)	116	449	129	75	426	73	246	149	140	77	182	214
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (m)	45.0		45.0	26.0		70.0	20.0		0.0	50.0		0.0
Storage Lanes	1		1	1		1	1		1	1		0
Taper Length (m)	2.5			2.5			2.5			2.5		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	0.99		0.94	0.99		0.95	0.99		0.94	0.98		0.96
Frt			0.850			0.850			0.850		0.919	
Fit Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1789	1883	1601	1789	1883	1601	1789	1883	1601	1789	1654	0
Fit Permitted	0.342			0.317			0.191			0.654		
Satd. Flow (perm)	638	1883	1502	590	1883	1523	355	1883	1497	1211	1654	0
Right Turn on Red			Yes			Yes			Yes		Yes	
Satd. Flow (RTOR)			140			127			152		78	
Link Speed (k/h)		48			48			48			48	
Link Distance (m)		87.2			180.9			204.7			121.6	
Travel Time (s)		6.5			13.6			15.4			9.1	
Confl. Peds. (#/hr)	13		18	18		13	21		13	13		21
Confl. Bikes (#/hr)		7			7			26			26	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	126	488	140	82	463	79	267	162	152	84	198	233
Shared Lane Traffic (%)												
Lane Group Flow (vph)	126	488	140	82	463	79	267	162	152	84	431	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	NA
Protected Phases		4			8		5	2		1	6	
Permitted Phases	4		4	8		8	2		2	6		
Detector Phase	4	4	4	8	8	8	5	2	2	1	6	
Switch Phase												
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	4.0	10.0	10.0	4.0	10.0	
Minimum Split (s)	25.5	25.5	25.5	28.5	28.5	28.5	8.0	30.3	30.3	8.0	30.3	
Total Split (s)	36.0	36.0	36.0	36.0	36.0	36.0	13.0	36.0	36.0	8.0	31.0	
Total Split (%)	45.0%	45.0%	45.0%	45.0%	45.0%	45.0%	16.3%	45.0%	45.0%	10.0%	38.8%	
Maximum Green (s)	30.5	30.5	30.5	30.5	30.5	30.5	9.5	30.7	30.7	4.5	25.7	
Yellow Time (s)	3.4	3.4	3.4	3.4	3.4	3.4	3.5	3.4	3.4	3.5	3.4	
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	2.1	0.0	1.9	1.9	0.0	1.9	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	5.5	5.5	5.5	5.5	5.5	5.5	3.5	5.3	5.3	3.5	5.3	
Lead/Lag							Lead	Lag	Lag	Lead	Lag	
Lead-Lag Optimize?							Yes	Yes	Yes	Yes	Yes	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	C-Max	C-Max	None	Min	Min	None	Min	
Walk Time (s)	8.0	8.0	8.0	8.0	8.0	8.0		8.0	8.0		8.0	
Flash Dont Walk (s)	12.0	12.0	12.0	15.0	15.0	15.0		17.0	17.0		17.0	
Pedestrian Calls (#/hr)	0	0	0	0	0	0		0	0		0	
Act Effct Green (s)	34.4	34.4	34.4	34.4	34.4	34.4	36.6	28.4	28.4	28.1	21.8	
Actuated g/C Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.46	0.36	0.36	0.35	0.27	
v/c Ratio	0.46	0.60	0.19	0.32	0.57	0.11	0.80	0.24	0.24	0.18	0.85	

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13: Ellis St & Clement Ave  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Control Delay	22.4	20.1	4.7	21.7	21.9	1.4	33.5	18.9	4.1	12.5	38.5	
Queue Delay	0.0	3.5	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	22.4	23.6	4.7	21.7	22.2	1.4	33.5	18.9	4.1	12.5	38.5	
LOS	C	C	A	C	C	A	C	B	A	B	D	
Approach Delay		19.9			19.5			21.7			34.3	
Approach LOS		B			B			C			C	
Queue Length 50th (m)	11.3	44.6	0.9	8.3	53.3	0.0	23.8	17.1	0.0	6.7	49.8	
Queue Length 95th (m)	m20.2	85.6	m4.9	20.9	86.9	3.0	#50.1	29.1	10.5	13.0	#83.2	
Internal Link Dist (m)		63.2			156.9			180.7			97.6	
Turn Bay Length (m)	45.0		45.0	26.0		70.0	20.0			50.0		
Base Capacity (vph)	274	809	725	253	809	727	332	722	668	457	584	
Starvation Cap Reductn	0	227	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	54	0	0	0	0	0	1	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.46	0.84	0.19	0.32	0.61	0.11	0.80	0.22	0.23	0.18	0.74	
Intersection Summary												
Area Type:	Other											
Cycle Length:	80											
Actuated Cycle Length:	80											
Offset:	0 (0%), Referenced to phase 4:EBTL and 8:WBTL, Start of Green											
Natural Cycle:	70											
Control Type:	Actuated-Coordinated											
Maximum v/c Ratio:	0.85											
Intersection Signal Delay:	23.2											
Intersection Capacity Utilization:	86.3%											
Analysis Period (min):	15											
#	95th percentile volume exceeds capacity, queue may be longer.											
	Queue shown is maximum after two cycles.											
m	Volume for 95th percentile queue is metered by upstream signal.											










Splits and Phases: 13: Ellis St & Clement Ave



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Synchro 9 Report LM













14: Sunset Dr & Sunset Drive Access  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

						
Lane Group	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Traffic Volume (vph)	25	5	5	264	324	137
Future Volume (vph)	25	5	5	264	324	137
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt	0.979				0.960	
Flt Protected	0.960			0.999		
Satd. Flow (prot)	1770	0	0	1882	1808	0
Flt Permitted	0.960			0.999		
Satd. Flow (perm)	1770	0	0	1882	1808	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	81.8			110.1	121.0	
Travel Time (s)	14.7			8.3	9.1	
Confl. Peds. (#/hr)			37			37
Confl. Bikes (#/hr)		7				7
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	5	5	287	352	149
Shared Lane Traffic (%)						
Lane Group Flow (vph)	32	0	0	292	501	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	36.3%			ICU Level of Service A		
Analysis Period (min)	15					

14: Sunset Dr & Sunset Drive Access  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

						
Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations	 			 	 	
Traffic Volume (veh/h)	25	5	5	264	324	137
Future Volume (Veh/h)	25	5	5	264	324	137
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	5	5	287	352	149
Pedestrians	37					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	3					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)					121	
pX, platoon unblocked						
vC, conflicting volume	760	464	538			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	760	464	538			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	92	99	99			
cM capacity (veh/h)	360	580	998			
Direction, Lane #	WB 1	SE 1	NW 1			
Volume Total	32	292	501			
Volume Left	27	5	0			
Volume Right	5	0	149			
cSH	383	998	1700			
Volume to Capacity	0.08	0.01	0.29			
Queue Length 95th (m)	2.1	0.1	0.0			
Control Delay (s)	15.3	0.2	0.0			
Lane LOS	C	A				
Approach Delay (s)	15.3	0.2	0.0			
Approach LOS	C					
Intersection Summary						
Average Delay	0.7					
Intersection Capacity Utilization	36.3%			ICU Level of Service		A
Analysis Period (min)	15					

15: Ellis St & Ellis Street Site Access  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

Lane Group	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	0	42	0	338	431	15
Future Volume (vph)	0	42	0	338	431	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt		0.865			0.996	
Flt Protected						
Satd. Flow (prot)	0	1629	0	1883	1876	0
Flt Permitted						
Satd. Flow (perm)	0	1629	0	1883	1876	0
Link Speed (k/h)	20			48	48	
Link Distance (m)	65.5			121.6	332.5	
Travel Time (s)	11.8			9.1	24.9	
Confl. Peds. (#/hr)			21			21
Confl. Bikes (#/hr)		7				26
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	46	0	367	468	16
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	46	0	367	484	0
Sign Control	Stop			Free	Free	
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	33.7%			ICU Level of Service A		
Analysis Period (min)	15					

15: Ellis St & Ellis Street Site Access  
5/11/2017

PM Peak Hour  
PD 2030 No NBL at Ellis Access

	EBL	EBR	NBL	NBT	SBT	SBR
Movement						
Lane Configurations						
Traffic Volume (veh/h)	0	42	0	338	431	15
Future Volume (Veh/h)	0	42	0	338	431	15
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	46	0	367	468	16
Pedestrians	21					
Lane Width (m)	3.7					
Walking Speed (m/s)	1.2					
Percent Blockage	2					
Right turn flare (veh)						
Median type				None	None	
Median storage (veh)						
Upstream signal (m)				122		
pX, platoon unblocked	0.93					
vC, conflicting volume	864	497	505			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	816	497	505			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	92	100			
cM capacity (veh/h)	316	563	1041			
Direction, Lane #	EB 1	NB 1	SB 1			
Volume Total	46	367	484			
Volume Left	0	0	0			
Volume Right	46	0	16			
cSH	563	1041	1700			
Volume to Capacity	0.08	0.00	0.28			
Queue Length 95th (m)	2.0	0.0	0.0			
Control Delay (s)	12.0	0.0	0.0			
Lane LOS	B					
Approach Delay (s)	12.0	0.0	0.0			
Approach LOS	B					
<b>Intersection Summary</b>						
Average Delay		0.6				
Intersection Capacity Utilization		33.7%		ICU Level of Service	A	
Analysis Period (min)		15				

## APPENDIX E

TAC Signal Warrant



## City of Kelowna - Traffic Signal Warrant Analysis

Main Street (name) Water St / Clement Ave  
 Side Street (name) Sunset Dr  
 Quadrant / Int #  
 for Warrant Calculation Results, please hit 'Page Down'

Comments

Note: Summed the Existing Balanced AM and PM peak hours and factored them up by 2.61 to represent average 6 hour peak volumes.

Road Authority: City of Kelowna  
 City: Kelowna  
 Analysis Date: 2017 May 08, Mon  
 Count Date: NA - Data provided by City of Kelowna  
 Date Entry Format: (yyyy-mm-dd)

Lane Configuration		Excl LT	Th & LT	Through	Th+RT+LT	Th & RT	Excl RT	UpStream Signal (m)	# of Thru Lanes
Water St / Clement Ave WB	WB	0				1		73	1
Water St / Clement Ave EB	EB		1					860	1
Sunset Dr NB	NB								
Sunset Dr SB	SB				1				

Are the Sunset Dr SB right turns significantly impeded by through movements? (y/n)

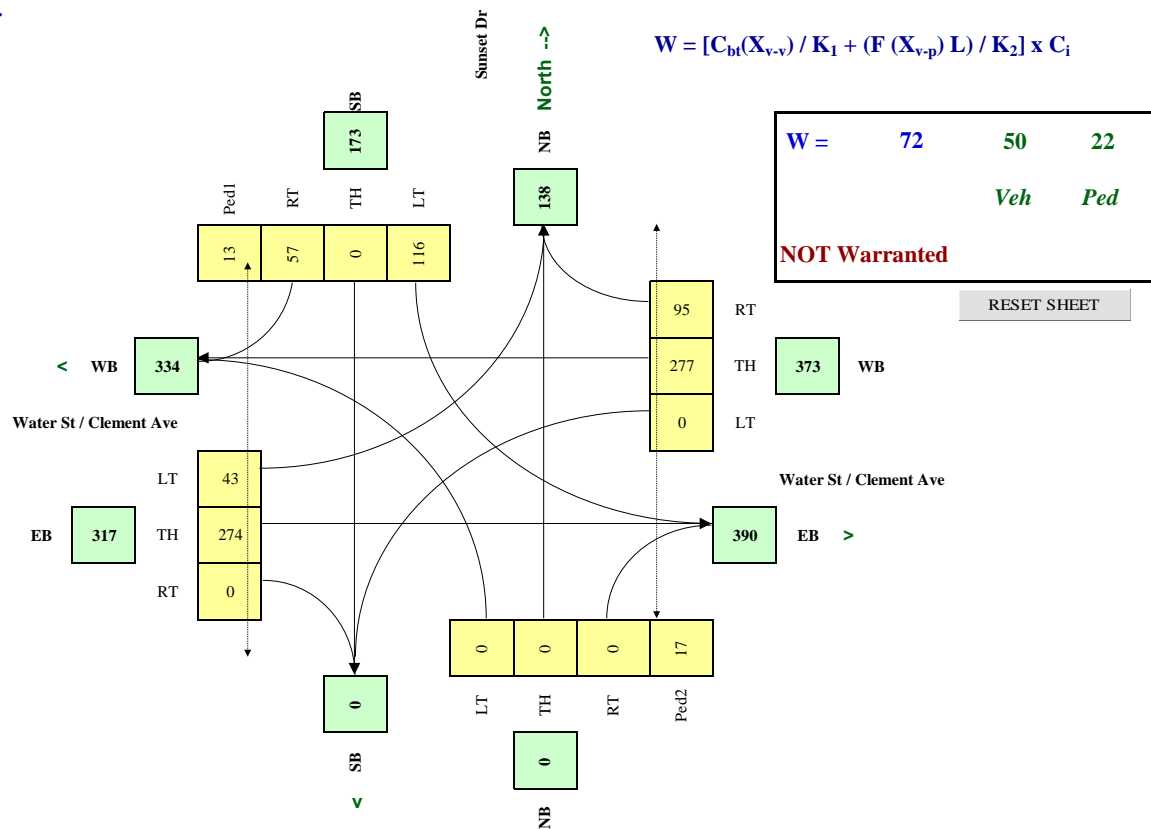
Other input		Speed (Km/h)	Truck %	Bus Rt (y/n)	Median (m)
Water St / Clement Ave	EW	50	2.0%	y	0.0
Sunset Dr	NS		2.0%	n	

Demographics		
Elem. School/Mobility Challenged	(y/n)	n
Senior's Complex	(y/n)	y
Pathway to School	(y/n)	n
Metro Area Population	(#)	179,839
Central Business District	(y/n)	n

Traffic Input	NB			SB			WB			EB			Ped1 NS	Ped2 NS	Ped3 EW	Ped4 EW
	LT	Th	RT	LT	Th	RT	LT	Th	RT	LT	Th	RT	W Side	E Side	N Side	S Side
				696		339			1663	572	256	1643	78	99	84	
press 'Set Peak Hours' Button to set the peak hour periods																
Total (6-hour peak)	0	0	0	696	0	339	0	1,663	572	256	1,643	0	78	99	84	0
Average (6-hour peak)	0	0	0	116	0	57	0	277	95	43	274	0	13	17	14	0

### Average 6-hour Peak Turning Movements

$$W = [C_{bt}(X_{v-v}) / K_1 + (F(X_{v-p}) L) / K_2] \times C_i$$





# APPENDIX F

NCHRP Internal Capture

NCHRP 8-51 Internal Trip Capture Estimation Tool					
<b>Project Name:</b>	1187 Sunset Drive	<b>Organization:</b>	Bunt & Associates		
<b>Project Location:</b>	Kelowna, BC	<b>Performed By:</b>	Lynn Machacek		
<b>Scenario Description:</b>	AM Peak Hour	<b>Date:</b>	May 8, 2017		
<b>Analysis Year:</b>	2020 & 2030	<b>Checked By:</b>			
<b>Analysis Period:</b>	AM Street Peak Hour	<b>Date:</b>			

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs <sup>1</sup>	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				10	6	4
Restaurant				6	4	2
Cinema/Entertainment				0		
Residential				179	31	148
Hotel				0		
All Other Land Uses <sup>2</sup>				0		
Total				195	41	154

Table 2-A: Mode Split and Vehicle Occupancy Estimates							
Land Use	Entering Trips				Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized		Veh. Occ.	% Transit	% Non-Motorized
Office							
Retail	1.25	4%	9%		1.25	4%	9%
Restaurant							
Cinema/Entertainment							
Residential	1.25	4%	9%		1.25	4%	9%
Hotel							
All Other Land Uses <sup>2</sup>							

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		1	0	1	0
Restaurant	0	0		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	1	1	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	243	51	192
Internal Capture Percentage	3%	8%	2%
External Vehicle-Trips <sup>3</sup>	165	33	132
External Transit-Trips <sup>4</sup>	9	2	7
External Non-Motorized Trips <sup>4</sup>	20	4	16

Table 6-A: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	13%	40%
Restaurant	50%	0%
Cinema/Entertainment	N/A	N/A
Residential	3%	1%
Hotel	N/A	N/A

<sup>1</sup>Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

<sup>2</sup>Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

<sup>3</sup>Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A

<sup>4</sup>Person-Trips

\*Indicates computation that has been rounded to the nearest whole number.

*Estimation Tool Developed by the Texas Transportation Institute*

NCHRP 8-51 Internal Trip Capture Estimation Tool					
<b>Project Name:</b>	1187 Sunset Drive	<b>Organization:</b>	Bunt & Associates		
<b>Project Location:</b>	Kelowna, BC	<b>Performed By:</b>	Lynn Machacek		
<b>Scenario Description:</b>	PM Peak Hour	<b>Date:</b>	May 8 , 2017		
<b>Analysis Year:</b>	2020 & 2030	<b>Checked By:</b>			
<b>Analysis Period:</b>	PM Street Peak Hour	<b>Date:</b>			

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)						
Land Use	Development Data (For Information Only)			Estimated Vehicle-Trips		
	ITE LUCs <sup>1</sup>	Quantity	Units	Total	Entering	Exiting
Office				0		
Retail				37	18	19
Restaurant				52	35	17
Cinema/Entertainment				0		
Residential				211	141	70
Hotel				0		
All Other Land Uses <sup>2</sup>				0		
Total				300	194	106

Table 2-P: Mode Split and Vehicle Occupancy Estimates						
Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.	% Transit	% Non-Motorized	Veh. Occ.	% Transit	% Non-Motorized
Office						
Retail	1.25	4%	9%	1.25	4%	9%
Restaurant						
Cinema/Entertainment						
Residential	1.25	4%	9%	1.25	4%	9%
Hotel						
All Other Land Uses <sup>2</sup>						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail					100	
Restaurant						
Cinema/Entertainment						
Residential		100				
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*						
Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		0	0	0	0	0
Retail	0		7	0	6	0
Restaurant	0	7		0	3	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	2	5	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary			
	Total	Entering	Exiting
All Person-Trips	363	234	129
Internal Capture Percentage	17%	13%	23%
External Vehicle-Trips <sup>3</sup>	221	149	72
External Transit-Trips <sup>4</sup>	11	8	3
External Non-Motorized Trips <sup>4</sup>	24	16	8

Table 6-P: Internal Trip Capture Percentages by Land Use		
Land Use	Entering Trips	Exiting Trips
Office	N/A	N/A
Retail	39%	54%
Restaurant	34%	59%
Cinema/Entertainment	N/A	N/A
Residential	5%	8%
Hotel	N/A	N/A

<sup>1</sup>Land Use Codes (LUCs) from *Trip Generation Informational Report*, published by the Institute of Transportation Engineers.

<sup>2</sup>Total estimate for all other land uses at mixed-use development site-not subject to internal trip capture computations in this estimator

<sup>3</sup>Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

<sup>4</sup>Person-Trips

\*Indicates computation that has been rounded to the nearest whole number.

*Estimation Tool Developed by the Texas Transportation Institute*

## APPENDIX G

1190 Richter Street (RCMP Headquarters) TIA

CITY OF KELOWNA

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# **KELOWNA RCMP DETACHMENT TRAFFIC IMPACT ASSESSMENT (PHASE 2)**

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## **REPORT – PHASE 2**

MARCH 2013  
ISSUED FOR REVIEW  
EBA FILE: 704-V31203051-01



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## LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the City of Kelowna and their agents. EBA Engineering Consultants Ltd. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the City of Kelowna, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user.



## Table of Contents

<b>1</b>	<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>2</b>	<b>INTRODUCTION .....</b>	<b>2</b>
<b>3</b>	<b>BACKGROUND TRAFFIC CONDITIONS .....</b>	<b>3</b>
3.1	Road Network.....	3
3.2	Intersection Configurations .....	3
3.3	Pedestrian Facilities .....	4
3.4	Bicycle Facilities.....	4
3.5	Transit Services .....	5
3.6	Background Volumes .....	5
3.7	Future Network Changes .....	6
3.8	Intersection Analysis .....	6
	Opening Horizon Year .....	8
	2030 Horizon Year .....	8
3.9	Effect of Widening Clement Avenue .....	9
<b>4</b>	<b>SITE TRAFFIC .....</b>	<b>10</b>
4.1	Overview of Development Plan.....	10
4.2	Trip Generation.....	10
4.3	Trip Distribution.....	12
4.4	Trip Assignment .....	12
<b>5</b>	<b>SITE IMPACT ANALYSIS .....</b>	<b>15</b>
5.1	Combined Traffic Volumes .....	15
5.2	Combined Intersection Analysis.....	15
	Opening Year Analysis .....	16
	2030 Combined Results.....	16
5.3	Effect of Widening Clement Avenue .....	17
<b>6</b>	<b>SITE ACCESS .....</b>	<b>18</b>
6.1	Site Access Review .....	18
6.2	Safety .....	18
<b>7</b>	<b>TRANSIT ACCESS.....</b>	<b>19</b>
7.1	Transit Service Review .....	19
7.2	Transit Access Review .....	19
<b>8</b>	<b>PEDESTRIAN AND BICYCLE ACCESS.....</b>	<b>20</b>
8.1	Pedestrian Facilities Review .....	20
8.2	Bicycle Facilities Review .....	20



<b>9</b>	<b>CONCLUSIONS &amp; RECOMMENDATIONS.....</b>	<b>21</b>
9.1	Background Conditions .....	21
9.2	Site Traffic .....	21
9.3	Combined Traffic Conditions.....	21
9.4	Site Access.....	22
9.5	Transit Access .....	22
9.6	Pedestrian and Bicycle Access .....	22
<b>10</b>	<b>CLOSURE.....</b>	<b>23</b>

## FIGURES

Figure 1.	Site Location
Figure 2.	Intersection Lane Configurations
Figure 3.	Transit and Bicycle Facilities
Figure 4.	2013 Background Traffic Volumes
Figure 5.	2030 Background Traffic Volumes
Figure 6.	Site Traffic Volumes (Build Out 2035)
Figure 7.	2013 Combined Traffic Volumes
Figure 8.	2030 Combined Traffic Volumes

## TABLES

Table 1.	Existing Intersection Configuration
Table 2.	Pedestrian Facilities
Table 3.	Intersection Level Of Service
Table 4.	2013 Background Traffic Conditions
Table 5.	2030 Background Traffic Conditions
Table 6.	2030 Traffic Conditions – With Clement Improvements
Table 7.	Employee Breakdown
Table 8.	Trip Generation - 2018
Table 9.	Trip Generation - 2035
Table 10.	Trip Distribution
Table 11.	2013 Combined Traffic Conditions
Table 12.	2030 Combined Traffic Conditions
Table 13.	2030 Combined Traffic Conditions – With Clement Improvements

# I EXECUTIVE SUMMARY

To be provided in IFU report.



## 2 INTRODUCTION

The City of Kelowna is planning to construct a new RCMP detachment on the north side of Clement Avenue between St. Paul Street and Richter Street just north of downtown Kelowna. This detachment will replace the existing Doyle Avenue facility. The figure below illustrates the location of the site.

Figure 1. Site Location



The transportation assessment for the site covers two phases:

1. Phase 1: An on-site transportation review covering expected traffic levels, the potential role of Transportation Demand Management and establishing an appropriate parking supply.
2. Phase 2: A detailed analysis of the impact of site traffic on the surrounding road network.

This report covers *Phase 2*, and includes:

- A review of background traffic conditions.
- A review of combined traffic conditions to determine the need for improvements to mitigate the impact of site traffic on the adjacent road network.
- An assessment of the site access points.
- An assessment of transit, pedestrian and bicycle access to the site



## 3 BACKGROUND TRAFFIC CONDITIONS

### 3.1 Road Network

The figure below presents the road network in the vicinity of the site. The key roads are summarized as follows:

- **Clement Avenue:** This arterial road runs east-west from Water Street in the west to Glenmore Drive/Spall Road in the east. It is currently one lane in each direction in the vicinity of the site, and two lanes per direction east of Graham Street.
- **Doyle Avenue:** This major collector connects Water Street in the west to Richter Street in the east.
- **Stockwell Avenue:** This major collector connects Lombardy Square, east of Gordon Drive, in the east to Richter Street.
- **Ellis Street:** Ellis Street is a two lane arterial connecting Highway 97 in the south to Broadway Avenue in the north.
- **St. Paul Street:** This local road runs parallel to Ellis Street between Gaston Avenue north of the site and Bernard Avenue in the south.
- **Richter Street:** Richter Street is classified as an arterial road south of Clement Avenue and a collector street to the north. It runs from Broadway Avenue in the north to Lakeshore Road in the south. The City is proposing the main site access point on this street.
- **Ethel Street:** Ethel Street is classified as a collector road south of Clement Avenue and a local street to the north.
- **Graham Street:** This is a local north-south road between Ethel Street and Gordon Drive.
- **Gordon Drive:** south of Clement Avenue this is an arterial road running south to Crest Drive, while to the north of Clement Avenue it is a minor arterial road running to Trench Place.
- **Cerise Drive:** Cerise Drive is a minor collector running north from Clement Avenue to Mountain Avenue.
- **Clifton Road:** Clifton Road is a two lane arterial road that the city intends to upgrade to four lanes in the future. It runs north from Clement Avenue.
- **Spall Road/Glenmore Road:** This four lane arterial runs from Winfield in the north to Springfield Road in the south. It is known as Spall Road south of Bernard Avenue and Glenmore Road to the north.

### 3.2 Intersection Configurations

EBA analyzed 11 intersections as part of this study including five signalized and five unsignalized intersections and one pedestrian signal. The next table and figure summarise and illustrate the lane configuration and traffic control for each of these intersections.

**Table 1. Existing Intersection Configuration**

Direction		Eastbound			Westbound			Northbound			Southbound			Comments
East-west	North-south	L	T	R	L	T	R	L	T	R	L	T	R	Control
Clement Avenue	Ellis Street							>					<	Signal
Clement Avenue	St Paul Street	>		<	>		<	>		<	>		<	N-S Stop
Clement Avenue	Richter Street			<			<	>			>		<	Signal
Clement Avenue	Ethel Street			<			<	>		<	>		<	N-S Stop
Clement Avenue	Graham Street			<		2	<	>		<	>		<	N-S Stop
Clement Avenue	Gordon Drive		2	<		2	<						<	Signal
Clement Avenue	Cerise Drive		2	x	x	2	<	x	x	x	x	x	<	Ped Signal; SB Stop
Clement Avenue	Clifton Road		2	x	x	2		x	x	x	2	x		Signal
Clement Avenue	Spall Road	2	x		x	x	x		2	x	x	2		Signal
Doyle Avenue	Richter Street		x		x	x	x	>		x	x		<	EB Stop
Stockwell Avenue	Richter Street	x	x	x		x	<	x		<	>		x	WB Stop

\*Note: '>' or '<' = shared with adjacent lane; 'X' = no such movement

### 3.3 Pedestrian Facilities

Pedestrian facilities exist along many of the street surrounding the site. The following table summarizes these facilities in the vicinity of the site. Pedestrian crosswalks are provided at the intersections of Clement Avenue/Ellis Street to the west of the site and Clement Avenue/Richter Street to the east of the site.

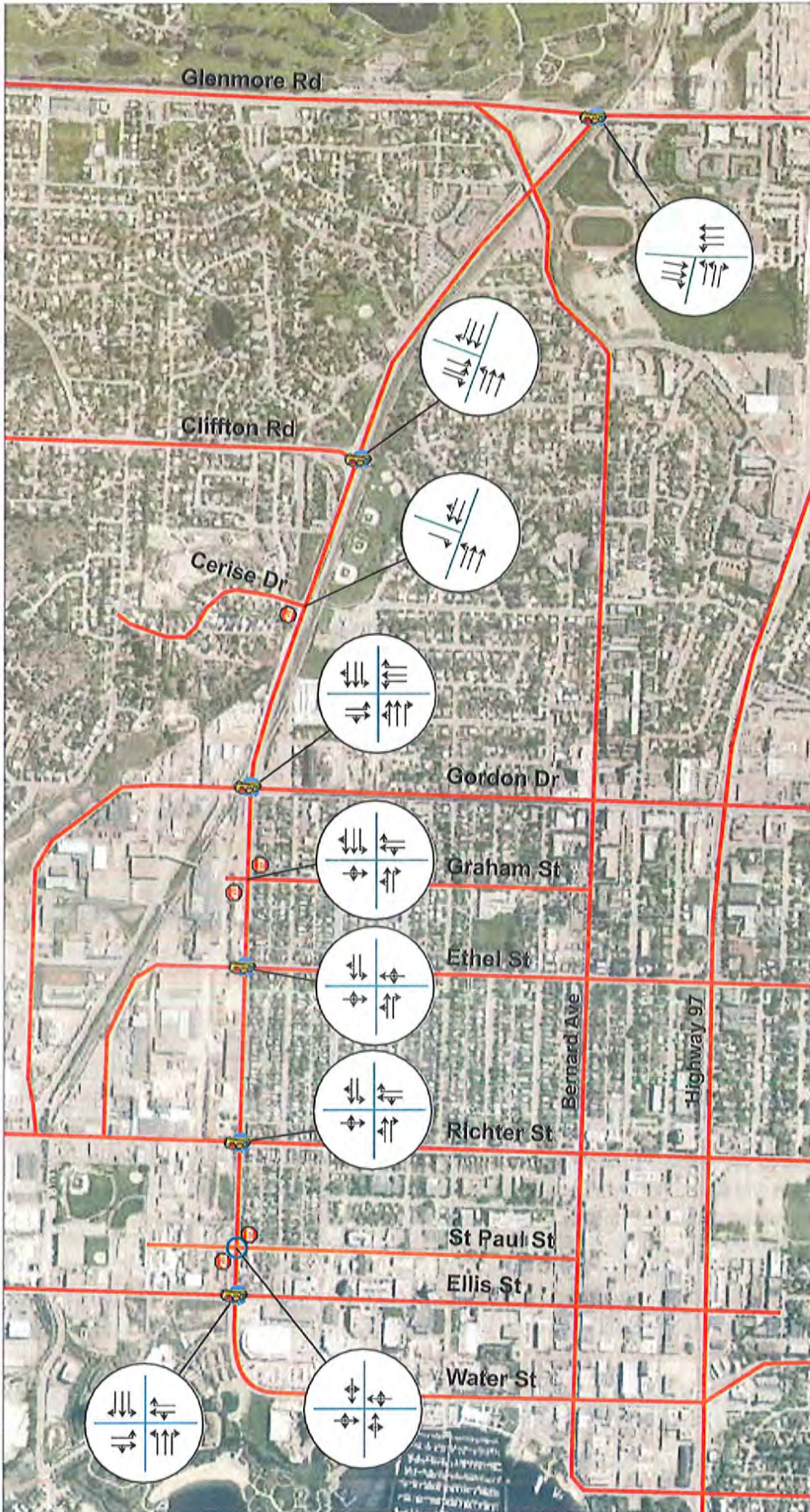
**Table 2. Pedestrian Facilities**

Street	Location	Sidewalks
Clement Avenue	East of St. Paul	South Side
Clement Avenue	West of St. Paul	Both Sides
Ellis Street		Both Sides
St. Paul Street	North of Clement Avenue	West Side
St. Paul Street	South of Clement Avenue	Both Sides
Richter Street	North of Clement Avenue	None
Richter Street	South of Clement Avenue	Both Sides
Ethel Street	North of Clement Avenue	None
Ethel Street	South of Clement Avenue	Both Sides

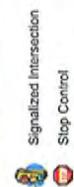
### 3.4 Bicycle Facilities

There are bicycle facilities provided on Richter Street and on Cawston Avenue. The next figure shows the existing bicycle facilities in the vicinity of the study area.





LEGEND



NOTES

CLIENT

City of Kelowna

RCMP Detachment - Phase II

Build Out Site Traffic Volumes

PROJECT NO.	DRAWN	CHECKED	APPROVED	REV
704-15120005-01	YT	MM	MM	0
OFFICE	DATE			
EBA-JA-NC	February 6, 2013			



STATUS  
ISSUED FOR REVIEW

Figure 2



Figure 3. Transit and Bicycle Facilities



### 3.5 Transit Services

The figure above also shows the transit routes in the vicinity of the RCMP development. The routes serving the site are:

- (a) **Route 2 – Downtown Connector:** This route runs between the Queensway Exchange in downtown Kelowna and Cambridge Avenue in the north end. It operates approximately every 30 minutes Monday to Saturday during the day, and hourly evenings and Sundays.
- (b) **Route #6 – Glenmore/UBCO Express:** This express route connects the Queensway Exchange to the UBC Okanagan Exchange. Service is provided during peak hours only: northbound in the a.m. peak hours and southbound in the p.m. peak hours plus one trip in the a.m. peak hour.
- (c) **Route #7 – Glenmore:** This route connects the Queensway Exchange to the Orchard Park Exchange via Union and Glenmore. Service is provided every 15 minutes during peak hours, 60 minutes evenings and Sundays and every 30 minutes at other times.

Since the proposed location is further away from the Queensway Exchange than today, any staff members using transit will likely use a bus to connect between the Queensway Exchange and the new site.

### 3.6 Background Volumes

The City provided its most recent traffic count data for all but one of the study intersections, and these volumes were used as the basis for this study. No traffic count data was available for the intersection of Clement Avenue/Cerise Drive, so turning movement traffic at this location was estimated based on projected volumes in the City's EMME model, as well as the traffic count data at adjacent intersections.

The City's recent traffic counts are the basis for the existing traffic volumes on the surrounding road network. Next, Kelowna's EMME Transportation Model was reviewed to establish growth rates which are in turn used to project future traffic volumes.



The resulting annual growth rate as determined through this methodology was 1.4% per year. This rate was used to factor up the most recent count data for the various intersections to the 2013 and to the 2030 values. The 2013 and 2030 volumes are shown in Figures 4 and 5 respectively.

### 3.7 Future Network Changes

The City has plans to widen Clement Avenue to a four lane road with centre median. As part of this widening, the north leg of St. Paul Street is to be restricted to right-in/right-out, while the south leg is to be right-in/right-out/left in. The Richter Street intersection will be upgraded to provide left turn lanes on both the north and south legs. The Ethel Street intersection will be signalized. At Graham Street, the existing movements from the north and south leg will be restricted to right turns. Bicycle lanes are to be provided along Clement Avenue on both sides.

Clement Avenue is to be extended eastwards to Highway 33 as the Central Okanagan Multi-Use Corridor (COMC). EMME results show only a small change in traffic volumes at the study area intersections as a result of this change. In the a.m. peak hour, the increase in traffic volumes along Clement Avenue is less than 100 vehicles per hour west of Gordon Drive and between 100 and 200 vehicles per hour between Gordon Drive and Spall Road. The volumes between Gordon Drive and Spall Road are higher in the p.m. peak hour at approximately 100 vehicles per hour westbound and 275 vehicles per hour eastbound.

### 3.8 Intersection Analysis

The calculation for Level of Service (LoS) at the key intersections follows the Highway Capacity Manual (HCM) method. For signalised intersections, the operational analysis methodology gives three indicators for the overall performance of an intersection and for the individual turning movements:

3. **First:** *volume to capacity ratio (v/c)* where the volume is the number of vehicles making a certain movement, and capacity is the maximum number of vehicles accommodated in one hour. This takes into account (for the movement): lanes available, protected or permitted operation, conflicting traffic, cycle length, and amount of green time. *The higher the v/c ratio, the more congested the intersection becomes.* When the v/c ratio is greater than 1.00, more vehicles are trying to make a given movement than there is capacity for.
4. **Second:** *average delay per vehicle*, based on the cycle length, the green time for each movement and the v/c ratios.
5. **Third:** level of service, as a function of average delay. The larger the average delay - and the higher the v/c ratio - the worse is the level of service. The next table shows the relationship between level of service, delay and v/c ratio.

As prescribed in the City's Terms of Reference, one of the objectives is to identify improvements for any movements exceeding v/c ratios of 0.90 for the 2017 horizon year and 1.00 for the 2030 horizon year, or a Level of Service F in both cases.











**Table 3. Intersection Level Of Service**

Level of Service (LoS)	Signalised Intersection	Delay criteria	Unsignalised Intersection
	Stopped Delay/Vehicle (s/veh)		Average. Total Delay (sec)
<b>A</b>	≤ 10	Little or no delays	≤ 10
<b>B</b>	> 10 and ≤ 20	Short traffic delays	> 10 and ≤ 15
<b>C</b>	> 20 and ≤ 35	Average traffic delays	>15 and ≤ 25
<b>D</b>	> 35 and ≤ 55	Long traffic delays	>25 and ≤ 35
<b>E</b>	> 55 and ≤ 80	Very long traffic delays	> 35 and ≤ 50
<b>F</b>	> 80	Failure	> 50

The HCM also prescribes the methodology for measuring performance of unsignalized intersections. The methodology estimates the capacity of each movement from the conflicting pedestrian and traffic volumes. The capacity less the actual volume is the *reserve capacity*. This represents the additional traffic volume each movement can accommodate, which determines the operational LoS for the movement.

While the level of service and delay for an unsignalized intersection provide a measure of overall performance, it is commonly specific turning movements which are of most interest. With only low turning volumes to or from the minor road, and high through volumes on the main road, delays to turning vehicles can become excessive. As delays increase, turning vehicles will attempt to turn across unacceptable gaps provoking conflicts.

We used the *Highway Capacity Manual* Operational Method, as implemented in Synchro 8, using the City's Synchro parameters, to analyse the key intersections under 2013, 2017, and 2030 background traffic conditions. The following table summarises the results. We can remark the following:

**Table 4. 2013 Background Traffic Conditions**

Intersection	a.m. peak hour		p.m. peak hour		Comments
	v/c	LoS	v/c	LoS	
Clement Avenue/Ellis Street	0.45	B	0.70	B	
Clement Avenue/St Paul Street	0.14	A	0.18	A	
Clement Avenue/Richter Street	0.53	B	0.82	B	
Clement Avenue/Ethel Street	0.52	A/F	1.02	B/F	
Clement Avenue/Graham Street	0.39	A	0.60	A/F	
Clement Avenue/Gordon Street	0.75	C	0.82	C	
Clement Avenue/Cerise Street	0.59	A	0.36	A	
Clement Avenue/Clifton Street	0.76	B	0.70	B	
Clement Avenue/Spall Street	0.79	B	0.93	C	
Doyle Avenue/Richter Street	0.20	A	0.49	A	
Stockwell Avenue/Richter Street	0.13	A	0.18	A	

v/c = maximum v/c ratio;

LoS = overall Level of Service.

Second letter indicates one or more movements individually operates at LoS F

**Table 5. 2030 Background Traffic Conditions**

Intersection	a.m. peak		p.m. peak		Comments
	v/c	LoS	v/c	LoS	
Clement Avenue/Ellis Street	0.57	B	0.87	C	
Clement Avenue/St Paul Street	0.21	A	0.28	A	
Clement Avenue/Richter Street	0.67	B	0.96	C	
Clement Avenue/Ethel Street	0.55	A/F	4.44	F	
Clement Avenue/Graham Street	0.49	A	0.58	A/F	
Clement Avenue/Gordon Drive	1.05	C	1.15	E/F	
	0.82	C	0.90	C	a.m.: signal timing changes p.m.: EB LT advance only
			0.93	D	Add eastbound right turn lane
Clement Avenue/Cerise Drive	0.65	A	0.45	A	
Clement Avenue/Clifton Road	0.88	B	0.92	B	
Clement Avenue/Spall Road	1.08	D	1.17	D/F	
	0.88	C	0.89	C	a.m.: timing changes p.m.: second northbound left turn lane
Doyle Avenue/Richter Street	0.28	A	0.70	B	
Stockwell Avenue/Richter Street	0.17	A	0.22	A	

v/c = maximum v/c ratio;

LoS = overall Level of Service.

Second letter indicates one or more movements individually operates at LoS F

## Opening Horizon Year

In the 2013 horizon year, almost all movements at the analyzed intersections are anticipated to operate with acceptable Levels of Service and v/c ratios. Exceptions are noted below.

- **Clement Avenue/Ethel Street:** In the a.m. peak hour the southbound movements are anticipated to operate at Level of Service F. In the p.m. peak hour the southbound movements operate at a v/c of greater than 1.00 and at Level of Service F, while in the northbound direction, movements operate at Level of Service F. Adding an additional southbound lane would reduce the v/c ratio, but would not improve the Level of Service due to the high volume of traffic on Clement Avenue. In addition, the southbound volumes are very small.
- **Clement Avenue/Graham Street:** The southbound movements at this intersection operate at Level of Service F in the p.m. peak hour. Given the low volume of such traffic, no improvements are recommended.

## 2030 Horizon Year

In the 2023 horizon year, almost all movements at the analyzed intersections are anticipated to operate with acceptable Levels of Service and v/c ratios. Exceptions are noted below.

- **Clement Avenue/Richter Street:** This intersection is anticipated to operate at a maximum v/c ratio of 0.96 in the p.m. peak hour, just below the 1.00 threshold.
- **Clement Avenue/Ethel Street:** In the p.m. peak hour the northbound and southbound movements operate at a v/c of greater than 1.00 and at Level of Service F, while in the a.m. peak hour, the northbound southbound



movements operate at Level of Service F, but with a v/c ratio of less than 1.00. Adding an additional southbound lane would reduce the v/c ratio, but would not improve the Level of Service due to the high volume of traffic on Clement Avenue.

- **Clement Avenue/Graham Street:** The northbound and southbound movements at this intersection operate at Level of Service F in the p.m. peak hour. Given the low volume of such traffic, no improvements are recommended.
- **Clement Avenue/Gordon Drive:** In the p.m. peak hour this intersection is anticipated to operate at a v/c ratio of 1.15. Retiming the signal and removing the westbound, northbound and southbound left turn phases would reduce the v/c ratio and Level of Service to acceptable levels. As an alternative, an eastbound right turn lane could be added. In the a.m. peak hour, timing adjustments would be sufficient to reduce the v/c ratios.
- **Clement Avenue/Spall Road:** This intersection is anticipated to operate over capacity in both peak hours. In the a.m. peak hours, signal timing changes will be sufficient to reduce the v/c ratio to less than 1.00, while in the p.m. peak hour a second northbound left turn lane will be needed.

In summary, at the 2030 horizon year, implementing signal phasing changes at Clement Avenue/Gordon Drive and a second northbound left turn lane at Clement Avenue/Spall Road will improve intersection operations so as to meet the City's threshold values.

### 3.9 Effect of Widening Clement Avenue

The intersection analysis results shown above did not take into account the widening of Clement Avenue to four lanes. If this occurs, then there will be considerable improvement in the v/c ratios at a number of intersections. The following table presents the 2030 results with the widening of Clement Avenue in place (including signal timing revisions) and key results are noted as follows:

**Table 6. 2030 Traffic Conditions – With Clement Improvements**

Intersection	v/c	LoS	v/c	LoS	Comments
Clement Avenue/St Paul Street	0.26	A	0.30	A	
Clement Avenue/Richter Street	0.35	A	0.63	B	
Clement Avenue/Ethel Street	0.56	A	0.57	A	Signal
Clement Avenue/Graham Street	0.49	A	0.50	A	

v/c = maximum v/c ratio;

LoS = overall Level of Service.

- **Clement Avenue/Richter Street:** The operation of this intersection would improve operations, reducing the v/c ratio to 0.35 in the a.m. peak hour and 0.63 in the p.m. peak hour.
- **Clement Avenue/Ethel Street:** With this intersection signalized, the v/c ratios will be reduced to 0.56 in the a.m. peak hour and 0.57 in the p.m. peak hour with all movements operating at Level of Service C or better, including those that are now currently stop controlled.
- **Clement Avenue/Graham Street:** At this intersection, the high delay left turn and through movements have been eliminated, thus the intersection is anticipated to operate well.

In summary, the proposed widening of Clement Avenue, and related changes, will improve intersection operations between Ellis Street and Gordon Drive such that no further improvements will be needed.



## 4 SITE TRAFFIC

The trip generation and distribution for site traffic was determined and documented in the Phase I report. For ease of reference, this is presented again in this section.

### 4.1 Overview of Development Plan

The development of the new RCMP detachment, just north of downtown Kelowna, has the following characteristics:

- Area: an 86,000 ft<sup>2</sup> (7,990 m<sup>2</sup>) site
- Other use: the possibility of adding a fire station or other municipal services to the site.
- Access: right-in / right-out turn on Clement Avenue, and all movements on Richter Street.

The Queensway transit exchange is located only a short distance away from the existing facility. The new RCMP building will be located approximately 900 metres, or an 11 minute walk, away from the exchange.

The facility will replace the existing facility located in downtown. Parking for current RCMP officers occurs both on the current Doyle Street site, as well as in adjacent municipal parking lots.

### 4.2 Trip Generation

Analysis of the traffic impacts from a new development is typically based on application of standard trip generation rates such as those published by the Institute of Transportation Engineers (ITE). This development is not a standard development that falls under an ITE category. The closest category that could apply is an *office building*.

As an office building, based on the ITE rates, the RCMP building would generate between 160 and 170 vehicles trips during the weekday peak hours, with trips being predominantly inbound in the morning and outbound in the afternoon. The peak time for trips in this category occurs between 7 and 9 a.m. and between 4 to 6 p.m.

The peak hours for the site are expected to be around 7 a.m., when most shifts start, and 3 p.m., when most shifts end. Thus the peak trip generation may not coincide with the street peak hours. This report presents the estimate for trip generation for the site's peak hours.

Staff at the RCMP detachment fall into three categories: Officers actively working in the field, Officers working primarily in the office, and Civilian/government employees.

Preliminary data provided by the City indicates that 228 staff will be based at this detachment during the peak shift in 2018, increasing to 279 in 2035.

**Table 7. Employee Breakdown**

Type	Shift Time	Staff (2018)	Staff (2035)
On Duty Officers (field)	6 a.m. to 6 p.m.	11	11
	7 a.m. to 7 p.m.	11	11
	6 p.m. to 5 a.m.	11	11
	7 p.m. to 6 a.m.	11	11
Other Officers	7 a.m. to 3 p.m.	102	130

Peak Shift Officers	7 a.m. to 3 p.m.	124	152
Office Staff	7 a.m. to 3 p.m.	104	127
<b>Total</b>	<b>7 a.m. to 3 p.m.</b>	<b>228</b>	<b>279</b>

Note: There may be some additional staff present outside the 7 to 3 peak hours.

There will be two 'watches' split into four general duty shifts: 6 a.m. to 6 p.m., 7 a.m. to 7 p.m., 6 p.m. to 5 a.m. and 7 p.m. to 6 a.m. On each of these shifts there are 11 officers. The shift that starts at 7 a.m. will generate two trips per officer, one as they arrive in their vehicle and the other as they leave in the police car. The remaining watches will generate only a small number of trips.

The majority of the staff works from 7 a.m. to 3 p.m. For trip generation purposes, for the remaining officers and staff, we applied a rate of 0.80 trips per person (a.m. peak) and 0.75 trips per person (p.m. peak). This accounts for some employees not driving, some arriving earlier or later than the peak hour, and some off sick or on holidays. The total number of officers on duty during the peak shift in 2018 will be approximately 124, increasing to 152 in 2030, including the remaining general duty officers. Other staff will amount to approximately 104 in 2018, increasing to 127 in 2035.

This study applies a combination of ITE rates and rates estimated from "first principals." These take into account the types and number of employees and their expected arrival and departure times. The next two tables summarize the trip generation for 2018 and 2035.

**Table 8. Trip Generation - 2018**

Staff	No of employees	a.m. peak hour					p.m. peak hour				
		Rate	%in	Total	In	Out	Rate	%in	Total	In	Out
<b>General Duty Shifts</b>											
- 700-1900	11	2.00	50	22	11	11	0.20	50	2	1	1
- 600-1800	11	0.20	50	2	1	1	0.20	50	2	1	1
- 1900-600	11	0.20	50	2	1	1	0.20	50	2	1	1
- 1800-500	11	0.20	50	2	1	1	0.20	50	2	1	1
<b>Other Officers</b>	102	0.80	89	82	73	9	0.75	15	77	11	65
<b>Other Staff</b>	104	0.80	89	83	74	9	0.75	15	78	12	66
<b>Total</b>	<b>356</b>			<b>193</b>	<b>161</b>	<b>32</b>			<b>163</b>	<b>28</b>	<b>136</b>

Note: Peak hours are approximately 6:30 to 7:30 a.m. and 2:30 to 3:30 p.m.

**Table 9. Trip Generation - 2035**

Direction	No of employees	a.m. peak hour					p.m. peak hour				
		Rate	%in	Total	In	Out	Rate	%in	Total	In	Out
<b>General Duty Shifts</b>											
- 700-1900	11	2.00	50	22	11	11	0.20	50	2	1	1
- 600-1800	11	0.20	50	2	1	1	0.20	50	2	1	1
- 1900-600	11	0.20	50	2	1	1	0.20	50	2	1	1
- 1800-500	11	0.20	50	2	1	1	0.20	50	2	1	1
<b>Other Officers</b>	130	0.80	89	104	93	11	0.75	15	98	15	83
<b>Other Staff</b>	127	0.80	89	102	90	116	0.75	15	95	14	81
<b>Total</b>	<b>288</b>			<b>234</b>	<b>197</b>	<b>37</b>			<b>202</b>	<b>33</b>	<b>168</b>

Note: Peak hours are approximately 6:30 to 7:30 a.m. and 2:30 to 3:30 p.m.



Overall, at build-out (2035) the development should generate 234 vehicle trips in the morning peak hour and 202 trips in the afternoon peak. Opening day trip generation (2018) should be 193 and 163 trips in the morning and afternoon peak hours respectively.

### 4.3 Trip Distribution

The trip distribution for the zone with the RCMP facility in the regional EMMÉ model provided the potential origin-destination structure of site traffic. This model contains assignments for both the a.m. and p.m. peak hours. The following table presents a summary of the results.

**Table 10. Trip Distribution**

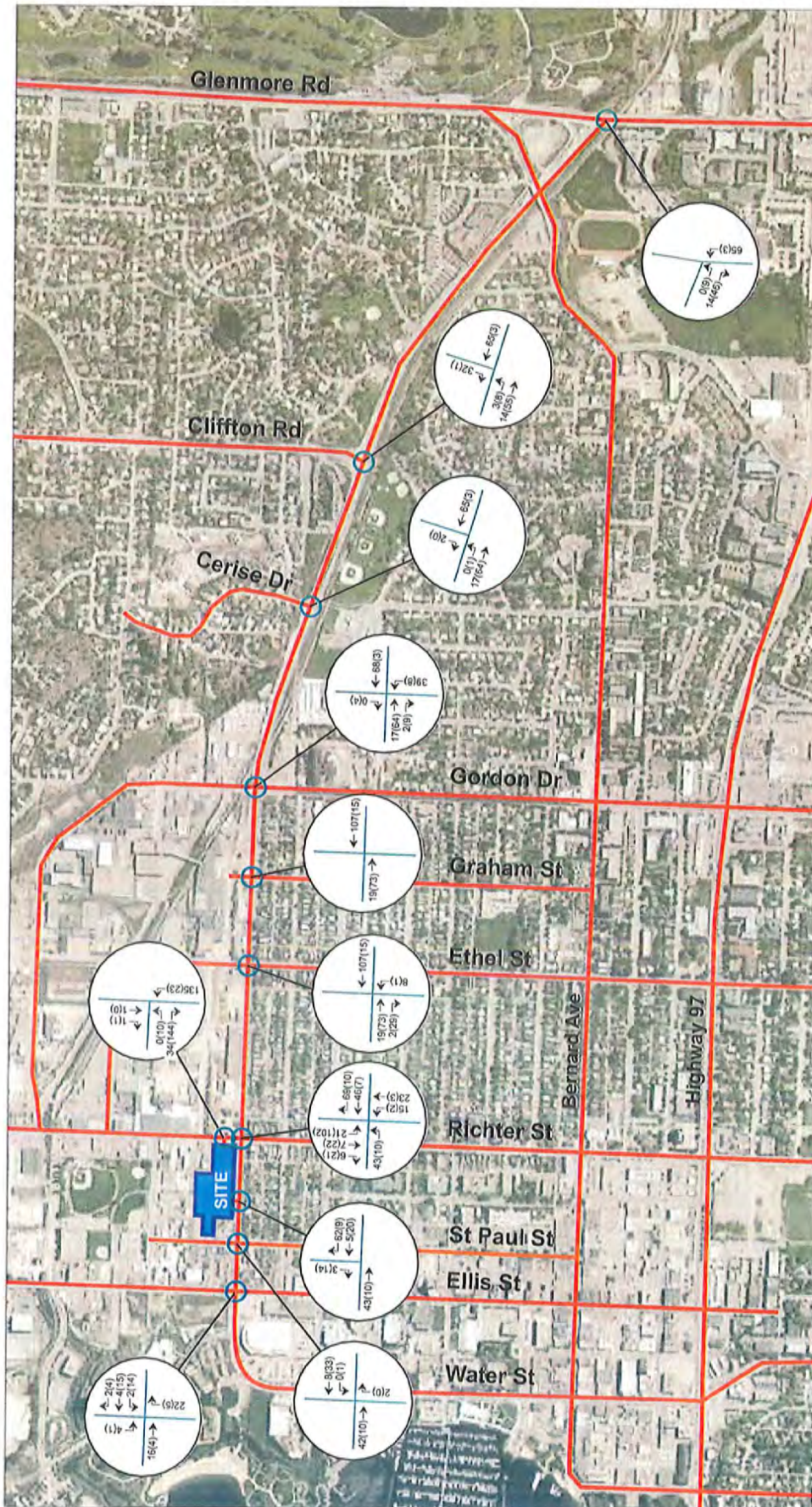
Direction	a.m. peak hour		p.m. peak hour	
	Inbound	Outbound	Inbound	Outbound
Clement West	8%	11%	12%	9%
Clement East	58%	57%	49%	61%
Ellis North	2%	6%	3%	2%
Ellis South	11%	6%	15%	8%
Richter North	1%	0%	3%	6%
Richter South	19%	20%	17%	13%
St. Paul South	1%	0%	1%	1%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>


The orientation of the majority of site traffic should be to and from the east. The next highest approach will be to and from the south (20-30%).

### 4.4 Trip Assignment

The above trip generation and distribution was applied to the site traffic and assigned to the road network, taking into account the proposed location access (see the next figure).





LEGEND	NOTES	CLIENT	City of Kelowna	RCMP Detachment - Phase II			
				Build Out Site Traffic Volumes			
				PROJECT NO. 705-V0120051-01	DRAWN MM	DATE March 2013	Figure 6
				OFFICE EBA-VANC	DATE March 2013		
XXX AM Peak Hour Traffic Volumes (XXX) PM Peak Hour Traffic Volumes	STATUS ISSUED FOR REVIEW	 EBA A TRAFFIC CONSULTING COMPANY					

The analysis does not make any specific reduction for the closing of the existing RCMP facility on Doyle Avenue. These results are, therefore, somewhat conservative as they include trips to and from that facility. When the RCMP moves out of the Doyle Avenue facility, either a new tenant may move in, or the site could be re-developed. In either case, there will be new trips replacing the RCMP trips.



## 5 SITE IMPACT ANALYSIS

### 5.1 Combined Traffic Volumes

The combined traffic volumes for the 2013 and 2030 horizon years come from superimposing the site traffic volume onto the background traffic volumes. The figures on the next pages illustrate the resulting combined traffic volumes for the two horizon years.

### 5.2 Combined Intersection Analysis

At this point the key intersections in the vicinity of the site required a new analysis under combined traffic conditions for the two horizon years. The tables below present the results with the following key findings:

**Table 11. 2013 Combined Traffic Conditions**

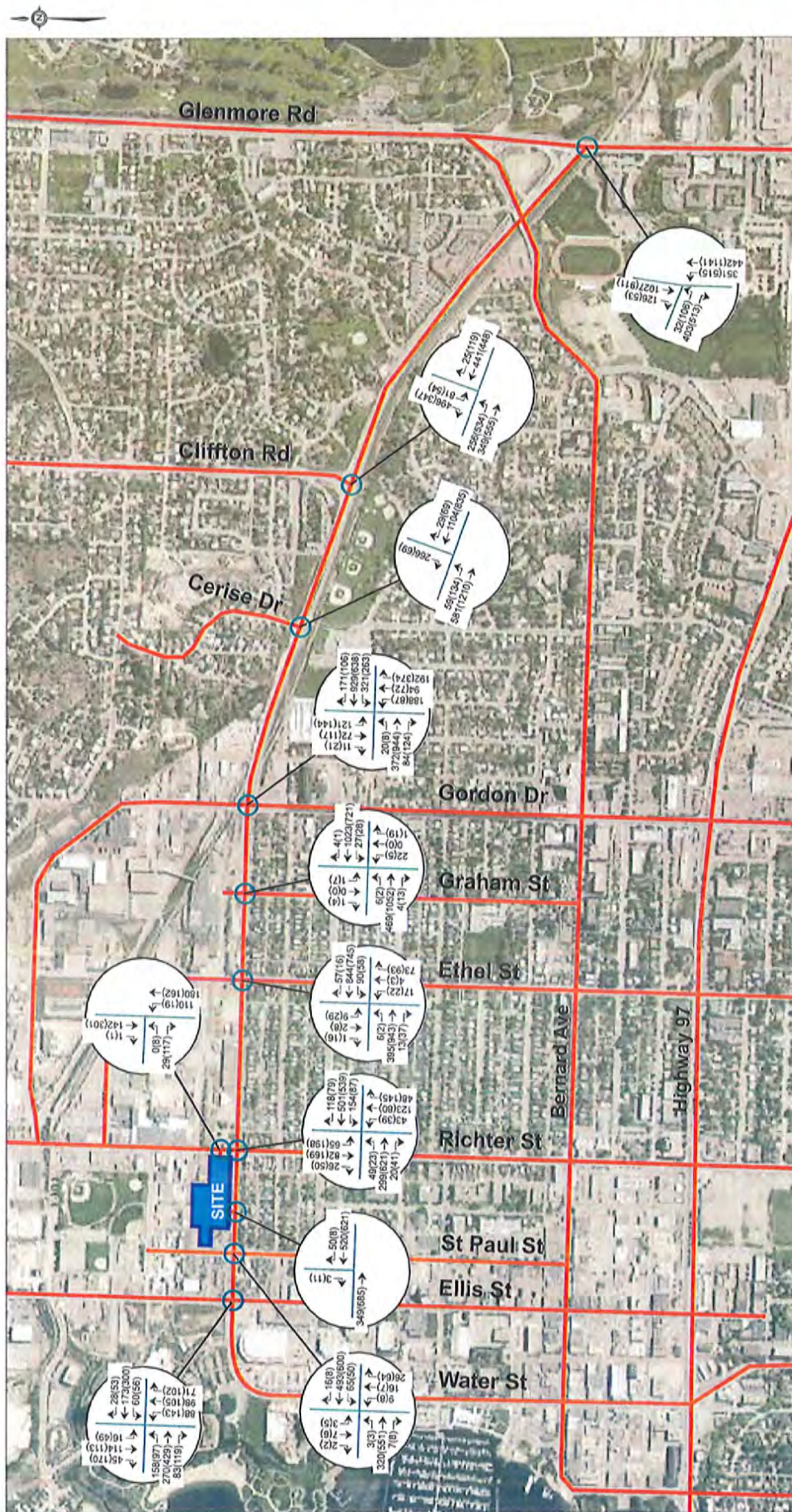
Intersection	a.m. peak		p.m. peak		Comments
	v/c	LoS	v/c	LoS	
Clement Avenue/Ellis Street	0.47	B	0.70	B	
Clement Avenue/St Paul Street	0.14	A	0.18	A	
Clement Avenue/Richter Street	0.67	B	1.08	C/F	
			0.87	C	Timing changes
Clement Avenue/Ethel Street	0.21	A/F	1.20	C/F	
Clement Avenue/Graham Street	0.42	A	0.64	A/F	
Clement Avenue/Gordon Drive	0.77	C	0.87	C	
Clement Avenue/Cerise Drive	0.56	A	0.37	A	
Clement Avenue/Clifton Road	0.77	B	0.70	B	
Clement Avenue/Spall Road	0.86	C	0.93	C	
			0.90	C	Timing changes
Doyle Avenue/Richter Street	0.21	A	0.50	A	
Stockwell Avenue/Richter Street	0.15	A	0.18	A	

v/c = maximum v/c ratio;

LoS = overall Level of Service.

Second letter indicates one or more movements individually operates at LoS F





# LEGEND

XXX AM Peak Hour Traffic Volumes  
 XXXX PM Peak Hour Traffic Volumes

## NOTES

STATUS  
 ISSUED FOR REVIEW

## CLIENT

City of Kelowna

## RCMP Detachment - Phase II

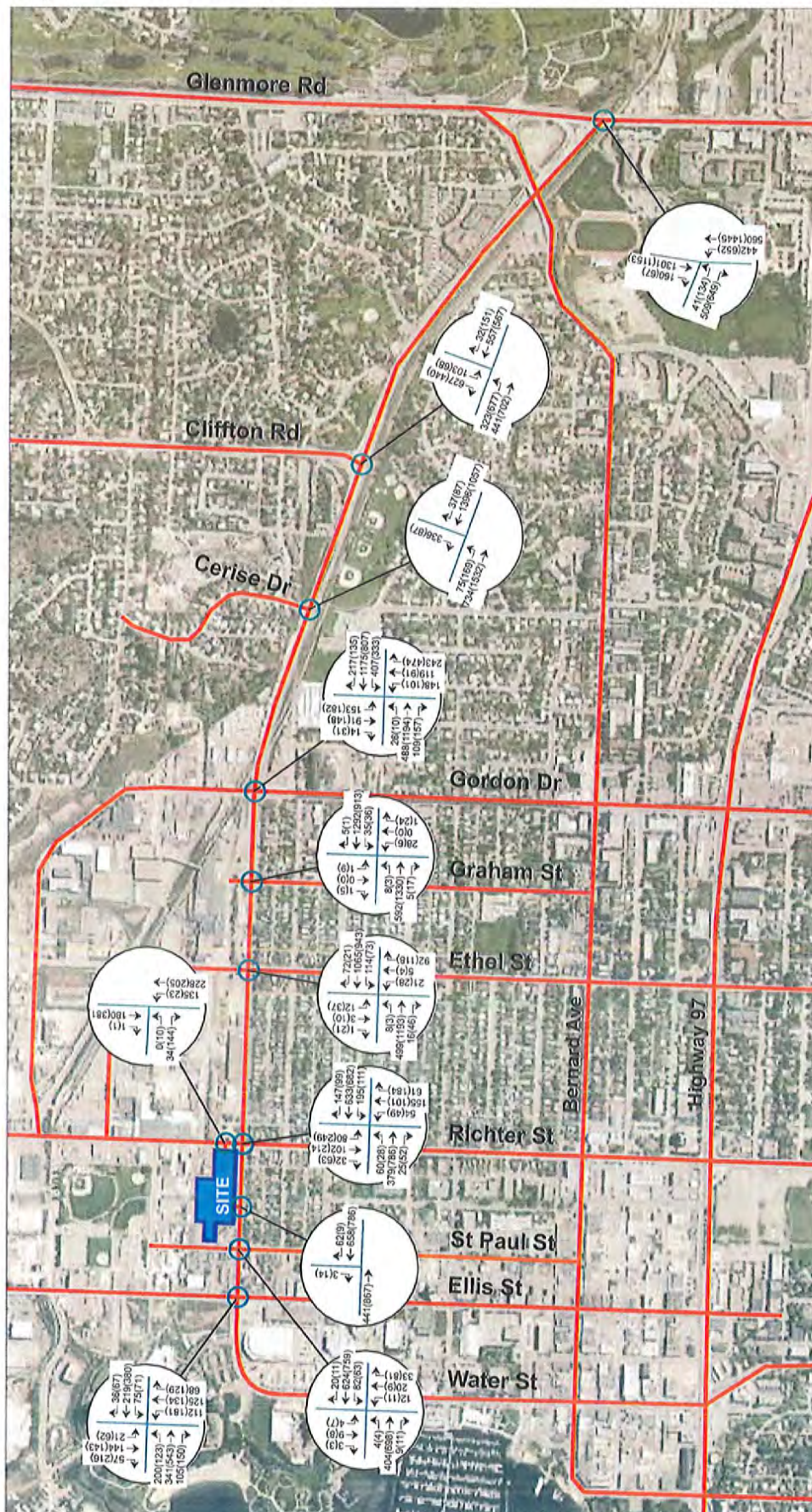
## 2013 Combined Traffic Volumes



PROJECT NO.	704-V012005-01
OWN	CD
YR	MM
REV	MM
DATE	March 2013
OFFICE	EEA-VANC

Figure 7





# LEGEND

XXX AM Peak Hour Traffic Volumes  
XXX PM Peak Hour Traffic Volumes

## NOTES

ISSUED FOR REVIEW

City of Kelowna

RCMP Detachment - Phase II

2030 Combined Traffic Volumes

Figure 8

PROJECT NO.	DWN	CAD	APVD	REV
704-V3120305-01	Y	M	M	0
DATE	OFFICE	DATE	OFFICE	DATE
March 2013	EBA-VANC	March 2013	EBA-VANC	March 2013



EBA  
A TETRA TECH COMPANY



**Table 12. 2030 Combined Traffic Conditions**

Intersection	a.m. peak		p.m. peak		Comments
	v/c	LoS	v/c	LoS	
Clement Avenue/Ellis Street	0.57	B	0.88	C	
Clement Avenue/St Paul Street	0.22	A	0.29	A	
Clement Avenue /Richter Street	0.82	B	1.39	E	
			0.94	D	NBL, SBL, SB ADV
Clement Avenue /Ethel Street	0.87	A/F	6.07	F	
Clement Avenue /Graham Street	0.53	A	0.81	A/F	
Clement Avenue /Gordon Drive	1.05	D	1.22	E/F	
	0.86	C	0.91	C	a.m.: signal timing revisions; p.m.: signal timing revisions and phasing changes
			0.98	D	Add eastbound right turn lane, no phasing changes
Clement Avenue /Cerise Drive	0.58	A	0.47	A	
Clement Avenue /Clifton Road	0.91	B	0.93	B	
Clement Avenue /Spall Road	1.08	D	1.17	D/F	
	0.89	C	0.99	C	a.m.: signal timing changes p.m.: Add second northbound left turn lane
Doyle Avenue /Richter Street	0.28	A	0.74	E	
Stockwell Avenue/Richter Street	0.19	A	0.23	C	

v/c = maximum v/c ratio;

LoS = overall Level of Service.

Second letter indicates one or more movements individually operate at LoS F.

## Opening Year Analysis

- **Clement Avenue/Richter Street:** In the p.m. peak hour, the critical movements are anticipated to be the southbound movements. Signal timing changes can reduce the v/c ratio to less than 0.90.
- **Clement Avenue/Ethel Street:** As with background traffic conditions, the northbound and southbound movements will operate at Level of Service F, with the southbound movements operating over capacity. Providing additional lanes will increase capacity, but would not reduce delays to an acceptable level. The volume of through and left turns from the site street are relatively low.
- **Clement Avenue/Graham Street:** As with background traffic conditions, the southbound movement is anticipated to operate at Level of Service F in the p.m. peak hour. Due to the low volume of traffic making this movement, no improvements are recommended.
- **Clement Avenue/Spall Road:** Using the existing signal timings, the v/c ratio is anticipated to reach 0.93 in the p.m. peak hour. Minor signal timing changes could reduce this to 0.90.

In summary, implementing signal timing changes at selected intersections at the 2013 horizon year will improve operations to as to meet the City's thresholds.

## 2030 Combined Results

For the 2030 horizon the target v/c ratio is increased to 1.00.

- **Clement Avenue/Richter Street:** This intersection is anticipated to operate at a maximum v/c ratio of 1.39 in the p.m. peak hour. Adding a southbound left turn lane and reconfiguring the south leg to provide a left turn lane along with a shared through and right turn lane would reduce the v/c ratio to 0.94.
- **Clement Avenue/Ethel Street:** In the p.m. peak hour the northbound and southbound movements operate at a v/c of greater than 1.00 and at Level of Service F. As with background conditions, providing an additional southbound lane would reduce the v/c ratio, but would not improve the Level of Service due to the high volume of traffic on Clement Avenue.
- **Clement Avenue/Graham Street:** The northbound and southbound movements at this intersection operate at Level of Service F in the p.m. peak hour. Given the low volume of such traffic, no improvements are recommended.
- **Clement Avenue/Gordon Drive:** In the p.m. peak hour this intersection is anticipated to operate at a v/c ratio of 1.15. As with background conditions, retiming the signal and removing the westbound, northbound and southbound left turn phases would reduce the v/c ratio and Level of Service to acceptable levels. An alternative would be to provide an eastbound right turn lane. In the a.m. peak hour, timing adjustments would be sufficient to reduce the v/c ratios.
- **Clement Avenue/Spall Road:** This intersection is anticipated to operate over capacity in both peak hours. In the a.m. peak hours, signal timing changes will be sufficient to reduce the v/c ratio to less than 0.90, while in the p.m. peak hour a second northbound left turn lane will be needed.

In summary, at all but three intersections, no more than signal timing changes will be needed. At Clement Avenue/Richter Street adding northbound and southbound left turn lanes, along with a southbound left turn phase will be needed if Clement Avenue is not widened. At the intersection of Clement Avenue/Spall Road a second northbound left turn lane will be required, while at Clement Avenue/Gordon Drive either signal phasing changes will need to be made or an eastbound right turn lane added. With these changes, the City's thresholds will be met.

### 5.3 Effect of Widening Clement Avenue

The results presented above do not take into account the potential widening for Clement Avenue. Results with this widening in place will be improved. The following table presents the results, and key results are summarized below.

**Table 13. 2030 Combined Traffic Conditions – With Clement Improvements**

Intersection	a.m. peak		p.m. peak		Comments
	v/c	LoS	v/c	LoS	
Clement Avenue/St Paul Street	0.26	A	0.31	A	
Clement Avenue/Richter Street	0.40	A	0.73	B	
Clement Avenue/Ethel Street	0.61	A	0.73	B	Signal
Clement Avenue/Graham Street	0.53	A	0.53	A	

v/c = maximum v/c ratio;

LoS = overall Level of Service.

Second letter indicates one or more movements individually operates at LoS F



- Clement Avenue/Richter Street: With the proposed improvement in place this intersection is projected to operate at a v/c ratio of 0.65 and at Level of Service B in the p.m. peak hour. No further improvements will be needed.
- Clement Avenue/Ethel Street: With the widening of Clement Avenue through this intersection and its signalization, the v/c ratio will be improved to 0.73 in the p.m. peak hour with a Level of Service B.
- Clement Avenue/Graham Street: With Clement Avenue widened, and the left turn and through movements restricted, operations will be improved, with the intersection operating at a v/c ratio of 0.53.

In summary, with the Clement Avenue upgrades in place, the operations at the intersections between Ellis Street and Gordon Drive such that no further improvements will be needed.



## 6 SITE ACCESS

### 6.1 Site Access Review

The City is planning to upgrade Clement Avenue in the future to a four lane divided road. With this upgrade, the site access to Clement Avenue will be restricted to right-in/right-out due to the planned median on Clement Avenue. This access will operate well through to the 2030 horizon with this configuration. A magazine storage length of 15 metres will be needed along with a single entrance lane and a single exit lane.

At the main Richter Street access, a magazine storage length of 23 metres is needed due to the higher volume of traffic entering and exiting here; however, a single entrance and exit lane can serve the projected traffic.

### 6.2 Safety

Transportation Association of Canada (TAC) guidelines recommend the minimum distances between accesses and signalized intersections. For Clement Avenue, an arterial road, a clearance distance of 70 metres is needed between Richter Avenue and the site access. The site access point should be located east of the taper for the proposed westbound to southbound left turn lane on Clement Avenue at St. Paul Street.

To provide for good traffic flow and clearance to the Clement Avenue intersection, the Richter Avenue access should be located opposite Vaughan Avenue. This will provide the clearance needed to Clement Avenue – 55 metres based on TAC – while limiting conflicts with traffic turning in and out of Vaughan Avenue.

Once a site plan has been established, the recommendations in this section should be reviewed.

## 7 TRANSIT ACCESS

### 7.1 Transit Service Review

Transit services were reviewed as part of Phase I of this project. Details of the existing transit services are provided above. The following presents a summary of these results as they pertain to RCMP trips.

Since the proposed location is further away from the Queensway Exchange, any staff members using transit will likely use a bus to connect between the Queensway Exchange and the new site.

- The first #2 North End Shuttle bus of the day – the nearest route to the site – leaves the downtown Queensway Exchange at 7:31 a.m., making it inconvenient for those arriving for start times earlier than 8 a.m. For officers finishing at 5 a.m. or 6 a.m., there would be a considerable wait for this bus.
- Routes #6 and #7 stop at Richter Street/Cawston Street to the south of the site and provide a connection to the Queensway exchange in downtown Kelowna.
- On Route #6, the first trip leaves downtown at 6:25 a.m., while the first route #7 trip leaves at 6:53 a.m., probably too late for a 7 a.m. start.
- Connections to these services at the Queensway Exchange are only possible from some routes, depending on their arrival times. Four routes provide a connection with the #6 or #7 and four routes do not.

### 7.2 Transit Access Review

As noted in the Phase I report, accessing the site via transit can be difficult due to the fact that shift changes for RCMP officers occur before the typical a.m. peak hour. Consideration should be given to providing both earlier service to Queensway Exchange, which would benefit RCMP as well as other downtown uses, and providing earlier service on Routes #2, the North End Shuttle to serve these early arrivals and departures by providing a connection between the Queensway Exchange and the site. This is a relatively short route compared to routes #6, and #7, so providing an additional trip would not be as onerous.

## 8 PEDESTRIAN AND BICYCLE ACCESS

### 8.1 Pedestrian Facilities Review

It is important that pedestrians travelling to and from the site are provided with good facilities so that they can safely access the site. In addition, good facilities will make it not only safe, but desirable, to walk to and from the site.

In order to provide access to adjacent pedestrian facilities, sidewalks will be needed along the Clement Avenue and Richter Street frontages of the site. This would provide a connection to the existing sidewalk on the north side of Clement Avenue west of St. Paul Street, which in turn connects to the signalized intersection of Clement Avenue/Ellis Street where crosswalks are provided across all four legs. On Ellis Street, there are sidewalks on both sides as there are on Richter Street south of Clement Avenue.

For pedestrians connecting to bus services, route #2 can be accessed at the Clement Avenue/Ellis Street intersection, while Routes #6 and #7 can be accessed via the sidewalks on Richter Street to connect to these services at Cawston Avenue.

### 8.2 Bicycle Facilities Review

The site is currently served with good bicycle routes, namely Richter Street in the north-south direction adjacent to the site, and Cawston Avenue, in the east-west direction south of the site. The proposed upgrading of Clement Avenue to a four lane road will include bicycle lanes passing in front of the site. These three routes combined will provide good access to the development.

Our Phase I Report provided recommendations regarding on-site bicycle facilities and end of trip facilities. Ten Class I spaces at opening year and 12 Class I spaces at build out are needed for the development. End of trip facilities such as lockers and showers would also be needed to encourage bicycle usage.



## 9 CONCLUSIONS & RECOMMENDATIONS

Based on the various analyses, our conclusions and recommendations are as follows:

### 9.1 Background Conditions

- Clement Avenue/Ethel Street: With no Clement Avenue upgrades the Ethel Street traffic is anticipated to operate at Level of Service F by 2030. In the short term, due to the low volume of traffic making these movements, no changes are recommended. With the planned upgrade of Clement Avenue and the signalization of the intersection, this problem will be solved.
- Clement Avenue/Graham Street: The Graham Street movements at this intersection operate at Level of Service F in both peak hours by 2030. Given the low volume of such traffic, no improvements are recommended. With the proposed Clement Avenue upgrade, Graham Street traffic will be restricted to right out, thus reducing the delays.
- Clement Avenue/Gordon Drive: In the 2030 p.m. peak hour this intersection is anticipated to operate at a v/c ratio of 1.15. Retiming the signal and removing the westbound, northbound and southbound left turn phases would reduce the v/c ratio and Level of Service to acceptable levels as would adding an eastbound right turn lane.
- Clement Avenue/Spall Road: This intersection is anticipated to operate over capacity in both peak hours. A second northbound left turn lane would be needed by 2030 to improve the intersection's operations.
- Other Intersections: As the remaining intersections are anticipated to operate well, no improvements are required.

### 9.2 Site Traffic

- Based on a review of the various components of the site, at build out the site will generate 234 vehicles trips in the a.m. peak hour and 202 vehicle trips in the p.m. peak hour. Details of the trip generation were provided in the Phase I report.

### 9.3 Combined Traffic Conditions

- Clement Avenue/Richter Street: This intersection is anticipated to operate at a maximum v/c ratio of 1.39 in the p.m. peak hour of 2030. Adding a southbound left turn lane and reconfiguring the south leg to provide a left turn lane along with a shared through and right turn lane would reduce the v/c ratio to 0.94. The planned upgrades to Clement Avenue, which include the noted left turn lanes, would also improve intersection operation to below the threshold levels.
- Clement Avenue/Ethel Street: In the p.m. peak hour the northbound and southbound movements are projected to operate at a v/c of greater than 1.00 and at Level of Service F. The proposed upgrading of Clement Avenue and signalization of this intersection would improve this intersection's operations significantly.
- Clement Avenue/Graham Street: The northbound and southbound movements at this intersection operate at Level of Service F in the p.m. peak hour. Once the Clement Avenue improvements are in place, including the restriction of movements, these high delays will be rectified.
- Clement Avenue/Gordon Drive: In the p.m. peak hour this intersection is anticipated to operate at a v/c ratio of 1.15. As with background conditions timing the signal and removing the westbound, northbound and

southbound left turn phases would reduce the v/c ratio and Level of Service to acceptable levels. An alternative would be to provide an eastbound right turn lane.

- **Clement Avenue/Spall Road:** This intersection is anticipated to operate over capacity in both peak hours. In the a.m. peak hours, signal timing changes will be sufficient to improve operations while in the p.m. peak hour a second northbound left turn lane will be needed.

#### 9.4 Site Access

- At the Clement Avenue and Richter Avenue site access points, one entrance lane and one exit lane should be provided. The Clement Avenue access will be restricted to right-in/right out.
- A magazine storage length of 15 metres should be provided at the Clement Avenue access and 23 metres at the Richter Avenue access.
- The Clement Access should be located east of the proposed westbound to southbound left turn lane and taper at St. Paul Street and at least 70 metres west of Richter Street.
- The Richter Avenue Access should be located opposite Vaughan Avenue.

#### 9.5 Transit Access

- Consideration should be given to providing an earlier #2 North End Shuttle trip to serve early morning arrivals and departures. Additional early service on other routes to Queensway exchange would benefit RCMP employees and downtown employees.

#### 9.6 Pedestrian and Bicycle Access

- In order to provide access to adjacent pedestrian facilities, sidewalks will be needed along the Clement Avenue and Richter Street frontages of the site. This would provide a connection to the existing sidewalk on the north side of Clement Avenue west of St. Paul Street, which in turn connects to the signalized intersection of Clement Avenue/Ellis Street where crosswalks are provided across all four legs.
- The site is currently served with good bicycle routes, namely Richter Street in the north-south direction adjacent to the site, and Cawston Avenue, in the east-west direction south of the site. The proposed upgrading of Clement Avenue to a four lane road will include bicycle lanes passing in front of the site.
- Our Phase I Report recommended ten Class I bicycle spaces at opening year and 12 Class I spaces at build out in addition to end of trip facilities such as lockers and showers.



## 10 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Sincerely,

EBA Engineering Consultants Ltd.

Prepared by:

Reviewed by:

**Issued for Review**

**Issued for Review**

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# APPENDIX A

## EBA GENERAL CONDITIONS

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# GENERAL CONDITIONS

## TRAFFIC/TRANSPORTATION REPORT

This Traffic/Transportation Report incorporates and is subject to these "General Conditions".

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### 1.0 USE OF REPORT AND OWNERSHIP

This Traffic/Transportation Report pertains to a specific site, a specific development, and a specific scope of work. The Traffic/Transportation Report may include plans, drawings, profiles and other support documents that collectively constitute the Traffic/Transportation Report. The Report and all supporting documents are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, analyses or other contents of the Traffic/Transportation Report when it is used or relied upon by any party other than EBA's Client, unless authorized in writing by EBA. Any unauthorized use of the Traffic/Transportation Report is at the sole risk of the user.

All reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

### 2.0 ALTERNATIVE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

### 3.0 INFORMATION PROVIDED TO EBA BY OTHERS

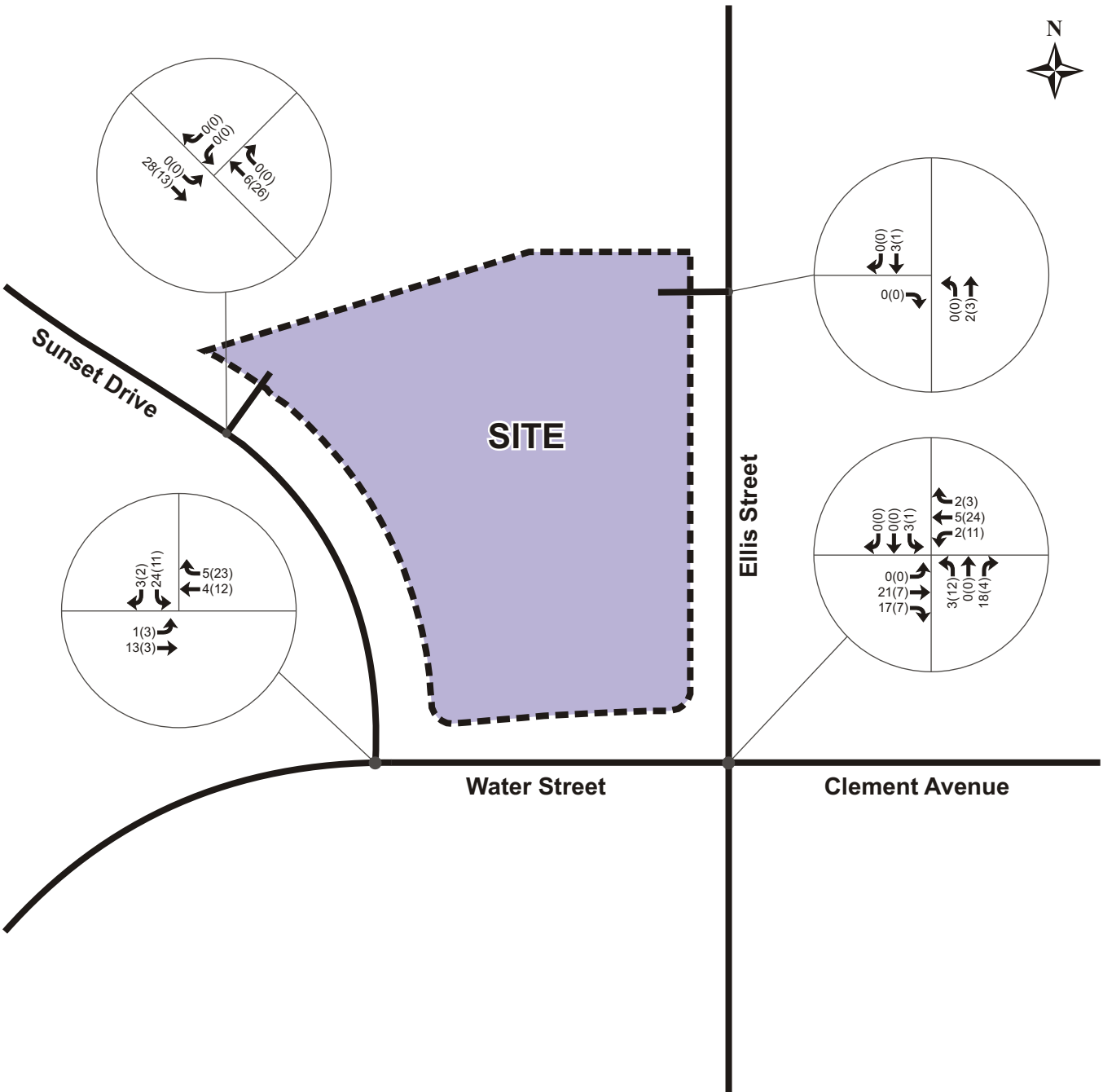
During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.



# APPENDIX H

## Background Development Site Trips





**LEGEND**

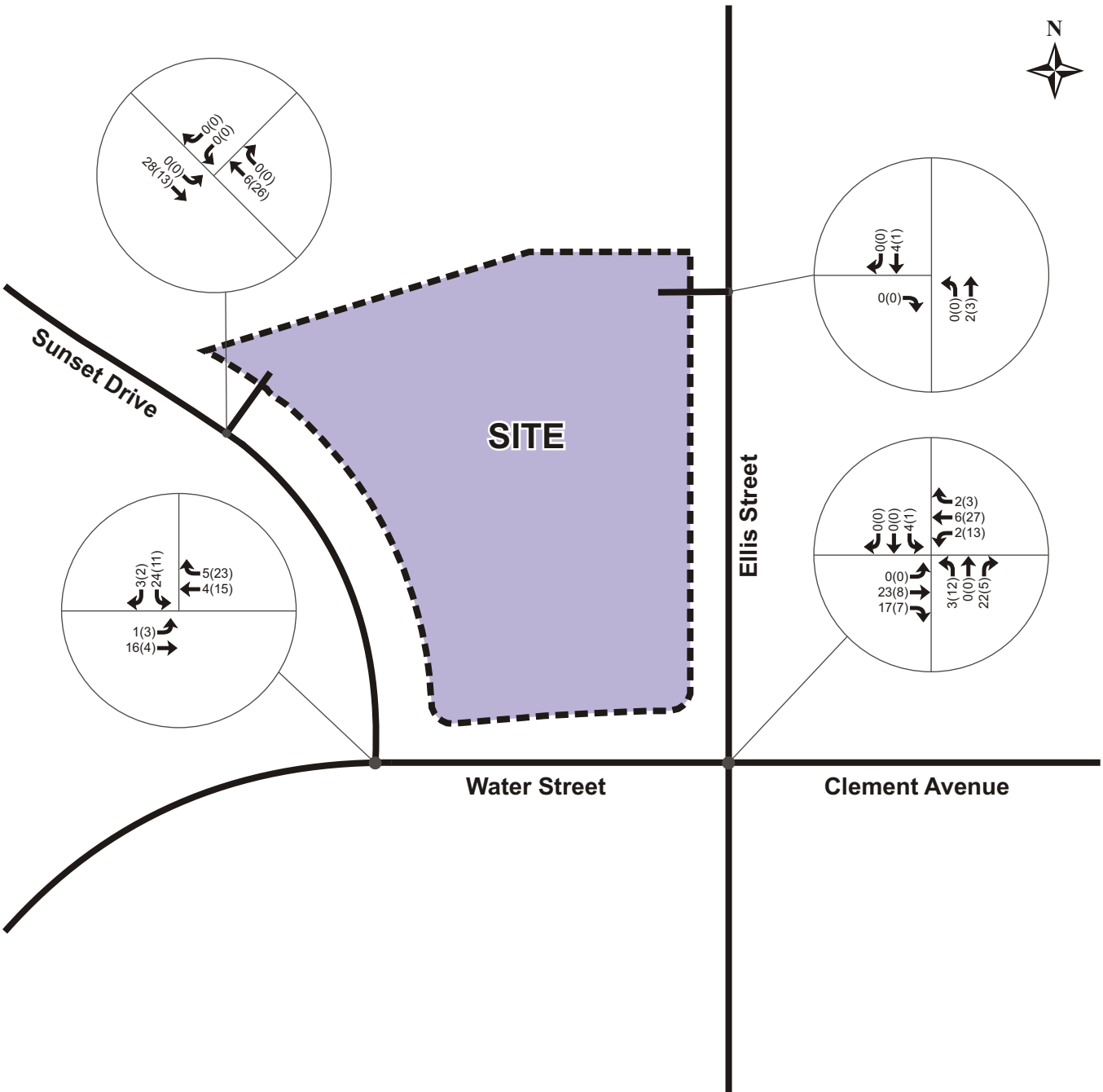
↶ ↷ ↸ Vehicle Volumes

XX AM Peak Hour

(ZZ) PM Peak Hour

Appendix H.1  
Background 2020 Development Trips





### LEGEND

↶ ↷ ↸ Vehicle Volumes

XX AM Peak Hour

(ZZ) PM Peak Hour

## Appendix H.2 Background 2030 Development Trips

