

**Project No.** 0362021

**Date:** 10-Nov-20

**To:**

Gideon Genade  
Principal Town Planner  
Gideon Town Planning  
[gg@gideontownplanning.com.au](mailto:gg@gideontownplanning.com.au)

**From:**

Chris Hewitt  
Principal Civil Engineer  
McMurtrie Consulting Engineers  
[chris@mcmengineers.com](mailto:chris@mcmengineers.com)

**Re:** **Traffic Advice – Proposed Coffee Drive-Through Establishment**

---

## 1. INTRODUCTION

McMurtrie Consulting Engineers (MCE) has been engaged by Kele Property Group to undertake an investigation of traffic impacts related to the proposed Coffee Drive-Through Establishment – located at 40,42 and 44 Albert Street, Rockhampton City, QLD 4701.

## 2. BACKGROUND

The site is located on the north western corner of the George Street and Albert Street intersection and described as Lot 1,2 and 3 on RP 602012.

The use for the site is for a Coffee Drive -Through.

The closest intersection is at George Street and Albert Street and this intersection is under the jurisdiction of the Department of Transport and Main Roads (DTMR) and the latest traffic counts provided by DTMR are from 2013. These counts have been included as **Attachment 1**. The sites frontages of George Street and Albert Street are under the control of the Rockhampton Regional Council (RRC).

**Figure 1** below shows the development site location.

**PLANS AND DOCUMENTS  
referred to in the REFERRAL  
AGENCY RESPONSE**



**SARA ref:** 2011-19864 SRA .....

**Date:** 21 December 2020 .....



Figure 1 Development Site Location Lot 1,2 and 3 on RP 602012

### 3. SITE OPERATION AND EXISTING SITUATION

The proposed site currently provides for 3 individual private residences and provides for 3 access crossovers to Albert Street and 1 access crossover to George Street. The proposed site layout, as included as **Attachment 2** and shown in **Figure 2** below, maintains a single left in only ingress from George Street and removes the 3 individual access points from Albert Street and replaces it with a left out only egress (main site egress) as far as possible from the George Street/Albert Street traffic signals.

The main site ingress is proposed via George Lane – noting George Lane is currently left in/left out only and the development proposal also proposes a right turn in from Albert Street via a proposed median break on Albert Street. Such a median break with access to George Lane is concurrent with similar treatments at Archer, Fitzroy and Denham Streets although this proposed use will generate significantly lower traffic volumes than the fast food uses at these 3 streets.

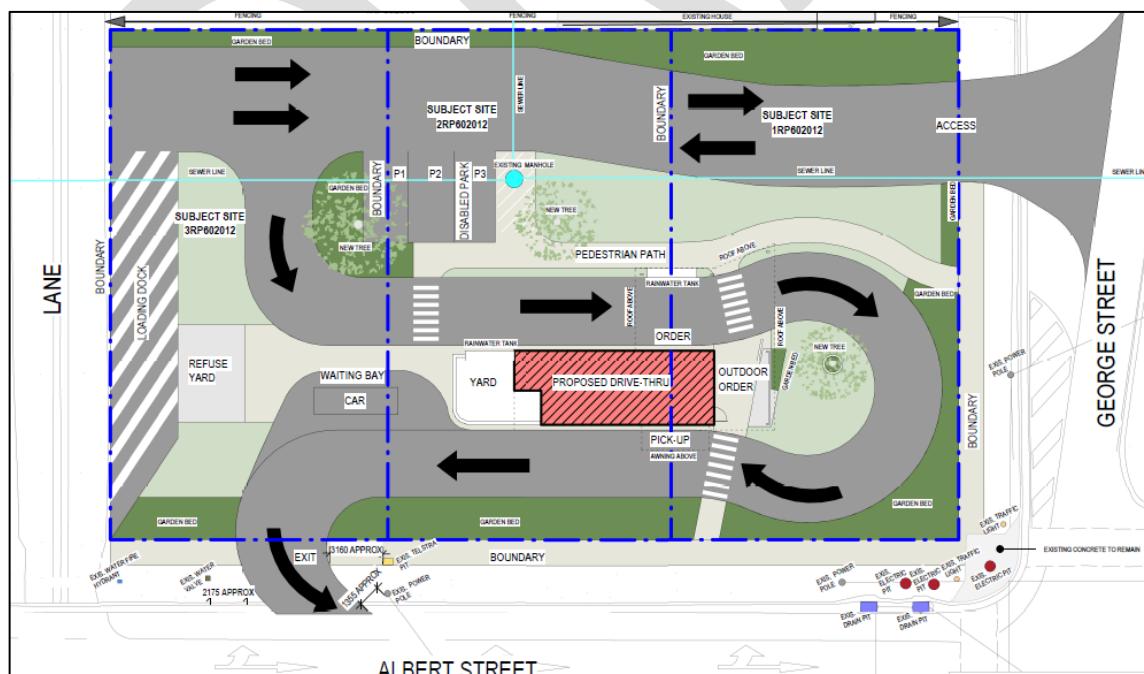


Figure 2 Proposed Development Carpark and Access Layout

#### 4. DEVELOPMENT VOLUMES AND NETWORK ASSIGNMENT

The new proposed use is for a drive through coffee shop.

Drive through coffee is not comprehensively covered in terms of generation rates in either the DTMTR Road Planning and Design Manual (RPDM) or the Road and Transport Authority (RTA) Guide to Traffic Generation.

The ITE Common Trip Generation Rates Manual (10<sup>th</sup> Edition) recommends a peak hour generation of 83.33 trips/1000SF for a coffee/donut shop with drive through and no seating. It also states that a passby trip reduction of 60% is attributable to this rate. This equates to a peak rate of 90 vehicles/100m<sup>2</sup> GFA for access with a 60% reduction for additional development traffic on the network.

The proposed development is for 49m<sup>2</sup> so peak hour development generation equates to 44 vph accessing site and an additional 18 vph on the network. When compared to the existing land uses which could generate up to 3 vph it takes the additional peak hour traffic on the network as a result of the development to only 15 vph. At these volumes the impact upon the operation of the George Street/Albert Street signalised intersection will be entirely negligible when compared to existing hourly volumes. The site accesses however will require assessment.

Network assignment of development traffic and peak hour volumes are as per **Figure 3** below and background volumes are as per **Attachment 1** inflated at an extremely conservative 3% compound growth rate from 2013 to the 10 year design horizon of 2031. We have assumed 22vph in and 22vph out for the peak hour development traffic movements.

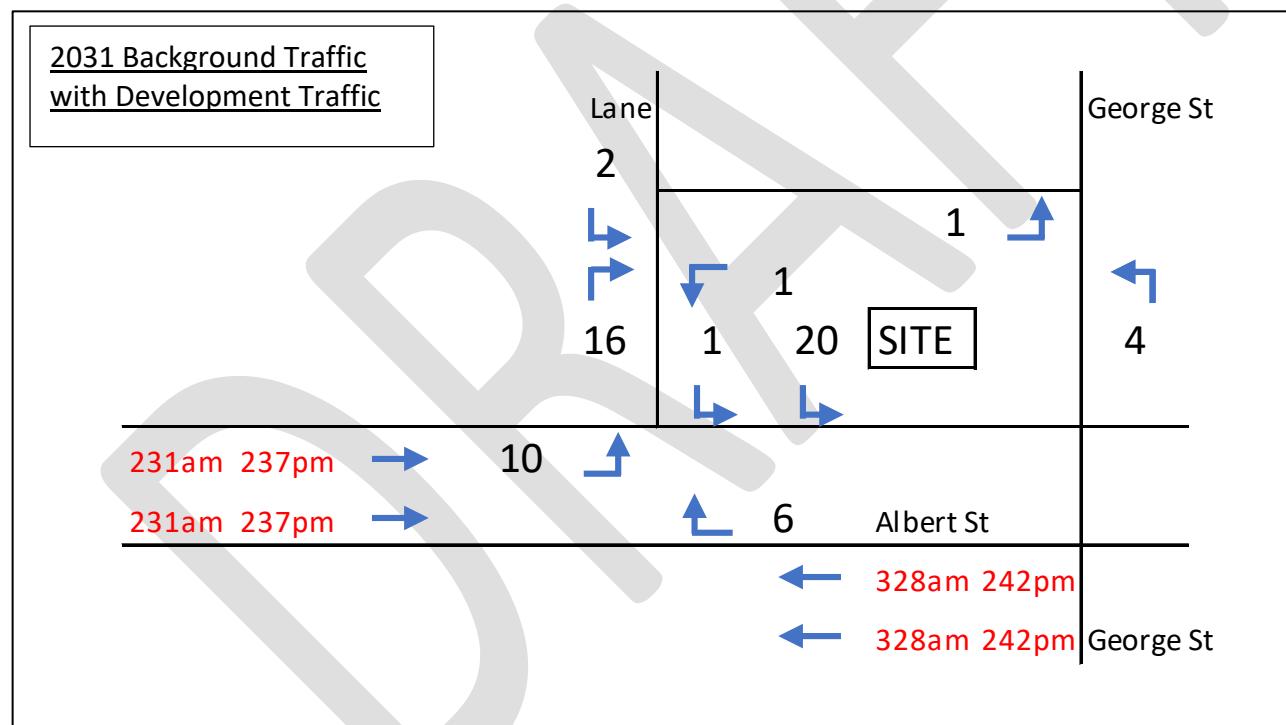


Figure 3 Network Assignment and Peak Volumes at Site Accesses for 2031 Design Year

#### 5. SITE ACCESS ASSESSMENT

Based on these low peak hour development traffic volumes the only significant movements are the left and right turn access to George Lane from Albert Street.

Based on **Figure 4** below the left and right turn access to George Lane from Albert Street operate comfortably as a BAL and CHR(s) configurations at the 10 year design horizon. A CHR(s) at comfortably fits in between George Street and George Lane

Note, that it would be advantageous if Council would consider permitting “Keep Clear” linemarking across Albert Street at the proposed median break to George Lane. Although right turn volumes are low and a CHR(s) is capable of handling up to 50 vph turning right at this location “Keep Clear” linemarking would ensure no queuing whatsoever of right turning vehicles into George Lane from Albert Street.

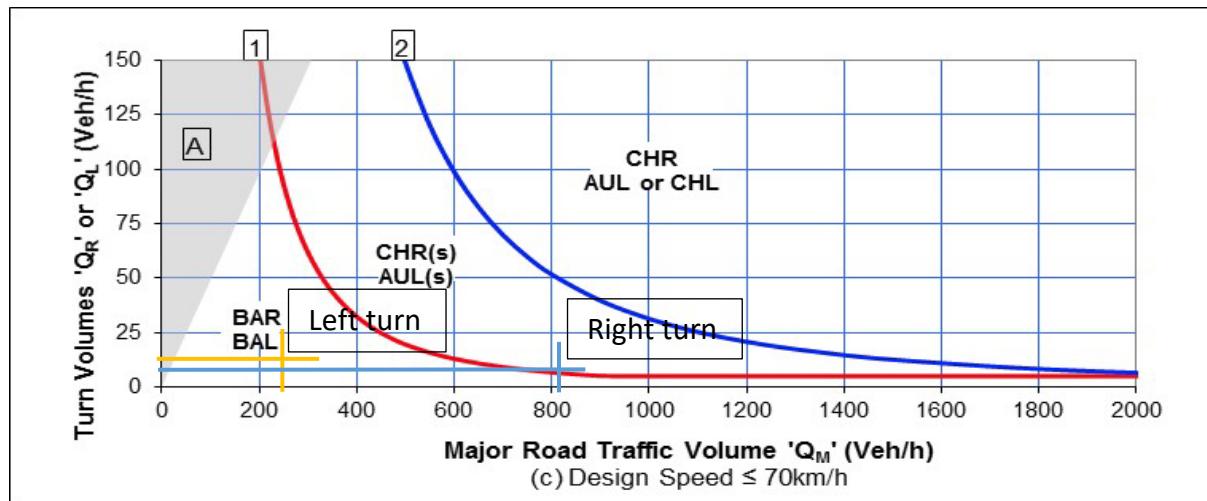


Figure 4 Warrants - major road turn treatments - Normal Design Domain

Safe Intersection Sight Distance (SISD) in accordance with Austroads Part 4A is easily achieved for a 70kph design speed when looking to the west towards the Base Hospital as shown in **Figures 5** for George Lane and site egress visibility. This also applies to the proposed right turn median break at George Lane. Note that the median break is proposed for vehicles into George lane only and not outbound vehicles.



Figure 5 Visibility towards the west

For access visibility for the George Street site access SISD in accordance with Austroads Part 4A is comfortably achieved for an 80kph design speed when looking to the south along George Street. Additionally, minimum Stopping Sight Distance (SSD) in accordance with AS2890.1-2004 Section 3.2.4 and Figure 3.2 – Sight Distance at Access Driveways is achieved for 40kph for left turning vehicles from Albert Street into George Street – note that vehicles making this manoeuvre would not likely be travelling at more than 20kph in any case.



Figure 6 Access Visibility towards the south

## 6. SWEPT PATH ASSESSMENT AND DELIVERY VEHICLES

A swept path assessment has also been attached (see **Attachment 3**) showing access and egress for passenger vehicles and also the largest site vehicle a single rigid delivery/refuse collection vehicle. Note that the drive-thru queue length comfortably exceeds RRC's requirements of 10 cars.

Kind regards,

**Chris Hewitt**

Principal Civil Engineer RPEQ 5141

### ATTACHMENTS:

Attachment 1 – Traffic Count Data from TMR

Attachment 2 – Proposed Site Layout

Attachment 3 – Swept Path Plan

**Attachment 1 – Traffic Count Data from TMR**

DRAFT

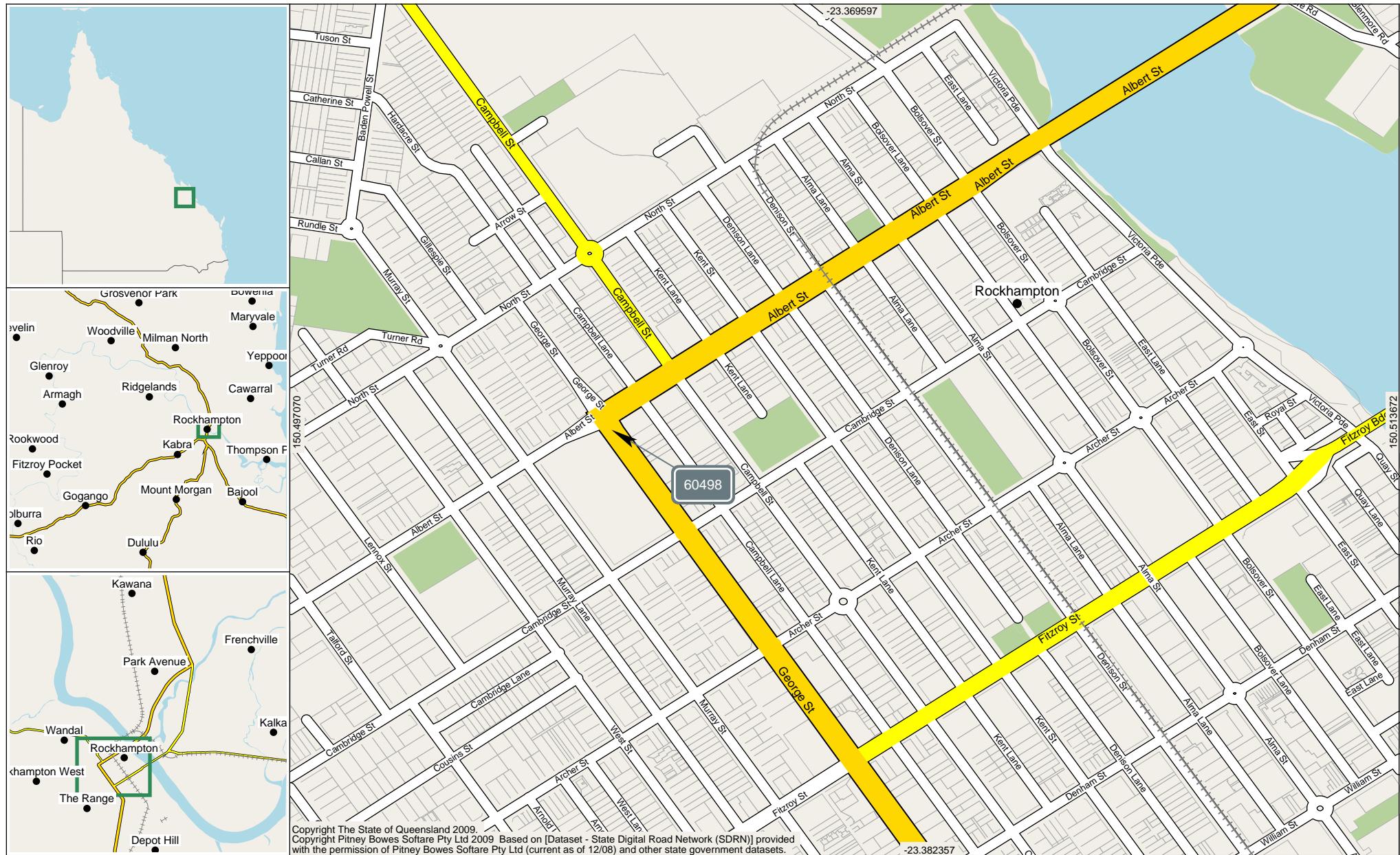
Traffic Analysis and Reporting System  
**Intersection Analysis Report**

Area 404 - Fitzroy District

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

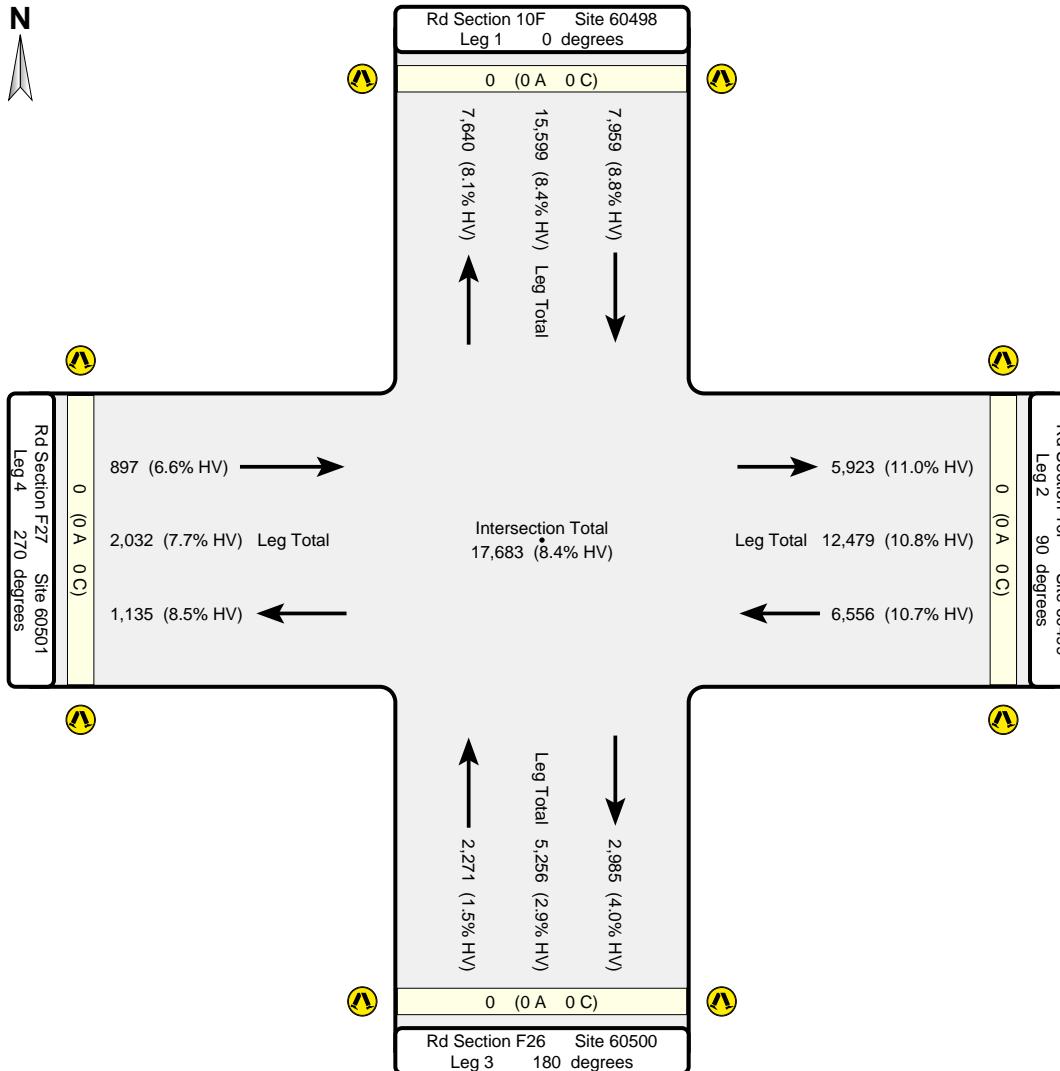
Page 1 of 30 (1 of 31)



Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

## Summary



Leg	Angle	Road Section	Site	TDist	Site Description
1	0	10F	60498	0.706	Albert St to Mackay @ George St
2	90	10F	60499	0.705	George St to Gladstone @ Albert St/Bruce
3	180	F26	60500	0.000	Albert St to Hospital @ George St
4	270	F27	60501	0.000	George St to North St @ Albert St/Bruce

Traffic Analysis and Reporting System  
**Intersection Analysis Report**

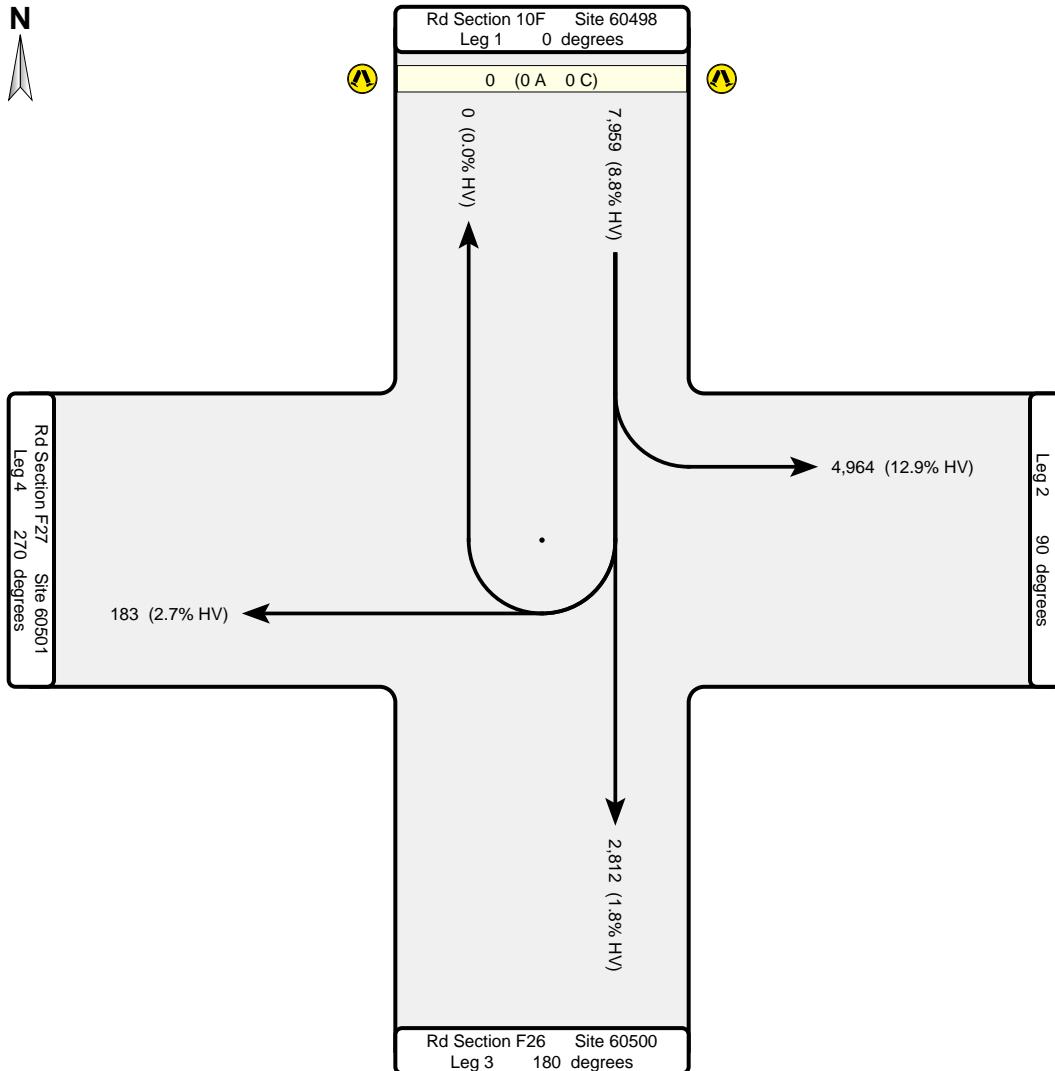
Area 404 - Fitzroy District

Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
Intersection 5200 - George St & Albert St (L&RHS)  
Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Page 3 of 30 (3 of 31)

Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George St



Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George St

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15	72	33	1		
06:15-06:30	97	27	2		
06:30-06:45	94	32	2		
06:45-07:00	82	34	4		
07:00-07:15	76	40	8		
07:15-07:30	100	48	2		
07:30-07:45	142	99	6		
07:45-08:00	153	113	7		

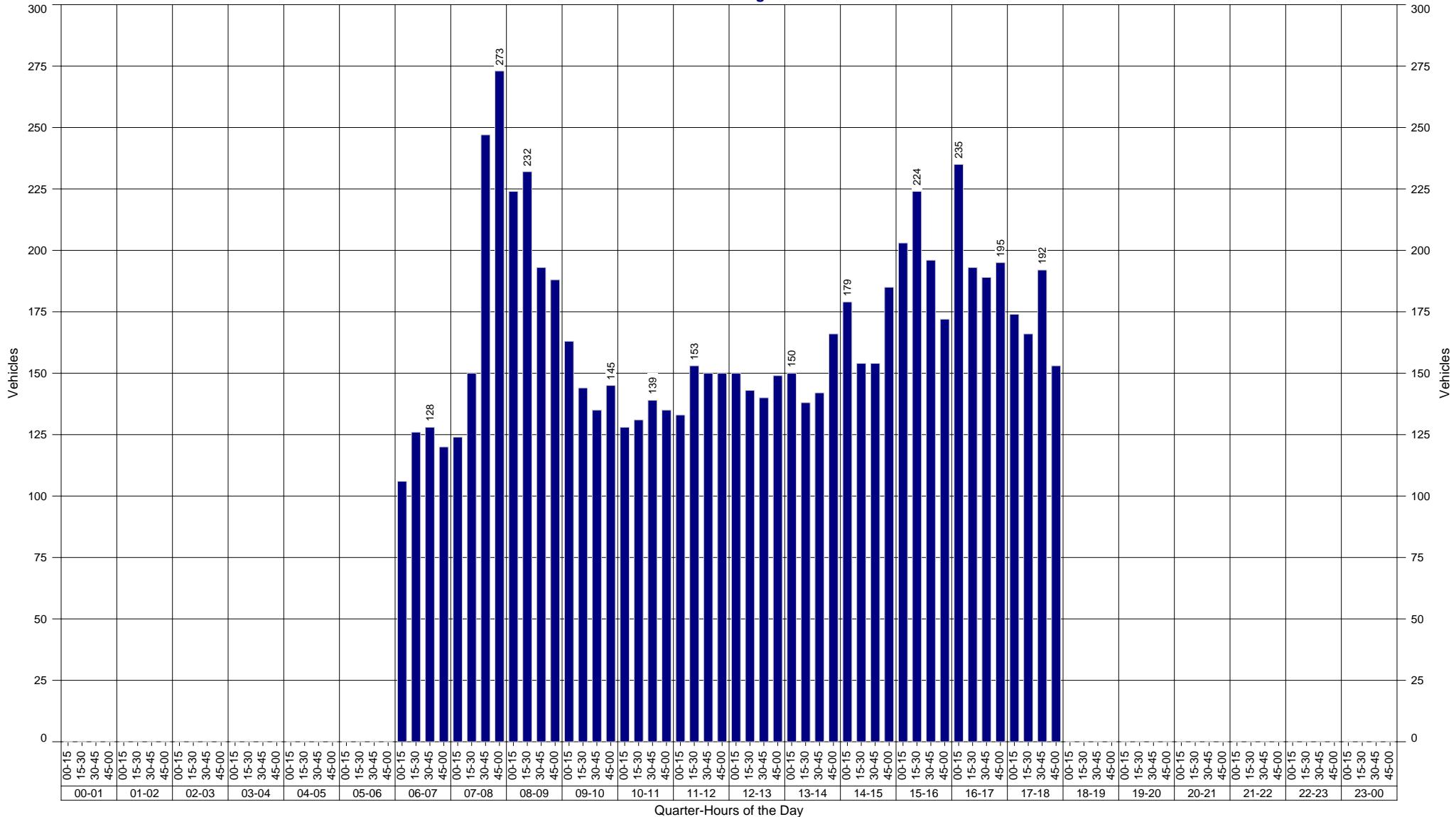
Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	125	95	4		
08:15-08:30	136	90	6		
08:30-08:45	107	81	5		
08:45-09:00	106	78	4		
09:00-09:15	84	75	4		
09:15-09:30	89	54	1		
09:30-09:45	79	56	0		
09:45-10:00	100	44	1		
10:00-10:15	79	46	3		
10:15-10:30	82	49	0		
10:30-10:45	89	49	1		
10:45-11:00	83	47	5		
11:00-11:15	92	37	4		
11:15-11:30	93	53	7		
11:30-11:45	93	53	4		
11:45-12:00	93	52	5		
12:00-12:15	97	50	3		
12:15-12:30	97	44	2		
12:30-12:45	80	58	2		
12:45-13:00	87	59	3		
13:00-13:15	91	59	0		
13:15-13:30	99	37	2		
13:30-13:45	88	51	3		
13:45-14:00	99	60	7		
14:00-14:15	107	70	2		
14:15-14:30	92	59	3		
14:30-14:45	101	45	8		
14:45-15:00	122	59	4		
15:00-15:15	117	77	9		
15:15-15:30	125	92	7		
15:30-15:45	129	65	2		
15:45-16:00	116	55	1		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	148	75	12		
16:15-16:30	126	66	1		
16:30-16:45	126	58	5		
16:45-17:00	128	64	3		
17:00-17:15	104	63	7		
17:15-17:30	101	62	3		
17:30-17:45	133	54	5		
17:45-18:00	105	45	3		
18:00-18:15					
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

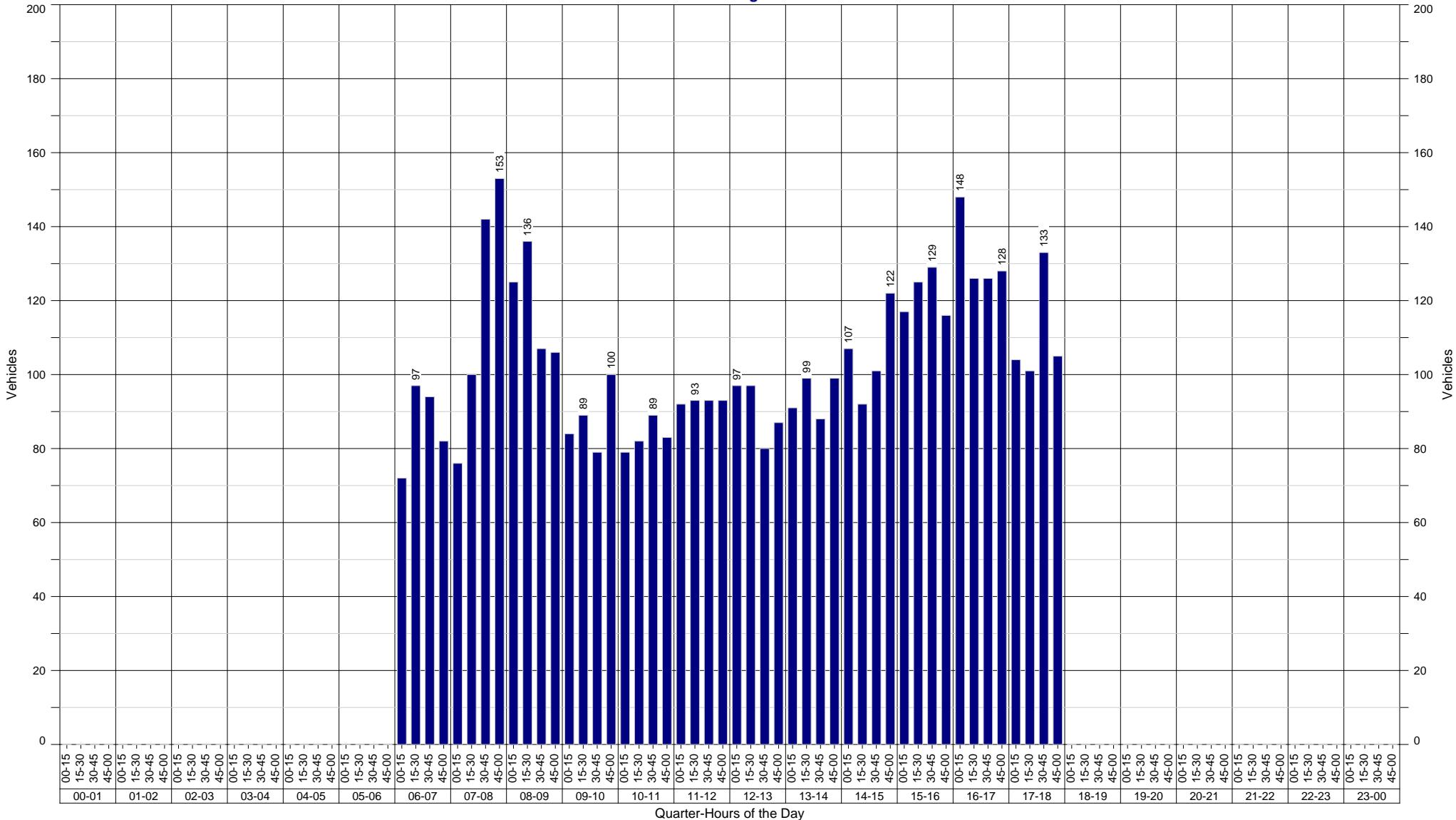
Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George St

Total volume 7,959

**Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes**


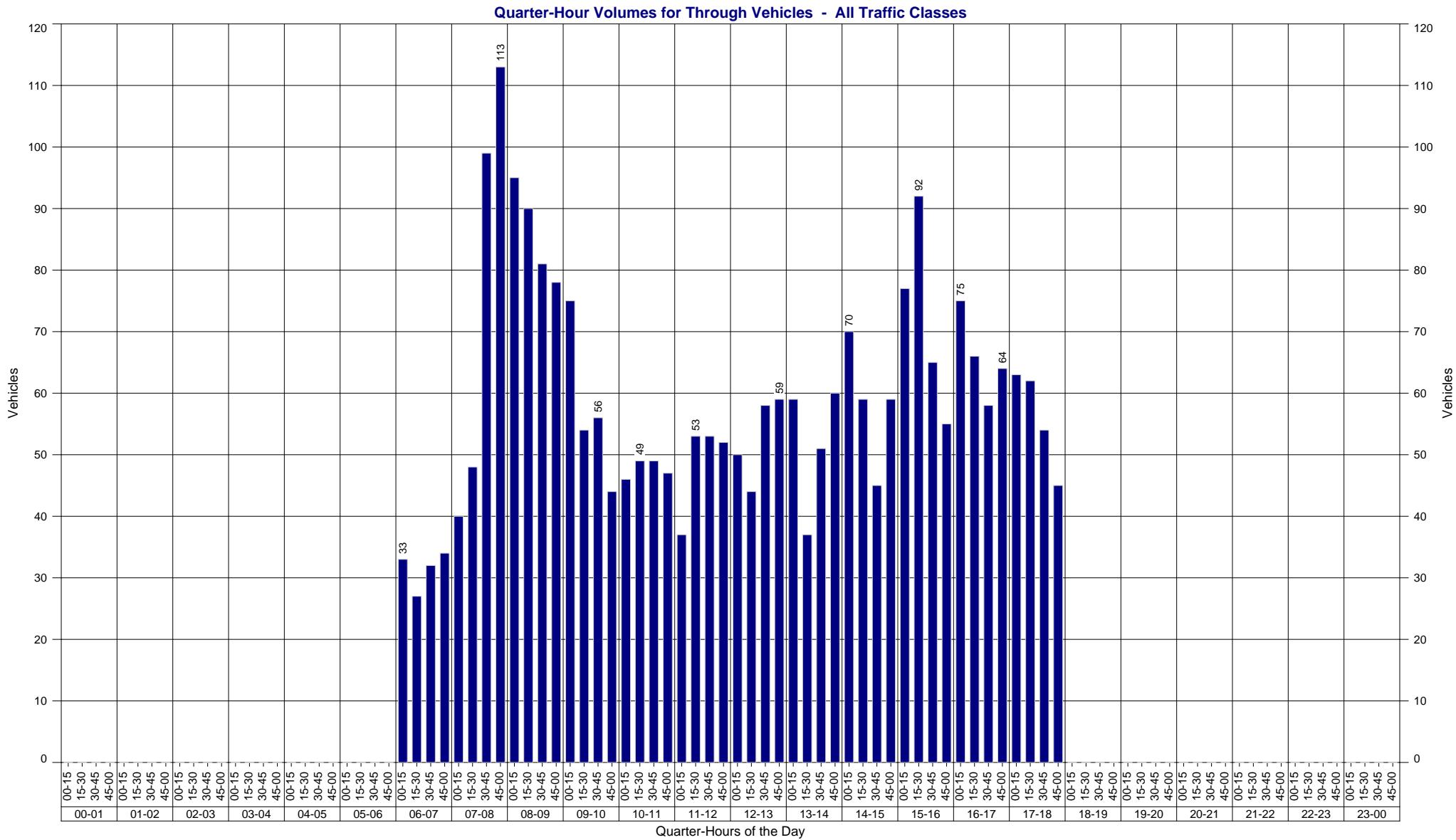
Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George St

Total volume 4,964

**Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes**


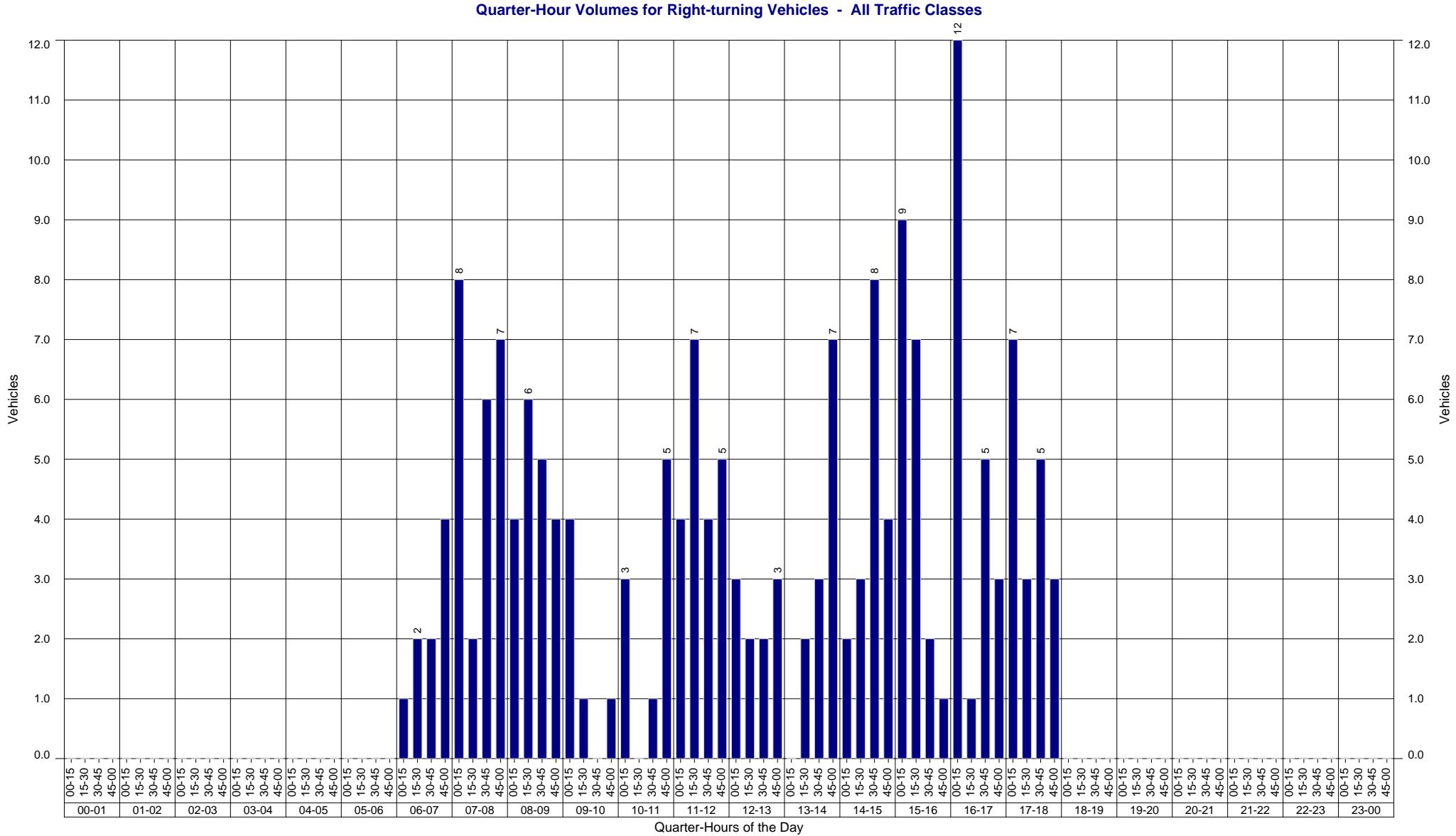
Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George S

Total volume 2 812



Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George St

Total volume 183



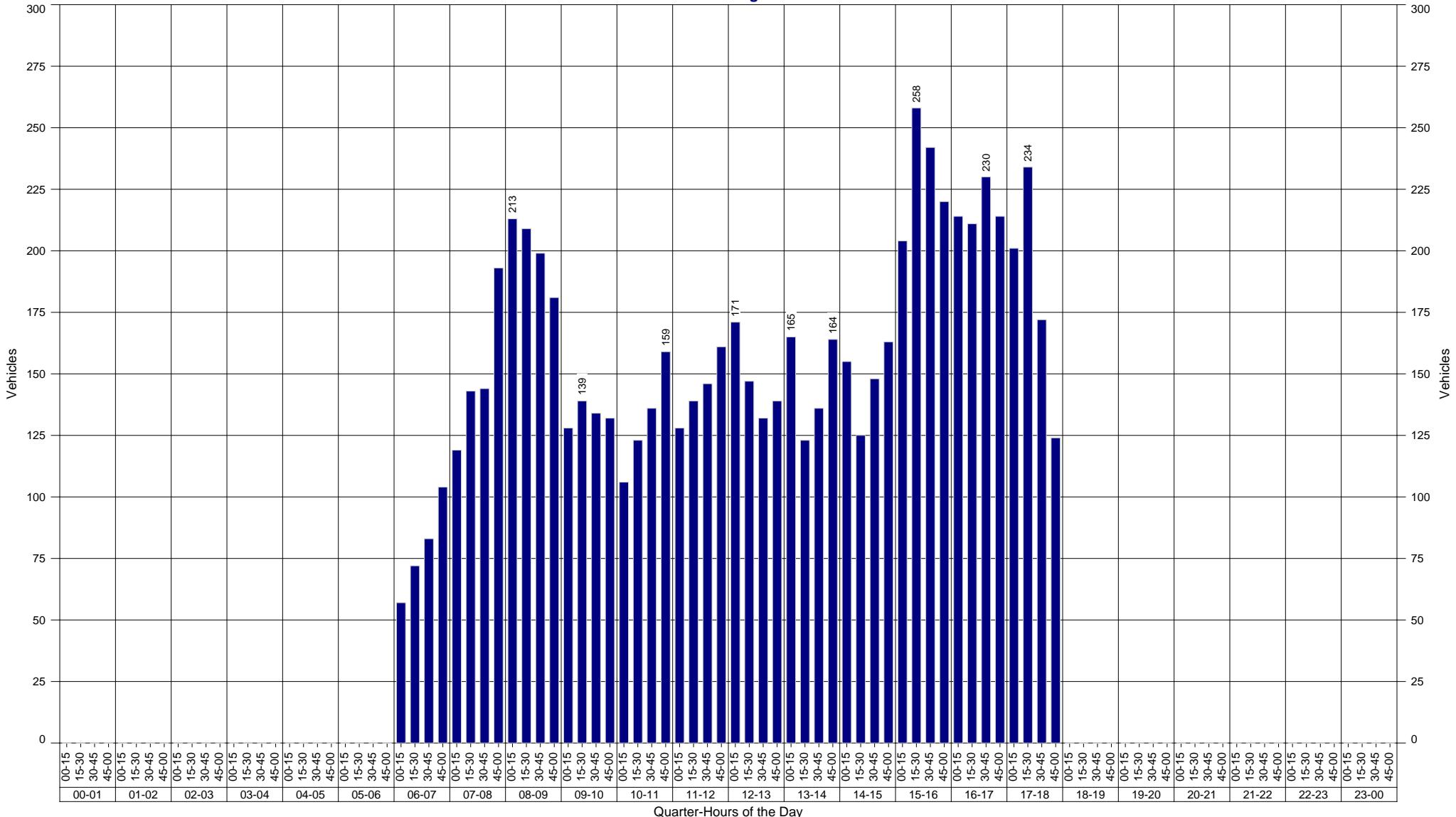
Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Leg 1 Site 60498 Tdist 0.706 km Albert St to Mackay @ George St

Total volume 7,640

**Quarter-Hour Volumes for All Vehicles Exiting the Intersection - All Traffic Classes**


07-Sep-2020 11:06

Area 404 - Fitzroy District

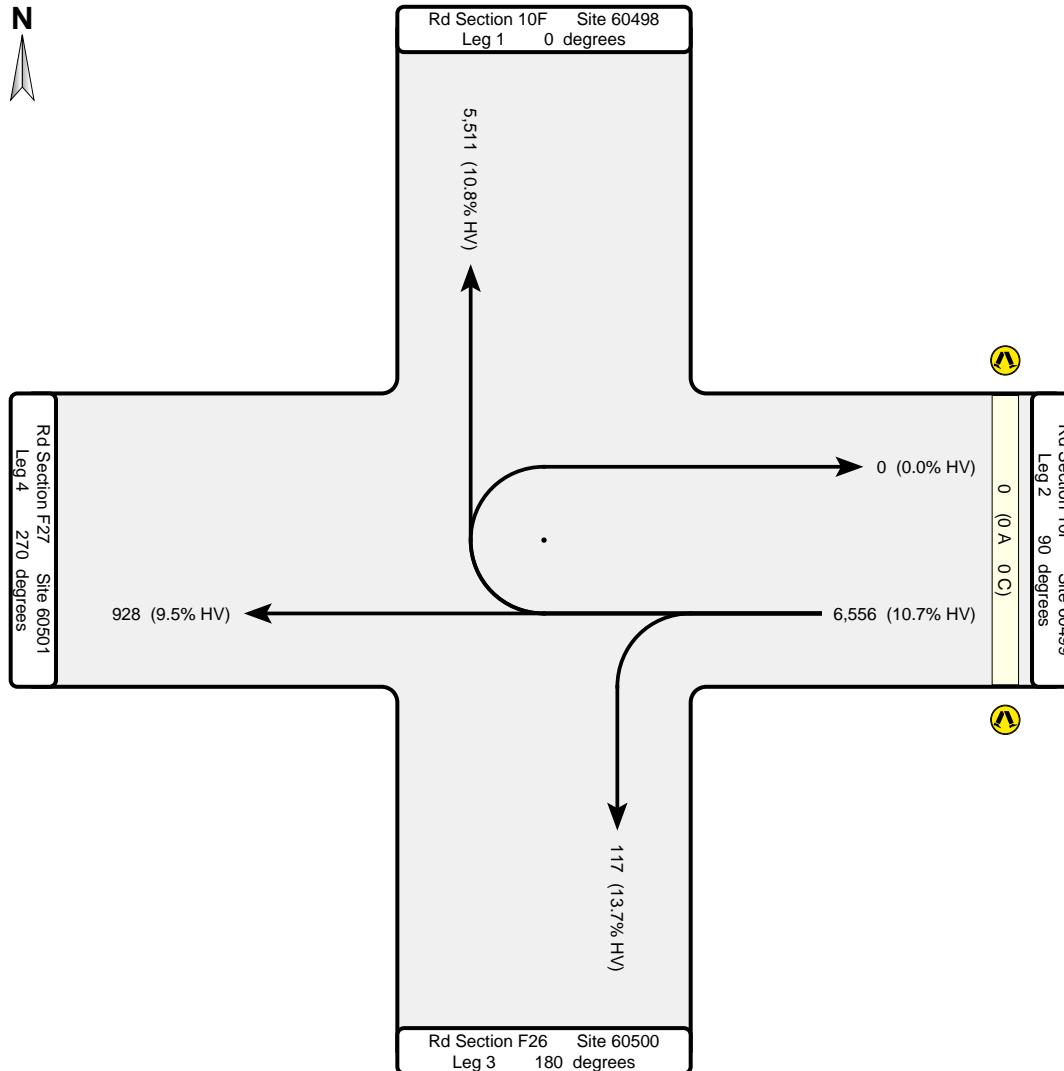
Traffic Analysis and Reporting System  
**Intersection Analysis Report**

Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
Intersection 5200 - George St & Albert St (L&RHS)  
Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Page 10 of 30 (10 of 31)

Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce



Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15	12	8	48		
06:15-06:30	2	6	60		
06:30-06:45	0	13	66		
06:45-07:00	3	18	94		
07:00-07:15	1	8	96		
07:15-07:30	1	9	102		
07:30-07:45	1	19	95		
07:45-08:00	2	18	128		

Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	1	22	137		
08:15-08:30	2	25	135		
08:30-08:45	2	31	132		
08:45-09:00	2	33	135		
09:00-09:15	3	17	100		
09:15-09:30	0	20	107		
09:30-09:45	2	10	105		
09:45-10:00	4	14	110		
10:00-10:15	1	17	86		
10:15-10:30	3	17	95		
10:30-10:45	0	8	107		
10:45-11:00	2	18	111		
11:00-11:15	8	13	95		
11:15-11:30	2	20	98		
11:30-11:45	1	17	114		
11:45-12:00	4	19	112		
12:00-12:15	6	23	135		
12:15-12:30	1	25	103		
12:30-12:45	0	32	84		
12:45-13:00	4	17	97		
13:00-13:15	4	16	117		
13:15-13:30	1	13	84		
13:30-13:45	1	8	98		
13:45-14:00	6	15	124		
14:00-14:15	1	23	112		
14:15-14:30	3	23	82		
14:30-14:45	1	15	102		
14:45-15:00	4	16	128		
15:00-15:15	3	25	146		
15:15-15:30	1	31	161		
15:30-15:45	3	25	171		
15:45-16:00	4	29	157		

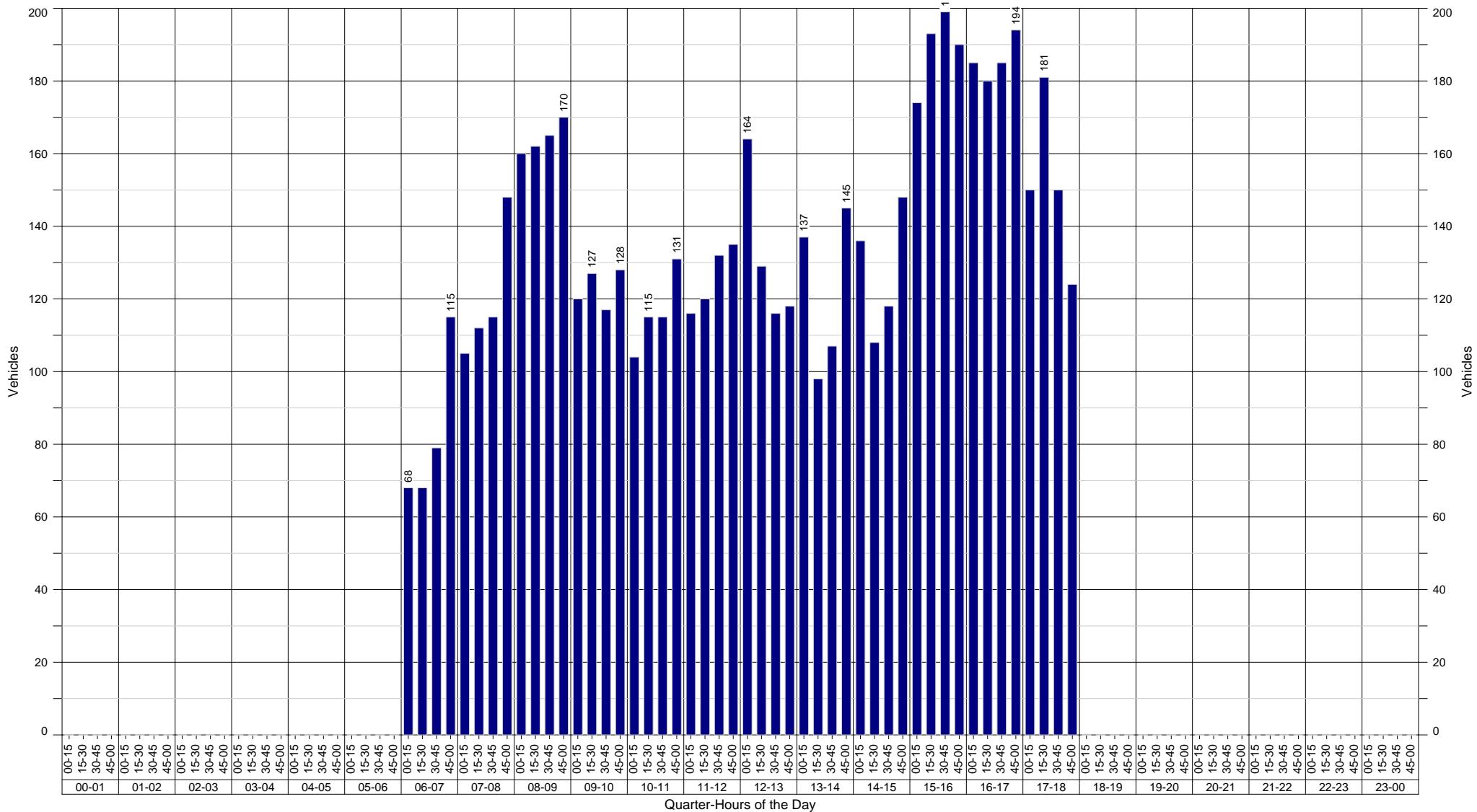
Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	1	19	165		
16:15-16:30	2	26	152		
16:30-16:45	6	19	160		
16:45-17:00	1	25	168		
17:00-17:15	0	19	131		
17:15-17:30	3	35	143		
17:30-17:45	1	26	123		
17:45-18:00	1	23	100		
18:00-18:15					
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce

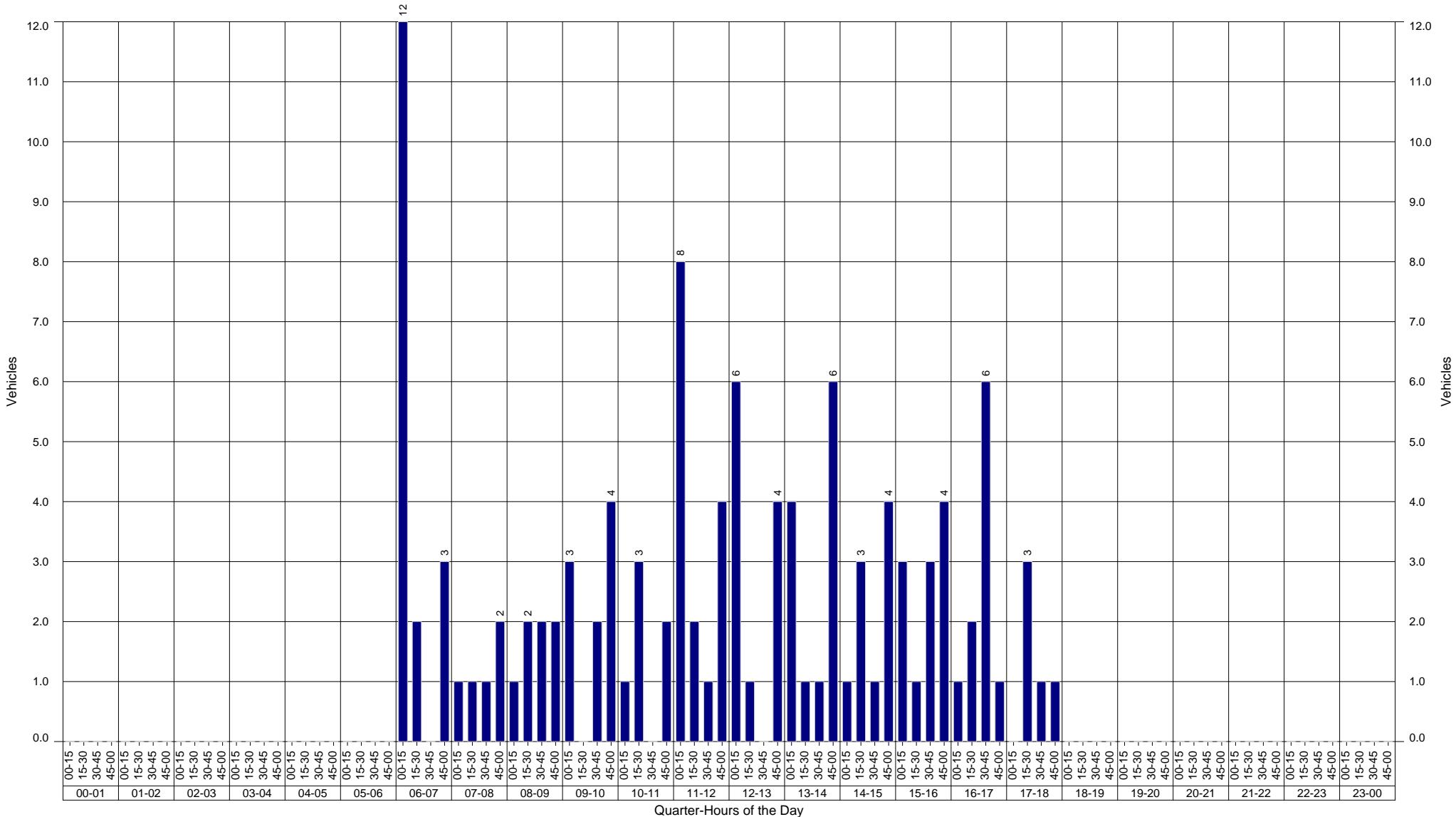
Total volume 6.556

**Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes**



Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce

Total volume 117

**Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes**


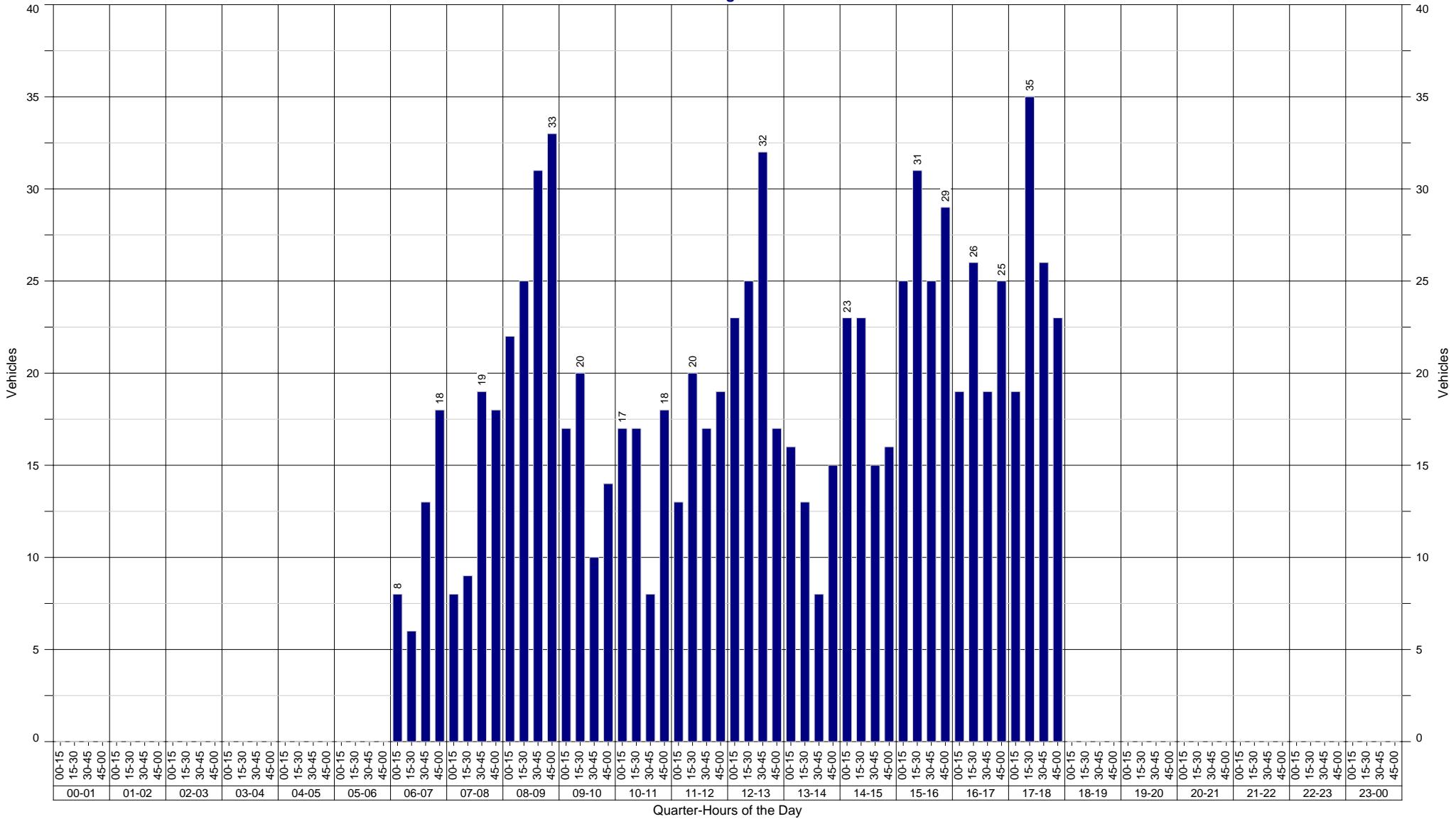
Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce

Total volume 928

Quarter-Hour Volumes for Through Vehicles - All Traffic Classes



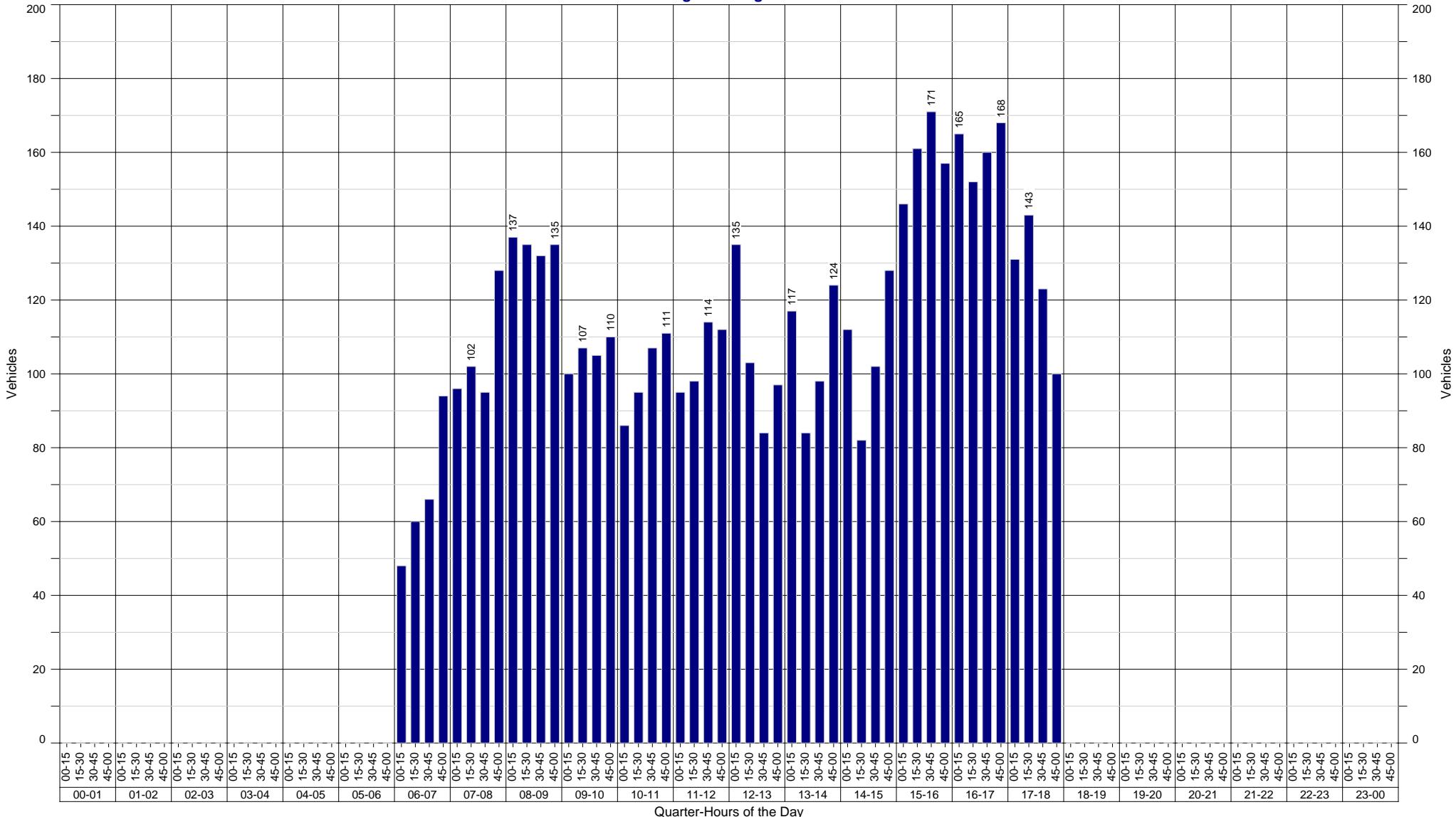
Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
Intersection 5200 - George St & Albert St (L&RHS)  
Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

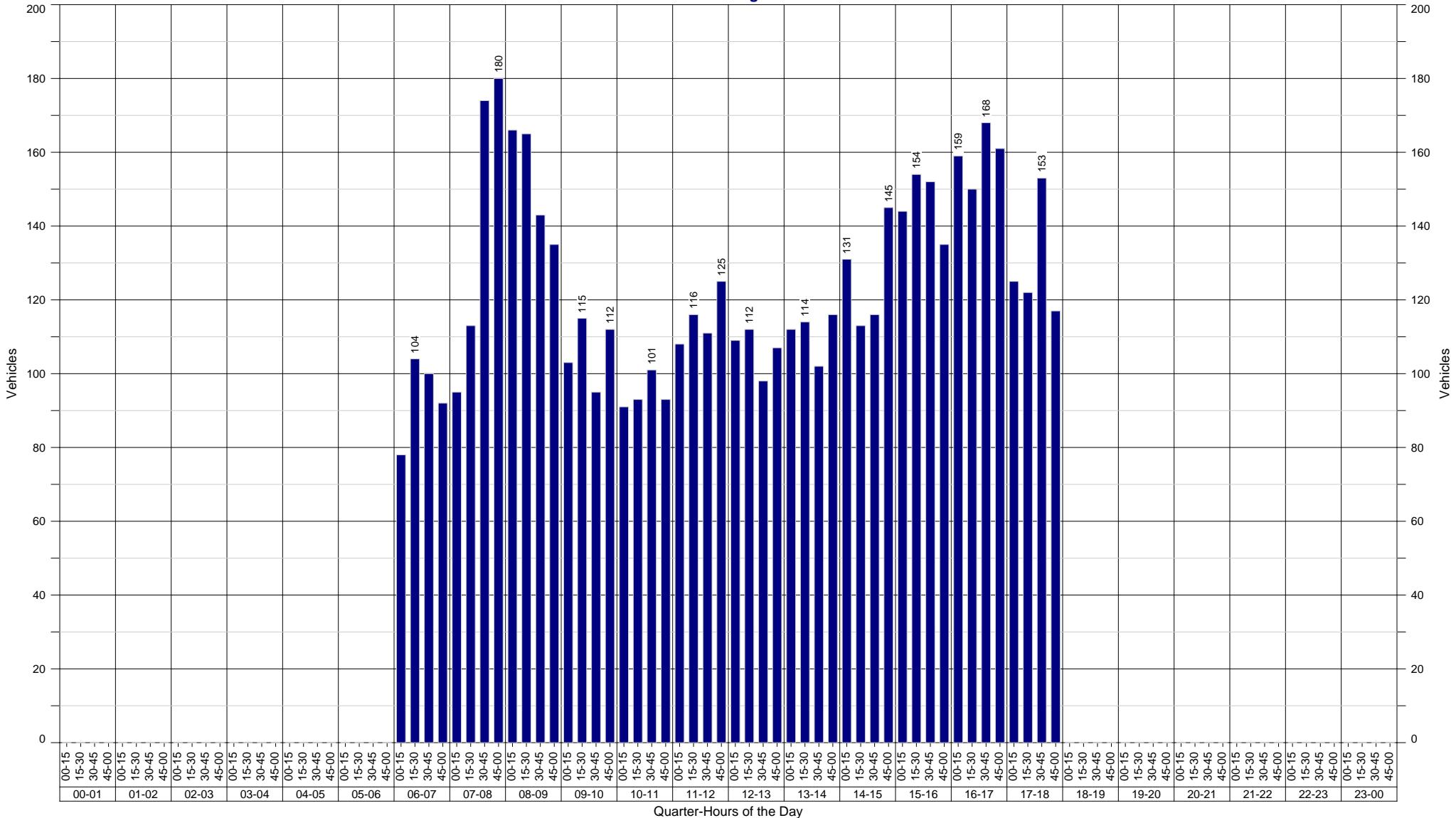
Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce

Total volume 5,511

**Quarter-Hour Volumes for Right-turning Vehicles - All Traffic Classes**


Leg 2 Site 60499 Tdist 0.705 km George St to Gladstone @ Albert St/Bruce

Total volume 5,923

**Quarter-Hour Volumes for All Vehicles Exiting the Intersection - All Traffic Classes**


Traffic Analysis and Reporting System  
**Intersection Analysis Report**

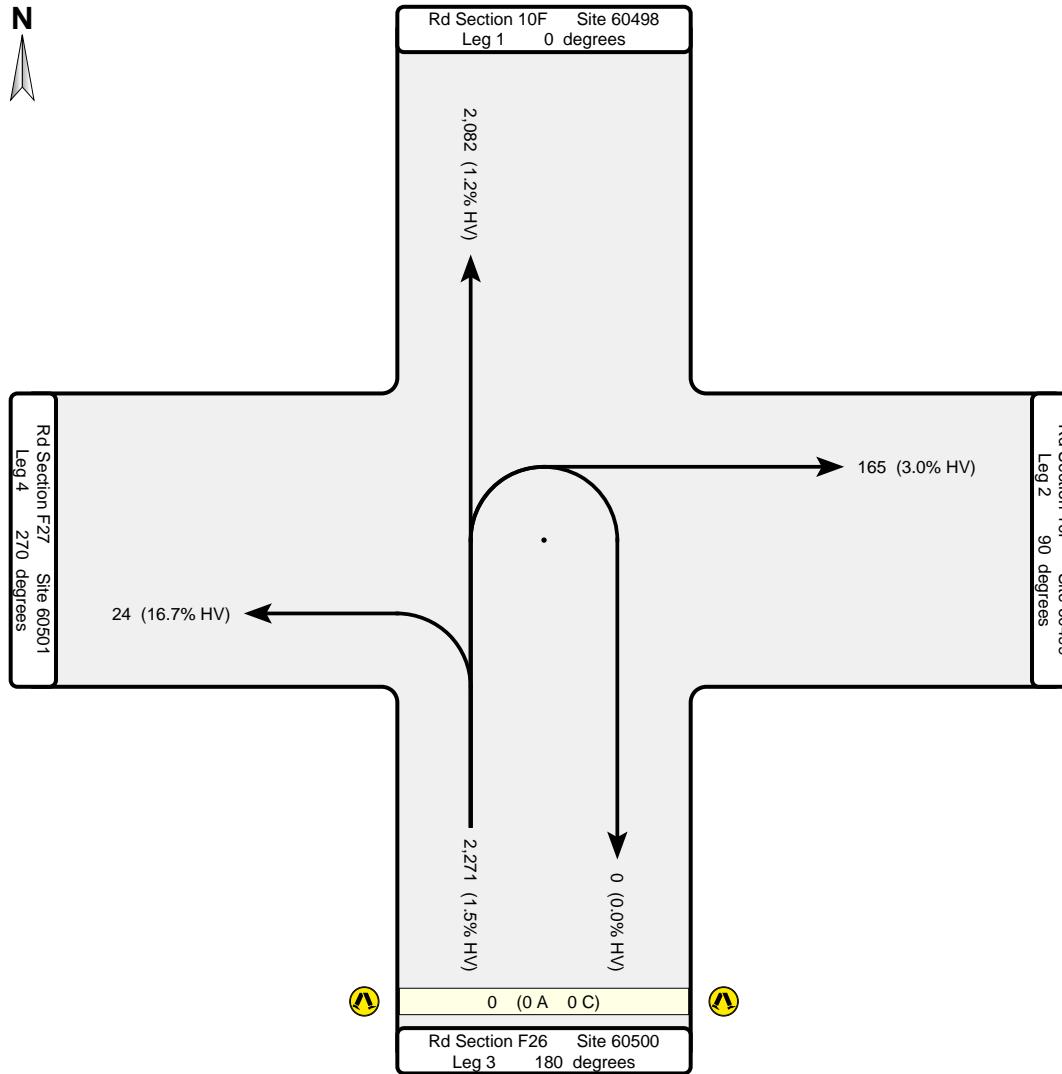
Area 404 - Fitzroy District

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Page 17 of 30 (17 of 31)

Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St



Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15	0	9	1		
06:15-06:30	0	12	1		
06:30-06:45	1	17	1		
06:45-07:00	0	10	3		
07:00-07:15	0	23	1		
07:15-07:30	0	40	1		
07:30-07:45	0	48	1		
07:45-08:00	0	63	5		

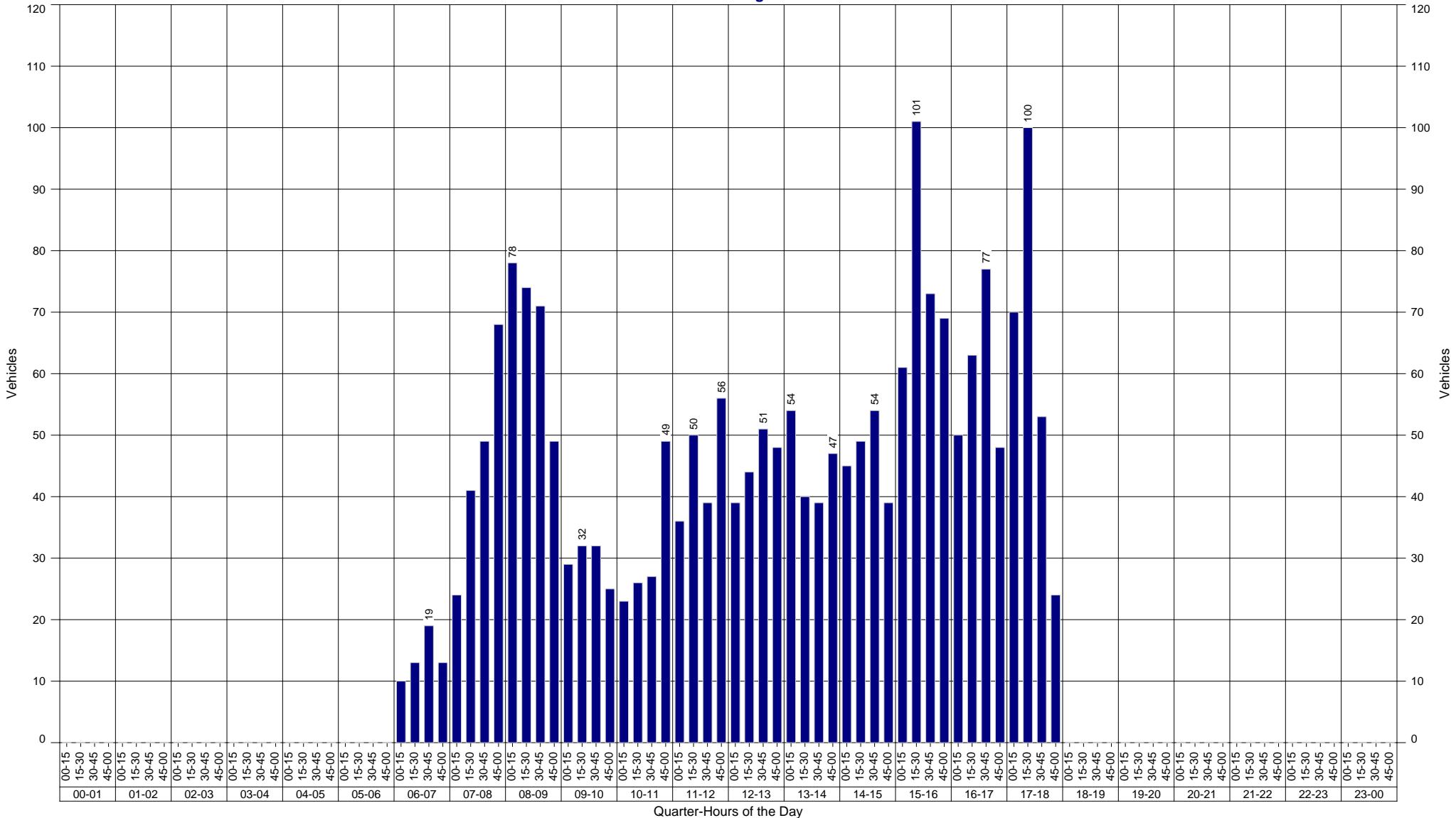
Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	0	76	2		
08:15-08:30	0	73	1		
08:30-08:45	1	67	3		
08:45-09:00	1	45	3		
09:00-09:15	1	25	3		
09:15-09:30	0	29	3		
09:30-09:45	1	29	2		
09:45-10:00	0	22	3		
10:00-10:15	1	19	3		
10:15-10:30	1	23	2		
10:30-10:45	0	27	0		
10:45-11:00	2	46	1		
11:00-11:15	0	32	4		
11:15-11:30	4	41	5		
11:30-11:45	1	32	6		
11:45-12:00	1	48	7		
12:00-12:15	0	36	3		
12:15-12:30	0	43	1		
12:30-12:45	0	45	6		
12:45-13:00	1	42	5		
13:00-13:15	0	47	7		
13:15-13:30	0	37	3		
13:30-13:45	0	38	1		
13:45-14:00	0	39	8		
14:00-14:15	0	42	3		
14:15-14:30	0	41	8		
14:30-14:45	2	46	6		
14:45-15:00	0	35	4		
15:00-15:15	0	57	4		
15:15-15:30	0	97	4		
15:30-15:45	0	71	2		
15:45-16:00	0	62	7		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	0	47	3		
16:15-16:30	1	58	4		
16:30-16:45	0	68	9		
16:45-17:00	0	44	4		
17:00-17:15	0	68	2		
17:15-17:30	4	91	5		
17:30-17:45	1	49	3		
17:45-18:00	0	23	1		
18:00-18:15					
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

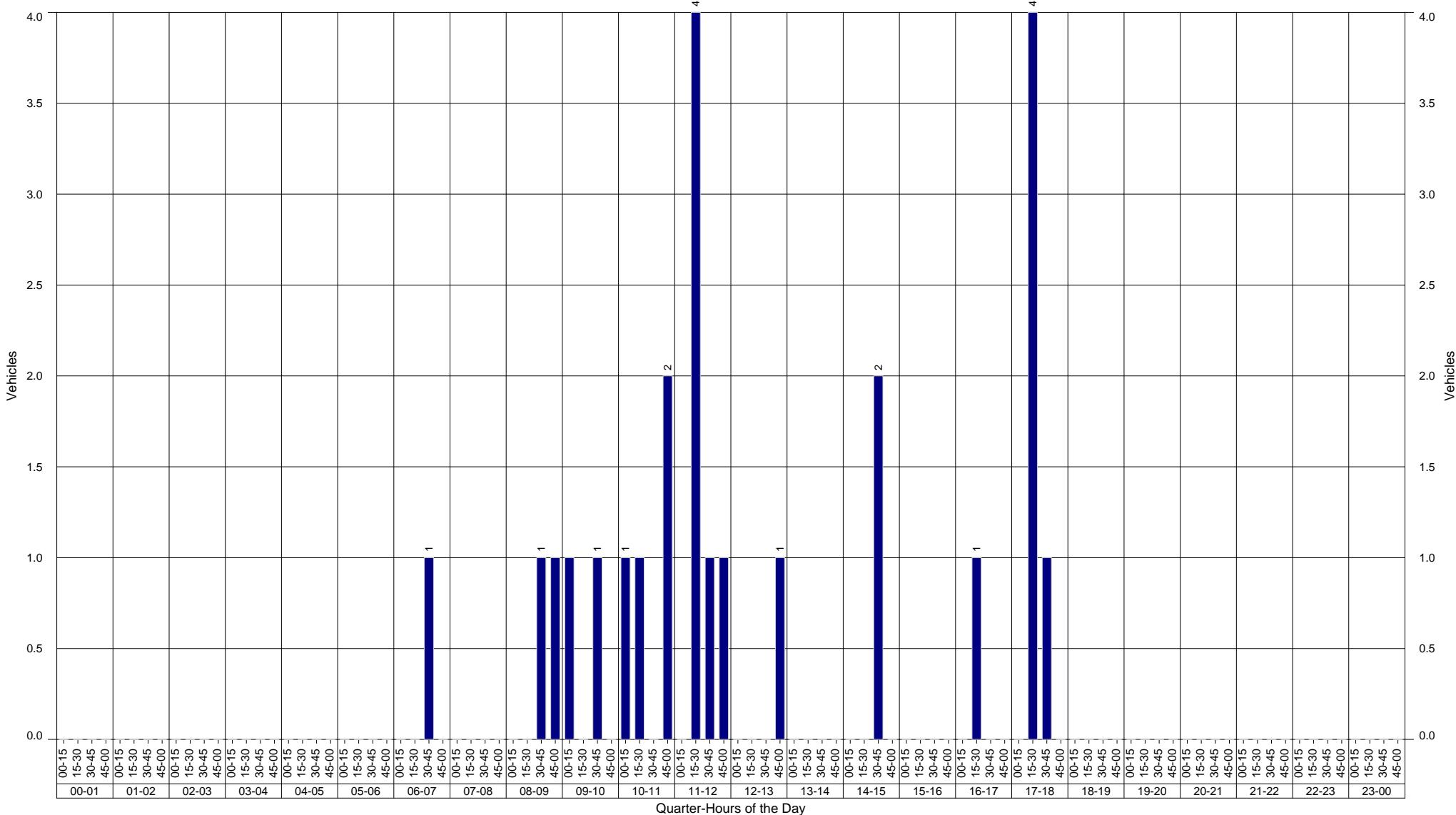
Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St

Total volume 2,271

**Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes**


Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St

Total volume 24

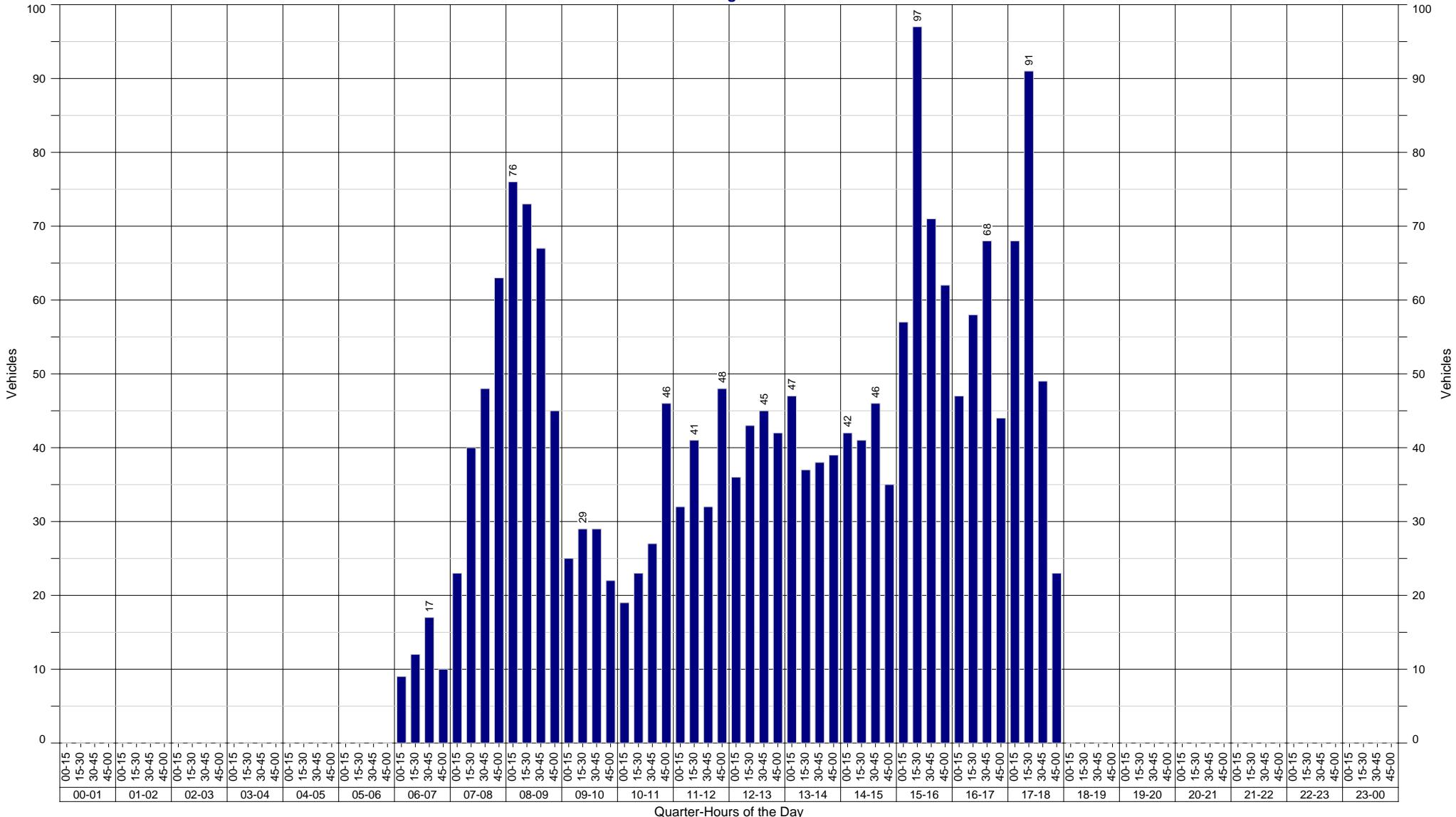
**Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes**


Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

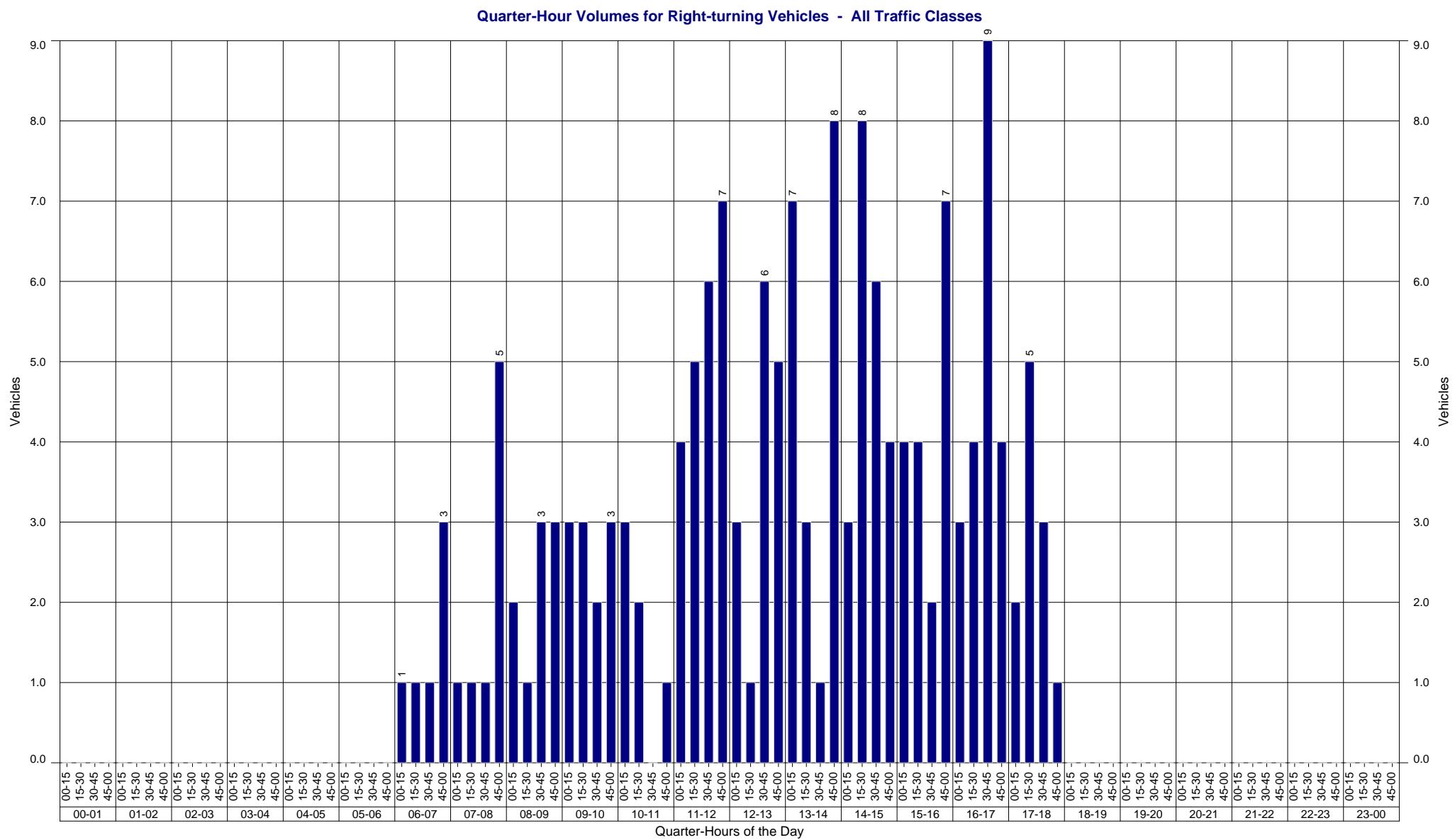
Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St

Total volume 2,082

**Quarter-Hour Volumes for Through Vehicles - All Traffic Classes**


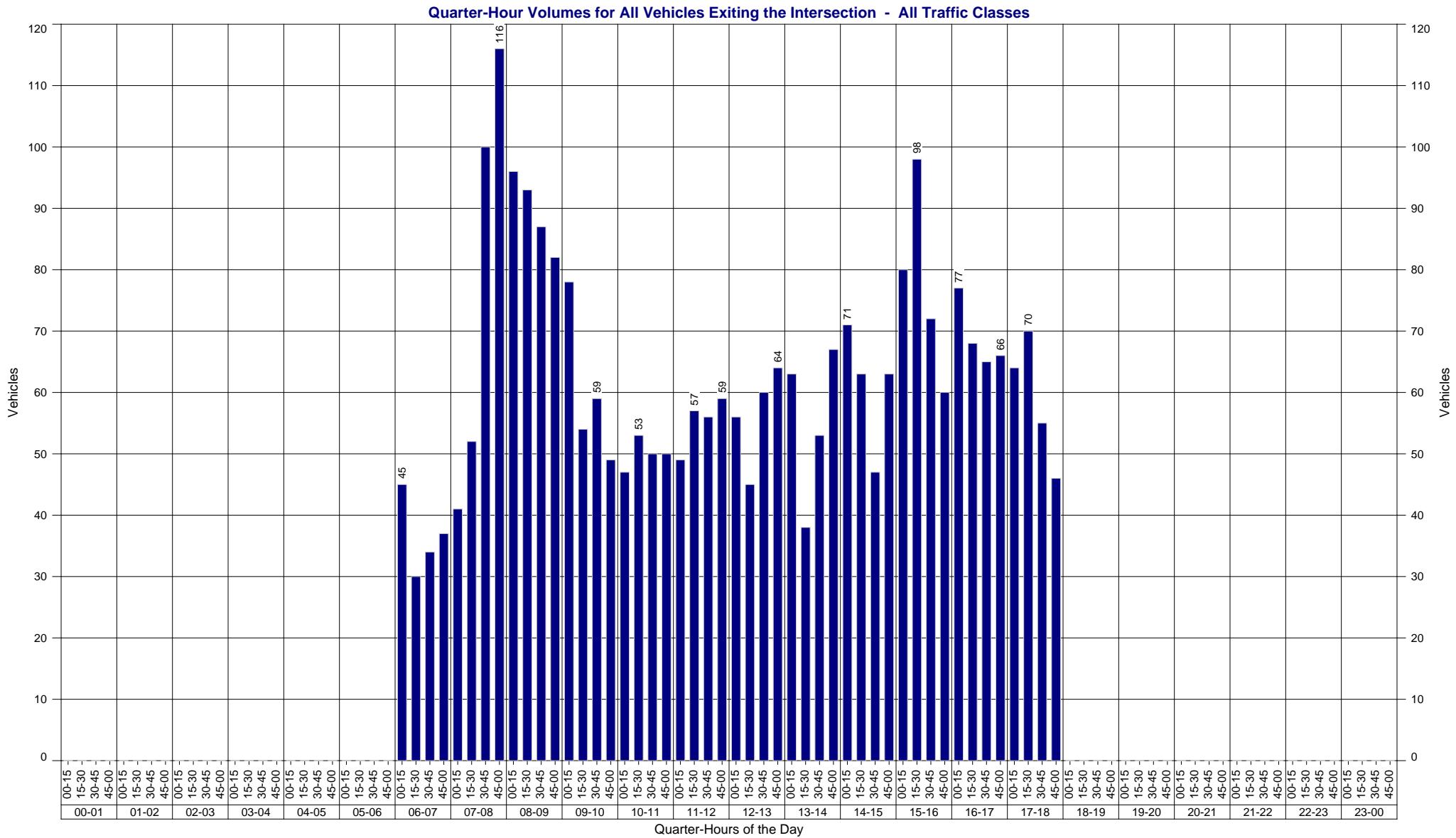
Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St

Total volume 165

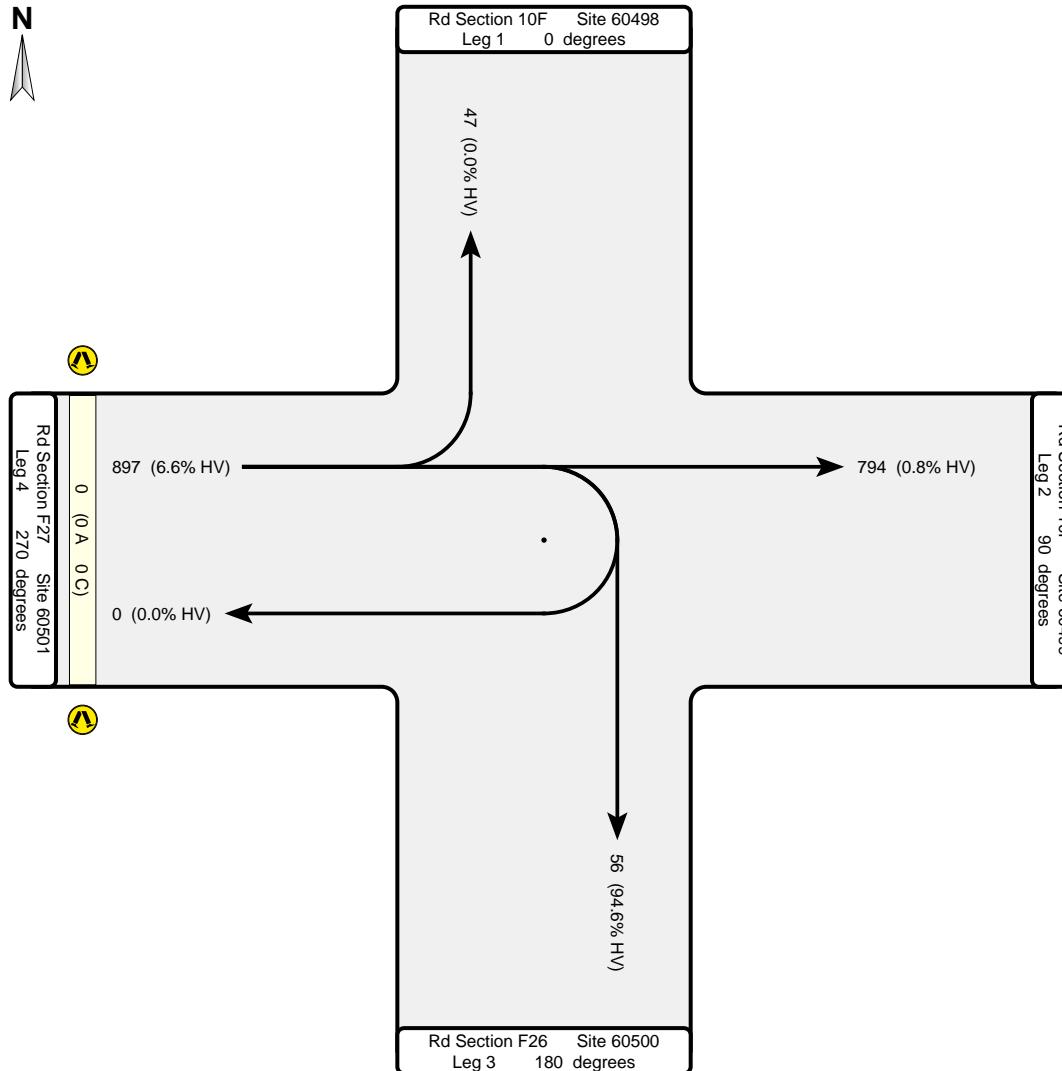


Leg 3 Site 60500 Tdist 0.000 km Albert St to Hospital @ George St

Total volume 2.985



Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce



Traffic Analysis and Reporting System  
**Intersection Analysis Report**

 Road Section 10F - BRUCE HIGHWAY (ROCKHAMPTON-ST LAWRENCE)  
 Intersection 5200 - George St & Albert St (L&RHS)  
 Tuesday 19-Feb-2013 06:00 - 18:00

**TARS**

Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce

Time	Left	Through	Right	U-Turn	Pedestrians
00:00-00:15					
00:15-00:30					
00:30-00:45					
00:45-01:00					
01:00-01:15					
01:15-01:30					
01:30-01:45					
01:45-02:00					
02:00-02:15					
02:15-02:30					
02:30-02:45					
02:45-03:00					
03:00-03:15					
03:15-03:30					
03:30-03:45					
03:45-04:00					
04:00-04:15					
04:15-04:30					
04:30-04:45					
04:45-05:00					
05:00-05:15					
05:15-05:30					
05:30-05:45					
05:45-06:00					
06:00-06:15	0	5	0		
06:15-06:30	0	6	1		
06:30-06:45	0	5	2		
06:45-07:00	0	7	0		
07:00-07:15	0	18	0		
07:15-07:30	1	12	3		
07:30-07:45	1	31	0		
07:45-08:00	2	22	1		

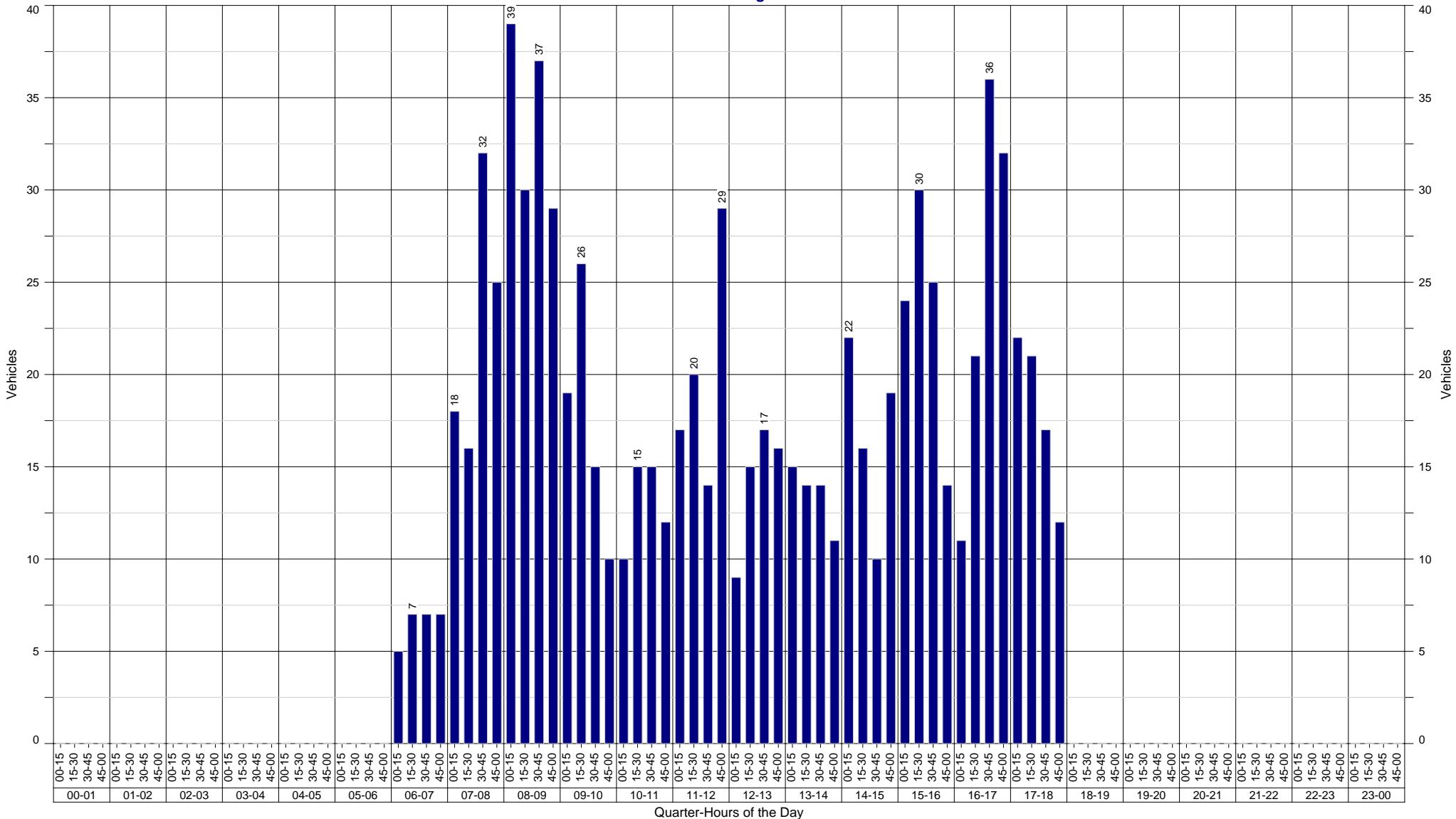
Time	Left	Through	Right	U-Turn	Pedestrians
08:00-08:15	0	39	0		
08:15-08:30	1	28	1		
08:30-08:45	0	33	4		
08:45-09:00	1	26	2		
09:00-09:15	3	16	0		
09:15-09:30	3	23	0		
09:30-09:45	0	14	1		
09:45-10:00	0	9	1		
10:00-10:15	1	9	0		
10:15-10:30	5	9	1		
10:30-10:45	2	12	1		
10:45-11:00	2	9	1		
11:00-11:15	1	12	4		
11:15-11:30	0	18	2		
11:30-11:45	0	12	2		
11:45-12:00	1	25	3		
12:00-12:15	0	9	0		
12:15-12:30	1	14	0		
12:30-12:45	3	12	2		
12:45-13:00	0	15	1		
13:00-13:15	1	14	0		
13:15-13:30	2	12	0		
13:30-13:45	0	13	1		
13:45-14:00	1	9	1		
14:00-14:15	1	21	0		
14:15-14:30	2	13	1		
14:30-14:45	0	9	1		
14:45-15:00	0	19	0		
15:00-15:15	1	23	0		
15:15-15:30	0	25	5		
15:30-15:45	0	21	4		
15:45-16:00	1	12	1		

Time	Left	Through	Right	U-Turn	Pedestrians
16:00-16:15	2	8	1		
16:15-16:30	1	20	0		
16:30-16:45	2	33	1		
16:45-17:00	2	29	1		
17:00-17:15	2	19	1		
17:15-17:30	0	16	5		
17:30-17:45	0	17	0		
17:45-18:00	1	11	0		
18:00-18:15					
18:15-18:30					
18:30-18:45					
18:45-19:00					
19:00-19:15					
19:15-19:30					
19:30-19:45					
19:45-20:00					
20:00-20:15					
20:15-20:30					
20:30-20:45					
20:45-21:00					
21:00-21:15					
21:15-21:30					
21:30-21:45					
21:45-22:00					
22:00-22:15					
22:15-22:30					
22:30-22:45					
22:45-23:00					
23:00-23:15					
23:15-23:30					
23:30-23:45					
23:45-24:00					

Blank cells indicate the non-collection of corresponding counts.

Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce

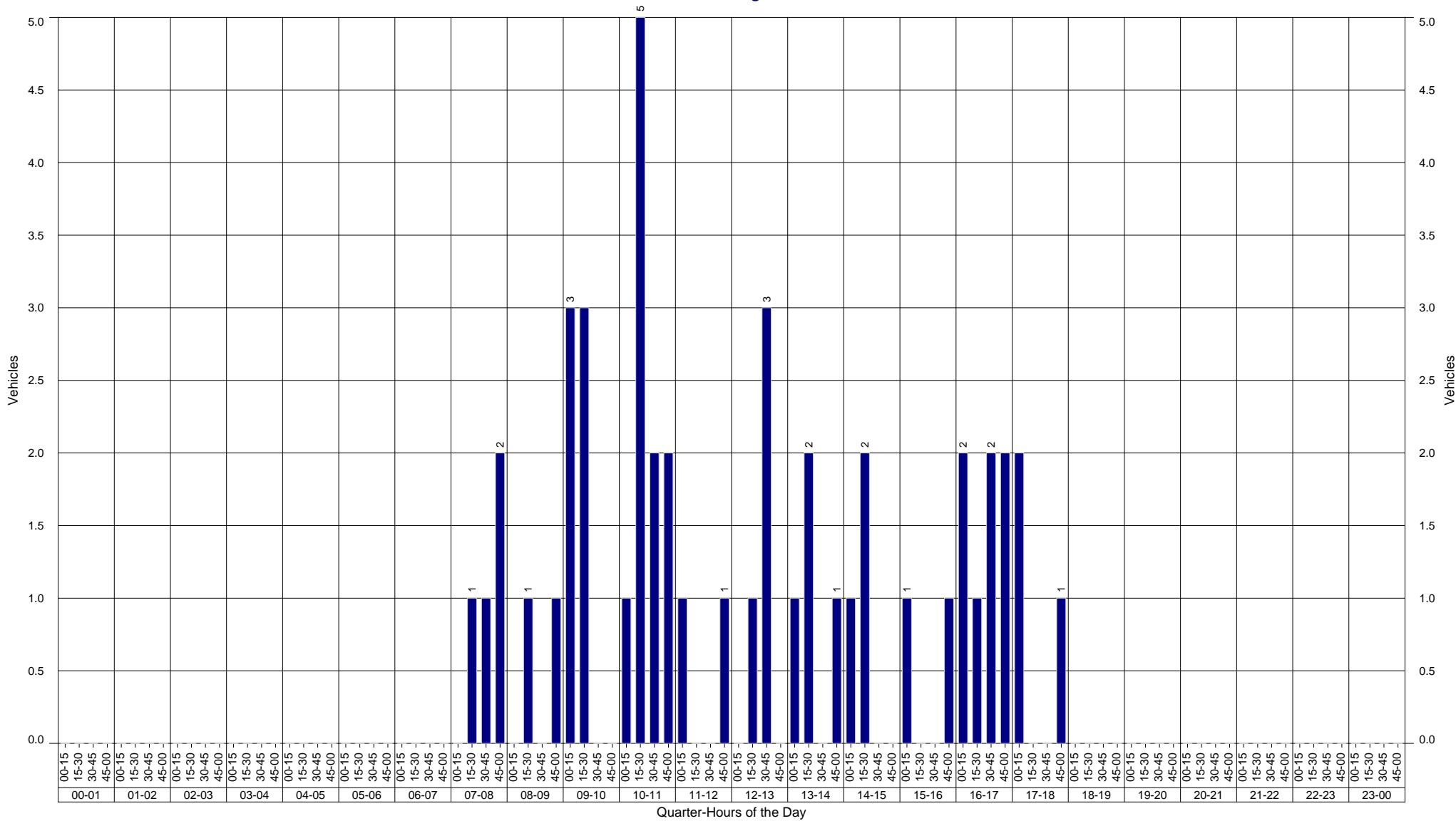
Total volume 897

**Quarter-Hour Volumes for All Vehicles Entering the Intersection - All Traffic Classes**


Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce

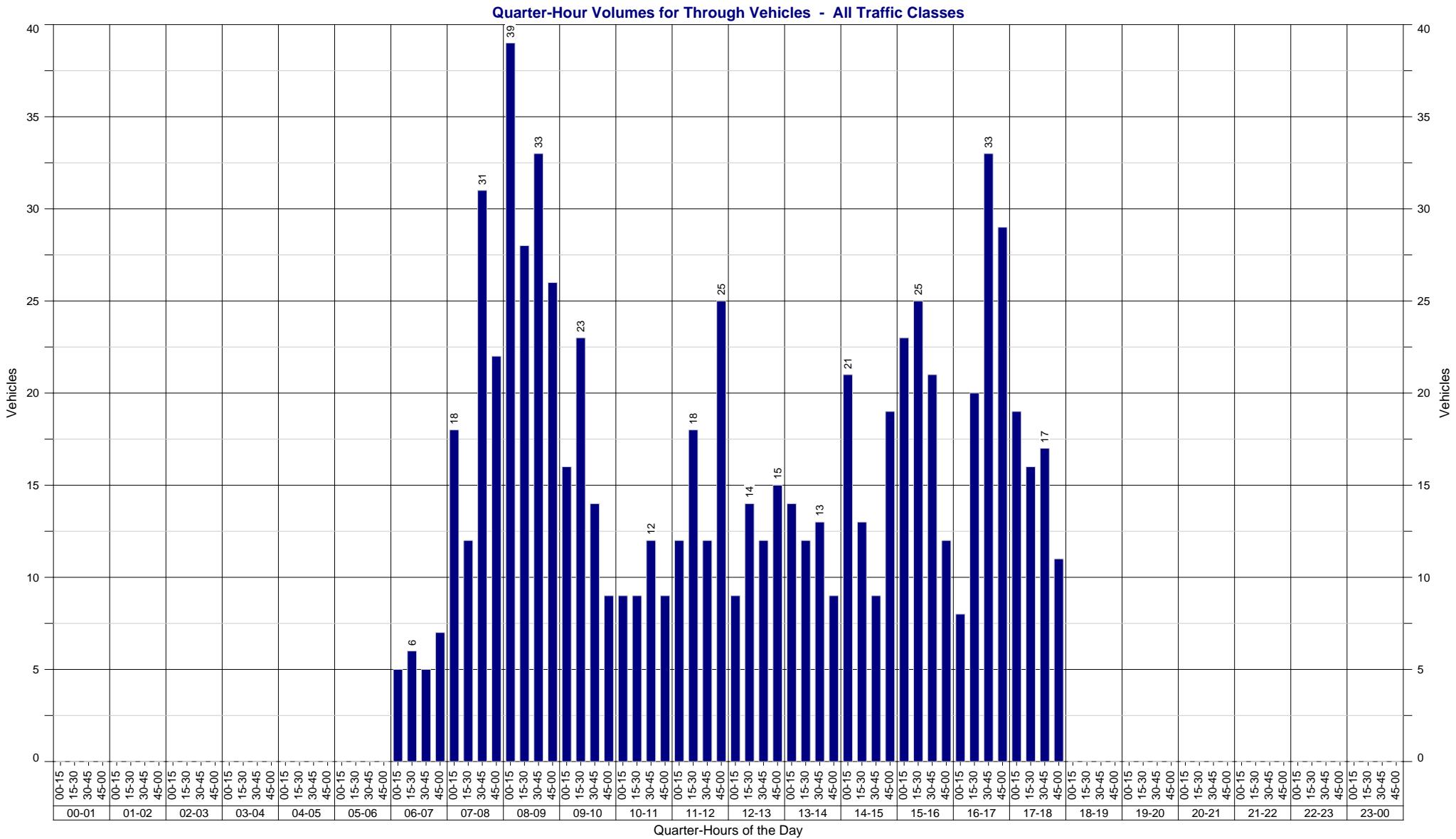
Total volume 47

## Quarter-Hour Volumes for Left-turning Vehicles - All Traffic Classes



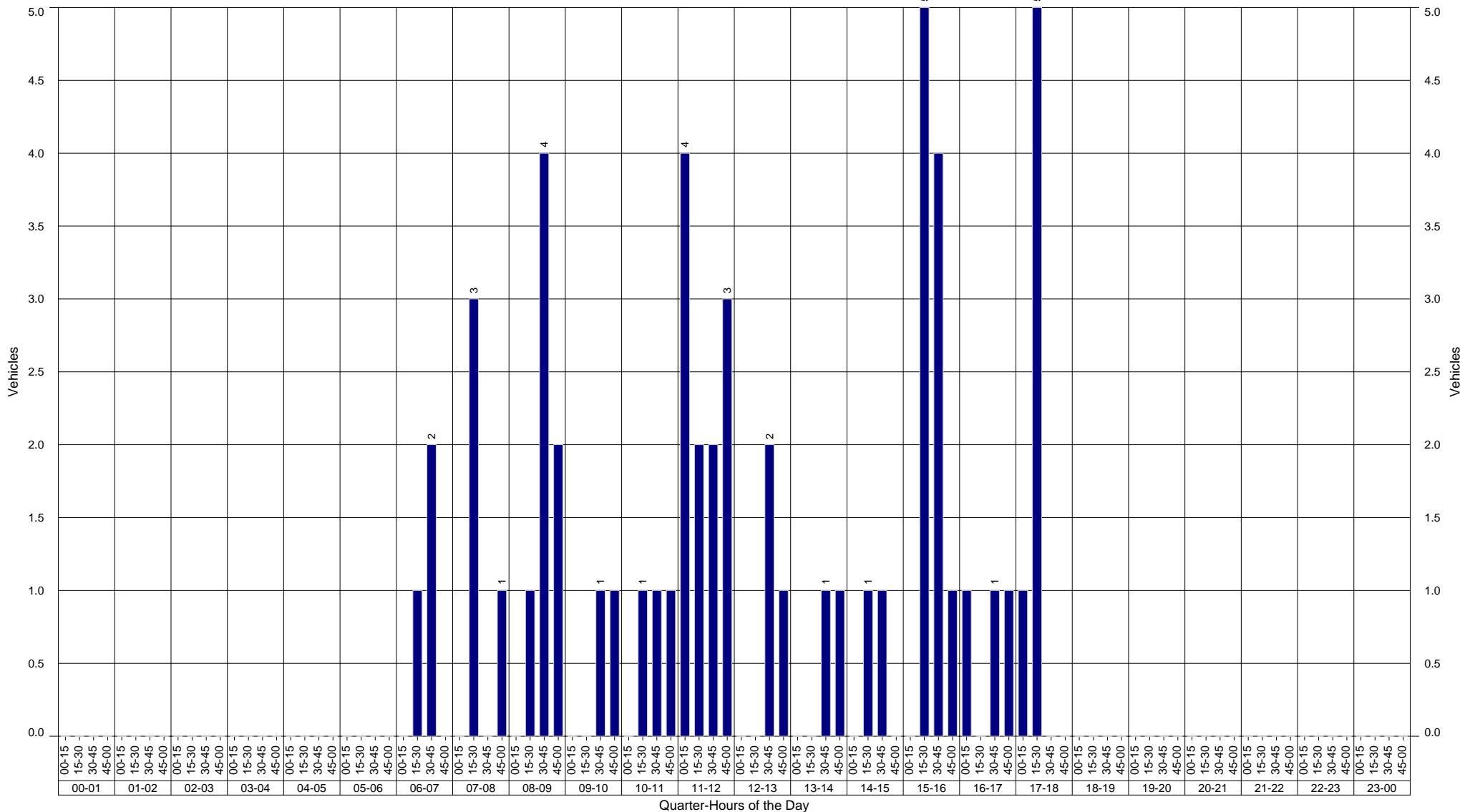
Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce

Total volume 794



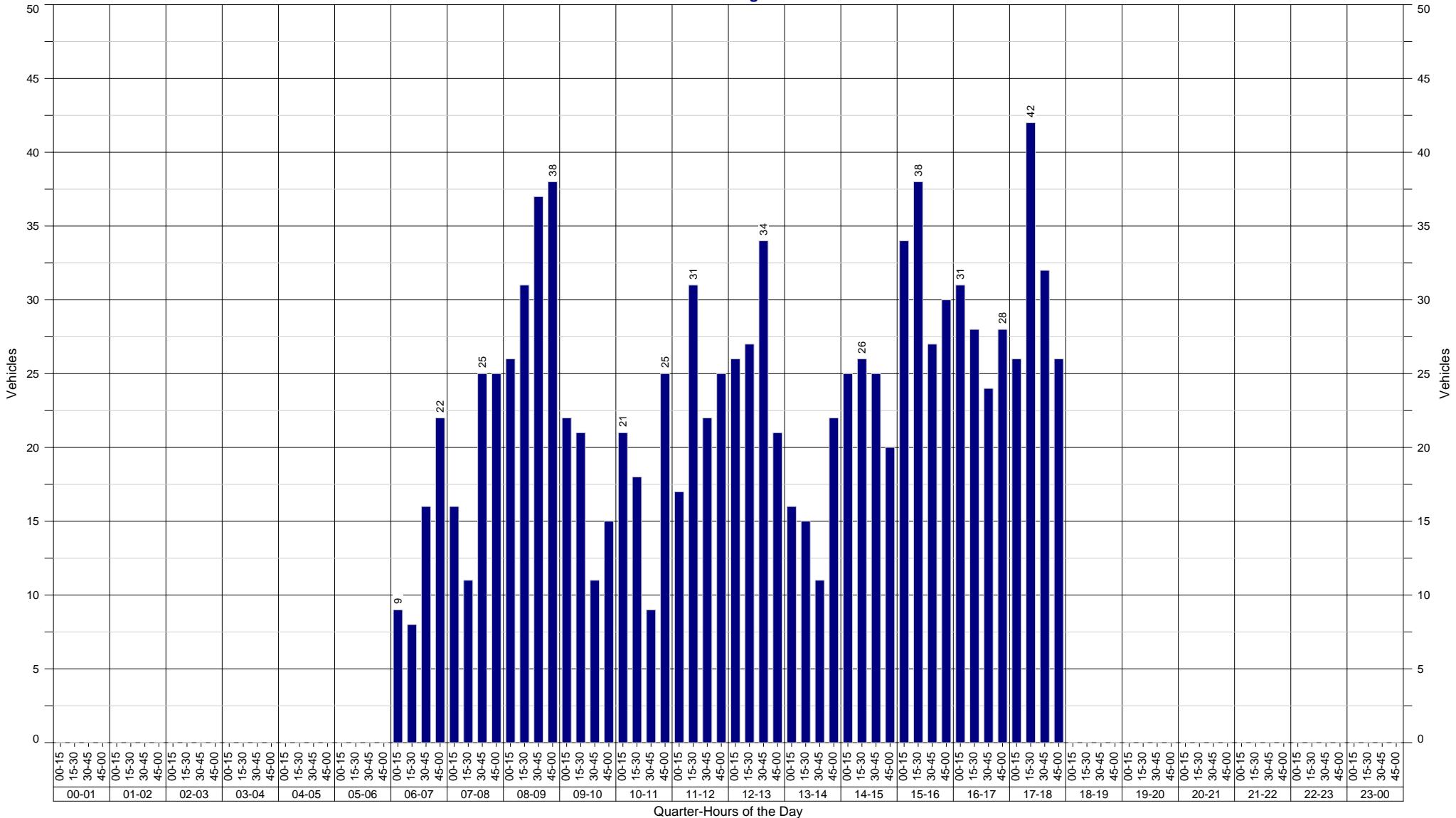
Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce

Total volume 56

**Quarter-Hour Volumes for Right-turning Vehicles - All Traffic Classes**


Leg 4 Site 60501 Tdist 0.000 km George St to North St @ Albert St/Bruce

Total volume 1,135

**Quarter-Hour Volumes for All Vehicles Exiting the Intersection - All Traffic Classes**


## Intersection Analysis Report

Displays traffic and pedestrian flows in both diagram and tabular formats at an intersection on a particular day.

### Content includes:

- Actual day counts.
- Traffic volume in, volume out and total volume for each leg.
- Pedestrian flows when available.

Please Note: This data is not averaged.

### Important Information

It is important to note that data in this report are the actual traffic counts for the associated time interval on the date indicated. This report does not display an Annual Average Daily Traffic (AADT).

### Annual Average Daily Traffic (AADT)

Annual Average Daily Traffic (AADT) is the number of vehicles passing a point on a road in a 24 hour period, averaged over a calendar year.

### Angle

Specifies in degrees how far off north the northern most leg points.

### Area

For administration purposes the Department of Transport and Main Roads has divided Queensland into 12 Districts. The Area field in TSDM reports displays the District Name and Number.

District Name	District
Central West District	401
Darling Downs District	402
Far North District	403
Fitzroy District	404
Mackay/Whitsunday District	405
Metropolitan District	406
North Coast District	407
North West District	409
Northern District	408
South Coast District	410
South West District	411
Wide Bay/Burnett District	412

### Gazettal Direction

Is the direction of the traffic flow. It can be easily recognised by referring to the name of the road eg. Road Section: 10A Brisbane - Gympie denotes that the gazettal direction is from Brisbane to Gympie.

### Intersection

The unique code and description of the Intersection.

### Leg

The code that identifies each leg of the intersection.

- Leg 1 North
- Leg 2 East
- Leg 3 South
- Leg 4 West

The Traffic Analysis and Reporting System (TARS) database has a design limitation that restricts counts to 3way or 4way intersections.

### Pedestrians

Pedestrian counts are collected where required and can be classed into Adult (A) and Children (C).

### Percentage Heavy Vehicles

%HV are displayed for each turning movement when collected.

### Road Section

Is the Gazettal road from which the traffic data is collected. Each Road Section is given a code, allocated sequentially in Gazettal Direction. Larger roads are broken down into sections and identified by an ID code with a suffix for easier data collection and reporting (eg. 10A, 10B, 10C). Road Sections are then broken into AADT Segments which are determined by traffic volume.

### Site

The physical location of a traffic counting device. Sites are located at a specified Through Distance along a Road Section.

### Site Description

The description of the physical location of the traffic counting device.

### TDist

TDist or Through Distance is the physical location of the traffic count site measured in kilometres from the beginning of the Road Section.

### Traffic Classes

Are the categories for which data can be captured at an intersection:

#### Volume

- 00 All vehicles.

#### 2-Bin

- 0A Light vehicles
- 0B Heavy vehicles

#### 4-Bin

- 1A Short vehicles
- 1B Truck or bus
- 1C Articulated vehicles
- 1D Road train

### Vehicle Turning Movements

Turning movements describe the action of a vehicle at the intersection.

- L Left hand turn
- T Through traffic
- R Right hand turn
- U U-turn

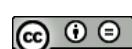
### Copyright

Copyright The State of Queensland (Department of Transport and Main Roads) 2013

### Licence

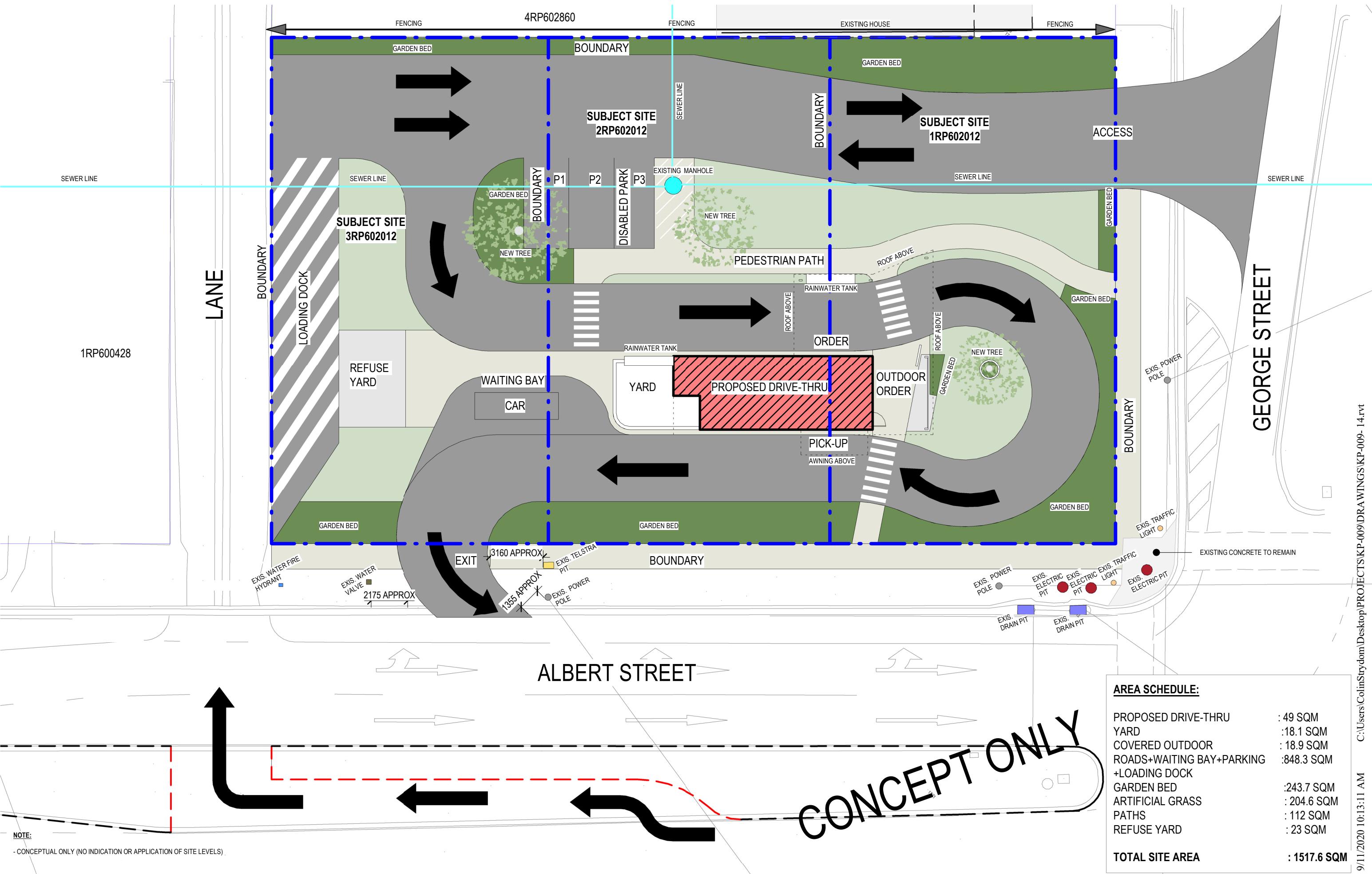
<http://creativecommons.org/licenses/by-nd/3.0/au>

This work is licensed under a Creative Commons Attribution 3.0 Australia (CC BY-ND) Licence. To attribute this material, cite State of Queensland (Department of Transport and Main Roads) 2013



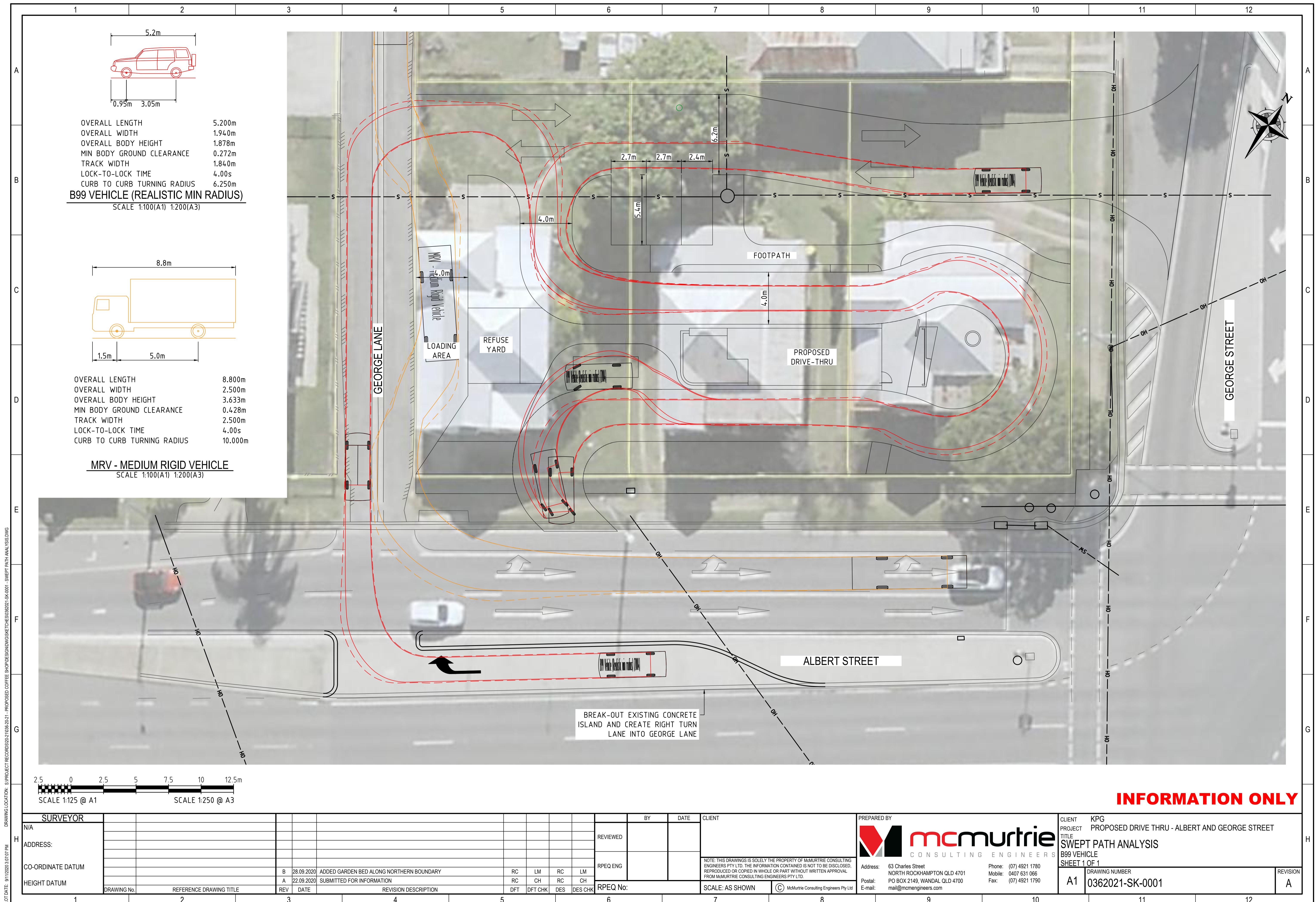
## **Attachment 2 – Proposed Site Layout**

DRAFT



## **Attachment 3 – Swept Path Plan**

DRAFT



# Stormwater Management Plan

*Proposed Coffee Shop*

*40, 42 & 44 Albert Street, Rockhampton City, Rockhampton*

***Prepared For: Kele Property Group***

Job No. 036-20-21

04 November 2020

Revision A

**PLANS AND DOCUMENTS  
referred to in the REFERRAL  
AGENCY RESPONSE**



SARA ref: 2011-19864 SRA .....

Date: 21 December 2020 .....

ABN 69 958 286 371

P (07) 4921 1780

F (07) 4921 1790

E mail@mcmengineers.com

PO Box 2149

Wandal Q 4700

63 Charles Street

North Rockhampton Q 4701

# Stormwater Management Plan

Rev.	Description	Signature	RPEQ No	Date
A	Issued For Approval		5141	04.11.20

This report has been prepared for the sole use of the Client. The information contained is not to be disclosed, reproduced or copied in whole or part without written approval from McMurtrie Consulting Engineers. The use of this report by unauthorised third parties shall be at their own risk and McMurtrie Consulting Engineers accept no duty of care to any such third party.

## CONTENTS

1.0	INTRODUCTION AND APPROACH.....	1
1.1.	PROJECT OVERVIEW.....	1
1.2.	METHODOLOGY .....	1
1.3.	DATA SOURCES.....	1
2.0	SITE CHARCTERISTICS .....	2
2.1.	SITE LOCATION .....	2
2.2.	TOPOGRAPHY .....	3
3.0	HYDROLOGY ASSESSMENT.....	4
3.1.	LAWFUL POINT OF DISCHARGE .....	4
3.2.	HYDROLOGIC MODELLING .....	4
3.2.1.	CATCHMENT HYDROLOGY PARAMETERS .....	5
3.2.2.	HYDROLOGY RESULTS .....	5
3.2.3.	EXTERNAL CATCHMENTS.....	8
4.0	HYDRAULIC ASSESSMENT.....	9
4.1	BACKGROUND .....	9
4.2	DETENTION.....	9
5.0	QUALITY ASSESSMENT.....	12
5.1.	BACKGROUND .....	12
5.2.	CONSTRUCTION PHASE.....	12
5.2.1.	KEY POLLUTANTS.....	12
5.2.2.	EROSION AND SEDIMENT CONTROLS .....	12
6.0	CONCLUSION .....	13
	APPENDIX A .....	A
	APPENDIX B .....	B
	APPENDIX C .....	C

# Stormwater Management Plan

*Proposed Coffee Shop*

## 1.0 INTRODUCTION AND APPROACH

---

### 1.1. PROJECT OVERVIEW

McMurtrie Consulting Engineers (MCE) have been commissioned by Kele Property Group to undertake a site-based Stormwater Management Plan (SMP) for a proposed coffee shop. The site is located at 40, 42, 44 Albert Street, Rockhampton City on Lots 1, 2 and 3 on RP602012.

The aim of this SMP is to demonstrate that the proposed development will comply with Capricorn Municipal Development Guidelines (CMDG), Queensland Urban Drainage Manual (QUDM 2016), Australian Rainfall and Runoff 2016 (ARR'16) and State Planning Policy (SPP 2017).

### 1.2. METHODOLOGY

The assessment methodology adopted for this SMP is summarised below.

- Broadly identify the contributing catchments to the project.
- Identify Lawful Point of Discharge (LPOD) for the site stormwater runoff.
- Identify the critical storm events and duration for this project
- Estimate peak discharge runoff for pre-development and post-development scenarios.
- Identify potential mitigation and management strategies to ensure no worsening to downstream catchments and infrastructure.

### 1.3. DATA SOURCES

The background data used to undertake this assessment were collected from the following sources:

- ARR'16 data hub
  - Rainfall data
  - Design storm ensemble temporal patterns
- Rockhampton Regional Council GIS data
- Preliminary overall layout plan (completed by Design Architecture)
- Pluviograph rainfall data for the 'Rockhampton Aero' station

## 2.0 SITE CHARACTERISTICS

### 2.1. SITE LOCATION

The site is located at 40, 42, 44 Albert Street, Rockhampton City on Lots 1, 2 and 3 on RP602012. Site details have been summarised within Table 1. The proposed site is located as per **Figure 1** below.

**Table 1:** Site Description

Registered Owner	Property and Location	
	Lot and Property Description	Address
Kele Property Group	Lots 1, 2 and 3 on RP602012	40, 42, 44 Albert Street, Rockhampton City, Rockhampton



**Figure 1:** Site Location

The proposed development site is located in the Rockhampton City area within the Rockhampton Regional Council Local Government Area. The site is approximately 0.152 ha in size

## 2.2. TOPOGRAPHY

The area is presently occupied by 3 Residential structures with sparse trees and grass. The site is bounded on the west by George Lane, the south by Albert Street, the east by George Street and north by residential lots. Typically, existing ground levels across the site are at RL12.6.



**Figure 2: Existing 3 Residential structures from intersection of Albert and George Street**

## 3.0 HYDROLOGY ASSESSMENT

### 3.1. LAWFUL POINT OF DISCHARGE

The existing site is generally falling 1% towards George lane, Albert Street and George street kerb, ultimately arriving at the existing stormwater pits on Albert Street. This point of discharge is under the lawful control of the local government and satisfies the requirements for Lawful Points of Discharge (LPOD) in accordance with QUDM.

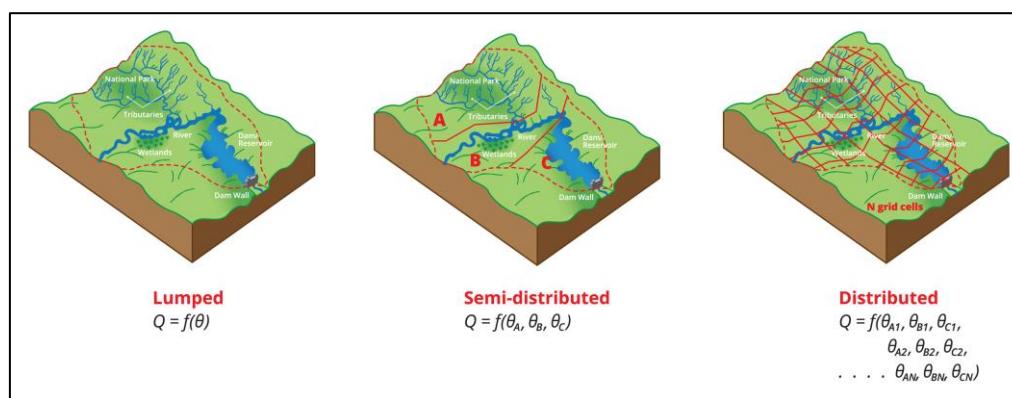
Any stormwater volume increase from post development will be detained to ensure there will be no adverse impacts on downstream properties and infrastructure.

### 3.2. HYDROLOGIC MODELLING

Hydrologic calculations have been undertaken using XPSTORM 2019 V1 for pre and post development scenarios. The modelling within XPSTORM environment has been undertaken to estimate the peak discharge for storms up to 1% AEP. Hydrologic modelling has been undertaken using the Laurendon Runoff Routing Method. Laurendon's Method is an industry leading hydrologic routing method that can be used for catchments ranging between  $10m^2$  up to  $20,000km^2$ . The information required to apply Laurendon's Method include:

- Rainfall Intensity Data (obtained from the Bureau of Meteorology 2016 IDF utility)
- Rainfall Temporal Patterns (obtained from the ARR'16 Data Hub)
- Catchment Area (ha)
- Catchment Slope
- Initial and Continuing Infiltration Data
- Catchment Roughness (Manning's 'n')

Given the relatively limited scope of this hydraulic impact assessment a lumped catchment approach, as defined by ARR'16 and shown in Figure 2 below, was applied to the hydrologic review of the site. The lumped approach is suitable for this site given the relative consistency in land use and the ultimate purpose of the model.



**Figure 3: Catchment Analysis Options**

### 3.2.1. CATCHMENT HYDROLOGY PARAMETERS

Table 2 and 3 summarises the input data for the development site in pre-development and post-development conditions.

**Table 2: Pre-Development Model Parameters (XP Storm)**

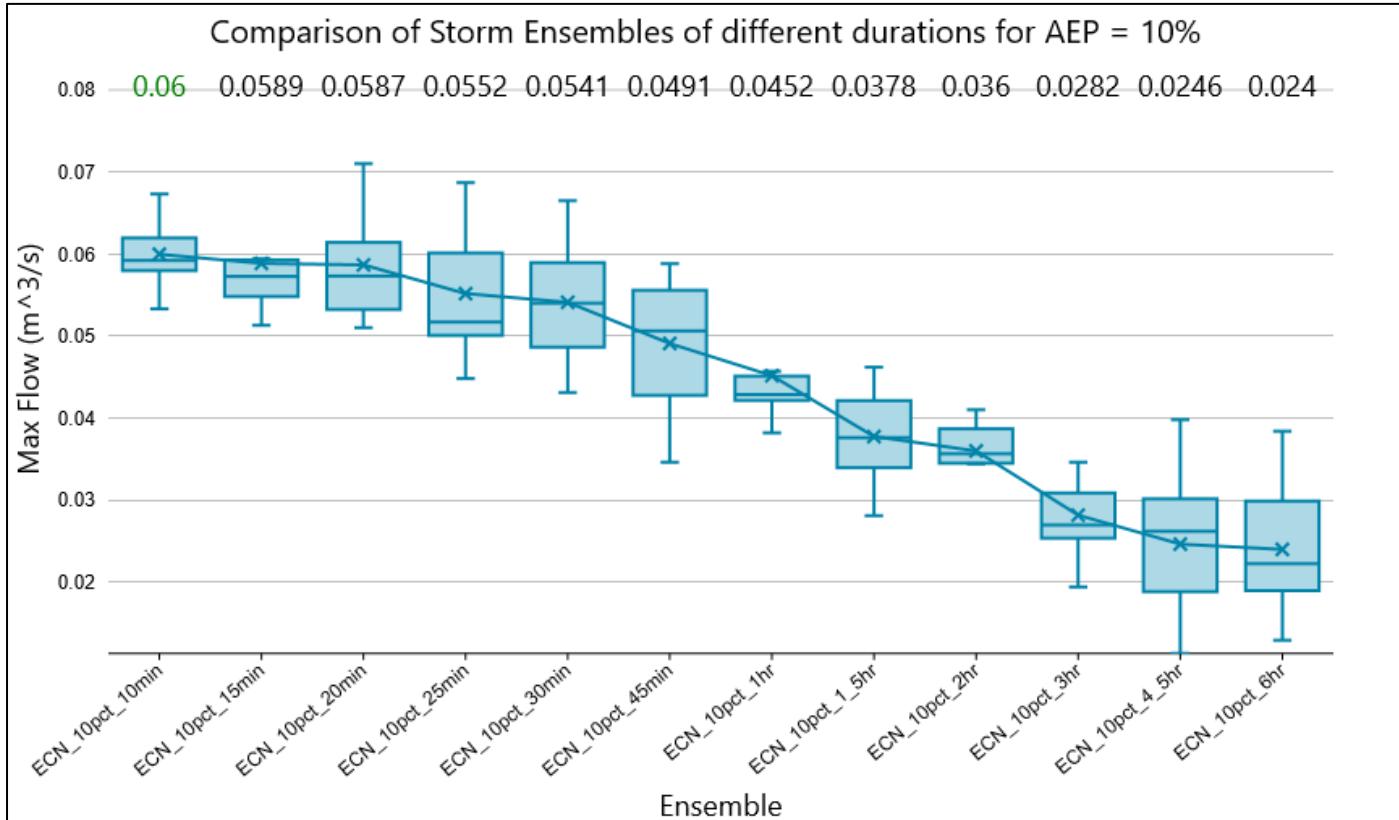
Parameter	Grass	Concrete	Roof Material
Area (ha)	0.092	0.007	0.053
Impervious (%)	0.0	100	100
Slope (%)	1	1	57
Laurenson ‘n’ (storage non-linearity exponent)	-0.285	-0.285	-0.285
Infiltration	Initial Loss (mm/hr)	0.0	0.0
	Continuing Loss (mm/hr)	1.7	0.0
Manning’s Roughness (n)	0.025	0.012	0.022

**Table 3: Post-Development Model Parameters (XP Storm)**

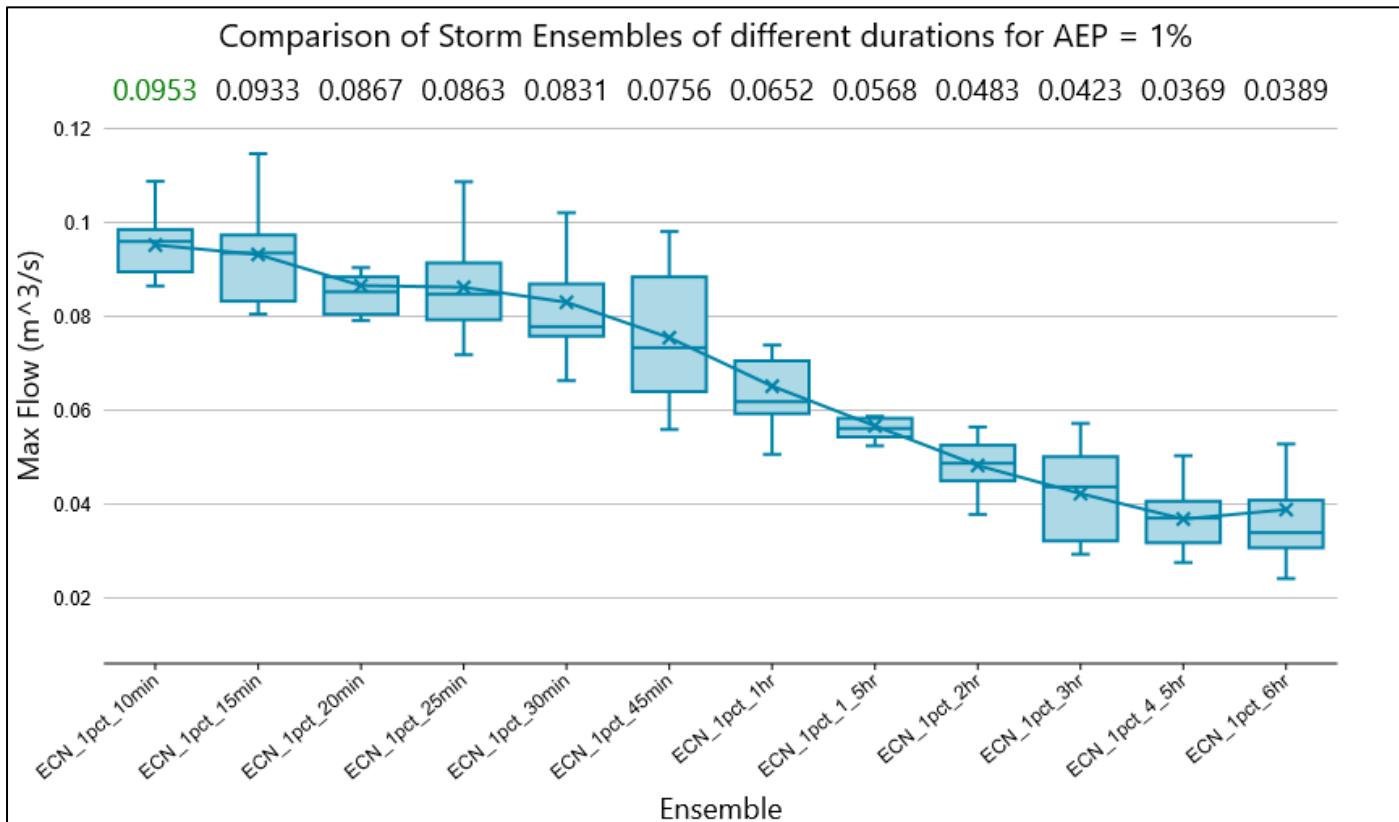
Parameter	Garden	Grass	Concrete	Roof Material
Area (ha)	0.025	0.021	0.094	0.012
Impervious (%)	0.0	0.0	100	100
Slope (%)	1	1	1	57
Laurenson ‘n’ (storage non-linearity exponent)	-0.285	-0.285	-0.285	-0.285
Infiltration	Initial Loss (mm/hr)	0.0	0.0	0.0
	Continuing Loss (mm/hr)	1.7	1.7	0.0
Manning’s Roughness (n)	0.06	0.025	0.012	0.022

### 3.2.2. HYDROLOGY RESULTS

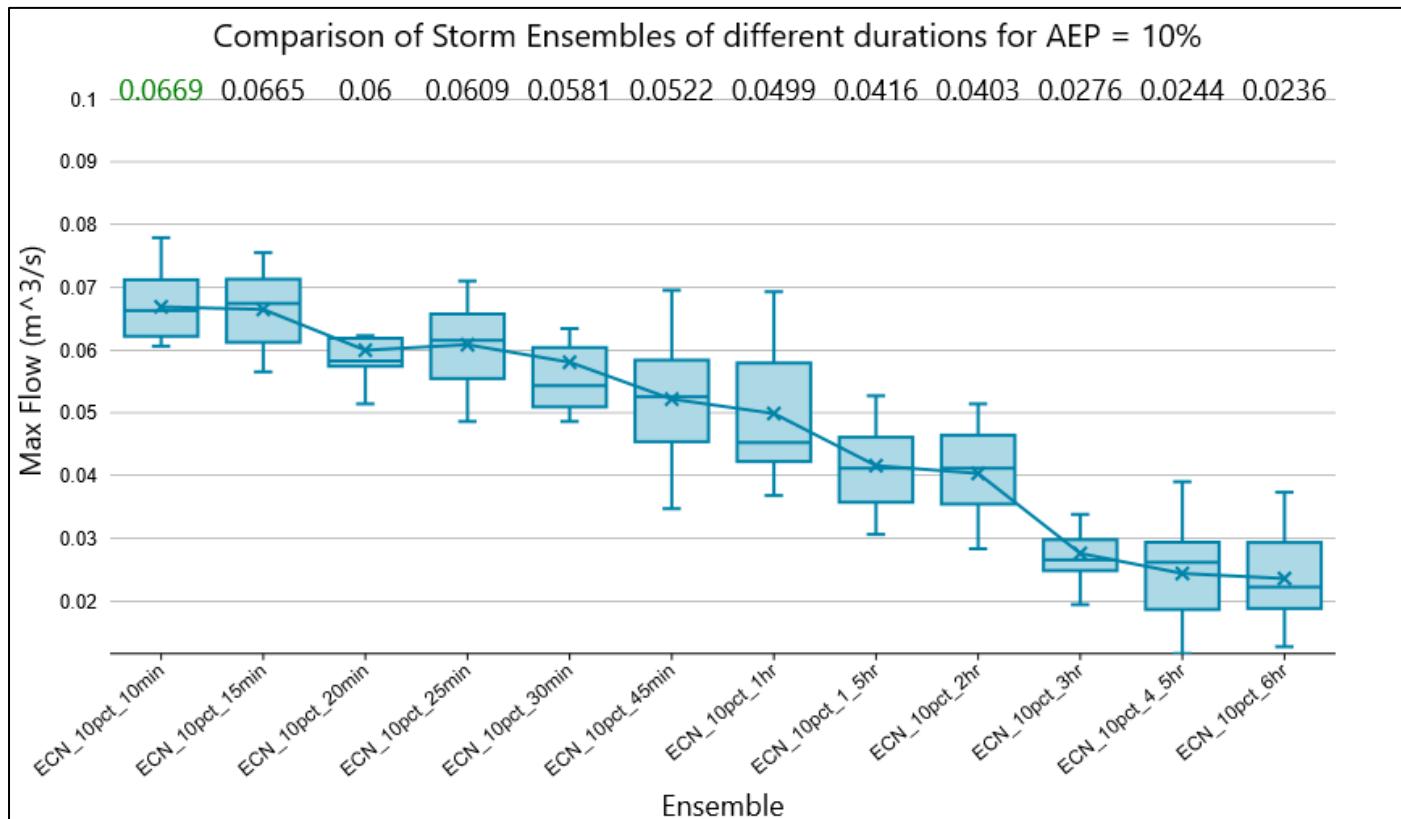
Applying the ARR’16 ensemble temporal patterns to the catchment allowed the identification of the critical duration for the mean minor (10% AEP) and major (1% AEP) storm event. Below figures are screen shots of Box and Whisker plot taken from XPSTORM software. This plot shows the comparison of storm ensembles for different durations for minor and major storm events. For complete box and whisker charts for the remainder of recurrence intervals refer Appendix B.



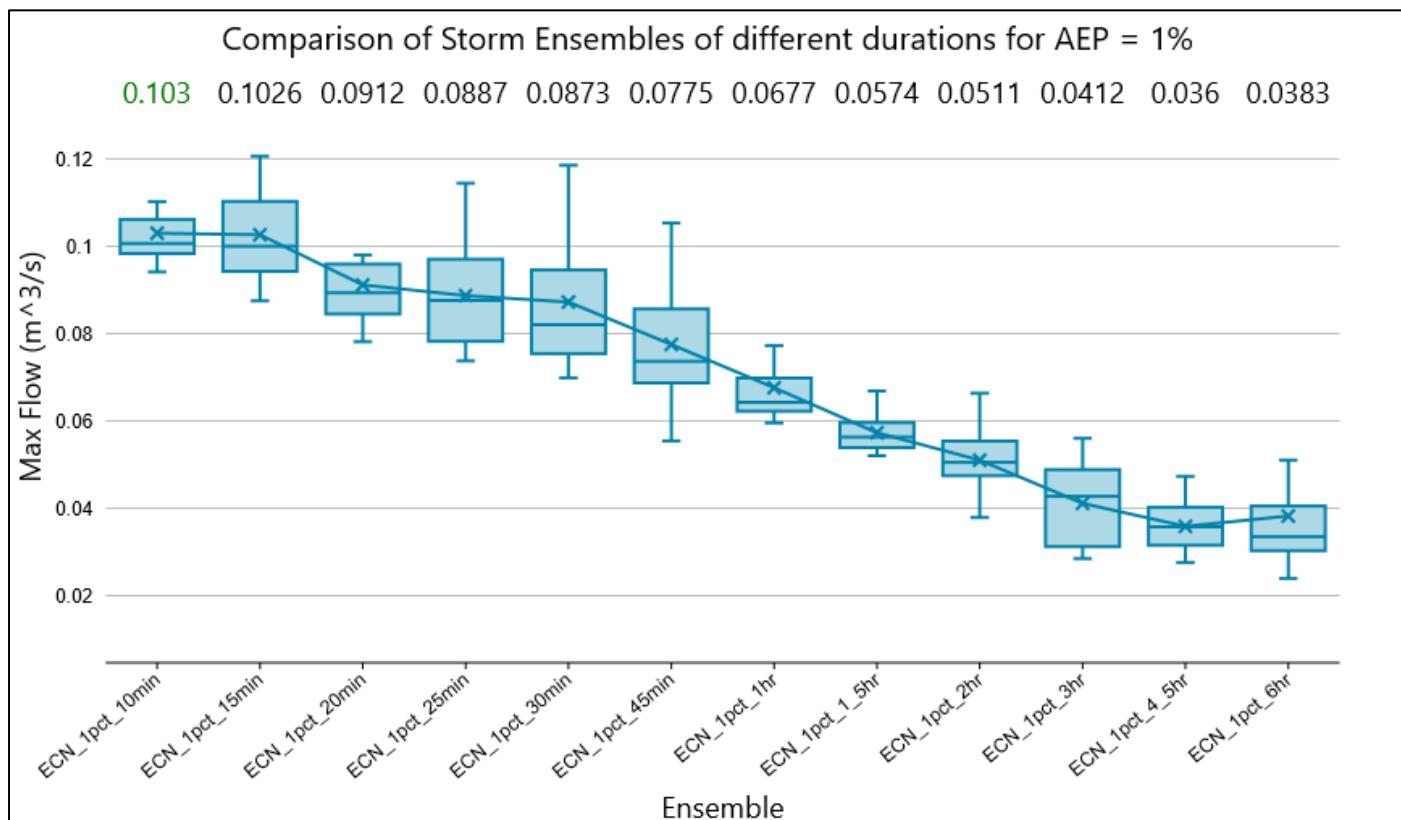
**Figure 4: Comparison of Storm Ensembles of different durations for 10% AEP (Pre-development) (XPSTORM Model)**



**Figure 5: Comparison of Storm Ensembles of different durations for 1% AEP (Pre-development) (XPSTORM Model)**



**Figure 6: Comparison of Storm Ensembles of different durations for 10% AEP (Post-development) (XPSTORM Model)**



**Figure 7: Comparison of Storm Ensembles of different durations for 1% AEP (Post-development) (XPSTORM Model)**

The peak results of each of the ensembles for minor and major storm events are summarised in Table 4 (Refer Appendix C for storm events for additional durations and recurrence intervals). The same storm events are applied to the hydraulic analysis.

**Table 4: Critical Storm Events**

<b>Annual Exceedance Probability (AEP %)</b>	<b>Max. Mean Storm Event</b>	
	<b>Pre development</b>	<b>Post development</b>
10% (Minor Event)	10pct_10min_8	10pct_10min_4
1% (Major Event)	1pct_10min_2	1pct_10min_3

### 3.2.3. EXTERNAL CATCHMENTS

There appears to be no external catchments impacting the subject site as the northern lot appears to fall into George Lane.

## 4.0 HYDRAULIC ASSESSMENT

### 4.1 BACKGROUND

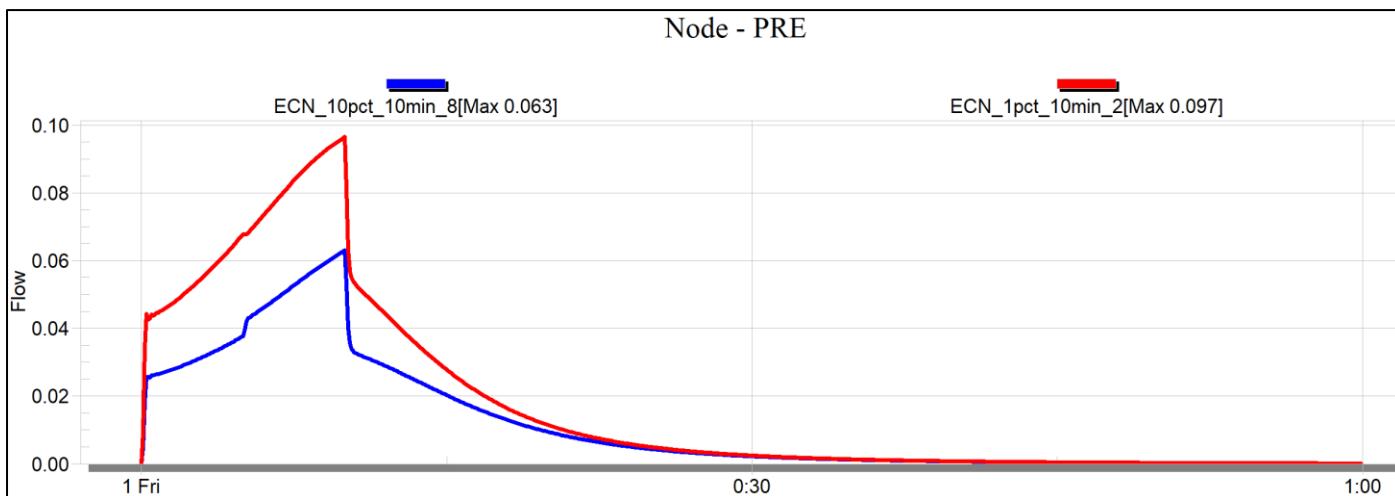
The hydraulic assessment for the site has been carried out using XPSTORM 2019 V1. The aim of the hydraulic modelling is to demonstrate that the post-development minor and major storm peak discharge at the LPOD is equal or less than the peak pre-development discharge. Series of pits and pipes will be utilised to convey discharge to the existing stormwater pit on Albert Street. The internal stormwater pits will be located in sags to allow storage, with a weir outlet onto George street for major storm events.

### 4.2 DETENTION

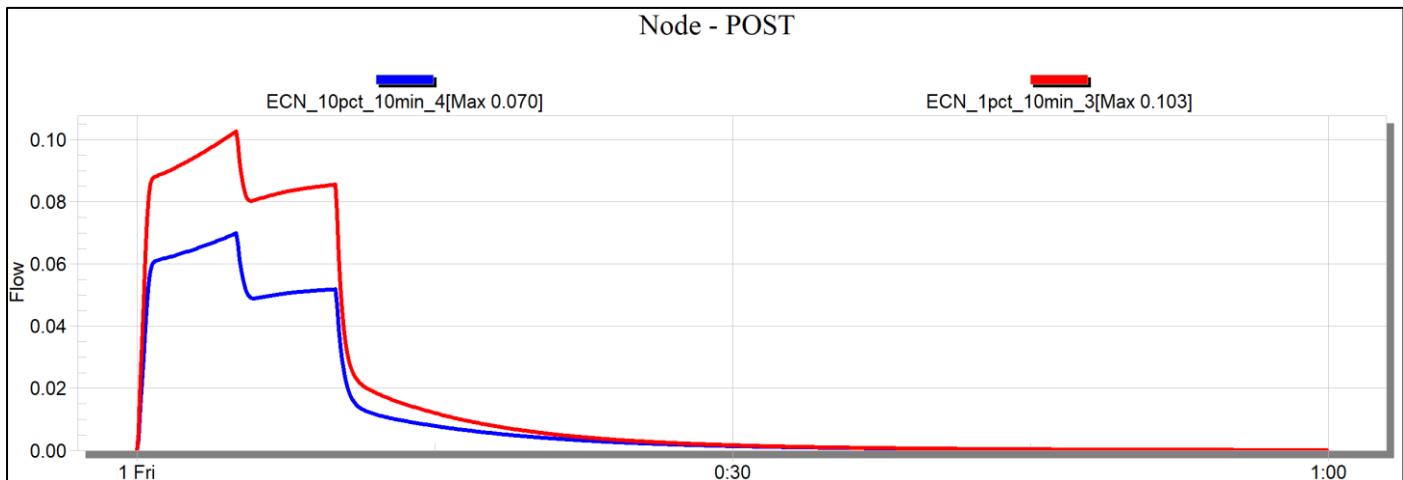
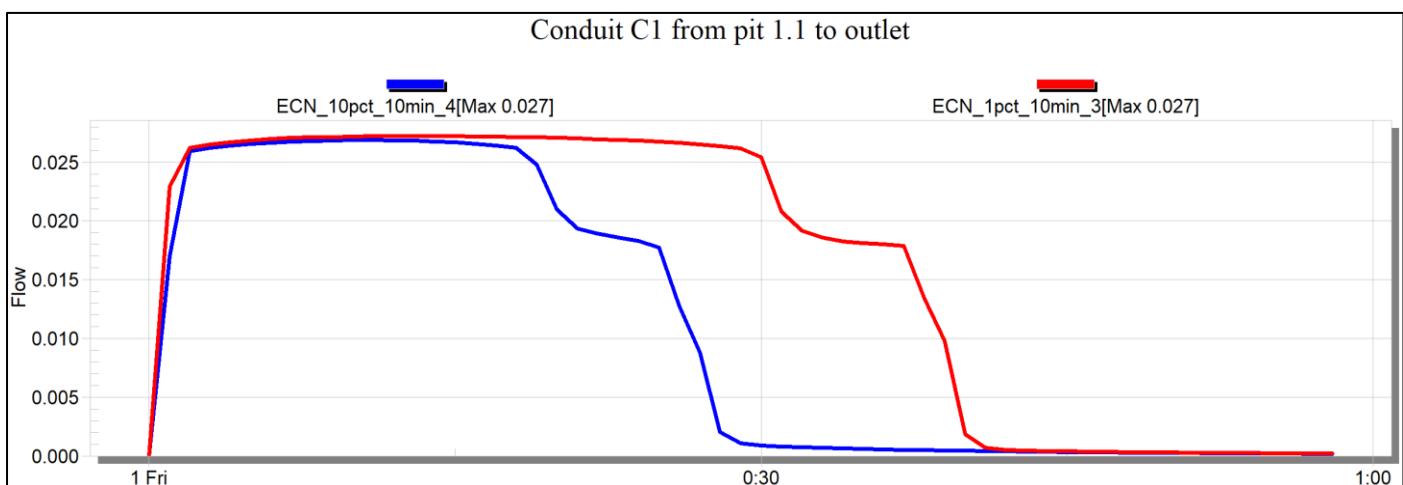
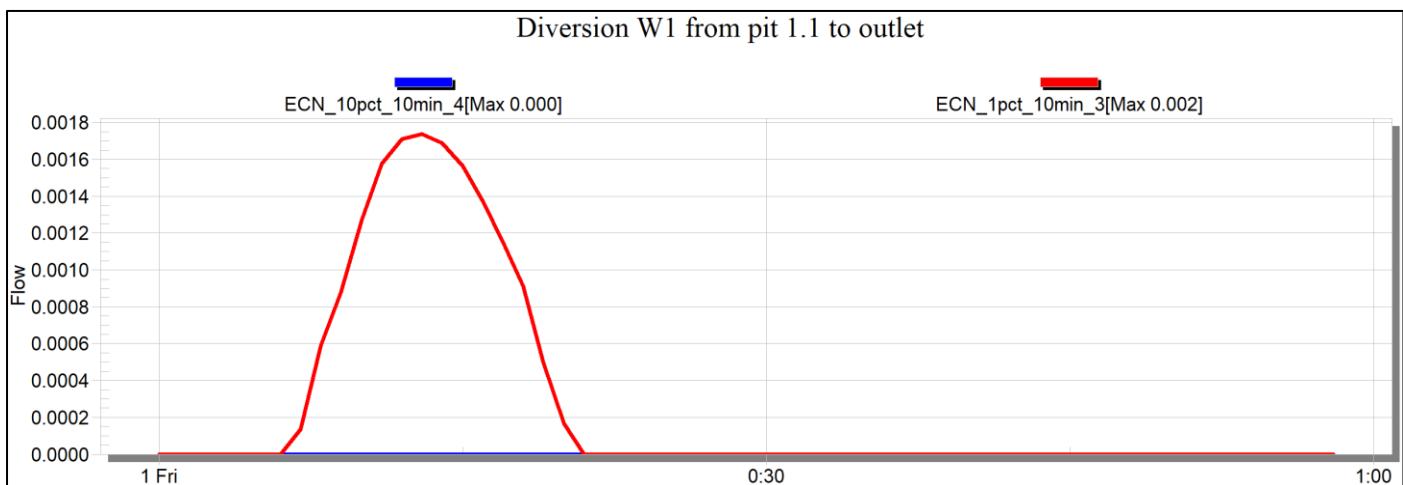
The proposed development will utilise approximately 83.5m<sup>3</sup> of detention volume at graded sag inlets to ensure no worsening to downstream catchments and infrastructure. The western loading bay cannot be detained, as such the detention strategy will have to account for this. Table 5 summarises the peak storm events for the pre-development and post-development conditions. Refer appendix B and C for hydrology and hydraulics of storm events with AEP 63.2%, 50%, 20% and 5%.

**Table 5: Peak Discharge Rate at LPOD**

Storm Event (AEP %)	Pre- Development Discharge (m <sup>3</sup> /s)	Post- Development Discharge – Unmitigated (m <sup>3</sup> /s)	Outflow from Open Detention Basin (m <sup>3</sup> /s)			
			125 uPVC	0.5 m Weir	Loading area	Total
63.2%	0.0318	0.0377	0.026	0.000	0.003	0.0290
50%	0.0358	0.0424	0.026	0.000	0.004	0.0300
20%	0.0491	0.0569	0.027	0.000	0.005	0.0320
10% (Minor Event)	0.0600	0.0669	0.027	0.000	0.005	0.0320
5%	0.0706	0.0774	0.027	0.000	0.007	0.0340
1% (Major Event)	0.0953	0.1010	0.027	0.002	0.008	0.0370



**Figure 8: Pre-Development Peak Discharge Rate at LPOD**

**Figure 9: Post-Development Peak Discharge Rate at LPOD****Figure 10: Outflow from site – 125mm pipe****Figure 11: Outflow from site – 0.5m Weir**

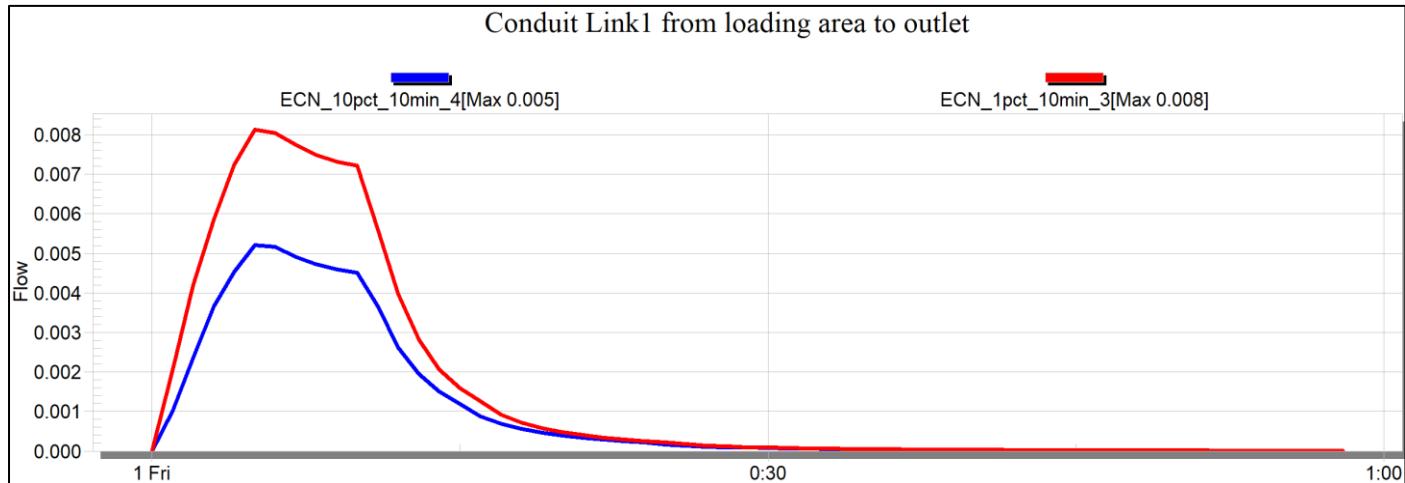
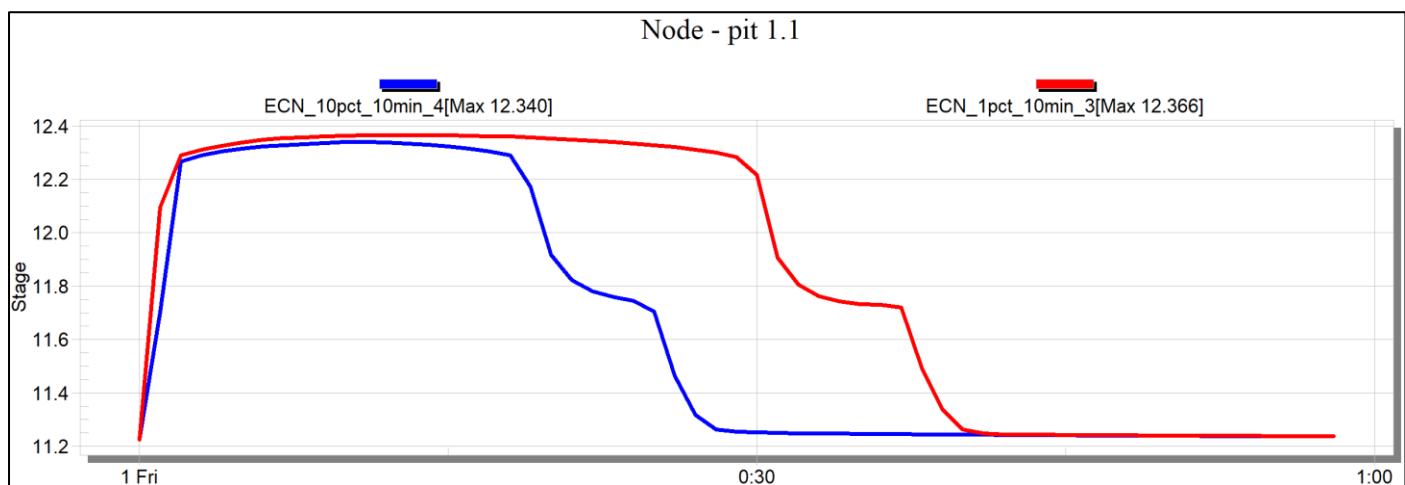
**Figure 12:** Outflow from site – unmitigated loading area**Figure 13:** Peak Water Level

Table 6 summarises storage parameters to achieve the target mitigated pre-development flow rates.

**Table 6: Stormwater network Parameters**

<b>Effective Detention Volume (approximate)</b>	<b>83.5m<sup>3</sup></b>
<b>Pit IL</b>	<b>11.225m</b>
<b>Pit SL</b>	<b>12.22m</b>
<b>Weir Width</b>	<b>0.5m</b>
<b>Weir RL</b>	<b>12.35m</b>
<b>Peak Water Level in 1% AEP (approximate)</b>	<b>12.366m</b>
<b>Peak Water Depth on road in 1% AEP (approximate)</b>	<b>0.146m</b>
<b>Outlet Structure</b>	<b>125mm uPVC with 0.5m Weir</b>

Outflow from stormwater pit will be discharged into existing stormwater pit on Albert Street.

## 5.0 QUALITY ASSESSMENT

### 5.1. BACKGROUND

The proposed development will result is on a subject site of 1515m<sup>2</sup>. State planning Policy states that water quality assessment benchmarks for MCU are for premises 2500m<sup>2</sup> or greater, therefore there is no requirement for water quality management of the operational phase of the development.

The development of the land has the potential to increase the pollutant loads within stormwater runoff and downstream watercourses. During construction phase of the development, disturbances to the existing ground have the potential to significantly increase sediment loads entering downstream drainage systems and watercourses.

The following sections describe construction phase controls.

### 5.2. CONSTRUCTION PHASE

#### 5.2.1. KEY POLLUTANTS

During the construction phase a number of key pollutants have been identified for this development. Table 7 illustrates the key pollutants that have been identified.

Pollutant	Sources
Litter	Paper, construction packaging, food packaging, cement bags, material off cuts.
Sediment	Exposed soils and stockpiles during earthworks and building works.
Hydrocarbons	Fuel and oil spills, leaks from construction equipment and temporary car park areas.

**Table 7: Key Pollutants – Construction Phase**

#### 5.2.2. EROSION AND SEDIMENT CONTROLS

Erosion and Sediment Control (ESC) devices employed on the site shall be designed and constructed in accordance with CMDG.

#### PRE CONSTRUCTION

- Stabilised site access/exit.
- Sediment fences to be located along the contour lines downstream of disturbed areas.
- Diversion drains to divert clean runoff around the construction site.
- Educate site personnel to the requirements of the Sediment and Erosion Control Plan.

#### CONSTRUCTION

- Maintain construction access/exit, sediment fencing, catch drains and all other existing controls as required.
- Progressively surface and revegetate finished areas as appropriate.

During construction, all areas of exposed soils allowing dust generation are to be suitably treated. Treatments will include mulching the soil and watering. Road access is to be regularly cleaned to prevent the transmission of soil on vehicle wheels and eliminate any build-up of typical road dirt and tyre dusts from delivery vehicles.

Adequate waste disposal facilities are to be provided and maintained on the site to cater for all waste materials such as litter hydrocarbons, toxic materials, acids or alkaline substances.

## 6.0 CONCLUSION

---

The following conclusions are drawn based on the above study of the site;

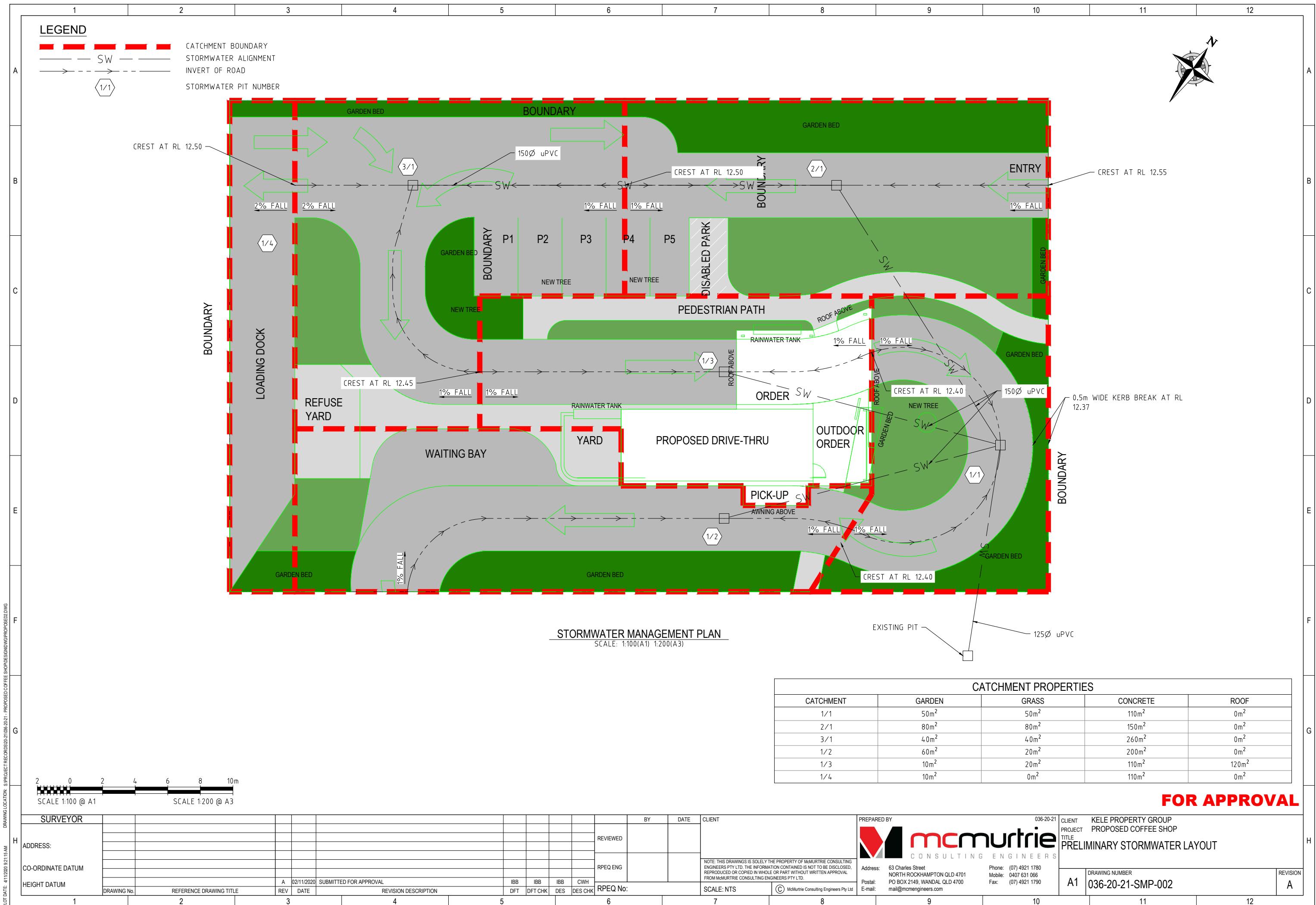
- Post-development runoff routed through an internal drainage network, with crests and sags to allow ponding for additional storage.
- Outflow from the stormwater network will be discharged into albert street stormwater pit, the legal point of discharge, via 125mm dia uPVC and 0.5m weir.
- There will be no stormwater quality strategy adopted for the operational phase of the development in accordance with the requirements of the State Planning Policy (July 2017).

## **APPENDIX A**

---

### **Stormwater Management Plan**

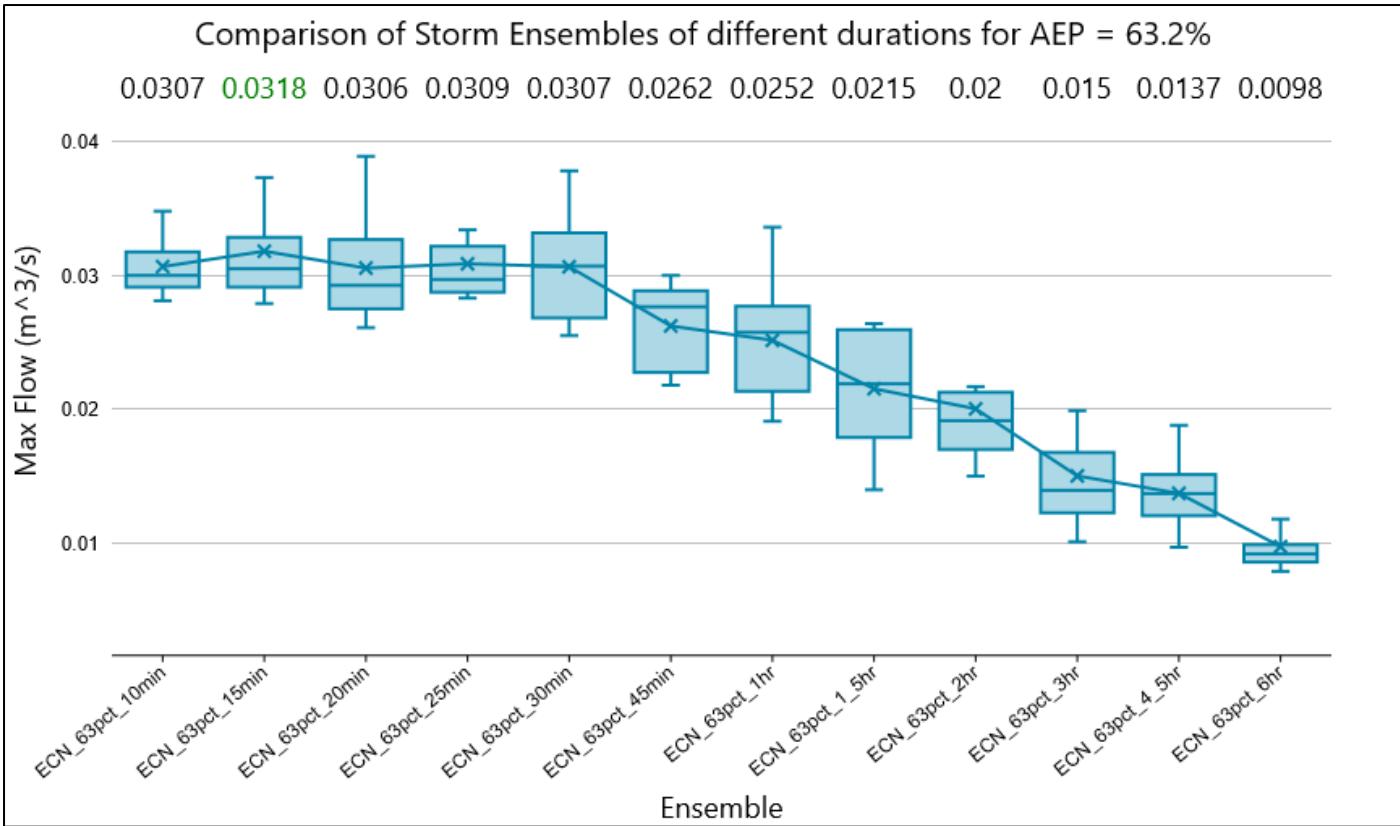
	1	2	3	4	5	6	7	8	9	10	11	12
A												
B												
C												
D												
E												
F												
G												
H												
DRAWING LOCATION: SURVEY RECORDS 2021/08/20-21 - PROPOSED COFFEE SHOP DESIGN EXISTING DWG												
<b>EXISTING CATCHMENT PLAN</b> <small>SCALE: 1:100(A1) 1:200(A3)</small>												
<b>LEGEND</b>												
<small>SCALE 1:100 @ A1      SCALE 1:200 @ A3</small>												
<b>FOR APPROVAL</b>												
SURVEYOR _____ ADDRESS: _____ CO-ORDINATE DATUM _____ HEIGHT DATUM _____ DRAWING No. _____ REFERENCE DRAWING TITLE _____ REV. _____ DATE _____												
BY _____ DATE _____ REVIEWED _____ RREQ ENG _____ IBB IBB IBB CWH DFT DFT CHK DES DES CHK RREQ No: _____ SCALE: NTS _____ © McMURTRIE CONSULTING ENGINEERS Pty Ltd												
PREPARED BY <b>mcmurtrie</b> CONSULTING ENGINEERS 036-20-21    CLIENT KELE PROPERTY GROUP PROJECT PROPOSED COFFEE SHOP TITLE EXISTING CATCHMENT PLAN Address: 63 Charles Street NORTH ROCKHAMPTON QLD 4701 Phone: (07) 4921 1780 Postal: PO BOX 2149, WANDAL QLD 4700 Mobile: 0407 631 066 E-mail: mail@mcmengineers.com Fax: (07) 4921 1790												
A1    DRAWING NUMBER 036-20-21-SMP-001    REVISION A												
1	2	3	4	5	6	7	8	9	10	11	12	



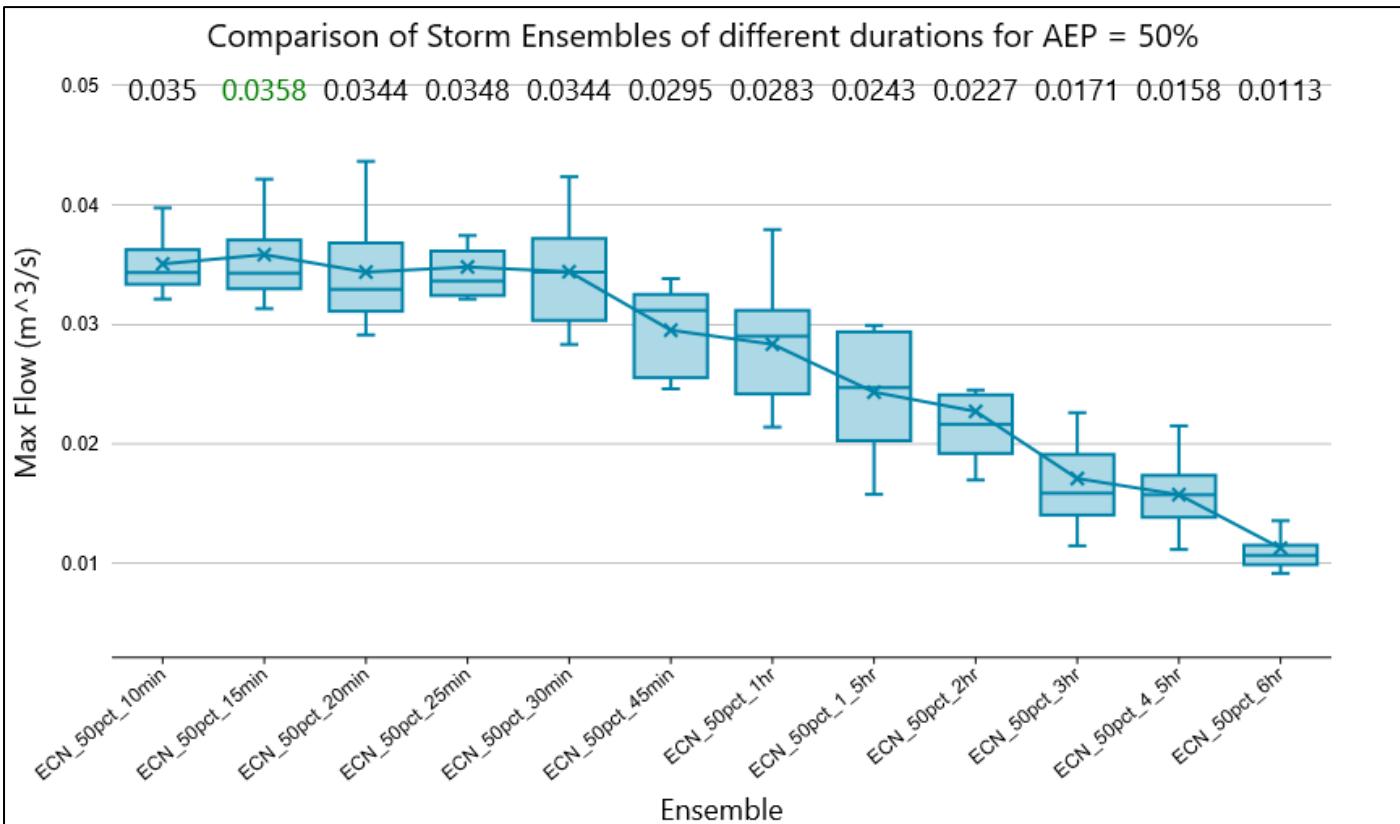
## **APPENDIX B**

---

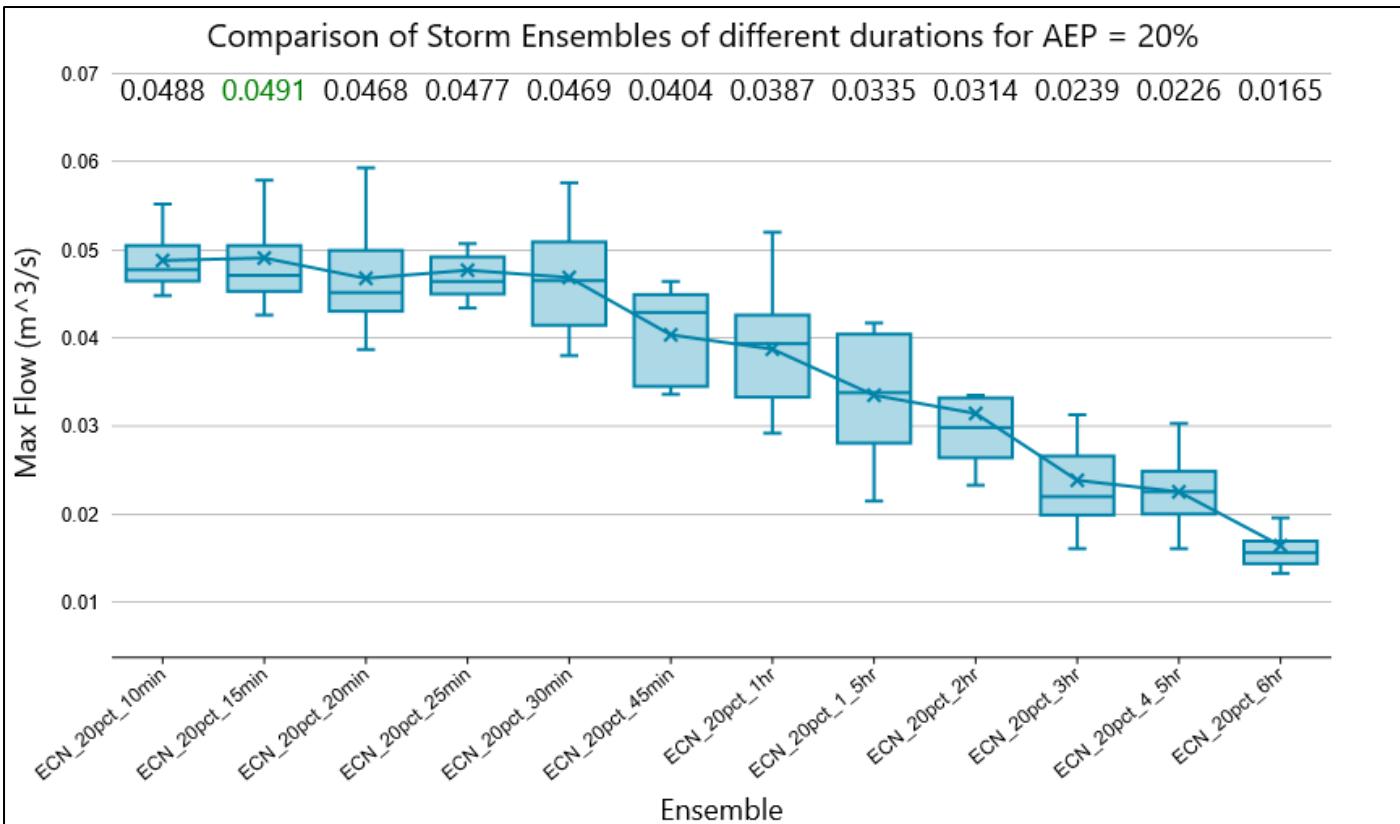
Additional Box and Whisker Charts



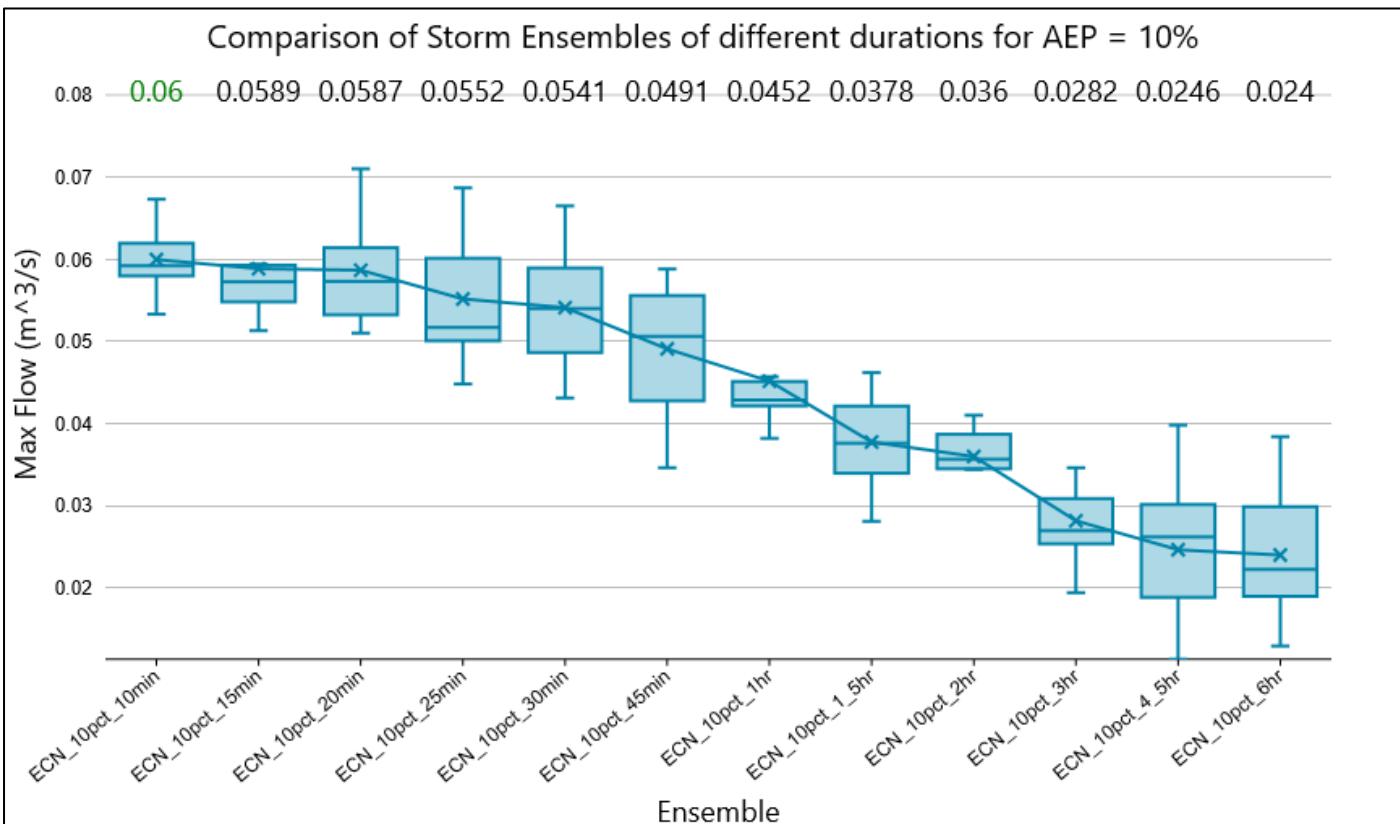
**Figure 1: Comparison of Storm Ensembles of different durations for 63.2% AEP (Pre-development) (XPSTORM Model)**



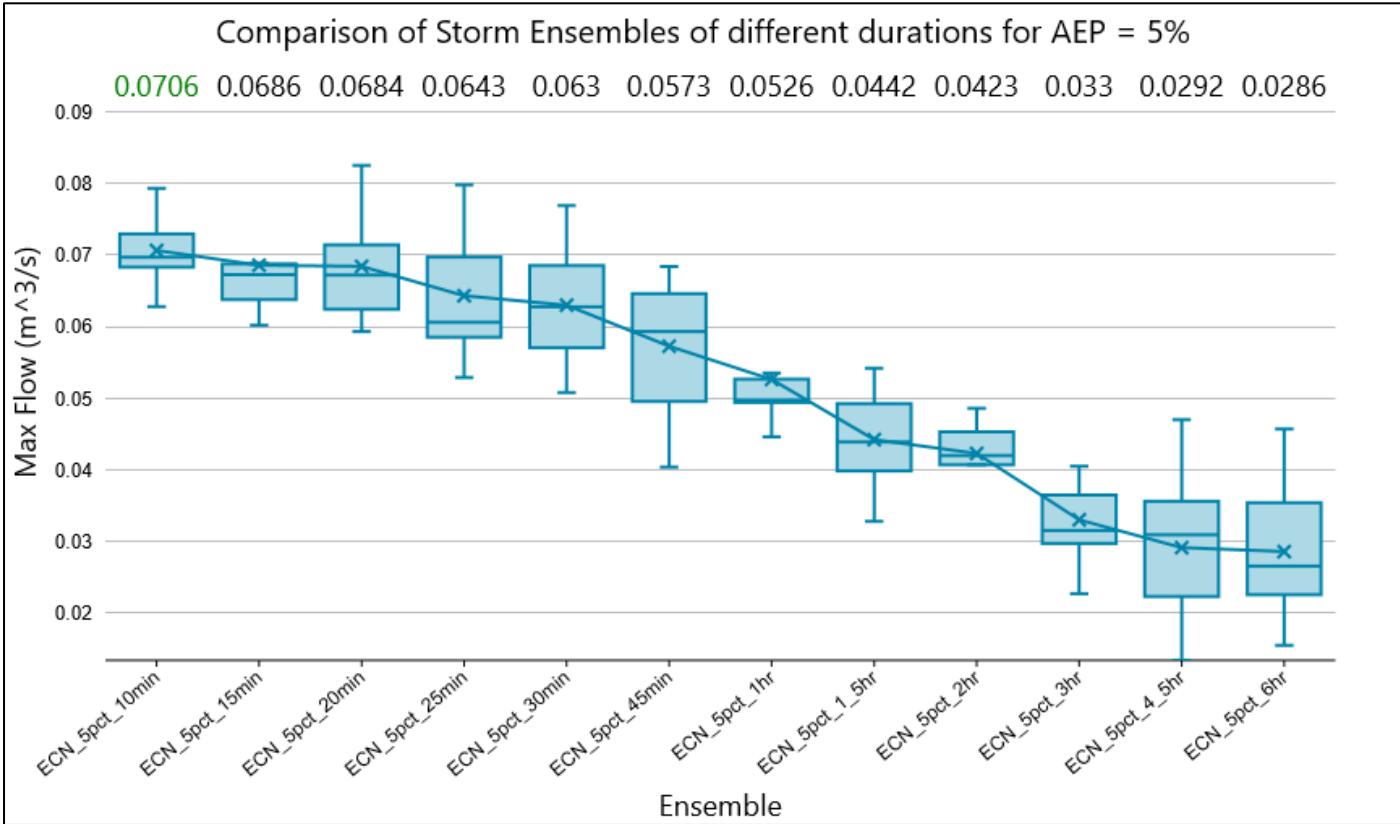
**Figure 2: Comparison of Storm Ensembles of different durations for 50% AEP (Pre-development) (XPSTORM Model)**



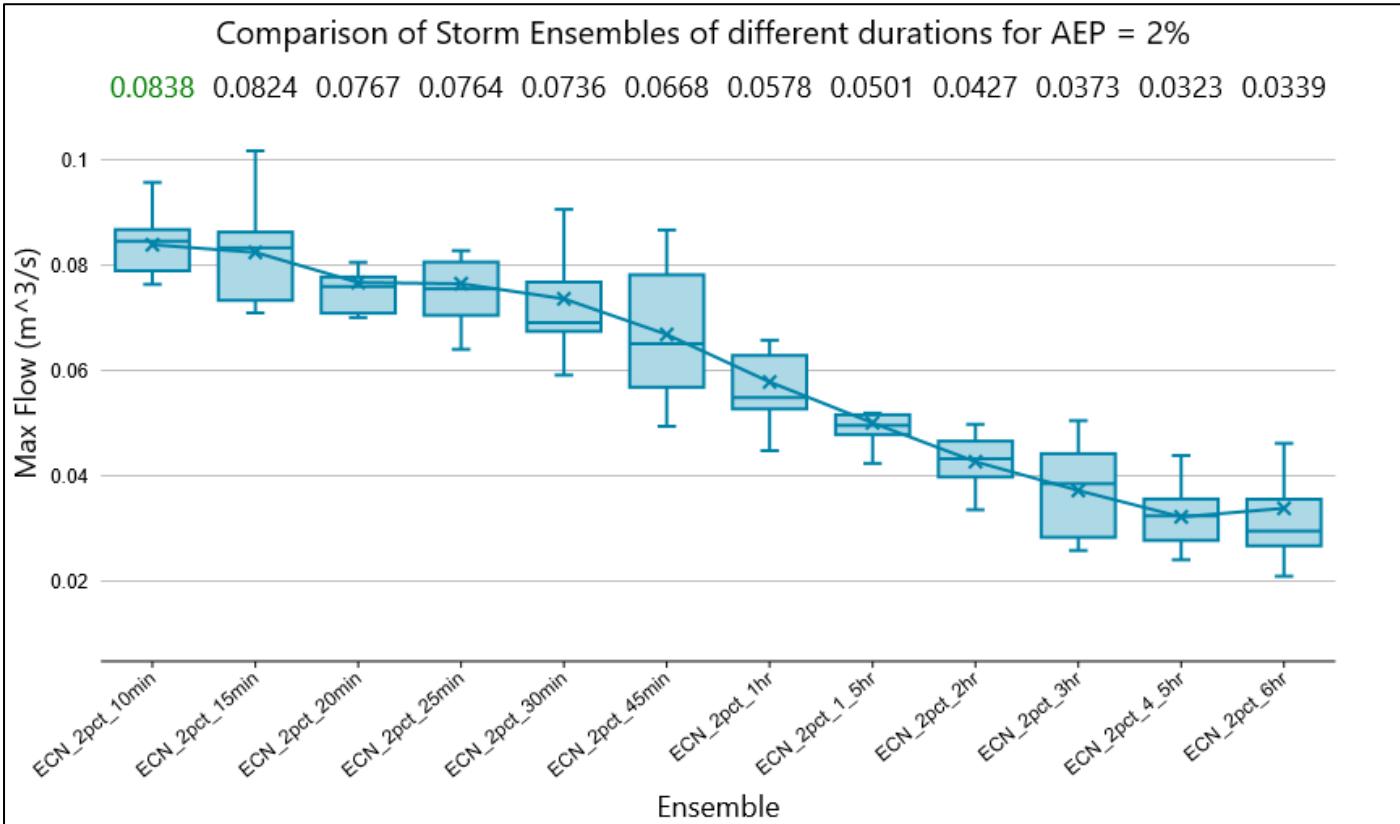
**Figure 3: Comparison of Storm Ensembles of different durations for 20% AEP (Pre-development) (XPSTORM Model)**



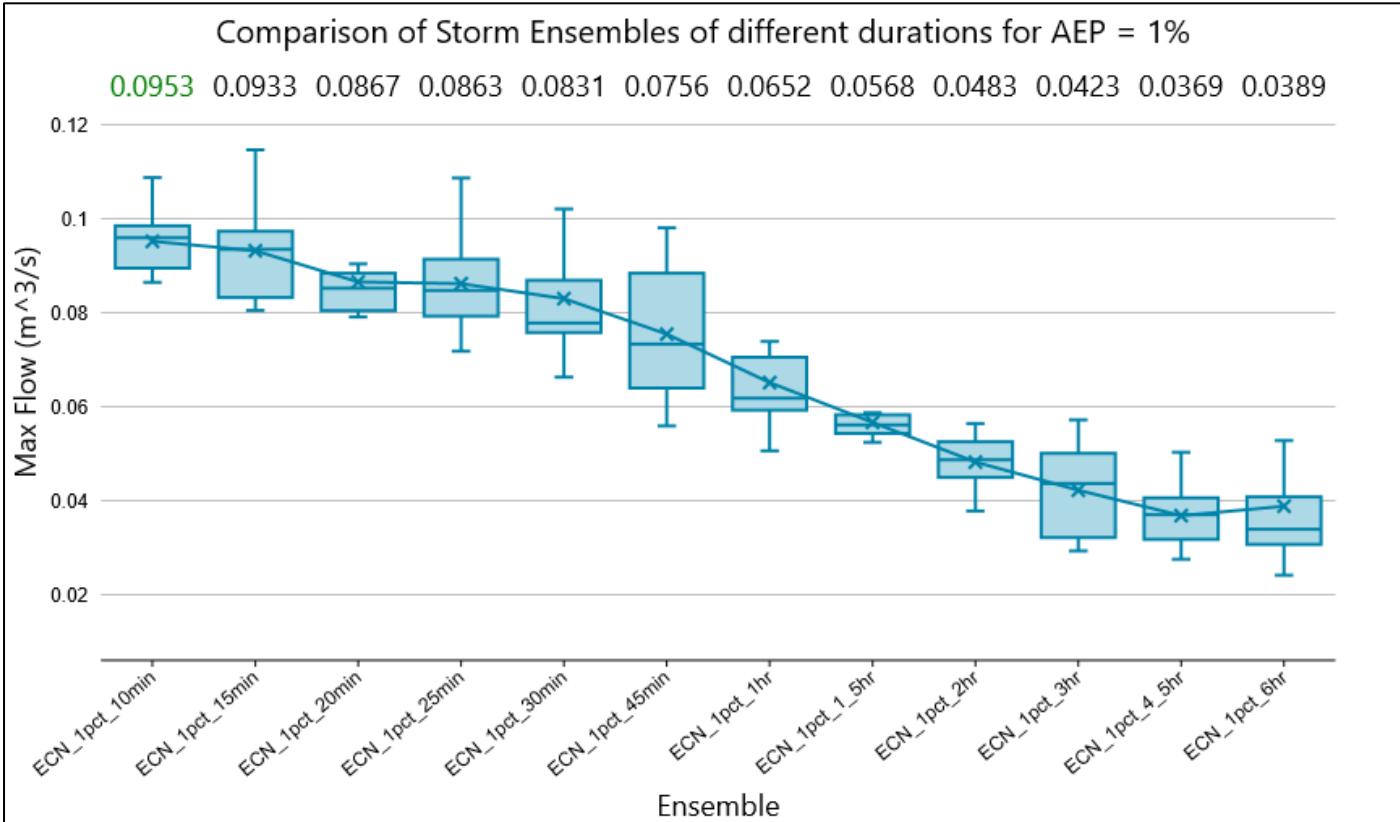
**Figure 4: Comparison of Storm Ensembles of different durations for 10% AEP (Pre-development) (XPSTORM Model)**



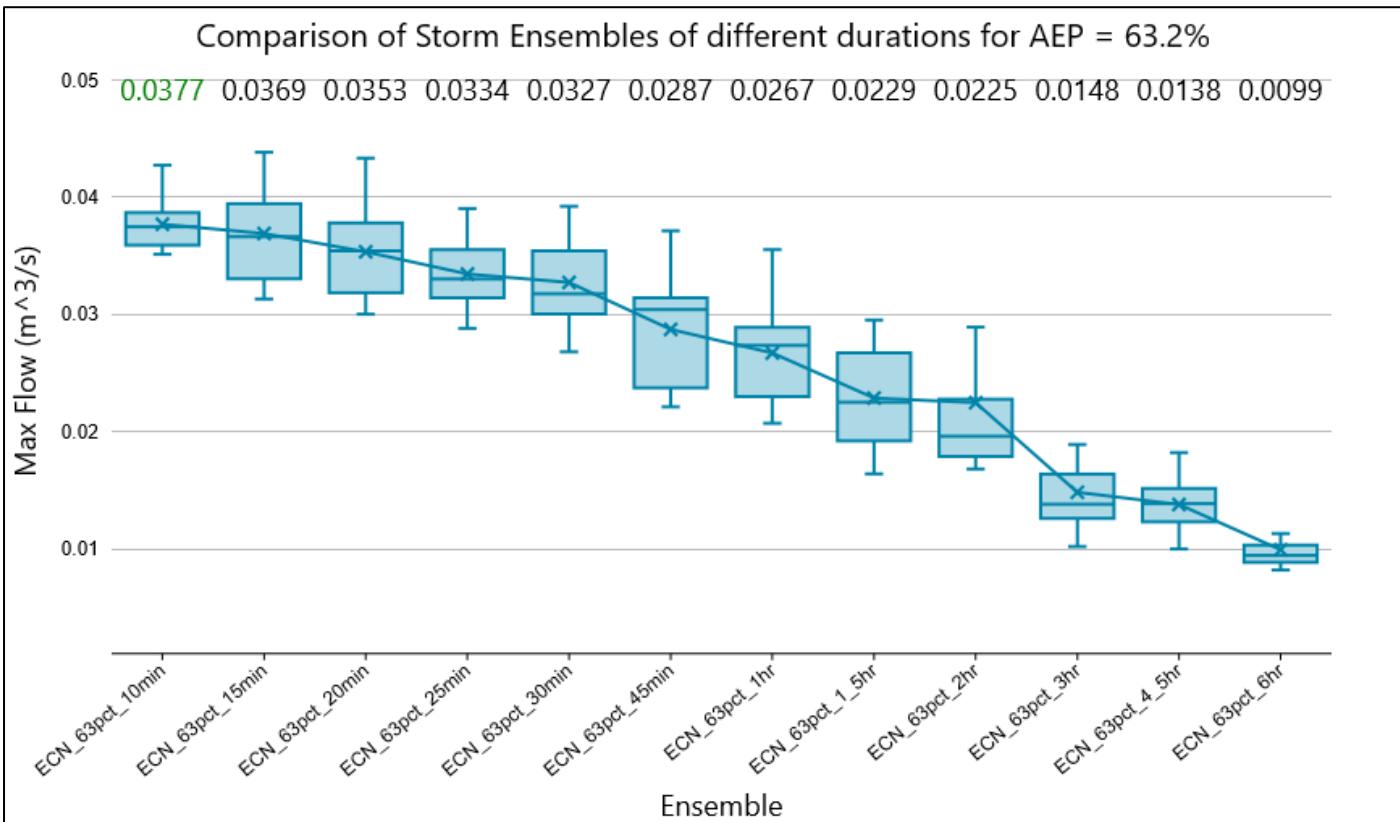
**Figure 5: Comparison of Storm Ensembles of different durations for 5% AEP (Pre-development) (XPSTORM Model)**



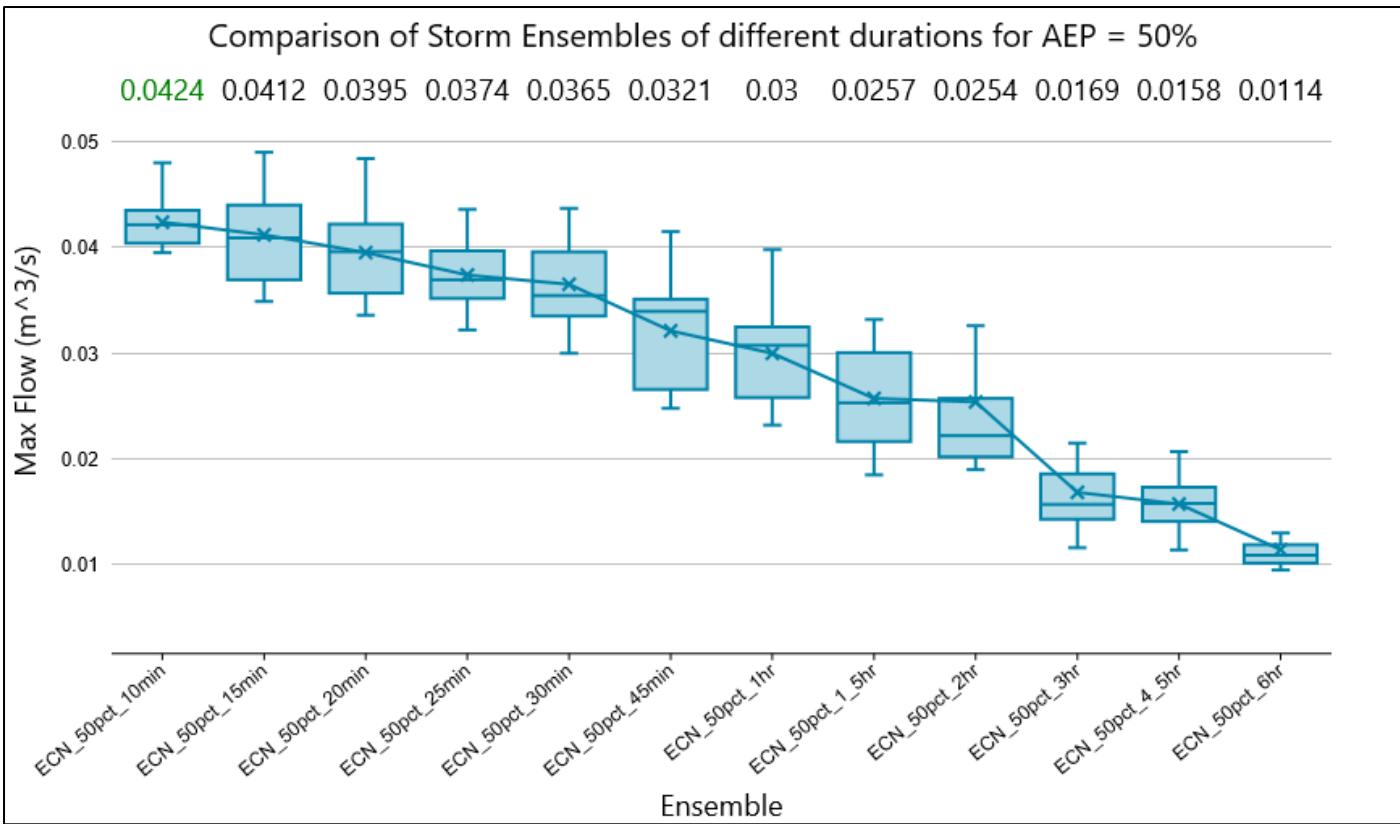
**Figure 6: Comparison of Storm Ensembles of different durations for 2% AEP (Pre-development) (XPSTORM Model)**



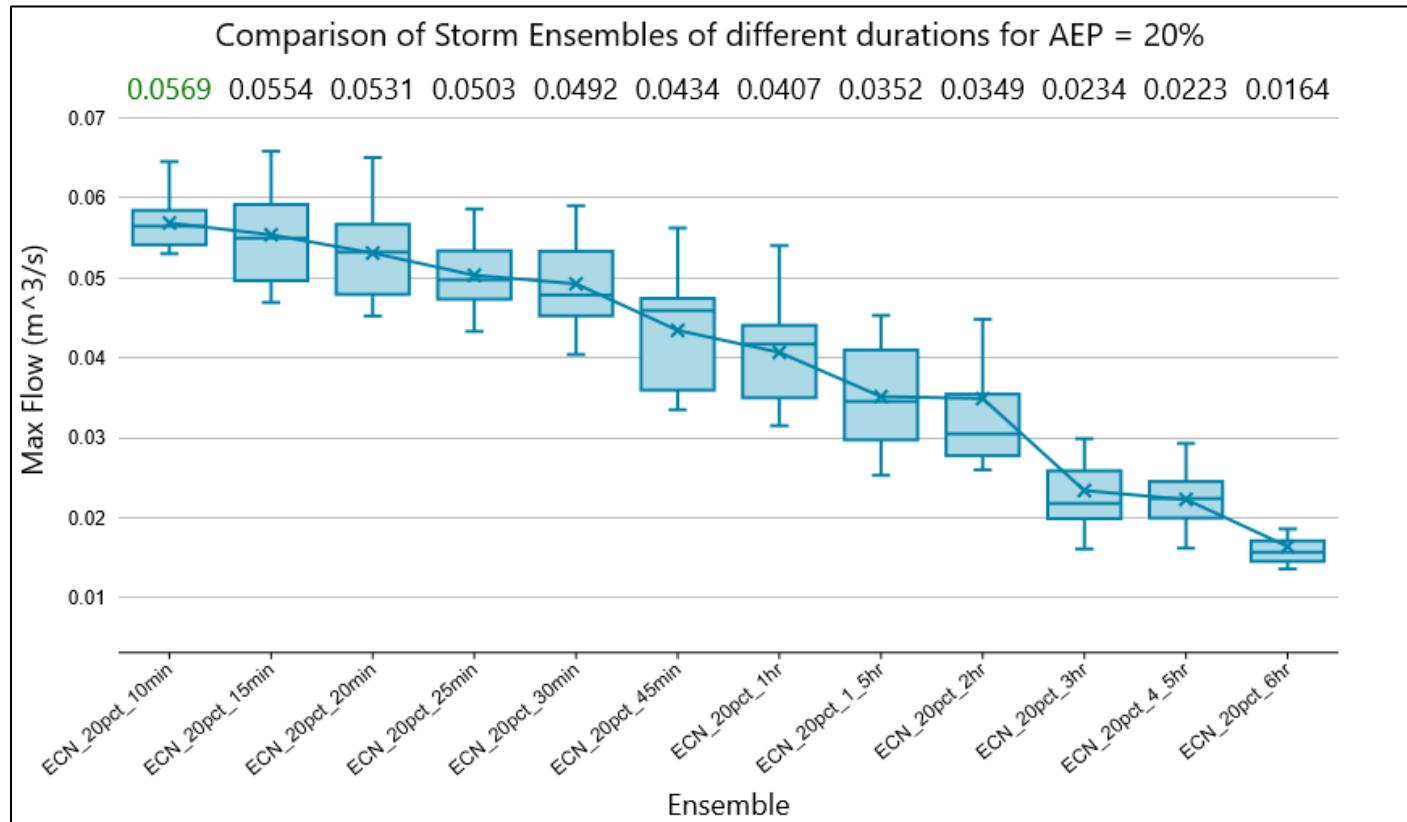
**Figure 7: Comparison of Storm Ensembles of different durations for 1% AEP (Pre-development) (XPSTORM Model)**



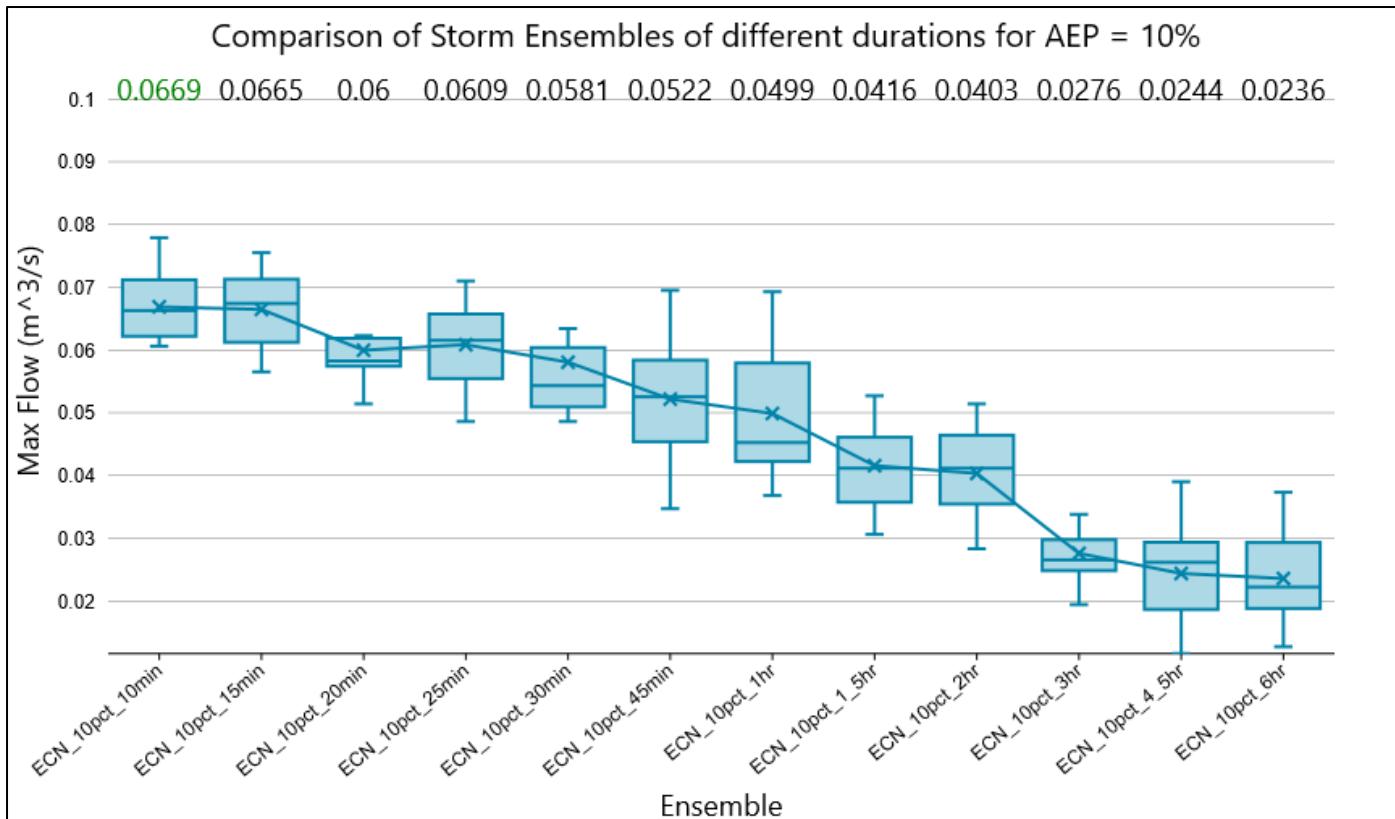
**Figure 8: Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development) (XPSTORM Model)**



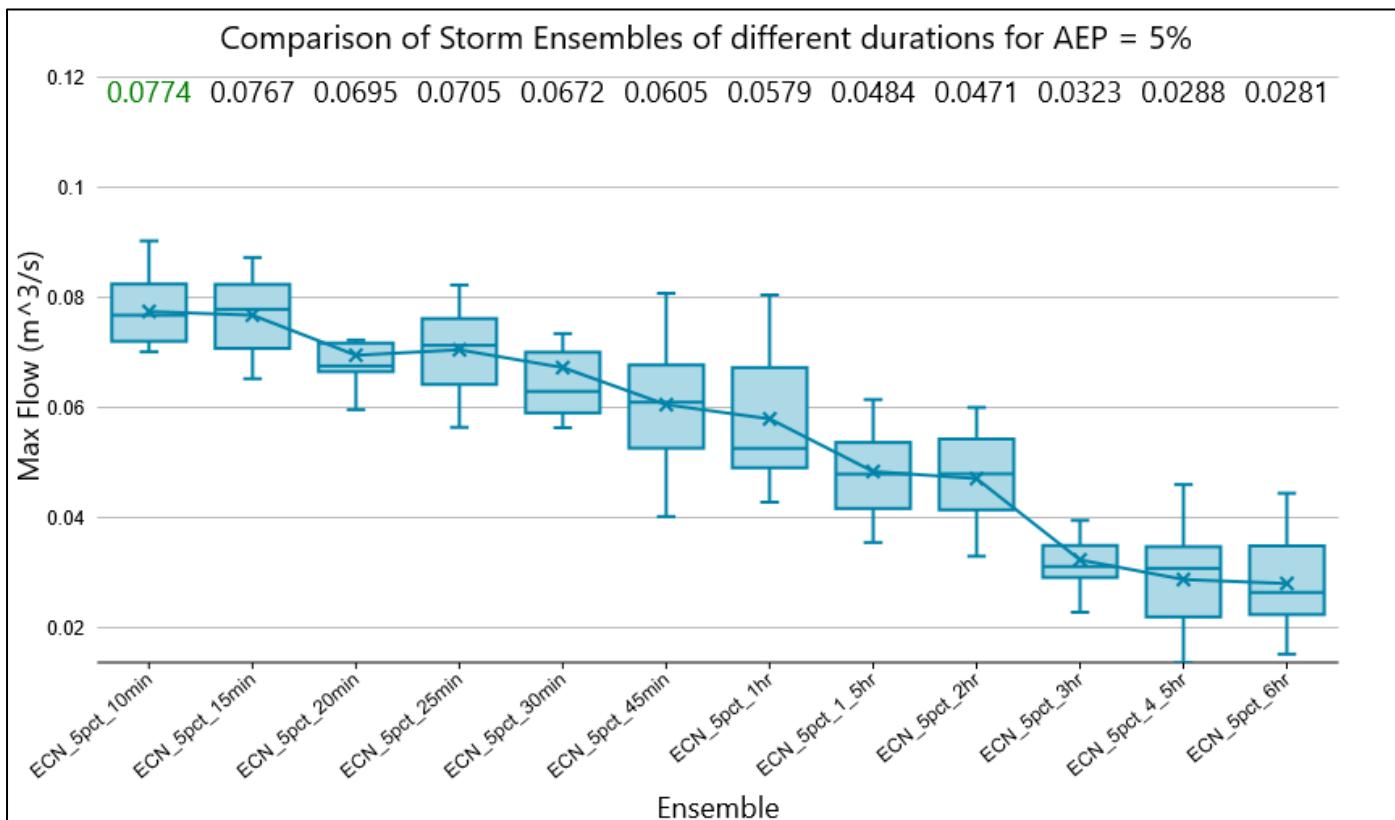
**Figure 9: Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development) (XPSTORM Model)**



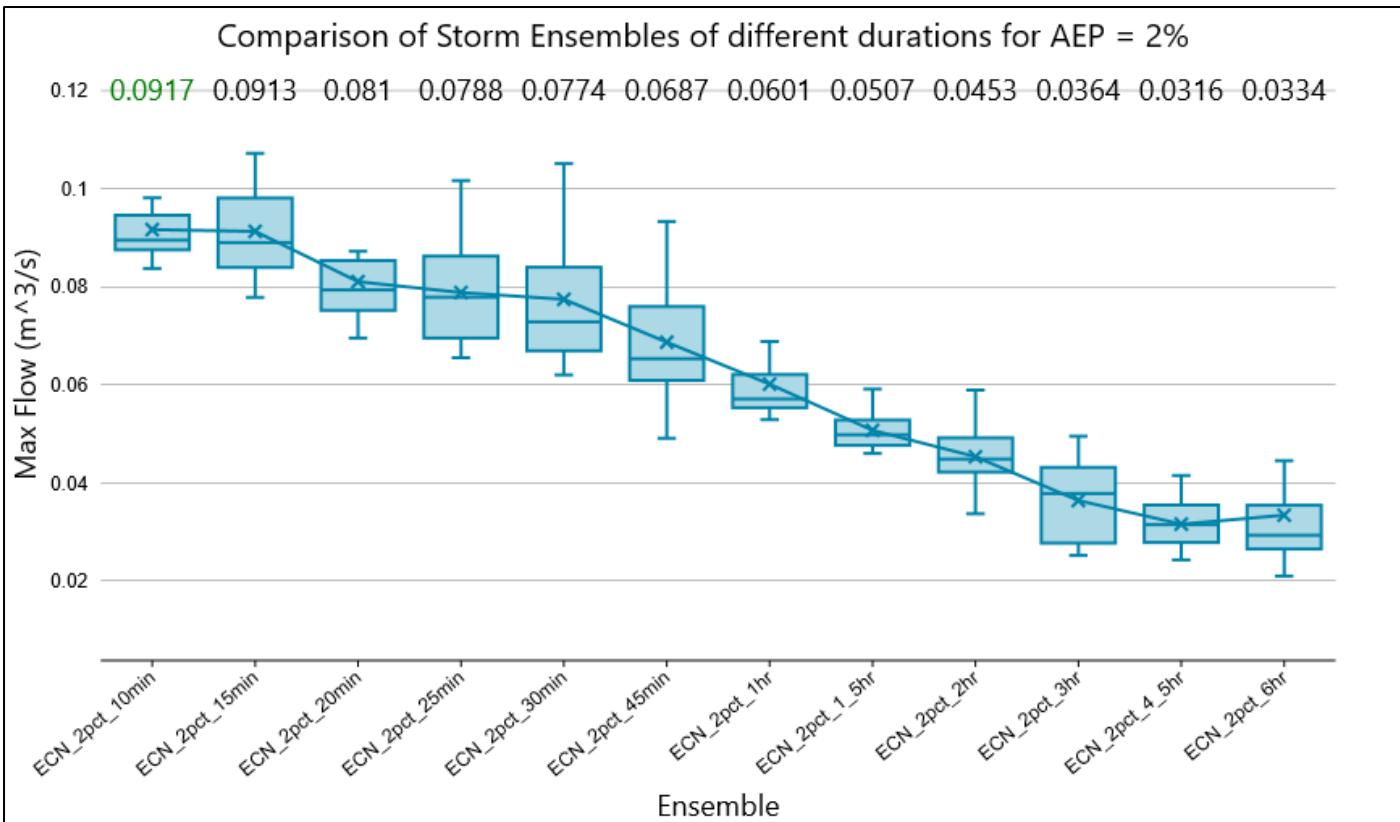
**Figure 10: Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development) (XPSTORM Model)**



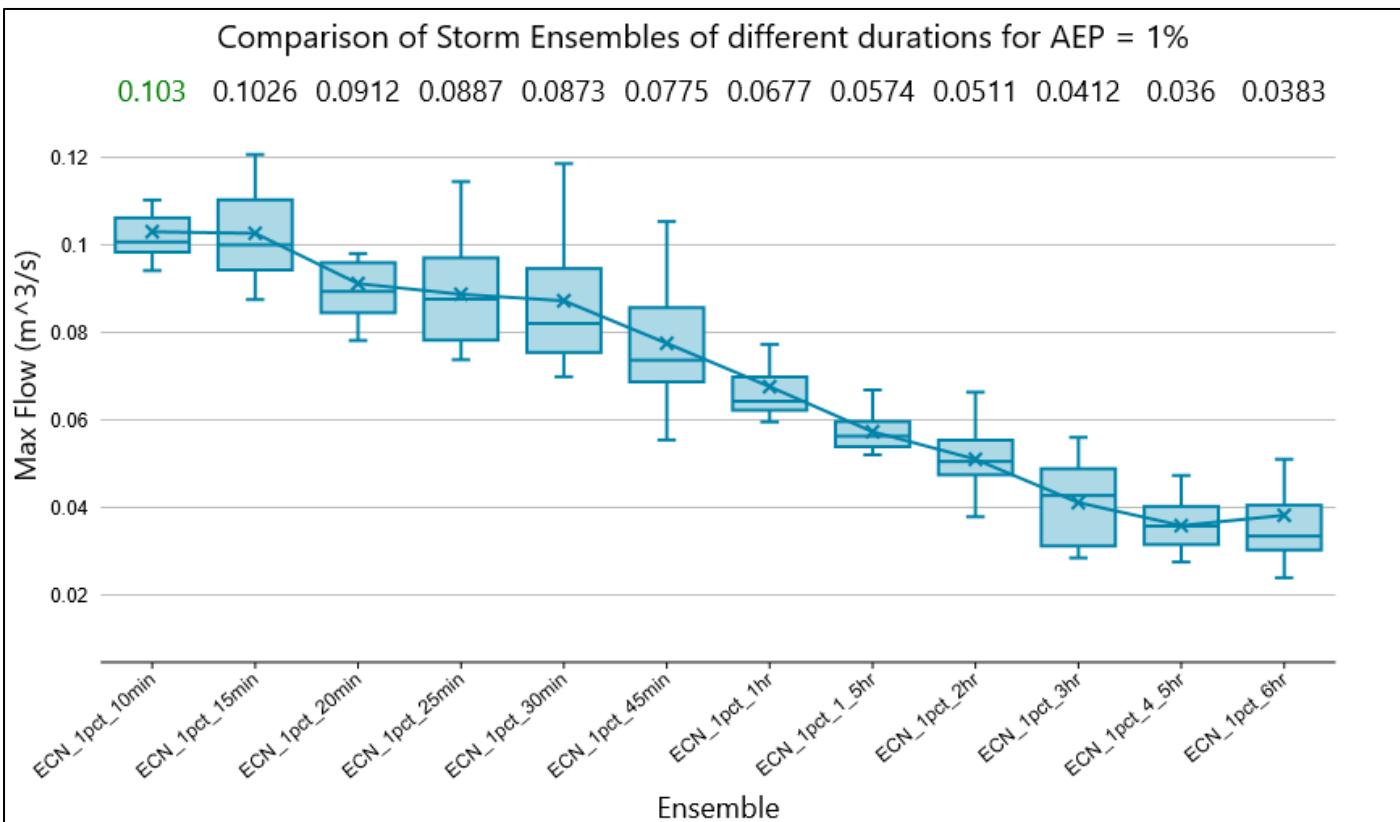
**Figure 11:** Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development)  
(XPSTORM Model)



**Figure 12:** Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development)  
(XPSTORM Model)



**Figure 13:** Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development)  
(XPSTORM Model)



**Figure 14:** Comparison of Storm Ensembles of different durations for 63.2% AEP (Post-development)  
(XPSTORM Model)

In order to ensure there is no actionable nuisance on the stormwater network site discharge will need to be reduced below that of the peak pre-development discharge for each recurrence interval. From the box and whisker charts it can be inferred that the mitigation strategy will need to account for the following events.

	Peak pre-development Storm events		Max mean Post-development Storm events greater than Peak pre-development Storm events					
AEP %	Event	Discharge (m³/s)	10 minute event	15 minute event	20 minute event	25 minute event	30 minute event	
63.2	15min_7	0.0318	10min_8	15min_1	20min_2	25min_3	30min_1	
50	15min_7	0.0358	10min_8	15min_1	20min_2	25min_4	30min_1	
20	15min_7	0.0491	10min_8	15min_1	20min_2	25min_4	30min_1	
10	10min_8	0.06	10min_4	15min_2	20min_5	25min_3	-	
5	10min_8	0.0706	10min_5	15min_2	20min_5	-	-	
2	10min_2	0.0838	10min_3	15min_4	-	-	-	
1	10min_2	0.0953	10min_3	15min_4	-	-	-	

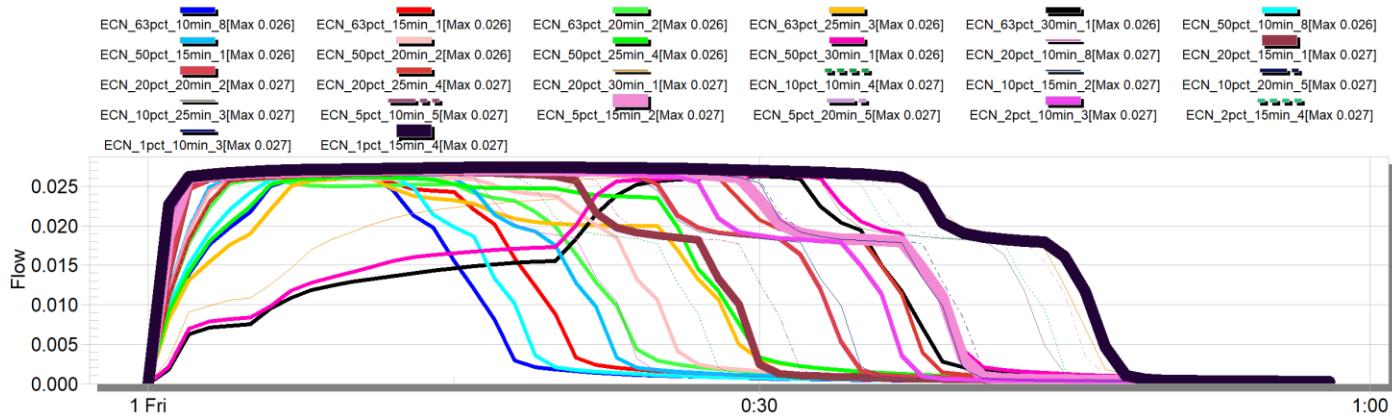
Refer appendix C for hydraulic graphs for the above events and table summarising net reduction in flow for all post development storms.

## **APPENDIX C**

---

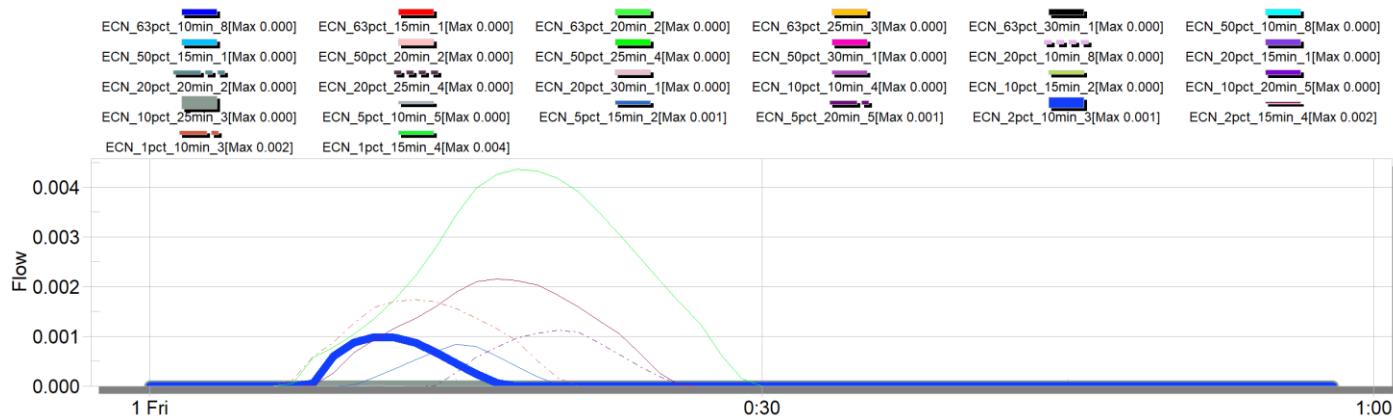
Additional storm hydraulic assessment

### Conduit C1 from pit 1.1 to outlet



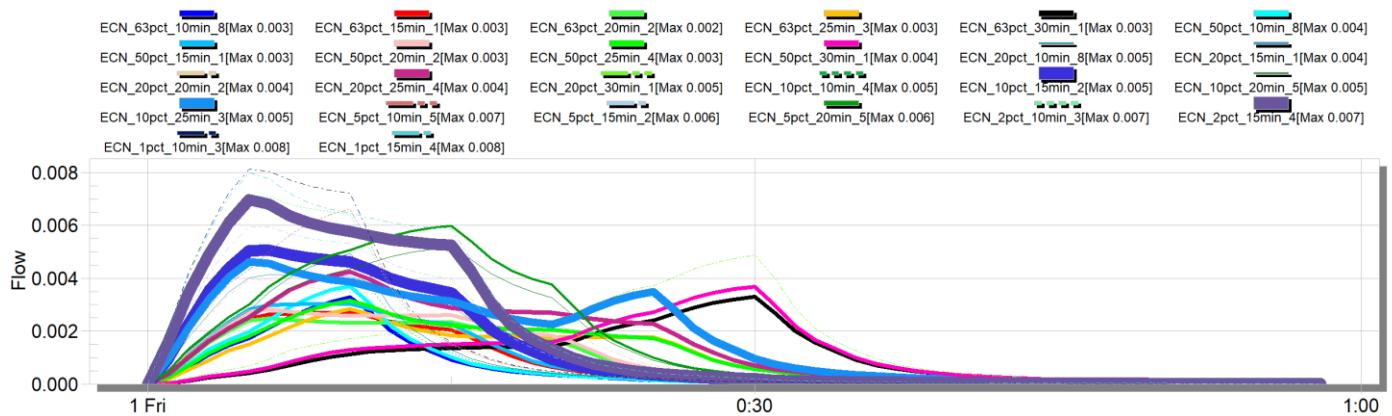
**Figure 1: Outflow from site – 125mm pipe**

### Diversion W1 from pit 1.1 to outlet



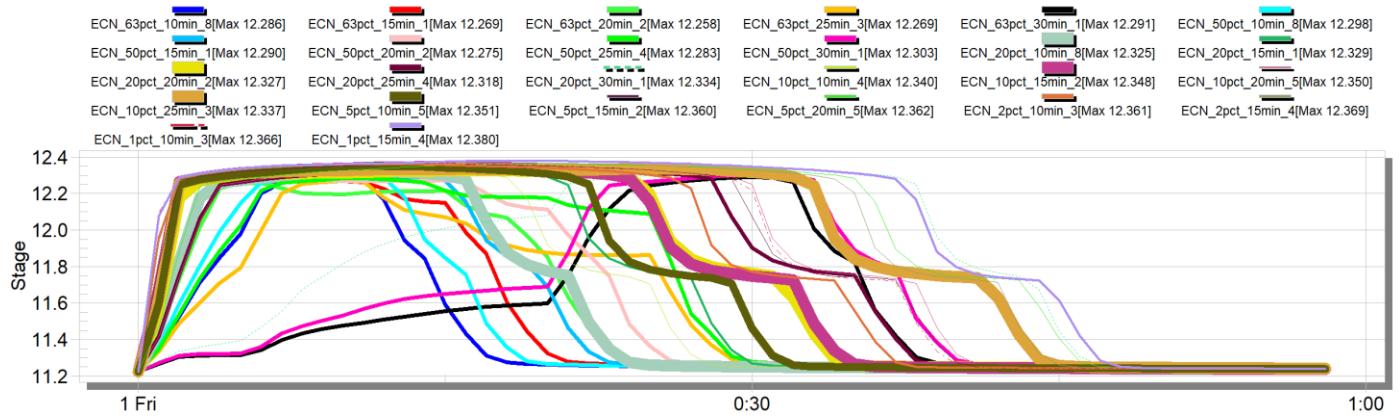
**Figure 2: Outflow from site – 0.5m Weir**

### Conduit Link1 from loading area to outlet



**Figure 3: Outflow from site – Unmitigated loading area**

### Node - pit 1.1



**Figure 4: Peak Water Level**

Refer below summary of graphs.

	Peak pre-development Storm events		Max mean Post-development Storm events greater than Peak pre-development Storm events																					
AEP %	Event	Discharge (m³/s)	10 minute event				15 minute event				20 minute event				25 minute event				30 minute event				Critical post development runoff	Change in peak runoff
			125 uPVC	0.5m Weir	Loading area	Total	125 uPVC	0.5m Weir	Loading area	Total	125 uPVC	0.5m Weir	Loading area	Total	125 uPVC	0.5m Weir	Loading area	Total	125 uPVC	0.5m Weir	Loading area	Total		
63.2	15min_7	0.0318	10min_8				15min_1				20min_2				25min_3				30min_1				0.029	-0.003
			0.026	0.000	0.003	0.029	0.026	0.000	0.003	0.029	0.026	0.000	0.002	0.028	0.026	0.000	0.003	0.029	0.026	0.000	0.003	0.029		
50	15min_7	0.0358	10min_8				15min_1				20min_2				25min_4				30min_1				0.030	-0.006
			0.026	0.000	0.004	0.030	0.026	0.000	0.003	0.029	0.026	0.000	0.003	0.029	0.026	0.000	0.003	0.029	0.026	0.000	0.004	0.030		
20	15min_7	0.0491	10min_8				15min_1				20min_2				25min_4				30min_1				0.032	-0.017
			0.027	0.000	0.005	0.032	0.027	0.000	0.004	0.031	0.027	0.000	0.004	0.031	0.027	0.000	0.004	0.031	0.027	0.000	0.005	0.032		
10	10min_8	0.06	10min_4				15min_2				20min_5				25min_3				-				0.032	-0.028
			0.027	0.000	0.005	0.032	0.027	0.000	0.005	0.032	0.027	0.000	0.005	0.032	0.027	0.000	0.005	0.032	-					
5	10min_8	0.0706	10min_5				15min_2				20min_5				-				-				0.034	-0.037
			0.027	0.000	0.007	0.034	0.027	0.001	0.006	0.034	0.027	0.001	0.006	0.034	-				-					
2	10min_2	0.0838	10min_3				15min_4				-				-				-				0.036	-0.048
			0.027	0.001	0.007	0.035	0.027	0.002	0.007	0.036	-				-				-					
1	10min_2	0.0953	10min_3				15min_4				-				-				-				0.039	-0.056
			0.027	0.002	0.008	0.037	0.027	0.004	0.008	0.039	-				-				-					