Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

3368 Carling Ave

- Based on Site Plan A1.1 prepared by Rosaline J. Hill dated July 22, 2020

Building ID	Area (m^2)	Population	Daily Rate of Demand [1]	Avg Day Demand		Max Day Demand [2]		Peak Hour Demand [2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
BLDG		27	350	6.6	0.11	16.4	0.27	36.1	0.60
Total Site :				**6.6**	**0.11**	**16.4**	**0.27**	**36.1**	**0.60**

1 Population counts based on a density of 1.8 persons/Apartment

2 Average day water demand for residential areas equal to 350 L/cap/d

3 The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:

maximum day demand rate = 2.5 x average day demand rate

peak hour demand rate = 2.2 x maximum day demand rate

Referenced from the City of Ottawa Sewer Design Guidelines (October 2012) and the Ottawa Design Guidelines: Water Distribution (July 2010)

A.2 FIRE FLOW REQUIREMENTS PER OFM

Fire Flow Calculations as per Ontario Building Code 2006 (Appendix A)

Job#	160401218	Designed by:	WAJ
Date	6-Oct-20	Checked by:	DCT
		Description:	3-Storey Res. + basement

$Q = KVS_{tot}$

Q = Volume of water required (L)
V = Total building volume (m3)
K = Water supply coefficient from Table 1
S_{tot} = Sotal of spatial coefficeint values from property line exposures on all sides as obtained from the formula

$S_{tot} = 1.0 + [S_{side1} + S_{side2} + S_{side3} + S_{side4}]$

1	Type of construction	Building Classification		Water Supply Coefficient
	combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		23
2	Area of one floor (m^2)	number of floors	Avg. height of ceiling (m)	Total Building Volume (m^3)
	494	4	2.94	5,809
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	1	0.5	2
	East	2	0.5	
	South	11.2	0	
	West	3.1	0.5	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				267,214
				Minimum Required Fire Flow (L/min)
				6,300

A.3 BOUNDARY CONDITIONS

Thiffault, Dustin

To: Gillis, Sheridan
Subject: RE: 3368 Carling Ave - Boundary Conditions

From: Robertson, Syd [mailto:Syd.Robertson@ottawa.ca]
Sent: Tuesday, December 29, 2015 10:39 AM
To: Gillis, Sheridan
Subject: FW: 3368 Carling Ave - Boundary Conditions

Hi Sheridan:

The following are boundary conditions, HGL, for hydraulic analysis at 3368 Carling (zone 1W) assumed to be connected to the 152mm on Bedale (domestic demands) and 305mm on Carling (fire flow). See attached PDF for connection locations.

Minimum HGL = 105.4m

Maximum HGL = 117.6m

Available Flow (Carling connection) =220 L/s assuming a residual of 20 psi and a ground elevation of 64.7m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Syd Robertson, C.E.T.
Project Manager, Infrastructure Approvals
Development Review Services Branch, Urban Outer Core
Planning & Growth Management Department
110 Laurier Ave. W., 4th Floor E
Ottawa, ON K1P 1J1

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27916
ottawa.ca/planning / ottawa.ca/urbanisme

From: Gillis, Sheridan [mailto:Sheridan.Gillis@stantec.com]
Sent: December 21, 2015 1:17 PM
To: Robertson, Syd
Subject: RE: 3368 Carling Ave - Boundary Condition Request

Hi Syd,
As discussed in our pre-consultation meeting on the 8th, could you provide water boundary conditions for Cardel's proposed development at 3368 Carling Avenue. We will be proposing to maintain the location of the connection to the 150mm main on Bedale but Fire Flows would be supplied via the existing infrastructure on Carling. The demands are as follows:

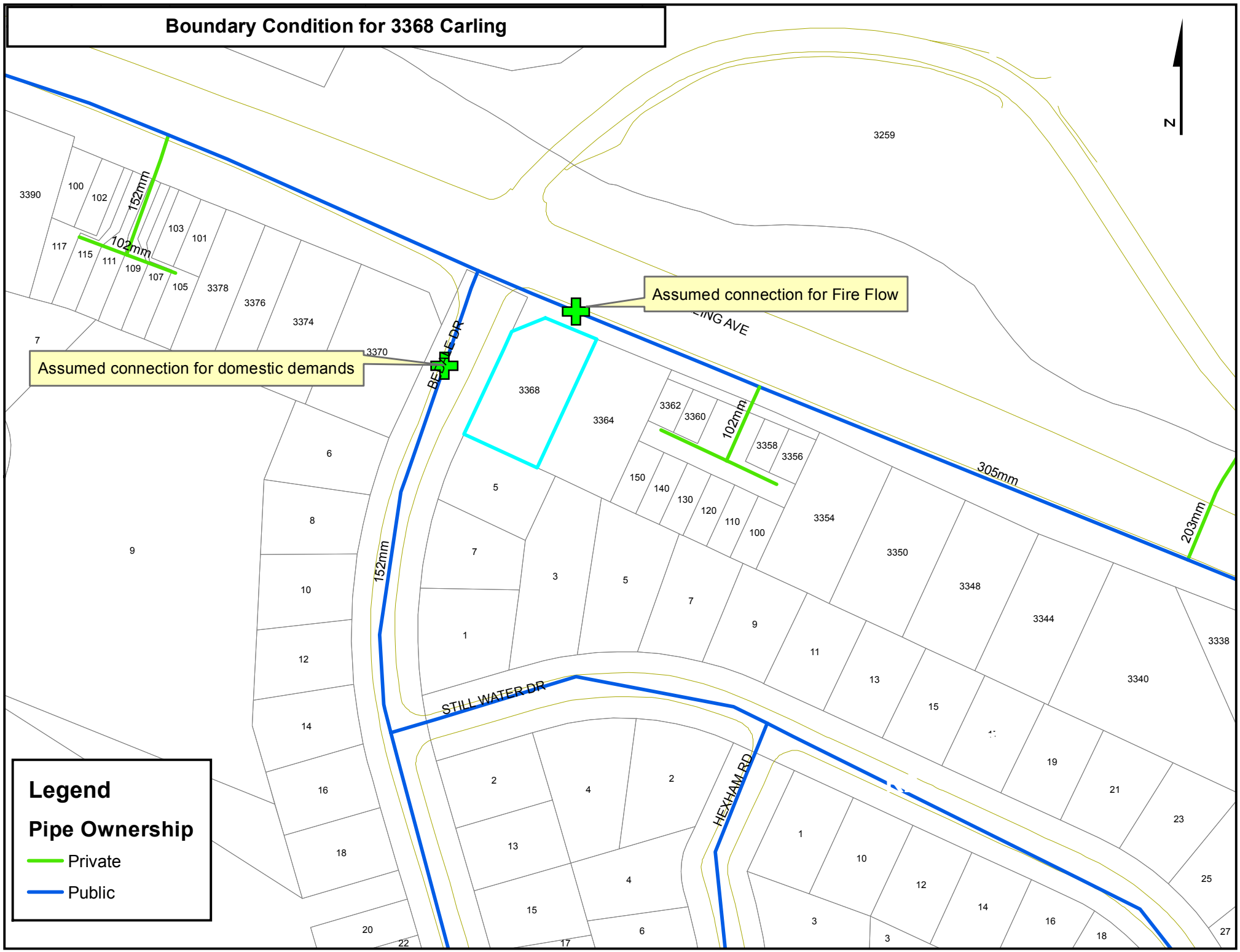
Type of Development:	Proposed 14 unit apartment building
Location of water service:	Proposed connection to the 150mm dia watermain on Bedale Drive
Average Day Demand:	0.109 L/sec
Maximum Day Demand:	0.273 L/sec
Peak Hourly:	0.602 L/sec
Fire Flow:	300 L/sec (18,000L/min)

The calculations are also attached, if you have any question please feel free to call,
Thanks, enjoy the holidays,

Sheridan Gillis
Project Manager, Urban Land Engineering
Stantec
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
Phone: (613) 725-5551

Mobile: (613) 799-1363
sheridan.gillis@stantec.com

Stantec
Design with community in mind


Boundary Condition for 3368 Carling
N
Assumed connection for Fire Flow
Assumed connection for domestic demands
3368
3259
3390
3370
3378
3376
3374
3364
3362
3360
3358
3356
3354
3350
3348
3344
3340
3338
152mm
102mm
305mm
203mm
STILL WATER DR
HEXHAM RD
Legend
Pipe Ownership
Private
Public

Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION: **3368 CARLING AVE**

DATE: 6/10/2020
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: DCT

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 16041218

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280	L/p/day	MINIMUM VELOCITY	0.60	m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000	L/ha/day	MAXIMUM VELOCITY	3.00	m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000	L/ha/day	MANNINGS n	0.013	
PEAKING FACTOR (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000	L/ha/day	BEDDING CLASS	B	
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000	L/ha/day	MINIMUM COVER	2.50	m
PERSONS / TOWN	2.7	INFILTRATION	0.33	L/s/ha	HARMON CORRECTION FACTOR	0.8	
PERSONS / AVG APARTMENT	1.8						

LOCATION			RESIDENTIAL AREA AND POPULATION									COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA	AVERAGE APT.	TOWN	SINGLE	POP.	CUMULATIVE AREA	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	AREA	ACCU. AREA	PEAK FLOW	TOTAL AREA	ACCU. AREA	INFILT. FLOW	FLOW	LENGTH	DIA	MATERIAL	CLASS	SLOPE	CAP. (FULL)	CAP. V PEAK FLOW	VEL. (FULL)	VEL. (ACT.)
			(ha)					(ha)			(L/s)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(L/s)	(ha)	(ha)	(L/s)	(L/s)	(m)	(mm)			(%)	(l/s)	(%)	(m/s)	(m/s)
BLDG	BLDG	TEE	0.100	15	0	0	27	0.10	27	4.00	0.35	0.000	0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.100	0.10	0.03	0.38	12.0	150 300	PVC	DR 28	1.00	15.3	**2.50%**	0.86	0.31

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

3368 Carling Ave

DATE: 2020-10-06
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: DCT

FILE NUMBER: 160401218

STORM SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013
MINIMUM COVER: 2.00 m
TIME OF ENTRY 10 min
BEDDING CLASS = B

LOCATION			DRAINAGE AREA																					PIPE SELECTION										
AREA ID	FROM	TO	AREA	AREA	AREA	AREA	AREA	C	C	C	C	A x C	ACCUM	A x C	ACCUM.	A x C	ACCUM.	A x C	ACCUM.	T of C	$I_{2\text{-YEAR}}$	$I_{5\text{-YEAR}}$	$I_{10\text{-YEAR}}$	$I_{100\text{-YEAR}}$	$Q_{CONTROL}$	ACCUM.	Q_{ACT}	LENGTH	PIPE WIDTH	PIPE	PIPE	MATERIAL	CLASS	SLOPE	Q_{CAP}	% FULL	VEL.	VEL.	TIME OF
NUMBER	M.H.	M.H.	(2-YEAR)	(5-YEAR)	(10-YEAR)	(100-YEAR)	(ROOF)	(2-YEAR)	(5-YEAR)	(10-YEAR)	(100-YEAR)	(2-YEAR)	AxC (2YR)	(5-YEAR)	AxC (5YR)	(10-YEAR)	AxC (10YR)	(100-YEAR)	AxC (100YR)						$Q_{CONTROL}$	(CIA/360)		OR DIAMETEI	HEIGHT	SHAPE				(FULL)		(FULL)	(ACT)	FLOW
			(ha)	(ha)	(ha)	(ha)	(ha)	(-)	(-)	(-)	(-)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(ha)	(min)	(mm/h)	(mm/h)	(mm/h)	(mm/h)	(L/s)	(L/s)	(L/s)	(m)	(mm)	(mm)	(-)	(-)	(-)	%	(L/s)	(-)	(m/s)	(m/s)	(min)
BLDG, UNC-1	BLDG	CBMH1	0.00	0.051	0.00	0.00	0.049	0.00	0.47	0.00	0.00	0.000	0.000	0.024	0.024	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	2.5	2.5	9.4	8.3	200	200	CIRCULAR	PVC	-	1.00	33.3	**28.33%**	1.05	0.76	0.18
EX-ST1A	CBMH1	CB2A	0.00	0.041	0.00	0.00	0.000	0.00	0.67	0.00	0.00	0.000	0.000	0.027	0.051	0.000	0.000	0.000	0.000	10.18	76.11	103.24	121.01	176.90	0.0	2.5	17.3	9.0	300	300	CIRCULAR	PVC	-	2.22	143.3	**12.04%**	2.04	1.14	0.13
EX-ST2A	CB2A	CB3A	0.00	0.036	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.032	0.084	0.000	0.000	0.000	0.000	10.32	75.62	102.56	120.21	175.73	0.0	2.5	26.4	26.5	300	300	CIRCULAR	PVC	-	0.94	93.2	**28.30%**	1.32	0.95	0.46
EX-ST3A	CB3A	CB4A	0.00	0.294	0.00	0.00	0.000	0.00	0.63	0.00	0.00	0.000	0.000	0.185	0.269	0.000	0.000	0.000	0.000	10.78	73.94	100.26	117.50	171.75	0.0	2.5	77.4	22.5	300	300	CIRCULAR	PVC	-	0.00	0.0	*	0.00	0.00	-
EX-ST4A	CB4A	OUTLET	0.00	0.105	0.00	0.00	0.000	0.00	0.90	0.00	0.00	0.000	0.000	0.095	0.364	0.000	0.000	0.000	0.000	11.24	72.35	98.07	114.93	167.96	0.0	2.5	101.5	20.0	450	450	CIRCULAR	CONCRETE	-	1.00	297.4	**34.14%**	1.81	1.38	0.24
																				11.48								450	450								

See PCSWMM model for design verification

C.2 RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **1604012128**
Project: **3368 Carling Avenue**
Date: **20-Aug-20**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Catchment Type	Sub-catchment Area ID / Description		Area (ha) "A"		Runoff Coefficient "C"	"A x C"		Overall Runoff Coefficient
Uncontrolled - Tributary	UNC-1	Hard	0.020		0.9	0.018		
		Soft	0.031		0.2	0.006		
		Subtotal		0.051			0.02397	0.470
Roof	ROOF	Hard	0.049		0.9	0.044		
		Soft	0.000		0.2	0.000		
		Subtotal		0.049			0.0441	0.900
Total				**0.100**			**0.068**	
Overall Runoff Coefficient= C:								**0.68**

Total Roof Areas	**0.049 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.051 ha**
Total Tributary Area to Outlet	**0.100 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**0.100 ha**

Stormwater Management Calculations

Project #1604012128, 3368 Carling Avenue
Modified Rational Method Calculatons for Storage

5 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	998.071
b =	6.053
c =	0.814

t (min)	I (mm/hr)
5	141.18
10	104.19
15	83.56
20	70.25
25	60.90
30	53.93
35	48.52
40	44.18
45	40.63
50	37.65
55	35.12
60	32.94

5 YEAR Predevelopment Target Release from Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1000
C: 0.50

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**14.5**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-1 — Uncontrolled - Tributary
Area (ha): 0.05
C: 0.47

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	6.9	6.9		
20	70.25	4.7	4.7		
30	53.93	3.6	3.6		
40	44.18	2.9	2.9		
50	37.65	2.5	2.5		
60	32.94	2.2	2.2		
70	29.37	2.0	2.0		
80	26.56	1.8	1.8		
90	24.29	1.6	1.6		
100	22.41	1.5	1.5		
110	20.82	1.4	1.4		
120	19.47	1.3	1.3		

Subdrainage Area: ROOF — Roof
Area (ha): 0.05 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	104.19	12.8	2.5	10.3	6.2	101.5	0.00
20	70.25	8.6	2.5	6.1	7.3	106.8	0.00
30	53.93	6.6	2.5	4.1	**7.4**	107.0	0.00
40	44.18	5.4	2.5	2.9	6.9	105.1	0.00
50	37.65	4.6	2.5	2.1	6.3	102.1	0.00
60	32.94	4.0	2.5	1.5	5.5	97.4	0.00
70	29.37	3.6	2.5	1.1	4.5	90.4	0.00
80	26.56	3.3	2.5	0.7	3.5	83.0	0.00
90	24.29	3.0	2.5	0.5	2.5	75.0	0.00
100	22.41	2.7	2.5	0.2	1.3	58.9	0.00
110	20.82	2.6	2.4	0.1	0.7	48.5	0.00
120	19.47	2.4	2.3	0.1	0.6	45.6	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	107.0	0.11	2.5	7.4	19.6	OK

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	0.049 ha			
Total 5yr Flow to Sewer	2.5 L/s	7	20 m^3	Ok
Non-Tributary Area	0.051 ha			
Total 5yr Flow Uncontrolled	6.9 L/s			
Total Area	0.100 ha			
Total 5yr Flow	9.5 L/s			
Target	14.5 L/s			

Project #1604012128, 3368 Carling Avenue
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

$I = a/(t + b)^c$

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

100 YEAR Predevelopment Target Release from Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1000
C: 0.50

Estimated Time of Concentration after Development

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**14.5**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-1 — Uncontrolled - Tributary
Area (ha): 0.05
C: 0.59

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	14.9	14.9		
20	119.95	10.0	10.0		
30	91.87	7.7	7.7		
40	75.15	6.3	6.3		
50	63.95	5.3	5.3		
60	55.89	4.7	4.7		
70	49.79	4.1	4.1		
80	44.99	3.7	3.7		
90	41.11	3.4	3.4		
100	37.90	3.2	3.2		
110	35.20	2.9	2.9		
120	32.89	2.7	2.7		

Subdrainage Area: ROOF — Roof
Area (ha): 0.05 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	24.3	2.5	21.8	13.1	130.3	0.00
20	119.95	16.3	2.5	13.8	16.6	140.9	0.00
30	91.87	12.5	2.5	10.0	18.0	145.1	0.00
40	75.15	10.2	2.5	7.7	18.5	146.7	0.00
50	63.95	8.7	2.5	6.2	**18.6**	146.9	0.00
60	55.89	7.6	2.5	5.1	18.3	146.1	0.00
70	49.79	6.8	2.5	4.3	17.9	144.8	0.00
80	44.99	6.1	2.5	3.6	17.3	143.0	0.00
90	41.11	5.6	2.5	3.1	16.6	141.0	0.00
100	37.90	5.2	2.5	2.6	15.8	138.6	0.00
110	35.20	4.8	2.5	2.3	15.0	136.1	0.00
120	32.89	4.5	2.5	2.0	14.1	133.3	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	146.9	0.15	2.5	18.6	19.6	OK

SUMMARY TO OUTLET

		Vrequired	Vavailable*	
Tributary Area	0.049 ha			
Total 5yr Flow to Sewer	2.5 L/s	19	20 m^3	Ok
Non-Tributary Area	0.051 ha			
Total 100yr Flow Uncontrolled	14.9 L/s			
Total Area	0.100 ha			
Total 100yr Flow	17.4 L/s			
Target	14.5 L/s			

Project #1604012128, 3368 Carling Avenue
Roof Drain Design Sheet, Area ROOF
Standard Watts Model R1100 Accuflow Roof Drain

Rating Curve				Volume Estimation				
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0013	0	0.025	11	0	0	0.025
0.050	0.0006	0.0025	1	0.050	44	1	1	0.050
0.075	0.0006	0.0025	2	0.075	98	2	2	0.075
0.100	0.0006	0.0025	6	0.100	174	3	6	0.100
0.125	0.0006	0.0025	11	0.125	272	6	11	0.125
0.150	0.0006	0.0025	20	0.150	392	8	20	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.6	251.7	0.6	0.06992
2.4	683.2	1.7	0.25969
5.7	1330.4	3.4	0.62924
11.3	2193.4	5.5	1.23851
19.5	3272.1	8.3	2.14742

Rooftop Storage Summary

Total Building Area (sq.m)		490
Assume Available Roof Area (sq.	80%	392
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		4
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		20
Estimated 100 Year Drawdown Time (h)		2.0

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

From Watts Drain Catalogue

Head (m)	L/s Open	75%	50%	25%	**Closed**
0.025	0.3155	0.3155	0.3155	0.3155	**0.3155**
0.050	0.6309	0.6309	0.6309	0.6309	**0.6309**
0.075	0.9464	0.8675	0.7886	0.7098	**0.6309**
0.100	1.2618	1.1041	0.9464	0.7886	**0.6309**
0.125	1.5773	1.3407	1.1041	0.8675	**0.6309**
0.150	1.8927	1.5773	1.2618	0.9464	**0.6309**

* Note: Number of drains can be reduced if multiple-notch drain used.

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.003	0.003	-
Depth (m)	0.107	0.147	0.150
Volume (cu.m)	7.4	18.6	19.6
Draintime (hrs)	0.8	2.0	

January 05, 2016 File No: **PC2015-0309**

To / Destinataire	**Simon Deiaco, Planner**
From / Expéditeur	**Syd Robertson, Project Manager, Infrastructure Approvals**
Subject / Objet	**Pre-Application Consultation** **3368 Carling Ave, Ward 7, Ottawa, ON** *The applicant is proposing to construct a 3-storey condominium apartment building containing 14 units, with one level of underground parking providing 18 parking spaces, in addition to two outdoor surface parking spaces. The building will include rooftop amenity space. Access to the site will be off of Bedale Drive, south of the proposed building, and will consist of a heated ramp down to the underground parking.*

Please note the following information pertaining to the engineering design submission for the above noted site:

1. Storm and Sanitary Sewer Services:

i. All servicing works to be coordinated with the Capital Works Project on Bedale Drive which includes the replacement of 375mm dia sanitary sewer with a 600mm dia. sanitary sewer in 2016 & the resurfacing the roadway in 2017. There are no proposed storm sewer works fronting 3368 Bedale Drive.

Note: A copy of the plan & profile drawing will be forwarded to the consultant when it becomes available.

ii. Connect the sanitary service to the proposed 600mm dia sanitary sewermain, above the springline of the main, as per Std Dwg S11.1 for connections to flexible main sewers.

iii. A storm connection to the existing CB on Bedale Drive will be permitted providing that the CB is replaced with a CBMH at the Owner's expense. The City will replace the last section of the downstream storm system (approx. 21m x 450mm dia CSP) as part of the City's Rehabilitation Program.

iv. Monitoring manholes will not be required.

2. Stormwater Management:

The Stormwater Management Criteria, for the subject site, is to be based on the following:

i. The 5-yr storm event using the IDF information derived from the Meteorological Services of Canada rainfall data, taken from the MacDonald Cartier Airport, collected 1966 to 1997.

ii. A maximum equivalent 'C' of 0.5.

iii. A time of concentration of 10 minutes.

iv. Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site.

v. Water quality treatment requirements – Contact Jocelyn Chandler, Planner, RVCA, by phone at (613) 692-3571, ext. 1137, or by email at jocelyn.chandler@rvca.ca.

3. Water Supply:

Water Boundary condition requests must include the location of the service and the expected loads required by the proposed development. Please provide the following information:

i. Location of service

ii. Type of development

iii. Amount of fire flow required: ___l/s

(Calculations as per the FUS Method – Refer to ISDTB-2014-02).

iv. Average daily demand: ___ l/s.

v. Maximum daily demand: ___l/s – *Refer to ISDTB-2010-02.*

vi. Maximum hourly daily demand: ___ l/s

4. Sidewalks & Curbs:

i. Redundant accesses to be fully reinstated to City standards with full height curb and sidewalk.

ii. Sidewalks to be completely replaced on both frontages, to current City standard widths (*2.0m wide on Carling Avenue & 1.8m wide on Bedale Drive).*

5. Road Widening and Corner Sight Triangle:

Confirm that the road widening & corner sight triangle requirements are satisfied as per the City's Official Plan.

6. Phase I ESA:

Phase I Environmental Site Assessment is to be completed as per Ontario Regulation 153/04.

7. References:

i. The Servicing Study Guidelines for Development Applications are available at the following address: http://ottawa.ca/en/development-application-review-process-0/servicing-study-guidelines-development-applications

ii. Servicing & site works shall be in accordance with the following documents:
   - Ottawa Sewer Design Guidelines (2013)
   - Ottawa Design Guidelines – Water Distribution (2010)
   - Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
   - City of Ottawa Slope Stability Guidelines for Development Applications (2004)
   - City of Ottawa Environmental Noise Control Guidelines (2006)
   - City of Ottawa Park and Pathway Development Manual (2012)
   - City of Ottawa Accessibility Design Standards (2012)
   - Ottawa Standard Tender Documents (2015)
   - Ontario Provincial Standards for Roads & Public Works (2015)

iii. Record drawings and utility plans are available for purchase from the City (Contact the City's Information Centre by email at InformationCentre@ottawa.ca or by phone at (613) 580-2424 x.44455).

Should you have any questions or require additional information, please contact me directly at (613) 580-2424, x 27916 or by email at Syd.Robertson@ottawa.ca.

Gillis, Sheridan

From: Robertson, Syd <Syd.Robertson@ottawa.ca>
Sent: Tuesday, January 26, 2016 9:35 AM
To: Gillis, Sheridan
Subject: RE: 3368 Carling Ave - Pre-Consultation Follow-Up, January 2016

Hi Sheridan:

The cistern can be eliminated from the SWM proposal providing the additional flows to the storm system are as indicated in your email below (approx. 8 L/s). Consideration was based on the relatively small lot size (0.1 ha) and that the subject site is in close proximity to the storm outlet.

Syd Robertson, C.E.T.
Project Manager, Infrastructure Approvals
Development Review Services Branch, Urban Outer Core
Planning & Growth Management Department
110 Laurier Ave. W., 4th Floor E
Ottawa, ON K1P 1J1

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27916
ottawa.ca/planning / ottawa.ca/urbanisme

From: Gillis, Sheridan [mailto:Sheridan.Gillis@stantec.com]
Sent: January 25, 2016 5:11 PM
To: Robertson, Syd
Subject: RE: 3368 Carling Ave - Pre-Consultation Follow-Up, January 2016

Hi Syd,
Just wondering if you've received any feedback on the requirement for additional quantity control on the Carling Site?

From: Gillis, Sheridan
Sent: Tuesday, January 19, 2016 7:21 PM
To: 'Robertson, Syd'
Subject: RE: 3368 Carling Ave - Pre-Consultation Follow-Up, January 2016

Hi Syd,
Following up on our phone conversation from last week, we've completed some preliminary stormwater analysis for the Carling site including modeling of the storm sewer outlet from our site to the Ottawa River (using overall drainage limits from the as-built profiles and available topo information). It looks like with the roof top storage the storm sewer has sufficient capacity for our site. Unfortunately although the sewer has capacity, restricting our site to the pre-development release rate will require that we install a cistern under the floor slab in the basement to provide additional storage. The cistern would provide less than 6.0cu.m of storage but add substantial cost and complexity to the mechanical system, and will need to be pumped from below the basement floor slab.

Without the cistern we would be directing approx. **8 L/sec** more to the storm sewer than the allowable release rate of 14.5 L/sec (CIA 2.78*0.50*104.19*0.10).

Given the limited inflow into the storm sewer and the proximity to the Ottawa River would a release rate slightly higher than the allowable pre-development value be considered by the city. Again this is all predicated on the sewer having sufficient capacity, which we would need to demonstrate in our submission.

Please let me know if this is something the city would consider. If you need any other information just let me know and we'll send it over.
Thanks again,

Sheridan Gillis
Project Manager, Urban Land Engineering
Stantec
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
Phone: (613) 725-5551

Mobile: (613) 799-1363
sheridan.gillis@stantec.com

Stantec
Design with community in mind

From: Robertson, Syd [mailto:Syd.Robertson@ottawa.ca]
Sent: Tuesday, January 05, 2016 2:14 PM
To: Gillis, Sheridan
Cc: lisa.dallarosa@cardelhomes.com; Deiaco, Simon; rosaline@rjhill.ca; Sarah@fdfountain.com
Subject: RE: 3368 Carling Ave - Pre-Consultation Follow-Up, January 2016

Hi Sheridan,

Attached please find a revised copy of the pre-consultation servicing memo, for the above noted site, which has been revised as follows:

- A storm connection to the existing CB on Bedale Drive will be permitted providing that the CB is replaced with a CBMH at the Owner's expense.
- Confirmation of the applicable SWM Criteria (To be based on the 5-yr storm event, C = 0.5, Tc = 10 minutes)

Please call me if you have any questions.

Thanks,

Syd Robertson, C.E.T.
Project Manager, Infrastructure Approvals
Development Review Services Branch, Urban Outer Core
Planning & Growth Management Department
110 Laurier Ave. W., 4th Floor E
Ottawa, ON K1P 1J1

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27916
ottawa.ca/planning / ottawa.ca/urbanisme

From: Gillis, Sheridan [mailto:Sheridan.Gillis@stantec.com]
Sent: December 21, 2015 2:38 PM
To: Robertson, Syd
Subject: RE: 3368 Carling Ave - Pre-Consultation Follow-Up, December 2015

Hi Syd,
Just following up on the engineering feedback for 3368 Carling Avenue. My initial impression is that the storm criteria, and requirement to connect to the Bedale 900mm will add substantial cost for the development. Given that the existing site is completely impervious, and we will actually be adding more landscaped area, and attenuating flows up to the 100 year storm we would expect substantially less contribution to the existing storm sewer. With that in mind, would there be any opportunity to front end, or cost share on replacement of the CSP to allow us to use the current outlet?
Let me know, or feel free to call if you'd like to discuss in more detail,
Best Regards,

Sheridan Gillis
Project Manager, Urban Land Engineering
Stantec
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
Phone: (613) 725-5551

Mobile: (613) 799-1363
sheridan.gillis@stantec.com

Stantec
Design with community in mind

From: Lisa Dalla Rosa [mailto:lisa.dallarosa@cardelhomes.com]
Sent: Thursday, December 17, 2015 1:32 PM
To: ROSALINE HILL (rosaline@rjhill.ca); Gillis, Sheridan; Sarah Marsh (Sarah@fdfountain.com)
Subject: FW: 3368 Carling Ave - Pre-Consultation Follow-Up, December 2015

Please see the attached and below.

Thanks.

LDR

From: Deiaco, Simon [mailto:Simon.Deiaco@ottawa.ca]
Sent: Thursday, December 17, 2015 11:45 AM
To: Lisa Dalla Rosa <lisa.dallarosa@cardelhomes.com>
Cc: Deiaco, Simon <Simon.Deiaco@ottawa.ca>; Robertson, Syd <Syd.Robertson@ottawa.ca>; 'rosaline@rjhill.ca' <rosaline@rjhill.ca>
Subject: 3368 Carling Ave - Pre-Consultation Follow-Up, December 2015

Lisa, following up from our preconsultation meeting I am attaching some preliminary comments along with the submission requirements for an application for Site Plan Control.

Urban Design

As we will be expecting additional design material as the project evolves, here are some areas that may benefit from further consideration:

- Exterior amenity space, location and design;
- Access ramp and entrance stair (to be fully on private property) design and location;
- Entrance feature/canopy to identify building's main entrance;
- Size of parking ramp (width, see below);
- Side-yard material treatment regarding second exiting and access to exterior amenity space;
- Location and layout of front and side-yard landscaping;
- Material and design of large concrete elements.

Planning

- The required yard setbacks should be taken from the existing property line. Staff will work with your team to ensure that the new building does not encroach (either above or below grade) onto the new limit of the City right of way. This new limit should be shown on all plans.

- Staff appreciate your letter going out to the community in advance of an application and consultation with the Ward office. As part of the site plan control process a public meeting may be organized through the Ward office.

- It was noted that you have approached the neighbouring property to the east regarding a potential acquisition or collaboration. Has this avenue been exhausted?

- Future discussions will have to take place on the need for any relief required through the Committee of Adjustment.

- Section 107(aa)(i) states that the *maximum* width of a driveway is 3.6m leading to less that 20 spaces. Please revise accordingly.

- The site may be subject to municipal waste collection. This will be determined ASAP.

- Prior to formal submission, staff recommends a follow up meeting with the Ward office.

Engineering Review

Please see the attached documents and image.

Regards,

Simon M. Deiaco, MCIP, RPP
Planner III
Development Review (Urban Services)
Urbaniste III
Examen des project d'amenagement (Services urbains)

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 15641
ottawa.ca/planning / ottawa.ca/urbanisme

C.3 PCSWMM MODEL INPUT AND OUTPUT FILES

```
[TITLE]

[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
START_DATE           1/7/2016
START_TIME           00:00
REPORT_START_DATE    1/7/2016
REPORT_START_TIME    00:00
END_DATE             1/8/2016
END_TIME             00:00
SWEEP_START          1/1
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
ALLOW_PONDING        NO
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  H-W
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
MAX_TRIALS           8
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              1

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT     0.0
DRY_ONLY     NO

[JUNCTIONS]
;;               Invert     Max.       Init.      Surcharge  Ponded
;;Name           Elev.      Depth      Depth      Depth      Area
;;-------------- ---------- ---------- ---------- ---------- ----------
CB2              62.17      2.09       0          0          0
CB3              61.9       2.64       0          0          0
CB4              61.75      2.85       0          0          0
CBMH1            62.46      1.94       0          0          0

[OUTFALLS]
;;               Invert     Outfall      Stage/Table      Tide
;;Name           Elev.      Type         Time Series      Gate Route To
;;-------------- ---------- ------------ ---------------- ---- ----------------
OUTFALL          61         FREE                          NO

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet
Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset
```

```
Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
C1                 CBMH1            CB2              9          0.013      62.46
62.26      0          0
C2                 CB2              CB3              26.5       0.013      62.17
61.92      0          0
C3                 CB3              CB4              22.5       0.013      61.9
61.9       0          0
C4                 CB4              OUTFALL          20         0.013      61.75
61.55      0          0

[XSECTIONS]
;;Link           Shape        Geom1            Geom2      Geom3      Geom4
Barrels
;;-------------- ------------ ---------------- ---------- ---------- ----------
----------
C1                 CIRCULAR     0.3              0          0          0          1

C2                 CIRCULAR     0.3              0          0          0          1

C3                 CIRCULAR     0.3              0          0          0          1

C4                 CIRCULAR     0.45             0          0          0          1


[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------
C1                 0          0.199      0          NO         0
C2                 0          0.168      0          NO         0
C3                 0          0.021      0          NO         0
C4                 0          0.021      0          NO         0

[INFLOWS]
;;                                                 Param    Units    Scale
Baseline Baseline
;;Node           Parameter        Time Series      Type     Factor   Factor   Value
  Pattern
;;-------------- ---------------- ---------------- -------- -------- --------
-------- --------
CB2                FLOW             ""               FLOW     1.0      1        15.8

CB3                FLOW             ""               FLOW     1.0      1        90.3

CB4                FLOW             ""               FLOW     1.0      1        32.3

CBMH1              FLOW             ""               FLOW     1.0      1        32.3


[REPORT]
INPUT      YES
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS       -274.238454486055 -28.585196955244 13.0589740231455
600.289136060124
UNITS            Meters
```

```
[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
CB2              -190.402         4.486
CB3              -210.339         172.957
CB4              -238.252         365.352
CBMH1            0                0
OUTFALL          -261.179         571.704

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
```

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.010)

WARNING 04: minimum elevation drop used for Conduit C3

****
Element Count
****
Number of rain gages 0
Number of subcatchments ... 0
Number of nodes 5
Number of links 4
Number of pollutants 0
Number of land uses 0

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CB2	JUNCTION	62.17	2.09	0.0	Yes
CB3	JUNCTION	61.90	2.64	0.0	Yes
CB4	JUNCTION	61.75	2.85	0.0	Yes
CBMH1	JUNCTION	62.46	1.94	0.0	Yes
OUTFALL	OUTFALL	61.00	1.00	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%Slope	Roughness
C1	CBMH1	CB2	CONDUIT	9.0	2.2228	0.0130
C2	CB2	CB3	CONDUIT	26.5	0.9434	0.0130
C3	CB3	CB4	CONDUIT	22.5	0.0014	0.0130
C4	CB4	OUTFALL	CONDUIT	20.0	1.0001	0.0130

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
C1	CIRCULAR	0.30	0.07	0.07	0.30	1	144.18
C2	CIRCULAR	0.30	0.07	0.07	0.30	1	93.93
C3	CIRCULAR	0.30	0.07	0.07	0.30	1	

```
3.56
  C4               CIRCULAR            0.45     0.16     0.11     0.45        1
285.13


  ***********************************************************
  NOTE: The summary statistics displayed in this report are
  based on results found at every computational time step,
  not just on results from each reporting time step.
  ***********************************************************

  ***************
  Analysis Options
  ***************
  Flow Units ............... LPS
  Process Models:
    Rainfall/Runoff ........ NO
    RDII ................... NO
    Snowmelt ............... NO
    Groundwater ............ NO
    Flow Routing ........... YES
    Ponding Allowed ........ NO
    Water Quality .......... NO
  Flow Routing Method ...... DYNWAVE
  Starting Date ............ JAN-07-2016 00:00:00
  Ending Date .............. JAN-08-2016 00:00:00
  Antecedent Dry Days ...... 0.0
  Report Time Step ......... 00:01:00
  Routing Time Step ........ 5.00 sec
  Variable Time Step ....... YES
  Maximum Trials ........... 8
  Number of Threads ........ 1
  Head Tolerance ........... 0.001524 m


  **************************        Volume        Volume
  Flow Routing Continuity        hectare-m      10^6 ltr
  **************************     ---------     ---------
  Dry Weather Inflow .......         0.000         0.000
  Wet Weather Inflow .......         0.000         0.000
  Groundwater Inflow .......         0.000         0.000
  RDII Inflow ..............         0.000         0.000
  External Inflow ..........         1.475        14.749
  External Outflow .........         1.474        14.741
  Flooding Loss ............         0.000         0.000
  Evaporation Loss .........         0.000         0.000
  Exfiltration Loss ........         0.000         0.000
  Initial Stored Volume ....         0.000         0.000
  Final Stored Volume ......         0.001         0.006
  Continuity Error (%) .....         0.009


  **************************
  Time-Step Critical Elements
  **************************
  Link C1 (99.99%)


  ******************************
  Highest Flow Instability Indexes
  ******************************
  All links are stable.
```

****
Routing Time Step Summary
****

Minimum Time Step	:	1.82 sec
Average Time Step	:	2.73 sec
Maximum Time Step	:	5.00 sec
Percent in Steady State	:	0.00
Average Iterations per Step	:	2.00
Percent Not Converging	:	0.01

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days hr:min	Reported Max Depth Meters
CB2	JUNCTION	0.53	0.53	62.70	0 00:02	0.16
CB3	JUNCTION	0.73	0.92	62.82	0 00:00	0.22
CB4	JUNCTION	0.25	0.25	62.00	0 00:02	0.08
CBMH1	JUNCTION	0.24	0.24	62.70	0 00:02	0.07
OUTFALL	OUTFALL	0.00	0.00	61.00	0 00:00	0.00

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CB2	JUNCTION	15.80	50.28	0 00:00	1.37	4.16	0.041
CB3	JUNCTION	90.30	138.42	0 00:02	7.8	12	0.027
CB4	JUNCTION	32.30	170.72	0 00:02	2.79	14.7	0.015
CBMH1	JUNCTION	32.30	32.30	0 00:00	2.79	2.79	0.024
OUTFALL	OUTFALL	0.00	170.74	0 00:02	0	14.7	0.000

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
CB2	JUNCTION	23.98	0.137	1.563
CB3	JUNCTION	23.99	0.597	1.723

****
Node Flooding Summary
****

No nodes were flooded.

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
OUTFALL	100.00	170.63	170.74	14.741
System	100.00	170.63	170.74	14.741

****
Link Flow Summary
****

Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
C1	CONDUIT	34.48	0 00:00	1.64	0.24	0.91
C2	CONDUIT	48.12	0 00:02	0.86	0.51	1.00
C3	CONDUIT	138.42	0 00:02	1.98	38.89	0.96
C4	CONDUIT	170.74	0 00:02	1.87	0.60	0.56

****
Flow Classification Summary
****

Inlet Conduit	Adjusted /Actual Length	Fraction of Time in Flow Class: Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd Ctrl
C1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

```
0.00
  C2                      1.00   0.00  0.00  0.00  1.00  0.00  0.00  0.00  0.00
0.00
  C3                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00
0.00
  C4                      1.00   0.00  0.00  0.00  0.00  0.00  0.00  1.00  0.00
0.00
```

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
C1	0.01	0.01	23.98	0.01	0.01
C2	23.99	23.99	23.99	0.01	0.01
C3	0.01	23.99	0.01	24.00	0.01

Analysis begun on: Thu Jan 28 15:29:37 2016
Analysis ended on: Thu Jan 28 15:29:38 2016
Total elapsed time: 00:00:01

Appendix D GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

patersongroup

Geotechnical Investigation

Proposed Multi-Storey Building
3368 Carling Avenue
Ottawa, Ontario

Prepared For

Cardel Homes

January 6, 2016

Report: PG3682-1

TABLE OF CONTENTS

PAGE

APPENDICES

1.0 Introduction

Paterson Group (Paterson) was commissioned by Cardel Homes to complete a geotechnical study for the proposed multi-storey building to be located at 3368 Carling Avenue, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan in Appendix 2).

The objectives of the geotechnical investigation were:

- ❑ to review existing borehole logs and available information;
- ❑ to provide geotechnical recommendations pertaining to design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. The report contains the original findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as understood at the time of writing this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope for this present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Project

The proposed project will consist of a three to four storey building with one level of underground parking and will occupy the majority of the subject site.

3.0 Background Information

Four (4) boreholes were completed by SPL Consultants Limited in August 2014 within the subject site. Four boreholes were completed to provide general coverage of the proposed development. The boreholes were advanced to a maximum depth of 18 m and a groundwater monitoring well was installed at all of the borehole locations, except BH 14-2. The test hole locations are presented on Drawing PG3682-1 - Test Hole Location Plan included in Appendix 2. Diamond core drilling was completed at one location to confirm the depth to bedrock and bedrock quality.

The subsurface profiles are presented on the Log of Borehole sheets presented in Appendix 1.

3.1 Surface Conditions

The subject site is located at 3368 Carling Avenue, which is located at the southeast corner of the intersection of Carling Avenue and Bedale Drive in the City of Ottawa. The site was formerly occupied by a single storey commercial building with a single basement level. The single storey building was surrounded by an at grade, paved parking area. The subject site is approximately 1.5 m above the adjacent roadways and slopes from the building downward to the property boundaries. The subject site is surrounded by residential development to the east, west and south and green space to the north.

3.2 Subsurface Profile

Generally, the soil profile encountered at the borehole locations consists of a pavement structure and non-specified fill overlying a native silty clay layer which extends to 10.7 to 12.2 m below existing ground surface. The non-specified fill material consists of silty clay mixed with trace crushed stone and is approximately 1.2 to 1.5 m thick. The native silty clay layer consists of a stiff to very stiff crust extending to a 5 to 6 m depth followed by a 6.0 to 8.5 m thick unweathered silty clay, which is of a firm to very stiff consistency. The unweathered silty clay is underlain by very loose to loose silty sand till, which is approximately 2.7 to 5.1 m thickness and extends to bedrock. A limestone bedrock was encountered at a depth of 14.8 to 15.8 m.

Bedrock

Weathered limestone bedrock was encountered at depths ranging between 14.8 to 15.8 m below the existing ground surface. Bedrock was cored at BH14-2. Based on the recovered cores, the rock quality designation (RQD) values were calculated for the rock core and the bedrock quality was assessed based on the results. Generally, the bedrock is good to excellent quality.

Practical refusal to DCPT was encountered at BH 14-3 at 15.8 m depth. Additionally, practical refusal to augering was encountered at BH 14-1 and BH 14-4, at 14.9 m and 12.8 m, respectively.

Based on available geological mapping, dolomite bedrock of the Oxford Formation is present in this area with an overburden thickness ranging between 10 to 15 m.

Specific details of the soil profile at each test hole location are presented on the Soil Profile and Test Data sheets in Appendix 1.

3.3 Groundwater

Monitoring wells were installed at BH14-1, BH14-3 and BH14-4. Groundwater levels were obtained 7 days after the drilling program in the groundwater monitoring wells. The groundwater levels varied between 3.2 to 4.5 m below ground surface. Groundwater levels are subject to seasonal fluctuations and therefore, groundwater levels could be higher at the time of construction.

4.0 Discussion

4.1 Geotechnical Assessment

The subject site is satisfactory for the proposed development from a geotechnical perspective. It is anticipated that the proposed building will be constructed over conventional shallow footings.

Due to the presence of a silty clay deposit, a permissible grade raise restriction is required for the subject site.

The above and other considerations are further discussed in the following sections.

4.2 Site Grading and Preparation

Stripping Depth

Topsoil, deleterious fill and soils containing significant amounts of organics, should be stripped from under any buildings and other settlement sensitive structures. Precautions should be taken to ensure that all bearing surfaces and subgrade soils remain undisturbed during site preparation activities.

Fill Placement

Fill placed for grading beneath the proposed building, unless otherwise specified, should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. The fill should be tested and approved prior to delivery to the site. The fill should be placed in maximum 300 mm thick lifts and be compacted to a minimum of 98% of the standard proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where ground surface settlement is of minor concern. The backfill should be spread in thin lifts and at a minimum compacted by the tracks of the spreading equipment to minimize voids. If the backfill is to be placed to increase the subgrade level for paved areas, the material should be compacted in thin lifts to a minimum density of 95% of the respective SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Protective Mud Slab

It is anticipated that the excavation bottom will be over a silty clay subgrade which will require protection from disturbance due to worker traffic. Consideration should be given to placing a 50 to 75 mm thick lean concrete mud slab over the undisturbed clay surface once exposed. The lean concrete should consist of a minimum 17 MPa compressive strength concrete.

4.3 Foundation Design

Shallow Footing Foundation

Strip footings, up to 3 m wide, and pad footings, up to 6 m wide, founded on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **175 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **275 kPa**. A geotechnical resistance factor of 0.5 was applied to the reported bearing resistance value at ULS.

A permissible grade raise restriction of 1.5 m above existing ground surface is recommended for the subject site.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed in the dry prior to the placement of concrete for footings.

The bearing resistance value given for footings at SLS will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to an engineered fill, stiff silty clay above the groundwater table when a plane extending horizontally and vertically from the underside of the footing at a minimum of 1.5H:1V passing through in situ soil of the same or higher bearing capacity as the bearing medium soil.

4.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class D** for the foundations considered. Refer to the latest verision of the Ontario Building Code for a full discussion of the earthquake design requirements. The soils underlying the subject site are not susceptible to liquefaction.

4.5 Basement Slab

All organic containing and/or deleterious materials, as well as, disturbed soils should be removed from beneath the floor slab prior to placement of concrete. The basement area for the proposed building will be mostly parking and the recommended pavement structure noted in Subsection 4.8 will be applicable. However, if a concrete floor slab will be constructed for storage purposes, the upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone. All backfill material placed within the proposed building footprint should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 98% of the SPMDD.

All soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill or concrete. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of the SPMDD.

4.6 Basement Wall

There are several combinations of backfill materials and retained soils that could be applicable for the basement walls of the subject structure. However, the conditions can be well-represented by assuming the retained soil consists of a material with an angle of internal friction of 30 degrees and dry unit weight of 20 kN/m^3.

If undrained conditions are anticipated, the applicable effective unit weight of the retained soil can be taken as 13 kN/m^3, where applicable. A hydrostatic pressure should be added to the total static earth pressure when calculating the effective unit weight. The total earth pressure (P_{AE}) includes both the static earth pressure component (P_o) and the seismic component (ΔP_{AE}).

Lateral Earth Pressures

The static horizontal earth pressure (P_o) can be calculated using a triangular earth pressure distribution equal to $K_o \cdot \gamma \cdot H$ where:

K_o = at-rest earth pressure coefficient of the applicable retained soil, 0.5
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)

An additional pressure having a magnitude equal to $K_o \cdot q$ and acting on the entire height of the wall should be added to the above diagram for any surcharge loading, q (kPa), that may be placed at ground surface adjacent to the wall. The surcharge pressure should only be applicable for static analyses and should not be calculated in conjunction with the seismic loading case.

Actual earth pressures could be higher than the “at-rest” case if care is not exercised during the compaction of the backfill materials to maintain a minimum separation of 0.3 m from the walls with the compaction equipment.

Seismic Earth Pressures

The seismic earth pressure (ΔP_{AE}) can be calculated using the earth pressure distribution equal to $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ where:

a_c = $(1.45-a_{max}/g)a_{max}$
γ = unit weight of fill of the applicable retained soil (kN/m^3)
H = height of the wall (m)
g = gravity, 9.81 m/s^2

The peak ground acceleration, (a_{max}), for the Ottawa area is 0.32g according to OBC 2012. Note that the vertical seismic coefficient is assumed to be zero.

The total earth pressure (P_{AE}) is considered to act at a height, h (m), from the base of the wall, where:

$h = \{Po \cdot (H/3) + \Delta P_{AE} \cdot (0.6 \cdot H)\}/P_{AE}$

The earth pressures calculated are unfactored. For the ULS case, the earth pressure loads should be factored as live loads, as per OBC 2012.

4.7 Pavement Structure

Asphalt pavement is not anticipated to be required at the subject site. However, should a flexible pavement be considered for the project, the recommended flexible pavement structures shown in Tables 1 and 2 would be applicable.

Table 1 - Recommended Flexible Pavement Structure - Car Only Parking Areas

Thickness (mm)	Material Description
50	**Wear Course -** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill

Table 2 - Recommended Flexible Pavement Structure - Access Ramp	
Thickness (mm)	**Material Description**
40	**Wear Course** - HL-3 or Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - HL-8 or Superpave 19.0 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
400	**SUBBASE** - OPSS Granular B Type II
	SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project.

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 98% of the SPMDD.

Pavement Structure Drainage

The pavement structure performance is dependent on the moisture condition at the contact zone between the subgrade material and granular base. Failure to provide adequate drainage under conditions of heavy wheel loading could result in the subgrade fines pumped into the stone subbase voids, thereby reducing the load bearing capacity.

Due to the impervious nature of the subgrade materials consideration should be provided to installing sub-drains during the pavement construction. The subdrains should extend in four orthogonal directions and longitudinally when placed along a curb. The clear crushed stone surrounding the drainage lines or the pipe, should be wrapped with suitable filter cloth. The subdrain inverts should be approximately 300 mm below subgrade level and placed in accordance with City of Ottawa specifications. The subgrade surface should be shaped to promote water flow to the drainage lines.

5.0 Design and Construction Precautions

5.1 Foundation Drainage and Backfill

A perimeter drainage system is recommended for the proposed building. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 10 mm clear crushed stone, placed at the foundation level around the exterior perimeter of the structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Backfill against the exterior sides of the foundation walls should consist of free-draining non frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for placement as backfill against the foundation walls, unless placed in conjunction with a composite drainage system, such as Miradrain G100N or Delta Drain 6000. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be used for backfill material.

5.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum of 1.5 m thick soil cover (or equivalent) should be provided.

A minimum of 2.1 m thick soil cover (or equivalent) should be provided for exterior unheated footings, such as exterior columns, piers, etc.

5.3 Excavation Side Slopes

Temporary Side Slopes

Excavation side slopes constructed in fill materials should excavated to acceptable slopes or retained by shoring systems from the beginning of the excavation until the structure is backfilled. Since the building will occupy the majority of the subject site, a temporary shoring system is anticipated for construction.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or shallower. A shallower slope is required for excavations below groundwater level. The subsurface soils are considered to be a Type 2 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

A trench box is recommended to protect personnel working in trenches with steep or vertical sides. Services are expected to be installed by "cut and cover" methods and excavations should not remain exposed for extended periods of time.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements should be designed by a structural engineer, specializing in shoring design. The shoring will depend on the depth of the excavation, the proximity of the adjacent structures and the elevation of the adjacent building foundations, roadways and underground services.

The design and implementation of the temporary systems will be the responsibility of the excavation contractor. The geotechnical information provided below is to assist the contractor in completing a safe shoring system. The shoring designer should take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation event will not negatively impact the shoring system or soils supported by the system. Any changes during construction to the approved shoring design should be reported immediately to the owner's consultants prior to implementation.

The temporary system could consist of soldier pile and lagging system or interlocking steel sheet piling. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. The shoring system could be cantilevered, anchored or braced. Generally, the shoring systems is provided with tie-back rock anchors to ensure the stability. The shoring system is recommended to be adequately supported to resist toe failure and inspected to ensure that the sheet piles extend well below the excavation base. If consideration is given to utilizing a raker style support for the shoring system, the structural engineer should ensure that the design selected minimizes lateral movements to tolerable levels.

The earth pressures acting on the shoring system may be calculated with the following parameters.

Table 3 - Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Dry Unit Weight (γ), kN/m^3	20
Effective Unit Weight (γ), kN/m^3	13

The active earth pressure should be calculated where wall movements are permissible, while the at-rest pressure should be calculated if movement is not permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

A hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be calculated full weight, with no hydrostatic groundwater pressure component. For design purposes, the minimum factor of safety of 1.5 should be calculated.

5.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the City of Ottawa.

Excavation to approximately 4 m depth or shallower, below the existing grade, should be within the silty clay crust material. If deeper excavations are expected, the services will be excavated through the unweathered grey silty clay.

The pipe bedding for sewer and water pipes should consist of at least 150 mm of OPSS Granular A material. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of the SPMDD. The bedding material should extend at a minimum to the spring line of the pipe. The placement of clear stone is not recommended for bedding or cover as the finer particles of the native and backfill may migrate into the clear stone voids, thereby reducing the pipe support.

The cover material, which should consist of OPSS Granular A, should extend from the spring line of the pipe to at a minimum of 300 mm above the obvert of the pipe. The material should be placed in maximum 300 mm thick lifts and compacted to a minimum of 95% of the SPMDD.

Generally,the brown silty clay should be possible to place above the cover material if the excavation and backfilling operations are completed in dry weather conditions. Wet silty clay materials will be difficult for placement, as the high water content are impractical for the desired compaction without an extensive drying period.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should match the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

To reduce long-term lowering of the groundwater level, clay seals should be provided in the service trenches, where the services are located below the local groundwater table. The seals should be a minimum of 1.5 m long (in the trench direction) and should extend from trench wall to trench wall. The seals should extend from the frost line and fully penetrate the bedding, subbedding and cover material. The barriers should consist of relatively dry impervious material placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at a maximum of 60 m intervals in the service trenches.

5.5 Groundwater Control

Due to the relatively impervious nature of the silty clay materials, groundwater infiltration into the excavations should be low and controllable by open sumps. A perched groundwater condition may be encountered within the silty sand deposit which may produce significant temporary groundwater infiltration levels. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

A temporary MOE permit to take water (PTTW) will be required for this project if more than 50,000 L/day are to be pumped during the construction phase. At least 4 to 5 months should be allowed for completion of the application and issuance of the permit by the MOE.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance to the founding medium.

5.6 Winter Construction

The subsurface conditions mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

In the event that construction is completed during below zero temperatures, the founding stratum and excavation side slopes should be protected from freezing temperatures by the installation of straw, propane heaters, tarpaulins or other suitable means. The excavation base should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.

The trench excavations should be constructed in a manner that should avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the construction is completed. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

5.7 Corrosion Potential and Sulphate

The analytical test results indicate that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate. The results of the chloride content, pH and resistivity indicate the presence of a aggressive environment for exposed ferrous metals.

6.0 Recommendations

The following material testing and observation program should be performed by a geotechnical consultant and is required for the foundation design data provided herein to be applicable:

- ❏ Review of the proposed structure(s) and adjacent structures from a geotechnical perspective.
- ❏ Observation of all bearing surfaces prior to the placement of concrete.
- ❏ Sampling and testing of the concrete and fill materials used.
- ❏ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❏ Observation of all subgrades prior to backfilling and follow-up field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming the work has been conducted in general accordance with the recommendations could be issued, upon request, following the completion of a satisfactory materials testing and observation program by the geotechnical consultant.

7.0 Statement of Limitations

The recommendations made in this report are for review and design purposes. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, we request immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine its suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

A geotechnical investigation is a limited sampling of a site. The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Cardel Homes and their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Joe Forsyth, P.Eng.

David J. Gilbert, P. Eng.

Report Distribution:

- ❑ Cardel Homes(3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

BOREHOLE LOGS BY OTHERS

ANALYTICAL TESTING RESULTS

LOG OF BOREHOLE BH14-1

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/21/2014

REF. NO.: 10000823
ENCL NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS / 0.3 m	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
101.1 / 0.0	**ASPHALT** 40 mm				
100.8 / 0.3	**CRUSHED SAND AND GRAVEL** brown, moist (Granular Base)				
	SILTY CLAY trace gravel, dark brown, moist, firm (FILL)	1	SS	2	
		2	SS	6	
99.6 / 1.5	**SILTY CLAY** grey brown, moist, stiff to very stiff (Weathered Crust)	3	SS	10	
		4	SS	12	
		5	SS	7	
	- silty sand seam	6	SS	17	
95.0 / 6.1	**SILTY CLAY** with silty sand seams, grey, wet, stiff to very stiff	7	SS	1	-Hollow stem augered to 6.1 m then advanced casing to 14.9 m
			VANE		
			VANE		

GROUND WATER CONDITIONS: Cuttings; Bentonite; W. L. 97.4 m Aug 28, 2014; Sand; Screen

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (25 50 75 100 125)
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (25 50 75)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (KN/m³)

ELEVATION: 101, 99, 98, 97, 96, 95, 94, 93, 92

+4
+10

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

Continued Next Page

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▽ ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH14-1

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/21/2014

REF. NO.: 10000823
ENCL NO.:

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	"N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (25 50 75 100 125)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (25 50 75)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (KN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY with silty sand seams, grey, wet, stiff to very stiff(Continued)						91					
			8	SS	1		90					
			9A 9B	SS SS	1		89					
88.9												
12.2	**SILTY SAND** trace clay, grey, wet, very loose to loose		10	SS	1		88					
			11	SS	8							
			12	SS	2		87					
			13	SS	5							
86.2												
14.9	**End of Borehole** Notes: 1 - Borehole was advanced with hollow stem augers to 6.1 m depth then advanced with casing to 14.9 m depth. Casing filled with water prior to SPT sampling below 10.7 m depth. 2 - Borehole terminated at 14.9 m below surface on casing refusal. 3 - Water level on completion of sampling at a depth of 2.5 m below surface. 4 - 50 mm dia. monitoring well installed in adjacent auger hole 5 - Date Water Level Aug 28, 2014 3.7 m											

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▽ ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH14-2

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/19/2014

REF. NO.: 10000823
ENCL NO.:

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS / 0.3 m
100.8					
100.7 / 0.1	**ASPHALT** 100 mm				
100.6 / 0.2	**CRUSHED SAND AND GRAVEL** brown, moist (Granular Base)				
	SILTY CLAY trace to some gravel, trace roots, brown, moist, firm (FILL)		1	SS	6
			2	SS	7
99.5 / 1.4	**SILTY CLAY** grey brown to brown, moist, stiff to very stiff (Weathered Crust)		3	SS	13
			4	SS	11
			5	SS	6
96.5 / 4.4	**SILTY CLAY** with silty sand seams, grey brown to grey, moist, stiff to very stiff		6	SS	2
				VANE	
				VANE	
	- grey below 6.0 m		7	SS	WH
				VANE	
				VANE	
			8A	SS	1
			8B	SS	
				VANE	
			9	SS	WH
				VANE	

GROUND WATER CONDITIONS

ELEVATION: 100, 99, 98, 97, 96, 95, 94, 93, 92, 91

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (25 50 75 100 125)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
+4 >100 kPa
+6 +8 >100 kPa
+2 >100 kPa

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (25 50 75)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (KN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▼ ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH14-2

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/19/2014

REF. NO.: 10000823
ENCL NO.:

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (KN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY with silty sand seams, grey brown to grey, moist, stiff to very stiff(Continued)			VANE						
			10	SS	WH		90			
				VANE						
				VANE			89			
88.8										
12.1	**SILTY SAND** trace clay, grey, wet, very loose		11	SS	WR		88			
			12	SS	2		87		21.1	0 73 24 3 - approx. 0.3 m of heave inside hollow stem auger when center plug removed
86.0							86			
14.8	**LIMESTONE** fresh, grey, thin to medium bedded with some shale seams, moderately to widely spaced discontinuities - TCR: 100% - SCR: 99% - RQD: 99%		1	CORE			85			
	- TCR: 97% - SCR: 92% - RQD: 85%		2	CORE			84			
82.9							83			
17.9	**End of Borehole** Notes: 1 - Switched from augering to NQ rock coring at a depth of 14.8 m below surface after encountering auger refusal. 2 - Water level after augering was at a depth of 6.9 m below surface. 3 - Water level after completion of borehole was at a depth of 7.0 m below surface									

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
25 50 75 100 125 >100 kPa
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 25 50 75

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▽ ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH14-3

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/20/2014

REF. NO.: 10000823
ENCL NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS / 0.3 m "N"
100.8 / 0.0	**ASPHALT** 120 mm			
100.7 / 0.1	**CRUSHED SAND AND GRAVEL** grey brown, moist, loose (Granular Base)	1	SS	8
100.4 / 0.5	**SILTY CLAY** trace gravel, dark brown, moist, firm (FILL)	2	SS	6
99.3 / 1.5	**SILTY CLAY** grey brown, moist, stiff to very stiff (Weathered Crust)	3	SS	13
		4	SS	8
		5	SS	7
		6	SS	1
95.7 / 5.1	**SILTY CLAY** with silty sand seams, grey, wet, stiff to very stiff		VANE	
			VANE	
		7	TW	
			VANE	
			VANE	
		8	SS	1
			VANE	
			VANE	
		9	TW	

Cuttings
Bentonite
W. L. 96.3 m
Aug 28, 2014
Sand
Screen

DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (KN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL
0 1 57 42

>100 kPa

Continued Next Page

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▽ ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

LOG OF BOREHOLE BH14-3

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/20/2014

REF. NO.: 10000823
ENCL NO.:

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (25 50 75 100 125)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (25 50 75)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (KN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
90.1	**SILTY CLAY** with silty sand seams, grey, wet, stiff to very stiff(Continued)											
10.7	**SILTY SAND** trace clay, grey, wet, very loose to loose		10	SS	1		90		○			
			11	SS	7		89		○		20.5	0 87 12 1
	- some silt		12	SS	3		88		○			
85.0			13	SS	5		87		○			0 70 24 6
15.8	**End of Borehole** Notes: 1 - Borehole terminated at 15.8 m below surface on auger refusal. 2 - Water level after completion of borehole was at a depth of 8.2 m below surface. 3 - 50 mm dia. monitoring well advanced in adjacent auger hole 4 - Date Water Level Aug 28, 2014 4.5 m						86 85					

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▽ ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH14-4

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/20/2014

REF. NO.: 10000823
ENCL NO.:

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	"N" BLOWS 0.3 m
101.1 / 0.0	**ASPHALT** 120 mm			
100.9 / 0.1	**CRUSHED SAND AND GRAVEL** some silt, brown, moist (Granular Base)	1	SS	4
100.3 / 0.9	**SILTY CLAY** brown grey, moist, firm to stiff (FILL)	2	SS	8
99.7 / 1.4	**SILTY CLAY** brown, moist, stiff to very stiff (Weathered Crust)	3	SS	11
		4	SS	11
		5	SS	6
		6	SS	2
			VANE	
			VANE	
95.0 / 6.1	**SILTY CLAY** with silty sand seams, grey, wet, stiff to very stiff	7	SS	1
			VANE	
			VANE	
		8	TW	
			VANE	
			VANE	
	- firm at 9.8 m	9	SS	2
			VANE	

GROUND WATER CONDITIONS: Cuttings; Bentonite; W. L. 97.9 m Aug 28, 2014; Sand; Screen

ELEVATION: 101, 99, 97, 96, 94, 93, 92

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 25 50 75 100 125

VANE: >100 kPa; >100 kPa; 10; >100 kPa; 11; >100 kPa; 3

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 25 50 75

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (KN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▽ ▼

GRAPH NOTES
$+^3$, $\times^3$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

LOG OF BOREHOLE BH14-4

PROJECT: Cardel Homes - 3368 Carling Avenue
CLIENT: Cardel Homes
PROJECT LOCATION: 3368 Carling Avenue, Ottawa, ON
DATUM: local
BH LOCATION: See Location Plan

DRILLING DATA
Method: Hollow Stem Auger Drilling
Diameter: 203
Date: Aug/20/2014

REF. NO.: 10000823
ENCL NO.:

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (KN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	SILTY CLAY with silty sand seams, grey, wet, stiff to very stiff(Continued)			VANE			91	+2				
90.4							Cave					
10.7	**SILTY SAND** trace clay, grey, wet, very loose		10	SS	1		90		○			
							89					
88.3			11	SS	WH				○			
12.8	**End of Borehole** Notes: 1 - Borehole terminated at 12.8 m below surface. 2 - Water level upon completion of borehole was at a depth of 8.2 m below surface 3 - Date Water Level Aug 28, 2014 3.2 m											

SPL SOIL LOG-OTTAWA 10000823 - 3368 CARLING AVENUE.GPJ SPL.GDT 17/9/14

GROUNDWATER ELEVATIONS
Shallow/ Single Installation ▽ ▼ Deep/Dual Installation ▼ ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

Client: SPL Consultants Ltd.
146 Colonnade Rd., Unit 17
Ottawa, ON
K2E 7Y1
Attention: Ms. Wendy McLaughlin
PO#:
Invoice to: SPL Consultants Ltd.

Report Number: 1418214
Date Submitted: 2014-08-27
Date Reported: 2014-08-29
Project: 10000823
COC #: 172975

				Lab I.D.	1129070	1129071	1129072
				Sample Matrix	Soil	Soil	Soil
				Sample Type			
				Sampling Date	2014-08-19	2014-08-19	2014-08-19
				Sample I.D.	BH 14-2 SS7	BH 14-3 SS3	BH 14-3 SS11
Group	**Analyte**	**MRL**	**Units**	**Guideline**			
Agri. - Soil	pH	2.0			8.8	8.1	8.9
General Chemistry	Cl	0.002	%		0.024	0.017	<0.002
	Electrical Conductivity	0.05	mS/cm		0.66	0.72	0.07
	Resistivity	1	ohm-cm		1520	1410	14300
	SO4	0.01	%		0.03	0.02	<0.01

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG3682-1 - TEST HOLE LOCATION PLAN

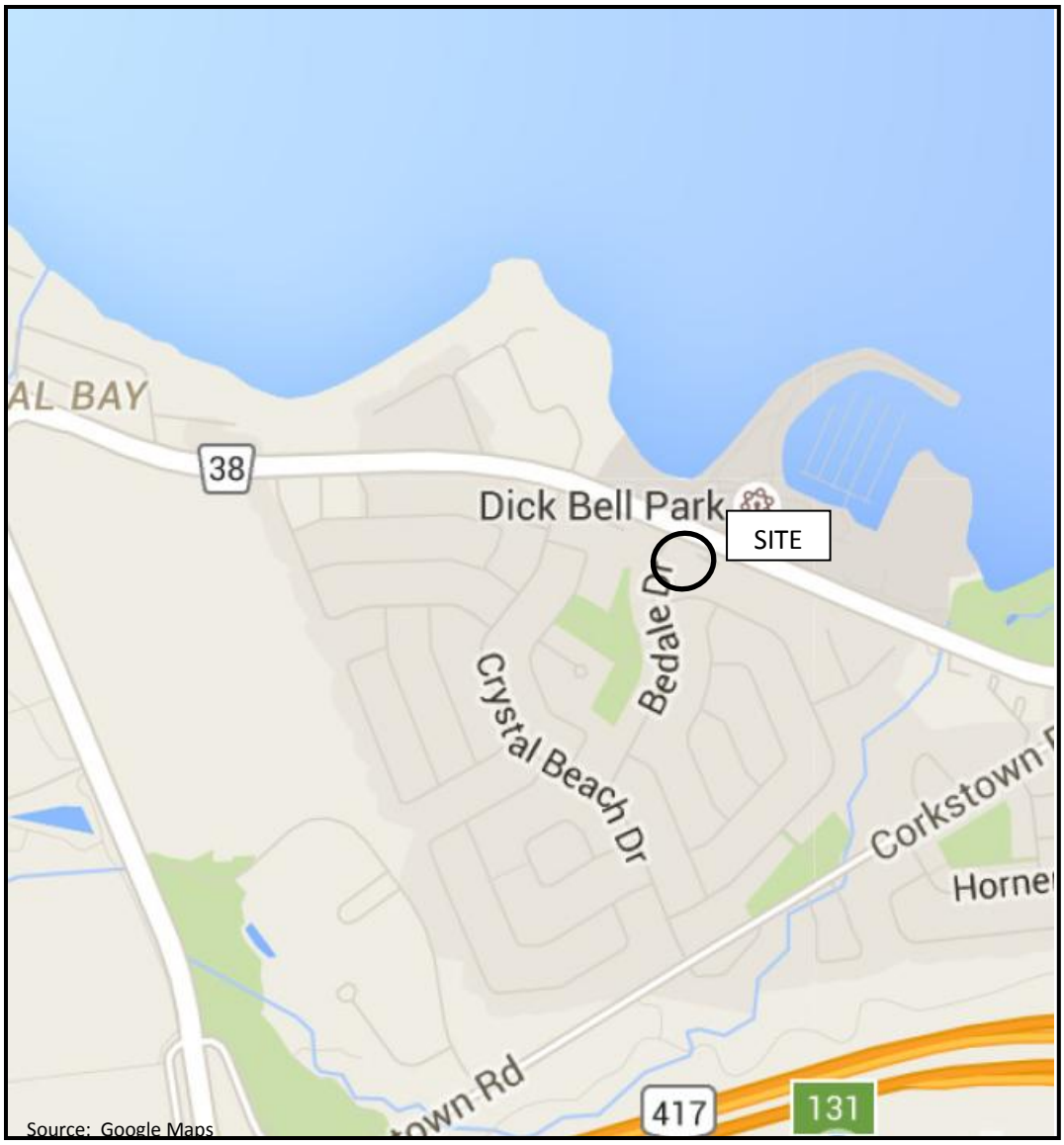
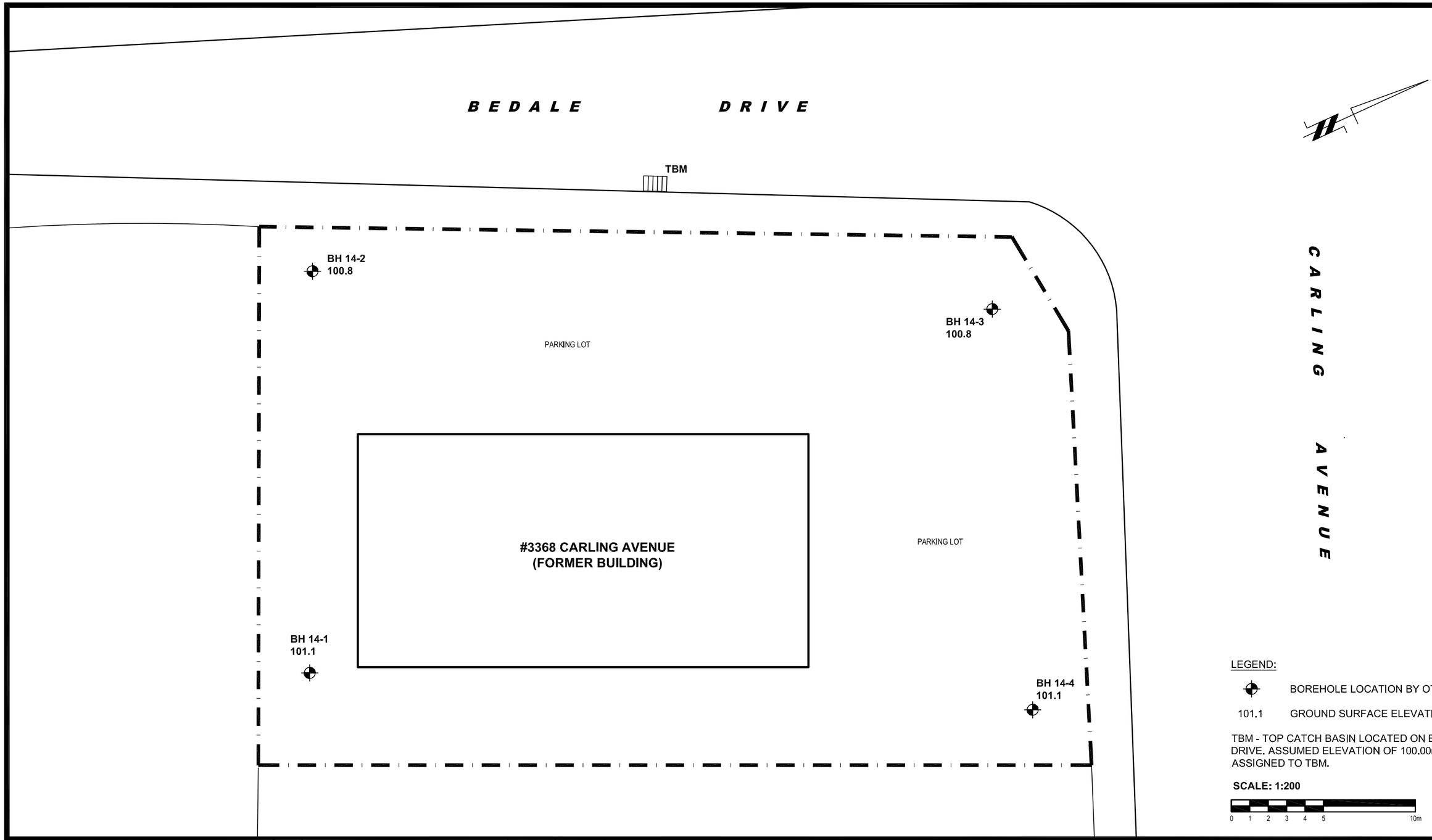


FIGURE 1

KEY PLAN



LEGEND:

BOREHOLE LOCATION BY OTHERS

101.1 GROUND SURFACE ELEVATION (m)

TBM - TOP CATCH BASIN LOCATED ON BEDALE DRIVE. ASSUMED ELEVATION OF 100.00m WAS ASSIGNED TO TBM.

SCALE: 1:200

0 1 2 3 4 5 10m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL

CARDEL HOMES

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDING - 3368 CARLING AVENUE
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:200	Date: 12/2015
Drawn by: CPB	Report No.: PG3682
Checked by: JF	Dwg. No.: PG3682-1
Approved by: DG	Revision No.: 0

p:\autocad drawings\geotechnical\pg3682-1 thlp.dwg

Appendix E DRAWINGS