Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401234
Project Name: 244 Fountain Place
Date: 10/10/2019
Fire Flow Calculation #: 5
Description: Three Storey Apartment Building

Notes: Horizontal firewall between the second and third floor. Calculations are based on area of the first two storeys.

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Ordinary Construction						1	-
2	Determine Ground Floor Area of One Unit	-						307	-
	Determine Number of Adjoining Units	-						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						2	-
4	Determine Required Fire Flow	($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min						-	5000
5	Determine Occupancy Charge	Limited Combustible						-15%	4250
6	Determine Sprinkler Reduction	Conforms to NFPA 13						-30%	-1700
		Standard Water Supply						-10%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						100%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	> 45	14.5	2	0-30	Wood Frame or Non-Combustible	0%	1105
		East	> 45	22.7	2	31-60	Wood Frame or Non-Combustible	0%	
		South	3.1 to 10	14.5	2	0-30	Ordinary or Fire-Resistive with Unprotected Openings	15%	
		West	10.1 to 20	22.7	2	31-60	Ordinary or Fire-Resistive with Unprotected Openings	11%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							4000
		Total Required Fire Flow in L/s							66.7
		Required Duration of Fire Flow (hrs)							1.75
		Required Volume of Fire Flow (m^3)							420

A.2 FIRE FLOW REQUIREMENTS PER FUS

244 Fountain Place - Domestic Water Demand Estimates

- Based on Propsed Site Plan by Figurr Architectes, 2019/10/09 (160401234)

Building ID	Units	Population	Daily Rate of Demand	Avg Day Demand		Max Day Demand		Peak Hour Demand	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
BLDG	20	36.4	350	8.8	0.15	22.1	0.37	48.7	0.81
Total Site :	**20**	**36.4**		**8.8**	**0.15**	**22.1**	**0.37**	**48.7**	**0.81**

Assume 2.1p/2 bedroom units and 1.4p/1 bedroom units

Maximum day demand rate = 2.5 x average day demand rate

Maximum hour demand rate = 2.2 x maximum day demand rate

A.3 BOUNDARY CONDITIONS

Thiffault, Dustin

From: Gillis, Sheridan
Sent: Thursday, October 13, 2016 10:04 AM
To: Thiffault, Dustin
Subject: FW: 244 Rideau Place - Hydraulic Boundary Conditions
Attachments: 244 Rideau Place April 2016.pdf

FYI, boundary conditions for Fountain Place.

From: White, Joshua [mailto:Joshua.White@ottawa.ca]
Sent: Thursday, April 14, 2016 4:21 PM
To: Rathnasooriya, Thakshika
Cc: Gillis, Sheridan; Thiffault, Dustin
Subject: RE: 244 Rideau Place - Hydraulic Boundary Conditions

Good afternoon Thakshika,

Please find the following boundary condtions for 224 Rideau Place.

If you have any questions please let me know.

Cheers

Josh

The following are boundary conditions, HGL, for hydraulic analysis at 244 Rideau Place (zone 1W) assumed to be connected to the 152mm on Rideau Place (see attached PDF for location).

Minimum HGL = 105.4m

Maximum HGL = 118.1m; *the maximum pressure is estimated to be close to 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required.*

Available flow = 70 L/s assuming a residual of 20 psi and a ground elevation of 62.9m

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.

Joshua White, P.Eng.
Project Manager, Infrastructure Approvals
Development Review, Urban Services, City of Ottawa

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 15843
Email: joshua.white@ottawa.ca
ottawa.ca/planning / ottawa.ca/urbanisme

From: Rathnasooriya, Thakshika [mailto:Thakshika.Rathnasooriya@stantec.com]
Sent: Thursday, April 07, 2016 2:42 PM
To: White, Joshua
Cc: Gillis, Sheridan; Thiffault, Dustin
Subject: 244 Rideau Place - Hydraulic Boundary Conditions

Hello Joshua,

I'm looking for watermain hydraulic boundary conditions for the proposed site at 244 Rideau Place. We anticipate connecting to the existing 150mm watermian on Rideau Place.

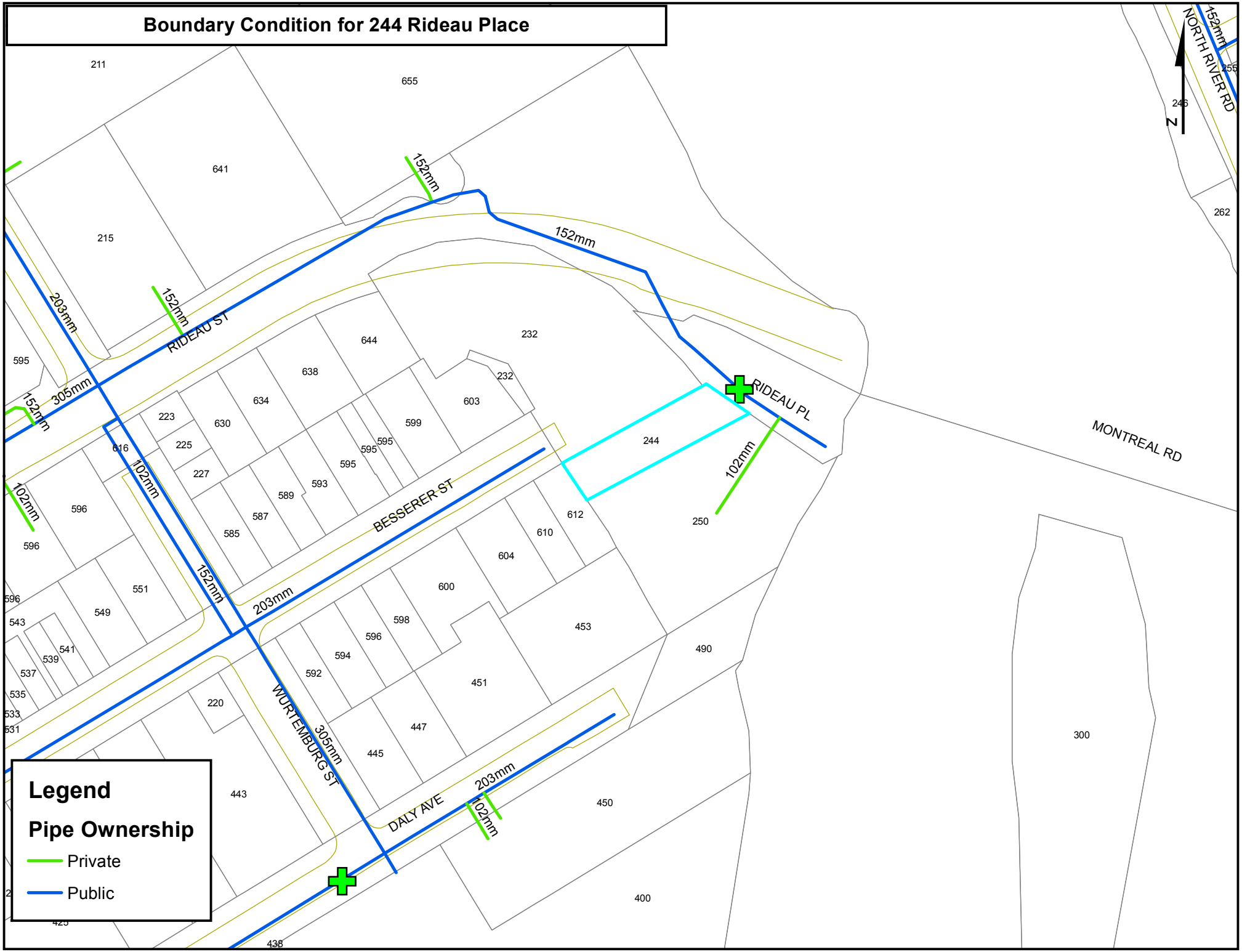
Attached are the FUS calculations for the proposed building. The intended land use is residential, for a 3 story apartment building comprising 20 units.

Estimated domestic demands and fire flow requirements for the site are as follows:
Average Day Demand – 0.15L/s
Max Day Demand - 0.36L/s
Peak Hour Demand - 0.80L/s
Fire Flow Requirement per FUS - 150L/s

Thanks,

Thakshika Rathnasooriya
Stantec
400 - 1331 Clyde Avenue Ottawa ON K2C 3G4
Phone: (613) 724-4081
Fax: (613) 722-2799
Thakshika.Rathnasooriya@stantec.com

Boundary Condition for 244 Rideau Place



Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

244 Fountain Place

DATE: 10/10/2019
REVISION: 3
DESIGNED BY: WAJ
CHECKED BY: SG

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401234

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	50,000 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 (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	50,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / 1 BEDROOM	1.4	INFILTRATION	0.33 l/s/Ha		
PERSONS / 2 BEDROOMS	2.1				

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	SINGLE	UNITS 1 BEDROOM	2 BEDROOM	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)
			(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)
BLDG	2	1	0.07	0	8	12	36	0.07	36	4.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.07	0.07	0.02	0.50	8.7	150 300	PVC	SDR 35	1.00	15.3	**3.23%**	0.86

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

244 Fountain Place

DATE: 10-Oct-2019
REVISION: 3
DESIGNED BY: WJ
CHECKED BY: SG

FILE NUMBER: 1604-01234

STORM SEWER DESIGN SHEET
(City of Ottawa)

DESIGN PARAMETERS

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

	1:5 yr	1:10 yr
a =	998.071	1174.184
b =	6.053	6.014
c =	0.814	0.816

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 NUMBER	FROM M.H.	TO M.H.	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (ROOF) (ha)	C (-)	ACCUM. AREA (5YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	ACCUM. AREA (10YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	T of C (min)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (NOTE 1) (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
EXT-1, EXT-4, STM-1	EX DCB	EX MH	0.41	0.00	0.00	0.56	0.41	0.231	0.231	0.00	0.000	0.000	10.00	104.19	122.14	0.0	0.0	66.9	9.9	300	300	CIRCULAR	PVC	-	0.50	68.0	**98.38%**	0.97	1.01	0.16
EXT-2, EXT-3	EX MH	OUTFALL	0.06	0.10	0.00	0.79	0.47	0.047	0.278	0.10	0.079	0.079	10.16	103.34	121.13	0.0	0.0	106.4	5.2	600	600	CIRCULAR	CONCRETE	-	0.10	202.6	**52.53%**	0.69	0.60	0.14
													10.31																

From: Eric Lalande
To: Rathnasooriya, Thakshika
Subject: Re: 244 Fountain Place, Ottawa
Date: Thursday, August 30, 2018 10:51:06 AM
Attachments: image001.png

Hi Thakshika,

As the driveway and parking has been removed, and the RVCA considers rooftop run-off as clean, from a water quality perspective, the RVCA has no requirements for water quality, at this time. However, the RVCA encourages best management practices (such as increased infiltration) where possible. I do note that the project is within the regulated area, and that a permit from the RVCA is required (as it is an area of unstable slopes).

Let me know if you require anything else.

Thank you,

Eric Lalande, MCIP, RPP
Planner, RVCA

From: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Sent: August 30, 2018 10:25 AM
To: Eric Lalande
Subject: RE: 244 Fountain Place, Ottawa

Hi Eric,

We previously had correspondence with Jocelyn Chandler regarding quality treatment for the proposed site on 244 Fountain Place. As she is no longer with the RVCA I was hoping you might be able to review the site, or forward this e-mail to the appropriate contact.

Please find attached the revised Site Plan. The proposed 3 storey site now comprises 27 units and amenity space. The driveway aisle and rear yard parking has been removed.

The City still does not require any stormwater attenuation on-site due to its close proximity to Rideau River. Would you be able to confirm if there is a requirement for quality control measures on the proposed site.

Please don't hesitate to give me a call if you require any further information.

Thank you,

Shika Rathnasooriya

Engineering Intern

Direct: 613 722-4420
Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4 CA

From: Jocelyn Chandler [mailto:jocelyn.chandler@rvca.ca]
Sent: Friday, February 26, 2016 11:45 AM
To: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Subject: Re: 244 Rideau Place, Ottawa

Hello Sheridan,
The Rideau River requires enhanced (80% TSS removal) quality control for stormwater. However if your parking area is only the drive aisle and three spaces, and you are utilizing permeable pavers, that would be considered sufficient/acceptable from our perspective.
I would note that the entire site is subject to Ontario Regulation 174/06 as administered by the RVCA. A permit from the RVCA will be required for any site alteration works or construction. A supporting geotechnical report will be required as the regulatory boundary is indicated to be triggered by unstable slopes.

Please contact me if you require additional information or clarity. Jocelyn

Jocelyn Chandler M.Pl. MCIP, RPP
Planner, RVCA
t) 613-692-3571 x1137
f) 613-692-0831
jocelyn.chandler@rvca.ca
www.rvca.ca
mail: Box 599 3889 Rideau Valley Dr., Manotick, ON K4M 1A5
courier: 3889 Rideau Valley Dr., Nepean, ON K2C 3H1

print out thereof, immediately. Your cooperation is appreciated.

From: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Sent: February 25, 2016 3:10 PM
To: Jocelyn Chandler
Subject: 244 Rideau Place, Ottawa

Hi Jocelyn,
We've been retained by TC United to help develop a 16 unit apartment building at 244 Rideau Place in Ottawa. The site is currently undeveloped with grass and tree coverage over most of the property. The proposed development will include the apartment building, a proposed driveway for rear parking and a mixture of hard surface and soft surface landscaped areas. The proposed driveway is partially covered by the second storey of the building which will be cantilevered over half the drive aisle.

Due to the proximity to the Rideau River the city prefers not to attenuate the stormwater, so there's no defined quantity control targets. However we are looking to confirm RVCA requirements for quality control on-site. The proposed concept plan includes a flat roof which will discharge the rooftop stormwater to grade, and we've proposed permeable pavers for the driveway and rear parking for water quality improvement. The remainder of the site will be amenity space with mostly soft surface landscaping. Could you review and let me know if this would be acceptable quality treatment for the site. The sewers in the area have limited capacity so we'd like to avoid installing a below grade quality unit if at all possible. If you need any other information feel free to call.

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

Design with community in mind

Thiffault, Dustin

From: White, Joshua <Joshua.White@ottawa.ca>
Sent: Wednesday, March 09, 2016 10:50 AM
To: Gillis, Sheridan
Subject: RE: 244 Rideau Place, Ottawa

Hello Sheridan,

As I stated in the pre-consult I will not be requiring quantity control for the site due to the proximity to the Rideau River. With that said if the proposal include a connection to the storm sewer you need to demonstrate that sufficient capacity in the storm is available for the increased flows. Beyond the plan & profile of the sewer I do not have any further information regarding the existing capacity of that sewer. Also if the intent is to connect the roof directly into the storm sewer than some SWM would be required on the roof so not to exceed the capacity of the sewer and to conform with the sewer design guidelines.

You will need to have some discussions with the RVCA regarding the quality control aspects of the SWM and other impacts of the development on the Rideau River and vice versa.

Joshua White, P.Eng.
Project Manager, Infrastructure Approvals
Development Review, Urban Services, City of Ottawa
Please consider the environment before printing this e-mail.

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 15843
Email: joshua.white@ottawa.ca
ottawa.ca/planning / ottawa.ca/urbanisme

From: Gillis, Sheridan [mailto:Sheridan.Gillis@stantec.com]
Sent: Tuesday, March 08, 2016 10:57 AM
To: White, Joshua
Subject: RE: 244 Rideau Place, Ottawa

Hi Josh,
I've forwarded the client our due diligence on 244 Rideau and I think they're ready to move forward with an offer. They've had Paterson look at the geotechnical as well and had good results. Before we finalize our recommendations I'd like to get some feedback from you to confirm some of our assumptions. Again any background on the site or the area would be helpful.
Thanks,
Sheridan
P.S. if you'd like to take a look at our servicing assessment just let me know,

From: Gillis, Sheridan
Sent: Tuesday, March 01, 2016 2:36 PM
To: Joshua.White@ottawa.ca
Subject: RE: 244 Rideau Place, Ottawa

Hi Josh,
Just following up on our pre-consultation from a few weeks ago on 244 Rideau. We've received infrastructure/UCC mapping from the City Infocentre, but have been unable to determine accurate invert information for the storm sewer (I'm hoping you might have something on file). I've included some correspondence below from the RVCA regarding quality control for the site. I think we can come up with a site plan arrangement with permeable pavers/roof discharge to satisfy the quality criteria. With this in mind I'm hoping we can avoid a connection to the combined sewer other than for sanitary servicing.

I know we talked about the lack of quantity storage in our meeting, but are there any other servicing constraints for this area, or specific development criteria that would need to be met to develop the site for residential use. Given the age of the neighborhood and proximity to the river really any relevant background information would be helpful,

Thanks for looking at this again, hoping this was your last pre-consult on 244 Rideau,

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: Jocelyn Chandler [mailto:jocelyn.chandler@rvca.ca]
Sent: Friday, February 26, 2016 11:45 AM
To: Gillis, Sheridan
Subject: Re: 244 Rideau Place, Ottawa

Hello Sheridan,
The Rideau River requires enhanced (80% TSS removal) quality control for stormwater. However if your parking area is only the drive aisle and three spaces, and you are utilizing permeable pavers, that would be considered sufficient/acceptable from our perspective.
I would note that the entire site is subject to Ontario Regulation 174/06 as administered by the RVCA. A permit from the RVCA will be required for any site alteration works or construction. A supporting geotechnical report will be required as the regulatory boundary is indicated to be triggered by unstable slopes.

Please contact me if you require additional information or clarity. Jocelyn

Jocelyn Chandler M.Pl. MCIP, RPP
Planner, RVCA
t) 613-692-3571 x1137
f) 613-692-0831

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www.rvca.ca
mail: Box 599 3889 Rideau Valley Dr., Manotick, ON K4M 1A5
courier: 3889 Rideau Valley Dr., Nepean, ON K2C 3H1

From: Gillis, Sheridan <Sheridan.Gillis@stantec.com>
Sent: February 25, 2016 3:10 PM
To: Jocelyn Chandler
Subject: 244 Rideau Place, Ottawa

Hi Jocelyn,
We've been retained by TC United to help develop a 16 unit apartment building at 244 Rideau Place in Ottawa. The site is currently undeveloped with grass and tree coverage over most of the property. The proposed development will include the apartment building, a proposed driveway for rear parking and a mixture of hard surface and soft surface landscaped areas. The proposed driveway is partially covered by the second storey of the building which will be cantilevered over half the drive aisle.

Due to the proximity to the Rideau River the city prefers not to attenuate the stormwater, so there's no defined quantity control targets. However we are looking to confirm RVCA requirements for quality control on-site. The proposed concept plan includes a flat roof which will discharge the rooftop stormwater to grade, and we've proposed permeable pavers for the driveway and rear parking for water quality improvement. The remainder of the site will be amenity space with mostly soft surface landscaping. Could you review and let me know if this would be acceptable quality treatment for the site. The sewers in the area have limited capacity so we'd like to avoid installing a below grade quality unit if at all possible. If you need any other information feel free to call.

Best Regards,

Sheridan Gillis

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

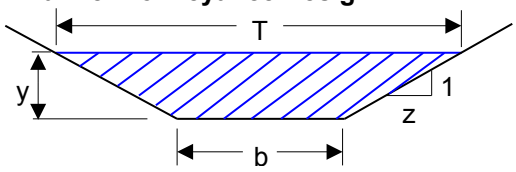
Mobile: (613) 799-1363
sheridan.gillis@stantec.com

Design with community in mind

Job # 160401234 - 244 Fountain Place

Date: 10-Sep-19

Channel Conveyance Design



$$A = (b + z \cdot y)y$$

$$P = b + 2 \cdot y \cdot \sqrt{1 + z^2}$$

$$R = \frac{A}{P}$$

$$T = b + 2zy$$

$$Q = \frac{A}{n} R^{2/3} \sqrt{S}$$

$$V = \frac{Q}{A}$$

$$Fr = \sqrt{\frac{Q^2 T}{gA^3}}$$

Expected Flow Depth		
n=	0.03	
z=	3.00	
b=	0.00	
y=	0.15	
A=	0.07	
P=	0.95	
R=	0.07	
S=	0.03	
T=	0.90	
Q=	0.0829	m3/s
V=	1.23	m/s
Fr # =	1.43	

Flow Generated		
C=	0.25	(0.2 *25%)
I =	214.27	(100yr + 20)
A=	0.0576	
Q=	8.58	

100 Year Flow Generated =	8.58	L/s
Full Flow Channel Capacity =	82.93	L/s

Channel OK

Appendix D GEOTECHNICAL INVESTIGATION

patersongroup

Consulting Engineers

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

Geotechnical Engineering
Environmental Engineering
Hydrogeology
Geological Engineering
Materials Testing
Building Science
Archaeological Services

www.patersongroup.ca

April 24, 2016
PG3780-LET.01

TC United Group
800 Industrial Avenue, Suite 9
Ottawa, Ontario
K1G 4B8

Attention: **Mr. Ryan Rutherford**

Subject: **Geotechnical Investigation**
Proposed Residential Building
244 Rideau Place - Ottawa

Dear Sir,

Paterson Group (Paterson) was commissioned by TC United Group to conduct a geotechnical investigation for the proposed residential building to be located at 244 Rideau Place in the City of Ottawa, Ontario.

The proposed project is understood to consist of a four (4) storey building with an at grade parking area, an access lane and landscaped areas.

1.0 Field Investigation

The fieldwork for the current investigation was conducted on March 7, 2016, and consisted of a test pit excavated by a rubber tired backhoe. The test pit was advanced to a maximum of 2.5 m depth. The test pit sidewalls were reviewed in the field by Paterson personnel once excavated, under the direction of a senior engineer from the geotechnical division. The field procedure consisted of reviewing the test pit sidewalls, sampling and testing the overburden at selected locations.

The approximate test pit location is presented on Drawing PG3780-1 - Test Hole Location Plan.

2.0 Field Observations

The subject site is currently undeveloped with several mature trees. The ground surface across the subject site is generally at grade with Rideau Place and lower than the west and north properties. A dry laid stone retaining wall varying between 1.5 to 0.5 m in height was observed along the north property boundary. The subject site is bordered to the east and south by existing residential properties. Besserer Park borders the subject site to the north and Rideau Place to the east.

Generally, the subsurface profile encountered at the test pit location consists of topsoil with rootlets and gravel overlying stiff to very stiff silty clay deposit. The test pit was terminated at a 2.5 m depth with the silty clay layer. Refer to the Soil Profile and Test Data sheet attached for specific details of the soil profile encountered at the test pit location.

Based on available geological mapping, the bedrock consists of interbedded limestone and shale from the Verulam formation. Bedrock is expected to range between 15 and 25 m depth.

Based on the field observations, the long-term groundwater level was not encountered. However, based on experience in the immediate area, the long-term groundwater level is expected between 4 to 5 m depth. Groundwater levels are subject to seasonal fluctuations and therefore, the groundwater levels could vary at the time of construction.

3.0 Geotechnical Assessment

From a geotechnical perspective, the subject site is suitable for the proposed residential building. The proposed low-rise residential building is expected to be constructed over conventional shallow foundations placed on an undisturbed, stiff silty clay bearing surface.

Due to the silty clay layer, the proposed development will be subjected to a permissible grade raise restriction. A permissible grade raise restriction of 0.8 m is recommended for the subject site to minimize settlement of the proposed building and surrounding buildings and infrastructure.

It is understood that a retaining wall is required along the north, west and south side of the subject site adjacent to the proposed parking area. A design completed by an engineer specializing in these works is required for the proposed retaining wall, where greater than 1 m in height.

Site Grading and Preparation

Topsoil, asphalt, and fill, containing deleterious or organic materials, should be stripped from under any building, paved areas, pipe bedding and other settlement sensitive structures. Care should be provided to not disturb adequate bearing soils at subgrade level during site preparation activities.

Engineered fill placed for grading beneath the proposed building footprint, 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 lift thickness of 300 mm and compacted with suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where surface settlement is of minor concern. The existing materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If the existing materials are to be placed to increase the subgrade level for areas to be paved, the non-specified existing fill should be compacted in 300 mm lifts and compacted to a minimum density of 95% of the respective SPMDD.

Foundation Design

Footings placed on an approved engineered fill or an undisturbed, stiff silty clay bearing surface, can be designed using a bearing resistance value at SLS of **125 kPa** and a factored bearing resistance value at ULS of **180 kPa**. A geotechnical resistance factor of 0.5 was applied to the bearing resistance value at ULS.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, have been removed prior to the placement of concrete for footings. The bearing resistance value at SLS given for footings 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 a soil bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1.5H:1V, passing through in situ soil or engineered fill of equal or higher capacity as the soil.

Permissible Grade Raise Recommendations

A **permissible grade raise restriction of 0.8 m** is recommended for the subject site. A post-development groundwater lowering of 0.5 m was considered in the permissible grade raise restriction calculations.

Design for Earthquakes

The site class for seismic site response can be taken as **Class D** for foundations constructed at the subject site. Refer to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

Slab on Grade Construction

With the removal of all topsoil, and fill, containing significant amounts of organic or deleterious materials, within the footprint of the proposed buildings, the native soil or approved fill surface will be considered to be an acceptable subgrade surface on which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II is recommended for backfilling below the floor slab.

It is recommended that the upper 200 mm of sub-slab fill consist of 19 mm clear crushed stone for the basement floor slab. If a slab-on-grade is to be constructed, the upper 200 mm of sub-slab fill should consist of a Granular A crushed stone.

Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular A or Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

Pavement Structure

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas and access lanes.

Table 1 - Recommended 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 soils or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 2 - Recommended Pavement Structure - Access Lanes and Heavy Truck Parking Areas	
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 soils 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 backfilled 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.

4.0 Design and Construction Precautions

Foundation Drainage and Backfill

A perimeter foundation drainage system is recommended to be provided for the proposed structure. The system should consist of a 150 mm diameter perforated corrugated plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing 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 are not recommended for placement as backfill against the foundation walls, unless placed in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000. The drainage geocomposite should be connected to the perimeter foundation drainage system. Otherwise, imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should be placed for foundation backfill.

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.

Exterior unheated footings, such as isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the structure proper and require additional protection, such as soil cover of 2.1 m or a combination of soil cover and foundation insulation.

Excavation Side Slopes

The excavation side slopes in overburden materials should either be excavated to acceptable slopes or be retained by shoring systems from the beginning of the excavation until the structure is backfilled.

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be excavated at 1H:1V or shallower. The shallower slope is required for excavation below groundwater level. The subsurface soil is considered to be a Type 2 and 3 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 maintain safe working distance 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.

Groundwater Control

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.

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

Pipe Bedding and Backfill

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer and water pipes when placed on soil subgrade. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to a minimum of 300 mm above the obvert of the pipe should consist of OPSS Granular A (concrete or PSM PVC pipes) or sand (concrete pipe). The bedding and cover materials should be placed in maximum 300 mm thick lifts compacted to a minimum of 95% of the SPMDD.

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.

Winter Construction

If winter construction is considered for this project, precautions should be provided for frost protection. The subsurface soil conditions mainly 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.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the installation of straw, propane heaters and 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 completed in a manner to avoid the introduction of frozen materials, snow or ice into the trenches. Where excavations are constructed in proximity of existing structures precaution to adversely affecting the existing structure due to the freezing conditions should be provided.

5.0 Recommendations

A materials testing and observation services program is a requirement for the provided foundation design data to be applicable. The following aspects of the program should be performed by the geotechnical consultant:

- ❏ Review detailed grading plan(s) 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.
- ❏ Field density tests to determine the level of compaction achieved.
- ❏ Sampling and testing of the bituminous concrete including mix design reviews.

A report confirming that the construction have been conducted in general accordance with Paterson's recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

6.0 Statement of Limitations

The recommendations provided in the report are in accordance with Paterson's present understanding of the project. Paterson request 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 the test locations, Paterson requests immediate notification to permit reassessment of the recommendations.

The recommendations provided should only be used by the design professionals associated with this project. The recommendations are not intended for contractors bidding on or constructing the project. The latter should evaluate the factual information provided in the report. The contractor should also determine the suitability and completeness for the intended construction schedule and methods. Additional testing may be required for the contractors purpose.

The present report applies only to the project described in the report. The use of the report for purposes other than those described above or by person(s) other than TC United Group or their agents is not authorized without review by Paterson.

Best Regards,

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng.

David J. Gilbert, P.Eng.

Attachments

- ❑ Soil Profile and Test Data sheets
- ❑ Figure 1 - Key Plan
- ❑ Drawing PG3780-1 - Test Hole Location Plan

Report Distribution

- ❑ TC United Group (3 copies)
- ❑ Paterson Group (1 copy)

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Building - 244 Rideau Place
Ottawa, Ontario

DATUM TBM - Top spindle of fire hydrant located on east of subject site. An arbitrary elevation of 100.00m was assigned to the TBM.

FILE NO. PG3780

REMARKS

HOLE NO. TP 1

BORINGS BY Backhoe **DATE** March 7, 2016

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content %	Piezometer Construction
GROUND SURFACE						0	100.07	20 40 60 80	
TOPSOIL		G	1						
0.30									
Brown **SILTY SAND** with clay, rootlets and gravel									
0.45									
		G	2			1	99.07	130	
Very stiff, brown **SILTY CLAY** with tree roots in upper 1.0m									
		G	3			2	98.07	130	
2.50									
End of Test Pit									
(TP dry upon completion)									

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2$ / (D10 x D60)
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

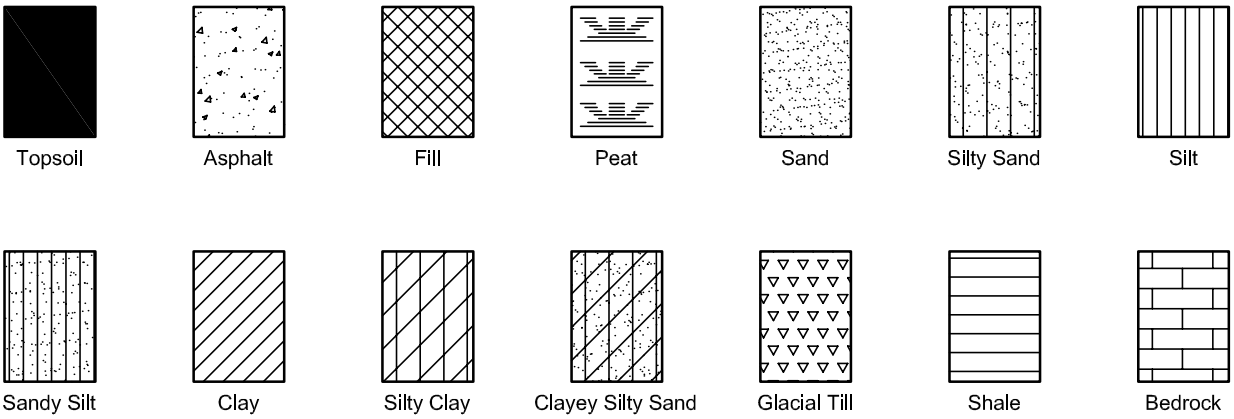
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

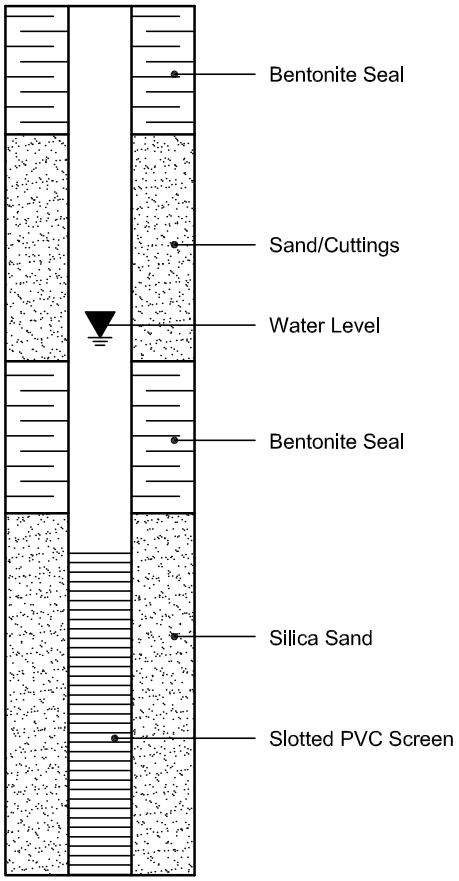
SYMBOLS AND TERMS (continued)

STRATA PLOT

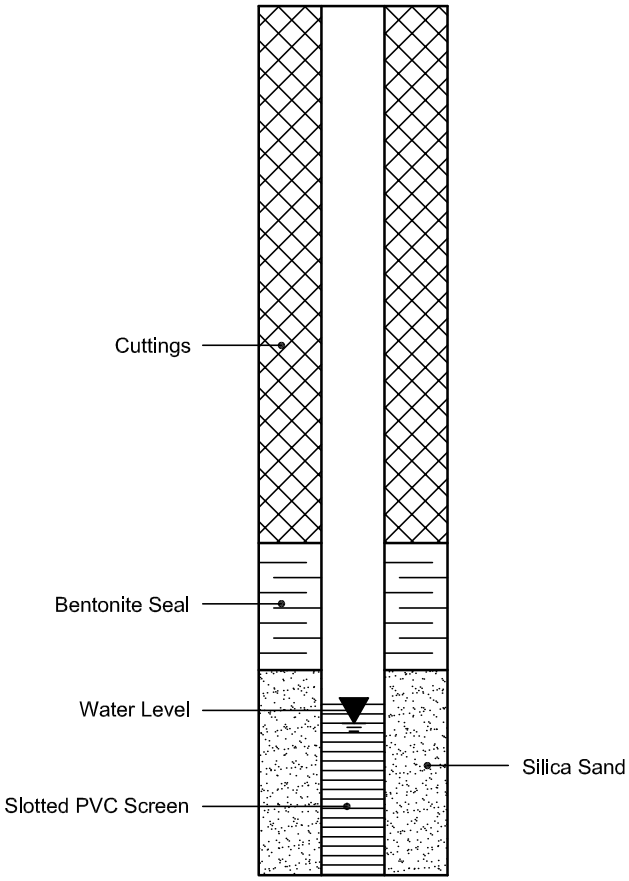


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



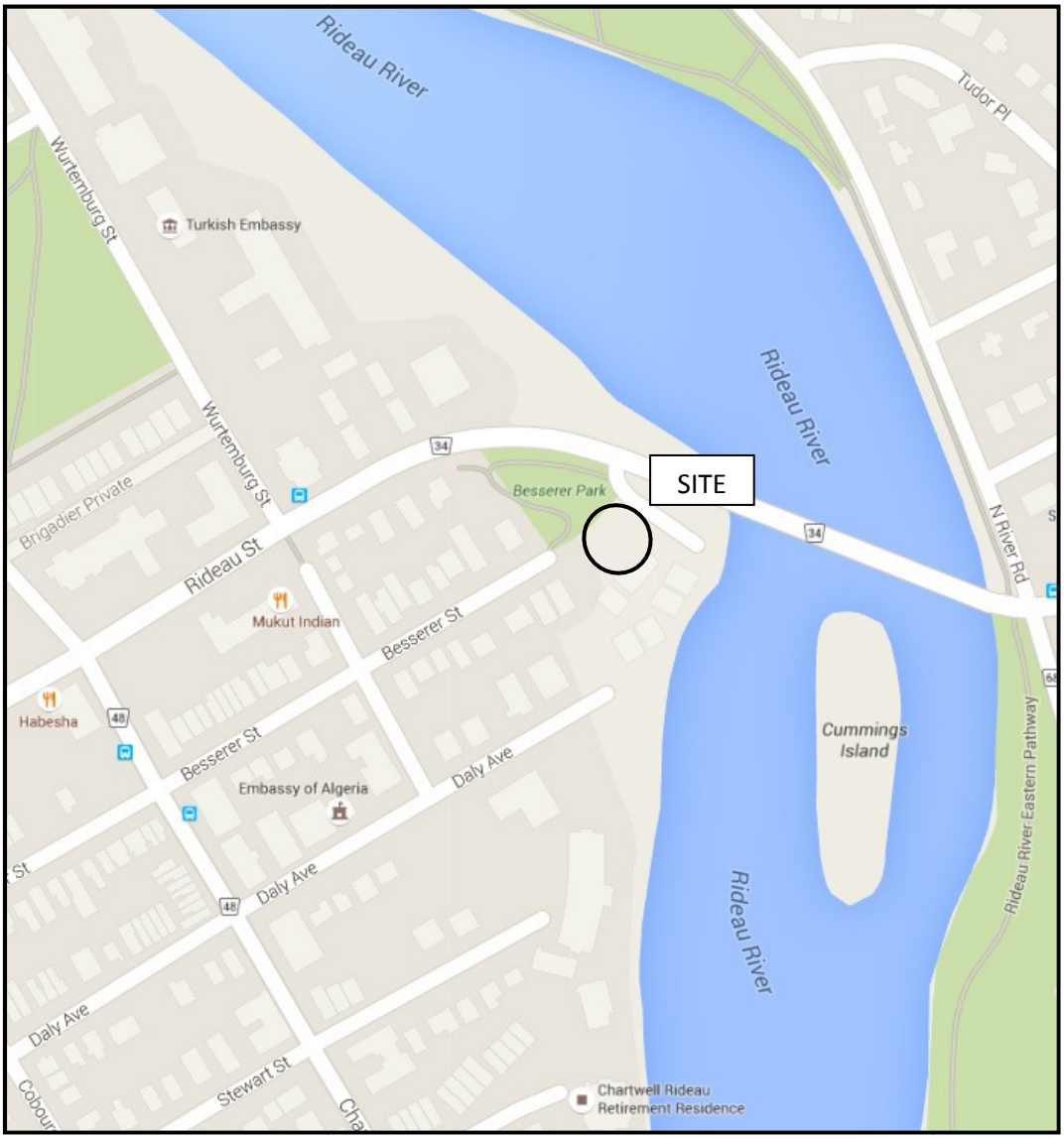
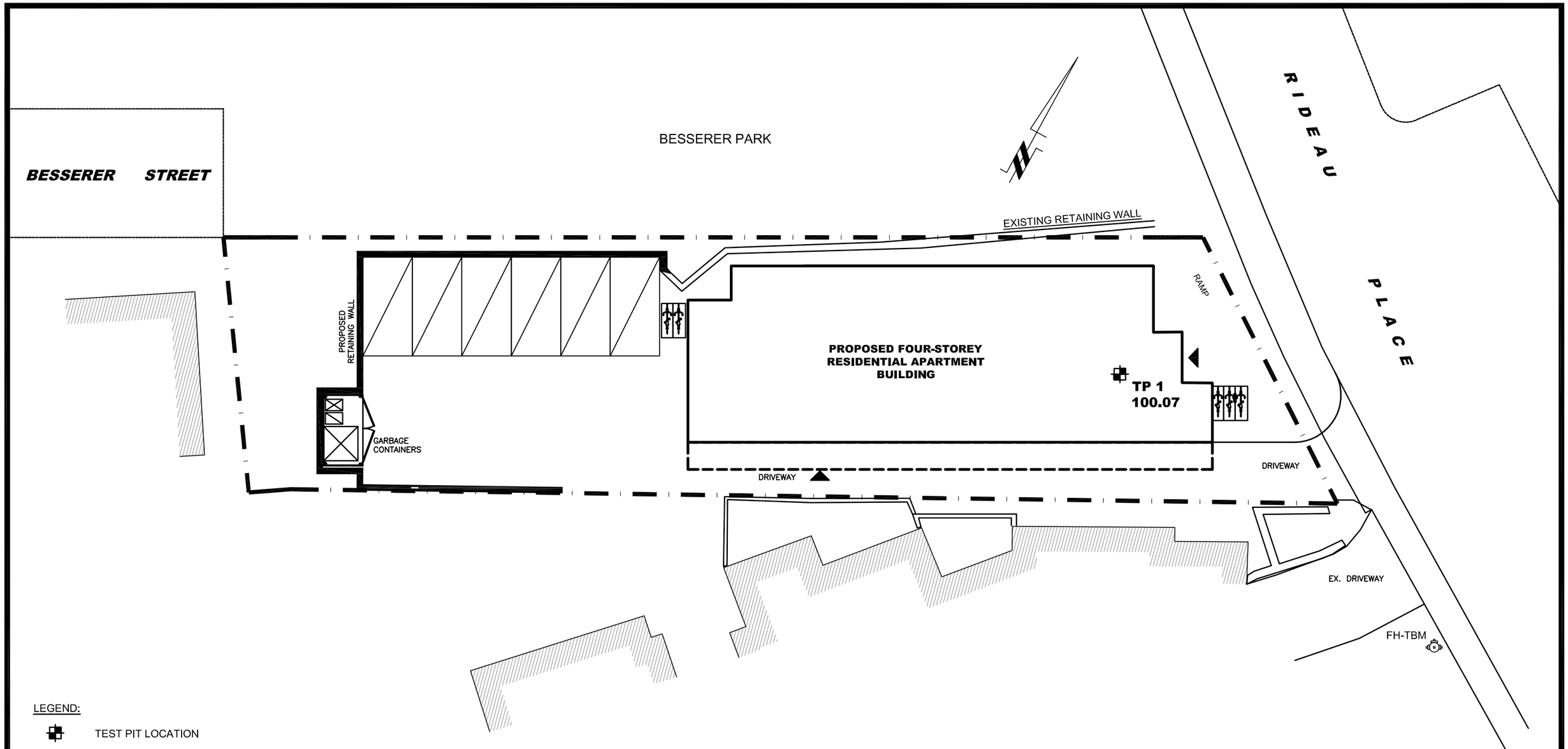


FIGURE 1

KEY PLAN



LEGEND:

TEST PIT LOCATION

100.07 GROUND SURFACE ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. AN ARBITRARY ELEVATION OF 100.00m WAS ASSIGNED TO THE TBM.

0 1 2 3 4 5 10m

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NO.	REVISIONS	DATE	INITIAL
0			

TC UNITED GROUP

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL BUILDING - 244 RIDEAU PLACE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:200	Date: 04/2016
Drawn by: MPG	Report No.: PG3780-1
Checked by: FA	Dwg. No.: PG3780-1
Approved by: DJG	Revision No.: 0

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Appendix E DRAWINGS