Site Servicing and Stormwater Management Report,1155 Joseph Cyr Street, ON

File: 160401587

Prepared for:
TC United Development Corp.

Prepared by:
Stantec Consulting Ltd.
1331 Clyde Avenue, Suite 400
Ottawa, ON K2C 3G4

October 1, 2020

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Thakshika Rathnasooriya	October 1, 2020	Kris Kilborn

Sign-off Sheet

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Prepared by ______________________
(signature)

Thakshika Rathnasooriya, P.Eng.

Reviewed by ______________________
(signature)

Kris Kilborn

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1.0 INTRODUCTION

Stantec Consulting Ltd. Has been commissioned by TC United Development Corp. to prepare a servicing study in support of Site Plan Control submission for the proposed development located at 1155 Joseph Cry Street. The 0.16ha (0.4 acre) site is currently zoned Mixed Use Centre Zone (MC) and is located in the City of Ottawa in the south east quadrant of the intersection of Cyrville Road and Joseph Cyr Street and is illustrated on **Figure 1.1**. The proposed mixed-use development comprises a single 6 storey building with commercial units on a portion of the first floor and 117 residential apartment units.

The intent of this report is to provide a servicing scenario for the site that is free of conflicts, provides on-site servicing in accordance with City of Ottawa design guidelines, and utilizes the existing local infrastructure in accordance with the guidelines outlined per consultation with City of Ottawa staff.

Figure 1.1: Location Plan

2.0 BACKGROUND

The following background studies have been referenced during the servicing and stormwater management design of the proposed site:

- *Geotechnical investigation, proposed Multi-Storey Building, 1155 Joseph Cyr Street and 1082 Cyrville Road, Ottawa, ON,* Paterson Group, July 24, 2020
- City of Ottawa Design Guidelines – Water Distribution, Infrastructure Services Department, City of Ottawa, First Edition, July 2010
- City of Ottawa Sewer Design Guidelines, 2nd Ed., City of Ottawa, October 2012
- Technical Bulletin ISTB-2018-01 Revision to Ottawa Design Guidelines – Sewer, City of Ottawa, March 2018
- Technical Bulletin ISTB-2018-02 Revision to Ottawa Design Guidelines – Water Distribution, City of Ottawa, March 2018

3.0 WATER SUPPLY SERVICING

3.1 BACKGROUND

The proposed mixed use development is located on the south-western side of the intersection of Cyrville Road and Joseph Cyr Street in the Cyrville community of the City of Ottawa. The property is located within the City's Pressure Zone 1E. The proposed site will be serviced via a 150mm building service connection to the existing 250 mm watermain along Cyrville Road as shown on the Site Servicing Plan (see **Drawing SSGP-1**). Average ground elevations of the site are approximately 70.14m. Under normal operating conditions, hydraulic grade lines vary from approximately 110.2m to 118.4m as confirmed through boundary conditions as provided by the City of Ottawa (see **Appendix A.3**).

3.2 WATER DEMANDS

Water demands for the development were estimated using the Ministry of Environment's Design Guidelines for Drinking Water Systems (2008) and the Ottawa Design Guidelines – Water Distribution (2010). A daily rate of 350 L/cap/day has been applied for the population of the proposed site. Population densities have been assumed 2.1 pers./two-bedroom apartment units, and 1.4 pers./studio and one-bedroom apartment units. See **Appendix A.1** for detailed domestic water demand estimates. Additionally, commercial demands have been estimated at 28,000L/ha/day of floor area.

The average day demand (AVDY) for the entire site was determined to be 0.71 L/s. The maximum daily demand (MXDY) is 2.5 times the AVDY for residential areas and 1.5 times the AVDY for commercial areas, which sums to 1.76L/s. The peak hour demand (PKHR) is 2.2 times the MXDY for residential areas and 1.8 times the MXDY for commercial areas, totaling 3.88 L/s.

Non-combustible with fire-resistance ratings was considered in the assessment for fire flow requirements according to the Ontario Building Code (OBC) Guidelines. As a residential apartment the building falls under occupancy Class C. Based on calculations per the OBC Guidelines. The minimum required fire flows for this development are 150 L/s (9,000L/min, see **Appendix A.2**).

3.3 PROPOSED SERVICING

Per the boundary conditions provided by the City of Ottawa and based on an approximate elevation on-site of 70.14m, adequate flows are available for the subject site with pressures ranging from 40.1m (57.0psi) to 48.3m (68.7psi). This pressure range is within the guidelines of 50-80 psi based on Ottawa's Design Guidelines for Water Distribution. Assuming a 5psi head loss per floor of development, pressures at the 6th level of the building might possibly be below the required

40psi, and as such, jet pumps to be designed by the mechanical engineering consultant will be required to service the upper levels of the development.

Using boundary conditions for the proposed development under maximum day demands and a fire flow requirement of 9,000L/min per the OBC methodology, it can be confirmed that the system will maintain a residual pressure of approximately 58.6 psi; which is in excess of the required 140 kPa (20 psi). The above demonstrates that the existing watermain within Cyrville Road can provide adequate fire and domestic flows in excess of flow requirements for the subject site.

3.4 SUMMARY OF FINDINGS

The proposed development is located in an area of the City's water distribution system that has sufficient capacity to provide both the required domestic and emergency fire flows. Based on boundary conditions as provided by City of Ottawa staff, fire flows are available for this development based on OBC guidelines and as per the City of Ottawa water distribution guidelines. Pumps to service the upper levels will need to be designed by the mechanical consultant.

October 1, 2020

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

The site will be serviced via an existing 150 mm diameter sanitary service lateral running north along the site which ultimately discharges into the 375 mm diameter sanitary sewer within Cyrville Road ROW (see **Drawing SSP-1**).

4.2 DESIGN CRITERIA

As outlined in the City of Ottawa Sewer Design Guidelines and the MECP's Design Guidelines for Sewage Works, the following criteria were used to calculate estimated wastewater flow rates and to size the sanitary sewers:

- Minimum Velocity – 0.6 m/s (0.8 m/s for upstream sections)
- Maximum Velocity – 3.0 m/s
- Manning roughness coefficient for all smooth wall pipes – 0.013
- Minimum size – 200mm dia. for residential areas
- Average Wastewater Generation – 280L/cap/day
- Peak Factor – 4.0 (Harmon's)
- Extraneous Flow Allowance – 0.33 l/s/ha (conservative value)
- Manhole Spacing – 120 m
- Minimum Cover – 2.5m
- Population density for studio and single-bedroom apartments – 1.4 pers./apartment
- Population density for two-bedroom apartments – 2.1 pers./bedroom

4.3 PROPOSED SERVICING

The proposed site will be serviced by gravity sewers which will direct the wastewater flows (approx. 2.3 L/s with allowance for infiltration) to the existing 375 mm diameter sanitary sewer. A sanitary sewer design sheet for the proposed sanitary sewers is included in **Appendix B.1.** Full port backwater valves are to be installed on all sanitary services within the site to prevent any surcharge from the downstream sewer main from impacting the proposed property.

5.0 STORMWATER MANAGEMENTF

5.1 OBJECTIVES

The objective of this stormwater management plan is to determine the measures necessary to control the quantity/quality of stormwater released from the proposed development to criteria established during the pre-consultation/zoning process, and to provide sufficient detail for approval and construction.

5.2 SWM CRITERIA AND CONSTRAINTS

Criteria were established by combining current design practices outlined by the City of Ottawa Design Guidelines (2012), and through consultation with City of Ottawa staff. The following summarizes the criteria, with the source of each criterion indicated in brackets:

General

- Use of the dual drainage principle (City of Ottawa).
- Wherever feasible and practical, site-level measures should be used to reduce and control the volume and rate of runoff. (City of Ottawa)
- Assess impact of 100-year event outlined in the City of Ottawa Sewer Design Guidelines on major & minor drainage system (City of Ottawa)
- The proposed site is not subject to quality control criteria due to the small site size and land usage of the development (City of Ottawa).

Storm Sewer & Inlet Controls

- Size storm sewers to convey 5-year storm event under free-flow conditions using City of Ottawa I-D-F parameters (City of Ottawa).
- Site Discharge rates for each storm event to be restricted to 5-year storm event pre-development rates with a maximum pre-development C coefficient of 0.5 (City of Ottawa).
- Proposed site to discharge the existing 675mm storm sewer on Joseph Cyr Street ROW at the western boundary of the subject site (City of Ottawa).
- 100-year Storm HGL to be a minimum of 0.30 m below building foundation footing (City of Ottawa).

Surface Storage & Overland Flow

- Building openings to be minimum of 0.15m above the 100-year water level (City of Ottawa)
- Maximum depth of flow under either static or dynamic conditions shall be less than 0.35m in the 100-year event (City of Ottawa)
- Provide adequate emergency overflow conveyance off-site (City of Ottawa)

5.3 STORMWATER MANAGEMENT

The intent of the stormwater management plan presented herein is to mitigate any negative impact that the proposed development will have on the existing storm sewer infrastructure, while providing adequate capacity to service the proposed building, parking and access areas. The proposed stormwater management plan is designed to retain runoff on the roof and subsurface storage area to ensure that peak flows after construction will not exceed the allowable site release rate detailed below.

Stormwater runoff from the proposed development will be directed to an existing 675 mm diameter storm sewer on Joseph Cyr Street. A summary of subareas and runoff coefficients is provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management subcatchments.

5.3.1 Allowable Release Rate

Available topographic information the existing conditions drainage elevations for the site are shown on drawing EX-1.

The Modified Rational Method was employed to assess the rate of runoff generated during pre-development conditions. The City of Ottawa Sewer Design Guidelines identify the modified rational method as an acceptable method for determining underground storage requirements for a site of less than 2 ha in area.

The peak 100-year post-development discharge from the subject site is to be limited to the 5-year pre-development rate, to a maximum runoff coefficient C of 0.5. The predevelopment release rate for the area has been determined using the rational method based on the criteria above.

The predevelopment release rate for the area has been determined using the rational method and existing runoff coefficient C values for varying surface treatments per below:

- Asphalt/Hard Surface areas – C=0.90
- Gravel areas – C=0.70
- Grassed/Pervious areas – C=0.20

A time of concentration for the predevelopment area (10 minutes) was assigned based on the relatively small site and its proximity to the existing drainage outlet for the site. C coefficient values have been increased by 25% for the post-development 100-year storm event based on MTO Drainage Manual recommendations. Peak flow rates have been calculated using the rational method as follows:

Q = 2.78 CiA
Where: Q = peak flow rate, L/s
A = drainage area, ha
I = rainfall intensity, mm/hr (per Ottawa IDF curves)
C = site runoff coefficient

The target release rate for the site is summarized in **Table 1** below:

Table 1: Target Release Rate

Design Storm	Target Flow Rate (L/s)
All Events	23.4

5.3.2 Storage Requirements

The site requires quantity control measures to meet the restrictive stormwater release criteria. It is proposed that rooftop storage via restricted roof drains in combination with subsurface parking storage with inlet control devices (ICD's)be used to reduce site peak outflow to target rates.

5.3.2.1 Rooftop Storage

It is proposed to retain stormwater on the building rooftop by installing restricted flow roof drains. The following calculations assume the roofs will be equipped with standard Watts Model RD-100_A_ADJ Accuflow Roof Drains which will be 50% closed.

Watts Drainage "Accutrol" roof drain weir data has been used to calculate a practical roof release rate and detention storage volume for the rooftops. It should be noted that the "Accutrol" weir has been used as an example only, and that other products may be specified for use, provided that the total roof drain release rate is restricted to match the maximum rate of release indicated in **Table 2**, and that sufficient roof storage is provided to meet (or exceed) the resulting volume of detained stormwater. Storage volume and controlled release rate are summarized in **Table 2**:

Table 2: 100 Year Summary of Roof Controls

Area ID	Depth (mm)	Discharge (L/s)	Volume Stored (m^3)
Roof	150	4.99	38.38

Drainage from the roof is to directly discharge to an uncontrolled area that will be specified through coordination with architect.

5.3.2.2 Surface Storage

Per the modified rational method calculations included as part of **Appendix C.2**, the remainder of the site is to be directed towards a catch basin and manhole (CB1 and STM1)complete with

IPEX Tempest LMF 100 ICD to meet the target peak discharge rate during the 100-year event. In order to control peak discharge from the subject site to within target levels, a superpipe has been provided between catch basins and manhole to provide storage volume in the amount of approximately 4.4m3.

Controlled release rates and storage volumes required are summarized in **Table 3**: Surface Storage Areas (CB-1A, CB-1B, CB-1C).

Table 3: Surface Storage Areas (CB-1A, CB-1B, CB-1C)

Tributary Area	Design Storm	Design Head (m)	Discharge (L/s)	Orifice Type	$V_{required}$ (m^3)
CB-1A, CB-1B, CB-1C	5-Year	0.29	4.81	IPEX Tempest LMF 100 ICD	1.7
	100-Year	0.53	6.52		3.6

5.3.2.3 Uncontrolled Area

Due to grading restrictions, one sub catchment area has been designed without a storage component. The existing catchment area also discharges off-site uncontrolled to the adjacent Cyrville Road and Joseph Cyr Street. Peak discharges from uncontrolled areas have been considered in the overall SWM plan and have been balanced through overcontrolling proposed site discharge rates to meet target levels.

Table 4: Uncontrolled Non-Tributary Area (UNC-1)

Design Storm	Discharge (L/s)
5-Year	5.40
100-Year	11.56

5.3.3 Results

Table 5 identifies the release rates associated with the proposed stormwater management plan and demonstrates adherence to target peak outflow rates of the site.

Table 5: Summary 100 Year Event Release Rates

	100-Year Peak Discharge (L/s)
Uncontrolled	11.6
Controlled – Surface	6.5
Controlled – Roof	5.0
Total	**23.1**
Target	**23.4**

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.16ha in area. The topography across the site is sloped towards the northern boundary of the proposed site, and currently drains from southwest to northeast, with overland flow generally being directed to the adjacent Cyrville Road ROW. A grading plan (see **Drawing GP-1**) has been provided to satisfy the stormwater management requirements, adhere to any geotechnical restrictions for the site, and provide for minimum cover requirements for storm and sanitary sewers where possible. Site grading has been established to provide emergency overland flow routes required for stormwater management in accordance with City of Ottawa requirements.

The subject site maintains emergency overland flow routes for flows deriving from storm events in excess of the maximum design event to the existing Cyrville Road and Joseph Cyr Street as depicted in **Drawing GP-1.**

7.0 UTILITIES

Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available within subsurface utility infrastructure within the Joseph Cyr Street and Cyrville Road ROW. Exact size, location and routing of utilities, along with determination of any off-site works required for redevelopment, will be finalized after design circulation.

8.0 APPROVALS

An Ontario Ministry of the Environment, Conservation and Parks (MECP) Environmental Compliance Approval (ECAs, formerly Certificates of Approval C of A) under the Ontario Water Resources Act is not expected to be required for the development. The Rideau Valley Conservation Authority will be consulted in order to obtain municipal approval for the site development.

Requirement for a MECP Permit to Take Water (PTTW) for pumping during construction of the underground parking levels will be confirmed by the geotechnical consultant.

9.0 EROSION CONTROL DURING CONSTRUCTION

Erosion and sediment controls must be in place during construction. The following recommendations to the contractor will be included in contract documents.

1. Implement best management practices to provide appropriate protection of the existing and proposed drainage system and the receiving water course(s).
2. Limit extent of exposed soils at any given time.
3. Re-vegetate exposed areas as soon as possible.
4. Minimize the area to be cleared and grubbed.
5. Protect exposed slopes with plastic or synthetic mulches.
6. Provide sediment traps and basins during dewatering.
7. Install sediment traps (such as SiltSack® by Terrafix) between catch basins and frames.
8. Plan construction at proper time to avoid flooding.

The contractor will, at every rainfall, complete inspections and guarantee proper performance. The inspection is to include:

9. Verification that water is not flowing under silt barriers.
10. Clean and change silt traps at catch basins.

Refer to **Drawing ECDS-1** for the proposed location of silt fences and other erosion control structures.

10.0 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was conducted by Paterson Group in July 2020. The report summarizes the geotechnical design parameters and construction recommendations. For details which are not summarized below, please see the original Paterson Group report.

Subsurface soil conditions within the boundaries of the proposed site were determined by 4 boreholes distributed across the site. The subsurface profile across the site consists of asphaltic concreate and fill material made up of brown silty sand with crushed stone, gravel and trace clay. The glacial till layer consists of silty clay with sand, gravel, cobbles and boulders underlain the fill layer.

Groundwater elevations were monitored on July 15, 2020 and measured depths between 3.0 to 4.0m. Bedrock elevations were encountered at elevations of 5.2 to 5.8m below existing ground elevations. The site is not subjected to permissible grade raise restrictions due to the absence of silty clay deposit.

Table 6: 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 soil, or OPSS Granular B Type I or II material placed over in situ soil or fill.

Table 7: Recommended Pavement Structure –Access Lanes and Heavy Truck Parking/Loading 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
450	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.

October 1, 2020

11.0 CONCLUSIONS

11.1 WATER SERVICING

Based on the supplied boundary conditions for existing watermains and estimated domestic and fire flow demands for the subject site, it is anticipated that the proposed servicing in this development will provide sufficient capacity to sustain both the required domestic demands and emergency fire flow demands of the proposed site. Pumps to service the upper levels will need to be designed by the mechanical consultant.

11.2 SANITARY SERVICING

The proposed sanitary sewer network is sufficiently sized to provide gravity drainage of the proposed site. The subjected site will be serviced by a gravity sewer service lateral which will direct wastewater flows (approx. 2.3 L/s) to the existing 375mm dia. sanitary sewer within Cyrville Road ROW at the northern boundary of the property. The proposed drainage outlet has sufficient capacity to receive sanitary discharge from the site.

11.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with local and provincial standards. Rooftop storage with controlled roof drains, and subsurface storage via a large diameter storage pipe has been proposed to limit peak storm sewer inflows to the existing 675mm diameter storm sewers along Joseph Cyr Street ROW. The downstream receiving sewer has sufficient capacity to receive runoff volumes from the site.

11.4 GRADING

Grading for the site has been designed to provide an emergency overland flow route as per City requirements and reflects the recommendations in the Geotechnical Investigation Report prepared by Paterson Group. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

11.5 UTILITIES

Utility infrastructure exists within the Cyrville Road and Joseph Cyr Street ROW at the north and western boundary of the proposed site. It is anticipated that existing infrastructure will be sufficient to provide a means of distribution for the proposed site. Exact size, location and routing of utilities will be finalized after design circulation.

11.6 APPROVALS/PERMITS

An MECP Environmental Compliance Approval is not expected to be required for the subject site. Requirements for a Permit to Take Water (PTTW) are not anticipated. Need for a PTTW for sewer construction dewatering and building footing excavation will be confirmed by the geotechnical consultant. The Rideau Valley Conservation Authority will need to be consulted in order to obtain municipal approval for site development. No other approval requirements from other regulatory agencies are anticipated.

Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

1155 Joseph Cyr Street - Domestic Water Demand Estimates

	Number of Units	Density	Population
Bachelor	33.0	1.4	46.2
1 BR	70.0	1.4	98.0
2 BR	14.0	2.1	29.4

Building ID	Area (m^2)	Population	Daily Rate of Demand [1 2] ($L/m^2/day$)	Avg Day Demand		Max Day Demand [3,4]		Peak Hour Demand [3,4]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Residential		174	350	42.2	0.70	105.5	1.76	232.1	3.87
Commercial	132		28000	0.3	0.00	0.4	0.01	0.7	0.01
Total Site :				**42.5**	**0.71**	**105.9**	**1.76**	**232.8**	**3.88**

1 Average day water demand for residential areas are equal to 350 L/cap/d
2 28,000 L/gross ha/day is used to calculate water demand for commercial facilities.
3 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
4 Water demand criteria used to estimate peak demand rates for commercial and institutional areas are as follows:
maximum day demand rate = 1.5 x average day demand rate
peak hour demand rate = 1.8 x maximum day demand rate

A.2 FIRE FLOW REQUIREMENTS PER OBC

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

Job#	1604-01587	Designed by:	TKR
Date	13-Jul-20	Checked by:	KK
		Description:	7 Floor Apt

$$Q = KVS_{tot}$$

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
	Non-Combustible without Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		16
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	1136	7	18.9	150,293
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	4	0.5	2
	East	0.3	0.5	
	South	0.3	0.5	
	West	4.4	0.5	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				4,809,376
				Minimum Required Fire Flow (L/min)
				9,000

A.3 BOUNDARY CONDITIONS

From:	Mashaie, Sara
To:	Kilborn, Kris
Cc:	Rathnasooriya, Thakshika
Subject:	FW: Joseph Cyr, 1155_UD Comments_PRE 3
Date:	Thursday, July 30, 2020 10:49:45 AM
Attachments:	2020-07-13_OBC Fire Flow Calculator.pdf 1155 Joseph Cyr July 2020.pdf

Hi Kris,

Please find the boundary conditions.

The following are boundary conditions, HGL, for hydraulic analysis at 1155 Joseph Cyr (zone 1E) assumed to be connected to the 152mm on Joseph Cyr and the 254mm on Cyrville (see attached PDF for location).

Minimum HGL = 110.2m

Maximum HGL = 118.4m

MaxDay + FireFlow (150 L/s) @ Connection 1 = 101.5m

MaxDay + FireFlow (150 L/s) @ Connection 2 = 111.4m

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.

Regards,

Sara Mashaie, P.Eng., ing.
Project Manager | Gestionnaire de Projet
Development Review, East Branch | Examen des projets d'aménagement, Secteur est
Planning, Infrastructure and Economic Development Department | Services de la planification, de l'infrastructure et du développement économique
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West. Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 27885, sara.mashaie@ottawa.ca

From: Mashaie, Sara
Sent: July 23, 2020 9:26 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Subject: RE: Joseph Cyr, 1155_UD Comments_PRE 3

Hi Kris,

Thank you. I have forwarded the request to our water modelling team and will reply back as soon as received.

Regards,

Sara Mashaie, P.Eng., ing.
Project Manager | Gestionnaire de Projet
Development Review, East Branch | Examen des projets d'aménagement, Secteur est
Planning, Infrastructure and Economic Development Department | Services de la planification, de l'infrastructure et du développement économique
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613.580.2424 ext./poste 27885, sara.mashaie@ottawa.ca

From: Kilborn, Kris <kris.kilborn@stantec.com>
Sent: July 22, 2020 4:14 PM
To: Mashaie, Sara <sara.mashaie@ottawa.ca>
Cc: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Subject: FW: Joseph Cyr, 1155_UD Comments_PRE 3

Good afternoon Sara

In response to your email of today, I am forwarding the email from July 20 for the Boundary condition request for the 1155 Joseph Cyr Project.

Sincerely

Kris Kilborn
Senior Associate,
Business Center Practice Leader

Community Development

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Kilborn, Kris
Sent: Monday, July 20, 2020 9:04 AM
To: Boughton, Michael <Michael.Boughton@ottawa.ca>
Cc: Roberto Campos <rcampos@figurr.ca>
Subject: FW: Joseph Cyr, 1155_UD Comments_PRE 3

Good morning Michael and Hope all is well

I am working with TC United Group and Figurr Architects on a project at 1155 Joseph Cyr in the City of Ottawa and inquiring if there has been anyone assigned to this file from the Infrastructure Group.
I am hoping that you could pass along the watermain boundary request for the development so we can determine the available Domestic and Fire Flows to service the property.

Please see attached and below

I am looking for watermain hydraulic boundary conditions for 1155 Joseph Cyr Street. The proposed mixed use site consists of one 6 storey building, with commercial area on the ground floor . We anticipate connecting to two existing watermains, a 150mm on Joseph Cyr Street and a 300mm along Cyrville Road.

Please find estimated domestic demands and fire flow requirements for the site as mentioned below:

Average Day Demand – 0.71 L/s
Max Day Demand - 1.76 L/s
Peak Hour Demand - 3.88 L/s
Fire Flow Requirement per OBC for the 6 storey apartment building - 150 L/s (9,000 L/min)

Don't hesitate to call if you have any questions

Sincerely

Kris Kilborn
Senior Associate,
Business Center Practice Leader
Community Development

Mobile: 613 297-0571
Fax: 613 722-2799
kris.kilborn@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

From: Roberto Campos <rcampos@figurr.ca>
Sent: Monday, July 20, 2020 8:55 AM
To: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: FW: Joseph Cyr, 1155_UD Comments_PRE 3

Kris,

Here is an old email from the City… The planner is Michael Boughton.

From: Wang, Randolph <Randolph.Wang@ottawa.ca>
Sent: Monday, June 1, 2020 5:39 PM
To: Boughton, Michael <Michael.Boughton@ottawa.ca>
Subject: Joseph Cyr, 1155_UD Comments_PRE 3

Hi Michael,

Here are round three urban design preconsultation comments on the proposed development.

1. A Design Brief is required as part of the submission. The Terms of Reference of the Design Brief is attached for reference.
2. Moving forward, please provide a complete set of design drawings and renderings as indicated in the Terms of Reference of the Design Brief. This should include (but not limited to) conceptual massing on the abutting lots to assist evaluation of the proposed design, and section drawings to show how grading issues are addressed through design. Please demonstrate how the design will contribute to creating a pedestrian-friendly environment in the public streets.
3. The site is within a Design Priority Area, and is subject to the formal review of the UDRP.
4. The conceptual design shown at the meeting last week is an improvement from the previous one. However, the greatest concern remains to be the challenging relationship between the proposed development and the potential development on the abutting properties. The site is situated within an area subject to very permissive zoning regulations. Generally speaking, zoning for the area (MC and TD) allows for almost full lot coverage development up to 6 storeys. There is no requirement for rear yard and interior side yard setback. Only the portion of a building above 6-storeys is required to setback to establish separation between high-rise towers. The site itself is currently subject to a maximum FSI of 2.0. The proposed development apparently exceeds the current maximum. The conceptual design establishes building setbacks (approximately 3m) from the interior lot line and the rear lot line, which are not required by the current zoning. The design also includes details along the interior lot line to further improve the situation. Here are a few suggestions for further consideration. The bullets below correspond to the numbers shown in the attached diagrams.
    1. Units facing interior side yard at basement level and levels 1 to 3: apply details developed for levels 4 to 6.
    2. Northernmost units at levels 4 to 6 facing interior side yard: apply details developed for the

rest of the units.

3. Units facing rear yard at levels 2 to 6: consider further building setback.
4. Commercial unit at level 1: consider extension to establish a stronger building presence on Cyrville Road.
5. Light well at intersection is interesting yet should be pursued with caution. Considerations should be given to animating the pedestrian realm and pedestrian safety.
6. Please remove parking between building and the side walk and consider enclose parking from public views.

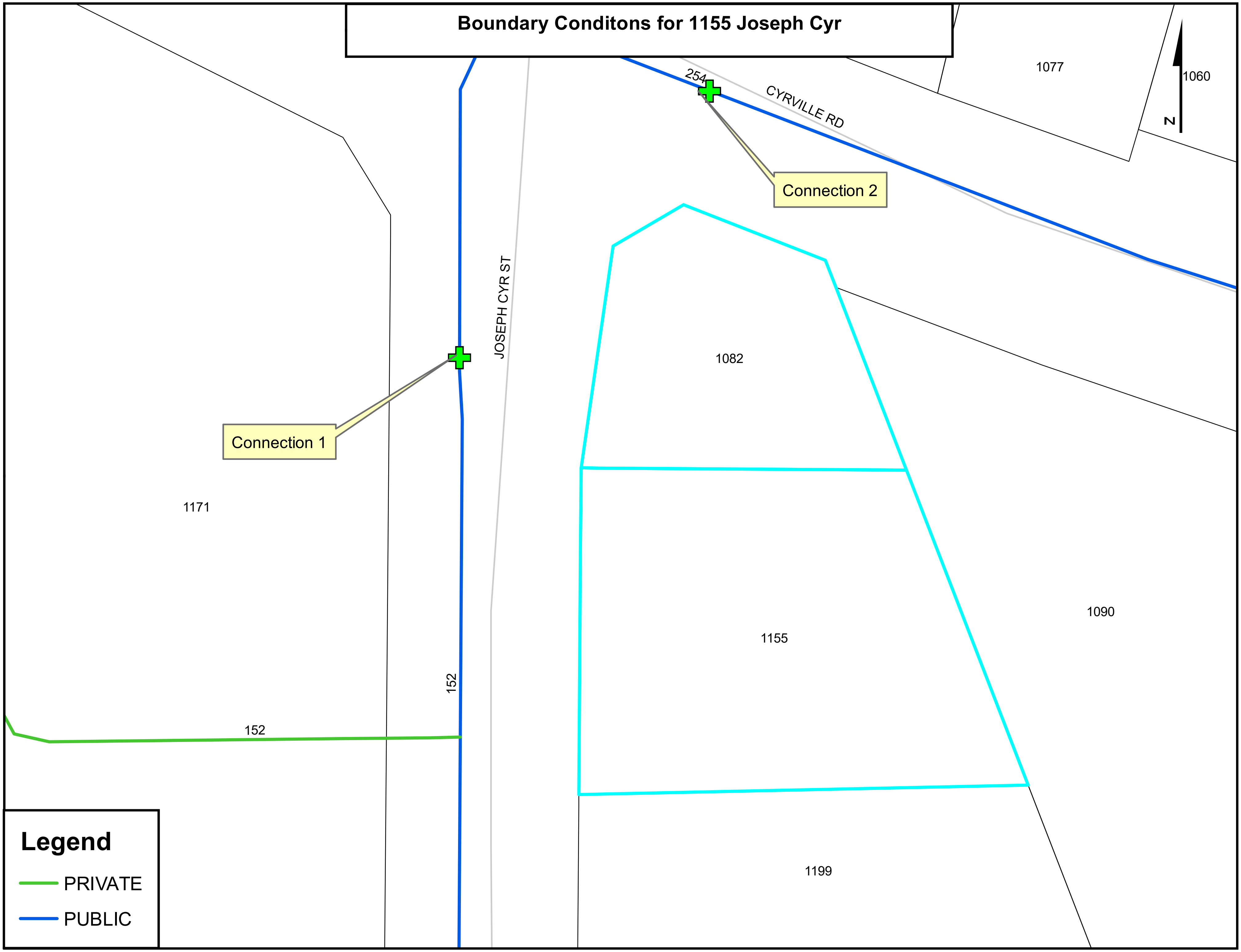
Thanks! If you have any questions about these comments. Please feel free to call.

Randolph

'

'

Boundary Conditons for 1155 Joseph Cyr



Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

SUBDIVISION:	**1155 Joseph Cyr Street**
DATE:	9/30/2020
REVISION:	1
DESIGNED BY:	TR
CHECKED BY:	KK

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401587

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 / STUDIO	1.4	INSTITUTIONAL	28,000 L/ha/day	MINIMUM COVER	2.50 m
PERSONS / 1 BEDROOM	1.4				
PERSONS / 1 BEDROOM + DEN	2.1	INFILTRATION	0.33 L/s/ha	HARMON CORRECTION FACTOR	0.8
PERSONS / 2 BEDROOM	2.1				

LOCATION			RESIDENTIAL AREA AND POPULATION										COMMERCIAL	
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	STUDIO	1 BEDROOM	1 BEDROOM + DEN	2 BEDROOM	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (L/s)	AREA (ha)	ACCU. AREA (ha)
SITE	BLDG	CYRVILLE ROAD	0.150	33	70	0	14	174	0.150	174	4.00	2.25	0.010	0.010

AREA ID NUMBER	INDUSTRIAL (L) AREA (ha)	INDUSTRIAL (L) ACCU. AREA (ha)	INDUSTRIAL (H) AREA (ha)	INDUSTRIAL (H) ACCU. AREA (ha)	INSTITUTIONAL AREA (ha)	INSTITUTIONAL ACCU. AREA (ha)	GREEN / UNUSED AREA (ha)	GREEN / UNUSED ACCU. AREA (ha)	C+I+I PEAK FLOW (L/s)	INFILTRATION TOTAL AREA (ha)	INFILTRATION ACCU. AREA (ha)	INFILTRATION INFILT. FLOW (L/s)	TOTAL FLOW (L/s)
SITE	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.00	0.160	0.160	0.05	2.31

AREA ID NUMBER	PIPE LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
SITE	16.0	150	PVC	DR 28	1.00	15.3	**15.06%**	0.86	0.51
		375							

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

1155 Joseph Cyr Street

STORM SEWER DESIGN SHEET
(City of Ottawa)

DATE:	2020-10-01
REVISION:	1
DESIGNED BY:	TR
CHECKED BY:	

FILE NUMBER: 160401587

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 BEDDING CLASS B

MINIMUM COVER: 2.00 m

TIME OF ENTRY 10 min

LOCATION			DRAINAGE AREA																								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
CB-1A, CB-1B, CB-1C	BLDG	EX. MH	0.000	0.02	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.000	0.000	0.011	0.011	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	0.0	0.0	3.2
																				10.17							

AREA ID NUMBER	PIPE SELECTION											
	LENGTH (m)	PIPE WIDTH OR DIAMETER (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)
CB-1A, CB-1B, CB-1C	12.1	150	150	CIRCULAR	PVC	SDR 28	8.38	44.3	**7.3%**	2.50	1.21	0.17
		675	675									

C.2 RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401587**
Project: **1155 Joseph Cyr Street**
Date: **01-Oct-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**
Roof	ROOF	Hard	0.100		0.9	0.090		
		Soft	0.000		0.2	0.000		
	Subtotal			0.1			0.09	0.90
Controlled - Tributary	CB-1A, CB-1B, CB-1C	Hard	0.011		0.9	0.010		
		Soft	0.007		0.2	0.001		
	Subtotal			0.017806			0.0111929	0.63
Uncontrolled -Tributary	UNC-1, UNC-2	Hard	0.014		0.9	0.013		
		Soft	0.030		0.2	0.006		
	Subtotal			0.04384			0.018632	0.43
Total				**0.162**			**0.120**	
Overall Runoff Coefficient= C:								**0.74**

Total Roof Areas	**0.100 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.062 ha**
Total Tributary Area to Outlet	**0.162 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**0.162 ha**

Stormwater Management Calculations

Project #160401587, 1155 Joseph Cyr Street
Modified Rational Method Calculatons for Storage

5 yr Intensity | I = a/(t + b)^c | a = 998.071 | b = 6.053 | c = 0.814
City of Ottawa

t (min)	I (mm/hr)
10	104.19
20	70.25
30	53.93
40	44.18
50	37.65
60	32.94
70	29.37
80	26.56
90	24.29
100	22.41
110	20.82
120	19.47

5 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1616
C: 0.50

Typical Time of Concentration

tc (min)	I (5 yr) (mm/hr)	Qtarget (L/s)
10	104.19	**23.41**

5 YEAR Modified Rational Method for Entire Site

Subdrainage Area: ROOF — Roof
Area (ha): 0.100 — 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	26.07	3.87	22.20	13.32	103.3	0.00
20	70.25	17.58	4.03	13.55	16.25	109.7	0.00
30	53.93	13.49	4.07	9.42	**16.96**	111.3	0.00
40	44.18	11.05	4.06	6.99	16.79	110.9	0.00
50	37.65	9.42	4.03	5.39	16.18	109.6	0.00
60	32.94	8.24	3.98	4.26	15.34	107.7	0.00
70	29.37	7.35	3.93	3.42	14.37	105.6	0.00
80	26.56	6.65	3.87	2.78	13.33	103.3	0.00
90	24.29	6.08	3.81	2.27	12.25	100.9	0.00
100	22.41	5.61	3.73	1.88	11.25	97.8	0.00
110	20.82	5.21	3.65	1.56	10.33	94.4	0.00
120	19.47	4.87	3.56	1.31	9.42	91.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	111	0.11	4.07	16.96	40.00	0.00

Subdrainage Area: CB-1A, CB-1B, CB-1C — Controlled - Tributary
Area (ha): 0.018
C: 0.63

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	7.11	4.48	2.63	1.58
20	70.25	6.22	4.81	1.41	**1.69**
30	53.93	5.75	4.81	0.94	1.69
40	44.18	5.44	4.74	0.70	1.67
50	37.65	5.20	4.65	0.55	1.64
60	32.94	5.01	4.56	0.45	1.61
70	29.37	4.84	4.47	0.37	1.57
80	26.56	4.69	4.38	0.32	1.53
90	24.29	4.56	4.29	0.27	1.48
100	22.41	4.43	4.19	0.24	1.43
110	20.82	4.29	4.08	0.21	1.38
120	19.47	4.17	3.98	0.18	1.33

Orifice Diameter: LMF100
Invert Elevation 69.00 m
T/G Elevation 70.40 m
Max Ponding Depth 0.29 m
Downstream W/L 68.09 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	70.69	0.29	4.81	1.69	4.38	OK

Subdrainage Area: UNC-1, UNC-2 — Uncontrolled -Tributary
Area (ha): 0.044
C: 0.43

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	104.19	5.40	5.40		
20	70.25	3.64	3.64		
30	53.93	2.79	2.79		
40	44.18	2.29	2.29		
50	37.65	1.95	1.95		
60	32.94	1.71	1.71		
70	29.37	1.52	1.52		
80	26.56	1.38	1.38		
90	24.29	1.26	1.26		
100	22.41	1.16	1.16		
110	20.82	1.08	1.08		
120	19.47	1.01	1.01		

Project #160401587, 1155 Joseph Cyr Street
Modified Rational Method Calculatons for Storage

100 yr Intensity | I = a/(t + b)^c | a = 1735.688 | b = 6.014 | c = 0.820
City of Ottawa

t (min)	I (mm/hr)
10	178.56
20	119.95
30	91.87
40	75.15
50	63.95
60	55.89
70	49.79
80	44.99
90	41.11
100	37.90
110	35.20
120	32.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.1616
C: 0.50

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: ROOF — Roof
Area (ha): 0.100 — 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	49.64	4.56	45.08	27.05	130.8	0.00
20	119.95	33.35	4.83	28.52	34.22	141.4	0.00
30	91.87	25.54	4.94	20.60	37.08	145.7	0.00
40	75.15	20.89	4.98	15.91	38.19	147.3	0.00
50	63.95	17.78	4.99	12.79	**38.38**	147.6	0.00
60	55.89	15.54	4.97	10.57	38.03	147.1	0.00
70	49.79	13.84	4.95	8.89	37.35	146.1	0.00
80	44.99	12.51	4.91	7.59	36.45	144.7	0.00
90	41.11	11.43	4.87	6.55	35.39	143.2	0.00
100	37.90	10.54	4.83	5.71	34.23	141.4	0.00
110	35.20	9.79	4.79	5.00	33.01	139.6	0.00
120	32.89	9.14	4.74	4.41	31.73	137.7	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	148	0.15	4.99	38.38	40.00	0.00

Subdrainage Area: CB-1A, CB-1B, CB-1C — Controlled - Tributary
Area (ha): 0.018
C: 0.79

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	11.51	6.12	5.39	3.23
20	119.95	9.50	6.52	2.98	3.57
30	91.87	8.51	6.52	1.99	**3.58**
40	75.15	7.90	6.44	1.46	3.51
50	63.95	7.47	6.33	1.14	3.42
60	55.89	7.15	6.22	0.92	3.33
70	49.79	6.88	6.12	0.77	3.23
80	44.99	6.66	6.01	0.65	3.14
90	41.11	6.47	5.91	0.56	3.04
100	37.90	6.31	5.81	0.49	2.95
110	35.20	6.15	5.72	0.43	2.86
120	32.89	6.02	5.63	0.39	2.78

Orifice Diameter: LMF100
Invert Elevation 69.00 m
T/G Elevation 70.40 m
Max Storage Depth 0.53 m
Downstream W/L 68.09 m

Volume in CB1 and STM1 when head = 0.51: 0.38
Max available volume in CB's: 0.99

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	70.93	0.53	6.52	3.58	4.38	OK
					0.81	

Subdrainage Area: UNC-1, UNC-2 — Uncontrolled -Tributary
Area (ha): 0.044
C: 0.53

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	11.56	11.56		
20	119.95	7.77	7.77		
30	91.87	5.95	5.95		
40	75.15	4.87	4.87		
50	63.95	4.14	4.14		
60	55.89	3.62	3.62		
70	49.79	3.22	3.22		
80	44.99	2.91	2.91		
90	41.11	2.66	2.66		
100	37.90	2.45	2.45		
110	35.20	2.28	2.28		
120	32.89	2.13	2.13		

Stormwater Management Calculations

Project #160401587, 1155 Joseph Cyr Street
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	0.162	ha				
Total 5yr Flow to Sewer	14.28	L/s	0	0	m^3	Ok
Non-Tributary Area	0.000	ha				
Total 5yr Flow Uncontrolled	0.00	L/s				
Total Area	0.162	ha				
Total 5yr Flow	14.28	L/s				
Target	23.41	L/s				

Project #160401587, 1155 Joseph Cyr Street
Modified Rational Method Calculatons for Storage

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	0.162	ha				
Total 100yr Flow to Sewer	23.07	L/s	3.58	4.38	m^3	Ok
Non-Tributary Area	0.000	ha				
Total 100yr Flow Uncontrolled	0.00	L/s				
Total Area	0.162	ha				
Total 100yr Flow	23.07	L/s				
Target	23.41	L/s				

Project #160401587, 1155 Joseph Cyr Street
Roof Drain Design Sheet, Area BLDG
Standard Watts Model R1100 Accutrol 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	22	0	0	0.025
0.050	0.0006	0.0025	1	0.050	89	1	1	0.050
0.075	0.0008	0.0032	5	0.075	200	4	5	0.075
0.100	0.0009	0.0038	12	0.100	356	7	12	0.100
0.125	0.0011	0.0044	23	0.125	556	11	23	0.125
0.150	0.0013	0.0050	40	0.150	800	17	40	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.3	513.7	1.3	0.14269
4.8	1115.4	3.5	0.45252
11.7	1810.1	6.9	0.95531
23.0	2557.9	11.3	1.66583
39.8	3338.8	16.9	2.59329

Rooftop Storage Summary

Total Building Area (sq.m)		1000
Assume Available Roof Area (sq.	80%	800
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)		40
Estimated 100 Year Drawdown Time (h)		2.5

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

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

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	0.3155
0.075	0.9464	0.8675	**0.7886**	0.7098	0.3155
0.100	1.2618	1.1041	**0.9464**	0.7886	0.3155
0.125	1.5773	1.3407	**1.1041**	0.8675	0.3155
0.150	0	1.5773	**1.2618**	0.9464	0.3155

Calculation Results

	5yr	**100yr**	**Available**
Qresult (cu.m/s)	0.004	0.005	-
Depth (m)	0.111	0.148	0.150
Volume (cu.m)	17.0	38.4	40.0
Draintime (hrs)	1.3	2.5	

Appendix D GEOTECHNICAL INVESTIGATION

Geotechnical Engineering

Environmental Engineering

Hydrogeology

Geological Engineering

Materials Testing

Building Science

Archaeological Services

patersongroup

Geotechnical Investigation

Proposed Multi-Storey Building
1155 Joseph Cyr Street
and 1082 Cyrville Road
Ottawa, Ontario

Prepared For

TC United Development Corporation
c/o ZW Project Management

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

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

July 24, 2020

Report PG5400-1

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Appendices

Appendix 1 Soil Profile and Test Data Sheets
Symbols and Terms
Analytical Testing Results

Appendix 2 Figure 1 - Key Plan
Drawing PG5400-1 - Test Hole Location Plan

1.0 Introduction

Paterson Group (Paterson) was commissioned by ZW Management on behalf of TC United Development Corporation to conduct a geotechnical investigation for the proposed multi-storey building to be located at the southeast corner of the intersection between 1155 Joseph Cyr Street and 1082 Cyrville Road, in the City of Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 2 of this report).

The objectives of the investigation were to:

- ❑ Determine the subsoil and groundwater conditions at this site by means of boreholes.
- ❑ Provide geotechnical recommendations for the 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. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

2.0 Proposed Development

It is understood that the development will consist of a 3-storey apartment building with one (1) underground level. The basement level will host additional residential units and storage areas. Associated at-grade parking areas, access lanes and landscaped areas are further anticipated. It is expected that the proposed building will be municipally serviced.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the geotechnical investigation was carried out on July 8, 2020 and consisted of four (4) boreholes advanced to a maximum depth of 6.7 m below existing ground surface. The borehole locations were determined in the field by Paterson personnel taking into consideration site features and underground services. The locations of the boreholes are shown on Drawing PG5400-1 - Test Hole Location Plan included in Appendix 2.

The boreholes were advanced using a truck-mounted auger drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer. The test hole procedures consisted of advancing the boreholes to the required depths at the selected locations and sampling the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using three different techniques, namely, sampled directly from the auger flights (AU) or collected using a 50 mm diameter split-spoon (SS) sampler. All soil samples were visually inspected and initially classified on site. The auger and split-spoon samples were placed in sealed plastic bags and transported to our laboratory for further examination and classification. The depths at which the auger and split spoon samples were recovered from the boreholes are shown as AU and SS, respectively, on the Soil Profile and Test Data sheets presented in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as "N" values on the Soil Profile and Test Data sheets. The "N" value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Overburden thickness was evaluated by dynamic cone penetration testing (DCPT) at BH 1. The DCPT consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment. Due to the low resistance exerted by the silty clay in some boreholes, the cone was pushed using the hydraulic head of the drill rig until resistance to penetration was encountered. The hammer was then used to further advance the cone to practical refusal.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are presented on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Groundwater monitoring wells were installed in BH 1, BH 3 and BH 4 to permit monitoring of the groundwater levels subsequent to the completion of the sampling program.

Sample Storage

All samples will be stored in the laboratory for a period of one month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test holes were located and surveyed in the field by Paterson personnel. The locations and ground surface elevations were determined using a hand held GPS incorporating a geodetic datum. The borehole locations and ground surface elevation at each borehole location are presented on Drawing PG5400-1 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the boreholes and visually examined in our laboratory to review the field logs.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site is currently occupied by two single family homes while the remainder of the site is occupied by parking lots, grass covered areas and mature trees. The existing ground surface across the site is relatively flat with a gentle downslope towards the north portion of the site.

The site is bordered to the north by Cyrville Road, to the west by Joseph Cyr Street and to the south and east by asphalt covered, at-grade parking areas.

4.2 Subsurface Profile

Overburden

Generally, the subsurface profile encountered at the borehole locations consists of two layers of asphaltic concrete and/or fill. The fill layer consists of brown silty sand with crushed stone, gravel and trace clay. The fill layer is underlain by a loose to dense glacial till layer consisting of a mixture of silty clay with sand, gravel, cobbles and boulders. Practical refusal to the DCPT was encountered at the depth of 7.4 m within BH 1, on the southeast end of the site. Practical refusal to the augering was encountered at a depth of 5.6 m below existing ground surface at BH 2, on the southwest end of the site.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for specific details of the soil profiles encountered at each test hole location.

Bedrock

Bedrock was encountered underlying the glacial till deposit at the depths ranging from 5.2 to 5.8 m below the existing ground surface on the north end of the site. The bedrock was observed to consist of weathered shale.

Based on available geological mapping, the bedrock in this area consists of dark brown to black shale of the Billings Formation with an overburden drift thickness of 2 to 5 m depth.

4.3 Groundwater

Groundwater levels were measured at the monitoring wells in the borehole locations of the current investigation on July 15, 2020. The measured groundwater levels in the piezometers at the borehole locations are presented in Table 1. The long term groundwater level can also be estimated based on the recovered soil samples' moisture levels and consistency. Based on these observations, the long term groundwater table is anticipated to be at a 3.0 to 4.0 m depth.

Table 1 - Summary of Groundwater Levels

Borehole Number	Measured Groundwater Level		Recording Date
	Depth (m)	Elevation (m)	
Groundwater Levels Based on Current Investigation (Report PG5400)			
BH 1	4.40	66.81	July 15, 2020
BH 3	3.36	66.70	July 15, 2020
BH 4	4.17	66.73	July 15, 2020

It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater level could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is satisfactory for the proposed building. It is recommended that the proposed building be founded on conventional shallow foundation placed over an undisturbed, compact to dense glacial till bearing surface, or on an engineered fill placed and compacted directly over the undisturbed compact glacial till bearing surface. Alternatively, footings can be placed over zero entry, vertical concrete in-filled trenches extended down to an undisturbed, glacial till bearing surface.

Due to the absence of a silty clay deposit, the subject site will not be subjected to permissible grade raise restrictions.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, asphalt, and deleterious fill, such as material containing high content of organic materials or construction remnants, should be stripped entirely from under the proposed building footprint and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the proposed building should consist of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A or Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building and paved areas should be compacted to at least 98% of the material's standard Proctor maximum dry density (SPMDD).

Non-specified existing fill, along with site-excavated soil, can be used as general landscaping fill where settlement of the ground surface is of minor concern. This material should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If this material is to be used to build up the subgrade level for areas to be paved, it should be compacted in thin lifts to at least 95% of the material's SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless used in conjunction with a composite drainage membrane.

5.3 Foundation Design

Bearing Resistance Values

Footings placed on an undisturbed, compact glacial till or engineered fill placed over an undisturbed, compact glacial till bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**, incorporating a geotechnical factor of 0.5.

If the glacial till subgrade is observed to be in a loose state of compactness, the material should be proof rolled using suitable vibratory equipment making several passes **under dry conditions and above freezing temperatures** and approved by Paterson at the time of construction.

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 glacial till above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class C** for the foundations bearing on a compact glacial till. A higher site class, such as Class B, may be applicable for footings bearing on glacial till within 3 m vertical separation from the bedrock surface. However, a site specific seismic shear wave test will be required to confirm the feasibility of a site seismic Class B.

Soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab Construction

With the removal of all topsoil and deleterious material, containing organic matter, within the footprint of the proposed building, the compact glacial till will be considered an acceptable subgrade surface on which to commence backfilling for floor slab construction. The upper 200 mm of sub-slab fill is recommended to consist of 19 mm clear crushed stone.

Any soft or poor performing areas within the basement slab subgrade should be removed and backfilled with appropriate backfill material prior to placing the subslab granular fill 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. All backfill material within the footprint of the proposed building should be placed in maximum 300 mm thick loose layers and compacted to the minimum 98% of its SPMDD.

5.6 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 a bulk (drained) unit weight of 20 kN/m^3. The applicable effective (undrained) 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 using the effective unit weight.

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 will only be applicable for static analyses and should not be used 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 total seismic force (P_{AE}) includes both the earth force component (P_o) and the seismic component (ΔP_{AE}). The seismic earth force (ΔP_{AE}) can be calculated using $0.375 \cdot a_c \cdot \gamma \cdot H^2/g$ 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 earth force component (P_o) under seismic conditions can be calculated using $P_o = 0.5\ K_o\ \gamma\ H^2$, where $K_o = 0.5$ for the soil conditions noted above.

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

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

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

5.7 Pavement Structure

Where required at the subject site, the recommended pavement structures for car only parking areas and access lanes are shown in Tables 2 and 3.

Table 2 - 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 soil or OPSS Granular B Type I or II material placed over in situ soil or fill	

Table 3 - Recommended Pavement Structure - Access Lanes and Heavy Truck Parking/Loading 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
450	**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. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, such as Terratrack 200 or equivalent, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system 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 which is placed at the footing level around the exterior perimeter of the structure. An interior perimeter drainage pipe should be placed along the building perimeter along with a sub-floor drainage system. The perimeter drainage pipe and under-floor drainage system should direct water to sump pit(s) within the lower basement area.

Sub-slab Drainage

Sub-slab drainage is recommended to control water infiltration. For preliminary design purposes, we recommend that 150 mm diameter perforated pipes be placed at approximate 6 m centres underlying the basement slabs. The spacing of the sub-slab drainage system should be confirmed at the time of completing the excavation when water infiltration can be better assessed.

Foundation Backfill

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 re-use as backfill against the foundation walls, unless used in conjunction with a drainage geocomposite, such as Miradrain G100N or Delta Drain 6000, connected to the perimeter foundation drainage system. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 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 in this regard.

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

6.3 Excavation Side Slopes

Unsupported Excavations

The side slopes of excavations in the soil and fill overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e. unsupported excavations).

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsurface soils at this site are 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 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.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

Temporary Shoring

If a temporary shoring system is considered, the design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the designer. Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should take into account the potential for a fully saturated condition following a significant precipitation event. Any changes to the approved shoring design system should be reported immediately to the owner’s representative prior to implementation.

Temporary shoring may be required to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements will depend on the depth of the excavation, the proximity of the adjacent buildings and underground structures, and the elevation of the adjacent building foundations and underground services. Additional information can be provided when the above details are known.

For design purposes, the temporary system may 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 added to the earth pressures described below. These systems can be cantilevered, anchored or braced.

The earth pressures acting on the shoring system may be calculated using the following parameters provided in Table 4.

Table 4 - Soil Parameters for Shoring System Design

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
Total Unit Weight (γ), kN/m^3	20
Submerged Unit Weight (γ), kN/m^3	13

Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure their stability. It is further recommended that the toe of the shoring be adequately supported to resist toe failure.

The geotechnical design of grouted rock anchors in sedimentary bedrock is based upon two possible failure modes. The anchor can fail either by shear failure along the grout/rock interface or by pullout of a 60 to 90 degree cone of rock with the apex of the cone near the middle of the bonded length of the anchor.

The anchor derives its capacity from the bonded portion, or fixed anchor length, at the base of the anchor. An unbonded portion, or free anchor length, is also usually provided between the rock surface and the start of the bonded length. A factored tensile grout to rock bond resistance value at ULS of **1.0 MPa**, incorporating a resistance factor of 0.3, can be used. A minimum grout strength of 40 MPa is recommended.

The design of the rock anchors for temporary shoring can be based on the values provided in Table 5. From a geotechnical perspective, the fixed anchor length will depend on the diameter of the drill holes.

Table 5 - Recommended Rock Anchor Lengths - Grouted Rock Anchor

Diameter of Drill Hole (mm)	Anchor Lengths (m)			Factored Tensile Resistance (kN)
	Bonded Length	Unbonded Length	Total Length	
75	4	1.2	5.2	250
	5.6	1.7	7.3	500
	7.9	2.4	10.3	1000
125	3.9	1.1	5	250
	5.3	1.6	6.9	500
	7.2	2.2	9.4	1000

It is recommended that the anchor drill hole diameter be within 1.5 to 2 times the rock anchor tendon diameter and the anchor drill holes be inspected by geotechnical personnel and should be flushed clean prior to grouting. The use of a grout tube to place grout from the bottom up in the anchor holes is further recommended.

The geotechnical capacity of each rock anchor should be proof tested at the time of construction. More information on testing can be provided upon request. Compressive strength testing is recommended to be completed for the rock anchor grout. A set of grout cubes should be tested for each day grout is prepared.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications & Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

A minimum of 150 mm of OPSS Granular A should be placed for bedding for sewer or water pipes when placed on soil subgrade. If the bedding is placed on bedrock, the thickness of the bedding should be increased to 300 mm for sewer pipes. The bedding should extend to the spring line of the pipe. The material should be placed in a maximum 300 mm thick loose lifts and compacted to a minimum of 95% of its SPMDD.

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

6.5 Groundwater Control

Groundwater Control for Building Construction

Based on our observations, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations.

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.

Permit to Take Water

It is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of the shallow excavation. 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 Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

Long-term Groundwater Control

Our recommendations for the proposed building's long-term groundwater control are presented in Subsection 6.1. Any groundwater encountered along the building's perimeter or sub-slab drainage system will be directed to the proposed building's sump pit. It is expected that groundwater flow will be low (i.e.- less than 25,000 L/day) with peak periods noted after rain events. It is anticipated that the groundwater flow will be controllable using conventional open sumps.

Impacts on Neighbouring Structures

It is understood that one (1) underground level is included for the proposed building. Based on the existing groundwater level, the extent of any significant groundwater lowering will take place within a limited range of the proposed building. Based on the proximity of neighbouring buildings and minimal zone impacted by the groundwater lowering, the proposed development will not negatively impact the neighbouring structures and infrastructure. It should be noted that no issues are expected with respect to groundwater lowering that would cause long term damage to adjacent structures surrounding the proposed building.

6.6 Winter Construction

The subsoil conditions at this site 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 of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters, tarpaulins or other suitable means. In this regard, the base of the excavations 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 carried out in a manner that will 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 work takes place. 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.

6.7 Corrosion Potential and Sulphate

The results on analytical testing show that the sulphate content is less than 0.1%. The results are indicative that Type 10 Portland Cement would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity in indicative of a moderate to slightly aggressive corrosive environment.

7.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❏ 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 these works have been conducted in general accordance with our recommendations could be issued, upon request, following the completion of a satisfactory material testing and observation program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided in this report are in accordance with our present understanding of the project. We request permission to review our recommendations when the drawings and specifications are completed.

A geotechnical investigation of this nature 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.

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 TC United Development Corporation or their agents is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

Faisal I. Abou-Seido, P.Eng

David J. Gilbert, P.Eng.

Report Distribution

- ❑ TC United Development (e-mail copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE July 8, 2020

FILE NO. PG5400

HOLE NO. BH 1

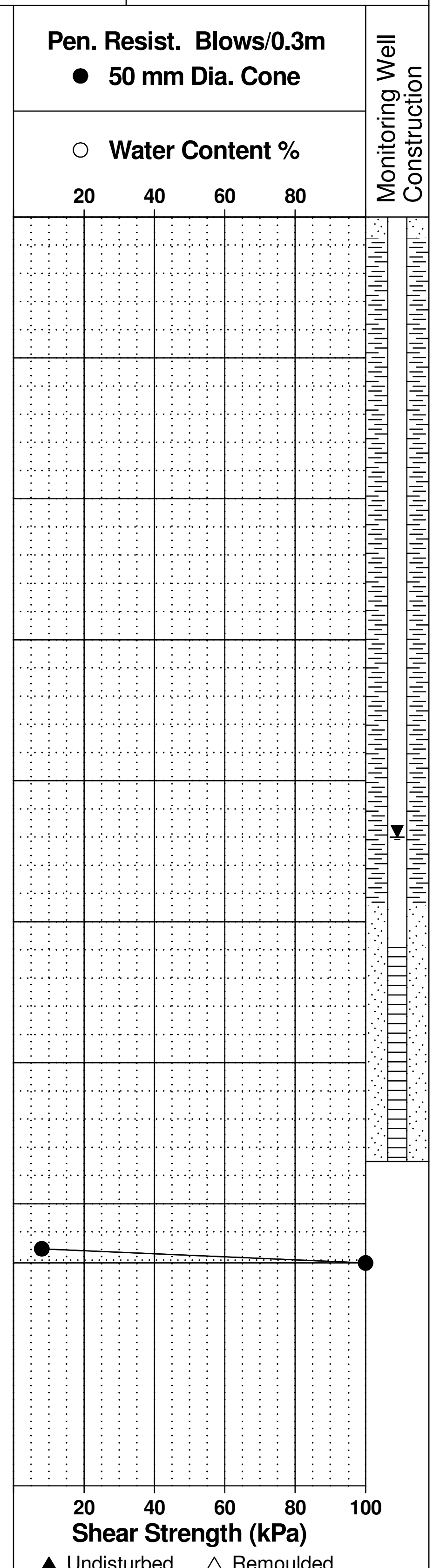
SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Brown silty sand with crushed stone	0.51	AU	1		
FILL: Brown silty sand, some gravel and brick	1.52	SS	2	21	12
GLACIAL TILL: Loose to compact, brown silty clay with sand, gravel, cobbles and boulders	6.70	SS	3	75	6
		SS	4	54	22
		SS	5	79	11
		SS	6	33	11
		SS	7	50	10
		SS	8	46	8
		SS	9	38	7
Dynamic Cone Penetration Test commenced at 6.70m depth. Inferred **GLACIAL TILL**	7.42				

End of Borehole

Practical DCPT refusal at 7.42m depth.

(GWL @ 4.40m - July 15, 2020)

DEPTH (m)	ELEV. (m)
0	71.21
1	70.21
2	69.21
3	68.21
4	67.21
5	66.21
6	65.21
7	64.21



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154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill

DATE July 8, 2020

FILE NO. PG5400

HOLE NO. BH 2

SOIL DESCRIPTION	Depth to base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	71.20
Asphaltic concrete	0.08						
FILL: Brown silty sand, trace gravel	1.52	AU	1				
		SS	2	58	27	1	70.20
GLACIAL TILL: Compact to loose, brown silty clay with sand, gravel, cobbles and boulders	5.56	SS	3	46	19	2	69.20
		SS	4	54	9	3	68.20
		SS	5	62	14		
		SS	6	42	9	4	67.20
		SS	7	33	9	5	66.20
		SS	8	67	50+		
End of Borehole Practical refusal to augering at 5.56m depth.							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

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

Monitoring Well Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5400

REMARKS

HOLE NO. BH 3

BORINGS BY CME-55 Low Clearance Drill **DATE** July 8, 2020

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.06
FILL: Brown silty sand, trace gravel (0.46)		AU	1				
FILL: Brown clayey silt to silty clay, trace sand and gravel		SS	2	58	4	1	69.06
(2.13)		SS	3	67	5	2	68.06
GLACIAL TILL: Compact, brown silty clay with sand, gravel, cobbles and boulders		SS	4	79	10	3	67.06
		SS	5	83	14		
		SS	6	92	15	4	66.06
(5.18)		SS	7	64	50+	5	65.06
BEDROCK: Weathered shale (6.70)						6	64.06
End of Borehole							
(GWL @ 3.36m - July 15, 2020)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
1155 Joseph Cyr Street and 1082 Cyrville Road
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY CME-55 Low Clearance Drill **DATE** July 8, 2020

FILE NO. PG5400

HOLE NO. BH 4

SOIL DESCRIPTION	Depth of base (m)	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
FILL: Brown silty sand, some gravel	0.60	AU	1		
TOPSOIL	0.69				
GLACIAL TILL: Loose to compact, brown silty clay with sand, gravel, cobbles and boulders	5.79	SS	2	21	7
		SS	3	50	7
		SS	4	58	22
		SS	5	33	19
		SS	6	54	17
		SS	7	71	43
		SS	8	46	24
BEDROCK: Weathered shale	6.70	SS	9	100	50+

End of Borehole

(GWL @ 4.17m - July 15, 2020)

DEPTH (m)	ELEV. (m)
0	70.90
1	69.90
2	68.90
3	67.90
4	66.90
5	65.90
6	64.90

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction

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

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

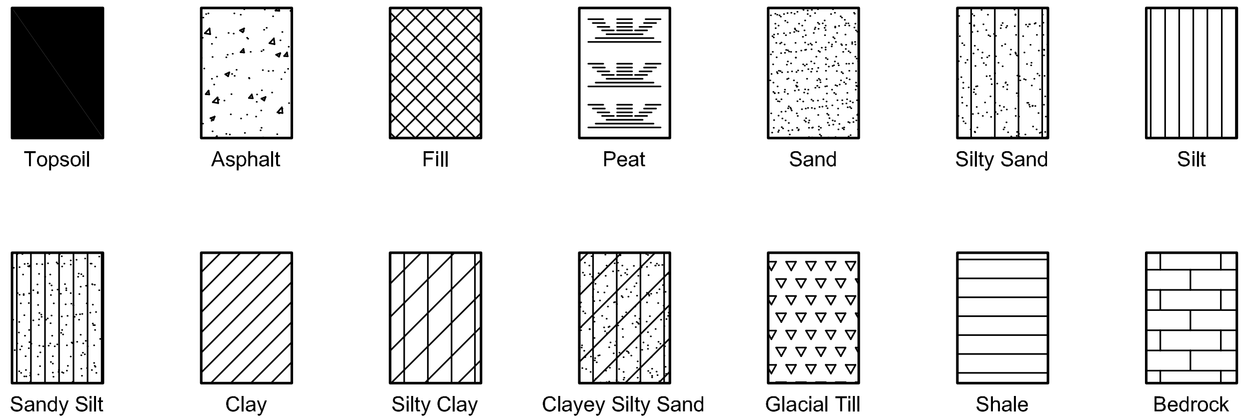
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void 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.

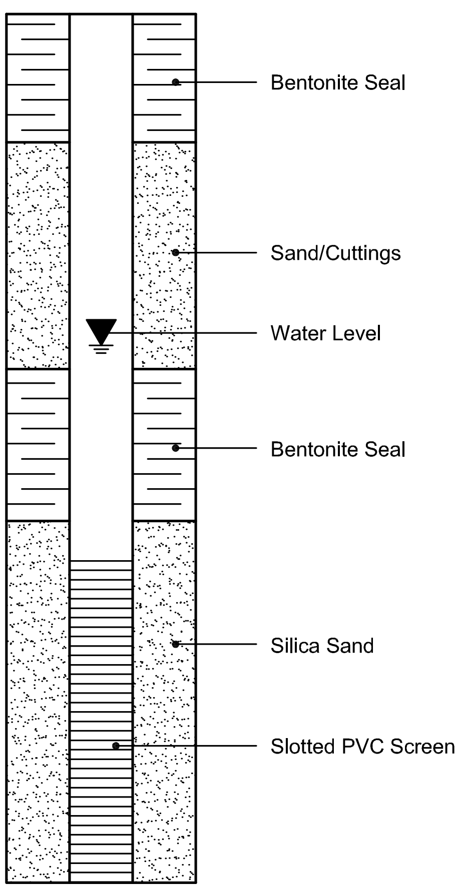
SYMBOLS AND TERMS (continued)

STRATA PLOT

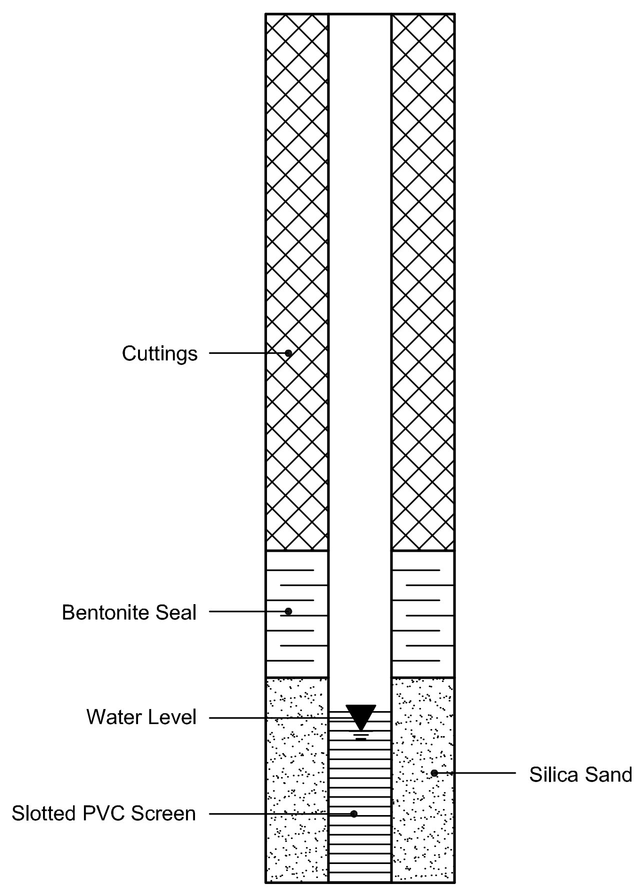


MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION



Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 30339

Report Date: 14-Jul-2020

Order Date: 9-Jul-2020

Project Description: PG5400

	Client ID:	BH4-SS4	-	-	-
	Sample Date:	08-Jul-20 14:35	-	-	-
	Sample ID:	2028452-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	90.1	-	-	-
General Inorganics					
pH	0.05 pH Units	7.83	-	-	-
Resistivity	0.10 Ohm.m	49.2	-	-	-
Anions					
Chloride	5 ug/g dry	14	-	-	-
Sulphate	5 ug/g dry	63	-	-	-

APPENDIX 2

FIGURE 1 - KEY PLAN

DRAWING PG5400-1 - TEST HOLE LOCATION PLAN

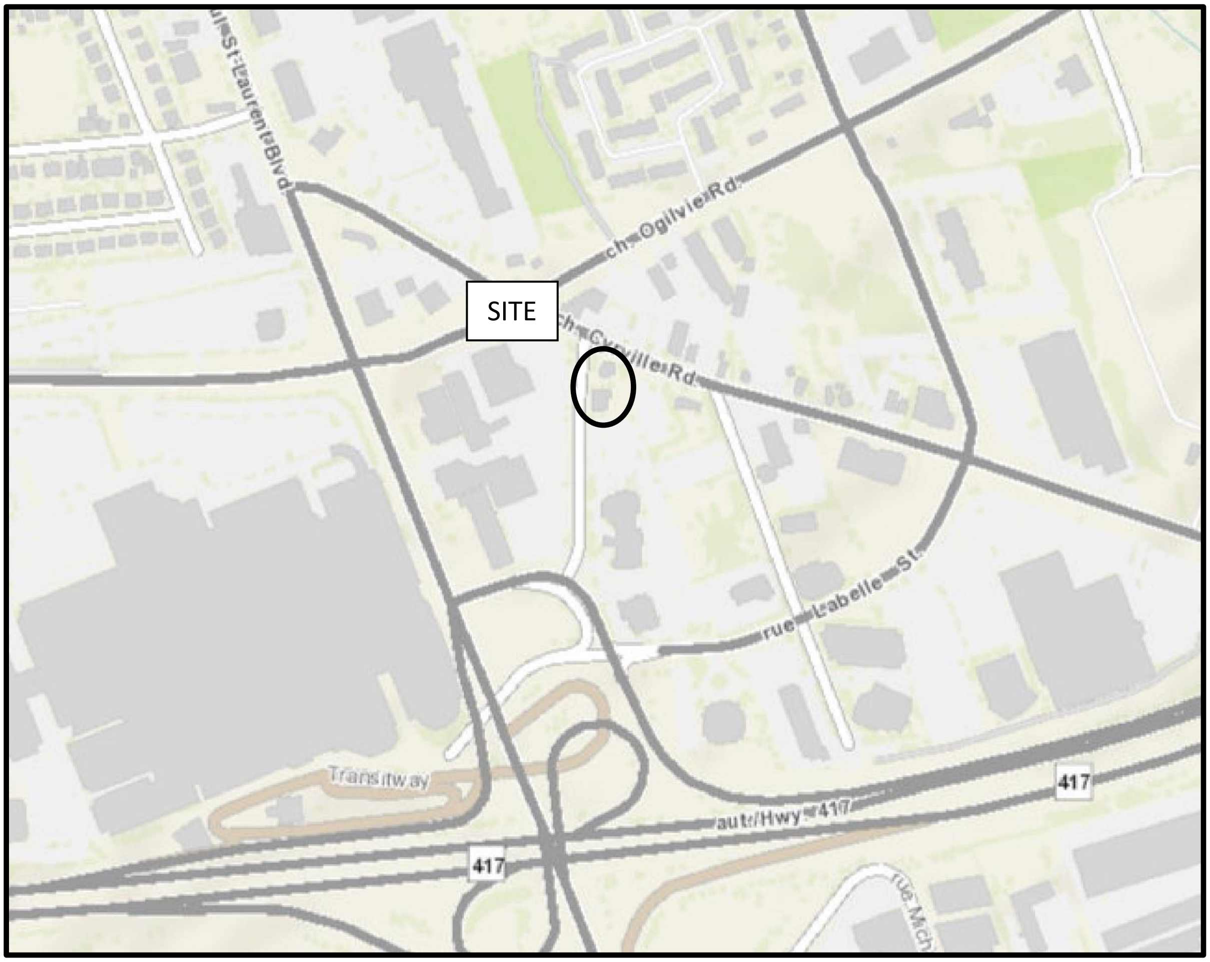
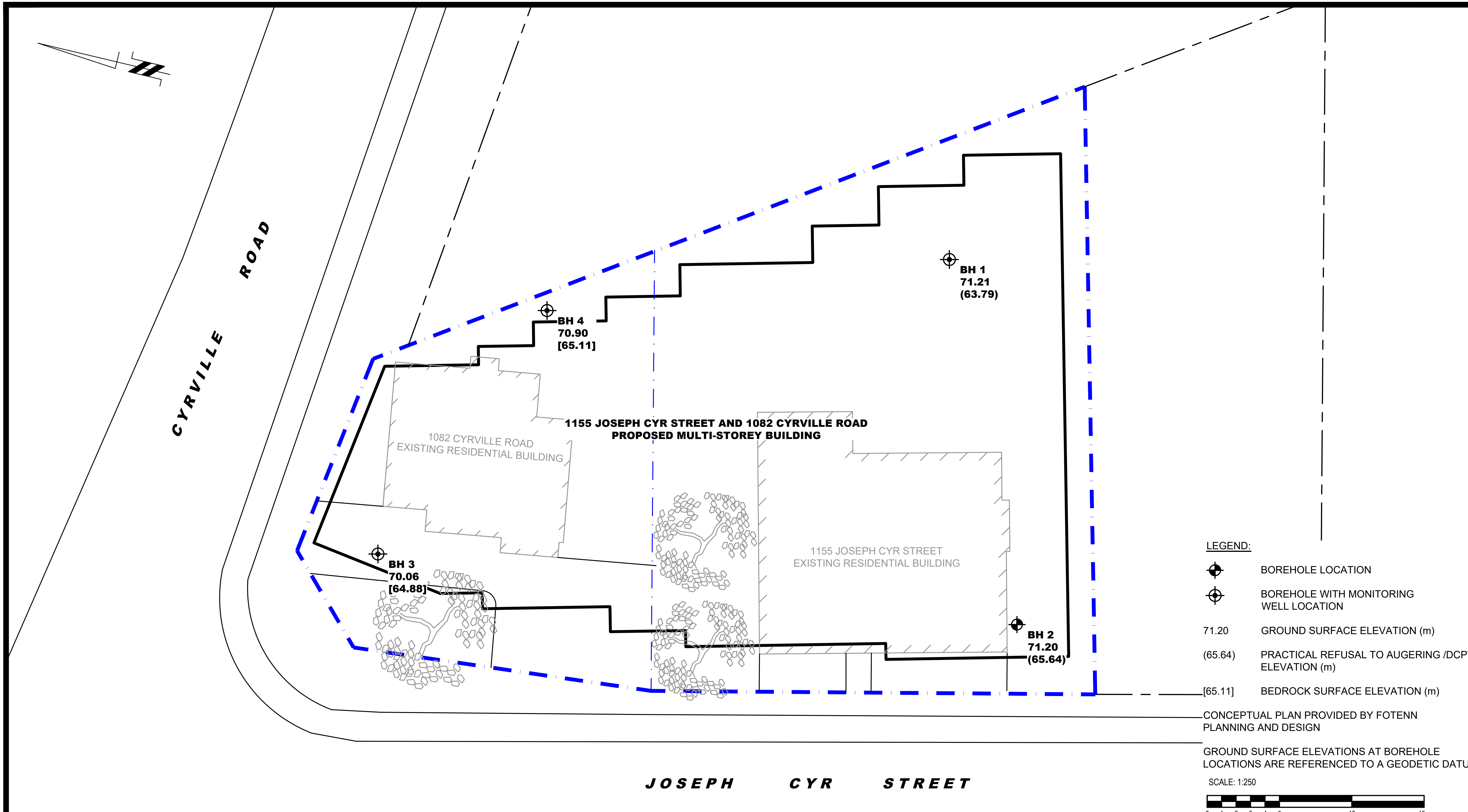


FIGURE 1

KEY PLAN



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NO.	REVISIONS	DATE	INITIAL

TC UNITED DEVELOPMENT CORP.
GEOTECHNICAL INVESTIGATION
PROPOSED MULTI-STOREY BUILDING
1155 JOSEPH CYR STREET AND 1082 CYRVILLE ROAD
OTTAWA, ONTARIO

Title:
TEST HOLE LOCATION PLAN

Scale: 1:250	Date: 07/2020
Drawn by: YA	Report No.: PG5400-1
Checked by: YT	Dwg. No.: PG5400-1
Approved by: FA	Revision No.:

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Appendix E DRAWINGS