Site Servicing and Stormwater Management Report, Holland Cross Ottawa, ON

File: 160410274

Prepared for:
LaSalle Investment Management

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

August 13, 2020

Revision	Description	Prepared by		Checked by
0	Site Servicing and Stormwater Management Report	Thakshika Rathnasooriya	August 11, 2020	Kris Kilborn

Sign-off Sheet

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Prepared by ______________________________
(signature)

Thakshika Rathnasooriya, P.Eng.

LICENSED PROFESSIONAL ENGINEER
T.K. RATHNASOORIYA
100225159
2020-08-13
PROVINCE OF ONTARIO

Reviewed by ______________________________
(signature)

Kris Kilborn

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1.0 INTRODUCTION

This Site Servicing and Stormwater Management Report has been prepared to support an application for Zoning Amendment for a property known municipally as 1560 Scott Street. The site is currently zoned Mixed Use Centre Zone (MC) and is located in the City of Ottawa in the north west quadrant of the intersection of Hamilton Avenue and Bullman Street and is illustrated on **Figure 1.1**. The proposed mixed-use development comprises a single 29 storey building with retail on the first floor and 337 residential apartment units above. The 0.30ha (0.74 acre) site is currently designated as office space.

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 Engineering Design Input Holland Cross Expansion, 1560 Scott Street, Ottawa, ON,* Golder Associates Inc., May 2020
- *Servicing & Stormwater Management Report, Holland Cross Expansion, Ottawa, ON, Novatech Engineers, Planners & Landscape Architects, August 2014*
- 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 north-western side of the intersection of Bullman Street and Hamilton Avenue in the Hintonburg community of the City of Ottawa. The property is located within the City's Pressure Zone 1W. Average ground elevations of the site are approximately 61.95m. Under normal operating conditions, hydraulic grade lines vary from approximately 107.9m to 114.6m as confirmed through boundary conditions as provided by the City of Ottawa.

According to City of Ottawa District Plans, existing water infrastructure present on the proposed site is a 150 mm diameter PVC watermain branching off a 200 mm PVC watermain running along Hamilton Avenue. Given the size of the development and domestic demand requirements for the proposed high-rise buildings, two separate connections to the main are required with separated by a valve for redundancy. The proposed site will be serviced via a 150mm building service connection to the existing 200 mm watermain along Hamilton Avenue as shown on the Site Servicing Plan (see **Drawing SSGP-1**).

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 and 1 bedroom plus den apartment units, and 1.4 pers./studio and one-bedroom apartment units. See **Appendix A.1** for detailed domestic water demand estimates. Additionally, commercial and retail domestic 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 2.63 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 6.55 L/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 14.41 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 62.0m, adequate flows are available for the subject site with pressures ranging from 46.0m (65.4psi) to 52.7m (74.9psi). 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 29th level of the building will 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 60.4 psi; which is in excess of the required 140 kPa (20 psi). The above demonstrates that the existing watermain within Hamilton Avenue can provide adequate fire and domestic flows in excess of flow requirements for the subject site. An existing hydrant is located east of the subject site and is within 45m of the proposed building siamese connection per OBC requirements.

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.

4.0 WASTEWATER SERVICING

4.1 BACKGROUND

The site will be serviced via an existing 250 mm diameter sanitary service lateral running east along the site which ultimately discharges into the 250 mm diameter sanitary sewer within Hamilton Avenue ROW (see **Drawing SSGP-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 one-bedroom plus den and 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. 8.3 L/s with allowance for infiltration) to the existing 250 mm diameter sanitary sewer. A sanitary sewer design sheet for the proposed sanitary sewers is included in **Appendix B.1.** Capacity in the downstream sanitary sewer system will be assessed during detailed design. 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 MANAGEMENT

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

- All stormwater runoff from the proposed site up to and including the 100 year event to be stored on site and released into the minor system at a maximum rate equivalent to 53.9 L/s calculated based on 2-year pre-development rates.
- Proposed site to discharge the existing 200mm diameter storm sewer running east along the site and connection to the 450mm storm sewer on Hamilton Avenue ROW at the 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 buildings, parking and access areas. The proposed stormwater management plan is designed to detain runoff on the roof 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 200 mm diameter storm sewer running east along the site and then south along 450mm diameter storm sewer on Hamilton Avenue.

A summary of subareas and runoff coefficients is provided in **Appendix C**, and **Drawing SD-1** indicates the stormwater management sub catchments.

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 2-year pre-development rate. 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)
2-Year and 100-Year	53.9

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 assumed surface parking storage with inlet control devices (ICD's)be used to reduce site peak outflow to target rates. Existing ICD sizes within catch basins will be confirmed during detailed design.

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	6.30	55.78

Drainage from the roof is anticipated to directly discharge to the existing 200mm storm service.

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 two catch basins (L101A and L102A)complete with IPEX Tempest HF or LMF Orifice ICD to meet the target peak discharge rate for the during the 100-year event. The catch basins are within the existing infrastructure and current ICD sizes will be confirmed at time of detailed design. The MRM sheet assumes ICD sizes of 108mm to meet target release rate from the proposed site.

At the time of detailed design, the required 16m^3 of storage will be detained on the proposed site through surface ponding or a cistern within the parking garage.

Controlled release rates and storage volumes required are summarized in **Table 3**: Surface Storage Areas (L101A and L102A)

Table 3: Surface Storage Areas (L101A and L102A)

Tributary Area	Design Storm	Design Head (m)	Discharge (L/s)	Orifice Type	$V_{required}$ (m^3)
L101A	2-Year	0.18	10.5	IPEX Tempest HF 108mm Orifice	0.0
	100-Year	0.18	10.5		7.6
L102A	2-Year	1.19	27.0	IPEX Tempest HF 108mm Orifice	0.0
	100-Year	1.19	27.0		8.6

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 Hamilton Avenue. 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)
2-Year	2.01
100-Year	5.83

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	5.8
Controlled – Surface	37.5
Controlled – Roof	6.3
Total	**49.6**
Target	**53.9**

6.0 GRADING AND DRAINAGE

The proposed development site measures approximately 0.3ha in area. The topography across the site is relatively flat on the northern boundary with a marginally increased slope on the southern boundary of the proposed building , and currently drains from west to east, with overland flow generally being directed to the adjacent Hamilton Avenue ROW. A grading plan (see **Drawing SSGP-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 Hamilton Avenue as depicted in **Drawing SSGP-1.**

7.0 UTILITIES

Hydro, Bell, Gas and Cable servicing for the proposed development should be readily available within subsurface utility infrastructure within the Hamilton Avenue 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 maybe a requirement if existing sewers are shared to outlet onto Hamilton Avenue as the proposed site is expected to be severed into a separate parcel of land.

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 GEOTECHNICAL INVESTIGATION

A geotechnical investigation was conducted by Golder Associates Ltd. in May 2020. Subsurface soil conditions within the boundaries of the proposed site were determined by 4 test pits distributed across the site. Some investigations were previously completed in 1986 by McRostie. The subsurface profile across the site described by the previous investigation consists of 2.3m of fill material made up by topsoil, sand gravel, clay, bricks, wood, metal and concrete below the original ground surface and underlain by glacial till.

An organic layer was found to be 0.3m to 0.8m thick near the building in test pits M120/E120 and N150/E120 at depths of 1.7m and 1.35m below ground surface. It is anticipated that during construction of the existing building the noted materials above were removed.

Bedrock elevations were previously encountered at elevations of 59.8 to 61.0m. Groundwater levels have altered since previous investigation and current water levels are influenced by existing building drainage systems.

10.0 CONCLUSIONS

10.1 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.

10.2 SANITARY SERVICING

The existing 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. 8.3 L/s) to the existing 250mm dia. sanitary sewer service and ultimately to the 250mm dia. sewer along Hamilton Avenue at the eastern boundary of the property. The existing drainage outlet has sufficient capacity to receive sanitary discharge from the site.

10.3 STORMWATER SERVICING

The proposed stormwater management plan is in compliance with local and provincial standards. Rooftop storage and minimal surface storage has been controlled to meet the allowable release rate to the existing 200mm diameter storm service lateral draining to the 450mm diameter storm sewer within Hamilton Avenue ROW. The downstream receiving sewer has sufficient capacity to receive runoff volumes from the site.

10.4 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 Golder Associates Ltd. Erosion and sediment control measures will be implemented during construction to reduce the impact on existing facilities.

10.5 UTILITIES

Utility infrastructure exists within the Hamilton Avenue ROW at the eastern 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.

10.6 APPROVALS/PERMITS

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 maybe a requirement if existing sewers are shared to outlet onto Hamilton Avenue as the proposed site is expected to be severed into a separate parcel of land. Requirement for a MECP Permit to Take Water (PTTW) for sewer and building construction will be confirmed by the geotechnical consultant.

Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

Holland Cross Phase 3 Residential

Project #160410274
July 24 2020

	Number of Units	Density	Population
Studio	24.0	1.4	33.6
1 BR	66.0	1.4	92.4
1BR + Den	115.0	2.1	241.5
2 BR	132.0	2.1	277.2

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		645	350	156.7	2.61	391.7	6.53	861.8	14.36
Lobby and Amenity Space	474		28000	0.9	0.02	1.4	0.02	2.5	0.04
Total Site :				**157.6**	**2.63**	**393.1**	**6.55**	**864.3**	**14.41**

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# 1604-10274
Date 12-Aug-20

Designed by: TKR
Checked by: KK
Description: 29 Floor Ap

$$Q = KVS_{tot}$$

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 with Fire-Resistance Ratings	A-2, B-1, B-2, B-3, C, D		10
2	Area of one floor (m^2)	number of floors	height of ceiling (m)	Total Building Volume (m^3)
	1370.5	29	3.0	119,919
3	Side	Exposure Distance (m)	Spatial Coefficient	Total Spatial Coeffiecient
	North	0	0.5	2
	East	6.5	0.35	
	South	16.0	0	
	West	0	0.5	
4	Established Fire Safety Plan?	Reduction in Volume (%)		Total Volume Reduction
	no	0%		0%
5				**Total Volume 'Q' (L)**
				2,398,380
				Minimum Required Fire Flow (L/min)
				9,000

A.3 BOUNDARY CONDITIONS

Boundary Conditons for Hamilton Avenue - 29 Storey Condo

From: Wu, John
To: Rathnasooriya, Thakshika
Subject: RE: Boundary Conditions
Date: Thursday, July 30, 2020 4:07:21 PM
Attachments: Hamilton Avenue July 2020.pdf

Here is the result:

The following are boundary conditions, HGL, for hydraulic analysis on Hamilton Avenue (zone 1E) assumed to be connected to the 203mm on Hamilton Avenue (see attached PDF for location).

Minimum HGL = 107.9m

Maximum HGL = 114.6m

Max Day + FF = 104.4m

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.

John

From: Rathnasooriya, Thakshika <Thakshika.Rathnasooriya@stantec.com>
Sent: July 29, 2020 2:46 PM
To: Wu, John <John.Wu@ottawa.ca>
Cc: Kilborn, Kris <kris.kilborn@stantec.com>
Subject: Boundary Conditions

Hi John,

I am looking for watermain hydraulic boundary conditions for Holland Cross Phase 3 residential. The proposed residential building consists of 29 storeys. We anticipate connecting to the existing 150mm watermain service in addition to constructing a secondary connection(basic day demand is greater than 50 m3/day). The service is connected to the exiting 200mm diameter watermains on Hamilton Avenue North and Bullman Street. (please see attached figure).

Please see the estimated domestic demands and fire flow requirements for the site as mentioned below:
Average Day Demand – 2.63 L/s
Max Day Demand - 6.55 L/s
Peak Hour Demand - 14.41 L/s
Fire Flow Requirement per OBC were used for the apartment building - 150 L/s (9,000 L/min)

Thank you,
Shika Rathnasooriya , P.Eng.

Direct: 613 724-4081
Thakshika.Rathnasooriya@stantec.com

Stantec
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4

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Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

Stantec

SUBDIVISION:

HOLLAND CROSS

DATE: 8/12/2020
REVISION: 1
DESIGNED BY: WAJ
CHECKED BY:

SANITARY SEWER DESIGN SHEET

(City of Ottawa)

FILE NUMBER: 160410274

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**		**INDUSTRIAL (L)**		**INDUSTRIAL (H)**		**INSTITUTIONAL**		**GREEN / UNUSED**		**C+I+I**	**INFILTRATION**			**TOTAL**	**PIPE**								
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)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (L/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (L/s)	**FLOW** (L/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
SITE	BLDG	EX. TEE	0.360	24	66	115	132	645	0.360	645	3.91	8.18	0.000	0.000	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.00	0.360	0.360	0.12	8.30	16.1	250	PVC	SDR 35	1.00	60.6	**13.69%**	1.22	0.71
																													250							

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

Stantec

HOLLAND CROSS

DATE:	2020-05-28
REVISION:	1
DESIGNED BY:	WAJ
CHECKED BY:	

STORM SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: **160410274**

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	MANNING'S n =	0.013		BEDDING CLASS	B
b =	6.199	6.053	6.014	6.014	MINIMUM COVER:	2.00	m		
c =	0.810	0.814	0.816	0.820	TIME OF ENTRY	10	min		

LOCATION			DRAINAGE AREA																									PIPE SELECTION											
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)	$I_{2\text{-YEAR}}$ (mm/h)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$I_{100\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
BLDG, L101A, L102A	BLDG	EX. MH	0.130	0.00	0.00	0.00	0.14	0.82	0.00	0.00	0.00	0.107	0.107	0.000	0.000	0.000	0.000	0.000	0.000	10.00	76.81	104.19	122.14	178.56	6.3	6.3	29.1	6.6	200	200	CIRCULAR	PVC	SDR 28	1.00	33.3	**87.5%**	1.05	1.06	0.10
																				10.10									200	200									

C.2 RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160410274**
Project: **Holland Cross**
Date: **05-Aug-20**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table

Sub-catchment Area			**Area (ha) "A"**		**Runoff Coefficient "C"**	**"A x C"**		**Overall Runoff Coefficient**
Catchment Type	**ID / Description**							
Controlled - Tributary	L102A	Hard	0.071		0.9	0.064		
		Soft	0.009		0.2	0.002		
		Subtotal		0.08			0.0656	0.820
Controlled - Tributary	L101A	Hard	0.045		0.9	0.041		
		Soft	0.005		0.2	0.001		
		Subtotal		0.05			0.0415	0.830
Uncontrolled - Non-Tributary	UNC-1	Hard	0.008		0.9	0.007		
		Soft	0.012		0.2	0.002		
		Subtotal		0.02			0.0094	0.470
Roof	BLDG	Hard	0.140		0.9	0.126		
		Soft	0.000		0.2	0.000		
		Subtotal		0.14			0.126	0.900
Total				**0.290**			**0.243**	
Overall Runoff Coefficient= C:								**0.84**

Total Roof Areas	**0.140**	**ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.130**	**ha**
Total Tributary Area to Outlet	**0.270**	**ha**
Total Uncontrolled Areas (Non-Tributary)	**0.020**	**ha**
Total Site	**0.290**	**ha**

Stormwater Management Calculations

Project #160410274, Holland Cross
Modified Rational Method Calculatons for Storage

2 yr Intensity
City of Ottawa

I = a/(t + b)^c

		t (min)	I (mm/hr)
a =	732.951	10	76.81
b =	6.199	20	52.03
c =	0.81	30	40.04
		40	32.86
		50	28.04
		60	24.56
		70	21.91
		80	19.83
		90	18.14
		100	16.75
		110	15.57
		120	14.56

2 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.2900
C: 0.87

Typical Time of Concentration

tc (min)	I (2 yr) (mm/hr)	Qtarget (L/s)
10	76.81	**53.87**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L102A — Controlled - Tributary
Area (ha): 0.08
C: 0.82

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	14.01	27.00	0.00	**0.00**
20	52.03	9.49	27.00	0.00	**0.00**
30	40.04	7.30	27.00	0.00	**0.00**
40	32.86	5.99	27.00	0.00	**0.00**
50	28.04	5.11	27.00	0.00	**0.00**
60	24.56	4.48	27.00	0.00	**0.00**
70	21.91	4.00	27.00	0.00	**0.00**
80	19.83	3.62	27.00	0.00	**0.00**
90	18.14	3.31	27.00	0.00	**0.00**
100	16.75	3.05	27.00	0.00	**0.00**
110	15.57	2.84	27.00	0.00	**0.00**
120	14.56	2.66	27.00	0.00	**0.00**

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 108.00 mm
Invert Elevation 60.48 m
T/G Elevation 61.38 m
Max Ponding Depth 0.29 m
Downstream W/L 60.15 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	61.67	1.19	27.00	0.00	0.00	Adjust ICD

Subdrainage Area: L101A — Controlled - Tributary
Area (ha): 0.05
C: 0.83

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	8.86	10.50	0.00	**0.00**
20	52.03	6.00	10.50	0.00	**0.00**
30	40.04	4.62	10.50	0.00	**0.00**
40	32.86	3.79	10.50	0.00	**0.00**
50	28.04	3.24	10.50	0.00	**0.00**
60	24.56	2.83	10.50	0.00	**0.00**
70	21.91	2.53	10.50	0.00	**0.00**
80	19.83	2.29	10.50	0.00	**0.00**
90	18.14	2.09	10.50	0.00	**0.00**
100	16.75	1.93	10.50	0.00	**0.00**
110	15.57	1.80	10.50	0.00	**0.00**
120	14.56	1.68	10.50	0.00	**0.00**

Storage: Above CB

Orifice Equation: = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 108.00 mm
Invert Elevation 62.59 m
T/G Elevation 62.77 m
Max Ponding Depth 0.00 m
Downstream W/L 58.20 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
5-year Water Level	62.77	0.18	10.50	0.00	0.00	Adjust ICD

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.02
C: 0.47

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	2.01	2.01		
20	52.03	1.36	1.36		
30	40.04	1.05	1.05		
40	32.86	0.86	0.86		
50	28.04	0.73	0.73		
60	24.56	0.64	0.64		

Project #160410274, Holland Cross
Modified Rational Method Calculatons for Storage

100 yr Intensity
City of Ottawa

I = a/(t + b)^c

		t (min)	I (mm/hr)
a =	1735.688	10	178.56
b =	6.014	20	119.95
c =	0.820	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): 0.2900
C: 0.87

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: L102A — Controlled - Tributary
Area (ha): 0.08
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	39.71	27.00	12.71	**7.63**
20	119.95	26.68	27.00	0.00	0.00
30	91.87	20.43	27.00	0.00	0.00
40	75.15	16.71	27.00	0.00	0.00
50	63.95	14.22	27.00	0.00	0.00
60	55.89	12.43	27.00	0.00	0.00
70	49.79	11.07	27.00	0.00	0.00
80	44.99	10.01	27.00	0.00	0.00
90	41.11	9.14	27.00	0.00	0.00
100	37.90	8.43	27.00	0.00	0.00
110	35.20	7.83	27.00	0.00	0.00
120	32.89	7.32	27.00	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 108.00 mm
Invert Elevation 60.48 m
T/G Elevation 61.38 m
Max Ponding Depth 0.29 m
Downstream W/L 60.15 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	61.67	1.19	27.00	7.63	0.00	Adjust ICD
					-7.63	

Subdrainage Area: L101A — Controlled - Tributary
Area (ha): 0.05
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	24.82	10.50	14.32	**8.59**
20	119.95	16.67	10.50	6.17	7.41
30	91.87	12.77	10.50	2.27	4.08
40	75.15	10.45	10.50	0.00	0.00
50	63.95	8.89	10.50	0.00	0.00
60	55.89	7.77	10.50	0.00	0.00
70	49.79	6.92	10.50	0.00	0.00
80	44.99	6.25	10.50	0.00	0.00
90	41.11	5.71	10.50	0.00	0.00
100	37.90	5.27	10.50	0.00	0.00
110	35.20	4.89	10.50	0.00	0.00
120	32.89	4.57	10.50	0.00	0.00

Storage: Surface Storage Above CB

Orifice Equation: Q = CdA(2gh)^0.5 Where C = 0.61
Orifice Diameter: 108.00 mm
Invert Elevation 62.59 m
T/G Elevation 62.77 m
Max Ponding Depth 0.00 m
Downstream W/L 58.20 m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	62.77	0.18	10.50	8.59	0.00	Adjust ICD
					-8.59	

Subdrainage Area: UNC-1 — Uncontrolled - Non-Tributary
Area (ha): 0.02
C: 0.59

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	5.83	5.83		
20	119.95	3.92	3.92		
30	91.87	3.00	3.00		
40	75.15	2.45	2.45		
50	63.95	2.09	2.09		
60	55.89	1.83	1.83		

Stormwater Management Calculations

Project #160410274, Holland Cross
Modified Rational Method Calculatons for Storage

70	21.91	0.57	0.57
80	19.83	0.52	0.52
90	18.14	0.47	0.47
100	16.75	0.44	0.44
110	15.57	0.41	0.41
120	14.56	0.38	0.38

Subdrainage Area: BLDG　　Roof
Area (ha): 0.14　　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	76.81	26.90	4.16	22.74	13.65	92.3	0.33
20	52.03	18.23	4.47	13.75	16.50	99.8	0.25
30	40.04	14.03	4.63	9.40	**16.92**	100.5	0.12
40	32.86	11.51	4.70	6.81	16.34	99.4	0.01
50	28.04	9.82	4.73	5.09	15.27	96.5	-0.11
60	24.56	8.60	4.74	3.86	13.91	93.0	-0.23
70	21.91	7.68	4.73	2.94	12.37	89.0	-0.35
80	19.83	6.95	4.71	2.24	10.73	84.7	-0.46
90	18.14	6.36	4.68	1.68	9.05	80.3	-0.57
100	16.75	5.87	4.64	1.22	7.33	75.9	-0.67
110	15.57	5.45	4.61	0.85	5.60	67.9	-0.89
120	14.56	5.10	4.56	0.54	3.87	59.1	-1.12

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
5-year Water Level	100.52	0.10	4.75	16.92	56.00	0.20

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	0.270	ha				
Total 2yr Flow to Sewer	42.3	L/s	0	0	m^3	Ok
Non-Tributary Area	0.020	ha				
Total 2yr Flow Uncontrolled	2.0	L/s				
Total Area	0.290	ha				
Total 2yr Flow	44.3	L/s				
Target	53.9	L/s				

Project #160410274, Holland Cross
Modified Rational Method Calculatons for Storage

70	49.79	1.63	1.63
80	44.99	1.47	1.47
90	41.11	1.34	1.34
100	37.90	1.24	1.24
110	35.20	1.15	1.15
120	32.89	1.07	1.07

Subdrainage Area: BLDG　　Roof
Area (ha): 0.14　　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	69.50	5.72	63.78	38.27	131.2	0.00
20	119.95	46.68	6.07	40.62	48.74	142.3	0.00
30	91.87	35.76	6.21	29.54	53.17	147.0	0.00
40	75.15	29.25	6.28	22.97	55.12	149.1	0.00
50	63.95	24.89	6.30	18.59	**55.77**	149.8	0.00
60	55.89	21.75	6.30	15.46	55.65	149.6	0.00
70	49.79	19.38	6.28	13.10	55.03	149.0	0.00
80	44.99	17.51	6.24	11.27	54.08	148.0	0.00
90	41.11	16.00	6.21	9.80	52.89	146.7	0.00
100	37.90	14.75	6.16	8.59	51.55	145.3	0.00
110	35.20	13.70	6.11	7.59	50.09	143.7	0.00
120	32.89	12.80	6.06	6.74	48.55	142.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	149.76	0.15	6.30	55.77	56.00	0.00

SUMMARY TO OUTLET

			Vrequired	Vavailable*		
Tributary Area	0.270	ha				
Total 100yr Flow to Sewer	43.8	L/s	0	0	m^3	Ok
Non-Tributary Area	0.020	ha				
Total 100yr Flow Uncontrolled	5.8	L/s				
Total Area	0.290	ha				
Total 100yr Flow	49.6	L/s				
Target	53.9	L/s				

Project #160410274, Holland Cross
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	0.0016	0	0.025	31	0	0	0.025
0.050	0.0006	0.0032	2	0.050	124	2	2	0.050
0.075	0.0008	0.0039	7	0.075	280	5	7	0.075
0.100	0.0009	0.0047	17	0.100	498	10	17	0.100
0.125	0.0011	0.0055	32	0.125	778	16	32	0.125
0.150	0.0013	0.0063	56	0.150	1120	24	56	0.150

Drawdown Estimate

Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
1.8	575.3	1.8	0.15981
6.7	1249.2	4.9	0.50682
16.3	2027.3	9.6	1.06995
32.1	2864.8	15.8	1.86573
55.7	3739.5	23.6	2.90448

Rooftop Storage Summary

Total Building Area (sq.m)		1400
Assume Available Roof Area (sq.	80%	1120
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		5
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		56
Estimated 100 Year Drawdown Time (h)		2.9

* 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	0.75	**0.5**	0.25	Closed
0.025	0.3155	0.3155	**0.3155**	0.3155	0.3155
0.05	0.6309	0.6309	**0.6309**	0.6309	0.6309
0.075	0.9464	0.8675	**0.7886**	0.7098	0.6309
0.1	1.2618	1.1041	**0.9464**	0.7886	0.6309
0.125	1.5773	1.3407	**1.1041**	0.8675	0.6309
0.15	1.8927	1.5773	**1.2618**	0.9464	0.6309

Calculation Results	**5yr**	**100yr**	**Available**
Qresult (cu.m/s)	0.005	0.006	-
Depth (m)	0.101	0.150	0.150
Volume (cu.m)	16.9	55.8	56.0
Draintime (hrs)	1.1	2.9	

Appendix D GEOTECHNICAL INVESTIGATION

REPORT

Geotechnical Engineering Design Input Holland Cross Expansion

1560 Scott Street, Ottawa, Ontario

Submitted to:

Pomerleau
220-343 Preston Street
Ottawa, ON, K1S 1N4

Submitted by:

Golder Associates Ltd.
1931 Robertson Road,
Ottawa, Ontario, K2H 5B7

20141578

May 2020

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DRAWINGS

APPENDICES

Appendix A

1.0 INTRODUCTION

Golder Associates Ltd. (Golder) previously carried out a geotechnical desktop review as part of a Site Plan Agreement application to the City of Ottawa for the proposed expansion to the Holland Cross facility, located at 1560 Scott Street in Ottawa, Ontario. The results of that desktop review were provided in the Golder report dated December 2013 (Report Number 13-1121-0176).

The purpose of that previous report was to assess the subsurface conditions at the site by means of review of existing geotechnical information and, based on an interpretation of the factual information available, to provide preliminary engineering input on the geotechnical design aspects of the project, including comments on construction considerations which could influence design decisions. The foundation engineering guidelines provided in that previous report were consistent with the procedures outlined in the 2006 Ontario Building Code (OBC). At that time, the proposed expansion consisted of development of a 12 storey low-rise building with two basement/below grade levels.

It is understood that the proposed building design has subsequently been modified to comprise a 23 storey building, also with two basement/below grade levels.

The purpose of this report is to provide updated geotechnical recommendations in accordance with the current 2012 OBC to reflect the changes in the proposed design.

The reader is referred to the “Important Information and Limitations of This Report” which follows the text but forms an integral part of this document.

2.0 BACKGROUND INFORMATION

2.1 Site and Project Descriptions

Consideration is being given to the design and construction of a 23 storey building to be located at 1560 Scott Street in Ottawa, Ontario (see Key Plan, Figure 1).

The following is known about the existing property:

- The proposed building will be located in the southeast corner of an overall site that is bordered to the north by Scott Street, to the west by Holland Avenue, to the south by multi-storey residential buildings and to the east by Hamilton Avenue.
- The overall site measures about 140 m by 140 m in plan area and contains two 7 storey office buildings, one along the northern perimeter and one on the western perimeter border, and a 2 storey building in the southern part of the site. A single storey building covers most of the remainder of the site footprint.
- The existing facility in the area of the proposed 23 storey building consists of a low-rise building with two basement levels. These building areas will be demolished to allow for construction of the expansion.

The current development plans indicate:

- The proposed building footprint is identified on the Site Plan, see Figure 2.
- The proposed building will be 23 storeys in height and encompass a plan area of about 36 m by 47 m.
- Similar to the existing structure at the site, the proposed structure will have 2 basement/below-grade levels.

Additional details on finished floor slab levels were not available at the time of preparation of this report.

2.2 Available Subsurface Information

Previous subsurface investigations at or near the site were carried out by Golder, and also by McRostie Genest Middlemiss and Associates (McRostie) who have since joined Golder. The following reports were reviewed in the assessment of site conditions for this study, which include the investigations for the existing development:

1) Report to J.L. Richards & Associates Ltd. by Golder titled "*Geotechnical Investigation, Proposed Watermain and Sanitary Sewer Replacement, Holland Avenue, Scott Street to Tyndall Street, Ottawa, Ontario*" dated June 2012 (Report No. 11-1121-0281).

2) Letter to Laurnic Investments by McRostie titled "*Holland and Spencer Avenues, Beech Foundry Site, Rock Elevations*" dated June 6, 1984 (Report No. SF-2481).

3) Report to Citicom Inc., Brisbin Brooke Beynon, Architects and Carwood Leclair Inc. Consulting Engineers by McRostie titled "*Holland Cross Project, Holland Ave., Spencer St. & Scott St., Ottawa*" dated July 3, 1986 (Report No. SF-2687).

Golder also previously carried Vertical Seismic Profiling (VSP) geophysical testing on a nearby Tunney's Pasture site for Public Works and Government Services Canada in 2011 and that information has also been reviewed in preparation of this report.

Based on the available information, the subsurface conditions are anticipated to consist surficial fill material overlying glacial till and then by bedrock with the bedrock surface located at depths varying from about 0.5 to 2.8 m below the original ground surface.

Published bedrock geology mapping indicates that the site is underlain by dolomite and limestone of the Bobcaygeon Formation.

3.0 SUBSURFACE CONDITIONS

3.1 General

The approximate locations of the boreholes and test pits previously advanced at the site are identified on Figure 2. Relevant borehole and test pit records from the previous investigations by McRostie in the immediate vicinity of the proposed building are provided in Appendix A.

The following provides an overview of the subsurface conditions encountered in the test pits and boreholes previously advanced at the site followed by more detailed descriptions of the major soil strata and shallow groundwater conditions. It should be noted that the previous investigations pre-dated development of the site and, as such, the near surface conditions are anticipated to have been altered by the existing development (e.g., removal of materials to permit construction of the existing below-grade structures) including bedrock excavations.

In general, the subsurface conditions consist of up to approximately 2.8 m of surficial fill materials overlying limestone bedrock. Organic materials and/or glacial till deposits were present between the fill materials and bedrock at some locations on the site.

3.2 Surficial Fill Materials, Organic Material and Glacial Till

The records for the McRostie test pits and boreholes encountered a concrete slab at ground surface with a thickness ranging between about 60 to 150 mm in test pits numbered 2 to 11, inclusively. Topsoil was encountered in some test pits over the site ranging in thickness from about 200 to 300 mm. A layer of fill material was present underlying the concrete slab, topsoil or at surface, within or near the proposed building footprint; the fill extended to depths of up to about 2.3 m below the original ground surface (but was locally thinner). The past investigations generally describe the fill material as being comprised of a variety of materials including topsoil, sand, gravel, clay, bricks, wood, metal, concrete and other debris.

A 0.3 to 0.8 m thick organic layer was encountered at or near the proposed building footprint (i.e., in borehole 86-8 and at test pits N120/E120 and N150/E120) at depths of 0.40, 1.7 and 1.35 m below the ground surface, respectively.

The previous geotechnical investigations carried out on this site indicate that the fill and/or organic materials were underlain by glacial till at or near the proposed building footprint. The glacial till consists of a heterogeneous mixture of gravel, cobbles, and boulders in a silty sand matrix.

As the proposed building footprint currently contains two below grade levels, it is anticipated that the most if not all of the above noted materials were removed during construction of the existing building.

3.3 Bedrock

The near surface materials described above are underlain by bedrock. Records for the McRostie boreholes indicate that limestone bedrock was encountered at depths ranging between 0.52 and 2.8 m below ground surface (Elevation 59.6 to 61.2 m) within the overall site. At test pits and boreholes advanced within or near the footprint of the proposed tower, the bedrock surface was encountered at elevations of about 59.8 to 61.0 m.

The upper portion of the rock was noted to be slightly weathered and soil filled seams within the bedrock were identified in the core drilling program.

3.4 Groundwater

The existing groundwater data indicates that, at least seasonally, the groundwater level was near ground surface. Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring, and during and following periods of sustained precipitation.

However, it is noted that the groundwater levels at this site have likely been altered as a result of the existing development (e.g., current water levels are anticipated to be influenced by existing building drainage systems).

4.0 DISCUSSION

4.1 General

This section of the report provides preliminary engineering input on the geotechnical design aspects of the proposed development, based on our interpretation of available information described herein and the project requirements.

The foundation engineering guidelines presented in this section of the report have been developed in a manner consistent with the procedures outlined in 2012 OBC for Limit States Design.

4.2 Excavations

Details on the finished floor elevations for the proposed building were not available at the time of preparation of this report. However, it is understood that the proposed building will be constructed within a portion of the existing building footprint which contains two below-grade levels and which will be demolished prior to construction of the new building. The proposed building will also incorporate two below-grade levels. As the proposed and existing buildings both have two underground levels, it is anticipated that excavations will be limited primarily to new footing areas.

The available subsurface information suggests that the bedrock surface in the immediate vicinity of the proposed building was located at shallow depth (i.e., at depths ranging between about 1.6 and 2.5 m below ground surface at the time of the previous investigations). The founding levels for new building foundations are therefore expected to be within limestone bedrock.

In general, the subsurface conditions on this site consisted of topsoil and fill overlying glacial till, with the bedrock surface located at depths varying from about 1.6 to 2.5 m below the ground surface at the time of the previous investigations. In accordance with the Occupational Health and Safety Act (OHSA) of Ontario, the soils above the water table at this site would generally be classified as Type 3 soils and side slopes in the overburden *above the water table* may therefore be sloped at a minimum of 1H:1V. However, in accordance with the OHSA of Ontario, the soils below the water table would generally be classified as Type 4 soils, and excavation side slopes must be sloped at a minimum of 3H:1V if dewatering of these materials is not carried out. This condition is not, however, anticipated to exist.

Depending on the final excavation geometry, some shoring/temporary support may be needed for the excavation adjacent to the loading dock facility located immediately north of the proposed building and/or adjacent to Hamilton Avenue to prevent undermining of the roadways.

It is expected that near vertical walls may be developed in the bedrock for the shallow excavations needed for new footing construction. However, the exposed bedrock should be inspected by qualified geotechnical personnel at the time of excavation to confirm this assessment.

Similarly, if/where the existing foundation walls are removed; vertical bedrock excavation walls are anticipated to be feasible.

Shallow depths of bedrock removal for this project, such as those required for localized excavations for footings, could be accomplished using mechanical methods (such as hoe ramming in conjunction with line drilling).
Care will need to be taken to protect the adjacent structures/foundations from damage during bedrock excavation. It is expected/assumed that blasting will not be required.

It is assumed that there is an existing drainage system below the existing building floor slab which has lowered the groundwater level to below the base of the existing building. Provided that the bulk excavation for the new building does not extend substantially below the current below-grade building levels, groundwater inflow into the foundation excavations can probably be handled by pumping from properly constructed and filtered sumps located within the excavations.

4.3 Foundations

It is understood that the proposed building will have two basement levels. It is expected that the excavation will extend about 1 to 2 m below the basement floor level to accommodate footing construction. At these levels, new building foundations are expected to be founded within limestone bedrock.

For initial assessment purposes, it is expected that footings founded on or within the competent limestone bedrock would be sized using an Ultimate Limit States (ULS) factored bearing resistance in the range of 2 to 4 MPa; additional site-specific investigation will be required prior to detailed design to further assess and optimize design bearing pressures.

Provided the bedrock surface is acceptably cleaned of loose or broken bedrock, the settlement of footings at the corresponding service (unfactored) load is considered negligible therefore the SLS condition will not govern the design.

The ultimate resistance of the footings to lateral loading may be calculated using an ULS friction value of 0.7 (unfactored) across the interface between the footing and the bedrock. If greater resistance is required, the footings could be provided with shear keys or prestressed rock anchors could be used to increase the normal stress level across the interface. Further guidance on this issue can be provided, if required.

The available information from previous investigations at the site typically does not include detailed descriptions of bedrock weathering conditions but did identify the presence of soil filled seams within the bedrock. Based on these conditions, it is recommended that probe holes (50 mm diameter drilled holes) be advanced within the footing areas to depths of about 2 m below founding level. These probe holes should be inspected by the geotechnical engineer and would be used to confirm that the weathered bedrock has been entirely removed and no soil filled seams are present beneath the footings. Contract drawings should include provision for making variations in footing sizes or founding elevations in the event that weathered or other poor quality rock or soil infilled seams are encountered.

4.4 Seismic Design

The seismic design provisions of the 2012 OBC depend, in part, on the shear wave velocity of the upper 30 m of soil and/or rock below founding level.

Site specific shear wave velocity profiling, using the Vertical Seismic Profiling (VSP) method (down-hole geophysical method), was carried out in a borehole on an adjacent Tunney's Pasture site for Public Works and Government Services Canada in 2011.

A review of the borehole information indicates that both sites are underlain by similar overburden conditions (i.e., less than about 1 m of fill material) and similar bedrock conditions (i.e., limestone of the Bobcaygeon Formation). The results of the nearby VSP testing would therefore also be applicable to this site as permitted by the OBC. The results of the VSP testing indicated an average shear-wave velocity for the bedrock of 2,200 m/s. As such, this site can be assigned a Seismic Site Class A.

4.5 Basement Floor Slab

In preparation for the construction of the basement floor slab, all loose, wet, and disturbed material should be removed from beneath the floor slab. The feasibility of reusing existing underslab granular fill materials can also be evaluated.

Provision should be made for at least 300 mm of 16 mm clear crushed stone to form the base of the floor slab. To prevent hydrostatic pressure build up beneath the floor slab, it is suggested that the granular base for the floor slab be drained. This should be achieved by installing rigid 100 mm diameter perforated pipes in the floor slab bedding at 6 m centres. The perforated pipes should discharge to a positive outlet such as a storm sewer or a sump from which the water is pumped.

If or where an asphalt surface will be provided for the basement level, a thickness of at least 150 mm of OPSS Granular A base materials should be provided above the clear stone. The Granular A should be compacted to at least 100 percent of the material's Standard Proctor Maximum Dry Density (SPMDD).

4.6 Frost Protection

All perimeter and exterior foundation elements or interior foundation elements in unheated areas should be provided with a minimum of 1.5 m of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 m of earth cover.

It is expected that these requirements will be satisfied for all of the structure footings due to the deep founding levels required to accommodate the below-grade parking.

4.7 Basement Walls

The backfill and drainage requirements for basement walls, as well as the lateral earth pressures will depend on the type of excavation that is made to construct the basement levels.

The following sections assume that water-tight construction will not be required. If it is determined that water-tight construction is needed, additional design guidelines will be required.

4.7.1 Open Cut Excavations

The soils at this site are frost susceptible and should not be used as backfill against exterior, unheated, or well insulated foundation elements within the depth of potential frost penetration (1.5 m) to avoid problems with frost adhesion and heaving. Free draining backfill materials are also required if hydrostatic water pressure against the basement walls (and potential leakage) is to be avoided. The foundation and basement walls therefore should be backfilled with non-frost susceptible sand or sand and gravel conforming to the requirements for OPSS Granular B Type I.

To avoid ground settlements around the basement walls which could affect site grading and drainage, all of the backfill materials should be placed in 0.3 m thick lifts and compacted to at least 95 percent of the material's SPMDD.

The basement wall backfill should be drained by means of a perforated pipe subdrain in a surround of 19 mm clear stone, fully wrapped in a geotextile, which leads by positive drainage to a storm sewer or to a sump from which the water is pumped.

4.7.2 Excavations in Bedrock

Where basement walls will be poured against bedrock, vertical drainage such as Miradrain or equivalent must be installed on the face of the bedrock to provide the necessary drainage. The top edge of the vertical drainage should be sealed or covered with a geotextile to prevent the loss of soil into the void between the sheet and geotextile of the drainage system.

Where the basement walls will be constructed using formwork, it will be necessary to backfill a narrow gallery with free draining backfill between the shoring or bedrock face and the outside of the walls. The backfill should consist of 6 mm clear stone ‘chip’, placed by a stone slinger or chute.

In no case should the clear stone chip be placed in direct contact with other soils. For example, surface landscaping or backfill soils placed near the top of the clear stone back fill should be separated from the clear stone with a geotextile.

Both the drain pipe for the wall backfill and/or the drainage system should be connected to a perimeter drain at the base of the excavation which is connected to a sump pump.

4.7.3 Lateral Earth Pressures

It is considered that three design conditions exist with regards to the lateral earth pressures that will be exerted on the basement walls:

1) Walls cast directly against the bedrock face.
2) Walls cast against formwork with a narrow backfilled gallery provided between the basement wall and the adjacent excavation bedrock face.
3) Walls cast against formwork with a wide backfilled gallery provided between the basement wall and the adjacent excavation face.

For Case 1 there will be no effective lateral earth pressures on the basement wall under static conditions.

For Case 2, the magnitude of the lateral earth pressure depends on the magnitude of the arching which can develop in the backfill and therefore depends on the width of the backfill, its angle of internal friction, as well as the interface friction angles between the backfill and both the rock face and the basement wall. The magnitude of the lateral earth pressure can be calculated as:

$$\sigma_h(z) = \frac{\gamma B}{2\,tan\,\delta}\left(1 - e^{-2K\frac{z}{B}tan\,\delta}\right) + \,K\,q$$

Where: $\sigma_h(z)$ = Lateral earth pressure on the basement wall at depth z, in kPa;

K = Earth pressure coefficient, use 0.6;

γ = Unit weight of retained soil, use 20 kN/m^3 for clear stone chip;

B = Width of backfill (between basement wall and bedrock face), m;

δ = Average interface friction angle at backfill-basement wall and backfill-rock face interfaces, use 15°;

z = Depth below top of formwork, m; and,

q = Uniform surcharge at ground surface to account for traffic, equipment, or stock piled materials (use 15 kPa).

For Case 3, the basement walls should be designed to resist lateral earth pressures calculated as:

$$\sigma_h(z) = K_o\,(\gamma z + q)$$

Where: $\sigma_h(z)$ = Lateral earth pressure on the wall at depth z, in kPa;

K_o = At-rest earth pressure coefficient, use 0.5;

γ = Unit weight of retained soil, use 22 kN/m^3;

z = Depth below top of wall, m; and,

Conventional damp proofing of the basement walls is appropriate with the above design approach. For concrete walls poured against shoring or bedrock, damp proofing using a crystalline barrier such as Crystal Lok, Xypex or equivalent could be used. The use of a concrete additive that provides reduced permeability could also be considered.

For all cases, hydrostatic groundwater pressures would also need to be considered if the structure is designed to be water-tight.

The lateral earth pressures acting on the below-grade walls as a result of seismic events will be highly dependent on the backfill types and methods. For Case 3, the lateral earth pressures noted above would increase under seismic loading conditions. The earthquake-induced dynamic pressure distribution, which is to be added to the static earth pressure distribution, is a linear distribution with maximum pressure at the top of the wall and minimum pressure at its toe (i.e., an inverted triangular pressure distribution).

The combined pressure distribution (static plus seismic) may be determined as follows:

$$\sigma_h(z) = K_o\,\gamma\,z + (K_{AE} - K_A)\,\gamma\,(H\text{-}z);\ \text{non-yielding walls}$$

Where: K_{AE} = The seismic earth pressure coefficient, use 0.42;

K_a = The static active earth pressure coefficient

H = The total depth to the bottom of the foundation wall (m).

For the other backfill design conditions, design lateral pressures resulting from seismic loading should be assessed during the next design stage once further details on building and backfill configuration are available.

Hydrodynamic groundwater pressures would also need to be considered if the structure is designed to be water-tight. However, more sophisticated analyses may need to be carried out at the detailed design stage.

All of the lateral earth pressure equations are given in an unfactored format and will need to be factored for Limit States Design purposes.

It has been assumed that the underground parking levels will be maintained at minimum temperatures but will not be permitted to freeze. If these areas are to be unheated, additional guidelines for the design of the basement walls and foundations will be required.

In areas where pavement or other hard surfacing will abut the building, differential frost heaving could occur between the granular fill immediately adjacent to the building and the more frost susceptible backfill placed beyond the wall backfill. To reduce the severity of this differential heaving, the backfill adjacent to the wall should be placed to form a frost taper. The frost taper should be brought up to pavement subgrade level from 1.5 m below finished exterior grade at a slope of 3 horizontal to 1 vertical, or flatter, away from the wall. The granular fill should be placed in maximum 300 mm thick lifts and should be compacted to at least 95 percent of the material's SPMDD using suitable vibratory compaction equipment.

4.8 Impacts on Adjacent Development

Possible impacts on adjacent developments could result from:

- Ground movement around the perimeter of the excavation.
- Ground settlements due to the planned temporary and permanent groundwater level lowering, if sensitive and compressible clay soils exist within the expected zone of influence of the groundwater level lowering (which, as discussed below, it not the case for this development).

A preconstruction survey of all structures located within close proximity to this site should be carried out prior to commencement of the excavation.

The structures that are mostly at risk of being impacted by ground movements associated with construction of the new building are the portions of the existing structure that are located immediately adjacent to the excavation (e.g., the parkade structure ramps to the south and the single storey building located in the central portion of the site. It is understood that these structures also contain two below-grade levels and are anticipated to be supported on spread footings on bedrock.

As a general guideline for excavation planning, the excavation for the new structure should not come within 0.5 m of the edge of the footings of the existing buildings. To avoid undermining of the rock and/or disturbance of the rock, careful line drilling of the excavation limits in this area must be undertaken.

Given the relatively shallow depth of additional bedrock excavation, no rock reinforcement is anticipated to be required for this excavation. However, the exposed bedrock should be inspected by qualified geotechnical personnel at the time of excavation to confirm that assessment particularly in areas where excavations will be developed in close proximity to existing foundations.

Temporary and permanent groundwater level lowering would be an issue with regards to surrounding ground settlements if sensitive and compressible clay soils exist within the expected zone of influence of the groundwater level lowering (both during construction and in the long term due to the foundation drainage system). It is noted that the lowest level of the new structure is expected to be at or close to the lowest level of the existing structure; therefore, provided similar drainage systems are used for the new building, the construction of this building is not anticipated to result in a significant permanent groundwater lowering compared to existing conditions. Furthermore, the review of information from investigations at and nearby the site as well as published geologic mapping does not indicate that compressible soils are present near this zone. Based on these conditions, groundwater level lowering will not be an issue with regards to ground settlements due to overstressing sensitive and compressible clay soils.

4.9 Environmental Considerations

The site is located in an area of the City that is known to contain contaminated groundwater; therefore, the development of deep excavations or the installation of dewatering systems that could cause substantial changes to groundwater flow patterns (either during construction or in the long term) should be avoided.

5.0 ADDITIONAL CONSIDERATIONS

Additional site specific investigation will be required prior to finalising the design of the building in order to more accurately assess the bedrock characteristics immediately beneath the building footprint; this information would be used as input to geotechnical aspects of detailed design (e.g., confirming design bearing pressures for foundations, providing information for use in assessing rock anchors that could be required to resist seismic loading, etc.).

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that bedrock having adequate bearing capacity has been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction viewpoint.

Pumping from the excavation will result in groundwater flow from the surrounding properties towards this site. Therefore, groundwater contamination beneath adjacent properties, if present, could be drawn towards this site. If any such pumping is planned, additional chemical testing should be carried out prior to construction to determine the groundwater quality so that disposal requirements can be confirmed. The inflow of contaminated groundwater during construction could result in increased groundwater disposal costs.

At the time of the writing of this report, only preliminary details for the proposed development were available. Golder should be retained to review the detailed drawings and specifications for this project prior to tendering to ensure that the guidelines in this report have been adequately interpreted.

6.0 CLOSURE

We trust this report meets with your current requirements. If you have any questions regarding this report, please contact the undersigned.

Golder Associates Ltd.

LICENSED PROFESSIONAL ENGINEER
K. T. C. POWER
100130652
2020/05/04
PROVINCE OF ONTARIO

Matt

Kenton Power, P.Eng., MASc.
Geotechnical Engineer

Matt Kennedy, M.Sc.(Eng.), P.Eng.
Senior Geotechnical Engineer

KCP/MJK/hdw

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https://golderassociates.sharepoint.com/sites/125056/project files/6 deliverables pomerleau/20141578-rev0-holland cross 0405_20.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

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Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client, **Pomerleau.** The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder cannot be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

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The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder cannot be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

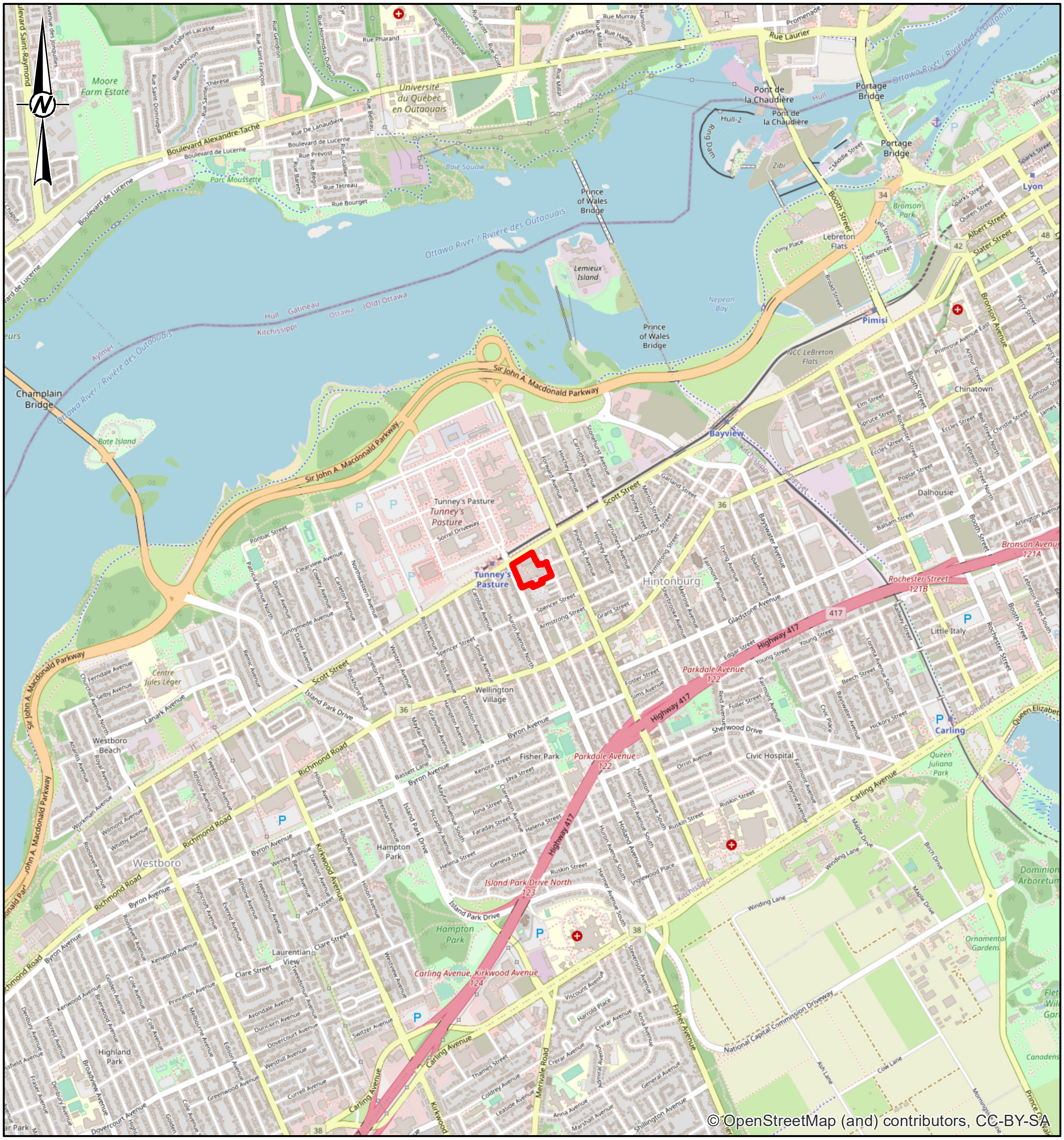
Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.



LEGEND

🟥 STUDY AREA

0	250	500	1,000

1:25,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE

REFERENCE(S)

1. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83
COORDINATE SYSTEM: MTM ZONE 9 VERTICAL DATUM: CGVD28

CLIENT
POMERLEAU

PROJECT
HOLLAND CROSS EXPANSION
OTTAWA, ONTARIO

TITLE
KEY PLAN

CONSULTANT

GOLDER

YYYY-MM-DD	2020-04-13
DESIGNED	----
PREPARED	BR/JEM
REVIEWED	KCP
APPROVED	MJK

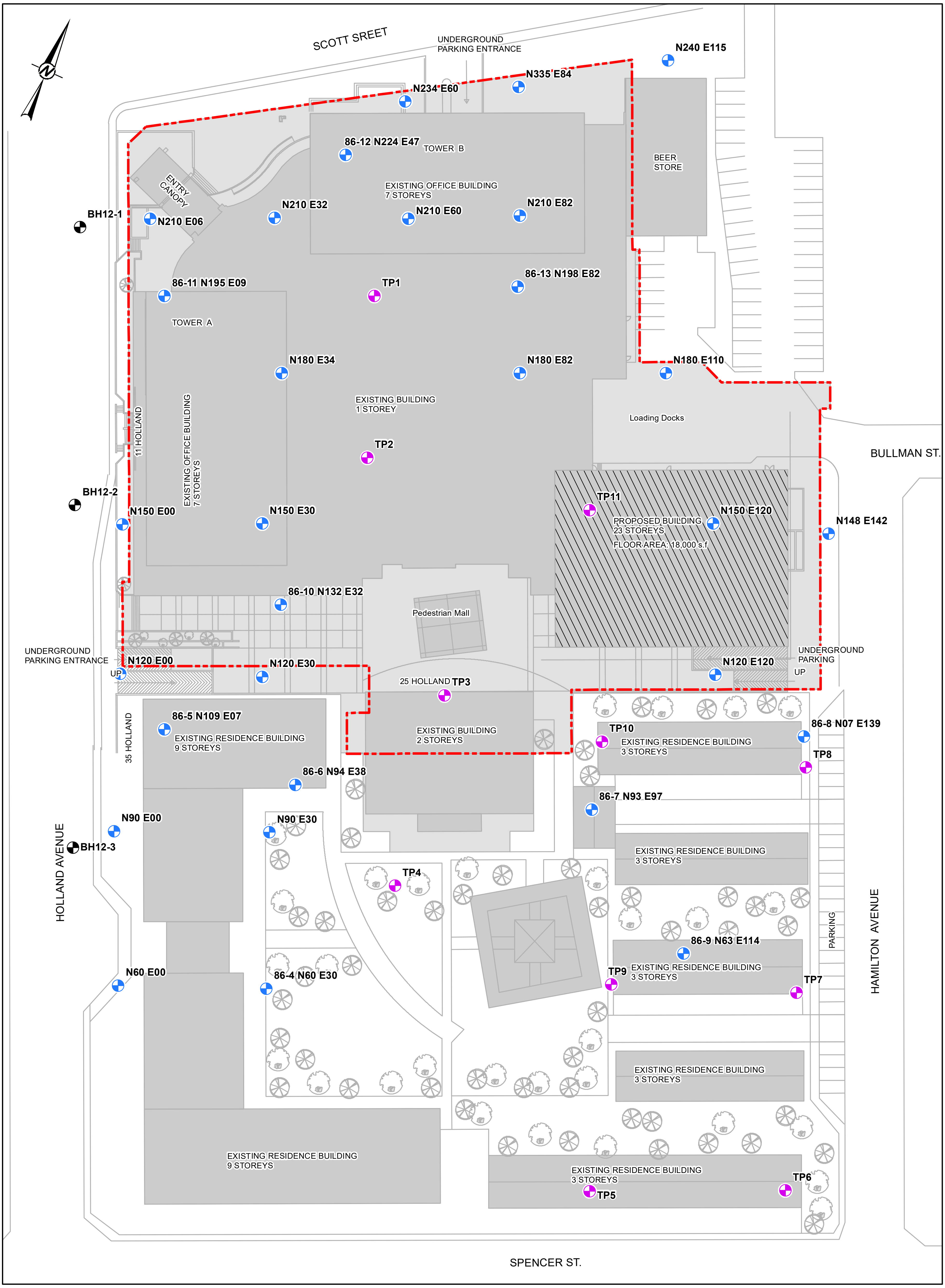
PROJECT NO.	CONTROL	REV.	FIGURE
20141578	0001	0	1

Path: N:\Active\Spatial_IM\Pomerleau\Holland_Cross\99_PROJ\20141578_Pomerleau_Geotech\0001_Geotech_Investigation\20141578-0001-BG-0001.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

25mm

0



LEGEND

- ◐ EXISTING BOREHOLE/TEST PIT - PREVIOUS INVESTIGATION 11-1121-0281 (GOLDER) (NOT TO SCALE=APPROXIMATE LOCATIONS)
- ◐ EXISTING BOREHOLE/TEST PIT - PREVIOUS INVESTIGATION SF2481 (MCROSTIE GENEST MIDDLEMISS)
- ◐ EXISTING BOREHOLE/TEST PIT - PREVIOUS INVESTIGATION SF2687 (MCROSTIE GENEST MIDDLEMISS)
- ▭ EXISTING BUILDINGS
- ▨ PROPOSED BUILDING
- ⬚ STUDY AREA

0 10 20 40

1:750 METRES

REFERENCE(S)

1. BASE CAD PLAN "SITEPLAN TO COLONNADE (26, JULY 2013).DWG" PROVIDED BY COLONNADE DEVELOPMENT INC.
2. PROJECTION: TRANSVERSE MERCATOR, DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

CLIENT
POMERLEAU

PROJECT
HOLLAND CROSS EXPANSION
OTTAWA, ONTARIO

CONSULTANT

GOLDER

YYYY-MM-DD	2020-04-13
DESIGNED	----
PREPARED	BR/JEM
REVIEWED	KCP
APPROVED	MJK

TITLE
SITE PLAN

PROJECT NO.	CONTROL	REV.	FIGURE
20141578	0001	0	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

APPENDIX A

Borehole and Test Pit Records
Previous Investigation
(McRostie Genest Middlemiss & Associates Ltd.,
Report No. SF-2687)

McROSTIE GENEST MIDDLEMISS
& ASSOCIATES LTD. & ASSOCIÉS LTÉE
CONSULTING ENGINEERS - INGÉNIEURS CONSEILS
OTTAWA CANADA

SOIL PROFILE & TEST SUMMARIES
PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

Holland and Spencer

SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.03 m DATE May 26 & June 2,86

NOTES See Plate No. 2

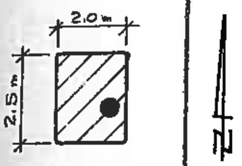
HOLE / FORAGE No. & Test Pit 86-4
N 60 E 30

DEPTH IN METRES / PROFONDEUR - METRES

Small Scale Penetrometer kPa / Petit Pénétromètre kPa

Essai - Standard Pénétration Blows - Coups / 30cm

SAMPLE / ÉCHANTILLON No.



water at El. 60.73 →

Bottom of pit →

DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES - PROFONDEUR - METRES	ELEVATION m / NIVEAU m
Ground Surface - Niveau du Sol	0	62.03
FILL - sand gravel metal wood concrete & brick	1.00	61.03
	2.20	59.83
LIMESTONE core recovery 98%	2.95	59.08
LIMESTONE core recovery 99%	3.94	58.09
LIMESTONE core recovery 100%	4.36	57.67
LIMESTONE core recovery 100%	5.64	56.39
LIMESTONE core recovery 100%	6.91	55.12
LIMESTONE core recovery 100%	7.20	54.93

Bottom of hole

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ______ Hammer
Chute Libre ______ Drop
No Casing - Sans Tubage
Barre ______ Dia. Rod

~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups / 30 cm ou Résistance au Cisaillement (kPa)~~

← water level June 4,86 El. 60.83

0 25 50 75 100

WATER CONTENT / % TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY, CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

PLATE / PLAQUE No. 6

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Holland and Spencer

SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO): 61.62 m

DATE: May 28 & June 4,86

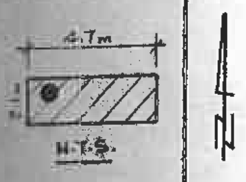
NOTES: See Plate No. 2

HOLE / FORAGE No. & Test Pit 86-5
N 109 E 7

~~Probing or Vane Test~~ ~~Sondage au Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~



Depth in metres / Profondeur en mètres	Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	Sample No. / Échantillon	Description of soil / du sol	Depth in metres / Profondeur - mètres	Elevation m / Niveau m	
				Ground Surface - Niveau du Sol	0	61.62	
1				FILL - sand gravel & topsoil with some crushed stone brick & wood & a little metal & ashes	1.00	60.62	
2	water seepage at	El. 59.62 →					
	Bottom of pit				2.30	59.32	
				LIMESTONE core recovery 98%	2.82	58.80	← water level June 9,86 El. 58.77
3	seam at	El. 58.35 →		LIMESTONE core recovery 96%	3.27	58.35	
	seam at seam at	El. 58.05 El. 58.02		core recovery 97%	3.61	58.01	
4	seam at	El. 57.01 →		LIMESTONE core recovery 99%	4.61	57.01	
5				LIMESTONE core recovery 100%	5.84	55.78	
				core recovery 100%	5.93	55.69	
6	seam at	El. 54.90 →		LIMESTONE core recovery 100%	6.72	54.90	
7				LIMESTONE core recovery 100%	7.33	54.29	
				Bottom of hole			

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ○
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

R: REMOULDED - REMANIÉ
CR: CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR: NO RECOVERY - NON RÉCUPÉRÉ

PLATE / PLAQUE No. 7

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Holland and Spencer

SF2687

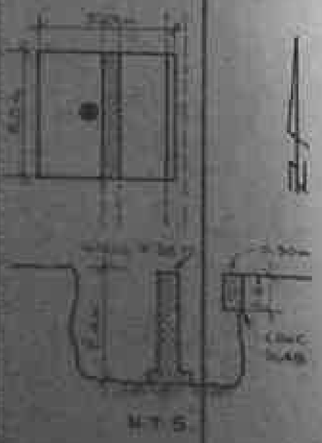
ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.21 m

DATE May 27 & June 3,86

NOTES See Plate No. 2

HOLE / FORAGE No. & Test Pit 86-6
N. 94 E38

SAMPLE / ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL Ground Surface - Niveau du Sol	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
		0	62.21
	FILL - sand gravel ashes brick wood and boulders up to 0.60 m dia.	1.00	61.21
	Bottom of pit	2.40	59.81
	LIMESTONE core recovery 97%	3.80	58.41
	LIMESTONE core recovery 98%	5.32	56.89
	LIMESTONE core recovery 100%	6.82	55.39
	LIMESTONE core recovery 100%	7.35	54.86
	Bottom of hole		



Probing or Vane Test / Sondage ou Essai au Scissomètre
Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod
Blows / 30 cm or Shear Strength (kPa)
Coups / 30 cm ou Résistance au Cisaillement (kPa)

overnight water level
El. 60.73

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ○
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ☐
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

PLATE / PLAQUE No. 8

[illegible] NON RÉCUPÉRÉ

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.41 m DATE May 27 & June 4,86

NOTES See Plate No. 2

HOLE / FORAGE & Test Pit No. 86-7, cont'
N 93 E 97

DEPTH IN METRES / PROFONDEUR - MÈTRES	[illegible]	[illegible]	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL ~~Ground Surface - Niveau du Sol~~	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATON m / NIVEAU m
					7.00	55.41
				core recovery 99%	7.37	55.04
				LIMESTONE		
8	1cm seam at El. 54.59 →			core recovery 94%	7.83	54.58
				Bottom of hole		
9						
10						
11						
12						
13						
14						

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups / 30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

PLATE / PLAQUE No. 9

RE = REMOULDED - REMANIÉ
CR = CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 62.41 m DATE May 27 & June 4,86

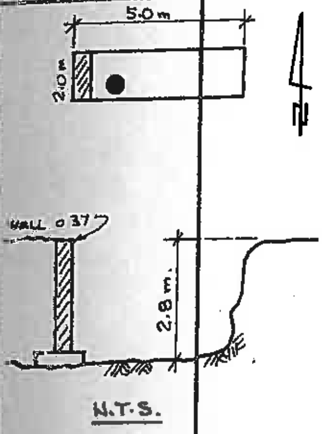
NOTES See Plate NO. 2

HOLE FORAGE & Test Pit No. 86-7
N 93 E 97

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~



Small Scale Penetrometer kPa Petit Pénétromètre kPa	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m	WATER CONTENT % TENEUR EN EAU
		Ground Surface - Niveau du Sol	0	62.41	
		FILL - sand brick metal concrete blocks rubber broken rock & a few large pieces of concrete	1.00	61.41	
			2.00	60.41	water level June 9, 86 El. 60.33
bottom of pit →		LIMESTONE	2.80	59.61	
1cm seam at El.59.32 →		core recovery 100%	3.09	59.32	
		LIMESTONE core recovery 100%			
seam at El. 57.71 →			4.70	57.71	
		LIMESTONE core recovery 100%	5.96	56.45	
7cm soft drilling at El. 56.33 → 1cm soft drilling at El. 56.23 →		LIMESTONE	7.00	55.41	
		Borehole continued			

0 25 50 75 100

R: REMOULDED - REMANIÉ
CR: CORE RECOVERY, CAROTTE RECUPÉRÉE
NR: NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT % TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

PLATE PLAQUE No. 10

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.67 m

DATE May 27 & June 3,86

NOTES See Plate No. 2

HOLE / FORAGE No. & Test Pit 86-8
N 107 E 139

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

Essai - Standard Pénétration Blows - Coups / 30 cm

SAMPLE / ÉCHANTILLON No.

M.T.S.

DEPTH IN METRES / PROFONDEUR - MÈTRES		DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m	
		Ground Surface - Niveau du Sol	0	61.67	
		FILL - crushed stone	0.15	61.52	
		FILL - fine sand & ashes	0.40	61.27	← overnight water level El. 61.27
	Bottom of pit →	ORGANIC material	0.72	60.95	
		LIMESTONE core recovery 91%	0.97	60.70	
1		LIMESTONE core recovery 100%	1.73	59.94	
2		LIMESTONE core recovery 100%	2.14	59.53	
		LIMESTONE core recovery 94%	2.52	59.15	
3, 4		LIMESTONE core recovery 100%	4.14	57.53	
5, 6	Seam at El.56.38 →	LIMESTONE core recovery 99%	5.78	55.89	
		↑ Bottom of hole			
7					

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ——— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ ——— △

PLATE / PLAQUE No. 11

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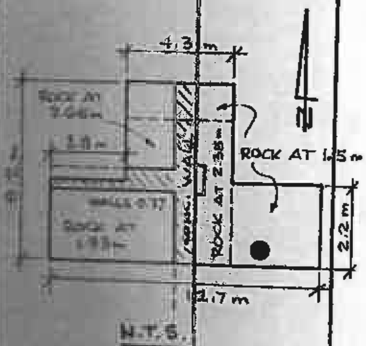
ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.06 m DATE May 27 & June 3,86

NOTES See Plate No. 2

HOLE / FORAGE No. & Test pit 86-9
N 63 E 114

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~
Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod
~~Blows/30 cm or Shear Strength (kPa)~~ ~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES / PROFONDEUR MÈTRES	Small Scale Penetrometer kPa / Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE / ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL Ground Surface - Niveau du Sol	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m	
					0	62.06	
				FILL - sand gravel boulders brick broken rock wood metal & ashes			
	bottom of pit →				1.50	60.56	
				LIMESTONE core recovery 100%			
	3cm seam at El. 60.24 →				1.82	60.24	
				core recovery 80%	1.90	60.16	← overnight water level El. 60.08
				LIMESTONE			
	1cm seam at El. 59.88 →			core recovery 81%	2.26	59.80	
				LIMESTONE core recovery 100%	3.52	58.54	
				LIMESTONE core recovery 100%	4.52	57.54	
	seam at El. 56.27 →			LIMESTONE core recovery 100%	5.79	56.27	
				LIMESTONE core recovery 95%	6.60	55.46	
				Bottom of hole			



0 25 50 75 100

RM = REMOULDED - REMANIÉ
CR = CORE RECOVERY / CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉE

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE —— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ —— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ —— △

PLATE / PLAQUE No. 12

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.96 m DATE May 28 & June 4,86

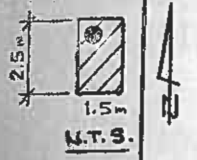
NOTES See Plate No. 2

HOLE / FORAGE No. & Test Pit 86-10
N 132 E 30

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~



	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
	Ground Surface - Niveau du Sol	0	61.96
	FILL - crushed stone	0.10	61.86
	FILL - sand & gravel with some ashes coal metal & wood		
Bottom of pit →	LIMESTONE	1.07	60.89
seam at El. 60.61 →	core recovery 80%	1.27	60.69
	core recovery 100%	1.50	60.46
	core recovery 100%	1.60	60.36
seam at El. 60.20 →	core recovery 100%	1.80	60.16
seam at El. 60.08 →	core recovery 100%	1.90	60.06
		3.00	58.96
	LIMESTONE	4.00	57.96
		5.00	56.96
seam at El. 56.19 →	core recovery 99%	5.77	56.19
	LIMESTONE core recovery 100%	6.57	55.39
	Bottom of hole		

water level June 9,86
El. 58.90

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU

NATURAL / NATURELLE ———— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ —— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ — △

PLATE / PLAQUE No. 13

R: REMOULDED - REMANIÉ
CR: CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR: NO RECOVERY - NON RÉCUPÉRÉ

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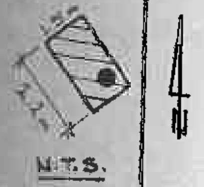
ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO): 61.73 m

DATE: May 28 & June 3,86

NOTES: See Plate No. 2

HOLE / FORAGE No. & Test Pit 86-11
N 195 E 9

	Essai - Standard Pénétration Blows - Coups / 30 cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
			Ground Surface - Niveau du Sol	0	61.73
	ASPHALT		FILL - crushed stone	0.08	61.65
			FILL - sand & ashes with some metal wood & pieces of electric wire	0.20	61.53
	Bottom of pit			1.15	60.58
all water lost at El.60.08			LIMESTONE core recovery 95%	2.66	59.07
			LIMESTONE core recovery 100%	4.16	57.57
			LIMESTONE core recovery 93%	5.68	56.05
			LIMESTONE core recovery 100%	6.20	55.53
			Bottom of hole		



~~Probing or Vane Test~~ ~~Sondage au Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

← overnight water level El. 59.69

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ——— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ ——— △

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

PLATE / PLAQUE No. 14

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO): 61.67 m
DATE: May 30 & June 2,86
NOTES: See Plate No. 2

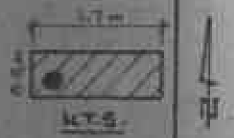
HOLE / FORAGE No. & Test Pit 86-12
N 224 E 47

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

[illegible]	[illegible]	[illegible] Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL Ground Surface - Niveau du Sol	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
				FILL sand & crushed stone with a trace of metal & ashes	0	61.67
	Bottom of pit →				0.52	61.15
				LIMESTONE core recovery 54%	1.02	60.65
				LIMESTONE core recovery 60%	2.52	59.15
all water lost at El.57.44 all water returning at El.57.45				LIMESTONE core recovery 91%	4.02	57.65
				LIMESTONE core recovery 85% Bottom of hole	5.57	56.10



←water level June 4,86
El. 58.86

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ———— ○
LIQUID LIMIT / LIMITE DE LIQUIDITÉ —— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ —— △

PLATE / PLAQUE No. 15

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 61.73 m DATE May 30 & June 4,86

NOTES See Plate No. 2

HOLE FORAGE No. & Test Pit 86-13 86-13A
N 198 E 82

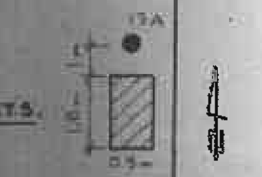
~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau __________ Hammer
Chute Libre __________ Drop
No Casing - Sans Tubage
Barre __________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30cm ou Résistance au Cisaillement (kPa)~~

SAMPLE ÉCHANTILLON No.

Zesti - Standard Pénétration Blows - Coups / 30cm



DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - METRES	ELEVATION m NIVEAU m
Ground Surface - Niveau du Sol	0	61.73
FILL - topsoil	0.20	61.53
FILL - sand & gravel with a trace of ashes & metal		
Bottom of pit	0.80	60.93
LIMESTONE core recovery 86%	2.32	59.41
LIMESTONE core recovery 100%	3.82	57.91
LIMESTONE core recovery 61%	4.72	57.01
LIMESTONE core recovery 94%	5.80	55.93
Bottom of hole		

water level June 9,86
El. 60.73

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE —— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ —— ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ —— △

PLATE PLAQUE No. 16

R - REMOULDED - REMANIÉ
CR - CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR - NO RECOVERY - NON RÉCUPÉRÉ

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Holland and Spencer

SE2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 61.43 m DATE May 30, 1986

NOTES See Plate No. 2

~~HOLE~~
~~FORAGE~~ No.
Test Pit
N 60 E 00

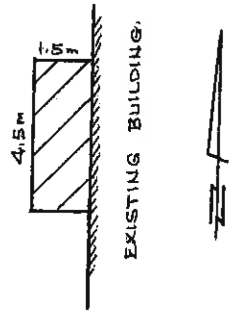
~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

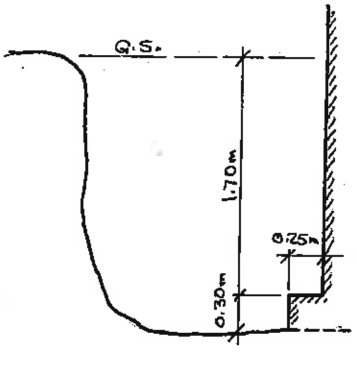
Marteau ____________ Hammer
Chute Libre ____________ Drop
No Casing - Sans Tubage
Barre ____________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
	Ground Surface - Niveau du Sol	0	61.43
	FILL - topsoil	0.30	61.13
	FILL - sand & gravel with some topsoil brick & concrete blocks with a little metal ashes & glass	2.00	59.43
	Bottom of pit on rock		

1
2
3
4
5
6
7





N.T.S.

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU

NATURAL
NATURELLE ———— ⊙
LIQUID LIMIT
LIMITE DE LIQUIDITÉ ———— ⊡
PLASTIC LIMIT
LIMITE DE PLASTICITÉ — △

PLATE
PLAQUE
No. 24

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY, CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

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Holland ans Spencer

SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 61.37 m DATE May 30, 1986

NOTES See Plate No. 2

~~HOLE~~
~~FORAGE~~ No.
Test Pit
N 90 E 00

DEPTH IN METRES / PROFONDEUR - METRES

Small Scale Penetrometer kPa / Petit Pénétromètre kPa

Essai - Standard Pénétration / Blows - Coups / 30cm

SAMPLE No. / ÉCHANTILLON No.

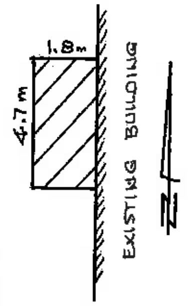
~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

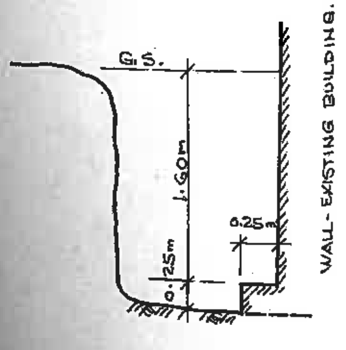
Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - METRES	ELEVATION m / NIVEAU m
Ground Surface - Niveau du Sol	0	61.37
FILL - topsoil	0.30	61.07
FILL - sand gravel & topsoil with some brick metal concrete blocks wood glass & a little organic material	1.85	59.52
Bottom of pit on rock		

Depth scale: 1 2 3 4 5 6 7





N.T.S.

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

PLATE
PLAQUE
No. 25

[illegible]
[illegible]
[illegible]
[illegible] RÉCUPÉRÉ

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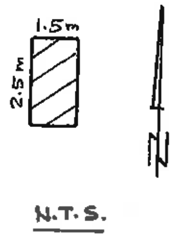
SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.91 m DATE May 26, 1986

NOTES See Plate No. 2

~~HOLE~~ ~~FORAGE~~ No. Test Pit N 90 E 30

DEPTH IN METRES / PROFONDEUR - MÈTRES	[illegible]	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL Ground Surface - Niveau du Sol	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
					0	61.91
				FILL - sand & organic material with some ashes brick broken rock & boulders		
1	water at El. 60.71 →					
2					2.05	59.86
				Bottom of pit on rock		
3						
4						
5						
6						
7						



~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups / 30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

R - REMOULDED - REMANIÉ
CR - CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR - NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

PLATE PLAQUE No. 26

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.25 m DATE May 29, 1986

NOTES See Plate No. 2

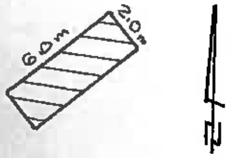
~~HOLE~~ ~~FORAGE~~ No. Test Pit N 120 E 00

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES / PROFONDEUR - METRES	Small Scale Penetrometer kPa / Petit Pénétromètre kPa	Essai - Standard Pénétration / Blows - Coups / 30cm	SAMPLE / ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
				Ground Surface - Niveau du Sol	0	61.25
				FILL - crushed stone	0.10	61.15
				FILL - sand gravel & topsoil with some brick metal ashes & boulders & a little cloth & glass		
1						
2	water seepage at El. 59.30			Bottom of pit on rock	1.95	59.30
3						
4						
5						



N.T.S.

0 25 50 75 100

R - REMOULDED - REMANIÉ
CR - CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR - NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ——— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ ——— △

PLATE / PLAQUE No. 27

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SF26B7

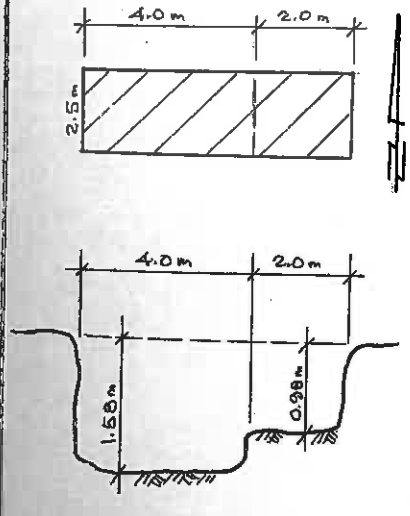
ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.05 m DATE May 28, 1986

~~HOLE~~ ~~FORAGE~~ No. Test Pit N 120 E 30

NOTES See Plate No. 2

DEPTH IN METRES / PROFONDEUR MÈTRES	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
			Ground Surface - Niveau du Sol	0	62.05
			FILL - crushed stone	0.10	61.95
			FILL - sand & gravel with some ashes & a little wood brick & topsoil	0.50	61.55
			medium dense coarse SAND & GRAVEL with some boülders up to 0.6 m dia.	1.58	60.47
			Bottom of pit on rock		

Depth scale: 1, 2, 3, 4, 5, 6, 7



N.T.S.

~~Probing or~~ ~~Vane Test~~ / ~~Sondage ou~~ ~~Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

R - REMOULDED - REMANIÉ
CR = CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ——— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ ——— △

PLATE / PLAQUE No. 28

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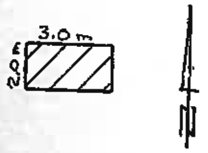
SE2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.24 m DATE May 26, 1986

NOTES See Plate No. 2

~~HOLE~~ ~~FORAGE~~ No. Test Pit N 120 E 120

DEPTH IN METRES / PROFONDEUR EN MÈTRES	[illegible] kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
				Ground Surface, Niveau du Sol	0	62.24
				FILL - sand & clay with some wood brick & concrete		
1						
	water seepage at El, 60.54				1.70	60.54
2				ORGANIC material		
					2.45	59.79
				Bottom of pit on rock		
3						
4						
5						
6						
7						



N.T.S.

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau _________ Hammer
Chute Libre _________ Drop
No Casing - Sans Tubage
Barre _________ Dia. Rod

~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups / 30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

R: REMOULDED - REMANIÉ
CR: CORE RECOVERY
CAROTTE RÉCUPÉRÉE
— : NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

PLATE / PLAQUE No. 29

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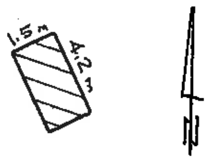
SE2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 61.74 m DATE May 30, 1986

NOTES See Plate No. 2

~~HOLE~~
~~FORAGE~~ No.
Test Pit
N 150 E 00

DEPTH IN METRES PROFONDEUR - MÈTRES	Small Scale Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL Ground Surface - Niveau du Sol	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m	~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~ Marteau ____ Hammer Chute Libre ____ Drop No Casing - Sans Tubage Barre ____ Dia. Rod ~~Blows/30 cm or Shear Strength (kPa)~~ ~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~
					0	61.74	
				FILL - crushed stone	0.10	61.64	
				FILL - sand gravel & topsoil with some brick & ashes & a little metal & glass	1.25	60.49	
				Bottom of pit on rock			



N.T.S.

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL
NATURELLE ⊙
LIQUID LIMIT
LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT
LIMITE DE PLASTICITÉ △

PLATE
PLAQUE
No. 30

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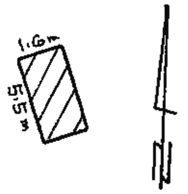
SFa687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.96 m DATE May 28, 1986

~~HOLE~~ ~~FORAGE~~ No. Test Pit N 150 E 30

NOTES See Plate No. 2

DEPTH IN METRES / PROFONDEUR METRES	Shear Scale Penetrometer kPa / Petit Pénétromètre kPa	Essai-Standard Pénétration Blows-Coups/30cm	SAMPLE No. / ÉCHANTILLON	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - METRES	ELEVATION m / NIVEAU m	~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~ Marteau ________ Hammer Chute Libre ________ Drop No Casing - Sans Tubage Barre ________ Dia. Rod ~~Blows/30 cm or Shear Strength (kPa)~~ ~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~
				Ground Surface - Niveau du Sol	0	61.96	
				FILL - crushed stone	0.10	61.86	
				FILL - sand & gravel with some wood ashes metal & brick	1.00	60.96	
1				rock removed by shovel	1.14	60.82	
				Bottom of pit on rock			
2							
3							
4							
5							
6							
7							



N.T.S.

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

PLATE / PLAQUE No. 31

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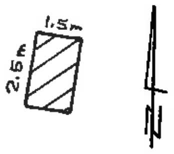
SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 61.50 m
DATE May 26, 1986
NOTES See Plate No. 2

~~HOLE~~ ~~FORAGE~~ No. Test Pit
N 150 E 120

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~
Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod
~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES PROFONDEUR - MÈTRES	Shell Vane Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL Ground Surface Niveau du Sol	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
					0	61.50
				FILL - topsoil sand gravel bricks & pieces of wood		
1						
	water seepage at El. 60.20		→		1.35	60.25
				ORGANIC material		
					1.60	59.95
				Bottom of pit on rock		
2						
3						
4						
5						
6						
7						



N.T.S.

0 25 50 75 100

R: REMOULDED - REMANIÉ
CR: CORE RECOVERY
CAROTTE RECUPÉRÉE
NR: NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ — ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ — △

PLATE PLAQUE No. 32

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SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.67 m DATE May 29, 1986

NOTES See Plate No. 2

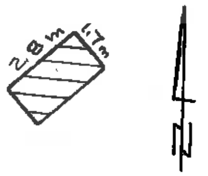
~~HOLE~~ ~~FORAGE~~ No. Test Pit
N 150 E 150

~~Probing or~~ ~~Sondage ou~~
~~Vane Test~~ ~~Essai au Scissomètre~~

Marteau ____________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES PROFONDEUR - MÈTRES	Small Scale Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30 cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
				Ground Surface - Niveau du Sol	0	61.67
				FILL - crushed stone	0.10	61.57
				FILL - topsoil & sand with some broken rock ashes metal & glass	1.80	60.87
				Bottom of pit on rock		



N.T.S.

1 2 3 4 5 6 7

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY - CAROTTE RÉCUPERÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE —— ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ —— ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ —— △

PLATE PLAQUE No. 33

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.37 m DATE May 28, 1986

NOTES See Plate No. 2

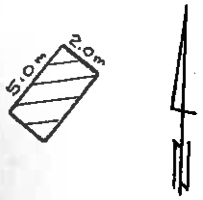
~~HOLE~~ ~~FORAGE~~ No. Test Pit N 180 E 30

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES PROFONDEUR-MÈTRES	[illegible]	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
				Ground Surface - Niveau du Sol	0	62.37
				FILL - crushed stone	0.10	62.27
				FILL - sand gravel & topsoil with some ashes brick broken rock metal & wood	1.80	60.57
				Bottom of pit on rock		



N.T.S.

0 25 50 75 100

R : REMOULDED - REMANIÉ
CR : CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR : NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ ——— △

PLATE PLAQUE No. 34

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Holland and Spencer

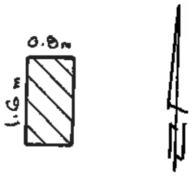
SF2687

ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 61.73 m DATE May 30, 1986

NOTES See Plate No. 2

~~HOLE~~
~~FORAGE~~ No.
Test Pit
N 180 E 82

DEPTH IN METRES PROFONDEUR EN MÈTRES	Pocket Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE No. ÉCHANTILLON	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
				Ground Surface - Niveau du Sol	0	61.73
				FILL - topsoil	0.20	61.53
				FILL - fine sand with a little metal & brick	0.70	61.03
				Bottom of pit on rock		



N.T.S.

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU

NATURAL
NATURELLE ———— ⊙
LIQUID LIMIT
LIMITE DE LIQUIDITÉ ———— ⊡
PLASTIC LIMIT
LIMITE DE PLASTICITÉ ———— △

PLATE
PLAQUE
No. 35

R - REMOULDED - REMANIÉ
CR - CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR - NO RECOVERY - NON RÉCUPÉRÉ

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.06 m DATE May 29, 1986

~~HOLE~~ ~~FORAGE~~ Test Pit No. N 180 E 110

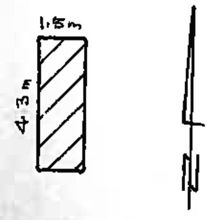
NOTES See Plate No. 2

~~Probing or~~ ~~Vane Test~~ ~~Sondage ou~~ ~~Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES / PROFONDEUR - MÈTRES	Small Scale Penetrometer kPa / Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL Ground Surface, Niveau du Sol	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
					0	62.06
				FILL - topsoil	0.25	61.81
				FILL - fine sand	0.50	61.56
				TOPSOIL	0.58	61.48
				loose coarse SAND & GRAVEL	0.90	61.16
	water seepage at → El. 59.96			medium dense sandy TILL with a few boulders up to 0.45 m dia.	2.30	59.76
				Bottom of pit on rock		



N.T.S.

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

PLATE / PLAQUE No. 36

R - REMOULDED - REMANIÉ
CORE RECOVERY
CR - CAROTTE RÉCUPÉRÉE
NR - NO RECOVERY - NON RÉCUPÉRÉ

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~~HOLE~~ ~~FORAGE~~ No. Test Pit N 210 E 6

ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 61.14 m DATE May 29, 1986

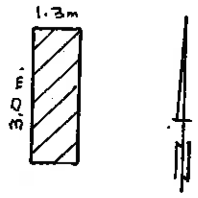
NOTES See Plate No. 2

DEPTH IN METRES / PROFONDEUR METRES	[illegible] kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - METRES	ELEVATION m / NIVEAU m
				Ground Surface, Niveau du Sol	0	61.14
				FILL - crushed stone	0.10	61.04
				FILL - sand & gravel with some ashes broken rock brick & metal		
1					1.00	60.14
				Bottom of pit on rock		
2						
3						
4						
5						
6						
7						

~~Probing or~~ ~~Vane Test~~ ~~Sondage ou~~ ~~Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~



N.T.S.

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY / CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

PLATE / PLAQUE No. 37

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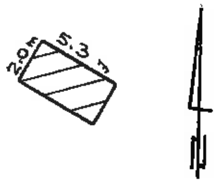
ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 62.38 DATE May 28, 1986

~~HOLE~~ ~~FORAGE~~ No. Test Pit N 210 E 3~~0~~2

NOTES See Plate No. 2

DEPTH IN METRES PROFONDEUR - METRES	[illegible] Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - METRES	ELEVATION m NIVEAU m
				Ground Surface, Niveau du Sol	0	62.38
				FILL - topsoil	0.30	62.08
1				FILL - sand & gravel with some broken rock brick metal wood glass & topsoil	1.80	60.58
2				Bottom of pit on rock		
3						
4						
5						
6						
7						



N.T.S.

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Mouton ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups / 30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

R: REMOULDED - REMANIÉ
CR: CORE RECOVERY CAROTTE RÉCUPÉRÉE
NR: NO RECOVERY - NON RÉCUPÉRÉ

PLATE PLAQUE No. 38

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 61.73 m DATE May 30, 1986

NOTES See Plate No. 2

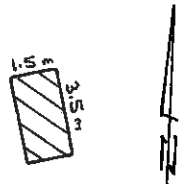
~~HOLE~~ ~~FORAGE~~ No. Test Pit N 210 E 60

~~Probing or Vane Test~~ ~~Sondage au Essai au Scissomètre~~

Marteau ______ Hammer
Chute Libre ______ Drop
No Casing - Sans Tubage
Barre ______ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES PROFONDEUR - MÈTRES	Field Penetrometer kPa Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
				Ground Surface - Niveau du Sol	0	61.73
				FILL - crushed stone		
					0.25	61.48
				FILL - topsoil		
					0.47	61.26
				FILL - till with a trace of brick & metal		
					0.86	60.87
				Bottom of pit on rock		



N.T.S.

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

PLATE PLAQUE No. 39

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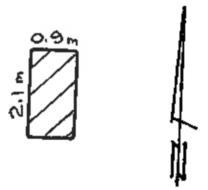
ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 61.82 m DATE May 30, 1986
NOTES See Plate No. 2

~~HOLE~~
~~FORAGE~~ No.
Test Pit
N 210 E 82

DEPTH IN METRES PROFONDEUR - MÈTRES	Small Scale Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30 cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL Ground Surface - Niveau du Sol	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
					0	61.82
				FILL - topsoil	0.20	61.62
				FILL - medium sand with a piece of concrete pipe & a trace of metal	1.10	60.72
				Bottom of pit on rock		



N.T.S.

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~
Marteau _______ Hammer
Chute Libre _______ Drop
No Casing - Sans Tubage
Barre _______ Dia. Rod
~~Blows / 30 cm or Shear Strength (kPa)~~
~~Coups / 30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL
NATURELLE ⊙
LIQUID LIMIT
LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT
LIMITE DE PLASTICITÉ △

PLATE
PLAQUE
No. 40

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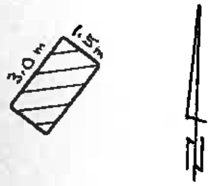
ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 61.71 m DATE May 30, 1986

~~HOLE~~ ~~FORAGE~~ No. Test Pit N234 E 60

NOTES See Plate No. 2

DEPTH IN METRES PROFONDEUR - METRES	Shear Scale Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - METRES	ELEVATION m NIVEAU m
				Ground Surface - Niveau du Sol	0	61.71
				FILL - topsoil & sand with a trace of metal brick & ashes		
				Bottom of pit on rock	0.75	60.96
1						
2						
3						
4						
5						
6						
7						



N.T.S.

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ________ Hammer
Chute Libre ________ Drop
No Casing - Sans Tubage
Barre ________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

0 25 50 75 100

R = REMOULDED - REMANIÉ
CR = CORE RECOVERY CAROTTE RÉCUPÉRÉE
NR = NO RECOVERY - NON RÉCUPÉRÉ

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

PLATE PLAQUE No. 41

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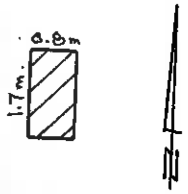
ELEVATION OF GROUND SURFACE (ZERO DEPTH)
NIVEAU DU SOL (PROFONDEUR ZERO) 62.17 m DATE May 30, 1986
NOTES See Plate No. 2

~~HOLE~~ ~~FORAGE~~ No. Test Pit
N 235 E 84

DEPTH IN METRES PROFONDEUR - MÈTRES	Small Scale Penetrometer kPa Petit Pénétromètre kPa	Essai - Standard Pénétration Blows - Coups / 30 cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL DU SOL	DEPTH IN METRES PROFONDEUR - MÈTRES	ELEVATION m NIVEAU m
				Ground Surface - Niveau du Sol	0	62.17
				FILL - topsoil		
					0.30	61.87
				FILL - sand gravel & topsoil with a trace of brick & metal		
					1.10	61.07
				Bottom of pit on rock		

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~
Marteau ______ Hammer
Chute Libre ______ Drop
No Casing - Sans Tubage
Barre ______ Dia. Rod
~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

1
2
3
4
5
6
7



N.T.S.

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

PLATE PLAQUE No. 42

R : REMOULDED - REMANIÉ
CR : CORE RECOVERY
CAROTTE RÉCUPÉRÉE
NR : NO RECOVERY - NON RÉCUPÉRÉ

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 62.11 m DATE May 30, 1986

NOTES See Plate No. 2

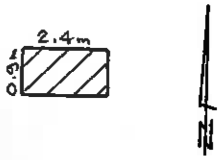
~~HOLE~~ ~~FORAGE~~ No. Test Pit N 240 E 115

~~Probing or Vane Test~~ ~~Sondage ou Essai au Scissomètre~~

Marteau ____________ Hammer
Chute Libre __________ Drop
No Casing - Sans Tubage
Barre __________ Dia. Rod

~~Blows/30 cm or Shear Strength (kPa)~~
~~Coups/30 cm ou Résistance au Cisaillement (kPa)~~

DEPTH IN METRES / PROFONDEUR - MÈTRES	Small Scale Penetrometer kPa / Petit Pénétromètre kPa	Essai - Standard Pénétration / Blows - Coups / 30 cm	SAMPLE ÉCHANTILLON No.	DESCRIPTION OF SOIL / DU SOL	DEPTH IN METRES / PROFONDEUR - MÈTRES	ELEVATION m / NIVEAU m
				Ground Surface - Niveau du Sol	0	62.11
				FILL - topsoil	0.20	61.91
				FILL - sand & gravel with some ashes brick wood metal asphalt & glass	0.95	61.16
				boulders up to 0.6 m dia. in dense sandy TILL	1.80	60.31
				Bottom of pit on rock		



N.T.S.

0 25 50 75 100

WATER CONTENT
% TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

RM: REMOULDED - REMANIÉ
CR: CORE RECOVERY - CAROTTE RÉCUPÉRÉE
NR: NO RECOVERY - NON RÉCUPÉRÉ

PLATE / PLAQUE No. 43

Holland and Spencer Avenues, Beech Foundry Site, Rock Elevations

McRostie Genest Middlemiss

June 6, 1984

(Report No. SF-2481)

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SPENCER ST.

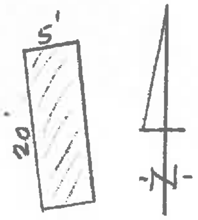
SF2481

ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 205.2 DATE MAY 16/84

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 1

NOTES BM (EL. 206.65) GEODETIC CITY OF OTTAWA PLATE ON NORTHEAST CORNER OF OF SPERRY GYROSCOPE BLDG. AT SOUTHWEST CORNER OF PARKDALE & SPENCER

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DUG BY TRACK MOUNTED SHOVEL **DESCRIPTION** OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau	~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~ MARTEAU----HAMMER CHUTE LIBRE---DROP NO CASING SANS TUBAGE BARRE-----DIA. ROD ~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~ ~~COUPS/PIED OU~~ ~~RÉSISTANCE AU CISAILLEMENT~~ ~~K/PD.2~~
				-FILL- SAND, GRAVEL, & ASHES, WITH SOME METAL, WOOD, GLASS, & BRICK	0'	205.2	
SLIGHT WATER SEEPAGE AT EL. 199.2				BOTTOM OF PIT ON ROCK	6'	199.2	



R = REMOULDED-REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

%WATER CONTENT %TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ ——— △

PLATE PLAQUE No.

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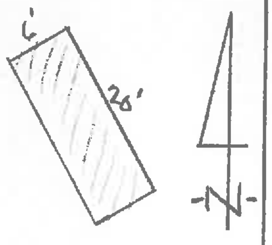
SF 2481

ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 203.9 DATE MAY 16/84

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 2

NOTES SEE PLATE No. 2

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau	~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~ MARTEAU----HAMMER CHUTE LIBRE---DROP NO CASING SANS TUBAGE BARRE-----DIA. ROD ~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~ ~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~
				CONCRETE SLAB	0 0.2	203.9 203.7	
				- FILL - SAND WITH SOME CLAY METAL, BRICK ASHES & WOOD.			
				BOTTOM OF PIT ON ROCK	5'	198.9	



R = REMOULDED - REMANIE
CR = CORE RECOVERY – CAROTTE RECUPEREE

WATER CONTENT % TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ☐
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

PLATE PLAQUE No.

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 203.5 DATE MAY 16, 1984

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 3

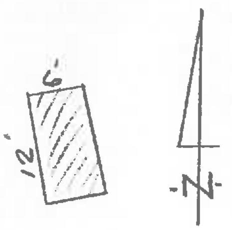
NOTES SEE PLATE No. 2

~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~

MARTEAU----HAMMER
CHUTE LIBRE---DROP
NO CASING SANS TUBAGE
BARRE-----DIA. ROD

~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~
~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau
				CONCRETE SLAB	0.0 0.2	203.5 203.3
				-FILL- SAND & GRAVEL WITH SOME WOOD, METAL BRICK & BROKEN ROCK	1.5	202.0
				DENSE SANDY TILL	5.8'	197.7
				BOTTOM OF PIT ON ROCK		



R = REMOULDED-REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

% WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ——— ☐
PLASTIC LIMIT LIMITE DE PLASTICITÉ ——— △

PLATE PLAQUE No.

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OTTAWA CANADA

SOIL PROFILE & TEST SUMMARIES
PROFIL SOUTERRAIN ET RÉSUMÉ DES ESSAIS

SPENCER ST.

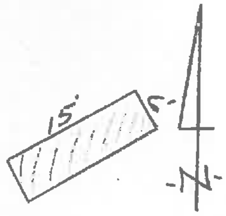
SF2481

ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 204.1 DATE MAY 16, 1984

~~HOLE FORAGE~~ No. TEST PIT 4

NOTES SEE PLATE No. 2

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai - Standard Pénétration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur - Pied	Elevation Niveau	~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~ MARTEAU----HAMMER CHUTE LIBRE---DROP NO CASING SANS TUBAGE BARRE-----DIA. ROD ~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~ ~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~
				CONCRETE SLAB	0	204.1	
					0.5	203.6	
				-FILL- SAND & GRAVEL WITH SOME METAL, ASHES, WOOD, & BRICK, WITH A FEW BOULDERS UP TO 24" Ø			
					6.3	197.8	
				BOTTOM OF PIT ON ROCK			



R = REMOULDED - REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

WATER CONTENT % TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ ——— △

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 201.5 DATE MAY 16, 1984

~~HOLE FORAGE~~ No. TEST PIT 5

NOTES SEE PLATE No. 2

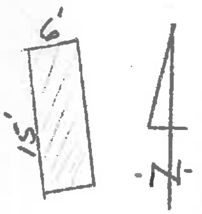
Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur - Pied	Elevation Niveau
				ASPHALT	0	201.5
				-FILL- SAND & GRAVEL	0.3	201.2
				TOPSOIL	1.5'	2000
				DENSE SANDY TILL WITH SOME BOULDERS UP TO 18" ⌀	2'	199.5
				BOTTOM OF PIT ON ROCK	6.5'	195.0

~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~

MARTEAU----HAMMER
CHUTE LIBRE---DROP

NO CASING SANS TUBAGE
BARRE-----DIA. ROD

~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~
~~COUPS/PIED OU RÉSISTANCE AU K/PD.2 CISAILLEMENT~~



R = REMOULDED-REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ——— ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ ——— △

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 203.1 DATE MAY 16, 1984

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 6

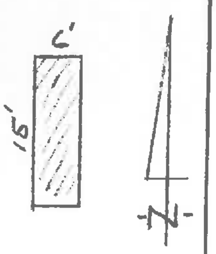
NOTES SEE PLATE NO. 2

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau
				CONCRETE SLAB	0.0 0.2'	203.1 202.9
				-FILL- SAND & GRAVEL WITH SOME METAL & WOOD, & A TRACE OF BRICK & TOPSOIL	3.6'	199.5
				BOTTOM OF PIT ON ROCK		

~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~

MARTEAU----HAMMER
CHUTE LIBRE---DROP
NO CASING SANS TUBAGE
BARRE-----DIA. ROD

~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~
~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~



R = REMOULDED-REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

WATER CONTENT % TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

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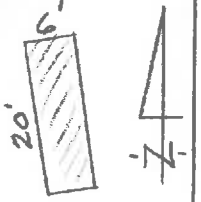
ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 203.8 DATE MAY 16, 1984

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 7

NOTES SEE PLATE NO. 2

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau	~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~ MARTEAU----HAMMER CHUTE LIBRE---DROP NO CASING SANS TUBAGE BARRE-----DIA. ROD ~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~ ~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~
				CONCRETE SLAB	0 0.3	203.8 203.5'	
				-FILL- SAND, GRAVEL, & BROKEN ROCK WITH A LITTLE BRICK & METAL			
SLIGHT WATER SEEPAGE AT EL. 199.4			→	BOTTOM OF PIT ON ROCK	4.4'	199.4	



R = REMOULDED-REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

% WATER CONTENT TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ☐
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

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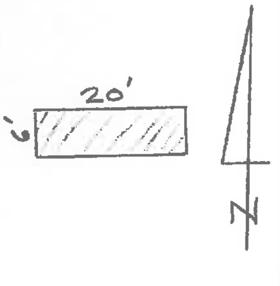
ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 203.5 DATE MAY 16, 1984

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 8

NOTES SEE PLATE No. 2

Compressive Strength K.S.F. / Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. / Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL / DU SOL Ground Surface – Niveau du Sol	Depth in Feet / Profondeur-Pied	Elevation / Niveau
				CONCRETE SLAB	0' 0.3'	203.5 203.2
				-FILL- SAND, GRAVEL, & BROKEN ROCK WITH SOME METAL, & BRICK, & A TRACE OF WOOD	4'	199.5
				BOTTOM OF PIT ON ROCK		

~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~
MARTEAU----HAMMER
CHUTE LIBRE---DROP
NO CASING SANS TUBAGE
BARRE-----DIA. ROD
~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~
~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~



R = REMOULDED-REMANIE
CR = CORE RECOVERY – CAROTTE RECUPEREE

%WATER CONTENT / %TENEUR EN EAU
NATURAL / NATURELLE ⊙
LIQUID LIMIT / LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT / LIMITE DE PLASTICITÉ △

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ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 203.0 DATE MAY 16, 1984

~~HOLE~~ ~~FORAGE~~ No. TEST PIT 9

NOTES SEE PLATE No. 2

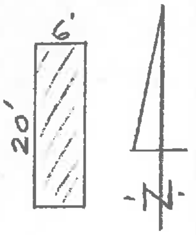
Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample Echantillon No.	DESCRIPTION OF SOIL DU SOL Ground Surface Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau
				CONCRETE SLAB	0' 0.2'	203.0 202.8
				-FILL- SAND & GRAVEL WITH SOME BRICK, BROKEN ROCK, METAL, WOOD, & TOPSOIL		
				BOTTOM OF PIT ON ROCK	4.7'	198.3

~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~

MARTEAU----HAMMER
CHUTE LIBRE---DROP

NO CASING SANS TUBAGE
BARRE-----DIA. ROD

~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~
~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~



R = REMOULDED-REMANIE
CR = CORE RECOVERY - CAROTTE RECUPEREE

% WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ☐
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

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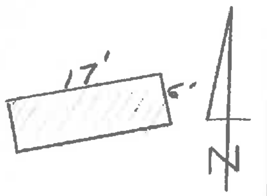
ELEVATION OF GROUND SURFACE (ZERO DEPTH) NIVEAU DU SOL (PROFONDEUR ZERO) 204.9 DATE MAY 16, 1984

~~HOLE FORAGE~~ No. TEST PIT 10

NOTES SEE PLATE No.2

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur-Pied	Elevation Niveau	~~PROBING OR VANE TEST~~ ~~SONDAGE OU ESSAI AU MOULINET~~ MARTEAU----HAMMER CHUTE LIBRE---DROP NO CASING SANS TUBAGE BARRE-----DIA. ROD ~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F. COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~
				CONCRETE SLAB	0'	204.9	
				-FILL- SAND, GRAVEL, & BROKEN ROCK WITH SOME BRICK METAL & WOOD	0.3'	204.6	
				TOPSOIL	3.9'	201.0	
				DENSE SANDY TILL	4.3'	200.6	
				BOTTOM OF PIT ON ROCK	7.5'	197.4	



R = REMOULDED-REMANIE
CR = CORE RECOVERY CAROTTE RECUPEREE

WATER CONTENT %TENEUR EN EAU
NATURAL NATURELLE ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ⊡
PLASTIC LIMIT LIMITE DE PLASTICITÉ △

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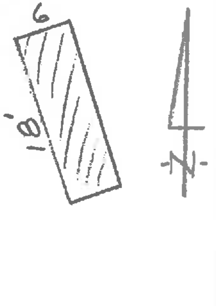
ELEVATION OF GROUND SURFACE (ZERO DEPTH) / NIVEAU DU SOL (PROFONDEUR ZERO) 205.0
DATE MAY 16, 1984
~~HOLE~~ ~~FORAGE~~ No. TEST PIT 11
NOTES SEE PLATE No. 2

Compressive Strength K.S.F. Résistance à la Compression K/Pd.2	Small Scale Penetrometer K.S.F. Petit Pénétromètre K/Pd.2	Essai-Standard Penetration Blows/ft.-Coups/pd	Sample No. Echantillon	DESCRIPTION OF SOIL DU SOL Ground Surface – Niveau du Sol	Depth in Feet Profondeur - Pied	Elevation Niveau
					0'	205.0
				CONCRETE SLAB		
					0.3'	204.7
				-FILL- SAND, GRAVEL & BROKEN ROCK WITH SOME BRICK & METAL		
					3.1'	201.9
				TOPSOIL		
					3.4'	201.6
				DENSE SANDY TILL		
					5.4'	199.6
				BOTTOM OF PIT ON ROCK		

~~PROBING OR VANE TEST~~
MARTEAU----HAMMER
CHUTE LIBRE---DROP

~~SONDAGE OU ESSAI AU MOULINET~~
NO CASING SANS TUBAGE
BARRE-----DIA. ROD

~~BLOWS/FOOT OR SHEAR STRENGTH K.S.F.~~
~~COUPS/PIED OU RÉSISTANCE AU CISAILLEMENT K/PD.2~~



R = REMOULDED-REMANIE
CR = CORE RECOVERY / CAROTTE RECUPEREE

% WATER CONTENT
% TENEUR EN EAU
NATURAL NATURELLE ——— ⊙
LIQUID LIMIT LIMITE DE LIQUIDITÉ ——— ☐
PLASTIC LIMIT LIMITE DE PLASTICITÉ ——— △

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Appendix E REPORT EXCERPTS

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- Municipal Infrastructure
- Environmental / Water Resources
- Traffic/ Transportation
- Structural
- Recreational

Planning

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- Planning Application Management
- Municipal
- Planning Documents & Studies
- Expert Witness (OMB)
- Wireless Industry

Landscape Architecture

- Urban Design & Streetscapes
- Recreation & Parks Planning
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32 Years

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CITY OF OTTAWA

SERVICING & STORMWATER MANAGEMENT REPORT

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SERVICING & STORMWATER MANAGEMENT REPORT

Prepared For:

Colonnade Development Ltd.
16 Concourse Gate, Suite 200
Ottawa, Ontario
K2E 7S8

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

December 2013
Revised August 2014

Novatech File: 113150
Ref: R-2013-108

NOVATECH
Engineers, Planners & Landscape Architects

August 25, 2014

City of Ottawa
Planning and Growth Management Department
Development Review (Urban) Services Branch
Infrastructure Approvals Division
110 Laurier Avenue West
Ottawa, ON K1P 1J1

Attention: Kristin Bazinet

Dear Madam:

Re: 1560 Scott Street – Holland Cross Expansion
Servicing Design Brief
Our File No.: 113150

Please find enclosed six (6) copies of the Holland Cross Expansion – Servicing and Stormwater Management Report, dated August 2014. This report has been revised per City comments and is hereby submitted for approval.

If you have any questions, please contact the undersigned.

Yours truly,

NOVATECH

Cara Ruddle, P.Eng.
Project Manager

cc: Kelly Rhodenizer, Colonnade Development Ltd.

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1.0 INTRODUCTION

Novatech Engineering Consultants Ltd. has been retained by Colonnade Development Ltd. to prepare a Servicing and Stormwater Management Report in support of the re-zoning and site plan applications. The site is located at 1560 Scott Street on the southeast corner of the intersection of Scott Street and Holland Street in the City of Ottawa. Figure 1 is a Key Plan showing the site location.

2.0 EXISTING AND PROPOSED DEVELOPMENT

The property is approximately 3.2 hectares in size and is currently occupied by an existing seven storey tall complex consisting of two six storey office towers on top of a 1 storey retail podium. The site is bounded by office buildings to the north (Holland Cross), residential housing to the east and west, and residential condominiums to the south. Figure 2 shows the existing conditions of the site.

It is proposed to demolish part of the existing 1 storey retail building, and to construct a 12 storey office building (approximately 18,000ft^2 per floor) over the existing parking garage. Therefore, the building footprint will remain the same. Underground parking is already provided as part of the previous development. Refer to Figure 3 – Proposed Site Plan for details.

3.0 WATERMAIN SERVICING

The existing building complex is serviced by two 150mm diameter water services from Holland Ave and Bullman St, and one 50mm diameter water service from Scott Street. These existing water services connect to the municipal water system surrounding the existing development. The internal building water system will be extended to service the proposed development. Refer to Figure 4 – Existing Services for details on the existing water system.

Hydraulic boundary conditions were provided by the City of Ottawa and are as follows:

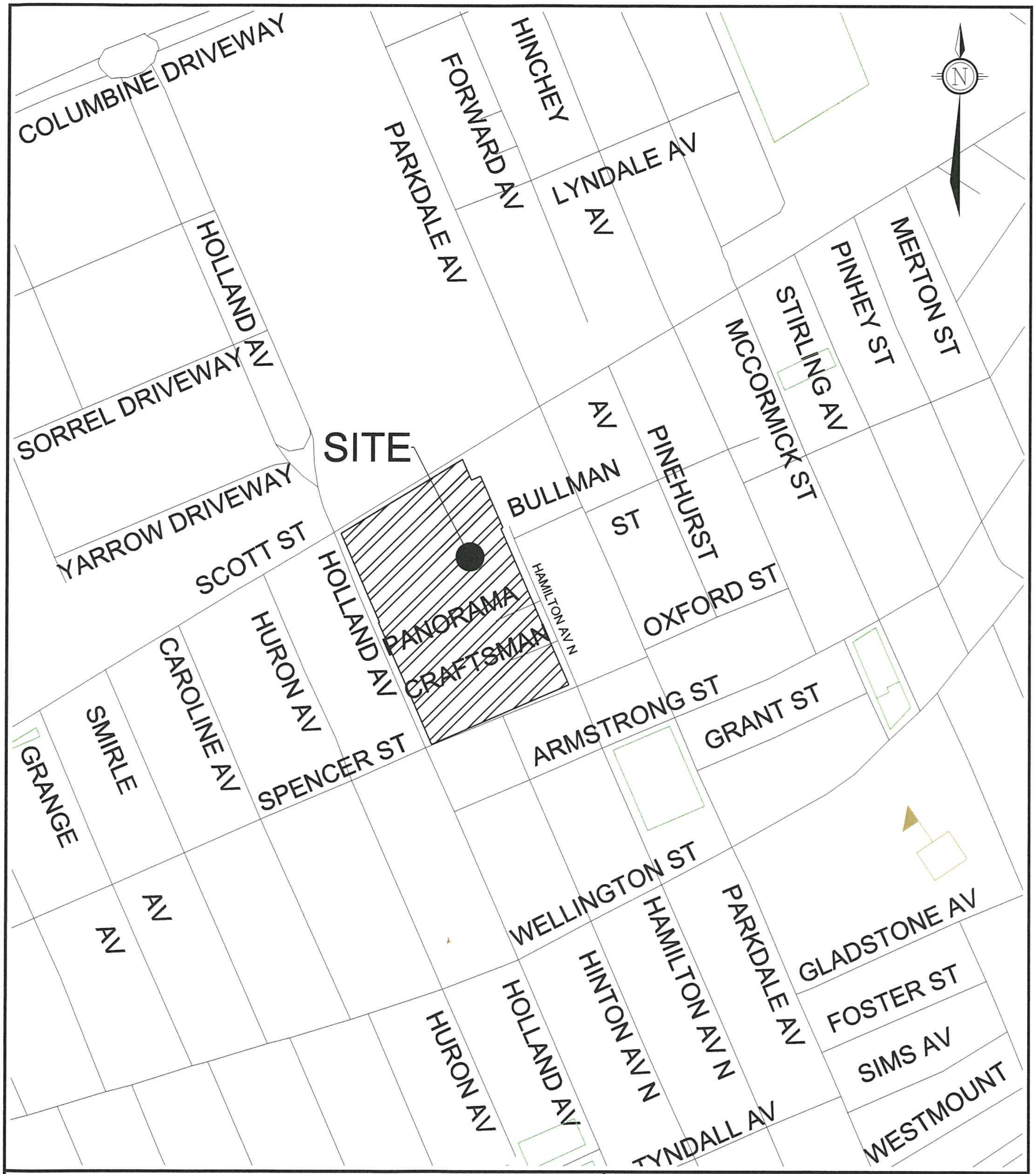
Minimum HGL = 107.4m
Maximum HGL = 115.8m
Max Day + FF = 77.5m

3.1 Domestic Water Demand

The following domestic water demands are based on the City of Ottawa Water Distribution Guidelines (Gross Site Area), and the Ontario Building Code, OBC, (Gross Floor Area). The Gross Floor Area method results in a more conservative value, which is used for this report. Refer to Appendix A for detailed calculations.

Estimated water demands for the entire complex including the proposed expansion are as follows:

$Q_{avg\ day}$ = (47,409m^2 / 9.3 m^2/pers) x 75L/pers/day
$Q_{avg\ day}$ = 382,331L/day = 4.43 L/s



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ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M IP6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

1560 SCOTT STREET - HOLLAND CROSS PHASE 3

KEY PLAN

DEC 2013 113150 FIGURE 1

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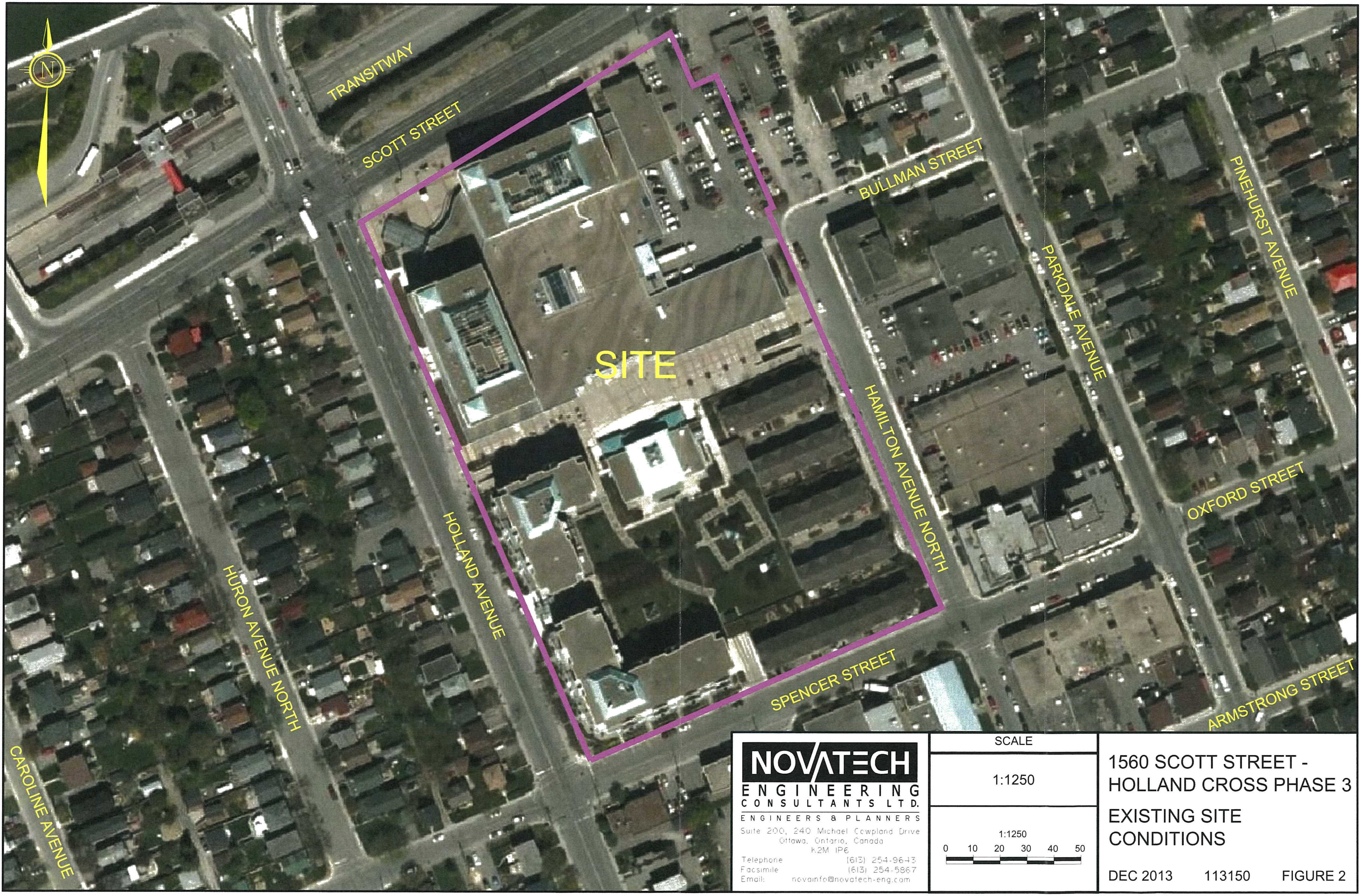

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Email: novainfo@novatech-eng.com

SCALE
1:1250

1:1250
0 10 20 30 40 50

1560 SCOTT STREET -
HOLLAND CROSS PHASE 3

EXISTING SITE
CONDITIONS

DEC 2013 113150 FIGURE 2

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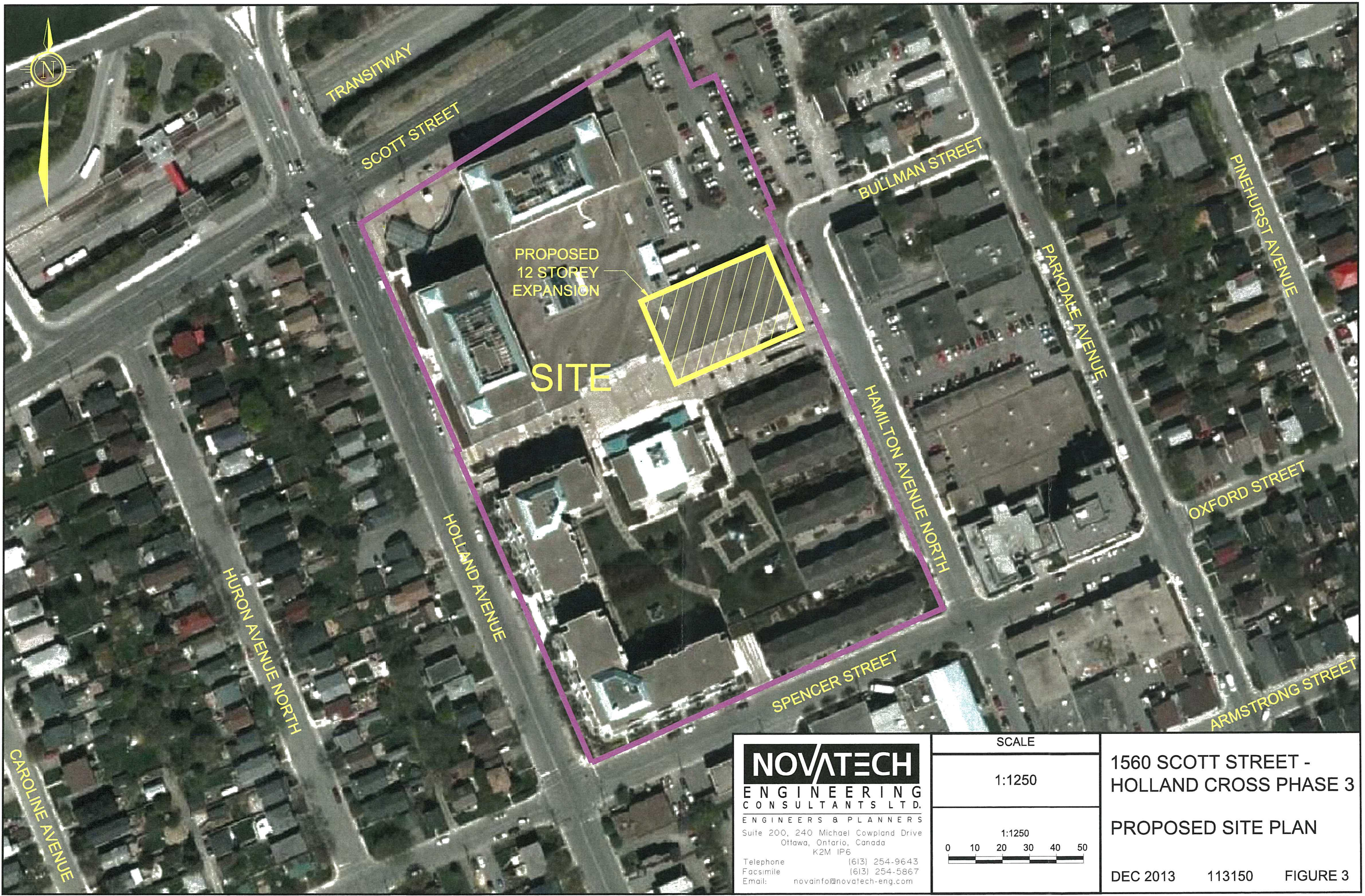

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SCALE
1:1250

1:1250
0 10 20 30 40 50

1560 SCOTT STREET - HOLLAND CROSS PHASE 3

PROPOSED SITE PLAN

DEC 2013 113150 FIGURE 3

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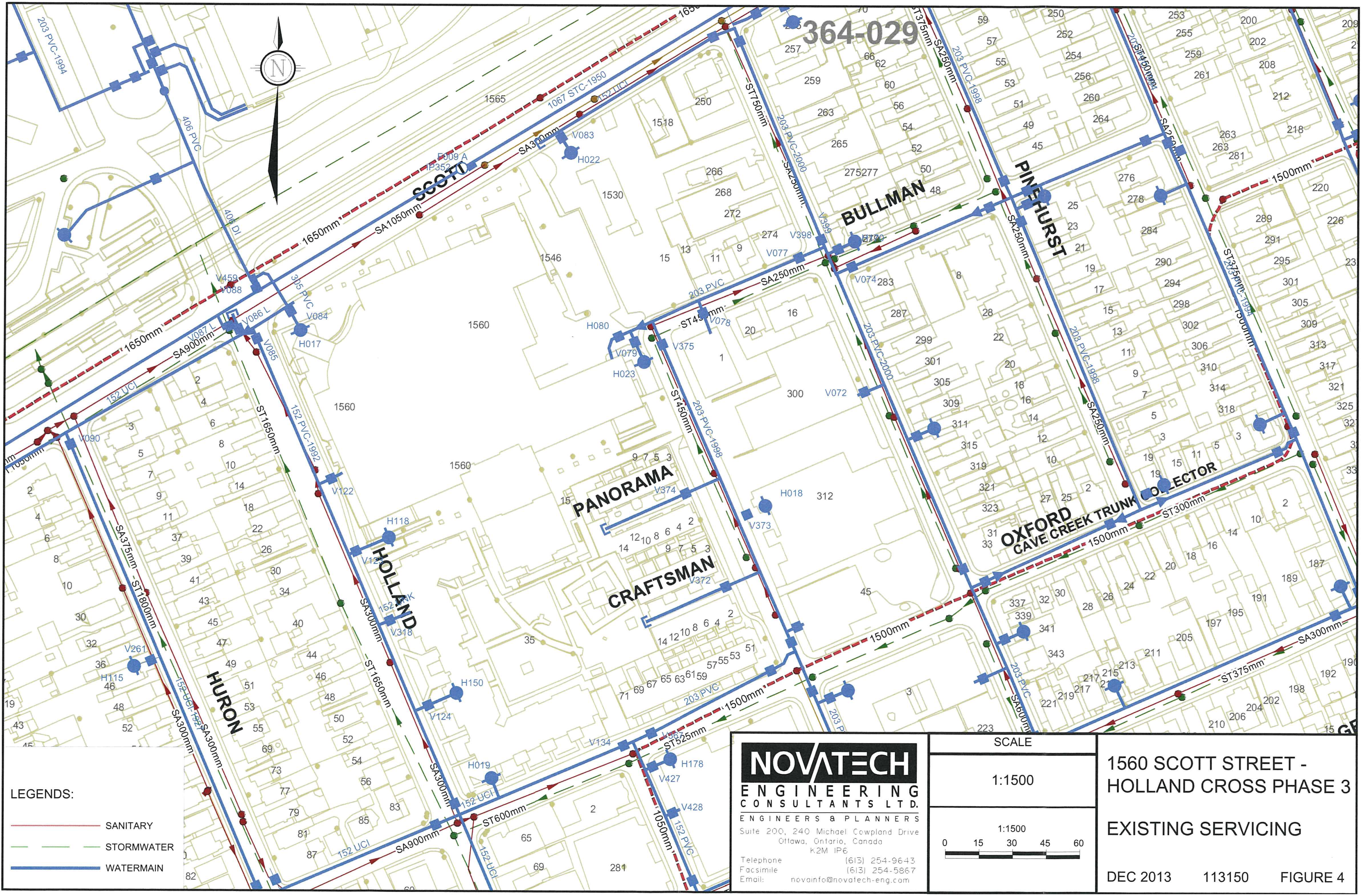

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LEGENDS:

SANITARY

STORMWATER

WATERMAIN

NOVATECH
ENGINEERING
CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
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Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

SCALE
1:1500

1:1500
0 15 30 45 60

1560 SCOTT STREET -
HOLLAND CROSS PHASE 3

EXISTING SERVICING

DEC 2013 113150 FIGURE 4

3.2 Fire Demand

For this type of building, the existing underground parking garage is classified as "Ordinary Hazard" (Group 1), and the new office building is classified as "Light Hazard." The calculations for required fire flow are based on the existing garage; therefore there is only a marginal increase in the required fire flow for the new addition.

The required fire demand is calculated using the Fire Underwriters Survey (FUS) Guidelines. The required fire demand is calculated to be 100L/s using the FUS method. Using the National Fire Protection Association (NFPA) Standard for Sprinkler Systems the supply requirement is 41.0L/s for the sprinklers and hoses. Refer to Appendix A for detailed calculations.

According to the hydraulic boundary conditions provided by the City, the existing 200mm dia. watermain on Hamilton Street and Bullman Avenue has a hydraulic grade line of 77.5m at the maximum day demand plus a fire demand of 92.7L/s. This results in 92.7L/s of fire flow available at 22.4psi. Therefore the existing municipal watermain can provide the fire demand at a pressure greater than 20 psi.

4.0 SANITARY SERVICING

The existing building is serviced by a 150mm diameter sanitary which connects to an existing 250mm diameter sanitary sewer within the Hamilton Street right-of-way. It is proposed to extend the internal plumbing to service the proposed development.

A review of the existing downstream sewer system is required to ensure there are no capacity issues. The sanitary flows from the proposed development are calculated to be 2.8L/s. Drainage areas and flows have been calculated for the downstream area and input into a sanitary sewer design sheet. There appears to be no issue with capacity in the existing sanitary sewer system due to the proposed development. Refer to Appendix B for flow calculations, the drainage area plan and sanitary sewer design sheet.

5.0 STORM SERVICING

5.1 Existing Drainage and Servicing

As indicated previously, the site is currently developed with single storey building as part of an existing office and retail development. The existing building is serviced by an existing 200mm storm service that connects to a 450mm diameter storm sewer at the Hamilton Avenue / Bullman Street intersection.

Stormwater from the building areas flow into roof drains and outlets to storm services which connect to the City storm sewer system along Scott Street, Holland Avenue and Hamilton Avenue. The remaining parking area sheet drains to catchbasins which outlet to the City storm sewer system on Scott Street.

5.2 Proposed Site Drainage

Stormwater from the proposed development will drain to roof drains and outlet to the existing storm service per existing conditions and continue to outlet to the existing storm sewer on Hamilton Avenue.

5.3 Stormwater Management

The building footprint will not change from existing conditions. Therefore, there is no increase in storm flows from the proposed development and stormwater management is not required.

6.0 EROSION AND SEDIMENT CONTROL MEASURES

6.1 Temporary Measures

Temporary erosion and sediment control measures will be implemented during construction. Silt fence and filter cloth catches will be used as erosion and sediment control measures. Details are provided on Figure 7.

Filter cloth catches should be inspected daily, and after every rain event to determine maintenance, repair or replacement requirements. Sediments or granulars that enter site sewers shall be removed immediately by the contractor. These measures will be implemented prior to the commencement of construction and maintained in good order until vegetation has been established.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The conclusions of this report are as follows:

- Water servicing, including both domestic and fire protection, can be provided by connection to the existing watermain infrastructure along Bullman Street.
- Sanitary flows for the proposed development have been calculated and there is sufficient capacity within the existing City sanitary sewer system along Bullman Street to service the development.
- Quantity and quality control of stormwater is not required, as there will be no change to the existing stormwater drainage.
- The existing overland flow route will be maintained.
- Erosion and sediment control measures will be implemented during construction.

NOVATECH

Prepared by:

LICENSED PROFESSIONAL ENGINEER
C. J. RUDDLE
Aug 25/14
PROVINCE OF ONTARIO

Cara Ruddle, P.Eng.
Project Manager

Reviewed by:

J. Lee Sheets, CET
Sr. Project Manager

APPENDIX A

Watermain Information

The following are boundary conditions (provided by the City of Ottawa), HGL, for hydraulic analysis at 150 Holland Avenue assumed to be connected to the 200mm on Hamilton Street and Bullman Avenue.

Minimum HGL = 107.4m

Maximum HGL = 115.8m

Max Day + FF (92.7 L/s) = 77.5m

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

Pressure Check:

Centreline of road at the intersection of Hamilton Street and Bullman Avenue = 61.7m (refer to the City as-built drawings)

2.31ft = 1 psi

Maximum HGL = (115.8m - 61.7m) x 3.281ft/m ÷ 2.31ft/1psi = 76.8psi

Minimum HGL = (107.4m - 61.7m) x 3.281ft/m ÷ 2.31ft/1psi = 64.9psi

- The system has adequate pressure under peak hour demand condition.

Fire Flow Check

Max Day + FF (92.7L/s) = (77.5m - 61.7m) x 3.281ft/m ÷ 2.31ft/1psi = 22.4psi

- The system has adequate pressure for fire flow conditions.

1560 Scott Street
HYDRAULIC ANALYSIS

12 Storey New Expansion Water Demand

Node	Area	Demand (L/s)		
		Average Day	Max. Daily	Peak Hour
Gross Floor Area (m^2)				
New	19564	1.83	2.74	3.29
Existing	27845	2.60	3.90	7.02
Total	**47409**	**4.43**	**6.64**	**10.30**
Gross Site Area (ha)				
New	0.0	0.00	0.00	0.00
Existing	1.7	0.53	0.80	1.44
Total	**1.7**	**0.53**	**0.80**	**1.44**

Notes:

1. All water demand calculations based on the City of Ottawa Design Guidelines for Water Distribution Table 4.2.
2. Water Demand is based assuming all lands to be Other Commercial with a demand of 28,000L/gross ha/d.
3. Peaking Factors: Maximum Daily Demand = 1.5 average daily demand ; Peak Hour = 1.8 max daily demand.
4. Gross Floor Area demand calculations based on Ontario Building Code; 9.3 m^2/pers and 75 L/pers/day

Prepared By:
NOVATECH ENGINEERING CONSULTANTS LTD.
Date: December 9, 2013

M:\2013\113150\DATA\Calculations\WaterDemand Dec 2013.xls

12 Storey Office Building
Fire Flow Calculations - Holland Cross Expansion

As per Fire Underwriter's Survey Guidelines

PROJECT: Holland Cross Expansion **DATE: December 12, 2013**
JOB#: 113150

C	**Coefficient related to type of construction**	[yes/no]	
	◆ Wood frame		1.5
	◆ Ordinary construction		1
	◆ Non-combustible construction		0.8
	◆ Fire resistive construction (> 3 hrs)	yes	0.6
	◆ Interpolation (Using FUS Tables)		

Foot Print of New Tower	18,610 ft^2
Gross Floor area of Expanded Common Podium	99,060 ft^2
Gross Floor area of Existing Garage	129,920 ft^2

A **Area of structure considered (m^2)** 5,320 <==> **57,269** ft^2

(All floors excluding Basement, under 2-Storeys)

*Note: This assumes protected openings, and considers 40% of the common 1 storey podium, plus 25% of the GFA of each of the two adjacent floors (New Tower + 40% of Garage)

F **Required fire flow (L/min)**

$F = 220\ C\ (A)^{0.5}$ ***10,000 L/min***

Occupancy hazard reduction of surcharge	[yes/no]		
◆ Non-combustible		-25%	
◆ Limited combustible	yes	-15%	* Due to Parking Garage
◆ Combustible		0%	
◆ Free burning		15%	
◆ Rapid burning		25%	
			8,500 L/min **(1)**

Sprinkler Reduction

◆ Non-combustible - Fire Resistive (3)	yes	50%	***4,250 L/min*** **(2)**

Exposure surcharge (cumulative (%))	[yes/no]			
0 - 3 m		25%		
3.1 - 10 m		20%		
10.1 - 20 m	yes	15%	1 side	15%
20.1 - 30 m	yes	10%	1 side	10%
30.1- 45 m	no	5%	1 side	
		Cumulative Total		**25%**

2,125 L/min

Fire Wall Separation

- Number of Party Walls * 1000 L/min

(As per City of Ottawa Standard) ***2,125 L/min*** **(3)**

REQUIRED FIRE FLOW [(1) - (2) + (3)]		***6,000 L/min***
(2,000 L/min < Fire Flow < 45,000 L/min)	***or***	***100 L/s***
Rounded to nearest 1000L/min	***or***	***1,321 IGPM***

BY: *Alex McAuley*

6-4.5.9* For individual fasteners, the loads determined in 6-4.5.6 shall not exceed the allowable loads provided in Figure 6-4.5.9.

The type of fasteners used to secure the bracing assembly to the structure shall be limited to those shown in Figure 6-4.5.9. For connections to wood, through bolts with washers on each end shall be used. Holes for through bolts shall be $^1/_{16}$ in. (1.6 mm) greater than the diameter of the bolt.

Exception No. 1: Where it is not practical to install through bolts due to the thickness of the member or inaccessibility, lag screws shall be permitted. Holes shall be pre-drilled $^1/_8$ in. (3.2 mm) smaller than the maximum root diameter of the lag screw.

Exception No. 2: Other fastening methods are acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 6-4.5.9. Calculations shall be permitted where required by the authority having jurisdiction.

6-4.5.10 Sway bracing assemblies shall be listed for a maximum load rating. The loads shall be reduced as shown in Table 6-4.5.10 for loads that are less than 90 degrees from vertical.

Exception: Where sway bracing utilizing pipe, angles, flats, or rods as shown in Table 6-4.5.8 is used, the components do not require listing. Bracing fittings and connections used with those specific materials shall be listed.

Table 6-4.5.10 Allowable Horizontal Load on Brace Assemblies Based on the Weakest Component of the Brace Assembly

Brace Angle	Allowable Horizontal Load
30–40 degrees from vertical	Listed load rating divided by 2.000
45–59 degrees from vertical	Listed load rating divided by 1.414
60–89 degrees from vertical	Listed load rating divided by 1.155
90 degrees from vertical	Listed load rating

6-4.5.11 Bracing shall be attached directly to feed and cross mains. Each run of pipe between changes in direction shall be provided with both lateral and longitudinal bracing.

Exception: Pipe runs less than 12 ft (3.6 m) in length shall be permitted to be supported by the braces on adjacent runs of pipe.

6-4.5.12 A length of pipe shall not be braced to sections of the building that will move differentially.

6-4.6 Restraint of Branch Lines.

6-4.6.1* Restraint is considered a lesser degree of resisting loads than bracing and shall be provided by use of one of the following:

(1) A listed sway brace assembly
(2) A wraparound U-hook satisfying the requirements of 6-4.5.3, Exception No. 3
(3) No. 12, 440-lb (200-kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe
(4) Other approved means

Wire used for restraint shall be located within 2 ft (610 mm) of a hanger. The hanger closest to a wire restraint shall be of a type that resists upward movement of a branch line.

6-4.6.2 The end sprinkler on a line shall be restrained against excessive vertical and lateral movement.

6-4.6.3* Where upward or lateral movement would result in an impact against the building structure, equipment, or finish materials, branch lines shall be restrained at intervals not exceeding 30 ft (9 m).

6-4.6.4* Sprig-ups 4 ft (1.2 m) or longer shall be restrained against lateral movement.

6-4.7 Hangers and Fasteners Subject to Earthquakes.

6-4.7.1 C-type clamps (including beam and large flange clamps) used to attach hangers to the building structure in areas subject to earthquakes shall be equipped with a restraining strap. The restraining strap shall be listed for use with a C-type clamp or shall be a steel strap of not less than 16 gauge thickness and not less than 1 in. (25.4 mm) wide for pipe diameters 8 in. (203 mm) or less and 14 gauge thickness and not less than $1^1/_4$ in. (31.7 mm) wide for pipe diameters greater than 8 in. (203 mm). The restraining strap shall wrap around the beam flange not less than 1 in. (25.4 mm). A lock nut on a C-type clamp shall not be used as a method of restraint. A lip on a "C" or "Z" purlin shall not be used as a method of restraint.

Where purlins or beams do not provide an adequate lip to be secured by a restraining strap, the strap shall be through-bolted or secured by a self-tapping screw.

6-4.7.2 C-type clamps (including beam and large flange clamps), with or without restraining straps, shall not be used to attach braces to the building structure.

6-4.7.3 Powder-driven fasteners shall not be used to attach braces to the building structure.

Exception: Powder-driven fasteners shall be permitted where they are specifically listed for service in resisting lateral loads in areas subject to earthquakes.

6-4.7.4 Powder-driven fasteners shall not be used to attach hangers to the building structure where the systems are required to be protected against earthquakes using a horizontal force factor exceeding 0.50 W_p, where W_p is the weight of the water-filled pipe.

Exception: Powder-driven fasteners shall be permitted where they are specifically listed for horizontal force factors in excess of 0.50 W_p.

Chapter 7 Design Approaches

7-1 General.

7-1.1 Water demand requirements shall be determined from the occupancy hazard fire control approach of Section 7-2.

Exception: Special design approaches as permitted in Section 7-9.

7-1.2 For buildings with two or more adjacent occupancies that are not physically separated by a barrier or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding occupancy shall extend 15 ft (4.6 m) beyond its perimeter.

7-2 Occupancy Hazard Fire Control Approach.

7-2.1 Occupancy Classifications.

7-2.1.1 Occupancy classifications for this standard relate to sprinkler installations and their water supplies only. They shall not be used as a general classification of occupancy hazards.

7-2.1.2 Occupancies or portions of occupancies shall be classified according to the quantity and combustibility of contents, the expected rates of heat release, the total potential for energy release, the heights of stockpiles, and the presence of flammable and combustible liquids, using the definitions contained in Section 1-4. Classifications are as follows:

Light hazard

Ordinary hazard (Groups 1 and 2)

Extra hazard (Groups 1 and 2)

Special occupancy hazard *(see Section 7-10)*

7-2.2 Water Demand Requirements — Pipe Schedule Method.

7-2.2.1 Table 7-2.2.1 shall be used in determining the minimum water supply requirements for light and ordinary hazard occupancies protected by systems with pipe sized according to the pipe schedules of Section 8-5. Pressure and flow requirements for extra hazard occupancies shall be based on the hydraulic calculation methods of 7-2.3. The pipe schedule method shall be permitted only for new installations of 5000 ft² (465 m²) or less or for additions or modifications to existing pipe schedule systems sized according to the pipe schedules of Section 8-5. Table 7-2.2.1 shall be used in determining the minimum water supply requirements.

Exception No. 1: The pipe schedule method shall be permitted for use in systems exceeding 5000 ft² (465 m²) where the flows required in Table 7-2.2.1 are available at a minimum residual pressure of 50 psi (3.4 bar) at the highest elevation of sprinkler.

Exception No. 2: The pipe schedule method shall be permitted for additions or modifications to existing extra hazard pipe schedule systems.

7-2.2.2 The lower duration value of Table 7-2.2.1 shall be acceptable only where remote station or central station waterflow alarm service is provided.

7-2.2.3* The residual pressure requirement of Table 7-2.2.1 shall be met at the elevation of the highest sprinkler. *(See the Exceptions to 7-2.2.1).*

7-2.2.4 The lower flow figure of Table 7-2.2.1 shall be permitted only where the building is of noncombustible construction or the potential areas of fire are limited by building size or compartmentation such that no open areas exceed 3000 ft² (279 m²) for light hazard or 4000 ft² (372 m²) for ordinary hazard.

Table 7-2.2.1 Water Supply Requirements for Pipe Schedule Sprinkler Systems

Occupancy Classification	Minimum Residual Pressure Required (psi)	Acceptable Flow at Base of Riser (Including Hose Stream Allowance) (gpm)	Duration (minutes)
Light hazard	15	500–750	30–60
Ordinary hazard	20	850–1500	60–90

For SI units, 1 gpm = 3.785 L/min; 1 psi = 0.0689 bar.

7-2.3 Water Demand Requirements — Hydraulic Calculation Methods.

7-2.3.1 General.

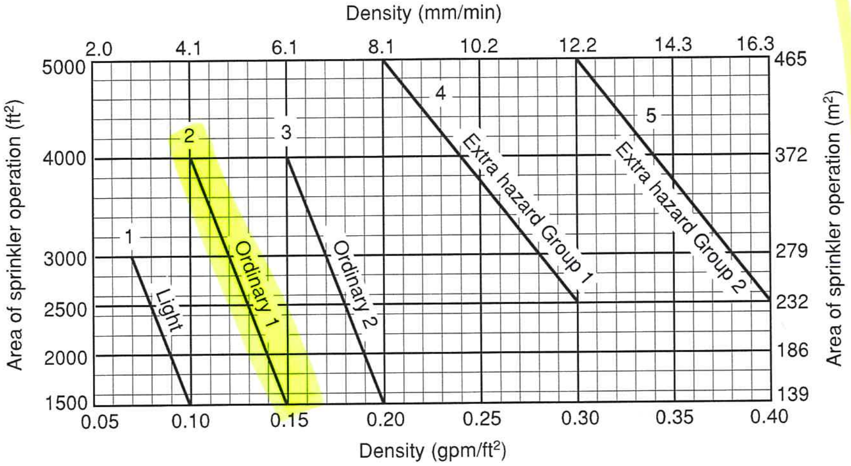
7-2.3.1.1* The minimum water supply requirements for a hydraulically designed occupancy hazard fire control sprinkler system shall be determined by adding the hose stream demand from Table 7-2.3.1.1 to the water supply for sprinklers determined in 7-2.3.1.2. This supply shall be available for the minimum duration specified in Table 7-2.3.1.1.

Exception No. 1: An allowance for inside and outside hose shall not be required where tanks supply sprinklers only.

Exception No. 2: Where pumps taking suction from a private fire service main supply sprinklers only, the pump need not be sized to accommodate inside and outside hose. Such hose allowance shall be considered in evaluating the available water supplies.

7-2.3.1.2 The water supply for sprinklers only shall be determined either from the area/density curves of Figure 7-2.3.1.2 in accordance with the method of 7-2.3.2 or be based upon the room design method in accordance with 7-2.3.3, at the discretion of the designer. For special areas under consideration, as described in 7-2.3.4, separate hydraulic calculations shall be required in addition to those required by 7-2.3.2 or 7-2.3.3.

Figure 7-2.3.1.2 Area/density curves.



TO BE CONSERVATIVE
-CURVE 2
4000ft² x 0.10gpm/ft² = 400gpm

SPRINKLERS
400gpm => 25.2 L/s

HOSE DEMAND
250gpm => 15.8 L/s

TOTAL SUPPLY REQUIREMENT
650gpm => 41.0L/s

7-2.3.1.3 Regardless of which of the two methods is used, the following restrictions shall apply:

(a) For areas of sprinkler operation less than 1500 ft² (139 m²) used for light and ordinary hazard occupancies, the density for 1500 ft² (139 m²) shall be used. For areas of sprinkler operation less than 2500 ft² (232 m²) for extra hazard occupancies, the density for 2500 ft² (232 m²) shall be used.

(b) *For buildings having unsprinklered combustible concealed spaces (as described in 5-13.1.1 and 5-13.7), the minimum area of sprinkler operation shall be 3000 ft² (279 m²).

Exception No. 1: Combustible concealed spaces filled entirely with noncombustible insulation.

*Exception No. 2: *Light or ordinary hazard occupancies where noncombustible or limited combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft³ (4.8 m³) or less in volume.*

*Exception No. 3: *Concealed spaces where the exposed surfaces have a flame spread rating of 25 or less and the materials have been demonstrated to not propagate fire in the form in which they are installed in the space.*

(c) Water demand of sprinklers installed in racks or water curtains shall be added to the ceiling sprinkler water demand at the point of connection. Demands shall be balanced to the higher pressure. *(See Chapter 8.)*

(d) Water demand of sprinklers installed in concealed spaces or under obstructions such as ducts and cutting tables need not be added to ceiling demand.

(e) Where inside hose stations are planned or are required, a total water allowance of 50 gpm (189 L/min) for a single hose station installation or 100 gpm (378 L/min) for a multiple hose station installation shall be added to the sprinkler requirements. The water allowance shall be added in 50-gpm (189-L/min) increments beginning at the most remote hose station, with each increment added at the pressure required by the sprinkler system design at that point.

(f) When hose valves for fire department use are attached to wet pipe sprinkler system risers in accordance with 5-15.5.2, the water supply shall not be required to be added to standpipe demand as determined from NFPA 14, *Standard for the Installation of Standpipe and Hose Systems.*

Exception No. 1: Where the combined sprinkler system demand and hose stream allowance of Table 7-2.3.1.1 exceeds the requirements of NFPA 14, Standard for the Installation of Standpipe and Hose Systems, this higher demand shall be used.

Exception No. 2: For partially sprinklered buildings, the sprinkler demand, not including hose stream allowance, as indicated in Table 7-2.3.1.1 shall be added to the requirements given in NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

(g) Water allowance for outside hose shall be added to the sprinkler and inside hose requirement at the connection to the city water main or a yard hydrant, whichever is closer to the system riser.

(h) The lower duration values in Table 7-2.3.1.1 shall be permitted where remote station or central station waterflow alarm service is provided.

(i) Where pumps, gravity tanks, or pressure tanks supply sprinklers only, requirements for inside and outside hose need not be considered in determining the size of such pumps or tanks.

7-2.3.1.4 Total system water supply requirements shall be determined in accordance with the hydraulic calculation procedures of Section 8-4.

7-2.3.2 Area/Density Method.

7-2.3.2.1 The water supply requirement for sprinklers only shall be calculated from the area/density curves in Figure 7-2.3.1.2 or from Section 7-10 where area/density criteria is specified for special occupancy hazards. When using Figure 7-2.3.1.2, the calculations shall satisfy any single point on the appropriate area/density curve as follows:

(1) Light hazard area/density curve 1
(2) Ordinary hazard (Group 1) area/density curve 2
(3) Ordinary hazard (Group 2) area/density curve 3
(4) Extra hazard (Group 1) area/density curve 4
(5) Extra hazard (Group 2) area/density curve 5

It shall not be necessary to meet all points on the selected curve.

Exception: Sprinkler demand for storage occupancies as determined in Sections 7-3 through 7-8.

7-2.3.2.2 For protection of miscellaneous storage, miscellaneous tire storage, and storage up to 12 ft (3.7 m) in height, the discharge criteria in Table 7-2.3.2.2 shall apply.

Table 7-2.3.1.1† Hose Stream Demand and Water Supply Duration Requirements for Hydraulically Calculated Systems

Occupancy or Commodity Classification	Inside Hose (gpm)	Total Combined Inside and Outside Hose (gpm)	Duration (minutes)
Light hazard	0, 50, or 100	100	30
Ordinary hazard	0, 50, or 100	250	60–90
Extra hazard	0, 50, or 100	500	90–120
Rack storage, Class I, II, and III commodities up to 12 ft (3.7 m) in height	0, 50, or 100	250	90
Rack storage, Class IV commodities up to 10 ft (3.1 m) in height	0, 50, or 100	250	90
Rack storage, Class IV commodities up to 12 ft (3.7 m) in height	0, 50, or 100	500	90
Rack storage, Class I, II, and III commodities over 12 ft (3.7 m) in height	0, 50, or 100	500	90
Rack storage, Class IV commodities over 12 ft (3.7 m) in height and plastic commodities	0, 50, or 100	500	120
General storage, Class I, II, and III commodities over 12 ft (3.7 m) up to 20 ft (6.1 m)	0, 50, or 100	500	90
General storage, Class IV commodities over 12 ft (3.7 m) up to 20 ft (6.1 m)	0, 50, or 100	500	120
General storage, Class I, II, and III commodities over 20 ft (6.1 m) up to 30 ft (9.1 m)	0, 50, or 100	500	120
General storage, Class IV commodities over 20 ft (6.1 m) up to 30 ft (9.1 m)	0, 50, or 100	500	150
General storage, Group A plastics ≤ 5 ft (1.5 m)	0, 50, or 100	250	90
General storage, Group A plastics over 5 ft (1.5 m) up to 20 ft (6.1 m)	0, 50, or 100	500	120
General storage, Group A plastics over 20 ft (6.1 m) up to 25 ft (7.6 m)	0, 50, or 100	500	150

For SI units, 1 gpm = 3.785 L/min.

From: White, Joshua <Joshua.White@ottawa.ca>
Sent: October-29-13 3:49 PM
To: Alex McAuley
Cc: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Good eye Alex. There was a mistake in the model. We are looking into it please find the revision below to the HGL.

The Max Day + FF HGL is actually 77.5m, not 112.2m.

Cheers

Josh

From: Alex McAuley [mailto:a.mcauley@novatech-eng.com]
Sent: October 11, 2013 11:28 AM
To: White, Joshua
Cc: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Josh,

Can you please double check the HGL below? The Max Day + Fire Flow is 4.8m above the Min HGL, which is unusual.

Thank you,

Alex McAuley, P.Eng
Project Engineer
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643
Fax: 613-254-5867

From: Alex McAuley
Sent: October-11-13 11:22 AM
To: 'White, Joshua'
Cc: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Thank you Josh,

Regards,

Alex McAuley, P.Eng
Project Engineer
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643
Fax: 613-254-5867

From: White, Joshua [mailto:Joshua.White@ottawa.ca]
Sent: October-11-13 9:44 AM
To: Alex McAuley
Cc: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Hi Alex,

I have received the revised boundary conditions.

Cheers

Josh

Please find attached the revised boundary conditions for the above noted

******The following information may be passed on to the consultant, but do NOT forward this e-mail directly.******

The following are boundary conditions, HGL, for hydraulic analysis at 1560 Scott Street (zone 1W) assumed to be connected to the existing 152mm on Bullman (see attached PDF for location).

Minimum HGL = 107.4 m

Maximum HGL = 115.8 m

Max Day + FF (92.7 L/s) = 112.2 m

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.

From: Alex McAuley [mailto:a.mcauley@novatech-eng.com]
Sent: October 08, 2013 10:04 AM
To: White, Joshua
Cc: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Hi Josh,

Thank you for the information.

We will be reusing the existing 150mm diameter water service that is fed from the corner of Bullman Street and Hamilton Ave N. The information provided below is for the Holland Street service, and gives us approximately 22.8psi during fire flow conditions which is sufficient. We are close to the Scott Street trunk watermain, so I wouldn't anticipate a major drop, but will there be any change to the HGL at that location?

I attached a sketch with the location of the service we are proposing to use.

Regards,

Alex McAuley, P.Eng
Project Engineer
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643
Fax: 613-254-5867

From: White, Joshua [mailto:Joshua.White@ottawa.ca]
Sent: October-07-13 11:10 AM
To: Alex McAuley
Subject: RE: Holland Cross - 1560 Scott Street

Hi Alex,

Here is the results of the water boundary condition modeling.

Cheers

Josh

The following are boundary conditions, HGL, for hydraulic analysis at 1560 Scott Street (zone 1W) assumed to be connected to the existing 152mm on Holland Avenue (see attached PDF for location).

Minimum HGL = 108.8 m

Maximum HGL = 115.3 m

Max Day + FF (92.7 L/s) = 77.0 m

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.

From: Alex McAuley [mailto:a.mcauley@novatech-eng.com]
Sent: September 27, 2013 10:36 AM
To: White, Joshua
Subject: RE: Holland Cross - 1560 Scott Street

Hi Josh,

We will be reusing the existing water connection.

Alex McAuley, P.Eng
Engineer
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643
Fax: 613-254-5867

From: White, Joshua [mailto:Joshua.White@ottawa.ca]
Sent: September-26-13 1:19 PM
To: Alex McAuley
Subject: RE: Holland Cross - 1560 Scott Street

Hi Alex,

Just to confirm the water connection will be from the internal private water main, or are you planning on installing a connection to the water main in the street.

Cheers

Josh

From: Alex McAuley [mailto:a.mcauley@novatech-eng.com]
Sent: September 26, 2013 11:44 AM
To: White, Joshua
Cc: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Josh,

Per our phone conversation yesterday, I have revised our fire flow calculations for the new addition based on FUS for a sprinklered office building with fire resistive construction.

I have calculated the fire flows and demands based on the new expansion only, as the existing two towers have independent services.

Fire Flow (FUS) = 92.7 L/s
Average Daily Flow = 1.88 L/s
Max Day Flow = 2.81 L/s
Max hourly Flow = 3.38 L/s

Please let me know if you require additional information.

Regards,

Alex McAuley, P.Eng
Engineer
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643
Fax: 613-254-5867

From: Cara Ruddle
Sent: September-19-13 11:02 AM
To: Alex McAuley
Subject: FW: Holland Cross - 1560 Scott Street

Cara Ruddle, P.Eng.
Project Manager
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643 x 220
Fax: 613-254-5867

The information contained in this email message is confidential and is for exclusive use of the addressee.

From: White, Joshua [mailto:Joshua.White@ottawa.ca]
Sent: September-19-13 11:05 AM
To: Cara Ruddle
Subject: RE: Holland Cross - 1560 Scott Street

Hi Cara,

The fire flow should be based off of the Fire Under Writers Survey. Also the may I please have the following information;

Average Daily Flow: l/s
Max Day Flow: l/s
Max hourly Flow: l/s

I have put in a request to our ISD regarding possible servicing constraints in the area and I will relay them to you once I have received them.

Cheers

Josh

From: Cara Ruddle [mailto:c.ruddle@novatech-eng.com]
Sent: September 19, 2013 10:43 AM
To: White, Joshua
Subject: Holland Cross - 1560 Scott Street

Josh:
Using the NFPA 13 Sprinkler/Hose demands and a max day office demand we have calculated a fire flow requirement of 650gpm (43.82L/s) for the new 12 storey building. We would use the existing 150mm water service at the corner of Bullman and Hamilton.

Sanitary flows are calculated to be just less than 3.0 L/s. The sanitary connection for the building is also by the intersection of Bullman and Hamilton.

As discussed, please provide boundary conditions for the water system and any servicing constraints that you are aware of for this development.

Please call or email if you have any questions. Thanks.

Cara Ruddle, P.Eng.
Project Manager
****
Novatech Engineering Consultants Ltd
200-240 Michael Cowpland Drive
Ottawa . Ontario . Canada . K2M 1P6

Office: 613-254-9643 x 220
Fax: 613-254-5867

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APPENDIX B

Sanitary Sewer Information

SANITARY SEWER DESIGN SHEET

NOVATECH
ENGINEERING
CONSULTANTS LTD.

PROJECT : 113150
DESIGNED BY: ARM
CHECKED BY: CJR
DATE: 09-Dec-13
DATE REVISED:

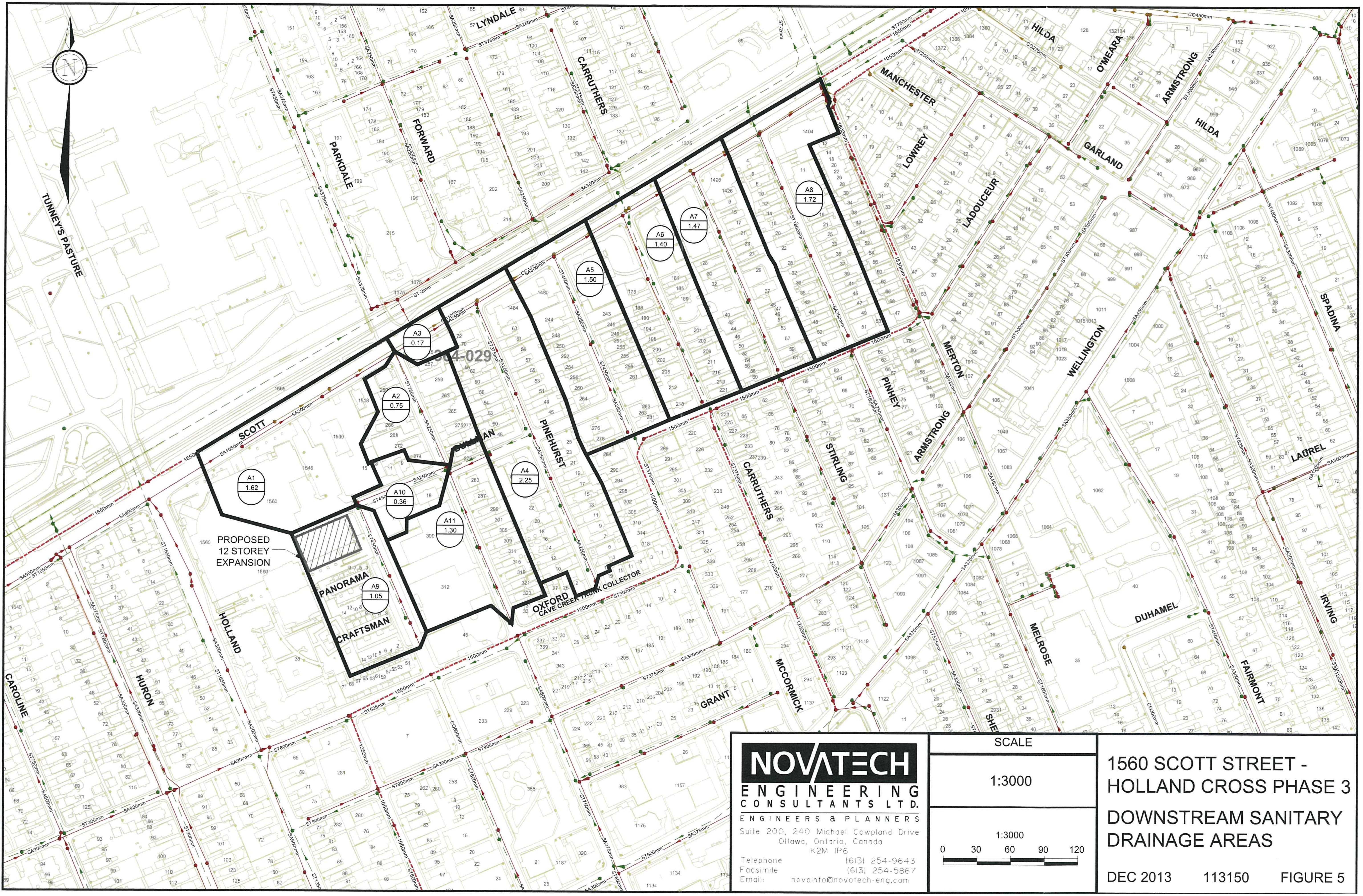
LOCATION				JOBS & POPULATION											PROPOSED SEWER PIPE						CHECK
STREET	FROM	TO	AREA (ha)	Jobs (per ha) 207	Population (per ha) 48	CUMULATIVE			Jobs/Commercial		Population		PEAK EXTRAN. FLOW Q(i) (L/s) 0.28	PEAK DESIGN FLOW Q(d) (L/s)	DIA. (mm)	PIPE ID (mm)	TYPE OF PIPE	SLOPE (%)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	Qpeak/ Qcap
						Jobs	POP.	AREA (ha)	PEAK FACTOR (M)	FLOW Q(p) (L/s)	PEAK FACTOR (M)	POP. FLOW Q(p) (L/s)									
Hamilton Av N	Oxford	Bullman	1.05	217	50	217	50	1.05	1.50	0.28	4.00	0.81	0.29	1.39	250	251.5	DR 35	0.24	29.6	0.60	4.7%
12 Storey Office	Bullman			2161	0	2161	0	1.05	1.50	2.81	4.00	0.00	0.29	3.11	250	251.5	DR 35	0.24	29.6	0.60	10.5%
Bullman	Hamilton	Parkdale	0.36	75	17	2453	67	2.46	1.50	3.19	4.00	1.09	0.69	4.97	250	251.5	DR 35	0.24	29.6	0.60	16.8%
Parkdale	Oxford	Bullman	1.30	269	62	2722	129	3.76	1.50	3.54	4.00	2.09	1.05	6.69	250	251.5	DR 35	0.24	29.6	0.60	22.6%
Parkdale	Bullman	Scott	0.75	155	36	2877	165	4.51	1.50	3.75	4.00	2.67	1.26	7.68	250	251.5	DR 35	0.24	29.6	0.60	26.0%
Scott		Parkdale	1.62	335	78	335	78	1.62	1.50	0.44	4.00	1.26	0.45	2.15	250	251.5	DR 35	0.24	29.6	0.60	7.3%
Scott	Parkdale	Pinehurst	0.17	35	8	3247	251	6.30	1.50	4.23	4.00	4.07	1.76	10.06	250	251.5	DR 35	0.24	29.6	0.60	34.0%
Scott	Pinehurst		2.25	466	108	3713	359	8.55	1.50	4.83	4.00	5.82	2.39	13.05	300	299.4	DR 35	0.19	41.9	0.60	31.1%
Scott		Carruthers	1.50	311	72	4024	431	10.05	1.50	5.24	4.00	6.98	2.81	15.04	300	299.4	DR 35	0.19	41.9	0.60	35.9%
Scott	Carruthers	Stirling	1.40	290	67	4314	498	11.45	1.50	5.62	3.98	8.02	3.21	16.84	300	299.4	DR 35	0.19	41.9	0.60	40.2%
Scott	Stirling	Pinhey	1.47	304	71	4618	569	12.92	1.50	6.01	3.94	9.09	3.62	18.72	300	299.4	DR 35	0.19	41.9	0.60	44.7%
Scott	Pinhey	Merton	1.72	356	83	4974	652	14.64	1.50	6.48	3.91	10.33	4.10	20.91	300	299.4	DR 35	0.19	41.9	0.60	49.9%

* Note: Assumed minimum slope

Notes:

1. Q(d) = Q(p) + Q(i) , where
   Q(d) = Design Flow (L/sec)
   Q(p) = Population Flow (L/sec)
   Q(i) = Extraneous Flow (L/sec)
2. Q(i) = 0.28 L/sec/ha
3. Q(p) = (PxqxM/86.4), where
   P = Persons (Population = 48/ha, Jobs=207/ha)
   q = Average per capita flow = 350 L/cap/day
   M = Harmon Formula (maximum of 4.0)
4. Depth of flow/Diameter from Hydraulic properties of circular pipes flowing partially full
5. Population/Jobs Target Density 2031 = 250/ha (17915 jobs, 4204 pop = 255/ha density at 2031) per Figure 30 for Tunney's-Quad area (*Residential Land Strategy for Ottawa 2006-2031, City of Ottawa Feb 2009*)

Breakdown	Jobs	Population
Projected	17915	4204
Percentage	81.0%	19.0%
At 255/ha =	207	48



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Email:	novainfo@novatech-eng.com

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1560 SCOTT STREET - HOLLAND CROSS PHASE 3

DOWNSTREAM SANITARY DRAINAGE AREAS

DEC 2013 113150 FIGURE 5

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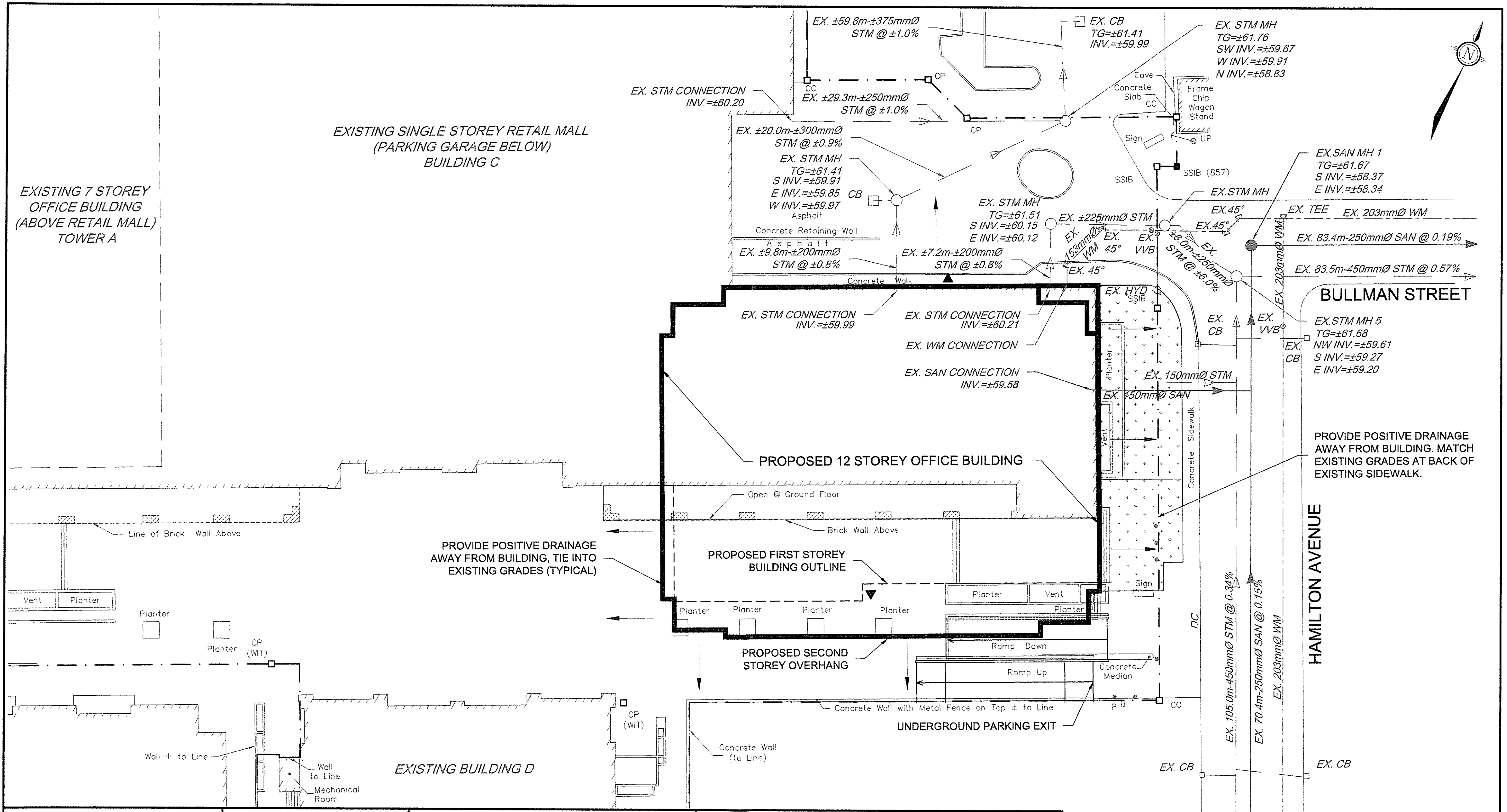
APPENDIX C

Engineering Figures



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1560 SCOTT STREET- HOLLAND CROSS PHASE 3

GRADING AND SERVICING

DEC 2013 113150 FIGURE 6

NOTE:

ALL UNDERGROUND INFORMATION WITHIN PROPERTY LIMITS OBTAINED FROM RYBKA, SMITH AND GINSLER LIMITED CONSULTING ENGINEERS PLAN TITLED "SITE PLAN-MECHANICAL" DATED AUGUST 26, 1987. ALL UNDERGROUND INFORMATION WITHIN CITY OF OTTAWA RIGHT OF WAY OBTAINED FROM CITY OF OTTAWA PLAN AND PROFILE RECORD DRAWINGS 2032-1 & 2032-2 (CITY OF OTTAWA RECORD NUMBER 14274) DATED JULY 13, 2006.

ALL INFORMATION CONTAINED ON THIS PLAN IS APPROXIMATE. ALL SERVICE LOCATIONS AND ELEVATIONS ARE TO BE CONFIRMED ON SITE AT THE TIME OF CONSTRUCTION.

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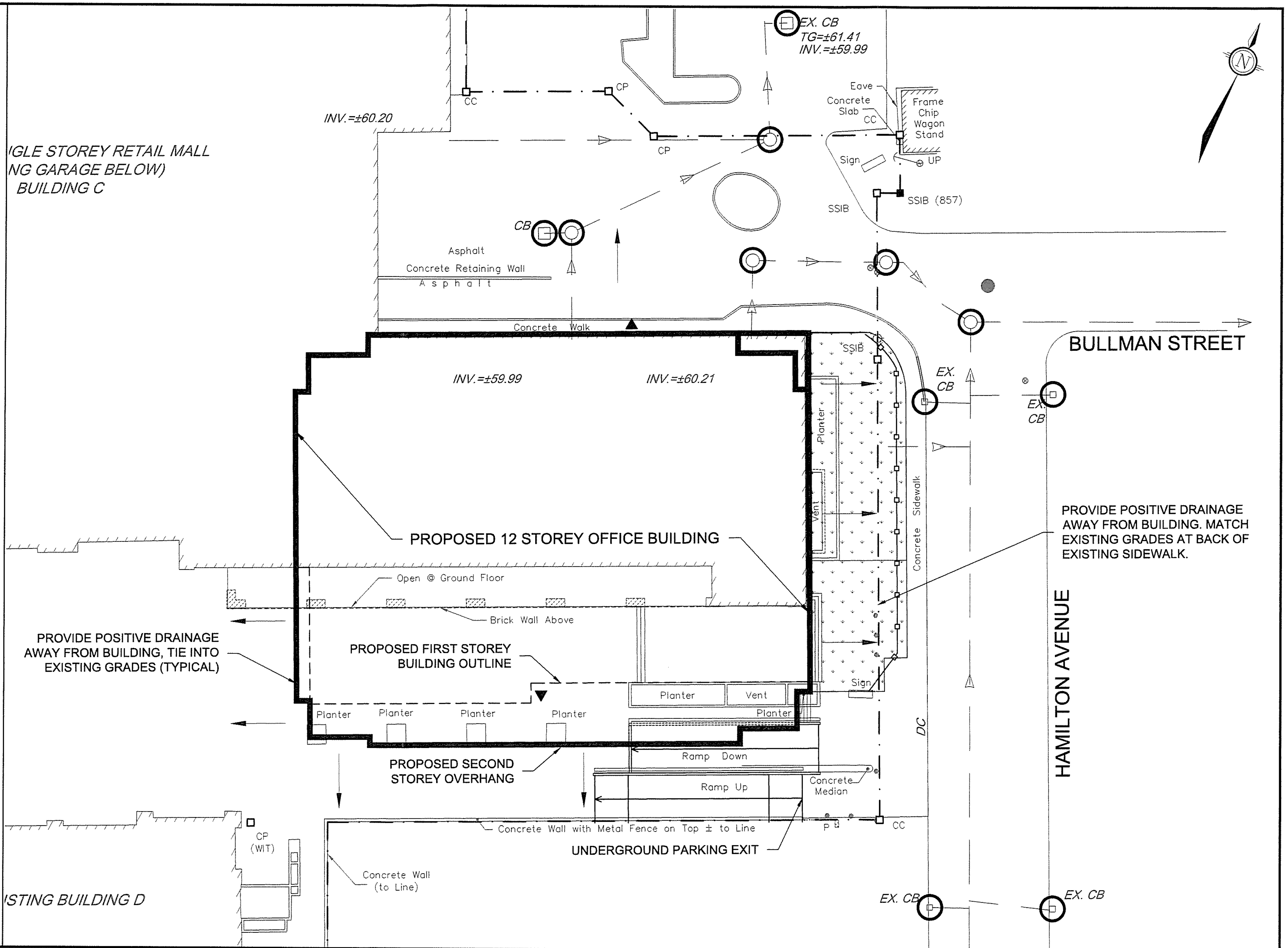
EROSION AND SEDIMENT CONTROL NOTES:

1. THE OWNER AGREES TO PREPARE AND IMPLEMENT AN EROSION AND SEDIMENT CONTROL PLAN TO THE SATISFACTION OF THE CITY OF OTTAWA, APPROPRIATE TO THE SITE CONDITIONS, PRIOR TO UNDERTAKING ANY SITE ALTERATIONS (FILLING, GRADING, REMOVAL OF VEGETATION, ETC.) AND DURING ALL PHASES OF SITE PREPARATION AND CONSTRUCTION IN ACCORDANCE WITH THE CURRENT BEST MANAGEMENT PRACTICES FOR EROSION AND SEDIMENT CONTROL SUCH AS BUT NOT LIMITED TO INSTALLING FILTER CLOTHS ACROSS MANHOLE/CATCHBASIN LIDS TO PREVENT SEDIMENTS FROM ENTERING STRUCTURES AND INSTALL AND MAINTAIN A LIGHT DUTY SILT FENCE BARRIER AS REQUIRED.
2. THE CONTRACTOR SHALL PLACE FILTER CLOTH UNDER THE CATCHBASIN AND MANHOLE GRATES FOR THE DURATION OF CONSTRUCTION AND WILL REMAIN IN PLACE DURING ALL PHASES OF CONSTRUCTION.
3. SILT FENCING FOR ENTIRE PERIMETER OF SITE, SHALL BE UTILIZED TO CONTROL EROSION FROM THE SITE DURING CONSTRUCTION.
4. THE CONTRACTOR ACKNOWLEDGES THAT FAILURE TO IMPLEMENT EROSION AND SEDIMENT CONTROL MEASURES MAY BE SUBJECT TO PENALTIES IMPOSED BY ANY APPLICABLE REGULATORY AGENCY.

LEGEND

◯	FILTER CLOTH CATCH
-□---□---□-	SILT FENCE PER OPSD 219.110
— — ▷	EXISTING STORM PIPE
☐	EXISTING CB
○	EXISTING STORM MH
●	EXISTING SANITARY MH



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1560 SCOTT STREET- HOLLAND CROSS PHASE 3

EROSION AND SEDIMENT CONTROL PLAN

DEC 2013 113150 FIGURE 7

NOTE:

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APPENDIX D

City of Ottawa Checklist

Project Name: Holland Cross Expansion
Project Number: 113150
Date: 13/12/2013

Development Servicing Study Checklist

4.1 General Content	**Addressed (Y/N/NA)**	**Section**	**Comments**
Executive Summary (for larger reports only).	NA		
Date and revision number of the report.	Y		
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y		
Plan showing the site and location of all existing services.	Y		
Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.	N		Refer to Planning Rationale
Summary of Pre-consultation Meetings with City and other approval agencies.	N		
Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.	NA		
Statement of objectives and servicing criteria.	Y		
Identification of existing and proposed infrastructure available in the immediate area.	Y		
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	NA		
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	NA		The proposed building will occupy the majority of the site.

Development Servicing Study Checklist

4.1 General Content	Addressed (Y/N/NA)	Section	Comments
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	NA		
Proposed phasing of the development, if applicable.	NA		
Reference to geotechnical studies and recommendations concerning servicing.	NA		
All preliminary and formal site plan submissions should have the following information:			
Metric scale	Y		
North arrow (including construction North)	Y		
Key plan	Y		
Name and contact information of applicant and property owner	Y		
Property limits including bearings and dimensions	Y		
Existing and proposed structures and parking areas	Y		
Easements, road widening and rights-of-way	Y		
Adjacent street names	Y		

Development Servicing Study Checklist

4.2 Water	Addressed (Y/N/NA)	Section	Comments
Confirm consistency with Master Servicing Study, if available.	N		None Known
Availability of public infrastructure to service proposed development.	Y		
Identification of system constraints.	N		None Known
Identify boundary conditions.	Y		City supplied
Confirmation of adequate domestic supply and pressure.	Y		
Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Y		
Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Y		
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	NA		No phasing planned
Address reliability requirements such as appropriate location of shut-off valves.	Y		
Check on the necessity of a pressure zone boundary modification.	NA		
Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Y		
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y		
Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	NA		
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y		
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	NA		

Development Servicing Study Checklist

4.3 Wastewater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).	Y		
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N		
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N		
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y		
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	Y		
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Y		
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y		
Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).	NA		
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	NA		
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	NA		
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	NA		
Special considerations such as contamination, corrosive environment etc.	NA		

Development Servicing Study Checklist

4.4 Stormwater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y		
Analysis of the available capacity in existing public infrastructure.	N		Hard surface areas and theferore, storm flows are not being increased.
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	N		Drainage patterns are not being altered.
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y		
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	N		The site will be roof and underground parking (sanitary sewer)
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y		
Set-back from private sewage disposal systems.	NA		
Watercourse and hazard lands setbacks.	NA		
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	NA		
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	NA		
Storage requirements (complete with calcs) and conveyance capacity for 5 yr and 100 yr events.	Y		
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	NA		
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	NA		
Any proposed diversion of drainage catchment areas from one outlet to another.	NA		
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM facilities.	NA		
If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.	NA		

Development Servicing Study Checklist

4.4 Stormwater	**Addressed (Y/N/NA)**	**Section**	**Comments**
Identification of municipal drains and related approval requirements.	NA		
Description of how the conveyance and storage capacity will be achieved for the development.	NA		
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	NA		
Inclusion of hydraulic analysis including HGL elevations.	NA		
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	NA		
Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.	NA		
Identification of fill constrains related to floodplain and geotechnical investigation.	NA		

Development Servicing Study Checklist

4.5 Approval and Permit Requirements	**Addressed (Y/N/NA)**	**Section**	**Comments**
Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.	NA		
Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	NA		
Changes to Municipal Drains.	NA		
Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	NA		

4.6 Conclusion	**Addressed (Y/N/NA)**	**Section**	**Comments**
Clearly stated conclusions and recommendations.	Y		
Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.	Y		
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y		

Appendix F DRAWINGS