Lithos

March 2017

UD14-005

Functional Servicing and Stormwater Management Report

Project: 231 Cobourg Street

Uganda High Commission Ottawa

Lithos Group Inc.
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Principal

LITHOS GROUP INC.

Issues and Revisions Registry

Identification	Date	Description of issued and/or revision
Final FSR/SWM Report	2017-3-31	Issued for Site Plan Application (SPA)

Statement of Conditions

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Executive Summary

Lithos Group Inc. (Lithos) was retained by Uganda High Commission Ottawa (Owner) and Ten-2-Four Architecture Inc. (Architect) to prepare a Functional Servicing and Stormwater Management Report in support of a Site Plan Application for a proposed office use development at 231 Cobourg Street, in the City of Ottawa (City). The following summarizes our conclusions:

Storm Drainage

The site stormwater discharge will be controlled to the 5-year pre-development flow and will be connected to the existing 750 mm diameter storm sewer on Cobourg Street. In order to attain the target flows and meet the City's requirements, quantity controls will be utilized and up to 5.7 m^3 of underground storage will be required for up to a 100-yr event. The stormwater management (SWM) system will be designed to provide enhanced level (Level 3) protection as specified by the Ministry of the Environment (MOE). Quality control will be provided by the building and landscaped areas for a total suspended solids (TSS) removal of 80%.

Sanitary Sewers

The existing sanitary flow is calculated at 0.08 L/s. The proposed total peak sanitary discharge flow from the site is approximately 0.06 L/s, thus there will be a reduction in net flow of 0.02 L/s. Therefore the existing infrastructure can support the proposed development. The flow will be directed to an existing 250 mm sanitary sewer on Wilbrod Street. The existing infrastructure has the capacity to support the sanitary flow from the proposed development.

Water Supply

Water supply for the site will be from the existing 300 mm diameter watermain on the east side of Cobourg Street. It is anticipated that a total design flow or 146.28 L/s will be required to support the proposed development. According to the boundary conditions provided by the City of Ottawa, the existing infrastructure will support the proposed development.

Site Grading

The proposed grades will improve the existing drainage conditions to meet the City's requirements. Grades will be maintained wherever feasible.

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APPENDICES

1.0 Introduction

Lithos Group Inc. (Lithos Group) was retained by Uganda High Commission Ottawa (Owner) and Ten-2-Four Architecture Inc. (Architect) to prepare a Functional Servicing and Stormwater Management Report in support of a Site Plan Application (SPA) for the proposed development (Uganda's Embassy) to be located at 231 Cobourg Street in the City of Ottawa.

The purpose of this report is to provide site-specific information for the City's review with respect to infrastructure required to support the proposed development regarding storm drainage, sanitary sewers, and water supply.

We contacted the City's engineering records department to obtain existing information in preparation of this report. The following documents were available for our review:

- As built plan of Cobourg Street, Plan No. 2706, 2/12;
- As built plan of Wilbrod Street, Plan No. 2706. 11/12;
- 2015 Water Distribution plans;
- Topographic Survey prepared by MMM Geomatics Ontario Limited;
- Boundary conditions provided by John Wu, P.Eng. John Wu, P.Eng. Project Manager, Infrastructure Approval Development Review (Urban Services) – pre-consultation can be found in **Appendix B**;
- Site Plan and Statistics prepared by Ten 2 Four Architecture Inc. dated March 22, 2017.

2.0 Site Description

The existing site is approximately 0.038 hectares of residential - use and it is currently occupied by a two-storey brick development. The site is located north of the intersection between Cobourg Street and Wilbrod Street, in the City of Ottawa and is bound by residential buildings to the north and east, Wilbrod Street to the south and Cobourg Street to the west. Refer to **Figures 1 and 2** at the end of the report, and the site photographs in **Appendix A.**

3.0 Site Proposal

The proposed development will be a low-rise (3-storey) office building. The building will consist of approximately 0.068ha of gross floor area (GFA), facilitated by four (4) outdoor parking spots.

4.0 Terms of Reference and Methodology

4.1. Terms of Reference

The following references and technical guidelines were consulted in the present study:

- **City of Ottawa Servicing Study Guidelines**, online edition,
- **City of Ottawa Sewer Design Guidelines**, (2012),
- **City of Ottawa Design Guidelines – Water Distribution**, (2010),
- **Ministry of environment (MOE) Design Guidelines – Water Distribution** (2010)
- **MOE Design Guidelines for Sewage Works** (2008)
- **MOE Stormwater Planning and Design Manual** (2003)
- **Ontario Building Code** (2012)

4.2. Methodology: Stormwater Drainage and Management

This report provides a detailed Stormwater Management (SWM) review of the pre and post-development conditions and comments on opportunities to reduce peak flows, as per the City of Ottawa guidelines. This is illustrated on a proposed **Site Servicing Plan (SS-01)**. (Submitted separately)

The stormwater management criteria for this development are based on the City of Ottawa Sewer Design Guidelines, as well as the Ministry of the Environment's Stormwater Planning and Design Manual, 2003 (SWMP Manual). The following design criteria will be reviewed:

- Post-development peak flow for the 100-year from the site should be controlled to the five (5)-year target flow, for connection to a dedicated storm sewer;
- When the imperviousness of the existing property is greater than 50%, the maximum value of the runoff coefficient, "c", used in calculating the pre-development peak runoff rate is limited to 0.50;
- A safe overland flow route to the Right of Way (ROW), will be provided for all flows in excess of the 100-year storm event;

4.3. Methodology: Sanitary Discharge

The sanitary sewage discharge from the site will be determined using sanitary sewer design sheets that consider the land use and building statistics as supplied by the design team. The calculated values provide peak sanitary flow discharge that considers infiltration.

The estimated sanitary discharge flows from the proposed site will be calculated based on the criteria shown in **Table 4.1.** (City of Ottawa Sewer Design Guidelines).

Table 4.1 – Sanitary Design Criteria

Design Parameter	Value
Residential 1 Bedroom Apartment	1.4 p/unit
Residential 2 Bedroom Apartment	2.1 p/unit
Residential 3 Bedroom Apartment	3.1 p/unit
Residential Average Day Demand	350 L/cap/day
Peaking Factor	Harmon's Peak. Factor Min.2 -Max. 4
Office Space	75 L/9.3 m^2/day
Infiltration and Inflow Allowance	0.28 L/s/ha
Sanitary sewers are to be sized employing the Manning's Equation	$Q = \frac{1}{n} AR^{2/3} S^{1/2}$
Minimum Sewer Size	200 mm diameter
Minimum Manning's 'n'	0.013
Minimum Depth of Cover	2.5 m from crown of sewer to grade
Minimum Full Flowing Velocity	0.6 m/s
Maximum Full Flowing Velocity	3.0 m/s

4.4. Methodology: Water Usage

The fire flow requirements were estimated using the method prescribed by the Fire Underwriters Survey (FUS). This method is based on the floor area of the building to be protected, the type and combustibility of the structural frame and the separation distances with adjoining building units.

The domestic water usage was calculated based on the City of Ottawa Guidelines – Water Distribution outlined in **Table 4.2.**

Table 4.2 – Water Usage

Design Parameter	Value
Commercial Average Day Demand	2.5 L/m^2/d
Commercial Maximum Day Demand	1.5 x Average Day
Commercial Maximum Hour	1.8 x Maximum Day
Minimum Depth of Cover	2.4 m from top of watermain to finished grade
During Peak Hour Demand desired operating pressure is within	350kPa and 480KPa
During normal operating conditions pressure must not drop below	275kPa
During fire flow operating pressure must not drop below	140kPa

City Design guidelines for water distribution provide guidance for determining the method for estimating Fire Demand. As indicated, the requirements for levels of fire protection on private property are covered in the Ontario Building Code. Section 7.2.11 of the OBC addresses the installation of water service pipes and fire service mains. Part 3 of the OBC outlines the requirement for Fire Protection, Occupant Safety, and Accessibility; and subsection A-3.2.5.7 provides the provisions for firefighting. Based on trained personnel responding to the emergency, and water supply being delivered through a municipal, the required minimum provision for water supply flow rates shall not be less than 2,700L/min or greater than 9,000L/min (OBC Section A.3.2.5.7, Table 2). The City of Ottawa was contacted in June 2015 to obtain boundary conditions based on an estimated water demand. Correspondence with the city is included in **Appendix B**.

5.0 Stormwater Management and Drainage

5.1. Existing Conditions

According to available records, there is an existing 750 mm storm sewer on Cobourg Street running south towards Wilbrod Street and then continues as a 900mm storm sewer on Wilbrod flowing east.

The existing site is primarily covered by building thus there is no major infiltration onsite. Although the existing run-off coefficient is estimated at 0.75, the City of Ottawa requires target flow calculations based on a run-off coefficient of 0.5. **Table 5.1** shows the input parameters which are illustrated on pre-development conditions.

Table 5.1 – Target Input Parameters

Catchment	Drainage Area (ha)	C	Tc (min.)
A1 Pre	0.038	0.50	10

Peak flows calculated for the existing conditions are shown in **Table 5.2**. Detailed calculations are in **Appendix C**.

Table 5.2 – Target Peak Flows

Catchment	Peak Flow Rational Method (L/s)		
	2-year	5-year	100-year
A1 Pre	4.1	5.5	9.4

As shown in **Table 5.2**, the post-development flows will need to be controlled to the target flow of 5.5 L/s.

5.2. Stormwater Management

In order to meet the City standards as well as the SWMP Manual criteria, the development flow rate is to be controlled to the five (5)-year target flow established in **Section 4.2**. The site consists of three (3) internal drainage areas:

1. A1 Post – Takes into account the green roof which is controlled in underground chambers. Details of the green roof can be found in **Appendix C**;
2. A2 Post – Storm runoff of the rooftop, landscaped and hardscaped areas, also controlled in underground chambers;
3. EXTERNAL 1 – It is the external 'landscaped' rainwater that drains from 469 Wilbrod Street towards 231 Cobourg Street and controlled in underground chambers;

The post-development drainage areas and its corresponding runoff coefficients are shown on the post-development drainage area plan **DAP-2**, and summarized in **Table 5.3** below.

Table 5.3 – Post-development Input Parameters

Drainage Area	Drainage Area (ha)	C	Tc(min.)
A1 Post (green roof – controlled in chambers)	0.006	0.45	10
A2 Post (rooftop, landscaped and hardscaped areas – controlled in chambers)	0.032	0.84	10
EXTERNAL 1 (landscaped area– controlled in chambers)	0.008	0.30	10

5.2.1. Quantity Controls

The Modified Rational Method has been used to calculate the runoff release rate from the site and to determine the maximum storage required during each storm event. Results for the 2, 5, and 100-year storm events are provided in **Table 5.4.** The detailed post-development quantity control calculations are provided in **Appendix C**.

Table 5.4 – Post-development Quantity Control as Per City Requirements

Storm Event	Target Flow (L/s)	Underground Chambers Storage Volume (m^3)	Total Site Release Rate (L/s)
2-year	5.5	1.9	3.1
5-year		2.9	3.7
100-year		5.7	5.3

As shown in **Table 5.4**, in order to control post-development flows to 5-year pre-development conditions, a target flow of 5.5 L/s is to be satisfied. The required on-site storage is accommodated by the combination of green roof application and underground chambers. The green roof make up considered for this development will be the low maintenance extensive green roof (3"-5" depth) by Green Roof Technology, capable to retain 9 lbs/ft^2 or 43.9 L/m^2 (refer to **Appendix C**, for details). The external flow that is draining from the adjacent properties is also stored in the underground chambers. Consequently, the water from the green roof, from the landscaped areas (internal and external), from the rooftop and from driveway and paved areas, is stored within the chambers and released to the network with a 5.3 L/s release rate achieved for a 100-yr event.

The proposed SWM plan in conjunction with the proposed grading and servicing, retains enough runoff volume to reduce the post-development peak flows for each storm event to the required target flow.

5.2.2. Underground Storage Chambers

As mentioned above, underground storage is proposed to meet the water quantity control requirements. Stormwater from the entirety of site, will be gravity driven into the holding chambers. The 100-yr storm yielded 7 underground chambers capable to store the required 5.7 m, controlled by a 75mm diameter orifice plate. Although the underground chambers design sheet calls for 6 chambers, the actual numbers of SC310 chambers will be 8, since the maximum head cannot be more than 0.22 m (0.20m achieved) in order to meet the allowable 5-year pre-development release rate. Refer to **Appendix C** for more details.

5.2.3. Quality Controls

Enhanced quality protection will be provided through the use of a Downstream Defender, which would be located on site, accomplishing 80% TSS removal as required by the RVCA & MOE. Refer to **Appendix C** for the respective sizing report.

5.3. Proposed Storm Connection

The proposed development will connect to the 750 mm storm sewer on Cobourg Street via a 150 mm storm sewer service connection with a minimum grade of 2.0% (or equivalent pipe design). The post-development 100-year storm will be designed to match the five 5-year pre-development storm. Therefore, since the post-development discharge rate will meet the 5-year pre-development rate, it is anticipated that this development will not adversely affect flow conditions downstream. Flows above the 100-year event will be conveyed both overland and within pipes to the adjacent municipal right-of-ways (ROW). Refer to engineering drawing **SG-01** (submitted separately) for overland flow in excess of the 100-year storm event.

6.0 Sanitary Drainage System

6.1. Existing Sanitary Drainage System and Flows

The site is currently occupied by residential development. According to available records, there is an abandoned 300 mm combined sewer on Cobourg Street, and there is an existing 250 mm sanitary sewer along Wilbrod Street, flowing west and continues as a 525 mm sanitary sewer located on Cobourg Street, flowing north towards Stewart Street.

6.2. Existing Sanitary Flows

The existing sanitary discharge from the site is calculated using the sanitary sewer design sheet and design criteria outlined in **Table 4.1**, to be approximately 0.08 L/s under peak flow conditions. Detailed calculations are included in **Appendix D**.

6.3. Proposed Sanitary Flows

Using the design criteria and the proposed development statistics, the new building will discharge 0.06 L/s into the City's infrastructure, therefore, there is a net decrease in sanitary flow of approximately 0.02 L/s. In summary, a sanitary downstream analysis is not required and the new development will not adversely affect downstream flow conditions. The existing sanitary sewer network will be adequate to service the proposed development. For detailed calculations refer to the sanitary sewer design sheet in **Appendix D**.

6.4. Proposed Sanitary Connection

The proposed development will outlet to the existing 250 mm sanitary sewer on Wilbrod, running west to the intersection of Cobourg Street and Wilbrod Street. For the calculated peak flow, the connection will be made with a 150 mm diameter pipe, sloped at a minimum of 2.0% grade. Refer to engineering drawing **SS-01** (submitted separately) for the connection details.

7.0 Water Supply System

7.1. Existing System

The subject property lies within the City of Ottawa 1W pressure zone. The existing watermain system consists of a 300 mm diameter watermain on the east side of Cobourg Street and extends to north side of Wilbrod Street. Furthermore, there is an abandoned 125 mm watermain running along both Cobourg Street and Wilbrod Street.

7.2. Proposed Water Supply Requirements

The estimated water consumption was calculated based on the occupancy rates shown on **Table 4.2** in **Section 4.4**, according to the City of Ottawa Guidelines. Based on the proposed use, it is anticipated that an average consumption of approximately 0.02 L/s, a maximum daily consumption of 0.03 L/s and a peak hourly demand of 0.05 L/s will be required to service this development with domestic water. Detailed calculations are found in **Appendix E**.

The fire flow requirements we estimated using the method prescribed by the Fire Underwriters Survey (FUS) be undertaken to assess the minimum requirement for fire suppression. The fire flow calculations is normally conducted for the greater storey and the two immediately adjacent storeys. In this case, since the second floor is open to below, there is no fire protection from ground floor to second floor. Thus, the greater storey is assumed to be the sum of those two (2) floors. **Table 7.1** illustrates the input parameters used for the FUS calculations. According to our calculations, a minimum fire suppression flow of approximately 146.25 L/s (2319 USGPM) will be required. Refer to detailed calculations found in **Appendix E**.

Table 7.1 – Fire Flow Input Parameters

Parameter	Frame used for Building	Combustibility of Contents	Presence of Sprinklers	Separation Distance			
				North	East	South	West
Value according to FUS options	Wood frame construction	Combustible	No	10.1m-20m	3.1m-10m	Road	Road
Surcharge/reduction from base flow	1.5	0%	0%	15%	20%	0%	0%

In summary, the required design flow is the sum of 'the minimum fire suppression flow' and 'maximum daily demand' (146.25+0.03 = 146.28 L/s, 2319 USGPM).

The City of Ottawa was contacted in May 2012 to obtain boundary conditions based on an estimated water demand. **Table 7.2** summarizes the anticipated water demand and boundary conditions for the proposed development based on the City of Ottawa Guidelines – Water Distribution.

Table 7.2 – Water Demand and Boundary Conditions

Design Parameter	Anticipated Demand[1] (L/min)	Boundary Condition2 (m H_2O)
Average Day Demand	1.2	Max HGL = 106.3
Max Day + Fire Flow	1.8 + 8,760= 8.761,8	107.5
Peak Hour	2.7 x Average Daily	Min HGL = 118.6

1. Water demand calculations per City of Ottawa Guidelines. See **Appendix E** for detailed calculations.
2. Boundary conditions supplied by the City of Ottawa. Assumed ground elevation 70.0m.

According to the water demand calculations, the estimated water supply for fire protection is 8,761.8 L/m which is between the minimum 2,700 L/min and the maximum 9,000 L/min, as required from the OBC. Therefore, it is anticipated, that the existing water infrastructure will support the proposed development.

7.3. Proposed Watermain Connection

It is proposed that the development be serviced via a private 50 mm diameter domestic service connection to the existing 300 mm diameter watermain located within the Cobourg Street right-of-way. According to City standards the watermain will be constructed with a minimum depth of cover of 2.4m.

8.0 Site Grading

8.1. Existing Grades

Overland flow of the site currently drains towards adjacent properties.

8.2. Proposed Grades

The proposed grades will improve the existing drainage conditions to meet the City's requirements. Flows beyond the 100-year event will be directed towards adjacent right of ways. Grades will be maintained wherever feasible.

9.0 Conclusions and Recommendations

Based on our investigations, we conclude the following:

Storm Drainage

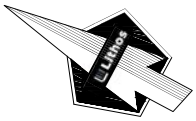
The site stormwater discharge will be controlled to the 5-year pre-development flow and will be connected to the existing 750 mm diameter storm sewer on Cobourg Street. In order to attain the target flows and meet the City's requirements, quantity controls will be utilized and up to 5.7 m^3 of underground storage will be required for up to a 100-yr event. The stormwater management (SWM) system will be designed to provide enhanced level (Level 3) protection as specified by the Ministry of the Environment (MOE). Quality control will be provided by the building and landscaped areas for a total suspended solids (TSS) removal of 80%.

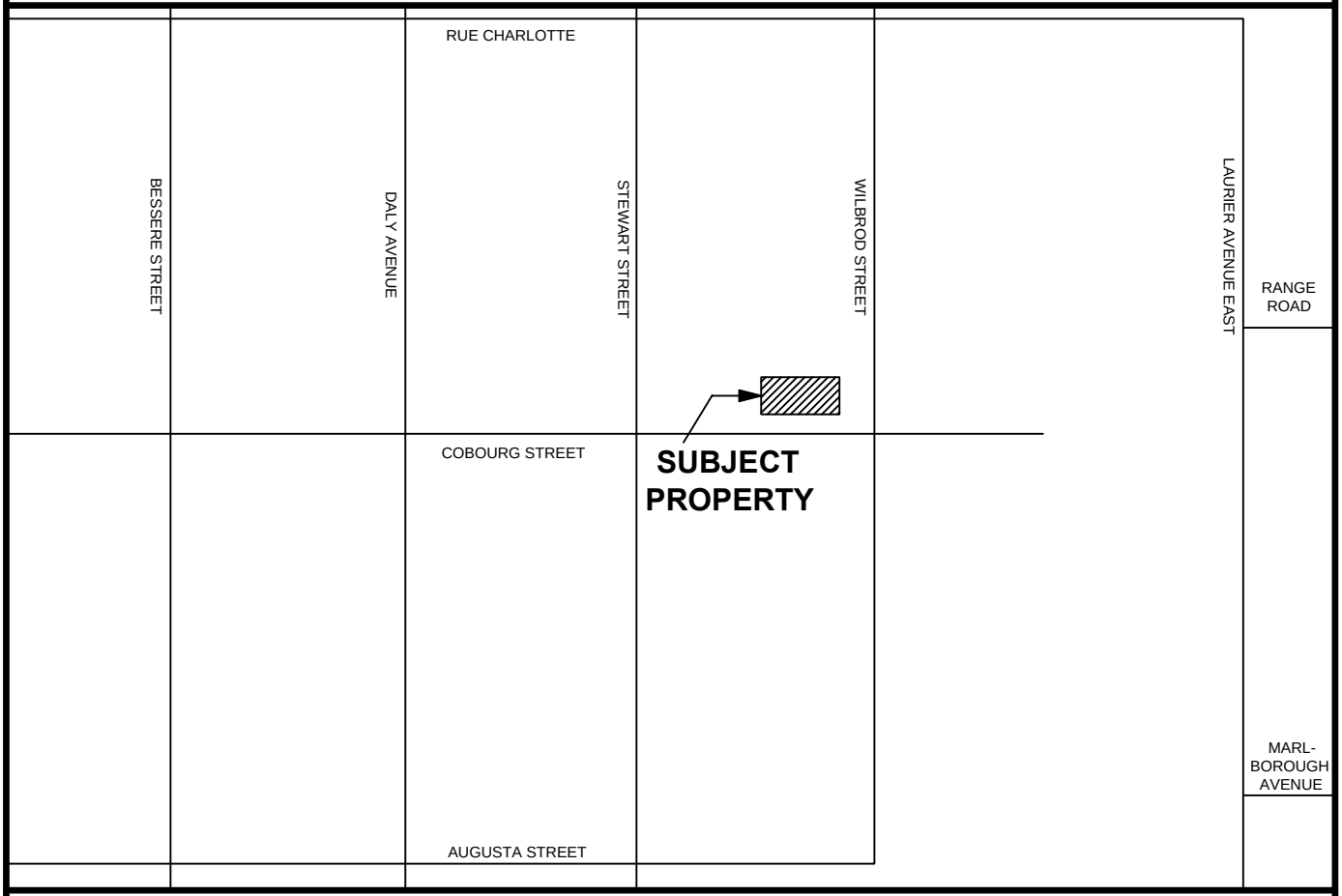
Sanitary Sewers

The existing sanitary flow is calculated at 0.08 L/s. The proposed total peak sanitary discharge flow from the site is approximately 0.06 L/s, thus there will be a reduction in net flow of 0.02 L/s. Therefore the existing infrastructure can support the proposed development. The flow will be directed to an existing 250 mm sanitary sewer on Wilbrod Street. The existing infrastructure has the capacity to support the sanitary flow from the proposed development.

Water Supply

Water supply for the site will be from the existing 300 mm diameter watermain on the east side of Cobourg Street. It is anticipated that a total design flow or 146.28 L/s will be required to support the proposed development. According to the boundary conditions provided by the City of Ottawa, the existing infrastructure will support the proposed development.





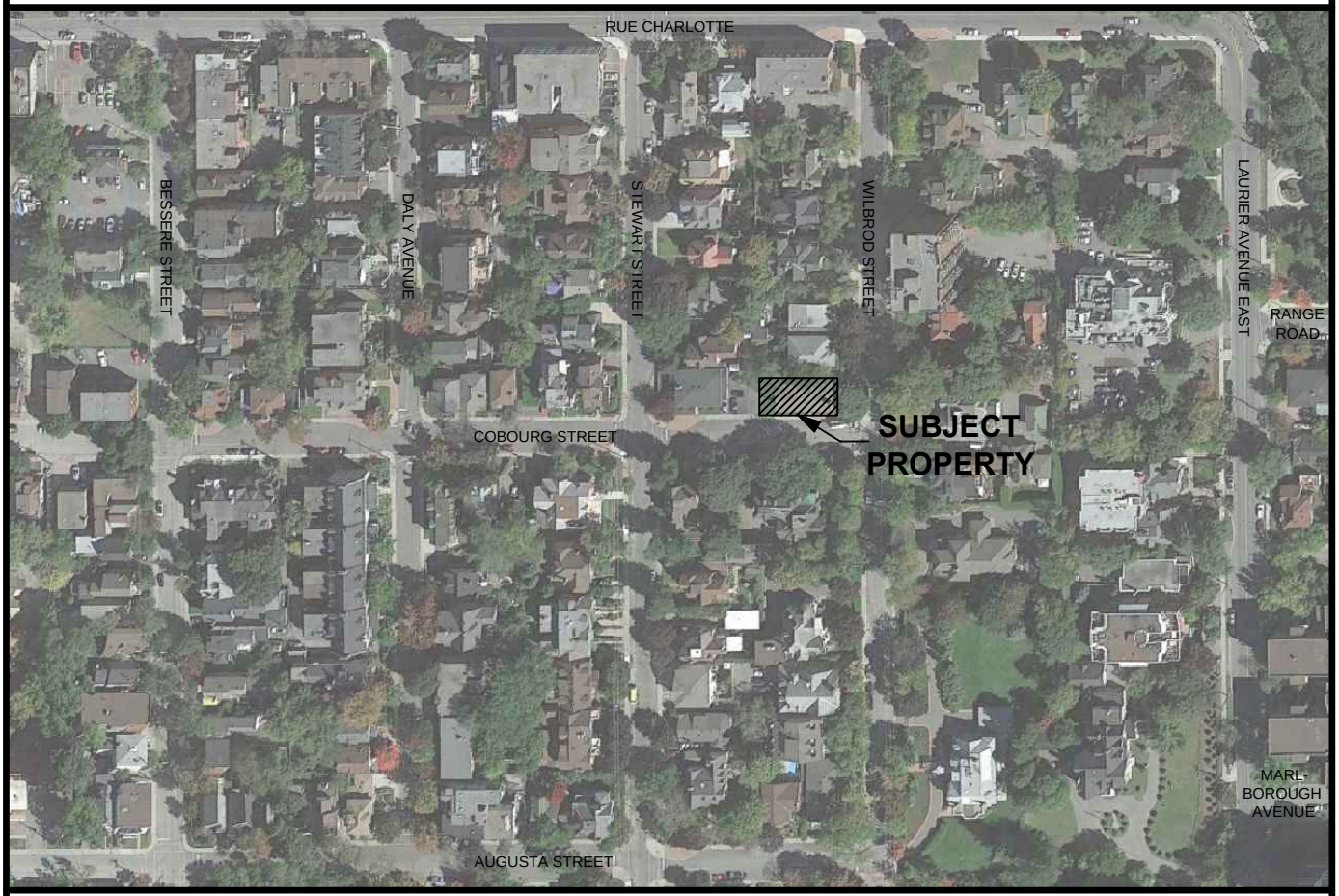
Lithos

788 O'Connor Drive, Toronto, Ontario M4B 2S6

LOCATION PLAN

COMMERCIAL/INSTITUTIONAL DEVELOPMENT
231 COBOURG STREET
OTTAWA, ONTARIO

DATE:	MARCH 2017	PROJECT No:	UD14-005
SCALE:	N.T.S.	FIGURE No:	FIG 1



Lithos

788 O'Connor Drive, Toronto, Ontario M4B 2S6

AERIAL PLAN

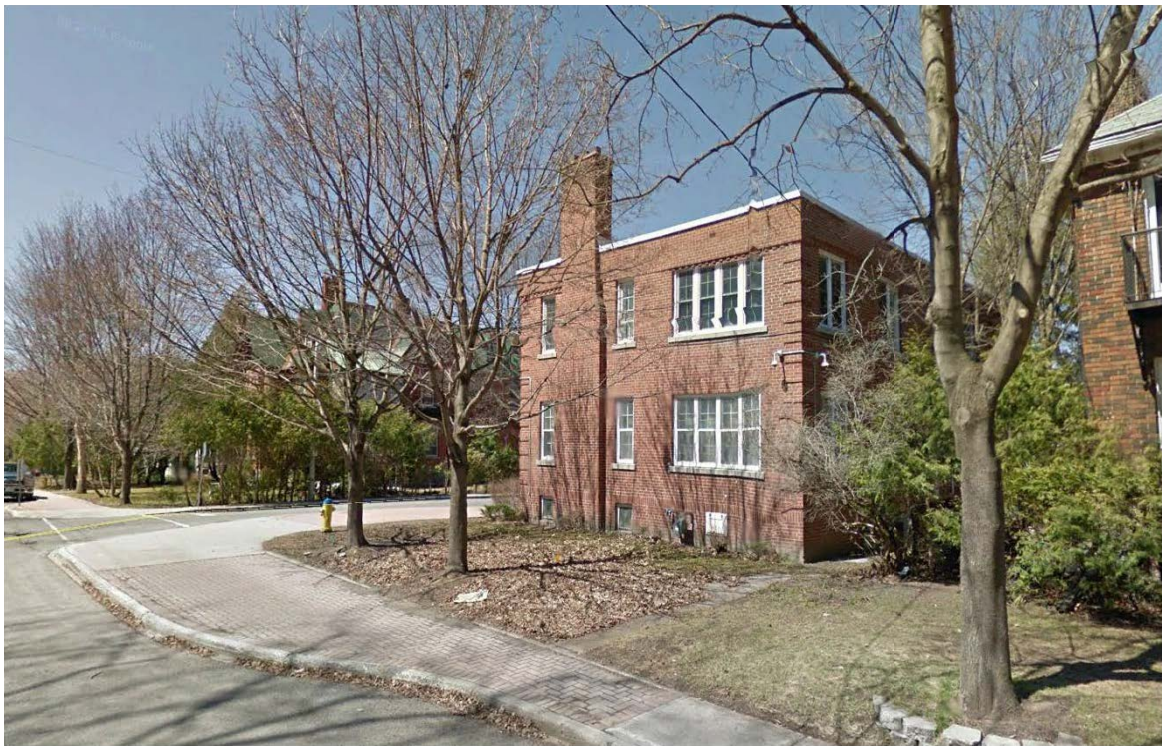
COMMERCIAL/INSTITUTIONAL DEVELOPMENT
231 COBOURG STREET
OTTAWA, ONTARIO

DATE:	MARCH 2017	PROJECT No:	UD14-005
SCALE:	N.T.S.	FIGURE No:	FIG 2

APPENDIX A
Site Photographs

South Corner of Property

West Corner of Property



East Corner of Property

APPENDIX B
Background Information

SURVEYOR'S REAL PROPERTY REPORT AND
TOPOGRAPHIC SURVEY

PART 1

PLAN OF

PART OF LOT 43
NORTH SIDE OF WILBROD STREET
REGISTERED PLAN 6
CITY OF OTTAWA

MMM GEOMATICS ONTARIO LIMITED
2013

SCALE 1: 200

2 0 2 4 6 8 12 metres

METRIC

DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

BEARING NOTE

BEARINGS ARE ASTRONOMIC AND ARE DERIVED FROM THE NORTHERLY LIMIT OF WILBROD STREET AS SHOWN ON PLAN BY AOV DATED JUNE 11, 1992 HAVING A BEARING OF N58°48'50"E.

LEGEND & NOTES

■	DENOTES SURVEY MONUMENT FOUND
□	DENOTES SURVEY MONUMENT SET
SIB	DENOTES STANDARD IRON BAR
IB	DENOTES IRON BAR
SSIB	DENOTES SHORT STANDARD IRON BAR
Ø	DENOTES ROUND
CC	DENOTES CUT CROSS
CP	DENOTES CONCRETE PIN
(SU)	DENOTES SOURCE UNKNOWN
MEAS	DENOTES MEASURED
WIT	DENOTES WITNESS
-OW-	DENOTES OVERHEAD UTILITY WIRES
UP	DENOTES UTILITY POLE
MMM	DENOTES MMM GEOMATICS ONTARIO LIMITED
1236	DENOTES PAUL A. RIDDELL LTD.
(647)	DENOTES H.R. FARLEY, O.L.S.
(1175)	DENOTES H.A.K. SHIPMAN, O.L.S.
PL	DENOTES REGISTERED PLAN 6
P1	DENOTES AOV PLAN DATED JUNE 11/92
P2	DENOTES FARLEY & MARTIN DATED APRIL/72
D1	DENOTES INST. N414187
D2	DENOTES INST. CR527294
D3	DENOTES INST. N625598
CLF	DENOTES CHAINLINK FENCE
EA	DENOTES EDGE OF ASPHALT
T/G	DENOTES TOP OF GRATE
T/F	DENOTES TOP OF FOUNDATION
FP	DENOTES FLAG POLE

□ CB ..... Denotes CATCH BASIN
..... Denotes CONIFER TREE
..... Denotes FIRE HYDRANT
MH ..... Denotes MANHOLE
..... Denotes DECIDUOUS TREE
..... Denotes TRAFFIC SIGN
WV ..... Denotes WATER VALVE
GAS ..... Denotes GAS VALVE
GUTTER ..... Denotes STANDARD BARRIER CURB AND GUTTER
CURB ..... Denotes BARRIER TYPE CURB
..... Denotes BUSH OR HEDGE

BENCHMARK

ELEVATIONS ARE GEODETIC AND WERE ESTABLISHED USING LEICA SMARTNET AND ARE TRANSFORMED TO ORTHOMETRIC HEIGHTS USING HT2-0.

NOTES

ALL UNDERGROUND UTILITY SERVICE INFORMATION IS DERIVED FROM CITY OF OTTAWA. PLAN SHEET No. D-15-20 AND WERE VERIFIED IN ON SITE WHERE POSSIBLE. MARSHALL MACKLIN MONAGHAN ONTARIO LIMITED ASSUMES NO RESPONSIBILITY AS TO THE ACCURACY, CORRECTNESS AND COMPLETENESS OF THE UNDERGROUND SERVICE INFORMATION SHOWN ON THE FACE OF THIS PLAN. UTILITIES MUST BE LOCATED BY THE UTILITY COMPANIES BEFORE CONSTRUCTION BEGINS.

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT:

1. THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT, AND THE REGULATIONS MADE UNDER THEM.
2. THE SURVEY WAS COMPLETED ON AUGUST 7 th, 2013.

DATE: _____

MART HIMMA
ONTARIO LAND SURVEYOR

ASSOCIATION OF ONTARIO LAND SURVEYORS
PLAN SUBMISSION FORM
1867940

THIS PLAN IS NOT VALID UNLESS IT IS AN EMBOSSED ORIGINAL COPY ISSUED BY THE SURVEYOR
In accordance with Regulation 1026, Section 29(3)

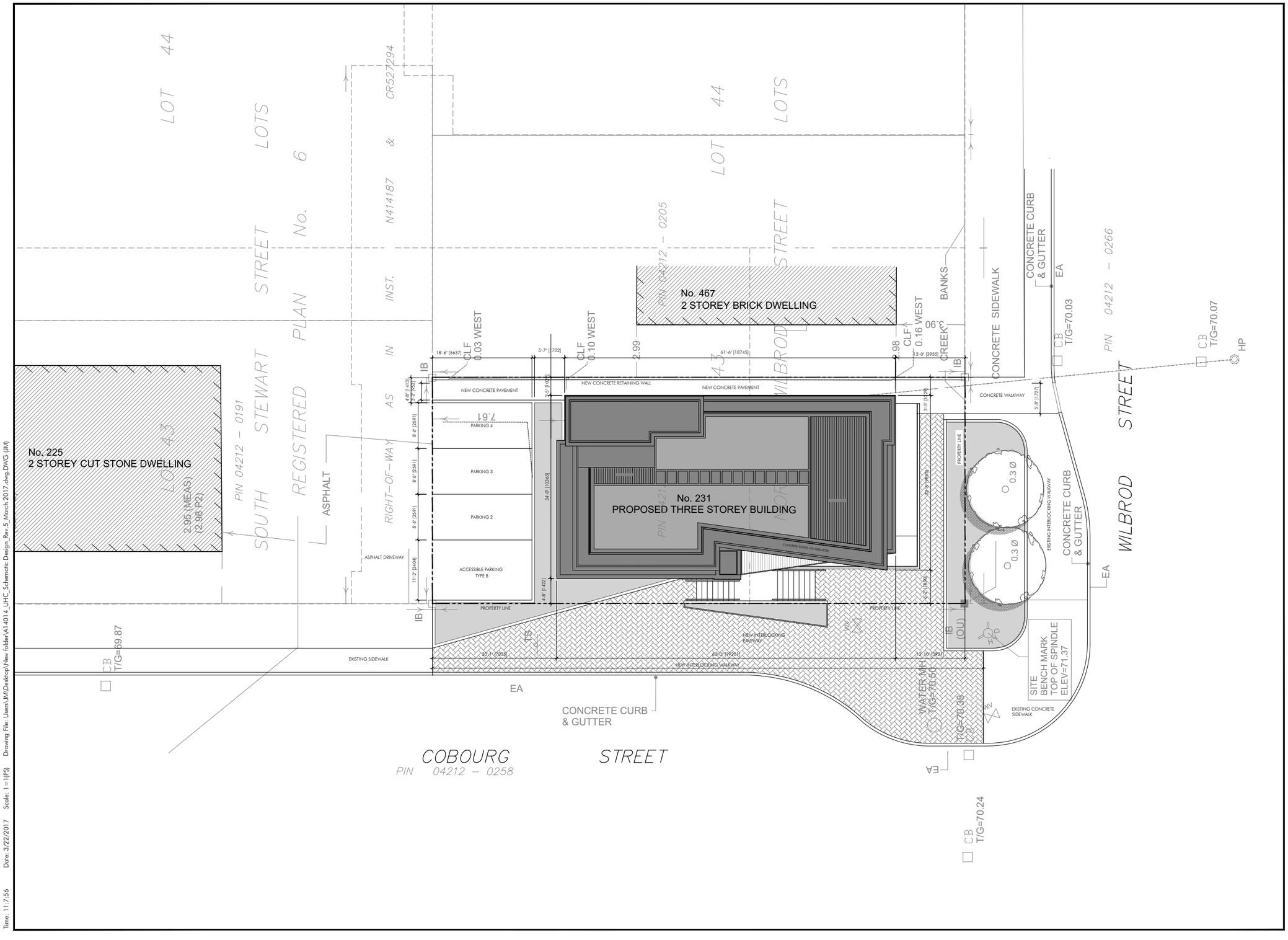
THIS REPORT WAS PREPARED FOR
UGANDA HIGH COMMISSION
AND THE UNDERSIGNED ACCEPTS NO RESPONSIBILITY FOR USE BY OTHER PARTIES

PART 2
THIS PLAN MUST BE READ IN CONJUNCTION WITH THE SURVEY REPORT DATED AUGUST 15, 2013

MMM Geomatics Ontario Limited
Ontario Land Surveyors
1145 Hunt Club Road Suite 300 Ottawa, Ontario K1V 0Y3
Ph 613-736-7200 Fax 613-736-8710
Website www.mmm.ca
Email ottro@mmm.ca

Drawing Number : 20-13-042-000-1

P.Chief: AS | Dwg. By: YB | Chk'd by: MH
Job Number: 20-13-042-000 | File Name: SRPR13-042-C3D.DWG



TEN 2 FOUR ARCHITECTURE INC.
55 Eglinton Ave. East - Suite 606
Toronto, Ontario. M4P 1G8
T 416.440.1024 F 416.484.1024

PROJECT NORTH

TRUE NORTH

SEAL

ISSUE

NO.	DATE	DESCRIPTION
1	15 June, 2015	To Consultants for Coordination
2	22 June, 2015	For Inception Report
3	31 July, 2015	UHC: Schematic Design Review
4	06 Feb, 2017	Consultants Coordination
5	13 Feb, 2017	Inception Report- Heritage & SPA
6	22 Mar, 2017	Consultants Coordination

CLIENT:
Uganda High Commission
350 Sparks Street, Suite 1210
Ottawa, Ontario. K1R 7S8

PROJECT:
New Chancery Building
231 Cobourg Street, Ottawa, Ontario. K1N 8J2

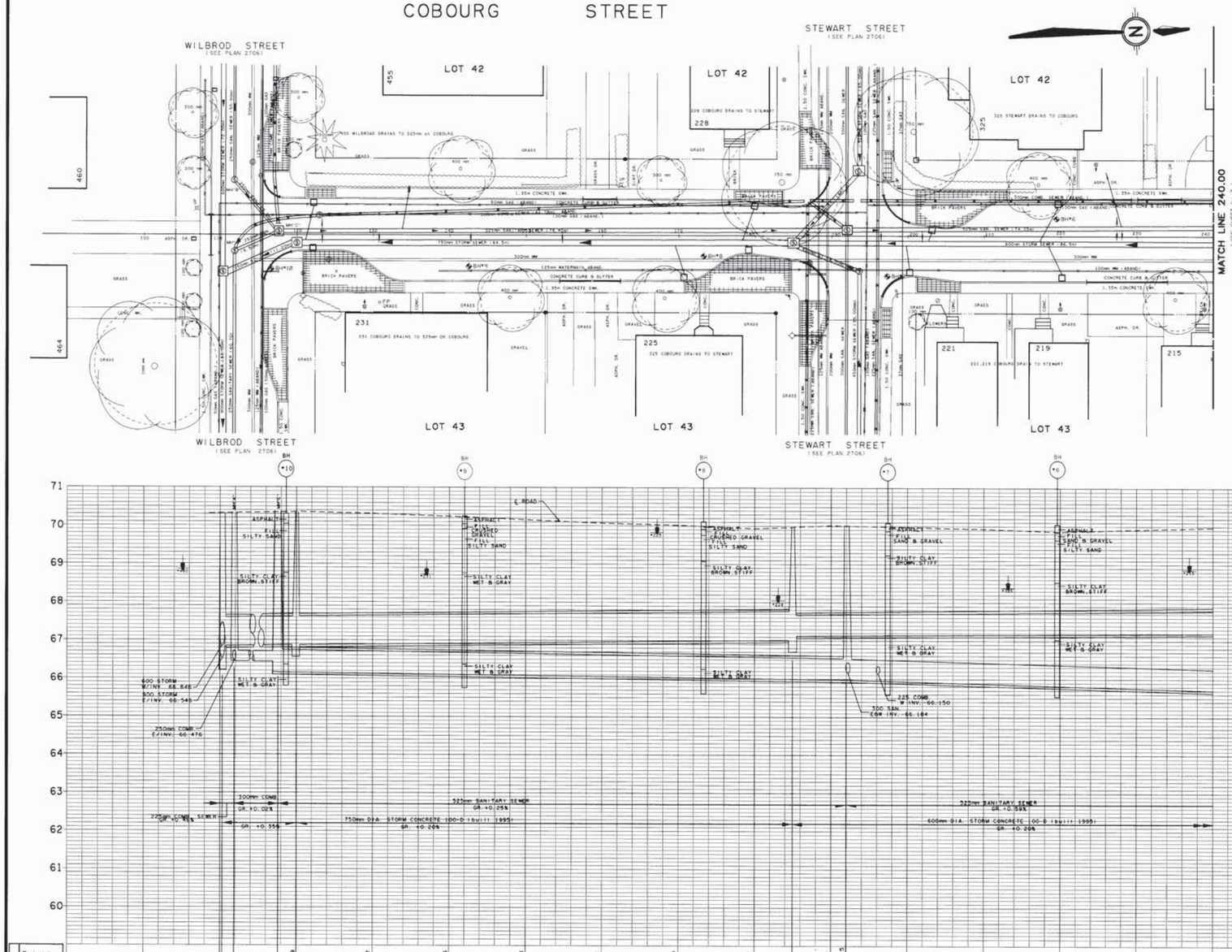
PROJECT NO.:
A14014

DRAWING TITLE:
Proposed Site Plan

SCALE:	DATE:	SHEET NO:
1/4" = 1'-0"	June 2015	A1
DRAWN BY: [1024]	REVIEWED BY:	

Time: 11:7:56 Date: 3/22/2017 Scale: 1 = 1[PS] Drawing File: Users\JM\Desktop\New folder\A14014_UHC_Schematic Design_Rev.5_March 2017.dwg DWG (JM)

2706 COBOURG ST. (2)



Stations	Inverts Existing (sewer)	Type B. Diameter (sewer)	West	East	Existing Surface
110	110.30 66.456 750mm SAN N/W 110.82 66.461 450mm SAN N/W 110.82 66.495 300 COMB				70.379
120	117.60 66.413 250mm SAN (S/W) 66.172 525mm SAN N 66.875 750mm ST. S/E	(10 Mh. 78") 250mm SAN (S/W) 525mm SAN N			
130					70.307
140					70.235
150					70.163
160					70.091
170					70.019
180					69.947
185.00	87.005 750 ST.(S)				70.015
190	87.125 600 ST.(N)				FR 70.015
192.00	65.989 525 SAN. (NBS)				
193.07	66.184				
200					69.972
210					69.922
220					69.871
230					69.921
240					69.971

Elevations

Existing Surface | East | West | Type B. Diameter (sewer) | Inverts Existing (sewer) | Stations

This drawing was created using Microstation 4.0 (CADD)

Revisions:

No.	Date	Description	Drawn By	Appr'd By

Design:

Designed By MR. J. RANA		Date Structural Check By 20-3-94	Date
Survey Detail By MR. P. DRAPER		Date Checked By 10-2-94	Date
Drafting By MR. G. J. SMITZER		Date Checked By 11-4-94	Date

Hal Pascoe P. Eng
Chief Design & Const. Eng.

Final Measurements:

Construction Type SEWER-ROAD-WATER	Inspector P. DRAPER
Work Commenced JUNE 95	Instrumentman N/A
Work Completed NOV. 95	Field Book # N/A
Contractor TAGGART	Date APRIL 96
Drafting Revisions P. DRAPER	Date Checked By MAY 1996

Notes:

- Caution, while illustrations and utilities shown are taken from best available information, they cannot be guaranteed.
- Contractor is requested to check with all utility companies before digging.
- Soil information shown is not guaranteed and contractors are advised to collect additional soils information as deemed necessary.
- Actual rock line recorded during construction of existing.
- Soil information taken from : TROW ENG. LTD., JAN. /94
- Reference bench mark : INDEX No. 261 , ELEV. 71.058
- Date of television inspection : TAMARACK /NOV. /94
- This plan supercedes (in whole or in part) plan * A-3-A
- Registered Plan * : 5R-3939, 4R-2665
- When reduced, the scale of this drawing is approximately 1:400 horizontally and 1:80 vertically. Do not scale this drawing.

As Built Notes:

- Boreholes prior to construction.
- See typical road cross sections for road structure material depths.

City of Ville d' **Ottawa**

Department Of Engineering And Works
Engineering Branch
Design And Construction Division
111 SUSSEX DRIVE, OTTAWA, ONTARIO, K1N 5A1

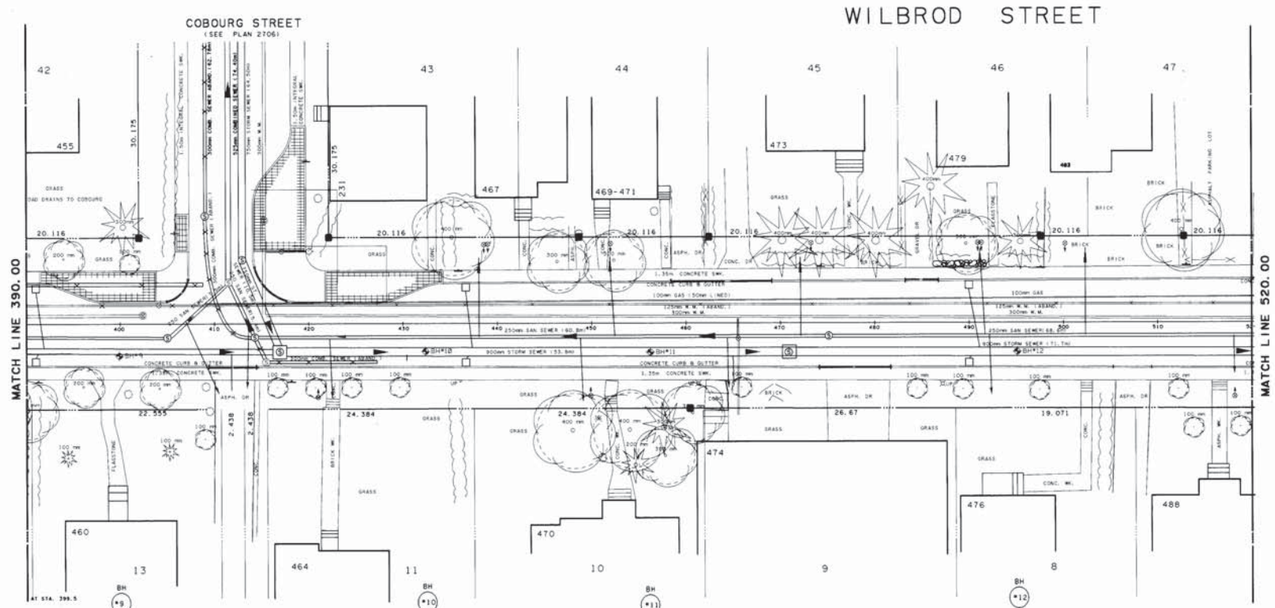
D. G. Curry, P. Eng. — Commissioner
W. R. Cole, P. Eng. — Branch Director

COBOURG STREET
FROM WILBROD STREET TO STA. 240.00

Contract No.	Survey Books	Contact Tape Notes	Plan No.
93C2706	N/A	HOR. 1:250 VERT. 1:50	2706 Sheet 2 of 12

CADD Filename: 2706s4.dgn
Reference Filename: 2706cob.dgn
arrwdr.dgn

2706 WILBROD STREET (11)



*This drawing was created using Microstation 4.0 (CADD)

Revisions:

No.	Date	Description	Drawn By	Appr'd By

Design:

Designed By	Date	Structural Check By	Date
MR. J. RANA	20-3-94		
Survey Detail By	Date	Checked By	Date
MR. P. DRAPER	10-2-94		
Drafting By	Date	Checked By	Date
MR. G.J. SMITZER	11-4-94		

Hal Pascoe P.Eng
Inter Design & Const. Ltd.

Final Measurements:

Construction Type	Inspector
SEWER, ROAD, WATER	P. DRAPER
Work Commenced	Instrumentman
JUNE 95	N/A
Work Completed	Field Book #
NOV. 95	N/A
Contractor	Date
TAGGART	APRIL. 96
Drafting Revisions	Notes Checked By
P. DRAPER	MAY 1998

Notes:

- Caution, while illustrations and utilities shown are taken from best available information, they cannot be guaranteed.
- Contractor is requested to check with all utility companies before digging.
- Soil information shown is not guaranteed and contractors are advised to collect additional soils information as deemed necessary.
- Actual rock line recorded during construction of existing
- Soil information taken from : TROW ENG. LTD. ,JAN./94
- Reference bench mark : INDEX No. 261 ,ELEV. 71.058
- Date of television inspection : TAMARACK /NOV./94
- This plan supercedes (in whole or in part) plan * A-3-A
- Registered Plan * : 5R-3939, 4R-2865
- When reducad, the scale of this drawing is approximately 1:400 horizontally and 1:80 vertically. Do not scale this drawing.

As Built Notes:

- Boreholes prior to construction
- See typical road cross sections for road structure material depths

City of Ville d' **Ottawa**

Department Of Engineering And Works
Engineering Branch
Design And Construction Division
111 SUSSEX DRIVE, OTTAWA, ONTARIO, K1N 5A1

D. G. Curry, P. Eng.	W. R. Cole, P. Eng.
Commissioner	Branch Director

WILBROD STREET

Contract No.	Survey Books	Scales: (See note)	Plan No.
93C2706	N/A	HOR. 1:250 VERT. 1:50	2706 Sheet 11 of 12

CADD Filename: 2706s13.dgn
Reference: 2706s1.dgn
offsedr.dgn

CN1

2015 Water Distribution System

Department of Infrastructure Services

This map was compiled from existing & collected engineering Information from the City of Ottawa Geographic Information System and is protected by copyright. The location of Infrastructure is approximate and should not be used for construction purposes.

Scale 1:2500

Ottawa

Legend

- Public Hydrant
- Private Hydrant
- Summer only Flusher Hydrant
- Flusher Hydrant
- Acoustic Fibre Optic
- Gate Valve
- Tapping Valve
- Butterfly Valve (B)
- Buried Valve (BU)
- Drain Pipe
- Check Valve (CV)
- Closed Valve (CL)
- Drain-Out Valve (D)
- Left Hand Valve (L)
- Spot Elevation (X 84.9)
- Pressure Reducing Valve (P)
- Air Relief Valve (A)
- Bypass Valve (Y)
- Feedermain Valve (F000)
- Inspection Plate (IP 363)
- Cap
- Reducer
- Jump
- Water Meter (M)
- Water Service
- Backbone Pipe
- Watermain with Pipe Diameter, Material and Install Year (e.g. 203 PVC-1981)
- Pipe Casing
- Pressure Zone Delineation and Identifier (e.g. 2W)
- Well (W)
- Elevated Tank (T)
- Water Pumping Station (PS)
- Water Reservoir
- Water Treatment Plant (WTP)

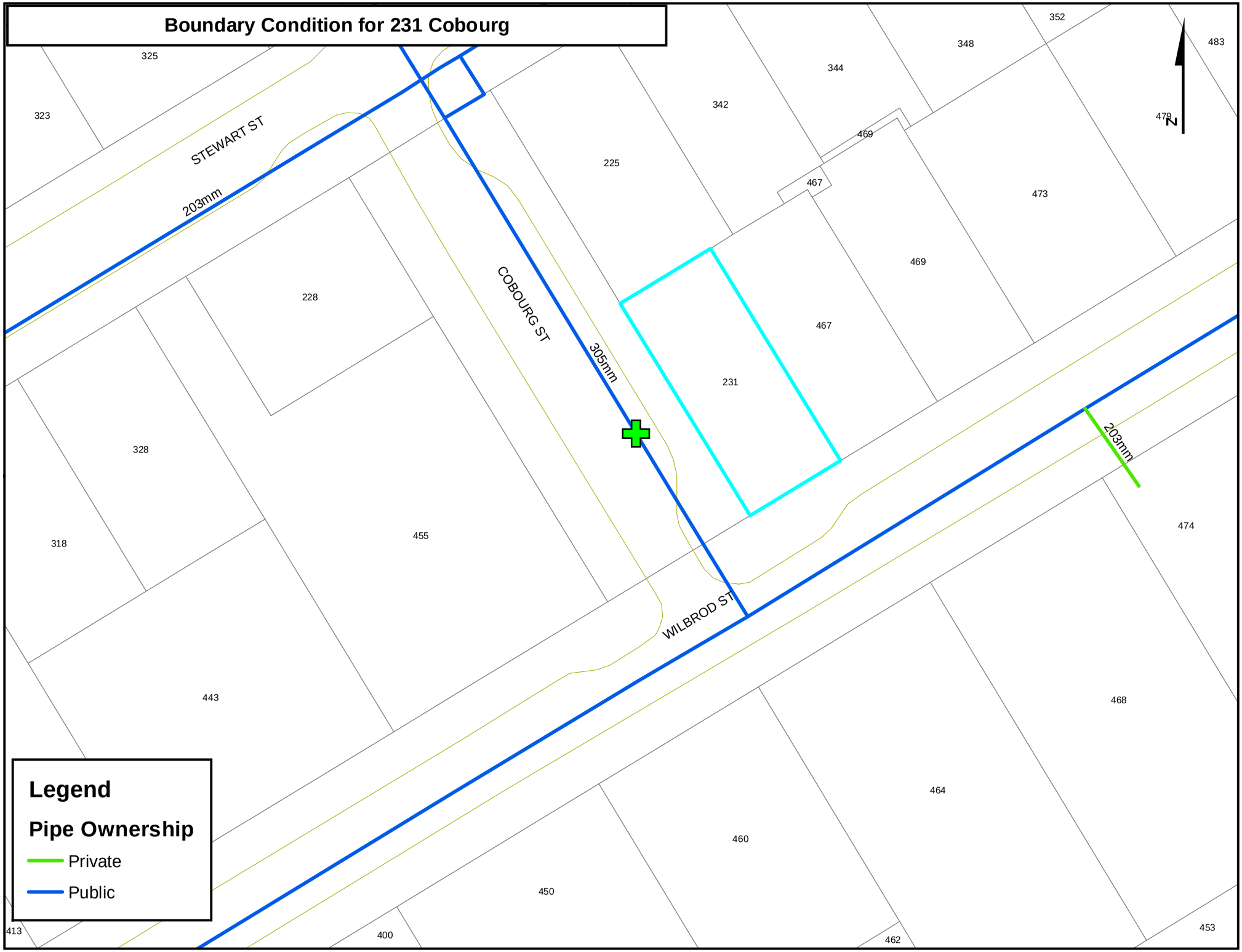
Pipe Equivalents

nominal (mm)	actual (inches)	nominal (mm)	actual (inches)	nominal (mm)	actual (inches)
100	4	675	27	1800	72
150	6	750	30	1950	78
200	8	825	33	2025	80
250	10	900	36	2100	84
300	12	975	39	2250	90
375	15	1050	42	2400	96
400	16	1200	48	2550	102
450	18	1350	54	2700	108
525	21	1500	60	2850	114
600	24	1650	66	3000	120

Pipe Materials

A - ASBESTOS
CI - CAST IRON
CO - COPPER
CO0 - AWWA C300
CO1 - AWWA C301
CO2 - AWWA C302
CO3 - AWWA C303
DI - DUCTILE IRON
PE - POLYETHYLENE (DR11 TO DR21)
PVC - POLYVINYL CHLORIDE
STC - CONCRETE LINED STEEL PIPE
UCI - UNLINED CAST IRON
UNK - UNKNOWN MATERIAL

366-034	368-034	370-034
366-033	368-033	370-033
366-032	368-032	370-032
366-031	368-031	370-031
366-030	368-030	370-030


Boundary Condition for 231 Cobourg
325
323
STEWART ST
203mm
228
328
318
455
443
COBOURG ST
305mm
225
342
344
348
352
483
479
N
469
467
473
231
469
467
203mm
474
WILBROD ST
468
464
460
450
413
400
462
453
Legend
Pipe Ownership
Private
Public

Matina Sakoutsiou

From: Wu, John [mailto:John.Wu@ottawa.ca]
Sent: Wednesday, June 24, 2015 4:29 PM
To: Matina Sakoutsiou
Subject: RE: 231 Cobourg Street

Here is the result:

The following are boundary conditions, HGL, for hydraulic analysis at 231 Cobourg (zone 1W) assumed to be connected to the 305mm on Cobourg (see attached PDF for location).

Minimum HGL = 106.3m

Maximum HGL = 118.6m

MaxDay (0.03 L/s) + FireFlow (146 L/s) = 107.5m

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: Matina Sakoutsiou [mailto:matinas@lithosgroup.ca]
Sent: Thursday, June 18, 2015 12:35 PM
To: Wu, John
Cc: 'Nick Moutzouris'
Subject: RE: 231 Cobourg Street

Hello John,

Attached you may find the data requested, in order to provide me the boundary conditions.

The address is 231 Cobourg Street at the intersection with Wibrod Street.
Should you need any additional information feel free to contact me.

Thank you.

Matina Sakoutsiou, M.Arch
Architect/Designer

Lithos Group Inc.
788 O'Connor Drive
Toronto, Ontario M4B 2S6
T: (416) 750-7769
Email: MatinaS@LithosGroup.ca
Website: www.LithosGroup.ca

From: Wu, John [mailto:John.Wu@ottawa.ca]
Sent: Tuesday, June 16, 2015 9:22 AM
To: Matina Sakoutsiou
Subject: RE: 231 Cobourg Street

Hi, Matina:

I need you provide me with the information I required , then I can send to IMD group to get the boundary condition, we do not provide the hydrant result.

Thanks.

John

From: Matina Sakoutsiou [mailto:matinas@lithosgroup.ca]
Sent: Monday, June 15, 2015 7:17 PM
To: Wu, John
Subject: RE: 231 Cobourg Street

Hello John,

Thanks for the information. I can do the analysis, I need the boundary conditions, more specifically, the fire hydrant test results of the subject site. Would you be able to provide this information to me?

Thank you.

Matina Sakoutsiou, M.Arch
Architect/Designer

Lithos Group Inc.
788 O'Connor Drive
Toronto, Ontario M4B 2S6
T: (416) 750-7769
Email: MatinaS@LithosGroup.ca
Website: www.LithosGroup.ca

From: Wu, John [mailto:John.Wu@ottawa.ca]
Sent: Monday, June 15, 2015 3:50 PM
To: matinas@lithosgroup.ca
Subject: 231 Cobourg Street

Hi, Matina:

For a question like "how should I confirm that the fire line coming from the street to the new development will provide adequate amount of water, in a fire occasion. ",

You need use the FUS method to calculate the required fire flow for fire fighting , along with your daily domestic demand, maxday demand, max hour demand to me, I will send the City's IMD group to run the model, and get the result to see if there is enough water available for fire fighting.

I will send the result to you when the result is available.

John Wu, P.Eng.
Project Manager, Infrastructure Approval
Development Review (Urban Services)
Gestionnaire de projet, Approbation de L'infrastructure
Examen des projects d'amenagement (Services urbains)

PLANNING AND GROWTH MANAGEMENT
URBANISME ET GESTION DE LA CROISSANCE

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27734
ottawa.ca/planning / ottawa.ca/urbanisme

4.1 General Content

☒ Executive Summary (for larger reports only).

Comments: *Included in report.*

☒ Date and revision number of the report.

Comments: *See title page.*

☒ Location map and plan showing municipal address, boundary, and layout of proposed development.

Comments: *See Figures 1,2 at the end of the report and Appendix B.*

☒ Plan showing the site and location of all existing services.

Comments: *See Servicing Plan UD14-005/SS-01 for services within proposed site and surrounding area (Submitted separately)*

☐ 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.

Comments: *See Appendix B and DAP 1,2 at the end of the report.*

☒ Summary of Pre-consultation Meetings with City and other approval agencies.

Comments: *Pre-consultation conducted via e-mail, see Appendix A.*

☐ 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.

Comments: *N/A*

☒ Statement of objectives and servicing criteria.

Comments: *Stated throughout the report*

☒ Identification of existing and proposed infrastructure available in the immediate area.

Comments: *See Servicing Plan UD14-005/SS-01 for services within the site plan and surrounding areas (Submitted separately)*

☐ 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).

Comments: N/A

☒ 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 neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

Comments: *See Grading Plan UD14-005/SG-01 (Submitted separately)*

☐ 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.

Comments: N/A

☐ Proposed phasing of the development, if applicable.

Comments: N/A

☐ Reference to geotechnical studies and recommendations concerning servicing.

Comments: N/A

☒ All preliminary and formal site plan submissions should have the following information:

- ☒ Metric scale
- ☒ North arrow (including construction North)
- ☒ Key plan
- ☒ Name and contact information of applicant and property owner
- ☒ Property limits including bearings and dimensions
- ☒ Existing and proposed structures and parking areas
- ☒ Easements, road widening and rights-of-way
- ☒ Adjacent street names

Comments:

4.2 Development Servicing Report: Water

☒ Confirm consistency with Master Servicing Study, if available

Comments: *Water as per City standards and updated design guidelines*

☒ Availability of public infrastructure to service proposed development

Comments: *See section 7.2.*

☐ Identification of system constraints

Comments: *N/A*

☒ Identify boundary conditions

Comments: *See section 7.2.*

☒ Confirmation of adequate domestic supply and pressure

Comments: *See section 7.2 and Appendix E.*

☒ 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.

Comments: *See section 7.2 and Appendix E.*

☐ 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.

Comments: *N/A*

☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

Comments: *N/A*

☐ Address reliability requirements such as appropriate location of shut-off valves

Comments: *N/A*

☐ Check on the necessity of a pressure zone boundary modification.

Comments: *N/A*

☒ 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

Comments: *See Appendix E.*

☒ 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.

Comments: *See section 7.3 and Servicing plan UD14-005/SS-01 (Submitted separately)*

☐ 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.

Comments: *N/A*

☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.

Comments: *See section 4.4.*

☒ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

Comments: *See Appendix B.*

4.3 Development Servicing Report: Wastewater

☒ 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).

Comments: See Section 4.3.

☐ Confirm consistency with Master Servicing Study and/or justifications for deviations.

Comments: N/A

☐ 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.

Comments: N/A

☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.

Comments: See Section 6.1.

☒ 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)

Comments: See Section 6.3.

☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

Comments: N/A

☐ Special considerations such as contamination, corrosive environment etc.

Comments: N/A

4.4 Development Servicing Report: Stormwater

☐ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

Comments: N/A

☒ Analysis of available capacity in existing public infrastructure.

Comments: See Section 5.3.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

Comments: See DAP 1,2 at the end of the report.

☒ 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.

Comments: See Section 5.2.1 and Appendix C.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

Comments: See Sections 5.2.2 and 5.2.3.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

Comments: See Section 5.3.

☐ Set-back from private sewage disposal systems.

Comments: N/A

☐ Watercourse and hazard lands setbacks.

Comments: N/A

☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

Comments: N/A

☐ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

Comments: N/A

☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).

Comments: See Appendix C.

☐ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.

Comments: N/A

☒ 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.

Comments: See Sections 5.2, 5.2, Appendix C and Servicing plan UD14-005/SS-01.

☐ Any proposed diversion of drainage catchment areas from one outlet to another.

Comments: N/A

☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.

Comments: See Section 5.3 ans Servicing Plan UD14-005/SS-01

☒ 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.

Comments: Quantity control is proposed. See Section 5 and Servicing plan UD14-005/SS-01.

☐ Identification of potential impacts to receiving watercourses

Comments: N/A

☐ Identification of municipal drains and related approval requirements.

Comments: N/A

☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.

Comments: *See Section 5 and Servicing plan UD14-005/SS-01.*

☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

Comments: *See Section 4.2 and Grading Plan UD14-005/SG-01.*

☐ Inclusion of hydraulic analysis including hydraulic grade line elevations.

Comments: *N/A*

☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.

Comments: *See Erosion Control plan UD14-005/EC-01.*

☐ 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.

Comments: *N/A*

☐ Identification of fill constraints related to floodplain and geotechnical investigation.

Comments: *N/A*

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

☐ 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.

Comments: N/A

☐ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

Comments: N/A

☐ Changes to Municipal Drains.

Comments: N/A

☐ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

Comments: N/A

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

Comments: See Section 9.0

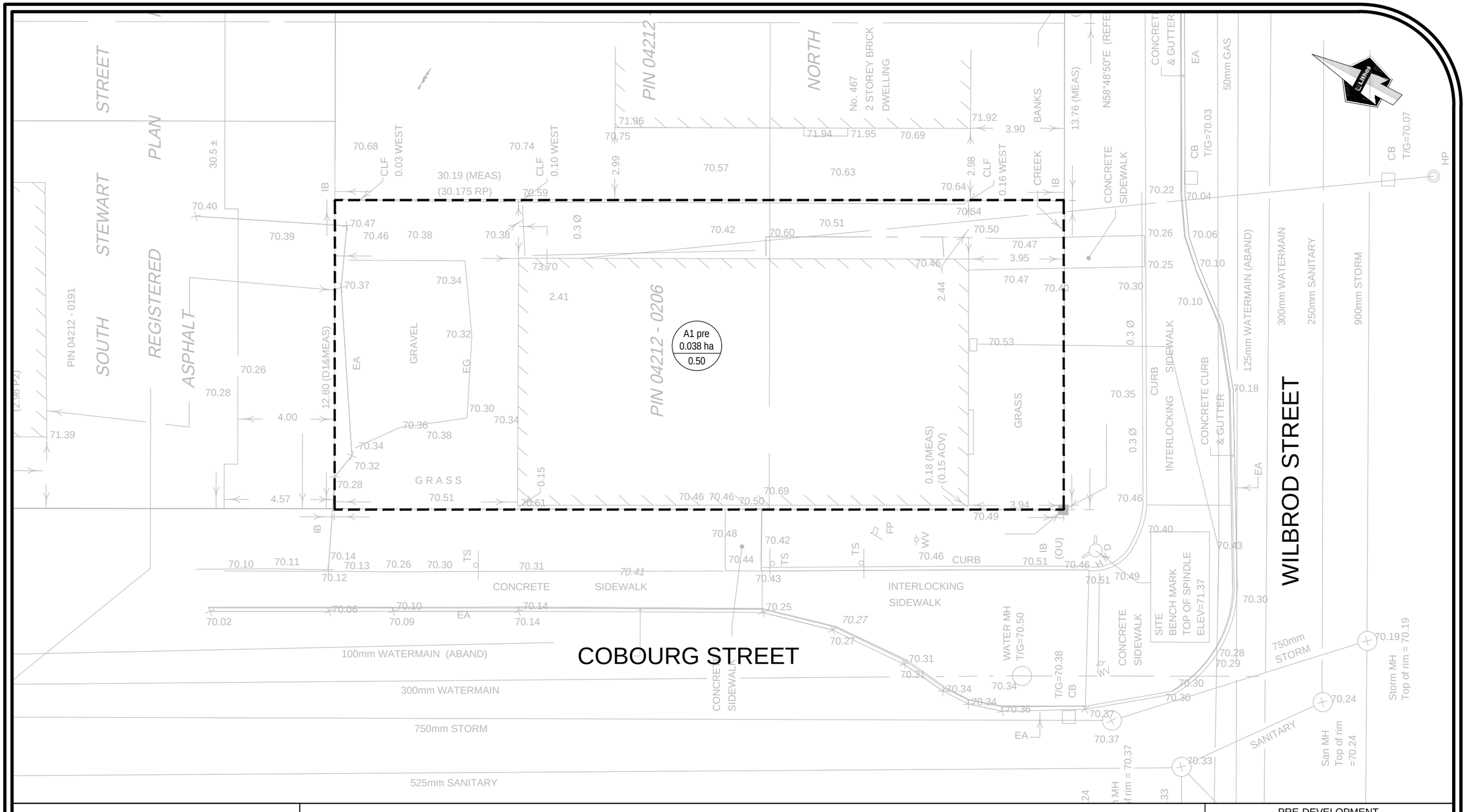
☐ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

Comments: N/A

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario

Comments: Report is signed.

APPENDIX C
Storm Analysis



Lithos

788 O'Connor Drive, Toronto, Ontario M4B 2S6

LEGEND

- STORM DRAINAGE AREA NUMBER
- DRAINAGE AREA (ha)
- COMPOSITE RUNOFF COEFFICIENT

A1 pre
0.04 ha
0.50

PRE-DEVELOPMENT STORM DRAINAGE AREA

PRE-DEVELOPMENT DRAINAGE AREA PLAN

INSTITUTIONAL / COMMERCIAL DEVELOPMENT
231 COBOURG STREET
OTTAWA, ONTARIO

DATE: MARCH 2017	PROJECT No: UD14-005
SCALE: N.T.S.	FIGURE No: DAP1

Lithos

Rational Method
Pre-Development Flow Calculation

231 Cobourg Street
File No. UD14-005
City of Ottawa
Date: March 2017

Prepared By: Matina Sakoutsiou
Reviewed by: Nick Moutzouris, P.Eng., M.A.Sc.

Input Parameters

Area Number	Area (ha)	C	Tc (min.)
A1 pre	0.038	0.50	10

Rational Method Calculation

Event 2 yr
IDF Data Set City of Ottawa
a = 732.95
b = 6.199
c = 0.810

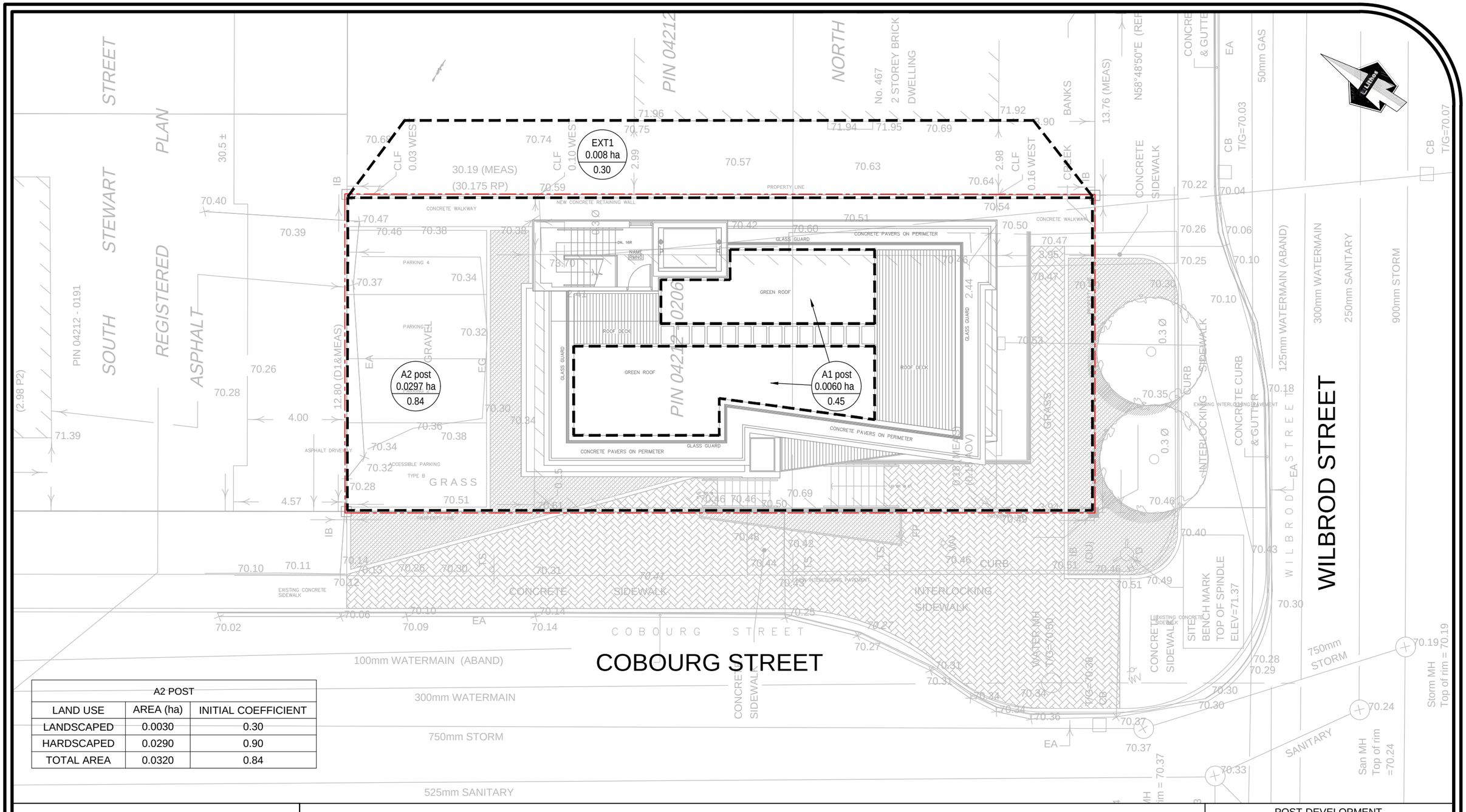
Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 pre	0.038	0.50	0.02	10	76.8	0.004	4.1

Event 5 yr
IDF Data Set City of Ottawa
a = 998.07
b = 6.053
c = 0.814

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 pre	0.038	0.50	0.02	10	104.2	0.005	5.5

Event 100 yr
IDF Data Set City of Ottawa
a = 1735.69
b = 6.014
c = 0.820

Area Number	A (ha)	C	AC	Tc (min.)	I (mm/h)	Q (m^3/s)	Q (L/s)
A1 pre	0.038	0.50	0.02	10	178.6	0.009	9.4



A2 POST		
LAND USE	AREA (ha)	INITIAL COEFFICIENT
LANDSCAPED	0.0030	0.30
HARDSCAPED	0.0290	0.90
TOTAL AREA	0.0320	0.84

LEGEND

- A1 post / 0.04 ha / 0.50 — STORM DRAINAGE AREA NUMBER; DRAINAGE AREA (ha); COMPOSITE RUNOFF COEFFICIENT
- POST-DEVELOPMENT STORM DRAINAGE AREA
- PROPERTY LINE

Lithos
788 O'Connor Drive, Toronto, Ontario, M4B-2S6

POST-DEVELOPMENT DRAINAGE AREA PLAN

COMMERCIAL DEVELOPMENT
231 COBOURG STREET
OTTAWA, ONTARIO

DATE: MARCH 2017	PROJECT No: UD14-005
SCALE: N.T.S.	FIGURE No: DAP2

Modified Rational Method - Two Year Storm

Site Flow and Storage Summary

231 Cobourg Street

File No: UD14-005
Date: March 2017
Prepared by: Matina Sakoutsiou
Reviewed by: Nick Moutzouris, P.Eng., M.A.Sc.

2-Year Design Storm

a=	732.95
b=	6.199
c=	0.81
I =	$a / (T_C + b)^c$

Drainage Area A1 Post
Green Roof - Controlled in Chambers

Area (A1) =	**0.0083**	ha
"C" =	**0.45**	
AC1=	**0.004**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Water Retention=	**43.90**	L/m^2
Volume of Void Space =	**3.6**	m^3
Max. Release Rate =	**0.00**	L/s

Drainage Area A2 Post
Controlled in Chambers

Area (A2) =	**0.0320**	ha
"C" =	**0.84**	
AC2=	**0.027**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Rel. Rate =	**5.76**	L/s

Type	Area (ha)	"C"
Landscaped	0.003	0.30
Hardscaped	0.0290	0.90
Total Area (A2)	**0.0320**	**0.84**

Drainage Area EXTERNAL 1
From 469 Wilbrod Street - Controlled in Chambers

Area EXT 1 =	**0.008**	ha
"C" =	**0.30**	
ACexternal=	**0.002**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Rel. Rate =	**0.5**	L/s

Total Site
Total Site = A1 + A2 + EXT 1

5-yr Pre-Development (Allowable) Site Release Rate =	**5.5**	L/s
Site Controlled Release Rate =	**3.1**	L/s
Max. Storage Chambers =	**1.9**	m^3
Stor. Chambers footprint Area =	28.0	m^2

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Time	**Rainfall Intensity**	**Storm Runoff (A1 post)**	**Total Storm Volume (A1 post)**	**Green Roof Captured Volume (A1 Post)**	**Released Volume (A1 Post)**	**Released Runoff (A1 Post)**	**Storm Runoff (A2 post)**	**Total Storm Volume (A2 post)**	**Storm Runoff EXT 1**	**Total Storm Volume EXT1**	**Total Storm Runoff Volume**	**Released Volume**	**Storage Volume**	**Storage Depth**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)	(m)
10.0	76.8	0.001	0.48	3.6	0.00	0.000	0.006	3.46	0.001	0.31	3.76	1.86	1.9	0.07
15.0	61.8	0.001	0.58	3.6	0.00	0.000	0.005	4.17	0.000	0.37	4.54	2.80	1.7	0.06
20.0	52.0	0.001	0.65	3.6	0.00	0.000	0.004	4.68	0.000	0.42	5.10	3.73	1.4	0.05
25.0	45.2	0.000	0.70	3.6	0.00	0.000	0.003	5.08	0.000	0.45	5.53	4.66	0.9	0.03
30.0	40.0	0.000	0.75	3.6	0.00	0.000	0.003	5.41	0.000	0.48	5.89	5.59	0.3	0.01
35.0	36.1	0.000	0.79	3.6	0.00	0.000	0.003	5.68	0.000	0.50	6.18	6.52	0.0	0.00
40.0	32.9	0.000	0.82	3.6	0.00	0.000	0.002	5.92	0.000	0.53	6.44	7.46	0.0	0.00
45.0	30.2	0.000	0.85	3.6	0.00	0.000	0.002	6.12	0.000	0.54	6.67	8.39	0.0	0.00
50.0	28.0	0.000	0.87	3.6	0.00	0.000	0.002	6.31	0.000	0.56	6.87	9.32	0.0	0.00
55.0	26.2	0.000	0.90	3.6	0.00	0.000	0.002	6.48	0.000	0.58	7.05	10.25	0.0	0.00
60.0	24.6	0.000	0.92	3.6	0.00	0.000	0.002	6.63	0.000	0.59	7.22	11.18	0.0	0.00
65.0	23.2	0.000	0.94	3.6	0.00	0.000	0.002	6.77	0.000	0.60	7.37	12.12	0.0	0.00
70.0	21.9	0.000	0.95	3.6	0.00	0.000	0.002	6.90	0.000	0.61	7.52	13.05	0.0	0.00
75.0	20.8	0.000	0.97	3.6	0.00	0.000	0.002	7.02	0.000	0.62	7.65	13.98	0.0	0.00
80.0	19.8	0.000	0.99	3.6	0.00	0.000	0.001	7.14	0.000	0.63	7.77	14.91	0.0	0.00
85.0	18.9	0.000	1.00	3.6	0.00	0.000	0.001	7.25	0.000	0.64	7.89	15.84	0.0	0.00
90.0	18.1	0.000	1.02	3.6	0.00	0.000	0.001	7.35	0.000	0.65	8.00	16.77	0.0	0.00
95.0	17.4	0.000	1.03	3.6	0.00	0.000	0.001	7.44	0.000	0.66	8.11	17.71	0.0	0.00
100.0	16.7	0.000	1.04	3.6	0.00	0.000	0.001	7.54	0.000	0.67	8.21	18.64	0.0	0.00
105.0	16.1	0.000	1.05	3.6	0.00	0.000	0.001	7.62	0.000	0.68	8.30	19.57	0.0	0.00
110.0	15.6	0.000	1.07	3.6	0.00	0.000	0.001	7.71	0.000	0.69	8.39	20.50	0.0	0.00
115.0	15.0	0.000	1.08	3.6	0.00	0.000	0.001	7.79	0.000	0.69	8.48	21.43	0.0	0.00
120.0	14.6	0.000	1.09	3.6	0.00	0.000	0.001	7.86	0.000	0.70	8.56	22.37	0.0	0.00
125.0	14.1	0.000	1.10	3.6	0.00	0.000	0.001	7.94	0.000	0.71	8.64	23.30	0.0	0.00
130.0	13.7	0.000	1.11	3.6	0.00	0.000	0.001	8.01	0.000	0.71	8.72	24.23	0.0	0.00
135.0	13.3	0.000	1.12	3.6	0.00	0.000	0.001	8.08	0.000	0.72	8.80	25.16	0.0	0.00
140.0	12.9	0.000	1.13	3.6	0.00	0.000	0.001	8.14	0.000	0.72	8.87	26.09	0.0	0.00
145.0	12.6	0.000	1.14	3.6	0.00	0.000	0.001	8.21	0.000	0.73	8.94	27.03	0.0	0.00
150.0	12.3	0.000	1.14	3.6	0.00	0.000	0.001	8.27	0.000	0.74	9.00	27.96	0.0	0.00
155.0	11.9	0.000	1.15	3.6	0.00	0.000	0.001	8.33	0.000	0.74	9.07	28.89	0.0	0.00
160.0	11.7	0.000	1.16	3.6	0.00	0.000	0.001	8.39	0.000	0.75	9.13	29.82	0.0	0.00
165.0	11.4	0.000	1.17	3.6	0.00	0.000	0.001	8.45	0.000	0.75	9.20	30.75	0.0	0.00

Modified Rational Method - Five Year Storm

Site Flow and Storage Summary

231 Cobourg Street

File No: UD14-005
Date: March 2017
Prepared by: Matina Sakoutsiou
Reviewed by: Nick Moutzouris, P.Eng., M.A.Sc.

5-Year Design Storm

a=	998.07
b=	6.053
c=	0.81
I =	$a / (T_C + b)^c$

Drainage Area A1 Post
Green Roof - Controlled in Chambers

Area (A1) =	**0.0060**	ha
"C" =	**0.45**	
AC1=	**0.003**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Water Retention=	**43.90**	L/m^2
Volume of Void Space =	**2.6**	m^3
Max. Release Rate =	**0.00**	L/s

Drainage Area A2 Post
Controlled in Chambers

Area (A2) =	**0.0320**	ha
"C" =	**0.84**	
AC2=	**0.027**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Rel. Rate =	**7.81**	L/s

Type	Area (ha)	"C"
Landscaped	0.003	0.30
Hardscaped	0.0290	0.90
Total Area (A2)	**0.0320**	**0.84**

Drainage Area EXTERNAL 1
From 469 Wilbrod Street - Controlled in Chambers

Area EXT 1 =	**0.008**	ha
"C" =	**0.30**	
ACexternal=	**0.002**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Rel. Rate =	**0.7**	L/s

Total Site
Total Site = A1 + A2 + EXT 1

5-yr Pre-Development (Allowable) Site Release Rate =	**5.5**	L/s
Site Controlled Release Rate =	**3.7**	L/s
Max. Storage Chambers =	**2.9**	m^3
Stor. Chambers footprint Area =	28.0	m^2

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Time	**Rainfall Intensity**	**Storm Runoff (A1 post)**	**Total Storm Volume (A1 post)**	**Green Roof Captured Volume (A1 Post)**	**Released Volume (A1 Post)**	**Released Runoff (A1 Post)**	**Storm Runoff (A2 post)**	**Total Storm Volume (A2 post)**	**Storm Runoff EXT 1**	**Total Storm Volume EXT1**	**Total Storm Runoff Volume**	**Released Volume**	**Storage Volume**	**Storage Depth**
(min)	**(mm/hr)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3/s)**	**(m3/s)**	**(m^3)**	**(m^3/s)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m^3)**	**(m)**
10.0	104.2	0.001	0.47	2.6	0.00	0.000	0.008	4.69	0.001	0.42	5.11	2.23	2.9	0.10
15.0	83.6	0.001	0.56	2.6	0.00	0.000	0.006	5.64	0.001	0.50	6.14	3.34	2.8	0.10
20.0	70.3	0.001	0.63	2.6	0.00	0.000	0.005	6.32	0.000	0.56	6.88	4.46	2.4	0.09
25.0	60.9	0.000	0.69	2.6	0.00	0.000	0.005	6.85	0.000	0.61	7.46	5.57	1.9	0.07
30.0	53.9	0.000	0.73	2.6	0.00	0.000	0.004	7.28	0.000	0.65	7.93	6.68	1.2	0.04
35.0	48.5	0.000	0.76	2.6	0.00	0.000	0.004	7.64	0.000	0.68	8.32	7.80	0.5	0.02
40.0	44.2	0.000	0.80	2.6	0.00	0.000	0.003	7.95	0.000	0.71	8.66	8.91	0.0	0.00
45.0	40.6	0.000	0.82	2.6	0.00	0.000	0.003	8.23	0.000	0.73	8.96	10.02	0.0	0.00
50.0	37.7	0.000	0.85	2.6	0.00	0.000	0.003	8.47	0.000	0.75	9.23	11.14	0.0	0.00
55.0	35.1	0.000	0.87	2.6	0.00	0.000	0.003	8.69	0.000	0.77	9.47	12.25	0.0	0.00
60.0	32.9	0.000	0.89	2.6	0.00	0.000	0.002	8.89	0.000	0.79	9.69	13.37	0.0	0.00
65.0	31.0	0.000	0.91	2.6	0.00	0.000	0.002	9.08	0.000	0.81	9.89	14.48	0.0	0.00
70.0	29.4	0.000	0.93	2.6	0.00	0.000	0.002	9.25	0.000	0.82	10.07	15.59	0.0	0.00
75.0	27.9	0.000	0.94	2.6	0.00	0.000	0.002	9.41	0.000	0.84	10.25	16.71	0.0	0.00
80.0	26.6	0.000	0.96	2.6	0.00	0.000	0.002	9.56	0.000	0.85	10.41	17.82	0.0	0.00
85.0	25.4	0.000	0.97	2.6	0.00	0.000	0.002	9.70	0.000	0.86	10.57	18.94	0.0	0.00
90.0	24.3	0.000	0.98	2.6	0.00	0.000	0.002	9.84	0.000	0.87	10.71	20.05	0.0	0.00
95.0	23.3	0.000	1.00	2.6	0.00	0.000	0.002	9.96	0.000	0.89	10.85	21.16	0.0	0.00
100.0	22.4	0.000	1.01	2.6	0.00	0.000	0.002	10.08	0.000	0.90	10.98	22.28	0.0	0.00
105.0	21.6	0.000	1.02	2.6	0.00	0.000	0.002	10.20	0.000	0.91	11.10	23.39	0.0	0.00
110.0	20.8	0.000	1.03	2.6	0.00	0.000	0.002	10.31	0.000	0.92	11.22	24.51	0.0	0.00
115.0	20.1	0.000	1.04	2.6	0.00	0.000	0.002	10.41	0.000	0.93	11.34	25.62	0.0	0.00
120.0	19.5	0.000	1.05	2.6	0.00	0.000	0.001	10.51	0.000	0.93	11.45	26.73	0.0	0.00
125.0	18.9	0.000	1.06	2.6	0.00	0.000	0.001	10.61	0.000	0.94	11.55	27.85	0.0	0.00
130.0	18.3	0.000	1.07	2.6	0.00	0.000	0.001	10.70	0.000	0.95	11.65	28.96	0.0	0.00
135.0	17.8	0.000	1.08	2.6	0.00	0.000	0.001	10.79	0.000	0.96	11.75	30.07	0.0	0.00
140.0	17.3	0.000	1.09	2.6	0.00	0.000	0.001	10.88	0.000	0.97	11.85	31.19	0.0	0.00
145.0	16.8	0.000	1.10	2.6	0.00	0.000	0.001	10.96	0.000	0.97	11.94	32.30	0.0	0.00
150.0	16.4	0.000	1.10	2.6	0.00	0.000	0.001	11.04	0.000	0.98	12.03	33.42	0.0	0.00
155.0	15.9	0.000	1.11	2.6	0.00	0.000	0.001	11.12	0.000	0.99	12.11	34.53	0.0	0.00
160.0	15.6	0.000	1.12	2.6	0.00	0.000	0.001	11.20	0.000	1.00	12.20	35.64	0.0	0.00
165.0	15.2	0.000	1.13	2.6	0.00	0.000	0.001	11.27	0.000	1.00	12.28	36.76	0.0	0.00

Modified Rational Method - Hundred Year Storm

Site Flow and Storage Summary

231 Cobourg Street

File No: UD14-005
Date: March 2017
Prepared by: Matina Sakoutsiou
Reviewed by: Nick Moutzouris, P.Eng., M.A.Sc.

100-Year Design Storm

a=	1735.69
b=	6.014
c=	0.82
I =	$a / (T_C + b)^c$

Drainage Area A1 Post
Green Roof - Controlled in Chambers

Area (A1) =	**0.0060**	ha
"C" =	**0.45**	
AC1=	**0.003**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Water Retention=	**43.90**	L/m^2
Volume of Void Space =	**2.6**	m^3
Max. Release Rate =	**0.000**	L/s

Drainage Area A2 Post
Controlled in Chambers

Area (A2) =	**0.0320**	ha
"C" =	**0.84**	
AC2=	**0.027**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Rel. Rate =	**13.39**	L/s

Type	Area (ha)	"C"
Landscaped	0.0030	0.30
Hardscaped	0.0290	0.90
Total Area (A2)	**0.0320**	**0.84**

Drainage Area EXTERNAL 1
From 469 Wilbrod Street - Controlled in Chambers

Area EXT 1 =	**0.008**	ha
"C" =	**0.30**	
ACexternal=	**0.002**	
Tc =	**10.0**	min
Time Increment =	**5.0**	min
Max. Rel. Rate =	**1.2**	L/s

Total Site
Total Site = A1 + A2 + EXT 1

5-yr Pre-Development (Allowable) Site Release Rate =	**5.5**	L/s
Site Controlled Release Rate =	**5.3**	L/s
Max. Storage Chambers =	**5.7**	m^3
Stor. Chambers footprint Area =	28.0	m^2

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Time	**Rainfall Intensity**	**Storm Runoff (A1 post)**	**Total Storm Volume (A1 post)**	**Green Roof Captured Volume (A1 Post)**	**Released Volume (A1 Post)**	**Released Runoff (A1 Post)**	**Storm Runoff (A2 post)**	**Total Storm Volume (A2 post)**	**Storm Runoff EXT 1**	**Total Storm Volume EXT1**	**Total Storm Runoff Volume**	**Released Volume**	**Storage Volume**	**Storage Depth**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3/s)	(m3/s)	(m^3)	(m^3/s)	(m^3)	(m^3)	(m^3)	(m^3)	(m)
10.0	178.6	0.001	0.80	2.6	0.00	0.000	0.013	8.04	0.001	0.71	8.75	3.18	5.6	0.20
15.0	142.9	0.001	0.96	2.6	0.00	0.000	0.011	9.65	0.001	0.86	10.50	4.77	5.7	0.20
20.0	120.0	0.001	1.08	2.6	0.00	0.000	0.009	10.80	0.001	0.96	11.76	6.36	5.4	0.19
25.0	103.8	0.001	1.17	2.6	0.00	0.000	0.008	11.68	0.001	1.04	12.72	7.95	4.8	0.17
30.0	91.9	0.001	1.24	2.6	0.00	0.000	0.007	12.40	0.001	1.10	13.50	9.55	4.0	0.14
35.0	82.6	0.001	1.30	2.6	0.00	0.000	0.006	13.01	0.001	1.16	14.16	11.14	3.0	0.11
40.0	75.1	0.001	1.35	2.6	0.00	0.000	0.006	13.53	0.001	1.20	14.73	12.73	2.0	0.07
45.0	69.1	0.001	1.40	2.6	0.00	0.000	0.005	13.98	0.000	1.24	15.23	14.32	0.9	0.03
50.0	64.0	0.000	1.44	2.6	0.00	0.000	0.005	14.39	0.000	1.28	15.67	15.91	0.0	0.00
55.0	59.6	0.000	1.48	2.6	0.00	0.000	0.004	14.76	0.000	1.31	16.07	17.50	0.0	0.00
60.0	55.9	0.000	1.51	2.6	0.00	0.000	0.004	15.09	0.000	1.34	16.43	19.09	0.0	0.00
65.0	52.6	0.000	1.54	2.6	0.00	0.000	0.004	15.40	0.000	1.37	16.77	20.68	0.0	0.00
70.0	49.8	0.000	1.57	2.6	0.00	0.000	0.004	15.68	0.000	1.39	17.08	22.27	0.0	0.00
75.0	47.3	0.000	1.59	2.6	0.00	0.000	0.004	15.95	0.000	1.42	17.37	23.86	0.0	0.00
80.0	45.0	0.000	1.62	2.6	0.00	0.000	0.003	16.20	0.000	1.44	17.64	25.45	0.0	0.00
85.0	43.0	0.000	1.64	2.6	0.00	0.000	0.003	16.43	0.000	1.46	17.89	27.05	0.0	0.00
90.0	41.1	0.000	1.66	2.6	0.00	0.000	0.003	16.65	0.000	1.48	18.13	28.64	0.0	0.00
95.0	39.4	0.000	1.69	2.6	0.00	0.000	0.003	16.86	0.000	1.50	18.36	30.23	0.0	0.00
100.0	37.9	0.000	1.71	2.6	0.00	0.000	0.003	17.06	0.000	1.52	18.57	31.82	0.0	0.00
105.0	36.5	0.000	1.72	2.6	0.00	0.000	0.003	17.25	0.000	1.53	18.78	33.41	0.0	0.00
110.0	35.2	0.000	1.74	2.6	0.00	0.000	0.003	17.43	0.000	1.55	18.97	35.00	0.0	0.00
115.0	34.0	0.000	1.76	2.6	0.00	0.000	0.003	17.60	0.000	1.56	19.16	36.59	0.0	0.00
120.0	32.9	0.000	1.78	2.6	0.00	0.000	0.002	17.76	0.000	1.58	19.34	38.18	0.0	0.00
125.0	31.9	0.000	1.79	2.6	0.00	0.000	0.002	17.92	0.000	1.59	19.52	39.77	0.0	0.00
130.0	30.9	0.000	1.81	2.6	0.00	0.000	0.002	18.08	0.000	1.61	19.68	41.36	0.0	0.00
135.0	30.0	0.000	1.82	2.6	0.00	0.000	0.002	18.22	0.000	1.62	19.84	42.95	0.0	0.00
140.0	29.2	0.000	1.84	2.6	0.00	0.000	0.002	18.37	0.000	1.63	20.00	44.55	0.0	0.00
145.0	28.4	0.000	1.85	2.6	0.00	0.000	0.002	18.50	0.000	1.64	20.15	46.14	0.0	0.00
150.0	27.6	0.000	1.86	2.6	0.00	0.000	0.002	18.64	0.000	1.66	20.29	47.73	0.0	0.00
155.0	26.9	0.000	1.88	2.6	0.00	0.000	0.002	18.77	0.000	1.67	20.43	49.32	0.0	0.00
160.0	26.2	0.000	1.89	2.6	0.00	0.000	0.002	18.89	0.000	1.68	20.57	50.91	0.0	0.00
165.0	25.6	0.000	1.90	2.6	0.00	0.000	0.002	19.01	0.000	1.69	20.70	52.50	0.0	0.00

Lithos

Orifice Design

231 Cobourg Street
File No. UD14-005
Date: March 2017
Prepared by: Matina Sakoutsiou
Reviewed by: Nick Moutzouris, P.Eng., M.A.Sc.

Orifice Equation for 75 mm Plate

$$Q = C \times A \times \sqrt{2 \times g \times h}$$

100 yr event		
d=	75	mm
C=	0.6	
A=	0.004	m^2
g=	9.81	m/s^2
h=	0.20	m
Q=	**5.3**	**L/s**

5 yr event		
d=	75	mm
C=	0.6	
A=	0.004	m^2
g=	9.81	m/s^2
h=	0.10	m
Q=	**3.7**	**L/s**

2 yr event		
d=	75	mm
C=	0.6	
A=	0.004	m^2
g=	9.81	m/s^2
h=	0.07	m
Q=	**3.1**	**L/s**

Lithos

Water Quality Calculations

231 Cobourg Street
File No. UD14-005
March 2017

Surface	Method	Effective TSS Removal	Area (ha)	% Area of Controlled Site	Overall TSS Removal
Green Roof	Inherent	80%	0.006	16%	13%
Rooftop	Inherent	80%	0.013	34%	27%
Driveway/Landscape/Pavement	Downstream Defender	80%	0.019	50%	40%
Total			0.038	100%	80%

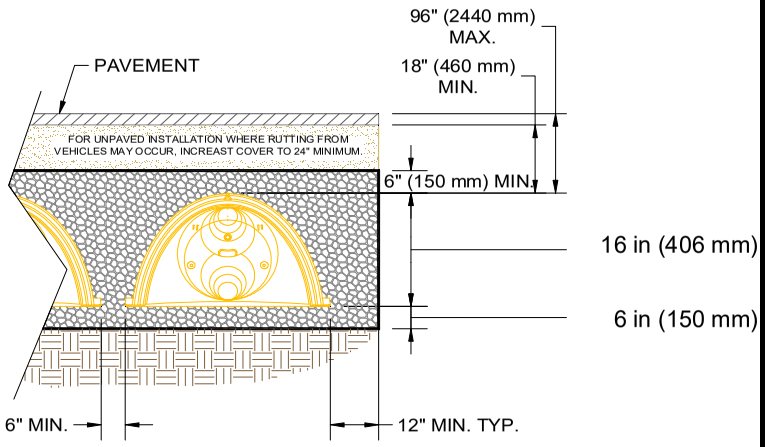
StormTech
Detention • Retention • Recharge
Subsurface Stormwater Management℠

Units: **Metric**

Project: UD14-005 - 231 Cobourg Street - Ottawa
By: Matina Sakoutsiou
Point of Contact
Date: March 2017

System Requirements

Required Storage Volume	**8**	cubic meters
Select Stormtech Chamber System	SC-310	
Stone Porosity (Industry Standard = 40%)	**40%**	
Stone Foundation Depth	150	mm
Storage Volume Per Chamber	0.87	cubic meters
Avg Cover over Chambers (460mm min. & 2440mm max.)	460	mm



Number of Chambers Required - 9

Approximate Bed Size Required	28	square meters
Tons of Stone Required	26	Tonnes
Volume of Excavation	28	cubic meters
Area of Filter Fabric	85	square meters
# of End Caps Required	**6**	Each
Length of ISOLATOR ROW	**8.68**	m
ISOLATOR FABRIC	**10**	square meters

Is the limiting dimension for the bed the width or length? **length**

Controlled by Width (Rows)

Width	**1.85**	m
# of Chambers Long	-	EA
# of Rows	-	EA
Actual Length	-	m
Actual Width	-	m

Controlled by Length

Length	**11**	m
# of Chambers long	4	EA
# of Rows	3	EA
Actual Length	9.78	m
Actual Width	3.50	m

1 of the chambers rows will contain only 1 chambers

Material Estimate

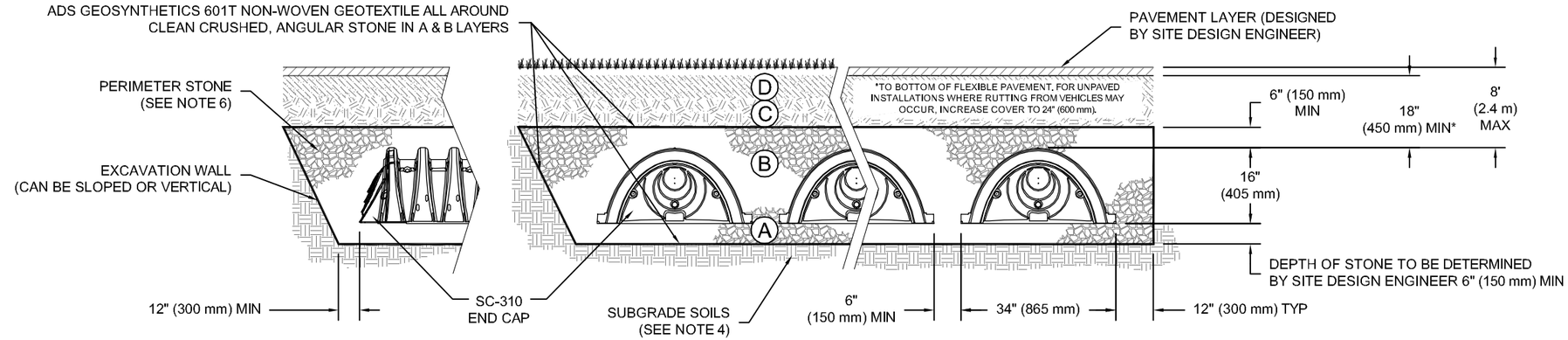
To use this sheet: Please enter data into the blue and green cells. If switching between Imperial and Metric units please check the correct units and data is input in the green cells.

Please call StormTech @ 888-892-2694 for conceptual cost estimates.

ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. [2 3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

1. SC-310 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS", OR ASTM F2922
"STANDARD SPECIFICATION FOR POLYETHYLENE (PE) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-310 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
5. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
6. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.

SC-310
STANDARD CROSS SECTION

DATE: 11/18/14 | DRAWN: JLM | CHECKED: JLM | PROJECT #:

REV	DRW	CHK	DESCRIPTION
01/19/16	JLM	JLM	UPDATE

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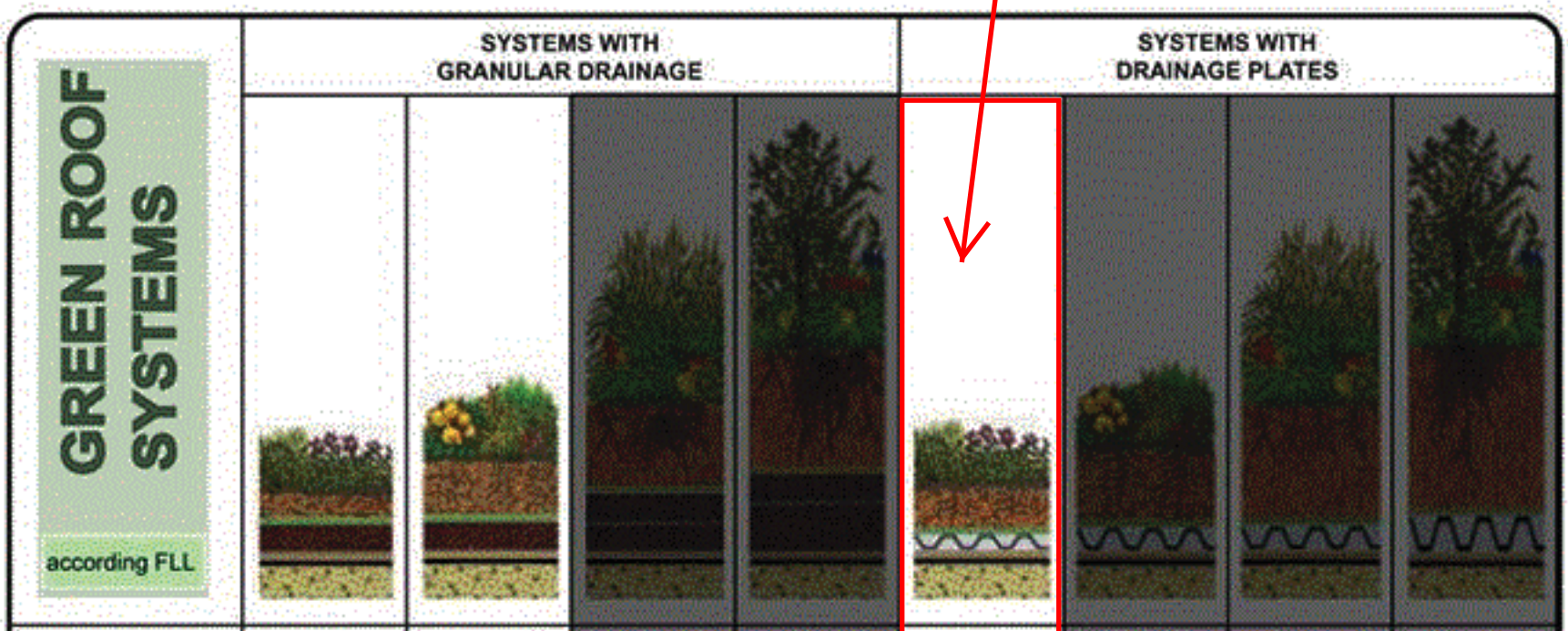
HILLIARD, OH 43026
1-800-733-7473

Extensive Green Roofs

3" DEEP EXTENSIVE GREEN ROOF WATER RETENTION EQUALS TO:
23 lbs/sq.ft - 14 lbs/sq.ft =
= 9 lbs/sq.ft = 43.9 L/sq.m

Extensive Green Roof - An extensive green roof system is characterized of its vegetation, ranging from sedums to small grasses, herbs and flowering herbaceous plants, which need **little maintenance** and **no permanent irrigation system**. The growing medium depth for an extensive green roof system is typically 6 inches or less. These systems are ideal for efficient **stormwater management** with **low maintenance needs**. Extensive greenroofs are very cost efficient. Please read the case study "The Economics of Green Roofs from the Perspective of the Commercial Client" in our green roof case study section. Extensive green roofs are ideal for integrated PV/Solar systems like the Sun-Root system.

Click here to view a time lapse video of an **extensive green roof installation**.



system designation	G1	G2	G3	G4	P1	P2	P3	P4
typical plants	sedum herbs	sedum herbs perennials	perennials grasses shrubs	grasses shrubs trees	sedum herbs	sedum herbs perennials	perrenials grasses shrubs	grasses shrubs trees
extensive soil mix	2"	4"	-	-	3"	5"	-	-
intensive soil mix	-	-	6"	9"	-	-	8"	12"
separation fabric	1/8"	1/8"	1/8"	1/8"	1/8"	1/8"	1/8"	1/8"
granular drainage	2"	2"	4"	6"	-	-	-	-
drainage plate	-	-	-	-	1"	1-1/2"	1-1/2"	2-1/2"
drainage mat	-	-	-	-	-	-	-	-
protection mat	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"
nominal thickness	4"	6"	10"	15"	4"	7"	10"	15"
dry weight	19 lbs/ft²	28 lbs/ft²	45 lbs/ft²	69 lbs/ft²	14 lbs/ft²	23 lbs/ft²	34 lbs/ft²	52 lbs/ft²
saturated weight	26 lbs/ft²	41 lbs/ft²	70 lbs/ft²	105 lbs/ft²	23 lbs/ft²	37 lbs/ft²	57 lbs/ft²	85 lbs/ft²
minimum slope	0:12	0:12	0:12	0:12	1/4:12	1/4:12	1/4:12	1/4:12
maximum slope	1:12	1:12	1:12	1:12	1:12	1:12	1:12	1:12
water retention/Year*	50%	60%	70%	80%	50%	60%	70%	80%
irrigation system	-	-	subsurface	subsurface	-	-	surface	surface

* conservative numbers

Stormwater Solutions

Downstream Defender®

Online Sizing Calculator Project Summary

Project Details

231 Cobourg Street
Ottawa, Ontario, K1N 8J2
Canada
Application: Primary Treatment
Development Type: Redevelopment

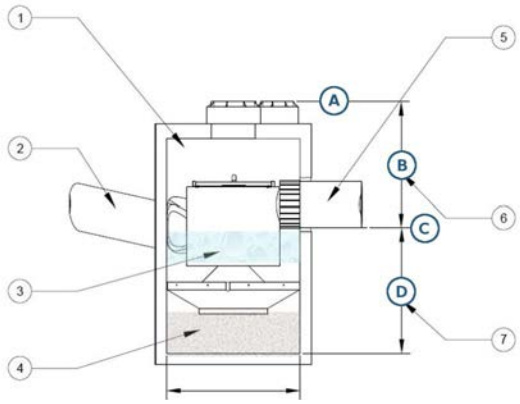
Contact Details

Matina Sakoutsiou
Lithos Inc.
Toronto, Ontario
Canada

07/01/2015

Downstream Defender Specification

1	Vortex Chamber Diameter	4 ft
2	Maximum Inlet Pipe Diameter	12"
3	Oil Storage Capacity	70 gal
4	Sediment Storage Capacity	0.7 yd³
5	Outlet Pipe Diameter	12"
6	Minimum Stormdrain Depth	2.8 ft
7	Standard Depth	4.1 ft



List Of Downstream Defenders On Project

Reference Name / Site Designation:	Downstream defender	Downstream Defender Size:	4-ft
Sizing Method:	Target Particle Size	Downstream Defender is Set:	Online
Target Particle Size:	106 Microns	Rim Elevation (A):	6.88 ft
Total Suspended Solids Removal:	80%	Minimum Depth (B):	2.8 ft
Water Quality Flow Rate:	0.21 cfs	Invert Elevation of Outlet (C):	3.08 ft
Peak Flow Rate:	2.05 cfs	Distance from Outlet Invert to Sump (D):	4.1 ft

Hydro International, Stormwater Solutions, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com Email: stormwaterinquiry@hydro-int.com

APPENDIX D
Sanitary Data Analysis

SANITARY SEWER DESIGN SHEET

231 Cobourg Street

CITY OF OTTAWA

LOCATION	SECTION AREA (ha.)	RESIDENTIAL: No OF UNITS Residential / 2 Bed Apart. @ 2.1 ppu	RESIDENTIAL: SECTION POP. (persons)	RESIDENTIAL: AVERAGE RES. FLOW '@' 350 L/c/d (L/s)	RESIDENTIAL: HARMON PEAKING FACTOR	RESIDENTIAL: RES. PEAK FLOW (L/s)	OFFICE: OFFICE AREA (ha.)	OFFICE: AVERAGE OFFICE FLOW @75L/9.3m²/d (L/s)	INFILTRATION: TOTAL ACCUM. AREA (ha.)	INFILTRATION: INFILT. @ 0.28 L/s/ha. (L/s)	TOTAL DESIGN FLOW (L/s)	SEWER DESIGN: PIPE LENGTH (m)	PIPE DIA. (mm)	SLOPE (%)	FULL FLOW CAPACITY n = 0.013 (L/sec)	% of DESIGN CAPACITY (%)
column number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Existing Condition																
Residential Development	0.038	2	4	0.02	4.00	0.07	0.00	0.00	0.04	0.011	**0.08**	-	-	-	-	-
Proposed Condition																
Office Building	0.038	0	0	0.00	4.00	0.00	0.05	0.05	0.04	0.011	**0.06**	14.0	200	2.0%	46.38	0.12%
										Total Net Flow	**-0.02**					

Existing building - includes two 2-bedroom apartments
Proposed building - includes approximately 500m of office space
Residential Flow Rate - 350 litres/capita/day
Office Flow Rate - 75 L/9.3m²/day
Infiltration - 0.28 L/s/ha
Peaking Factor = 1 + [14 / (4 + $P^{0.5}$)], P=Population in thousands
Site Area: 0.038 Ha

Prepared by: Matina Sakoutsiou
Reviewed by: Nick Moutzouris, P.Eng., M.A.Sc.
Date: March 2017

Project: 231 Cobourg Street
Project: UD14-004
City of Ottawa Sheet 1 OF 1

APPENDIX E
Water Data Analysis

Lithos

WATER DEMAND

231 Cobourg Street
File No: UD14-003
Date: March 2017
Prepared by: Matina Sakoutsiou
Reviewed By: Nick Moutzouris, P.Eng., M.A.Sc.

Fire Flow Calculation

1 $F = 220\ C\ (A)^{1/2}$

Where F= Fire flow in Lpm
C= construction type coefficient
= 1.5 wood frame construction (combustible)
A = total floor area in sq.m. excluding basements

		Area Applied
Level 1&2=	340.78 m^2	100%
Level -1=	167.91 m^2	0%
Level 3=	170.60 m^2	25%
=	383.4 sq.m.	

Note: The levels indicated, reference the floors with the largest areas (refer to architectural design)

F = 6,461.85 L/min

F = 6,500 L/min Round to nearest 100 l/min

2 Occupancy Reduction
0% reduction for combustible occupancy
F = 6500 L/min

3 Sprinkler Reduction
0% Reduction for NFPA Sprinkler System
F = 6500 l/min

4 Separation Charge

0%	West	Road	
15%	North	10.1m to 20m	
0%	South	Road	
20%	East	3.1m to 10m	
35%	Total Separation Charge		2275 L/min

F = 8,775.00 L/min
146.25 L/s
F = 2318 US GPM

Domestic Flow Calculations

Area = 679.3 m^2
Average Day Demand = 2.5 $L/m^2/day$ (OBC) 1 US Gallon=3.785 L
= 0.02 L/s
= 0 US GPM 1 US GPM=15.852L/s

Max. Daily Demand Peaking Factor = 1.5
Max. Daily Demand = 0.03 L/s = 0 US GPM

or

Max. Hourly Demand Peaking Factor = 2.7
Max. Hourly Demand = 0.05 L/s = 1 US GPM

Max Daily Demand = 0.03 L/s
Fire Flow = 146.25 L/s

Required 'Design' Flow = 146.28 L/s
2319 US GPM

Note: Required 'Design' Flow is the maximum of either:
1) Fire Flow + Maximum Daily Demand
2) Maximum Hourly Demand