Functional Site Servicing and Stormwater Management Report 365 Forest Street, Ottawa, ON

Client:
11061917 Canada Inc.
200-768 St. Joseph Boulevard
Gatineau, QC J8Y 4B8

Submitted for:
Zoning By-law Amendment & Official Plan Amendment

Project Name:
365 Forest Street

Project Number:
OTT-00252570-A0

Prepared By:
EXP
2650 Queensview Drive
Ottawa, ON K2B 8H8
t: +1.613.688.1899
f: +1.613.225.7337

Date Submitted:
2020-01-27

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f: +1.613.225.7337

Prepared by:

Jason Fitzpatrick, P.Eng.
Project Engineer

Approved by:

Bruce Thomas

Bruce Thomas, P.Eng.
Senior Project Manager

Date Submitted:
2020-01-27

Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Overview

EXP Services Inc. (EXP) was retained by 11061917 Canada Inc. to prepare a Functional Site Servicing and Stormwater Management report for the proposed redevelopment of 365 Forest Street in support of a Zoning By-Law Amendment and Official Plan Amendment.

The 0.54-hectare site is situated at the corner of Richmond Road and Forest Street as illustrated in **Figure 1-1** below. The site is within the City of Ottawa urban boundary and situated in Bay Ward. The description of the subject property is noted below:

- Part of Lots 42, 56 and 57, Registered Plan 311, in the City of Ottawa, consisting of:
- PIN 039620357 or 1420 Richmond Road.
- PIN 039620356 or 365 Forest Street.
- PIN 039620352 or 2589 Bond Street.
- PIN 039620390 & PIN 039620391, 2583 Bond Street.

The development will consist of two high-rise buildings. Tower A is a 12-storey high-rise comprised of 182 units and Tower B is 11-storey high-rise and comprised of 212 units. Below the towers, five levels of underground parking will be provided.

This report will discuss the adequacy of the adjacent municipal watermain, sanitary sewers and storm sewers to provide the required water supply, convey the sewage and stormwater flows that will result from the proposed development. This report provides a design brief for submission, along with the engineering drawings, for City approval.

Figure 1-1 - Site Location

2 Existing Conditions

Within the four subject properties, there are two (2) existing buildings. The following summarizes the current land use conditions.

- 1420 Richmond Road — Vacant property, but currently used as gravel parking lot.
- 365 Forest Street — Automobile garage and repair shop including asphalt parking lot.
- 2589 Bond Street — Automobile repair shop and asphalt parking lot.
- 2583 Bond Street — Vacant property.

All four properties are zoned Arterial Mainstreet Zone (AM10).

The topography of the subject site falls in a southerly and easterly direction along Forest Street and Bond Street, with a localized roadway sag condition on Forest Street approximately ±50m south of Richmond Road.

3 Existing Infrastructure

The site includes two commercial buildings that will be removed during the redevelopment of the site.

From review of the sewer and watermain mapping, as-built drawings and Utility Central Registry (UCC) plans, the following summarizes the onsite and adjacent offsite infrastructure:

<u>Within property</u>

- Storm, sanitary and watermain laterals to the two buildings that will be abandoned

<u>On Bond Street</u>

- 150mm watermain
- 225mm sanitary sewer
- 300mm storm sewer
- 35mm Gas / Bell / Streetlighting/ Hydro

<u>On Forest Street</u>

- 300mm watermain
- 250mm sanitary sewer
- 300mm storm sewer
- Hydro /Bell / Streetlighting / Hydro

<u>On Richmond Road</u>

- 300mm watermain
- 250mm sanitary sewer
- 300mm storm sewer
- 200mm Gas / Hydro / Bell / Streetlighting

As-built drawings for Bond Street, Forest Street, and Richmond Road were obtained from the City's vault and are included in **Appendix F**.

1.3 Pre-Consultation / Permits / Approvals

A pre-consultation meeting was held with the City prior to design commencement. This meeting outlined the submission requirements and provided information to assist with the development proposal. A copy of pre-consultation correspondence is included in **Appendix E**.

The proposed site is located within the Rideau Valley Conservation Authority (RVCA) jurisdiction, therefore signoff from the RVCA will be required prior to Site Plan approval. The RVCA has been contacted to confirm the stormwater management quality control requirements. A copy of the correspondence with the RCVA is attached in **Appendix E**.

Generally, an Environmental Compliance Approval (ECA) would be obtained from the Ministry of Environment, Conservation and Parks (MECP), formerly the Ministry of the Environment and Climate Change (MOECC), for any onsite private Sewage Works.

The onsite Sewage Works would generally include the onsite stormwater works such as flow controls, associated stormwater detention, and treatment works. However, an Approval Exemption under Ontario Regulation 525/98 can be applied. Under Section 3 of O'Reg 525/98, Section 53 (1) and (3) do not apply to the alteration, extension, replacement or a change to a stormwater management facility that 1) is designed to service one lot or parcel of land, b) discharges into a storm sewer that is not a combined sewer, c) does not service industrial land or a structure located on industrial land, and finally d) is not located on industrial land.

Based on this exemption, if the parcels noted above are merged into one property parcel, then by completing this the Approval Exemptions under O'Reg 525/98, would be satisfied and not require an ECA. Prior to City signoff on the infrastructure design a pre-consultation meeting will be held with the local MECP, to confirm that the site will not require an ECA.

In addition, various design guidelines were referred to in preparing the current report including:

- Bulletin ISDTB-2012-4 (20 June 2012)
  - Technical Bulletin ISDTB-2014-01 (05 February 2014)
  - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
  - Technical Bulletin ISDTB-2018-01 (21 March 2018)
  - Technical Bulletin ISDTB-2018-04 (27 June 2018)
- Ottawa Design Guidelines – Water Distribution, July 2010 (WDG001), including:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).
- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 1999.
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing.

4 Water Servicing

4.1 Existing Water Servicing

The subject site is within the City of Ottawa 1W pressure zone. The site is currently serviced by the existing 305mm watermain on Forest Street and the 150mm watermain on Bond Street. The two existing buildings are serviced by laterals that will be blanked during construction.

4.2 Water Servicing Proposal

The proposed development will consist of two high-rise buildings. Tower A is a 12-storey high-rise comprised of 182 units and Tower B is 11 storeys and comprised of 212 units. Architectural plans and rendering of the proposed building along with building statistics are provided in **Appendix H.**

Water supply for the site will be provided by twin 200mm watermains supplied from the existing watermain on Forest Street. The need for a twin watermain is the result of the average day water demands exceeding 50 m^3/day. The watermain feeds from the underground parking level will connect directly to the existing 300mm watermain on Forest Street and will have an isolation valve between them, consistent with City of Ottawa Water Design Guidelines.

The buildings will be protected by an automatic sprinkler systems. A fire department connection (or siamese) will be located within 45 metres of an adjacent municipally owned fire hydrant. In order to achieve this, a new hydrant will be installed off the existing 300mm watermain within Forest Street. Detailed layout of the proposed water services is provided in drawing C100 of **Appendix H.**

4.3 Water Servicing Design

The water servicing requirements for the proposed building is designed in accordance with the City Design Guidelines (July 2010). The following steps indicate the basic methodology that was used in our analysis:

- Estimated water demands under average day, maximum day and peak hour conditions. As the total population estimate was greater than 500, standard residential peaking factors were used, rather than based on MECP Table 3-3 which would be necessary when the design population is than 500 persons.
- Estimated the required fire flow (RFF) based on the Fire Underwriters Survey (FUS).
- Obtained hydraulic boundary conditions (HGL) from the City, based on the above water demands and required fire flows.
- Boundary condition data and water demands were used to estimate the pressure at the proposed building, and this was compared to the City's design criteria.

Since the average day demand exceed 50 m^3 per day, two watermain feeds to the building will be necessary as per Section 4.31 of the WDG001. Please refer to **Appendix B** for detailed calculations of the total water demands.

A review of the estimated watermain pressures at the building connection, based on the boundary conditions provided, was completed based on using two watermains. **Table B-5** in **Appendix B** provides a comparison of anticipated pressures at the building connection based on using a single or double watermain feed. A single watermain analysis was completed to determined if the water pressure still met the City requirement during either the maximum day plus fire flow or peak hour condition, if one of the laterals was out of service.

Based on results, the use of two 150mm watermains would result in a pressure of ±41.3 psi at the building, while the use of two 200mm watermains would improve the pressure to ±43.6 psi under maximum day plus fire flow conditions. The minimal

difference in pressure is the result of the short length of the water service lateral. In the event one of the watermains are down for service, the pressure at the building using only a single 150mm or 200mm watermain would be ±33.3 psi or ±41.5 psi respectively.

Under peak hour conditions, there is little difference using a 150mm or 200mm watermain, with anticipated pressure at the building of ±46.5 psi.

Based on the results, the installation of two 200mm watermains with a shut-off valve between them is proposed. Detailed calculations of the anticipated water pressures, based on City of Ottawa boundary conditions, is provided in **Table B-5**.

No pressure reducing measures are required as operating pressures are within 50 psi and 80 psi.

4.4 Water Servicing Design Criteria

Table 4-1 below summarizes the Design Criteria that was used to establish the water demands and the required fire flows, based on the proposed building uses. The design parameters that apply to this project and used for calculations are identified below in **Table 4-1**.

Table 4-1 - Summary of Water Supply Design Criteria

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	
Population Density – Semi-detached Home	2.7 persons/unit	
Population Density – Townhome or Terrace Flat	1.8 persons/unit	
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	✓
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	✓
Population Density – Two Bedroom Apartment	2.1 persons/unit	✓
Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	✓
Average Day Demands – Residential	350 L/person/day	✓
Average Day Demands – Commercial / Institutional	28,000 L/gross ha/day	✓
Average Day Demands – Light Industrial / Heavy Industrial	35,000 or 55,000 L/gross ha/day	
Maximum Day Demands – Residential	2.5 x Average Day Demands	✓
Maximum Day Demands – Commercial / Institutional	1.5 x Average Day Demands	
Peak Hour Demands – Residential	5.5 x Average Day Demands	✓
Peak Hour Demands – Commercial / Institutional	2.7 x Average Day Demands	
Fire Flow Requirements Calculation	FUS	✓
Depth of Cover Required	2.4m	✓
Maximum Allowable Pressure	551.6 kPa (80 psi)	✓
Minimum Allowable Pressure	275.8 kPa (40 psi)	✓
Minimum Allowable Pressure during fire flow conditions	137.9 kPa (20 psi)	✓

4.5 Estimated Water Demands

The following **Table 4-2** below summarizes the anticipated water demands for the proposed development based on following:

- Tower A having 182 units and estimated population of 276.5 persons.
- Tower B having 212 units and estimated population of 324.8 persons.

Table 4-2 : Water Demand Summary

Water Demand Conditions	Tower A - Water Demands (L/sec)	Tower B - Water Demands (L/sec)	Total Water Demands (L/sec)
Average Day	1.3	1.3	2.6
Max Day	3.1	3.3	6.4
Peak Hour	6.5	7.2	13.7

4.6 Boundary Conditions

Hydraulic Grade Line (HGL) boundary conditions were obtained from the City for design purposes. A copy of the correspondence received from the City is provided in **Appendix F**.

The following hydraulic grade line (HGL) boundary conditions were provided:

- Minimum HGL = 108.5 m
- Max Day + Fire Flow = 107.0 m
- Maximum HGL = 115.7 m

Based on a ground elevation of approximately 74.85m at the boundary condition location this results in a system water pressure of 32.7m or 46.5 psi during peak hour conditions.

4.7 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along the adjacent roadways: Bond Street, Forest Street, Croydon Avenue, and Richmond Road. The required fire flows for the proposed buildings were calculated based on typical values as established by the Fire Underwriters Survey 1999 (FUS).

The following equation from the Fire Underwriters document “Water Supply for Public Fire Protection”, 1991, was used for calculation of the on-site supply rates required to be supplied by the hydrants:

$F = 200 * C * \sqrt{(A)}$

where:

F	=	Required Fire flow in Litres per minute
C	=	Coefficient related to type of Construction
A	=	Total Floor Area in square metres

The proceeding **Table 4-3** summarizes the parameters used for estimating the Required Fire Flows (RFF) based on the Fire Underwriters Survey (FUS) and the latest City of Ottawa Technical Bulletins. The RFFs were estimated in accordance with ISTB-2018-02, and based on floor areas provided by the architect, which are illustrates in **Appendix H.**

The following summarizes the parameters used for both proposed buildings.

- Type of Construction — Non-combustible
- Occupancy — Limited combustible
- Sprinkler Protection — Fully Supervised Automatic Sprinkler

Table 4-3 - Summary of Design Parameters Used in Calculating Required Fire Flows (RFF) Using FUS

Design Parameter	Value
Coefficient Related to type of Construction C	0.80 (Towers A, Tower B)
Total Floor Area (m2)	7,305 (Tower A) 8,966 (Tower B)
Fire Flow prior to reduction (L/min)	15,043 (Tower A) 16,665 (Tower B)
Reduction Due to Occupancy Non-combustible (-25%), Limited Combustible (-15%), Combustible (0%), Free Burning (+15%), Rapid Burning (+25%)	-15% (Tower A) -15% (Tower B)
Reduction due to Sprinkler (Max 50%) Sprinkler Conforming to NFPA 13 (-30%), Standard Water Supply (-10%), Fully Supervised Sprinkler (-10%)	-50% (Tower A) -50% (Tower B)
Exposures	+20% (Tower A) +46% (Tower B)

The estimated required fire flows (RFF) based on the FUS methods is: 133 L/sec for Tower A, and 183 L/sec for Tower B.

4.8 Review of Hydrant Spacing

A review of the hydrant spacing was completed to ensure compliance with Appendix I of Technical Bulletin ISTB-2018-02. As per Section 3 of Appendix I all hydrants within 150 metres were reviewed to assess the total possible available flow from these contributing hydrants. For each hydrant the distance to the proposed building was determined to arrive at the contribution of fire flow from each. All hydrants are expected to be of Class AA as per Section 5.1 of Appendix I. For each hydrant the straight-line distance, distance measured along a fire route or roadway, whether its location is accessible, and its contribution to the required fire flow.

Table 4-4 – Required Fire Flows

Building	Required Fire Flow (L/min)	Available Fireflow Based on Hydrant Spacing as per ISTB-2018-02 (L/min)
Tower A	8,000 (or 133 L/sec)	20,900
Tower B	11,000 (or 183 L/sec)	24,700

The total available contribution of flow from hydrants was estimated at ±21,000 L/min and ±25,000 L/min for Towers A and B, whereas the required fire flows (RFF) for each building is only 8,000 L/min and 11,000 L/min. Therefore, the available flows from hydrants exceed each building's fire flow requirements as identified in Appendix I of Technical Bulletin ISTB-2018-02. Additional information on the available flows from hydrants is provided in **Table B-4**.

5 Sewage Servicing

5.1 Existing Sewage Conditions

The subject property is located within the Pinecrest Collector Sewershed, which then discharges to the West Nepean Collector. From the property sewage is discharged:

- Southerly on Forest Street (±45m of 250mm pipe),
- Easterly on Bond Street (130m of 225mm pipe)
- Northerly on Croydon Avenue (±180m of 225mm and 250mm pipe)
- Easterly on Richmond Road (±625m of 300mm pipe) to Pinecrest Collector
- Northerly on Transitway (±460m of 900mm pipe) to West Nepean Collector

Sewage Flows within the property were estimated in order to compare with developed conditons. **Table 5-3** below summarizes the approximate sewage flows generated from the existing properties, based on a commerical flow and infiltration allowance.

Table 5-1 – Summary of Existing Sewage Flows

Sewage Condition	Sanitary Sewage Flow (L/sec)
Average Day Sewage Flow	0.26
Infiltration Flow (at 0.33 L/ha/sec)	0.18
Peak Wet Weather Sewage Flow	0.44

5.2 Proposed Sewage Conditions

It is proposed to provide one single sanitary sewer connection from the subject property to the existing sanitary sewer on Bond Street. Each tower will have a separate building lateral which will discharge to an onsite sanitary manhole. This manhole will be installed near the property line and be used as a monitoring manhole. The sanitary sewer system was designed based on a population flow with an area-based infiltration allowance. A 250mm diameter sanitary sewer is proposed with a minimum 2% slope, having a capacity of 87.7 L/sec based on Manning's Equation under full flow conditions. Based on the OBC, the maximum permitted hydraulic load for a 250mm at 2% is 4,500 fixture units. **Table 5-2** below summarizes the design parameters used.

Table 5-2 – Summary of Wastewater Design Criteria / Parameters

Design Parameter	Value	Applies
Population Density – Single-family Home	3.4 persons/unit	
Population Density – Semi-detached Home	2.7 persons/unit	
Population Density – Duplex	2.3 persons/unit	
Population Density – Townhome (row)	2.7 persons/unit	
Population Density – Bachelor Apartment	1.4 persons/unit	
Population Density – Bachelor + Den Apartment	1.4 persons/unit	
Population Density – One Bedroom Apartment	1.4 persons/unit	✓
Population Density – One Bedroom plus Den Apartment	1.4 persons/unit	✓
Population Density – Two Bedroom Apartment	2.1 persons/unit	✓

Population Density – Two Bedroom plus Den Apartment	2.1 persons/unit	✓
Average Daily Residential Sewage Flow	280 L/person/day	
Average Daily Commercial / Intuitional Flow	28,000 L/gross ha/day	✓
Average Light / Heavy Industrial Daily Flow	35,000 / 55,000 L/gross ha/day	
Residential Peaking Factor – Harmon Formula (Min = 2.0, Max =4.0, with K=0.8)	$M = 1 + \frac{14}{4 + P^{0.5}} * k$	✓
Commercial Peaking Factor	1.5	✓
Institutional Peaking Factor	1.5	
Industrial Peaking Factor	As per Table 4-B (SDG002)	
Unit of Peak Extraneous Flow (Dry Weather / Wet Weather)	0.05 or 0.28 L/s/gross ha	
Unit of Peak Extraneous Flow (Total I/I)	0.33 L/s/gross ha	✓

The estimated peak sanitary flow rate from the proposed property at 365 Forest Street is **6.7 L/sec** based on City Design Guidelines. Sewage rates below include a total infiltration allowance of 0.33 L/ha/sec based on the total gross site area.

Table 5-3 – Summary of Anticipated Sewage Rates

Sewage Condition	Sanitary Sewage Flow (L/sec)
Peak Residential / Commercial Flow	6.53
Infiltration Flow	0.18
Peak Design Flow	6.71

A review of the downstream sanitary sewer capacity was completed. The minimum sewer capacity of the last sewer run on Croydon Street (with a slope of 0.36%) has a calculated full flow capacity of 27 L/sec. It is anticipated that the increase in peak sewage flows up to 6.3 L/sec can be accommodated in the downstream sanitary sewer system.

6 Storm Servicing & Stormwater Management

Since the subject properties are located within the Ottawa River East subwatershed, stormwater works are therefore subject to both the Rideau Valley Conservation Authority (RVCA) and City of Ottawa (COO) approval.

The RVCA was contacted to determine quality control requirements for the site. Correspondence from the RVCA is provided in **Appendix F**, which clarifies that no onsite quality control is required. Similarly, no quality control was noted in the pre-consultation meeting held with the COO, which is also provided in **Appendix F.**

The requirements related to stormwater quantity control were noted in the pre-consultation meeting as follows:

- *Stormwater quantity control criteria – control the quantity to the 5-year pre-development/existing level for all storms up to and including the 100-year storm.*
- *When using the modified rational method to calculate the storage requirements for the site, the underground storage should not be included in the overall available storage. The modified rational method assumes that the restricted flow rate is constant throughout the storm which, in this case, underestimates the storage requirement prior to the 1: 100-year head elevation being reached. Alternately, if you wish to include the underground storage, you may use an assumed average*

release rate equal to 50% of the peak allowable rate. Otherwise, disregard the underground storage as available storage or provide modeling to support the design.

6.1 Design Criteria

The proposed stormwater system is designed in conformance with the latest version of the City of Ottawa Design Guidelines (October 2012). Section 5 "Storm and Combined Sewer Design" and Section 8 "Stormwater Management". A summary of the design criteria that relates to this design report is the proceeding sections below.

6.2 Minor System Design Criteria

- The storm sewer was sized based on the Rational Method and Manning's Equation under free flow conditions for the 2-year storm using a 10-minute inlet time.
- Since a detailed site plan was available for the site, including building footprints, calculations of the average runoff coefficients for each drainage area were completed.
- Minimum sewer slopes to be based on minimum velocities for storm sewers of 0.80 m/sec.

6.3 Major System Design Criteria

- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm. On-site storage is calculated based on the 100-year design storm with on-site detention storage provided on the roof and within the underground parking structure (stormwater cistern).
- On site storage is provided and calculated for up to the 100-year design storm. There is no surface ponding proposed on the ground surface.
- Overland flow routes are provided.
- The vertical distance from the spill elevation on the street and the ground elevation at the buildings is at least 15cm.
- The emergency overflow spill elevation is at least 30 cm below the lowest building opening.

6.4 Runoff Coefficients

Runoff coefficients used for were based on actual areas taken from CAD. Runoff coefficients for impervious surfaces (roofs, asphalt, and concrete) were taken as 0.90, whereas those for pervious surfaces (grass/landscaping) were taken as 0.20. Average runoff coefficients were calculated for subcatchments (or drainage areas) using the area-weighting routine in PCSWMM. The runoff coefficients for pre-development and post-development catchments are provided in **Appendix D**, with a summary provided in in **Table 6-1** below.

Table 6-1 – Summary of Runoff Coefficients

Location	Area (hectares)	Pre-Development Runoff Coefficient, C_{AVG}	Post-Development Runoff Coefficient, C_{AVG}
Entire Site	0.5434	0.75	0.71

6.5 Time of Concentration

A minimum time of concentration of 10-minutes was used for both pre-development and post-development subcatchments.

6.6 Pre-Development Conditions

Under current conditions stormwater runoff from the 0.5434-hectare site is divided into two drainage areas. Stormwater runoff discharges: 1) in a northwestern direction towards Richmond Road / Forest Street and 2) in a southern direction towards Bond Street. **Figure A-1** illustrates these pre-development drainage areas. These drainage areas (or subcatchments) are derived from PCSWMM using the Watershed Delineation Tool.

Table 6-2 – Summary of Pre-Development Flows

Return Period Storm	Peak Flows to Richmond Road / Forest Street Storm Sewers (L/sec)	Peak Flows to Bond Street Storm Sewers (L/sec)	Total Peak Flows (L/sec)
2-year	26.1	61.4	87.5
5-year	35.4	83.3	118.8
100-year	75.9	178.4	254.2

6.7 Allowable Release Rate

Rather than meeting pre-development released rates, the City of Ottawa imposes a more restrictive stormwater release rate as noted in Section 8.3.7.3 of the SDG002. The allowable discharge release rate from the site was established using the peak flows derived based on a 5-year return period storm, a maximum runoff coefficient of 0.50 and a standard time of concentration of 10 minutes.

The allowable release rate of 78.8 L/sec from the proposed site will be based on a 5-year storm event. **Table D-9** provides detailed calculations on the total allowable peak flow, and the distribution to each outfall. In summary, the allowable release rate of 78.8 L/sec is comprised of 23.9 L/sec to Forest Street and 54.8 L/sec to Bond Street.

6.8 Proposed Stormwater System

Stormwater runoff from the proposed site will drain from a combination of controlled and uncontrolled areas. As a result of the changes onsite the overall post-development runoff coefficient will change over pre-development conditions. This increase / decrease in runoff is the result of changes due to site development (i.e. additional hard surfaces, roof areas and hard landscaping).

A storm drainage plan is illustrated on **Figure A-2**. A total five (5) subcatchments (or drainage areas) within the development site are shown on this drawing with average runoff coefficients calculated for each drainage area. As the entire site property contains an underground parking structure, the stormwater works shall consist of the following elements:

- Flow-control roof drains for Towers A & B. Each building to have a separate storm lateral connection to municipal system.
- Runoff from surface areas will be collected by area drains and discharge to underground storage (stormwater cistern) located in the underground parking structure. This in turn discharges to one of the storm laterals noted above.
- Remaining drainage areas along frontage of Forest Street and Bond Street to flow uncontrolled to right-of-way.

Table 6-3 – Summary of Post-Development Flows

Return Period Storm	Peak Flows to Richmond Road / Forest Street Storm Sewers (L/sec)	Peak Flows to Bond Street Storm Sewers (L/sec)	Total Peak Flows (L/sec)	Allowable Peak Flows (L/sec)
2-year	5.6	19.2	24.9	78.8
5-year	7.6	26.1	33.7	
100-year	14.9	54.5	69.5	
			Allowable to Forest / Richmond =	23.9
			Allowable to Bond =	54.6

To achieve the quantity control requirements and meet the allowable discharge rates as noted in **Section 6.7**, the roof drains on both Towers will require flow controlled weirs. Based on the roof areas, an estimate of the number of roof drains required was completed. WATTS ACCUTROL weirs were used to determine the total discharge rates from the roof areas based on the number of drains. In addition, the total cumulative prism volumes on the roofs were calculated at a maximum permitted depth of 150mm. Additional information on the estimated 100-year volumes is provided in **Section 6.9**.

6.9 Flow Attenuation

Stormwater flow attenuation will be achieved by utilizing roof storage and stormwater storage in the underground parking structure. Using the allowable release rates, the Modified Rational Method was used to determine the 2-year, 5-year, and 100-year volumes that will occur for corresponding release rates.

Table D-12, Table D-13 and **Table D-14** provide the storage volumes necessary on the roof and in the underground parking structure to attenuate the controlled release rates. **Table D-11** summarizes the combined controlled and uncontrolled flows leaving the subject site. A summary of release rates, storage volume requirements, and provided storage volumes are identified in **Table 6-4** below.

Table 6-4 – Summary of Post-Development Storage

Area No.	Outlet	Release Rate (L/s)			Storage Required (m^3) (MRM)			Storage Provided (m^3)		Control Method
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Roof	Cistern	
Tower A Roof	Richmond / Forest	5.9	8.0	15.1	12.9	17.3	32.8	52.2		Flow Controlled Roof Drains with Weir (Set at Open Position)
Surface - Uncontrolled		0.1	0.1	0.2						None
Surface - Uncontrolled		0.6	0.8	1.7						None
Surface - Uncontrolled		0.4	0.5	1.1						None
Tower B Roof	Bond St	5.9	8.0	15.1	20.6	27.6	52.1	70.9		Flow Controlled Roof Drains with Weir (Set at Open Position)
Surface - Controlled		11.4	15.4	33.0	7.3	9.9	35.3		35.3	Pump Rate from Cistern
Surface - Uncontrolled		0.6	0.9	1.8						none
Totals =		24.7	33.6	68.1	40.7	54.8	120.1	123.1	35.3	

7 Erosion & Sediment Control

During all construction activities, erosion and sedimentation shall be controlled by the following techniques:

- Filter cloth shall be installed between the frame and cover of all adjacent catch basins and catch basin manhole structures.
- Heavy duty silt fencing will be used to control runoff around the construction area. Silt fencing locations are identified on the site grading and erosion control plan.
- A mud mat will be installed at the construction entrance to help avoid mud from being transported to offsite roads.
- Visual inspection shall be completed daily on sediment control barriers and any damage repaired immediately. Care will be taken to prevent damage during construction operations.
- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed.
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract.
- During the course of construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer.
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) OPSS 805 and City of Ottawa specifications.

8 Conclusions and Recommendations

This Functional Servicing & Stormwater Report outlines the rationale which will be used to service the proposed development. The following summarizes the servicing requirements for the site:

Water

- Two parallel 200mm watermains are proposed to service the residential Towers A and B, as the average day demands exceed 50 m^3 per day, which is mandatory as per Section 4.31 of the WDG001.
- The Required Fire Flows (RFFs) were estimated at **8,000 L/min** (133 L/sec) for Tower A, and **11,000 L/min** (183 L/sec) for Tower B. The total minimum available flows for firefighting purposes, based on the contribution from hydrants, was estimated at **20,900 L/min**.
- Based on hydraulic boundary conditions (HGL) provided by the City of Ottawa, a system pressure of **±46.5 psi** under peak hourly demands is anticipated at the proposed building. This exceeds the City's guideline of 20 psi.

Sewage

- Estimated peak sewage flows of **6.7 L/sec** are anticipated. This exceeds current sewage flows of **0.44 L/sec** under existing conditions. A cursory review of the downstream sanitary sewer system from the site and the Pinecrest Collector indicates minimum pipe capacity of 27 L/sec for a sewer run on Croydon Ave.

Stormwater

- For the stormwater system, the allowable capture rate from the entire site was calculated based on a runoff coefficient of 0.50, time of concentration of 10 minutes for a 5-year storm event. The allowable release rate for the entire site was calculated to be **78.8 L/sec**. Runoff in excess of this will be detained onsite for up to the 100-year storm.
- Two minor surface drainage areas will flow uncontrolled to the right-of-way. The 100-year peak flows from these two areas were accounted for (ie. subtracted) from the total runoff rate to establish the allowable rate.
- In order to meet the allowable release rate, a total retention volume of **±120.1 m^3** metres is required.
- Runoff on the building roofs will be controlled using flow-controlled roof drains. For each roof-drain is equipped with WATTS ACCUTROL weirs and set at the OPEN position are proposed. Each drain having maximum discharge rate of 30 gpm at 150mm depth. A maximum discharge rate of **15.1 L/sec for each tower** was established for the 100-year event.
- A total 100-year storage volume requirements on the roofs of Tower A and Tower B was estimated as **84.9 m^3** (32.8 m^3 and 52.1 m^3 respectively), based on the above release rates, using the Modified Rational Method. The volumes available on the roofs are **123.1.5 m^3** (52.2 m^3 and 70.9 m^3 respectively), therefore exceeding the required volumes.
- Runoff from the surface areas above the parking structure will be collected and detained in an underground stormwater chamber (cistern) located in the parking structure. The allowable discharge rate of **33.5 L/sec** from the cistern will be met using an equal pump rate. The volume necessary to detain the 100-year event, is **35.3 m^3**, based on using 50% of the allowable release rate as required by the City of Ottawa. The stormwater tank (cistern) will be sized to hold a minimum volume of approximately **35.3 m^3.**

Erosion & Sediment Control

- Erosion and sediment control methods will be used during construction to limit erosion potential.

9 Legal Notification

This report was prepared by EXP Services Inc. for the account of 11061917 Canada Inc.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Appendix A - Figures

Figure A-1 - Pre-Development Drainage Areas

Figure A-2 - Post-Development Drainage Areas

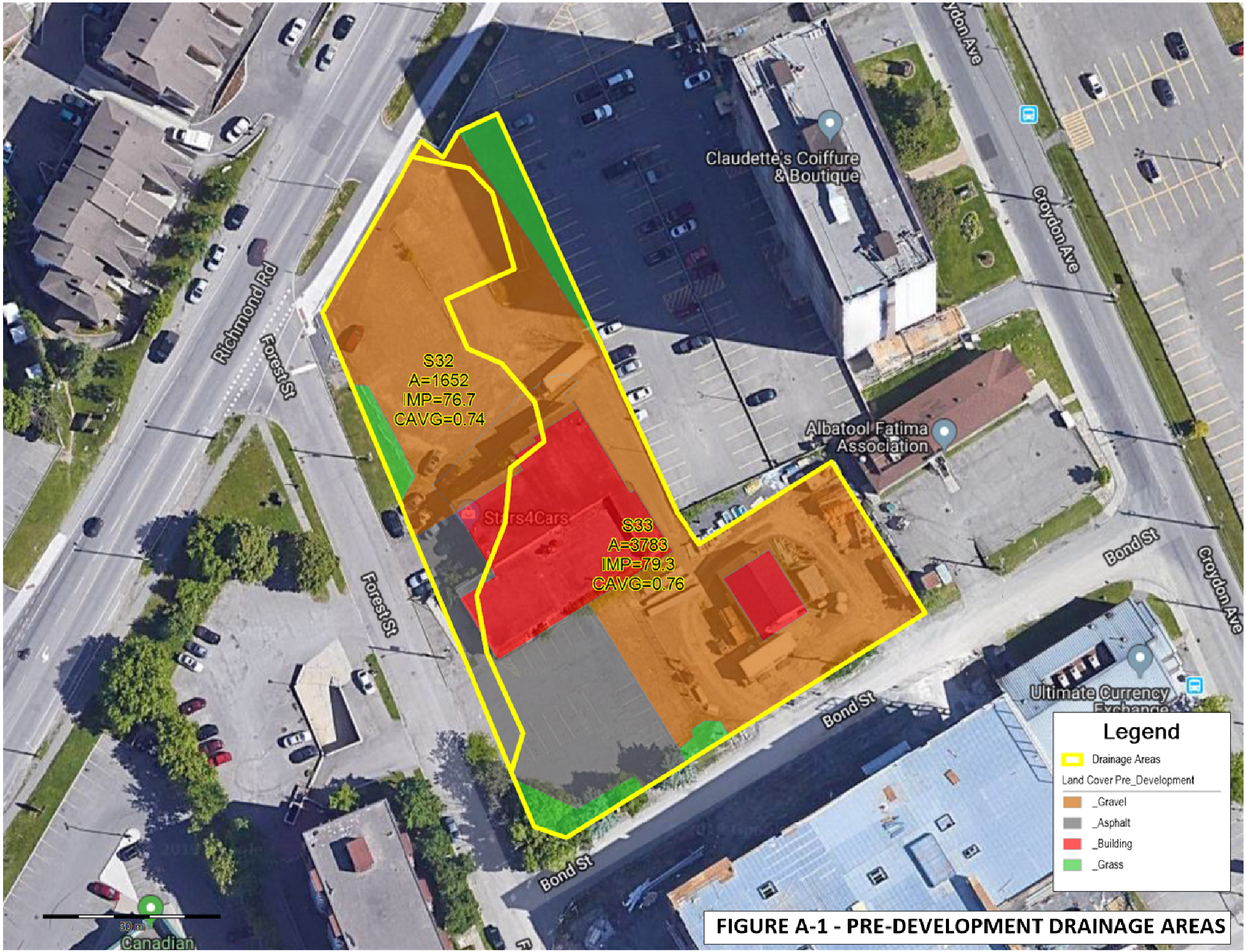


FIGURE A-1 - PRE-DEVELOPMENT DRAINAGE AREAS

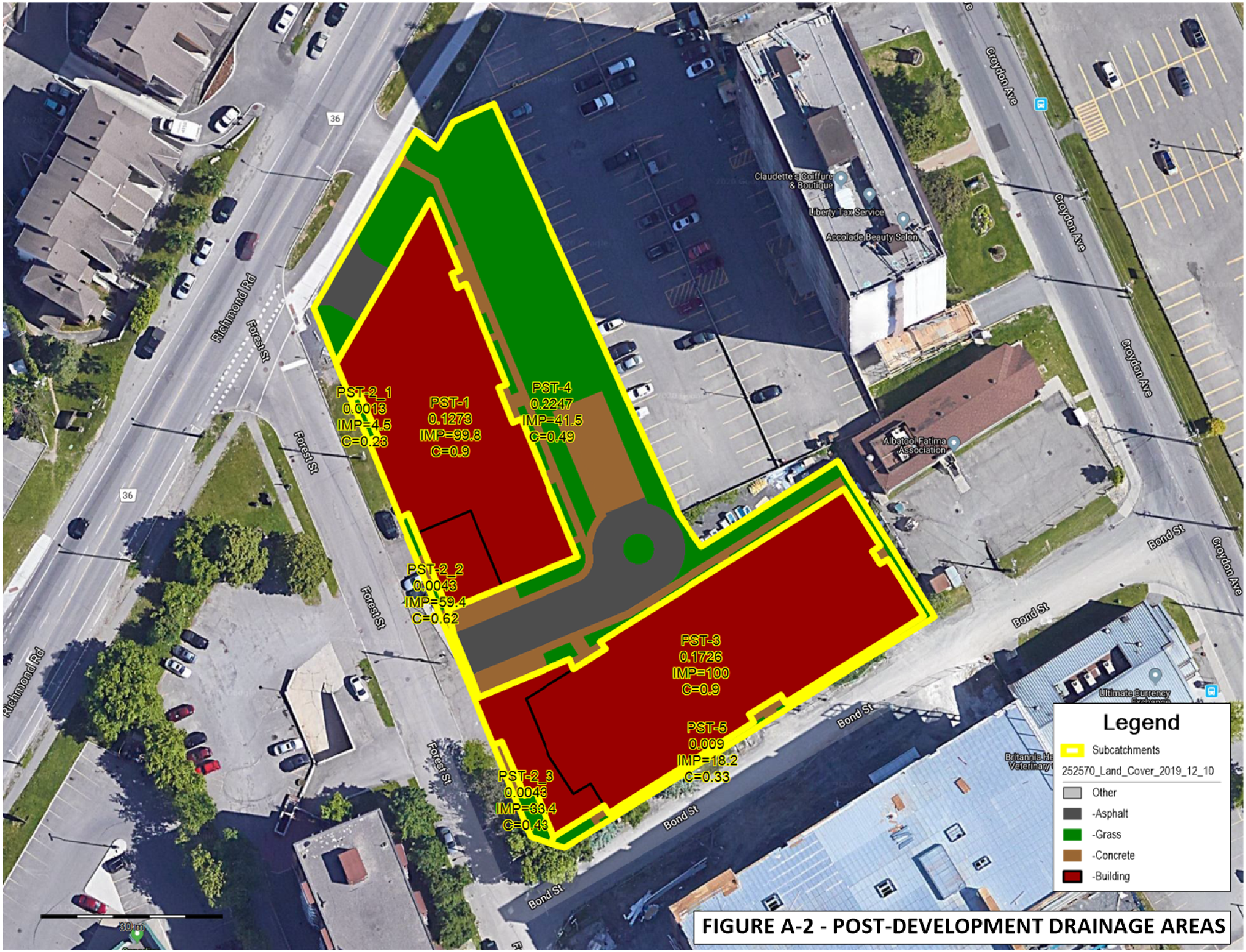


FIGURE A-2 - POST-DEVELOPMENT DRAINAGE AREAS

Appendix B – Water Servicing Tables

Table B-1 – Water Demand Chart

Table B-2 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower A

Table B-3 – Fire Flow Requirements Based on Fire Underwriters Survey (FUS) – Tower B

Table B-4 – Available Fire Flows Based on Hydrant Spacing

Table B-5 – Estimated Water Pressure at Proposed Building

Table B-1

Water Demand Chart

Building	No. of Units										Total Pop	Residential Demands					Commercial						Total Demands in (L/sec)		
	Singles/Semis/Towns				Apartments							Avg Day Demand (L/day)	Max Day Peaking Factor	Max Hour Peaking Factor	Max Day Demand (L/day)	Peak Hourly Demand (L/day)	Area (ha)	Avg Demand (L/day)	Peaking Factors		Max Day Demand (L/day)	Peak Hour Demand (L/day)	Avg Day (L/s)	Max Day (L/s)	Peak Hour (L/s)
	Single Familty	Semi	Duplex	Townhome	Bachelor	1-Bed Apt	1-Bed +Den Apt	2 Bed Apt	2-Bed +Den Apt	3 Bed Apt									Max Day	Peak Hour					
Tower A						57	94	19	12		276.5	96,775	2.5	5.5	241,938	532,263	0.5435	15,218	1.5	1.8	22827.0	27392.4	1.30	3.06	6.48
Tower B						30	142	39	1		324.8	113,680	2.5	5.5	284,200	625,240							1.32	3.29	7.24
Totals =						87	236	58	13		601.3	210,455			526,138	1,157,503	0.5435				22,827.0	27,392.4	2.61	6.35	13.71

Unit Densities	Persons/Unit
Singles	3.4
Semi-Detached	2.7
Duplex	2.3
Townhome	2.7
Bachelor Apt Unit	1.4
1-Bed Apt Unit	1.4
1-Bed + Den Apt Unit	1.4
2-Bed Apt Unit	2.1
2-Bed + Den Apt Unit	2.1
3-Bed Apt Unit	3.1

Residential

Residential Consumption (L/pers/day) =	350
Max Day Peaking Factor (* avg day) =	2.5
Peak Hour Factor (* avg day) =	5.5

Industrial/Commercial/Institutional Water Consumption

Light Industrial (L/gross ha/day) =	35,000
Heavy Industrial (L/gross ha/day) =	55,000
Commer/Instit (L/gross ha/day) =	28,000
Max Day Peaking Factor (* avg day) =	1.5
Peak Hour Factor (* avg day) =	1.8

Project:	365 Forest Street
Designed: J. Fitzpatrick, P.Eng.	Location: Ottawa, Ontario
Checked: B. Thomas, P.Eng.	
File Reference: 252570 Water - Demand Chart, Jan 27, 2020.xlsx	Page No: 1 of 1

TABLE B-2
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR TOWER A

An estimate of the Fire Flow required for a given fire area may be estimated by:

$$F = 220 * C * \sqrt{A}$$

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input				Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Non-combustible Construction				0.8	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)			Area	% Used	Area Used			
	Floor 12		1,104	50%	552	2 largest adjoining floors+ 50% of floors above (up to eight)		
	Floor 11		1,104	50%	552			
	Floor 10		1,237	50%	619			
	Floor 9		1,237	50%	619			
	Floor 8		1,237	50%	619			
	Floor 7		1,197	50%	599			
	Floor 6		1,249	50%	625			
	Floor 5		1,249	50%	625			
	Floor 4		1,249	100%	1,249			
	Floor 3		1,249	100%	1,249			
	Floor 2		1,173	0%	0			
	Floor 1 (Ground)		1,178	0%	0			
	Basement (At least 50% below grade, not included)		0					
Fire Flow (F)	F = 220 * C * SQRT(A)							15,043
Fire Flow (F)	Rounded to nearest 1,000							**15,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,250	12,750
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-3,825	8,925
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,275	7,650
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,275	6,375
	Not Fully Supervised or N/A	0%				

Choose Structure Exposure Distance	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
	Side 1 (west)	53	6	> 45.1	Type B	45	19	855	6	0%	20%	1,275	7,650
	Side 2 (east)	17	3	10.1 to 20	Type B	0	0	0	3A	10%			
	Front (north)	52	6	> 45.1	Type B	29	2	58	6	0%			
	Back (south)	15.0	3	10.1 to 20	Type B	23	12	30	3A	10%			
Obtain Required Fire Flow											Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =		**8,000**
											Total Required Fire Flow, L/s =		**133**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B-3
FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999 FOR TOWER B

An estimate of the Fire Flow required for a given fire area may be estimated by:

$$F = 220 * C * \sqrt{A}$$

where: F = required fire flow in litres per minute
A = total floor area in m^2 (including all storeys, but excluding basements at least 50% below grade)
C = coefficient related to the type of construction

Task	Options	Multiplier	Input	Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Non-combustible Construction	0.8	
	Ordinary Construction	1			
	Non-combustible Construction	0.8			
	Fire Resistive Construction	0.6			

Input Building Floor Areas (A)	Area	% Used	Area Used	
Floor 11	1,439	50%	720	2 largest adjoining floors+ 50% of floors above (up to eight)
Floor 10	1,637	50%	819	
Floor 9	1,637	50%	819	
Floor 8	1,637	50%	819	
Floor 7	1,586	50%	793	
Floor 6	1,666	50%	833	
Floor 5	1,666	50%	833	
Floor 4	1,666	100%	1,666	
Floor 3	1,666	100%	1,666	
Floor 2	1,486	0%	0	
Floor 1 (Ground)	1,513	0%	0	
Basement (At least 50% below grade, not included)	0			

Fire Flow (F)	F = 220 * C * SQRT(A)	16,665
Fire Flow (F)	Rounded to nearest 1,000	**17,000**

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)
Choose Combustibility of Building Contents	Non-combustible	-25%	Limited Combustible	-15%	-2,550	14,450
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-4,335	10,115
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,445	8,670
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-1,445	7,225
	Not Fully Supervised or N/A	0%				

Choose Structure Exposure Distance	Exposures	Separ-ation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	
	Side 1 (west)	26	4	20.1 to 30	Type B	4	1	4	4A	6%	46%	3,324	10,549
	Side 2 (east)	7	2	3.1 to 10	Type B	14	8	112	2D	19%			
	Front (north)	15	3	10.1 to 20	Type B	25	12	300	3E	15%			
	Back (south)	27.0	4	20.1 to 30	Type B	66	11	30	4A	6%			

Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =	**11,000**
	Total Required Fire Flow, L/s =	**183**

Exposure Charges for Exposing Walls of Wood Frame Construciton (from Table G5)

Type A	Wood-Frame or non-conbustible
Type B	Ordinary or fire-resisitve with unprotected openings
Type C	Ordinary or fire-resisitve with semi-protected openings
Type D	Ordinary or fire-resisitve with blank wall

Conditons for Separation

Separation Dist	Condition
0m to 3m	1
3.1m to 10m	2
10.1m to 20m	3
20.1m to 30m	4
30.1m to 45m	5
> 45.1m	6

TABLE B-4

AVAILABLE FIRE FLOWS BASED ON HYDRANT SPACING

Hydrant #	Location	Tower A		Tower B	
		[1]Distance (m)	[2]Fire Flow Contribution (L/min)	Distance (m)	Fire Flow Contribution (L/min)
New FH-1	Forest Steet	12	5,700	10	5,700
360024H013	Forest Steet at Richmond Rd	10	5,700	60	5,700
360024H038	Forest Steet at Carling Ave	120	3,800	75	3,800
360024HP120	Forest Steet near Bond St	35	5,700	75	3,800
360024H041	Bond Street at Croydon Ave	165	0	35	5,700
Total (L/min)			20,900		24,700
FUS RFF in L/min or (L/sec)			8,000 (133)		11,000 (183)
Meets Requreiment (Yes/No)			Yes		Yes

Notes:

[1]Distance is measured along a road or fire route.

[2]Fire Flow Contribution for Class AA Hydrant from Table 1 of Appendix I, ISTB-2018-02

TABLE B-5

ESTIMATED WATER PRESSURE AT PROPOSED BUILDING

Description	From	To	Demand (L/sec)	Pipe Length (m)	Pipe Dia (mm)	Dia (m)	Q (m3/sec)	Area (m2)	C	Vel (m/s)	Slope of HGL (m/m)	Head Loss (m)	Elev From (m)	Elev To (m)	*Elev Diff (m)	Pressure From kPa	(psi)	Pressure To kPa	(psi)	Pressure Drop (psi)
Avg Day Conditons																				
Single 200mm watermain	Main	Building	2.6	11 m	204	0.204	0.0026	0.032685	110	0.0799	6.7E-05	0.0007	74.85	75.80	-1.0	330.1	(47.9)	320.8	(46.5)	1.4
Double 200mm watermain	Main	Building	1.3	11 m	204	0.204	0.0013	0.032685	110	0.0399	1.9E-05	0.0002	74.85	75.80	-1.0	330.1	(47.9)	320.8	(46.5)	1.4
Max Day Conditons																				
Single 200mm watermain	Main	Building	6.4	11 m	204	0.204	0.0064	0.032685	110	0.1943	0.00035	0.0038	74.85	75.80	-1.0	400.7	(58.1)	391.4	(56.8)	1.4
Double 200mm watermain	Main	Building	3.2	11 m	204	0.204	0.0032	0.032685	110	0.0971	9.6E-05	0.0011	74.85	75.80	-1.0	400.7	(58.1)	391.4	(56.8)	1.4
Peak Hour Conditons																				
Single 200mm watermain	Main	Building	13.7	11 m	204	0.204	0.0137	0.032685	110	0.4195	0.00144	0.0159	74.85	75.80	-1.0	330.1	(47.9)	320.6	(46.5)	1.4
Double 200mm watermain	Main	Building	6.9	11 m	204	0.204	0.0069	0.032685	110	0.2097	0.0004	0.0044	74.85	75.80	-1.0	330.1	(47.9)	320.7	(46.5)	1.4
Max Day Plus Fireflow Conditons																				
Single 200mm watermain	Main	Building	189.4	11 m	204	0.204	0.1894	0.032685	110	5.7932	0.18663	2.0529	74.85	75.80	-1.0	315.4	(45.7)	285.9	(41.5)	4.3
Double 200mm watermain	Main	Building	94.7	11 m	204	0.204	0.0947	0.032685	110	2.8966	0.0517	0.5687	74.85	75.80	-1.0	315.4	(45.7)	300.5	(43.6)	2.2
Peak Hour Conditons (Review of 150mm)																				
Single 200mm watermain	Main	Building	13.7	11 m	155	0.155	0.0137	0.018869	110	0.7266	0.0055	0.0605	74.85	75.80	-1.0	330.1	(47.9)	320.2	(46.4)	1.4
Double 200mm watermain	Main	Building	6.9	11 m	155	0.155	0.0069	0.018869	110	0.3633	0.00152	0.0168	74.85	75.80	-1.0	330.1	(47.9)	320.6	(46.5)	1.4
Max Day Plus Fireflow (Review of 150mm)																				
Single 150mm watermain	Main	Building	189.4	11 m	155	0.155	0.1894	0.018869	110	10.035	0.71114	7.8225	74.85	75.80	-1.0	315.4	(45.7)	229.3	(33.3)	12.5
Double 150mm watermain	Main	Building	94.7	11 m	155	0.155	0.0947	0.018869	110	5.0174	0.19699	2.1669	74.85	75.80	-1.0	315.4	(45.7)	284.8	(41.3)	4.4

Water Demand Info

Average Demand =	2.61	L/sec
Max Day Demand =	6.35	L/sec
Peak Hr Deamand =	13.71	L/sec
Fireflow Requriement =	183	L/sec
Max Day Plus FF Demand =	189.4	L/sec

Pipe Lengths

From watermain to building =	11 m
Hazen Williams C Factor for Friction Loss in Pipe, C=	110

Boundary Conditon

	Min HGL	Max HGL	Peak Hr	Max Day + Fireflow	
HGL (m)	108.5	115.7	108.5	107.0	(From City of Ottawa)
Approx Ground Elev (m) =	74.85	74.85	74.85	74.85	
Approx Bldg FF Elev (m) =	75.80	75.80	75.80	75.80	
Pressure (m) =	33.65	40.85	33.65	32.15	
Pressure (Pa) =	330,107	400,739	330,107	315,392	
Pressure (psi) =	47.9	58.1	47.9	45.7	

Appendix C – Sanitary Servicing Tables

Table C-6 – Sanitary Sewer Design Sheet

Table C-6

SANITARY SEWER CALCULATION SHEET

LOCATION			RESIDENTIAL AREAS AND POPULAITONS												COMMERCIAL				INFILTRATION				SEWER DATA						
				NUMBER OF UNITS							POPULATION				AREA (ha)				AREA (ha)										
Street	U/S MH	D/S MH	Area (ha)	Single	Semi	1-Bed Apt.	1-Bed + Den Apt	2-Bed Apt.	2-Bed + Den Apt	3-Bed Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
Forest	Tower A	MH 200	0.2717			57	94	19	12		276.5	276.5	4.00	3.58	0.5435	0.5435	1.0	0.176	0.2717	0.2717	0.09	3.85	250	251.46	2.0	6.1	85.4	5%	1.72
	Tower B	MH 200	0.2717			30	142	39	1		324.8	324.8	4.00	4.21					0.2717	0.2717	0.09	4.30	250	251.46	2.0	1.0	85.4	5%	1.72
	MH 200	MHSA25319										601.3	3.35	6.53						0.5434	0.18	6.71	250	251.46	2.0	14.3	85.4	8%	1.72
			0.543			**87**	**236**	**58**	**13**		**601**								**0.543**										

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)		Unit Type	Ppu	
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	Peak Population Flow, (L/sec)	Singles =	3.4	J. Fitzpatrick, P.Eng.
or L/gross ha/sec =	0.324				= P*q*M/86.4	Semi-Detached =	2.7	
Institutianal Avg. Daily Flow (L/s/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	Peak Extraneous Flow, (L/sec)	1-bed Apt	1.4	Checked:
or L/gross ha/sec =	0.324		1.0	(when area <20%)	= I*Ac	1-bed + Den Apt	1.4	
Light Industrial Flow (L/gross ha/day) =	35,000				Residential Peaking Factor, M	2-bed Apt. Unit =	2.1	B. Thomas, P.Eng.
or L/gross ha/sec =	0.4051	Residential Correction Factor, K =	0.80		= 1 + (14/(4+P^0.5)) * K	2-bed + Den Apt	2.1	
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		Sewer Capacity, Qcap (L/sec)	3-bed Apt. Unit =	3.1	File Reference:
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)	= $1/N \; S1^{/2} \; R^{2/3} \; A_c$			252570 Sanitary - Sewer Design Sheet, Jan 27, 2020.xlsx

Designed:	Project:
J. Fitzpatrick, P.Eng.	365 Forest Street
Checked:	Location:
B. Thomas, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
252570 Sanitary - Sewer Design Sheet, Jan 27, 2020.xlsx	**1 of 1**

Appendix D – Stormwater Servicing Tables

Table D-7 AVERAGE RUNOFF COEFFICIENTS FOR PRE-DEVELOPMENT

Runoff Coeffients		C_{GRAVEL} =	0.725	C_{ROOF} =	0.90	C_{GRASS} =	0.20	$C_{Asphalt}$ =	0.900
Area No.	Gravel Areas (m^2)	A * C_{ASPH}	Roof Areas (m^2)	A * C_{ROOF}	Grassed Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	C_{AVG} (see note)
PRE-1								1652.0	0.74
PRE-2								3782.5	0.76

Notes
1) Cavg derived with area-weighting command in PCSWMM

Table D-8 ESTIMATION OF PRE-DEVELOPMENT PEAK FLOWS

Catchment No.	Area (ha)	Outlet Location	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr		
				I_2 (mm/hr)	Cavg	Q_{2PRE} (L/sec)	I_5 (mm/hr)	Cavg	Q_{5PRE} (L/sec)	I_{100} (mm/hr)	Cavg	Q_{100PRE} (L/sec)
PRE-1	0.1652	To Richmond / Forest	10.0	76.81	0.74	26.1	104.29	0.74	35.4	178.56	0.93	75.9
PRE-2	0.3783	To Bond St	10.0	76.81	0.76	61.4	104.29	0.76	83.3	178.56	0.95	178.4
Totals	0.5435					87.5			118.8			254.2

Notes
1) Intensity, I = $732.951/(Tc+6.199)^{0.810}$ (2-year, City of 0ttawa)
2) Intensity, I = $998.071/(Tc+6.035)^{0.814}$ (5-year, City of 0ttawa)
3) Intensity, I = $1735.688/(Tc+6.014)^{0.820}$ (100-year, City of Ottawa)
4) Cavg for 100-year is increased by 25% to a maximum of 1.0

Table D-9 ESTIMATION OF ALLOWABLE PEAK FLOWS (Based on Max C=0.50 with Tc=10mins)

Area (onsite)	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr		
			I_5 (mm/hr)	Cavg	Q_{5ALLOW} (L/sec)	I_5 (mm/hr)	Cavg	Q_{5ALLOW} (L/sec)
PRE-1	0.1652	10	76.81	0.50	17.6	104.29	0.50	23.9
PRE-2	0.3783	10	76.81	0.50	40.4	104.29	0.50	54.8
Totals	0.5435				**58.0**			**78.8**

Notes
1) Allowable Capture Rate is based on 5-year storm at Tc=10 minutes.
2) Intensity, I5 = 998.071/(Tc+6.035)^0.814 (5-year, City of 0ttawa)

Allowable Discharge (based on 5-yr storm)

Table D-10 AVERAGE RUNOFF COEFFICIENTS FOR POST-DEVELOPMENT

Runoff Coeffients	$C_{ASPH/CONC}$ = 0.90	C_{ROOF} = 0.90	C_{GRASS} = 0.20								
Area No.	Outlet Location	Asphalt & Conc Areas (m^2)	A * C_{ASPH}	Roof Areas (m^2)	A * C_{ROOF}	Grassed Areas (m^2)	A * C_{GRASS}	Sum AC	Total Area (m^2)	C_{AVG} (see note)	Comment
PST-1	To Richmond / Forest								1273	0.90	Tower A Roof
PST-2_1									13	0.23	Surface - Uncontrolled
PST-2_2									43	0.62	Surface - Uncontrolled
PST-2_3									43	0.43	Surface - Uncontrolled
PST-3	To Bond St								1726	0.90	Tower B Roof
PST-4									2247	0.49	Surface - Controlled
PST-5									90	0.33	Surface - Uncontrolled
Totals									5,435		

Notes
1) Cavg derived with area-weighting command in PCSWMM

Table D-11 SUMMARY OF POST-DEVELOPMENT PEAK FLOWS (Uncontrolled and Controlled)

			Storm = 2 yr				Storm = 5 yr				Storm = 100 yr					
Area No	Area (ha)	Time of Conc, Tc (min)	C_{AVG}	I_2 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_5 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_{100} (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	Outlet	Comments
PST-1	0.1273	10	0.90	76.81	24.5	**(5.9)**	0.90	104.19	33.2	**(8.0)**	1.00	178.56	63.2	**(15.1)**		Tower A Roof
PST-2_1	0.0013	10	0.23	76.81	0.1	**(0.1)**	0.23	104.19	0.1	**0.1**	0.29	178.56	0.2	**0.2**	To Richmond / Forest	Surface - Uncontrolled
PST-2_2	0.0043	10	0.62	76.81	0.6	**(0.6)**	0.62	104.19	0.8	**0.8**	0.78	178.56	1.7	**1.7**		Surface - Uncontrolled
PST-2_3	0.0043	10	0.43	76.81	0.4	**0.4**	0.43	104.19	0.5	**0.5**	0.54	178.56	1.1	**1.1**		Surface - Uncontrolled
PST-3	0.1726	10	0.90	76.81	33.2	**(5.9)**	0.90	104.19	45.0	**(8.0)**	1.00	178.56	85.7	**(15.1)**		Tower B Roof
PST-4	0.2247	10	0.49	76.81	23.5	**(11.4)**	0.49	104.19	31.9	**(15.4)**	0.61	178.56	68.3	**(33.0)**	To Bond St	Surface - Controlled
PST-5	0.0090	10	0.33	76.81	0.6	**0.6**	0.33	104.19	0.9	**0.9**	0.41	178.56	1.8	**1.8**		Surface - Uncontrolled
Totals	0.5435				82.8	**24.7**			112.3	**33.6**			222.0	**68.1**		

Notes
2-yr Storm Intensity, I = 732.951/(Tc+6.199)^0.810 (City of Ottawa)
5-yr Storm Intensity, I = 998.071/(Tc+6.035)^0.814 (City of Ottawa)
100-yr Storm Intensity, I = 1735.688/(Tc+6.014)&^0.820 (City of Ottawa)
Time of Concentration (min), Tc = ***10***
For Flows under column Qcap which are shown in brackets ***(0.0)*** *, denotes flows that are controlled*

Table D-12 Storage Volumes for 2-year, 5-Year and 100-Year Storms Area: PST-1

Area No: PST-1
C_{AVG} = 0.90 (2-yr)
C_{AVG} = 0.90 (5-yr)
C_{AVG} = 1.00 (100-yr, Max 1.0)
Time Interval = 5.00 (mins)
Drainage Area = 0.1273 (hectares)

Duration (min)	Release Rate = 5.9 (L/sec); Return Period = 2 (years); IDF Parameters, A = 732.951, B = 0.810, C = 6.199; (I = A/(T_c+C)					Release Rate = 8.0 (L/sec); Return Period = 5 (years); IDF Parameters, A = 998.071, B = 0.814, C = 6.053; (I = A/(T_c+C)					Release Rate = 15.1 (L/sec); Return Period = 100 (years); IDF Parameters, A = 1735.688, B = 0.820, C = 6.014; (I = A/(T_c+C)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	53.3	5.86	47.4	0.00	230.5	73.4	7.951	65.5	0.00	398.6	141.1	15.140	125.9	0.00
5	103.6	33.0	5.86	27.1	8.14	141.2	45.0	7.951	37.0	11.10	242.7	85.9	15.140	70.8	21.23
10	76.8	24.5	5.86	18.6	11.16	104.2	33.2	7.951	25.2	15.14	178.6	63.2	15.140	48.1	28.83
15	61.8	19.7	5.86	13.8	12.43	83.6	26.6	7.951	18.7	16.80	142.9	50.6	15.140	35.4	31.89
20	52.0	16.6	5.86	10.7	12.85	70.3	22.4	7.951	14.4	17.31	120.0	42.4	15.140	27.3	32.77
25	45.2	14.4	5.86	8.5	12.79	60.9	19.4	7.951	11.4	17.17	103.8	36.8	15.140	21.6	32.42
30	40.0	12.8	5.86	6.9	12.41	53.9	17.2	7.951	9.2	16.61	91.9	32.5	15.140	17.4	31.27
35	36.1	11.5	5.86	5.6	11.81	48.5	15.5	7.951	7.5	15.75	82.6	29.2	15.140	14.1	29.58
40	32.9	10.5	5.86	4.6	11.06	44.2	14.1	7.951	6.1	14.69	75.1	26.6	15.140	11.5	27.49
45	30.2	9.6	5.86	3.8	10.18	40.6	12.9	7.951	5.0	13.47	69.1	24.4	15.140	9.3	25.10
50	28.0	8.9	5.86	3.1	9.21	37.7	12.0	7.951	4.0	12.12	64.0	22.6	15.140	7.5	22.48
55	26.2	8.3	5.86	2.5	8.17	35.1	11.2	7.951	3.2	10.68	59.6	21.1	15.140	6.0	19.67
60	24.6	7.8	5.86	2.0	7.06	32.9	10.5	7.951	2.5	9.15	55.9	19.8	15.140	4.6	16.71
65	23.2	7.4	5.86	1.5	5.90	31.0	9.9	7.951	1.9	7.55	52.6	18.6	15.140	3.5	13.62
70	21.9	7.0	5.86	1.1	4.70	29.4	9.4	7.951	1.4	5.90	49.8	17.6	15.140	2.5	10.42
75	20.8	6.6	5.86	0.8	3.46	27.9	8.9	7.951	0.9	4.19	47.3	16.7	15.140	1.6	7.13
80	19.8	6.3	5.86	0.5	2.18	26.6	8.5	7.951	0.5	2.44	45.0	15.9	15.140	0.8	3.75
85	18.9	6.0	5.86	0.2	0.88	25.4	8.1	7.951	0.1	0.66	43.0	15.2	15.140	0.1	0.31
90	18.1	5.8	5.86	-0.1	-0.45	24.3	7.7	7.951	-0.2	-1.16	41.1	14.5	15.140	-0.6	-3.19
95	17.4	5.5	5.86	-0.3	-1.79	23.3	7.4	7.951	-0.5	-3.01	39.4	14.0	15.140	-1.2	-6.75
100	16.7	5.3	5.86	-0.5	-3.16	22.4	7.1	7.951	-0.8	-4.89	37.9	13.4	15.140	-1.7	-10.36
Max =					**12.85**					**17.31**					**32.77**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration
7) Parameters a,b,c are for City of Ottawa

Table D-13 Storage Volumes for 2-year, 5-Year and 100-Year Storms Area: PST-3

Area No: PST-3
C_{AVG} = 0.90 (2-yr)
C_{AVG} = 0.90 (5-yr)
C_{AVG} = 1.00 (100-yr, Max 1.0)
Time Interval = 5.00 (mins)
Drainage Area = 0.1726 (hectares)

Duration (min)	Release Rate = 5.9 (L/sec); Return Period = 2 (years); IDF Parameters, A = 732.951, B = 0.810, C = 6.199 (I = A/(T_c+C)					Release Rate = 8.0 (L/sec); Return Period = 5 (years); IDF Parameters, A = 998.071, B = 0.814, C = 6.053 (I = A/(T_c+C)					Release Rate = 15.1 (L/sec); Return Period = 100 (years); IDF Parameters, A = 1735.688, B = 0.820, C = 6.014 (I = A/(T_c+C)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	72.2	5.86	66.4	0.00	230.5	99.5	7.951	91.6	0.00	398.6	191.3	15.140	176.1	0.00
5	103.6	44.7	5.86	38.9	11.66	141.2	61.0	7.951	53.0	15.90	242.7	116.5	15.140	101.3	30.39
10	76.8	33.2	5.86	27.3	16.38	104.2	45.0	7.951	37.0	22.23	178.6	85.7	15.140	70.5	42.32
15	61.8	26.7	5.86	20.8	18.73	83.6	36.1	7.951	28.1	25.32	142.9	68.6	15.140	53.4	48.08
20	52.0	22.5	5.86	16.6	19.93	70.3	30.3	7.951	22.4	26.86	120.0	57.6	15.140	42.4	50.90
25	45.2	19.5	5.86	13.6	20.47	60.9	26.3	7.951	18.3	27.52	103.8	49.8	15.140	34.7	52.03
30	40.0	17.3	5.86	11.4	20.58	53.9	23.3	7.951	15.3	27.61	91.9	44.1	15.140	28.9	52.09
35	36.1	15.6	5.86	9.7	20.39	48.5	21.0	7.951	13.0	27.30	82.6	39.6	15.140	24.5	51.42
40	32.9	14.2	5.86	8.3	19.99	44.2	19.1	7.951	11.1	26.71	75.1	36.1	15.140	20.9	50.20
45	30.2	13.1	5.86	7.2	19.43	40.6	17.5	7.951	9.6	25.90	69.1	33.1	15.140	18.0	48.58
50	28.0	12.1	5.86	6.2	18.75	37.7	16.3	7.951	8.3	24.93	64.0	30.7	15.140	15.5	46.64
55	26.2	11.3	5.86	5.4	17.95	35.1	15.2	7.951	7.2	23.82	59.6	28.6	15.140	13.5	44.45
60	24.6	10.6	5.86	4.7	17.08	32.9	14.2	7.951	6.3	22.59	55.9	26.8	15.140	11.7	42.05
65	23.2	10.0	5.86	4.1	16.13	31.0	13.4	7.951	5.5	21.27	52.6	25.3	15.140	10.1	39.47
70	21.9	9.5	5.86	3.6	15.13	29.4	12.7	7.951	4.7	19.88	49.8	23.9	15.140	8.8	36.75
75	20.8	9.0	5.86	3.1	14.07	27.9	12.0	7.951	4.1	18.42	47.3	22.7	15.140	7.5	33.91
80	19.8	8.6	5.86	2.7	12.97	26.6	11.5	7.951	3.5	16.89	45.0	21.6	15.140	6.4	30.95
85	18.9	8.2	5.86	2.3	11.83	25.4	11.0	7.951	3.0	15.32	43.0	20.6	15.140	5.5	27.90
90	18.1	7.8	5.86	2.0	10.66	24.3	10.5	7.951	2.5	13.70	41.1	19.7	15.140	4.6	24.77
95	17.4	7.5	5.86	1.7	9.46	23.3	10.1	7.951	2.1	12.05	39.4	18.9	15.140	3.8	21.56
100	16.7	7.2	5.86	1.4	8.22	22.4	9.7	7.951	1.7	10.35	37.9	18.2	15.140	3.0	18.28
Max =					**20.58**					**27.61**					**52.09**

Notes
1) Peak flow is equal to the product of 2.78 x C x I x A
2) Rainfall Intensity, $I = A/(Tc+C)^B$
3) Release Rate = Min (Release Rate, Peak Flow)
4) Storage Rate = Peak Flow - Release Rate
5) Storage = Duration x Storage Rate
6) Maximium Storage = Max Storage Over Duration
7) Parameters a,b,c are for City of Ottawa

Table D-14 Storage Volumes for 2-year, 5-Year and 100-Year Storms Area: PST-4

Area No: PST-4

C_{AVG} = 0.49 (2-yr)

C_{AVG} = 0.49 (5-yr)

C_{AVG} = 0.61 (100-yr, Max 1.0)

Time Interval = 2.00 (mins)

Drainage Area = 0.2247 (hectares)

Actual Release Rate (L/sec) = 33.0

Percentage of Actual Rate (City of Ottawa requirement) 50%

Release Rate Used for Estimation of 100-year Storage (L/sec) = 16.5

Duration (min)	Release Rate = 11.4 (L/sec), Return Period = 2 (years), IDF Parameters, A = 732.951, B = 0.810, C = 6.199, (I = A/(T$_c$+C)					Release Rate = 15.4 (L/sec), Return Period = 5 (years), IDF Parameters, A = 998.071, B = 0.814, C = 6.053, (I = A/(T$_c$+C)					Release Rate = 16.5 (L/sec), Return Period = 100 (years), IDF Parameters, A = 1735.688, B = 0.820, C = 6.014, (I = A/(T$_c$+C)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	51.2	11.36	39.8	0.00	230.5	70.5	15.405	55.1	0.00	398.6	152.5	16.5	136.0	0.00
2	133.3	40.8	11.36	29.5	3.53	182.7	55.9	15.405	40.5	4.86	315.0	120.5	16.5	104.0	12.48
4	111.7	34.2	11.36	22.8	5.48	152.5	46.7	15.405	31.3	7.51	262.4	100.4	16.5	83.9	20.14
6	96.6	29.6	11.36	18.2	6.56	131.6	40.3	15.405	24.9	8.95	226.0	86.5	16.5	70.0	25.19
8	85.5	26.2	11.36	14.8	7.10	116.1	35.5	15.405	20.1	9.66	199.2	76.2	16.5	59.7	28.66
10	76.8	23.5	11.36	12.2	7.29	104.2	31.9	15.405	16.5	9.89	178.6	68.3	16.5	51.8	31.09
12	69.9	21.4	11.36	10.0	7.23	94.7	29.0	15.405	13.6	9.78	162.1	62.0	16.5	45.5	32.78
14	64.2	19.7	11.36	8.3	6.98	86.9	26.6	15.405	11.2	9.41	148.7	56.9	16.5	40.4	33.94
16	59.5	18.2	11.36	6.9	6.58	80.5	24.6	15.405	9.2	8.85	137.5	52.6	16.5	36.1	34.68
18	55.5	17.0	11.36	5.6	6.08	75.0	22.9	15.405	7.5	8.15	128.1	49.0	16.5	32.5	35.11
20	52.0	15.9	11.36	4.6	5.48	70.3	21.5	15.405	6.1	7.32	120.0	45.9	16.5	29.4	35.27
22	49.0	15.0	11.36	3.6	4.82	66.1	20.2	15.405	4.8	6.39	112.9	43.2	16.5	26.7	35.23
24	46.4	14.2	11.36	2.8	4.09	62.5	19.1	15.405	3.7	5.38	106.7	40.8	16.5	24.3	35.01
26	44.0	13.5	11.36	2.1	3.31	59.3	18.2	15.405	2.8	4.31	101.2	38.7	16.5	22.2	34.65
28	41.9	12.8	11.36	1.5	2.48	56.5	17.3	15.405	1.9	3.17	96.3	36.8	16.5	20.3	34.16
30	40.0	12.3	11.36	0.9	1.62	53.9	16.5	15.405	1.1	1.98	91.9	35.1	16.5	18.6	33.57
32	38.3	11.7	11.36	0.4	0.73	51.6	15.8	15.405	0.4	0.75	87.9	33.6	16.5	17.1	32.88
34	36.8	11.3	11.36	-0.1	-0.20	49.5	15.2	15.405	-0.3	-0.52	84.3	32.2	16.5	15.7	32.11
36	35.4	10.8	11.36	-0.5	-1.15	47.6	14.6	15.405	-0.8	-1.82	81.0	31.0	16.5	14.5	31.27
38	34.1	10.4	11.36	-0.9	-2.12	45.8	14.0	15.405	-1.4	-3.15	77.9	29.8	16.5	13.3	30.37
40	32.9	10.1	11.36	-1.3	-3.11	44.2	13.5	15.405	-1.9	-4.51	75.1	28.8	16.5	12.3	29.40
Max =					**7.29**					**9.89**					**35.27**

Notes

1) Peak flow is equal to the product of 2.78 x C x I x A

2) Rainfall Intensity, $I = A/(Tc+C)^B$

3) Release Rate = Min (Release Rate, Peak Flow)

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

7) Parameters a,b,c are for City of Ottawa

TABLE D-15
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER A

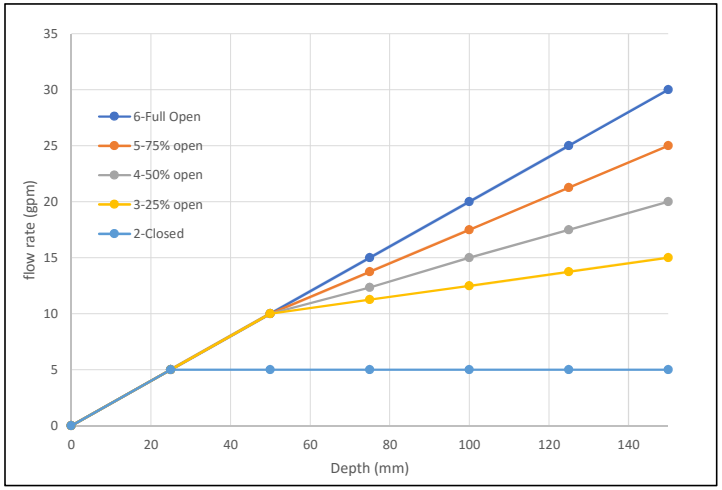
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



BUILDING ROOF INFORMATION

Buidling Number	**D-15**	
Total Roof Area (m2)	**1273**	
Minimum Number of Drains Required	1.4	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	29,279	
Max Permitted Load from All Drains (L/sec)	32.5	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	400	
Estimated Distance from roof edge to drains (m)	**10**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	4	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	8	*Use if known*
Effecive Roof Percentage (%)	**82%**	*Allowance for 100 s.m. of Mechanical units on roof plus 130 s.m terrace*
Effecive Total Roof Area (m2)	1043	
Area per Drain (m2)	130	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	63.7	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	15.1	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.24	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00252	0.025	3.6	0.0	0.2
0.05	10	0.63	0.00505	0.05	14.5	0.2	1.9
0.075	15	0.95	0.00757	0.075	32.6	0.8	6.5
0.1	20	1.26	0.01009	0.1	57.9	1.9	15.5
0.125	25	1.58	0.01262	0.125	90.5	3.8	30.2
0.15	30	1.89	0.01514	0.15	130.4	6.5	52.2
Weir Position = **6-Full Open**							

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outlfow (L/sec)
0	0.0000
0.025	2.5236
0.05	5.0472
0.075	7.5708
0.1	10.0944
0.125	12.6180
0.15	15.1416

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	3.6
0.05	14.5
0.075	32.6
0.1	57.9
0.125	90.5
0.15	130.4

TABLE D-16
ESTIMATION OF ROOF STORAGE AND OUTFLOW - TOWER B

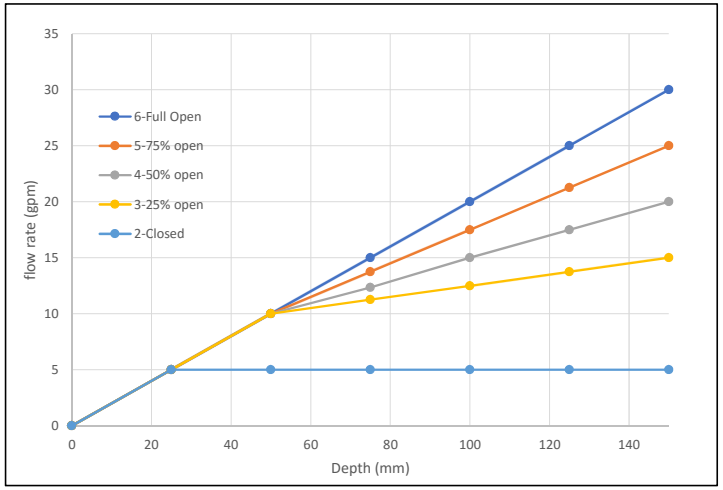
WATTS ADJ ACCUTROL WEIR FLOW RATES (Flow Rates at Various Depths)

Depth	Weir Position					
	1-None	2-Closed	3-25% open	4-50% open	5-75% open	6-Full Open
	Max Flow Rate per wier @150mm in gpm					
0	0	0	0	0	0	0
0.025	0	5	5	5	5	5
0.05	0	5	10	10	10	10
0.075	0	5	11.25	12.35	13.75	15
0.1	0	5	12.5	15	17.5	20
0.125	0	5	13.75	17.5	21.25	25
0.15	0	5	15	20	25	30

WATTS ADJ ACCUTROL WEIR FLOW RATES (Data From Manufacturer's Catalog)

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0
2-Closed	0	5	5	5	5	5	5	0.315
3-25% open	0	5	10	11.25	12.5	13.75	15	0.946
4-50% open	0	5	10	12.35	15	17.5	20	1.262
5-75% open	0	5	10	13.75	17.5	21.25	25	1.577
6-Full Open	0	5	10	15	20	25	30	1.893

GRAPH OF FLOW RATE VERSUS DEPTH FOR VARIOUS WEIR POSITIONS



BUILDING ROOF INFORMATION

Buidling Number	**D-16**	
Total Roof Area (m2)	**1726**	
Minimium Number of Drains Required	1.9	*Minimium of 1 drain every 900 sqaure metres (OBC 7.4.10.4)*
15-min Rainfall Factor for Ottawa (mm)	**23**	*(OBC Supp SB-1)*
Max Permitted Load from All Drains (Litres)	39,698	
Max Permitted Load from All Drains (L/sec)	44.1	*Hydraulic Load expressed in L/sec (OBC Section 7.4.10.3)*
Estimated area per drain (m2)	400	
Estimated Distance from roof edge to drains (m)	**10**	*Not more than 15m from Edge of Roof and 30m to Adjacent Dains (OBC Section 7.4.10.3)*
Estimated No. of Drains Requried	5	*Based on Total Roof Area / Area per Drain*
Actual No. of Drains Used	8	*Use if known*
Effecive Roof Percentage (%)	**82%**	*Allowance for 100 s.m. of Mechanical units on roof plus 208s.m terrace*
Effecive Total Roof Area (m2)	1418	
Area per Drain (m2)	177	*Based on Effectiive Roof Area / Actual Number of Drains Used*
Max Depth of Ponding at Drains (mm)	**150**	
Estimated Total Volume for Ponding on Roof (m3)	86.3	*Prisim formula, V = 1/3*A*d*
Maximium release rate per drain at 150mm (usgpm)	**30**	*Based on 1 Wier Per Drain and Fully Open Position*
Max Release Rate from Roof (L/sec)	15.1	*Based on Maximum Depth of Ponding of 150mm*
Equiv Runoff C for 100-yr Storm	0.18	*Based on 100-yr storm Intensity of 178.6 mm/hr, where I =1735.688 / (Tc + 6.014)^0.820, with Tc=10min)*

RATING CURVE FOR ROOF

DISCHARGE VERSUS DEPTH				AREA VERSUS DEPTH			Total Ponding Volume - All Drains (m3)
Ponding Depth (m)	Discharge Rate Per Drain (gpm)	Discharge Rate Per Drain (m3/sec)	Total Discharge All Drains (m3/sec)	Ponding Depth (m)	Ponding Area (m2)	Ponding Volume Per Drain (m3)	
0	0	0.00	0.00000	0	0.0	0.0	0.0
0.025	5	0.32	0.00252	0.025	4.9	0.0	0.3
0.05	10	0.63	0.00505	0.05	19.7	0.3	2.6
0.075	15	0.95	0.00757	0.075	44.3	1.1	8.9
0.1	20	1.26	0.01009	0.1	78.8	2.6	21.0
0.125	25	1.58	0.01262	0.125	123.1	5.1	41.0
0.15	30	1.89	0.01514	0.15	177.3	8.9	70.9
Weir Position =	**6-Full Open**						

RATING CURVE FOR MODELLING OUTLET

Head or Ponding Depth (m)	Outlfow (L/sec)
0	0.0000
0.025	2.5236
0.05	5.0472
0.075	7.5708
0.1	10.0944
0.125	12.6180
0.15	15.1416

RATING CURVE FOR MODELLING ROOF STORAGE

Head or Ponding Depth (m)	Ponding Area (m2)
0	0.0
0.025	4.9
0.05	19.7
0.075	44.3
0.1	78.8
0.125	123.1
0.15	177.3

Appendix E – Consultation / Correspondence

Email on Water System Boundary Conditions

Email Sent to RCVA on Stormwater Management Requirements

Email Received from RCVA on Stormwater Management Requirements

Jason Fitzpatrick

From: Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>
Sent: Wednesday, July 24, 2019 9:42 AM
To: Dickinson, Mary; Jason Fitzpatrick
Subject: RE: Request for Boundary Conditions - 365 Forest Street
Attachments: 365 Forest July 2019.pdf

Categories: RECEIVED - ACTION REQUIRED

Hi Jason,

Here is the boundary conditions for the subject application. Please see attached for the connection locations.

The following are boundary conditions, HGL, for hydraulic analysis at 365 Forest (zone 1W) assumed to be connected to the 305mm on Forest and 305mm on Richmond (see attached PDF for location).

Minimum HGL = 108.5m, same at both connections

Maximum HGL = 115.7m, same at both connections

MaxDay + FireFlow (150L/s) = 107.0m, Forest connection

MaxDay + FireFlow (150L/s) = 109.0m, Richmond connection

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.

Santhosh

From: Dickinson, Mary
Sent: July 10, 2019 3:58 PM
To: Kuruvilla, Santhosh <Santhosh.Kuruvilla@ottawa.ca>; jason.fitzpatrick@exp.com
Subject: FW: Request for Boundary Conditions - 365 Forest Street

Hi Jason,

I'm forwarding your request to Santhosh Kuruvilla who will be able to make the request for the boundary conditions.

Thank you,
Mary

Mary Dickinson, MCIP, RPP
Planner
Development Review West
Urbaniste
Examen des demandes d'aménagement ouest

City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 13923
ottawa.ca/planning / ottawa.ca/urbanisme

From: Jason Fitzpatrick <jason.fitzpatrick@exp.com>
Sent: July 10, 2019 3:32 PM
To: Dickinson, Mary <mary.dickinson@ottawa.ca>
Cc: Bruce Thomas <bruce.thomas@exp.com>; Moe Ghadban <Moe.Ghadban@exp.com>
Subject: Request for Boundary Conditions - 365 Forest Street

Hi Mary,

We are working with the Heafey Group on a site plan application for 365 Forest Street, and would appreciate if you could arrange for IAD/water Resources to provide hydraulic boundary conditions that we will need for the watermain design. I have attached a sketch of the site and the approximate boundary condition locations. We are requesting boundary conditions at locations at this time to evaluate the best connection location within the right of way.

The following is a summary of the demands and the required fire flows (RFF) we have estimated. We would appreciate the hydraulic boundary conditions based on our estimated water demands and required fire flows as noted below:

Average Day: 2.4 L/sec
Max Day: 6.0 L/sec
Peak Hour: 13.2 L/sec
Fire flow (RFF): Tower A: 100 L/sec, Tower B: 150 L/sec (worst case). (based on FUS method)
Max Day + FF: 156.0 L/sec.

In the event you require confirmation of the above demands and the RFF, I've attached the design tables for reference.

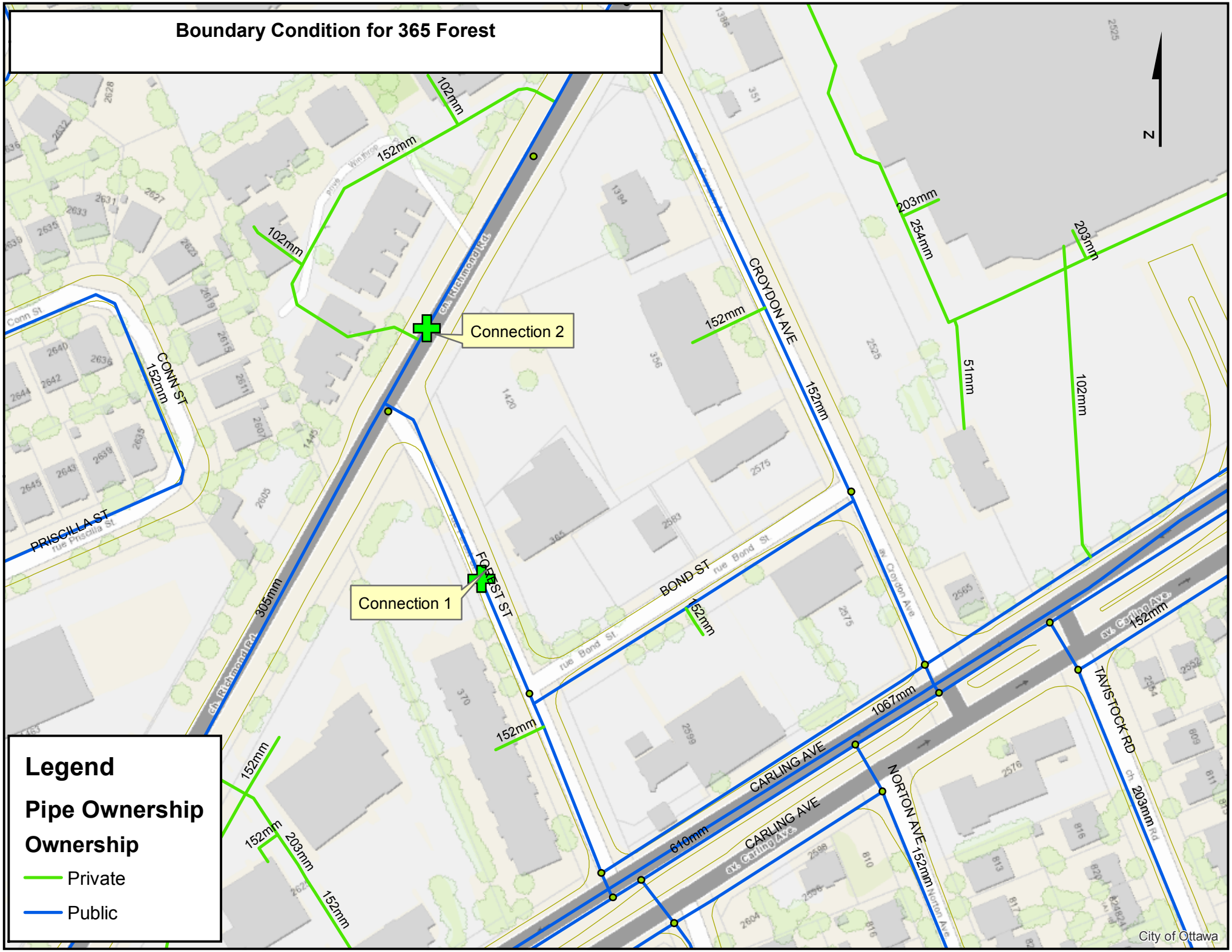
Regards,

Jason Fitzpatrick, P.Eng.
EXP | Project Engineer
t : +1.613.688.1899 | m : +1.613.302.7441 | e : jason.fitzpatrick@exp.com
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA

exp.com | legal disclaimer
keep it green, read from the screen

'

'


Boundary Condition for 365 Forest
Connection 2
Connection 1
CONN ST
PRISCILLA ST
FOREST ST
BOND ST
CROYDON AVE
CARLING AVE
NORTON AVE
TAVISTOCK RD
ch. Richmond Rd.
102mm
152mm
203mm
254mm
51mm
305mm
1067mm
610mm
Legend
Pipe Ownership
Ownership
Private
Public
N
City of Ottawa

Moe Ghadban

From: Moe Ghadban
Sent: Monday, September 23, 2019 9:20 AM
To: glen.mcdonald@rvca.ca
Cc: Jason Fitzpatrick
Subject: Request for SWM Criteria for 365 Forest Street
Attachments: 365 Forest Street.pdf

Hi Glen,

We are preparing a site servicing and stormwater report for a client who is proposing to construct two high rise buildings at 365 Forest street. Tower A is a 13-storey high-rise comprised of 235 units and Tower B is 12-storeys and comprised of 140 units. (See attached PDF)

There will be a shared underground parking garage for both high rise buildings.

We are emailing the Conservation Authority to provide the water quality requirements for the proposed development.

Thank you for your review and input.

Regards,

Moe Ghadban
EXP | Engineering Designer
t : +1.613.688.1899 | m : +1.613.808.4089 | e : moe.ghadban@exp.com
2650 Queensview Drive
Suite 100
Ottawa, ON K2B 8H6
CANADA

Moe Ghadban

From: Eric Lalande <eric.lalande@rvca.ca>
Sent: Tuesday, October 15, 2019 9:31 AM
To: Moe Ghadban
Cc: Jason Fitzpatrick
Subject: RE: Request for SWM Criteria for 365 Forest Street

Hi Moe,

The RVCA has will not require quality control protection for the city, however encourage best management practices where possible.

Thank you,

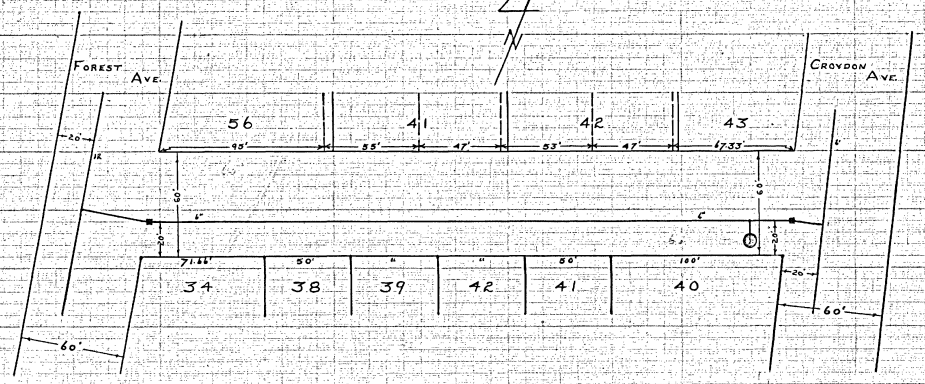
Eric Lalande, MCIP, RPP
Planner, Rideau Valley Conservation Authority
613-692-3571 x1137

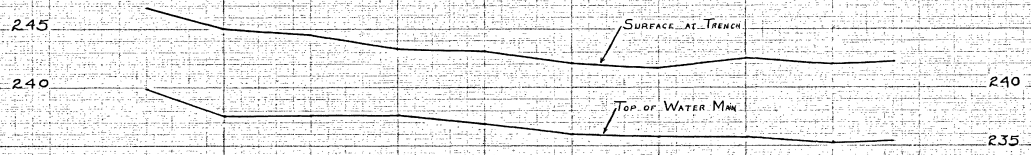
Appendix F – Background Information

City of Ottawa Vault Drawings (Plan and Profiles)

WATTS ACCUTROL Weir for Roof Drains

BOND ST.





0-41.5 - 6"x12" SDR @ FOREST

0-04 - 6" VALVE

0+00

1+00

2+00

3+00

3+40 - HYD 11' OFF 6" WM

3+64 - 6" VALVE

3+85 - 6"x6" SDR @ CROYDON

CITY OF OTTAWA
WATER WORKS DEPARTMENT

6" W.M. INSTALLED ON BOND ST
FROM FOREST AVE.
TO CROYDON AVE.

DWN BY L. J. Irvine — DATE: JAN. 29/60

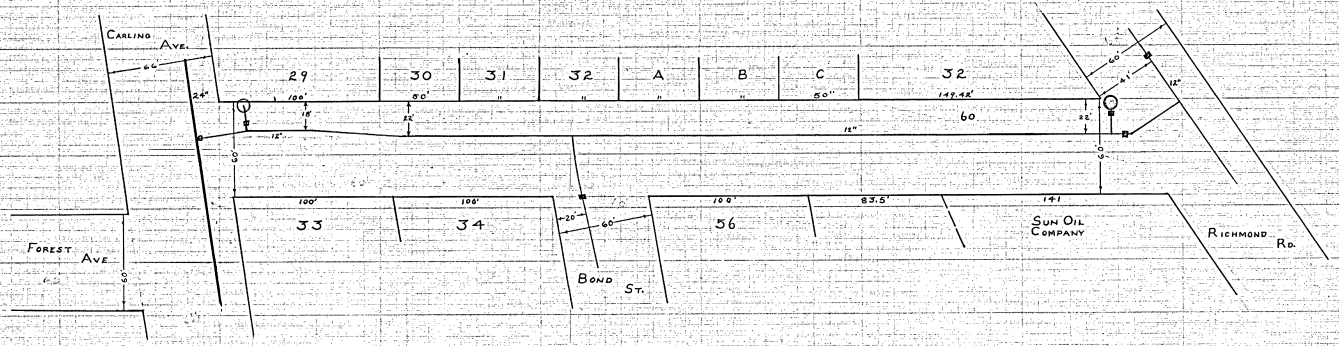
ENGINEER K. — SCALE: HOR. 1"=40' VERT. 1"=6'

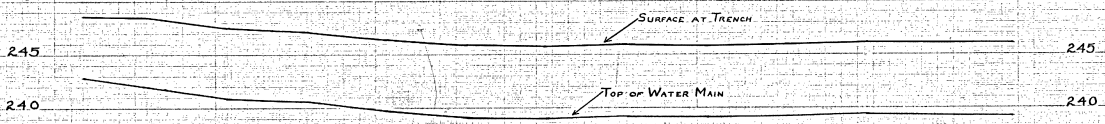
DEPUTY COMMISSIONER — INSTALLED SEPT. 1959

COMMISSIONER OF WATER WORKS — BOOK NO. 170

6114

FOREST AVE.

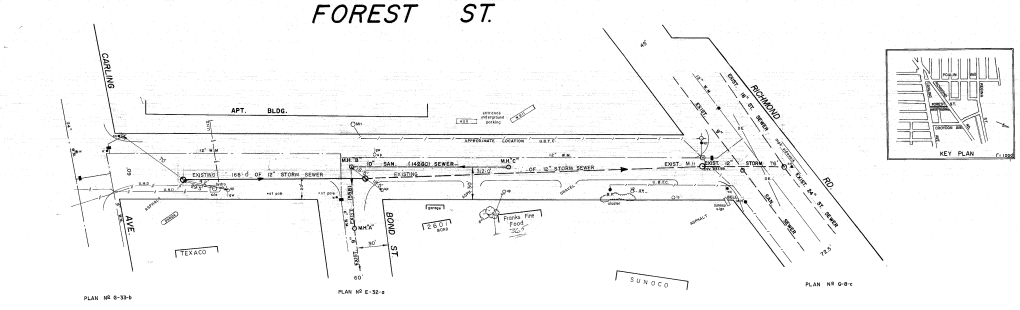


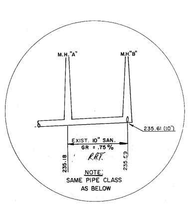


0+00 - EXISTING DR. FOR HYD.
0+10 - EXISTING 12" W.M.
1+00
2+00
2+35 - 4"x12" SDR. BEND S.E.
3+00
4+00
5+00
5+50 - 12"x12"x8" H.F. & W.M.
5+78 - 8" GATE VALVE
5+92 - 8" BLIND
5+92 - 12"x12" SDR. RICHMOND RD.

CITY OF OTTAWA WATER WORKS DEPARTMENT	
12" W.M. INSTALLED ON FOREST AVE. FROM CARLING AVE. TO RICHMOND RD.	
DWN BY: L. J. Irvine	DATE: FEB. 1/60
ENGINEER W.	SCALE: HOR. 1"=40' VERT. 1"=6'
DEPUTY COMMISSIONER	INSTALLED: SEPT. 1959
COMMISSIONER OF WATER WORKS	BOOK NO. 170

6114





CITY OF OTTAWA DEPARTMENT OF PHYSICAL ENVIRONMENT SEWER SERVICES AND POLLUTION CONTROL BRANCH			
PROPOSED STORM SEWER IN *FOREST ST* FROM CHAINAGE 1+53 to 6+38			
L.D. SMITH P.Eng BRANCH DIRECTOR	DATE APRIL 5,74	CHECKED BY	SCALE HOR. 1"=40' VER. 1"= 6'
J.E. MacKenzie P.Eng COMMISSONER	FEILD BOOK	DRAWN BY P.F. HAYES.	PLAN Nº.
K.C. Spero DESIGNED BY	CHIEF DESIGN AND CONST. ENGIN.		

NOTE

SOILS INFORMATION SHOWN IS NOT GUARANTEED AND CONTRACTORS ARE ADVISED TO COLLECT ADDITIONAL INFORMATION AS DEEMED NECESSARY.

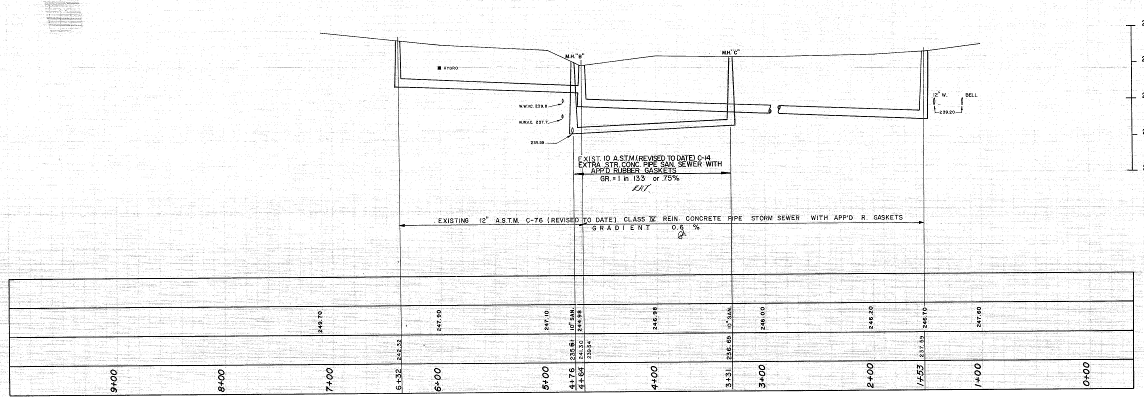
UTILITIES SHOWN ARE TAKEN FROM THE BEST AVAILABLE RECORDS. CONTRACTOR IS REQUESTED TO CHECK WITH ALL UTILITY COMPANIES BEFORE DIGGING.

FINAL MEASUREMENTS
SANITARY SEWER
WORK START FEB 72
WORK COMP. MAR 72
INSPECTOR T. CONNORS
CONTRACTOR FARRELL CONST.
INSTRU. MAN D. McNAB
BOOK 3535
JUNE 8/72 R.E.L.

FINAL MEASURMENT	
FOREST ST. FROM RICHMOND	FOR STORM TO 480' SOUTH
WORK START. OCT.1,74 WORK COMP. OCT.25,74 FINAL MEAS. OCT.,24,74	DESIGNER K. SPERO INSPECTOR E. CONNERS CONTRACTOR HANSEN
FIELD BOOKS DESIGN 3681 CONSTR. 3681 FINAL MEAS. 3681	INST. MAN R. ST GERMAIN APPROVED BY. D. SMALL CONTRACT NO. FINAL MEAS. FOLDER 1309
TO ORIGINALS K. TOEG	DATE : NOV. 29, 74

CITY OF OTTAWA BENCH MARK N-52 CARLING & FOREST
ELEVATION 249.86

27/1/72	BELL TEL.	AS INDICATED	B.A.G.
"	WATER	"	"
"	GAS	NILL	"
"	HYDRO	NILL	"
16/7/74	BELL. TEL.	AS INDICATED	P.F. HAYES.
"	HYDRO	"	"

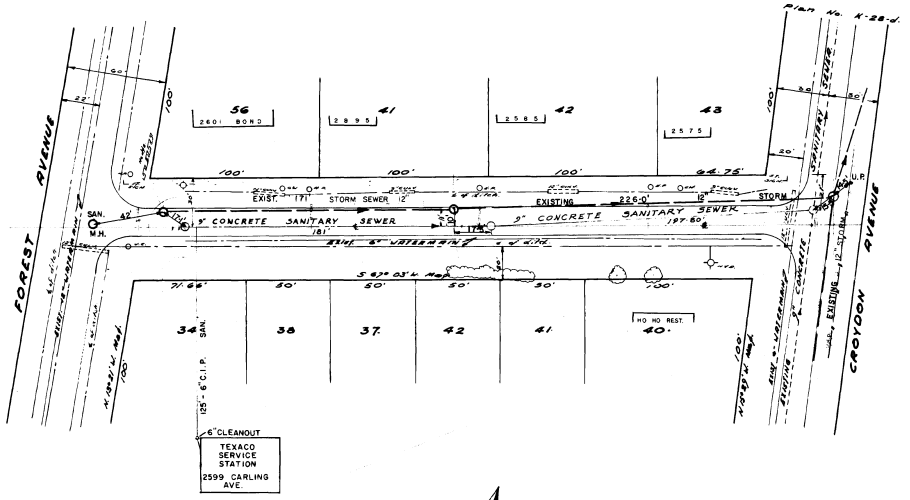


SANITARY SEWER
IN
FOREST ST.
FROM FOREST TO 145' NORTH

K.C. Spero Jan 27 72
B.A.G. 1" = 40'
R.A. TINMAN 1" = 6'
27 / 1 / 71
3535
D-38-e

D38e

BOND STREET



NOTE
UTILITIES SHOWN ARE TAKEN FROM THE BEST AVAILABLE RECORDS. CONTRACTORS ARE REQUESTED TO CHECK WITH ALL UTILITY COMPANIES BEFORE DIGGING.

SOILS INFORMATION SHOWN IS NOT GUARANTEED AND CONTRACTORS ARE ADVISED TO COLLECT ADDITIONAL SOILS INFORMATION AS DEEMED NECESSARY.

NOTES

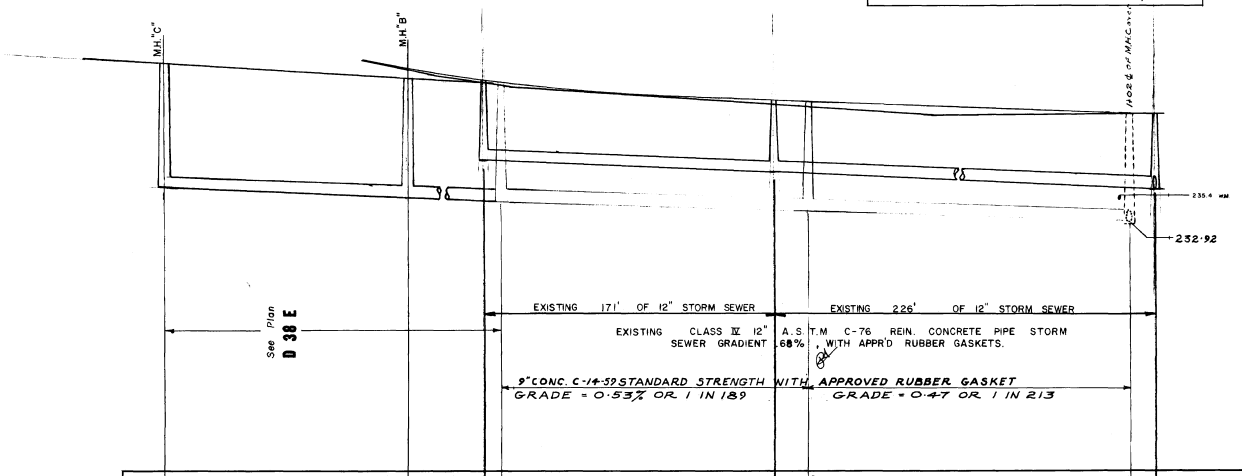
REG'D PLAN N°: 3114348.
HYDRO - 16/7/74. P.F. HAYES.

FINAL MEASURMENT	
BOND STREET FROM CROYDON AVE.	FOR STORM SEWER TO FOREST AVE.
WORK START. OCT. 1, 74	DESIGNER K. SPERO
WORK COMP. OCT. 25, 74	CONTRACTOR HANSEN
FINAL MEAS. OCT. 24, 74	INSPECTOR E. CONNERS
FIELD BOOKS	INST. MAN R. ST GERMAIN
DESIGN 3681	APPROVED BY D. SMALL
CONSTR. 3681	
FINAL MEAS. 3681	F. M. FOLDER 1309
TO ORIGINAL K. TOEG	DATE : DEC. 3, 1974

CITY OF OTTAWA
DEPARTMENT OF PHYSICAL ENVIRONMENT
SEWER SERVICES AND POLLUTION CONTROL BRANCH
STORM SEWER
BOND STREET

K.C. SPERO DESIGNED BY	DRAWN BY P.F. HAYES	SCALE HOR 1"=40' VER. 1"=6'
L.B. SMITH P. ENG BRANCH DIRECTOR	CHECKED BY	DATE APRIL, 3/74
J.E. MacKENZIE P. ENG COMMISSIONER		
CHIEF DESIGN AND CONST ENGINEER	FIELD BOOK 3681	PLAN N°

REVISIONS			
DATE:	DESCRIPTION	DRN. BY	APP. BY
	SANITARY SEWER Work Commenced Nov. 1961 Work Completed Nov. 1961 Contractor Sparling Const. Inspector A. Shields Final Measurments Dec. 12/61 Book 3078 Page 22 Instrumentman D.R. McNab		



HOUSE CONNECTIONS

HOUSE	LENGTH	LOCATION
2583	33'	13' E/M.H. 2+94
2575	33'	88' W/M.H. 2+74
2601	33'	5' E/M.H. 4+75

ELEVATIONS	
ROAD GRADE	
SURFACE	
INVERT	
STATION	6+00 5+00 4+86 4+75 4+00 3+15 3+00 2+94 2+00 1+00 0+90 0+00

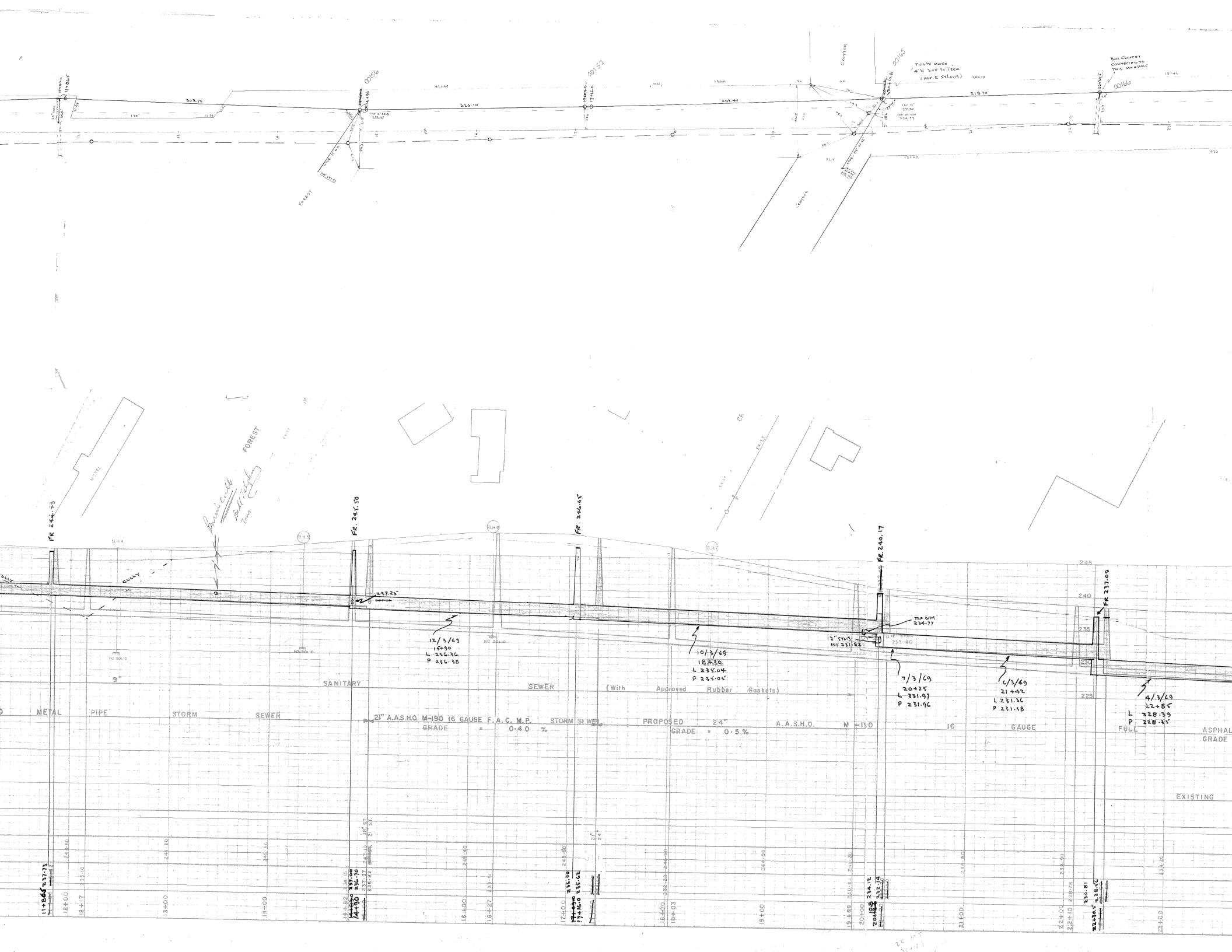
DESIGN BY	DATE
ROAD GRADE	
SAN. SEWER C.N. McCoomb	July 20/61
STORM SEWER K.C. Spero	

CITY OF OTTAWA
PLANNING AND WORKS DEPARTMENT
SEWERAGE AND DRAINAGE

BOND STREET
CROYDON AVE. to FOREST AVENUE.

DRAWN BY: R. H.P.	SCALE:	
CHECKED BY: C.N.	Hor: 1"=40'	
DATE: 45-10-1961	Ver: 1"=6'	
R.E. AYERS ASSOC.	PLAN NO. E-32-a.	
INQUIRY BOOK: 958		

E-32a


FORREST
FR 244.43
FR. 241.50
FR. 240.65
FR 240.17
FR 237.09
237.25
12/3/69
15+90
L 236.36
P 236.38
10/3/69
18+30
L 235.04
P 235.05
7/3/69
20+25
L 231.97
P 231.96
6/3/69
21+42
L 231.36
P 231.58
4/3/69
L 228.39
P 228.31
12" STUB
INV 231.82
TOP WM
234.77
SANITARY SEWER (With Approved Rubber Gaskets)
METAL PIPE STORM SEWER
21" A.A.S.H.O. M-190 16 GAUGE F.A.C.M.P. STORM SEWER
GRADE = 0.40 %
PROPOSED 24" A.A.S.H.O. M-150 16 GAUGE
GRADE = 0.5 %
FULL
ASPHAL
GRADE
EXISTING

WATTS®	Adjustable Accutrol Weir Tag: _____	Adjustable Flow Control for Roof Drains

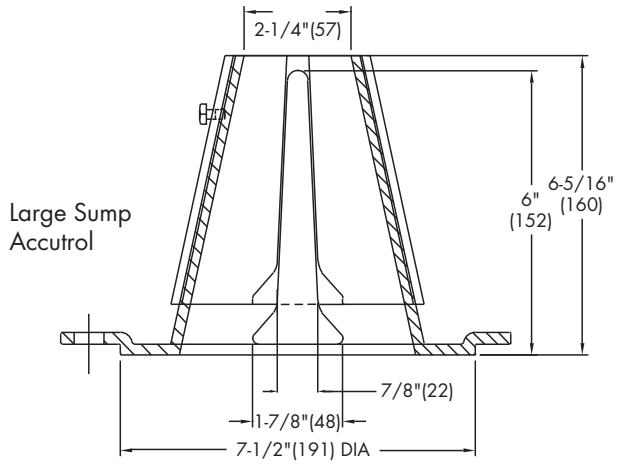
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

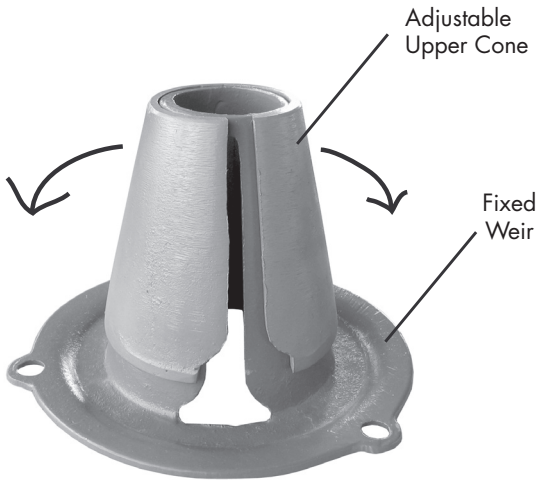
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2"of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3"of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm (per inch of head) x 2 inches of head] + 2-1/2 gpm (for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	5	5	5	5	5

Job Name _____ Contractor _____

Job Location _____ Contractor's P.O. No. _____

Engineer _____ Representative _____

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A Watts Water Technologies Company

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Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

Appendix G – Checklist

GENERAL CONTENT		RESPONSE
☐	Executive Summary (for larger reports only).	Not included
☒	Date and revision number of the report.	Date of report provided
☒	Location map and plan showing municipal address, boundary, and layout of proposed development.	Page 1 and Appendix G
☒	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.	Section 2 of report
☒	Summary of Pre-consultation Meetings with City and other approval agencies.	In Appendix E
☐	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.	No Master Servicing Studies.
☒	Statement of objectives and servicing criteria.	Section 1 of report
☒	Identification of existing and proposed infrastructure available in the immediate area.	Section 2 & 3 of report
☐	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).	Not applicable
☐	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.	Not applicable
☐	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.	Not applicable
☐	Proposed phasing of the development, if applicable.	Not applicable
☐	Reference to geotechnical studies and recommendations concerning servicing.	Not applicable
☒	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	Functional Report, Civil and Architectural Plans provided all this information.
DEVELOPMENT SERVICING REPORT: WATER		**RESPONSE**
☐	Confirm consistency with Master Servicing Study, if available Availability of public infrastructure to service proposed development Identification of system constraints	Not applicable
☒	Identify boundary conditions	Section 4.6
☒	Confirmation of adequate domestic supply and pressure	Section 4.3
☒	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.	Section 4.7
☒	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.	Section 4.6 & Table B-5 Appendix B
☐	Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design	Not applicable
☒	Address reliability requirements such as appropriate location of shut-off valves Check on the necessity of a pressure zone boundary modification.	Section 4.3
☒	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	Section 4.5 & Table B-1 Appendix B
☒	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.	Section 4.2

☐	Description of off-site required feeder mains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	Not applicable
☒	Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Table B-1 Appendix B
☐	Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	Not applicable
DEVELOPMENT SERVICING REPORT: WASTEWATER		**RESPONSE**
☒	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).	Section 5.1
☐	Confirm consistency with Master Servicing Study and/or justifications for deviations.	Not applicable
☒	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.	Section 5.2
☒	Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Section 5.2
☐	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)	Not applicable
☒	Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	Table C-6 in Appendix C
☒	Description of proposed sewer network including sewers, pumping stations, and forcemains.	Section 5.2
☐	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).	Not applicable
☐	Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	Not applicable
☐	Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	Not applicable
☐	Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	Not applicable
☐	Special considerations such as contamination, corrosive environment etc.	Not applicable
DEVELOPMENT SERVICING REPORT: STORMWATER CHECKLIST		**RESPONSE**
☒	Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)	Section 6
☐	Analysis of available capacity in existing public infrastructure.	Not applicable
☒	A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.	Figure A-1 & A-2
☐	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.	Not Applicable
☐	Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Not Applicable
☒	Description of the stormwater management concept with facility locations and descriptions with references and supporting information.	Section 6.2 & 6.3
☐	Set-back from private sewage disposal systems. Watercourse and hazard lands setbacks.	Not Applicable
☒	Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	Appendix E
☐	Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	Not Applicable
☒	Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).	Section 6.9 & Table D12-D16 of Appendix D

☐	Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	Not Applicable
☒	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.	Section 6.6, 6.8 & Table D-8 & D11 of Appendix D
☐	Any proposed diversion of drainage catchment areas from one outlet to another.	Not Applicable
☒	Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.	Section 6.8
☐	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.	Not Applicable
☐	Identification of potential impacts to receiving watercourses Identification of municipal drains and related approval requirements.	Not Applicable
☒	Descriptions of how the conveyance and storage capacity will be achieved for the development.	Section 6.9
☒	100-year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Grading Plan
☐	Inclusion of hydraulic analysis including hydraulic grade line elevations.	Not Applicable
☒	Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Section 7
☐	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.	Not Applicable – No requirements from Conservation Authority
☐	Identification of fill constraints related to floodplain and geotechnical investigation.	See geotechnical report
☒	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:	Appendix E
☐	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 theAct.	Not Applicable
☐	Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.	Not Applicable
☐	Changes to Municipal Drains.	Not Applicable
☐	Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)	Not Applicable
CONCLUSION CHECKLIST		**RESPONSE**
☒	Clearly stated conclusions and recommendations	In Section 8
☒	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.	Appendix E
☒	All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario	Signed and stamped

Appendix H – Drawings

Site Plan and Renderings (17 pages)

Site Servicing Plan, C100

Site Grading Plan, C200

GROUPE HEAFEY

RICHMOND ROAD & FOREST STREET

LAPALME RHEAULT ARCHITECTES +ASSOCIÉS

Dessiné par : Tanya Nadeau
Conçu par : Christian Rheault

53 blvd Saint-Raymond, Suite 200-A
Gatineau, QC J8Y 1R8
www.lrarch.ca

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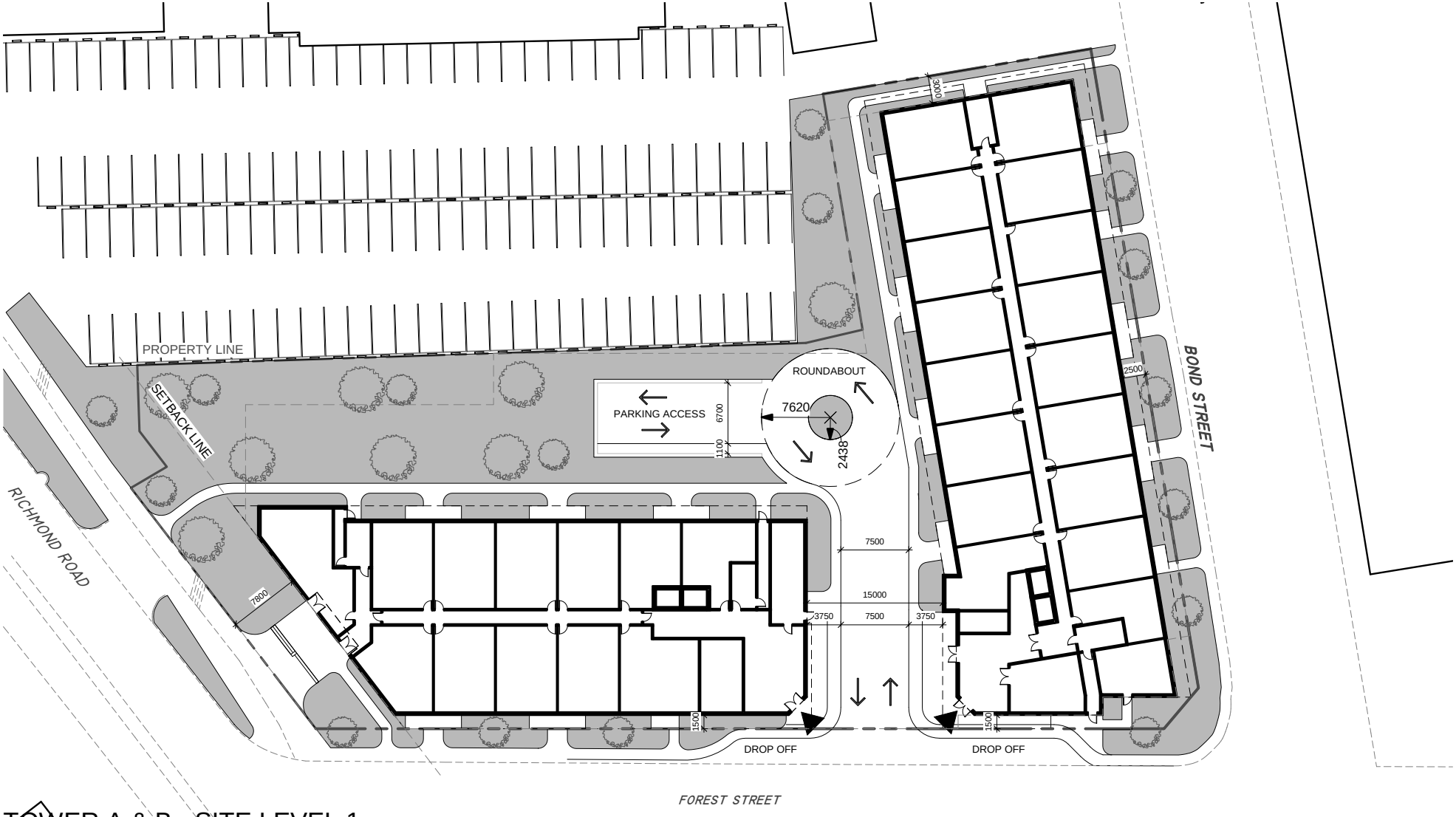

TOWER A & B - SITE LEVEL 1

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 400

LAPALME RHEAULT
ARCHITECTES | +ASSOCIÉS

Dessiné par : Author
Conçu par : Designer

53 blvd Saint-Raymond, Suite 200-A
Gatineau, QC J8Y 1R8
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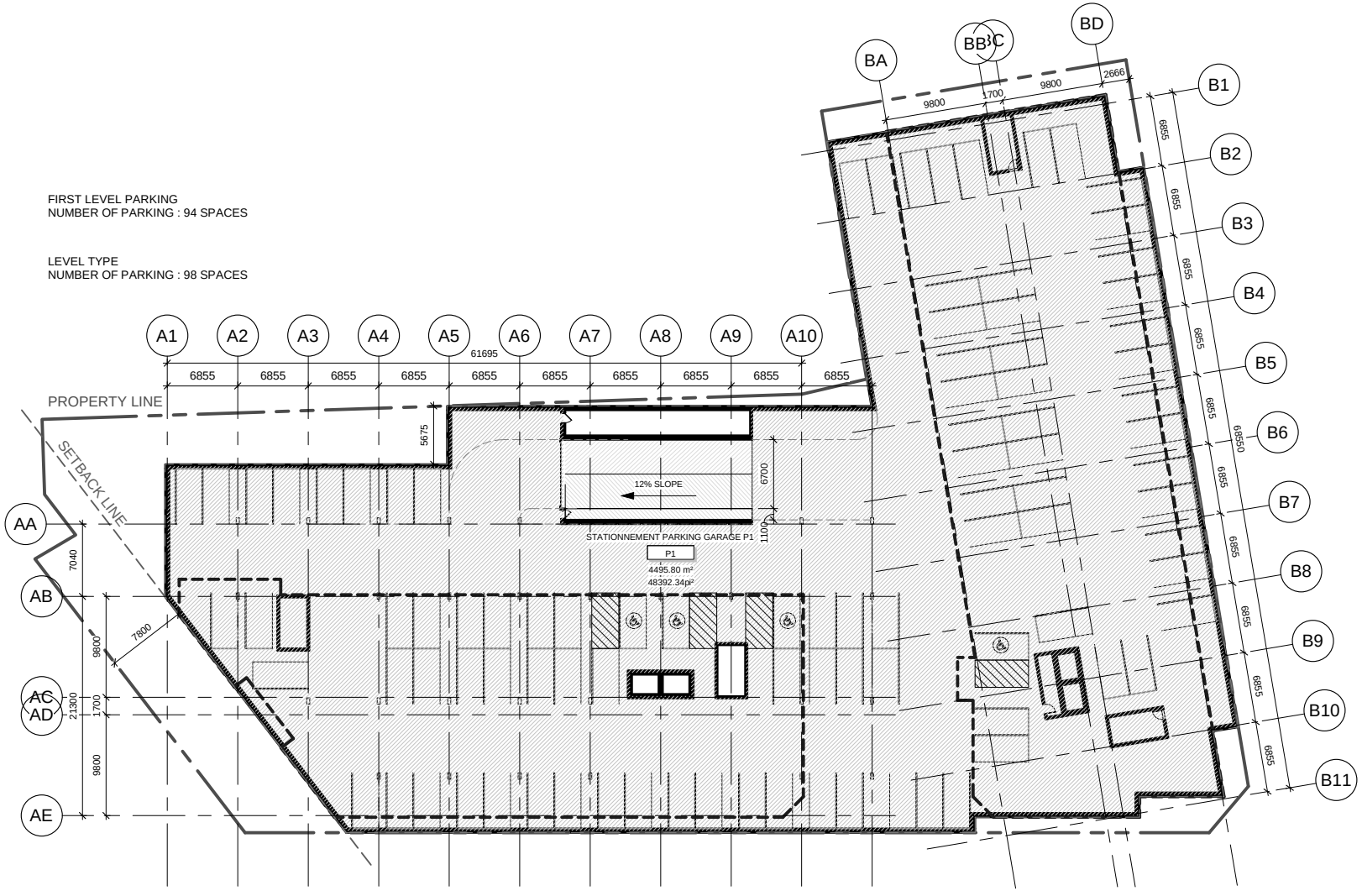

TOWER A & B - PARKING LEVEL P1

GROUP HEAFEY

365 Forest Street
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1 : 400

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Conçu par : Christian Rheault

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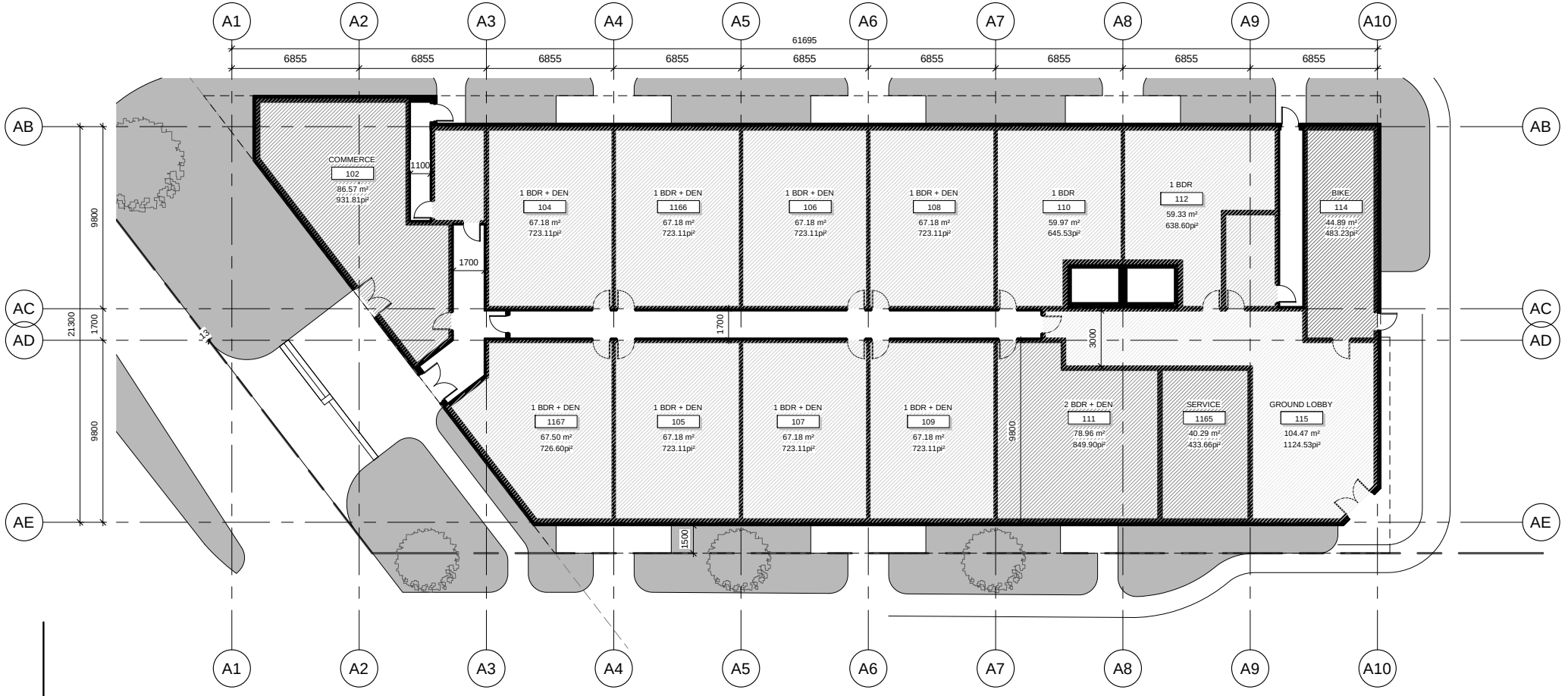

TOWER A - LEVEL 1

GROUP HEAFEY

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Ottawa, ON K2B 7Z7
1 : 200

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Conçu par : Christian Rheault

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GROSS AREA LEGEND

1 BDR | **1 BDR + DEN** | **2 BDR** | **2 BDR + DEN** | **STAIRS** | **Calculating...**

TOWER A - LEVEL 2

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

ESQUISSE

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ES05

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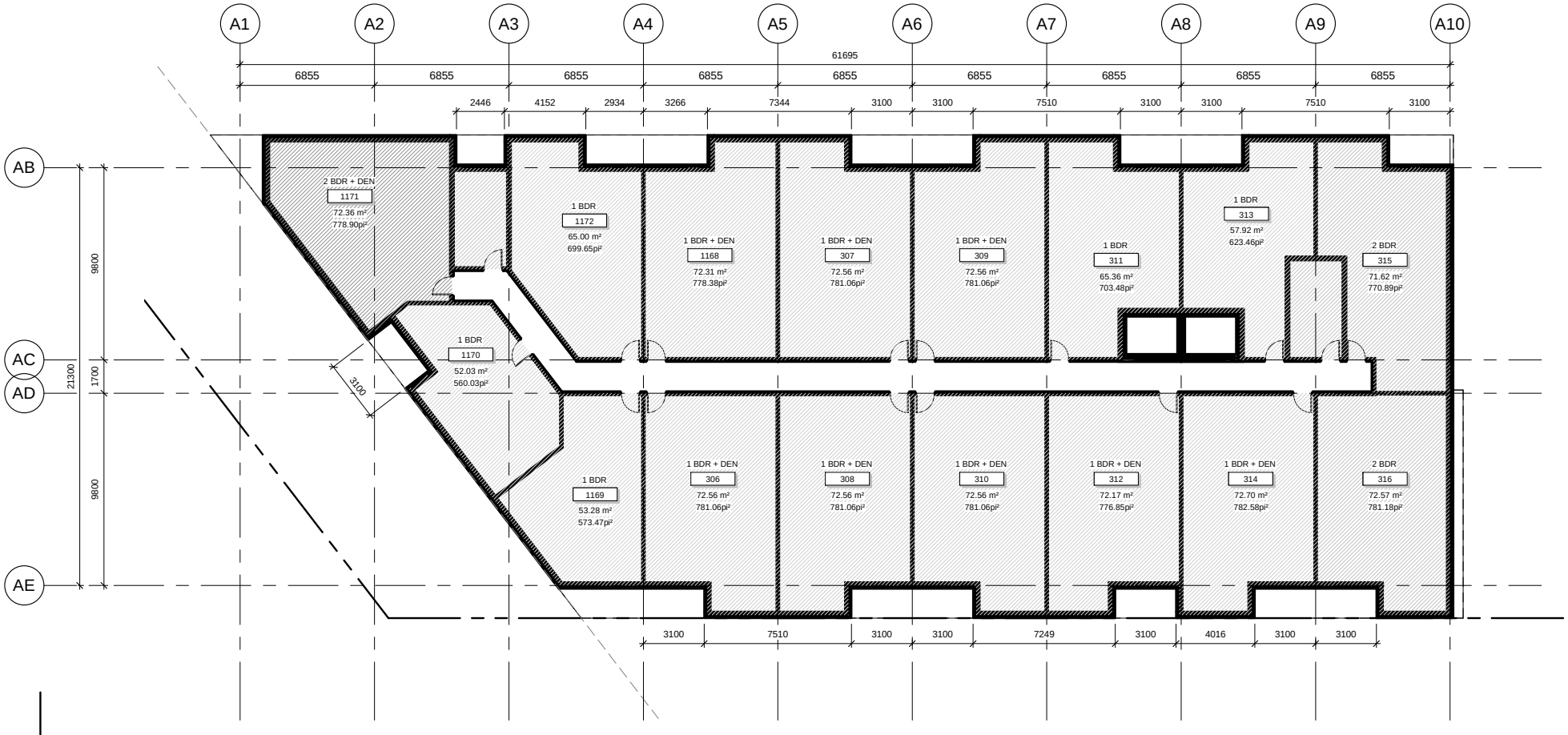

GROSS AREA LEGEND

1 BDR | **1 BDR + DEN** | **2 BDR** | **2 BDR + DEN** | **STAIRS** | **Calculating...**

TOWER A - LEVEL 3 TO 6

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

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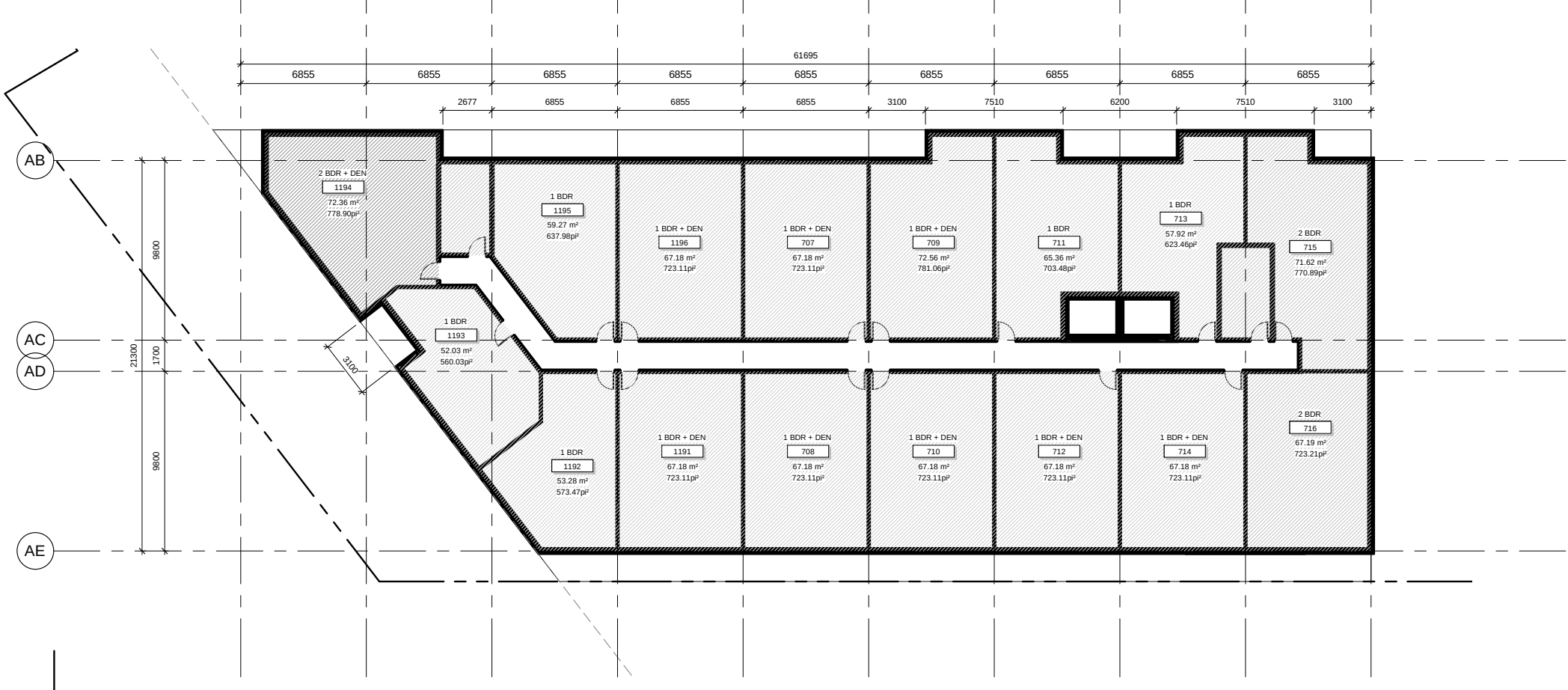

GROSS AREA LEGEND

1 BDR | **1 BDR + DEN** | **2 BDR** | **2 BDR + DEN** | **STAIRS** | **Calculating...**

TOWER A - LEVEL 7

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

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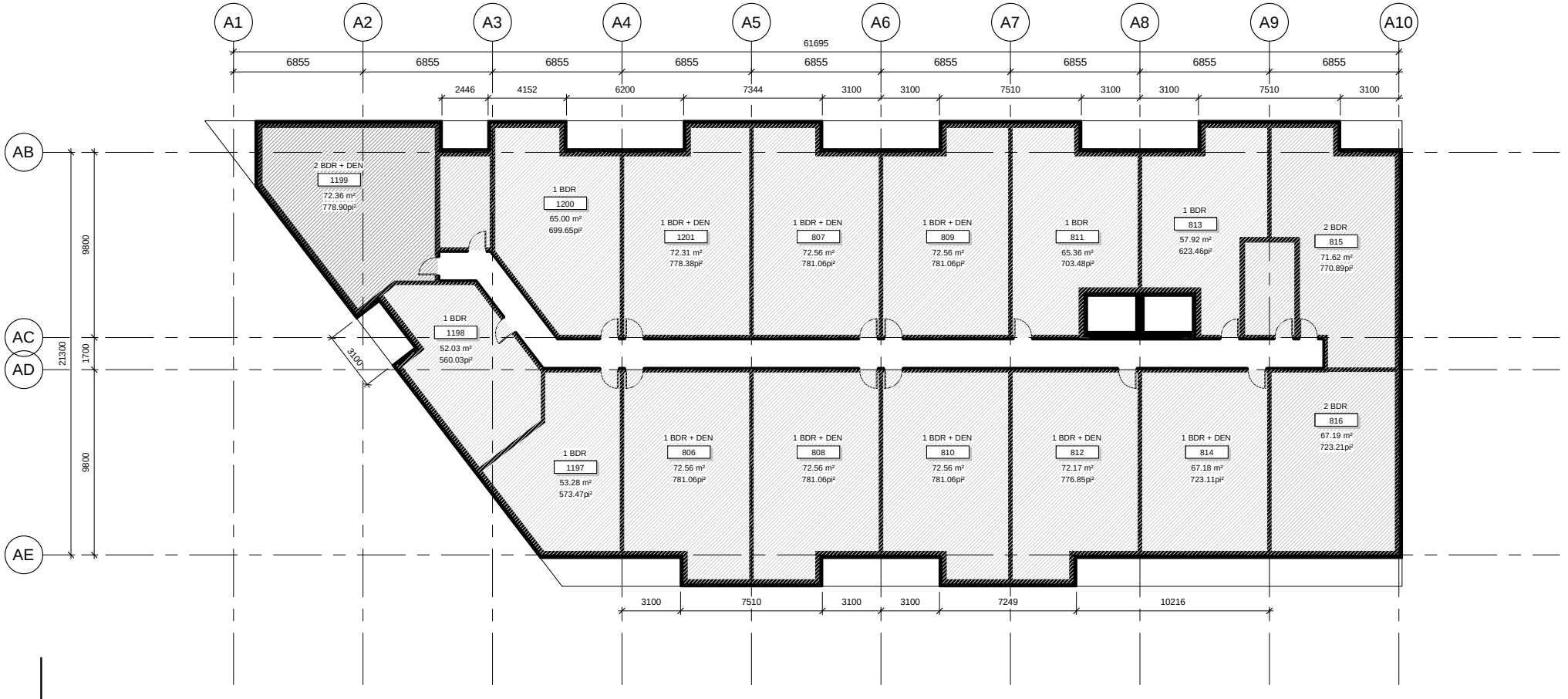

GROSS AREA LEGEND

1 BDR | **1 BDR + DEN** | **2 BDR** | **2 BDR + DEN** | **STAIRS** | **Calculating...**

TOWER A - LEVEL 8 TO 10

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GROUP HEAFEY
365 Forest Street
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1 : 200

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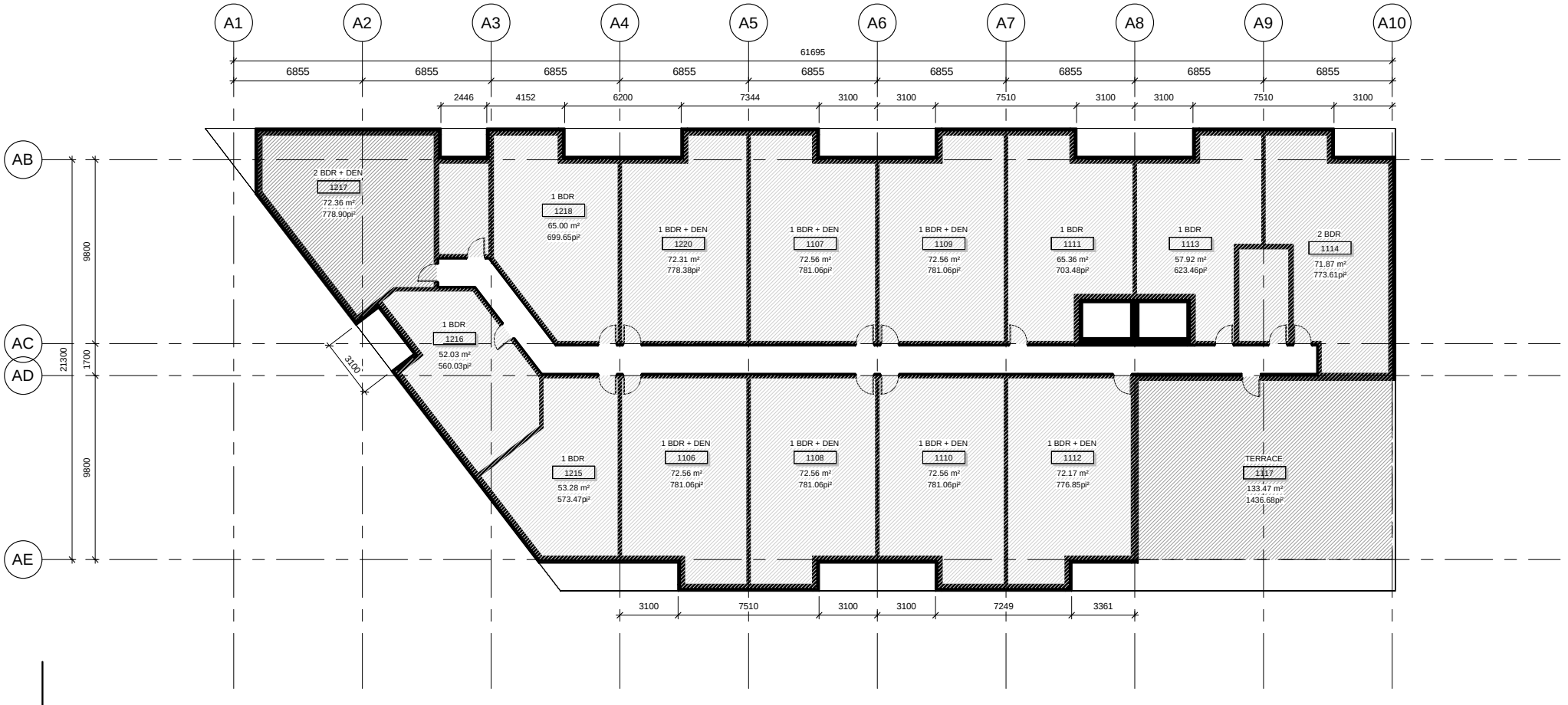

GROSS AREA LEGEND

1 BDR | **1 BDR + DEN** | **2 BDR** | **2 BDR + DEN** | **STAIRS** | **TERRACE** | **Calculating...**

TOWER A - LEVEL 11 & 12

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

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Dessiné par : Tanya Nadeau
Conçu par : Christian Rheault

53 blvd Saint-Raymond, Suite 200-A
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ROOM TYPOLOGY - TOWER A

LEVEL	NAME	QTY
LEVEL 1	1 BDR	2
LEVEL 1	1 BDR + DEN	8
LEVEL 1	2 BDR + DEN	1
LEVEL 2	1 BDR	5
LEVEL 2	1 BDR + DEN	8
LEVEL 2	2 BDR	1
LEVEL 2	2 BDR + DEN	1
LEVEL 3	1 BDR	5
LEVEL 3	1 BDR + DEN	8
LEVEL 3	2 BDR	2
LEVEL 3	2 BDR + DEN	1
LEVEL 4	1 BDR	5
LEVEL 4	1 BDR + DEN	8
LEVEL 4	2 BDR	2
LEVEL 4	2 BDR + DEN	1
LEVEL 5	1 BDR	5
LEVEL 5	1 BDR + DEN	8
LEVEL 5	2 BDR	2
LEVEL 5	2 BDR + DEN	1
LEVEL 6	1 BDR	5
LEVEL 6	1 BDR + DEN	8
LEVEL 6	2 BDR	2
LEVEL 6	2 BDR + DEN	1
LEVEL 7	1 BDR	5
LEVEL 7	1 BDR + DEN	8
LEVEL 7	2 BDR	2
LEVEL 7	2 BDR + DEN	1
LEVEL 8	1 BDR	5
LEVEL 8	1 BDR + DEN	8
LEVEL 8	2 BDR	2
LEVEL 8	2 BDR + DEN	1
LEVEL 9	1 BDR	5
LEVEL 9	1 BDR + DEN	8
LEVEL 9	2 BDR	2
LEVEL 9	2 BDR + DEN	1
LEVEL 10	1 BDR	5
LEVEL 10	1 BDR + DEN	8
LEVEL 10	2 BDR	2
LEVEL 10	2 BDR + DEN	1
LEVEL 11	1 BDR	5
LEVEL 11	1 BDR + DEN	7
LEVEL 11	2 BDR	1
LEVEL 11	2 BDR + DEN	1
LEVEL 12	1 BDR	5
LEVEL 12	1 BDR + DEN	7
LEVEL 12	2 BDR	1
LEVEL 12	2 BDR + DEN	1
TOTAL UNITS: 182		

1 BDR - TOWER A

NIVEAU	NOM	NOMBRE
LEVEL 1	1 BDR	2
LEVEL 2	1 BDR	5
LEVEL 3	1 BDR	5
LEVEL 4	1 BDR	5
LEVEL 5	1 BDR	5
LEVEL 6	1 BDR	5
LEVEL 7	1 BDR	5
LEVEL 8	1 BDR	5
LEVEL 9	1 BDR	5
LEVEL 10	1 BDR	5
LEVEL 11	1 BDR	5
LEVEL 12	1 BDR	5
TOTAL: 57		

2 BDR - TOWER A

NIVEAU	NOM	NOMBRE
LEVEL 2	2 BDR	1
LEVEL 3	2 BDR	2
LEVEL 4	2 BDR	2
LEVEL 5	2 BDR	2
LEVEL 6	2 BDR	2
LEVEL 7	2 BDR	2
LEVEL 8	2 BDR	2
LEVEL 9	2 BDR	2
LEVEL 10	2 BDR	2
LEVEL 11	2 BDR	1
LEVEL 12	2 BDR	1
TOTAL: 19		

TYPOLOGY - TOWER A

NOM	NOMBRE	%
1 BDR	57	27%
1 BDR + DEN	94	55%
2 BDR	19	11%
2 BDR + DEN	12	7%
TOTAL DE LOGEMENTS: 182		100%

1 BDR + DEN - TOWER A

NIVEAU	NOM	NOMBRE
LEVEL 1	1 BDR + DEN	8
LEVEL 2	1 BDR + DEN	8
LEVEL 3	1 BDR + DEN	8
LEVEL 4	1 BDR + DEN	8
LEVEL 5	1 BDR + DEN	8
LEVEL 6	1 BDR + DEN	8
LEVEL 7	1 BDR + DEN	8
LEVEL 8	1 BDR + DEN	8
LEVEL 9	1 BDR + DEN	8
LEVEL 10	1 BDR + DEN	8
LEVEL 11	1 BDR + DEN	7
LEVEL 12	1 BDR + DEN	7
TOTAL: 94		

2 BDR + DEN - TOWER A

NIVEAU	NOM	NOMBRE
LEVEL 1	2 BDR + DEN	1
LEVEL 2	2 BDR + DEN	1
LEVEL 3	2 BDR + DEN	1
LEVEL 4	2 BDR + DEN	1
LEVEL 5	2 BDR + DEN	1
LEVEL 6	2 BDR + DEN	1
LEVEL 7	2 BDR + DEN	1
LEVEL 8	2 BDR + DEN	1
LEVEL 9	2 BDR + DEN	1
LEVEL 10	2 BDR + DEN	1
LEVEL 11	2 BDR + DEN	1
LEVEL 12	2 BDR + DEN	1
TOTAL: 12		

LAPALME RHEAULT ARCHITECTES | +ASSOCIÉS

Dessiné par : Tanya Nadeau
Conçu par : Christian Rheault

53 blvd Saint-Raymond, Suite 200-A
Gatineau, QC J8Y 1R8
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GROUP HEAFEY
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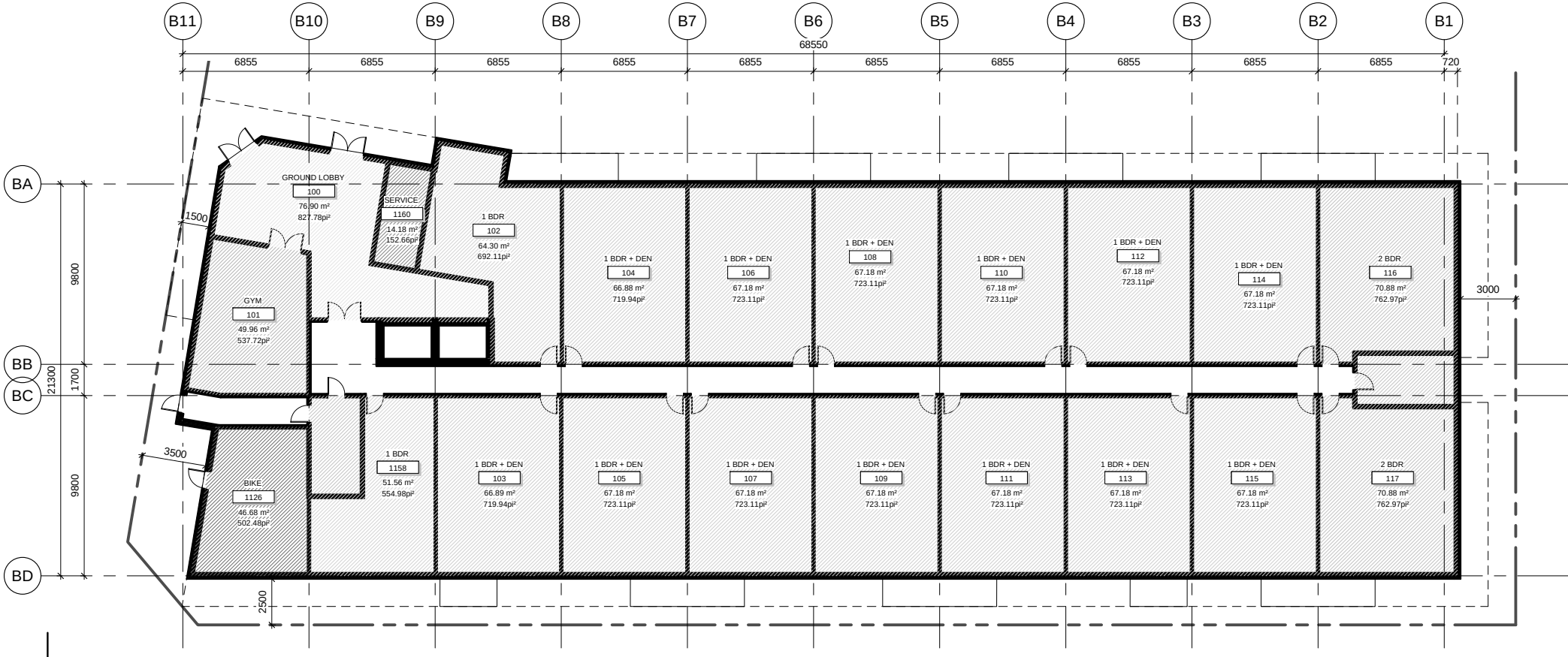

GROSS AREA LEGEND

1 BDR | 1 BDR + DEN | 2 BDR | BIKE | GROUND LOBBY | GYM | SERVICE | STAIRS

TOWER B - LEVEL 1

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

LAPALME RHEAULT ARCHITECTES | +ASSOCIÉS

Dessiné par : Tanya Nadeau
Conçu par : Christian Rheault

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Gatineau, QC J8Y 1R8
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GROSS AREA LEGEND

1 BDR **1 BDR + DEN** **2 BDR** **GYM** **STAIRS**

TOWER B - LEVEL 2

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

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GROSS AREA LEGEND

1 BDR **1 BDR + DEN** **2 BDR** **STAIRS**

TOWER B - LEVEL 3 TO 6

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

LAPALME RHEAULT ARCHITECTES +ASSOCIÉS

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Conçu par : Christian Rheault

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2020.01.08

GROSS AREA LEGEND

1 BDR **1 BDR + DEN** **2 BDR** **STAIRS**

TOWER B - LEVEL 7

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

LAPALME RHEAULT ARCHITECTES +ASSOCIÉS

Dessiné par : Tanya Nadeau
Conçu par : Christian Rheault

53 blvd Saint-Raymond, Suite 200-A
Gatineau, QC J8Y 1R8
www.lrarch.ca

1887-2303-19

ES13

2020.01.08

GROSS AREA LEGEND

1 BDR **1 BDR + DEN** **2 BDR** **STAIRS**

TOWER B - LEVEL 8 TO 10

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

LAPALME RHEAULT ARCHITECTES +ASSOCIÉS

Dessiné par : Tanya Nadeau
Conçu par : Christian Rheault

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ES14

2020.01.08

GROSS AREA LEGEND

1 BDR | 1 BDR + DEN | 2 BDR | 2 BDR + DEN | MULTI PURPOSE | STAIRS | TERRACE

TOWER B - LEVEL 11

GROUP HEAFEY

365 Forest Street
Ottawa, ON K2B 7Z7
1 : 200

LAPALME RHEAULT ARCHITECTES +ASSOCIÉS

Dessiné par : Author
Conçu par : Designer

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Gatineau, QC J8Y 1R8
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ES15

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ROOM TYPOLOGY - TOWER B

LEVEL	NAME	QTY
NIVEAU 1	1 BDR	2
NIVEAU 1	1 BDR + DEN	13
NIVEAU 1	2 BDR	2
NIVEAU 2	1 BDR	3
NIVEAU 2	1 BDR + DEN	13
NIVEAU 2	2 BDR	3
NIVEAU 3	1 BDR	3
NIVEAU 3	1 BDR + DEN	13
NIVEAU 3	2 BDR	4
NIVEAU 4	1 BDR	3
NIVEAU 4	1 BDR + DEN	13
NIVEAU 4	2 BDR	4
NIVEAU 5	1 BDR	3
NIVEAU 5	1 BDR + DEN	13
NIVEAU 5	2 BDR	4
NIVEAU 6	1 BDR	3
NIVEAU 6	1 BDR + DEN	13
NIVEAU 6	2 BDR	4
NIVEAU 7	1 BDR	3
NIVEAU 7	1 BDR + DEN	13
NIVEAU 7	2 BDR	4
NIVEAU 8	1 BDR	3
NIVEAU 8	1 BDR + DEN	13
NIVEAU 8	2 BDR	4
NIVEAU 9	1 BDR	3
NIVEAU 9	1 BDR + DEN	13
NIVEAU 9	2 BDR	4
NIVEAU 10	1 BDR	3
NIVEAU 10	1 BDR + DEN	13
NIVEAU 10	2 BDR	4
NIVEAU 11	1 BDR	1
NIVEAU 11	1 BDR + DEN	12
NIVEAU 11	2 BDR	2
NIVEAU 11	2 BDR + DEN	1
TOTAL DE LOGEMENTS: 212		

1 BDR - TOWER B

LEVEL	NAME	QTY
NIVEAU 1	1 BDR	2
NIVEAU 2	1 BDR	3
NIVEAU 3	1 BDR	3
NIVEAU 4	1 BDR	3
NIVEAU 5	1 BDR	3
NIVEAU 6	1 BDR	3
NIVEAU 7	1 BDR	3
NIVEAU 8	1 BDR	3
NIVEAU 9	1 BDR	3
NIVEAU 10	1 BDR	3
NIVEAU 11	1 BDR	1
TOTAL: 30		

2 BDR - TOWER B

LEVEL	NAME	QTY
NIVEAU 1	2 BDR	2
NIVEAU 2	2 BDR	3
NIVEAU 3	2 BDR	4
NIVEAU 4	2 BDR	4
NIVEAU 5	2 BDR	4
NIVEAU 6	2 BDR	4
NIVEAU 7	2 BDR	4
NIVEAU 8	2 BDR	4
NIVEAU 9	2 BDR	4
NIVEAU 10	2 BDR	4
NIVEAU 11	2 BDR	2
TOTAL: 39		

TYPOLOGY - TOWER B

NAME	QTY	%
1 BDR	30	13%
1 BDR + DEN	142	66%
2 BDR	39	21%
2 BDR + DEN	1	1%
TOTAL DE LOGEMENTS: 212		100%

1 BDR + DEN - TOWER B

LEVEL	NAME	QTY
NIVEAU 1	1 BDR + DEN	13
NIVEAU 2	1 BDR + DEN	13
NIVEAU 3	1 BDR + DEN	13
NIVEAU 4	1 BDR + DEN	13
NIVEAU 5	1 BDR + DEN	13
NIVEAU 6	1 BDR + DEN	13
NIVEAU 7	1 BDR + DEN	13
NIVEAU 8	1 BDR + DEN	13
NIVEAU 9	1 BDR + DEN	13
NIVEAU 10	1 BDR + DEN	13
NIVEAU 11	1 BDR + DEN	12
TOTAL: 142		

2 BDR + DEN - TOWER B

LEVEL	NAME	QTY
NIVEAU 11	2 BDR + DEN	1
TOTAL: 1		

LAPALME RHEAULT ARCHITECTES +ASSOCIÉS

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GROUP HEAFEY
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Ottawa, ON K2B 7Z7

ESQUISSE

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ES16

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