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36 Years

WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD

SERVICING AND STORMWATER MANAGEMENT REPORT

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SERVICING AND STORMWATER MANAGEMENT REPORT

WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD
OTTAWA, ONTARIO

Prepared by:

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

March 5, 2021

Novatech File: 119067
Ref No. R-2021-029

March 5, 2021

Planning and Infrastructure Approvals
City of Ottawa
110 Laurier Avenue West
Ottawa, Ontario, K1P 1J1

Attention: Wendy Tse, Planner

Dear Ms. Tse:

Reference: 2020 Walkley Road, Ottawa
Servicing and Stormwater Management Report
Our File No.: 119067

Please find enclosed the 'Servicing and Stormwater Management Report' for the above noted project. This report has been prepared in support of a Zoning By-law Amendment and Site Plan Control Applications and is hereby submitted for review and approval.

Should you have any questions or require additional information, please contact the undersigned.

Yours truly,

NOVATECH

Matt Hrehoriak, P.Eng.
Project Engineer | Land Development Engineering

cc: Eric Cordon, Canderel

Suite 200, 240 Michael Cowpland Drive, Ottawa ON K2M 1P6 Tel: 613.254.9643 Fax: 613.254.5867 www.novatech-eng.com

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LIST OF ENGINEERING DRAWINGS (SEPARATE FROM REPORT)

See Appendix F for Drawing Listing

1.0 INTRODUCTION

Novatech has been retained to prepare a Servicing and Stormwater Management Report for the proposed development located at 2020 Walkley Road, Ottawa, Ontario. This report will support the Zoning By-Law Amendment and Site Plan Application for the subject development. **Figure 1** Key Plan shows the site location.

2.0 EXISTING CONDITIONS

The total site area is approximately 5.7 hectares in size and is currently developed with two buildings, which include an office component, warehouse space and associated parking. There are existing entrances to the site from Conroy Rd. and Walkley Rd.

The site is bounded by Walkley Rd. to the north, developed light industrial buildings to the east, St Laurent Blvd to the south, and Conroy Rd. to the west. The topography of the site is generally flat with localized sloping around existing catchbasins on site. **Figure 2** shows the existing site conditions.

3.0 PROPOSED DEVELOPMENT

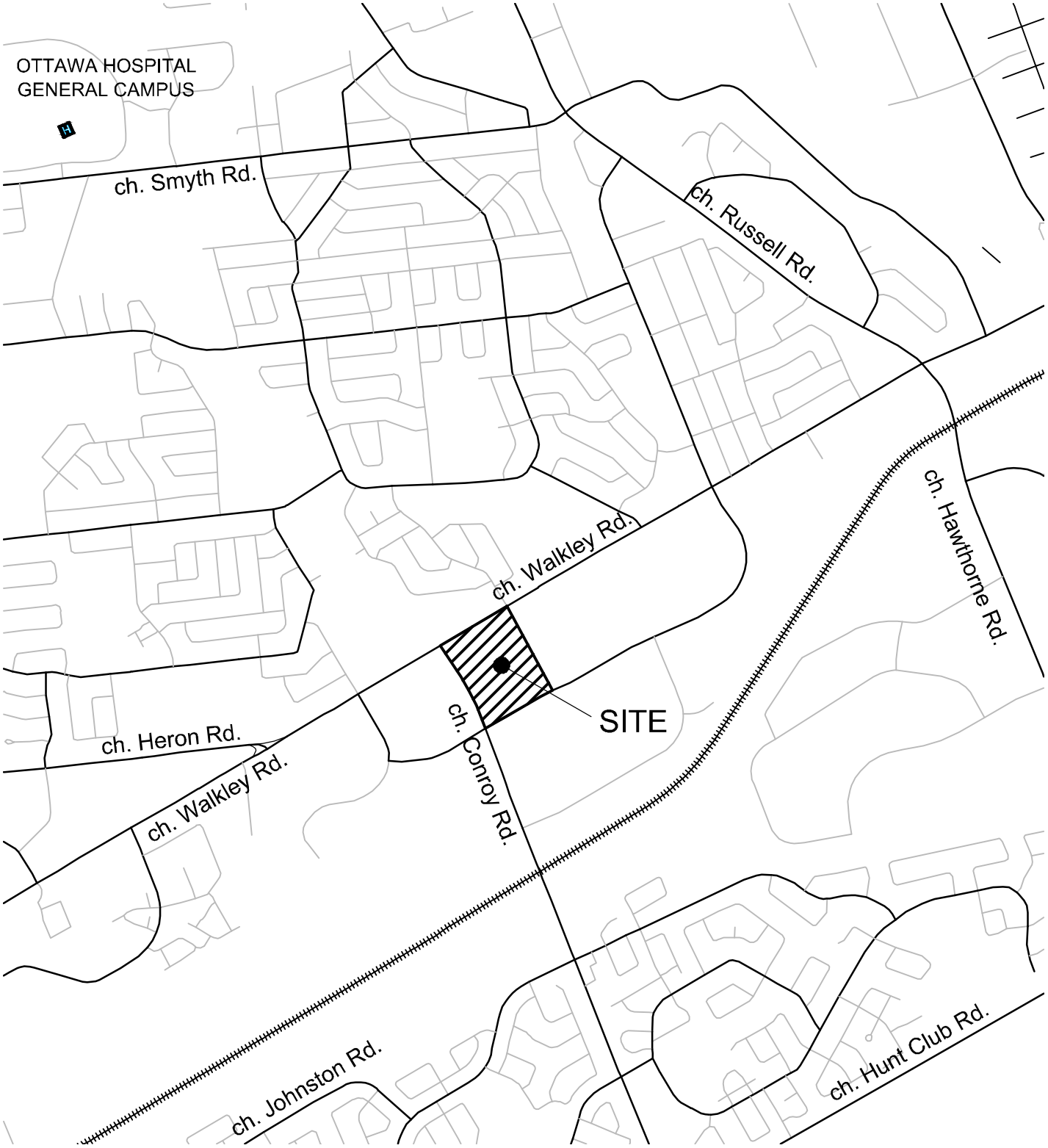
It is proposed to re-develop the site with three new single-story warehouse buildings with associated loading docks and surface parking lots. The proposed re-development of the site will be completed in three phases. The phased development approach allows for the existing buildings to remain in operation while construction of the new warehouse buildings is completed. In phase one it is proposed to construct a new warehouse fronting onto St Laurent Blvd. with 8,547m² of floor space. In phase one a small portion of the existing building fronting onto Conroy Rd. will be demolished to allow for the proposed loading dock. In phase two it is proposed to demolish the remainder of the existing building fronting onto Conroy Rd. and construct a new warehouse with 8,500m² of floor space. Finally, in phase 3 it is proposed to demolish the existing building fronting onto Walkley Rd. and construct a new warehouse with 7,650 m² of floor space. **Figure 3 - 5** shows the proposed re-development and phasing.

The proposed access to the site will remain from Conroy Rd. and Walkley Rd. with an additional new entrance proposed on St Laurent Blvd. In addition to the site plan works there are also road modifications proposed on Conroy Rd. and Walkley Rd. It should be noted that this report should be read in conjunction with the engineering drawing set. The relevant engineering drawings are referenced throughout the report and the full drawing set is listed in **Appendix F**.

4.0 SITE CONSTRAINTS

A geotechnical investigation was also completed for the subject development and a report provided entitled 'Geotechnical Investigation Commercial Development – 2020 Walkley Road Ottawa, Ontario' prepared by Gemtec dated February 23, 2021(we may get an updated version). The following is a summary of the findings of this report:

- The proposed grading design does not exceed the bearing capacity of the native material. Therefore, there are no grade raise concerns with the proposed design.
- Grey shale bedrock was encountered at 17.8m-22.1m below ground surface.
- Groundwater levels are 2.1m-2.4m below ground surface. Groundwater entering the excavation is anticipated to be less than 50,000 L/day therefore, an Environmental Activity and Sector Registry (EASR) will likely not be required.



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N

WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD

KEY PLAN

SCALE		
N.T.S		
DATE	JOB	FIGURE
MARCH 2021	119067	1

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WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD

EXISTING CONDITIONS PLAN

SCALE		
N.T.S		
DATE	JOB	FIGURE
MARCH 2021	119067	2

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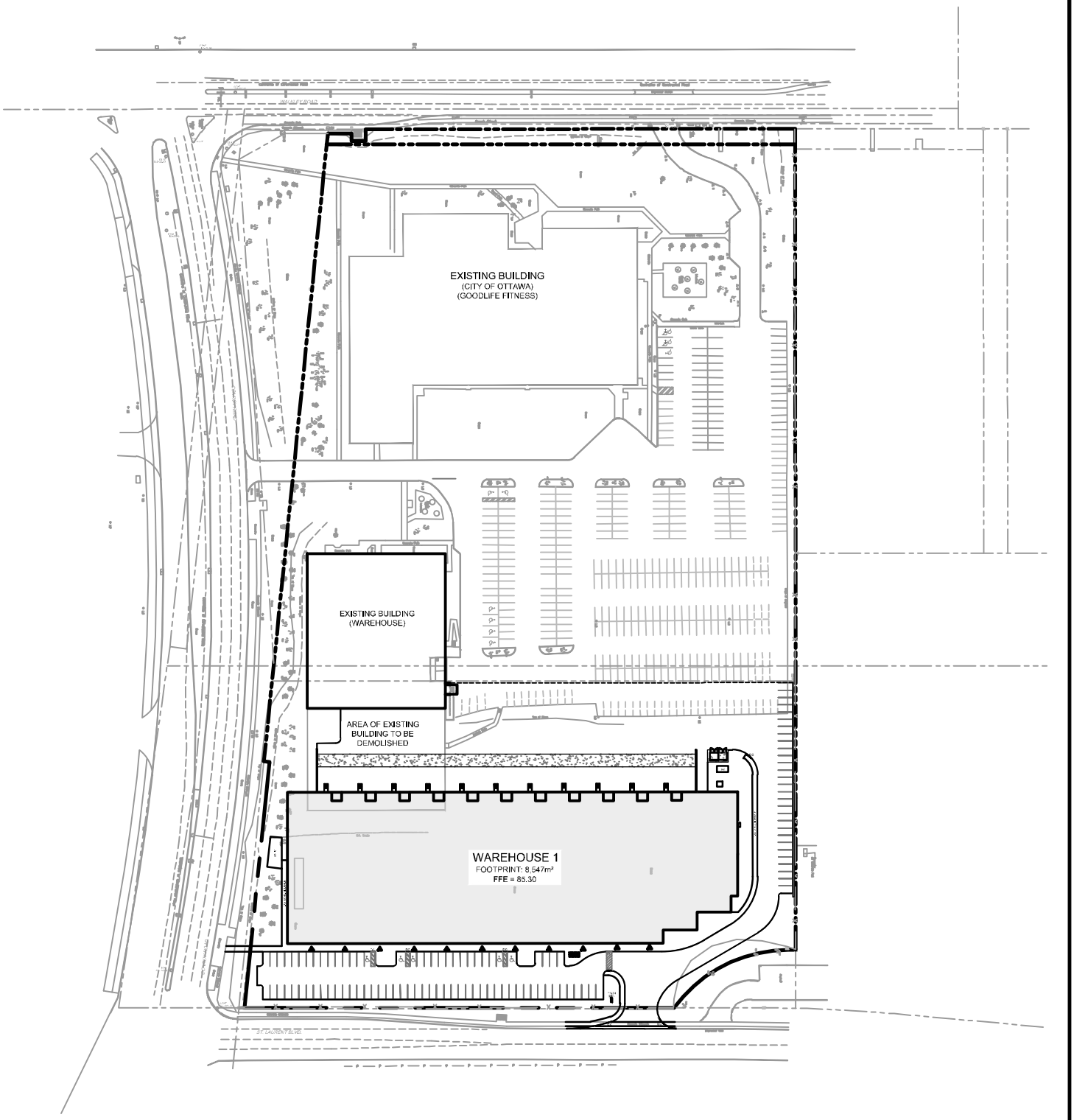

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WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD

SITE PLAN - PHASE 1

SCALE		
N.T.S		
DATE	JOB	FIGURE
MARCH 2021	119067	3

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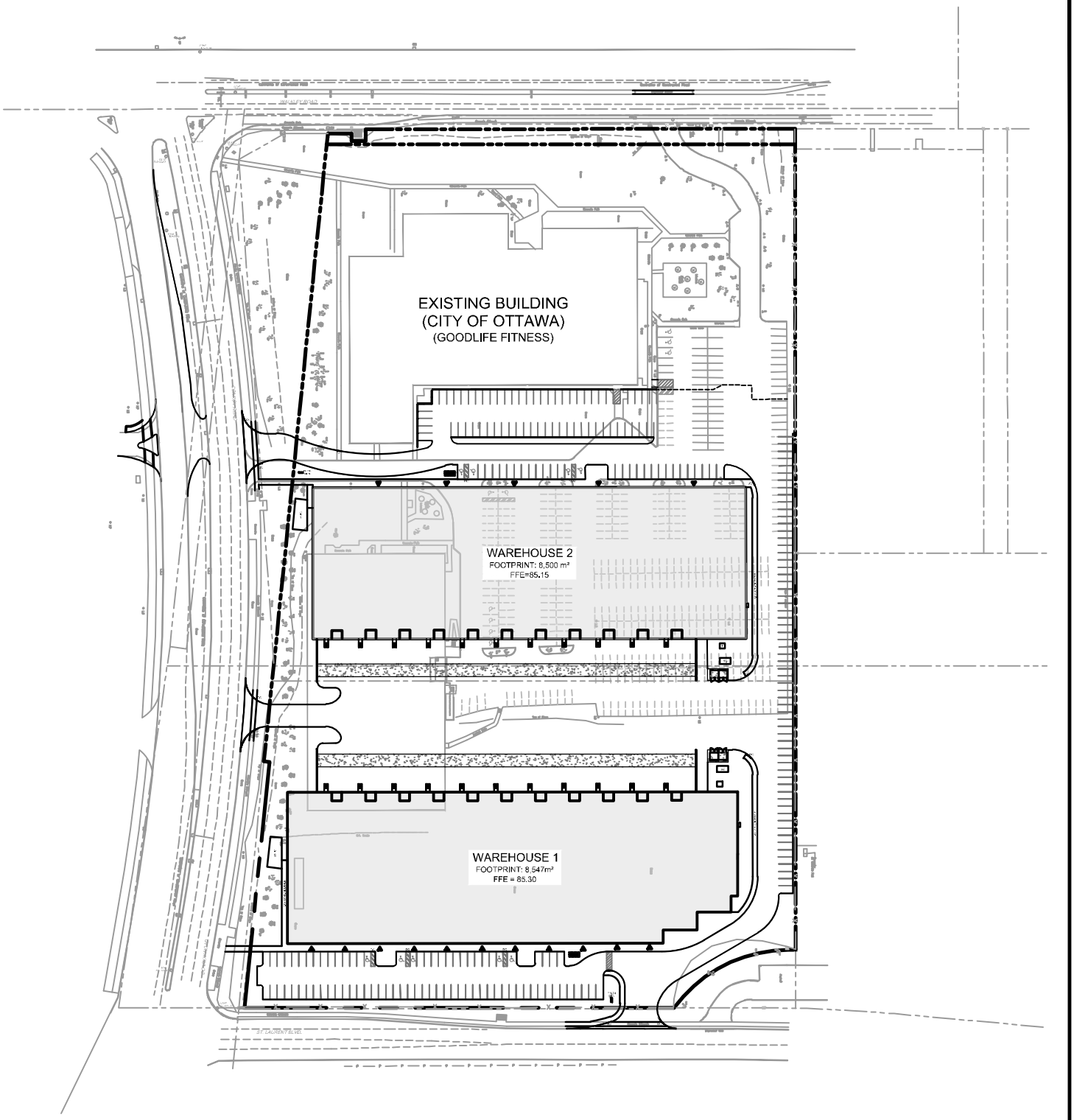

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WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD

SITE PLAN - PHASE 2

SCALE		
N.T.S		
DATE	JOB	FIGURE
MARCH 2021	119067	4

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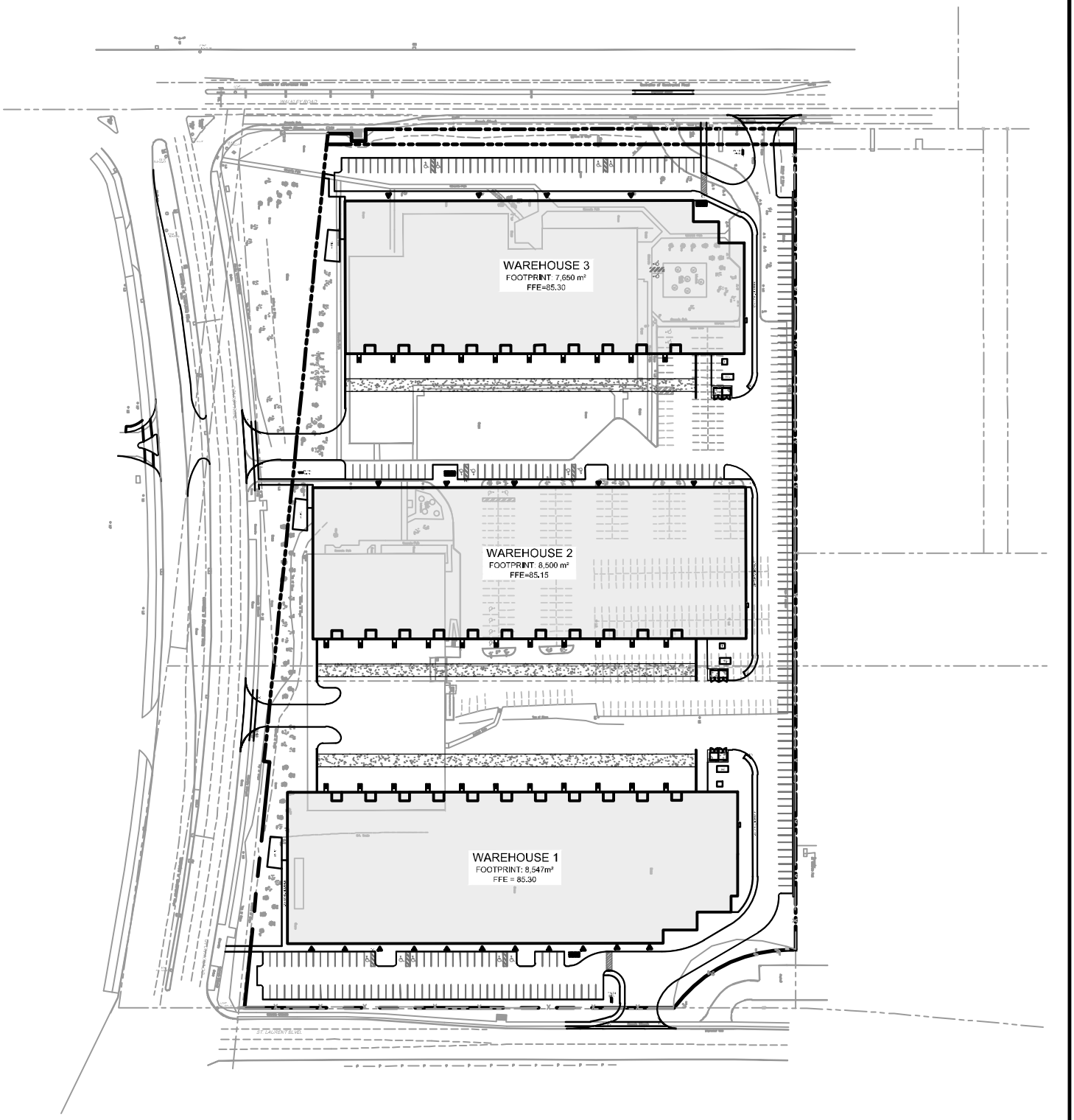

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WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD

SITE PLAN - PHASE 3

SCALE		
N.T.S		
DATE	JOB	FIGURE
MARCH 2021	119067	5

M:\2019\119067\CAD\Design\Figures\Report Figures\FIGURE 5 - SP3.dwg, PHASE 3, Feb 28, 2021 - 1:04pm, amestwarp

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- Catchbasins are to be equipped with 3m long stub drains extending in two directions at the subgrade level to provide adequate drainage of parking areas.

5.0 WATER SERVICING

The existing development is currently serviced from the 400mm diameter watermain in Walkley Rd. There is currently two 200mm dia. and one 150mm dia. diameter private watermains on site that service the existing 2 buildings. The 200mm diameter watermain that services the building fronting on Conroy Rd. also provides fire protection for the site by servicing a hydrant between the two existing buildings. This watermain will be abandoned during phase 2 construction as it is located directly under the footing of the phase three building.

It is proposed to service the development from the existing 400mm dia. watermain in Walkley Rd. and the existing 300mm dia. watermain in St Laurent Blvd. The phase one building will be directly serviced from St Laurent Blvd. with a proposed 200mm dia. service. The phase two and three buildings will be serviced from Walkley Rd. with a new 200mm dia. service on the west of the phase three building. Refer to the General Plan of Services (119067-GP) for further details.

Design Criteria from the City of Ottawa Water Distribution Guidelines and section 8 of the Ontario Building Code were used to calculate the theoretical water demands for the proposed development. The demand calculations were based on flow requirements from the different uses on the site which include, commercial office space and light industrial warehouse space.

The water demand calculations for the proposed development are calculated based on the following criteria:

- Industrial Water Demand
  - per each water closet = 950L/day
  - per each loading bay = 150L/day (each)
- Commercial Office Water Demand
  - per each 9.3m² floor space = 75L/day
- Peaking Factor
  - Max Day = 1.5
  - Peak Hour = 1.8

The domestic water demands for the proposed development are summarized in **Table 5.1** below.

Table 5.1: Domestic Water Demand Summary

Use	Ave. Daily Demand (L/s)	Max. Daily Demand (L/s)	Peak Hour Demand (L/s)
Industrial Flows	0.41	0.61	1.10
Commercial Flows	0.23	0.35	0.62
Total Domestic Demands	**0.64**	**0.96**	**1.72**

The proposed warehouse buildings are to be sprinklered with the Siamese connections located at the front of each building within 45m of a fire hydrant. The Existing hydrants in the Walkley Rd. and St Laurent Blvd. rights-of-way along with two proposed private hydrants will provide fire protection for the proposed development. The required fire demand was calculated using the Fire Underwriters Survey (FUS) Guidelines. The required fire demand for the site was based on the

worst-case scenario. The FUS calculations indicate that warehouse 1 at 167 L/s is governing fire flow for the proposed development.

This water demand information was submitted to the City for boundary conditions from the City's water model. The proposed boundary conditions from the City assumes that the site will connect to the 400mm dia. watermain in Walkley Rd. and 300mm dia. Watermain in St Laurent Boulevard which is in the 2W2C pressure zone of the City of Ottawa water distribution network. Refer to **Table 5.2** for a summary of the proposed boundary conditions and hydraulic analysis.

Table 5.2 Water Boundary Conditions and Hydraulic Analysis Summary

Criteria	Head (m)	Pressure[1] (psi)	Pressure Requirements (psi)
Connection 1 (400mm dia. Walkley Rd)			
Max HGL	124.3	55.5	< 80psi
Min HGL	130.1	63.7	> 40psi
Max Day + Fire Flow	125.9	57.7	> 20psi
Connection 2 (300mm dia. St Laurent Blvd)			
Max HGL	124.7	56.0	< 80psi
Min HGL	130.0	63.6	> 40psi
Max Day + Fire Flow	124.8	56.2	> 20psi

[1]Pressures based on proposed finished floor elevation of 85.30

These boundary conditions were used for analyzing the performance of the proposed and existing watermain systems for three theoretical conditions:

1) High Pressure check under Average Day conditions
2) Peak Hour demand
3) Maximum Day + Fire Flow demand.

The hydraulic analysis indicates that the system can provide adequate pressures and flow to meet the domestic and fire flow requirements for the site. Refer to **Appendix A** for detailed water demand calculations, watermain schematics and City of Ottawa boundary conditions.

6.0 SANITARY SERVICING

The existing development is currently serviced by a private 125mm dia. sanitary service which connects to the existing 525mm dia. sanitary sewer within Walkley Rd. There is also an existing 300mm dia. sanitary sewer in St Laurent Blvd. which is proposed to service the phase one warehouse by extending a 200mm service onto the site. It is proposed to service the phase two and three warehouses by extending a 200mm dia. sewer from the existing 525mm dia. sewer in Walkley Rd. Refer to the General Plan of Services (119067-GP) for more details.

The total theoretical peak sanitary flow for the existing and proposed development was calculated based on criteria from the City of Ottawa Sewer Design Guidelines and Ontario Building Code. A comparison of the existing and proposed peak sanitary flows are provided below in **Table 6.1**.

Table 6.1 Peak Sanitary Flows Comparison Summary

	Pre-Development (L/s)	Post-Development (L/s)	Increase / (Decrease) (L/s)
Peak Flows	0.00	0.78	0.78
Extraneous Flows	0.58	0.62	0.04
Total Peak Flows St Laurent Blvd Sewer	0.58	**1.40**	**0.82**
Peak Flows	1.76	1.48	(0.28)
Extraneous Flows	1.31	1.26	(0.05)
Total Peak Flows Walkley Road Sewer	**3.07**	**2.75**	(0.32)

Based on the results of the sanitary flow comparison the existing sewers will have adequate capacity to service the proposed developments. The marginal increase to the St Laurent Blvd. sanitary sewer is marginal and will have negligible effects. The proposed 200mm diameter sanitary sewers on site have a theoretical capacity ranging from of 23.2 – 56.8 L/s at the proposed slope of 0.5 -3.0%. Therefore, there is adequate capacity in the proposed infrastructure to convey the required peak flows of 1.4 L/s and 2.75 L/s from the site. Refer to **Appendix B** for detailed sanitary flow calculations and Drainage Area Plans.

7.0 STORM SERVICING

The existing site is currently serviced by a private storm sewer system which outlets via a 525mm dia. pipe to the existing 1500mm dia. trunk storm sewer in Walkley Rd. There is also an existing 375/450mm dia. local storm sewer in Conroy Rd. and a 600/750mm dia. local storm sewer in St Laurent Blvd. fronting the site. The existing private storm sewer currently services the developed portion of the site. The remainder of the site drains to existing catchbasins on the south side of the property which outlet to the Conroy Rd. and St Laurent Blvd. sewers.

It is proposed to service the phase one warehouse from the existing 750mm diameter storm sewer in St Laurent Blvd. The phase one storm sewer system will service the rear loading dock and front parking lot with pipes ranging in size from 200mm-450mm in diameter. It is proposed to service the phase two and three warehouses from the existing 1500mm dia. trunk storm sewer in Walkley Rd. The phase two and three storm sewer system will service the rear loading docks and front parking lots for warehouse 2 and 3 with pipes ranging in size from 200mm-600mm in diameter. The large boulevard area to the west of the proposed warehouse buildings will continue to be serviced to the existing 375/450mm dia. sewer in Conroy Rd. Refer to the General Plan of Services (119067-GP) for more details.

The proposed storm sewers have been sized to convey the uncontrolled 2-year storm event using the Rational Method; as per the *City of Ottawa Sewer Design Guidelines (OSDG)* (October 2012). The proposed 450mm and 600mm dia. outlet pipes at a slope of 1.0% and 0.5% have a full-flow capacity of 297.2 L/s and 452.7 L/s respectively. The design criteria used in sizing the storm sewers are summarized in Table 7.1.

Table 7.1: Storm Sewer Design Parameters

Parameter	Design Criteria
Private Roads	2 Year Return Period
Storm Sewer Design	Rational Method
IDF Rainfall Data	Ottawa Sewer Design Guidelines
Initial Time of Concentration (Tc)	10 min
Minimum Velocity	0.8 m/s
Maximum Velocity	3.0 m/s
Minimum Diameter	250 mm

A storm sewer drainage area plan and design sheet for the proposed storm sewer system is provided in **Appendix C** for reference.

8.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

The proposed storm drainage and stormwater management design for the site is discussed in the following sections of the report.

8.1 Stormwater Management Criteria and Objectives

The stormwater management criteria and objectives for the site are as follows, per the City of Ottawa's requirements:

For storm flows being directed to municipal storm sewers in Walkley Rd:

- Control post-development storm flows, up to an including the 100-year design event, to the maximum allowable release rate, using a runoff coefficient equivalent to existing conditions, but in no case greater than C=0.5, a time of concentration no less than 10 minutes and a 2-year rainfall intensity from City of Ottawa IDF curves.

For storm flows being directed to municipal storm sewers in Conroy Rd and St Laurent Blvd:

- Control post-development storm flows, up to an including the 100-year design event, to the maximum allowable release rate, using a runoff coefficient equivalent to existing conditions, but in no case greater than C=0.5, a time of concentration no less than 10 minutes and a 5-year rainfall intensity from City of Ottawa IDF curves.

- Provide a dual drainage system (i.e. minor and major system flows);
- Maximize the use of on-site storage on the building roofs, within the paved parking areas and underground in pipes and structures,
- Ensure that no surface ponding will occur on the paved surfaces (with the exception of depressed loading dock areas) during the 2-year storm event;
- Provide on-site water quality control equivalent to an 'Enhanced' Level of Protection (i.e., minimum 80% long-term TSS removal), as required by the Conservation Authority; and,
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

8.2 Existing Conditions and Allowable Release Rates

As indicated previously there is an existing private storm sewer system servicing the existing development. This system currently outlets to the existing 1500mm dia. Trunk storm sewer in Walkley Rd. The remainder of the undeveloped portion of the site drains to existing catchbasins on the south side of the property which outlet to the Conroy Road and St Laurent Boulevard sewers. The majority of the existing storm infrastructure will be removed or abounded in the proposed condition however, the general outlet locations will be maintained. Refer to the existing stormwater management drainage area plan **117203-EXSWM,** in **Appendix D**, which shows the existing drainage areas.

During the early stages of the detailed design process a Technical Memorandum was prepared by Novatech and reviewed by the City of Ottawa to confirm the allowable release rates and outlet locations for the site. The City of Ottawa confirmed the stormwater control requirements as listed above and approved the proposed storm sewer outlet locations. This memo along with City correspondence is provided in **Appendix F** for Reference.

The allowable release rate to each storm sewer outlet was determined using rational method calculations. The allowable release rate to each storm sewer connection was calculated to be 38.4 L/s to Conroy Road, 117.2 L/s to St Laurent Boulevard and 313.4 L/s to Walkley Road. A summary of the allowable release rates is provided in **Table 8.1.** Refer to **Appendix D** for detailed rational method calculations, time of concertation calculations and the **Existing SWM Drainage Area Plan (119067-EXSWM).**

Table 8.1: Allowable Release Rates

Drainage Area ID	Drainage Area (ha)	Run off Coefficient C	Outlet Location	Time of Concentration (min)	Allowable Flow (L/s)
EX 1A	0.79	0.20	St Laurent Blvd	10	45.8
EX 1B	0.63	0.41	St Laurent Blvd	11	71.4
EX 1	1.42	0.29	St Laurent Blvd	11	**117.2**
EX 2	0.73	0.20	Conroy Road	12	**38.4**
EX 3	3.65	0.50	Walkley Road	15	**313.4**

8.3 Proposed Conditions – Quantity Control

As stated in **Section 8.1**, the criteria specific to quantity control for the Site is as follows:

- Control the 100-year post-development flow from the site to an allowable release rate corresponding to the 5-year pre-development peak flow for the St Laurent Blvd and Conroy Rd sewer and to the 2-year pre-development peak flow for the Walkley Rd sewer.
- Ensure that no surface ponding will occur on the paved surfaces (exception for proposed depressed loading docks) during the 2-year storm event.

As previously described the site outlets to three municipal storm sewers. The overall area tributary to each sewer outlet has been divided into multiple smaller drainage areas as follows:

St Laurent Boulevard Storm Sewer (Phase 1)

Area A-1, A-2

- Stormwater from the landscape areas fronting onto St Laurent Blvd will sheet drain directly to the road. Quantity control of storm water will not be provided for this area.

Area A-3

- Stormwater from the building roof will be captured and controlled by flow control roof drains prior to releasing to the onsite storm sewer system. Storage of stormwater will be provided for storms up to and including the 100-year event on the roof area.

Area A-4 – A-8

- Stormwater from loading dock, parking lot, and access road will be collected in catchbasins and conveyed by the onsite storm sewer system to the existing municipal storm sewer in St Laurent Blvd. The release of stormwater to the municipal system will be controlled through the implementation of inlet control devices. Storage of stormwater will be provided in the underground storm sewer system and on the surface through localized ponding at catchbasins.

Conroy Road Storm Sewer (Phase 1,2,3)

Area B1, B2

- Stormwater from the landscape areas to the west of warehouse 1 & 3 will be collected by existing catchbasins and drain uncontrolled to the existing storm sewer in Conroy Rd. Quantity control of storm water will not be provided for this area.

Area B3

- Stormwater from the landscape areas to the west of warehouse 2 will be collected by a new catchbasin and conveyed to the Conroy Rd storm sewer. The release of stormwater to the municipal system will be controlled through the implementation of and inlet control device. Storage of stormwater will be provided on the surface in the landscaped swale.

Walkley Road Storm Sewer (Phase 2,3)

Area C1

- Stormwater from the small landscape areas fronting onto Walkley Rd. will sheet drain directly to the road. Quantity control of storm water will not be provided for this area.

Area C2, C3

- Stormwater from the building roofs will be captured and controlled by flow control roof drains prior to releasing to the onsite storm sewer system. Storage of stormwater will be provided for storms up to and including the 100-year event on the roof area.

Area C-4 – C-8

- Stormwater from loading dock, parking lot, and access road areas will be collected in catchbasins and conveyed by the onsite storm sewer system to the existing municipal storm sewer in Walkley Rd. The release of stormwater to the municipal system will be controlled through the implementation of inlet control devices. Storage of stormwater will be provided in the underground storm sewer system and on the surface through localized ponding at catchbasins.

Refer to the Stormwater Management Plan (119067-SWM) for the various drainage areas. Following the City of Ottawa guidelines for modified rational method calculations the controlled flow areas with combined underground and surface storage have been controlled to 50% of the allowable release.

Table 8.2 below summarizes the flow, storage required, and maximum storage provided for each of the drainage areas to the St Laurent Blvd storm sewer.

Table 8.2 Stormwater Management Summary - St Laurent Blvd

Area ID	Area (ha)	C	Orifice Size & Type	2 Year Storm Event		5 Year Storm Event		100 Year Storm Event		
				Flow (L/s)	Req. Vol. (m^3)	Flow (L/s)	Req. Vol. (m^3)	Flow (L/s)	Req. Vol. (m^3)	Max. Vol. Prov. (m^3)
A-1	0.037	0.20	N/A	1.0	N/A	1.4	N/A	3.1	N/A	N/A
A-2	0.026	0.25	N/A	1.1	N/A	1.5	N/A	3.2	N/A	N/A
A-3	0.855	0.90	100-A-ADJ	10.5	153.3	12.1	11.5	22.1	25.9	26.2
Total (Direct Runoff & Roof Area)				**12.6**		**15.0**		**28.4**		
A-4	0.497	0.81	LMF 100	15.0	53.4	15.2	81.7	15.5	195.1	507.8
A-5	0.273	0.85	LMF 100	13.5	23.9	15.2	35.9	15.5	91.8	127.3
A-6	0.041	0.83	LMF 60	4.1	1.9	4.6	3.2	4.7	9.6	17.3
A-7	0.052	0.78	LMF 55	4.1	2.7	4.3	4.6	4.5	12.8	27.7
A-8	0.028	0.78	LMF 55	4.1	0.8	4.0	1.4	4.1	5.0	7.6
Total Post (Controlled Flows Only)				**40.8**		**43.3**		**44.3**		
50% Allowable Release Rate				**44.4**		**44.4**		**44.4**		
Total Post Development Flow				**53.4**		**58.3**		**72.7**		
Total Allowable Release Rate				**117.2**		**117.2**		**117.2**		
Total Pre-Development Flow				**86.4**		**117.2**		**239.7**		

Table 8.3 below summarizes the flow, storage required, and maximum storage provided for each of the drainage areas to the Conroy Rd storm sewer.

Table 8.3 Stormwater Management Summary – Conroy Rd

Area ID	Area (ha)	C	Orifice Size & Type	2 Year Storm Event		5 Year Storm Event		100 Year Storm Event		
				Flow (L/s)	Req. Vol. (m^3)	Flow (L/s)	Req. Vol. (m^3)	Flow (L/s)	Req. Vol. (m^3)	Max. Vol. Prov. (m^3)
B-1	0.076	0.31	N/A	5.0	N/A	6.8	N/A	13.9	N/A	N/A
B-2	0.114	0.26	N/A	6.4	N/A	8.6	N/A	17.9	N/A	N/A
B-3	0.097	0.26	LMF 85	5.5	0.0	6.0	0.87	6.2	5.51	7.03
Total Post Development Flow				**16.9**		**15.4**		**38.0**		
Total Allowable Release Rate				**38.4**		**38.4**		**38.4**		
Total Pre-Development Flow				**28.4**		**38.4**		**82.3**		

Table 8.4 below summarizes the flow, storage required, and maximum storage provided for each of the drainage areas to the Walkley Rd storm sewer.

Table 8.4 Stormwater Management Summary – Walkley Rd

Area ID	Area (ha)	C	Orifice Size & Type	2 Year Storm Event		5 Year Storm Event		100 Year Storm Event		
				Flow (L/s)	Req. Vol. (m^3)	Flow (L/s)	Req. Vol. (m^3)	Flow (L/s)	Req. Vol. (m^3)	Max. Vol. Prov. (m^3)
C-1	0.019	0.24	N/A	1.0	N/A	1.3	N/A	2.7	N/A	N/A
C-2	0.845	0.90	100-A-ADJ	10.5	150.9	12.1	211.7	22.1	411.7	429.3
C-3	0.765	0.90	100-A-ADJ	9.0	139.1	11.8	187.3	18.9	378.7	388.6
Total (Direct Runoff & Roof Area)				**20.5**		**25.3**		**43.7**		
C-4	0.574	0.87	83mm Plate	19.1	65.3	19.6	99.8	20.3	236.9	485.2
C-5	0.066	0.80	LMF 80	6.8	2.7	7.5	4.7	7.7	14.5	46.3
C-6	0.047	0.86	LMF 70	5.3	2.0	5.7	3.6	6.0	10.7	21.0
C-7	0.303	0.87	83mm Plate	19.2	23.7	22.7	35.0	23.5	93.2	94.2
C-8	0.405	0.87	83mm Plate	20.5	36.6	20.7	58.5	21.2	146.1	325.8
C-9	0.056	0.88	LMF 70	5.5	3.0	5.8	5.0	6.0	14.6	24.8
C-10	0.069	0.79	LMF 70	6.4	3.5	6.2	5.8	6.4	16.7	41.9
C-11	0.129	0.57	LMF 90	10.0	3.5	10.5	6.6	10.9	20.5	38.7
C-12	0.332	0.63	83mm Plate	16.7	17.1	22.8	22.9	25.0	64.0	104.2
Total Post (Controlled Flows Only)				**109.5**		**121.5**		**127.0**		
50% Allowable Release Rate				**134.8**		**134.8**		**134.8**		
Total Post Development Flow				**130.0**		**146.8**		**170.7**		
Total Allowable Release Rate				**31.4**		**313.4**		**313.4**		
Total Pre-Development Flow				**423.4**		**572.8**		**1101.4**		

Refer to **Appendix D** for Rational Method calculations, Modified Rational Method calculations, stage storage curves, and orifice Calculations. Refer to the Grading Plans (119067-GR) and the Stormwater Management Plan (119067-SWM) for more details.

8.4 Proposed Conditions – Quality Control

Quality control of stormwater shall be provided to an *Enhanced* level of treatment or 80% removal of total suspended solids. Quality control for stormwater from parking and paved surfaces will be provided through the installation of two oil grit separator units. The proposed OGS units are CDS PMSU2025_5 and PMSU3030_6 which will be located at the outlet to the municipal sewer in St Laurent Blvd. and Walkley Rd. respectively. The OGS units will provide enhanced levels of water quality prior to discharging into the municipal storm sewer system. The target level of protection for long term removal of TSS is 80% with an overall treatment of 100% of the total runoff.

Refer to **Appendix D** for the CDS unit operation, design, performance and maintenance summary parameters as well as the annual TSS removal efficiency data.

8.5 Major Overland Flow Route

A major overland flow route will be provided for storms greater than the 100-year storm event. For the areas directly fronting onto St Laurent Blvd and Walkley Rd (front of warehouse 1 and 3) stormwater will spill directly to the rights-of-way. Stormwater from the remainder of the site will spill as per existing conditions through the rear and side yard of the neighbouring property at 2400

St Laurent Blvd to reach the right-of-way. This is an existing condition that cannot easily be rectified as the existing pavement elevations of Walkley Rd, Conroy Rd and St Laurent Blvd directly fronting the site are approximately 0.6-2m above the existing spill elevation for the site. The major overland system is shown on the Grading Plan (119067-GR).

9.0 EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter socks (catchbasin inserts) will be placed in existing and proposed catchbasins and catchbasin manholes, and will remain in place until vegetation has been established and construction is completed;
- Silt fencing will be placed along the surrounding construction limits;
- Mud mats will be installed at the site entrances;
- Strawbale or rock check dams will be installed in swales and ditches;
- The contractor will be required to perform regular street sweeping and cleaning as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site;

Erosion and sediment control measures should be inspected daily and after every rain event to determine maintenance, repair or replacement requirements. Sediments or granulars that enter site sewers shall be removed immediately by the contractor. These measures will be implemented prior to the commencement of construction and maintained in good order until vegetation has been established. Refer to the Erosion and Sediment Control Plan (119067-ESC) for additional information.

10.0 CONCLUSIONS AND RECOMMENDATIONS

Watermain

The analysis of the existing and proposed watermain network confirms the following:

- The proposed 200mm dia. watermain that connects to the existing 300mm dia. watermain in St Laurent Blvd and the 400mm dia. watermain in Walkley Rd can service the proposed development.
- It is anticipated that there are adequate pressures in the existing watermain infrastructure to meet the required domestic demands for the development.
- It is anticipated that there is adequate flow to service the proposed fire protections system.

Sanitary Servicing

The analysis of the existing and proposed sanitary system confirms the following:

- It is anticipated there is adequate capacity within the existing sanitary infrastructure to service the proposed development. The increase in post development flows from pre-development are considered negligible .
- The proposed sanitary system on site has been designed accordingly to convey the post-development flows.

Stormwater Management

The following provides a summary of the storm sewer and stormwater management system:

- The proposed storm sewer system for phase one is to connect to the existing 750mm dia. storm sewer system in St Laurent Blvd.
- The proposed storm sewer system for phase two and three is to connect to the existing 1500mm dia. storm trunk sewer system in Walkley Rd.
    - Storm sewers (minor system) have been designed to convey the uncontrolled 2-year peak flow using the Rational Method.
    - Underground storage is be provided within the storm sewers and structures.
    - There will be no surface ponding during the 2-year storm event except for in the depressed loading dock areas.
- Parking lots have been graded to ensure that static ponding depths do not exceed 0.35m.
    - As per existing condition a major overland flow route is provided to St Laurent Blvd through the rear and side yard of the neighbouring property at 2400 St Laurent Blvd.
- Quality control of stormwater will be provided through implementation of OGS units at each storm sewer outlet.

Erosion and Sediment control

- Erosion and sediment control measures (i.e. filter fabric, catchbasin inserts, silt fences, etc.) will be implemented prior to construction and are to remain in place until vegetation is established.

11.0 CLOSURE

The preceding report is respectfully submitted for review and approval. Please contact the undersigned should you have questions or require additional information.

NOVATECH

Prepared by:

Matt Hrehoriak, P.Eng.
Project Engineer
Land Development Engineering

Reviewed by:

J. Lee Sheets, C.E.T.
Director
Land Development Engineering

APPENDIX A
Water Servicing Information

Project No. 119067
Project Name: 2020 Walkley Road
Project Location: Ottawa

NOVATECH
Engineers, Planners & Landscape Architects

Date: February 2021

Domestic Water Demands

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Industrial :	150	L/day/loading bay
	950	L/day/washroom
Commercial	75	L/day/parking space

Industrial Peaking Factors City of Ottawa Water Distrubution Guidelines

Conditions	Peaking Factor	
Maximum Day	1.5	x avg day
Peak Hour	1.8	x max day

Proposed Development Conditions

	Warehouse 1	Warehouse 2	Warehouse 3	Totals
Office Floor Area (sqm)	855	850	765	2470
No. Loading Bays	11	11	10	32
No. Wasrooms	11	11	10	32
Total Daily Volume (Liters)	18995	18955	17169	55119
Avg Day Demand (L/s)	0.220	0.219	0.199	**0.64**
Max Day Demand (L/s)	0.330	0.329	0.298	**0.96**
Peak Hour Demand (L/s)	0.594	0.592	0.537	**1.72**

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

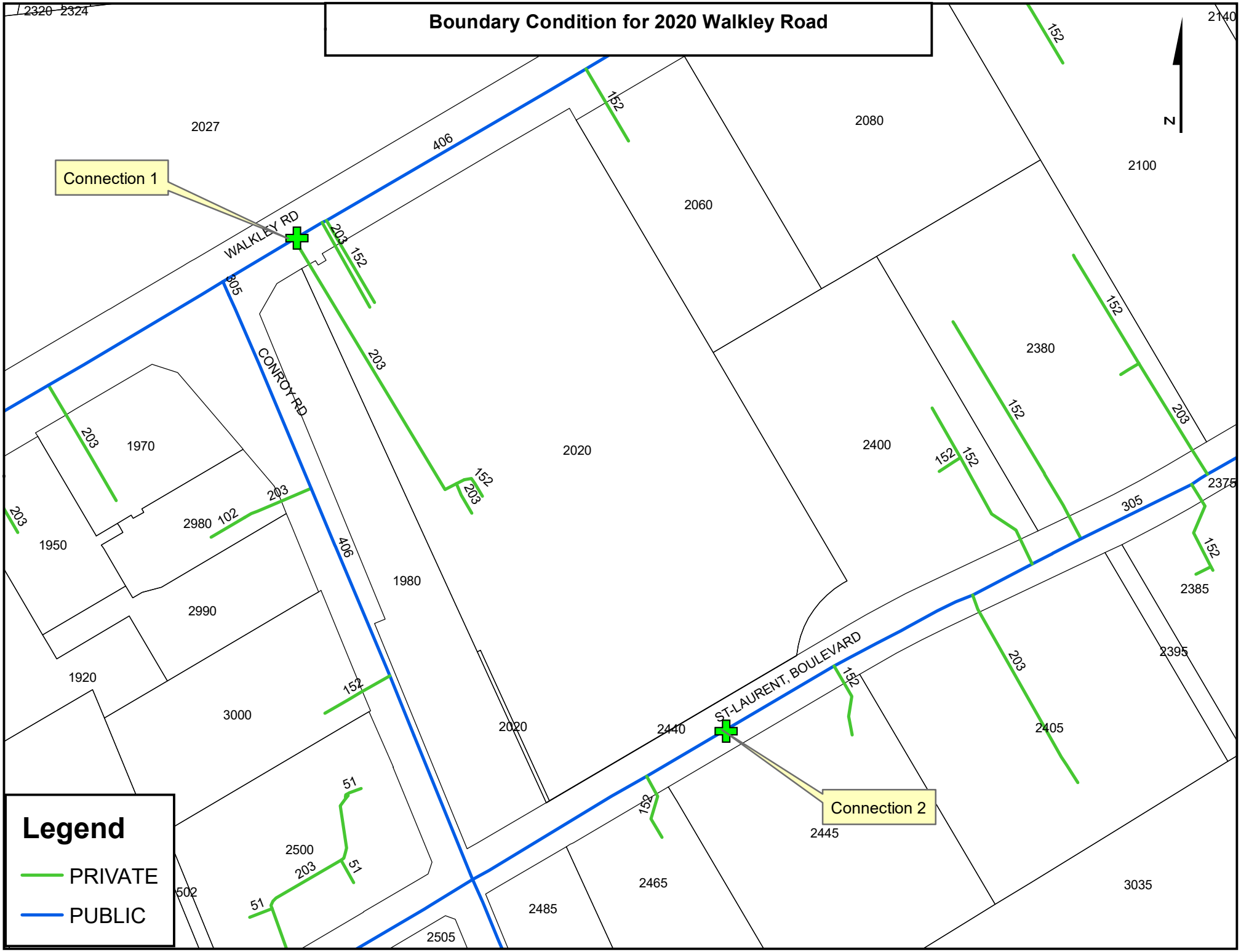
NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 119067
Project Name: 2020 Walkley Road
Date: 12/23/2020
Input By: Matt Hrehoriak
Reviewed By: Lee Sheets

Legend: Input by User; No Information or Input Required

Building Description: 1 Storey Warehouse
Non-combustible construction

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction **C**	Wood frame		1.5	0.8	
		Ordinary construction		1		
		Non-combustible construction	Yes	0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	8590			
		Number of Floors/Storeys	1			
		Area of structure considered (m^2)			**8,590**	
	F	**Base fire flow without reductions**				**16,000**
		F = 220 **C** (**A**)$^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	0%	**16,000**
		Limited combustible		-15%		
		Combustible	Yes	0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-8,000**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	Yes	-10%	-10%	
				Cumulative Total	**-50%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	> 45.1m		0%	**1,600**
		East Side	20.1 - 30 m		10%	
		South Side	> 45.1m		0%	
		West Side	> 45.1m		0%	
				Cumulative Total	**10%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**10,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**167**
				or	USGPM	2,642
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	1200


Boundary Condition for 2020 Walkley Road
Connection 1
Connection 2
WALKLEY RD
CONROY RD
ST-LAURENT, BOULEVARD
N
2320 2324
2140
2027
2080
2100
2060
2380
2400
2020
1970
1950
2980
2990
1980
1920
3000
2020
2440
2445
2405
2395
2385
2375
2500
2465
2485
3035
2505
406
305
203
152
102
51
Legend
PRIVATE
PUBLIC

Matthew Hrehoriak

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: Wednesday, January 13, 2021 11:20 AM
To: Matthew Hrehoriak
Subject: RE: 2020 Walkley Boundary Condition Request
Attachments: 2020 Walkley Road January 2021.pdf

Hi Matt,

Please find below and attached the water boundary conditions for 2020 Walkley -

The following are boundary conditions, HGL, for hydraulic analysis 2020 Walkley (zone 2W2C) assumed to be connected to the 406mm on Walkley Road and 305mm on St Laurent Boulevard (see attached PDF for location).

Connection 1:

Minimum HGL = 124.3m

Maximum HGL = 130.1m

Max Day + Fire Flow (167 L/s) = 125.9m

Connection 2:

Minimum HGL = 124.7m

Maximum HGL = 130.0m

Max Day + Fire Flow (167 L/s) = 124.8m

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.

Thanks,
Adam

Adam Baker, EIT
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 26552, Adam.Baker@ottawa.ca

From: Matthew Hrehoriak <m.hrehoriak@novatech-eng.com>
Sent: January 05, 2021 2:40 PM

To: Baker, Adam <adam.baker@ottawa.ca>
Subject: RE: 2020 Walkley Boundary Condition Request

See attached water connection locations sketch. We are planning to reuse the existing water connection on Walkley Road to service the site and provide a second connection separated by an isolation valve for redundancy. On a side note will you be able to review the SWM memo this week, we would like buy in before we begin any detailed SWM calculations.

Let me know if you have any questions.

Thanks,

Matthew Hrehoriak, P.Eng., Project Engineer | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 273 | Fax: 613.254.5867

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: Tuesday, January 5, 2021 11:23
To: Matthew Hrehoriak <m.hrehoriak@novatech-eng.com>
Subject: RE: 2020 Walkley Boundary Condition Request

Hi Matthew,

For this request could you please provide a sketch showing the proposed watermain connection points in Walkley, Conroy, and St-Laurent.

Thank you,
Adam

Adam Baker, EIT
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 26552, Adam.Baker@ottawa.ca

From: Matthew Hrehoriak <m.hrehoriak@novatech-eng.com>
Sent: January 04, 2021 9:21 AM
To: Baker, Adam <adam.baker@ottawa.ca>
Subject: 2020 Walkley Boundary Condition Request

I have calculated the proposed water demands for the development at 2020 Walkley Road. I am sending you this e-mail to request watermain boundary conditions for the 400mm dia. municipal WM fronting the subject property in Walkley Road, Conroy Road and St Laurent Blvd. The anticipated water demands for the proposed development are as follows:

- Average Day Demand = 0.54 L/s
- Maximum Day Demand = 0.81 L/s
- Peak Hour Demand = 1.46 L/s
- Maximum Fire Flow Demand = 167 L/s (see attached FUS calculations for details)

Regards,

Matthew Hrehoriak, P.Eng., Project Engineer | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 273 | Fax: 613.254.5867

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APPENDIX B
Sanitary Servicing Information

Project No. 119067
Project Name: 2020 Walkley Road
Project Location: Ottawa

Date: FEBRUARY 2021

Existing Peak Sanitary Flows

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Commercial	75	L/ day/ 9.3 m of Office Space

Industrial & Commercial Sanitary Peaking Factors

Conditions	**Peaking Factor**
Commercial	1.5

Proposed Development Conditions

	Undeveloped Area	Conroy Building	Walkley Building	**Total**
Commercial Floor Area sqm	0	6383	6191	12574
Peak Commercial Flows (L/s)	0.00	0.89	0.87	1.76
Site Area (ha)	1.755	2.065	1.890	5.71
Extraneuos Flows (L/s/ha)	0.33	0.33	0.33	0.33
Infiltration (L/s)	0.58	0.68	0.62	1.88
Total Peak Sanitary Flows (L/s)	0.58	1.58	1.49	3.64

Total Peak Sanitary Flow to St Laurent Blvd **0.58 L/s**
Total Peak Sanitary Flow to Walkley Rd **3.07 L/s**

Project No. 119067
Project Name: 2020 Walkley Road
Project Location: Ottawa

NOVATECH
Engineers, Planners & Landscape Architects

Date: FEBRUARY 2021

Proposed Peak Sanitary Flows

Daily Demands from OBC Table 8.2.1.3

Establishment	Daily Demand Volume	
Industrial :	150	L/day/loading bay
	950	L/day/washroom
Commercial	75	L/ day/ 9.3 m of Office Space

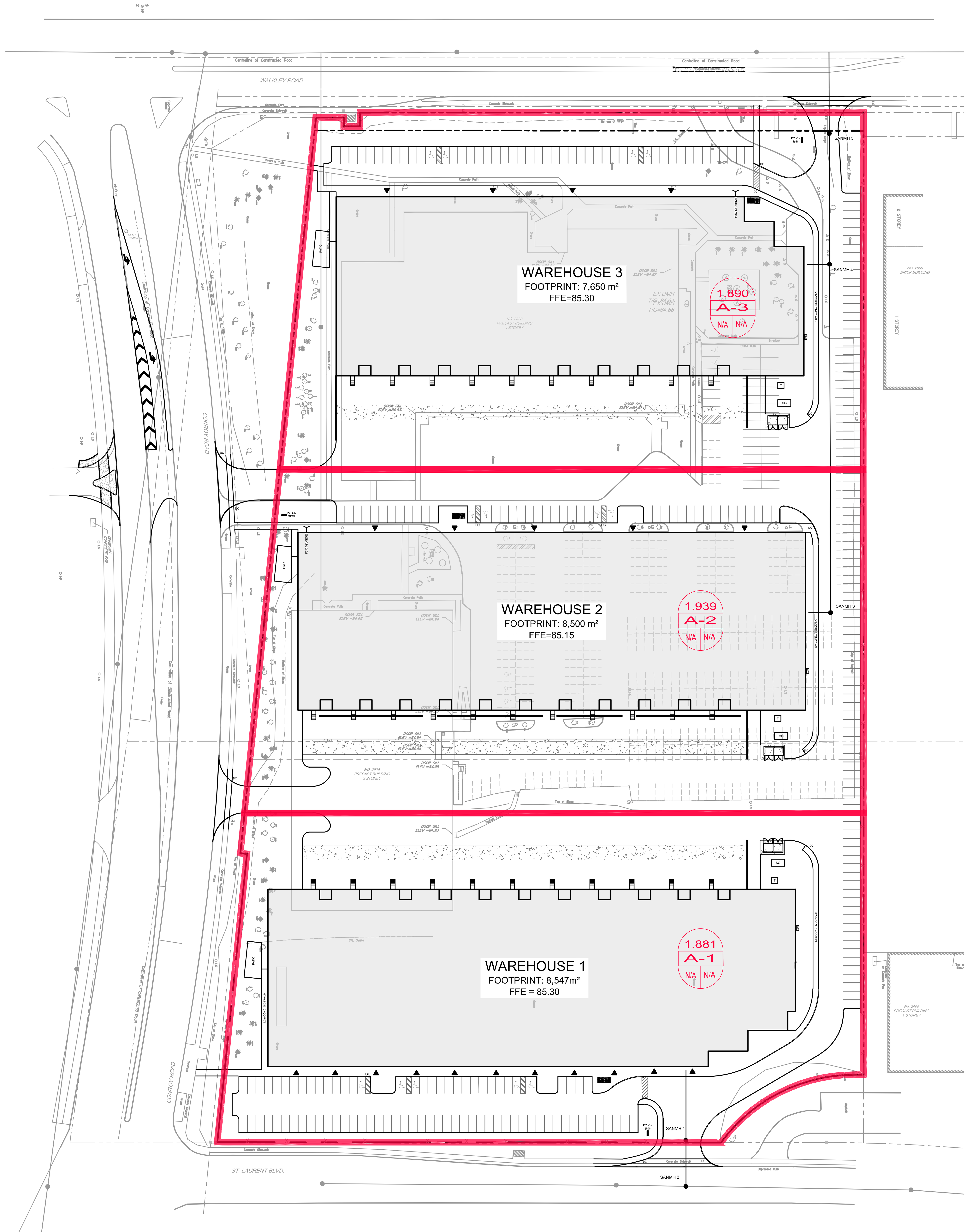
Industrial & Commercial Sanitary Peaking Factors

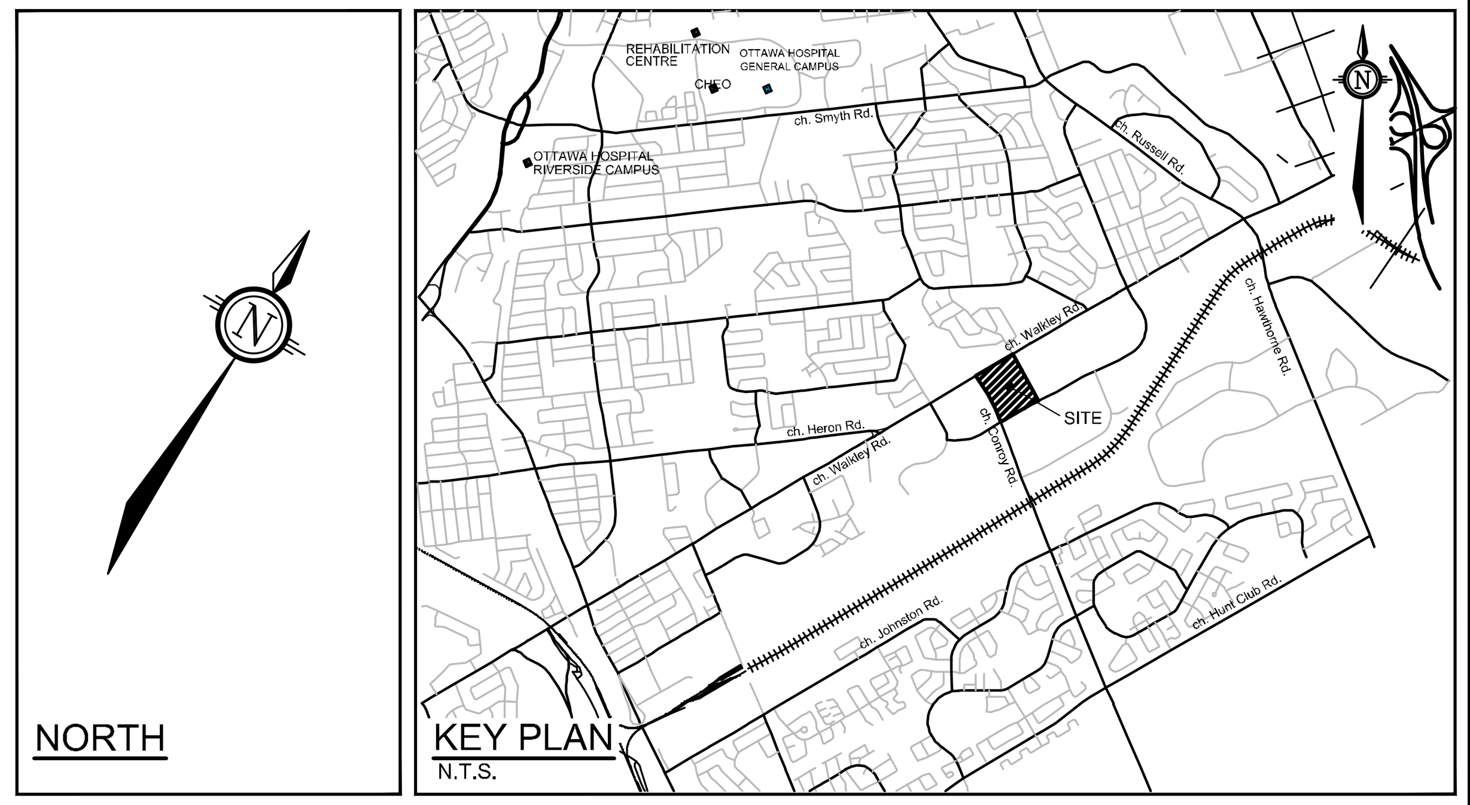
Conditions	**Peaking Factor**
Commercial	1.5
Light Industrial	4.7

Proposed Development Conditions

	Warehouse 1	Warehouse 2	Warehouse 3	**Total**
Office Floor Area sqm	855	850	765	2470
No. Loading Bays	11	11	10	32
No. Washrooms	11	11	10	32
Peak Commercial Flows (L/s)	0.12	0.12	0.11	0.35
Peak Industrial Flows (L/s)	0.66	0.66	0.60	1.91
Site Area (ha)	1.881	1.939	1.890	5.71
Extraneuos Flows (L/s/ha)	0.33	0.33	0.33	0.33
Infiltration (L/s)	0.62	0.64	0.62	1.88
Total Peak Sanitary Flows (L/s)	1.40	1.42	1.33	4.14

Total Peak Sanitary Flow to St Laurent Blvd **1.40 L/s**
Total Peak Sanitary Flow to Walkley Rd **2.75 L/s**





LEGEND

- PROPERTY LINE
- PROPOSED SANITARY SEWER AND MANHOLE
- SAN MH — EXISTING SANITARY MANHOLE & SEWER
- SANITARY SEWER DRAINAGE AREA BOUNDARY
- 6.388 / A-01 / N/A N/A — DRAINAGE AREA (ha) / SAN SEWER PIPE RUN / POPULATION / NO. UNITS

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

Owner:
Manulife Ontario Property Portfolio Inc.
55 Metcalfe Street - Suite 1490
Ottawa, ON
M5G 2L5

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	ISSUED FOR SITE PLAN APPLICATION	MAR 5/21	MJH
1.	ISSUED FOR COORDINATION	MAR 01/21	MJH

SCALE 1:750

1:750 — 0 10 20 30

DESIGN MJH/ARM
CHECKED JLS
DRAWN MJH/ARM
CHECKED JLS
APPROVED MJH

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA

DRAWING NAME
SANITARY DRAINAGE AREA PLAN

PROJECT No. 119067
REV REV #2
DRAWING No. 119067-SAN

PLANA1.DWG - 841mmx594mm

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Project No. 119067
Project Name: Walkley Conroy Warehouses
Project Location: 2020 Walkley Road, Ottawa

Engineers, Planners & Landscape Architects

Date: February 2021

Sanitary Sewer Design Sheet

LOCATION			COMMERCIAL / INDUTRIAL FLOW							PIPE					
AREA ID	FROM	TO	AREA (ha)	ACCUM AREA (ha)	PEAK FACTOR	PEAK FLOW (l/s)	ACCUM PEAK FLOW (l/s)	INFIL. FLOW (l/s)	TOTAL PEAK FLOW (l/s)	PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	Q/Qfull
St Laurent Blvd 300mm dia San Sewer Outlet															
A-01	WAREHOUSE 1	SAN MH 1	1.881	1.881	4.7	0.78	0.78	0.62	1.40	200	2.00	21.6	46.3	1.5	3.0%
	SAN MH 1	SAN MH 2	0.000	1.881		0.00	0.78	0.62	1.40	200	3.00	14.1	56.8	1.8	2.5%
Walkley Road 525mm dia San Sewer Outlet															
A-02	WAREHOUSE 2	SAN MH 3	1.939	1.939	4.7	0.78	0.78	0.64	1.42	200	2.00	5.7	46.3	1.5	3.1%
	SAN MH 3	SANMH 4	0.000	1.939		0.00	0.78	0.64	1.42	200	0.50	106.7	23.2	0.7	6.1%
A-03	WAREHOUSE 3	SANMH 4	1.890	1.890	4.7	0.71	0.71	0.62	1.33	200	2.00	6.9	46.3	1.5	2.9%
	SANMH 4	SAN MH 5	0.000	3.829		0.00	1.49	1.26	2.75	200	0.50	40.1	23.2	0.7	11.9%
	SAN MH 5	EX SEWER	0.000	3.829		0.00	1.49	1.26	2.75	200	2.00	25.0	46.3	1.5	5.9%

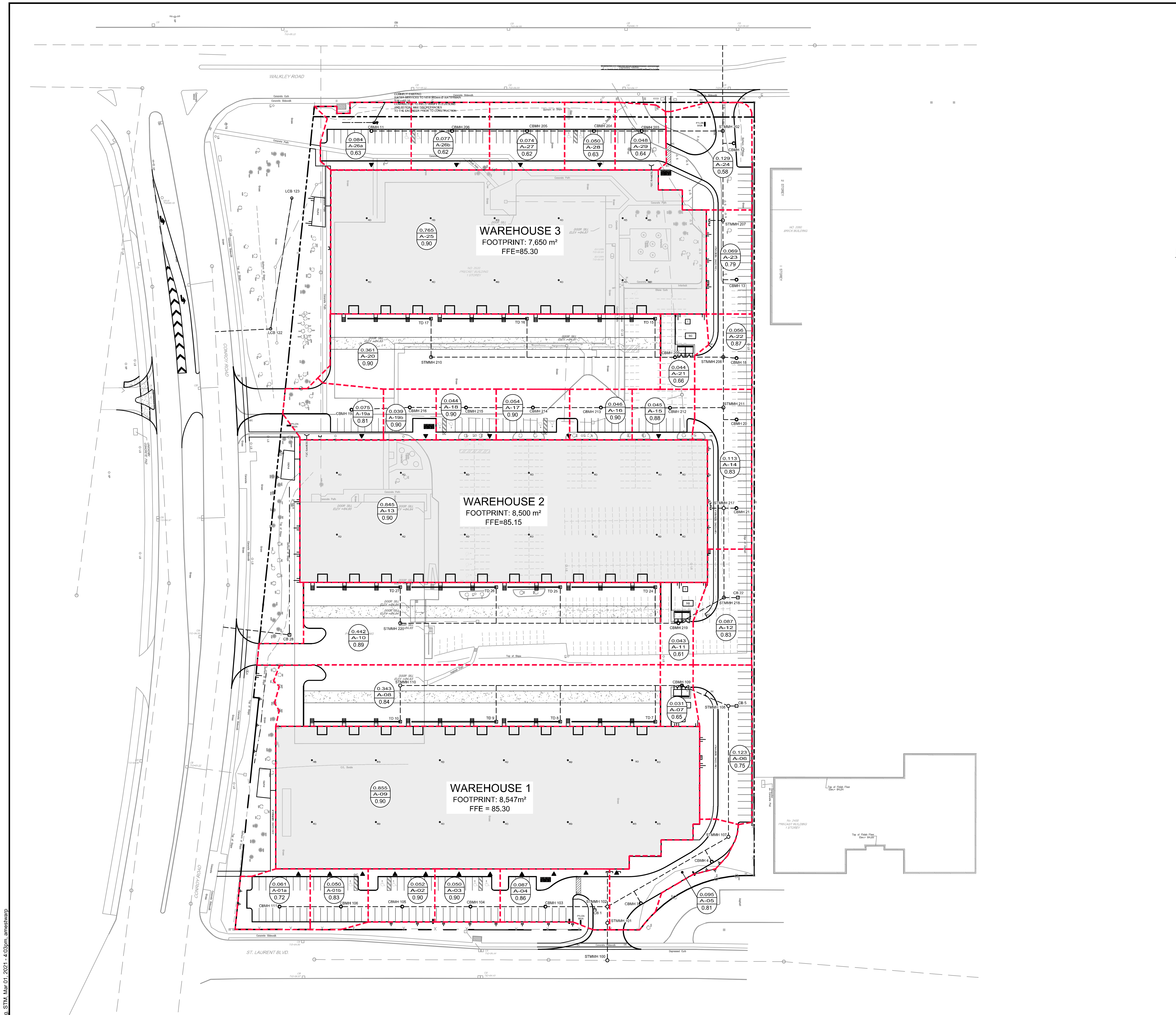
Notes: Refer to Peak Sanitary Flow Calculation sheet for detailed peak flows calculations.

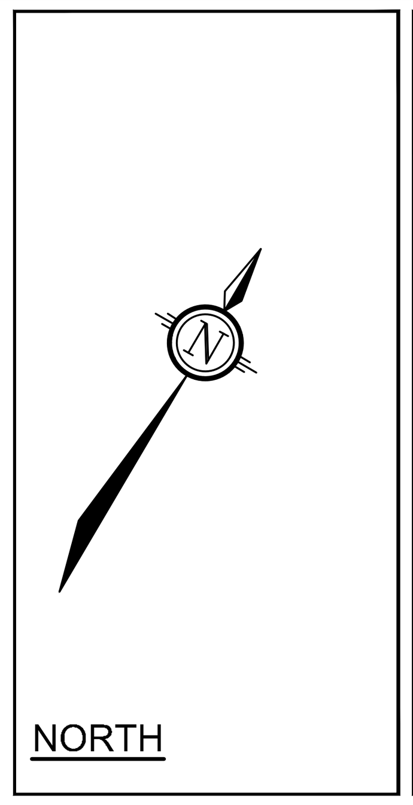
Design Parameters:

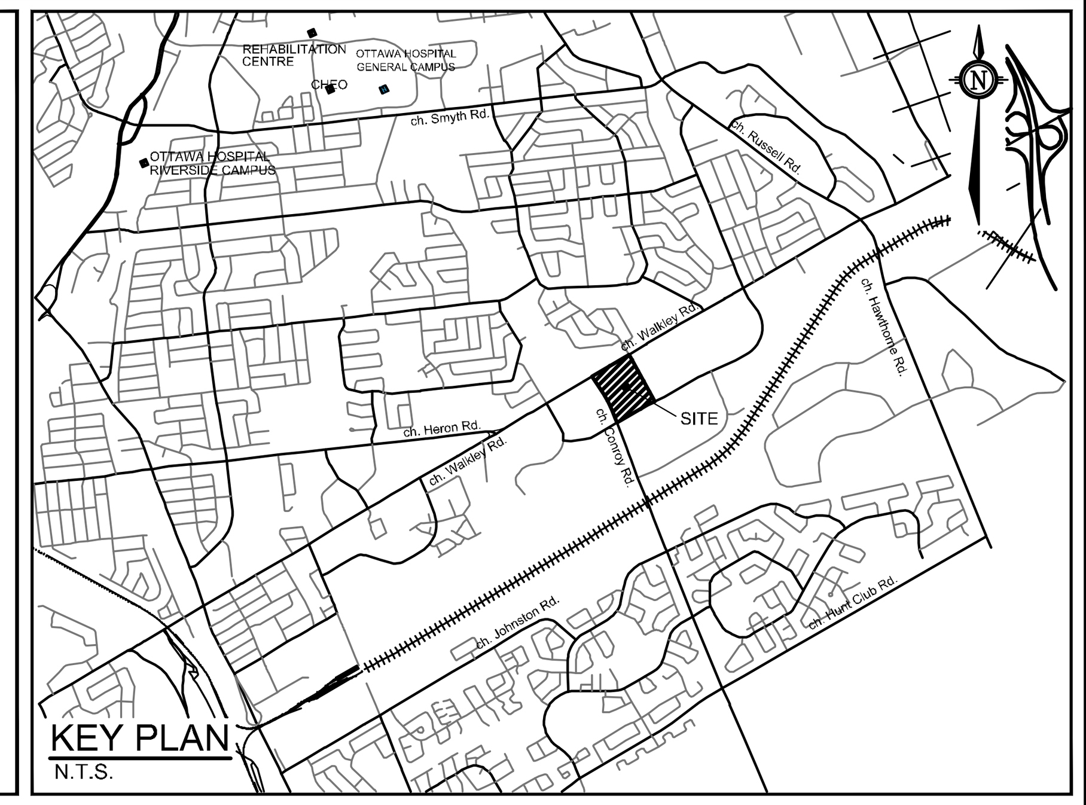
City of Ottawa Sewer Design Guidelines (Appendix 4-A)
- Extraneous Flows 0.33 l/s/ha
- Commercial Peaking Factor 1.5

City of Ottawa Sewer Design Guidelines (Appendix 4-B)
Industrial Peaking factor 4.7

APPENDIX C
Storm Servicing Information







LEGEND

0.64	DRAINAGE AREA (ha)
A-11	DRAINAGE AREA ID
0.90	RUNOFF COEFFICIENT
	STORM SEWER DRAINAGE AREA BOUNDARY
	PROPOSED STORM SEWER C/W MANHOLE
	PROPOSED CATCHBASIN MANHOLE
	PROPOSED CATCHBASIN
	PROPOSED TRENCH DRAIN
	PROPOSED LANDSCAPE CATCHBASIN
RD	PROPOSED ROOF DRAIN
STM MH	EXISTING STORM MANHOLE & SEWER
CB 1	EXISTING CATCHBASIN
	EXISTING CATCHBASIN MANHOLE

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

Owner:
Manulife Ontario Property Portfolio Inc.
55 Metcalfe Street - Suite 1490
Ottawa, ON
M5G 2L5

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	ISSUED FOR SITE PLAN APPLICATION	MAR 5/21	MJH
1.	ISSUED FOR COORDINATION	MAR 01/21	MJH

SCALE: 1:750

DESIGN: MJH/ARM
CHECKED: JLS
DRAWN: MJH/ARM
CHECKED: JLS
APPROVED: MJH

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA

DRAWING NAME
STORM DRAINAGE AREA PLAN

PROJECT No. 119067
REV: REV #2
DRAWING No. 119067-STM

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WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA
Project No.: 119067

STORM SEWER DESIGN SHEET
(2020 WALKLEY)
FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION			AREA (ha)					FLOW							TOTAL FLOW	SEWER DATA							
AREA ID	From Manhole	To Manhole	Total Area (ha)	C = 0.20	C = 0.90	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
PHASE 1 ST LAURENT BLVD (1:2 YEAR STORM EVENT)																							
A-08	STMMH 110	CBMH 109	0.343	0.028	0.315	0.84	0.29	0.804	0.804	10.00	76.81			61.8	61.8	0.381	375	PVC	0.30	107.4	100.1	0.88	2.04	62%
							0.00	0.000	0.000	10.00													
							0.00	0.000	0.000	10.00													
A-07	CBMH 109	STMMH 108	0.031	0.011	0.020	0.65	0.02	0.056	0.860	12.04	69.77			60.0	60.0	0.381	375	PVC	0.30	19.3	100.1	0.88	0.37	60%
							0.00	0.000	0.000	12.04													
							0.00	0.000	0.000	12.04													
A-06	STMMH 108	STMMH 107	0.123	0.027	0.096	0.75	0.09	0.255	1.115	12.40	68.66			76.6	76.6	0.381	375	PVC	0.30	49.9	100.1	0.88	0.95	77%
							0.00	0.000	0.000	12.40													
							0.00	0.000	0.000	12.40													
A-05	STMMH 107	STMMH 102	0.095	0.015	0.080	0.79	0.08	0.209	1.325	13.35	65.95			87.4	87.4	0.457	450	Conc	0.30	53.2	162.8	0.99	0.89	54%
							0.00	0.000	0.000	13.35													
							0.00	0.000	0.000	13.35													
A-01a	CBMH 111	CBMH 106	0.061	0.016	0.045	0.72	0.04	0.122	0.122	10.00	76.81			9.3	9.3	0.381	375	PVC	0.50	23.4	129.2	1.13	0.34	7%
							0.00	0.000	0.000	10.00													
							0.00	0.000	0.000	10.00													
A-01b	CBMH 106	CBMH 105	0.048	0.005	0.043	0.83	0.04	0.111	0.232	10.34	75.51			17.5	17.5	0.381	375	PVC	0.50	23.4	129.2	1.13	0.34	14%
							0.00	0.000	0.000	10.34													
							0.00	0.000	0.000	10.34													
A-02	CBMH 105	CBMH 104	0.052		0.052	0.90	0.05	0.130	0.362	10.69	74.26			26.9	26.9	0.381	375	PVC	0.50	26.0	129.2	1.13	0.38	21%
							0.00	0.000	0.000	10.69													
							0.00	0.000	0.000	10.69													
A-03	CBMH 104	CBMH 103	0.050		0.050	0.90	0.05	0.125	0.488	11.07	72.93			35.6	35.6	0.381	375	PVC	0.50	28.6	129.2	1.13	0.42	28%
							0.00	0.000	0.000	11.07													
							0.00	0.000	0.000	11.07													
A-04	CBMH 103	STMMH 102	0.087	0.005	0.082	0.86	0.07	0.207	0.695	11.49	71.52			49.7	49.7	0.381	375	PVC	0.50	23.6	129.2	1.13	0.35	38%
							0.00	0.000	0.000	11.49													
							0.00	0.000	0.000	11.49													
A-09	Building Service	STMMH 102	0.855		0.855	0.90	0.77	Controlled 100-year flow from roof drains = 22.1 L/s							22.1	0.203	200	PVC	2.00	13.4	48.3	1.49	0.15	46%
							0.00																
							0.00							22.1									
	STMMH 102	STMMH 101					0.00	0.000	2.020	14.25	63.61			128.5	150.6	0.457	450	Conc	1.00	6.2	297.2	1.81	0.06	51%
							0.00	0.000	0.000	14.25													
							0.00	0.000	0.000	14.25				22.1									
	STMMH 101	STMMH 100					0.00	0.000	2.020	14.30	63.46			128.2	150.3	0.457	450	Conc	1.00	14.3	297.2	1.81	0.13	51%
							0.00	0.000	0.000	14.30													
							0.00	0.000	0.000	14.30				22.1									
PHASE 2/3 WALKLEY ROAD (1:2 YEAR STORM EVENT)																							
A-10	STMMH 220	STMMH 219	0.442	0.004	0.438	0.89	0.39	1.097	1.097	10.00	76.81			84.3	84.3	0.381	375	PVC	0.30	106.1	100.1	0.88	2.01	84%
							0.00	0.000	0.000	10.00													
							0.00	0.000	0.000	10.00													
A-11	STMMH 219	STMMH 218	0.043	0.018	0.026	0.61	0.03	0.074	1.172	12.01	69.85			81.8	81.8	0.457	450	Conc	0.25	19.9	148.6	0.91	0.37	55%
							0.00	0.000	0.000	12.01													
							0.00	0.000	0.000	12.01													
A-12	STMMH 218	STMMH 217	0.087	0.009	0.078	0.83	0.07	0.200	1.372	12.38	68.73			94.3	94.3	0.457	450	Conc	0.25	34.1	148.6	0.91	0.63	63%
							0.00	0.000	0.000	12.38													
							0.00	0.000	0.000	12.38													

WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA
Project No.: 119067

STORM SEWER DESIGN SHEET
(2020 WALKLEY)
FLOW RATES BASED ON RATIONAL METHOD

NOVATECH
Engineers, Planners & Landscape Architects

LOCATION			AREA (ha)					FLOW							TOTAL FLOW	SEWER DATA							
AREA ID	From Manhole	To Manhole	Total Area (ha)	C = 0.20	C = 0.90	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
A-13	BUILDING SERVICE	STMMH 217	0.845	0.000	0.845	0.90	0.76	Controlled 100-year flow from roof drains = 22.1 L/s							22.1	0.203	200	PVC	2.00	5.2	48.3	1.49	0.06	46%
							0.00																	
							0.00							22.1										
A-14	STMMH 217	STMMH 211	0.113	0.012	0.101	0.83	0.09	0.260	1.632	13.01	66.91			109.2	131.3	0.533	525	Conc	0.20	38.4	200.5	0.90	0.71	65%
							0.00	0.000	0.000	13.01														
							0.00	0.000	0.000	13.01				22.1										
A-19a	CBMH 216	CBMH 215	0.075	0.010	0.065	0.81	0.06	0.168	0.168	10.00	76.81			12.9	12.9	0.381	375	PVC	0.30	22.2	100.1	0.88	0.42	13%
							0.00	0.000	0.000	10.00														
							0.00	0.000	0.000	10.00														
A-19b	CBMH 216	CBMH 215	0.039	0.000	0.039	0.90	0.04	0.098	0.266	10.42	75.22			20.0	20.0	0.381	375	PVC	0.30	21.5	100.1	0.88	0.41	20%
							0.00	0.000	0.000	10.42														
							0.00	0.000	0.000	10.42														
A-18	CBMH 215	CBMH 214	0.044	0.000	0.044	0.90	0.04	0.110	0.376	10.83	73.76			27.7	27.7	0.381	375	PVC	0.30	25.5	100.1	0.88	0.48	28%
							0.00	0.000	0.000	10.83														
							0.00	0.000	0.000	10.83														
A-17	CBMH 214	CBMH 213	0.054	0.000	0.054	0.90	0.05	0.135	0.511	11.31	72.10			36.8	36.8	0.381	375	PVC	0.30	25.9	100.1	0.88	0.49	37%
							0.00	0.000	0.000	11.31														
							0.00	0.000	0.000	11.31														
A-16	CBMH 213	CBMH 212	0.046	0.000	0.046	0.90	0.04	0.115	0.626	11.81	70.51			44.1	44.1	0.381	375	PVC	0.30	26.4	100.1	0.88	0.50	44%
							0.00	0.000	0.000	11.81														
							0.00	0.000	0.000	11.81														
A-15	CBMH 212	STMMH 211	0.045	0.001	0.044	0.88	0.04	0.110	0.736	12.31	68.96			50.8	50.8	0.381	375	PVC	0.30	20.4	100.1	0.88	0.39	51%
							0.00	0.000	0.000	12.31														
							0.00	0.000	0.000	12.31														
A-22	STMMH 211	STMMH 208	0.056	0.002	0.054	0.87	0.05	0.135	2.504	13.72	64.96			162.6	184.7	0.610	600	Conc	0.20	19.3	286.3	0.98	0.33	65%
							0.00	0.000	0.000	13.72														
							0.00	0.000	0.000	13.72				22.1										
A-20	STMMH 210	STMMH 209	0.361	0.001	0.360	0.90	0.32	0.901	0.901	10.00	76.81			69.2	69.2	0.381	375	PVC	0.30	93.0	100.1	0.88	1.77	69%
							0.00	0.000	0.000	10.00														
							0.00	0.000	0.000	10.00														
A-21	STMMH 209	STMMH 208	0.044	0.015	0.029	0.66	0.03	0.080	0.981	11.77	70.63			69.3	69.3	0.381	375	PVC	0.30	18.4	100.1	0.88	0.35	69%
							0.00	0.000	0.000	11.77														
							0.00	0.000	0.000	11.77														
A-23	STMMH 208	STMMH 207	0.069	0.011	0.058	0.79	0.05	0.151	3.635	14.05	64.11			233.0	255.1	0.610	600	Conc	0.20	52.1	286.3	0.98	0.89	89%
							0.00	0.000	0.000	14.05														
							0.00	0.000	0.000	14.05				22.1										
A-25	BUILDING SERVICE	STMMH 207	0.765	0.000	0.765	0.90	0.69	Controlled 100-year flow from roof drains = 18.9 L/s							18.9	0.203	200	PVC	2.00	5.4	48.3	1.49	0.06	39%
							0.00																	
							0.00							18.9										
A-24	STMMH 207	STMMH 202	0.129	0.060	0.069	0.58	0.07	0.206	3.841	14.93	61.92			237.9	278.9	0.610	600	Conc	0.30	34.1	350.6	1.20	0.47	80%
							0.00	0.000	0.000	14.93														
							0.00	0.000	0.000	14.93				41.0										

WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA
Project No.: 119067

STORM SEWER DESIGN SHEET
(2020 WALKLEY)
FLOW RATES BASED ON RATIONAL METHOD

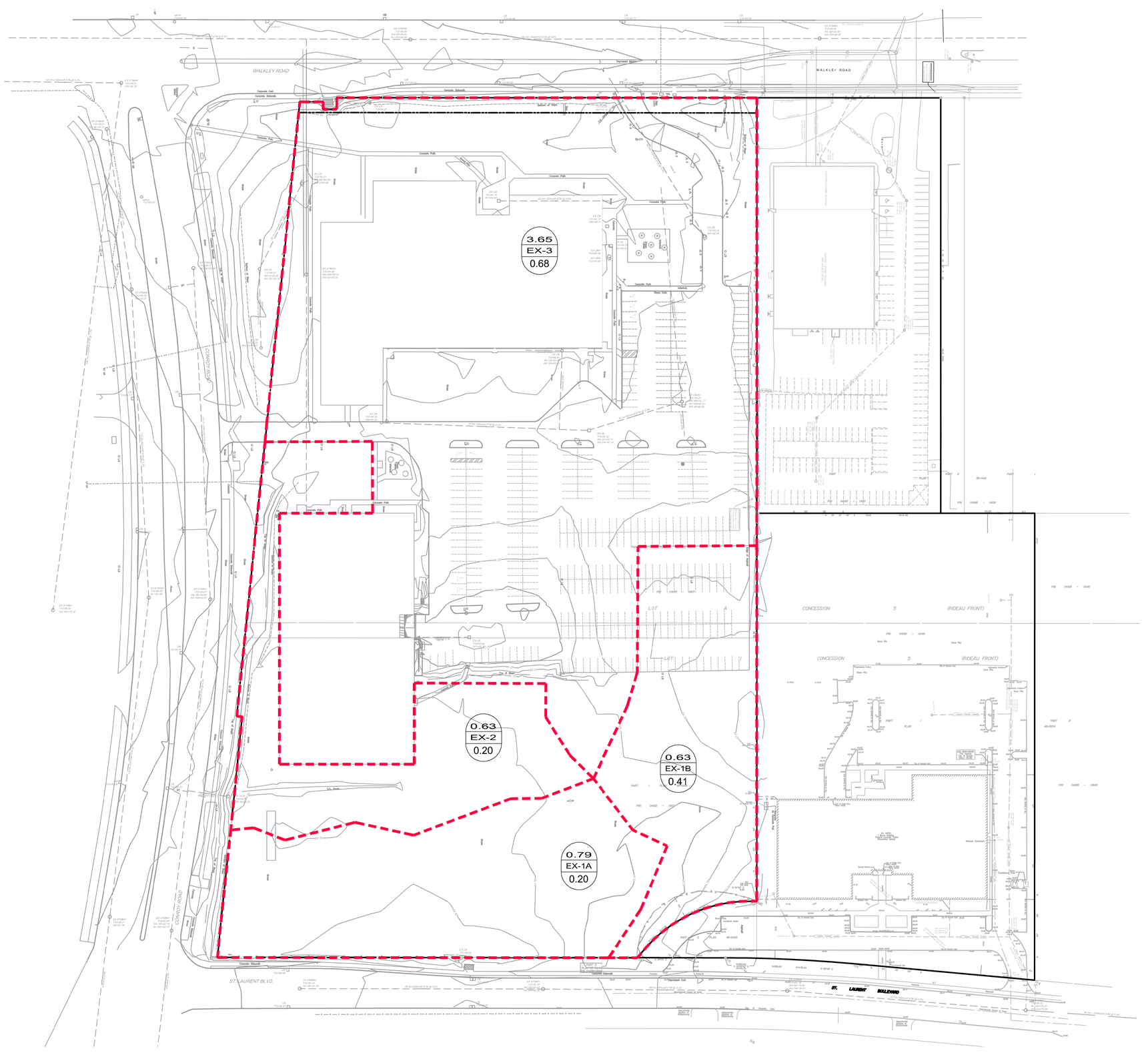
NOVATECH
Engineers, Planners & Landscape Architects

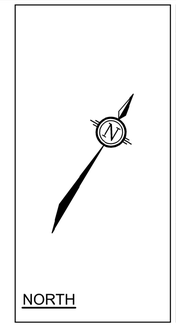
LOCATION			AREA (ha)					FLOW							TOTAL FLOW	SEWER DATA							
AREA ID	From Manhole	To Manhole	Total Area (ha)	C = 0.20	C = 0.90	C	AC (ha)	Indiv 2.78 AC	Accum 2.78 AC	Time of Concentration	Rainfall Intensity 2 Year (mm/hr)	Rainfall Intensity 5 Year (mm/hr)	Rainfall Intensity 10 Year (mm/hr)	Peak Flow (L/s)	Total Peak Flow, Q (L/s)	Dia. (m) Actual	Dia. (mm)	Type	Slope (%)	Length (m)	Capacity (L/s)	Velocity (m/s)	Flow Time (min)	Ratio Q/Q full
			0.084	0.032	0.052	0.63	0.05	0.147	0.147	10.00	76.81			11.3									
A-26a	CBMH 11	CBMH 206					0.00	0.000	0.000	10.00					11.3	0.381	375	PVC	0.30	30.8	100.1	0.88	0.58	11%
							0.00	0.000	0.000	10.00														
			0.077	0.030	0.047	0.62	0.05	0.133	0.280	10.58	74.63			20.9									
A-26b	CBMH 206	CBMH 205					0.00	0.000	0.000	10.58					20.9	0.381	375	PVC	0.30	28.6	100.1	0.88	0.54	21%
							0.00	0.000	0.000	10.58														
			0.074	0.029	0.045	0.62	0.05	0.128	0.409	11.13	72.73			29.7									
A-27	CBMH 205	CBMH 204					0.00	0.000	0.000	11.13					29.7	0.381	375	PVC	0.30	25.5	100.1	0.88	0.48	30%
							0.00	0.000	0.000	11.13														
			0.050	0.020	0.030	0.63	0.03	0.087	0.367	11.61	71.13			26.1									
A-28	CBMH 204	CBMH 203					0.00	0.000	0.000	11.61					26.1	0.381	375	PVC	0.30	18.2	100.1	0.88	0.35	26%
							0.00	0.000	0.000	11.61														
			0.048	0.018	0.030	0.64	0.03	0.085	0.452	11.96	70.03			31.7									
A-29	CBMH 203	STMMH 202					0.00	0.000	0.000	11.96					31.7	0.381	375	PVC	0.30	30.9	100.1	0.88	0.59	32%
							0.00	0.000	0.000	11.96														
							0.00	0.000	4.293	15.41	60.82			261.1									
	STMMH 202	STMMH 201					0.00	0.000	0.000	15.41					302.1	0.610	600	Conc	0.50	32.6	452.7	1.55	0.35	67%
							0.00	0.000	0.000	15.41				41.0										

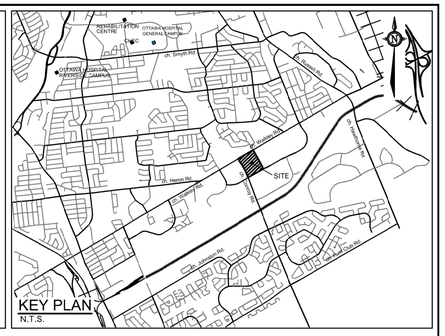
Q = 2.78 AIC, where
Q = Peak Flow in Litres per Second (L/s)
A = Area in hectares (ha)
I = Rainfall Intensity (mm/hr), 2 year storm
C = Runoff Coefficient

Consultant:	Novatech
Date:	March 1, 2021
Design By:	ARM
	Dwg. Reference: / Checked By:
	119067-STM / LS

APPENDIX D
Stormwater Management Calculations







LEGEND

0.64 / A-11 / 0.90 — DRAINAGE AREA (ha) / DRAINAGE AREA ID / RUNOFF COEFFICIENT

STORM SEWER DRAINAGE AREA BOUNDARY

STM MH — EXISTING STORM MANHOLE & SEWER

CB 1 — EXISTING CATCHBASIN

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

Owner:
Manulife Ontario Property Portfolio Inc.
55 Metcalfe Street - Suite 1490
Ottawa, ON
M5G 2L5

NOT FOR CONSTRUCTION

No.	REVISION	DATE	BY
2.	ISSUED FOR SITE PLAN APPLICATION	MAR 5/21	MJH
1.	ISSUED FOR COORDINATION	MAR 01/21	MJH

SCALE: 1:750 (1:750, 0 10 20 30)

DESIGN: MJH/ARM
CHECKED: JLS
DRAWN: MJH/ARM
CHECKED: JLS
APPROVED: MJH

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

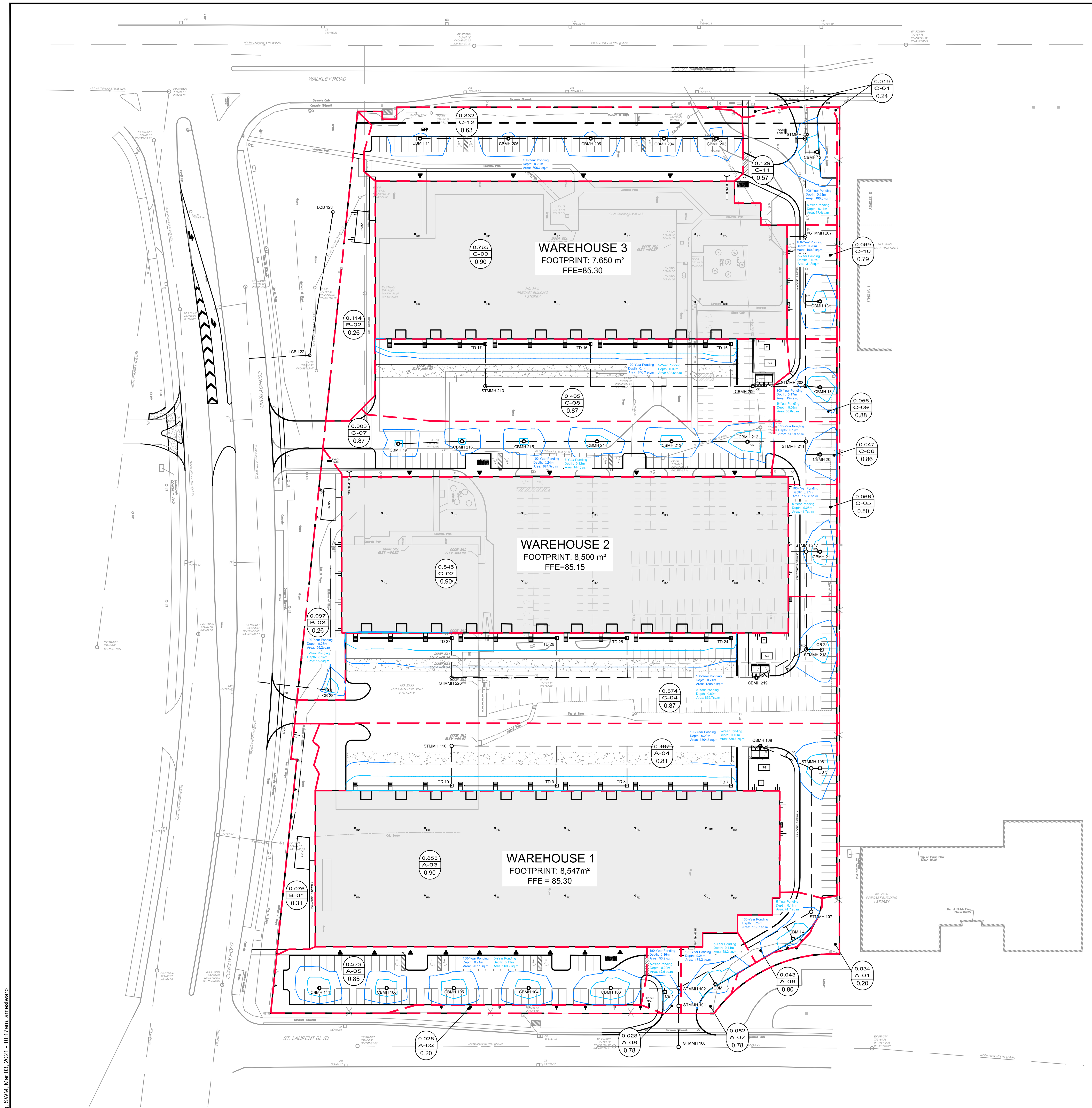
LOCATION
WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA

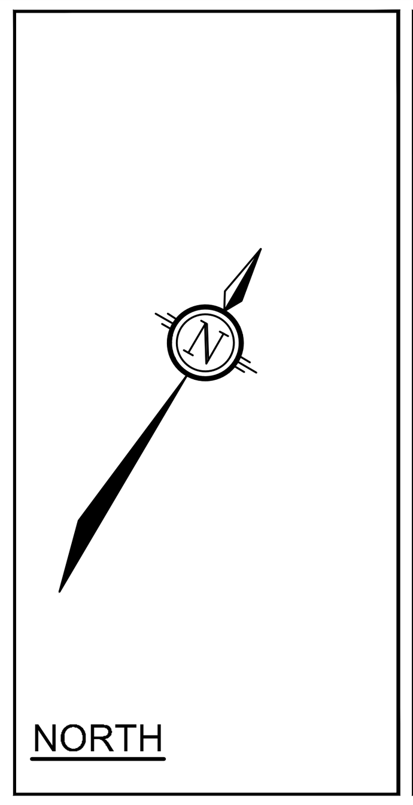
DRAWING NAME
EXISTING STORMWATER MANAGEMENT PLAN

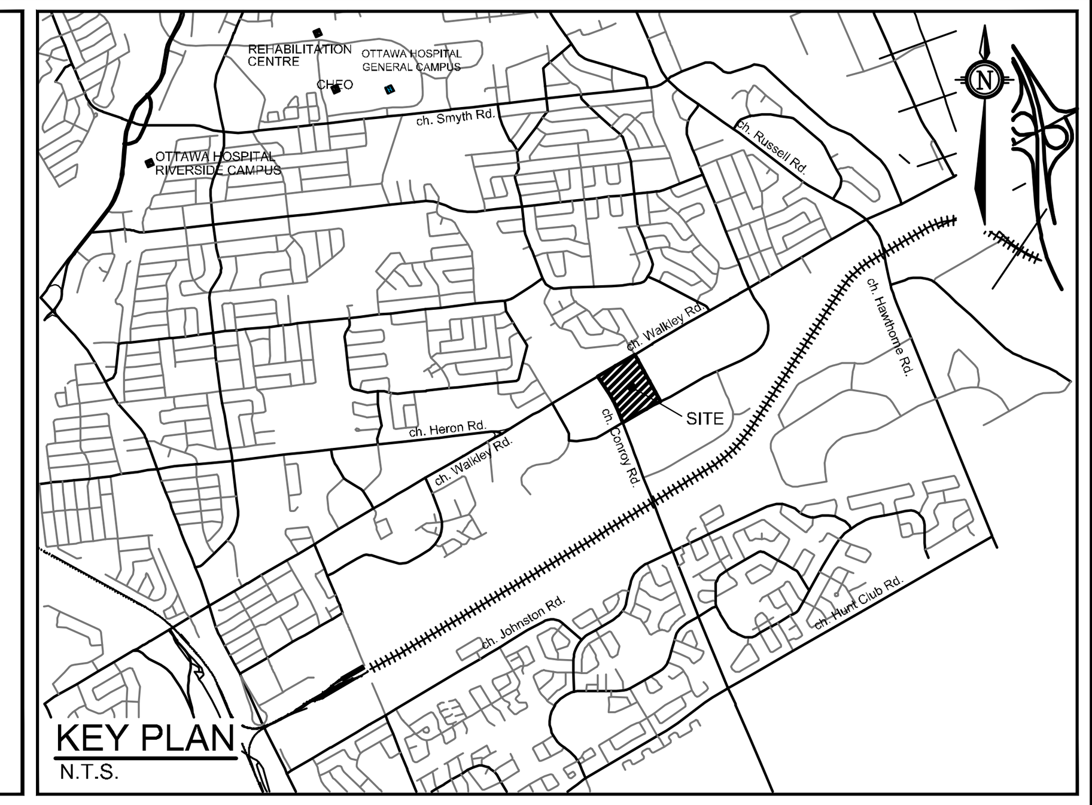
PROJECT No. 119067
REV REV #2
DRAWING No. 119067-EX SWM

M:\2019\119067\CAD\Design\119067- EX SWM.DWG, EX SWM, Mar 01, 2021 - 3:31pm, amestwarp

PLAN1.DWG - 841mmx594mm







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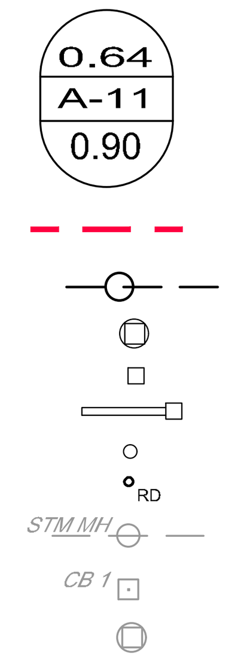

- DRAINAGE AREA (ha)
- DRAINAGE AREA ID
- RUNOFF COEFFICIENT
- STORM SEWER DRAINAGE AREA BOUNDARY
- PROPOSED STORM SEWER C/W MANHOLE
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- PROPOSED TRENCH DRAIN
- PROPOSED LANDSCAPE CATCHBASIN
- PROPOSED ROOF DRAIN
- *EXISTING STORM MANHOLE & SEWER*
- *EXISTING CATCHBASIN*
- *EXISTING CATCHBASIN MANHOLE*

WATTS ACCUTROL RD-100-A-ADJ ROOF DRAIN TABLE

WAREHOUSE	NUMBER OF DRAINS	WEIR SETTING	100-YEAR EVENT	
			HEAD	FLOW RATE
1	14	¾ OPEN	0.15m	22.1 L/s
2	14	¾ OPEN	0.15m	22.1 L/s
3	12	¾ OPEN	0.15m	18.9 L/s

TEMPEST LMF/MHF ICDs

LOCATION	MODEL NO. / ORFICE DIAMETER	100-YEAR EVENT	
		HEAD (m)	FLOW RATE (L/s)
CB 1	LMF 55	2.46	4.1
CBMH 3	LMF 55	2.74	4.5
CBMH 4	LMF 60	2.24	4.7
CBMH 103	LMF 100	3.00	15.5
STMMH 108	LMF 100	3.00	15.5
STMMH 218	83mm PLATE	1.87	20.3
CB 28	LMF 85	1.28	6.2
CBMH 21	LMF 80	1.77	7.7
CBMH 20	LMF 70	1.94	6.0
CBMH 212	83mm PLATE	2.49	23.5
CBMH 209	83mm PLATE	2.03	21.2
CBMH 18	LMF 70	1.92	6.0
CBMH 13	LMF 70	2.20	6.4
CBMH 12	LMF 90	2.33	10.9
CBMH 203	83mm PLATE	2.84	25.0

M:\2019\119067\CAD\Design\119067-SWM.dwg, SWM, Mar 03, 2021 - 10:17am, amestwarp

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

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SCALE
1:750
1:750
0 10 20 30

DESIGN MJH/ARM
CHECKED JLS
DRAWN MJH/ARM
CHECKED JLS
APPROVED MJH

FOR REVIEW ONLY

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Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
WALKLEY CONROY WAREHOUSES
2020 WALKLEY ROAD, CITY OF OTTAWA

DRAWING NAME
STORMWATER MANAGEMENT PLAN

PROJECT No. 119067
REV REV #2
DRAWING No. 119067-SWM

Time of Concentration - Existing Conditions

Uplands Overland Flow Method

Area ID	Overland Flow						Mannings Pipe Flow							Overall
	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Pipe Size (mm)	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Time of Concentration (min)
EX 1 A	95	85.00	84.10	0.9%	0.30	5.28								5
EX 1B	10						250	96	82.77	81.16	1.68	1.57	1.02	
							450	28	81.16	81.00	0.57	1.36	0.34	11
EX 2	125	84.9	84.5	0.3%	0.18	11.57								12
EX 3 A	10						150.00	76	83.5	83.1	0.50	0.61	2.08	
							300.00	36	83.1	82.8	0.92	1.31	0.46	
							525.00	110	83.1	82.8	0.20	0.89	2.06	15

Uplands Velocity Chart

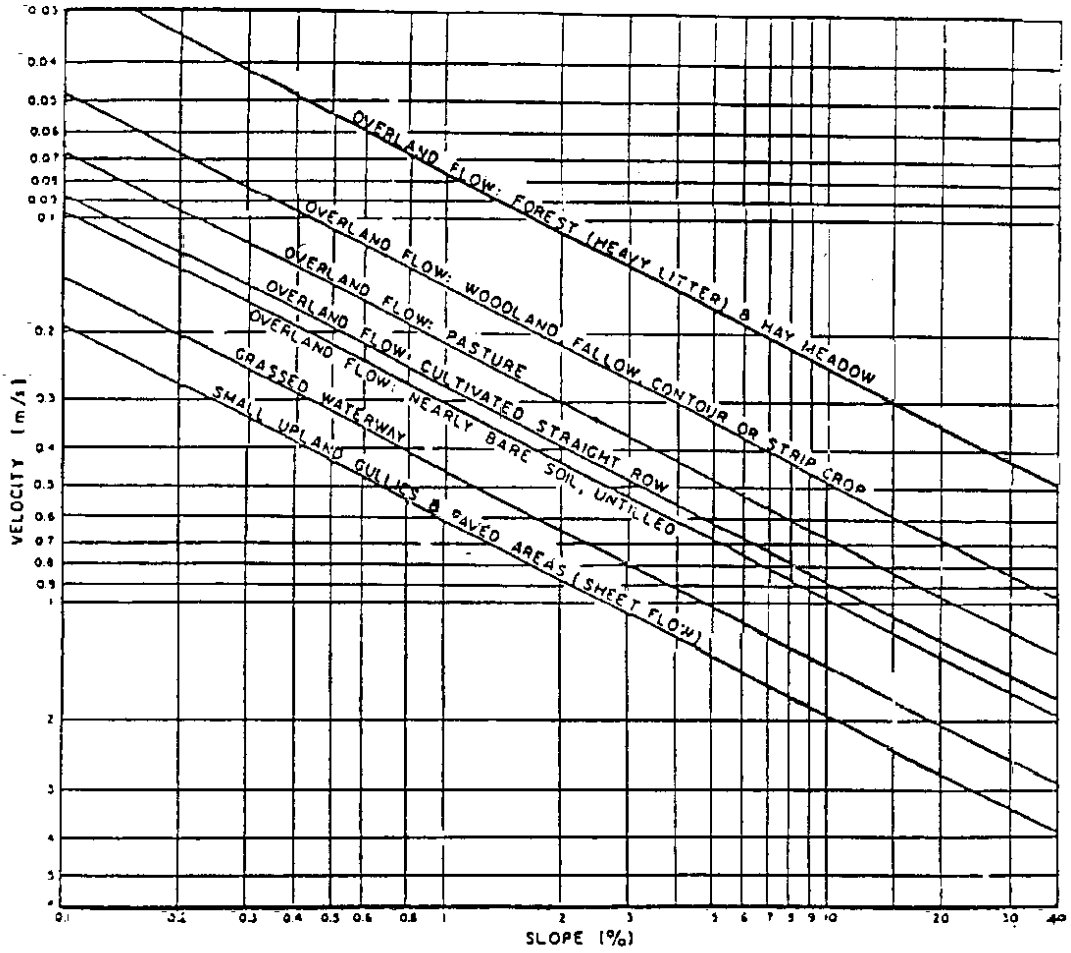

Figure A.5.2: Upland Method for Estimating Time of Concentration
(SCS National Engineering Handbook, 1971)

PROJECT #: 119067 **DATE PREPARED: FEBRUARY 2021**
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LOCATION: OTTAWA, ONTARIO

TABLE 1A: Pre-Development Runoff Coefficient "C" - EX-1A

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.00	0.90	0.20	0.25
0.79	Soft	0.79	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 1B: Pre-Development / Allowable EX-1A Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
St Laurent Blvd (600mm)	0.79	0.20	10	**33.7**	**45.8**	**98.0**

TABLE 1C: Pre-Development Runoff Coefficient "C" - EX-1B

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.19	0.90	0.41	0.48
0.63	Soft	0.44	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 1D: Pre-Development / Allowable EX-1B Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
St Laurent Blvd (1050mm)	0.630	0.41	11	**52.7**	**71.4**	**141.7**

Time of Concentration	Tc=	10	min	Flow Equation
Intensity (2 Year Event)	I_2=	76.81	mm/hr	Q = 2.78 x C x I x A
Intensity (5 Year Event)	I_5=	104.19	mm/hr	Where:
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr	C is the runoff coefficient
Time of Concentration	Tc=	11	min	I is the rainfall intensity, City of Ottawa IDF
Intensity (2 Year Event)	I_2=	73.17	mm/hr	A is the total drainage area
Intensity (5 Year Event)	I_5=	99.19	mm/hr	
Intensity (100 Year Event)	I_{100}=	169.91	mm/hr	100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$

5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$

2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

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LOCATION: OTTAWA, ONTARIO

TABLE 2A: Post-Development Runoff Coefficient "C" - A-1

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	-0.003	0.90	0.14	0.18
0.034	Soft	0.037	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 2B: Post-Development A-1 Flows

Outlet Options	**Area (ha)**	**C_{avg}**	**Tc (min)**	**$Q_{2\ Year}$ (L/s)**	**$Q_{5\ Year}$ (L/s)**	**$Q_{100\ Year}$ (L/s)**
St Laurent Blvd	0.034	0.14	10	**1.0**	**1.4**	**3.1**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

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TABLE 3A: Post-Development Runoff Coefficient "C" - A-2

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.000	0.90	0.20	0.25
0.026	Soft	0.026	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 3B: Post-Development A-2 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
St Laurent Blvd	0.026	0.20	10	**1.1**	**1.5**	**3.2**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

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TABLE 4A: Post-Development Runoff Coefficient "C" - A-3 Controlled Roof Area

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.000	0.90	0.90	1.00	1.00
0.855	Roof	0.855	0.90		1.00	
	Soft	0.000	0.20		0.25	

TABLE 4B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3 Controlled Roof Area

0.855 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	70	21.91	46.88	10.5	36.39	152.86
	75	20.81	44.52	10.5	34.04	153.19
	80	19.83	**42.42**	**10.5**	**31.94**	**153.30**
	85	18.94	40.53	10.5	30.04	153.23
	90	18.14	38.81	10.5	28.33	152.98

TABLE 4C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3 Controlled Roof Area

0.855 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	80	26.56	56.82	12.1	44.68	214.46
	85	25.37	54.27	12.1	42.13	214.84
	90	**24.29**	**51.96**	**12.1**	**39.81**	**215.00**
	95	23.31	49.86	12.1	37.71	214.96
	100	22.41	47.93	12.1	35.79	214.74

TABLE 4D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3 Controlled Roof Area

0.855 =Area (ha)
1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	90	41.11	97.72	22.1	75.63	408.43
	95	39.43	93.73	22.1	71.65	408.41
	100	**37.90**	**90.09**	**22.1**	**68.01**	**408.06**
	105	36.50	86.75	22.1	64.67	407.41
	110	35.20	83.67	22.1	61.59	406.50

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

Table 4E: Roof Drain Flows

Roof Drains		
Roof Area	8550	m²
Qty	14	
Type	Accutrol RD-100-A-ADJ	
Setting	3/4 Open	
Design Head	0.05-0.15	m
Design Flow 1" of head	0.32	L/s (ea)
Design Flow 2" of head	0.63	L/s (ea)
Design Flow 3" of head	0.87	L/s (ea)
Design Flow 4" of head	1.10	L/s (ea)
Design Flow 5" of head	1.34	L/s (ea)
Design Flow 6" of head	1.58	L/s (ea)

Table 4F: Total Roof Storage

Storm Event	# Roof Drains	Avg Area Per Roof Drain (m^2)	Avg Ponding Depth Per Roof Drain (m)	*Total Volume (m^3)	Total Volume (m^3) Required
2 Year	14	610.7	0.0625	178.13	153.30
5 Year	14	610.7	0.0762	217.17	215.00
100 Year	14	610.7	0.1524	434.34	408.06
Max Storage	14	610.7	0.1524	434.34	

*NOTE: Ponding volumes calculated using cone equation:

$$V = \frac{Area\ X\ Depth}{3}$$

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TABLE 5A: Post-Development Runoff Coefficient "C" - A-4

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.431	0.90		1.00	
0.497	Roof	0.000	1.00	0.81	1.00	0.90
	Soft	0.066	0.20		0.25	

TABLE 5B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.497 =Area (ha)
0.81 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	20	52.03	58.02	15.0	43.02	51.62
	25	45.17	50.36	15.0	35.36	53.05
	30	**40.04**	**44.65**	**15.0**	**29.65**	**53.37**
	35	36.06	40.21	15.0	25.21	52.94
	40	32.86	36.65	15.0	21.65	51.95

TABLE 5C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.497 =Area (ha)
0.81 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	25	60.90	67.90	15.2	52.70	79.05
	30	53.93	60.13	15.2	44.93	80.88
	35	**48.52**	**54.10**	**15.2**	**38.90**	**81.69**
	40	44.18	49.27	15.2	34.07	81.76
	45	40.63	45.30	15.2	30.10	81.28

TABLE 5D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.497 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	60	55.89	69.54	15.5	54.04	194.53
	65	52.65	65.49	15.5	49.99	194.98
	70	**49.79**	**61.94**	**15.5**	**46.44**	**195.05**
	75	47.26	58.79	15.5	43.29	194.80
	80	44.99	55.97	15.5	40.47	194.26

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

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TABLE 5D: Structure information

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
STMMH 107	1200	1.13	84.80	81.10	81.03
STMMH 108	1200	1.13	84.11	81.28	81.25
STMMH 109	1200	1.13	84.17	81.37	81.34
STMMH 110	1200	1.13	84.17	-	81.69
CB 5	600	0.36	84.05	-	82.05
TD	300	39.00	84.08	-	83.72

TABLE 5E: Pipe information

Structures	Size Dia.(mm)	Length	Inv UP	Inv DOWN
STMMH 107-108	375	49.9	81.25	81.10
STMMH 108-109	375	19.3	81.34	81.28
STMMH 109-110	375	107.4	81.69	81.37

TABLE 5F: Storage Provided - A-4

Storage Table									Total Storage		
Elevation (m)	System Depth (m)	STMMH 107 Volume (m^3)	STMMH 108 Volume (m^3)	STMMH 109 Volume (m^3)	STMMH 110 Volume (m^3)	CB 5 Volume (m^3)	TD Volume (m^3)	Pipe Storage Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
81.030	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
81.250	0.22	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	**0.25**
81.500	0.47	0.53	0.28	0.18	0.00	0.00	0.00	0.00	1.00	0.00	**1.00**
81.690	0.66	0.75	0.50	0.40	0.00	0.00	0.00	0.00	1.64	0.00	**1.64**
82.070	1.04	1.18	0.93	0.83	0.43	0.01	0.00	18.58	21.95	0.00	**21.95**
84.050	3.02	3.42	3.17	3.06	2.67	0.72	12.87	-	44.49	0.00	**44.49**
84.100	3.07	3.47	3.22	3.12	2.73	-	14.82	-	46.66	4.02	**50.68**
84.150	3.12	3.53	-	3.18	2.78	-	-	-	43.61	31.77	**75.38**
84.200	3.17	3.59	-	-	-	-	-	-	46.89	77.55	**124.44**
84.250	3.22	3.64	-	-	-	-	-	-	46.95	142.27	**189.22**
84.300	3.27	3.70	-	-	-	-	-	-	47.00	226.50	**273.50**
84.350	3.32	3.75	-	-	-	-	-	-	47.06	331.41	**378.47**
84.400	3.37	3.81	-	-	-	-	-	-	47.11	460.69	**507.80**

TABLE 5G: ORIFICE SIZING INFORMATION - A-4

Control Device					
Tempest ICD		100 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	15.0	53.4	2.85	84.10	450
1:5 Year	15.2	81.7	2.90	84.15	450
1:100 Year	15.5	195.1	3.00	84.25	450

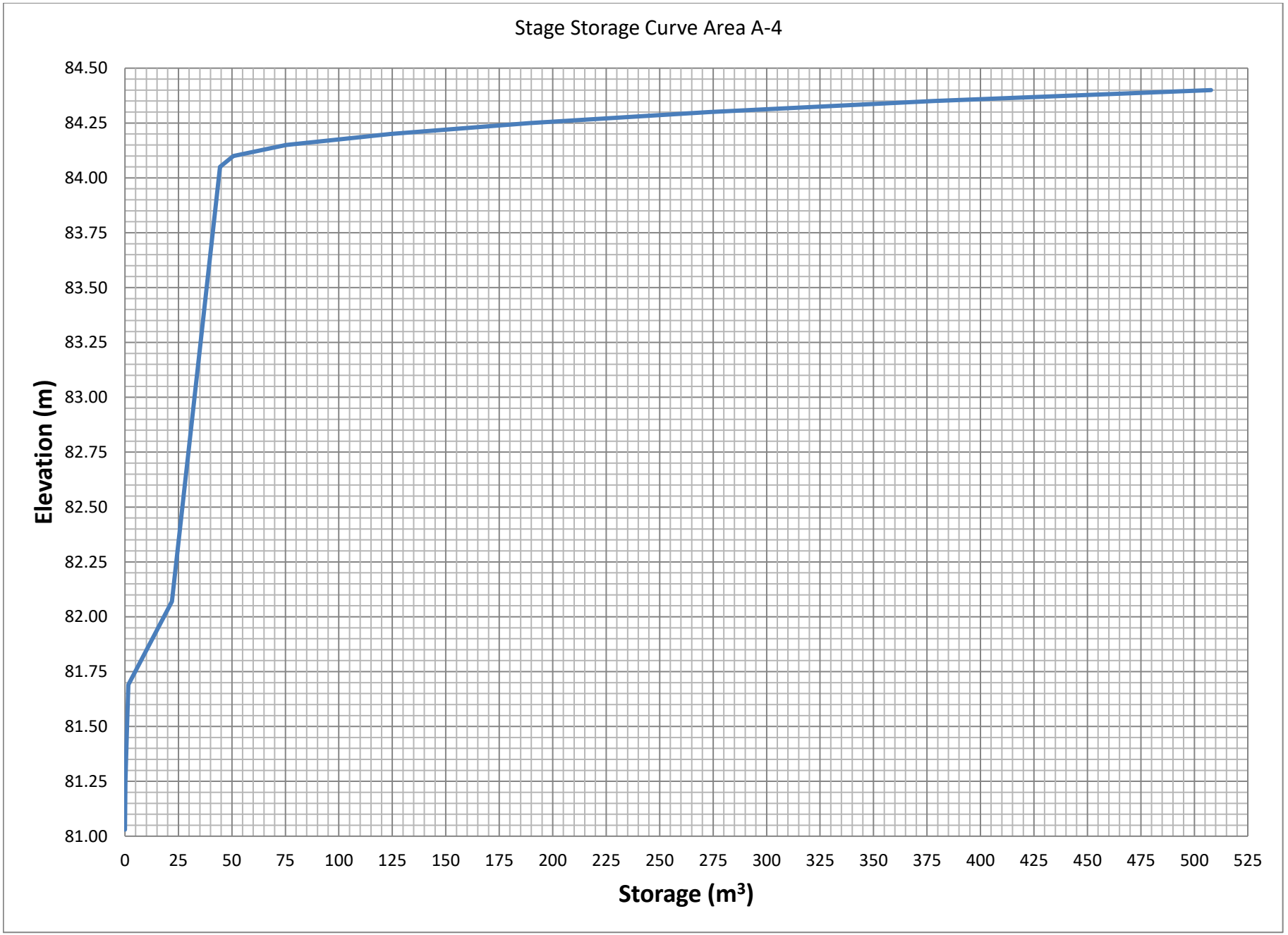
Stage Storage Curve Area A-4
Elevation (m)
84.50
84.25
84.00
83.75
83.50
83.25
83.00
82.75
82.50
82.25
82.00
81.75
81.50
81.25
81.00
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
525
Storage (m³)

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TABLE 6A: Post-Development Runoff Coefficient "C" - A-5

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.252	0.90	0.85	1.00	0.94
0.273	Roof	0.000	1.00		1.00	
	Soft	0.021	0.20		0.25	

TABLE 6B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-5

0.273 =Area (ha)
0.85 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	10	76.81	49.32	13.5	35.82	21.49
	15	61.77	39.67	13.5	26.17	23.55
	20	**52.03**	**33.41**	**13.5**	**19.91**	**23.90**
	25	45.17	29.01	13.5	15.51	23.26
	30	40.04	25.72	13.5	12.22	21.99

TABLE 6C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-5

0.273 =Area (ha)
0.85 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	10	104.19	66.91	15.2	51.71	31.03
	15	83.56	53.66	15.2	38.46	34.61
	20	**70.25**	**45.11**	**15.2**	**29.91**	**35.90**
	25	60.90	39.11	15.2	23.91	35.86
	30	53.93	34.63	15.2	19.43	34.98

TABLE 6D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-5

0.273 =Area (ha)
0.94 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	30	91.87	65.70	15.5	50.20	90.36
	35	82.58	59.06	15.5	43.56	91.47
	40	**75.15**	**53.74**	**15.5**	**38.24**	**91.78**
	45	69.05	49.38	15.5	33.88	91.48
	50	63.95	45.74	15.5	30.24	90.71

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

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TABLE 6D: Structure information - A-5

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 103	1200	1.13	84.63	81.66	81.65
CBMH 104	1200	1.13	84.65	81.81	81.80
CBMH 105	1200	1.13	84.65	81.95	81.94
CBMH 106	1200	1.13	84.65	82.08	82.07
CBMH 111	1200	1.13	84.65	-	82.20

TABLE 6E: Pipe information - A-5

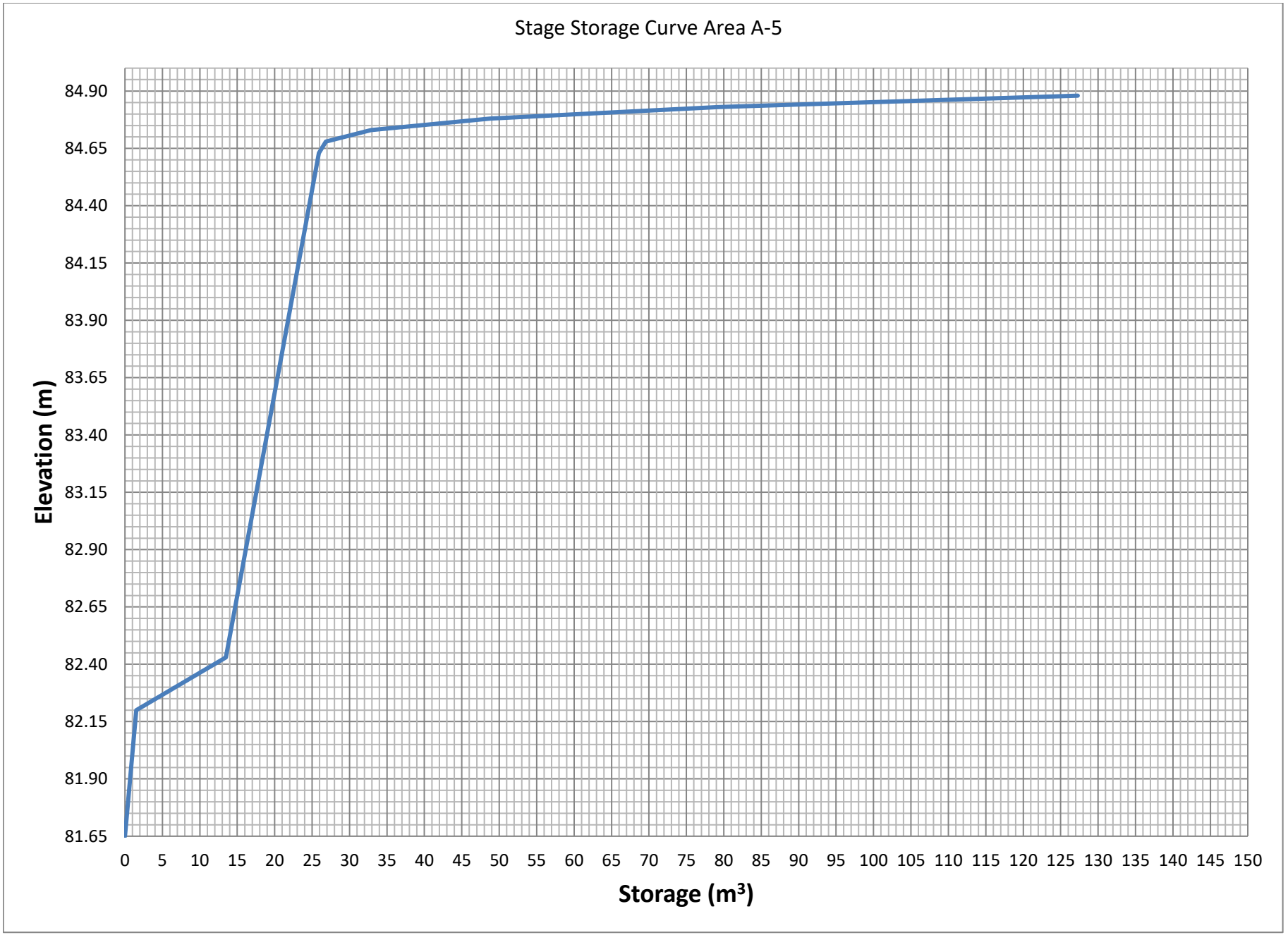
Structures	Size Dia.(mm)	Length	Inv UP	Inv DOWN
CBMH 103-104	450	28.60	81.80	81.66
CBMH 104-105	450	26.00	81.94	81.81
CBMH 105-106	450	23.30	82.07	81.95
CBMH 106-111	450	23.40	81.82	82.08

TABLE 6F: Storage Provided - A-5

Storage Table								Total Storage		
Elevation (m)	System Depth (m)	CBMH 103 Volume (m^3)	CBMH 104 Volume (m^3)	CBMH 105 Volume (m^3)	CBMH 106 Volume (m^3)	CBMH 111 Volume (m^3)	Pipe Storage Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
81.650	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
82.200	0.55	0.62	0.45	0.29	0.15	0.00	0.00	1.52	0.00	**1.52**
82.430	0.78	0.88	0.71	0.55	0.41	0.26	10.66	13.47	0.00	**13.47**
84.630	2.98	3.37	3.20	3.04	2.90	2.75	-	25.91	0.00	**25.91**
84.680	3.03	-	-	-	-	-	-	25.91	0.93	**26.84**
84.730	3.08	-	-	-	-	-	-	25.91	6.97	**32.88**
84.780	3.13	-	-	-	-	-	-	25.91	22.87	**48.78**
84.830	3.18	-	-	-	-	-	-	25.91	53.33	**79.24**
84.880	3.23	-	-	-	-	-	-	25.91	101.37	**127.28**

TABLE 6G: ORIFICE SIZING INFORMATION - A-5

Control Device					
Tempest ICD		100 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:5 Year	13.5	23.9	2.36	84.20	375
1:5 Year	15.2	35.9	2.90	84.74	375
1:100 Year	15.5	91.8	3.00	84.84	375


Stage Storage Curve Area A-5
Elevation (m)
84.90
84.65
84.40
84.15
83.90
83.65
83.40
83.15
82.90
82.65
82.40
82.15
81.90
81.65
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150
Storage (m³)

PROJECT #: 119067 **DATE PREPARED: FEBRUARY 2021**
PROJECT NAME: 2020 WALKLEY ROAD
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TABLE 7A: Post-Development Runoff Coefficient "C" - A-6

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.037	0.90	0.80	1.00	0.90
0.043	Roof	0.000	0.90		1.00	
	Soft	0.006	0.20		0.25	

TABLE 7B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-6

0.043 =Area (ha)
0.80 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	16.04	4.1	11.94	0.00
	5	103.57	9.93	4.1	5.83	1.75
	10	**76.81**	**7.37**	**4.1**	**3.27**	**1.96**
	15	61.77	5.92	4.1	1.82	1.64
	20	52.03	4.99	4.1	0.89	1.07

TABLE 7C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-6

0.043 =Area (ha)
0.80 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	22.11	4.6	17.51	0.00
	5	141.18	13.54	4.6	8.94	2.68
	10	**104.19**	**9.99**	**4.6**	**5.39**	**3.24**
	15	83.56	8.01	4.6	3.41	3.07
	20	70.25	6.74	4.6	2.14	2.57

TABLE 7D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-6

0.043 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	10	178.56	19.11	4.7	14.41	8.65
	15	142.89	15.29	4.7	10.59	9.53
	20	**119.95**	**12.84**	**4.7**	**8.14**	**9.77**
	25	103.85	11.11	4.7	6.41	9.62
	30	91.87	9.83	4.7	5.13	9.24

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

DATE PREPARED: FEBRUARY 2021

TABLE 7E: Structure information - A-6

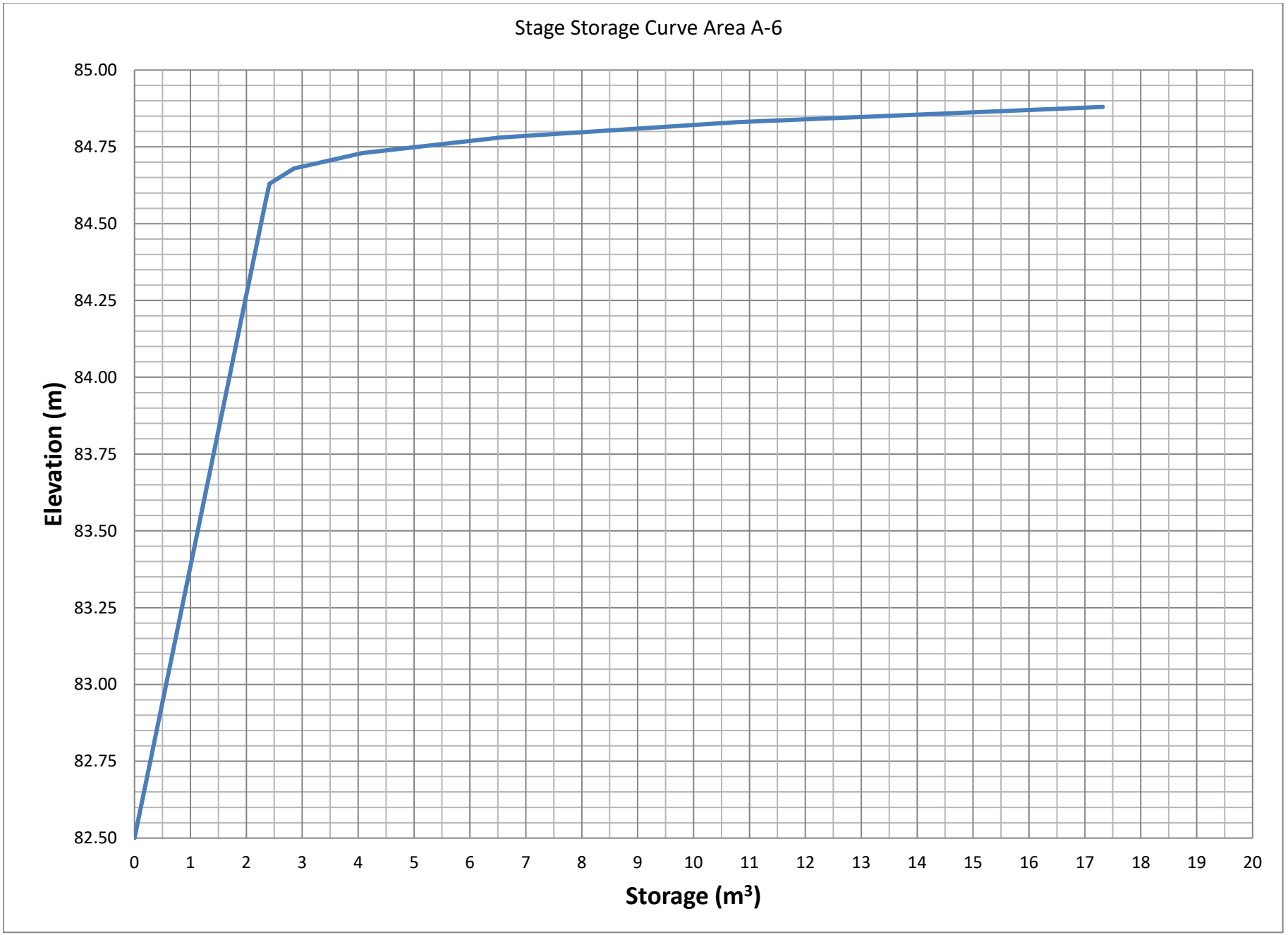
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 4	1200	1.13	84.58	N/A	82.50

TABLE 7F: Storage Provided - A-6

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 4 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.500	0.00	0.00	0.00	0.00	**0.00**
84.580	2.08	2.35	2.35	0.00	**2.35**
84.630	2.13	-	2.35	0.06	**2.41**
84.680	2.18	-	2.35	0.50	**2.85**
84.730	2.23	-	2.35	1.72	**4.07**
84.780	2.28	-	2.35	4.19	**6.54**
84.830	2.33	-	2.35	8.42	**10.77**
84.880	2.38	-	2.35	14.97	**17.32**

TABLE 7G: Orifice Sizing Information - A-6

Control Device					
Tempest ICD		60 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	4.1	2.0	1.65	84.25	200
1:5 Year	4.6	3.2	2.09	84.69	200
1:100 Year	4.7	9.8	2.22	84.82	200


Stage Storage Curve Area A-6
85.00
84.75
84.50
84.25
84.00
83.75
83.50
83.25
83.00
82.75
82.50
Elevation (m)
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Storage (m³)

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LOCATION: OTTAWA, ONTARIO

TABLE 8A: Post-Development Runoff Coefficient "C" - A-7

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.043	0.90	0.78	1.00	0.87
0.052	Roof	0.000	0.90		1.00	
	Soft	0.009	0.20		0.25	

TABLE 8B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-7

0.052 =Area (ha)
0.78 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	18.83	4.1	14.73	0.00
	5	103.57	11.66	4.1	7.56	2.27
	10	**76.81**	**8.65**	**4.1**	**4.55**	**2.73**
	15	61.77	6.95	4.1	2.85	2.57
	20	52.03	5.86	4.1	1.76	2.11

TABLE 8C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-7

0.052 =Area (ha)
0.78 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	5	141.18	15.90	4.3	11.60	3.48
	10	104.19	11.73	4.3	7.43	4.46
	15	**83.56**	**9.41**	**4.3**	**5.11**	**4.60**
	20	70.25	7.91	4.3	3.61	4.33
	25	60.90	6.86	4.3	2.56	3.83

TABLE 8D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-7

0.052 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	15	142.89	17.98	4.5	13.48	12.13
	20	119.95	15.09	4.5	10.59	12.71
	25	**103.85**	**13.06**	**4.5**	**8.56**	**12.85**
	30	91.87	11.56	4.5	7.06	12.70
	35	82.58	10.39	4.5	5.89	12.36

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

DATE PREPARED: FEBRUARY 2021

TABLE 8E: Structure information - A-7

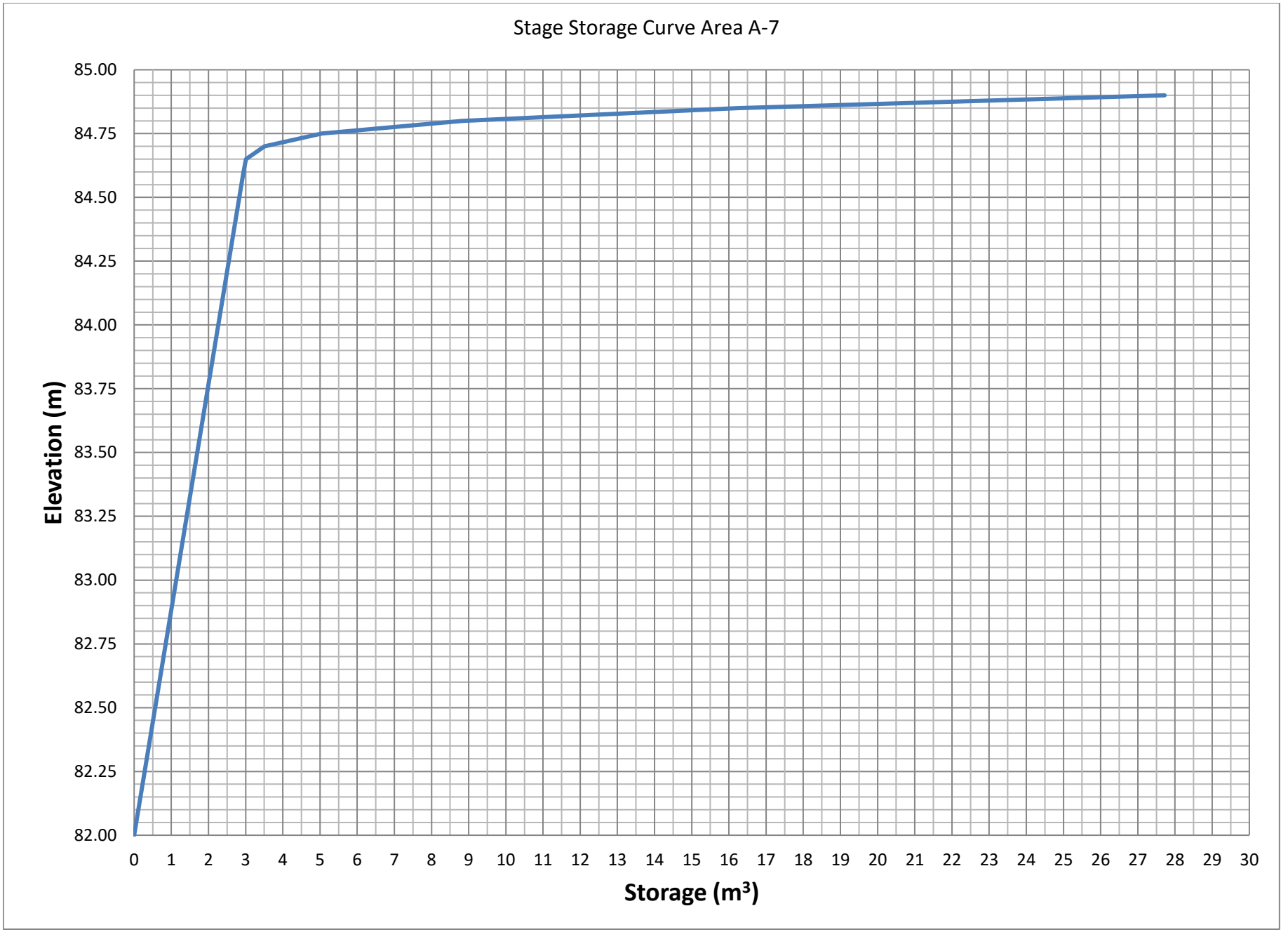
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 3	1200	1.13	84.60	N/A	82.00

TABLE 8F: Storage Provided - A-7

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 3 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.000	0.00	0.00	0.00	0.00	**0.00**
84.600	2.60	2.94	2.94	0.00	**2.94**
84.650	2.65	-	2.94	0.07	**3.01**
84.700	2.70	-	2.94	0.57	**3.51**
84.750	2.75	-	2.94	2.11	**5.05**
84.800	2.80	-	2.94	5.88	**8.82**
84.850	2.85	-	2.94	13.30	**16.24**
84.900	2.90	-	2.94	24.78	**27.72**

TABLE 8G: Orifice Sizing Information - A-7

Control Device					
Tempest ICD		55 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	4.1	2.7	2.40	84.5	200
1:5 Year	4.3	4.6	2.64	84.74	200
1:100 Year	4.5	12.8	2.74	84.84	200


Stage Storage Curve Area A-7
85.00
84.75
84.50
84.25
84.00
83.75
83.50
83.25
83.00
82.75
82.50
82.25
82.00
Elevation (m)
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Storage (m³)

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LOCATION: OTTAWA, ONTARIO

TABLE 8A: Post-Development Runoff Coefficient "C" - A-7

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.023	0.90	0.78	1.00	0.87
0.028	Roof	0.000	0.90		1.00	
	Soft	0.005	0.20		0.25	

TABLE 8B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-7

0.028 =Area (ha)
0.78 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	-5	632.75	38.17	3.7	34.47	-10.34
	0	167.22	10.09	3.7	6.39	0.00
	5	**103.57**	**6.25**	**3.7**	**2.55**	**0.76**
	10	76.81	4.63	3.7	0.93	0.56
	15	61.77	3.73	3.7	0.03	0.02

TABLE 8C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-7

0.028 =Area (ha)
0.78 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	13.90	4.0	9.90	0.00
	5	141.18	8.52	4.0	4.52	1.36
	10	**104.19**	**6.29**	**4.0**	**2.29**	**1.37**
	15	83.56	5.04	4.0	1.04	0.94
	20	70.25	4.24	4.0	0.24	0.29

TABLE 8D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-7

0.028 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	5	242.70	16.36	4.1	12.26	3.68
	10	178.56	12.04	4.1	7.94	4.76
	15	**142.89**	**9.63**	**4.1**	**5.53**	**4.98**
	20	119.95	8.09	4.1	3.99	4.78
	25	103.85	7.00	4.1	2.90	4.35

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

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DATE PREPARED: FEBRUARY 2021

TABLE 9E: Structure information - A-8

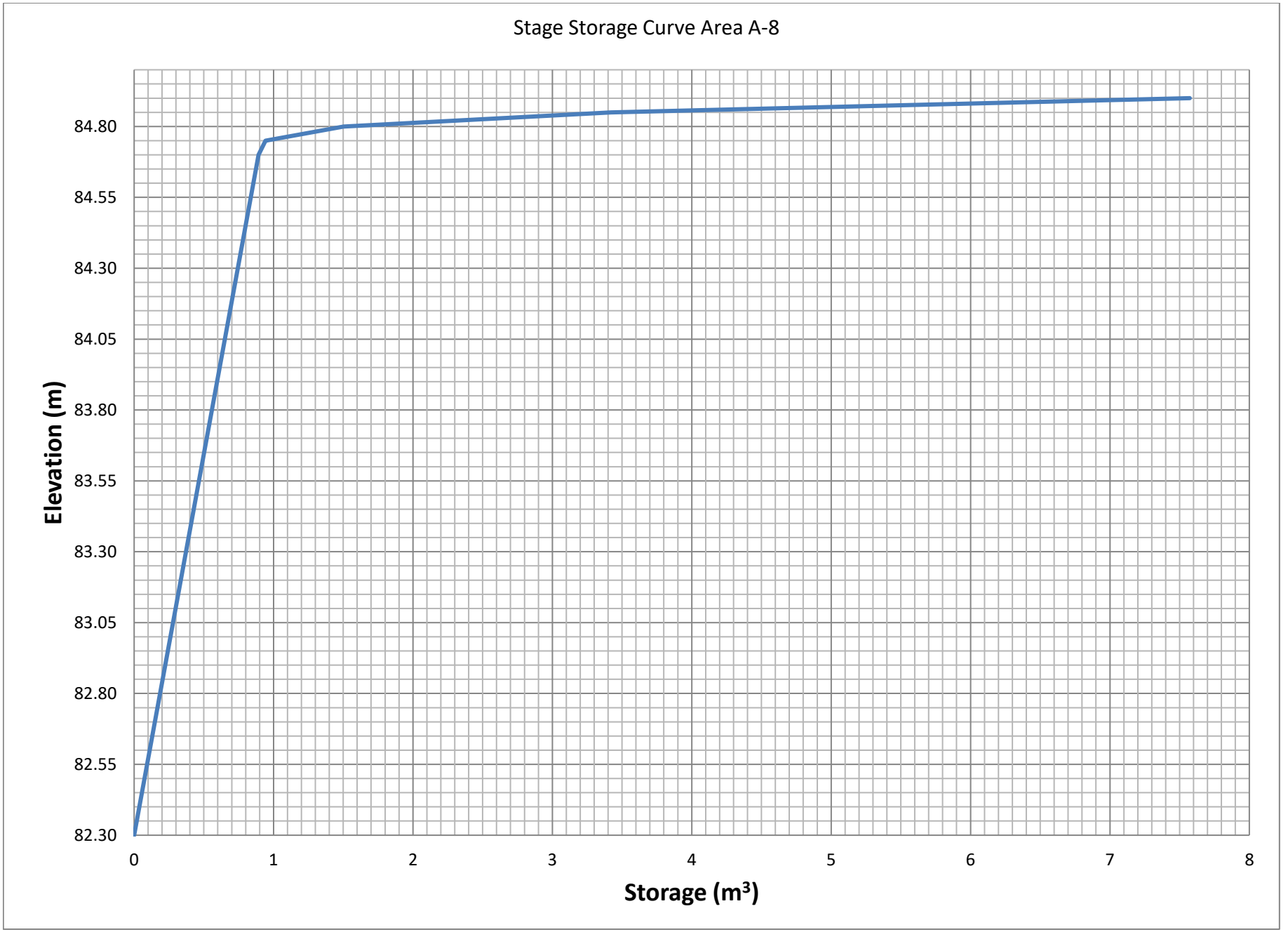
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CB 1	600	0.37	84.70	N/A	82.30

TABLE 9F: Storage Provided - A-8

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CB 1 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.300	0.00	0.00	0.00	0.00	**0.00**
84.700	2.40	0.89	0.89	0.00	**0.89**
84.750	2.45	-	0.89	0.05	**0.94**
84.800	2.50	-	0.89	0.61	**1.50**
84.850	2.55	-	0.89	2.53	**3.42**
84.900	2.60	-	0.89	6.68	**7.57**

TABLE 9G: Orifice Sizing Information - A-8

Control Device					
Tempest ICD		55 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	3.7	0.8	1.90	84.30	200
1:5 Year	4.0	1.4	2.39	84.79	200
1:100 Year	4.1	5.0	2.46	84.86	200


Stage Storage Curve Area A-8
Elevation (m)
84.80
84.55
84.30
84.05
83.80
83.55
83.30
83.05
82.80
82.55
82.30
0
1
2
3
4
5
6
7
8
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
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DATE PREPARED: FEBRUARY 2021

Table 10: Post-Development Stormwater Management Summary (St Laurent Blvd)

Area ID	Area (ha)	1:5 Year Weighted Cw	1:100 Year Weighted Cw	Control Device	Outlet Location	2 Year Storm Event				5 Year Storm Event				100 Year Storm Event			
						Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Max Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)
A-1	0.034	0.14	0.18	N/A	St Laurent Blvd	1.0	N/A			1.4	N/A			3.1	N/A		
A-2	0.026	0.18	0.25	N/A	St Laurent Blvd	1.1	N/A			1.5	N/A			3.2	N/A		
A-3	0.855	0.90	1.00	RD-100-A-ADJ	St Laurent Blvd	10.5	0.06	153.3	178.1	12.1	0.08	215.0	217.2	22.1	0.15	408.1	434.3
Post-Devlopment Flow (Direct Runoff & Roof Areas Only)						**12.6**				**15.0**				**28.4**			
A-4	0.497	0.81	0.90	LMF 100	St Laurent Blvd	15.0	0.05	53.4	507.8	15.2	0.10	81.7	507.8	15.5	0.20	195.1	507.8
A-5	0.273	0.85	0.94	LMF 100	St Laurent Blvd	13.5	0.00	23.9	127.3	15.2	0.11	35.9	127.3	15.5	0.21	91.8	127.3
A-6	0.043	0.80	0.90	LMF 60	St Laurent Blvd	4.1	0.00	2.0	17.3	4.6	0.11	3.2	17.3	4.7	0.24	9.8	17.3
A-7	0.052	0.78	0.87	LMF 55	St Laurent Blvd	4.1	0.00	2.7	27.7	4.3	0.14	4.6	27.7	4.5	0.24	12.8	27.7
A-8	0.028	0.78	0.87	LMF 55	St Laurent Blvd	4.1	0.00	0.8	7.6	4.0	0.09	1.4	7.6	4.1	0.16	5.0	7.6
Post-Devlopment Flow (Controlled Surface Flows Only)						**40.8**	**-**	**82.7**	**687.7**	**43.3**	**-**	**126.8**	**687.7**	**44.3**	**-**	**314.4**	**687.7**
50% of Controlled Area Allowable Release Rate						**44.4**				**44.4**				**44.4**			
Total Allowable Release Rate to St Laurent Blvd						**117.2**				**117.2**				**117.2**			
Total Post-Development Flows to St Laurent Blvd						**53.4**				**58.3**				**72.7**			
Total Pre-Development Flow to St Laurent Blvd						**86.4**				**117.2**				**239.7**			

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LOCATION: OTTAWA, ONTARIO

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DATE PREPARED: DECEMBER 2020

TABLE 1A: Pre-Development Runoff Coefficient "C" - EX-2

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.00	0.90	0.20	0.25
0.73	Soft	0.73	0.20		

TABLE 1B: Pre-Development / Allowable EX-2 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Conroy Rd	0.730	0.20	12	**28.4**	**38.4**	**82.3**

Time of Concentration	Tc=	12	min	Flow Equation
Intensity (2 Year Event)	I_2=	69.89	mm/hr	Q = 2.78 x C x I x A
Intensity (5 Year Event)	I_5=	94.70	mm/hr	Where:
Intensity (100 Year Event)	I_{100}=	162.13	mm/hr	C is the runoff coefficient

I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

100 year Intensity = $1735.688 / (\text{Time in min} + 6.014)^{0.820}$
5 year Intensity = $998.071 / (\text{Time in min} + 6.053)^{0.814}$
2 year Intensity = $732.951 / (\text{Time in min} + 6.199)^{0.810}$

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PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 2A: Post-Development Runoff Coefficient "C" - B-1

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.012	0.90	0.31	0.37
0.076	Soft	0.064	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 2B: Post-Development B-1 Flows

Outlet Options	**Area (ha)**	**C_{avg}**	**Tc (min)**	**$Q_{2\ Year}$ (L/s)**	**$Q_{5\ Year}$ (L/s)**	**$Q_{100\ Year}$ (L/s)**
Conroy Rd	0.076	0.31	10	**5.0**	**6.8**	**13.9**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 3A: Post-Development Runoff Coefficient "C" - B-1

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.010	0.90	0.26	0.32
0.114	Soft	0.104	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 3B: Post-Development B-1 Flows

Outlet Options	**Area (ha)**	**C_{avg}**	**Tc (min)**	**$Q_{2\ Year}$ (L/s)**	**$Q_{5\ Year}$ (L/s)**	**$Q_{100\ Year}$ (L/s)**
Conroy Rd	0.114	0.26	10	**6.4**	**8.6**	**17.9**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 4A: Post-Development Runoff Coefficient "C" - B-3

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.009	0.90	0.26	1.00	0.32
0.097	Roof	0.000	0.90		1.00	
	Soft	0.088	0.20		0.25	

TABLE 4B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - B-3

0.097 =Area (ha)
0.26 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	11.95	5.5	6.45	0.00
	5	103.57	7.40	5.5	1.90	0.57
	10	**76.81**	**5.49**	**5.5**	**-0.01**	**-0.01**
	15	61.77	4.41	5.5	-1.09	-0.98
	20	52.03	3.72	5.5	-1.78	-2.14

TABLE 4C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - B-3

0.097 =Area (ha)
0.26 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	16.47	6.0	10.47	0.00
	5	141.18	10.09	6.0	4.09	1.23
	10	**104.19**	**7.44**	**6.0**	**1.44**	**0.87**
	15	83.56	5.97	6.0	-0.03	-0.03
	20	70.25	5.02	6.0	-0.98	-1.18

TABLE 4D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - B-3

0.097 =Area (ha)
0.32 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	0	398.62	34.35	6.2	28.15	0.00
	5	242.70	20.92	6.2	14.72	4.41
	10	**178.56**	**15.39**	**6.2**	**9.19**	**5.51**
	15	142.89	12.31	6.2	6.11	5.50
	20	119.95	10.34	6.2	4.14	4.96

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 4E: Structure information - B-3

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CB 28	600	0.37	84.11	N/A	83.00

TABLE 4F: Storage Provided - B-3

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CB 28 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
83.000	0.00	0.00	0.00	0.00	**0.00**
84.110	1.11	0.41	0.41	0.00	**0.41**
84.160	1.16	-	0.41	0.03	**0.44**
84.210	1.21	-	0.41	0.24	**0.65**
84.260	1.26	-	0.41	0.82	**1.23**
84.310	1.31	-	0.41	1.95	**2.36**
84.360	1.36	-	0.41	3.81	**4.22**
84.410	1.41	-	0.41	6.62	**7.03**

TABLE 4G: Orifice Sizing Information - B-3

Control Device					
Tempest ICD			85 LMF		
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	5.5	0.0	1.01	84.11	200
1:5 Year	6.0	0.9	1.15	84.25	200
1:100 Year	6.2	5.5	1.28	84.38	200

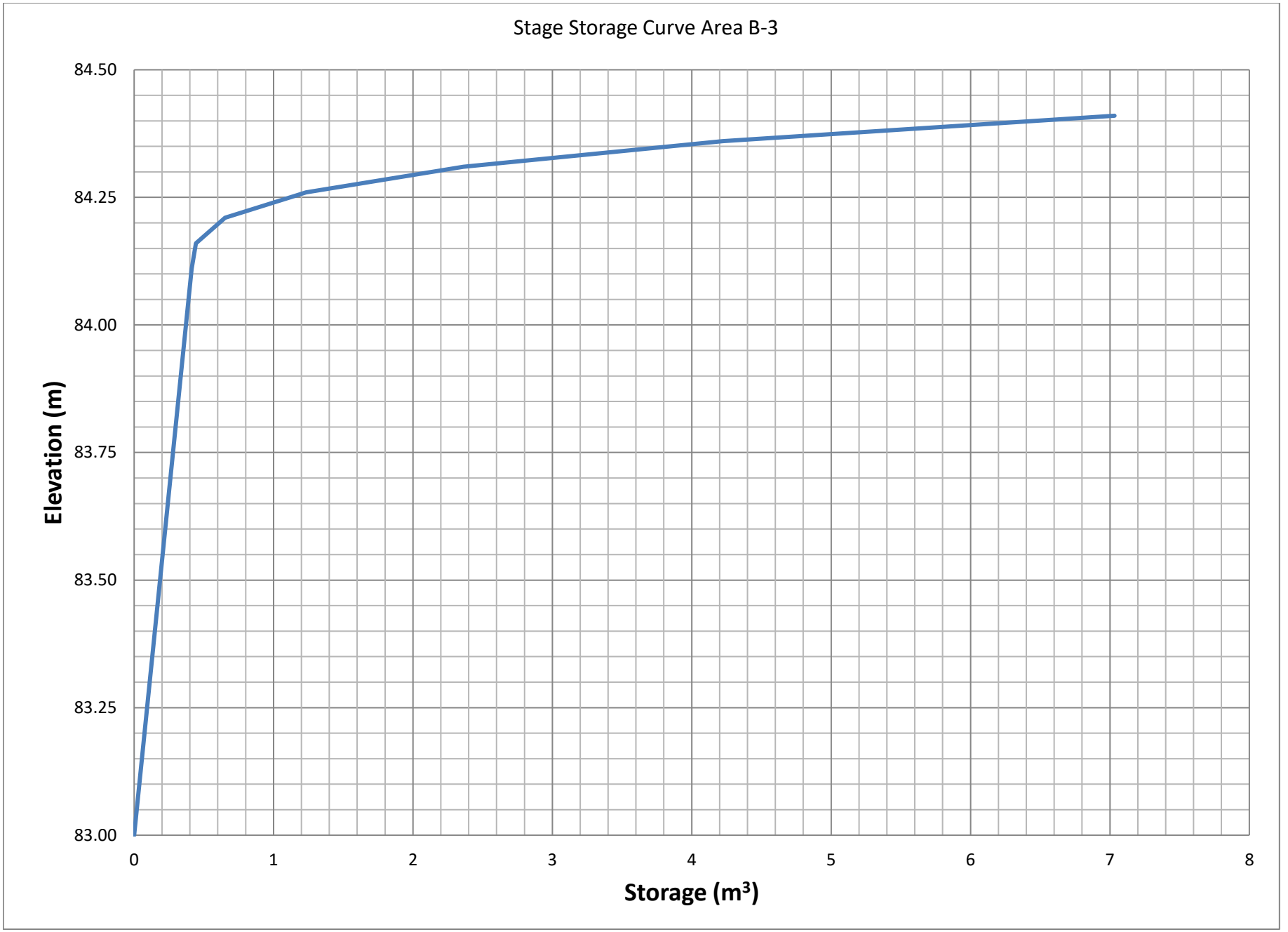
Stage Storage Curve Area B-3
84.50
84.25
84.00
83.75
83.50
83.25
83.00
Elevation (m)
0
1
2
3
4
5
6
7
8
Storage (m³)

Table 4: Post-Development Stormwater Management Summary (Conroy Rd)

Area ID	Area (ha)	1:5 Year Weighted Cw	1:100 Year Weighted Cw	Control Device	Outlet Location	2 Year Storm Event				5 Year Storm Event				100 Year Storm Event			
						Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Max Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)
B-1	0.076	0.31	0.37	N/A	Conroy Rd	5.0	N/A			6.8	N/A			13.9	N/A		
B-2	0.114	0.26	0.32	N/A	Conroy Rd	6.4	N/A			8.6	N/A			17.9	N/A		
B-3	0.097	0.26	0.32	LMF 85	Conroy Rd	5.5	0.00	0.00	7.03	6.0	0.14	0.87	7.03	6.2	0.27	5.51	7.03
Total Post-Development Flows to Conroy Rd						**16.9**				**15.4**				**38.0**			
Total Allowable Release Rate to Conroy Rd						**38.4**				**38.4**				**38.4**			
Total Pre-Development Flow to Conroy Rd						**28.4**				**38.4**				**82.3**			

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 1A: Pre-Development Runoff Coefficient "C" - EX-3

Area	Surface	Ha	"C"	C_{avg}	$*C_{100}$
Total	Hard	2.48	0.90	0.68	0.76
3.65	Soft	1.17	0.20		

TABLE 1B: Allowable EX-3 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)
Walkley Rd	3.65	0.50	15	**313.4**

TABLE 1C: Pre-Development EX-3 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{2\ Year}$ (L/s)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Walkley Rd	3.65	0.68	15	**423.4**	**572.8**	**1101.4**

Time of Concentration	Tc=	15	min	Flow Equation
Intensity (2 Year Event)	I_2=	61.77	mm/hr	Q = 2.78 x C x I x A
Intensity (5 Year Event)	I_5=	83.56	mm/hr	Where:
Intensity (100 Year Event)	I_{100}=	142.89	mm/hr	C is the runoff coefficient

I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: FEBRUARY 2021

TABLE 2A: Post-Development Runoff Coefficient "C" - C-1

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.001	0.90	0.24	0.29
0.019	Soft	0.018	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 2B: Post-Development C-1 Flows

Outlet Options	**Area (ha)**	**C_{avg}**	**Tc (min)**	**$Q_{2\ Year}$ (L/s)**	**$Q_{5\ Year}$ (L/s)**	**$Q_{100\ Year}$ (L/s)**
Walkley Road	0.019	0.24	10	**1.0**	**1.3**	**2.7**

Time of Concentration	Tc=	10	min
Intensity (2 Year Event)	I_2=	76.81	mm/hr
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$
2 year Intensity = 732.951 / (Time in min + 6.199) $^{0.810}$

Equations:
Flow Equation
$Q = 2.78 \times C \times I \times A$
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
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DATE PREPARED: FEBRUARY 2021

TABLE 3A: Post-Development Runoff Coefficient "C" - C-2 Controlled Roof Area

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.000	0.90	0.90	1.00	1.00
0.845	Roof	0.845	0.90		1.00	
	Soft	0.000	0.20		0.25	

TABLE 3B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-2 Controlled Roof Area

0.845 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	70	21.91	46.33	10.5	35.85	150.55
	75	20.81	44.00	10.5	33.52	150.85
	80	19.83	**41.92**	**10.5**	**31.44**	**150.92**
	85	18.94	40.05	10.5	29.57	150.81
	90	18.14	38.36	10.5	27.88	150.53

TABLE 3C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-2 Controlled Roof Area

0.845 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	80	26.56	56.16	12.1	44.01	211.27
	85	25.37	53.63	12.1	41.49	211.60
	90	**24.29**	**51.35**	**12.1**	**39.21**	**211.72**
	95	23.31	49.27	12.1	37.13	211.63
	100	22.41	47.37	12.1	35.23	211.38

TABLE 3D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-2 Controlled Roof Area

0.845 =Area (ha)
1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	90	41.11	96.57	22.1	74.49	402.25
	95	39.43	92.64	22.1	70.55	402.16
	100	**37.90**	**89.04**	**22.1**	**66.96**	**401.73**
	105	36.50	85.74	22.1	63.65	401.02
	110	35.20	82.69	22.1	60.61	400.04

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

Table 3E: Roof Drain Flows

Roof Drains		
Roof Area	8450	m²
Qty	14	
Type	Accutrol RD-100-A-ADJ	
Setting	3/4 Open	
Design Head	0.05-0.15	m
Design Flow 1" of head	0.32	L/s (ea)
Design Flow 2" of head	0.63	L/s (ea)
Design Flow 3" of head	0.87	L/s (ea)
Design Flow 4" of head	1.10	L/s (ea)
Design Flow 5" of head	1.34	L/s (ea)
Design Flow 6" of head	1.58	L/s (ea)

Table 4F: Total Roof Storage

Storm Event	# Roof Drains	Avg Area Per Roof Drain (m²)	Avg Ponding Depth Per Roof Drain (m)	*Total Volume (m³)	Total Volume (m³) Required
2 Year	14	603.6	0.0625	176.04	150.92
5 Year	14	603.6	0.0762	214.63	211.72
100 Year	14	603.6	0.1524	429.26	401.73
Max Storage	14	603.6	0.1524	429.26	

*NOTE: Ponding volumes calculated using cone equation:

$$V = \frac{Area\ X\ Depth}{3}$$

TABLE 4A: Post-Development Runoff Coefficient "C" - C-3 Controlled Roof Area

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.000	0.90	0.90	1.00	1.00
0.765	Roof	0.765	0.90		1.00	
	Soft	0.000	0.20		0.25	

TABLE 4B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-3 Controlled Roof Area

0.765 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	75	20.81	39.84	9.0	30.85	138.84
	80	19.83	37.95	9.0	28.97	139.06
	85	18.94	**36.26**	**9.0**	**27.28**	**139.11**
	90	18.14	34.73	9.0	25.74	139.00
	95	17.41	33.33	9.0	24.35	138.77

TABLE 4C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-3 Controlled Roof Area

0.765 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	75	27.89	53.38	11.8	41.55	186.98
	80	26.56	50.84	11.8	39.01	187.26
	85	**25.37**	**48.56**	**11.8**	**36.73**	**187.31**
	90	24.29	46.49	11.8	34.66	187.16
	95	23.31	44.61	11.8	32.78	186.84

TABLE 4D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3 Controlled Roof Area

0.765 =Area (ha)
1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	85	42.95	91.35	18.9	72.42	369.35
	90	41.11	87.43	18.9	68.50	369.92
	95	**39.43**	**83.87**	**18.9**	**64.94**	**370.15**
	100	37.90	80.61	18.9	61.68	370.08
	105	36.50	77.62	18.9	58.69	369.76

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

Table 4E: Roof Drain Flows

Roof Drains		
Roof Area	7650	m²
Qty	12	
Type	Accutrol RD-100-A-ADJ	
Setting	3/4 Open	
Design Head	0.05-0.15	m
Design Flow 1" of head	0.32	L/s (ea)
Design Flow 2" of head	0.63	L/s (ea)
Design Flow 3" of head	0.87	L/s (ea)
Design Flow 4" of head	1.10	L/s (ea)
Design Flow 5" of head	1.34	L/s (ea)
Design Flow 6" of head	1.58	L/s (ea)

Table 4F: Total Roof Storage

Storm Event	# Roof Drains	Avg Area Per Roof Drain (m²)	Avg Ponding Depth Per Roof Drain (m)	*Total Volume (m³)	Total Volume (m³) Required
2 Year	12	637.5	0.0625	159.38	139.11
5 Year	12	637.5	0.0889	226.70	187.31
100 Year	12	637.5	0.1524	388.62	370.15
Max Storage	12	637.5	0.1524	388.62	

*NOTE: Ponding volumes calculated using cone equation:

$$V = \frac{Area\ X\ Depth}{3}$$

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: FEBRUARY 2021

TABLE 5A: Post-Development Runoff Coefficient "C" - C-4

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.547	0.90	0.87	1.00	0.96
0.574	Roof	0.000	1.00		1.00	
	Soft	0.027	0.20		0.25	

TABLE 5B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-4

0.574 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	20	52.03	71.99	19.1	52.89	63.47
	25	45.17	62.49	19.1	43.39	65.09
	30	**40.04**	**55.40**	**19.1**	**36.30**	**65.35**
	35	36.06	49.89	19.1	30.79	64.66
	40	32.86	45.47	19.1	26.37	63.29

TABLE 5C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-4

0.574 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	25	60.90	84.26	19.6	64.66	96.98
	30	53.93	74.61	19.6	55.01	99.03
	35	**48.52**	**67.13**	**19.6**	**47.53**	**99.81**
	40	44.18	61.13	19.6	41.53	99.68
	45	40.63	56.21	19.6	36.61	98.86

TABLE 5D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-4

0.574 =Area (ha)
0.96 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	55	59.62	91.79	20.3	71.49	235.90
	60	55.89	86.05	20.3	65.75	236.68
	65	**52.65**	**81.05**	**20.3**	**60.75**	**236.91**
	70	49.79	76.65	20.3	56.35	236.66
	75	47.26	72.75	20.3	52.45	236.01

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 5D: Structure information

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
STMMH 218	1200	1.13	84.04	82.26	82.23
CBMH 219	1200	1.13	84.15	82.38	82.31
STMMH 220	1200	1.13	84.22	82.89	82.70
CB 22	600	0.36	83.95	-	82.05
TD	300	39.00	83.93	-	83.63

TABLE 5E: Pipe information

Structures	Size Dia.(mm)	Length	Inv UP	Inv DOWN
STMMH 218-219	450	19.8	82.31	82.26
STMMH 219-220	375	106.1	82.70	82.38

TABLE 5F: Storage Provided - C-4

Storage Table								Total Storage		
Elevation (m)	System Depth (m)	STMMH 218 Volume (m^3)	CBMH 219 Volume (m^3)	STMMH 220 Volume (m^3)	CB 22 Volume (m^3)	TD Volume (m^3)	Pipe Storage Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.230	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
82.310	0.08	0.09	0.00	0.00	0.09	0.00	0.00	0.18	0.00	**0.18**
82.700	0.47	0.53	0.44	0.00	0.23	0.00	0.00	1.21	0.00	**1.21**
83.075	0.84	0.96	0.87	0.42	0.37	0.00	14.41	17.02	0.00	**17.02**
83.930	1.70	1.92	1.83	1.39	0.68	11.70	-	31.93	0.00	**31.93**
83.950	1.72	1.95	1.85	1.41	0.68	-	-	32.01	3.59	**35.60**
84.000	1.77	2.00	1.91	1.47	-	-	-	32.18	30.09	**62.27**
84.050	1.82	2.06	1.97	1.53	-	-	-	32.35	74.27	**106.62**
84.100	1.87	-	2.02	1.58	-	-	-	32.46	137.57	**170.03**
84.150	1.92	-	2.08	1.64	-	-	-	32.57	220.94	**253.51**
84.200	1.97	-	-	1.70	-	-	-	32.63	325.19	**357.82**
84.250	2.02	-	-	-	-	-	-	32.63	452.53	**485.16**

TABLE 2G: Orifice Sizing information - C-1

Control Device
Round Plate Orifice 83 mm

Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m^3)	Area (m^2)	Dia. (mm)
1:2 Year	19.1	1.69	83.96	450.0	65.3	0.0054	83.0
1:5 Year	19.6	1.75	84.02	450.0	99.8	0.0054	83.0
1:100 Year	20.3	1.87	84.14	450.0	236.9	0.0054	83.0

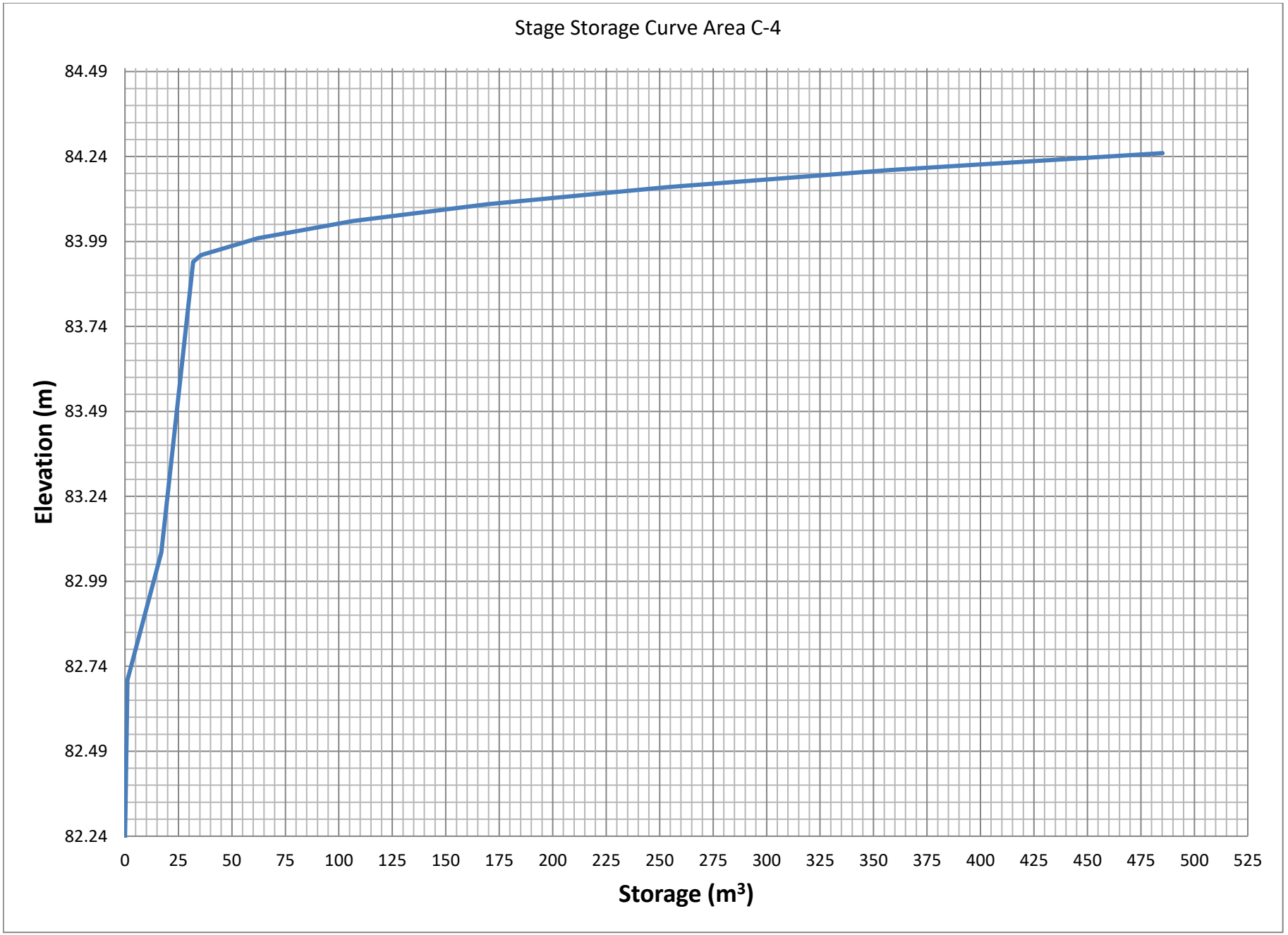
**The design Head is calculated based on the centre of the orifice at the bottom of the pipe

Orifice Control Sizing

Q = 0.62 x A x (2gh) x 0.5
Q is the release rate in m^3/s

A is the orifice area in m^2

g is the acceleration due to gravity, 9.81 m/s^2
h is the head of water above the orifice centre in m
d is the diameter of the orifice in m


Stage Storage Curve Area C-4
Elevation (m)
84.49
84.24
83.99
83.74
83.49
83.24
82.99
82.74
82.49
82.24
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
525
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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Engineers, Planners & Landscape Architects

DATE PREPARED: FEBRUARY 2021

TABLE 6A: Post-Development Runoff Coefficient "C" - C-5

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.057	0.90	0.80	1.00	0.90
0.066	Roof	0.000	0.90		1.00	
	Soft	0.009	0.20		0.25	

TABLE 6B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-5

0.066 =Area (ha)
0.80 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	24.69	6.8	17.89	0.00
	5	103.57	15.29	6.8	8.49	2.55
	10	**76.81**	**11.34**	**6.8**	**4.54**	**2.72**
	15	61.77	9.12	6.8	2.32	2.09
	20	52.03	7.68	6.8	0.88	1.06

TABLE 6C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-5

0.066 =Area (ha)
0.80 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	34.02	7.5	26.52	0.00
	5	141.18	20.84	7.5	13.34	4.00
	10	**104.19**	**15.38**	**7.5**	**7.88**	**4.73**
	15	83.56	12.33	7.5	4.83	4.35
	20	70.25	10.37	7.5	2.87	3.44

TABLE 6D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-5

0.066 =Area (ha)
0.90 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	10	178.56	29.41	7.7	21.71	13.03
	15	142.89	23.54	7.7	15.84	14.25
	20	**119.95**	**19.76**	**7.7**	**12.06**	**14.47**
	25	103.85	17.11	7.7	9.41	14.11
	30	91.87	15.13	7.7	7.43	13.38

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 6E: Structure information - C-5

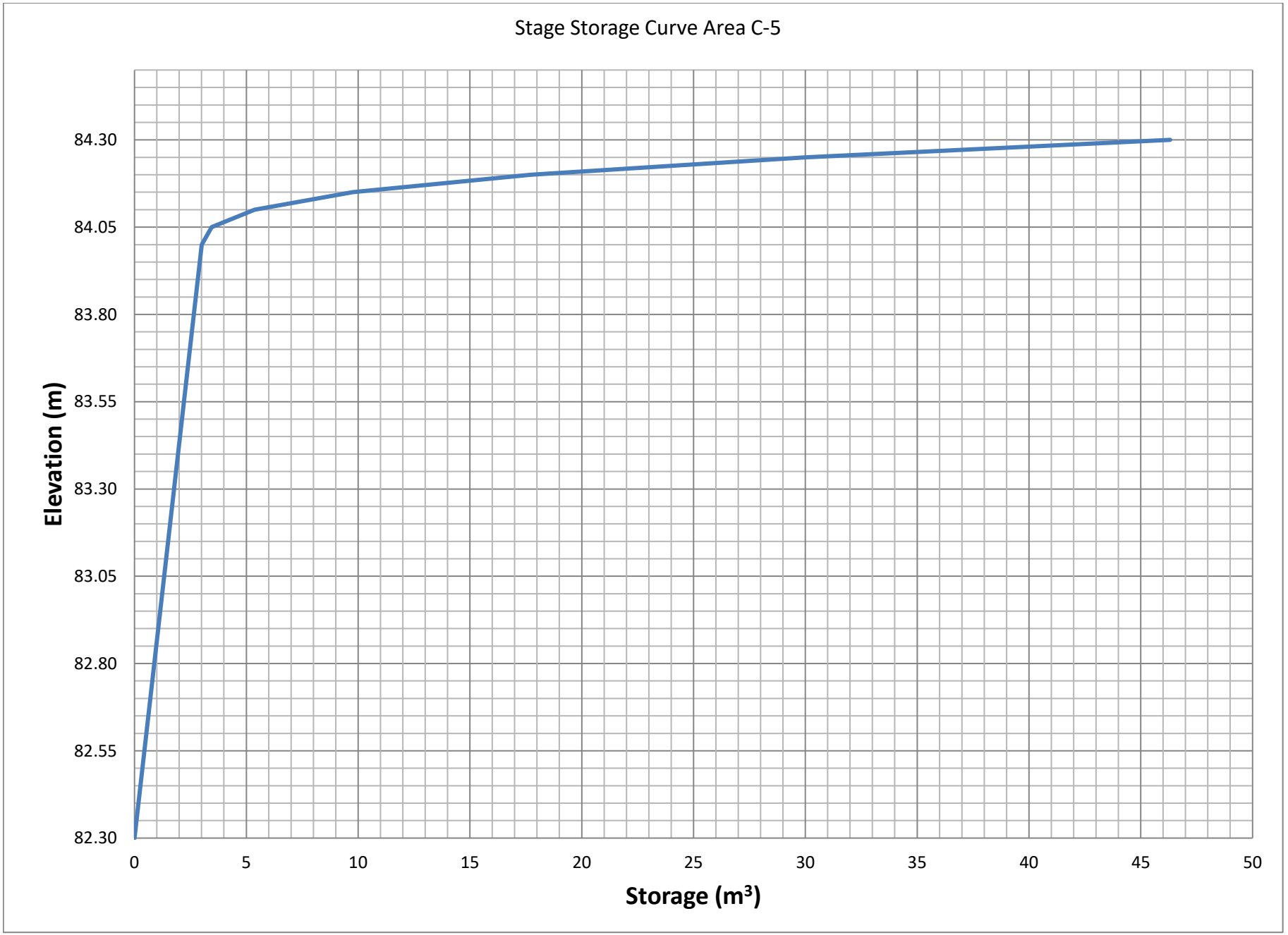
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 21	1500	1.77	84.00	N/A	82.30

TABLE 6F: Storage Provided - C-5

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 21 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.300	0.00	0.00	0.00	0.00	**0.00**
84.000	1.70	3.00	3.00	0.00	**3.00**
84.050	1.75	-	3.00	0.45	**3.45**
84.100	1.80	-	3.00	2.36	**5.36**
84.150	1.85	-	3.00	6.77	**9.77**
84.200	1.90	-	3.00	14.71	**17.71**
84.250	1.95	-	3.00	26.97	**29.97**
84.300	2.00	-	3.00	43.31	**46.31**

TABLE 6G: Orifice Sizing Information - C-5

Control Device					
Tempest ICD			80 LMF		
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	6.8	2.7	1.45	83.85	200
1:5 Year	7.5	4.7	1.68	84.08	200
1:100 Year	7.7	14.5	1.77	84.17	200


Stage Storage Curve Area C-5
84.30
84.05
83.80
83.55
83.30
83.05
82.80
82.55
82.30
Elevation (m)
0
5
10
15
20
25
30
35
40
45
50
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: FEBRUARY 2021

TABLE 7A: Post-Development Runoff Coefficient "C" - C-6

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.044	0.90	0.86	1.00	0.95
0.047	Roof	0.000	0.90		1.00	
	Soft	0.003	0.20		0.25	

TABLE 7B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-6

0.047 =Area (ha)
0.86 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	18.69	5.3	13.39	0.00
	5	103.57	11.57	5.3	6.27	1.88
	10	**76.81**	**8.58**	**5.3**	**3.28**	**1.97**
	15	61.77	6.90	5.3	1.60	1.44
	20	52.03	5.81	5.3	0.51	0.62

TABLE 7C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-6

0.047 =Area (ha)
0.86 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	25.76	5.7	20.06	0.00
	5	141.18	15.78	5.7	10.08	3.02
	10	**104.19**	**11.64**	**5.7**	**5.94**	**3.57**
	15	83.56	9.34	5.7	3.64	3.27
	20	70.25	7.85	5.7	2.15	2.58

TABLE 7D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-6

0.047 =Area (ha)
0.95 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	10	178.56	22.21	6.0	16.21	9.73
	15	142.89	17.78	6.0	11.78	10.60
	20	**119.95**	**14.92**	**6.0**	**8.92**	**10.71**
	25	103.85	12.92	6.0	6.92	10.38
	30	91.87	11.43	6.0	5.43	9.77

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 7E: Structure information - C-6

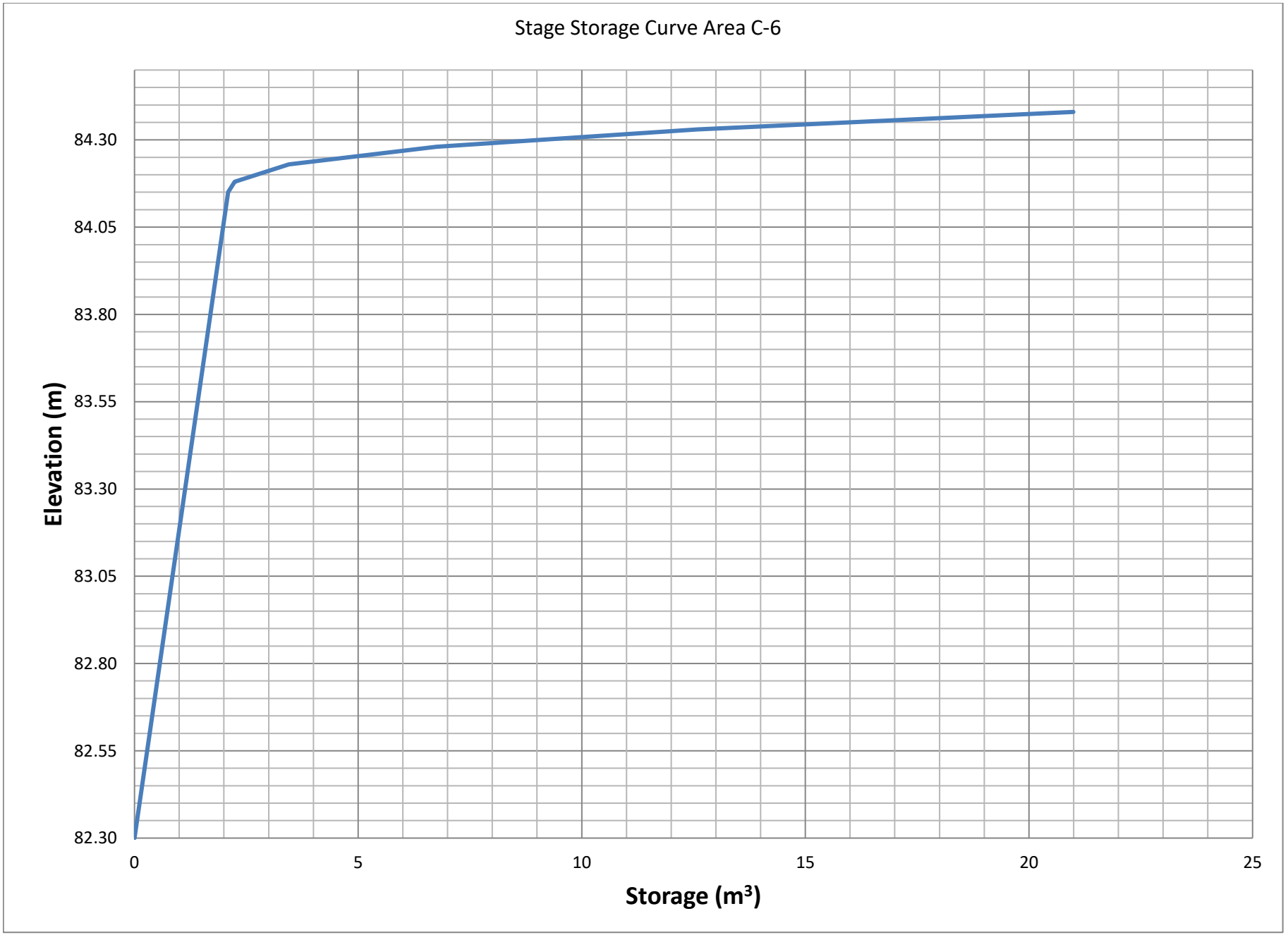
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 20	1200	1.13	84.15	N/A	82.30

TABLE 7F: Storage Provided - C-6

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 20 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.300	0.00	0.00	0.00	0.00	**0.00**
84.150	1.85	2.09	2.09	0.00	**2.09**
84.180	1.88	-	2.09	0.15	**2.24**
84.230	1.93	-	2.09	1.36	**3.45**
84.280	1.98	-	2.09	4.66	**6.75**
84.330	2.03	-	2.09	10.50	**12.59**
84.380	2.08	-	2.09	18.90	**20.99**

TABLE 7G: Orifice Sizing Information - C-6

Control Device					
Tempest ICD		70 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	5.3	2.0	1.35	83.75	200
1:5 Year	5.7	3.6	1.69	84.09	200
1:100 Year	6.0	10.7	1.94	84.34	200


Stage Storage Curve Area C-6
84.30
84.05
83.80
83.55
83.30
83.05
82.80
82.55
82.30
Elevation (m)
0
5
10
15
20
25
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: FEBRUARY 2021

TABLE 8A: Post-Development Runoff Coefficient "C" - C-7

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.292	0.90	0.87	1.00	0.97
0.303	Roof	0.000	1.00		1.00	
	Soft	0.011	0.20		0.25	

TABLE 8B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-7

0.303 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	5	103.57	76.30	19.2	57.10	17.13
	10	76.81	56.58	19.2	37.38	22.43
	15	**61.77**	**45.50**	**19.2**	**26.30**	**23.67**
	20	52.03	38.33	19.2	19.13	22.96
	25	45.17	33.27	19.2	14.07	21.11

TABLE 8C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-5

0.303 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	5	141.18	104.01	22.7	81.31	24.39
	10	104.19	76.76	22.7	54.06	32.44
	15	**83.56**	**61.56**	**22.7**	**38.86**	**34.97**
	20	70.25	51.75	22.7	29.05	34.86
	25	60.90	44.86	22.7	22.16	33.24

TABLE 8D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-7

0.303 =Area (ha)
0.97 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	20	119.95	98.29	23.5	74.79	89.75
	25	103.85	85.09	23.5	61.59	92.39
	30	**91.87**	**75.28**	**23.5**	**51.78**	**93.20**
	35	82.58	67.67	23.5	44.17	92.75
	40	75.15	61.57	23.5	38.07	91.38

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 8E: Structure information - C-7

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 212	1200	1.13	84.50	82.22	82.21
CBMH 213	1200	1.13	84.55	82.31	82.30
CBMH 214	1200	1.13	84.55	82.40	82.39
CBMH 215	1200	1.13	84.60	82.49	82.48
CBMH 216	1200	1.13	84.60	82.56	82.55
CBMH 19	1200	1.13	84.60	-	82.63

TABLE 8F: Pipe information - C-7

Structures	Size Dia.(mm)	Length	Inv UP	Inv DOWN
CBMH 212-213	375	28.60	82.30	82.22
CBMH 213-214	375	26.00	82.39	82.31
CBMH 214-215	375	23.30	82.48	82.40
CBMH 215-216	375	23.40	81.82	82.49
CBMH 216-19	375	22.20	82.63	82.56

TABLE 8G: Storage Provided - C-7

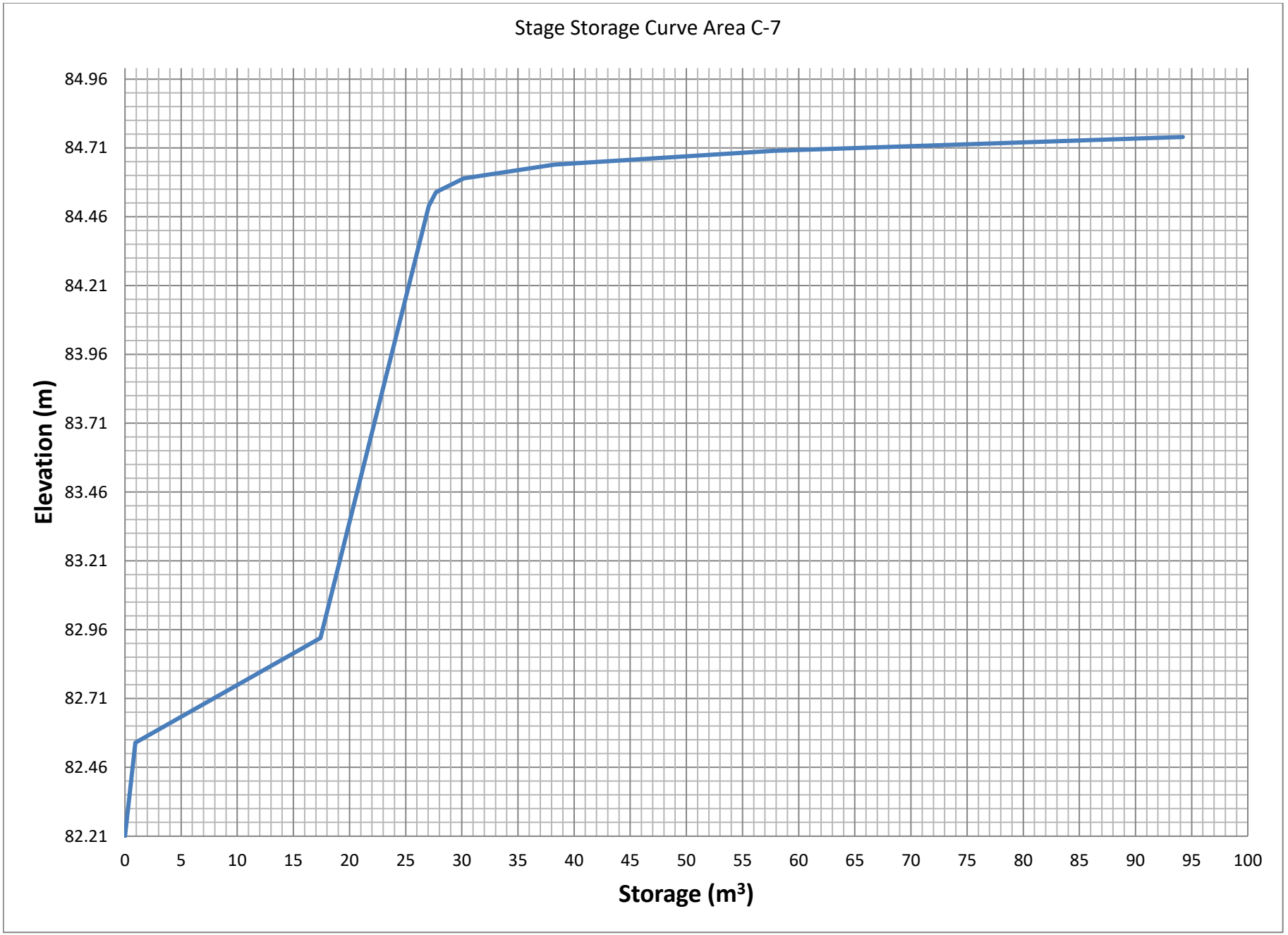
Storage Table									Total Storage		
Elevation (m)	System Depth (m)	CBMH 212 Volume (m^3)	CBMH 213 Volume (m^3)	CBMH 214 Volume (m^3)	CBMH 215 Volume (m^3)	CBMH 216 Volume (m^3)	CBMH 19	Pipe Storage Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.210	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
82.550	0.34	0.38	0.28	0.18	0.08	0.00	0.00	0.00	0.93	0.00	**0.93**
82.930	0.72	0.81	0.71	0.61	0.51	0.43	0.34	12.99	16.41	1.00	**17.41**
84.500	2.29	2.59	2.49	2.39	2.28	2.21	2.11	-	27.06	0.00	**27.06**
84.550	2.34	-	2.54	2.44	2.34	2.26	2.17	-	27.35	0.36	**27.71**
84.600	2.39	-	-	-	2.40	2.32	2.23	-	27.51	2.66	**30.17**
84.650	2.44	-	-	-	-	-	-	-	27.51	10.75	**38.26**
84.700	2.49	-	-	-	-	-	-	-	27.51	30.22	**57.73**
84.750	2.54	-	-	-	-	-	-	-	27.51	66.70	**94.21**

TABLE 8H: Orifice Sizing information - C-7

Control Device
Round Plate Orifice 83 mm

Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m^3)	Area (m^2)
	19.2	1.66	83.91	375.0	23.67	0.0054
1:5 Year	22.7	2.37	84.62	375.0	34.97	0.0054
1:100 Year	23.5	2.49	84.74	375.0	93.20	0.0054

**The design Head is calculated based on the centre of the orifice at the bottom of the pipe


Stage Storage Curve Area C-7
84.96
84.71
84.46
84.21
83.96
83.71
83.46
83.21
82.96
82.71
82.46
82.21
Elevation (m)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: FEBRUARY 2021

TABLE 9A: Post-Development Runoff Coefficient "C" - C-8

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.388	0.90	0.87	1.00	0.97
0.405	Roof	0.000	1.00		1.00	
	Soft	0.017	0.20		0.25	

TABLE 9B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-8

0.405 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	10	76.81	75.29	20.5	54.79	32.87
	15	61.77	60.55	20.5	40.05	36.04
	20	**52.03**	**51.00**	**20.5**	**30.50**	**36.60**
	25	45.17	44.27	20.5	23.77	35.66
	30	40.04	39.25	20.5	18.75	33.75

TABLE 9C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-8

0.405 =Area (ha)
0.87 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	15	83.56	81.91	20.7	61.21	55.08
	20	70.25	68.86	20.7	48.16	57.79
	25	**60.90**	**59.69**	**20.7**	**38.99**	**58.49**
	30	53.93	52.86	20.7	32.16	57.89
	35	48.52	47.56	20.7	26.86	56.40

TABLE 9D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-8

0.405 =Area (ha)
0.97 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	35	82.58	90.05	21.2	68.85	144.58
	40	75.15	81.94	21.2	60.74	145.78
	45	**69.05**	**75.30**	**21.2**	**54.10**	**146.06**
	50	63.95	69.74	21.2	48.54	145.62
	55	59.62	65.02	21.2	43.82	144.60

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 9E: Structure information

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 209	1200	1.13	84.25	82.16	82.15
STMMH 210	1200	1.13	84.50	-	82.44
TD	300	34.50	84.08	-	83.78

TABLE 9F: Pipe information

Structures	Size Dia.(mm)	Length	Inv UP	Inv DOWN
CBMH 209 - STMMH 210	375	93.0	82.44	82.16

TABLE 9G: Storage Provided - C-8

Storage Table					Total Storage			
Elevation (m)	System Depth (m)	CBMH 209 Volume (m^3)	STMMH 210 Volume (m^3)	TD Volume (m^3)	Pipe Storage Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.150	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
82.440	0.29	0.33	0.00	0.00	0.00	0.33	0.00	**0.33**
82.815	0.66	0.75	0.42	0.00	9.78	10.96	0.00	**10.96**
84.080	1.93	2.18	1.85	10.35	-	24.17	0.00	**24.17**
84.100	1.95	2.21	1.88	-	-	24.22	3.03	**27.25**
84.150	2.00	2.26	1.93	-	-	24.33	23.95	**48.28**
84.200	2.05	2.32	1.99	-	-	24.44	56.09	**80.53**
84.250	2.10	2.38	2.05	-	-	24.56	99.41	**123.97**
84.300	2.15	-	2.10	-	-	24.61	154.22	**178.83**
84.350	2.20	-	2.16	-	-	24.67	221.23	**245.90**
84.400	2.25	-	2.22	-	-	24.73	301.11	**325.84**

TABLE 9H: Orifice Sizing information - C-8

Control Device
Round Plate Orifice 83 mm

Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m^3)	Area (m^2)	Dia. (mm)
1:2 Year	20.5	1.93	84.12	450.0	36.6	0.0054	83.0
1:5 Year	20.7	1.98	84.17	450.0	58.5	0.0054	83.0
1:100 Year	21.2	2.03	84.22	450.0	146.1	0.0054	83.0

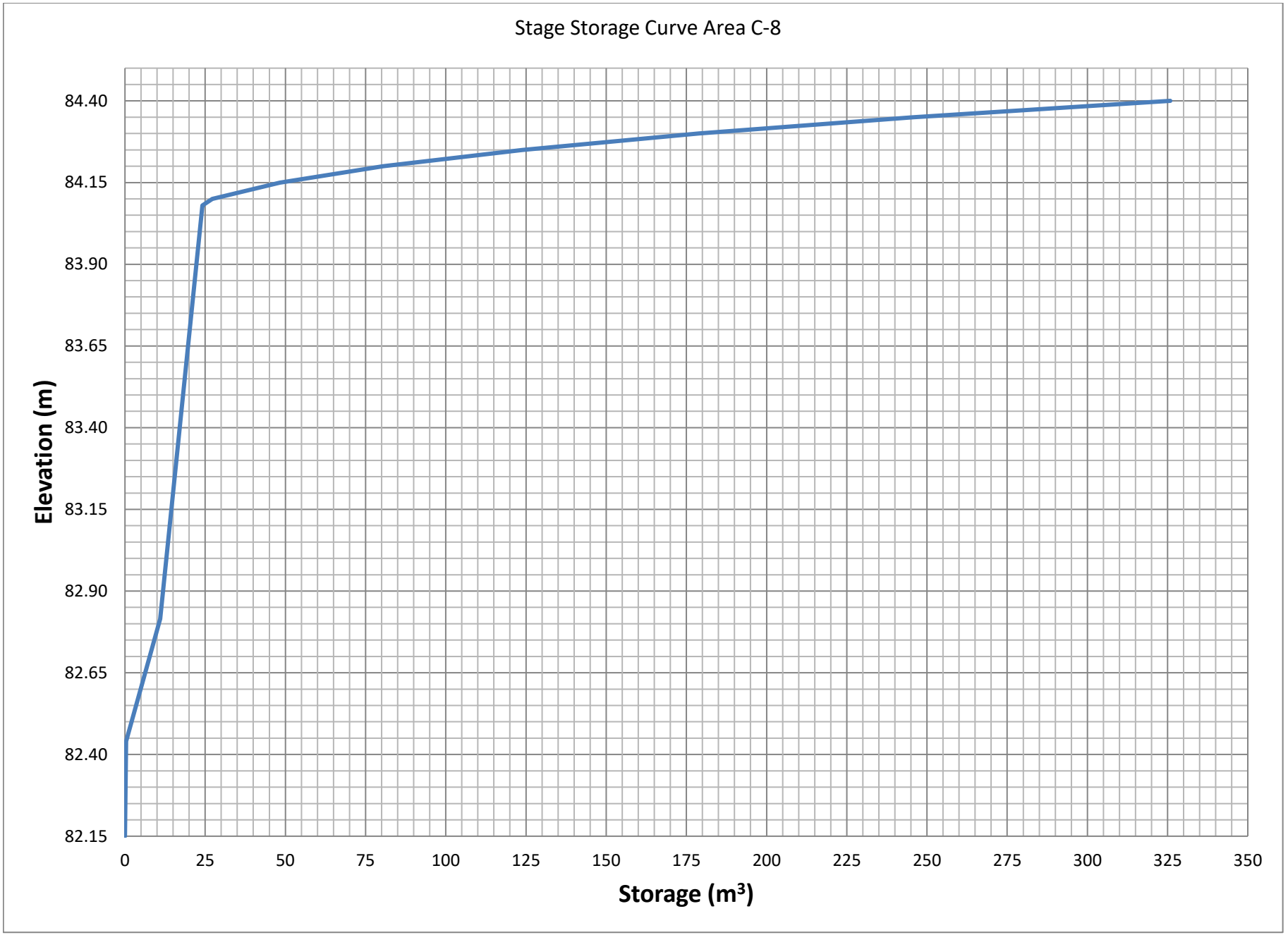
**The design Head is calculated based on the centre of the orifice at the bottom of the pipe

Orifice Control Sizing

Q = 0.62 x A x (2gh) x 0.5
Q is the release rate in m^3/s

A is the orifice area in m^2

g is the acceleration due to gravity, 9.81 m/s^2
h is the head of water above the orifice centre in m
d is the diameter of the orifice in m


Stage Storage Curve Area C-8
Elevation (m)
84.40
84.15
83.90
83.65
83.40
83.15
82.90
82.65
82.40
82.15
0
25
50
75
100
125
150
175
200
225
250
275
300
325
350
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 10A: Post-Development Runoff Coefficient "C" - C-9

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.054	0.90	0.88	1.00	0.97
0.056	Roof	0.000	0.90		1.00	
	Soft	0.002	0.20		0.25	

TABLE 10B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-9

0.056 =Area (ha)
0.88 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	22.78	5.5	17.28	0.00
	5	103.57	14.11	5.5	8.61	2.58
	10	**76.81**	**10.46**	**5.5**	**4.96**	**2.98**
	15	61.77	8.41	5.5	2.91	2.62
	20	52.03	7.09	5.5	1.59	1.91

TABLE 10C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-9

0.056 =Area (ha)
0.88 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	31.40	5.8	25.60	0.00
	5	141.18	19.23	5.8	13.43	4.03
	10	**104.19**	**14.19**	**5.8**	**8.39**	**5.04**
	15	83.56	11.38	5.8	5.58	5.02
	20	70.25	9.57	5.8	3.77	4.52

TABLE 10D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-9

0.056 =Area (ha)
0.97 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	10	178.56	27.05	6.0	21.05	12.63
	15	142.89	21.65	6.0	15.65	14.08
	20	**119.95**	**18.17**	**6.0**	**12.17**	**14.61**
	25	103.85	15.73	6.0	9.73	14.60
	30	91.87	13.92	6.0	7.92	14.25

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 10E: Structure information - C-9

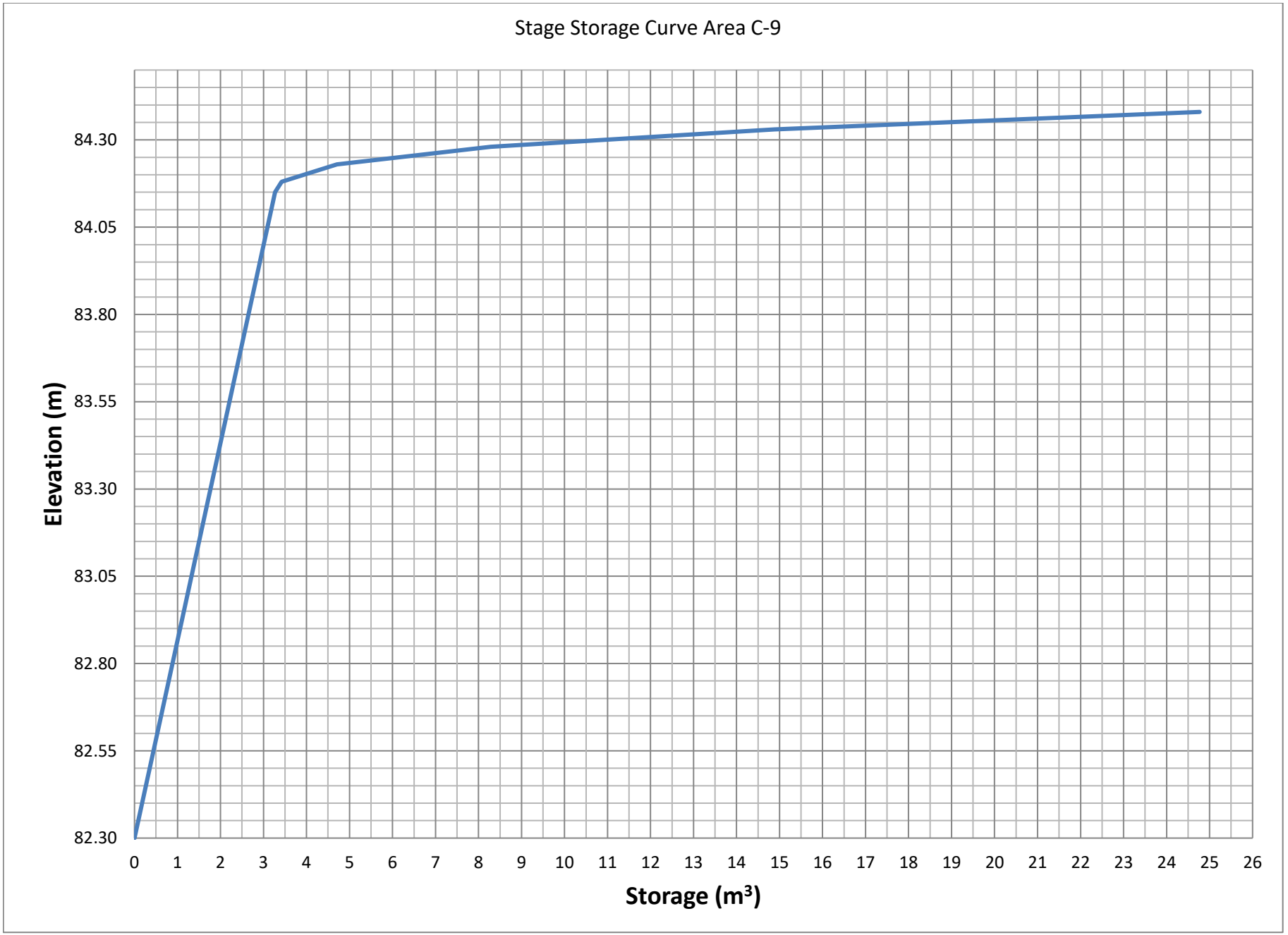
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 18	1500	1.77	84.15	N/A	82.30

TABLE 10F: Storage Provided - C-9

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 18 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.300	0.00	0.00	0.00	0.00	**0.00**
84.150	1.85	3.27	3.27	0.00	**3.27**
84.180	1.88	-	3.27	0.15	**3.42**
84.230	1.93	-	3.27	1.44	**4.71**
84.280	1.98	-	3.27	5.02	**8.29**
84.330	2.03	-	3.27	11.61	**14.88**
84.380	2.08	-	3.27	21.50	**24.77**

TABLE 10G: Orifice Sizing Information - C-9

Control Device					
Tempest ICD			70 LMF		
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	5.5	3.0	1.65	84.05	200
1:5 Year	5.8	5.0	1.84	84.24	200
1:100 Year	6.0	14.6	1.92	84.32	200


Stage Storage Curve Area C-9
Elevation (m)
84.30
84.05
83.80
83.55
83.30
83.05
82.80
82.55
82.30
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 11A: Post-Development Runoff Coefficient "C" - C-10

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.058	0.90	0.79	1.00	0.88
0.069	Roof	0.000	0.90		1.00	
	Soft	0.011	0.20		0.25	

TABLE 11B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-10

0.069 =Area (ha)
0.79 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	25.29	5.8	19.49	0.00
	5	103.57	15.66	5.8	9.86	2.96
	10	**76.81**	**11.62**	**5.8**	**5.82**	**3.49**
	15	61.77	9.34	5.8	3.54	3.19
	20	52.03	7.87	5.8	2.07	2.48

TABLE 11C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-10

0.069 =Area (ha)
0.79 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	5	141.18	21.35	6.2	15.15	4.55
	10	104.19	15.76	6.2	9.56	5.73
	15	**83.56**	**12.64**	**6.2**	**6.44**	**5.79**
	20	70.25	10.62	6.2	4.42	5.31
	25	60.90	9.21	6.2	3.01	4.51

TABLE 11D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-10

0.069 =Area (ha)
0.88 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	15	142.89	24.13	6.4	17.73	15.96
	20	119.95	20.26	6.4	13.86	16.63
	25	**103.85**	**17.54**	**6.4**	**11.14**	**16.71**
	30	91.87	15.52	6.4	9.12	16.41
	35	82.58	13.95	6.4	7.55	15.85

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 11E: Structure information - C-10

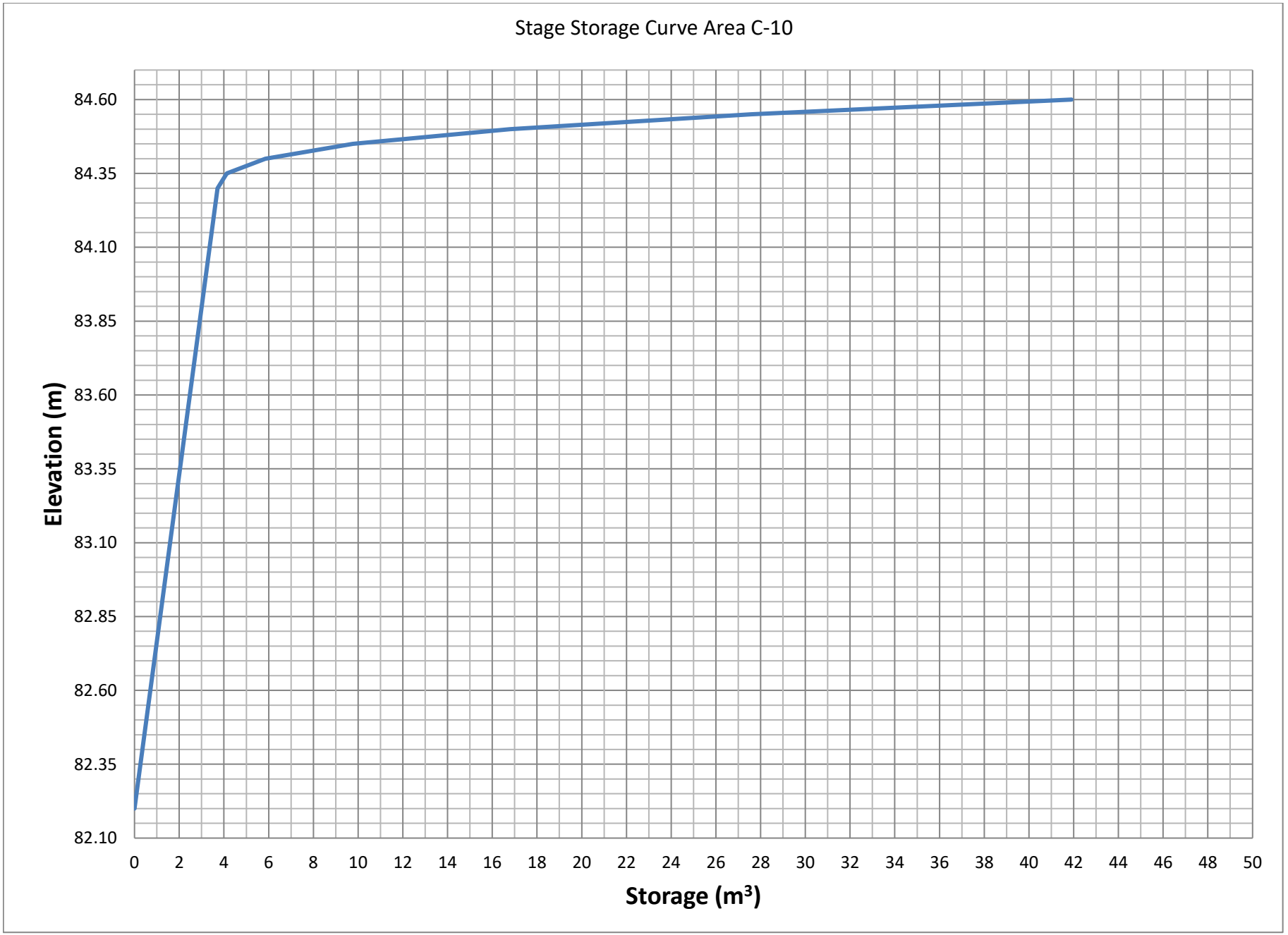
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 13	1500	1.77	84.30	N/A	82.20

TABLE 11F: Storage Provided - C-10

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 13 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.200	0.00	0.00	0.00	0.00	**0.00**
84.300	2.10	3.71	3.71	0.00	**3.71**
84.350	2.15	-	3.71	0.42	**4.13**
84.400	2.20	-	3.71	2.14	**5.85**
84.450	2.25	-	3.71	6.06	**9.77**
84.500	2.30	-	3.71	13.08	**16.79**
84.550	2.35	-	3.71	23.87	**27.58**
84.600	2.40	-	3.71	38.19	**41.90**

TABLE 11G: Orifice Sizing Information - C-10

Control Device					
Tempest ICD			70 LMF		
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	5.8	3.5	1.75	84.05	200
1:5 Year	6.2	5.8	2.07	84.37	200
1:100 Year	6.4	16.7	2.20	84.50	200


Stage Storage Curve Area C-10
Elevation (m)
84.60
84.35
84.10
83.85
83.60
83.35
83.10
82.85
82.60
82.35
82.10
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
46
48
50
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 12A: Post-Development Runoff Coefficient "C" - C-11

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.069	0.90	0.57	1.00	0.65
0.129	Roof	0.000	0.90		1.00	
	Soft	0.060	0.20		0.25	

TABLE 12B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-11

0.129 =Area (ha)
0.57 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	0	167.22	34.45	10.0	24.45	0.00
	5	103.57	21.34	10.0	11.34	3.40
	10	**76.81**	**15.82**	**10.0**	**5.82**	**3.49**
	15	61.77	12.72	10.0	2.72	2.45
	20	52.03	10.72	10.0	0.72	0.86

TABLE 12C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-11

0.129 =Area (ha)
0.57 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	0	230.48	47.48	10.5	36.98	0.00
	5	141.18	29.08	10.5	18.58	5.57
	10	**104.19**	**21.46**	**10.5**	**10.96**	**6.58**
	15	83.56	17.21	10.5	6.71	6.04
	20	70.25	14.47	10.5	3.97	4.77

TABLE 12D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-11

0.129 =Area (ha)
0.65 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	10	178.56	41.70	10.9	30.80	18.48
	15	142.89	33.37	10.9	22.47	20.22
	20	**119.95**	**28.01**	**10.9**	**17.11**	**20.53**
	25	103.85	24.25	10.9	13.35	20.03
	30	91.87	21.45	10.9	10.55	19.00

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

TABLE 12E: Structure information - C-11

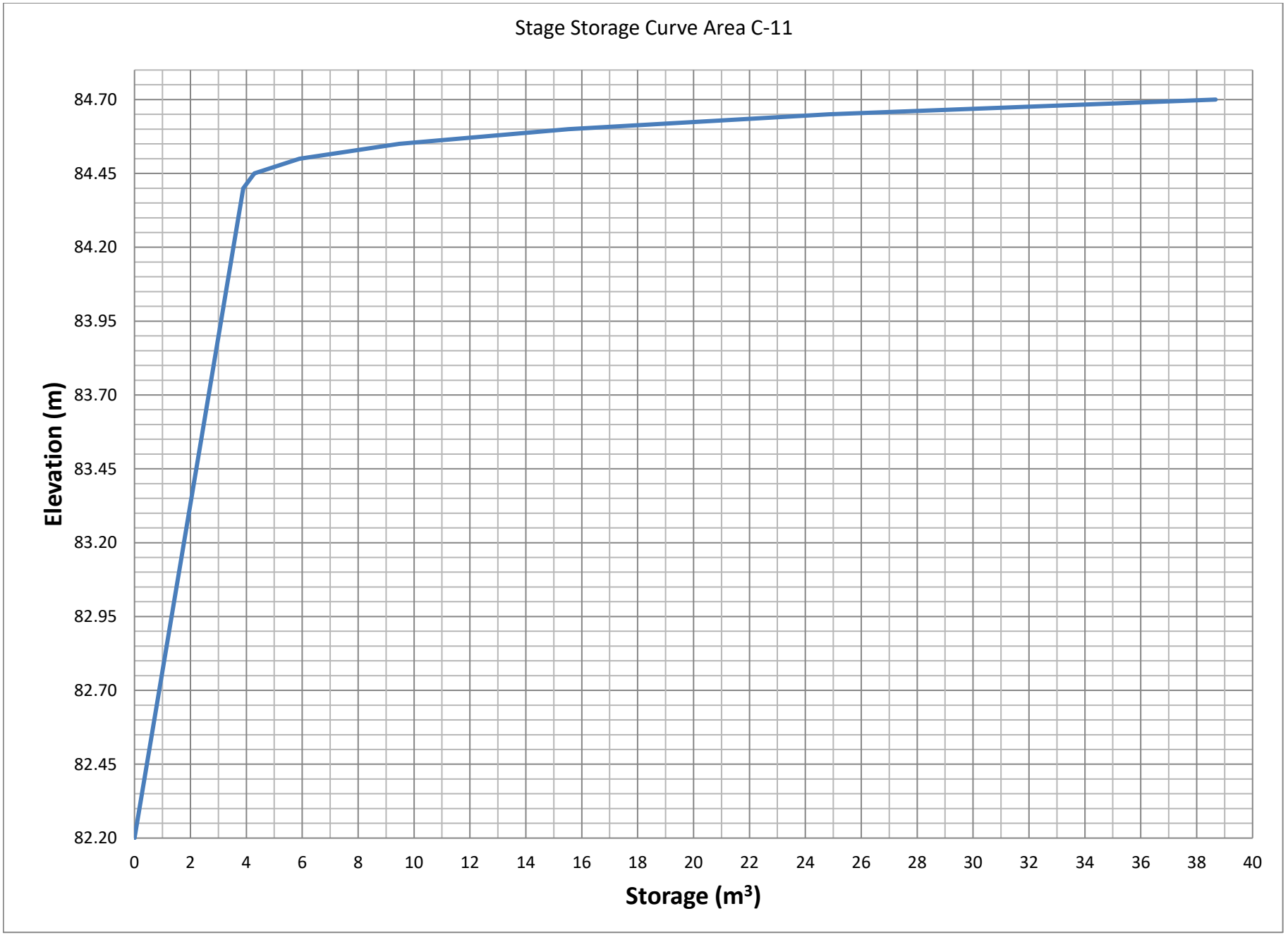
Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 12	1500	1.77	84.40	N/A	82.20

TABLE 12F: Storage Provided - C-11

Storage Table				Total Storage	
Elevation (m)	System Depth (m)	CBMH 12 Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
82.200	0.00	0.00	0.00	0.00	**0.00**
84.400	2.20	3.89	3.89	0.00	**3.89**
84.450	2.25	-	3.89	0.40	**4.29**
84.500	2.30	-	3.89	2.01	**5.90**
84.550	2.35	-	3.89	5.58	**9.47**
84.600	2.40	-	3.89	11.63	**15.52**
84.650	2.45	-	3.89	20.97	**24.86**
84.700	2.50	-	3.89	34.79	**38.68**

TABLE 12G: Orifice Sizing Information - C-11

Control Device					
Tempest ICD		90 LMF			
Design Event	**Flow**	**Volume Required**	**Head**	**Elevation**	**Outlet Dia. (mm)**
1:2 Year	10.0	3.5	1.95	84.25	200
1:5 Year	10.5	6.6	2.21	84.51	200
1:100 Year	10.9	20.5	2.33	84.63	200


Stage Storage Curve Area C-11
84.70
84.45
84.20
83.95
83.70
83.45
83.20
82.95
82.70
82.45
82.20
Elevation (m)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
Storage (m³)

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 13A: Post-Development Runoff Coefficient "C" - C-12

			5 Year Event		100 Year Event	
Area	Surface	Ha	"C"	C_{avg}	"C" + 25%	*C_{avg}
Total	Hard	0.202	0.90	0.63	1.00	0.71
0.332	Roof	0.000	1.00		1.00	
	Soft	0.130	0.20		0.25	

TABLE 13B: 2 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-12

0.332 =Area (ha)
0.63 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
2 YEAR	5	103.57	59.83	16.7	43.13	12.94
	10	76.81	44.37	16.7	27.67	16.60
	15	**61.77**	**35.68**	**16.7**	**18.98**	**17.08**
	20	52.03	30.06	16.7	13.36	16.03
	25	45.17	26.09	16.7	9.39	14.09

TABLE 13C: 5 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-12

0.332 =Area (ha)
0.63 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
5 YEAR	5	141.18	81.56	22.8	58.76	17.63
	10	104.19	60.19	22.8	37.39	22.43
	15	**83.56**	**48.27**	**22.8**	**25.47**	**22.92**
	20	70.25	40.58	22.8	17.78	21.34
	25	60.90	35.18	22.8	12.38	18.57

TABLE 13D: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - C-12

0.332 =Area (ha)
0.71 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	15	142.89	93.15	25.0	68.15	61.34
	20	119.95	78.20	25.0	53.20	63.84
	25	**103.85**	**67.70**	**25.0**	**42.70**	**64.05**
	30	91.87	59.89	25.0	34.89	62.80
	35	82.58	53.83	25.0	28.83	60.55

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
PROJECT NAME: 2020 WALLEY ROAD
LOCATION: OTTAWA

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DATE PREPARED: FEBRUARY 2021

TABLE 13E: Structure information - C-12

Structures	Size Dia.(mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CBMH 203	1200	1.13	84.65	81.98	81.97
CBMH 204	1200	1.13	84.65	82.04	82.03
CBMH 205	1200	1.13	84.65	82.13	82.12
CBMH 206	1200	1.13	84.65	82.23	82.22
CBMH 11	1200	1.13	84.65	-	82.32

TABLE 13F: Pipe information - C-12

Structures	Size Dia.(mm)	Length	Inv UP	Inv DOWN
CBMH 203-204	375	18.20	82.03	81.98
CBMH 204-205	375	25.50	82.12	82.04
CBMH 205-206	375	28.60	82.22	82.13
CBMH 206-11	375	30.80	81.82	82.23

TABLE 13G: Storage Provided - C-12

Storage Table								Total Storage		
Elevation (m)	System Depth (m)	CBMH 203 Volume (m^3)	CBMH 204 Volume (m^3)	CBMH 205 Volume (m^3)	CBMH 206 Volume (m^3)	CBMH 11 Volume (m^3)	Pipe Storage Volume (m^3)	Underground Volume (m^3)*	Ponding Volume (m^3)	**Total Volume (m^3)**
81.970	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
82.320	0.35	0.40	0.33	0.23	0.11	0.00	0.00	1.06	0.00	**1.06**
82.695	0.72	0.82	0.75	0.65	0.54	0.42	10.85	14.03	0.00	**14.03**
84.650	2.68	3.03	2.96	2.86	2.75	2.64	-	25.09	0.00	**25.09**
84.700	2.73	-	-	-	-	-	-	25.09	1.51	**26.60**
84.750	2.78	-	-	-	-	-	-	25.09	7.17	**32.26**
84.800	2.83	-	-	-	-	-	-	25.09	19.53	**44.62**
84.850	2.88	-	-	-	-	-	-	25.09	41.76	**66.85**
84.900	2.93	-	-	-	-	-	-	25.09	79.15	**104.24**

TABLE 13H: Orifice Sizing information - C-12

Control Device
Round Plate Orifice 83 mm

Design Event	Flow (L/S)	Head (m)	Elev (m)	Outlet dia. (mm)	Volume (m^3)	Area (m^2)
	16.7	1.26	83.27	375.0	17.08	0.0054
1:5 Year	22.8	2.36	84.37	375.0	22.92	0.0054
1:100 Year	25.0	2.84	84.85	375.0	64.05	0.0054

**The design Head is calculated based on the centre of the orifice at the bottom of the pipe

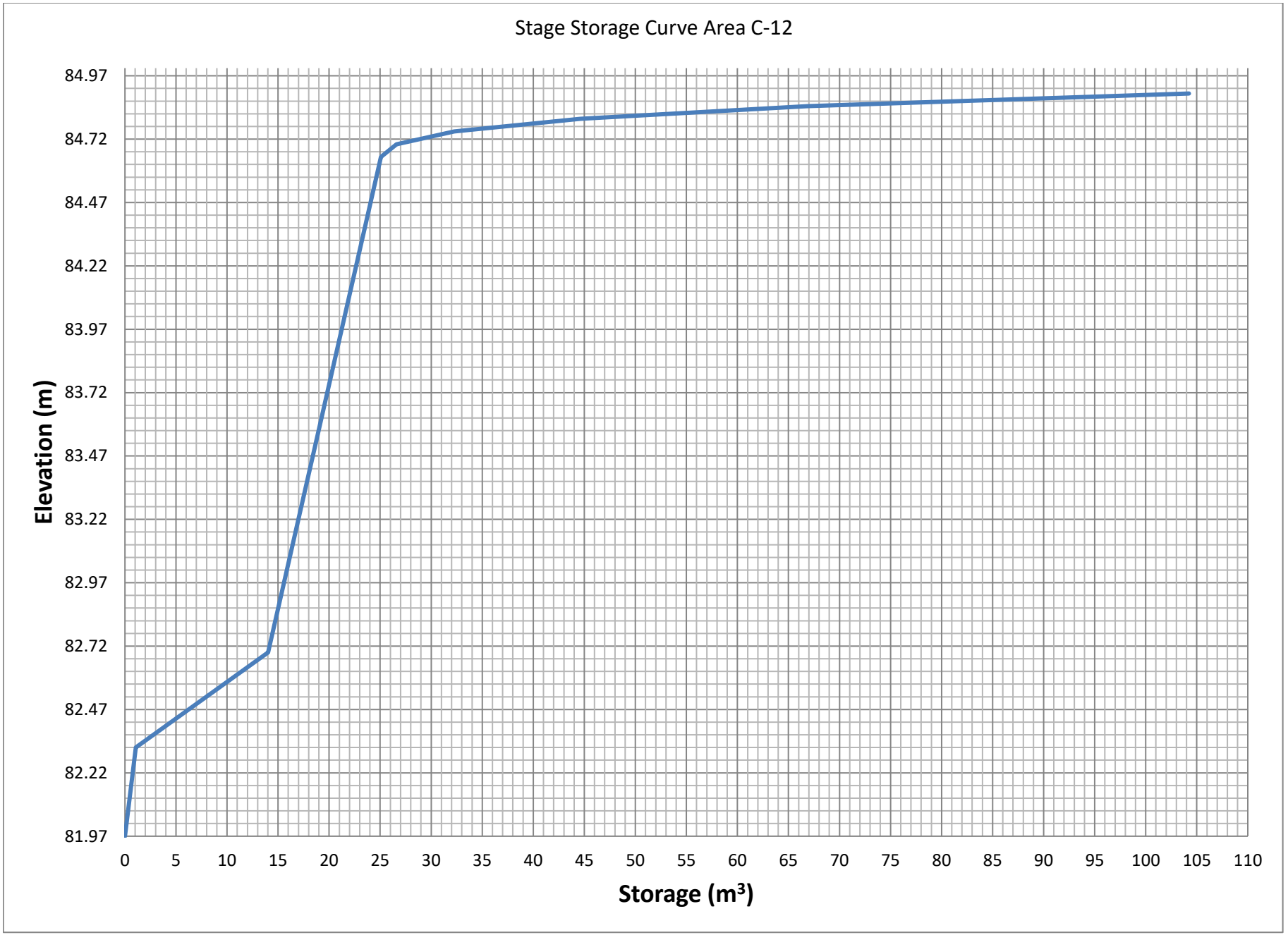

Stage Storage Curve Area C-12
Elevation (m)
84.97
84.72
84.47
84.22
83.97
83.72
83.47
83.22
82.97
82.72
82.47
82.22
81.97
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
Storage (m³)

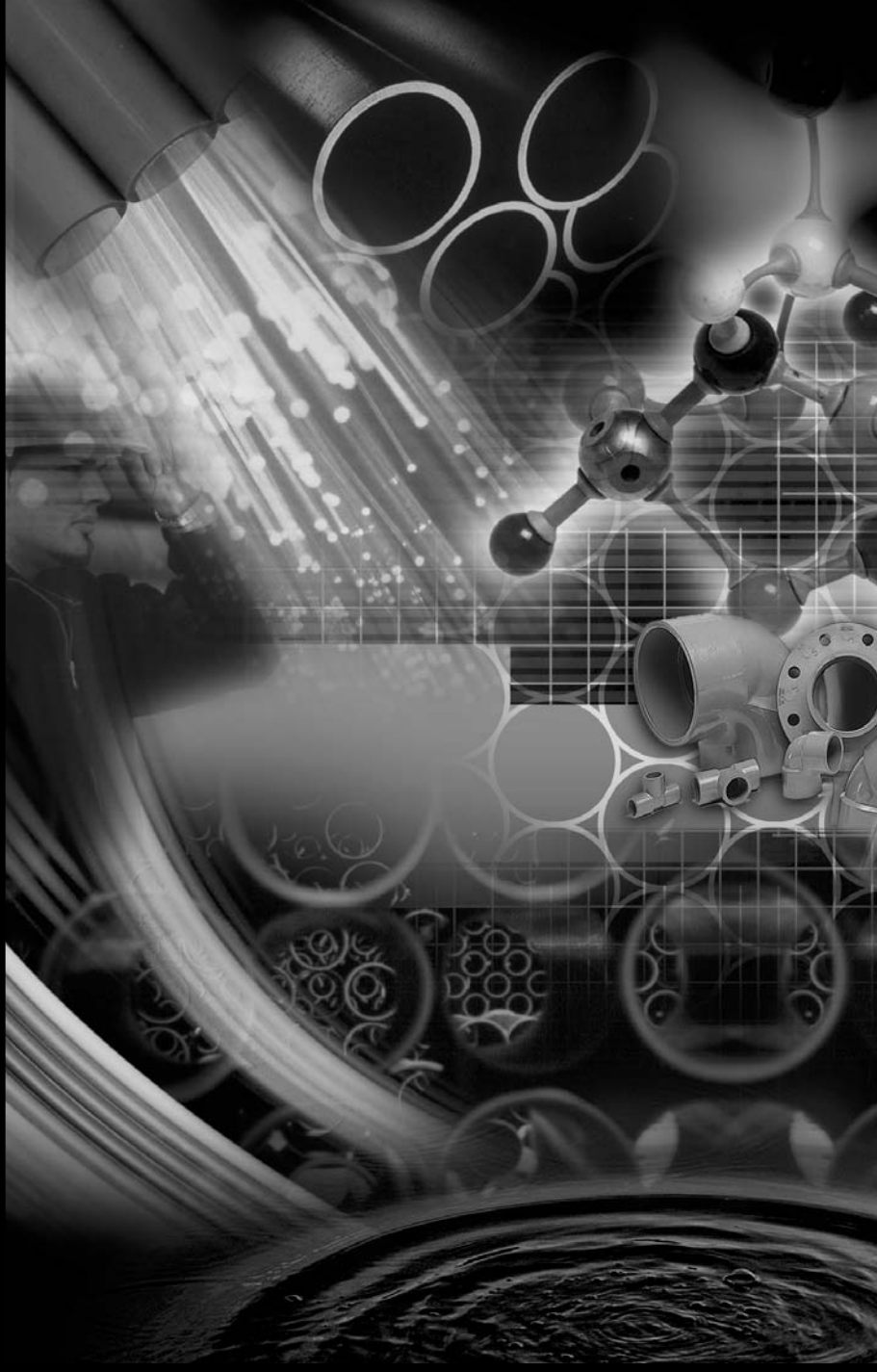
Table 14: Post-Development Stormwater Management Summary (Walkley Road)

Area ID	Area (ha)	1:5 Year Weighted Cw	1:100 Year Weighted Cw	Control Device	Outlet Location	2 Year Storm Event				5 Year Storm Event				100 Year Storm Event			
						Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)	Release (L/s)	Max Ponding Depth (m)	Req'd Vol (cu.m)	Max. Vol. Provided (cu.m.)
C-1	0.019	0.24	0.29	N/A	Walkley Road	1.0	N/A			1.3	N/A			2.7	N/A		
C-2	0.845	0.90	1.00	RD-100-A-ADJ	Walkley Road	10.5	0.06	150.9	176.0	12.1	0.08	211.7	214.6	22.1	0.15	401.7	429.3
C-3	0.765	0.90	1.00	RD-100-A-ADJ	Walkley Road	9.0	0.06	139.1	159.4	11.8	0.09	187.3	226.7	18.9	0.15	370.1	388.6
Post-Devlopment Flow (Direct Runoff & Roof Areas Only)						**20.5**				**25.3**				**43.7**			
C-4	0.574	0.87	0.96	83mm Plate	Walkley Road	19.1	0.15	65.3	485.2	19.6	0.20	99.8	485.2	20.3	0.18	236.9	485.2
C-5	0.066	0.80	0.90	LMF 80	Walkley Road	6.8	0.00	2.7	46.3	7.5	0.08	4.7	46.3	7.7	0.17	14.5	46.3
C-6	0.047	0.86	0.95	LMF 70	Walkley Road	5.3	0.00	2.0	21.0	5.7	0.00	3.6	21.0	6.0	0.19	10.7	21.0
C-7	0.303	0.87	0.97	83mm Plate	Walkley Road	19.2	0.00	23.7	94.2	22.7	0.12	35.0	94.2	23.5	0.24	93.2	94.2
C-8	0.405	0.87	0.88	83mm Plate	Walkley Road	20.5	0.04	36.6	325.8	20.7	0.09	58.5	325.8	21.2	0.14	146.1	325.8
C-9	0.056	0.88	0.97	LMF 70	Walkley Road	5.5	0.00	3.0	24.8	5.8	0.09	5.0	24.8	6.0	0.17	14.6	24.8
C-10	0.069	0.79	0.88	LMF 70	Walkley Road	6.4	0.00	3.5	41.9	6.2	0.07	5.8	41.9	6.4	0.20	16.7	41.9
C-11	0.129	0.57	0.65	LMF 90	Walkley Road	10.0	0.00	3.5	38.7	10.5	0.11	6.6	38.7	10.9	0.23	20.5	38.7
C-12	0.332	0.63	0.71	83mm Plate	Walkley Road	16.7	0.00	17.1	104.2	22.8	0.00	22.9	104.2	25.0	0.20	64.0	104.2
Post-Devlopment Flow (Controlled Surface Flows Only)						**109.5**	**-**	**157.4**	**1182.1**	**121.5**	**-**	**241.9**	**1182.1**	**127.0**	**-**	**617.2**	**1182.1**
50% of Controlled Area Allowable Release Rate						**134.8**				**134.8**				**134.8**			
Total Allowable Release Rate to Walkley Road						**313.4**				**313.4**				**313.4**			
Total Post-Development Flows to Walkley Rod						**130.0**				**146.8**				**170.7**			
Total Pre-Development Flow to Walkley Road						**423.4**				**572.8**				**1101.4**			

Note: 2 Year Surface Ponding in Loading Dock Area Only

Volume III: TEMPEST™ INLET CONTROL DEVICES

Municipal Technical Manual Series



SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

MHF (Medium to High Flow) ICD

IPEX

PRODUCT INFORMATION: TEMPEST LOW, MEDIUM FLOW (LMF) ICD

Purpose

To control the amount of storm water runoff entering a sewer system by allowing a specified flow volume out of a catch basin or manhole at a specified head. This approach conserves pipe capacity so that catch basins downstream do not become uncontrollably surcharged, which can lead to basement floods, flash floods and combined sewer overflows.

Product Description

Our LMF ICD is designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter and larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 14 preset flow curves, the LMF ICD has the ability to provide flow rates: 2lps – 17lps (31gpm – 270gpm)

Product Function

The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during a rain event, preserving greater sewer capacity.

Product Construction

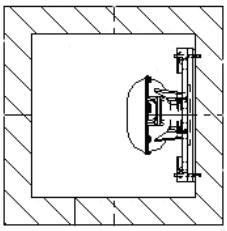
Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

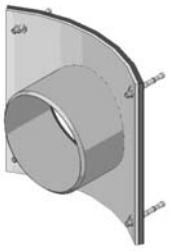
Will accommodate both square and round applications:

Square Application

Universal Mounting Plate



Round Application



+

Spigot CB Wall Plate

=

Universal Mounting Plate Hub Adapter

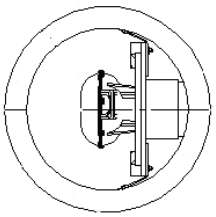


Chart 1: LMF 14 Preset Flow Curves

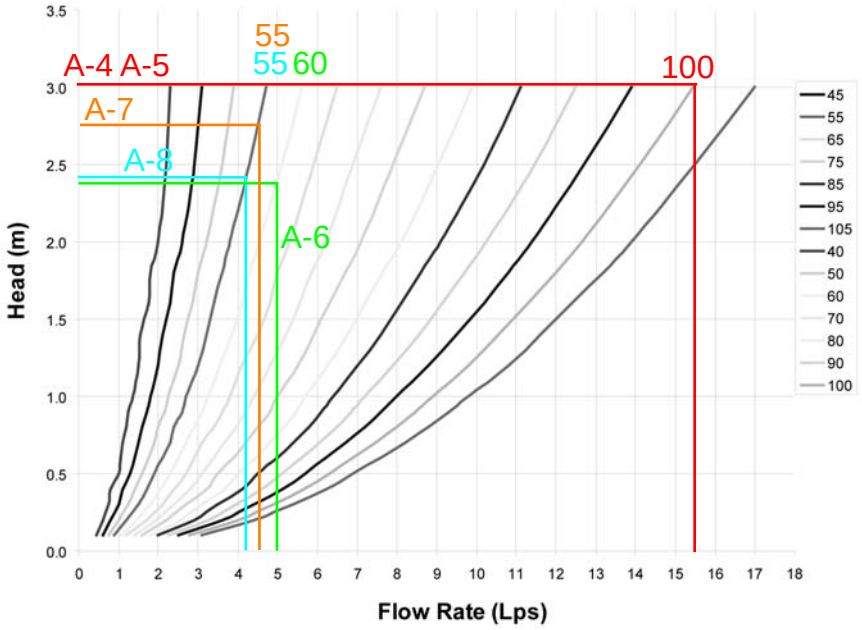


Chart 2: LMF Flow vs. ICD Alternatives

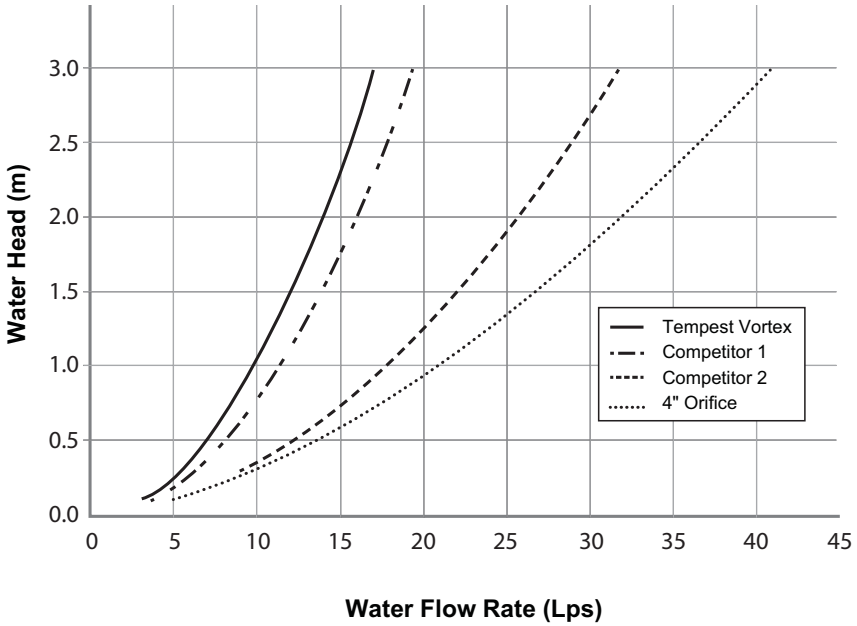


Chart 1: LMF 14 Preset Flow Curves

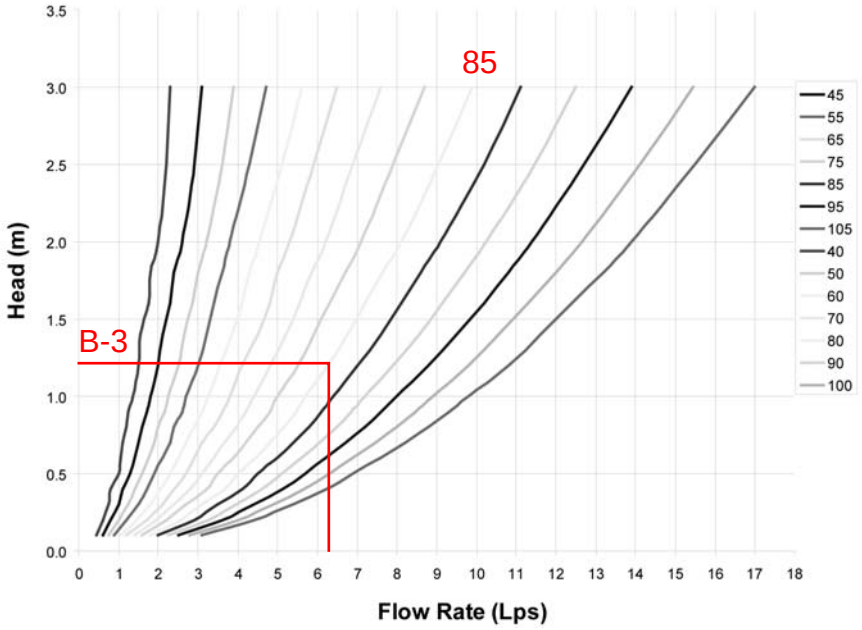


Chart 2: LMF Flow vs. ICD Alternatives

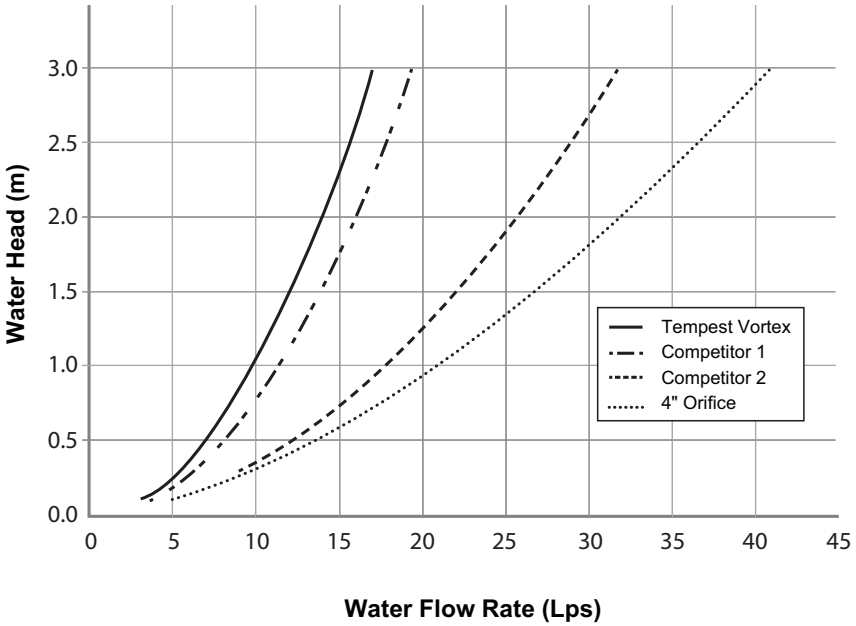


Chart 1: LMF 14 Preset Flow Curves

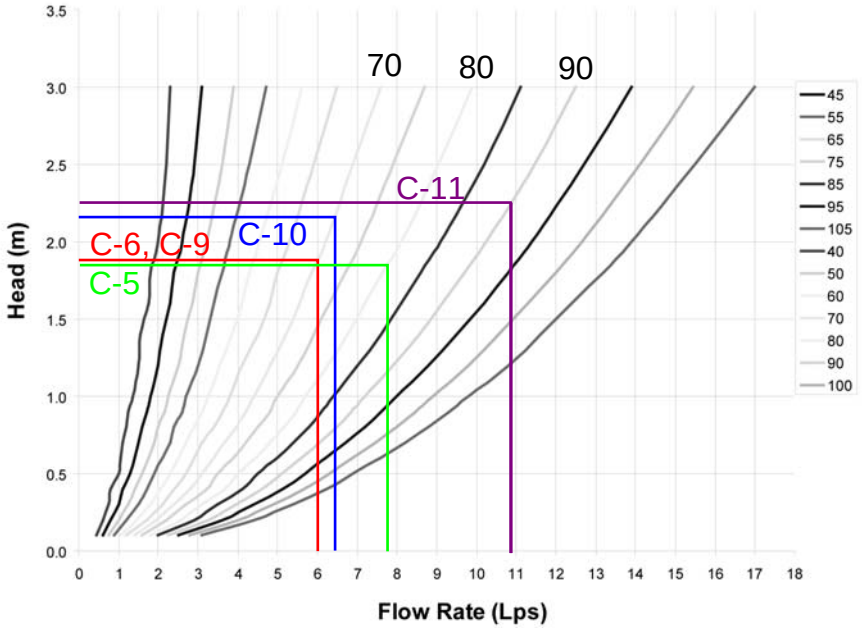
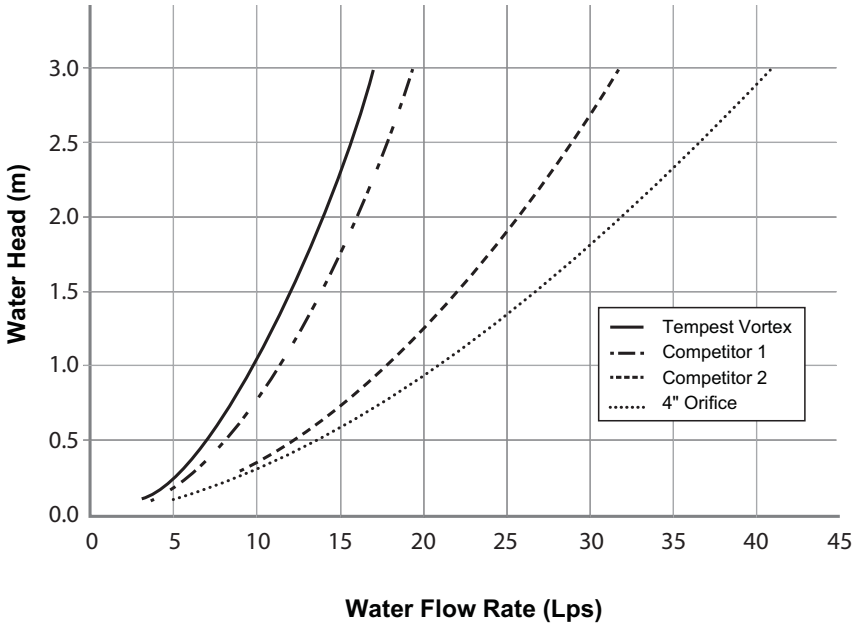


Chart 2: LMF Flow vs. ICD Alternatives



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST LMF ICD into a Square Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device.
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST LMF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the mounting plate and has created a seal.

⚠ WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut back the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

WATTS® DRAINAGE

Adjustable Accutrol Weir

Tag: RD-100-A-ADJ

Adjustable Flow Control for Roof Drains

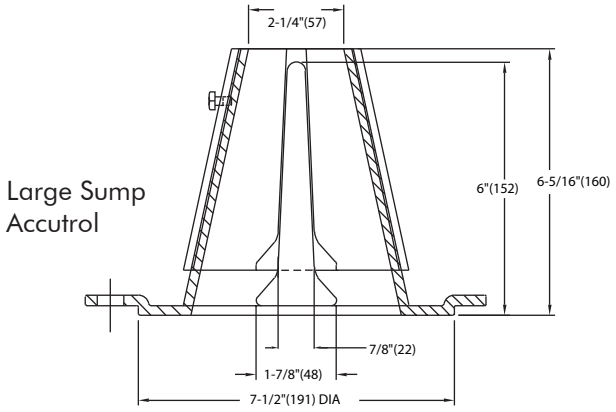
ADJUSTABLE ACCUTROL(for Large Sump Roof Drains only)

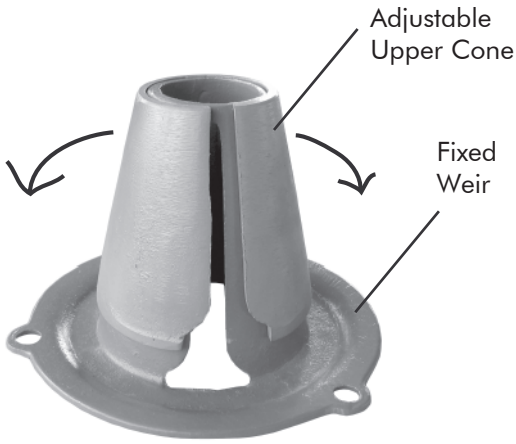
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the 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	Head of Water 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	10	10	10	10	10

Job Name _____ Contractor _____

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

Engineer _____ Representative _____

WATTS® DRAINAGE
CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca
CANADA

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area = 1.80 ha
Impervious: 90 %
CDS Model: PMSU2025_5
Flowrate: 45 l/s
IDF Data: Ottawa
PSD: FINE

Upstream Storage:
100yr Storage TBC m^3

Engineer: **Novatech**
Contact: Matthew Hrehoriak
Date: 26-Feb-21

Project: 2020 Walkley Rd.
Location: Ottawa, ON
OGS ID: CDS 1

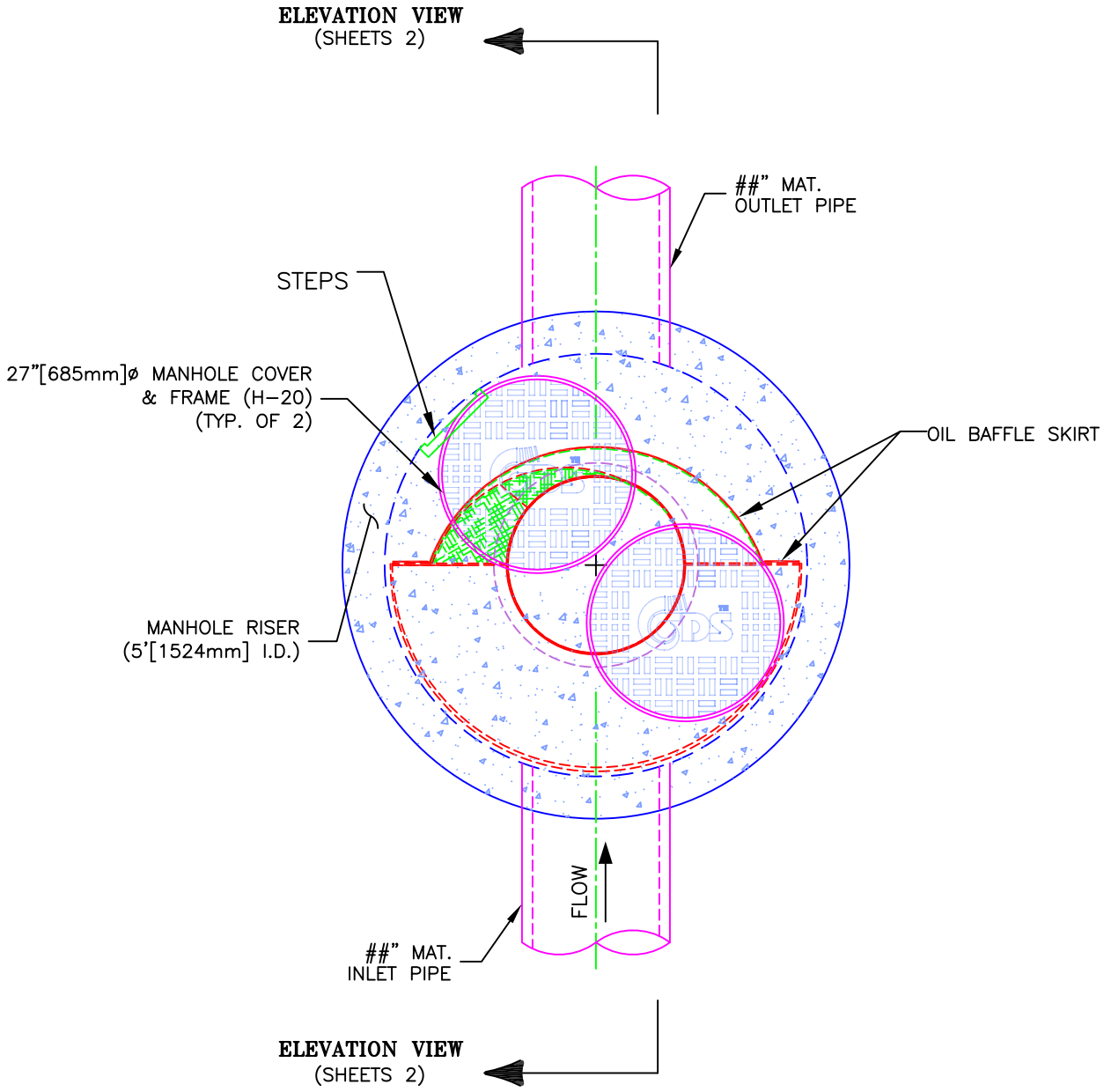
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	11.63	94.01	54778	54778	**100.00**	11.63	11.63	0.00	100.00
2-M	0.17	17.73	91.41	85475	85475	**99.75**	17.73	17.73	0.00	100.00
3-M	0.25	22.49	89.34	111061	111061	**98.17**	22.49	22.49	0.00	100.00
4-M	0.33	26.58	87.55	134335	134335	**95.04**	26.58	26.58	0.00	100.00
5-M	0.42	32.59	84.81	173431	173431	**90.91**	32.59	32.59	0.00	100.00
6-M	0.50	38.60	82.08	212527	212527	**86.47**	38.60	38.60	0.00	100.00
7-M	0.58	39.95	81.44	222855	222855	**82.01**	39.95	39.95	0.00	100.00
8-M	0.67	41.29	80.79	233183	233183	**77.67**	41.29	41.29	0.00	100.00
9-M	0.75	42.64	80.15	243511	243511	**73.64**	42.64	42.64	0.00	100.00
10-M	0.83	44.79	78.83	260701	262509	**69.90**	44.79	44.79	0.00	99.40
11-M	0.92	46.95	77.51	277892	281508	**66.40**	46.95	45.31	1.64	98.80
1-Yr	1	49.10	76.19	295082	300506	**63.21**	49.10	45.31	3.79	98.20
2-Yr	2	51.96	73.94	317032	329658	**39.35**	51.96	45.31	6.65	96.17
5-Yr	5	56.29	70.47	351676	378872	**18.13**	56.29	45.31	10.98	92.82
10-Yr	10	59.09	68.20	374833	414025	**9.52**	59.09	45.31	13.79	90.53
25-Yr	25	60.35	67.20	385195	430341	**3.92**	60.35	45.31	15.05	89.51
50-Yr	50	61.81	66.06	396901	449397	**1.98**	61.81	45.31	16.51	88.32
100-Yr	100	64.70	63.94	418437	486199	**1.00**	64.70	45.31	19.39	86.06
Average Annual TSS Removal Efficiency [%]:					**84.2**	Ave. Ann. T. Volume [%]:				**99.4**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

PLAN VIEW

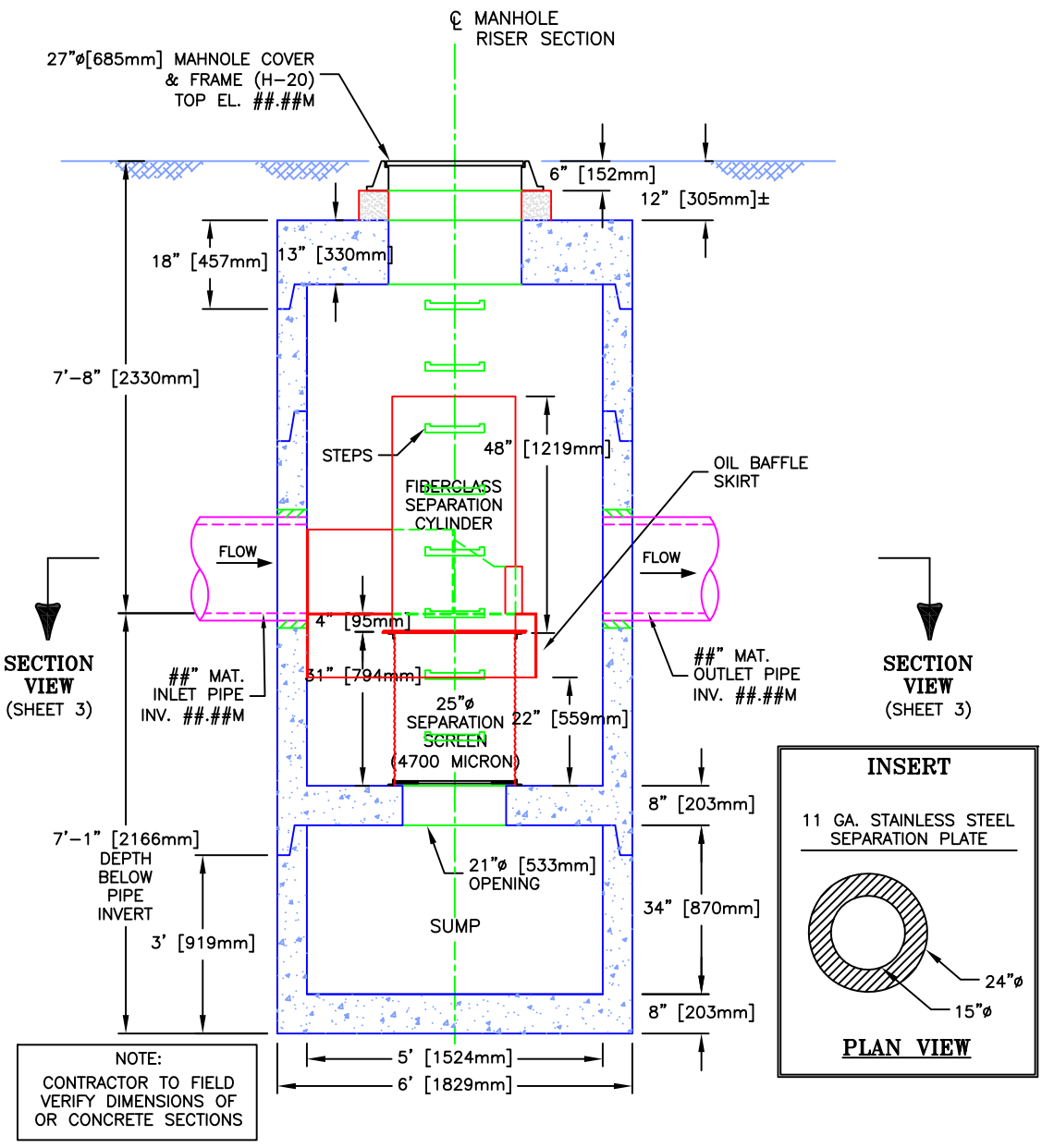


CDS MODEL PMSU20_25m, 45 L/s TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 2'
		DATE ##/##/##	SHEET 1
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

ELEVATION VIEW



CDS MODEL PMSU20_25m, 45 L/s TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# XX-##-###	SCALE 1" = 3'
		DATE ##/##/##	SHEET 2
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

Area = 3.61 ha
Impervious: 90 %
CDS Model: PMSU3030_6
Flowrate: 85 l/s
IDF Data: Ottawa
PSD: FINE

Upstream Storage:
100yr Storage TBC m^3

Engineer: **Novatech**
Contact: Matthew Hrehoriak
Date: 26-Feb-21

Project: 2020 Walkley Rd.
Location: Ottawa, ON
OGS ID: CDS 2

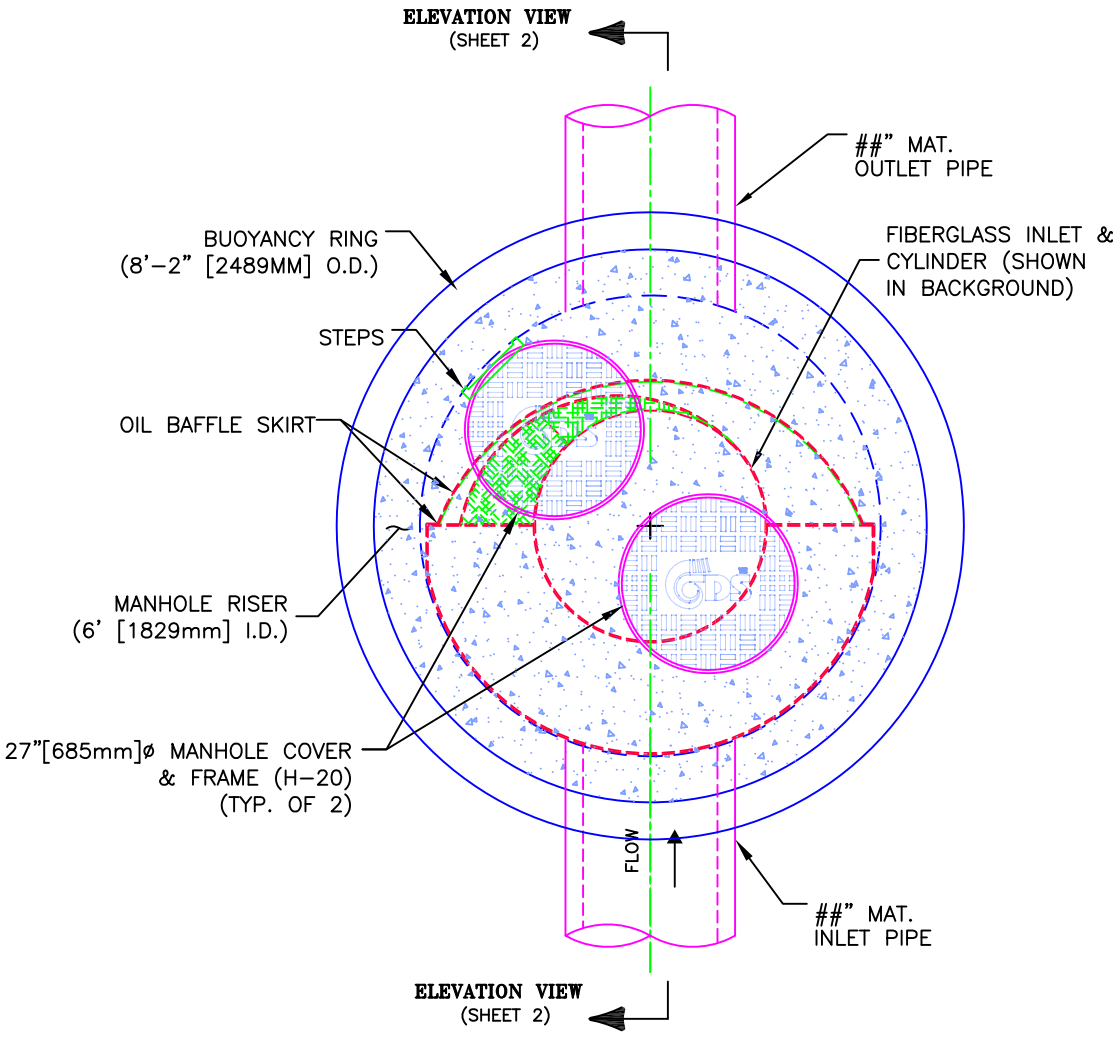
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	26.82	92.65	105085	105085	**100.00**	26.82	26.82	0.00	100.00
2-M	0.17	39.32	89.57	168007	168007	**99.75**	39.32	39.32	0.00	100.00
3-M	0.25	47.52	87.44	219384	219384	**98.17**	47.52	47.52	0.00	100.00
4-M	0.33	53.48	85.82	265332	265332	**95.04**	53.48	53.48	0.00	100.00
5-M	0.42	61.67	83.70	341782	341782	**90.91**	61.67	61.67	0.00	100.00
6-M	0.50	69.86	81.58	418231	418231	**86.47**	69.86	69.86	0.00	100.00
7-M	0.58	72.88	81.00	439232	439232	**82.01**	72.88	72.88	0.00	100.00
8-M	0.67	75.90	80.41	460232	460232	**77.67**	75.90	75.90	0.00	100.00
9-M	0.75	78.92	79.83	481232	481232	**73.64**	78.92	78.92	0.00	100.00
10-M	0.83	88.43	77.74	512654	522862	**69.90**	88.43	84.95	3.48	98.32
11-M	0.92	97.94	75.64	544077	564492	**66.40**	97.94	84.95	12.99	96.63
1-Yr	1	107.45	73.55	575499	606123	**63.21**	107.45	84.95	22.50	94.95
2-Yr	2	129.58	68.96	605073	675456	**39.35**	129.58	84.95	44.63	89.58
5-Yr	5	145.71	66.09	619553	719583	**18.13**	145.71	84.95	60.76	86.10
10-Yr	10	147.35	65.81	620794	723864	**9.52**	147.35	84.95	62.40	85.76
25-Yr	25	149.42	65.47	622325	729223	**3.92**	149.42	84.95	64.47	85.34
50-Yr	50	160.38	63.76	629610	756542	**1.98**	160.38	84.95	75.43	83.22
100-Yr	100	165.87	62.97	632787	769440	**1.00**	165.87	84.95	80.92	82.24
Average Annual TSS Removal Efficiency [%]:					**82.8**	Ave. Ann. T. Volume [%]:				**98.8**

Notes:
1) CDS Efficiency based on testing conducted at the University of Central Florida
2) CDS design flowrate and scaling based on standard manufacturer model & product specificiations

ECHELON ENVIRONMENTAL

CDS TECHNOLOGIES

PLAN VIEW

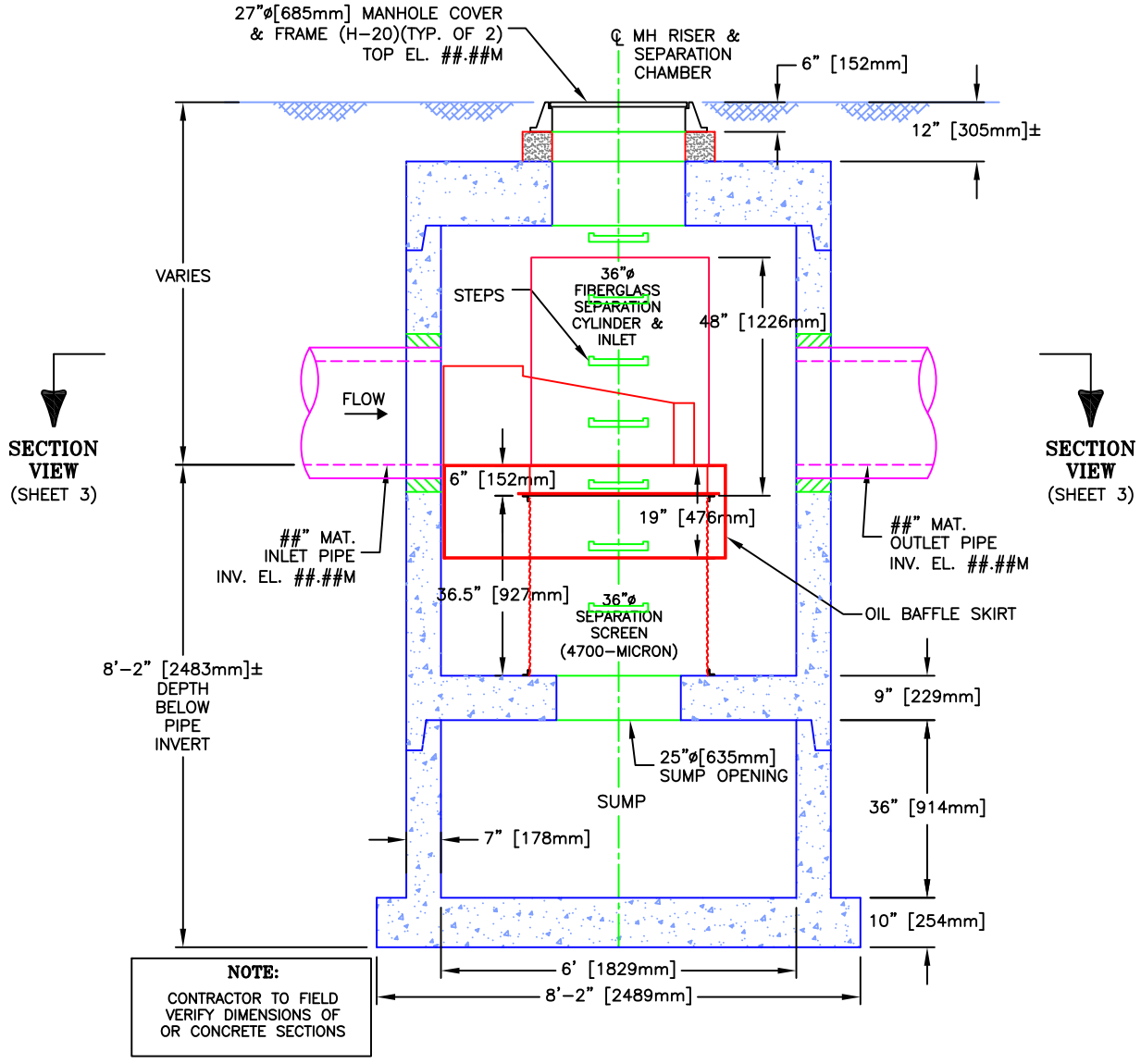


CDS MODEL PMSU30_30m, 85 L/s TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# CAN–##–###	SCALE 1" = 3'
		DATE ##/##/##	SHEET
		DRAWN INITIALS	1
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948–0000 Fax: (905) 948–0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848–9955

ELEVATION VIEW



CDS MODEL PMSU30_30m, 85 L/s TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS	PROJECT NAME CITY, STATE	JOB# CAN-##-###	SCALE 1" = 3'
		DATE ##/##/##	SHEET 2
		DRAWN INITIALS	
		APPROV.	

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577
CONTECH Stormwater Solutions Inc. 930 Woodcock Road, Suite 101, Orlando, Florida 32803 Tel: (800) 848-9955

APPENDIX E
Development Servicing Study Checklist

Walkley Conroy Warehouses
2020 Walkley Road, Ottawa
DEVELOPMENT SERVICING STUDY CHECKLIST

4.1 General Content	**Addressed (Y/N/NA)**	**Comments**
Executive Summary (for larger reports only).	N/A	
Date and revision number of the report.	Y	
Location map and plan showing municipal address, boundary, and layout of proposed development.	Y	Refer to Report Figures
Plan showing the site and location of all existing services.	Y	Refer to Grading and Servicing Plans
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.	Y	Refer to Site Plan
Summary of Pre-consultation Meetings with City and other approval agencies.	Y	
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.	N/A	
Statement of objectives and servicing criteria.	Y	Report Sections: 5.0 Water Servicing , 6.0 Sanitary Servicing, 7.0 Storm Servicing
Identification of existing and proposed infrastructure available in the immediate area.	Y	
Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).	N/A	
Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighboring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.	Y	Refer to Grading Plan and Stormwater Management Plan

Walkley Conroy Warehouses
2020 Walkley Road, Ottawa
DEVELOPMENT SERVICING STUDY CHECKLIST

4.1 General Content	**Addressed (Y/N/NA)**	**Comments**
Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.	N/A	
Proposed phasing of the development, if applicable.	N/A	
Reference to geotechnical studies and recommendations concerning servicing.	Y	Report Section 4.0 Site Constraints
All preliminary and formal site plan submissions should have the following information:		
Metric scale	Y	
North arrow (including construction	Y	
Key plan	Y	
Name and contact information of applicant and property owner	Y	
Property limits including bearings and dimensions	Y	
Existing and proposed structures and parking areas	Y	
Easements, road widening and rights-of-	Y	
Adjacent street names	Y	

Walkley Conroy Warehouses
2020 Walkley Road, Ottawa
DEVELOPMENT SERVICING STUDY CHECKLIST

4.2 Water	**Addressed (Y/N/NA)**	**Comments**
Confirm consistency with Master Servicing Study, if available.	N/A	
Availability of public infrastructure to service proposed development.	Y	Report Sections: 5.0 Water Servicing , 6.0 Sanitary Servicing, 7.0 Storm Servicing
Identification of system constraints.	N/A	
Identify boundary conditions.	Y	Provided by City of Ottawa
Confirmation of adequate domestic supply and pressure.	Y	Refer to Appendix A
Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.	Y	Refer to Appendix A
Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.	Y	Refer to Appendix A
Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design.	N/A	
Address reliability requirements such as appropriate location of shut-off valves.	Y	Refer to Appendix A
Check on the necessity of a pressure zone boundary modification.	N/A	
Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range.	Y	Report Section 5.0 Water Servicing
Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.	Y	Report Section 5.0 Water Servicing
Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.	N/A	
Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.	Y	Report Section 5.0 Water Servicing
Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.	N/A	

Walkley Conroy Warehouses
2020 Walkley Road, Ottawa
DEVELOPMENT SERVICING STUDY CHECKLIST

4.3 Wastewater	Addressed (Y/N/NA)	**Comments**
Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed	Y	Report Section 6.0 Sanitary Servicing
Confirm consistency with Master Servicing Study and/or justifications for deviations.	N/A	
Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.	N/A	
Description of existing sanitary sewer available for discharge of wastewater from proposed development.	Y	Report Section 6.0 Sanitary Servicing
Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)	y	Refer to Appendix B
Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.	N/A	
Description of proposed sewer network including sewers, pumping stations, and forcemains.	Y	Report Section 6.0 Sanitary Servicing
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).	N/A	
Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.	N/A	
Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.	N/A	
Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.	N/A	
Special considerations such as contamination, corrosive environment etc.	N/A	

Walkley Conroy Warehouses
2020 Walkley Road, Ottawa
DEVELOPMENT SERVICING STUDY CHECKLIST

4.4 Stormwater	**Addressed (Y/N/NA)**	**Comments**
Description of drainage outlets and downstream constraints including legality of outlet (i.e. municipal drain, right-of-way, watercourse, or private property).	Y	Report Sections 7.0 Storm Servicing and 8.0 Stormwater Management
Analysis of the available capacity in existing public infrastructure.	N	Stormwater release rates less than or equl to city allowabale release rate criteria
A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns and proposed drainage patterns.	Y	Refer to Stormwater Management Plan
Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.	Y	Report Section 8.0 Stormwater Management
Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.	Y	Report Section 8.0 Stormwater Management
Description of stormwater management concept with facility locations and descriptions with references and supporting information.	Y	Report Section 8.0 Stormwater Management
Set-back from private sewage disposal systems.	N/A	
Watercourse and hazard lands setbacks.	N/A	
Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.	N/A	
Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.	N/A	
Storage requirements (complete with calcs) and conveyance capacity for 5 yr and 100 yr events.	Y	Refer to Appendix D
Identification of watercourse within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.	N/A	
Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.	Y	Refer to Appendix D
Any proposed diversion of drainage catchment areas from one outlet to another.	N/A	
Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and SWM	N/A	
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.	N/A	

4.4 Stormwater	**Addressed (Y/N/NA)**	**Comments**
Identification of potential impacts to receiving watercourses.	N/A	
Identification of municipal drains and related approval requirements.	N/A	
Description of how the conveyance and storage capacity will be achieved for the development.	Y	Report Section 8.0 Stormwater Management
100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.	Y	Refer to Stormwater Management Plan
Inclusion of hydraulic analysis including HGL elevations.	N/A	
Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.	Y	Report Section 9.0 Erosion and Sediment Control
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.	N/A	
Identification of fill constrains related to floodplain and geotechnical investigation.	N/A	

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

4.6 Conclusion	**Addressed (Y/N/NA)**	**Comments**
Clearly stated conclusions and recommendations.	Y	Report Section 10.0 Conclusions and Recommendations
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.	N/A	T.B.D.
All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario.	Y	

APPENDIX F
Correspondence

Site Plan Pre - Application Consultation Notes

Date: October 1, 2020
Site Location: 2020 Walkley
Type of Development: ☐ **Residential (**☐ **townhomes,** ☐ **stacked,** ☐ **singles,** ☐ **apartments),** ☐ **Office Space,** ☐ **Commercial,** ☐ **Retail,** ☐ **Institutional,** ☒ **Industrial, Other:** N/A
Owner/Agent: Manulife Ontario Property/N45 Architecture Inc.
Project Manager: Adam Baker
Assigned Planner: Wendy Tse

Infrastructure

Due to the age of the existing development on site, sanitary and storm drainage areas were not readily available for the property of 2020 Walkley. The 1985 'Ottawa Business Park – Phase 2' (City Index #1905, Project #84-8460) development includes the southern portion of the 2020 Walkley property within its tributary drainage areas.

Water

Existing nearest public services:

- Walkley Road
  - 406mm ductile iron watermain
- Conroy Road
  - 406mm ductile iron watermain
- St-Laurent Blvd
  - 305mm ductile iron watermain

- Service areas with a basic demand greater than 50 m^3/day shall be connected with a minimum of two water services, separated by an isolation valve, to avoid creation of vulnerable service area.

Boundary conditions:
Civil consultant must request boundary conditions from the City's assigned Project Manager prior to first submission.

- Water boundary condition requests must include the location of the service(s) and the expected loads required by the proposed developments. Please provide all the following information:
  - Location of service(s)
  - Type of development and the amount of fire flow required (as per FUS, 1999).
  - Average daily demand: ___ l/s.
  - Maximum daily demand: ___l/s.
  - Maximum hourly daily demand: ___ l/s.
- Fire protection (Fire demand, Hydrant Locations)
- A water meter sizing questionnaire [water card] will have to be completed prior to receiving a water permit (water card will be provided post approval)

Sanitary Sewer

Existing nearest public services:

- Walkley Road
  - 525mm conc. sanitary sewer
- Conroy Road
  - 750mm conc. sanitary sewer
- St-Laurent Blvd
  - 300mm conc. sanitary sewer

- Any premise in which there is commercial or institutional food preparation shall install a grease and oil inceptor on all fixtures.

Storm Sewer

Existing nearest public services:

- Walkley Road
  - 1500mm conc. storm sewer (trunk)
- Conroy Road
  - 375mm conc. increasing to 450mm conc. storm sewer (East side of Conroy)
  - 300mm conc. increasing to 450mm conc. storm sewer (West side of Conroy)
- St-Laurent Blvd
  - 600mm conc. storm sewer

Storm Sewer Notes:

- Connections to trunk sewers should be avoided. Additional requirements may apply.

- For concrete sewer pipe, maintenance holes shall be installed when the service is greater than 50% of the diameter of the mainline concrete pipe

- The Environmental Site Assessment (ESA) may provide recommendations where site contamination may be present. The recommendations from the ESA need to be coordinated with the servicing report to ensure compliance with the Sewer Use By-Law.

Stormwater Management

Quality Control:

- This property is within the McEwan Creek sub-watershed. Quality requirements are required to be confirmed with the Rideau Valley Conservation Authority.

Quantity Control:

- Stormwater quantity controls will depend upon which outlet is chosen for the site. Once an outlet has been chosen, please confirm with the Project Manager the SWM criteria for the property. For the nearby public services, the criteria is as follows –
  - The pre-development runoff coefficient or a maximum equivalent 'C' of 0.5, whichever is less (§ 8.3.7.3).
  - A calculated time of concentration (Cannot be less than 10 minutes).
  - Flows to the storm sewer in excess of the 5-year storm release rate, up to and including the 100-year storm event, must be detained on site.

Ministry of Environment, Conservation and Parks (MECP)

All development applications should be considered for an Environmental Compliance Approval, under MECP regulations.

a. The consultants determine if an approval for sewage works under Section 53 of OWRA is required and determines what type of application. The City's project manager may help confirm and coordinate with the MECP as required.
b. The project will be either transfer of review (standard), transfer of review (additional), direct submission, or exempt as per O. Reg. 525/98.
c. Pre-consultation is not required if applying for standard or additional works (Schedule A of the Agreement) under Transfer Review.
d. Pre-consultation with local District office of MECP is recommended for direct submission.
e. Consultant completes an MECP request form for a pre-consultation. Sends request to moeccottawasewage@ontario.ca
f. ECA applications are required to be submitted online through the MECP portal. A business account required to submit ECA application. For more information visit https://www.ontario.ca/page/environmental-compliance-approval

g. It is unclear if the proposed development will remain as one property. An ECA will be required where the stormwater management services more than one property parcel.

NOTE: Site Plan Approval, or Draft Approval, is required before any Ministry of the Environment and Climate Change (MOECC) application is sent

General Service Design Comments

- The City of Ottawa requests that all new services be located within the existing service trench to minimize necessary road cuts.
- Monitoring manholes should be located within the property near the property line in an accessible location to City forces and free from obstruction (i.e. not a parking).
- Where service length is greater than 30 m between the building and the first maintenance hole / connection, a cleanout is required.
- The City of Ottawa Standard Detail Drawings should be referenced where possible for all work within the Public Right-of-Way.
- The upstream and downstream manhole top of grate and invert elevations are required for all new sewer connections.
- Services crossing the existing watermain or sewers need to clearly provide the obvert/invert elevations to demonstration minimum separation distances. A watermain crossing table may be provided.

Other

Are there are Capital Works Projects scheduled that will impact the application? ☐ **Yes** ☒ **No**

References and Resources

- As per section 53 of the Professional Engineers Act, O. Reg 941/40, R.S.O. 1990, all documents prepared by engineers must be signed and dated on the seal.
- All required plans are to be submitted on standard A1 size sheets (594mm x 841mm) sheets, utilizing a reasonable and appropriate metric scale as per City of Ottawa Servicing and Grading Plan Requirements: title blocks are to be placed on the right of the sheets and not along the bottom. Engineering plans may be combined, but the Site Plans must be provided separately. Plans shall include the survey monument used to confirm datum. Information shall be provided to enable a non-surveyor to locate the survey monument presented by the consultant.
- All required plans & reports are to be provided in *.pdf format (at application submission and for any, and all, re-submissions)
- Please find relevant City of Ottawa Links to Preparing Studies and Plans below: https://ottawa.ca/en/city-hall/planning-and-development/information-developers/development-application-review-process/development-application-submission/guide-preparing-studies-and-plans#standards-policies-and-guidelines
- To request City of Ottawa plan(s) or report information please contact the City of Ottawa Information Centre: InformationCentre@ottawa.ca<mailto:InformationCentre@ottawa.ca> (613) 580-2424 ext. 44455
- geoOttawa http://maps.ottawa.ca/geoOttawa/

SITE PLAN APPLICATION – Municipal servicing

For information on preparing required studies and plans refer to:
http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

S/A	Number of copies	ENGINEERING		S/A	Number of copies
S		1. Site Servicing Plan	2. Site Servicing Study	S	
S		3. Grade Control and Drainage Plan	4. Geotechnical Study	S	
		5. Composite Utility Plan	6. Groundwater Impact Study		
		7. Servicing Options Report	8. Wellhead Protection Study		
		9. Community Transportation Study and/or Transportation Impact Study / Brief	10. Erosion and Sediment Control Plan / Brief	S	
S		11. Storm water Management Report	12. Hydro-geological and Terrain Analysis		
		13. Water main Analysis	14. Noise Study		
		15. Roadway Modification Design Plan	16. Confederation Line Proximity Study		

The purpose of the noise study is to examine the effects of noise from the truck traffic/loading area and

Time of Concentration - Existing Conditions

Uplands Overland Flow Method

Area ID	Overland Flow						Mannings Pipe Flow							Overall
	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Pipe Size (mm)	Length (m)	Elevation U/S (m)	Elevation D/S (m)	Slope (%)	Velocity (m/s)	Travel Time (min)	Time of Concentration (min)
EX 1 A	95	85.00	84.10	0.9%	0.30	5.28								5
EX 1B	10						250	96	82.77	81.16	1.68	1.57	1.02	
							450	28	81.16	81.00	0.57	1.36	0.34	11
EX 2	125	84.9	84.5	0.3%	0.18	11.57								12
EX 3 A	10						150.00	76	83.5	83.1	0.50	0.61	2.08	
							300.00	36	83.1	82.8	0.92	1.31	0.46	
							525.00	110	83.1	82.8	0.20	0.89	2.06	15

Uplands Velocity Chart

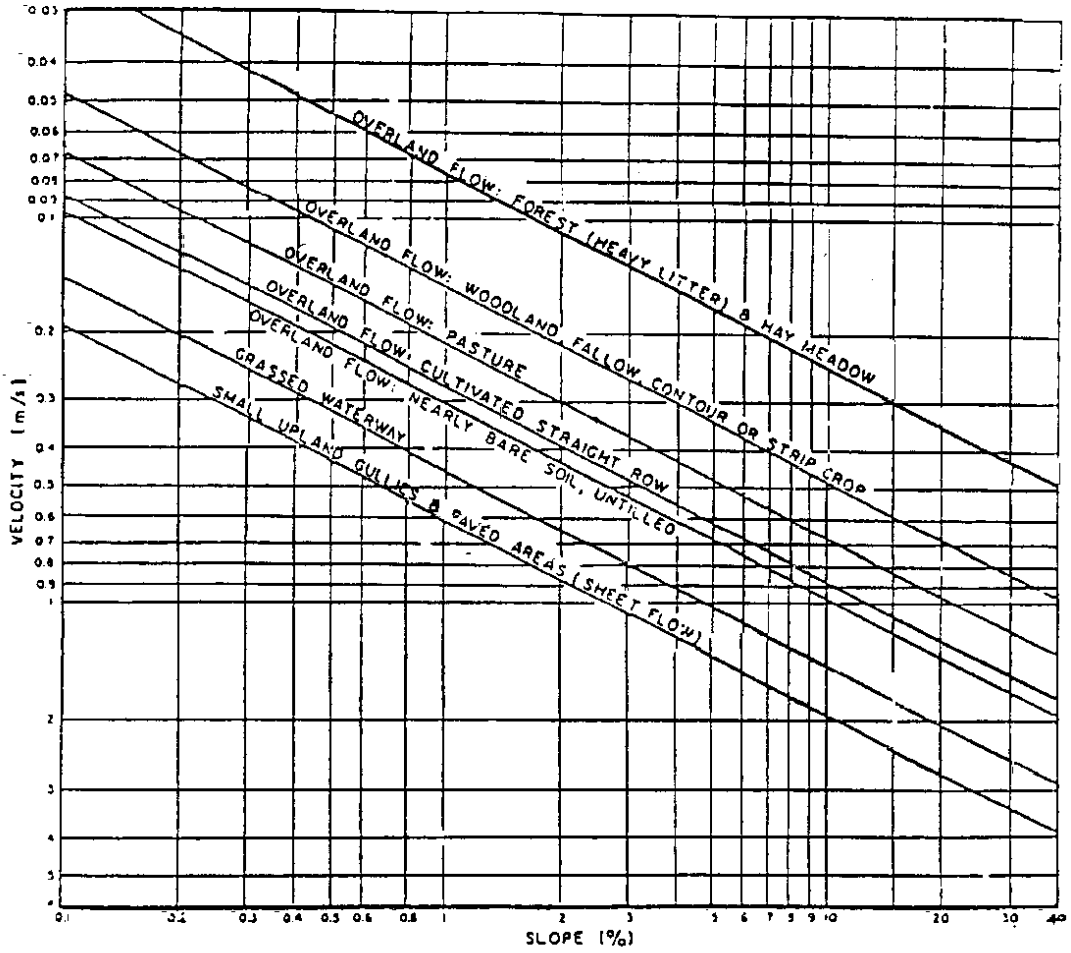


Figure A.5.2: Upland Method for Estimating Time of Concentration
(SCS National Engineering Handbook, 1971)

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 1A: Pre-Development Runoff Coefficient "C" - EX-1A

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.00	0.90	0.20	0.25
0.79	Soft	0.79	0.20		

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 1B: Pre-Development / Allowable EX-1A Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
St Laurent Blvd (600mm)	0.79	0.20	10	**45.8**	**98.0**

TABLE 1C: Pre-Development Runoff Coefficient "C" - EX-1B

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.19	0.90	0.41	0.48
0.63	Soft	0.44	0.20		

Runoff Coefficient Equation
$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$
* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 1D: Pre-Development / Allowable EX-1B Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
St Laurent Blvd (1050mm)	0.630	0.41	11	**43.6**	**177.7**

TABLE 1E: Pre-Development Runoff Coefficient "C" - EX-2

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.00	0.90	0.20	0.25
0.73	Soft	0.73	0.20		

TABLE 1F: Pre-Development / Allowable EX-2 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Conroy Rd	0.730	0.20	12	**38.4**	**82.3**

TABLE 1G: Pre-Development Runoff Coefficient "C" - EX-3

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	2.48	0.90	0.68	0.76
3.65	Soft	1.17	0.20		

TABLE 1H: Allowable EX-3 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{5\ Year}$ (L/s)
Walkley Rd	3.65	0.50	15	**423.9**

TABLE 1I: Pre-Development EX-3 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Conroy Rd	3.65	0.68	15	**649.2**	**1249.6**

Time of Concentration	Tc=	10	min	Equations:
Intensity (5 Year Event)	I_5=	104.19	mm/hr	Flow Equation
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr	Q = 2.78 x C x I x A
				Where:
Time of Concentration	Tc=	11	min	C is the runoff coefficient
Intensity (5 Year Event)	I_5=	99.19	mm/hr	I is the rainfall intensity, City of Ottawa IDF
Intensity (100 Year Event)	I_{100}=	169.91	mm/hr	A is the total drainage area
Time of Concentration	Tc=	12	min	100 year Intensity = $1735.688 / (Time in min + 6.014)^{0.820}$
Intensity (5 Year Event)	I_5=	94.70	mm/hr	5 year Intensity = $998.071 / (Time in min + 6.053)^{0.814}$
Intensity (100 Year Event)	I_{100}=	162.13	mm/hr	2 year Intensity = $732.951 / (Time in min + 6.199)^{0.810}$
Time of Concentration	Tc=	15	min	
Intensity (5 Year Event)	I_5=	83.56	mm/hr	
Intensity (100 Year Event)	I_{100}=	142.89	mm/hr	

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 2A: Post-Development Runoff Coefficient "C" - A-1

Area	Surface	Ha	"C"	C_{avg}	*C_{100}
Total	Hard	0.00	0.90	0.20	0.25
0.20	Soft	0.20	0.20		

Runoff Coefficient Equation

$C = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

* Runoff Coefficient increases by 25% up to a maximum value of 1.00 for the 100-Year event

TABLE 2B: Post-Development A-1 Flows

Outlet Options	Area (ha)	C_{avg}	Tc (min)	$Q_{5\ Year}$ (L/s)	$Q_{100\ Year}$ (L/s)
Conroy Rd	0.20	0.20	10	**11.6**	**24.8**

Time of Concentration	Tc=	10	min
Intensity (5 Year Event)	I_5=	104.19	mm/hr
Intensity (100 Year Event)	I_{100}=	178.56	mm/hr

100 year Intensity = 1735.688 / (Time in min + 6.014) $^{0.820}$
5 year Intensity = 998.071 / (Time in min + 6.053) $^{0.814}$

Equations:
Q = 2.78 x C x I x A
Where:
C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 3A: Post-Development Runoff Coefficient "C" - A-2

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.00	0.90	0.90	1.00	1.00
0.86	Roof	0.86	0.90		1.00	
	Soft	0.00	0.20		0.25	

TABLE 3C: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-2

0.86 =Area (ha)
1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	45	69.05	165.09	38.9	126.21	340.75
	50	63.95	152.90	38.9	114.02	342.06
	55	**59.62**	**142.55**	**38.9**	**103.67**	**342.11**
	60	55.89	133.63	38.9	94.75	341.11
	65	52.65	125.87	38.9	86.99	339.25

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 4A: Post-Development Runoff Coefficient "C" - A-3

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.75	0.90	0.77	1.00	0.86
0.92	Roof	0.00	0.90		1.00	
	Soft	0.17	0.20		0.25	

TABLE 4C: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-3

0.92 =Area (ha)
0.86 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	30	91.87	202.40	50.0	152.40	274.32
	35	82.58	181.93	50.0	131.93	277.06
	40	**75.15**	**165.56**	**50.0**	**115.56**	**277.34**
	45	69.05	152.13	50.0	102.13	275.75
	50	63.95	140.90	50.0	90.90	272.70

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_5 = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
PROJECT NAME: 2020 WALKLEY ROAD
LOCATION: OTTAWA, ONTARIO

NOVATECH
Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 5A: Post-Development Runoff Coefficient "C" - A-4

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.00	0.90	0.90	1.00	1.00
0.85	Roof	0.85	0.90		1.00	
	Soft	0.00	0.20		0.25	

TABLE 5C: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-4

0.85 =Area (ha)
1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	40	75.15	177.57	38.9	138.69	332.85
	45	69.05	163.17	38.9	124.29	335.57
	50	**63.95**	**151.12**	**38.9**	**112.24**	**336.73**
	55	59.62	140.89	38.9	102.01	336.64
	60	55.89	132.08	38.9	93.20	335.52

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
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DATE PREPARED: DECEMBER 2020

TABLE 6A: Post-Development Runoff Coefficient "C" - A-5

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	0.00	0.90	0.90	1.00	1.00
0.77	Roof	0.77	0.90		1.00	
	Soft	0.00	0.20		0.25	

TABLE 6C: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-5

0.77 =Area (ha)
1.00 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	45	69.05	147.81	34.9	112.95	304.97
	50	63.95	136.90	34.9	102.04	306.13
	55	**59.62**	**127.63**	**34.9**	**92.77**	**306.15**
	60	55.89	119.65	34.9	84.79	305.24
	65	52.65	112.70	34.9	77.84	303.56

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

PROJECT #: 119067
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Engineers, Planners & Landscape Architects

DATE PREPARED: DECEMBER 2020

TABLE 7A: Post-Development Runoff Coefficient "C" - A-6

			5 Year Event		100 Year Event	
Area	0.4	Ha	"C"	C_{avg}	"C" + 25%	$*C_{avg}$
Total	Hard	1.82	0.90	0.84	1.00	0.93
2.00	Roof	0.00	0.90		1.00	
	Soft	0.18	0.20		0.25	

TABLE 7C: 100 YEAR EVENT QUANTITY STORAGE REQUIREMENT - A-6

2.00 =Area (ha)
0.93 = C

Return Period	Time (min)	Intensity (mm/hr)	Flow Q (L/s)	Allowable Runoff (L/s)	Net Flow to be Stored (L/s)	Storage Req'd (m^3)
100 YEAR	5	242.70	1258.35	350.0	908.35	272.50
	10	178.56	925.77	350.0	575.77	345.46
	15	**142.89**	**740.86**	**350.0**	**390.86**	**351.78**
	20	119.95	621.91	350.0	271.91	326.29
	25	103.85	538.42	350.0	188.42	282.62

Equations:

Flow Equation

$Q = 2.78 \times C \times I \times A$

Where:

C is the runoff coefficient
I is the rainfall intensity, City of Ottawa IDF
A is the total drainage area

Runoff Coefficient Equation

$C_s = (A_{hard} \times 0.9 + A_{soft} \times 0.2)/A_{Tot}$

$C_{100} = (A_{hard} \times 1.0 + A_{soft} \times 0.25)/A_{Tot}$

Table 7: Post-Development Stormwater Mangement Summary

Area ID	Area (ha)	1:5 Year Weighted Cw	Oulet Location	5-Year Storm	100 Year Storm	
				Release (L/s)	Release (L/s)	Req'd Vol (cu.m)
A-1	0.20	0.20	Conroy Rd	11.6	24.8	N/A
Total Post Development Flow to Conroy Road				**11.6**	**24.8**	
Allowable Flow to Conroy Road				**38.4**	**38.4**	
A-2	0.86	0.90	St Laurent Blvd	21.7	38.9	342.11
A-3	0.92	0.77	St Laurent Blvd	50.0	50.0	277.34
Total Post Development Flow to St Laurent Blvd				**71.7**	**88.9**	
Allowable Flow to St Laurent Blvd				**89.4**	**89.4**	
A-4	0.85	0.90	Walkley Rd	21.7	38.9	336.73
A-5	0.77	0.90	Walkley Rd	19.5	34.9	306.15
A-6	2.00	0.84	Walkley Rd	350.0	350.0	351.78
Total Post Development Flow to Walkley Road				**391.2**	**423.7**	
Allowable Flow to Walkley Road				**423.9**	**423.9**	
Overall Total				**474.5**	**537.4**	
Overall Allowable				**551.7**	**551.7**	
Overall Pre Development				**777.0**	**1607.6**	

Matthew Hrehoriak

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: Wednesday, January 13, 2021 11:21 AM
To: Matthew Hrehoriak
Cc: Lee Sheets
Subject: RE: 2020 Walkley Boundary Condition Request

Hello,

To follow-up regarding the preliminary SWM memo –

- Based upon the comments from the City's Water Resources group, flows tributary to the 1550mm Central Walkley storm will need to be controlled to the 2-year peak rather than the 5-year. This does not include the Conroy and St-Laurent storm sewers which can remain as controlled to the 5-year event.

As well, your water boundary conditions have been prepared. I'll follow-up your original boundary conditions email with those.

Thanks,
Adam

Adam Baker, EIT
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 26552, Adam.Baker@ottawa.ca

From: Matthew Hrehoriak
Sent: Tuesday, January 5, 2021 14:39
To: 'Baker, Adam' <adam.baker@ottawa.ca>
Subject: RE: 2020 Walkley Boundary Condition Request

Hi Adam,

See attached water connection locations sketch. We are planning to reuse the existing water connection on Walkley Road to service the site and provide a second connection separated by an isolation valve for redundancy. On a side note will you be able to review the SWM memo this week, we would like buy in before we begin any detailed SWM calculations.

Let me know if you have any questions.

Thanks,

Matthew Hrehoriak, P.Eng., Project Engineer | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects

240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 273 | Fax: 613.254.5867

From: Baker, Adam <adam.baker@ottawa.ca>
Sent: Tuesday, January 5, 2021 11:23
To: Matthew Hrehoriak <m.hrehoriak@novatech-eng.com>
Subject: RE: 2020 Walkley Boundary Condition Request

Hi Matthew,

For this request could you please provide a sketch showing the proposed watermain connection points in Walkley, Conroy, and St-Laurent.

Thank you,
Adam

Adam Baker, EIT
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review - South Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue. Laurier Ouest. Ottawa (Ontario) K1P 1J1
613.580.2424 ext./poste 26552, Adam.Baker@ottawa.ca

From: Matthew Hrehoriak <m.hrehoriak@novatech-eng.com>
Sent: January 04, 2021 9:21 AM
To: Baker, Adam <adam.baker@ottawa.ca>
Subject: 2020 Walkley Boundary Condition Request

I have calculated the proposed water demands for the development at 2020 Walkley Road. I am sending you this e-mail to request watermain boundary conditions for the 400mm dia. municipal WM fronting the subject property in Walkley Road, Conroy Road and St Laurent Blvd. The anticipated water demands for the proposed development are as follows:

- Average Day Demand = 0.54 L/s
- Maximum Day Demand = 0.81 L/s
- Peak Hour Demand = 1.46 L/s
- Maximum Fire Flow Demand = 167 L/s (see attached FUS calculations for details)

Regards,

Matthew Hrehoriak, P.Eng., Project Engineer | Land Development Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x 273 | Fax: 613.254.5867

APPENDIX G
Drawings

Drawing Index (Separate from Report)

119067-COV – COVER PAGE

119067-ND – NOTES AND DETAILS

119067-GP1 – GENERAL PLAN OF SERVICES - PHASE 1 - SOUTH
119067-GP2 – GENERAL PLAN OF SERVICES - PHASE 2 - SOUTH
119067-GP3 – GENERAL PLAN OF SERVICES - PHASE 2 - NORTH
119067-GP4 – GENERAL PLAN OF SERVICES - PHASE 3 - NORTH

119067-GR1 – GRADING PLAN - PHASE 1 - SOUTH
119067-GR2 – GRADING PLAN - PHASE 2 - SOUTH
119067-GR3 – GRADING PLAN - PHASE 2 - NORTH
119067-GR4 – GRADING PLAN - PHASE 3 - NORTH

119067-ESC – EROSION SEDIMENT CONTROL PLAN