JULY 20, 2022

PROJECT NO: 1486-4809

SENT VIA: EMAIL
JENNIFER.MORRISON@CLVGROUP.COM

Fairview Limited Partnership
c/o CLV Group Developments Inc.
485 Bank St., Suite 200
Ottawa, ON K2P 1Z2

Attention: **Jennifer Morrison, RPP, MCIP**
Director of Development

RE: **SITE SERVICING & STORMWATER MANAGEMENT TECHNICAL ADDENDUM**
FOURTH SITE PLAN APPLICATION (CITY FILE NO. 535-001/20)
2243 FAIRVIEW STREET, 2269 FAIRVIEW STREET, 864 DRURY LANE
CITY OF BURLINGTON

Dear Jennifer,

Fairview Limited Partnership have retained C.F. Crozier & Associates (Crozier) to provide the following Site Servicing & Stormwater Management Technical Addendum in support of a Site Plan Application (SPA) for the property at 2243 Fairview Street, 2269 Fairview Street, and 864 Drury Lane (Fairview and Drury) in the City of Burlington. This Technical Addendum has been prepared to address the comments provided by the City of Burlington (March 10, 2022) to support the Site Plan Application approval.

Introduction and Executive Summary

This technical addendum demonstrates how the proposed development's servicing and stormwater management will integrate with the area's existing water, sanitary, and stormwater infrastructure.

The following revisions have been included within this technical addendum:

- The watermain size increased from a 200 mm diameter PVC watermain to a 300 mm diameter PVC watermain. Two additional services are proposed to each building, as requested by Halton Region. Fire flow calculations were updated based on the updated Fire Underwriter's Survey (2020) criteria.

- Minor revisions to the stormwater drainage areas due to site plan and grading changes. Stormwater management calculations (Modified Rational Method, Hydraulic Grade Line, erosion control calculations) have been revised to accommodate the drainage area changes.

- The previously proposed area drain within Metrolinx lands shown on the ultimate site servicing plan has been replaced with a ditch inlet catch basin to provide additional collection of external flows and conveyance capacity to future Building D.

- Revisions have been made to the storm sewer pipe design to address drawing comments received from the City of Burlington. These design changes have affected the footprint of the proposed Cupolex chamber as well as the footprint of the DeepRoot Silva cells within the property at Fairview and Drury (Site).

- The sizing report and detail for the Jellyfish filter within the Site have been revised based on the revised drainage areas and to accommodate for the external drainage area.

- Cupolex drawings have been provided with the updated tank orientation due to storm sewer modifications within the Site.

- DeepRoot Silva cell drawings have been provided with updated footprint areas due to storm sewer modifications within the Site.

- Storm pumps located within the Stormwater Management vault of Building C have been provided as specified by Smith + Andersen.

- A letter from Cupolex addressed to the City of Burlington has been included in Appendix C to highlight examples of projects in the Golden Horseshoe area where Cupolex units have been approved and constructed.

- An updated letter of reliance has been re-issued as part of the 4th Site Plan Application package.

Background Information

The following background documents have been reviewed in support of the servicing and stormwater management (SWM) design for the Site:

- Technical Addendum – Hydrogeological and Global Stability Characterization (Pinchin Ltd., May 20, 2022)

- Revised Hydrogeological Assessment – Phase 1 Construction – Buildings C1 and C2 (Pinchin Ltd., November 22, 2021)

- Geotechnical Investigation – Phase 1 Construction – Buildings C1 and C2 (Pinchin Ltd., August 12, 2021)

- City of Burlington Standard Specifications (February 2018)

- City of Burlington Stormwater Management Design Guidelines (May 2020)

- Ministry of the Environment – Stormwater Management Planning and Design Manual (March 2003)

- Office of the Fire Marshall – Fire Protection Water Supply Guideline for Part 3 In the Ontario Building Code (October 1999)

- Part 8 of The Building Code Compendium (2012)

- Regional Municipality of Halton - Water Wastewater Linear Design Manual (April 2019)

- City of Burlington Development Application Pre-Consultation Form (June 6, 2018)
- Burlington GO Mobility Hub Preferred Concept and Supporting Technical Memos, prepared by Brook McIlroy (November 9, 2017)

Water Servicing

Proposed Water Servicing

The proposed watermain and servicing distribution system follows the original layout as shown on Drawing C102A. A 300 mm diameter PVC watermain is proposed along Central Common Station and servicing / utility easement. The watermain size increase from the 200 mm to the 300 mm is necessary to accommodate the combined fire flow and maximum daily demand for domestic and commercial use as specified in the Halton Region Design Manual. The proposed watermain connects onto the existing 300 mm diameter watermain on Drury Lane and 250 mm diameter watermain on Fairview Street, complete with the proposed three valve chambers per Halton Region standard RH 402.050.

There are four service connections provided to the four proposed buildings in this development. Apart from Building C, each service connection will be installed per Region standard 401.010 complete with two (2) 200 mm fire watermain valves (one for residential use and one for commercial use) and two (2) 200 mm watermain valves (one for residential use and one for commercial use) located at the road right-of-way. Building C will be similarly serviced and includes a 100mm commercial water lead and valve instead of the 200 mm diameter, as recommended by the mechanical engineer. The domestic and commercial leads should be resized in future phases within future Site Plan Applications. The proposed fire and supply leads will be extended to the underground mechanical incoming servicing room at each building. The water connections will include a flow meter, check valves, backflow preventer and adhere to connection requirements according to Halton Region standards.

The proposed internal watermain distribution system will be constructed during Phase 1, however individual fire, domestic and commercial connections to future Buildings A, B, and D will be constructed in future phases, at the request of Halton Region. The proposed water design for the site in Phase 1 conditions is reflected on Drawing C102A and the ultimate conditions are reflected on Drawing C102B.

Design Water Demand

The Halton Region Water and Wastewater Linear Design Manual (dated April 2019) and the Burlington GO Mobility Hub Technical Memo (dated November 9, 2017) were used in conjunction with Core Architects Inc. Phase 1 statistics (Site Plan, July 20, 2022) to estimate the proposed water demands for domestic and commercial purposes. A summary of the results for phase 1 and ultimate build-out are presented in Table 1 and Table 2, respectively, with detailed calculations provided in Appendix A.

Table 1: Phase 1 - Existing and Proposed Domestic Water Demand

	Average Daily Demand (L/s)	**Maximum Daily Demand** (L/s)	**Peak Hourly Demand** (L/s)
Existing Water Demand	0.24	0.55	0.55
Proposed Domestic Site Water Demand	6.75	15.18	26.99
Proposed Commercial Site Water Demand	0.59	1.32	1.32
Increase in Water Demand	**7.10**	**15.96**	**27.77**

As shown in Table 1, the existing peak hourly domestic water demand for Phase 1 is 0.55 L/s. Phase 1 includes Building C (approximately 775 units) that will service a residential population of 2,120 and commercial population of 185. Following development, the Phase 1 peak hourly domestic and commercial water demand will be 28.32 L/s thus resulting in a water demand increase of 27.77 L/s for the entire property.

Table 2: Ultimate Build Out - Existing and Proposed Domestic Water Demand

	Average Daily Demand (L/s)	**Maximum Daily Demand** (L/s)	**Peak Hourly Demand** (L/s)
Existing Water Demand	0.97	2.19	2.19
Proposed Domestic Site Water Demand	15.39	34.62	59.82
Increase in Water Demand	**14.42**	**32.43**	**57.63**

As shown in Table 2, the existing peak hourly domestic water demand is 2.19 L/s. Following development, the peak hourly domestic water demand for the ultimate build-out will be 59.82 L/s thus resulting in a water demand increase of 57.63 L/s for the entire property (approximately 2514 units).

Fire Flow Demand

The Fire Underwriters Survey (FUS) method (2020) was used to establish the fire flow demand analysis for the development. The flow requirements were based on the largest known unobstructed floor area for the development. Building C level 1 has the largest Gross Floor Area (GFA) of 2,512.25m² from the project statistics prepared by Core Architects Inc. (July 20, 2022). As confirmed by the architect, all mixed commercial/residential buildings will be built with non-combustible construction material (Construction Coefficient = 0.8), includes 2-hour fire separations, and will have complete recognized automatic sprinkler system.

The sprinkler system is required to be designed and installed in accordance with NFPA 13, the water supply is standard for both the sprinkler system and the hydrants, and the sprinkler system should be fully supervised as defined by FUS 2020. The sprinkler system is to be designed by the Mechanical Engineer for the proposed building.

The available fire flow supply at 40 psi for the existing 250 mm diameter watermain was projected to be 119.91 L/s (1,901 US GPM) using the results from the November 30th, 2017, hydrant flow test. The existing supply will be able to accommodate a 66.7 L/s (1,057 US GPM) fire flow for a duration of 1.5 hours per the FUS calculations included in Appendix A**.** The Fire Flow Demand calculation is prepared to estimate the size of the incoming waterline only. The Mechanical Engineer for this development will complete the required analysis for fire protection, and the Architect will design fire separation methods per the determined fire flow rate to meet municipally available flows and pressures.

Sanitary Servicing

There are no proposed changes to the sanitary servicing design as part of this technical addendum. Please refer to the Servicing and Stormwater Management Report dated December 1, 2021, for the most current sanitary servicing design.

Grading and Drainage Conditions

Existing Drainage Conditions

Existing drainage conditions are consistent with the Site Servicing and Stormwater Management Report submitted by Crozier on December 1, 2021. Please refer to the previously submitted report for information on the existing drainage conditions of the Site area and the associated runoff coefficients and pre-development peak runoff rates.

Proposed Drainage Conditions

Table 3 below provides a summary of the post-development site areas and associated runoff coefficients updated based on the revised site plan (Core Architects, July 20, 2022) and grading revisions. Table 4 provides a summary of the post-development peak flow rates. Detailed Rational Method calculations have been included in Appendix B. Drawing C701 included with this technical addendum supersedes Figure 2 (Post-Development Storm Drainage Plan) previously submitted as part of the Site Servicing and Stormwater Management Report (December 2021).

Table 3: Post-Development Areas and Weighted Runoff Coefficients

Catchment No.	Total Area (ha)	Weighted Runoff Coefficients			
		2 to 10-year	25-year	50-year	100-year
201	0.11	0.70	0.77	0.83	0.87
202	0.29	0.95	1.00	1.00	1.00
203	0.66	0.95	1.00	1.00	1.00
204	0.76	0.95	1.00	1.00	1.00
205	0.76	0.95	1.00	1.00	1.00
206	0.59	0.95	1.00	1.00	1.00
Uncontrolled	0.09	0.95	1.00	1.00	1.00
Total Site	**3.26**	**0.94**	**1.00**	**1.00**	**1.00**
EXT	0.32	0.69	0.76	0.83	0.87
Total	**3.58**	**0.92**	**1.00**	**1.00**	**1.00**

Table 4: Post-Development Peak Runoff Rates

Storm Event	Peak Flow Rates (m^3/s)									
	201	202	203	204	205	206	Uncontrolled	Total Site	EXT	Total
2-year	0.017	0.060	0.137	0.157	0.157	0.122	0.019	0.669	0.048	**0.718**
5-year	0.022	0.078	0.177	0.203	0.203	0.158	0.024	0.865	0.063	**0.927**
10-year	0.025	0.089	0.203	0.233	0.233	0.181	0.028	0.993	0.072	**1.065**
25-year	0.032	0.109	0.249	0.286	0.286	0.222	0.034	1.218	0.092	**1.310**
50-year	0.038	0.120	0.275	0.315	0.315	0.245	0.037	1.346	0.111	**1.457**
100-year	0.043	0.132	0.300	0.345	0.345	0.268	0.041	1.473	0.126	**1.599**

External (Metrolinx) Drainage Conditions

There are no revisions to the external (Metrolinx) drainage area. Please refer to the Site Servicing and Stormwater Management Report (December 2021) for detailed information on this catchment.

Parkland Area Drainage Conditions

There are no revisions to the parkland drainage area. Please refer to the Site Servicing and Stormwater Management Report (December 2021) for detailed information on this drainage area.

Target Flow Rate to Downstream Sewers

There are no revisions to the target flow rate to downstream sewers. Please refer to the Site Servicing and Stormwater Management Report (December 2021) for detailed information on the Fairview Street storm sewer target flow rate.

Storm Sewer Servicing

The storm sewer design has maintained the same approach as described in the Site Servicing and Stormwater Management Report (December 2021). The storm sewer design sheet has been updated with the revised pipe invert and slope information changes and has been included in Appendix B.

A hydraulic grade line (HGL) analysis prepared in December 2021 has been updated for the revised storm sewer layout within the Site. Per the City's Stormwater Management (SWM) Guidelines (May 2020), the City assumes the municipal minor flow conveyance system is flowing at full capacity within an HGL analysis. Based on the existing grades at the 1200 mm diameter storm sewer site connection point within Fairview Street, a tailwater of 95.77 m was applied under the assumption that the existing storm sewer is at full capacity during the 100-year design storm event. Results of the HGL analysis within the Site determined that the hydraulic grade line is at least 0.30 m below ground surface during the 100-year design storm event throughout the Site. It is recommended that backflow preventors be installed at each building storm sewer connection to the underground stormwater management vaults to avoid potential risk for flows to back up into the buildings. The revised HGL design sheet has been included in Appendix B.

Emergency Overflow

Emergency overflow design for each of the underground stormwater management systems and the overland flow calculations have not been altered since the submission of the Site Servicing and Stormwater Management Report (December 2021). Please refer to this document for information on the emergency overflow design within the Site.

Stormwater Management

Stormwater Quantity Control

The target flow rate for areas discharging to the existing storm sewer on Fairview Street will be the minor (5-year) release rate of 0.525 m^3/s as calculated in the Site Servicing and Stormwater Management Report (December 2021). Catchments 203 and EXT remain consistent with the December 2021 reporting; all remaining catchment areas have been modified as part of this technical addendum due to site plan revisions and minor grading changes. Since the proposed development will increase the overall imperviousness of the site, compared to existing conditions, quantity controls are required to achieve the target flow rate which are described below:

Catchment 201: This catchment comprises of a temporary emergency access road complete with landscaped area, sidewalk and Turfstone. Uncontrolled stormwater runoff from this area is collected via a double catch basin and outlets via the site outlet to Fairview Street.

Catchments 202, 203, 204 and 205: Stormwater runoff is collected via area drains and conveyed internally through the respective building mechanical systems and directed to four separate underground storage tanks within the parking garages (1 tank per building). Additionally, permanent groundwater dewatering from each of the buildings will be collected via the foundation drains (designed by others) and conveyed internally through the building mechanical systems to the storage tanks. Each tank is sized based on the respective tributary drainage area and groundwater flow to meet the overall target flow rate for the site. Stormwater runoff collected into each underground tank must be pumped, since the tanks cannot drain by gravity to the storm sewer along Central Station Common. Runoff from areas 202 to 205 is overcontrolled to allow runoff from Catchment area 201, 206, and the Uncontrolled Area to flow uncontrolled while still meeting the target release rate for the site.

Catchment 206: Comprises the Central Station Common Right-of-Way (ROW). Stormwater runoff is collected in catch basins within the ROW and conveyed via the underground storm sewers. Runoff from this catchment area is proposed to drain uncontrolled to the storm sewer on Fairview Street.

Uncontrolled Area: The areas to the east of Building D, south and west of Building B, west of Building C, and small areas south of the trench drains in catchment 203 will sheet drain from the Site uncontrolled.

Catchment EXT: This catchment includes runoff from the external Metrolinx corridor. During Phase 1 of the development, runoff from this area will be routed around the east side of Building C and be conveyed through the site to Fairview Street, consistent with existing drainage patterns. During Phase 2, stormwater runoff from the Metrolinx corridor will be collected and conveyed into the Building D mechanical system to the SWM tank. Stormwater collected into the Building D SWM tank will be pumped to the storm sewer with the remainder of the drainage from Catchment 204. The designs of the internal system will be confirmed during Phase 2 under a separate site plan application.

As noted above, each of the storage tanks within the underground parking garages have also been sized to accommodate long-term groundwater dewatering which will ultimately discharge to storm sewers. Groundwater will be collected via foundation drains and conveyed via the building mechanical systems to the respective underground parking level storage (detention) tank.

Long-term groundwater dewatering rates provided by Pinchin Environmental (via emails dated August 19, 2020 and September 17, 2020, and via the Technical Addendum - Hydrogeological and Global Stability Characterization dated May 20, 2022), are summarized in As outlined in the email from Pinchin Environmental dated September 17, 2020, long-term dewatering rates provided for Buildings A and B are high-level (preliminary) estimates and will therefore need to be confirmed prior to site plan approval for future Phase 2 and Phase 3 of the development.

Table 5 below and have been accounted for in each of the P1 level tank designs and downstream storm sewer sizing.

As outlined in the email from Pinchin Environmental dated September 17, 2020, long-term dewatering rates provided for Buildings A and B are high-level (preliminary) estimates and will therefore need to be confirmed prior to site plan approval for future Phase 2 and Phase 3 of the development.

Table 5: Long-Term Groundwater Dewatering Rates

Building	Long-Term Groundwater Dewatering Rate (m^3/day)	Long-Term Groundwater Dewatering Rate (m^3/s)
A	130*	0.0015
B	320*	0.0037
C	94	0.0011
D	55	0.0007

*Preliminary dewatering estimates to be confirmed prior to site plan approval for Buildings A and B.

Modified Rational Method calculations were used to determine the post-development peak flow rates and required storage volumes for the site using City of Burlington's IDF data.

Required storage volumes were calculated for each building detention vault to over control the 100-year post-development peak flows to meet the 5-year pre-development target flow rate, while allowing Catchments 201, 206 and the Uncontrolled Area to drain uncontrolled.

Since long-term groundwater dewatering will be routed into the underground parking stormwater detention vaults and controlled by the outflow pump rate of the vault, the required storage volumes and peak flow calculations have been designed to include control of groundwater flows such that the total controlled release rate meets the 5-year target peak flow, while allowing Catchments 201, 206 and the Uncontrolled Area to drain uncontrolled.

A summary of the post-development peak flow rates and storage volumes to the site outlet are provided in Table 6 below and detailed calculations are included in Appendix B.

Table 6: Summary of Peak Flow Rates and Storage Volumes

Catchment ID	Target Flow Rate (m^3/s)	Uncontrolled 100-Year Storm Runoff Rates (m^3/s)	Long-Term Dewatering Rate (m^3/s)	Total Inflow to Storage Vault* (m^3/s)	Total Controlled 100-Year Release Rates* (m^3/s)	Underground Storage Required* (m^3)	Underground Storage Provided* (m^3)	Underground Storage Vault Location
201	0.525	0.043	N/A	N/A	0.043	N/A	N/A	N/A
202		0.132	0.0015	0.134	0.020	94.5	252.1	P1 Level of Building A
203		0.300	0.0037	0.304	0.032	252.8	417.6	P1 Level of Building B
204 & EXT		0.471	0.0007	0.472	0.087	311.5	389.4	P1 & P2 Level of Building D
205		0.345	0.0011	0.346	0.033	295.7	615.3	P1 & P2 Level of Building C
206		0.268	N/A	N/A	0.268	N/A	N/A	N/A
UNC		0.041	N/A	N/A	0.041	N/A	N/A	N/A
Total	**0.525**	**1.599**	**0.007**	**0.952**	**0.524**	**954.5**	**1,674.4**	**-**

*Total Inflows to storage vaults, total controlled 100-year release rates, as well as required and provided storage volumes above are inclusive of long-term groundwater dewatering.

As shown in the table above, the proposed quantity control measures reduce 100-year post-development peak flow rates to the target 5-year pre-development peak flow rate.

A minimum of 300 mm separation (freeboard) between the 100-year water level and the entrance to the underground parking is required as per Section 6.1.1.3 of the City's SWM guidelines. These values are summarized in Table 7 below.

Table 7: 100-Year Freeboard to Parking Garage Entrances

Building	Parking Garage Entrance Elevation (m)	100-Year Water Level Elevation in Tank (m)	Freeboard (m)
A	97.90	95.21	2.69
B	98.95	96.25	2.70
C	98.10	94.17	3.93
D	99.30	97.18	2.12

Stormwater Erosion Control

Erosion control shall provide extended detention of the 25 mm, 4-hour Chicago design storm runoff volume, released over a period of 24-48 hours. The Visual Otthymo (VO6.1) model catchment areas and impervious values were updated for the post-development site conditions modelling the 25 mm, 4-hour Chicago design storm to determine the resultant runoff volumes. Detailed output from the VO model is provided in Appendix B. Required extended detention volumes were calculated for each catchment using the runoff volume produced by the VO6.1 model, and drawdown times were calculated using the extended detention pump release rates; refer to Appendix B for these calculations. A summary of the revised extended detention volumes and drawdown durations is provided in Table 8 below.

Table 8: Underground Parking Level Tank Extended Detention Summary

Catchment	Building	Extended Detention Volume (m^3)	Extended Detention Release Rate (GPM)	Extended Detention Release Rate (m^3/s)	Extended Detention Drawdown Time (hours)
202	A	69.2	10	0.0006	30.5
203	B	157.8	15	0.0009	46.3
204 & EXT	D	239.9	25	0.0016	42.3
205	C	181.3	20	0.0013	39.9

During a 25 mm, 4-hour Chicago design storm, a runoff volume of 141 m^3 is generated from Catchment 206. A concrete structure formed by Cupolex Rialto H.1000 mm chambers are proposed and will provide an active storage volume of 143 m^3, between elevations 95.72 m and 96.23 m during the 25 mm design storm event. An internal control wall will be constructed within the manhole MH13 to control the volume within the proposed Cupolex chambers, located immediately downstream of the chambers to achieve the 25mm volume within the chambers prior to release. A Hydrovex model 32SVHV-1 will be installed within the control wall at an invert elevation of 95.72 m to control drawdown of the extended detention control volume. The top of the control wall will be set at an elevation of 96.23 m such that flows greater than the 25 mm runoff volume can drain uncontrolled to the downstream storm sewers. A summary of the extended detention drawdown for Catchment 206 is provided in Table 9.

Table 9: Cupolex Chamber Extended Detention Summary

Catchment	Extended Detention Volume (m^3)	Extended Detention Release Rate (m^3/s)	Extended Detention Drawdown Time (hours)
206	140.8	0.0008	48.9

Double catch basins 26 and 27 (as shown on Drawings C102A and C102B) are proposed with the lowest top grate elevation compared to the remaining catch basins along Central Station Common (upstream of the control manhole). As such, these double catch basins will provide relief of overflows from the underground storage chambers, if the outlet pipe becomes clogged.

Due to high groundwater conditions on site, the concrete Cupolex system will be designed as a waterproof system to prevent infiltration of groundwater into the system void space. Additionally, the Cupolex system will be designed to resist uplift from groundwater as well as to provide structural support for the overlying soils, Silva Cells (or approved equivalent), mature tree weights, and crane loading during construction.

Water Budget

There are no revisions to the water budget calculations. Please refer to the Site Servicing and Stormwater Management Report (December 2021) for detailed information on the water budget.

Underground Parking Level SWM Vault Details

A total of four (4) underground storage tanks are proposed within the underground parking garages to provide both retention of stormwater for re-use as irrigation and detention of stormwater for quantity (flood) and erosion control. An internal concrete wall will divide the SWM vaults into their respective retention / detention areas as described below. The floor slab elevations of the SWM vaults vary between 91.227 m and 94.127 m and the proposed storm sewers are at a minimum elevation of approximately 95.88 m within Central Station Common. Therefore, the stormwater runoff captured within the underground parking storage tanks will be discharged to the on-site storm sewers using pumps. SWM vault locations are depicted on Drawing C102B.

The retention vault component of each underground parking level tank will receive stormwater runoff from only the inherently 'clean' rooftop areas of the site which will be conveyed into the retention vault via the building mechanical systems. Each retention tank has been sized to retain 5 mm of runoff volume from the respective tributary rooftop area which will be re-used on site for irrigation of landscaped areas. Pump rates for irrigation of landscaped areas are to be specified by the mechanical engineer in consultation with the landscape architect. Redundancy shall be built into the pump design and a back-up generator proposed such that the pumps can continue to operate under emergency conditions where the main power source has been lost. A maximum 0.40 m sump depth has been accounted for within the retention tank water levels presented below to allow for submersible pumps. Flows more than the retention tank capacity will overflow to the adjacent detention vault for flood control prior to discharging to the storm sewers. Details regarding retention tank sizing are summarized in Table 10.

Table 10: Underground Parking Garage Level Retention Vaults Summary

Building	Retention Vault FFE (m)	Min. Retention Vault Internal Clear Footprint Area (m^2)	5 mm Retention Volume (m^3)	Retention Water Level (Includes 0.40 m Sump) (m)
A	93.127	4.0	9.5	95.90
B	93.127	6.5	19.0	96.45
C	91.227	6.25	17.5	94.43
D	94.127	6.0	16.0	97.19

*Note: Provided Retention Vault Footprint Areas are based on CORE Floor Plan Level P1 dated July 8, 2022 and email correspondence dated September 16, 2021.

The detention vault of each underground parking level tank will receive overflows from the retention tank as well as surface drainage captured via area drains and conveyed into the tank via the internal mechanical systems. Long-term groundwater dewatering collected via foundation drains will also be directed into the detention tanks via the internal mechanical systems. Under ultimate site plan conditions, captured external flows from the Metrolinx corridor will be conveyed via the mechanical systems to the Building D detention tank.

Each detention tank has been sized to overcontrol runoff for storm events up to and including the 100-year design storm such that the overall site target flow of 0.525 m^3/s is achieved, while allowing Catchments 201, 206 and the Uncontrolled Area to drain uncontrolled. Additionally, pump rates from each detention tank will provide extended detention of the runoff resulting from the 25 mm 4-hour Chicago design storm over a period of 24-48 hours. As such, two pumping rates have been specified for each tank to achieve extended detention targets and peak flow targets. Pumps will be specified by the mechanical engineer and each tank shall include a minimum of one back-up pump.

A back-up power supply (generator) shall be provided to the SWM vault pumps to allow the pumps to continue operating under emergency conditions. A maximum 0.40 m sump depth is provided in each tank to allow for submersible pumps. Details regarding the detention tank sizing are summarized in Table 11.

Table 11: Underground Parking Level Detention Vaults Summary

Building	Detention Vault FFE (m)	Min. Detention Vault Internal Clear Footprint Area (m^2)	Provided Detention Volume (m^3)	Storage Volumes (m^3)		Water Levels (Including 0.40 m sump) (m)	
				25 mm	100-Year	25 mm	100-Year
A	93.127	56.0	252.1	69.2	94.5	94.76	95.21
B	93.127	92.8	417.6	157.8	252.8	95.23	96.25
C	91.227	116.1	615.3	181.3	295.7	93.19	94.17
D	94.127	117.2	389.4	239.9	311.5	96.57	97.18

*Note: Provided Retention Vault Footprint Areas are based on CORE Floor Plan Level P1 dated July 8, 2022, and email correspondence dated September 16, 2021.

Best efforts have been made to achieve a maximum drawdown time of 48-hours for quantity control systems, according to City criteria. The proposed pump rates and corresponding quantity (detention) volume drawdown times are presented in Table 12 below.

Table 12: Underground Parking Level Detention Vault Pump Rate Summary

Building	Maximum Detention Tank Outflow Pump Rates	Max. Detention Volume Drawdown Time (hours)
A	10 GPM (0.0006 m^3/s) above water level 93.53 m 300 GPM (0.019 m^3/s) above water level 94.76 m	31.9
B	15 GPM (0.0009 m^3/s) above water level 93.53 m 500 GPM (0.032 m^3/s) above water level 95.23 m	48.5
C	20 GPM (0.0013 m^3/s) above water level 91.63 m 500 GPM (0.032 m^3/s) above water level 93.19 m	42.5
D	25 GPM (0.0016 m^3/s) above water level 94.53 m 1350 GPM (0.087 m^3/s) above water level 96.57 m	43.3

An access hatch grate is proposed for each of the underground parking level storage tanks which will allow relief for uncontrolled 100-year overflows to spill to the surface if the pumps become inoperable.

The overflow hatches will be located directly above the underground parking level tanks and located as close to Central Station Common as possible to minimize impact on pedestrian areas and prevent entrainment of the buildings, as well as to provide access for maintenance from the road. The proposed access hatch locations are shown on Drawing C102B.

Stormwater Quality Control

The stormwater quality strategy and design has not changed since the submission of the Site Servicing and Stormwater Management Report (December 2021). A treatment train approach has been maintained and consists of catch basin shields, a permanent pool within the Cupolex underground storage facility, and a Jellyfish filter.

Due to the revisions made to the catchment areas since the previous submission, an updated sizing report has been provided for the Jellyfish unit proposed within the Site. The updates made to the Jellyfish filter sizing resulted in the same unit being specified as previously submitted (JF10-15-4). The Jellyfish filter sizing summary has been provided in Table 13. Please refer to Appendix B for the detailed Jellyfish sizing report, a detail drawing, and ETV certificates.

Table 13: Jellyfish Filter Sizing Summary

Area (ha)	Percent Impervious (%)	Jellyfish Model	ETV Certified TSS Removal	Design TSS Removal
3.06	100%	JF10-15-4	80%	50%

Groundwater Dewatering

A standalone report has been prepared to discuss the temporary (construction) and long-term groundwater dewatering regarding the Site. Refer to the Long-Term Water Taking and Discharge Plan Report prepared by Crozier (June 2022) under separate cover.

Erosion and Sediment Control During Construction

No revisions to the erosion and sediment control measures during construction have been proposed as part of this technical addendum. Please refer to the previously submitted Site Servicing and Stormwater Management Report (December 2021) for details on the proposed erosion and sediment control measures during construction.

Conclusions

Based on the information contained in this report, we offer the following conclusions which remain consistent with the Site Servicing and Stormwater Management Report (December 2021):

1. Water servicing for the subject lands will be met using a new 200 mm diameter PVC watermain, with connection to the existing 250 mm diameter watermain on Fairview Street and 300 mm diameter watermain on Drury Lane. Two (2) 200 mm fire watermain valves (one for residential use and one for commercial use) and two (2) 200 mm watermain valves (one for residential use and one for commercial use) are proposed for Buildings A, B, and D. Building C will be similarly serviced and includes a 150mm commercial water lead and valve instead of the 200mm diameter, as recommended by the mechanical engineer. Hydrants and Siamese connections are proposed throughout the proposed development.

2. Sanitary servicing for the subject lands will be met using a new 200 mm diameter PVC sanitary sewer service connection to the existing 300 mm diameter sanitary sewer on Fairview Street. A sanitary service connection is proposed at each individual building to the underground parking garage.

3. The property's internal storm sewer system has been sized to convey the 5-year design storm event in accordance with City of Burlington design requirements. The proposed 750 mm diameter storm sewer is proposed to connect into the existing 1200 mm diameter storm sewer on Fairview Street.

4. The parkland area at the southwest corner of the property will be serviced independently from the rest of the development with a standalone storm sewer connection to the existing 1200 mm diameter storm sewer on Fairview Street.

5. The stormwater management quantity controls will control runoff from all storm events up to and including the 100-year post-development peak flows from the property to the 5-year pre-development target levels. Quantity control volumes will be accommodated within four separate underground storage tanks within two underground parking garages. Post-development flows from these areas will be controlled using pumps, since gravity drainage is not feasible.

6. Stormwater quality controls for the subject lands will be achieved through a treatment train approach comprising of CB shields, permanent pool within the underground chamber system, and a Jellyfish filter for surface drainage.

7. Stormwater erosion controls for the subject site will be provided within the four separate underground storage tanks within two underground parking garages as well as the underground storage chambers beneath Central Station Common.

8. Best efforts have been employed to maintain pre-development water balance conditions on site, however an annual infiltration defi cit of 687 m^3 (30%) was calculated.

Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.

Harrison Knill, E.I.T.
Water Resources Engineering Assistant

C.F. CROZIER & ASSOCIATES INC.



Rebecca Archer, P.Eng.
Water Resources Engineer

HK/stm

Enclosures

Appendix A – Water Calculations
Appendix B – Stormwater Management Calculations
Appendix C – Letter to City of Burlington from Cupolex
Drawing C701 – Storm Servicing Drainage Plan

I:\1400\1486-CLV Realty Corp\4809-2269 Fairview St & 84 Drury Ln\Reports\FSR_SWM Report\4th Submission_ADDENDUM (2022.07)\2022.07.20_(1486-4809)_FSR_SWM Addendum.docx

APPENDIX A

Water Calculations

From: Jessica Pettifer
Sent: July 20, 2022 5:42 PM
To: Madeleine Hooper
Subject: FW: Fairview and Drury Lane fire flows

Jessica Pettifer, P.Eng. | Project Engineer
DID: 905.771.4907

From: Brian Laye <blaye@corearchitects.com>
Sent: December 17, 2019 10:32 AM
To: Jessica Visser <jvisser@cfcrozier.ca>; Fatemeh Masoumian <fmasoumian@corearchitects.com>
Cc: Jim Firth <jfirth@cfcrozier.ca>
Subject: RE: Fairview and Drury Lane fire flows

Moring Jessica. Please see below

From: Jessica Visser [mailto:jvisser@cfcrozier.ca]
Sent: December 17, 2019 9:31 AM
To: Brian Laye <blaye@corearchitects.com>; Fatemeh Masoumian <fmasoumian@corearchitects.com>
Cc: Jim Firth <jfirth@cfcrozier.ca>
Subject: Fairview and Drury Lane fire flows

Hi Brian and Fatemeh,

Can you please confirm the following information for each building? We require answers to the following questions:

- Is the entire building sprinklered for each building? YES FOR ALL BUILDINGS.
- Are there fire breaks between each storey for each building? THERE WILL BE A 2HR FIRE SEPARATION BETWEEN EACH STOREY OF THE BUILDING.
- What sort of construction is being used in terms of fire safety for each building:
    - wood frame construction ordinary construction with brick or other masonry walls
    - combustible floor and interior
    - non-combustible construction with unprotected metal structural components
    - fire-resistive construction with fully protected frame, floors, roof BUILDING WILL BE NON-COMBUSTIBLE CONSTRUCTION AS DEFINED BY THE OBC.

This will assist us in improving our fire flow requirement calculations. Thank you.

Best Regards,
Jessica

Jessica Visser EIT | Land Development
C.F. Crozier & Associates Consulting Engineers
57 John Street West, P.O. Box 1011 | Bradford West Gwillimbury, ON L3Z 2B4

PROJECT NAME: 2243 Fairview Street, 2269 Fairview Street & 864 Drury Lane — **July 20, 2022**

Fire Protection Flow Calculation — Design By: SVN

CFCA File: **1486-4809** — Checked By: —

Water Supply for Public Fire Protection - 2020
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

1. An estimate of fire flow required for a given area may be determined by the formula:

F = 220 * C * sqrt A

where

F = the required fire flow in litres per minute
C = coefficient related to the type of construction
= 1.5 for wood frame construction (structure essentially all combustible)
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior)
= 0.8 for non-combustible construction (unprotected metal structural components)
= 0.6 for fire-resistive construction (fully protected frame, floors, roof)
A = The Effective floor area (GFA)

Fire resistive construction

0.8	Noncombustable construction Type II - From Core DWG. A002 Dated Nov. 2021

Total Effective Area

2.b)	Vertical openings protected	
Level P-1	255	**25% of GFA**
Level 1	2175	
Level 1M	82.25	**25% of GFA**
	2512.25	sq.m.

Therefore F= 9,000 L/min (rounded to nearest 1000 L/min)

2. Occupancy and Contents Adjustment Factor
Fire flow may be adjusted based on the type of occupancy or material contained.
Table 3 - Recommended Occupancy/Contents Changes

Group C - Residencial	-15%	
Group D - Business and Personal Services	-15%	Assumed Limited Occupancy and Contents
Group F - Storage garage	0%	Most Restrictive Occupancy
Interpolated Occupancy charge	8%	reduction

675 L/min reduction

3. Automatic Sprinkler Protection
The required fire flow may be reduced based on the adiquacy of the Sprinkler Protection

i)	Automatic Sprinkler Protection designed and installed in accordance with NFPA 13	30%
ii)	Water Supply is Standard for both the Sprinkler System and Fire Department hose lines	10%
iii)	protection.	10%

4,500 L/min reduction

Water Supply for Public Fire Protection - 2020
Fire Underwriters Survey

Part II - Guide for Determination of Required Fire Flow

4. Exposure Adjustment Charge: Water surcharge added based on proximity of adjacent properties.

Exposed buildings - From Building C			Building Type II		Building Height 14m	
Name		**Distance**	**Length to Height Factor**	**Charge**		
North	Adjacent Dwelling	<30		0%	0	No Exposed Structures - Metrolinx (Go Transit) Adjustment may be required
East	Adjacent Dwelling	0	236	5%	450	Building D - Shared fire wall (Openings Protected)
South	Adjacent Dwelling	27.2	180	4%	360	Building A (Openings Uprotected)
West	Adjacent Dwelling	23.3	110	4%	360	Leggat Car Dealership (Assumed Non Combustable construiction)
					360	**L/min Surcharge**

Note: Exposure adjustments for propopsed buildings NO CHARGE APPLIED to the East and South: Automatic Sprinkler System protecting exposed and subject buildings (Sprinkler system to comply with requirements set out in FUS 2020 - Recognition of Automatic Sprinkler Protection

Determine Required Fire Flow

No.1	9,000			
No. 2	675	reduction		
No. 3	4,500	reduction		
No. 4	360	surcharge		
Required Flow:	**4,185**	**L/min**		
Rounded to nearest 1000l/min:	**4,000**	**L/min**	or	66.7 L/s
				1,057 USGPM

Determine Required Fire Storage Volume

Flow from above	4,000	L/min
Required duration	1.50	hours
Therefore:	360,000	Litres or
	360	cu.m. is the required fire storage volume.

Required Duration of Fire Flow

Flow Required L/min	Duration (hours)
2,000 or less	1.0
3,000	1.25
4,000	1.5
5,000	1.75
6,000	2.0
8,000	2.0
10,000	2.0
12,000	2.5
14,000	3.0
16,000	3.5
18,000	4.0
20,000	4.5
22,000	5.0
24,000	5.5
26,000	6.0
28,000	6.5
30,000	7.0
32,000	7.5
34,000	8.0
36,000	8.5
38,000	9.0
40,000 and over	9.5

	No. of Floors	Units: Per Floor	Units: Total	Studio (400-500 sf)	1 Bed (500-675sf)	1 Bed+Den (675-775 sf)	2 Bed (775-900 sf)	2 Bed+Den (900-1000 sf)	3 Bed (1000-1100 sf)	Units: Total	GCA (GROSS CONSTRUCTION AREA): (sf) Per Floor	(sm) Per Floor	(sf) Total	(sm) Total
BUILDING A														
Level P(-3 & -4)	2	0	0	0	0	0	0	0	0	0	42,033	3,905	84,066	7810
Level P(-2)	1	0	0	0	0	0	0	0	0	0	42,033	3,905	42,033	3905
Level P(-1)	1	0	0	0	0	0	0	0	0	0	42,033	3,905	42,033	3905
Level 1	1	0	0	0	0	0	0	0	0	0	15,298	1,421	15,298	1421
Level 1M	1	0	0	0	0	0	0	0	0	0	2,972	276	2,972	276
level 2(PODIUM)	1	6	6	0	1	0	1	0	4	6	11,522	1,070	11,522	1,070
Level 3(PODIUM)	1	12	12	0	3	2	2	0	5	12	11,632	1,081	11,632	1,081
Level 4(PODIUM)	1	12	12	0	1	2	6	2	1	12	11,200	1,041	11,200	1,041
Level 5 (PODIUM)	1	12	12	0	1	2	6	1	2	12	11,200	1,041	11,200	1,041
Level 6(PODIUM)	1	12	12	0	1	2	6	1	2	12	11,200	1,041	11,200	1,041
Level 7-13(Lower Tower)	7	12	84	0	1	2	6	1	2	84	11,200	1,041	78,400	7,284
Level 14-33	20	10	200	1	3	3	3	0	0	200	8,222	764	164,440	15,277
Mechanical Penthouse	1	0	0	0	0	0	0	0	0	0	5,185	482	5,185	482
TOTAL				20	74	83	122	11	28	338			491,181	45,632
Unit Provided %										0				
Unit Required %				5.00%	35.00%	15.00%	38.00%	5.00%	2.00%	100.00%				
BUILDING B														
Level P(-5)	1	0	0	0	0	0	0	0	0	0	60,646	5,634	60,646	5,634
Level P(-3 & -4)	2	0	0	0	0	0	0	0	0	0	67,749	6,294	135,498	12,588
Level P(-2)	1	0	0	0	0	0	0	0	0	0	67,749	6,294	67,749	6,294
Level P(-1)	1	0	0	0	0	0	0	0	0	0	67,749	6,294	67,749	6,294
Level 1	1	10	10	0	0	0	9	0	1	10	40,750	3,786	40,750	3,786
Level 1M	1	0	0	0	0	0	0	0	0	0	9,398	873	9,398	873
Level 2(PDIUM)	1	27	27	0	3	1	5	8	10	27	36,752	3,414	36,752	3,414
Level 3(PDIUM)	1	27	27	0	3	1	5	8	10	27	36,748	3,414	36,748	3,414
Level 4(PDIUM)	1	27	27	0	3	1	10	4	9	27	36,267	3,369	36,267	3,369
Level 5 (PDIUM)	1	14	14	0	4	1	4	3	2	14	20,979	1,949	20,979	1,949
TOWER B1														
Level 6- 13	8	11	88	0	3	0	2	4	2	88	10,656	990	85,248	7,920
Level14-29	16	10	160	0	5	3	2	0	0	160	8,175	759	130,800	12,152
Mechanical Penthouse	1	0	0	0	0	0	0	0	0	0	5,206	484	5,206	484
TOWER B2														
Level 6- 13	8	11	88	0	1	4	3	2	1	88	10,368	963	82,944	7,706
Level 14-34	21	10	210	0	4	5	1	0	0	210	8,033	746	168,693	15,672
Mechanical Penthouse	1	0	0	0	0	0	0	0	0	0	6,025	560	6,025	560
TOTAL				0	209	189	126	71	56	651			991,452	92,109
Unit Provided%										0				
Unit Required%				5.00%	35.00%	15.00%	38%	5%	2.00%	100.00%				
BUILDING C														
Level P(-2) A	1	0	0	0	0	0	0	0	0	0	1,821	169	1,821	169
Level P(-2)	1	0	0	0	0	0	0	0	0	0	87,585	8,137	87,585	8137
Level P(-1)	1	0	0	0	0	0	0	0	0	0	87,585	8,137	87,585	8137
Level 1	1	0	0	0	0	0	0	0	0	0	75,311	6,997	75,311	6997
Level 1M	1	0	0	0	0	0	0	0	0	0	56,328	5,233	56,328	5,233
Level 2 (PODIUM)	1	13	13	0	1	4	5	0	3	13	75,413	7,006	75,413	7,006
Level 3(PODIUM)	1	15	15	0	2	6	4	0	3	15	75,867	7,048	75,867	7,048
Level 3A(PODIUM)	1	0	0	0	0	0	0	0	0	0	4,348	404	4,348	404
Level 4 (PODIUM)	1	15	15	0	6	3	6	0	0	15	31,102	2,889	31,102	2,889
TOWER C1														
Typical Tower-Level 5- 31	27	12	324	0	6	2	3	0	1	324	9,578	890	258,606	24,025
Level 32-SubPent house	1	10	10	0	1	3	4	0	2	10	9,578	890	9,578	890
Level 33-Pent-House	1	10	10	0	1	3	4	0	2	10	9,578	890	9,578	890
Mechanical Penthouse- Lower	1	0	0	0	0	0	0	0	0	0	5,747	534	5,747	534
Mechanical Penthouse-Upper	1	0	0	0	0	0	0	0	0	0	5,747	534	5,747	534
TOWER C2														
Typical Tower-Level 5- 35	31	12	372	0	6	2	4	0	0	372	9578	890	296,918	27,585
Level 36-Sub Pent house	1	10	10	0	1	3	5	0	1	10	9578	890	9,578	890
Level 37(Pent house)	1	6	6	0	1	2	3	0	0	6	9578	890	9,578	890
Mechanical Penthouse	1	0	0	0	0	0	0	0	0	0	5,747	534	5,747	534
TOTAL				0	361	140	236	0	38	775			1,106,437	102,791
Unit Provided%										0				
Unit Required%				5.00%	35.00%	15.00%	38%	5%	2.00%	100.00%				
BUILDING D														
Level P(-2)	1	0	0	0	0	0	0	0	0	0	88,621	8,233	88,621	8233
Level P(-1)	1	0	0	0	0	0	0	0	0	0	88,621	8,233	88,621	8233
Level 1	1	0	0	0	0	0	0	0	0	0	73,801	6,856	73,801	6856
Level 1M	1	0	0	0	0	0	0	0	0	0	53,615	4,981	53,615	4,981
Level2(PODIUM)	1	13	13	0	1	4	4	0	4	13	75,216	6,988	75,216	6,988
Level 3(PODIUM)	1	15	15	0	1	6	4	0	4	15	74,454	6,917	74,454	6,917
Level 3A(PODIUM)	1	0	0	0	0	0	0	0	0	0	3,637	338	3,637	338
Level 4 (PODIUM)	1	15	15	0	6	2	4	0	3	15	26,706	2,481	26,706	2,481
TOWER D1														
Typical Tower-Level 5- 31	27	12	324	0	6	2	3	0	1	324	9578	890	258,606	24,025
Level 32(Sub Pent house	1	10	10	0	1	2	5	0	2	10	9578	890	9,578	890
Level 33- Pent house	1	6	6	0	1	1	3	0	1	6	9578	890	9,578	890
Mechanical Penthouse	1	0	0	0	0	0	0	0	0	0	5,747	534	5,747	534
TOWER D2														
Typical Tower-Level 5- 33	29	12	348	0	6	2	4	0	0	348	9578	890	277,762	25,805
Level 34(Sub Pent house)	1	10	10	0	1	3	5	0	1	10	9578	890	9,578	890
Level 35(Pent house)	1	10	10	0	1	3	5	0	1	10	9578	890	9,578	890
Mechanical Penthouse	1	0	0	0	0	0	0	0	0	0	5,747	534	5,747	534
TOTAL				0	348	133	227	0	43	751			1,070,845	99,485
Unit Provided%										0				
Unit Required%				5.00%	35.00%	15.00%	38.00%	5.00%	2.00%	100.00%				
Total Unit Provided%				0.80%	39.44%	21.67%	28.27%	3.26%	6.56%					
Total Above Grade			2,515								1,859,052	171,191	3,659,915	340,017
Present-Day Site Area (sf)	369,219													
Present-Day Site Area (sm)	34,301.6													
F.A.R. (FLOOR AREA RATIO) (= Gross Floor Area / Site Area)	5.87													

Allowable Deductions (As Defined in Burlington Zoning Bylaw, Part 16 - Definitions)

	Vehicle Parking sf	Vehicle Parking sm	Lockers sf	Lockers sm	Bike Storage sf	Bike Storage sm	Air Handling Equipment sf	Air Handling Equipment am	Enclosed mail and hallways, excluding kiosk, stairways sf	sm	Elevators and associated equipment sf	sm	Washrooms sf	sm	Foyers, lobbies, but not waiting areas/rooms sf	sm	Total Deductions by Level sf	sm
BUILDING A																		
Level P(-3 & -4)	39,231	3645	1,705	158	0				0	0	209	19	0	0	310	29	41455	3851
Level P(-2)	39,431	3663	1,739	162	0				0	0	209	19	0	0	155	14	41534	3859
Level P(-1)	33,472	3110	101	9	0				249	23	209	19	0	0	273	25	34304	3187
Level 1	0	0	0	0	0				473	44	209	19	0	0	1249	116	1931	179
Level 1M	0	0	0	0	0				1369	127	209	19	0	0	0	0	1578	147
level 2(PODIUM)	0	0	0	0	0				735	68	209	19	0	0	0	0	944	88
Level 3(PODIUM)	0	0	0	0	0				687	64	209	19	0	0	0	0	896	83
Level 4(PODIUM)	0	0	0	0	0				740	69	209	19	0	0	0	0	949	88
Level 5 (PODIUM)	0	0	0	0	0				201	19	209	19	0	0	0	0	410	38
Level 6(PODIUM)	0	0	0	0	0				201	19	209	19	0	0	0	0	410	38
Level 7-13(Lower Tower)	0	0	0	0	0				201	19	209	19	0	0	0	0	410	38
Level 14-33	0	0	0	0	0				201	19	209	19	0	0	0	0	410	38
Mechanical Penthouse	0	0	0	0	0				201	19	209	19	0	0	0	0	410	38
TOTAL	112,134	10,418	3,545	329					5,258	488	2,717	252	0	0	1,987	185		
BUILDING B																		
Level P(-5)	54,651	5077	3,392	315					367	34	418	39			363	34	59191	5499
Level P(-3 & -4)	62,601	5816	7,488	696					0	0	418	39			778	72	71285	6623
Level P(-2)	65,238	6061	933	87					0	0	418	39			353	33	66942	6219
Level P(-1)	55,479	5154	447	42					367	34	418	39			960	89	57671	5358
Level 1	0	0	0	0					3,841	357	418	39			7,043	654	11302	1050
Level 1M	0	0	0	0					4,149	385	418	39			0	0	4567	424
Level 2(PDIUM)	0	0	0	0					4,300	399	418	39			0	0	4718	438
Level 3(PDIUM)	0	0	3,867	359					4,343	403	418	39			0	0	8628	802
Level 4(PDIUM)	0	0	3,867	359					4,343	403	418	39			0	0	8628	802
Level 5 (PDIUM)	0	0	0	0					402	37	418	39			0	0	820	76
TOWER B1																		
Level 6- 13	0	0	0	0					201	19	209	19			0	0	410	38
Level14-29	0	0	0	0					201	19	209	19			0	0	410	38
Mechanical Penthouse	0	0	0	0					201	19	209	19			0	0	410	38
TOWER B2																		
Level 6- 13	0	0	0	0					201	19	209	19			0	0	410	38
Level 14-34	0	0	0	0					201	19	209	19			0	0	410	38
Mechanical Penthouse	0	0	0	0					201	19	209	19			0	0	410	38
TOTAL	237,969	22,108	19,994	1,858					23,318	2,166	5,434	505	0	0	9,497	882		
BUILDING C																		
Level P(-2) A	1,821	169	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1821	169
Level P(-2)	70065	6509	8227	764	0	0			1593	148	542	50			915	85	81342	7557
Level P(-1)	70065	6509	1,454	135	2042	190			1593	148	542	50			915	85	76611	7117
Level 1	41502	3856	466	43	827	77			5255	488	542	50	283	26	3026	281	51901	4822
Level 1M	41918	3894	5,068	471	0	0			4939	459	542	50		0	317	29	52784	4904
Level 2 (PODIUM)	51,434	4778	3,758	349	0	0			3,483	324	542	50		0	630	59	59847	5560
Level 3(PODIUM)	51,474	4782	2,458	228	0	0			3,978	370	542	50		0	634	59	59086	5489
Level 3A(PODIUM)	4,348	404	0	0	0	0			0	0	0	0		0	0	0	4348	404
Level 4 (PODIUM)	0	0	0	0	0	0			1,842	171	542	50		0	0	0	2384	221
TOWER C1																		
Typical Tower-Level 5- 31	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Level 32-SubPent house	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Level 33-Pent-House	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Mechanical Penthouse- Lower	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Mechanical Penthouse-Upper	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
TOWER C2																		
Typical Tower-Level 5- 35	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Level 36-Sub Pent house	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Level 37(Pent house)	0	0	0	0	0	0			795	74	308	29			0	0	1103	102
Mechanical Penthouse	0	0	0	0	0	0			232	22	308	29			0	0	540	50
TOTAL	332,627	30,733	21,431	1,991	2,869	267			29,275	2,720	6,566	610			6,437	598		
BUILDING D																		
Level P(-2)	72330	6720	9977	927	0	0			1909	177	566	53			907	84	85689	7961
Level P(-1)	72330	6720	2367	220	0	0			1909	177	566	53			907	84	78079	7254
Level 1	41939	3896	0	0	3250	302			3997	371	566	53			2536	236	49038	4556
Level 1M	40630	3775	5272	490	0	0			5419	503	566	53			403	37	52290	4858
Level2(PODIUM)	50697	4710	3837	356	0	0			3663	340	566	53			620	58	59383	5517
Level 3(PODIUM)	50703	4710	4794	445	0	0			4326	402	566	53			631	59	61020	5669
Level 3A(PODIUM)	9101	846	0	0	0	0			0	0	0	0			75	7	9176	852
Level 4 (PODIUM)	0	0	0	0	0	0			1,856	172	566	53			0	0	2422	225
TOWER D1																		
Typical Tower-Level 5- 31	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
Level 32(Sub Pent house	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
Level 33- Pent house	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
Mechanical Penthouse	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
TOWER D2																		
Typical Tower-Level 5- 33	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
Level 34(Sub Pent house)	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
Level 35(Pent house)	0	0	0	0	0	0			795	74	320	30			0	0	1115	104
Mechanical Penthouse	0	0	0	0	0	0			232	22	320	30			0	0	552	51
TOTAL			26,247	2,438	3,250	302			26,967	2,505	5,956	553			6,079	565		

	GFA (GROSS FLOOR AREA = GCA - DEDUCTIONS): (sf) Per Floor	(sm) Per Floor	(sf) Total	(sm) Total	Amenity Area: Indoor (sf)	Indoor (sm)	Outdoor (sf)	Outdoor (sm)	Balcony (sf)	Balcony (sm)	Retail: sf	sm	Salable Units: Per Floor(Sf)	Total sf	Total sm	Total Salable: sf	sm	%
BUILDING A																		
Level P(-3 & -4)	578	54	1,156	107	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level P(-2)	499	46	499	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level P(-1)	7,729	718	7,729	718	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level 1	13,367	1,242	13,367	1,242	841	78	28,112	2,612	20,978	1,949	8,498	789	0	0	0	8,498	0	55.55%
Level 1M	1,394	130	1,394	130		0		0	0	0	0	0	0	0	0	0	0	0.00%
level 2(PODIUM)	10,578	983	10,578	983	2,633	245	1,374	128	0	0	0	0	6809	6809	633	6,809	633	59.10%
Level 3(PODIUM)	10,736	997	10,736	997	0	0	0	0	0	0	0	0	10574	10574	982	10,574	982	90.90%
Level 4(PODIUM)	10,251	952	10,251	952	0	0	1,229	114	0	0	0	0	10150	10150	943	10,150	943	90.63%
Level 5 (PODIUM)	10,790	1,002	10,790	1,002	0	0	0	0	0	0	0	0	10150	10150	943	10,150	943	90.63%
Level 6(PODIUM)	10,790	1,002	10,790	1,002	0	0	0	0	0	0	0	0	10115	10115	940	10,115	940	90.31%
Level 7-13(Lower Tower)	10,790	1,002	75,530	7,017	0	0	0	0	0	0	0	0	10115	70805	6578	70,805	6578	90.31%
Level 14-33	7,812	726	156,240	14,515	0	0	3,038	282	0	0	0	0	7139	142780	13265	142,780	13265	86.83%
Mechanical Penthouse	4,775	444	4,775	444	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL			313,835	29,156	3,474	323	33,753	3,136	20,978	1,949	8,498	789	65052	261383	24283	269,881	25073	54.95%
BUILDING B																		
Level P(-5)	1,455	135	1,455	135	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level P(-3 & -4)	-3,536	-329	-7,072	-657	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level P(-2)	807	75	807	75	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level P(-1)	10,078	936	10,078	936	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level 1	29,448	2,736	29,448	2,736	3,725	346	21,873	2,032	55,745	5,179	11,281	1,048	9629	9629	895	20910	1943	51.31%
Level 1M	4,831	449	4,831	449	0	0	0	0	0	0	0	0	9398	9398	873	9398	873	100.00%
Level 2(PDIUM)	32,034	2,976	32,034	2,976	0	0	3,976	369	0	0	0	0	27115	27115	2519	27115	2519	73.78%
Level 3(PDIUM)	28,120	2,612	28,120	2,612	0	0	0	0	0	0	0	0	27885	27885	2591	27885	2591	75.88%
Level 4(PDIUM)	27,639	2,568	27,639	2,568				0	0	0	0	0	27405	27405	2546	27405	2546	75.56%
Level 5 (PDIUM)	20,159	1,873	20,159	1,873	6,841	636	14,990	1,393	0	0	0	0	11615	11615	1079	11615	1079	55.36%
TOWER B1			147,499															
Level 6- 13	10,246	952	81,968	7,615	0	0	0	0	0	0	0	0	9471	75768	7039	75768	7039	88.88%
Level14-29	7,765	721	124,240	11,542	0	0	2,664	247	0	0	0	0	7044	112704	10471	112704	10471	86.17%
Mechanical Penthouse	4,796	446	4,796	446	0	0	0	0	0	0					0			
TOWER B2																		
Level 6- 13	9,958	925	79,664	7,401	0	0	0	0	0	0	0	0	9182	73456	6824	73456	6824	88.56%
Level 14-34	7,623	708	160,083	14,872	0	0	2,330	216	0	0	0	0	6901	144921	13464	144921	13464	85.91%
Mechanical Penthouse	5,615	522	5,615	522	0	0	0	0	0	0					0			
TOTAL			603,865	56,101	10,566	982	45,833	4,258	55,745	5,179	11,281	1,048	145645	519896	48300	531177	49348	53.58%
BUILDING C																		
Level P(-2) A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Level P(-2)	6,243	580	6,243	580	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Level P(-1)	10,974	1,020	10,974	1,020	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 1	23,410	2,175	23,410	2,175	1,942	180	5,242	487	64,175	5,962	10,063	935	0	0	0	10063	935	30.15%
Level 1M	3,544	329	3,544	329	0	0		0	0	0	0	0	0	0	0	0	0	0.00%
Level 2 (PODIUM)	15,566	1,446	15,566	1,446	0	0	840	78	0	0	0	0	11272	11272	1047	11272	1047	55.26%
Level 3(PODIUM)	16,781	1,559	16,781	1,559	0	0	839	78	0	0	0	0	13295	13295	1235	13295	1235	63.76%
Level 3A(PODIUM)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level 4 (PODIUM)	28,718	2,668	28,718	2,668	14,871	1,382	42,394	3,939	0	0	0	0	12938	12938	1202	12938	1202	41.60%
TOWER C1																		
Typical Tower-Level 5- 31	8,475	787	228,825	21,259	0	0	0	0	0	0	0	0	8374	226098	21005	226098	21005	87.43%
Level 32-SubPent house	8,475	787	8,475	787	0	0	0	0	0	0	0	0	8374	8374	778	8374	778	87.43%
Level 33-Pent-House	8,475	787	8,475	787	0	0	0	0	0	0	0	0	8374	8374	778	8374	778	87.43%
Mechanical Penthouse- Lower	4,644	431	4,644	431	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Mechanical Penthouse-Upper	4,644	431	4,644	431	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
TOWER C2																		
Typical Tower-Level 5- 35	8,475	787	262,725	24,408	0	0	0	0	0	0	0	0	8374	259594	24117	259594	24117	87.43%
Level 36-Sub Pent house	8,475	787	8,475	787	0	0	0	0					8374	8374	778	8374	778	87.43%
Level 37(Pent house)	8,475	787	8,475	787	3,307	307	0	0	0	0	0	0	4805	4805	446	4805	446	50.17%
Mechanical Penthouse	5,207	484	5,207	484	0	0	0	0	0	0			0	0	0	0	0	0.00%
TOTAL			645,181	59,939	20,120	1,869	49,315	4,582	64,175	5,962	10,063	935	84180	553,124	51387	563187	52322	50.90%
Unit Provided%											0	0						
Unit Required%											0	0						
BUILDING D																		
Level P(-2)	2,932	272	2,932	272	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level P(-1)	10,542	979	10,542	979	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level 1	24,763	2,301	24,763	2,301	3,355	312	6,686	621	61,939	5,754	10,777	1,001	0	0	0	10777	1001	34.18%
Level 1M	1,325	123	1,325	123	0	0		0	0	0	0	0	0	0	0	0	0	0.00%
Level2(PODIUM)	15,833	1,471	15,833	1,471	0	0	2,047	190	0	0	0	0	12829	12829	1192	12829	1192	56.71%
Level 3(PODIUM)	13,434	1,248	13,434	1,248	0	0	1,051	98	0	0	0	0	14033	14033	1304	14033	1304	64.19%
Level 3A(PODIUM)	-5,539	-515	-5,539	-515	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Level 4 (PODIUM)	24,284	2,256	24,284	2,256	11,301	1,050	43,921	4,080	0	0	0	0	14322	14322	1331	14322	1331	53.63%
TOWER D1																		
Typical Tower-Level 5- 31	8,463	786	228,501	21,228	0	0	0	0	0	0	0	0	8374	226098	21005	226098	21005	87.43%
Level 32(Sub Pent house	8,463	786	8,463	786									8374	8374	778	8374	778	87.43%
Level 33- Pent house	8,463	786	8,463	786	3,557	330	0	0	0	0	0	0	4809	4809	447	4809	447	50.21%
Mechanical Penthouse	4,632	430	4,632	430					0	0			0	0	0	0	0	0.00%
TOWER D2																		
Typical Tower-Level 5- 33	8,463	786	245,427	22,801	0	0	0	0	0	0	0	0	8374	242846	22561	242846	22561	87.43%
Level 34(Sub Pent house)	8,463	786	8,463	786	0	0	0	0					8374	8374	778	8374	778	87.43%
Level 35(Pent house)	8,463	786	8,463	786	0	0	0	0					8364	8364	777	8364	777	87.33%
Mechanical Penthouse	5,195	483	5,195	483	0	0	0	0					0	0	0	0	0	0.00%
TOTAL			605,181	56,223	18,213	1,692	53,705	4,989	61,939	5,754	10,777	1,001	87853	540049	50172	550826	51173	51.46%
Unit Provided%											0	0						
Unit Required%											40619	3774	382730	1874452	174142	1915071	177916	79.38%
Total Above Grade	615,887	57,218	2,168,062	201,419	52,373	4,866	182,606	16,965	202,837	18,844								

Parking area table	No.of Floor	Building C Parking Area Per Level(sf)	Total	Building D Parking area Per Level(sf)	Total	Rental (SF) Building (C+D)	Rental(SM) Building (C+D)	Total Rental (SF) Building (C,D)	Total Rental (SM) Building (C,D)	Building A Parking Area Per Level(sf)	Total	Building B Parking Area Per Level(sf)	Total	Rental (SF) Building (A+B)	Rental(SM) Building (A+B)	Total Rental (SF) Building (A,B)	Total Rental (SM) Building (A,B)	Total Parking GCA
Parking (-5)	1	0	0	0	0	0	0	0	0	0	0	60,646	60,646	60,646	5,634	60,646	5634	
Parking (-4)	1	0	0	0	0	0	0	0	0	42,180	42,180	67,749	67,749	109,929	10,213	109,929	10213	
Parking (-3)	1	0	0	0	0	0	0	0	0	42,180	42,180	67,749	67,749	109,929	10,213	109,929	10213	
Parking (-2) A	1	1,821	1,821	0	0	1,821	169	1,821	169	0	0	0	0	0	0	0	0	
Parking (-2)	1	87,585	87,585	88,621	88,621	176,206	16,370	176,206	16370	42,180	42,180	67,749	67,749	109,929	10,213	109,929	10213	
Parking (-1)	1	87,585	87,585	88,621	88,621	176,206	16,370	176,206	16370	42,180	42,180	67,749	67,749	109,929	10,213	109,929	10213	
Parking (1)	1	41,939	41,939	42,275	42,275	84,214	7,824	84,214	7824	0	0	0	0	0	0	0	0	
Parking (1M)	1	43,119	43,119	42,275	42,275	85,394	7,933	85,394	7933	0	0	0	0	0	0	0	0	
Parking (2)	1	55,014	55,014	52,594	52,594	107,608	9,997	107,608	9997	0	0	0	0	0	0	0	0	
Parking (3)	1	55,088	55,088	52,594	52,594	107,682	10,004	107,682	10004	0	0	0	0	0	0	0	0	
Parking (3A)	1	4,348	4,348	3,637	3,637	7,985	742	7,985	742	0	0	0	0	0	0	0	0	
Total parking Area			376,499		370,617			747,116	69,409		168,720		331,642			500,362	46,485	1,247,478

Parking Reqired

Building	Units	Occupant Parking(1per unit)	Visitor Parking(0.25 units)	TOTAL
A	338	338	85	423
B	651	651	163	814
C	775	775	194	969
D	751	751	188	939
Total	2,515	2,515	629	3,144

Bicycle

Building	Res. Required 0.5/ Unit	Res. Provided	Visitor Required 0.05/Unit	Visitor Provided	Retail Required 2+(1/1000sm)	Retail Provided	Total
A	169	172	16.9	17	1	2	191
B	325.5	346	32.55	36	1	2	384
C	387.5	389	39	39	3	8	436
D	375.5	380	37.55	49	1	2	431
Total	1257.5	1287	125.75	141	6	8	1436

Locker Provided

Building	P5	P3-P4	P2	P1	L1	L1M	L2	L3	L4	L5	L6	TOTAL	Locker Required (0.8 units)
A	0	78	39	2	0	0	0	0	0	0	0	119	270.4
B	91	198	27	11	0	0	105	107	107	0	0	646	520.8
C	0	0	221	12	12	173	76	75	0	0	0	569	620
D	0	0	255	53	0	196	98	175	0	0	0	777	600.8

Amenity Area: Building	Units	Amenity Area (SM) Required (Based on 16sm perUnit	Amenity Provided SM	Amenity area Provided,for each Unit(sm)	Balconies (Included in amenity area chart): Units * C: 5.9 sm D:5.9 sm	Units * C: 9.3 sm D:9.3 sm	Units * C:10.7sm D:10.7sm	Units * C:42.5sm D:42.5sm	Units * C:46.2 sm D:46.2 sm	Units * A:5.96 sm B:8.49sm	Number Of Units W/ 5.9 sm Balconies	Number Of Units W/ 9.3 sm Balconies	Number Of Units W/ 10.7 sm Balconies	Number of 42.5 sm Balconies	Number of 46.2 sm Balconies
A	338	5,408	5,407	16.00	0	0	0	0	0	1,949	11	0	0	0	0
B	651	10,416	10,419	16.00	0	0	0	0	0	5,179	41	0	0	0	0
C	775	12,400	12,413	16.02	1,835	1,469	2,658	213	46	0	311	158	247	5	1
D	751	12,016	12,436	16.56	1,788	1,395	2,572	213	46	0	303	150	239	5	1
Total	2,515	40,240	40,674	16.17	3,623	2,864	5,229	425	92	7,128	666	308	486	10	2

Parking Number Detail study — Required

BUILDING	Number of Units	Retail Area (sm)	Residential Parking Spaces (1 per unit)	Residential Barrier Free Parking Spaces 5-50 spaces: 1 accessible space 51-90 spaces: 2 accessible spaces 90+ spaces: 3% of required parking	Residential Electrical Vechicle Parking Spaces 20% Residential parking	Visitor: Proposed Reduced Visitor Parking Spaces (0.1/ Units)	Visitor: Barrier-free Parking Spaces 5-50 spaces: 1 accessible space 51-90 spaces: 2 accessible	Visitor: Electrical Vechicle Parking Spaces 20% Commercial parking	Commercial: Comercial Parking Spaces (3.5 per 100 sm)	Commercial: Barrier-free Parking Spaces 5-50 spaces: 1 accessible space 51-90 spaces: 2 accessible spaces 90+ spaces: 3% of required parking (included in commercial	Commercial: Electrical Vechicle Parking Spaces 20% Commercial parking	Maintenance Parking Spaces (1 per 75 units)	Electrical Vechicle Parking Spaces 20% Maintenance parking	Total Parking Spaces
A	338	789	338	10.14	67.6	33.8	1	7	28	1	6	4.51	0.90	403.94
B	651	1,048	651	19.53	130.2	65.1	2	13	37	2	7	8.68	1.74	761.46
C	775	864	775	23.25	155	77.5	2	16	30	1	6	10.33	2.07	893.09
D	752	1,001	752	22.56	150.4	75.2	2	15	35	1	7	10.03	2.01	872.27
TOTAL		3703	2516	75.48	503.2	251.6	7	50	130	5	26	33.55	6.71	2930.76

Parking Number Detail study — Provided

BUILDING	Residential: P1	P2	P2A	P3-P4p4(A&B)	p5	L1	L1M	L2	L3	L3A	Total	Residential Barrier-free Parking	Residential Electrical Vehicle Parking	Visitor (visitor- Commercial): L1	L1M	P1	Visitor Barrier-free Parking Spaces	Visitor Electrical Vehicle Parking Spaces	Commercial: p1	L1	Commercial Barrier-free Parking Spaces (included in commercial provision)	Commercial Electrical Vehicle Parking Spaces	Maintenance: (L1 in C&D) (P1 in A&B)	E.V (included in Maintenance provision)	total
A	18	107	0	214	0	0	0	0	0	0	339	7	0	0	0	32	1	0	30	0	1	0	5	0	406
B	31	159	0	320	141	0		0	0	0	651	43	0	0	0	46	2	0	50	0	2	0	8	0	755
C	195	181	0	0	0	37	68	142	139	13	775	23	160	25	53	0	2	19	0	37	2	4	10	2	900
D	184	192	0	0	0	6	117	138	122	15	774	22	160	60	15	0	2	12	0	35	1	7	10	2	894
TOTAL	428	639	0	534	141	43	185	280	261	28	2539	95	320	85	68	78	7	31	80	72	6	11	33		2955

Note 1: In Building B, All visitors will use the commercial parking garage to satisfy the visitor parking space requirement.
Note 2: In Building C, a portion of the visitors will use the commercial parking garage to satisfy the visitor parking space requirement.
Note 3: In Building D, a portion of the visitors will use the commercial parking garage to satisfy the visitor parking space requirement.

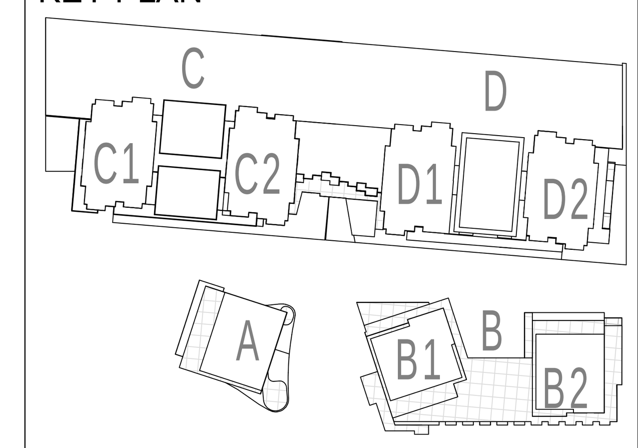
Parking summary									City Non Residential Required	Non Residential provided
Building	Resident Required	Resident Provided	Visitor Required (Unit*0.1)	Visitor Provided	Commercial Required	Commercial Provided	Maintenance Req.	Maintenance Provided	units * 0.16	Commercial+visitor+ Maintenance
A	338	339	33.8	32	28	30	4.51	5	54.1	67
B	651	651	65.1	46	37	50	8.68	8	104.2	104
C	775	775	77.5	78	30	37	10.33	10	124.0	125
D	752	774	75.2	75	35	35	10.03	10	120.3	120
Total	2516	2539	251.6	231	130	152	34	33	402.6	416

Note 1: In Building B, All visitors will use the commercial parking garage to satisfy the visitor parking space requirement. Note 2: In Building C, a portion of the visitors will use the commercial parking garage to satisfy the visitor parking space requirement.

	LEVELS	# OF FL	UNITS PER FLOOR: 1B	1B+D	2B	2B+D	3B	TOTAL UNITS/FL	TOTAL UNITS: 1B	1B+D	2B	2B+D	3B	TOTAL UNITS/BLD.	BARRIER FREE UNITS / FLOOR: 1B	1B+D	2B	2B+D	3B	TOTAL UNITS/FL	TOTAL BARRIER-FREE UNITS: 1B	1B+D	2B	2B+D	3B	TOTAL UNITS/BLD.
PODIUM	LEVEL 1	1							0	0	0	0	0	0												0
	LEVEL 2	1	1	4	5	0	3	13	1	4	5	0	3	13	1		1		2	4	1	0	1	0	2	4
	LEVEL 3	1	2	6	4	0	3	15	2	6	4	0	3	15	1		1		2	4	1	0	1	0	2	4
	LEVEL 4	1	6	3	6	0	0	15	6	3	6	0	0	15	2					2	2	0	0	0	0	2
	TOTAL PODIUM BUILDING C	4							9	13	15	0	6	43							4	0	2	0	4	10
TOWER C1	LEVEL 5-31	27	6	2	3	0	1	12	162	54	81	0	27	324	2		1		1	4	54	0	27	0	27	108
	LEVEL 32_SUB PH	1	1	3	4	0	2	10	1	3	4	0	2	10	1				1	2	1	0	0	0	1	2
	LEVEL 33_PH	1	1	3	4	0	2	10	1	3	4	0	2	10	1				1	2	1	0	0	0	1	2
	TOTAL TOWER C1	29							164	60	89	0	31	344							56	0	27	0	29	112
TOWER C2	LEVEL 5-35	31	6	2	4	0	0	12	186	62	124	0	0	372	2		1			3	62	0	31	0	0	93
	LEVEL 36_SUB PH	1	1	3	5	0	1	10	1	3	5	0	1	10	1					1	1	0	0	0	0	1
	LEVEL 37_PH	1	1	2	3	0	0	6	1	2	3	0	0	6	1					1	1	0	0	0	0	1
	TOTAL TOWER C2	33							188	67	132	0	1	388							64	0	31	0	0	95
TOTAL BUILDING C									361	140	236	0	38	775							124	0	60	0	33	217
TOTAL REQUIRED B.F.UNITS (WITH 15%)									76		36		6	118												
TOTAL PROVIDED B.F.UNITS																					124		60		33	217
																					24.8%		25.4%		86.8%	

DATE/TIME PRODUCED:2022-07-29 11:24:15 AM

KEY PLAN



NO.	REVISIONS	DATE
6	Reissued for Site Plan Approval	July 20, 2022
5	Reissued for Site Plan Approval	April 6, 2022
4	Reissued for Site Plan Approval	February 23, 2022
3	Reissued for Site Plan Approval	December 01, 2021
2	Issued for SPA Consultant Coordination	October 01, 2021
1	Reissued for Site Plan Approval	September 25, 2020

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CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS ON THE JOB.

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c/o Brookfield Properties Serviceco Inc.
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cc CLV Group Developments Inc.
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4706

DRAWN	SCALE
Author	
CHECKED	DATE
Checker	Nov. 2021

TITLE
STATS PAGE

PROJECT NO.	DRAWING NO.
18-223	A0002

PROJECT: 2243, 2269 Fairview St & 84 Drury Ln
PROJECT NO.: 1486-4809
CREATED BY: MP
CHECKED BY: JV
DATE: 2019-11-27
UPDATED: 2022-07-20

Domestic Water Demand - Phase 1 Existing Conditions

Site Statistics

Site Area: 0.85 ha

Landuse	Number of Units	Area (ha)	Population Density	Units
Commercial	-	0.85	90	Persons/ha

Total Commercial Population: **76.14** Persons

Design Parameters

Average Demand (L/capita/d)
275

Water Demand:

Average Commercial Daily Demand = 20,939 L/day
0.24 **L/s**

Peaking Factors
Max Day = 2.25
Peak Hour = 2.25

Average Day = 0.24 L/s
Max Day = **0.55** L/s
Peak Hour = **0.55** L/s

Summary Table:

Municipality	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Halton	0.24	0.55	0.55

Notes & References

Halton Region Design Criteria - Section 2.3
Light Commercial Areas

Halton Region Design Criteria - Section 2.4

Halton Region Design Criteria - Section 2.4

Max Day = Average Day Demand * Max Day
Peak Hour = Average Day Demand * Peak Hour

PROJECT: 2243, 2269 Fairview St & 84 Drury Ln
PROJECT NO.: 1486-4809
CREATED BY: MP
CHECKED BY: JV
DATE: 2019-11-27
UPDATED: 2022-07-20

Domestic Water Demand - Ultimate Existing Conditions

Site Statistics

Site Area: 3.40 ha

Landuse	Number of Units	Area (ha)	Population Density	Units
Commercial	-	3.4	90	Persons/ha

Total Commercial Population: **306** Persons

Design Parameters

Average Demand (L/capita/d)
275

Water Demand:

Average Commercial Daily Demand = 84,150 L/day
0.97 **L/s**

Peaking Factors
Max Day = 2.25
Peak Hour = 2.25

Average Day = 0.97 L/s
Max Day = **2.19** L/s
Peak Hour = **2.19** L/s

Summary Table:

Municipality	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Halton	0.97	2.19	2.19

Notes & References

Halton Region Design Criteria - Section 2.3
Light Commercial Areas

Halton Region Design Criteria - Section 2.4

Halton Region Design Criteria - Section 2.4

Max Day = Average Day Demand * Max Day
Peak Hour = Average Day Demand * Peak Hour

PROJECT: 2243, 2269 Fairview St & 84 Drury Ln
PROJECT NO.: 1486-4809
CREATED BY: MP
CHECKED BY: JV
DATE: 2020-06--24
UPDATED: 2022-07-20

Domestic Water Demand - Proposed Phase 1 Conditions

Notes & References

Total Residential Population:	**2120**	Persons	Site Stats are as per site plan provided by CORE Architects Inc dwg A001dated 2022/06/09
Total Commercial Population:	**185**	Persons	

Design Parameters:

Average Demand (L/capita/d)	
275	Halton Region Design Criteria - Section 2.4

Water Demand:

Average Residential Daily Demand =	583,000.00	L/day	
	6.75	**L/s**	
Average Commercial Daily Demand=	50,875.00	L/day	
	0.59	**L/s**	
Peaking Factors			
Max Day =	2.25		
Residential Peak Hour =	4.00		Halton Region Design Criteria - Section 2.4
Commercial Peak Hour =	2.25		
Combined:			
Average Day =	7.34	L/s	
Max Day =	**16.51**	L/s	Max Day = Average Day Demand * Max Day
Peak Hour =	**28.32**	L/s	Peak Hour = Average Day Demand * Peak Hour
Domestic:			
Average Day =	**6.75**	L/s	
Max Day =	**15.18**	L/s	Max Day = Average Day Demand * Max Day
Peak Hour =	**26.99**	L/s	Peak Hour = Average Day Demand * Peak Hour
Commercial:			
Average Day =	**0.59**	L/s	
Max Day =	**1.32**	L/s	Max Day = Average Day Demand * Max Day
Peak Hour =	**1.32**	L/s	Peak Hour = Average Day Demand * Peak Hour

Summary Table:

Municipality	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Halton	7.34	16.51	28.32

PROJECT: 2243, 2269 Fairview St & 84 Drury Ln
PROJECT NO.: 1486-4809
CREATED BY: MP
CHECKED BY: JV
DATE: 2017-11-27
UPDATED: 2022-07-20

Domestic Water Demand - Proposed Ultimate Build-Out Conditions

Site Statistics: Site Area: 3.43 ha

Landuse	Number of Units	Area (ha)	Population Density	Units
Residential Apatments	2,514	-	1.80	Person/unit
Commercial	-	3.43	90	Person/ha

Total Residential Population: **4525.2** Persons
Total Commercial Population: **309** Persons

Design Parameters:

Average Demand (L/capita/d)
275

Water Demand:

Average Residential Daily Demand = 1,244,430.00 L/day
14.40 **L/s**
Average Commercial Daily Demand= 84,892.50 L/day
0.98 **L/s**

Peaking Factors
Max Day = 2.25
Residential Peak Hour = 4.00
Commercial Peak Hour = 2.25

Average Day = 15.39 L/s
Max Day = **34.62** L/s
Peak Hour = **59.82** L/s

Summary Table:

Municipality	Average Daily Water Demand (L/s)	Max Day Demand (L/s)	Peak Hourly Demand (L/s)
Region of Halton	15.39	34.62	59.82

Notes & References

Site Stats are as per site plan provided by CORE Architects Inc dated 2021/11/29

Based on Mobility Hub Technical Memo

Halton Region Design Criteria - Section 2.3

Halton Region Design Criteria - Section 2.4

Halton Region Design Criteria - Section 2.4

Max Day = Average Day Demand * Max Day

Peak Hour = Average Day Demand * Peak Hour

PROJECT NAME: 2243 Fairview Street, 2269 Fairview Street & 864 Drury Lane **July 28, 2022**

Pipe Flow Capacities Design By: SVN

CFCA File: **1486-4809** Checked By: **Page 1**

Regional Municipality of Halton
Water Main Prelim Sizing

Proposed Watermain

Main Line

Fire Flow =	66.7	L/s	(Fire Underwriters Survey Method, 2020)
Max Day =	34.62	L/s	Halton Region Design Criteria - See Water Demand Calcs 2017/11/27
Peak Hour =	59.82	L/s	Halton Region Design Criteria - See Water Demand Calcs 2017/11/27
MAX Daily Demand + FF	101.32	L/s	Governs
Pear Hourly Demand	59.82	L/s	

Pipe Design

Provide 300 PVC

Coefficient of Roughness	130		
Hydraulic Radius	0.075	**m**	
Slope Energy Grade line	0.8	**%**	
Area	0.07	**m²**	
Ultimate flow rate Qu	**0.113**	**m³/s**	
	112.52	**l/s**	OK

Domestic Supply - Building C

Pear Hourly Demand 26.99 L/s

Pipe Design

Provide 200 PVC

Coefficient of Roughness	130		
Hydraulic Radius	0.05	**m**	
Slope Energy Grade line	0.5	**%**	
Area	0.03	**m²**	
Ultimate flow rate Qu	**0.030**	**m³/s**	
	30.05	**l/s**	OK

Commercial Supply - Building C

Pear Hourly Demand **1.32** L/s

Pipe Design

Provide 100 PVC

Coefficient of Roughness	130		
Hydraulic Radius	0.025	**m**	
Slope Energy Grade line	0.7	**%**	
Area	0.01	**m²**	
Ultimate flow rate Qu	**0.006**	**m³/s**	
	5.82	**l/s**	OK

Fire Flow Supply - Building C

Pear Hourly Demand **66.70** L/s

Pipe Design

Provide 200 PVC Provide 2 lines

Coefficient of Roughness	130		
Hydraulic Radius	0.05	**m**	
Slope Energy Grade line	0.7	**%**	
Area	0.03	**m²**	
Ultimate flow rate Qu	**0.072**	**m³/s**	
	72.08	**l/s**	OK

Notes:
Pipe sizes are preliminary. System pressure and head losses to be analysed.
Domestic and Commercial water demands for Ultimate conditions are based on Bylaw extrapolations

APPENDIX B

Stormwater Management Calculations

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: JNL
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2021-09-20

Modified Rational Method - Existing Conditions

City of Burlington Standards and Data

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
2 yr	681.5	6.0	0.780	78.4
5 yr	802.0	5.0	0.764	101.3
10 yr	918.3	5.0	0.763	116.3
25 yr	1066.0	5.0	0.762	135.4
50 yr	1172.3	5.0	0.761	149.3
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{pre} = 0.00278 * C_{pre} * I * A$

City of Burlington Standard Runoff Coefficients:

Landuse	C	Landuse	C	Landuse	C
Single Family Residential (<30 ft width)	0.65	Commercial	0.90	Impervious Areas (Asphalt, Concrete, Rooftops, Water Surfaces)	0.95
Single Family Residential (30-50 ft width)	0.60	Industrial	0.90	Gravel	0.80
Single Family Residential (>50 ft width)	Consult City Staff	Institutional (Schools & Churches)	0.75	Permeable Pavement	0.80
Semi-Detached Residential	0.70	Apartments	0.85	Pervious Areas (Grass, Meadow, Forest)	0.25
ROW Housing / Townhouses	0.75	Parks and Open Space	0.35		

As per City of Burlington SWM Design Guidelines - Table 4.1 (May 2020)

Existing Site Conditions

For less frequent, high intensity storms, the derived runoff coefficients should be multiplied by 1.1, 1.2 and 1.25 for 25, 50 and 100-year storms respectively. The product however cannot exceed 1.

Weighted Runoff Coefficient C:

Catchment #	Landuse	Area (ha)	2, 5, 10-year C	25-year C	50-year C	100-year C
101	Pervious Area (Grass)	0.17	0.25	0.28	0.30	0.31
	Impervious Area (Rooftop)	0.53	0.95	1.00	1.00	1.00
	Impervious Area (Asphalt/ Concrete)	2.05	0.95	1.00	1.00	1.00
	Total/ Weighted C:	**2.74**	**0.91**	**1.00**	**1.00**	**1.00**
102	Pervious Area (Grass)	0.04	0.25	0.28	0.30	0.31
	Impervious Area (Rooftop)	0.12	0.95	1.00	1.00	1.00
	Impervious Area (Asphalt/ Concrete)	0.36	0.95	1.00	1.00	1.00
	Total/ Weighted C:	**0.52**	**0.89**	**0.98**	**1.00**	**1.00**
TOTAL SITE / Weighted C		**3.26**	**0.90**	**1.00**	**1.00**	**1.00**
EXT	Pervious Area (Grass)	0.06	0.25	0.28	0.30	0.31
	Gravel (Railway)	0.26	0.80	0.88	0.96	1.00
	Total/ Weighted C:	**0.32**	**0.69**	**0.76**	**0.83**	**0.87**
TOTAL / Weighted C		**3.58**	**0.89**	**0.97**	**1.00**	**1.00**

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: JNL
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2021-09-20

Modified Rational Method - Existing Conditions

Rational Method Calculations

2-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
101	0.0028	2.74	0.91	10.0	78.4	0.542	542.5
102	0.0028	0.52	0.89	10.0	78.4	0.101	100.8
TOTAL SITE / Weighted C	**0.0028**	**3.26**	**0.90**	**10.0**	**78.4**	**0.643**	**643.3**
EXT	0.0028	0.32	0.69	10.0	78.4	0.048	48.4
TOTAL / Weighted C	**0.0028**	**3.58**	**0.89**	**10.0**	**78.4**	**0.692**	**691.7**

5-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
101	0.0028	2.74	0.91	10.0	101.3	0.701	701.1
102	0.0028	0.52	0.89	10.0	101.3	0.130	130.3
TOTAL SITE / Weighted C	**0.0028**	**3.26**	**0.90**	**10.0**	**101.3**	**0.831**	**831.4**
EXT	0.0028	0.32	0.69	10.0	101.3	0.063	62.6
TOTAL / Weighted C	**0.0028**	**3.58**	**0.89**	**10.0**	**101.3**	**0.894**	**894.0**

10-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
101	0.0028	2.74	0.91	10.0	116.3	0.805	804.8
102	0.0028	0.52	0.89	10.0	116.3	0.150	149.6
TOTAL SITE / Weighted C	**0.0028**	**3.26**	**0.90**	**10.0**	**116.3**	**0.954**	**954.4**
EXT	0.0028	0.32	0.69	10.0	116.3	0.072	71.8
TOTAL / Weighted C	**0.0028**	**3.58**	**0.89**	**10.0**	**116.3**	**1.026**	**1,026.3**

25-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
101	0.0028	2.74	1.00	10.0	135.4	1.030	1,030.5
102	0.0028	0.52	0.98	10.0	135.4	0.192	191.6
TOTAL SITE / Weighted C	**0.0028**	**3.26**	**1.00**	**10.0**	**135.4**	**1.222**	**1,222.1**
EXT	0.0028	0.32	0.76	10.0	135.4	0.092	92.0
TOTAL / Weighted C	**0.0028**	**3.58**	**0.97**	**10.0**	**135.4**	**1.314**	**1,314.0**

50-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
101	0.0028	2.74	1.00	10.0	149.3	1.138	1,138.0
102	0.0028	0.52	1.00	10.0	149.3	0.216	215.8
TOTAL SITE / Weighted C	**0.0028**	**3.26**	**1.00**	**10.0**	**149.3**	**1.354**	**1,353.9**
EXT	0.0028	0.32	0.83	10.0	149.3	0.111	110.6
TOTAL / Weighted C	**0.0028**	**3.58**	**1.00**	**10.0**	**149.3**	**1.465**	**1,464.5**

100-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
101	0.0028	2.74	1.00	10.0	163.2	1.244	1,243.9
102	0.0028	0.52	1.00	10.0	163.2	0.236	235.9
TOTAL SITE / Weighted C	**0.0028**	**3.26**	**1.00**	**10.0**	**163.2**	**1.480**	**1,479.7**
EXT	0.0028	0.32	0.87	10.0	163.2	0.126	126.0
TOTAL / Weighted C	**0.0028**	**3.58**	**1.00**	**10.0**	**163.2**	**1.606**	**1,605.7**

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809
CREATED BY: AS
UPDATED BY: HK
CHECKED BY: RSA
DATE: 2018-08-29
UPDATED: 2022-07-18

Rational Method - Proposed Conditions

City of Burlington Standards and Data
Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
2 yr	681.5	6.0	0.780	78.4
5 yr	802.0	5.0	0.764	101.3
10 yr	918.3	5.0	0.763	116.3
25 yr	1066.0	5.0	0.762	135.4
50 yr	1172.3	5.0	0.761	149.3
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{post} = 0.00278 * C_{post} * I * A$

City of Burlington Standard Runoff Coefficients:

Landuse	C	Landuse	C	Landuse	C
Single Family Residential (<30 ft width)	0.65	Commercial	0.90	Impervious Areas (Asphalt, Concrete, Rooftops, Water Surfaces / Area underlain by Parking Structure)	0.95
Single Family Residential (30-50 ft width)	0.60	Industrial	0.90	Gravel	0.80
Single Family Residential (>50 ft width)	Consult City Staff	Institutional (Schools & Churches)	0.75	Permeable Pavement	0.80
Semi-Detached Residential	0.70	Apartments	0.85	Pervious Areas (Grass, Meadow, Forest)	0.25
ROW Housing / Townhouses	0.75	Parks and Open Space	0.35		

As per City of Burlington SWM Design Guidelines - Table 4.1 (May 2020)

Proposed Site Conditions

For less frequent, high intensity storms, the derived runoff coefficients should be multiplied by 1.1, 1.2 and 1.25 for 25, 50 and 100-year storms respectively. The product however cannot exceed 1.

Weighted Runoff Coefficient C:

Catchment #	Landuse	Area (ha)	2, 5, 10-year C	25-year C	50-year C	100-year C	Percent Impervious
201	Parks and Open Space	0.04	0.25	0.28	0.30	0.31	-
	Impervious Area (Turfstone)	0.03	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete / Surface Area underlain by Parking Structure)	0.04	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.11**	**0.70**	**0.77**	**0.83**	**0.87**	**64%**
202	Pervious Area (Above Parking Structure)	0.08	0.95	1.00	1.00	1.00	-
	Impervious Area (Rooftops)	0.19	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete)	0.02	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.29**	**0.95**	**1.00**	**1.00**	**1.00**	**100%**
203	Pervious Area (Above Parking Structure)	0.06	0.95	1.00	1.00	1.00	-
	Impervious Area (Rooftops)	0.38	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete)	0.22	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.66**	**0.95**	**1.00**	**1.00**	**1.00**	**100%**
204	Pervious Area (Above Parking Structure)	0.17	0.95	1.00	1.00	1.00	-
	Impervious Area (Rooftops)	0.32	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete)	0.27	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.76**	**0.95**	**1.00**	**1.00**	**1.00**	**100%**
205	Pervious Area (Above Parking Structure)	0.16	0.95	1.00	1.00	1.00	-
	Impervious Area (Rooftops)	0.35	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete)	0.25	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.76**	**0.95**	**1.00**	**1.00**	**1.00**	**100%**
206	Pervious Area (Underlain by Parking Structure)	0.01	0.95	1.00	1.00	1.00	-
	Impervious Area (Rooftops)	0.00	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete)	0.58	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.59**	**0.95**	**1.00**	**1.00**	**1.00**	**100%**
Uncontrolled	Pervious Area (Underlain by Parking Structure)	0.00	0.95	1.00	1.00	1.00	-
	Impervious Area (Rooftops)	0.00	0.95	1.00	1.00	1.00	-
	Impervious Area (Asphalt/ Concrete)	0.09	0.95	1.00	1.00	1.00	-
	Total/ Weighted C:	**0.09**	**0.95**	**1.00**	**1.00**	**1.00**	**100%**
Total Site/ Weighted C:		**3.26**	**0.94**	**1.00**	**1.00**	**1.00**	**99%**
EXT	Pervious Area (Grass)	0.06	0.25	0.28	0.30	0.31	-
	Gravel (Railway)	0.26	0.80	0.88	0.96	1.00	-
	Total/ Weighted C:	**0.32**	**0.69**	**0.76**	**0.83**	**0.87**	**63%**
Total/ Weighted C:		**3.58**	**0.92**	**1.00**	**1.00**	**1.00**	**96%**

Rational Method - Proposed Conditions

Rational Method Calculations

2-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
201	0.0028	0.11	0.70	10.0	78.4	0.017	16.7
202	0.0028	0.29	0.95	10.0	78.4	0.060	60.0
203	0.0028	0.66	0.95	10.0	78.4	0.137	136.9
204	0.0028	0.76	0.95	10.0	78.4	0.157	157.3
205	0.0028	0.76	0.95	10.0	78.4	0.157	157.3
206	0.0028	0.59	0.95	10.0	78.4	0.122	122.1
Uncontrolled	0.0028	0.09	0.95	10.0	78.4	0.019	18.6
Total Site/ Weighted C:	**0.0028**	**3.26**	**0.94**	**10.0**	**78.4**	**0.669**	**669.1**
EXT	0.0028	0.32	0.69	10.0	78.4	0.048	48.4
Total/ Weighted C:	**0.0028**	**3.58**	**0.92**	**10.0**	**78.4**	**0.718**	**717.5**

5-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
201	0.0028	0.11	0.70	10.0	101.3	0.022	21.5
202	0.0028	0.29	0.95	10.0	101.3	0.078	77.6
203	0.0028	0.66	0.95	10.0	101.3	0.177	177.0
204	0.0028	0.76	0.95	10.0	101.3	0.203	203.4
205	0.0028	0.76	0.95	10.0	101.3	0.203	203.4
206	0.0028	0.59	0.95	10.0	101.3	0.158	157.9
Uncontrolled	0.0028	0.09	0.95	10.0	101.3	0.024	24.1
Total Site/ Weighted C:	**0.0028**	**3.26**	**0.94**	**10.0**	**101.3**	**0.865**	**864.8**
EXT	0.0028	0.32	0.69	10.0	101.3	0.063	62.6
Total/ Weighted C:	**0.0028**	**3.58**	**0.92**	**10.0**	**101.3**	**0.927**	**927.3**

10-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
201	0.0028	0.11	0.70	10.0	116.3	0.025	24.7
202	0.0028	0.29	0.95	10.0	116.3	0.089	89.1
203	0.0028	0.66	0.95	10.0	116.3	0.203	203.2
204	0.0028	0.76	0.95	10.0	116.3	0.233	233.4
205	0.0028	0.76	0.95	10.0	116.3	0.233	233.4
206	0.0028	0.59	0.95	10.0	116.3	0.181	181.2
Uncontrolled	0.0028	0.09	0.95	10.0	116.3	0.028	27.6
Total Site/ Weighted C:	**0.0028**	**3.26**	**0.94**	**10.0**	**116.3**	**0.993**	**992.7**
EXT	0.0028	0.32	0.69	10.0	116.3	0.072	71.8
Total/ Weighted C:	**0.0028**	**3.58**	**0.92**	**10.0**	**116.3**	**1.065**	**1,064.6**

25-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
201	0.0028	0.11	0.77	10.0	135.4	0.032	31.7
202	0.0028	0.29	1.00	10.0	135.4	0.109	109.1
203	0.0028	0.66	1.00	10.0	135.4	0.249	248.9
204	0.0028	0.76	1.00	10.0	135.4	0.286	286.0
205	0.0028	0.76	1.00	10.0	135.4	0.286	286.0
206	0.0028	0.59	1.00	10.0	135.4	0.222	222.1
Uncontrolled	0.0028	0.09	1.00	10.0	135.4	0.034	33.9
Total Site/ Weighted C:	**0.0028**	**3.26**	**1.00**	**10.0**	**135.4**	**1.218**	**1,217.7**
EXT	0.0028	0.32	0.76	10.0	135.4	0.092	92.0
Total/ Weighted C:	**0.0028**	**3.58**	**1.00**	**10.0**	**135.4**	**1.310**	**1,309.7**

50-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
201	0.0028	0.11	0.83	10.0	149.3	0.038	38.1
202	0.0028	0.29	1.00	10.0	149.3	0.120	120.4
203	0.0028	0.66	1.00	10.0	149.3	0.275	274.5
204	0.0028	0.76	1.00	10.0	149.3	0.315	315.4
205	0.0028	0.76	1.00	10.0	149.3	0.315	315.4
206	0.0028	0.59	1.00	10.0	149.3	0.245	244.9
Uncontrolled	0.0028	0.09	1.00	10.0	149.3	0.037	37.4
Total Site/ Weighted C:	**0.0028**	**3.26**	**1.00**	**10.0**	**149.3**	**1.346**	**1,346.1**
EXT	0.0028	0.32	0.83	10.0	149.3	0.111	110.6
Total/ Weighted C:	**0.0028**	**3.58**	**1.00**	**10.0**	**149.3**	**1.457**	**1,456.7**

100-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m^3/s)	Q (L/s)
201	0.0028	0.11	0.87	10.0	163.2	0.043	43.4
202	0.0028	0.29	1.00	10.0	163.2	0.132	131.6
203	0.0028	0.66	1.00	10.0	163.2	0.300	300.0
204	0.0028	0.76	1.00	10.0	163.2	0.345	344.8
205	0.0028	0.76	1.00	10.0	163.2	0.345	344.8
206	0.0028	0.59	1.00	10.0	163.2	0.268	267.6
Uncontrolled	0.0028	0.09	1.00	10.0	163.2	0.041	40.8
Total Site/ Weighted C:	**0.0028**	**3.26**	**1.00**	**10.0**	**163.2**	**1.473**	**1,473.0**
EXT	0.0028	0.32	0.87	10.0	163.2	0.126	126.0
Total/ Weighted C:	**0.0028**	**3.58**	**1.00**	**10.0**	**163.2**	**1.599**	**1,598.9**

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: JNL
UPDATED BY: ED
CHECKED BY: RSA

DATE: 2020-09-29
UPDATED: 2021-09-24

Rational Method - Proposed Overland Conditions

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{post} = 0.00278 * C_{post} * I * A$

City of Burlington Standards and Data

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

City of Burlington Standard Runoff Coefficients:

Landuse	C	Landuse	C	Landuse	C
Single Family Residential (<30 ft width)	0.65	**Commercial**	0.90	**Impervious Areas (Asphalt, Concrete, Rooftops, Water Surfaces / Area underlain by Parking Structure)**	0.95
Single Family Residential (30-50 ft width)	0.60	**Industrial**	0.90	**Gravel**	0.80
Single Family Residential (>50 ft width)	Consult City Staff	**Institutional (Schools & Churches)**	0.75	**Permeable Pavement**	0.80
Semi-Detached Residential	0.70	**Apartments**	0.85	**Pervious Areas (Grass, Meadow, Forest)**	0.25
ROW Housing / Townhouses	0.75	**Parks and Open Space**	0.35		

As per City of Burlington SWM Design Guidelines - Table 4.1 (May 2020)

For less frequent, high intensity storms, the derived runoff coefficients should be multiplied by 1.1, 1.2 and 1.25 for 25, 50 and 100-year storms respectively. The product however cannot exceed 1.

Proposed Site Conditions

Weighted Runoff Coefficient C:

Overland Flow Path	Landuse	Area (ha)	2, 5, 10-year C	25-year C	50-year C	100-year C
301 Overland via Servicing Easement to Fairview Street	Parks and Open Space	0.04	0.25	0.28	0.30	0.31
	Pervious Area (Above Parking Structure)	0.14	0.95	1.00	1.00	1.00
	Impervious Area (Rooftops/ Asphalt/ Concrete / Surface Area underlain by Parking Structure)	0.51	0.95	1.00	1.00	1.00
	Total/ Weighted C:	**0.69**	**0.71**	**0.78**	**0.85**	**0.89**
302 Overland via North-South Road (between Buildings A & B) to Fairview Street (including external)	Pervious Area (Grass)	0.06	0.25	0.28	0.30	0.31
	Pervious Area (Above Parking Structure)	0.37	0.95	1.00	1.00	1.00
	Gravel (Railway)	0.26	0.80	0.88	0.96	1.00
	Impervious Area (Rooftops/ Asphalt/ Concrete / Surface Area underlain by Parking Structure)	2.19	0.95	1.00	1.00	1.00
	Total/ Weighted C:	**2.89**	**0.92**	**1.00**	**1.00**	**1.00**
Total/ Weighted C:		**3.58**	**0.88**	**0.97**	**1.00**	**1.00**

Rational Method Calculations

100-Year Storm Event

Catchment Number	Unit Conversion Factor	Area (ha)	Runoff Coefficient	Tc (min)	I (mm/hr)	Q (m3/s)	Q (L/s)
301 Overland via Servicing Easement to Fairview Street	0.0028	0.69	0.89	10.0	163.2	0.279	278.6
302 Overland via North-South Road (between Buildings A & B) to Fairview Street (including external)	0.0028	2.89	1.00	10.0	163.2	1.310	1,309.6
Total/ Weighted C:	**0.0028**	**3.58**	**1.00**	**10.0**	**163.2**	**1.588**	**1,588.2**

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2022-07-18

Rational Method - Peak Flow Summary

As per City of Burlington SWM Design Guidelines for re-development sites, a maximum imperviousness of 36% (runoff coefficient of 0.50) shall be applied in calculating the target release rate

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
5 yr	802.0	5.0	0.76	101.3

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q = 0.00278 * C * I * A$

5 Year Storm

-	0.0028	factor	(Metric conversion)
C_{pre}	0.50	-	(Runoff coefficient)
$Area_{Pre}$	3.26	ha	(Drainage area)
T_c	10	min	
i	101.31	mm/hr	City of Burlington
Q_{pre}	**0.463**	**m^3/s**	**(Peak Flow)**

Total Site Target Flow

5-Year Target Site Flow =	0.463	m^3/s
5-Year External Flow =	0.063	m^3/s
Total Allowable Release Rate from Site =	**0.525**	**m^3/s**
100-Year Post-Development Uncontrolled Flow from Catchment 201=	0.043	m^3/s
Target Flow Available for Catchments 202 - 206 & EXT =	**0.482**	**m^3/s**
100-Year Post-Development Uncontrolled Flow from Catchment 206 and Uncontrolled Area =	0.308	m^3/s
Target Flow Available for Catchments 202-205 & EXT =	0.173	m^3/s

Catchment Number	Target Flow Avaiable	Area (ha)	Proposed Release Rate (m^3/s)
202	0.173	0.29	0.020
203		0.66	0.032
204 & EXT		1.08	0.087
205		0.76	0.033
Total	**0.173**	**2.79***	**0.172**

* Total does not include Catchment Areas 201 & 206

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
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CREATED BY: JNL
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2020-09-29
UPDATED: 2022-07-18

Surface Land Use Area Comparison

Existing Site Conditions:

Catchment #	Land Use Areas (ha)			
	Pervious	Rooftop	Impervious (Asphalt/ Concrete)	Total
101	0.17	0.53	2.05	2.74
102	0.04	0.12	0.36	0.52
Total	**0.21**	**0.65**	**2.40**	**3.26**

Proposed Site Conditions:

Catchment #	Land Use Areas (ha)			
	Pervious	Rooftop	Impervious (Asphalt/ Concrete)	Total
201	0.04	0.00	0.07	0.11
202	0.08*	0.19	0.02	0.29
203	0.06*	0.38	0.22	0.66
204	0.17*	0.32	0.27	0.76
205	0.16*	0.35	0.25	0.76
206	0.01	0.00	0.58	0.59
Uncontrolled	0.00	0.00	0.09	0.09
Total	**0.52**	**1.24**	**1.50**	**3.26**

*Note: under proposed conditions, pervious areas within Catchments 202-205 are above parking structures and therefore have a 0.95 runoff coefficient applied for runoff calculations

Proposed Compared to Existing:

Catchment #	Land Use Areas (ha)			
	Pervious	Rooftop	Impervious (Asphalt/ Concrete)	Net
Total	**+0.31**	**+0.59**	**-0.90**	**0.00**

CROZIER CONSULTING ENGINEERS

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PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2022-07-18

Modified Rational Method - 100-Year Post to 5-Year Pre

Catchment 202

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{post} = 0.00278 * C_{post} * I * A$

Storage
$S_d = Q_{post} \bullet T_d - Q_{controlled} (T_d + T_c) / 2$

100-Year Peak Release Rate

Catch. 202 Area:

-	0.0028	factor	(Metric conversion)
C_{post}	1.00	-	(Runoff coefficient)
Area	0.29	ha	(Drainage area)
T_c	10	min	
T_d	600	sec	

Description	Flow Rate (m^3/s)		Flow Rate (L/min.)	
Groundwater Dewatering Rate	0.0015	m^3/s	130*	m^3/day

*Estimate from Pinchin email dated Sept 17, 2020

Description	Flow Rate (m^3/s)		Flow Rate (GPM)		
Pump #1 Discharge Rate	0.0006	m^3/s	10	GPM	Pump Activates when water level exceeds 93.53 in SWM Vault
Pump #2 Discharge Rate	0.019	m^3/s	300	GPM	Pump Activates when water level exceeds 94.76 in SWM Vault
Catchment 202 Discharge Rate	**0.020**	**m^3/s**	**310**	**GPM**	

Storage Volume Calculations

Storage Volume Determination:

T_d	T_d	$I_{100\text{-}Year}$ @ T_d	Q_{post} Runoff	Q_{post} Dewatering	Q_{post} Total	Vol_{post}	Detention Basin Storage		
							$Q_{controlled}$	$Vol_{controlled}$	S_d
min	sec	mm/hr	m^3/s			m^3	m^3/s	m^3	m^3
10	600	163.2	0.132	0.0015	0.134	80.4	0.020	11.7	68.7
15	900	131.1	0.106	0.0015	0.108	97.2	0.020	17.6	79.6
20	1200	110.6	0.090	0.0015	0.091	109.6	0.020	23.5	86.1
25	1500	96.3	0.078	0.0015	0.080	119.5	0.020	29.3	90.2
30	1800	85.6	0.070	0.0015	0.071	127.9	0.020	35.2	92.7
35	2100	77.4	0.063	0.0015	0.064	135.1	0.020	41.1	94.0
40	2400	70.7	0.057	0.0015	0.059	141.4	0.020	46.9	94.5
45	2700	65.3	0.053	0.0015	0.055	147.2	0.020	52.8	94.4
50	3000	60.7	0.049	0.0015	0.051	152.4	0.020	58.7	93.7
55	3300	56.8	0.046	0.0015	0.048	157.2	0.020	64.5	92.7
60	3600	53.5	0.043	0.0015	0.045	161.7	0.020	70.4	91.3
65	3900	50.5	0.041	0.0015	0.043	165.9	0.020	76.3	89.6
70	4200	47.9	0.039	0.0015	0.040	169.8	0.020	82.1	87.7
75	4500	45.6	0.037	0.0015	0.039	173.6	0.020	88.0	85.6
80	4800	43.6	0.035	0.0015	0.037	177.1	0.020	93.9	83.2
85	5100	41.7	0.034	0.0015	0.035	180.5	0.020	99.7	80.8
90	5400	40.1	0.033	0.0015	0.034	183.7	0.020	105.6	78.1
95	5700	38.5	0.031	0.0015	0.033	186.9	0.020	111.5	75.4
100	6000	37.1	0.030	0.0015	0.032	189.8	0.020	117.3	72.5
								REQUIRED STORAGE VOLUME:	**94.5**

Per CORE email dated Sept. 16, 2021:

P1 Floor Elevation	93.127	m
Approx. P1 Ceiling Elevation	98.327	m
Approx. Clear Height in SWM Vault:	5.20	m
SWM Vault Footprint:	659	sq.ft
SWM Vault Footprint:	61	m^2
Retention Vault Footprint:	43	sq.ft
Retention Vault Footprint:	4.0	m^2
Detention Basin Footprint:	603	sq.ft
Detention Basin Footprint:	56.0	m^2

Tributary Roof Area:	0.19	ha
5mm Retention Volume:	9.5	m^3
5mm Retention Footprint:	4.00	m^2
Retention Height:	2.38	m
Sump Height:	0.40	m
Retention Water Level:	**95.90**	**m**
Clear Height in SWM Vault:	5.20	m
Sump Height:	0.40	m
100-Year Ponding Height:	1.69	m
100-Year Drawdown Time:	31.9	hours
Max. Provided Active Storage Volume:	**252.1**	**m^3**

Irrigation Volume (from MHBC):	4,677	m^3/year
Irrigation Volume:	30.6	m^3/day
Retention Tank Drawdown Time:	0.3	days

Note: Annual irrigation is considered between May - Sept (5 months)

Sump Water Level:	93.53	m
25mm Volume:	69.2	m^3
25mm Water Level:	**94.76**	**m**
100yr Water Level:	**95.21**	**m**
Freeboard:	3.11	m

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2022-07-18

Modified Rational Method - 100-Year Post to 5-Year Pre

Catchment 203

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{post} = 0.00278 * C_{post} * I * A$

Storage
$S_d = Q_{post} \bullet T_d - Q_{controlled} (T_d + T_c) / 2$

100-Year Peak Release Rate

Catch. 203 Area:

-	0.0028	factor	(Metric conversion)
C_{post}	1.00	-	(Runoff coefficient)
Area	0.66	ha	(Drainage area)
T_c	10	min	
T_d	600	sec	

Description	Flow Rate (m^3/s)		Flow Rate (L/min.)	
Groundwater Dewatering Rate	0.0037	m^3/s	320*	m^3/day

*Estimate from Pinchin email dated Sept 17, 2020

Description	Flow Rate (m^3/s)		Flow Rate (GPM)		
Pump #1 Discharge Rate	0.0009	m^3/s	15	GPM	Pump Activates when water level exceeds 93.53 in SWM Vault
Pump #2 Discharge Rate	0.032	m^3/s	500	GPM	Pump Activates when water level exceeds 95.23 in SWM Vault
Catchment 203 Discharge Rate	**0.032**	**m^3/s**	**515**	**GPM**	

Storage Volume Calculations

Storage Volume Determination:

T_d	T_d	$I_{100\text{-}Year}$ @ T_d	Q_{post} Runoff	Q_{post} Dewatering	Q_{post} Total	Vol_{post}	Detention Basin Storage		
							$Q_{controlled}$	$Vol_{controlled}$	S_d
min	sec	mm/hr	m^3/s			m^3	m^3/s	m^3	m^3
10	600	163.2	0.302	0.0037	0.306	183.5	0.032	19.5	164.0
15	900	131.1	0.243	0.0037	0.246	221.8	0.032	29.2	192.6
20	1200	110.6	0.205	0.0037	0.209	250.3	0.032	39.0	211.3
25	1500	96.3	0.178	0.0037	0.182	273.0	0.032	48.7	224.3
30	1800	85.6	0.159	0.0037	0.162	292.1	0.032	58.5	233.6
35	2100	77.4	0.143	0.0037	0.147	308.6	0.032	68.2	240.4
40	2400	70.7	0.131	0.0037	0.135	323.2	0.032	78.0	245.3
45	2700	65.3	0.121	0.0037	0.125	336.4	0.032	87.7	248.7
50	3000	60.7	0.112	0.0037	0.116	348.4	0.032	97.5	250.9
55	3300	56.8	0.105	0.0037	0.109	359.5	0.032	107.2	252.2
60	3600	53.5	0.099	0.0037	0.103	369.8	0.032	117.0	252.8
65	3900	50.5	0.094	0.0037	0.097	379.4	0.032	126.7	252.7
70	4200	47.9	0.089	0.0037	0.092	388.5	0.032	136.5	252.0
75	4500	45.6	0.085	0.0037	0.088	397.1	0.032	146.2	250.9
80	4800	43.6	0.081	0.0037	0.084	405.2	0.032	156.0	249.3
85	5100	41.7	0.077	0.0037	0.081	413.1	0.032	165.7	247.3
90	5400	40.1	0.074	0.0037	0.078	420.5	0.032	175.5	245.1
95	5700	38.5	0.071	0.0037	0.075	427.7	0.032	185.2	242.5
100	6000	37.1	0.069	0.0037	0.072	434.6	0.032	194.9	239.7
								REQUIRED STORAGE VOLUME:	**252.8**

Per CORE email dated Sept. 16, 2021:

P1 Floor Elevation	93.127	m	Tributary Roof Area:	0.38	ha	Irrigation Volume (from MHBC):	1,541	m^3/year
Approx. P1 Ceiling Elevation	98.327	m	5mm Retention Volume:	19.0	m^3			
Approx. Clear Height in SWM Vault:	5.20	m	5mm Retention Footprint:	6.50	m^2	Irrigation Volume:	10.1	m^3/day
			Retention Height:	2.92	m			
			Sump Height:	0.40	m			
			Retention Water Level:	**96.45**	**m**	Retention Tank Drawdown Time:	1.9	days
SWM Vault Footprint:	1,086	sq.ft						
SWM Vault Footprint:	101	m^2	Clear Height in SWM Vault:	5.20	m	*Note: Annual irrigation is considered between May - Sept (5 months)*		
			Sump Height:	0.40	m			
Retention Vault Footprint:	70	sq.ft	100-Year Ponding Height:	2.72	m	Sump Water Level:	93.53	m
Retention Vault Footprint:	6.5	m^2	100-Year Drawdown Time:	48.5	hours	25mm Volume:	157.8	m^3
						25mm Water Level:	**95.23**	**m**
Detention Basin Footprint:	999	sq.ft				**100yr Water Level:**	**96.25**	**m**
Detention Basin Footprint:	92.8	m^2	**Max. Provided Active Storage Volume:**	**417.6**	**m^3**	Freeboard:	2.08	m

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2022-07-18

Modified Rational Method - 100-Year Post to 5-Year Pre

Catchment 205

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{post} = 0.00278 * C_{post} * I * A$

Storage
$S_d = Q_{post} \bullet T_d - Q_{controlled} (T_d + T_c) / 2$

100-Year Peak Release Rate

Catch. 205 & EXT Area:

-	0.0028	factor	(Metric conversion)
C_{post}	1.00	-	(Runoff coefficient)
Area	0.76	ha	(Drainage area)
T_c	10	min	
T_d	600	sec	

Description	Flow Rate (m^3/s)		Flow Rate (L/min.)	
Groundwater Dewatering Rate	0.0011	m^3/s	65	L/min.

Description	Flow Rate (m^3/s)		Flow Rate (GPM)		
Pump #1 Discharge Rate	0.0013	m^3/s	20	GPM	Pump Activates when water level exceeds 91.63 in SWM Vault
Pump #2 Discharge Rate	0.032	m^3/s	500	GPM	Pump Activates when water level exceeds 93.19 in SWM Vault
Catchment 205	**0.033**	**m^3/s**	**520**	**GPM**	

Storage Volume Calculations

Storage Volume Determination:

T_d	T_d	$I_{100\text{-}Year}$ @ T_d	Q_{post} Runoff	Q_{post} Dewatering	Q_{post} Total	Vol_{post}	Detention Basin Storage		
							$Q_{controlled}$	$Vol_{controlled}$	S_d
min	sec	mm/hr	m^3/s			m^3	m^3/s	m^3	m^3
10	600	163.2	0.347	0.0011	0.348	209.0	0.033	19.7	189.3
15	900	131.1	0.279	0.0011	0.280	252.0	0.033	29.5	222.5
20	1200	110.6	0.235	0.0011	0.236	283.8	0.033	39.4	244.4
25	1500	96.3	0.205	0.0011	0.206	309.0	0.033	49.2	259.8
30	1800	85.6	0.182	0.0011	0.183	330.0	0.033	59.1	270.9
35	2100	77.4	0.165	0.0011	0.166	348.0	0.033	68.9	279.1
40	2400	70.7	0.151	0.0011	0.152	363.8	0.033	78.7	285.1
45	2700	65.3	0.139	0.0011	0.140	378.0	0.033	88.6	289.4
50	3000	60.7	0.129	0.0011	0.130	390.8	0.033	98.4	292.4
55	3300	56.8	0.121	0.0011	0.122	402.6	0.033	108.3	294.3
60	3600	53.5	0.114	0.0011	0.115	413.5	0.033	118.1	295.4
65	3900	50.5	0.108	0.0011	0.109	423.6	0.033	127.9	295.7
70	4200	47.9	0.102	0.0011	0.103	433.1	0.033	137.8	295.3
75	4500	45.6	0.097	0.0011	0.098	442.0	0.033	147.6	294.4
80	4800	43.6	0.093	0.0011	0.094	450.5	0.033	157.5	293.0
85	5100	41.7	0.089	0.0011	0.090	458.5	0.033	167.3	291.2
90	5400	40.1	0.085	0.0011	0.086	466.1	0.033	177.2	289.0
95	5700	38.5	0.082	0.0011	0.083	473.4	0.033	187.0	286.4
100	6000	37.1	0.079	0.0011	0.080	480.4	0.033	196.8	283.6
								REQUIRED STORAGE VOLUME:	**295.7**

Per CORE Architectural Plans dated Sept. 1, 2021:

P2 Floor Elevation	91.227	m
P1 Ceiling Elevation	97.227	m
Clear Height in SWM Vault:	6.00	m

Per CORE Floor Plan Level P1 dated July 8, 2022:

SWM Vault Footprint:	1,334	sq.ft
SWM Vault Footprint:	124	m^2
Retention Vault Footprint:	67	sq.ft
Retention Vault Footprint:	6.25	m^2
Detention Basin Footprint:	1250	sq.ft
Detention Basin Footprint:	116.1	m^2

Tributary Roof Area:	0.35	ha
5mm Retention Volume:	17.5	m^3
5mm Retention Footprint:	6.25	m^2
Retention Height:	2.80	m
Sump Height:	0.40	m
Retention Water Level:	**94.43**	**m**
Clear Height in SWM Vault:	6.00	m
Sump Height:	0.40	m
100-Year Ponding Height:	2.55	m
100-Year Drawdown Time:	42.5	hours
Max. Provided Active Storage Volume:	**615.3**	**m^3**

Irrigation Volume (from MHBC):	3,763	m^3/year
Irrigation Volume:	24.6	m^3/day
Retention Tank Drawdown Time:	0.7	days

Note: Annual irrigation is considered between May - Sept (5 months)

Sump Water Level:	91.63	m
25mm Volume:	181.3	m^3
25mm Water Level:	**93.19**	**m**
100yr Water Level:	**94.17**	**m**
Freeboard:	3.05	m

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: AS
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2018-08-29
UPDATED: 2022-07-18

Modified Rational Method - 100-Year Post to 5-Year Pre

Catchment 204 & EXT

Intensity with Tc = 10 min

Return Period	a	b	c	I (mm/hr)
100 yr	1281.3	5.0	0.761	163.2

As per City of Burlington SWM Design Guidelines - Appendix B (May 2020)

Intensity
$I = a / (T_d + b)^c$

Peak Flow
$Q_{post} = 0.00278 * C_{post} * I * A$

Storage
$S_d = Q_{post} \bullet T_d - Q_{controlled} (T_d + T_c) / 2$

100-Year Peak Release Rate

Catch. 204 & EXT Area:

-	0.0028	factor	(Metric conversion)
C_{post}	1.00	-	(Runoff coefficient)
Area	1.08	ha	(Drainage area)
T_c	10	min	
T_d	600	sec	

Description	Flow Rate (m^3/s)		Flow Rate (L/min.)	
Groundwater Dewatering Rate	0.0007	m^3/s	40	L/min.

Description	Flow Rate (m^3/s)		Flow Rate (GPM)		
Pump #1 Discharge Rate	0.0016	m^3/s	25	GPM	Pump Activates when water level exceeds 94.53 in SWM Vault
Pump #2 Discharge Rate	0.085	m^3/s	1350	GPM	Pump Activates when water level exceeds 96.57 in SWM Vault
Catchment 204 & EXT Discharge Rate	**0.087**	**m^3/s**	**1375**	**GPM**	

Storage Volume Calculations

Storage Volume Determination:

T_d	T_d	$I_{100\text{-}Year} @ T_d$	Q_{post} Runoff	Q_{post} Dewatering	Q_{post} Total	Vol_{post}	Detention Basin Storage		
							$Q_{controlled}$	$Vol_{controlled}$	S_d
min	sec	mm/hr	m^3/s			m^3	m^3/s	m^3	m^3
10	600	163.2	0.494	0.0007	0.494	296.7	0.087	52.0	244.6
15	900	131.1	0.397	0.0007	0.397	357.6	0.087	78.1	279.5
20	1200	110.6	0.335	0.0007	0.335	402.5	0.087	104.1	298.4
25	1500	96.3	0.291	0.0007	0.292	438.0	0.087	130.1	307.9
30	1800	85.6	0.259	0.0007	0.260	467.6	0.087	156.1	311.5
35	2100	77.4	0.234	0.0007	0.235	493.0	0.087	182.2	310.8
40	2400	70.7	0.214	0.0007	0.215	515.2	0.087	208.2	307.0
45	2700	65.3	0.198	0.0007	0.198	535.1	0.087	234.2	300.9
50	3000	60.7	0.184	0.0007	0.184	553.1	0.087	260.2	292.9
55	3300	56.8	0.172	0.0007	0.173	569.6	0.087	286.3	283.3
60	3600	53.5	0.162	0.0007	0.162	584.8	0.087	312.3	272.5
65	3900	50.5	0.153	0.0007	0.154	598.9	0.087	338.3	260.6
70	4200	47.9	0.145	0.0007	0.146	612.1	0.087	364.3	247.8
75	4500	45.6	0.138	0.0007	0.139	624.6	0.087	390.4	234.2
80	4800	43.6	0.132	0.0007	0.133	636.3	0.087	416.4	219.9
85	5100	41.7	0.126	0.0007	0.127	647.4	0.087	442.4	205.0
90	5400	40.1	0.121	0.0007	0.122	658.0	0.087	468.4	189.6
95	5700	38.5	0.117	0.0007	0.117	668.2	0.087	494.5	173.7
100	6000	37.1	0.112	0.0007	0.113	677.8	0.087	520.5	157.3
								REQUIRED STORAGE VOLUME:	**311.5**

Per CORE email dated Sept. 16, 2021:

P2 Floor Elevation	94.127	m
P1 Ceiling Elevation	98.150	m
Clear Height in SWM Vault:	4.02	m

Per CORE Floor Plan Level P1 dated July 8, 2022:

SWM Vault Footprint:	1,343	sq.ft
SWM Vault Footprint:	125	m^2
Retention Vault Footprint:	65	sq.ft
Retention Vault Footprint:	6.00	m^2
Detention Basin Footprint:	1261	sq.ft
Detention Basin Footprint:	117.2	m^2

Tributary Roof Area:	0.32	ha
5mm Retention Volume:	16.0	m^3
5mm Retention Footprint:	6.00	m^2
Retention Height:	2.67	m
Sump Height:	0.40	m
Retention Water Level:	**97.19**	**m**
Clear Height in SWM Vault:	4.02	m
Sump Height:	0.40	m
100-Year Ponding Height:	2.66	m
100-Year Drawdown Time:	43.3	hours
Max. Provided Active Storage Volume:	**389.4**	**m^3**

Irrigation Volume (from MHBC):	3,278	m^3/year
Irrigation Volume:	21.4	m^3/day
Retention Tank Drawdown Time:	0.7	days

Note: Annual irrigation is considered between May - Sept (5 months)

Sump Volume:	46.9	m^3
Sump Water Level:	94.53	m
25mm Volume:	239.9	m^3
25mm Water Level:	**96.57**	**m**
100yr Water Level:	**97.18**	**m**
Freeboard:	0.97	m

CROZIER CONSULTING ENGINEERS

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: JNL
UPDATED BY: HK
CHECKED BY: JP

DATE: 2020-09-29
UPDATED: 2022-07-18

Erosion Control Calculations

25mm, 4-hour Erosion Control Volumes:

Catchment	Area (ha)	Runoff Depth from 4-hour, 25mm Storm Event (mm)	Runoff Volume from 4-hour, 25mm Storm Event (m^3)
201	0.11	15.6	17.2
202	0.29	23.9	69.2
203	0.66	23.9	157.8
204 & EXT	1.08	22.2	239.9
205	0.76	23.9	181.3
206	0.59	23.9	140.8
Total	**3.49**	**-**	**806.2**

Additional Depth Topsoil:

Catchment	Area (ha)	Runoff Depth to be Retained (mm)	Runoff Volume to be Retained (m^3)	Pervious Area for Additional Depth of Topsoil to be Applied (m^2)	Additional Depth Topsoil (mm)	Assumed Soil Porosity	Retained Volume for Infiltration (m^3)
201	0.11	15.6	17.2	0.04	150	0.30	18.0

Erosion Control Volume Drawdown (Pump):

Catchment	Runoff Volume from 4-hour, 25mm Storm Event (m^3)	Pump 1 Discharge Rate (GPM)	Pump 1 Discharge Rate (m^3/s)	Drawdown Duration (hours)
202	69.2	10	0.0006	30.5
203	157.8	15	0.0009	46.3
204 & EXT	239.9	25	0.0016	42.3
205	181.3	20	0.0013	39.9

Erosion Control Volume Drawdown (Hydrovex):

Catchment	Runoff Volume from 4-hour, 25mm Storm Event (m^3)	Storage Footprint Area (m^2)	Hydrovex 32SVHV-1 Discharge Rate (m^3/s)	Drawdown Duration (hours)
206	140.8	311.0	0.0008	48.9

Quality Control - Treatment Train Calculations

Treatment Train Approach:

$$R = A + B - [(A \times B) / 100] \qquad \text{(Equation 4-1)}$$

Where:

R = Total TSS Removal Rate
A = TSS Removal Rate of the First or Upstream BMP
B = TSS Removal Rate of the Second or Downstream BMP

*As per 'New Jersey Stormwater Best Management Practices Manual' Equation 4-1 (February 2004) - see attached

TSS Removal:		
CB Shields (Rate 1) =	50	%
Cupolex System Sump (Rate 2) =	50	%

Overall Removal Rate
Rate 3 = Rate 1 + Rate 2 - [(Rate 1 x Rate 2)/100]

Rate 3 =	75	%

TSS Removal:		
Upstream Treatment (Rate 3) =	75	%
Jellyfish Filter (Rate 4) =	50	%

Overall Removal Rate
$R_{Overall}$ = Rate 3 + Rate 4 - [(Rate 3 x Rate 4)/100]

$R_{Overall}$ = 87.5 %

PROJECT: 2269 Fairview St & 84 Drury Ln
PROJECT No.: 1486-4809

CREATED BY: JNL
UPDATED BY: HK
CHECKED BY: RSA

DATE: 2020-09-29
UPDATED: 2022-07-18

Quality Control - Treatment Train Calculations

Quality Volume Sizing

Area Name	Drainage Area			
$A_{to-pond}$ =	0.59	ha	Percent Impervious	99.0%
$V_{permanent\ pool}$ =	129	m^3	Percent Pervious	1.0%
$V_{extended\ detention}$ =	24	m^3		

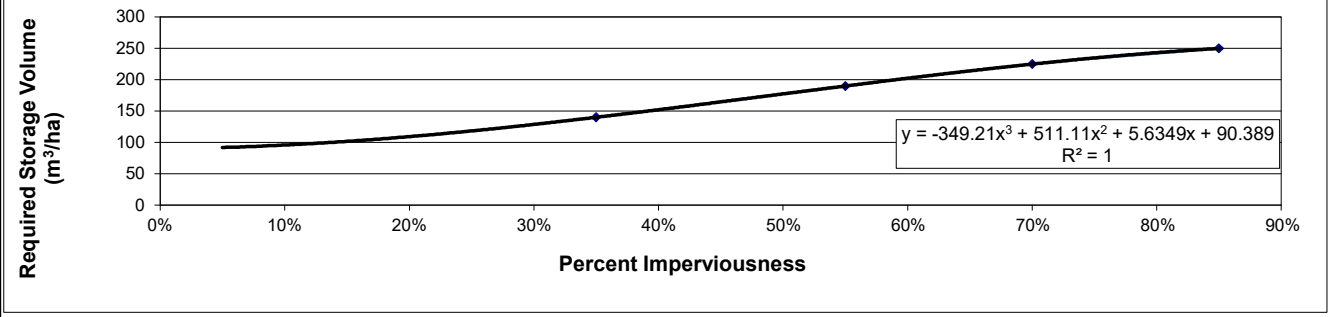
Storage Volume:	V =	258	m^3 / ha
Extended Detention:	V =	40	m^3 / ha
Permanent Pool:	V =	218	m^3 / ha

therefore, require extended detention storage of 24 m^3
and permanent pool volume of 129 m^3

MOE 2003 SWMP Manual: Water Quality Storage Requirements based on Receiving Waters *

PROTECTION LEVEL	SWMP Type	STORAGE VOLUME (m^3 / ha) FOR IMPERVIOUS LEVEL				
		35%	55%	70%	99%	85%
Enhanced	Wet Pond	140	190	225	**258**	250
Normal	Wet Pond	90	110	130		150
Basic	Wet Pond	60	75	85		95

* Table 3.2 from the MOE SWMP Planning & Design Manual, 2004, pg 3-10



CROZIER CONSULTING ENGINEERS

CITY OF BURLINGTON
STORM SEWER DESIGN SHEET

Project / Subdivision : 2243 Fairview Street
Consulting Engineer : CF CROZIER & ASSOCIATES
Project No.: 1486-4809

Prepared by: H.K.
Checked by: R.S.A
Last Revised: 2022-07-18

Design Parameters (5-yr Storm)

A= drainage area (ha)
C= runoff coefficient
Tc= time of concentration

T_{init}(min)= 10
A= 802.04
B= 5
C= 0.764

Manning's n 0.013

Design Equations

$$I = \frac{A}{(t + B)^C}$$

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

System to be Designed for: 5-YEAR STORM

NOTE: The pipe is limited to maximum values according to Table 7 of the Design Manual.

Storm Sewer Design Sheet

Location					Uncontrolled Drainage Area Characteristics											Sewer Data												Remarks
Street	Contributing Area ID	From MH.	To MH.	Roof Area (ha)	Surface Area (ha)	C	Surface AC	Surface Accum. AC	T_c (min)	I 5-yr (mm/hr)	Surface Captured Q (m^3/sec)	Cumulative Surface Captured Q (m^3/sec)	Building Q (m^3/sec)	Cumulative Building Q (m^3/sec)	Total Q (m^3/sec)	Number of Pipes	Diameter (mm)	Length (m)	Slope (%)	Qmax (m3/sec)	% Full	V (full) (m/s)	V (actual) (m/s)	Sect. Time	Accum. Time	Upper INV.	Lower INV.	Upper OBV.	Lower OBV.	
2243 Fairview Street, Burlington	206.1	CB1	MH2	0.00	0.03	0.95	0.03	0.03	10.00	101.3	0.008	0.008	0.000	0.000	**0.008**	1	300	1.7	1.00%	**0.097**	**8%**	1.37	0.82	0.02	10.02	97.02	97.00	97.32	97.30	
	206.2	CB3	MH2	0.00	0.04	0.95	0.04	0.04	10.00	101.3	0.011	0.011	0.000	0.000	**0.011**	1	300	5.7	1.00%	**0.097**	**11%**	1.37	0.89	0.07	10.07	97.06	97.00	97.36	97.30	
		MH2	MH3	0.00	0.00	0.95	0.00	0.07	10.07	101.0	0.000	0.019	0.000	0.000	**0.019**	1	300	18.6	0.50%	**0.068**	**27%**	0.97	0.82	0.32	10.39	96.94	96.85	97.24	97.15	
	203	Building 'B'	MH3	0.66	0.00	0.95	0.00	0.00	10.00	101.3	0.000	0.000	0.032	0.032	**0.032**	1	300	12.4	0.50%	**0.068**	**47%**	0.97	0.95	0.21	10.21	96.91	96.85	97.21	97.15	
		MH3	MH5	0.00	0.00	0.95	0.00	0.07	10.39	99.3	0.000	0.018	0.000	0.032	**0.050**	1	600	21.4	0.30%	**0.336**	**15%**	1.19	0.85	0.30	10.69	96.55	96.49	97.15	97.09	
	204 & EXT	Building 'D'	CBMH4	0.76	0.32	0.87	0.28	0.28	10.00	101.3	0.078	0.078	0.065	0.065	**0.143**	1	375	4.9	1.00%	**0.175**	**82%**	1.59	1.77	0.05	10.05	96.76	96.72	97.14	97.10	
	206.3	CBMH4	MH5	0.00	0.04	0.95	0.04	0.32	10.05	101.0	0.011	0.089	0.000	0.065	**0.154**	1	375	1.7	2.50%	**0.277**	**56%**	2.51	2.57	0.01	10.06	96.70	96.68	97.08	97.06	
	206.4	CB6	MH5	0.00	0.10	0.95	0.10	0.10	10.00	101.3	0.027	0.027	0.000	0.000	**0.027**	1	250	5.7	1.00%	**0.059**	**45%**	1.21	1.18	0.08	10.08	96.87	96.81	97.12	97.06	
	206.6	DCB7	MH5	0.00	0.06	0.95	0.06	0.06	10.00	101.3	0.016	0.016	0.000	0.000	**0.016**	1	300	1.7	1.00%	**0.097**	**17%**	1.37	1.00	0.02	10.02	96.34	96.32	96.64	96.62	
	206.5	CB12	MH5	0.00	0.04	0.95	0.04	0.04	10.00	101.3	0.011	0.011	0.000	0.000	**0.011**	1	250	5.7	1.00%	**0.059**	**18%**	1.21	0.91	0.08	10.08	96.46	96.40	96.71	96.65	
		MH5	MH8	0.00	0.00	0.95	0.00	0.57	10.69	97.9	0.000	0.156	0.000	0.097	**0.253**	1	600	86.8	0.30%	**0.336**	**75%**	1.19	1.30	1.22	11.91	96.46	96.20	97.06	96.80	
	202	Building 'A'	MH8	0.29	0.00	0.95	0.00	0.00	10.00	101.3	0.000	0.000	0.020	0.020	**0.020**	1	250	12.5	0.50%	**0.042**	**48%**	0.86	0.84	0.24	10.24	96.61	96.55	96.86	96.80	
	206.8	DCB26	MH8	0.00	0.15	0.95	0.14	0.14	10.00	101.3	0.040	0.040	0.000	0.000	**0.040**	1	375	1.5	1.00%	**0.175**	**23%**	1.59	1.28	0.02	10.02	96.22	96.21	96.59	96.58	
	206.7	DCB27	MH8	0.00	0.13	0.95	0.12	0.12	10.00	101.3	0.035	0.035	0.000	0.000	**0.035**	1	375	5.7	1.00%	**0.175**	**20%**	1.59	1.23	0.06	10.06	96.26	96.20	96.63	96.58	
		MH8	MH11	0.00	0.00	0.95	0.00	0.84	11.91	92.5	0.000	0.216	0.000	0.117	**0.333**	1	750	36.1	0.50%	**0.787**	**42%**	1.78	1.70	0.34	12.24	96.06	95.88	96.81	96.63	
		MH11	MH13	0.00	0.00	0.95	0.00	0.84	12.24	91.1	0.000	0.212	0.000	0.117	**0.329**	1	750	4.5	0.50%	**0.787**	**42%**	1.78	1.70	0.04	12.29	95.88	95.86	96.63	96.61	
	205	Building 'C'	MH13	0.76	0.00	0.95	0.00	0.00	10.00	101.3	0.000	0.000	0.052	0.052	**0.052**	1	375	6.3	6.57%	**0.449**	**12%**	4.07	2.65	0.03	10.03	96.39	95.98	96.77	96.36	
		MH13	MH22	0.00	0.00	0.95	0.00	0.84	12.29	90.9	0.000	0.212	0.000	0.169	**0.381**	1	750	4.4	0.40%	**0.704**	**54%**	1.59	1.62	0.05	12.33	95.69	95.67	96.44	96.42	
		MH22	MH18	0.00	0.00	0.95	0.00	0.84	12.33	90.7	0.000	0.212	0.000	0.169	**0.381**	1	750	2.9	2.50%	**1.760**	**22%**	3.98	3.15	0.01	12.34	95.65	95.58	96.40	96.33	
		MH18	DCBMH19	0.00	0.00	0.95	0.00	0.84	12.34	90.7	0.000	0.211	0.000	0.169	**0.380**	1	750	53.2	0.30%	**0.610**	**62%**	1.38	1.45	0.64	12.99	95.39	95.23	96.14	95.98	
	201	DCBMH19	MH20	0.00	0.11	0.71	0.08	0.92	12.99	88.2	0.019	0.225	0.000	0.169	**0.394**	1	750	12.4	0.30%	**0.610**	**65%**	1.38	1.46	0.15	13.14	95.20	95.16	95.95	95.91	
	200	DCBMH25	MH24	0.00	0.17	0.60	0.10	0.10	10.00	101.3	0.029	0.029	0.000	0.000	**0.029**	1	450	5.7	0.30%	**0.156**	**18%**	0.98	0.75	0.10	10.10	95.19	95.18	95.64	95.63	
EXTERNAL		MH24	PROP MH23	0.00	0.00	0.60	0.00	0.10	10.10	100.8	0.000	0.029	0.000	0.000	**0.029**	1	450	21.3	0.30%	**0.156**	**18%**	0.98	0.73	0.36	10.46	95.15	94.54	95.60	94.99	
		MH20	MH21	0.00	0.00	0.95	0.00	0.92	13.14	87.6	0.000	0.225	0.000	0.169	**0.394**	3	450	20.7	0.30%	**0.468**	**77%**	0.98	0.84	0.35	13.49	95.13	94.57	95.58	95.02	

CROZIER CONSULTING ENGINEERS

LOCATION	MANHOLE		INVERT ELEVATION		OBVERT ELEVATION		GROUND ELEVATION	COVER	MAX WSE	PIPE PARAMETERS					TOTAL FLOW	Q_{cap}	Q_o/Q_{cap}	COMPUTATIONAL COLUMNS					HEAD LOSS	SURCHARGE	HGL			PIPE SLOPE
	Upstream	Downstream	U/S	D/S	U/S	D/S	Upstream	Upstream	Upstream	Number of Pipes	Dia	Length	Slope	'n'				Pipe Area (m^2)	L/D	Friction Factor (f)	Velocity V (m/s)	$V^2/2g$	HL	Upstream	U/S	D/S	SLOPE	
			(m)	(m)	(m)	(m)	(m)	(m)	(m)		(mm)	(m)	(%)		(m^3/s)	(m^3/s)							(m)	(m)	(m)	(m)	(%)	(%)
EXTERNAL																									**95.77**	**Assuming existing pipe on Fairview Street is at full capacity**		
2243 Fairview Street, City of Burlington	MH21	MH23	94.57	94.54	95.77	95.74	96.64	0.87	96.64	1	1200	15.4	0.24%	0.013	1.718	1.910	0.90	1.131	13	0.0197	1.52	0.12	0.05	0.05	95.82	95.77	0.31	0.24%
	MH20	MH21	95.13	94.57	95.58	95.02	96.89	1.31	96.89	3	450	20.7	0.30%	0.013	0.438	1.405	0.31	0.477	45	0.0273	0.31	0.00	0.01	0.25	95.83	95.82	0.04	0.30%
	DCBMH19	MH20	95.20	95.16	95.95	95.91	96.65	0.70	96.65	1	750	12.4	0.30%	0.013	0.438	0.610	0.72	0.442	16	0.0231	0.99	0.05	0.02	0.00	95.95	95.91	0.32	0.30%
	MH18	DCBMH19	95.39	95.23	96.14	95.98	97.62	1.48	97.62	1	750	53.2	0.30%	0.013	0.423	0.610	0.69	0.442	70	0.0231	0.96	0.05	0.08	0.00	96.14	95.98	0.30	0.30%
	MH22	MH18	95.65	95.58	96.40	96.33	97.52	1.12	97.52	1	750	2.9	2.50%	0.013	0.423	1.760	0.24	0.442	4	0.0231	0.96	0.05	0.01	0.00	96.40	96.33	2.41	2.50%
	MH13	MH22	95.69	95.67	96.44	96.42	97.28	0.84	97.28	1	750	4.4	0.40%	0.013	0.423	0.704	0.60	0.442	6	0.0231	0.96	0.05	0.01	0.00	96.44	96.42	0.39	0.40%
	MH11	MH13	95.88	95.86	96.63	96.61	97.28	0.65	97.28	1	750	4.5	0.50%	0.013	0.330	0.787	0.42	0.442	6	0.0231	0.75	0.03	0.02	0.00	96.63	96.61	0.44	0.50%
	MH8	MH11	96.06	95.88	96.81	96.63	97.54	0.73	97.54	1	750	36.1	0.50%	0.013	0.332	0.787	0.42	0.442	47	0.0231	0.75	0.03	0.03	0.00	96.81	96.63	0.50	0.50%
	MH5	MH8	96.46	96.20	97.06	96.80	98.28	1.22	98.28	1	600	86.8	0.30%	0.013	0.248	0.336	0.74	0.283	142	0.0248	0.88	0.04	0.14	0.00	97.06	96.81	0.29	0.30%
	MH3	MH5	96.55	96.49	97.15	97.09	98.43	1.28	98.43	1	600	21.4	0.30%	0.013	0.068	0.336	0.20	0.283	35	0.0248	0.24	0.00	0.00	0.00	97.15	97.09	0.28	0.30%
	MH2	MH3	96.94	96.85	97.24	97.15	98.56	1.32	98.56	1	300	18.6	0.50%	0.013	0.017	0.068	0.25	0.071	61	0.0313	0.24	0.00	0.01	0.00	97.24	97.15	0.48	0.50%

DESIGN PARAMETERS

RETURN FREQUENCY = 100 YEARS

MINIMUM VELOCITY= 0.80 m/s

MANNING'S n= 0.013

MIN. HGL CLEARANCE = 0.30m

HGL=Major + Minor Losses

Major Loss= Pipe Friction (Darcy-Weisbach)

Minor Loss= Head loss correction for flow through MH, changes in pipe size, and pipe bends

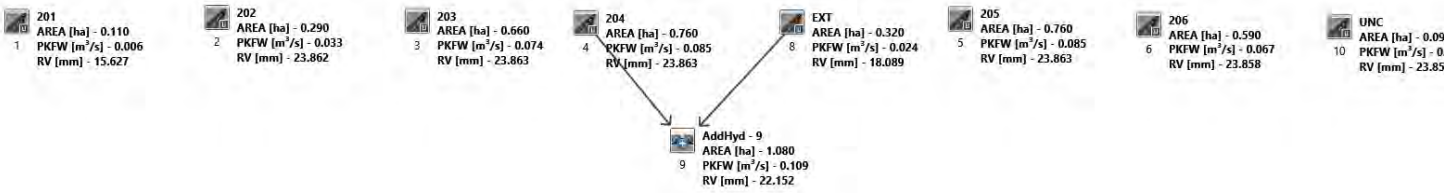
Friction Factor= 8g/c^2, where c=(1/n)*(D/4)^1/6

NOTE: 1- Max water surface elevation (Max WSE) indicates the maximum elevation attained in the ditch before runoff cascades over a downstream high point

2-U/S HGL Elevation Cells with values in bold, indicate that surcharge levels reach or exceed the maximum water surface elevation

HGL=Major + Minor Losses

PROJECT:	2269 Fairview Street	Completed by:	D.P.
PROJECT NUMBER:	1486-4809	Updated by:	H.K.
		Checked:	R.S.A.
Date:	2020-10-21		
Revised:	2022-07-12		


201
AREA [ha] - 0.110
PKFW [m³/s] - 0.006
RV [mm] - 15.627
1
202
AREA [ha] - 0.290
PKFW [m³/s] - 0.033
RV [mm] - 23.862
2
203
AREA [ha] - 0.660
PKFW [m³/s] - 0.074
RV [mm] - 23.863
3
204
AREA [ha] - 0.760
PKFW [m³/s] - 0.085
RV [mm] - 23.863
4
EXT
AREA [ha] - 0.320
PKFW [m³/s] - 0.024
RV [mm] - 18.089
8
205
AREA [ha] - 0.760
PKFW [m³/s] - 0.085
RV [mm] - 23.863
5
206
AREA [ha] - 0.590
PKFW [m³/s] - 0.067
RV [mm] - 23.858
6
UNC
AREA [ha] - 0.09
PKFW [m³/s] - 0
RV [mm] - 23.85
10
AddHyd - 9
AREA [ha] - 1.080
PKFW [m³/s] - 0.109
RV [mm] - 22.152
9

```
=================================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2008)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\hknill\AppData\Local\Civica\VH5\2d718621-d5ce-4be4-884c-1b3b0b2513ef\00d3c062-e0b
  Summary filename: C:\Users\hknill\AppData\Local\Civica\VH5\2d718621-d5ce-4be4-884c-1b3b0b2513ef\00d3c062-e0b


DATE: 07/19/2022                          TIME: 10:30:33

USER:



COMMENTS: _____________________________________________________________

-----------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : 25mm 4-Hour Chicago Storm     **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\hknill\AppD
|                  |              ata\Local\Temp\
|                  |              3dce3198-fb89-4daf-9559-d38c26fbe944\a1a45db7
| Ptotal= 25.02 mm |    Comments: 25mm 4-Hour Chicago Storm
--------------------
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    2.17 |  1.00    6.20 |  2.00    5.62 |  3.00    2.95
                0.17    2.38 |  1.17   12.18 |  2.17    4.80 |  3.17    2.76
                0.33    2.66 |  1.33   41.67 |  2.33    4.21 |  3.33    2.62
                0.50    3.03 |  1.50   15.28 |  2.50    3.78 |  3.50    2.47
                0.67    3.58 |  1.67    9.22 |  2.67    3.45 |  3.67    2.35
                0.83    4.47 |  1.83    6.88 |  2.83    3.18 |  3.83    2.23

-----------------------------------------------------------------------------

--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=   0.11
|ID= 1 DT= 5.0 min |   Total Imp(%)=  48.00   Dir. Conn.(%)=  48.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05          0.06
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      27.08         40.00
     Mannings n             =     0.013         0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.17 | 1.083    6.20 | 2.083    5.62 |  3.08    2.95
                0.167    2.17 | 1.167    6.20 | 2.167    5.62 |  3.17    2.95
                0.250    2.38 | 1.250   12.18 | 2.250    4.80 |  3.25    2.76
                0.333    2.38 | 1.333   12.18 | 2.333    4.80 |  3.33    2.76
                0.417    2.66 | 1.417   41.67 | 2.417    4.21 |  3.42    2.62
                0.500    2.66 | 1.500   41.67 | 2.500    4.21 |  3.50    2.62
                0.583    3.03 | 1.583   15.28 | 2.583    3.78 |  3.58    2.47
                0.667    3.03 | 1.667   15.28 | 2.667    3.78 |  3.67    2.47
                0.750    3.58 | 1.750    9.22 | 2.750    3.45 |  3.75    2.35
```

0.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
0.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

Max.Eff.Inten.(mm/hr)=	41.67	8.84	
over (min)	5.00	25.00	
Storage Coeff. (min)=	1.66 (ii)	20.28 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.32	0.05	
			TOTALS
PEAK FLOW (cms)=	0.01	0.00	0.006 (iii)
TIME TO PEAK (hrs)=	1.50	1.83	1.50
RUNOFF VOLUME (mm)=	24.02	8.10	15.63
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.96	0.32	0.62

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0002)	Area (ha)= 0.29
ID= 1 DT= 5.0 min	Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.29	0.00
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	43.97	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
0.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
0.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
0.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
0.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
0.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
0.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
0.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
0.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
0.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
0.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

Max.Eff.Inten.(mm/hr)=	41.67	11.63	
over (min)	5.00	5.00	
Storage Coeff. (min)=	2.21 (ii)	3.81 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.30	0.25	
			TOTALS
PEAK FLOW (cms)=	0.03	0.00	0.033 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50
RUNOFF VOLUME (mm)=	24.02	8.10	23.86
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.96	0.32	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB	
STANDHYD (0003)	Area (ha)= 0.66
ID= 1 DT= 5.0 min	Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.65	0.01

Dep. Storage (mm)=	1.00	1.50	
Average Slope (%)=	1.00	2.00	
Length (m)=	66.33	40.00	
Mannings n =	0.013	0.250	

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
0.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
0.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
0.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
0.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
0.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
0.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
0.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
0.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
0.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
0.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

			TOTALS
Max.Eff.Inten.(mm/hr)=	41.67	11.63	
over (min)	5.00	5.00	
Storage Coeff. (min)=	2.83 (ii)	4.43 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.28	0.23	
PEAK FLOW (cms)=	0.07	0.00	0.074 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50
RUNOFF VOLUME (mm)=	24.02	8.10	23.86
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.96	0.32	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0005)| Area (ha)= 0.76
ID= 1 DT= 5.0 min | Total Imp(%)= 99.00 Dir. Conn.(%)= 99.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area (ha)=		0.75	0.01
Dep. Storage (mm)=		1.00	1.50
Average Slope (%)=		1.00	2.00
Length (m)=		71.18	40.00
Mannings n =		0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
0.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
0.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
0.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
0.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
0.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
0.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
0.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
0.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
0.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
0.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

			TOTALS
Max.Eff.Inten.(mm/hr)=	41.67	11.63	
over (min)	5.00	5.00	
Storage Coeff. (min)=	2.96 (ii)	4.55 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.28	0.23	
PEAK FLOW (cms)=	0.08	0.00	0.085 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50

```
     RUNOFF VOLUME    (mm)=      24.02         8.10          23.86
     TOTAL RAINFALL   (mm)=      25.02        25.02          25.02
     RUNOFF COEFFICIENT   =       0.96         0.32           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0006)|   Area    (ha)=   0.59
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.58         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      62.72        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.17 | 1.083    6.20 | 2.083    5.62 |  3.08    2.95
              0.167    2.17 | 1.167    6.20 | 2.167    5.62 |  3.17    2.95
              0.250    2.38 | 1.250   12.18 | 2.250    4.80 |  3.25    2.76
              0.333    2.38 | 1.333   12.18 | 2.333    4.80 |  3.33    2.76
              0.417    2.66 | 1.417   41.67 | 2.417    4.21 |  3.42    2.62
              0.500    2.66 | 1.500   41.67 | 2.500    4.21 |  3.50    2.62
              0.583    3.03 | 1.583   15.28 | 2.583    3.78 |  3.58    2.47
              0.667    3.03 | 1.667   15.28 | 2.667    3.78 |  3.67    2.47
              0.750    3.58 | 1.750    9.22 | 2.750    3.45 |  3.75    2.35
              0.833    3.58 | 1.833    9.22 | 2.833    3.45 |  3.83    2.35
              0.917    4.47 | 1.917    6.88 | 2.917    3.18 |  3.92    2.23
              1.000    4.47 | 2.000    6.88 | 3.000    3.18 |  4.00    2.23

     Max.Eff.Inten.(mm/hr)=      41.67        11.63
               over (min)         5.00         5.00
     Storage Coeff.   (min)=      2.74 (ii)    4.33 (ii)
     Unit Hyd. Tpeak  (min)=      5.00         5.00
     Unit Hyd. peak   (cms)=      0.28         0.23
                                                          *TOTALS*
     PEAK FLOW        (cms)=      0.07         0.00          0.067 (iii)
     TIME TO PEAK     (hrs)=      1.50         1.50           1.50
     RUNOFF VOLUME     (mm)=     24.02         8.10          23.86
     TOTAL RAINFALL    (mm)=     25.02        25.02          25.02
     RUNOFF COEFFICIENT   =       0.96         0.32           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0004)|   Area    (ha)=   0.76
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                           IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.75         0.01
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      71.18        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.17 | 1.083    6.20 | 2.083    5.62 |  3.08    2.95
```

0.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
0.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
0.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
0.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
0.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
0.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
0.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
0.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
0.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
0.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

Max.Eff.Inten.(mm/hr)=	41.67	11.63	
over (min)	5.00	5.00	
Storage Coeff. (min)=	2.96 (ii)	4.55 (ii)	
Unit Hyd. Tpeak (min)=	5.00	5.00	
Unit Hyd. peak (cms)=	0.28	0.23	
			TOTALS
PEAK FLOW (cms)=	0.08	0.00	0.085 (iii)
TIME TO PEAK (hrs)=	1.50	1.50	1.50
RUNOFF VOLUME (mm)=	24.02	8.10	23.86
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.96	0.32	0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

CALIB
STANDHYD (0008) | Area (ha)= 0.32
ID= 1 DT= 5.0 min | Total Imp(%)= 63.00 Dir. Conn.(%)= 63.00

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.20	0.12
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	46.19	40.00
Mannings n	=	0.013	0.250

NOTE: RAINFALL WAS TRANSFORMED TO 5.0 MIN. TIME STEP.

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	2.17	1.083	6.20	2.083	5.62	3.08	2.95
0.167	2.17	1.167	6.20	2.167	5.62	3.17	2.95
0.250	2.38	1.250	12.18	2.250	4.80	3.25	2.76
0.333	2.38	1.333	12.18	2.333	4.80	3.33	2.76
0.417	2.66	1.417	41.67	2.417	4.21	3.42	2.62
0.500	2.66	1.500	41.67	2.500	4.21	3.50	2.62
0.583	3.03	1.583	15.28	2.583	3.78	3.58	2.47
0.667	3.03	1.667	15.28	2.667	3.78	3.67	2.47
0.750	3.58	1.750	9.22	2.750	3.45	3.75	2.35
0.833	3.58	1.833	9.22	2.833	3.45	3.83	2.35
0.917	4.47	1.917	6.88	2.917	3.18	3.92	2.23
1.000	4.47	2.000	6.88	3.000	3.18	4.00	2.23

Max.Eff.Inten.(mm/hr)=	41.67	8.84	
over (min)	5.00	25.00	
Storage Coeff. (min)=	2.28 (ii)	20.91 (ii)	
Unit Hyd. Tpeak (min)=	5.00	25.00	
Unit Hyd. peak (cms)=	0.30	0.05	
			TOTALS
PEAK FLOW (cms)=	0.02	0.00	0.024 (iii)
TIME TO PEAK (hrs)=	1.50	1.83	1.50
RUNOFF VOLUME (mm)=	24.02	8.10	18.09
TOTAL RAINFALL (mm)=	25.02	25.02	25.02
RUNOFF COEFFICIENT =	0.96	0.32	0.72

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 85.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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| ADD HYD  (  0009)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
       ID1= 1 (  0004):     0.76   0.085     1.50    23.86
     + ID2= 2 (  0008):     0.32   0.024     1.50    18.09
       ================================================
       ID = 3 (  0009):     1.08   0.109     1.50    22.15

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0010)|   Area    (ha)=   0.09
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.09         0.00
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      24.49        40.00
     Mannings n           =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                          ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.17 | 1.083    6.20 | 2.083    5.62 |  3.08    2.95
              0.167    2.17 | 1.167    6.20 | 2.167    5.62 |  3.17    2.95
              0.250    2.38 | 1.250   12.18 | 2.250    4.80 |  3.25    2.76
              0.333    2.38 | 1.333   12.18 | 2.333    4.80 |  3.33    2.76
              0.417    2.66 | 1.417   41.67 | 2.417    4.21 |  3.42    2.62
              0.500    2.66 | 1.500   41.67 | 2.500    4.21 |  3.50    2.62
              0.583    3.03 | 1.583   15.28 | 2.583    3.78 |  3.58    2.47
              0.667    3.03 | 1.667   15.28 | 2.667    3.78 |  3.67    2.47
              0.750    3.58 | 1.750    9.22 | 2.750    3.45 |  3.75    2.35
              0.833    3.58 | 1.833    9.22 | 2.833    3.45 |  3.83    2.35
              0.917    4.47 | 1.917    6.88 | 2.917    3.18 |  3.92    2.23
              1.000    4.47 | 2.000    6.88 | 3.000    3.18 |  4.00    2.23

     Max.Eff.Inten.(mm/hr)=      41.67        11.63
               over (min)         5.00         5.00
     Storage Coeff.  (min)=       1.56 (ii)    3.15 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.27
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50           1.50
     RUNOFF VOLUME    (mm)=      24.02         8.10          23.86
     TOTAL RAINFALL   (mm)=      25.02        25.02          25.02
     RUNOFF COEFFICIENT   =       0.96         0.32           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  85.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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 FINISH
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APPENDIX C

Letter to City of Burlington from Cupolex

CUPOLEX®
ENGINEERING SOLUTIONS INC.

Cupolex Engineering Solutions Inc.
55 Administration Rd, #6
Vaughan, Ontario
L4K 4G9
1-866-766-8276
cupolex.ca

May 31, 2022

Attention: City of Burlington

Via Email to: hknill@cfcorzier.ca

Re: Stormwater Management Solutions using Cupolex-formed Concrete Structures in the Golden Horseshoe Area

Cupolex Engineering Solutions Inc. has received a request from C.F. Crozier & Associates Inc. to provide design assistance for a cast-in-place concrete stormwater tank for "Holland Park" located at 2234 & 2269 Fairview St & 864 Drury Lane in Burlington, ON.

As part of the review by the City of Burlington, Cupolex has been asked to provide examples of other approved stormwater management solutions in the surrounding areas that have been designed by Cupolex. Below is a list of a few recent projects:

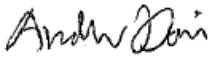
- Mississauga Valley Park, Mississauga (under construction): deep detention chamber with 5,260 m^3 of storage. It is situated well below the water table and designed with a raft slab to counter uplift pressure. Its intent is to provide flood relief to the Cooksville Creek watershed.
- 2200 Islington Ave, Toronto (under construction): two detention chambers with a combined storage of 4,226 m^3 for a commercial development. One of the chambers is integrated within the foundations of the upper-level parking deck.
- Gallanough Park, Vaughan (under construction): two deep detention chambers with a combined storage volume of 8,762 m^3 designed for flood relief of the city's storm sewer system.
- 73 Sluse Rd, East Gwillimbury (under construction): integrated shallow infiltration/detention chamber with 1,062 m^3 of storage on an industrial site with shallow groundwater.
- 175 Deerfield Rd, Newmarket (built 2021): two shallow infiltration chambers with a combined storage volume of 328 m^3 for stormwater quantity & quality control of a condo development.
- T3 Sterling Rd, Toronto (built 2021): deep detention chamber with 95 m^3 storage volume situated below the water table for stormwater detention of a condo development.
- Cretaro Homes, Beamsville (built 2019): detention tank with 204 m^3 storage volume.
- Evergreen Brickworks, Toronto (built 2017): approximately 2,000 m^2 of new concrete floor was formed using Cupolex to provide a void beneath the slab for wet floodproofing.

- 75 Ardelt Place, Kitchener (built 2015): 2,000 m^3 storage volume for an industrial site using a deep detention tank.

Cupolex provides engineered sealed drawings for all projects. Cupolex chambers can be designed for any loading. Should you need any further information, please do not hesitate to contact us.

Respectfully yours,

Andrew Davis BEng EIT



William. J. Cannizzaro/President



Drawings

C701 – Storm Servicing Drainage Plan

METROLINX

GO TRANSIT

EXT 0.32 | 0.69

BUILDING 'C' PARKING FFE:98.150

PARKING FFE:98.532

BUILDING 'D' PARKING FFE:99.300

GARAGE DOOR

LOADING

OFFICE

COMMERCIAL FFE:97.950

COMMERCIAL FFE:98.550

COMMERCIAL FFE:98.550

LOBBY FFE:99.000

205 0.76 | 0.95

204 0.76 | 0.95

206.8 0.15 | 0.95

206.6 0.06 | 0.95

206.7 0.13 | 0.95

206.5 0.04 | 0.95

206.3 0.04 | 0.95

206.1 0.03 | 0.95

206.2 0.04 | 0.95

206.4 0.10 | 0.95

202 0.29 | 0.95

203 0.66 | 0.95

201 0.11 | 0.70

200 0.17 | 0.60

BUILDING 'C' CONCRETE SWM VAULT
(LOCATED IN P1 & P2 LEVELS)
REQUIRED RETENTION VOLUME = 17.5 m³
REQUIRED DETENTION VOLUME = 295.7 m³
REFER TO DRAWING C 102D FOR DETAILS

TOTAL UNCONTROLLED DRAINAGE AREA = 0.09 ha
RUNOFF COEFFICIENT = 0.95

BUILDING 'D' CONCRETE SWM VAULT
(LOCATED IN P1 & P2 LEVELS)
REQUIRED RETENTION VOLUME = 16.0 m³
REQUIRED DETENTION VOLUME = 311.5 m³
REFER TO DRAWING C 102D FOR DETAILS

CUPOLEX SYSTEM
(LOCATED BELOW GROUND)
REQUIRED 25mm, 4-HOUR EVENT
VOLUME = 143.3 m³
REFER TO DWG. C 102E FOR ADDITIONAL DETAILS

BUILDING 'A' CONCRETE SWM VAULT
(LOCATED IN P1 LEVEL)
REQUIRED RETENTION VOLUME = 9.5 m³
REQUIRED DETENTION VOLUME = 94.5 m³
REFER TO DRAWING C 102D FOR DETAILS

BUILDING 'B' CONCRETE SWM VAULT
(LOCATED IN P1 LEVEL)
REQUIRED RETENTION VOLUME = 19.0 m³
REQUIRED DETENTION VOLUME = 252.8 m³
REFER TO DRAWING C 102D FOR DETAILS

ADDITIONAL 150mm DEPTH OF TOPSOIL TO BE APPLIED WITHIN 0.04 ha LANDSCAPED AREA OF SERVICING EASEMENT

12m SERVICING EASEMENT

FAIRVIEW STREET (BY REGISTERED PLAN 203) P.I.N. 07079-0080

DRURY LANE

LOT 5

SCALE: 1:400

REGIONAL APPROVAL

REGION DESIGN OF WATER AND/OR WASTEWATER SERVICES APPROVED SUBJECT TO DETAIL CONSTRUCTION CONFORMING TO HALTON REGION STANDARDS, SPECIFICATIONS AND LOCATION APPROVAL FROM AREA MUNICIPALITY

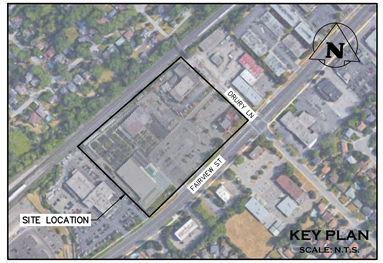
SIGNED: _____ DATED: _____

BUSINESS & TECHNICAL SERVICES

The Applicant should be aware that the approval of water systems on private property is the responsibility of the Local Municipality. Regardless, the Applicant must ensure that the Region of Halton's standards and specifications are met *(The Water and Wastewater Linear Design Manual may be obtained thru the Data Management Group at 905-825-6032)* Furthermore, all water quality tests must be completed to the Region of Halton's satisfaction, before the water supply can be turned on.

LEGEND

- PROPERTY LINE
- LIMIT OF CONSTRUCTION
- EXISTING WATERMAIN & GATE VALVE (XWM)
- EXISTING STORM SEWER & MANHOLE
- EXISTING SINGLE / DOUBLE CATCHBASIN
- EXISTING SANITARY SEWER & MANHOLE (XSAN)
- EXISTING GASMAIN (XGAS)
- EXISTING BELL LINE (XB)
- EXISTING STREET LIGHT CABLE & LIGHT STANDARD (XSL)
- EXISTING TV CABLE (XTV)
- EXISTING HYDRO (XH)
- EXISTING OVERHEAD HYDRO (XOH)
- PROPOSED WATERMAIN & GATE VALVE
- PROPOSED FIRE HYDRANT & GATE VALVE
- PROPOSED SIAMESE CONNECTION
- PROPOSED STORM SEWER & MANHOLE
- STM SEWER TO BE INSULATED PER OPSD 1109.030
- PROPOSED SANITARY SEWER & MANHOLE
- LIMIT OF UNDERGROUND PARKING
- PROPOSED ROAD REINSTATING
- PROPOSED SINGLE / DOUBLE CATCHBASIN
- PROPOSED SINGLE / DOUBLE CATCHBASIN MANHOLE
- WALL MOUNTED LIGHTS
- PROPOSED TREE PIT
- PROPOSED SILVA CELL
- PROPOSED VISITOR BIKE SPACE
- PROPOSED BACK-FLOW PREVENTOR STM
- PROPOSED STORMWATER VAULT W/IN UNDERGROUND PARKING GARAGE
- PROPOSED STORMWATER VAULT ACCESS HATCH
- PROPOSED BACKFLOW AND WATER METER PER HALTON REGION STANDARD S04.010 & 601.010
- PROPOSED HYDRO DUCT BANK
- PROPOSED COMMUNICATION DUCT BANK
- BUILDING ENTRANCE (PERSONNEL DOOR)
- DEPRESSED CURB
- BARRIER CURB
- PROPOSED LIGHT STANDARD
- EXISTING CURB
- UNCONTROLLED STORM DRAINAGE CATCHMENT (TOTAL = 0.09 ha)
- STORM DRAINAGE CATCHMENT
- CITY-OWNED PARK CATCHMENT
- CATCHMENT I.D.
- AREA (ha) | RUNOFF COEFFICIENT (5-YEAR)



KEY PLAN
SCALE: N.T.S.

LANDSCAPE

- PROPOSED LIGHT DUTY PEDESTRIAN CONCRETE PAVING
- PROPOSED HEAVY DUTY VEHICULAR CONCRETE PAVING
- PROPOSED VEHICULAR ASPHALT PAVING
- PROPOSED GRASS SEED
- PROPOSED LANDSCAPE AREA
- PROPOSED UNIT PAVERS
- PROPOSED SODDED AREA
- PROPOSED TURF STONE

FILE #535-001/20

Stamp: LICENSED PROFESSIONAL ENGINEER J. E. PETTIFER 100505043 JUL 20, 2022 PROVINCE OF ONTARIO

Stamp: LICENSED PROFESSIONAL ENGINEER PAVEL FILIPTSEV 100146817 JULY 20,2022 PROVINCE OF ONTARIO

No.	ISSUE / REVISION	YYYY/MMM/DD
4	ISSUED FOR FOURTH SPA SUBMISSION	2022/JUL/20
3	ISSUED FOR THIRD SPA SUBMISSION	2021/DEC/01
2	ISSUED FOR SECOND SPA SUBMISSION	2020/OCT/21
1	ISSUED FOR SPA SUBMISSION	2020/JAN/08

ELEVATION NOTE:

ELEVATIONS SHOWN HEREON ARE REFERRED TO THE CITY OF BURLINGTON BENCHMARK No. 1045

ELEVATION = 93.477m

SURVEY NOTES:

SURVEY COMPLETED BY R. AVIS SURVEYING INC. (2017/OCT/27)
PROJECT No.: 3141-0

BEARINGS ARE UTM GRID, DERIVED FROM RTN OBSERVATIONS
UTM ZONE 17, NAD83 (CSRS) (2010.0)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.9996781

SITE PLAN NOTES:

DESIGN ELEMENTS ARE BASED ON SITE PLAN BY CORE ARCHITECTS INC.
DRAWING No.: A001 THROUGH A819, (2022/07/20)
PROJECT No.: 18-223

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REFER TO SUE PREPARED BY PLANVIEW UTILITY SERVICES LTD. FOR EXISTING UNDERGROUND UTILITY LOCATIONS.

Developer

FAIRVIEW LIMITED PARTNERSHIP

c/o BROOKFIELD PROPERTIES SERVICECO INC.
181 BAY ST.
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c/c CLV GROUP DEVELOPMENTS INC.
485 BANK ST., SUITE 200
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Project

2243 FAIRVIEW ST., 2269 FAIRVIEW ST., 864 DRURY LN CITY OF BURLINGTON

Drawing

STORM SERVICING DRAINAGE PLAN

CROZIER CONSULTING ENGINEERS
2800 HIGH POINT DRIVE
SUITE 100
MILTON, ON L9T 6P4
905 875-0026 T
905 875-4915 F
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Drawn	Design	Project No.	
S.V.N./N.C.	M.P./P.F.	1486-4809	
Check	Check	Scale	Dwg.
J.P.	P.F.	1: 400	C 701