



**Site Servicing & Stormwater Management Report
Konson Warehouse – 1485 Upper Canada Street, Ottawa, ON.**

Client:
Dolyn Construction Ltd.

Project Number:
OTT-22023462-A0

Application Stage:
Site Plan Control

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Date Submitted:
April 11, 2023

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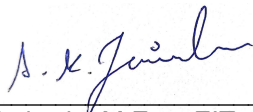
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1 Introduction

EXP Services Inc. (EXP) was retained by Dolyn Construction Ltd. to provide Site Servicing and Stormwater Management report for Konson Warehouse in the Kanata West Business Park located in Ottawa, ON.

The site is 1.84 hectares and located within the Kanata West Business Park (KWBP) – Phase 5. The site is bound by Upper Canada Street along the north and west property line, Campeau Drive along the south property line and commercial lots along the east property line. Refer to Figure A1 in Appendix A for the site location.

This servicing design report will address the Servicing requirements for the proposed development including the domestic and fire water, sanitary and storm servicing. The report will also cover the storm water management requirements and proposed methods to meet those requirements.

2 Existing Conditions

The subject property is currently vacant, with some vegetation and construction debris on it. The topography of the site is fairly flat, gradually sloping to the northeast towards the neighboring properties.

The existing municipal infrastructure present within the City ROW were installed during Phase 4 and Phase 5 construction of the Kanata West Business Park as part of the plan of subdivision. There are no known services or infrastructure within the property. The existing municipal infrastructure near the property within Upper Canada Street and Campeau Drive are noted below:

- Upper Canada Street:
 - Storm:
 - 975mm Ø Concrete Storm Sewer
 - 1050mm Ø Concrete Storm Sewer
 - 1650mm Ø Concrete Storm Sewer
 - Sanitary:
 - 250mm Ø PVC Sanitary Sewer
 - Water:
 - 200mm Ø PVC Watermain
 - 250mm Ø PVC Watermain
- Campeau Drive:
 - Storm:
 - 825mm Ø Concrete Storm Sewer
 - 900mm Ø Concrete Storm Sewer
 - Sanitary:
 - 250mm Ø PVC Sanitary Sewer
 - Water:
 - 300mm Ø PVC Watermain

3 References

Various documents were referred to in preparing the current report including:

- Sewer Design Guidelines, Second Edition, Document SDG002, October 2012, City of Ottawa (Guidelines) including:
 - Technical Bulletin ISDTB-2012-4 (20 June 2012)
 - Technical Bulletin ISDTB-2014-01 (05 February 2014)
 - Technical Bulletin PIEDTB-2016-01 (September 6, 2016)
 - Technical Bulletin ISDTB-2018-01 (21 March 2018)
 - Technical Bulletin ISDTB-2018-04 (27 June 2018)
 - Technical Bulletin ISDTB-2019-02 (08 July 2019)
- Ottawa Design Guidelines – Water Distribution, July 2010 (WDG001), including:
 - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
 - Technical Bulletin ISTB-2018-02 (21 March 2018)
 - Technical Bulletin ISTB-2021-03 (18 August, 2021)
- Ontario Ministry of Transportation (MTO) Drainage Manual, 1995-1997
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).
- Chapter 7 – National Engineering Handbook, United States Department of Agriculture (USDA), January 2009)
- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 2020
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing
- Design Brief – Kanata West Business Park – Phase 5 prepared by IBI Group, dated October 2019.
- Geotechnical Investigation Report – 1485 Upper Canada Street prepared by Paterson Group, dated January 2023.

4 Watermain Design

4.1 Required Fire Flow

The fire flow demand calculations were prepared based on the Fire Underwriters Survey (FUS, 2020) criteria. The construction type for the proposed warehouse building is classified as non-combustible. The building will have a fully supervised sprinkler system and combustible contents. The required fire flow was determined to be 183.3 L/s (11,000 L/min). Refer to Appendix B for detailed fire flow demand calculations.

4.2 Watermain Design

The domestic water demands for the proposed building were calculated as per the City of Ottawa Water Design Guidelines (July 2010). The proposed development is considered as light-industrial building. Therefore, an average demand of 35,000 L/gross ha/day was used. The peaking factors were considered as 1.5 and 1.8 for the max. day and peak hour demands, respectively. Refer to Appendix B for detailed calculations. The proposed building's domestic demands were as follows:

Light Industrial Water Demands:

Average daily demand = 0.74 L/s

Maximum daily demand = 1.12 L/s

Maximum hourly daily demand = 2.01 L/s

There is an existing 250mm diameter municipal watermain on Upper Canada Street. The estimated average daily demand of the proposed development is greater than 50 m³/day. Therefore, two water services of 150mm and 200mm diameter separated by an isolation valve are proposed to service the proposed development for domestic and sprinkler demands. The proposed water services are to be connected to the 250mm diameter municipal watermain on Upper Canada Street. A fire hydrant is also proposed to feed from the 200mm diameter water service within the property. This hydrant is location within 45m distance from the proposed fire department hose connection.

4.3 Pressure Check

The City of Ottawa provided boundary conditions based on the above noted domestic and fire flow demands at the connection point to the municipal water main on Upper Canada Street. These boundary conditions indicate that the minimum and maximum pressure in the existing municipal 250mm diameter watermain at the connection point on Upper Canada Street are 72.1 psi (497.37 kPa) and 78.1 psi (538.57 kPa), respectively. In addition, the residual pressure of 41.1 psi (283.51 kPa) was indicated by the city during max day + fire flow demand of 184.5 L/s. Based on this, a 150mm diameter water service connection would supply the average day, max day and peak hour demand of 0.74 L/sec, 1.12 L/sec and 2.01 L/sec at 78.0 psi, 72.0 psi and 72.0 psi residual pressures at the building finished floor elevation, respectively. The residual water pressures in the proposed water service are greater than the minimum requirement of 20psi (140kPa) and less than the maximum allowable limit of 80 psi.

Moreover, the proposed 150mm and 200mm dia. water services would supply total ±45 L/sec flow at ±1 psi head loss. A typical sprinkler system for the building of this size and magnitude requires 65 psi residual pressure at the building FFE. Based on the boundary conditions received from the City, it is assumed that flows greater than 45 L/sec would be available in 250mm municipal watermain on Upper Canada Street at ±66 psi residual pressure. Therefore, a sprinkler designer would have to confirm if the flow and pressure noted above are sufficient for the sprinkler system and suggest a booster pump accordingly.

Based on the above noted analysis, the existing water supply system and the proposed services will have adequate capacity to meet the domestic and fire demands for the proposed building. Refer to Appendix B for detailed calculations.

4.4 Review of Hydrant Spacing

A review of the hydrant spacing was completed to ensure compliance with Appendix I of Technical Bulletin ISTB-2018-02. As per Section 3 of Appendix I all hydrants within 150 meters were reviewed to assess the total possible contribution of flow from these contributing hydrants. For each hydrant, the distance to the proposed building was determined to arrive at the contribution of fire flow. A review of the available fire hydrant within 150m distance along the fire route from the building was carried out which is summarized in the table below.

Table 4-1: Summary of Nearby Municipal Hydrants

Hydrant #	Location	City / Private	Color Code	Distance from the Building (m)	Fire Flow Contribution for Class AA Hydrant (L/min)
348017H119	UPPER CANADA STREET	CITY	BLUE	139	3,800
348017H120	UPPER CANADA STREET	CITY	BLUE	53	5,700
348017H121	UPPER CANADA STREET	CITY	BLUE	77	3,800
348017H122	UPPER CANADA STREET	CITY	BLUE	118	3,800
348017H083	UPPER CANADA STREET	CITY	BLUE	63	5,700
348017H082	CAMPEAU DRIVE	CITY	BLUE	84	3,800
348017H081	CAMPEAU DRIVE	CITY	BLUE	57	5,700
348017H080	CAMPEAU DRIVE	CITY	BLUE	70	5,700
348017H092	-	CITY	BLUE	73	5,700
Total:					43,700

As noted in the table above, there are total nine (9) accessible fire hydrants within 150m distance along a fire route which equates to a total accessible fire flow of 43,700 L/min. This is well above the required fire flow of 11,000 L/min.

Based on the boundary conditions received from the city and review of the available municipal hydrants as noted above, the proposed development can be serviced for the required fire flow without any issues.

5 Sanitary Sewer Design

5.1 Peak Design Flow

There is an existing municipal 250mm diameter sanitary sewer on Upper Canada Street flowing towards Campeau Drive from north to south. The anticipated peak sanitary flows from the proposed industrial site have been calculated as per the City of Ottawa Sewer Design Guidelines (October 2012). The anticipated peak sanitary flows are calculated as follows:

Design Flows

Institutional Design Flow:	35,000 L/gross ha/day
Development Area:	1.84 hectares
Peak Factor:	1.5
Extraneous Flow:	0.33 L/s/ha
Peak Design Flow:	$=(35,000\text{L/ha/day})(1.84\text{ ha})(1.5)(1/86400)+(1.84\text{ha})(0.33\text{L/s/ha})$ =1.72 L/s

The proposed building at 1485 Upper Canada Street will be serviced by a new 200mm diameter sanitary service installed at a minimum slope of 2.0%. At this slope, the 200mm diameter sanitary services will have a capacity of 47.1 L/s and a full flow velocity of 1.72 m/s, which will be sufficient to service proposed development. Refer to the sanitary sewer design sheet in Appendix C and the Site Servicing plan (dwg #C101 and #C102) in Appendix F for further details.

6 Stormwater Management

6.1 Storm Design Criteria

The storm sewer system was designed in conformance with the City of Ottawa Sewer Design Guidelines (October 2012). The stormwater servicing design criteria for the proposed development are as follows:

- The proposed on-site storm sewer network / minor system is designed using Rational Method and Manning's Equation to convey runoff under free flow conditions for the 5-year return period.
- Post-development peak run-ff during 100-year storm event to be controlled to 408 L/sec and during 5-year storm to be controlled to 388 L/sec as identified in the Kanata West Business Park Design Brief prepared by IBI Group, dated October 2019.
- Maximum allowable ponding depth is 300 mm for surface ponding and 150mm for roof ponding.
- Flows from storm events greater than 100-year return period to be directed overland, away from the building towards the Upper Canada Street and Campeau Drive.
- Minimum freeboard of 300mm between the 100-year overland spill elevation and finished floor elevation. Minimum freeboard of 150mm between the 100-year overland spill elevation and lowest grades against the building foundation.
- Annual infiltration target of 73 mm for groundwater recharge as noted by MVCA in the pre-consultation meeting notes.
- Quality control criteria of 80% TSS removal as noted by MVCA in the pre-consultation meeting notes. Thermal mitigation is required as Feedmill Creek is a coolwater watercourse.

6.2 Pre-Development Conditions

The 1.84-hectare site at 1485 Upper Canada Street is currently a vacant land covered with minor vegetations and some construction debris. Surface runoff from the property flows towards the neighboring property to the east. The city ROW along the Upper Canada Street and Campeau Drive were developed as part of the plan of subdivision for the Kanata West Business Park Phase 4 and 5.

6.3 Allowable Release Rate

The allowable release rate for the site was identified in the Kanata West Business Park Phase 5 Design Brief prepared by IBI Group, dated October 2019. The City had noted in the pre-consultation meeting notes that the proposed development is part of the Kanata West Business Park and shall comply with the stormwater management criteria identified in the above-mentioned design brief. Therefore, the allowable release rate for up-to 100-year storm for the proposed development is considered as 408 L/sec.

6.4 Post-Development Conditions

Stormwater from the 1.84 ha drainage area will be controlled and released at a rate less than the allowable release rate for storms up to and including the 100-year storm event. An overland flow route is provided for storms greater than the 100-year event. In the post-development conditions, the stormwater run-off coefficients for the hard surfaces (concrete, asphalt, roof etc.) and soft surfaces (grass) are considered as 0.9 and 0.2, respectively. The estimated post-development average run-off coefficient is 0.83.

6.4.1 Storage Requirements and Allocation

Post development runoff will be detained on-site for storms up to and including the 100-year storm. The required SWM storage volumes will be achieved using the surface ponding in the landscaped areas, parking areas and ponding on the roof of the new building for up to 100-year storm event.

Surface ponding volumes over catch basins and roof drains were determined by applying the pyramid volume equation of one-third of the depth multiplied by the surface area of the pond. Ponding depths for the subject site must be equal to or less than 300 mm for the landscape and parking surfaces and 150mm for the roof during a 100-year storm event.

Refer to Stormwater Management Plan drawing #C400 in Appendix F for the drainage areas, associated ponding limits, ponding depth and control methods and refer to Appendix D for the detailed stormwater management calculations. The following table 6-1 summarizes the release rates and storage requirements for the proposed drainage areas within the subject site.

The proposed 100-year controlled release rate is 408 L/s and 5-year controlled release rate is 276 L/sec, which are compliant with the quantity control criteria noted in section 6.1 above. The available storage volume of 509 m³ is more than the required volume of 364.5 m³.

6.4.2 Flow Control Device Sizing

Stormwater runoff from the proposed development will be detained using inlet control devices (ICDs) and flow control roof drains. The proposed ICD manufacturer and models are summarized in Table 6-1 below. The required flow control from the roof will be achieved by mounting Watts Accutrol flow weirs on the roof drains. Further details regarding the ICDs and roof drains are provided in Appendix D. The 5-year and 100-year ponding limits, total ponding depth and location of the flow control measures are provided on drawing #C400 in Appendix F.

Table 6-1: Summary of SWM Storage Requirements

Area ID	Outlet Location	Area (ha)	Runoff Coefficient 'C'	100 Year Release (L/s)	100 Year storage required (m ³)	100 Year surface storage provided (m ³)	Control Method
A1	CB11, LCB03	0.12	0.65	37.0	8.8	15.3	Hydrovex 150 VHV-2
A2	CB10	0.09	0.79	35.0	6.8	8.2	Hydrovex 150 VHV-2
A3	CB09	0.08	0.77	33.0	6.5	11.4	Hydrovex 150 VHV-2
A4	CB07	0.08	0.79	30.0	6.5	21.0	Hydrovex 125 VHV-2
A5-1	DCB06	0.15	0.86	52.0	15.2	20.5	Hydrovex 200 VHV-2
A5-2	DCB04	0.08	0.88	30.0	6.5	30.3	Hydrovex 150 VHV-2
A6-1	DCB05	0.16	0.90	70.0	11.4	14.0	Hydrovex 200 VHV-2
A6-2	CB03	0.05	0.90	15.0	6.6	19.5	Hydrovex 100 VHV-2
A7	CB01, CB02	0.13	0.81	40.0	20.5	43.1	Hydrovex 150 VHV-2
A8	LCB01, LCB02	0.06	0.23				
A9	Trench Drain	0.02	0.90	8.5	NA	NA	Uncontrolled
A10-1	Upper Canada	0.00	0.20	0.3	NA	NA	Uncontrolled
A10-2	Campeau Drive	0.01	0.23	1.7	NA	NA	Uncontrolled
A11	Roof Drains	0.81	0.90	55.6	275.9	325.6	Watts Accutrol Weir
TOTAL		1.847		408.0	364.5	509.0	
Total Allowable Release L/s:				408.0	<i>(From Kanata West Business Park - Phase 5 Design Brief prepared by IBI Group, dated October 2019)</i>		

***Bold** flows are controlled.

6.4.3 Quality Control

Mississippi Valley Conservation Authority (MVCA) had noted quality control criteria as summarized in section 6.1 above (Also noted in the pre-consultation meeting noted included in Appendix E). In the KWBP-Phase 5 Design Brief (IBI, October 2019), it is noted that the West Pond 6 is designed to provide quality control criteria for the existing and proposed development within the Kanata West Business Park. The subject site is a tributary to Pond 6 West. The proposed stormwater management strategy is compliant with the criteria assigned to the subject site in the design brief. Therefore, the proposed development shall be successfully accommodated by Pond 6 West for the quality control. Hence, no additional quality control measures are proposed.

6.4.4 Infiltration

As noted in section 6.1 above, MVCA has assigned an annual infiltration target of 73 mm/year for the subject site for the groundwater recharge. With the subject site area of 1.84 ha, a 73 mm/year infiltration target equates to a total volume of 1343.2 m³. To meet this target, onsite infiltration systems consisting of the underground Stormtech chambers with a 0.5m thick drainage layer at the bottom are proposed. This system will receive stormwater from the roof drains only, to maintain the groundwater quality. Each of the 5 roof areas, as identified on drawing #C400 in Appendix F will have 2 roof drains. One roof drain with a Watts Accutrol weir having one notch set at full-open position which will discharge to the underground Stormtech chamber at a controlled release rate to meet the infiltration criteria. And second roof drain with a separate Watts Accutrol weir having multiple notches set at full-open position, will discharge to the storm sewer system. With this setup, the total peak discharge rate proposed from the roof is 55.6 L/sec out of which, max. 10.0 L/sec is directed towards the underground Stormtech chambers, equating to an ±18.0% flow split. The average annual precipitation in Ottawa area is 943.4 mm/year as per the historical data recorded at the Ottawa International Airport. With the proposed roof area of 8141.0 m², 943.4 mm/year rainfall results in a total volume of 7680.22 m³. 18.0% of the total rainfall volume from the proposed roof would be 1382.4 m³, which is more than the target infiltration volume of 1343 m³ noted above.

Geo-investigation report prepared by Paterson Group for the subject site noted that the soil type encountered at the boreholes consists of a compact brown silty sand to sandy silt at the depths greater than 1 m – 2 m from the existing surface. The noted soil type is classified in the hydrologic soil group C as per Chapter 7 of the National Engineering Handbook – USDA, 2009. This type of soil has the saturated hydraulic conductivity range of 4 mm/hr to 36 mm/hr. Based on the infiltration rate and hydraulic conductivity relationship equation provided in CVC and TRCA 2010, this would result in a critical infiltration rate of 46 mm/hr to 86 mm/hr. To ensure that the stormwater flows routed from the designated roof drains would be infiltrated, the Stormtech chambers are proposed to be dispersed across the site. Additionally, proposed 0.5m thick drainage layer below the Stormtech chambers will ensure initial high infiltration rates and provide storage when the subsurface soil reaches saturation. The chambers will provide additional buffer volume to ensure infiltration. Additionally, the bottom of the drainage layer will be placed at least 1.0m above the ground water elevation of ~102.46m noted in the Geo-investigation report. In the extreme weather conditions, the chambers will overflow into the nearby storm sewers. Refer to drawings #C101, C102 and C400 for the proposed Stormtech chamber locations.

With the above noted reasonings, the annual infiltration target of 73 mm/year can be achieved with the proposed development.

7 Erosion and Sediment Control

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

- Extent of exposed soils shall be limited at any given time;
- Exposed areas shall be re-vegetated as soon as possible;
- Minimize the area to be cleared and disruption of adjacent areas;
- Siltsack or approved equivalent shall be installed inside all catch basins, catch basin manholes, and storm manholes as identified on the erosion and sediment control plan;
- Visual inspection shall be completed daily on sediment control barriers and any damage will be repaired immediately. Care will be taken to prevent damage during construction operations;

- In some cases, barriers may be removed temporarily to accommodate the construction operations. The affected barriers will be reinstated at night when construction is completed;
- Sediment control devices will be cleaned of accumulated silt as required. The deposits will be disposed of as per the requirements of the contract;
- During construction, if the engineer believes that additional prevention methods are required to control erosion and sedimentation, the contractor will install additional silt fences or other methods as required to the satisfaction of the engineer; and,
- Construction and maintenance requirements for erosion and sediment controls are to comply with Ontario Provincial Standard Specification (OPSS) 805.

8 Conclusions

This report addresses the site servicing and stormwater management requirements for the site plan control application for the proposed development. Based on the analysis provided in this report, the conclusions are as follows:

- The proposed warehouse building will be serviced by 150mm and 200mm diameter dual watermains, which will adequately service the proposed development for the domestic and fire flow demands.
- The proposed building will be serviced by a 200mm diameter sanitary sewer, which will have adequate capacity to service the new building for the sanitary flows.
- Stormwater Management criteria for the proposed development will be achieved by restricting the post-development stormwater discharge rates up to and including the 100-year to the allowable release rates.
- Required on-site SWM storage volumes will be achieved using the surface storage in the landscaped areas and parking areas and roof storage using the flow control measures like ICDs and flow control roof drains.
- The annual infiltration target will be achieved by directing a portion of the stormwater from the building roof to the underground Stormtech chambers.
- The stormwater quality control for the proposed site is provided by the existing Pond 6 West. Therefore, no additional quality control measures are proposed.
- Temporary erosion and sediment control measures for the subject site have been identified.

Appendix A – Figures

Appendix B – Water Servicing

TABLE B2: FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 2020

PROJECT: OTT-22023462

Building: **Konson Development**



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

$$F = 220 * C * \text{SQRT}(A)$$

where: F = required fire flow in litres per minute
 A = total floor area in m² (including all storeys, but excluding basements at least 50% below grade)
 C = coefficient related to the type of construction

Task	Options	Multiplier	Input	Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5	Non-combustible Construction	0.8	
	Ordinary Construction	1			
	Non-combustible Construction	0.8			
	Fire Resistant Construction	0.6			
	Second Floor		8142	16284.0 m ²	
	First Floor		8142		
	Basement (At least 50% below grade, not included)		0		
Fire Flow (F)	F = 220 * C * SQRT(A)				22,459
Fire Flow (F)	Rounded to nearest 1,000				22,000

Reductions/Increases Due to Factors Effecting Burning

Task	Options	Multiplier	Input	Value Used	Fire Flow Change (L/min)	Fire Flow Total (L/min)						
Choose Combustibility of Building Contents	Non-combustible	-25%	Combustible	0%	0	22,000						
	Limited Combustible	-15%										
	Combustible	0%										
	Free Burning	15%										
	Rapid Burning	25%										
Choose Reduction Due to Sprinkler System	Adequate Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-6,600	15,400						
	No Sprinkler	0%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-2,200	13,200						
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%										
	Not Standard Water Supply or Unavailable	0%										
	Fully Supervised Sprinkler System	-10%	Fully Supervised Sprinkler System	-10%	-2,200	11,000						
Not Fully Supervised or N/A	0%											
Choose Structure Exposure Distance	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Length (m)	No of Storeys	Length-Height Factor	Sub-Condition	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)
	West	150	5	30.1 to 45	Type V	18	2	36	6	0%	0%	0
	East	200	5	30.1 to 45	Type V	94	0	0	6	0%		
	South	54	5	30.1 to 45	Type V	52	4	208	6	0%		
	North	43	5	30.1 to 45	Type V	105	8	840	6	0%		
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =											11,000
	Total Required Fire Flow, L/s =											183.3

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

Type V	Wood Frame
Type IV-III (U)	Mass Timber or Ordinary with Unprotected Openings
Type IV-III (P)	Mass Timber or Ordinary with Protected Openings
Type II-I (U)	Noncombustible or Fire Resistant with Unprotected Openings
Type II-I (P)	Noncombustible or Fire Resistant with Protected Openings

Conditons for Separation

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

TABLE B3

ESTIMATED WATER PRESSURE AT PROPOSED BUILDING FFE

Description	From	To	Demand (L/sec)	Pipe Length (m)	Pipe Dia (mm)	Dia (m)	Q (m3/sec)	Area (m2)	C	Vel (m/s)	Slope of HGL (m/m)	Head Loss (m)	Elev From (m)	Elev To (m)	*Elev Diff (m)	Pressure From (kPa (psi))	Pressure To (kPa (psi))	Pressure Drop (psi)
Avg Day Conditons																		
Single 150mm water service	Main	Building	0.74	97 m	150	0.150	0.0007	0.017671	110	0.0421	2.9E-05	0.0029	105.80	105.90	-0.1	538.6 (78.1)	537.6 (78.0)	0.1
Max Day Conditons																		
Single 150mm watermain	Main	Building	1.12	97 m	150	0.150	0.0011	0.017671	110	0.0632	6.2E-05	0.006	105.80	105.90	-0.1	497.4 (72.1)	496.3 (72.0)	0.2
Peak Hour Conditons																		
Single 150mm watermain	Main	Building	2.01	97 m	150	0.150	0.0020	0.017671	110	0.1138	0.00018	0.018	105.80	105.90	-0.1	497.4 (72.1)	496.2 (72.0)	0.2
Flow @65 psi for sprinkler system																		
Single 150mm watermain	Main	Building	15.00	97 m	150	0.150	0.0150	0.017671	110	0.8488	0.00762	0.7423	105.80	105.90	-0.1	0.0 (0.0)	-8.3 (-1.2)	1.2
Single 200mm watermain	Main	Building	30.00	97 m	200	0.200	0.0300	0.031416	110	0.9549	0.00678	0.6601	105.80	105.90	-0.1	0.0 (0.0)	-7.5 (-1.1)	1.1
Water Demand Info																		
Average Demand =	0.74	L/sec																
Max Day Demand =	1.12	L/sec																
Peak Hr Deamand =	2.01	L/sec																
Fireflow Requiriement =	183.3	L/sec																
Max Day Plus FF Demand =	184.5	L/sec																
Boundary Conditon																		
	<u>Min HGL</u>	<u>Max HGL</u>	<u>Max Day + Fireflow</u>															
HGL (m)	156.5	160.7	134.7	(From City of Ottawa)														
Approx Ground Elev (m) =	105.80	105.80	105.80															
Approx Bldg FF Elev (m) =	105.90	105.90	105.90															
Pressure (m) =	50.7	54.9	28.9															
Pressure (Pa) =	497,367	538,569	283,509															
Pressure (psi) =	72.1	78.1	41.1															

TABLE B4
AVAILABLE FIRE FLOWS BASED ON HYDRANT SPACING

Hydrant #	Location	City / Private	Color Code	Accessible (yes/no)	Konson Warehouse	
					¹ Dist (m)	² Fire Flow Contrib (L/min)
348017H119	UPPER CANADA STREET	CITY	BLUE	Yes	139	3,800
348017H120	UPPER CANADA STREET	CITY	BLUE	Yes	53	5,700
348017H121	UPPER CANADA STREET	CITY	BLUE	Yes	77	3,800
348017H122	UPPER CANADA STREET	CITY	BLUE	Yes	118	3,800
348017H083	UPPER CANADA STREET	CITY	BLUE	Yes	63	5,700
348017H082	CAMPEAU DRIVE	CITY	BLUE	Yes	84	3,800
348017H081	CAMPEAU DRIVE	CITY	BLUE	Yes	57	5,700
348017H080	CAMPEAU DRIVE	CITY	BLUE	Yes	70	5,700
348017H092	-	CITY	BLUE	Yes	73	5,700
Total (L/min)						43,700
Total (L/sec)						728
FUS RFF in L/min						183
Meets Requirement (Yes/No)						Yes
<p><u>Notes:</u></p> <p>1) Distance is measured along a road or fire route.</p> <p>2) Fire Flow Contribution for Class AA Hydrant from Table 1 of Appendix I, ISTB-2018-02</p>						

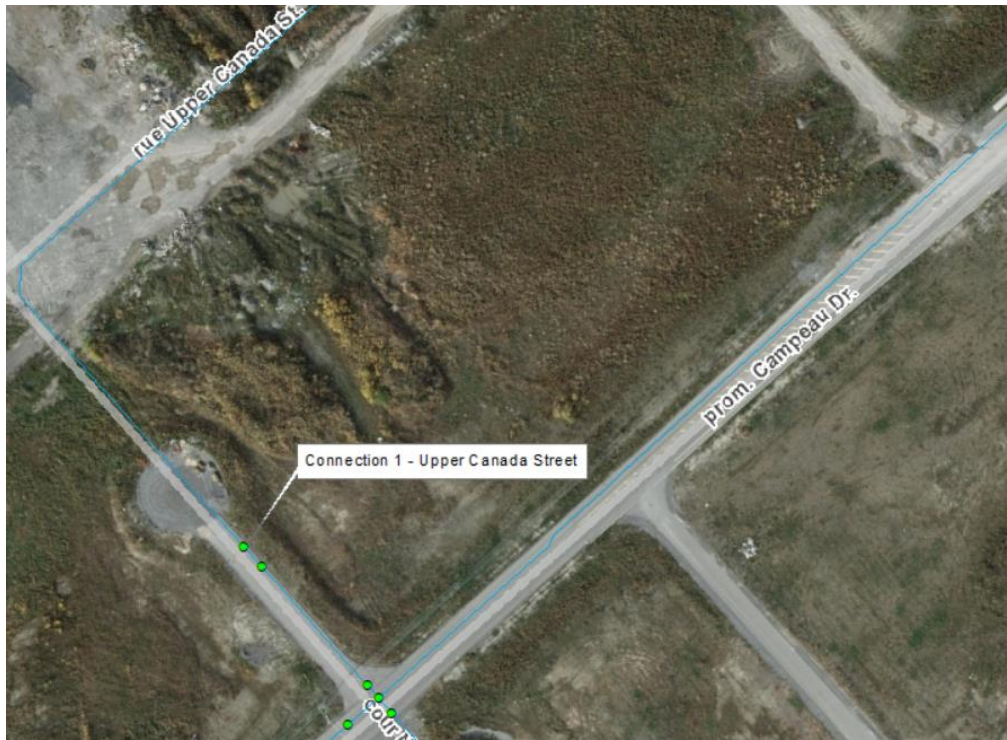
**WATER BOUNDARY CONDITIONS
FROM CITY OF OTTAWA**

Boundary Conditions 1485 Upper Canada Street (Konson Development)

Provided Information

Scenario	Demand	
	L/min	L/s
Average Daily Demand	44	0.74
Maximum Daily Demand	67	1.12
Peak Hour	121	2.01
Fire Flow Demand #1	16,980	283.00
Fire Flow Demand #2	15,000	250.00
Fire Flow Demand #3	11,100	185.00
Fire Flow Demand #4	10,000	166.67

Location



Future Condition: Location of future 305 mm watermain



Results

Existing Condition

Connection 1 - Upper Canada Street

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	160.7	79.2
Peak Hour	156.5	73.2
Max Day plus Fire Flow #1	108.5	5.1
Max Day plus Fire Flow #2	118.3	19.0
Max Day plus Fire Flow #3	134.7	42.2
Max Day plus Fire Flow #4	138.5	47.7

¹ Ground Elevation = 105.0 m

Future Condition

Connection 1 - Upper Canada Street

Demand Scenario	Head (m)	Pressure ¹ (psi)
Maximum HGL	160.7	79.2
Peak Hour	156.5	73.2
Max Day plus Fire Flow #1	117.3	17.5
Max Day plus Fire Flow #2	125.3	28.9
Max Day plus Fire Flow #4	141.8	52.4

¹ Ground Elevation = 105.0 m

Disclaimer

The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

*EXP Services Inc.
Konson Warehouse
1485 Upper Canada Street, Ottawa, ON
OTT-22023462-A0
April 11, 2023*

Appendix C – Sanitary Sewer Design Sheet



*EXP Services Inc.
Konson Warehouse
1485 Upper Canada Street, Ottawa, ON
OTT-22023462-A0
April 11, 2023*

Appendix D – Stormwater Management Design Sheet



**Table D1
Stormwater Management Summary**

Area ID	Outlet Location	Area (ha)	Runoff Coefficient 'C'	100 Year Release (L/s)	100 Year storage required (m ³)	100 Year surface storage provided (m ³)	Control Method
A1	CB11, LCB03	0.12	0.65	37.0	8.8	15.3	Hydrovex 150 VHV-2
A2	CB10	0.09	0.79	35.0	6.8	8.2	Hydrovex 150 VHV-2
A3	CB09	0.08	0.77	33.0	6.5	11.4	Hydrovex 150 VHV-2
A4	CB07	0.08	0.79	30.0	6.5	21.0	Hydrovex 125 VHV-2
A5-1	DCB06	0.15	0.86	52.0	15.2	20.5	Hydrovex 200 VHV-2
A5-2	DCB04	0.08	0.88	30.0	6.5	30.3	Hydrovex 150 VHV-2
A6-1	DCB05	0.16	0.90	70.0	11.4	14.0	Hydrovex 200 VHV-2
A6-2	CB03	0.05	0.90	15.0	6.6	19.5	Hydrovex 100 VHV-2
A7	CB01, CB02	0.13	0.81	40.0	20.5	43.1	Hydrovex 150 VHV-2
A8	LCB01, LCB02	0.06	0.23				
A9	Trench Drain	0.02	0.90	8.5	NA	NA	Uncontrolled
A10-1	Upper Canada	0.00	0.20	0.3	NA	NA	Uncontrolled
A10-2	Campeau Drive	0.01	0.23	1.7	NA	NA	Uncontrolled
A11	Roof Drains	0.81	0.90	55.6	275.9	325.6	Watts Accutrol Weir
TOTAL		1.847		408.0	364.5	509.0	
Total Allowable Release L/s:				408.0	<i>(From Kanata West Business Park - Phase 5 Design Brief prepared by IBI Group, dated October 2019)</i>		

Table D2 - CALCULATION OF AVERAGE RUNOFF COEFFICIENTS (POST-DEVELOPMENT)

Area No.	Outlet Location	Asphalt/Concrete Areas		Roof Areas		Pavers/Gravel Areas		Grassed Areas		Sum AC	Total Area (m ²)	C _{AVG}
		Area (m ²)	A * C	Area (m ²)	A * C	Area (m ²)	A * C	Area (m ²)	A * C			
		C=0.90		C=0.90		C=0.90		C=0.20				
A1	CB11, LCB03	777.80	700.0		0.0		0.0	439.18	87.84	787.9	1216.98	0.65
A2	CB10	730.13	657.1		0.0		0.0	139.32	27.86	685.0	869.45	0.79
A3	CB09	686.00	617.4		0.0		0.0	150.51	30.10	647.5	836.51	0.77
A4	CB07	652.00	586.8		0.0		0.0	127.16	25.43	612.2	779.16	0.79
A5-1	DCB06	1431.70	1288.5		0.0		0.0	87.76	17.55	1306.1	1519.46	0.86
A5-2	DCB04	739.80	665.8		0.0		0.0	24.00	4.80	670.6	763.80	0.88
A6-1	DCB05	1599.81	1439.8		0.0		0.0		0.00	1439.8	1599.81	0.90
A6-2	CB03	523.34	471.0		0.0		0.0		0.00	471.0	523.34	0.90
A7	CB01, CB02	1133.18	1019.9		0.0		0.0	161.99	32.40	1052.3	1295.17	0.81
A8	LCB01, LCB02	28.60	25.7		0.0		0.0	580.29	116.06	141.8	608.89	0.23
A9	Trench Drain	170.67	153.6		0.0		0.0		0.00	153.6	170.67	0.90
A10-1	Upper Canada		0.0		0.0		0.0	23.30	4.66	4.7	23.30	0.20
A10-2	Campeau Drive	4.50	4.1		0.0		0.0	117.50	23.50	27.6	122.00	0.23
A11	Roof Drains		0.0	8141.00	7326.9		0.0		0.00	7326.9	8141.00	0.90
Average Runoff Coeff =										C _{AVG} =	<u>15,327</u> 18,470	= 0.83

Table D3

SWM POST-DEVELOPMENT RUNOFF (UNCONTROLLED AND CONTROLLED)

Area No	Outlet Location	Area (ha)	Time of Conc. T _c (min)	Storm = 2-year				Storm = 5-year				Storm = 100-year			
				C _{AVG}	I ₂ (mm/hr)	Q (L/sec)	Q _{CAP} (L/sec)	C _{AVG}		Q (L/sec)	Q _{CAP} (L/sec)	C _{AVG-100Yr}	I ₁₀₀ (mm/hr)	Q (L/sec)	Q _{CAP} (L/sec)
A1	CB11, LCB03	0.122	10	0.65	76.81	16.8	16.8	0.65	104.19	22.8	22.8	0.81	178.56	48.9	37.0
A2	CB10	0.087	10	0.79	76.81	14.6	14.6	0.79	104.19	19.8	19.8	0.98	178.56	42.5	35.0
A3	CB09	0.084	10	0.77	76.81	13.8	13.8	0.77	104.19	18.8	18.8	0.97	178.56	40.2	33.0
A4	CB07	0.078	10	0.79	76.81	13.1	13.1	0.79	104.19	17.7	17.7	0.98	178.56	38.0	30.0
A5-1	DCB06	0.152	10	0.86	76.81	27.9	27.9	0.86	104.19	37.8	37.8	1.00	178.56	75.4	52.0
A5-2	DCB04	0.076	10	0.88	76.81	14.3	14.3	0.88	104.19	19.4	19.4	1.00	178.56	37.9	30.0
A6-1	DCB05	0.160	10	0.90	76.81	30.7	30.7	0.90	104.19	41.7	41.7	1.00	178.56	79.4	70.0
A6-2	CB03	0.052	10	0.90	76.81	10.1	10.1	0.90	104.19	13.6	13.6	1.00	178.56	26.0	15.0
A7	CB01, CB02	0.130	10	0.81	76.81	22.5	25.5	0.81	104.19	30.5	34.6	1.00	178.56	64.3	40.0
A8	LCB01, LCB02	0.061	10	0.23	76.81	3.0		0.23	104.19	4.1		0.29	178.56	8.8	
A9	Trench Drain	0.017	10	0.90	76.81	3.3	3.3	0.90	104.19	4.4	4.4	1.00	178.56	8.5	8.5
A10-1	Upper Canada	0.002	10	0.20	76.81	0.1	0.1	0.20	104.19	0.1	0.1	0.25	178.56	0.3	0.3
A10-2	Campeau Drive	0.012	10	0.23	76.81	0.6	0.6	0.23	104.19	0.8	0.8	0.28	178.56	1.7	1.7
A11	Roof Drains	0.814	10	0.90	76.81	156.4	37.3	0.90	104.19	212.2	44.3	1.00	178.56	404.1	55.6
Total		1.847				327.3	208.1			444.0	276.0			876.0	408.0

Notes

- 1) Intensity, I₂ = 732.951/(Tc+6.199)^{0.810} (2-year, City of Ottawa)
- 2) Intensity, I₅ = 998.071/(Tc+6.035)^{0.814} (5-year, City of Ottawa)
- 3) Intensity, I₁₀₀ = 1735.688/(Tc+6.014)^{0.820} (100-year, City of Ottawa)
- 4) Time of Concentration: T_c=10min
- 4) Flows under column Q_{CAP} which are **bold**, denotes flows that are controlled.

Table D4: 2-year, 5-year & 100-year Roof Drains Design Sheet - Using Flow Controlled Roof Drains

Project: 1485 UPPER CANADA STREET
 Location: City of Ottawa
 Date: APRIL 2023

Area #	Roof Drain Type	No Drains per Area	No of Weirs per Drain	Weir Position	Runoff Coeff (Cavg)		Drainage Area		2-year Event						5-year Event						100-year Event						Storage Required (MRM)			Maximum Storage Provided at Spill Elevation						
					2-year & 5-year	100-year	m ²	ha	Runoff Rate (L/sec)	2yr Ponding Depth (mm)	Roof Drain Capacity Per Weir (gpm)	Roof Drain Capacity Per Drain per weir (gpm)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	Runoff Rate (L/sec)	5yr Ponding Depth (mm)	Roof Drain Capacity Per Weir (gpm)	Roof Drain Capacity Per Drain per weir (gpm)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	Runoff Rate (L/sec)	100yr Ponding Depth (mm)	Roof Drain Capacity Per Weir (gpm)	Roof Drain Capacity Per Drain per weir (gpm)	Roof Drain Capacity Per Drain (L/sec)	Total Flow From Roof Drains (L/sec)	2-year (m ³)	5-year (m ³)	100-year (m ³)	Area Available for Storage (m ²)	Max Prism Depth (mm)	Max Prism Volume (m ³)	% Volume Used for Ponding			
A11-1	RD1, RD2	2	5	6-Full	0.90	1.00	1241.80	0.1242	23.865	94	18.8	94.0	5.930	5.930	32.373	112	22.4	112.0	7.066	7.066	61.642	141	28.2	141.0	8.896	8.896	12.28	20.93	41.19	993.4	150	49.7	25%	42%	83%	
A11-2	RD1, RD2	2	5	6-Full	0.90	1.00	1295.00	0.1295	24.887	95	19.0	95.0	5.994	5.994	33.759	113	22.6	113.0	7.129	7.129	64.283	142	28.4	142.0	8.959	8.959	13.04	22.19	43.62	1,036.0	150	51.8	25%	43%	84%	
A11-3	RD1, RD3	2	7	6-Full	0.90	1.00	1680.66	0.1681	32.299	94	18.8	131.6	8.303	8.303	43.813	112	22.4	156.8	9.893	9.893	83.427	140	28.0	196.0	12.366	12.366	16.29	27.84	55.06	1,344.5	150	67.2	24%	41%	82%	
A11-4	RD1, RD3	2	7	6-Full	0.90	1.00	1900.50	0.1901	36.524	96	19.2	134.4	8.479	8.479	49.544	114	22.8	159.6	10.069	10.069	94.340	143	28.6	200.2	12.631	12.631	19.51	33.16	65.10	1,520.4	150	76.0	26%	44%	86%	
A11-5	RD1, RD3	2	7	6-Full	0.90	1.00	2023.04	0.2023	38.879	97	19.4	135.8	8.568	8.568	52.739	115	23.0	161.0	10.158	10.158	100.423	144	28.8	201.6	12.719	12.719	21.44	36.31	70.90	1,618.4	150	80.9	26%	45%	88%	
Totals					0.9	0.9	8,141.0	0.8141	156.45		95.20	37.27	37.27	212.23		113.20	44.31	44.31	404.11		142.00	55.57	55.57	82.57	140.44	275.86	6513	325.6								
Min										94					112						140															
Max										97					115						144															

Runoff Based on the Following:

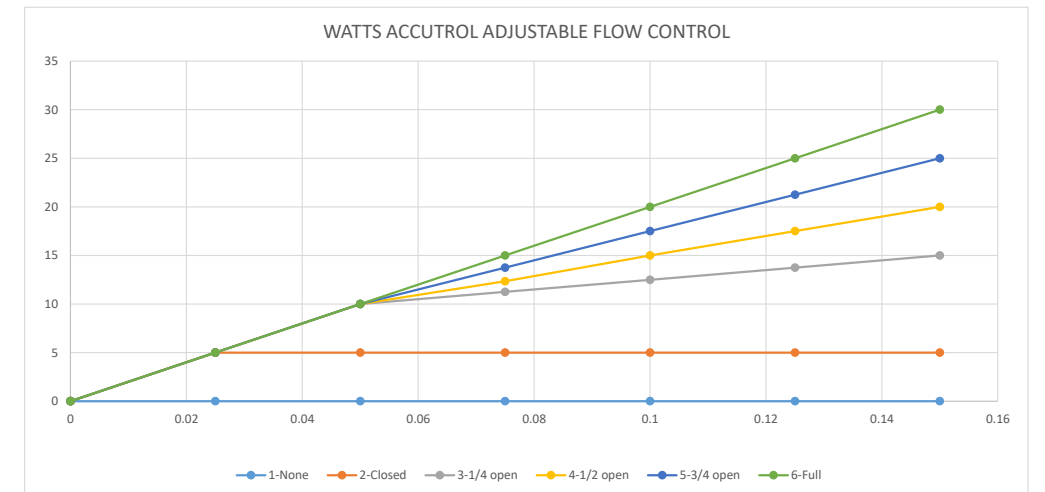
Storm Frequency (years) =	2	5	100
Time of Conc (mins) =	10	10	10
Storm Intensity (mm/hr) =	76.8	104.2	178.6

Roof Drains have Following Flow Rates per weir: WATTS Flow Controlled Drain

Weir Position	Flow (gpm) per depth							Max Flow Rate per Weir @150mm
	0	25	50	75	100	125	150	
	0	0.025	0.05	0.075	0.1	0.125	0.15	
1-None	0	0	0	0	0	0	0	0.000
2-Closed	0	5	5	5	5	5	5	0.315
3-1/4 open	0	5	10	11	13	14	15	0.946
4-1/2 open	0	5	10	12	15	18	20	1.262
5-3/4 open	0	5	10	14	18	21	25	1.577
6-Full	0	5	10	15	20	25	30	1.893

Roof Drain Types

Drain Type =	RD1	RD2	RD3
Max Overflow Depth (mm)	150 mm	150 mm	150 mm
Flow Controlled (Yes/No)	Yes	Yes	Yes
Ponding	Yes	Yes	Yes
Weir Desc	Accutrol	Accutrol	Accutrol
No. Weirs	1	4	6



Storage Volumes Roof Area #A11-1 (2 Year, 5 Year and 100 Year Storms)

$C_{AVG} = 0.90$ (dimensionless)

$C_{AVG} = 1.00$

Time Interval = 5 (mins)

Drainage Area = 0.12418 (hectares)

Duration (min)	Release Rate = 5.930 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951, B = 0.810 (I = A/(T _c +C), C = 6.199)					Release Rate = 7.0661 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071, B = 0.814 (I = A/(T _c +C), C = 6.053)					Release Rate = 8.8957 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.69, B = 0.820 (I = A/(T _c +C), C = 6.014)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	52.0	5.93	46.0	0.00	230.5	79.6	7.066	72.5	0.00	398.6	137.6	8.9	128.7	0.00
5	103.6	32.2	5.93	26.2	7.87	141.2	48.7	7.066	41.7	12.50	242.7	83.8	8.9	74.9	22.47
10	76.8	23.9	5.93	17.9	10.76	104.2	36.0	7.066	28.9	17.34	178.6	61.6	8.9	52.7	31.65
15	61.8	19.2	5.93	13.3	11.93	83.6	28.8	7.066	21.8	19.60	142.9	49.3	8.9	40.4	36.39
20	52.0	16.2	5.93	10.2	12.28	70.3	24.3	7.066	17.2	20.62	120.0	41.4	8.9	32.5	39.02
25	45.2	14.0	5.93	8.1	12.15	60.9	21.0	7.066	14.0	20.93	103.8	35.9	8.9	27.0	40.43
30	40.0	12.4	5.93	6.5	11.72	53.9	18.6	7.066	11.6	20.79	91.9	31.7	8.9	22.8	41.07
35	36.1	11.2	5.93	5.3	11.07	48.5	16.7	7.066	9.7	20.33	82.6	28.5	8.9	19.6	41.19
40	32.9	10.2	5.93	4.3	10.27	44.2	15.3	7.066	8.2	19.65	75.1	25.9	8.9	17.0	40.91
45	30.2	9.4	5.93	3.5	9.36	40.6	14.0	7.066	7.0	18.79	69.1	23.8	8.9	14.9	40.34
50	28.0	8.7	5.93	2.8	8.35	37.7	13.0	7.066	5.9	17.80	64.0	22.1	8.9	13.2	39.55
55	26.2	8.1	5.93	2.2	7.26	35.1	12.1	7.066	5.1	16.70	59.6	20.6	8.9	11.7	38.57
60	24.6	7.6	5.93	1.7	6.12	32.9	11.4	7.066	4.3	15.50	55.9	19.3	8.9	10.4	37.44
65	23.2	7.2	5.93	1.3	4.92	31.0	10.7	7.066	3.7	14.24	52.6	18.2	8.9	9.3	36.19
70	21.9	6.8	5.93	0.9	3.69	29.4	10.1	7.066	3.1	12.91	49.8	17.2	8.9	8.3	34.83
75	20.8	6.5	5.93	0.5	2.41	27.9	9.6	7.066	2.6	11.53	47.3	16.3	8.9	7.4	33.38
80	19.8	6.2	5.93	0.2	1.11	26.6	9.2	7.066	2.1	10.10	45.0	15.5	8.9	6.6	31.85
85	18.9	5.9	5.93	0.0	-0.23	25.4	8.8	7.066	1.7	8.63	43.0	14.8	8.9	5.9	30.26
90	18.1	5.6	5.93	-0.3	-1.58	24.3	8.4	7.066	1.3	7.12	41.1	14.2	8.9	5.3	28.60
95	17.4	5.4	5.93	-0.5	-2.97	23.3	8.0	7.066	1.0	5.58	39.4	13.6	8.9	4.7	26.89
100	16.7	5.2	5.93	-0.7	-4.36	22.4	7.7	7.066	0.7	4.02	37.9	13.1	8.9	4.2	25.14
105	16.1	5.0	5.93	-0.9	-5.78	21.6	7.5	7.066	0.4	2.42	36.5	12.6	8.9	3.7	23.33
110	15.6	4.8	5.93	-1.1	-7.22	20.8	7.2	7.066	0.1	0.81	35.2	12.2	8.9	3.3	21.50
115	15.0	4.7	5.93	-1.3	-8.66	20.1	6.9	7.066	-0.1	-0.83	34.0	11.7	8.9	2.8	19.62
120	14.6	4.5	5.93	-1.4	-10.12	19.5	6.7	7.066	-0.3	-2.49	32.9	11.4	8.9	2.5	17.71
Max =	12.28					20.93					41.19				

Notes

- 1) Peak flow is equal to the product of 2.78 x C x I x A
- 2) Rainfall Intensity, I = A/(T_c+C)^B
- 3) Release Rate = Min (Release Rate, Peak Flow)
- 4) Storage Rate = Peak Flow - Release Rate
- 5) Storage = Duration x Storage Rate
- 6) Maximum Storage = Max Storage Over Duration

Storage Volumes Roof Area #A11-2 (2 Year, 5 Year and 100 Year Storms)

$C_{AVG} = 0.90$ (dimensionless)

$C_{AVG} = 1.00$

Time Interval = 5 (mins)

Drainage Area = 0.12950 (hectares)

Duration (min)	Release Rate = 5.994 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951, B = 0.810 (I = A/(T _c +C), C = 6.199)					Release Rate = 7.1292 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071, B = 0.814 (I = A/(T _c +C), C = 6.053)					Release Rate = 8.9588 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.69, B = 0.820 (I = A/(T _c +C), C = 6.014)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	54.2	5.99	48.2	0.00	230.5	83.0	7.129	75.8	0.00	398.6	143.5	9.0	134.5	0.00
5	103.6	33.6	5.99	27.6	8.27	141.2	50.8	7.129	43.7	13.11	242.7	87.4	9.0	78.4	23.53
10	76.8	24.9	5.99	18.9	11.34	104.2	37.5	7.129	30.4	18.23	178.6	64.3	9.0	55.3	33.19
15	61.8	20.0	5.99	14.0	12.62	83.6	30.1	7.129	23.0	20.66	142.9	51.4	9.0	42.5	38.24
20	52.0	16.9	5.99	10.9	13.04	70.3	25.3	7.129	18.2	21.79	120.0	43.2	9.0	34.2	41.07
25	45.2	14.6	5.99	8.6	12.96	60.9	21.9	7.129	14.8	22.19	103.8	37.4	9.0	28.4	42.64
30	40.0	13.0	5.99	7.0	12.57	53.9	19.4	7.129	12.3	22.11	91.9	33.1	9.0	24.1	43.41
35	36.1	11.7	5.99	5.7	11.95	48.5	17.5	7.129	10.3	21.71	82.6	29.7	9.0	20.8	43.62
40	32.9	10.6	5.99	4.7	11.17	44.2	15.9	7.129	8.8	21.07	75.1	27.1	9.0	18.1	43.43
45	30.2	9.8	5.99	3.8	10.27	40.6	14.6	7.129	7.5	20.24	69.1	24.9	9.0	15.9	42.93
50	28.0	9.1	5.99	3.1	9.28	37.7	13.6	7.129	6.4	19.28	64.0	23.0	9.0	14.1	42.20
55	26.2	8.5	5.99	2.5	8.20	35.1	12.6	7.129	5.5	18.20	59.6	21.5	9.0	12.5	41.27
60	24.6	8.0	5.99	2.0	7.07	32.9	11.9	7.129	4.7	17.03	55.9	20.1	9.0	11.2	40.19
65	23.2	7.5	5.99	1.5	5.88	31.0	11.2	7.129	4.0	15.78	52.6	19.0	9.0	10.0	38.98
70	21.9	7.1	5.99	1.1	4.65	29.4	10.6	7.129	3.4	14.47	49.8	17.9	9.0	9.0	37.66
75	20.8	6.7	5.99	0.8	3.38	27.9	10.0	7.129	2.9	13.10	47.3	17.0	9.0	8.1	36.24
80	19.8	6.4	5.99	0.4	2.07	26.6	9.6	7.129	2.4	11.68	45.0	16.2	9.0	7.2	34.74
85	18.9	6.1	5.99	0.1	0.74	25.4	9.1	7.129	2.0	10.22	43.0	15.5	9.0	6.5	33.18
90	18.1	5.9	5.99	-0.1	-0.62	24.3	8.7	7.129	1.6	8.72	41.1	14.8	9.0	5.8	31.54
95	17.4	5.6	5.99	-0.4	-2.00	23.3	8.4	7.129	1.3	7.19	39.4	14.2	9.0	5.2	29.86
100	16.7	5.4	5.99	-0.6	-3.41	22.4	8.1	7.129	0.9	5.63	37.9	13.6	9.0	4.7	28.12
105	16.1	5.2	5.99	-0.8	-4.83	21.6	7.8	7.129	0.6	4.04	36.5	13.1	9.0	4.2	26.34
110	15.6	5.0	5.99	-0.9	-6.26	20.8	7.5	7.129	0.4	2.42	35.2	12.7	9.0	3.7	24.52
115	15.0	4.9	5.99	-1.1	-7.72	20.1	7.2	7.129	0.1	0.79	34.0	12.2	9.0	3.3	22.66
120	14.6	4.7	5.99	-1.3	-9.18	19.5	7.0	7.129	-0.1	-0.87	32.9	11.8	9.0	2.9	20.76
Max =	13.04					22.19					43.62				

Notes

- 1) Peak flow is equal to the product of 2.78 x C x I x A
- 2) Rainfall Intensity, I = A/(T_c+C)^B
- 3) Release Rate = Min (Release Rate, Peak Flow)
- 4) Storage Rate = Peak Flow - Release Rate
- 5) Storage = Duration x Storage Rate
- 6) Maximum Storage = Max Storage Over Duration

Storage Volumes Roof Area #A11-3 (2 Year, 5 Year and 100 Year Storms)

$C_{AVG} = 0.90$ (dimensionless)

$C_{AVG} = 1.00$

Time Interval = 5 (mins)

Drainage Area = 0.16807 (hectares)

Duration (min)	Release Rate = 8.303 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951 , B = 0.810 ($I = A/(T_c+C)$), C = 6.199					Release Rate = 9.8925 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071 , B = 0.814 ($I = A/(T_c+C)$), C = 6.053					Release Rate = 12.3657 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.688 , B = 0.820 ($I = A/(T_c+C)$), C = 6.014				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	70.3	8.30	62.0	0.00	230.5	107.7	9.893	97.8	0.00	398.6	186.2	12.4	173.9	0.00
5	103.6	43.6	8.30	35.2	10.57	141.2	66.0	9.893	56.1	16.82	242.7	113.4	12.4	101.0	30.31
10	76.8	32.3	8.30	24.0	14.40	104.2	48.7	9.893	38.8	23.27	178.6	83.4	12.4	71.1	42.64
15	61.8	26.0	8.30	17.7	15.90	83.6	39.0	9.893	29.1	26.23	142.9	66.8	12.4	54.4	48.96
20	52.0	21.9	8.30	13.6	16.29	70.3	32.8	9.893	22.9	27.52	120.0	56.0	12.4	43.7	52.41
25	45.2	19.0	8.30	10.7	16.04	60.9	28.5	9.893	18.6	27.84	103.8	48.5	12.4	36.2	54.23
30	40.0	16.8	8.30	8.5	15.36	53.9	25.2	9.893	15.3	27.55	91.9	42.9	12.4	30.6	55.00
35	36.1	15.2	8.30	6.9	14.41	48.5	22.7	9.893	12.8	26.83	82.6	38.6	12.4	26.2	55.06
40	32.9	13.8	8.30	5.5	13.24	44.2	20.6	9.893	10.8	25.80	75.1	35.1	12.4	22.7	54.59
45	30.2	12.7	8.30	4.4	11.92	40.6	19.0	9.893	9.1	24.54	69.1	32.3	12.4	19.9	53.72
50	28.0	11.8	8.30	3.5	10.47	37.7	17.6	9.893	7.7	23.10	64.0	29.9	12.4	17.5	52.55
55	26.2	11.0	8.30	2.7	8.92	35.1	16.4	9.893	6.5	21.51	59.6	27.9	12.4	15.5	51.12
60	24.6	10.3	8.30	2.0	7.29	32.9	15.4	9.893	5.5	19.80	55.9	26.1	12.4	13.7	49.50
65	23.2	9.7	8.30	1.4	5.59	31.0	14.5	9.893	4.6	17.99	52.6	24.6	12.4	12.2	47.70
70	21.9	9.2	8.30	0.9	3.83	29.4	13.7	9.893	3.8	16.09	49.8	23.3	12.4	10.9	45.77
75	20.8	8.8	8.30	0.4	2.02	27.9	13.0	9.893	3.1	14.12	47.3	22.1	12.4	9.7	43.71
80	19.8	8.3	8.30	0.0	0.17	26.6	12.4	9.893	2.5	12.09	45.0	21.0	12.4	8.7	41.54
85	18.9	8.0	8.30	-0.3	-1.72	25.4	11.9	9.893	2.0	10.00	43.0	20.1	12.4	7.7	39.29
90	18.1	7.6	8.30	-0.7	-3.64	24.3	11.3	9.893	1.5	7.86	41.1	19.2	12.4	6.8	36.95
95	17.4	7.3	8.30	-1.0	-5.59	23.3	10.9	9.893	1.0	5.68	39.4	18.4	12.4	6.1	34.54
100	16.7	7.0	8.30	-1.3	-7.57	22.4	10.5	9.893	0.6	3.46	37.9	17.7	12.4	5.3	32.06
105	16.1	6.8	8.30	-1.5	-9.57	21.6	10.1	9.893	0.2	1.20	36.5	17.1	12.4	4.7	29.53
110	15.6	6.5	8.30	-1.8	-11.59	20.8	9.7	9.893	-0.2	-1.08	35.2	16.4	12.4	4.1	26.94
115	15.0	6.3	8.30	-2.0	-13.63	20.1	9.4	9.893	-0.5	-3.40	34.0	15.9	12.4	3.5	24.30
120	14.6	6.1	8.30	-2.2	-15.69	19.5	9.1	9.893	-0.8	-5.74	32.9	15.4	12.4	3.0	21.63
Max =					16.29					27.84					55.06

Notes

- 1) Peak flow is equal to the product of $2.78 \times C \times I \times A$
- 2) Rainfall Intensity, $I = A/(T_c+C)^B$
- 3) Release Rate = Min (Release Rate, Peak Flow)
- 4) Storage Rate = Peak Flow - Release Rate
- 5) Storage = Duration x Storage Rate
- 6) Maximum Storage = Max Storage Over Duration

Storage Volumes Roof Area #A11-4 (2 Year, 5 Year and 100 Year Storms)

$C_{AVG} = 0.90$ (dimensionless)
 $C_{AVG} = 1.00$
 Time Interval = 5 (mins)
 Drainage Area = 0.19005 (hectares)

Duration (min)	Release Rate = 8.479 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951 , B = 0.810 ($I = A/(T_c+C)$), C = 6.199					Release Rate = 10.0692 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071 , B = 0.814 ($I = A/(T_c+C)$), C = 6.053					Release Rate = 12.6307 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.688 , B = 0.820 ($I = A/(T_c+C)$), C = 6.014				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	79.5	8.48	71.0	0.00	230.5	121.8	10.069	111.7	0.00	398.6	210.6	12.6	198.0	0.00
5	103.6	49.2	8.48	40.8	12.23	141.2	74.6	10.069	64.5	19.36	242.7	128.2	12.6	115.6	34.68
10	76.8	36.5	8.48	28.0	16.83	104.2	55.0	10.069	45.0	26.99	178.6	94.3	12.6	81.7	49.03
15	61.8	29.4	8.48	20.9	18.80	83.6	44.1	10.069	34.1	30.67	142.9	75.5	12.6	62.9	56.58
20	52.0	24.7	8.48	16.3	19.51	70.3	37.1	10.069	27.0	32.46	120.0	63.4	12.6	50.7	60.89
25	45.2	21.5	8.48	13.0	19.50	60.9	32.2	10.069	22.1	33.16	103.8	54.9	12.6	42.2	63.35
30	40.0	19.0	8.48	10.6	19.01	53.9	28.5	10.069	18.4	33.16	91.9	48.5	12.6	35.9	64.63
35	36.1	17.1	8.48	8.7	18.20	48.5	25.6	10.069	15.6	32.69	82.6	43.6	12.6	31.0	65.10
40	32.9	15.6	8.48	7.1	17.15	44.2	23.3	10.069	13.3	31.86	75.1	39.7	12.6	27.1	64.97
45	30.2	14.4	8.48	5.9	15.93	40.6	21.5	10.069	11.4	30.77	69.1	36.5	12.6	23.9	64.40
50	28.0	13.3	8.48	4.9	14.56	37.7	19.9	10.069	9.8	29.47	64.0	33.8	12.6	21.2	63.48
55	26.2	12.4	8.48	4.0	13.08	35.1	18.6	10.069	8.5	28.01	59.6	31.5	12.6	18.9	62.27
60	24.6	11.7	8.48	3.2	11.51	32.9	17.4	10.069	7.3	26.41	55.9	29.5	12.6	16.9	60.84
65	23.2	11.0	8.48	2.5	9.86	31.0	16.4	10.069	6.3	24.70	52.6	27.8	12.6	15.2	59.22
70	21.9	10.4	8.48	1.9	8.15	29.4	15.5	10.069	5.4	22.89	49.8	26.3	12.6	13.7	57.44
75	20.8	9.9	8.48	1.4	6.38	27.9	14.7	10.069	4.7	20.99	47.3	25.0	12.6	12.3	55.51
80	19.8	9.4	8.48	0.9	4.56	26.6	14.0	10.069	4.0	19.03	45.0	23.8	12.6	11.1	53.47
85	18.9	9.0	8.48	0.5	2.70	25.4	13.4	10.069	3.3	17.00	43.0	22.7	12.6	10.1	51.32
90	18.1	8.6	8.48	0.1	0.80	24.3	12.8	10.069	2.8	14.92	41.1	21.7	12.6	9.1	49.09
95	17.4	8.3	8.48	-0.2	-1.14	23.3	12.3	10.069	2.2	12.79	39.4	20.8	12.6	8.2	46.76
100	16.7	8.0	8.48	-0.5	-3.10	22.4	11.8	10.069	1.8	10.62	37.9	20.0	12.6	7.4	44.37
105	16.1	7.7	8.48	-0.8	-5.09	21.6	11.4	10.069	1.3	8.40	36.5	19.3	12.6	6.7	41.91
110	15.6	7.4	8.48	-1.1	-7.10	20.8	11.0	10.069	0.9	6.15	35.2	18.6	12.6	6.0	39.39
115	15.0	7.2	8.48	-1.3	-9.14	20.1	10.6	10.069	0.6	3.87	34.0	18.0	12.6	5.3	36.82
120	14.6	6.9	8.48	-1.6	-11.20	19.5	10.3	10.069	0.2	1.56	32.9	17.4	12.6	4.7	34.19
Max =					19.51					33.16					65.10

- Notes**
- 1) Peak flow is equal to the product of $2.78 \times C \times I \times A$
 - 2) Rainfall Intensity, $I = A/(T_c+C)^B$
 - 3) Release Rate = Min (Release Rate, Peak Flow)
 - 4) Storage Rate = Peak Flow - Release Rate
 - 5) Storage = Duration x Storage Rate
 - 6) Maximum Storage = Max Storage Over Duration

Storage Volumes Roof Area #A11-5 (2 Year, 5 Year and 100 Year Storms)

$C_{AVG} = 0.90$ (dimensionless)

$C_{AVG} = 1.00$

Time Interval = 5 (mins)

Drainage Area = 0.20230 (hectares)

Duration (min)	Release Rate = 8.568 (L/sec) Return Period = 2 (years) IDF Parameters, A = 732.951 , B = 0.810 ($I = A/(T_c+C)$), C = 6.199					Release Rate = 10.1575 (L/sec) Return Period = 5 (years) IDF Parameters, A = 998.071 , B = 0.814 ($I = A/(T_c+C)$), C = 6.053					Release Rate = 12.7190 (L/sec) Return Period = 100 (years) IDF Parameters, A = 1735.688 , B = 0.820 ($I = A/(T_c+C)$), C = 6.014				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	84.6	8.57	76.1	0.00	230.5	129.6	10.158	119.5	0.00	398.6	224.2	12.7	211.5	0.00
5	103.6	52.4	8.57	43.9	13.16	141.2	79.4	10.158	69.2	20.77	242.7	136.5	12.7	123.8	37.13
10	76.8	38.9	8.57	30.3	18.18	104.2	58.6	10.158	48.4	29.06	178.6	100.4	12.7	87.7	52.62
15	61.8	31.3	8.57	22.7	20.43	83.6	47.0	10.158	36.8	33.15	142.9	80.4	12.7	67.6	60.88
20	52.0	26.3	8.57	17.8	21.32	70.3	39.5	10.158	29.4	35.22	120.0	67.5	12.7	54.7	65.69
25	45.2	22.9	8.57	14.3	21.44	60.9	34.2	10.158	24.1	36.14	103.8	58.4	12.7	45.7	68.53
30	40.0	20.3	8.57	11.7	21.06	53.9	30.3	10.158	20.2	36.31	91.9	51.7	12.7	38.9	70.11
35	36.1	18.3	8.57	9.7	20.34	48.5	27.3	10.158	17.1	35.97	82.6	46.4	12.7	33.7	70.82
40	32.9	16.6	8.57	8.1	19.36	44.2	24.8	10.158	14.7	35.26	75.1	42.3	12.7	29.5	70.90
45	30.2	15.3	8.57	6.7	18.19	40.6	22.8	10.158	12.7	34.27	69.1	38.8	12.7	26.1	70.51
50	28.0	14.2	8.57	5.6	16.88	37.7	21.2	10.158	11.0	33.06	64.0	36.0	12.7	23.2	69.75
55	26.2	13.2	8.57	4.7	15.44	35.1	19.8	10.158	9.6	31.67	59.6	33.5	12.7	20.8	68.69
60	24.6	12.4	8.57	3.9	13.91	32.9	18.5	10.158	8.4	30.13	55.9	31.4	12.7	18.7	67.38
65	23.2	11.7	8.57	3.2	12.29	31.0	17.5	10.158	7.3	28.48	52.6	29.6	12.7	16.9	65.87
70	21.9	11.1	8.57	2.5	10.60	29.4	16.5	10.158	6.4	26.72	49.8	28.0	12.7	15.3	64.19
75	20.8	10.5	8.57	2.0	8.85	27.9	15.7	10.158	5.5	24.87	47.3	26.6	12.7	13.9	62.36
80	19.8	10.0	8.57	1.5	7.05	26.6	14.9	10.158	4.8	22.95	45.0	25.3	12.7	12.6	60.40
85	18.9	9.6	8.57	1.0	5.21	25.4	14.3	10.158	4.1	20.96	43.0	24.2	12.7	11.4	58.34
90	18.1	9.2	8.57	0.6	3.32	24.3	13.7	10.158	3.5	18.91	41.1	23.1	12.7	10.4	56.17
95	17.4	8.8	8.57	0.2	1.40	23.3	13.1	10.158	2.9	16.81	39.4	22.2	12.7	9.5	53.92
100	16.7	8.5	8.57	-0.1	-0.55	22.4	12.6	10.158	2.4	14.67	37.9	21.3	12.7	8.6	51.59
105	16.1	8.2	8.57	-0.4	-2.53	21.6	12.1	10.158	2.0	12.48	36.5	20.5	12.7	7.8	49.19
110	15.6	7.9	8.57	-0.7	-4.54	20.8	11.7	10.158	1.6	10.25	35.2	19.8	12.7	7.1	46.72
115	15.0	7.6	8.57	-1.0	-6.57	20.1	11.3	10.158	1.2	7.99	34.0	19.1	12.7	6.4	44.20
120	14.6	7.4	8.57	-1.2	-8.62	19.5	10.9	10.158	0.8	5.70	32.9	18.5	12.7	5.8	41.63
Max =	21.44					36.31					70.90				

Notes

- 1) Peak flow is equal to the product of $2.78 \times C \times I \times A$
- 2) Rainfall Intensity, $I = A/(T_c+C)^B$
- 3) Release Rate = Min (Release Rate, Peak Flow)
- 4) Storage Rate = Peak Flow - Release Rate
- 5) Storage = Duration x Storage Rate
- 6) Maximum Storage = Max Storage Over Duration

Table D5 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A1 $C_{AVG} = \frac{0.65}{(2\text{-yr})}$ $C_{AVG} = \frac{0.65}{(5\text{-yr})}$ $C_{AVG} = \frac{0.81}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.1217</u> (hectares)																	
Actual Release Rate (L/sec) = <u>37.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>37.00</u>																	
Duration (mins)	Release Rate = <u>16.82</u> (L/sec) Return Period = _____ (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>22.82</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>37.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)						
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)		
0	167.2	36.6	16.8	19.8	0.0	230.5	50.5	22.8	27.7	0.0	398.6	109.1	37.0	72.1	0.0		
5	103.6	22.7	16.8	5.9	1.8	141.2	30.9	22.8	8.1	2.4	242.7	66.4	37.0	29.4	8.8		
10	76.8	16.8	16.8	0.0	0.0	104.2	22.8	22.8	0.0	0.0	178.6	48.9	37.0	11.9	7.1		
15	61.8	13.5	16.8	-3.3	-3.0	83.6	18.3	22.8	-4.5	-4.1	142.9	39.1	37.0	2.1	1.9		
20	52.0	11.4	16.8	-5.4	-6.5	70.3	15.4	22.8	-7.4	-8.9	120.0	32.8	37.0	-4.2	-5.0		
25	45.2	9.9	16.8	-6.9	-10.4	60.9	13.3	22.8	-9.5	-14.2	103.8	28.4	37.0	-8.6	-12.9		
30	40.0	8.8	16.8	-8.1	-14.5	53.9	11.8	22.8	-11.0	-19.8	91.9	25.2	37.0	-11.8	-21.3		
35	36.1	7.9	16.8	-8.9	-18.7	48.5	10.6	22.8	-12.2	-25.6	82.6	22.6	37.0	-14.4	-30.2		
40	32.9	7.2	16.8	-9.6	-23.1	44.2	9.7	22.8	-13.1	-31.5	75.1	20.6	37.0	-16.4	-39.4		
45	30.2	6.6	16.8	-10.2	-27.5	40.6	8.9	22.8	-13.9	-37.6	69.1	18.9	37.0	-18.1	-48.9		
50	28.0	6.1	16.8	-10.7	-32.0	37.7	8.2	22.8	-14.6	-43.7	64.0	17.5	37.0	-19.5	-58.5		
55	26.2	5.7	16.8	-11.1	-36.6	35.1	7.7	22.8	-15.1	-49.9	59.6	16.3	37.0	-20.7	-68.2		
60	24.6	5.4	16.8	-11.4	-41.2	32.9	7.2	22.8	-15.6	-56.2	55.9	15.3	37.0	-21.7	-78.1		
65	23.2	5.1	16.8	-11.8	-45.8	31.0	6.8	22.8	-16.0	-62.5	52.6	14.4	37.0	-22.6	-88.1		
70	21.9	4.8	16.8	-12.0	-50.5	29.4	6.4	22.8	-16.4	-68.8	49.8	13.6	37.0	-23.4	-98.1		
75	20.8	4.6	16.8	-12.3	-55.2	27.9	6.1	22.8	-16.7	-75.2	47.3	12.9	37.0	-24.1	-108.3		
80	19.8	4.3	16.8	-12.5	-59.9	26.6	5.8	22.8	-17.0	-81.6	45.0	12.3	37.0	-24.7	-118.5		
85	18.9	4.1	16.8	-12.7	-64.6	25.4	5.6	22.8	-17.3	-88.0	43.0	11.8	37.0	-25.2	-128.7		
90	18.1	4.0	16.8	-12.8	-69.4	24.3	5.3	22.8	-17.5	-94.5	41.1	11.3	37.0	-25.7	-139.0		
95	17.4	3.8	16.8	-13.0	-74.1	23.3	5.1	22.8	-17.7	-101.0	39.4	10.8	37.0	-26.2	-149.4		
100	16.7	3.7	16.8	-13.2	-78.9	22.4	4.9	22.8	-17.9	-107.5	37.9	10.4	37.0	-26.6	-159.7		
Max =					1.8						2.4						8.8
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^{0.820} 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																	
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																	

Table D6 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A2 $C_{AVG} = \frac{0.79}{(2\text{-yr})}$ $C_{AVG} = \frac{0.79}{(5\text{-yr})}$ $C_{AVG} = \frac{0.98}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.0869</u> (hectares)															
Actual Release Rate (L/sec) = <u>35.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>35.00</u>															
Duration (mins)	Release Rate = <u>14.63</u> (L/sec) Return Period = _____ (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>19.84</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>35.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	31.8	14.6	17.2	0.0	230.5	43.9	19.8	24.0	0.0	398.6	94.9	35.0	59.9	0.0
5	103.6	19.7	14.6	5.1	1.5	141.2	26.9	19.8	7.0	2.1	242.7	57.8	35.0	22.8	6.8
10	76.8	14.6	14.6	0.0	0.0	104.2	19.8	19.8	0.0	0.0	178.6	42.5	35.0	7.5	4.5
15	61.8	11.8	14.6	-2.9	-2.6	83.6	15.9	19.8	-3.9	-3.5	142.9	34.0	35.0	-1.0	-0.9
20	52.0	9.9	14.6	-4.7	-5.7	70.3	13.4	19.8	-6.5	-7.8	120.0	28.6	35.0	-6.4	-7.7
25	45.2	8.6	14.6	-6.0	-9.0	60.9	11.6	19.8	-8.2	-12.4	103.8	24.7	35.0	-10.3	-15.4
30	40.0	7.6	14.6	-7.0	-12.6	53.9	10.3	19.8	-9.6	-17.2	91.9	21.9	35.0	-13.1	-23.6
35	36.1	6.9	14.6	-7.8	-16.3	48.5	9.2	19.8	-10.6	-22.3	82.6	19.7	35.0	-15.3	-32.2
40	32.9	6.3	14.6	-8.4	-20.1	44.2	8.4	19.8	-11.4	-27.4	75.1	17.9	35.0	-17.1	-41.1
45	30.2	5.8	14.6	-8.9	-23.9	40.6	7.7	19.8	-12.1	-32.7	69.1	16.4	35.0	-18.6	-50.1
50	28.0	5.3	14.6	-9.3	-27.9	37.7	7.2	19.8	-12.7	-38.0	64.0	15.2	35.0	-19.8	-59.3
55	26.2	5.0	14.6	-9.6	-31.8	35.1	6.7	19.8	-13.2	-43.4	59.6	14.2	35.0	-20.8	-68.7
60	24.6	4.7	14.6	-9.9	-35.8	32.9	6.3	19.8	-13.6	-48.8	55.9	13.3	35.0	-21.7	-78.1
65	23.2	4.4	14.6	-10.2	-39.8	31.0	5.9	19.8	-13.9	-54.3	52.6	12.5	35.0	-22.5	-87.6
70	21.9	4.2	14.6	-10.5	-43.9	29.4	5.6	19.8	-14.2	-59.8	49.8	11.9	35.0	-23.1	-97.2
75	20.8	4.0	14.6	-10.7	-48.0	27.9	5.3	19.8	-14.5	-65.4	47.3	11.2	35.0	-23.8	-106.9
80	19.8	3.8	14.6	-10.8	-52.1	26.6	5.1	19.8	-14.8	-71.0	45.0	10.7	35.0	-24.3	-116.6
85	18.9	3.6	14.6	-11.0	-56.2	25.4	4.8	19.8	-15.0	-76.6	43.0	10.2	35.0	-24.8	-126.4
90	18.1	3.5	14.6	-11.2	-60.3	24.3	4.6	19.8	-15.2	-82.2	41.1	9.8	35.0	-25.2	-136.2
95	17.4	3.3	14.6	-11.3	-64.5	23.3	4.4	19.8	-15.4	-87.8	39.4	9.4	35.0	-25.6	-146.0
100	16.7	3.2	14.6	-11.4	-68.6	22.4	4.3	19.8	-15.6	-93.4	37.9	9.0	35.0	-26.0	-155.9
Max =					1.5	2.1					6.8				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^B 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa															
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}															

Table D7 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A3 $C_{AVG} = \frac{0.77}{(2\text{-yr})}$ $C_{AVG} = \frac{0.77}{(5\text{-yr})}$ $C_{AVG} = \frac{0.97}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.0837</u> (hectares)																	
Actual Release Rate (L/sec) = <u>33.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>33.00</u>																	
Duration (mins)	Release Rate = <u>13.83</u> (L/sec) Return Period = _____ (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>18.76</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>33.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)						
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)		
0	167.2	30.1	13.8	16.3	0.0	230.5	41.5	18.8	22.7	0.0	398.6	89.7	33.0	56.7	0.0		
5	103.6	18.6	13.8	4.8	1.4	141.2	25.4	18.8	6.7	2.0	242.7	54.6	33.0	21.6	6.5		
10	76.8	13.8	13.8	0.0	0.0	104.2	18.8	18.8	0.0	0.0	178.6	40.2	33.0	7.2	4.3		
15	61.8	11.1	13.8	-2.7	-2.4	83.6	15.0	18.8	-3.7	-3.3	142.9	32.2	33.0	-0.8	-0.8		
20	52.0	9.4	13.8	-4.5	-5.4	70.3	12.6	18.8	-6.1	-7.3	120.0	27.0	33.0	-6.0	-7.2		
25	45.2	8.1	13.8	-5.7	-8.5	60.9	11.0	18.8	-7.8	-11.7	103.8	23.4	33.0	-9.6	-14.5		
30	40.0	7.2	13.8	-6.6	-11.9	53.9	9.7	18.8	-9.0	-16.3	91.9	20.7	33.0	-12.3	-22.2		
35	36.1	6.5	13.8	-7.3	-15.4	48.5	8.7	18.8	-10.0	-21.0	82.6	18.6	33.0	-14.4	-30.3		
40	32.9	5.9	13.8	-7.9	-19.0	44.2	8.0	18.8	-10.8	-25.9	75.1	16.9	33.0	-16.1	-38.6		
45	30.2	5.4	13.8	-8.4	-22.6	40.6	7.3	18.8	-11.4	-30.9	69.1	15.5	33.0	-17.5	-47.2		
50	28.0	5.0	13.8	-8.8	-26.3	37.7	6.8	18.8	-12.0	-35.9	64.0	14.4	33.0	-18.6	-55.8		
55	26.2	4.7	13.8	-9.1	-30.1	35.1	6.3	18.8	-12.4	-41.0	59.6	13.4	33.0	-19.6	-64.6		
60	24.6	4.4	13.8	-9.4	-33.9	32.9	5.9	18.8	-12.8	-46.2	55.9	12.6	33.0	-20.4	-73.5		
65	23.2	4.2	13.8	-9.7	-37.7	31.0	5.6	18.8	-13.2	-51.4	52.6	11.8	33.0	-21.2	-82.5		
70	21.9	3.9	13.8	-9.9	-41.5	29.4	5.3	18.8	-13.5	-56.6	49.8	11.2	33.0	-21.8	-91.5		
75	20.8	3.7	13.8	-10.1	-45.4	27.9	5.0	18.8	-13.7	-61.8	47.3	10.6	33.0	-22.4	-100.7		
80	19.8	3.6	13.8	-10.3	-49.2	26.6	4.8	18.8	-14.0	-67.1	45.0	10.1	33.0	-22.9	-109.8		
85	18.9	3.4	13.8	-10.4	-53.1	25.4	4.6	18.8	-14.2	-72.4	43.0	9.7	33.0	-23.3	-119.0		
90	18.1	3.3	13.8	-10.6	-57.0	24.3	4.4	18.8	-14.4	-77.7	41.1	9.3	33.0	-23.7	-128.2		
95	17.4	3.1	13.8	-10.7	-60.9	23.3	4.2	18.8	-14.6	-83.0	39.4	8.9	33.0	-24.1	-137.5		
100	16.7	3.0	13.8	-10.8	-64.9	22.4	4.0	18.8	-14.7	-88.3	37.9	8.5	33.0	-24.5	-146.8		
Max =					1.4						2.0						6.5
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^B 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																	
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																	

Table D8 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A4 $C_{AVG} = \frac{0.79}{(2\text{-yr})}$ $C_{AVG} = \frac{0.79}{(5\text{-yr})}$ $C_{AVG} = \frac{0.98}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.0779</u> (hectares)																
Actual Release Rate (L/sec) = <u>30.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>30.00</u>																
Duration (mins)	Release Rate = <u>13.07</u> (L/sec) Return Period = _____ (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>17.73</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>30.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)					
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	
0	167.2	28.5	13.1	15.4	0.0	230.5	39.2	17.7	21.5	0.0	398.6	84.8	30.0	54.8	0.0	
5	103.6	17.6	13.1	4.6	1.4	141.2	24.0	17.7	6.3	1.9	242.7	51.6	30.0	21.6	6.5	
10	76.8	13.1	13.1	0.0	0.0	104.2	17.7	17.7	0.0	0.0	178.6	38.0	30.0	8.0	4.8	
15	61.8	10.5	13.1	-2.6	-2.3	83.6	14.2	17.7	-3.5	-3.2	142.9	30.4	30.0	0.4	0.4	
20	52.0	8.9	13.1	-4.2	-5.1	70.3	12.0	17.7	-5.8	-6.9	120.0	25.5	30.0	-4.5	-5.4	
25	45.2	7.7	13.1	-5.4	-8.1	60.9	10.4	17.7	-7.4	-11.1	103.8	22.1	30.0	-7.9	-11.9	
30	40.0	6.8	13.1	-6.3	-11.3	53.9	9.2	17.7	-8.6	-15.4	91.9	19.5	30.0	-10.5	-18.8	
35	36.1	6.1	13.1	-6.9	-14.6	48.5	8.3	17.7	-9.5	-19.9	82.6	17.6	30.0	-12.4	-26.1	
40	32.9	5.6	13.1	-7.5	-17.9	44.2	7.5	17.7	-10.2	-24.5	75.1	16.0	30.0	-14.0	-33.6	
45	30.2	5.1	13.1	-7.9	-21.4	40.6	6.9	17.7	-10.8	-29.2	69.1	14.7	30.0	-15.3	-41.3	
50	28.0	4.8	13.1	-8.3	-24.9	37.7	6.4	17.7	-11.3	-34.0	64.0	13.6	30.0	-16.4	-49.2	
55	26.2	4.5	13.1	-8.6	-28.4	35.1	6.0	17.7	-11.8	-38.8	59.6	12.7	30.0	-17.3	-57.1	
60	24.6	4.2	13.1	-8.9	-32.0	32.9	5.6	17.7	-12.1	-43.7	55.9	11.9	30.0	-18.1	-65.2	
65	23.2	3.9	13.1	-9.1	-35.6	31.0	5.3	17.7	-12.5	-48.6	52.6	11.2	30.0	-18.8	-73.3	
70	21.9	3.7	13.1	-9.3	-39.2	29.4	5.0	17.7	-12.7	-53.5	49.8	10.6	30.0	-19.4	-81.5	
75	20.8	3.5	13.1	-9.5	-42.9	27.9	4.7	17.7	-13.0	-58.4	47.3	10.1	30.0	-19.9	-89.8	
80	19.8	3.4	13.1	-9.7	-46.5	26.6	4.5	17.7	-13.2	-63.4	45.0	9.6	30.0	-20.4	-98.1	
85	18.9	3.2	13.1	-9.8	-50.2	25.4	4.3	17.7	-13.4	-68.4	43.0	9.1	30.0	-20.9	-106.4	
90	18.1	3.1	13.1	-10.0	-53.9	24.3	4.1	17.7	-13.6	-73.4	41.1	8.7	30.0	-21.3	-114.8	
95	17.4	3.0	13.1	-10.1	-57.6	23.3	4.0	17.7	-13.8	-78.5	39.4	8.4	30.0	-21.6	-123.2	
100	16.7	2.9	13.1	-10.2	-61.3	22.4	3.8	17.7	-13.9	-83.5	37.9	8.1	30.0	-21.9	-131.6	
Max =					1.4						1.9	6.5				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^{0.820} 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																

Table D9 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A5-1 $C_{AVG} = \frac{0.86}{(2\text{-yr})}$ $C_{AVG} = \frac{0.86}{(5\text{-yr})}$ $C_{AVG} = \frac{1.00}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.1519</u> (hectares)																
Actual Release Rate (L/sec) = <u>52.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>52.00</u>																
Duration (mins)	Release Rate = <u>27.89</u> (L/sec) Return Period = _____ (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>37.83</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>52.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)					
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	
0	167.2	60.7	27.9	32.8	0.0	230.5	83.7	37.8	45.9	0.0	398.6	168.4	52.0	116.4	0.0	
5	103.6	37.6	27.9	9.7	2.9	141.2	51.3	37.8	13.4	4.0	242.7	102.5	52.0	50.5	15.2	
10	76.8	27.9	27.9	0.0	0.0	104.2	37.8	37.8	0.0	0.0	178.6	75.4	52.0	23.4	14.1	
15	61.8	22.4	27.9	-5.5	-4.9	83.6	30.3	37.8	-7.5	-6.7	142.9	60.4	52.0	8.4	7.5	
20	52.0	18.9	27.9	-9.0	-10.8	70.3	25.5	37.8	-12.3	-14.8	120.0	50.7	52.0	-1.3	-1.6	
25	45.2	16.4	27.9	-11.5	-17.2	60.9	22.1	37.8	-15.7	-23.6	103.8	43.9	52.0	-8.1	-12.2	
30	40.0	14.5	27.9	-13.3	-24.0	53.9	19.6	37.8	-18.3	-32.9	91.9	38.8	52.0	-13.2	-23.7	
35	36.1	13.1	27.9	-14.8	-31.1	48.5	17.6	37.8	-20.2	-42.5	82.6	34.9	52.0	-17.1	-35.9	
40	32.9	11.9	27.9	-16.0	-38.3	44.2	16.0	37.8	-21.8	-52.3	75.1	31.7	52.0	-20.3	-48.6	
45	30.2	11.0	27.9	-16.9	-45.7	40.6	14.8	37.8	-23.1	-62.3	69.1	29.2	52.0	-22.8	-61.6	
50	28.0	10.2	27.9	-17.7	-53.1	37.7	13.7	37.8	-24.2	-72.5	64.0	27.0	52.0	-25.0	-75.0	
55	26.2	9.5	27.9	-18.4	-60.7	35.1	12.8	37.8	-25.1	-82.8	59.6	25.2	52.0	-26.8	-88.5	
60	24.6	8.9	27.9	-19.0	-68.3	32.9	12.0	37.8	-25.9	-93.1	55.9	23.6	52.0	-28.4	-102.2	
65	23.2	8.4	27.9	-19.5	-76.0	31.0	11.3	37.8	-26.6	-103.6	52.6	22.2	52.0	-29.8	-116.1	
70	21.9	8.0	27.9	-19.9	-83.7	29.4	10.7	37.8	-27.2	-114.1	49.8	21.0	52.0	-31.0	-130.1	
75	20.8	7.6	27.9	-20.3	-91.5	27.9	10.1	37.8	-27.7	-124.7	47.3	20.0	52.0	-32.0	-144.2	
80	19.8	7.2	27.9	-20.7	-99.3	26.6	9.6	37.8	-28.2	-135.3	45.0	19.0	52.0	-33.0	-158.4	
85	18.9	6.9	27.9	-21.0	-107.1	25.4	9.2	37.8	-28.6	-146.0	43.0	18.1	52.0	-33.9	-172.7	
90	18.1	6.6	27.9	-21.3	-115.0	24.3	8.8	37.8	-29.0	-156.7	41.1	17.4	52.0	-34.6	-187.0	
95	17.4	6.3	27.9	-21.6	-122.9	23.3	8.5	37.8	-29.4	-167.4	39.4	16.7	52.0	-35.3	-201.5	
100	16.7	6.1	27.9	-21.8	-130.8	22.4	8.1	37.8	-29.7	-178.2	37.9	16.0	52.0	-36.0	-215.9	
Max =					2.9						4.0	15.2				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^B 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																

Table D10 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A5-2 $C_{AVG} = \frac{0.88}{(2\text{-yr})}$ $C_{AVG} = \frac{0.88}{(5\text{-yr})}$ $C_{AVG} = \frac{1.00}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.0764</u> (hectares)																
Actual Release Rate (L/sec) = <u>30.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>30.00</u>																
Duration (mins)	Release Rate = <u>14.32</u> (L/sec) Return Period = _____ (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>19.42</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>30.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)					
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	
0	167.2	31.2	14.3	16.9	0.0	230.5	43.0	19.4	23.5	0.0	398.6	84.6	30.0	54.6	0.0	
5	103.6	19.3	14.3	5.0	1.5	141.2	26.3	19.4	6.9	2.1	242.7	51.5	30.0	21.5	6.5	
10	76.8	14.3	14.3	0.0	0.0	104.2	19.4	19.4	0.0	0.0	178.6	37.9	30.0	7.9	4.7	
15	61.8	11.5	14.3	-2.8	-2.5	83.6	15.6	19.4	-3.8	-3.5	142.9	30.3	30.0	0.3	0.3	
20	52.0	9.7	14.3	-4.6	-5.5	70.3	13.1	19.4	-6.3	-7.6	120.0	25.5	30.0	-4.5	-5.4	
25	45.2	8.4	14.3	-5.9	-8.8	60.9	11.4	19.4	-8.1	-12.1	103.8	22.1	30.0	-7.9	-11.9	
30	40.0	7.5	14.3	-6.9	-12.3	53.9	10.1	19.4	-9.4	-16.9	91.9	19.5	30.0	-10.5	-18.9	
35	36.1	6.7	14.3	-7.6	-16.0	48.5	9.0	19.4	-10.4	-21.8	82.6	17.5	30.0	-12.5	-26.2	
40	32.9	6.1	14.3	-8.2	-19.7	44.2	8.2	19.4	-11.2	-26.9	75.1	16.0	30.0	-14.0	-33.7	
45	30.2	5.6	14.3	-8.7	-23.4	40.6	7.6	19.4	-11.9	-32.0	69.1	14.7	30.0	-15.3	-41.4	
50	28.0	5.2	14.3	-9.1	-27.3	37.7	7.0	19.4	-12.4	-37.2	64.0	13.6	30.0	-16.4	-49.3	
55	26.2	4.9	14.3	-9.4	-31.2	35.1	6.5	19.4	-12.9	-42.5	59.6	12.7	30.0	-17.3	-57.2	
60	24.6	4.6	14.3	-9.7	-35.1	32.9	6.1	19.4	-13.3	-47.8	55.9	11.9	30.0	-18.1	-65.3	
65	23.2	4.3	14.3	-10.0	-39.0	31.0	5.8	19.4	-13.6	-53.2	52.6	11.2	30.0	-18.8	-73.4	
70	21.9	4.1	14.3	-10.2	-43.0	29.4	5.5	19.4	-13.9	-58.6	49.8	10.6	30.0	-19.4	-81.6	
75	20.8	3.9	14.3	-10.4	-47.0	27.9	5.2	19.4	-14.2	-64.0	47.3	10.0	30.0	-20.0	-89.8	
80	19.8	3.7	14.3	-10.6	-51.0	26.6	5.0	19.4	-14.5	-69.5	45.0	9.6	30.0	-20.4	-98.1	
85	18.9	3.5	14.3	-10.8	-55.0	25.4	4.7	19.4	-14.7	-74.9	43.0	9.1	30.0	-20.9	-106.5	
90	18.1	3.4	14.3	-10.9	-59.1	24.3	4.5	19.4	-14.9	-80.4	41.1	8.7	30.0	-21.3	-114.9	
95	17.4	3.2	14.3	-11.1	-63.1	23.3	4.3	19.4	-15.1	-86.0	39.4	8.4	30.0	-21.6	-123.3	
100	16.7	3.1	14.3	-11.2	-67.2	22.4	4.2	19.4	-15.2	-91.5	37.9	8.0	30.0	-22.0	-131.7	
Max =					1.5						2.1	6.5				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^B 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																

Table D11 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A6-1 $C_{AVG} = \frac{0.90}{(2\text{-yr})}$ $C_{AVG} = \frac{0.90}{(5\text{-yr})}$ $C_{AVG} = \frac{1.00}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.1600</u> (hectares)																
Actual Release Rate (L/sec) = <u>70.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>70.00</u>																
Duration (mins)	Release Rate = <u>30.74</u> (L/sec) Return Period = <u>2</u> (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>41.71</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>70.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)					
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	
0	167.2	66.9	30.7	36.2	0.0	230.5	92.3	41.7	50.6	0.0	398.6	177.3	70.0	107.3	0.0	
5	103.6	41.5	30.7	10.7	3.2	141.2	56.5	41.7	14.8	4.4	242.7	107.9	70.0	37.9	11.4	
10	76.8	30.7	30.7	0.0	0.0	104.2	41.7	41.7	0.0	0.0	178.6	79.4	70.0	9.4	5.6	
15	61.8	24.7	30.7	-6.0	-5.4	83.6	33.4	41.7	-8.3	-7.4	142.9	63.6	70.0	-6.4	-5.8	
20	52.0	20.8	30.7	-9.9	-11.9	70.3	28.1	41.7	-13.6	-16.3	120.0	53.3	70.0	-16.7	-20.0	
25	45.2	18.1	30.7	-12.7	-19.0	60.9	24.4	41.7	-17.3	-26.0	103.8	46.2	70.0	-23.8	-35.7	
30	40.0	16.0	30.7	-14.7	-26.5	53.9	21.6	41.7	-20.1	-36.2	91.9	40.9	70.0	-29.1	-52.5	
35	36.1	14.4	30.7	-16.3	-34.2	48.5	19.4	41.7	-22.3	-46.8	82.6	36.7	70.0	-33.3	-69.9	
40	32.9	13.2	30.7	-17.6	-42.2	44.2	17.7	41.7	-24.0	-57.6	75.1	33.4	70.0	-36.6	-87.8	
45	30.2	12.1	30.7	-18.6	-50.3	40.6	16.3	41.7	-25.4	-68.7	69.1	30.7	70.0	-39.3	-106.1	
50	28.0	11.2	30.7	-19.5	-58.6	37.7	15.1	41.7	-26.6	-79.9	64.0	28.4	70.0	-41.6	-124.7	
55	26.2	10.5	30.7	-20.3	-66.9	35.1	14.1	41.7	-27.6	-91.2	59.6	26.5	70.0	-43.5	-143.5	
60	24.6	9.8	30.7	-20.9	-75.3	32.9	13.2	41.7	-28.5	-102.7	55.9	24.9	70.0	-45.1	-162.5	
65	23.2	9.3	30.7	-21.5	-83.8	31.0	12.4	41.7	-29.3	-114.2	52.6	23.4	70.0	-46.6	-181.7	
70	21.9	8.8	30.7	-22.0	-92.3	29.4	11.8	41.7	-29.9	-125.8	49.8	22.1	70.0	-47.9	-201.0	
75	20.8	8.3	30.7	-22.4	-100.9	27.9	11.2	41.7	-30.5	-137.4	47.3	21.0	70.0	-49.0	-220.4	
80	19.8	7.9	30.7	-22.8	-109.5	26.6	10.6	41.7	-31.1	-149.2	45.0	20.0	70.0	-50.0	-240.0	
85	18.9	7.6	30.7	-23.2	-118.1	25.4	10.2	41.7	-31.6	-160.9	43.0	19.1	70.0	-50.9	-259.6	
90	18.1	7.3	30.7	-23.5	-126.8	24.3	9.7	41.7	-32.0	-172.7	41.1	18.3	70.0	-51.7	-279.3	
95	17.4	7.0	30.7	-23.8	-135.5	23.3	9.3	41.7	-32.4	-184.5	39.4	17.5	70.0	-52.5	-299.0	
100	16.7	6.7	30.7	-24.0	-144.2	22.4	9.0	41.7	-32.7	-196.4	37.9	16.9	70.0	-53.1	-318.9	
Max =					3.2						4.4	11.4				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^B 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																

Table D12 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A6-2 $C_{AVG} = \frac{0.90}{(2\text{-yr})}$ $C_{AVG} = \frac{0.90}{(5\text{-yr})}$ $C_{AVG} = \frac{1.00}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.0523</u> (hectares)																
Actual Release Rate (L/sec) = <u>15.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>15.00</u>																
Duration (mins)	Release Rate = <u>10.06</u> (L/sec) Return Period = <u>2</u> (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>13.64</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>15.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)					
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	
0	167.2	21.9	10.1	11.8	0.0	230.5	30.2	13.6	16.5	0.0	398.6	58.0	15.0	43.0	0.0	
5	103.6	13.6	10.1	3.5	1.1	141.2	18.5	13.6	4.8	1.5	242.7	35.3	15.0	20.3	6.1	
10	76.8	10.1	10.1	0.0	0.0	104.2	13.6	13.6	0.0	0.0	178.6	26.0	15.0	11.0	6.6	
15	61.8	8.1	10.1	-2.0	-1.8	83.6	10.9	13.6	-2.7	-2.4	142.9	20.8	15.0	5.8	5.2	
20	52.0	6.8	10.1	-3.2	-3.9	70.3	9.2	13.6	-4.4	-5.3	120.0	17.5	15.0	2.5	2.9	
25	45.2	5.9	10.1	-4.1	-6.2	60.9	8.0	13.6	-5.7	-8.5	103.8	15.1	15.0	0.1	0.2	
30	40.0	5.2	10.1	-4.8	-8.7	53.9	7.1	13.6	-6.6	-11.8	91.9	13.4	15.0	-1.6	-2.9	
35	36.1	4.7	10.1	-5.3	-11.2	48.5	6.4	13.6	-7.3	-15.3	82.6	12.0	15.0	-3.0	-6.3	
40	32.9	4.3	10.1	-5.8	-13.8	44.2	5.8	13.6	-7.9	-18.9	75.1	10.9	15.0	-4.1	-9.8	
45	30.2	4.0	10.1	-6.1	-16.5	40.6	5.3	13.6	-8.3	-22.5	69.1	10.0	15.0	-5.0	-13.4	
50	28.0	3.7	10.1	-6.4	-19.2	37.7	4.9	13.6	-8.7	-26.1	64.0	9.3	15.0	-5.7	-17.1	
55	26.2	3.4	10.1	-6.6	-21.9	35.1	4.6	13.6	-9.0	-29.8	59.6	8.7	15.0	-6.3	-20.9	
60	24.6	3.2	10.1	-6.8	-24.6	32.9	4.3	13.6	-9.3	-33.6	55.9	8.1	15.0	-6.9	-24.7	
65	23.2	3.0	10.1	-7.0	-27.4	31.0	4.1	13.6	-9.6	-37.4	52.6	7.7	15.0	-7.3	-28.6	
70	21.9	2.9	10.1	-7.2	-30.2	29.4	3.8	13.6	-9.8	-41.1	49.8	7.2	15.0	-7.8	-32.6	
75	20.8	2.7	10.1	-7.3	-33.0	27.9	3.7	13.6	-10.0	-45.0	47.3	6.9	15.0	-8.1	-36.6	
80	19.8	2.6	10.1	-7.5	-35.8	26.6	3.5	13.6	-10.2	-48.8	45.0	6.5	15.0	-8.5	-40.6	
85	18.9	2.5	10.1	-7.6	-38.6	25.4	3.3	13.6	-10.3	-52.6	43.0	6.2	15.0	-8.8	-44.6	
90	18.1	2.4	10.1	-7.7	-41.5	24.3	3.2	13.6	-10.5	-56.5	41.1	6.0	15.0	-9.0	-48.7	
95	17.4	2.3	10.1	-7.8	-44.3	23.3	3.1	13.6	-10.6	-60.4	39.4	5.7	15.0	-9.3	-52.8	
100	16.7	2.2	10.1	-7.9	-47.2	22.4	2.9	13.6	-10.7	-64.3	37.9	5.5	15.0	-9.5	-56.9	
Max =					1.1						1.5	6.6				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^{0.820} 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa																
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}																

Table D13 Storage Volumes for 2-year, 5-Year and 100-Year Storms (MRM)

Area No: A7A8 $C_{AVG} = \frac{0.63}{(2\text{-yr})}$ $C_{AVG} = \frac{0.63}{(5\text{-yr})}$ $C_{AVG} = \frac{0.78}{(100\text{-yr, Max 1.0})}$ Time Interval = <u>5.00</u> (mins) Drainage Area = <u>0.1904</u> (hectares)															
Actual Release Rate (L/sec) = <u>40.00</u> Percentage of Actual Rate (City of Ottawa requirement) = <u>100%</u> (Set to 50% when U/G storage used) Release Rate Used for Estimation of 100-year Storage (L/sec) = <u>40.00</u>															
Duration (mins)	Release Rate = <u>25.50</u> (L/sec) Return Period = <u>2</u> (years) IDF Parameters, A = <u>733.0</u> , B = <u>0.810</u> (I = A/(T _c +C), C = <u>6.199</u>)					Release Rate = <u>34.59</u> (L/sec) Return Period = <u>5</u> (years) IDF Parameters, A = <u>998.1</u> , B = <u>0.814</u> (I = A/(T _c +C), C = <u>6.053</u>)					Release Rate = <u>40.00</u> (L/sec) Return Period = <u>100</u> (years) IDF Parameters, A = <u>1735.7</u> , B = <u>0.820</u> (I = A/(T _c +C), C = <u>6.014</u>)				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m ³)
0	167.2	55.5	25.5	30.0	0.0	230.5	76.5	34.6	41.9	0.0	398.6	165.4	40.0	125.4	0.0
5	103.6	34.4	25.5	8.9	2.7	141.2	46.9	34.6	12.3	3.7	242.7	100.7	40.0	60.7	18.2
10	76.8	25.5	25.5	0.0	0.0	104.2	34.6	34.6	0.0	0.0	178.6	74.1	40.0	34.1	20.5
15	61.8	20.5	25.5	-5.0	-4.5	83.6	27.7	34.6	-6.9	-6.2	142.9	59.3	40.0	19.3	17.4
20	52.0	17.3	25.5	-8.2	-9.9	70.3	23.3	34.6	-11.3	-13.5	120.0	49.8	40.0	9.8	11.7
25	45.2	15.0	25.5	-10.5	-15.8	60.9	20.2	34.6	-14.4	-21.6	103.8	43.1	40.0	3.1	4.6
30	40.0	13.3	25.5	-12.2	-22.0	53.9	17.9	34.6	-16.7	-30.0	91.9	38.1	40.0	-1.9	-3.4
35	36.1	12.0	25.5	-13.5	-28.4	48.5	16.1	34.6	-18.5	-38.8	82.6	34.3	40.0	-5.7	-12.0
40	32.9	10.9	25.5	-14.6	-35.0	44.2	14.7	34.6	-19.9	-47.8	75.1	31.2	40.0	-8.8	-21.2
45	30.2	10.0	25.5	-15.5	-41.7	40.6	13.5	34.6	-21.1	-57.0	69.1	28.7	40.0	-11.3	-30.6
50	28.0	9.3	25.5	-16.2	-48.6	37.7	12.5	34.6	-22.1	-66.3	64.0	26.5	40.0	-13.5	-40.4
55	26.2	8.7	25.5	-16.8	-55.5	35.1	11.7	34.6	-22.9	-75.7	59.6	24.7	40.0	-15.3	-50.4
60	24.6	8.2	25.5	-17.3	-62.4	32.9	10.9	34.6	-23.7	-85.1	55.9	23.2	40.0	-16.8	-60.5
65	23.2	7.7	25.5	-17.8	-69.5	31.0	10.3	34.6	-24.3	-94.7	52.6	21.8	40.0	-18.2	-70.8
70	21.9	7.3	25.5	-18.2	-76.5	29.4	9.7	34.6	-24.8	-104.3	49.8	20.7	40.0	-19.3	-81.2
75	20.8	6.9	25.5	-18.6	-83.6	27.9	9.3	34.6	-25.3	-114.0	47.3	19.6	40.0	-20.4	-91.8
80	19.8	6.6	25.5	-18.9	-90.8	26.6	8.8	34.6	-25.8	-123.7	45.0	18.7	40.0	-21.3	-102.4
85	18.9	6.3	25.5	-19.2	-98.0	25.4	8.4	34.6	-26.2	-133.4	43.0	17.8	40.0	-22.2	-113.1
90	18.1	6.0	25.5	-19.5	-105.2	24.3	8.1	34.6	-26.5	-143.2	41.1	17.1	40.0	-22.9	-123.9
95	17.4	5.8	25.5	-19.7	-112.4	23.3	7.7	34.6	-26.9	-153.0	39.4	16.4	40.0	-23.6	-134.7
100	16.7	5.6	25.5	-19.9	-119.6	22.4	7.4	34.6	-27.1	-162.9	37.9	15.7	40.0	-24.3	-145.6
Max =	2.7					3.7					20.5				
Notes 1) Peak flow is equal to the product of 2.78 x C x I x A 2) Rainfall Intensity, I = A/(T _c +C) ^B 3) Release Rate = Min (Release Rate, Peak Flow) 4) Storage Rate = Peak Flow - Release Rate 5) Storage = Duration x Storage Rate 6) Maximum Storage = Max Storage Over Duration 7) Parameters a,b,c are for City of Ottawa															
City of Ottawa IDF Data (from SDG002) IDF curve equations (Intensity in mm/hr) 100 year Intensity = 1735.688 / (Time in min + 6.014) ^{0.820} 50 year Intensity = 1569.580 / (Time in min + 6.014) ^{0.820} 25 year Intensity = 1402.884 / (Time in min + 6.018) ^{0.819} 10 year Intensity = 1174.184 / (Time in min + 6.014) ^{0.816} 5 year Intensity = 998.071 / (Time in min + 6.053) ^{0.814} 2 year Intensity = 732.951 / (Time in min + 6.199) ^{0.810}															

Table D14 5-YEAR STORM SEWER CALCULATION SHEET



Return Period Storm = 5 (5-years, 100-years)
 Default Inlet Time= 10 (minutes)
 Manning Coefficient = 0.013 (dimensionless)

LOCATION			AREA (hectares)				FLOW (UNRESTRICTED - RATIONAL METHOD)							SEWER DATA										
Location	From Node	To Node	Area No.	Area (ha)	Σ Area (ha)	Average R	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow (L/sec)	Return Period	Q (L/sec)	Dia (mm) Actual	Dia (mm) Nominal	Type	Slope (%)	Length (m)	Capacity (L/sec)	Velocity (m/s)		Time in Pipe, Tt (min)	Hydraulic Ratios	
																				Vf	Va		Qa/Qf	Va/Vf
	100	200	A7	0.1295	0.130	0.81	0.29	0.29	10.00	104.19	30.48	5.00	30.5	251.46	250	PVC	0.35	50.40	35.7	0.72	0.72	1.17	0.85	1.00
	200	300			0.130			0.29	11.17	98.38		5.00	28.8	251.46	250	PVC	0.45	35.90	40.5	0.81	0.80	0.75	0.71	0.98
	300	400	A8	0.06	0.190	0.23	0.04	0.33	11.92	95.02	3.75	5.00	31.5	251.46	250	PVC	0.45	77.10	40.5	0.81	0.80	1.61	0.78	0.98
	400	600			0.190			0.33	13.54	88.60		5.00	29.4	251.46	250	PVC	0.50	14.30	42.7	0.86	0.81	0.30	0.69	0.94
	BLDG	501	A11	0.814	0.814	0.90	2.04	2.04	10.00	104.19	212.23	5.00	212.2	366.42	375	PVC	2.00	23.00	233.1	2.25	2.25	0.17	0.91	1.00
	501	502			0.814			2.04	10.17	103.30		5.00	210.4	447.87	450	PVC	1.00	3.70	281.5	1.79	1.76	0.04	0.75	0.98
	502	600	A6+A5	0.4406	1.255	0.88	1.08	3.12	10.21	103.12	111.44	5.00	321.5	533	CONC	1.00	57.10	447.8	1.99	1.95	0.49	0.72	0.98	
	800	700	A1+A2+A3	0.292	0.292	0.73	0.59	0.59	10.00	104.19	61.42	5.00	61.4	299.36	300	PVC	0.50	22.51	68.0	0.97	0.97	0.39	0.90	1.00
	700	600	A4	0.087	0.379	0.79	0.19	0.78	10.39	102.19	19.46	5.00	79.7	366.42	375	PVC	0.30	22.51	90.3	0.87	0.87	0.43	0.88	1.00
	600	601						4.23	13.83	87.53		5.00	370.2	610	CONC	0.50	22.51	453.7	1.54	1.50	0.25	0.82	0.98	

TOTALS =

Definitions:
 Q = 2.78*AIR, where
 Q = Peak Flow in Litres per second (L/s)
 A = Watershed Area (hectares)
 I = Rainfall Intensity (mm/h)
 R = Runoff Coefficients (dimensionless)

Notes:
 Ottawa Rainfall Intensity Values:
 From Sewer Desing Guidelines, 2004

	<u>5yr</u>	<u>100yr</u>
a =	998.071	1735.688
b =	0.814	0.820
c =	6.053	6.014

Designed:
Amr Salem, P.Eng

Project:
1485 Upper Street

Checked:
A. Ansari, PEng.

Location:
Ottawa, Ontario

Dwg Reference:
C101, C102

File Ref:
22023462 - STM Design Sheet

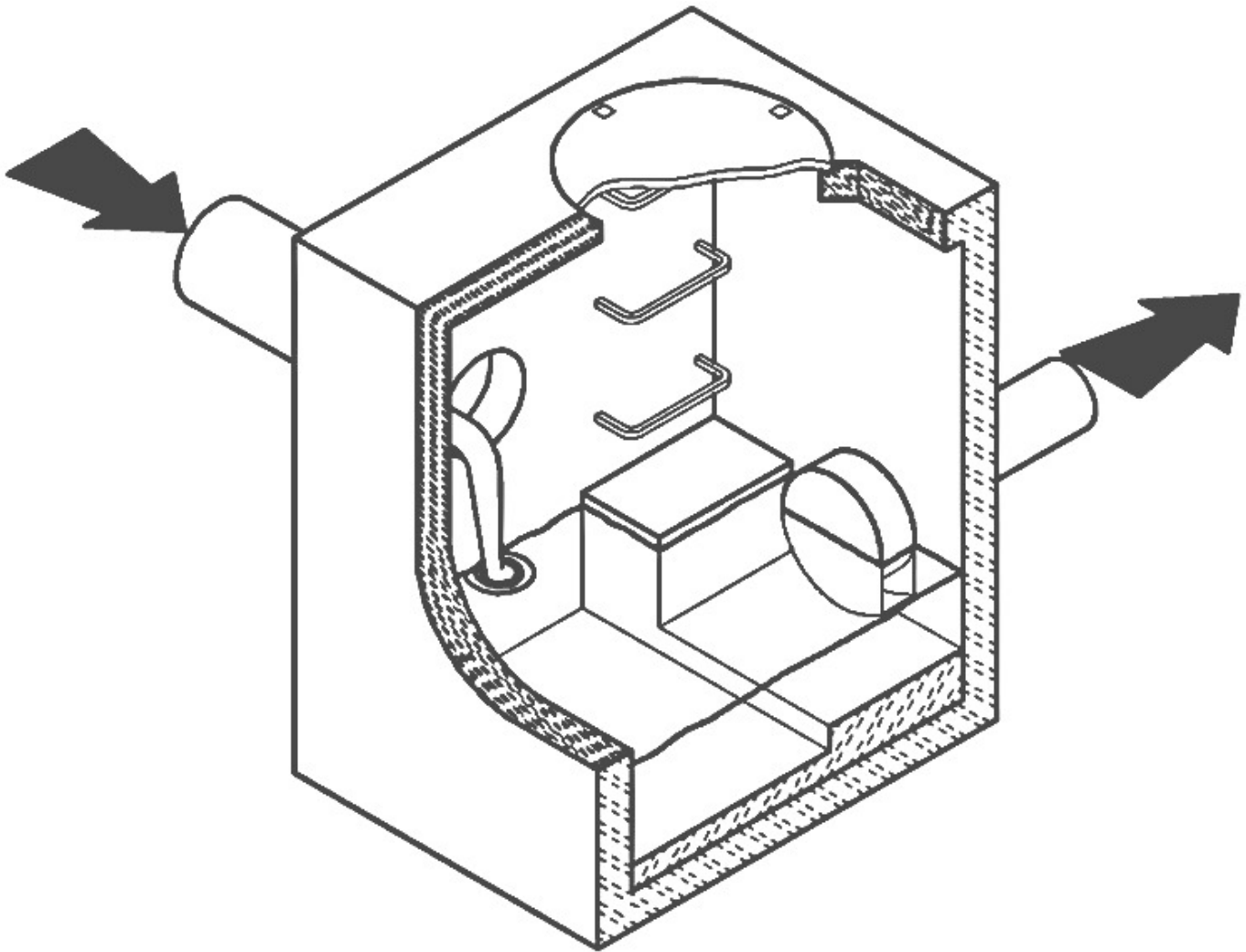
Sheet No:
1 of 1

**HYDROVEX VORTEX ICD PRODUCT DATA SHEET
AND ICD SELECTION CHART**

CSO/STORMWATER MANAGEMENT



HYDROVEX[®] VHV / SVHV
Vertical Vortex Flow Regulator



JOHN MEUNIER

HYDROVEX® VHV / SVHV VERTICAL VORTEX FLOW REGULATOR

APPLICATIONS

One of the major problems of urban wet weather flow management is the runoff generated after a heavy rainfall. During a storm, uncontrolled flows may overload the drainage system and cause flooding. Due to increased velocities, sewer pipe wear is increased dramatically and results in network deterioration. In a combined sewer system, the wastewater treatment plant may also experience significant increases in flows during storms, thereby losing its treatment efficiency.

A simple means of controlling excessive water runoff is by controlling excessive flows at their origin (manholes). **John Meunier Inc.** manufactures the **HYDROVEX® VHV / SVHV** line of vortex flow regulators to control stormwater flows in sewer networks, as well as manholes.

The vortex flow regulator design is based on the fluid mechanics principle of the forced vortex. This grants flow regulation without any moving parts, thus reducing maintenance. The operation of the regulator, depending on the upstream head and discharge, switches between orifice flow (gravity flow) and vortex flow. Although the concept is quite simple, over 12 years of research have been carried out in order to get a high performance.

The **HYDROVEX® VHV / SVHV** Vertical Vortex Flow Regulators (refer to **Figure 1**) are manufactured entirely of stainless steel, and consist of a hollow body (1) (in which flow control takes place) and an outlet orifice (7). Two rubber "O" rings (3) seal and retain the unit inside the outlet pipe. Two stainless steel retaining rings (4) are welded on the outlet sleeve to ensure that there is no shifting of the "O" rings during installation and use.

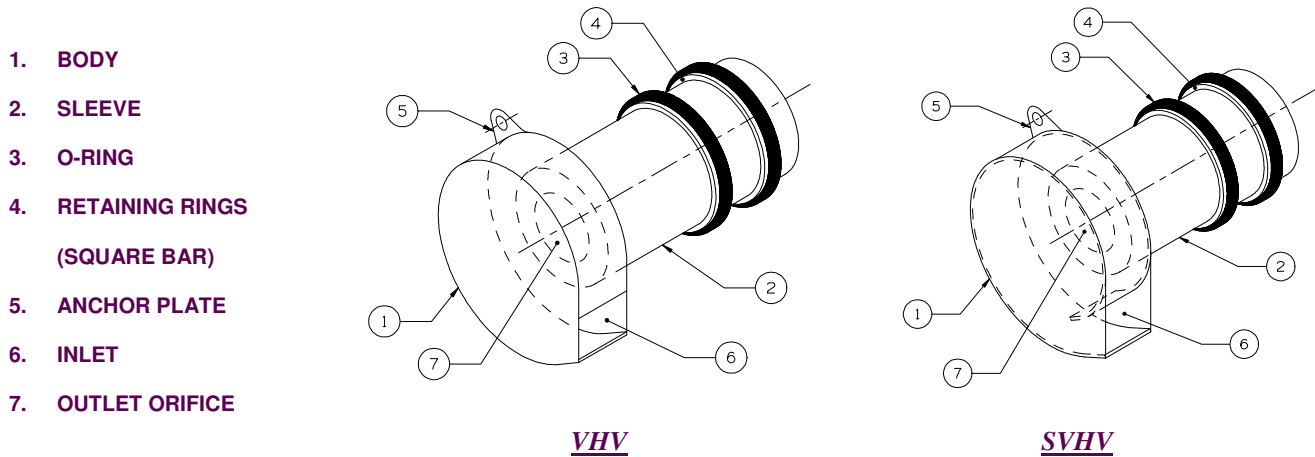


FIGURE 1: HYDROVEX® VHV-SVHV VERTICAL VORTEX FLOW REGULATORS

ADVANTAGES

- The **HYDROVEX® VHV / SVHV** line of flow regulators are manufactured entirely of stainless steel, making them durable and corrosion resistant.
- Having no moving parts, they require minimal maintenance.
- The geometry of the **HYDROVEX® VHV / SVHV** flow regulators allows a control equal to an orifice plate, having a cross section area 4 to 6 times smaller. This decreases the chance of blockage of the regulator, due to sediments and debris found in stormwater flows. **Figure 2** illustrates the comparison between a regulator model 100 SVHV-2 and an equivalent orifice plate. One can see that for the same height of water, the regulator controls a flow approximately four times smaller than an equivalent orifice plate.
- Installation of the **HYDROVEX® VHV / SVHV** flow regulators is quick and straightforward and is performed after all civil works are completed.
- Installation requires no special tools or equipment and may be carried out by any contractor.
- Installation may be carried out in existing structures.

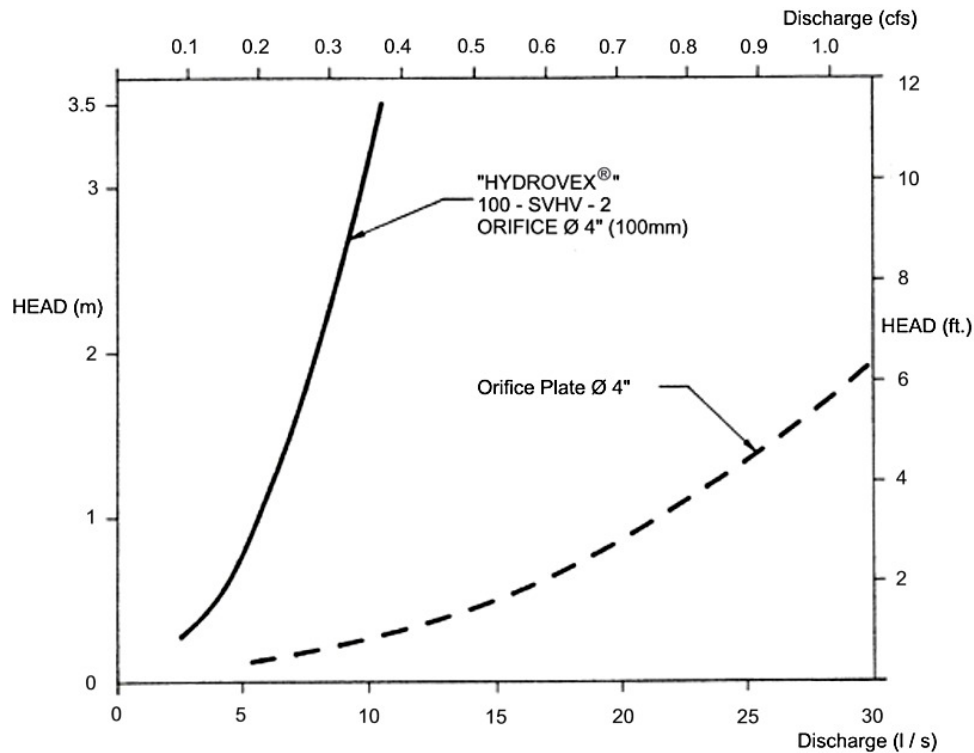


FIGURE 2: DISCHARGE CURVE SHOWING A HYDROVEX® FLOW REGULATOR VS AN ORIFICE PLATE

SELECTION

Selection of a **VHV** or **SVHV** regulator can be easily made using the selection charts found at the back of this brochure (see **Figure 3**). These charts are a graphical representation of the maximum upstream water pressure (head) and the maximum discharge at the manhole outlet. The maximum design head is the difference between the maximum upstream water level and the invert of the outlet pipe. All selections should be verified by John Meunier Inc. personnel prior to fabrication.

Example:

- ✓ Maximum design head 2m (6.56 ft.)
- ✓ Maximum discharge 6 L/s (0.2 cfs)
- ✓ Using **Figure 3** - VHV model required is a **75 VHV-1**

INSTALLATION REQUIREMENTS

All **HYDROVEX®** **VHV** / **SVHV** flow regulators can be installed in circular or square manholes. **Figure 4** gives the various minimum dimensions required for a given regulator. *It is imperative to respect the minimum clearances shown to ensure easy installation and proper functioning of the regulator.*

SPECIFICATIONS

In order to specify a **HYDROVEX**[®] regulator, the following parameters must be defined:

- The model number (ex: 75-VHV-1)
- The diameter and type of outlet pipe (ex: 6" diam. SDR 35)
- The desired discharge (ex: 6 l/s or 0.21 CFS)
- The upstream head (ex: 2 m or 6.56 ft.) *
- The manhole diameter (ex: 36" diam.)
- The minimum clearance "H" (ex: 10 inches)
- The material type (ex: 304 s/s, 11 Ga. standard)

* *Upstream head is defined as the difference in elevation between the maximum upstream water level and the invert of the outlet pipe where the **HYDROVEX**[®] flow regulator is to be installed.*

PLEASE NOTE THAT WHEN REQUESTING A PROPOSAL, WE SIMPLY REQUIRE THAT YOU PROVIDE US WITH THE FOLLOWING:

- *project design flow rate*
- *pressure head*
- *chamber's outlet pipe diameter and type*



Typical VHV model in factory

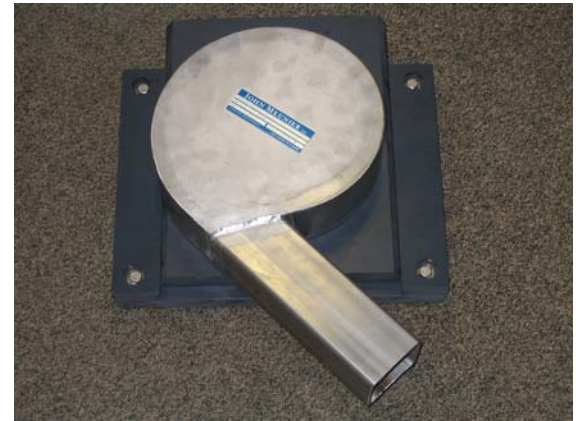
OPTIONS



FV – SVHV (mounted on sliding plate)



VHV-1-O (standard model with odour control inlet)



FV – VHV-O (mounted on sliding plate with odour control inlet)



VHV with Gooseneck assembly in existing chamber without minimum release at the bottom



VHV with air vent for minimal slopes



VHV/SVHV Vortex Flow Regulator

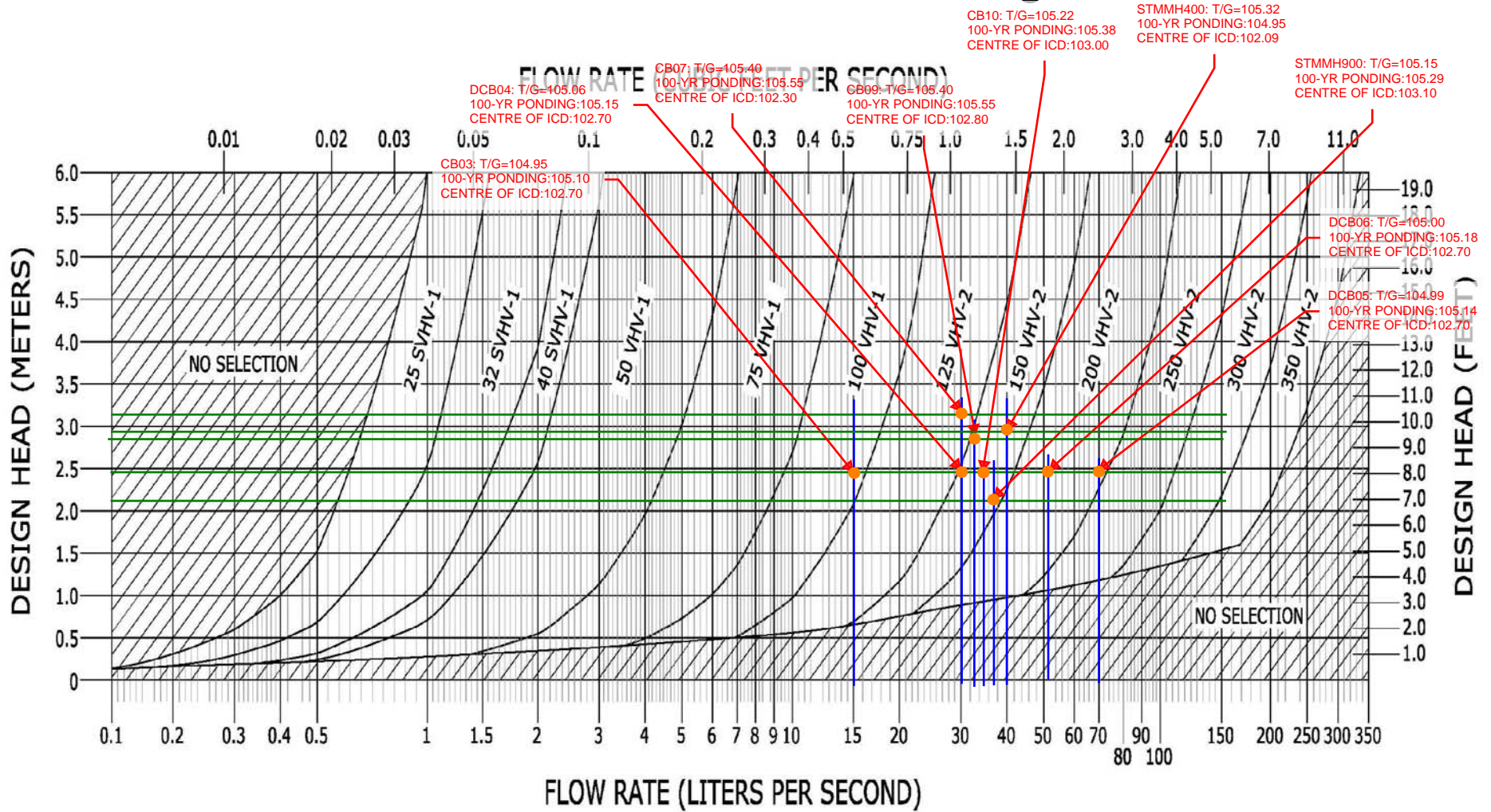


FIGURE 3

JOHN MEUNIER



SVHV Vertical Vortex Flow Regulator

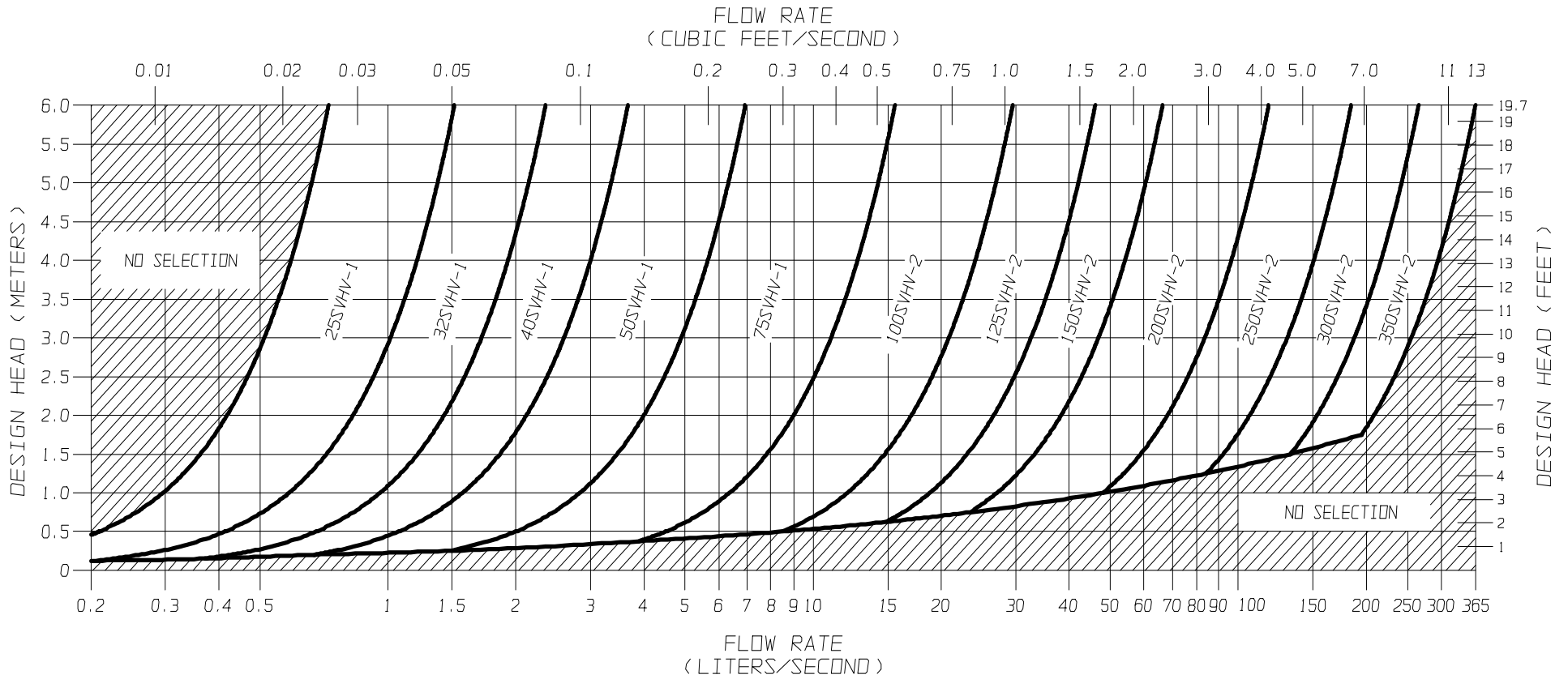
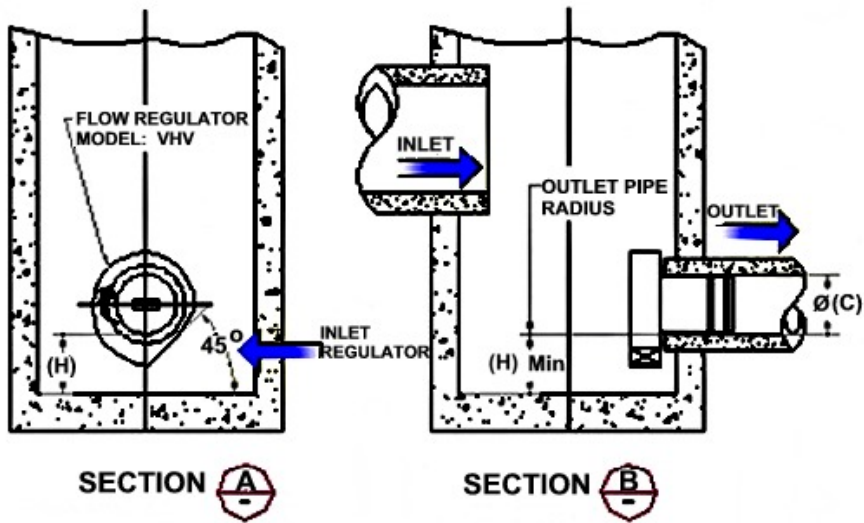
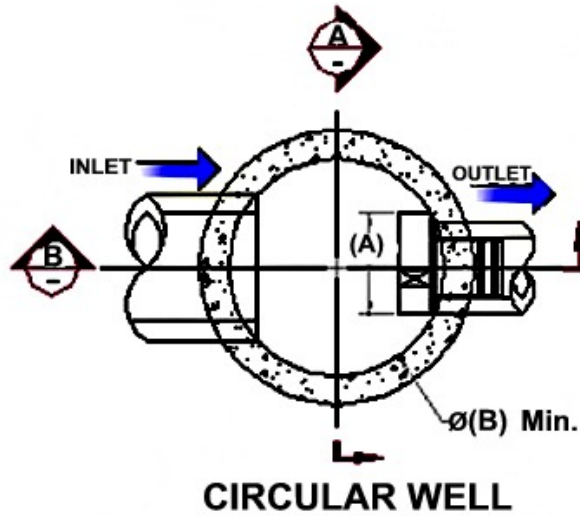


FIGURE 3 - SVHV

JOHN MEUNIER

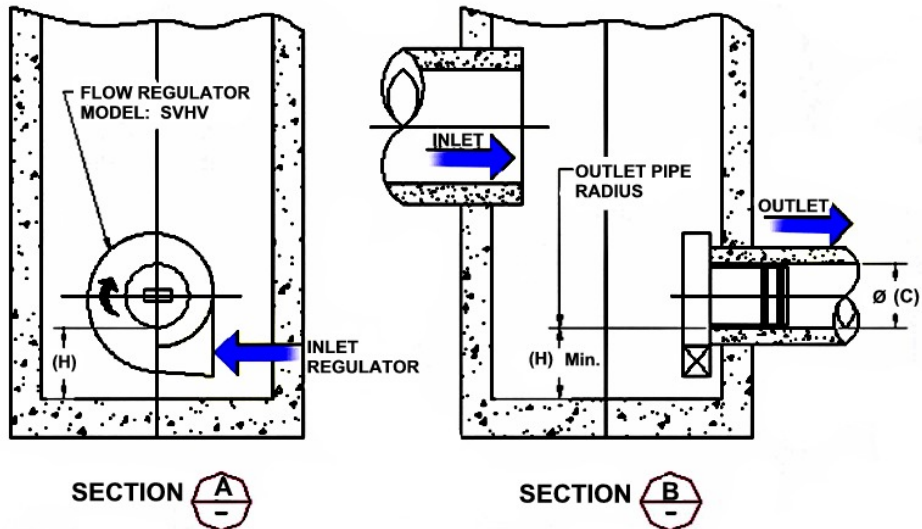
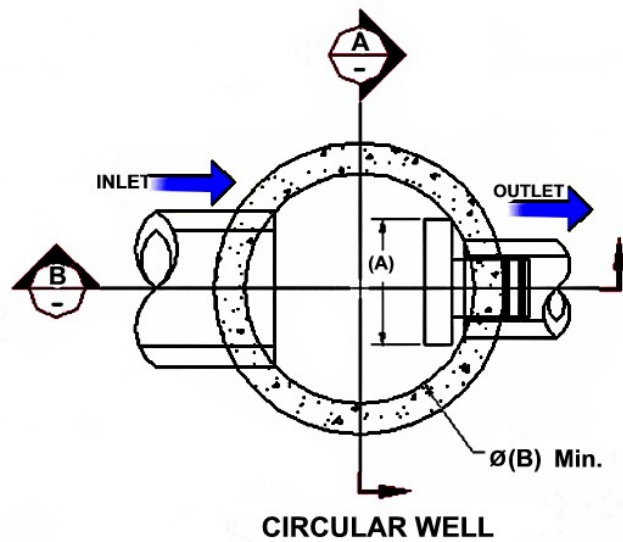
**FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL VHV)**

Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	900	36	150	6	200	8
125VHV-2	275	11	900	36	150	6	200	8
150VHV-2	350	14	900	36	150	6	225	9
200VHV-2	450	18	1200	48	200	8	300	12
250VHV-2	575	23	1200	48	250	10	350	14
300VHV-2	675	27	1600	64	250	10	400	16
350VHV-2	800	32	1800	72	300	12	500	20



FLOW REGULATOR TYPICAL INSTALLATION IN CIRCULAR MANHOLE
FIGURE 4 (MODEL SVHV)

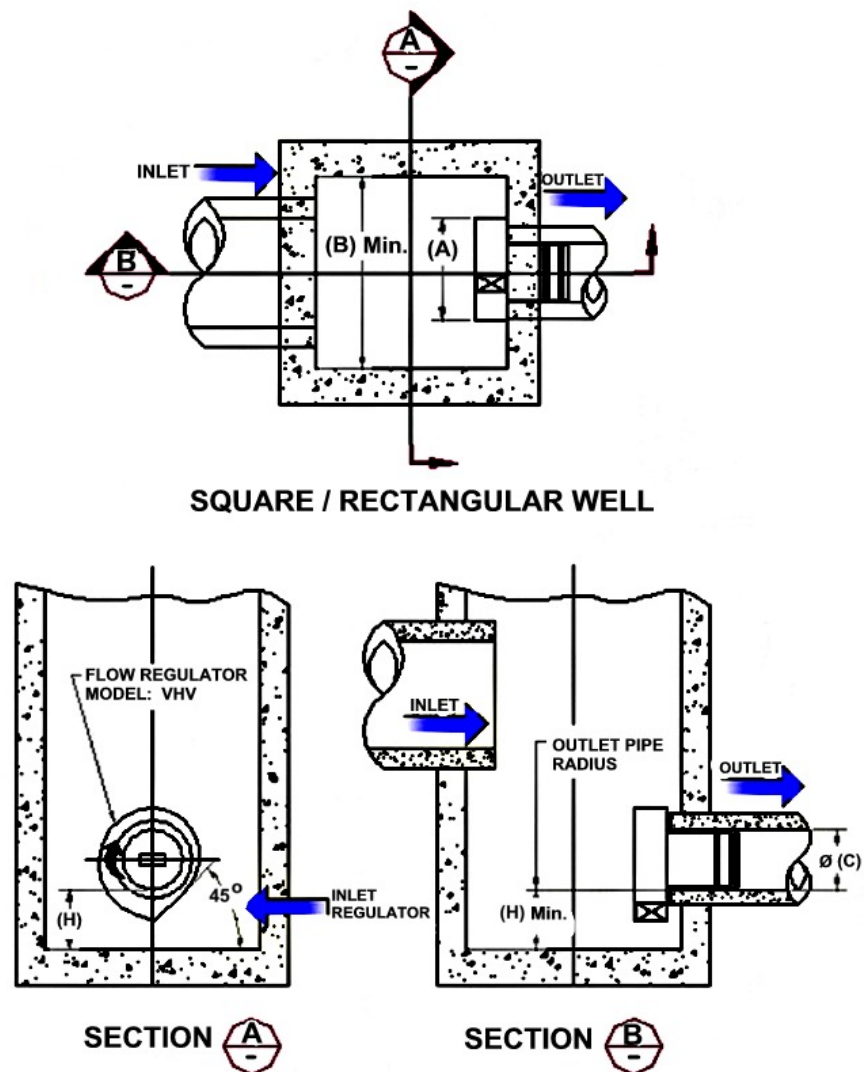
Model Number	Regulator Diameter		Minimum Manhole Diameter		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	900	36	150	6	275	11
100 SVHV-2	275	11	900	36	150	6	250	10
125 SVHV-2	350	14	900	36	150	6	300	12
150 SVHV-2	425	17	1200	48	150	6	350	14
200 SVHV-2	575	23	1600	64	200	8	450	18
250 SVHV-2	700	28	1800	72	250	10	550	22
300 SVHV-2	850	34	2400	96	250	10	650	26
350 SVHV-2	1000	40	2400	96	250	10	700	28



**FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL VHV)**

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
50VHV-1	150	6	600	24	150	6	150	6
75VHV-1	250	10	600	24	150	6	150	6
100VHV-1	325	13	600	24	150	6	200	8
125VHV-2	275	11	600	24	150	6	200	8
150VHV-2	350	14	600	24	150	6	225	9
200VHV-2	450	18	900	36	200	8	300	12
250VHV-2	575	23	900	36	250	10	350	14
300VHV-2	675	27	1200	48	250	10	400	16
350VHV-2	800	32	1200	48	300	12	500	20

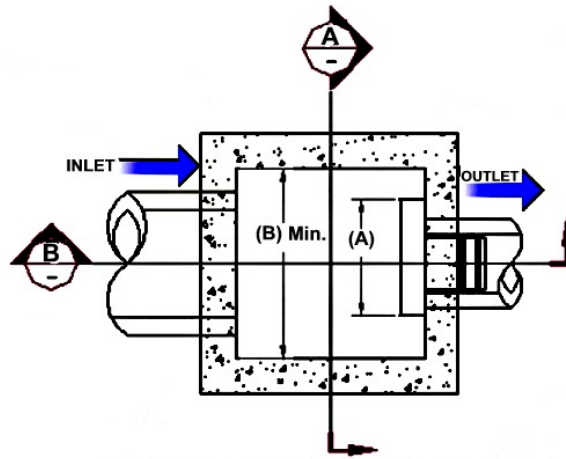
NOTE: *In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.*



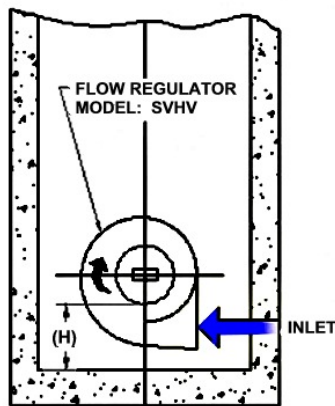
FLOW REGULATOR TYPICAL INSTALLATION IN SQUARE MANHOLE
FIGURE 4 (MODEL SVHV)

Model Number	Regulator Diameter		Minimum Chamber Width		Minimum Outlet Pipe Diameter		Minimum Clearance	
	A (mm)	A (in.)	B (mm)	B (in.)	C (mm)	C (in.)	H (mm)	H (in.)
25 SVHV-1	125	5	600	24	150	6	150	6
32 SVHV-1	150	6	600	24	150	6	150	6
40 SVHV-1	200	8	600	24	150	6	150	6
50 SVHV-1	250	10	600	24	150	6	150	6
75 SVHV-1	375	15	600	24	150	6	275	11
100 SVHV-2	275	11	600	24	150	6	250	10
125 SVHV-2	350	14	600	24	150	6	300	12
150 SVHV-2	425	17	600	24	150	6	350	14
200 SVHV-2	575	23	900	36	200	8	450	18
250 SVHV-2	700	28	900	36	250	10	550	22
300 SVHV-2	850	34	1200	48	250	10	650	26
350 SVHV-2	1000	40	1200	48	250	10	700	28

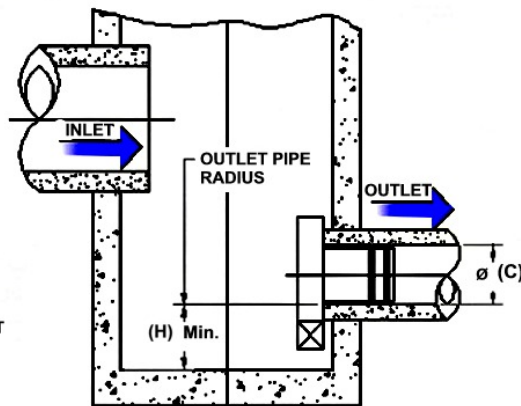
NOTE: *In the case of a square manhole, the outlet flow pipe must be centered on the wall to ensure enough clearance for the unit.*



SQUARE / RECTANGULAR WELL



SECTION A



SECTION B

INSTALLATION

The installation of a **HYDROVEX**[®] regulator may be undertaken once the manhole and piping is in place. Installation consists of simply fitting the regulator into the outlet pipe of the manhole. **John Meunier Inc.** recommends the use of a lubricant on the outlet pipe, in order to facilitate the insertion and orientation of the flow controller.

MAINTENANCE

HYDROVEX[®] regulators are manufactured in such a way as to be maintenance free; however, a periodic inspection (every 3-6 months) is suggested in order to ensure that neither the inlet nor the outlet has become blocked with debris. The manhole should undergo periodically, particularly after major storms, inspection and cleaning as established by the municipality

GUARANTY

The **HYDROVEX**[®] line of **VHV / SVHV** regulators are guaranteed against both design and manufacturing defects for a period of 5 years. Should a unit be defective, **John Meunier Inc.** is solely responsible for either modification or replacement of the unit.

John Meunier Inc.

ISO 9001 : 2008

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Fax: 514-334-5070 cs@johnmeunier.com

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Tel.: 905-286-4846 www.johnmeunier.com

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2209 Menlo Avenue

Glenside, PA USA 19038

Tel.: 412-417-6614 www.johnmeunier.com

Fax: 215-885-4741 astele@johnmeunier.com

Appendix E – Additional Information

Pre-Application Consultation Meeting Minutes

Property Address: 1485 Upper Canada

Location: Virtual – Microsoft Teams

Meeting Date: November 15, 2022

Attendees: Sarah Ezzio – Planner, City of Ottawa
Steven Payne – Planning Coop, City of Ottawa
Ann O’Connor– Urban Design, City of Ottawa
Julie Candow – Engineer, City of Ottawa
Patrick McMahon – Transportation, City of Ottawa
Jeff Goettling – Parks, City of Ottawa
Mercedes Liedtke - MVCA
Toon Dreessen - Architects DCA
Jimmy Wang, Property Owner - Konson Homes
Doug Burnside – Doly Construction
Melissa Guimond – Doly Construction

Regrets: Hayley Murray – Forester
Matthew Hayley – Environmental Planning

Policies/Designations of the site

- Official Plan – Suburban Transect, Mixed Industrial Designation
- Zoning – IP13, Business Park Industrial Zone
- Community Design Plan – Kanata West Concept Plan

Planning

1. This would be considered a complex site plan application, information about the fees is available at this [link](#). A Lifting of a Holding Symbol application is also needed in order to accommodate the proposed use.
2. Thank you for showing the pedestrian connections on the site. Please continue to develop the connections to and within the site.
3. Retail is not a permitted use on this site. Showrooms must be accessory to a permitted use, and are not permitted to exceed 25% of the GFA as per the provisions of the zoning by-law.
4. Please indicate where the snow storage is proposed to be located on the site plan.
5. Please look for opportunities to consolidate the loading areas to one area of the site where possible.
6. Show all the dimensions (in metric units) on the site plan for items like the garbage storage, snow storage, etc.
7. There is a Holding Symbol with an urban exception 2166 along the western edge of the property which would require a vibration and noise study to have it lifted.

- a. For more information, please see [here](#).
8. Please limit the amount of hard surfacing where possible on the site.
9. The new Official Plan calls for a 40% tree canopy coverage across neighbourhoods so we would appreciate finding opportunities on the site to plant more trees.
10. We would request landscaped medians around the parking to provide more tree canopy cover.
11. The subject property is located within the boundary of the Kanata West CDP, where it is designated as Prestige Business Park, and thus must conform to the policy. Please refer to the Kanata West CDP found [here](#).

Feel free to contact Sarah Ezzio, Planner (File Lead), at sarah.ezzio@ottawa.ca for follow-up questions.

Urban Design

1. An Urban Design Brief that follows the provided Terms of Reference is required upon submission of application.
2. Provisions of the Kanata West CDP and SP should be complied with.
3. Provide tree and soft-landscaping plantings
 - a. Please consider planting multiple trees between the front and corner property lines on Upper Canada St and Campeau Dr and the proposed internal road that winds around the proposed building. Between the planted trees, consider also including shrubs and other soft-landscaping/vegetative elements. Substantial landscaping on-site, aligned with the public ROW is highly encouraged.
4. Prioritize pedestrian and cycling movement and safety
 - a. Design staff support the five pedestrian crosswalks/pavement markings provided across the internal road and the associated pathways to the existing concrete sidewalk on the public roads.
 - b. Design staff support the provision of the three bicycle racks. Please ensure the movement of a cyclist coming into the site toward these bicycle spots is considered moving forward.
 - c. Ensure public sidewalks are built along the lot lines abutting the public ROW
5. Create animated facades facing the public realm
 - a. No elevations were provided in advance of this pre-consultation; however, when they are drafted, please consider creating an animated façade along the building walls that face the public ROW. Also, consider locating any internal office or commercial uses to be along these facades, to provide more interaction with the public realm than a storage use would.

Feel free to contact Ann O'Connor, Urban Design, at ann.oconnor@ottawa.ca for follow-up questions.

Transportation

1. Follow Traffic Impact Assessment Guidelines:
 - a) Start this process as soon as possible.
 - b) Applicant advised that the application will not be deemed complete until the submission of the draft step 1-4. Collaboration and communication between development proponents and City staff are required at the end of every step of the TIA process.
2. A noise study is not required.
3. On site plan:
 - a) Turning templates will be required for all accesses showing the largest vehicle to access the site; required for internal movements and at all access (entering and exiting and going in both directions). Accesses will require justification for a width of greater than 9m.
 - b) Show all curb radii measurements; ensure that all curb radii are reduced as much as possible.
 - c) Sidewalks are to be continuous across accesses as per City Specification 7.1.
4. Please review access configurations with respect to the Private Approach By-law. Some are too close to property lines and do not meet minimum offsets from each other.

Feel free to contact Patrick McMahon, Transportation Project Manager, at patrick.mcmahon@ottawa.ca for follow-up questions.

Forestry

1. Minimum Setbacks
 - Maintain 1.5m from sidewalk or MUP/cycle track or water service laterals.
 - Maintain 2.5m from curb
 - Coniferous species require a minimum 4.5m setback from curb, sidewalk or MUP/cycle track/pathway.
 - Maintain 7.5m between large growing trees, and 4m between small growing trees. Park or open space planting should consider 10m spacing, except where otherwise approved in naturalization / afforestation areas. Adhere to Ottawa Hydro's planting guidelines (species and setbacks) when **planting around overhead primary conductors.**

2. Tree specifications

- Minimum stock size: 50mm tree caliper for deciduous, 200cm height for coniferous.
- Maximize the use of large deciduous species wherever possible to maximize future canopy coverage
- Tree planting on city property shall be in accordance with the City of Ottawa’s Tree Planting Specification; and include watering and warranty as described in the specification (can be provided by Forestry Services).
- Plant native trees whenever possible
- No root barriers, dead-man anchor systems, or planters are permitted.
- No tree stakes unless necessary (and only 1 on the prevailing winds side of the tree)

3. Hard surface planting

- Curb style planter is highly recommended
- No grates are to be used and if guards are required, City of Ottawa standard (which can be provided) shall be used.
- Trees are to be planted at grade

4. Soil Volume

- Please document on the LP that adequate soil volumes can be met:

Tree Type/Size	Single Tree Soil Volume (m3)	Multiple Tree Soil Volume (m3/tree)
Ornamental	15	9
Columnar	15	9
Small	20	12
Medium	25	15
Large	30	18
Conifer	25	15

Please note that these soil volumes are not applicable in cases with Sensitive Marine Clay.

- Please follow the City’s 2017 Tree Planting in Sensitive Marine Clay guidelines

5. Tree Canopy

- The landscape plan shall show how the proposed tree planting will replace and increase canopy cover on the site over time, to support the City’s 40% urban forest canopy cover target.
- At a site level, efforts shall be made to provide as much canopy cover as possible, through tree planting and tree retention, with an aim of 40% canopy cover at 40 years, as appropriate.
- Indicate on the plan the projected future canopy cover at 40 years for the site.

Feel free to contact Hayley Murray, Forester, at hayley.murray@ottawa.ca for follow-up questions.

Engineering

1. The Servicing Study Guidelines for Development Applications are available at the following address: <https://ottawa.ca/en/planning-development-and-construction/development-information-residents/development-application-20#section-servicing-study-guidelines-for-development-applications>
2. Servicing and site works shall be in accordance with the following documents:
 - ⇒ Ottawa Sewer Design Guidelines (October 2012)
 - ⇒ Ottawa Design Guidelines – Water Distribution (2010)
 - ⇒ Geotechnical Investigation and Reporting Guidelines for Development Applications in the City of Ottawa (2007)
 - ⇒ City of Ottawa Slope Stability Guidelines for Development Applications (revised 2012)
 - ⇒ City of Ottawa Environmental Noise Control Guidelines (January, 2016)
 - ⇒ City of Ottawa Park and Pathway Development Manual (2012)
 - ⇒ City of Ottawa Accessibility Design Standards (2012)
 - ⇒ Ottawa Standard Tender Documents (latest version)
 - ⇒ Ontario Provincial Standards for Roads & Public Works (2013)
3. Record drawings and utility plans are also available for purchase from the City (Contact the City's Information Centre by email at geoinformation@ottawa.ca or by phone at (613) 580-2424 x.44455).
4. The water, sanitary, storm servicing and stormwater management criteria for the subject site are to be in accordance with the Kanata West Business Park – Phase 5 Design Brief, prepared by IBI Group (September 2019), attached, and the Kanata West Master Servicing Study (2006). The existing storm, sanitary and watermain infrastructure within Upper Canada Street, as well as the receiving storm pond, were designed to accommodate this site as per the KWBP – Phase 5

Design Brief. The capacity of pipes receiving flows from the subject site should be reviewed and confirmed within the Site Servicing Report. Flows to the storm sewer in excess of the allocated release rate, up to and included the 100-yr storm event, must be detained onsite.

5. All services to be grouped in one common trench to minimize the number of road cuts.
6. Water Boundary condition requests must include the location of the service (map or plan with connection location(s) indicated) and the expected loads required by the proposed development, including calculations. Please provide the following information:
 - a) Location of service
 - b) Type of development and the amount of fire flow required (as per FUS).
 - c) Average daily demand: ___ l/s.
 - d) Maximum daily demand: ___ l/s.
 - e) Maximum hourly daily demand: ___ l/s.
7. An MECP Environmental Compliance Approval is not anticipated to be required for this application unless the proposed development does not meet the following exemption criteria:
 - a) Is designed to service one lot or parcel of land;
 - b) Discharges into a storm sewer that is not a combined sewer;
 - c) Does not service industrial land or a structure located on industrial land; and
 - d) Is not located on industrial land. O.Reg. 525/98, s. 3; O.Reg. 40/15, s. 4.

In which “industrial land” means land used for the production, processing, repair, maintenance or storage of goods or materials, or the processing, storage, transfer or disposal of waste, but does not include land used primarily for the purpose of buying or selling;

- a) Goods or materials other than fuel, or
- b) Services other than vehicle repair services.

8. Phase 1 ESAs and Phase 2 ESAs must conform to clause 4.8.4 of the Official Plan that requires that development applications conform to Ontario Regulation 153/04.

Feel free to contact Julie Candow, Infrastructure Project Manager, at julie.candow@ottawa.ca for follow-up questions.

Environmental Planning

- Please review and incorporate bird safe design elements. Some of the risk factors include glass and related design traps such as corner glass and fly-through conditions, ventilation grates and open pipes, landscaping, light pollution. More guidance and solutions are available in the guidelines which can be found here:
https://documents.ottawa.ca/sites/documents/files/birdsafedesign_guidelines_en.pdf

Feel free to contact Matthew Hayley, Environmental Planner, at matthew.hayley@ottawa.ca for follow-up questions.

Parks

1. As per the [Parkland Dedication \(By-law No. 2022-280\) | City of Ottawa](#), as amended, parkland dedication will be required as a condition of development. In this circumstance given the parcel size and proposed use, Cash in Lieu of Parkland (CILP) would be considered appropriate.
2. Based in the details provided, the proposal would be best considered a commercial or industrial development for the purposes of the parkland dedication by-law. The applicant is encouraged to review the parkland dedication by-law should they feel that an alternative land use category be more appropriate. The parkland requirement for a commercial, industrial or retail use is calculated as 2% of the gross land area of the site being developed.
3. Has there been any past Parkland Dedication credited to the subject property parcel(s)? If so, please provide the associated documentation for Parks and Facilities Planning (PFP) review/ consideration. The conveyance of land for purposes or the payment of money in-lieu of accepting the conveyance is not required for development, redevelopment, subdivisions or consents, where it is known, or can be demonstrated that the required parkland conveyance or money in-lieu thereof has been previously satisfied.
4. Please identify for example in the Planning Rationale or by other means (when the initial development application is submitted) how the requirements in the Parkland Dedication (By-law No. 2022-280) will be or have been achieved.
5. Given the above comments and should Cash in Lieu of Parkland (CILP) be collected, the value of the land shall be determined by the City's Realty Services Branch or submitted otherwise according to By-law No. 2022-280. The owner is responsible for any appraisal costs incurred by the City.

November 15, 2022

6. Please note that the park comments are preliminary and will be finalized (and subject to change) upon receipt of the requested supporting documentation. Additionally, if the proposed land use changes, then the parkland dedication requirement will be re-evaluated accordingly.

Feel free to contact Jeff Goettling with Parks and Facilities Planning Services, at jeff.goettling@ottawa.ca for follow-up questions.

MVCA

1. MVCA has no concerns from a natural heritage/ natural hazard standpoint
2. We will require a stormwater management plan.
 - a. Please include the design criteria for the existing pond (Pond 6 West).
 - b. 80% TSS removal, or enhanced level of protection, is required as per the Carp River Watershed Subwatershed Study.
 - c. Thermal mitigation is required as Feedmill Creek is a coolwater watercourse
3. The Carp River Watershed Subwatershed Study identifies this site as a low groundwater recharge area, which has an annual infiltration target of 73mm/year.

Feel free to contact Mercedes Liedtke, Infrastructure Project Manager, at mliedtke@mvc.on.ca for follow-up questions.

General Comments

The list of required plans and studies are attached to this email.

Please refer to the links to "[Guide to preparing studies and plans](#)" and [fees](#) for general information. Additional information is available related to [building permits](#), [development charges](#), and the [Accessibility Design Standards](#). Be aware that other fees and permits may be required, outside of the development review process. You may obtain background drawings by contacting informationcentre@ottawa.ca.

These pre-con comments are valid for one year. If you submit a development application(s) after this time, you may be required to meet for another pre-consultation meeting and/or the submission requirements may change. You are as well encouraged to contact us for a follow-up meeting if the plan/concept will be further refined.

Appendix F – Drawings

- Topographic Survey for 1485 Upper Canada Street (11x17)
- Servicing Plan and Profile for Upper Canada Street and Campeau Drive Prepared by IBI Group (11x17)
- Proposed Architectural Site Plan, Floor Plan and Building Elevations (11x17)
- Civil Drawings for the Proposed Development (Included Separately)

BLOCK 1
REGISTERED PLAN 4M-1649

CITY OF OTTAWA

Prepared by Annis, O'Sullivan, Vollebakk Ltd.

January 10, 2023

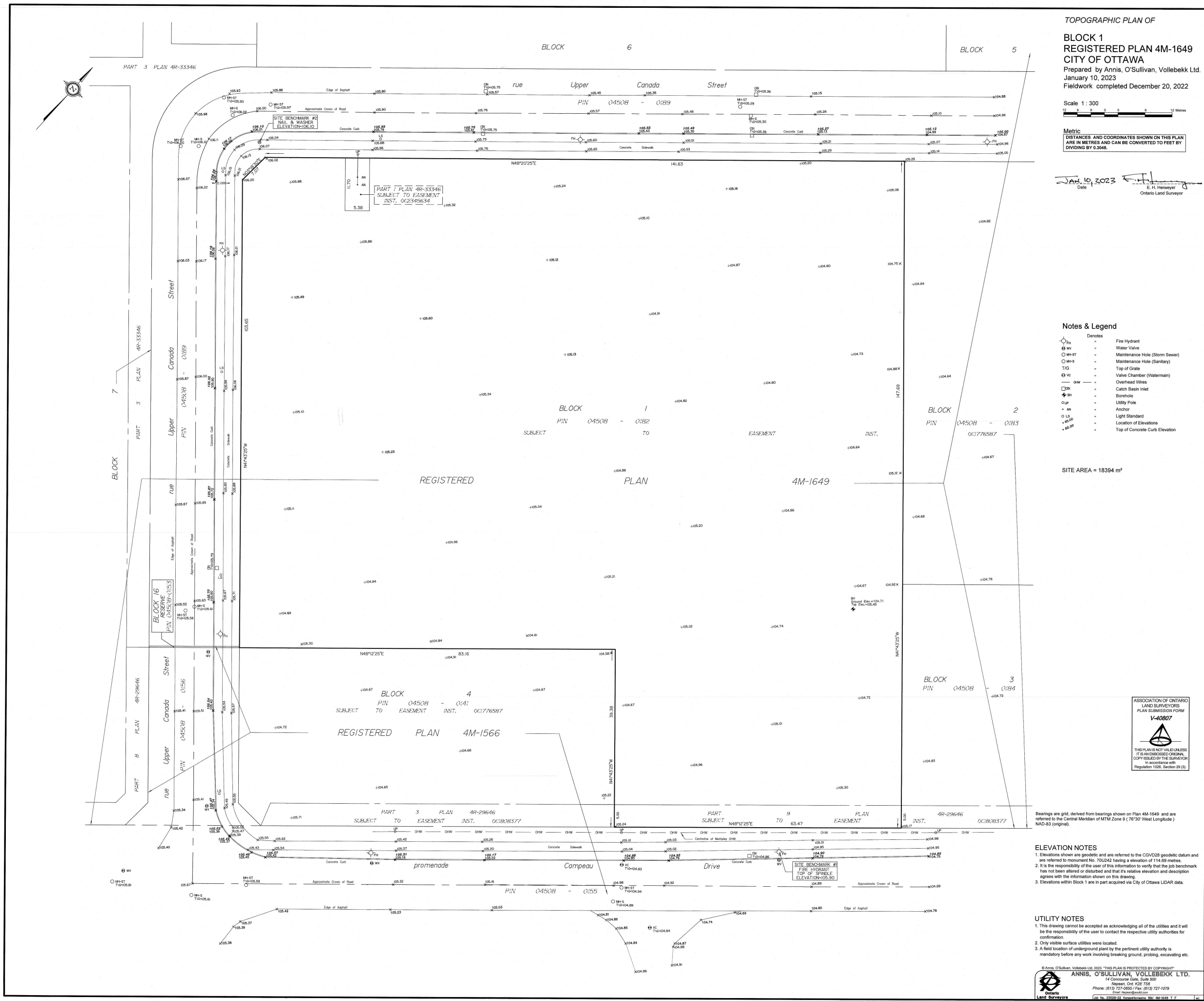
Fieldwork completed December 20, 2022

Scale 1 : 300



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

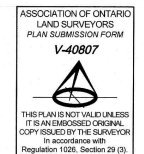
JAN 10, 2023
Date
E. H. Henvey
Ontario Land Surveyor



Notes & Legend

- Denotes
- ⊕ FH = Fire Hydrant
 - ⊕ WV = Water Valve
 - ⊕ M-S-T = Maintenance Hole (Storm Sewer)
 - ⊕ M-S = Maintenance Hole (Sanitary)
 - ⊕ TG = Top of Grate
 - ⊕ VC = Valve Chamber (Watermain)
 - OHW = Overhead Wires
 - ⊕ CBI = Catch Basin Inlet
 - ⊕ BH = Borehole
 - ⊕ UP = Utility Pole
 - ⊕ AN = Anchor
 - ⊕ LS = Light Standard
 - +105.00 = Location of Elevations
 - +105.00 = Top of Concrete Curb Elevation

SITE AREA = 18394 m²



Bearings are grid, derived from bearings shown on Plan 4M-1649 and are referred to the Central Meridian of MTM Zone 9 (70°30' West Longitude) NAD-83 (original).

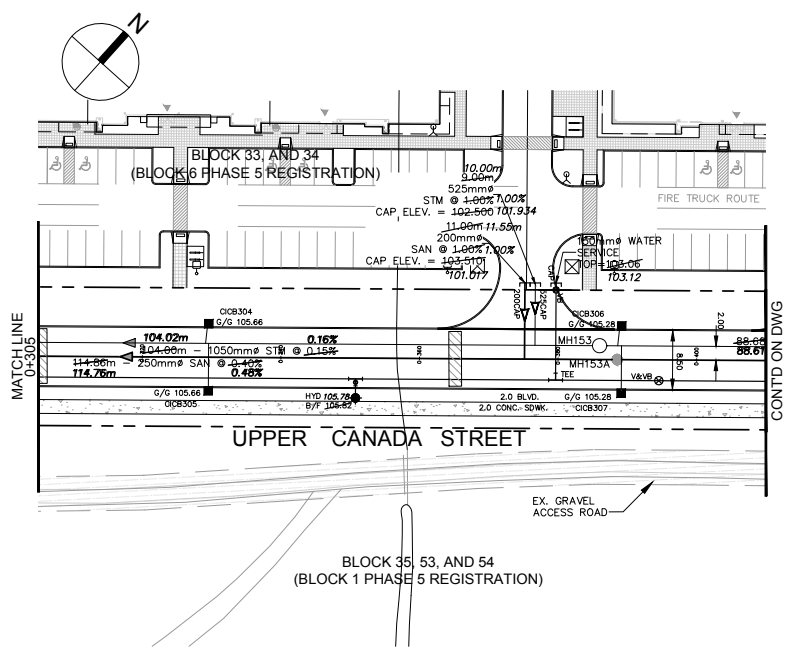
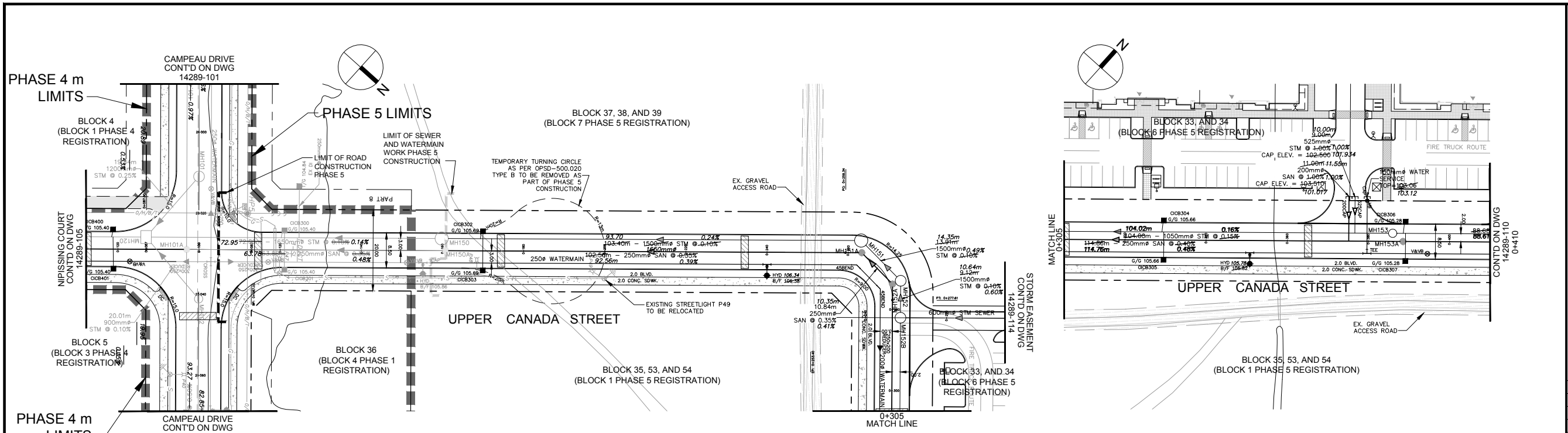
ELEVATION NOTES

1. Elevations shown are geodetic and are referred to the CGVD28 geodetic datum and are referred to monument No. 70U242 having an elevation of 114.69 metres.
2. It is the responsibility of the user of this information to verify that the job benchmark has not been altered or disturbed and that its relative elevation and description agrees with the information shown on this drawing.
3. Elevations within Block 1 are in part acquired by City of Ottawa LIDAR data.

UTILITY NOTES

1. This drawing cannot be accepted as acknowledging all of the utilities and it will be the responsibility of the user to contact the respective utility authorities for confirmation.
2. Only visible surface utilities were located.
3. A field location of underground plant by the pertinent utility authority is mandatory before any work involving breaking ground, probing, excavating etc.

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ANNIS, O'SULLIVAN, VOLLEBAKK LTD.
14 Concession Drive, Suite 100
Nepean, Ont. K2E 7S6
Phone: (613) 727-8800 / Fax: (613) 727-1079
Email: info@anniso.com
S.O. No. 2022-22, Registration No. 88-868, T. 7



- LEGEND:**
- MH3A SANITARY MANHOLE
 - MH3 STORM MANHOLE
 - CB 7/8 99.76 STREET CATCHBASIN c/w TOP OF GRATE
 - CB 7/8 99.76 CURB INLET CATCHBASIN c/w GUTTER GRADE
 - RVCB 17/8 100.27 REARYARD CB c/w TOP OF GRATE
 - DMH 97.40 DITCH INLET MANHOLE c/w TOP OF GRATE
 - DMH 97.40 STREET CATCHBASIN MANHOLE c/w GUTTER GRADE
 - V4VB VALVE AND VALVE BOX
 - V5C VALVE AND CHAMBER
 - HYD 100.56 HYDRANT c/w BOTTOM OF FLANGE ELEVATION
 - BARRIER CURB AS PER SC1.1
 - DEPRESSED BARRIER CURB AS PER SC1.1 COMPLETE WITH TWSI PER SC7.3
 - MOUNTABLE CURB AS PER SC1.3
 - PROPOSED CONCRETE SIDEWALK
 - ▨ REQUIRED FILL BELOW ROAD SUBGRADE
 - ▨ CLAY DYKES
 - HGL 103.54 HYDRAULIC GRADE LINE
 - EX. GRAVEL ACCESS ROAD

FOR EXISTING OF EXISTING CONSTRUCTION REFER TO DRAWING 14289-100A

19	RECORD DRAWINGS	LME	22:06:22
18	ADD SERVICE CONNECTIONS FOR BLOCKS 5 AND 6	LME	20:06:17
17	ISSUED FOR CONSTRUCTION PHASE 4 AND 5	LME	20:05:27
16	ISSUED FOR TENDER PHASE 4 AND 5	LME	20:02:12
15	REVISED AS PER PHASE 5 COMMENTS	LME	19:10:25
14	ISSUED FOR PHASE 5 REGISTRATION	LME	19:09:10
13	REVISED FOR PHASE 3 REGISTRATION	LME	18:09:14
12	ADDED CITY FILE NUMBER	LME	18:05:30
11	REVISED FOR PHASE 2 REGISTRATION	LME	18:04:20
10	RELOCATE V&VB, HYDRANT AND CAP AT BLOCK 33/34	LME	16:05:05
9	REVISED LIMIT BLK 35, RELOCATE V&VB, HYDRANT AND CAP.	LME	16:04:20
8	ISSUED FOR CONSTRUCTION	LME	16:01:19
7	ISSUED FOR MYLARS	LME	16:01:12
6	ISSUED TO TAGGART	LME	15:12:14
5	REVISED AS PER CITY COMMENTS	LME	15:10:15
4	REVISION PHASE 1 LIMITS	LME	15:08:19
3	REVISED AS PER NEW SITE PLAN AND CITY COMMENTS	LME	15:06:19
2	REVISED AS PER CITY COMMENTS	LME	15:04:08
1	ISSUED TO CITY FOR APPROVAL	LME	14:11:27
No.	REVISIONS	By	Date



IBI GROUP
400 - 333 Preston Street
Ottawa ON K1S 5N4 Canada
tel 613 225 1311 fax 613 225 9888
ibigroup.com

Project Title
KANATA WEST BUSINESS PARK PHASE 5



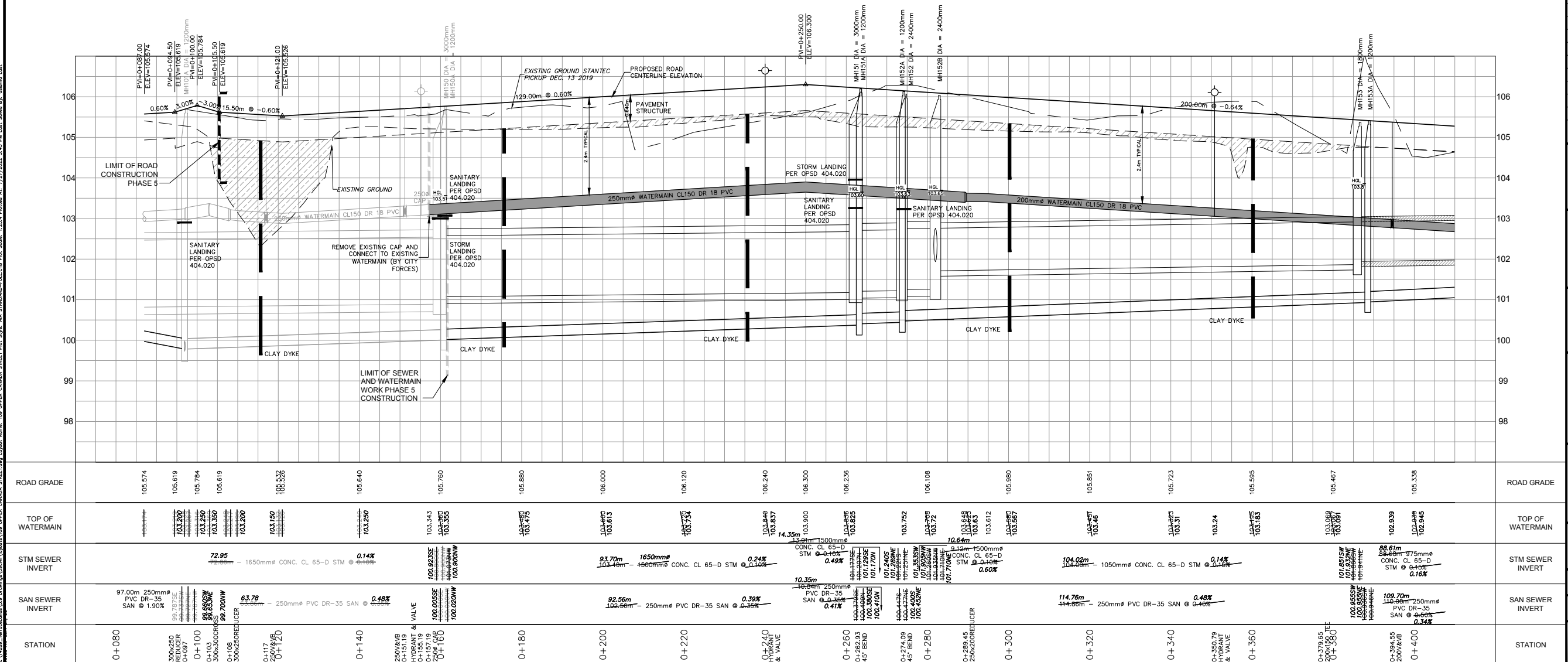
Drawing Title
UPPER CANADA STREET

FROM CAMPEAU DRIVE to STA. 0+410

Scale
HORIZ. SCALE 1:500
VERT. SCALE 1:50

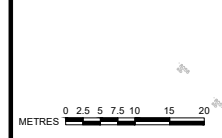
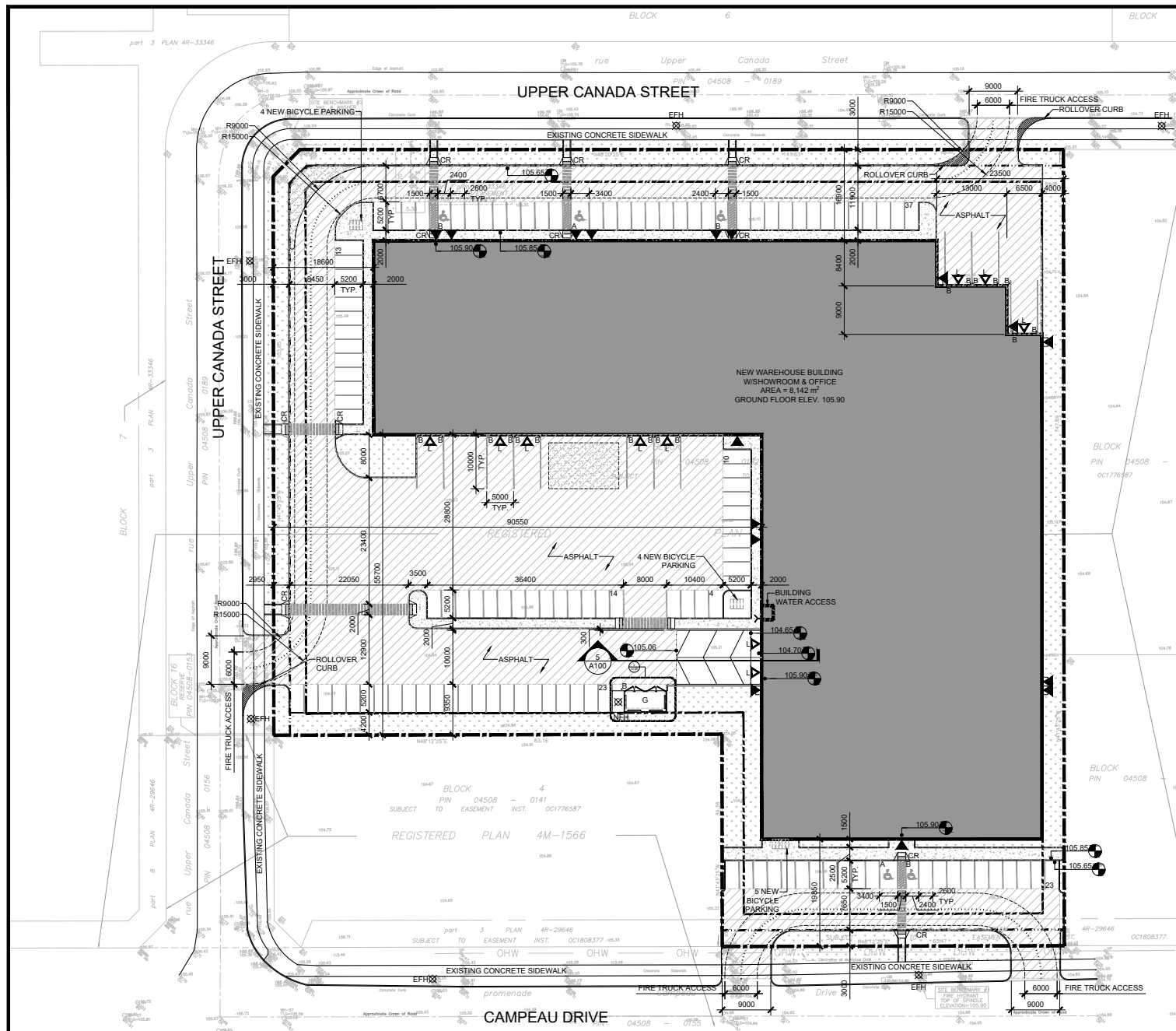
Design LME Date NOV. 2014
Drawn DPS Checked TRB

Project No. 14289 Drawing No. 109

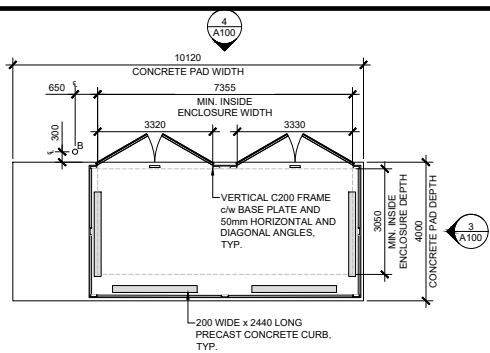


A:\14289_Terracotta\14289-109 UPPER CANADA STREET.dwg Plot Style: AIA STANDARD-FULL.ctb Plot Scale: 1:25.4 Printed At: 7/27/2022 3:45 PM Last Saved By: ahuma Last

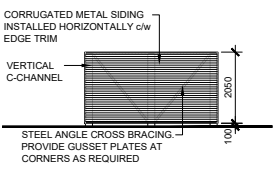
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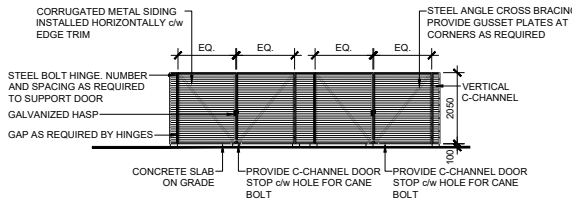
1 SITE PLAN
SCALE: 1:500



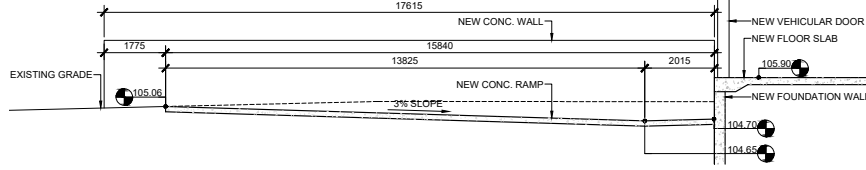
2 GARBAGE ENCLOSURE PLAN
SCALE: 1:100



3 GARBAGE ENCLOSURE SIDE ELEVATION
SCALE: 1:100



4 GARBAGE ENCLOSURE FRONT ELEVATION
SCALE: 1:100



5 LOADING RAMP SECTION
SCALE: 1:100

GENERAL SITE PLAN NOTES:

PROPERTY BOUNDARY INFORMATION, AND TOPOGRAPHIC INFORMATION DERIVED FROM SURVEYORS REAL PROPERTY REPORT AM-1648, CITY OF OTTAWA, PREPARED BY ANNIS, O'SULLIVAN, VOLLEBEKK LTD., SIGNED AND DATED 10 JANUARY, 2023

SITE AND BUILDING DATA:

SITE AREA	18,383 m ²
NEW BUILDING AREA	8,715 m ²
BUILDING HEIGHT	6.9m

GENERAL NOTES:

- FOR PAVED SURFACES, GRADING, SITE SERVICING, DRAINAGE EROSION AND SEDIMENT CONTROL, REFER TO CIVIL DRAWINGS.
- FOR PLANTING DETAILS, REFER TO LANDSCAPE DRAWINGS.

GROSS BUILDING AREA:

- (ONTARIO BUILDING CODE DEFINITION): THE TOTAL AREA OF ALL FLOORS ABOVE GRADE MEASURED BETWEEN THE OUTSIDE SURFACES OF EXTERIOR WALLS.
- GROSS FLOOR AREA (CITY OF OTTAWA ZONING BYLAW DEFINITION FOR THE PURPOSE OF DETERMINING PARKING REQUIREMENTS): GROSS LEASABLE FLOOR AREA MEANS THE TOTAL FLOOR AREA DESIGNED FOR TENANT OCCUPANCY AND EXCLUSIVE USE, MEASURED FROM THE INTERIORS OF OUTSIDE WALLS EXCLUDING FLOOR AREA OCCUPIED BY PARTY WALLS AND EXCLUDING:
 - FLOOR AREA OCCUPIED BY SHARED MECHANICAL SERVICE AND ELECTRICAL EQUIPMENT THAT SERVE THE BUILDING; (BY-LAW 2008-326)
 - COMMON HALLWAYS, CORRIDORS, STAIRWELLS, ELEVATOR SHAFTS AND OTHER VOIDS, STEPS AND LANDINGS; (BY-LAW 2008-326)
 - BICYCLE PARKING; MOTOR VEHICLE PARKING OR LOADING FACILITIES
 - COMMON LAUNDRY, STORAGE AND WASHROOM FACILITIES THAT SERVE THE BUILDING OR TENANTS;
 - COMMON STORAGE AREAS THAT ARE ACCESSORY TO THE PRINCIPAL USE OF THE BUILDING; (BY-LAW 2008-326)
 - COMMON AMENITY AREA AND PLAY AREAS ACCESSORY TO A PRINCIPLE USE ON THE LOT; AND (BY-LAW 2008-326) LIVING QUARTERS FOR A CARETAKER OF THE BUILDING.

ISSUE RECORD:

NO.	DESCRIPTION	DATE
1	FOR CLIENT REVIEW	2022/05/12
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5	FOR CO-ORDINATION/REVIEW	2023/02/28

ZONING:

ZONING DESIGNATIONS (PART 11):
ZONE IP-13 - BUSINESS PARK INDUSTRIAL ZONE

ZONING PROVISIONS

SETBACKS (SECTIONS 205 AND 206):	REQ.	PROVIDED
FRONT YARD:	6.00m	19.85m
CORNER SIDE YARD:	6.00m	18.60m
INTERIOR SIDE YARD:	4.00m	7.34m
REAR YARD:	4.00m	55.70m
REAR YARD:	4.00m	4.00m
REAR YARD:	6.00m	16.90m

BUILDING HEIGHT:

MAXIMUM: 22m
PROPOSED: 6.9m

PERMITTED ACCESSORY/DISPLAY AREA:

MAXIMUM: 25%
PROPOSED: 16%

LANDSCAPING (SECTION 205):

ABUTTING A STREET: 3.0m MINIMUM
NOT ABUTTING A STREET: NO MINIMUM

VEHICLE PARKING (SECTION 101): SCHEDULE 1A - AREA C

MINIMUM REQUIRED:	115
NUMBER PROVIDED:	116

BICYCLE PARKING (SECTION 111):

MINIMUM REQUIRED:	13
NUMBER PROVIDED:	13

LOADING ZONE (SECTION 113):

MINIMUM REQUIRED:	1
NUMBER PROVIDED:	10

PARKING FOR THE PHYSICALLY DISABLED (PARKING BYLAW 2003-530, SECTION 111):

MINIMUM REQUIRED:	2
NUMBER PROVIDED:	5

DRAWING LEGEND:

- ▲ LOCATION OF PEDESTRIAN DOORS
- ▲ LOCATION OF VEHICULAR DOORS
- B BOLLARD
- ♿ ACCESSIBLE PARKING SPACE C/W PAINTED LOGO & SIGN ON POST OR WALL
- L DESIGNATED LOADING ZONE
- CR CURB RAMP W/TWSI
- G NEW CONCRETE PAD MOUNTED GARBAGE ENCLOSURE
- ⊙ LIGHT STANDARD, SEE ELECTRICAL
- ⊗ EFH EXISTING FIRE HYDRANT
- ⊗ NFH NEW FIRE HYDRANT
- Y FIRE DEPARTMENT CONNECTION
- PROPERTY LINE
- PROPERTY SET BACK LINE
- LANDSCAPE SET BACK LINE
- FIRE TRUCK BACK-UP SPACE
- OUTLINE OF PROPOSED BUILDING
- SOFT LANDSCAPING, REFER TO LANDSCAPING DRAWINGS
- CONCRETE WALKING SURFACE, REFER TO CIVIL DRAWINGS
- EXTENT OF NEW FIRE ACCESS ROUTE c/w HEAVY DUTY ASPHALT, REFER TO CIVIL DRAWINGS
- SNOW STORAGE

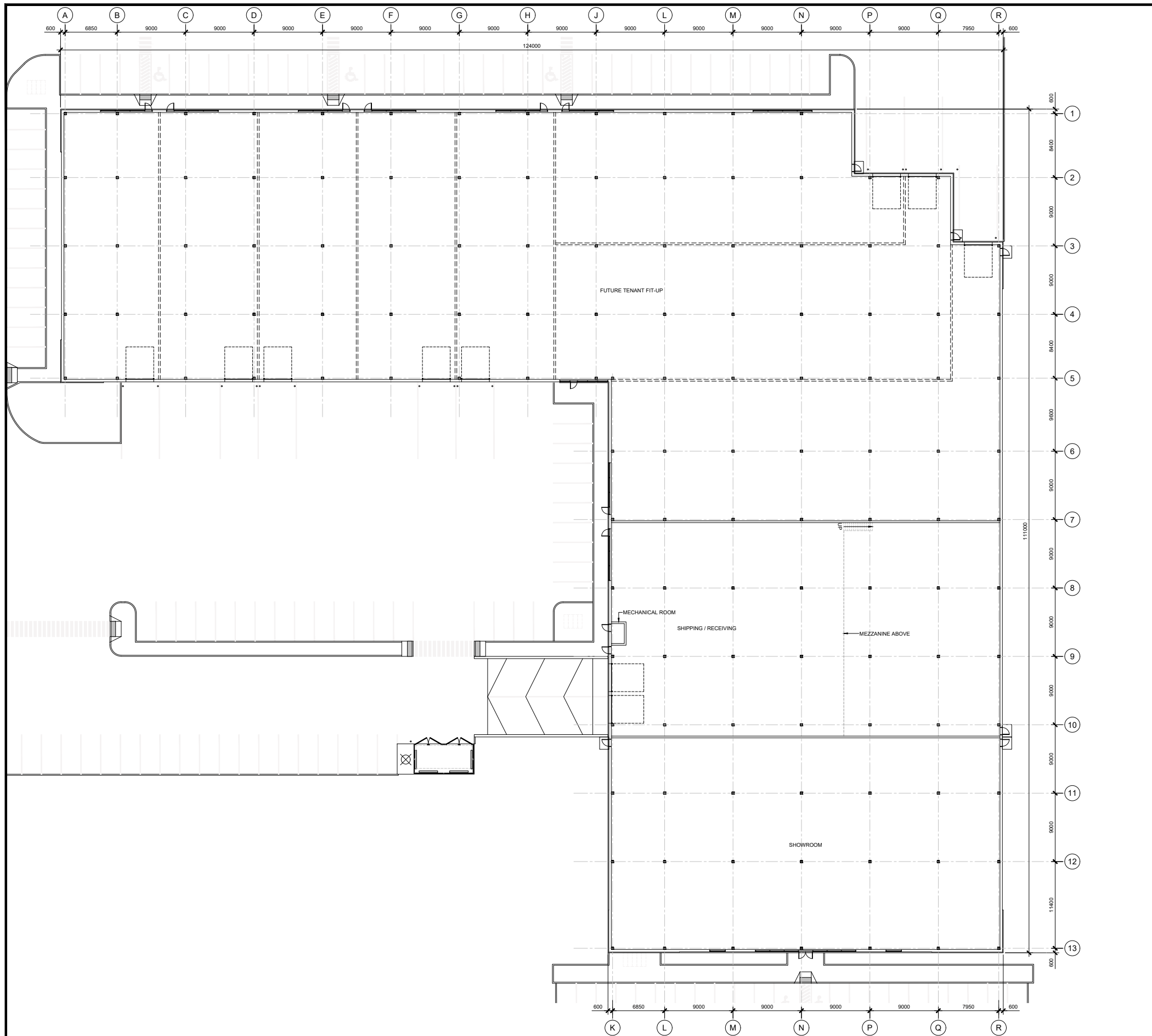
DCA A GROUP OF ARCHITECTS
201-1339 WELLINGTON ST. WEST OTTAWA ON K1Y 3B8
WWW.ARCHITECTSDCA.COM 613.725.2294

PROJECT TITLE
KONSON WAREHOUSE
BLOCK 1, SOUTH HALF LOT 4, CONCESSION 1
OTTAWA, ON

DRAWING TITLE
SITE PLAN

DATE	DRAWN	JOB NO.	DRAWING NO.
JAN. 2023	BRUC	3482	A100
SCALE	REVIEWED		
AS NOTED	TD		

ARCHITECTURAL



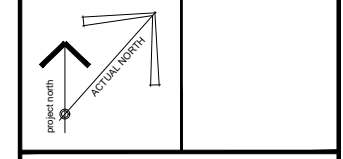
1
A200 GROUND FLOOR PLAN
SCALE: 1:250

GENERAL NOTES

- DO NOT SCALE DRAWINGS. ONLY FIGURED DIMENSIONS ARE TO BE USED. WHERE DOUBT EXISTS, FILE REQUEST FOR INTERPRETATION AND REQUEST CLARITY.
- IT IS THE RESPONSIBILITY OF THE GENERAL CONTRACTOR TO VERIFY DIMENSIONS ON SITE. REPORT DISCREPANCIES TO THE ARCHITECT PROMPTLY.
- GENERAL CONTRACTOR TO TAKE INTO ACCOUNT CONSTRUCTION TOLERANCE. GENERAL CONTRACTOR TO COORDINATE THE WORK OF DIFFERENT TRADES TO COMPLY WITH DESIGN INTENT.
- ALL WORK DESCRIBED IN THESE DRAWINGS AND SPECIFICATIONS ARE TO COMPLY WITH THE CURRENT EDITION OF THE ONTARIO BUILDING CODE (2012) OR NATIONAL BUILDING CODE (2010) INCLUDING MOST RECENT AMENDMENTS.
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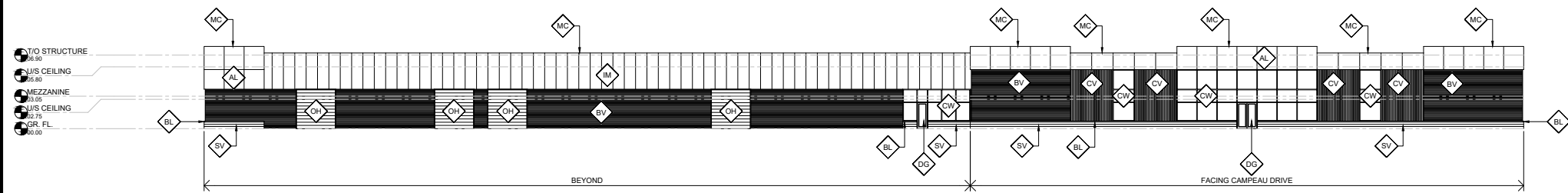


PROJECT TITLE
KONSON WAREHOUSE
BLOCK 1, SOUTH HALF LOT 4, CONCESSION 1
OTTAWA, ON

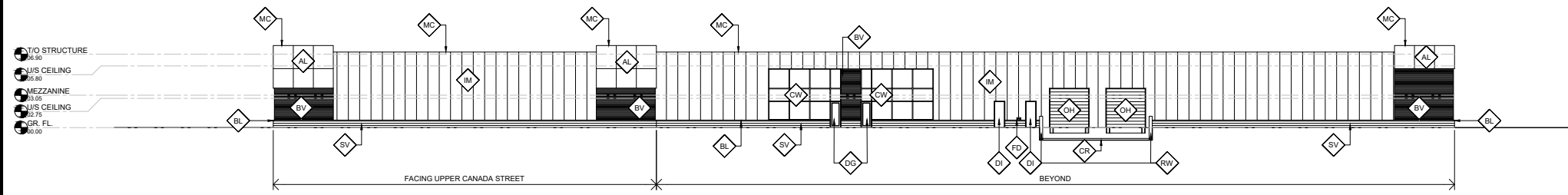
DRAWING TITLE
GROUND FLOOR PLAN

DATE	DRAWN	JOB NO.	DRAWING NO.
JAN. 2023	BRIC	3482	A200
SCALE	REVIEWED		
AS NOTED	TD		

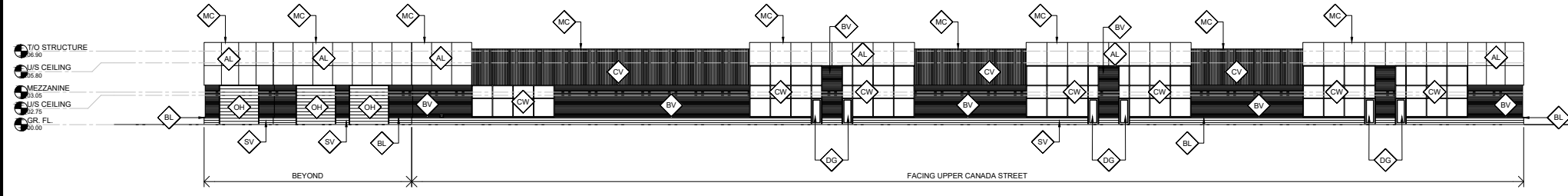
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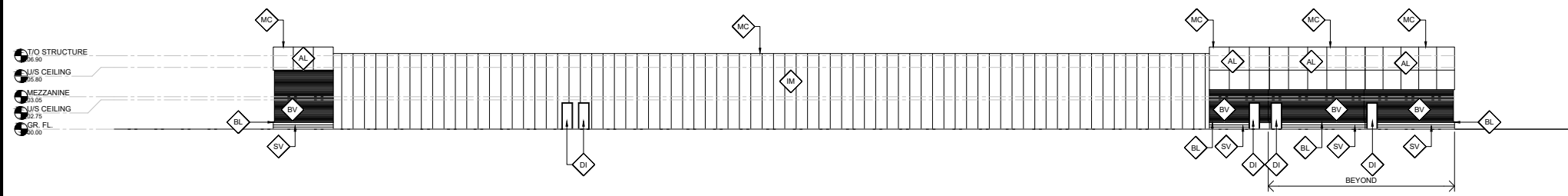
1 SOUTH ELEVATION
SCALE: 1:250



2 WEST ELEVATION
SCALE: 1:250



3 NORTH ELEVATION
SCALE: 1:250



4 EAST ELEVATION
SCALE: 1:250

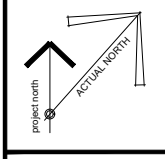
- DRAWING LEGEND:
- AL ALUMINUM COMPOSITE PANEL
 - BV BRICK VENEER
 - BL BRICK LEDGE
 - CR CONCRETE RAMP
 - CV PRE FINISHED CORRUGATED METAL SIDING (VERTICAL)
 - CW CURTAINWALL
 - DG DOOR, GLAZED
 - DI DOOR, INSULATED HOLLOW METAL
 - FD FIRE DEPARTMENT CONNECTION
 - IM INSULATED METAL PANEL
 - MC PRE FINISHED METAL CAP FLASHING
 - OH OVERHEAD DOOR
 - RW CONCRETE RETAINING WALL
 - SV SPLIT-FACE MASONRY VENEER

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PROJECT TITLE
KONSON WAREHOUSE
BLOCK 1, SOUTH HALF LOT 4, CONCESSION 1
OTTAWA, ON

DRAWING TITLE
BUILDING ELEVATIONS

DATE	DRAWN	JOB NO.	DRAWING NO.
JAN. 2023	BRIC	3482	A300
SCALE	REVIEWED		
AS NOTED	TD		

ARCHITECTURAL