Site Servicing and Stormwater Management Report 2140 Baseline Road

Type of Document
Site Plan Submission

Project Name
Ottawa Rental Apartment
2140 Baseline Road

Project Number
OTT-00245012-A0

Site Plan Control File Number
D07-12-18-0084

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Date Submitted
December 13, 2019

Baseline Constellation Limited Partnership

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1 Introduction

1.1 Site Description and Proposed Development

Baseline Constellation Partnership Inc. retained EXP Services Inc. (EXP) to prepare a site servicing and stormwater management report for a proposed 14-storey rental apartment building.

The 0.305-hectare development site is situated at 2140 Baseline Road, at the corner of Baseline Road and Constellation Crescent in the City of Ottawa (City), Ontario as shown on Figure A1 in Appendix A. The site is within Ward 8 or College Ward.

The property consists of the following parcels, all located in Lot 35, Concession 2 (Rideau Front), Geographic Township of Nepean, City of Ottawa.

- PIN 04692-1308, Parts 2, 3, 4 on Registered Plan 4R-26884
- PIN 04692-1310, Parts 6, 7 on Registered Plan 4R-26884
- PIN 04692-1312, Part 8 to Part 15 on Registered Plan 4R-26884
- PIN 04692-1315, Parts 16, 17 on Registered Plan 4R-26884
- PIN 04692-1317, Part 23 to Part 35 on Registered Plan 4R-26884

The development is comprised of 271 units, that contain 1 to 3 bedrooms.

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

1.2 Background Documents

Various design guidelines were referred to in preparing the current report including:

- Sewer Design Guidelines, Second Edition, Document SDG002, October 2012, City of Ottawa 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)
- Ottawa Design Guidelines – Water Distribution, July 2010 (WDG001), including:
  - Technical Bulletin ISDTB-2014-02 (May 27, 2014)
  - Technical Bulletin ISTB-2018-02 (21 March 2018)

- Stormwater Management Guidelines for the Pinecrest Creek / Westboro Area, JFSA, June 2012.
- Stormwater Management Planning and Design Manual, Ontario Ministry of the Environment and Climate Change, March 2003 (SMPDM).
- Design Guidelines for Drinking-Water Systems, Ontario Ministry of the Environment and Climate Change, 2008 (GDWS).
- Fire Underwriters Survey, Water Supply for Public Fire Protection (FUS), 1999.
- Ontario Building Code 2012, Ministry of Municipal Affairs and Housing.
- Ontario Ministry of Transportation (MTO) Drainage Manual, 1995-1997.

1.3 Existing Infrastructure

The current 0.3-hectare site is vacant and consists of grassed areas containing approximately eleven (11) mature trees. Prior to 2009, the site contained a one-way roadway connection from Constellation Crescent to Baseline Road. This roadway connection was removed, and Constellation Crescent / Gemini Way was re-configured into its current configuration as a tee-intersection. A two-way connection with a signalized intersection at Baseline Road and Constellation Crescent was created.

Within the 0.30-hectare site previously abandoned utilities exist. From review of the as-built drawings and Central Registry (UCC) plans, the sewer and water structures (manholes and catchbasin, etc.) were removed by 2009, however the sewer and water infrastructure piping were abandoned in place. The following summarizes the onsite and adjacent offsite existing utilities:

Within property

- Abandoned 525mm, 750mm, and 900mm storm sewers
- Abandoned 250mm and 300mm sanitary sewers
- Abandoned 200mm watermains
- Bell / Hydro / Telecom Ottawa. Status to be confirmed with the utility providers

On Gemini Way

- 525mm, 675mm, and 900mm storm sewers
- 250mm and 300mm sanitary sewers
- 200mm watermains
- Bell / Streetlighting

On Constellation Crescent

- 900mm storm sewers
- 250mm sanitary sewers
- Bell / Telecom Ottawa / Traffic / Streetlighting

On Baseline Road

- 525mm storm sewers
- 406mm, 1220mm watermains
- Bell / Traffic / Streetlighting

The as-built drawings for both Gemini Way and Constellation Crescent were obtained and are included in Appendix H.

1.4 Consultation and Permits

A pre-consultation meeting was held between Baseline Constellation Partnership and the City prior to design commencement. This meeting outlined the submission requirements and provided information to assist with the development proposal.

Generally, an Environmental Compliance Approval (ECA) would be obtained from the Ministry of Environment, Conservation and Parks (MECP), formerly the Ministry of the Environment and Climate Change (MOECC), for the onsite Private Sewage Works. The onsite sewage works would generally include the onsite flow controls, associated stormwater detention, and treatment works.

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

Therefore the 5 parcels noted in Section 1.1 will be merge into one property parcel. Completing this merge of parcels, will satisfy the Approval Exemptions under O'Reg 525/98, and not require an ECA. Prior to City signoff on the infrastructure design a pre-consultation meeting will be held with the local MECP, to confirm that the site will not require an ECA, for the reasons noted.

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

2 Geotechnical Considerations

A geotechnical investigation was completed by the Paterson Group Inc. dated January 03, 2019 and was prepared to establish the subsurface and groundwater conditions and to provide recommendations related to excavation, foundation design, backfilling requirements, site grading, pipe bedding, pavement structure.

In general, the site consists of topsoil underlain by fill followed by silty sand and silty clay. Three (3) boreholes were drilled to a maximum depth of 11.8 metres. The groundwater table is expected at between 4 and 5 metres below existing grade.

A maximum grade raise requirement of 1.5m was established for the site. The recommended pavement structure for access and fire lanes was established at: 40mm + 50mm of asphalt, 150mm granular "A" and 450mm depth of Granular "B".

3 Deviations

There are no noted deviations from the City Design Standards (SDG002). It should be noted that the stormwater management requirements, as dictated by the "Stormwater Management Guidelines for the Pinecrest Creek / Westboro Area, JFSA, June 2012", far exceed the standard infill development stormwater guidelines as noted in Section 8.3.7 of the SDG002.

Due to these master servicing requirements of the JFSA report, additional runoff volume, flood and erosion control requirements are necessary due to the sensitivity of the receiving Pinecrest Creek and Ottawa River, and lack of existing downstream stormwater management facilities.

4 Watermain Servicing

4.1 Methodology

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

- Estimated water demands under average day, maximum day and peak hour conditions. As the total population estimate of 482 persons was below 500, residential peaking factors were interpolated based on MOE Table 3-3. For ground floor commercial areas, average demands were taken from the SDG002, Appendix 4-A for similar uses.
- Estimated the required fire flow (RFF) based on the Fire Underwriters Survey (FUS).
- Obtained hydraulic boundary conditions (HGL) from the City, based on the above water demands and required fire flows.
- Boundary condition data and water demands were used to estimate the pressure at the proposed building, and this was compared to the City's of Ottawa's design criteria.

4.2 Design Criteria

We estimated the domestic water demands as shown below, using parameters from the WDG001 as follows:

Pressure Zone

Proposed site located in zone	=	2W

Number of Units

1-bedroom units	=	104
Studio Units	=	39
2-bedroom units	=	115
3-bedroom units	=	13

Densities

1-bedroom units (persons per unit)	=	1.4
Studio Units	=	1.4
2-bedroom units (persons per unit)	=	2.1
3-bedroom units (persons per unit)	=	3.1

Residential Populations

143, 1-bedroom units (@ 1.4 persons per unit)	=	145.6
39, studio units (@ 1.4 persons per unit)	=	54.6
115, 2-bedroom units (@ 2.1 persons per unit)	=	241.5
13, 3-bedroom units (@ 3.1 persons per unit)	=	40.3
	=	482.0

Commercial Areas

Ground Floor Commercial Areas (m^2)	=	1353

Demand Rates

Average Residential Demands (L/person/day)	=	350
Average Commercial Demands (L/m^2/day)	=	5

Peaking Factors

Max Day Residential Peaking Factor (as per MOE Table 3-3)	=	2.94 x avg. day
Peak Hour Residential Peaking Factor (as per MOE Table 3-3)	=	4.37 x avg. day
Max Day Commercial Peaking Factor	=	1.5 x avg. day
Peak Hour Commercial Peaking Factor	=	1.8 x max. day

Watermain Design

C factor (200 mm – 300 mm)	=	110
Minimum Allowable Pressure	=	275 kPa (40 psi)
Maximum Allowable Pressure	=	690 kPa (100 psi)
Minimum Static Pressure (Under Fire Flow Conditions)	=	140 kPa (20 psi)

Residential Water Demands

Average Residential Demands 482.0 persons x 350 L/person/day x (1/86,400 sec/day)	=	1.95 L/sec

Commercial Water Demands

Average Demands
1353 m^2 x 5 Litres/m^2/day x (1/86,400 sec/day) = 0.078 L/sec

Total Water Demands

Total Average Day Demands = 1.95 + 0.078 = 2.03 L/sec

Total Maximum Day Demands = 1.95 x 2.94 + (0.078) x 1.5 = 5.85 L/sec

Total Peak Hour Demands = 1.95 x 4.37 + (0.078) x 1.5 x 1.8 = 8.75 L/sec

The average day, maximum day, and peak hourly demands for the proposed building at 2140 Baseline Road are 2.0 L/sec, 5.9 L/sec, and 8.8 L/sec, respectively. Please note that the maximum day and peak hour factors, noted above, were determined based on MOECC GDWS Table 3-3 as the population of the proposed development is less than 500 persons. This requirement is noted in Section 4.2.8 of the City's WDG001. Detailed calculations of the domestic water demands are provided in Table C1.

4.3 Fire Flow Requirements

Water for fire protection will be available utilizing the proposed fire hydrants located along the adjacent roadways: Gemini Way, Baseline Road, and Constellation Crescent. The required fire flows for the proposed building were calculated based on typical values as established by the Fire Underwriters Survey 1999 (FUS).

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

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

where

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

A reduction for low hazard occupancy of -15% for residential dwellings, and an increase for fire area exposure of +11% was used. Below are the fire flow requirements.

Type of Construction	=	Non-combustible
Coeff Related to Construction	=	0.8
Ground Floor Area	=	1512.9 m^2
2nd to 6th Floor Area	=	1481.4 m^2
7th to 14 th Floor Area	=	1183.4 m^2
Number of Floors	=	14
Fire Flow Requirement, FF	=	$200 * 1.5 * \sqrt{(A)}$
	=	$200 * 1.5 * \sqrt{(8323.9)}$
	=	16,057 L/min or 16,000 L/min (rounded up)

Occupancy Class	=	Limited Combustible
Occupancy Charge	=	-15%
Fire Flow Requirement, FF	=	16,000 *-15%
(with reduction due to occupancy)	=	-2,400 L/min
	=	13600 L/min
Sprinkler Protection Credit		
	=	-30% (Sprinkler Conforming to NFPA 13)
	=	-10% (standard water supply for FD hose line)
Fire Flow Requirement, FF	=	13600 *-40%
(with Reduction due to sprinkler)	=	8,160 L/min
Charges Due to Exposures	=	sum for all sides
	=	0% + 5% + 0% + 6%
	=	11%
Required Fire Flow (RFF)	=	8,160 L/min + 1,496 L/min
	=	9,656 L/min
	=	10,000 L/min (rounded to closest 1,000)
	=	167 L/sec

Note that since the main floor commercial space was less than 10% of the total area, an occupancy charge under limited combustion could also be applied to the commercial space.

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 metres 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 from each. All hydrants are expected to be of Class AA as per Section 5.1 of Appendix I.

Table C4 in Appendix C summarizes all fire hydrants within a 150m distance from the proposed building. For each hydrant the straight-line distance, distance measured along a fire route or roadway, whether its location is accessible, and its contribution to the required fire flow. Figure A5 in Appendix A illustrates the hydrant locations in proximity to the site.

The total available contribution of flow from hydrants was estimated as 13,300L/min, which exceeds the required fire flow of 10,000 L/min as identified in Appendix I of Technical Bulletin ISTB-2018-02.

4.5 Boundary Conditions

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

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

- Minimum HGL = 127.5 m
- Max Day + Fire Flow = 112.0 m (Assuming 150 L/sec fire flow)
- Maximum HGL = 134.6 m

Based on a ground elevation of approximately 85.75m at the boundary condition location this results in a system water pressure of 41.75 m or 59.4 psi during peak hour conditions.

4.6 Watermain Design

Since the average day demands of 175.5 m^3 per day exceed 50 m^3 per day, two watermain feeds to the building will be necessary as per Section 4.31 of the WDG001.

A review of the estimated watermain pressures at the building connection, based on the boundary conditions provided and the use of two watermains was completed.

Table C3 in Appendix C provides a comparison of anticipate pressures at the building connecting based on using a single watermain or two watermains. A single watermain analysis was completed to determined if the water pressure still met the City requirement during either the maximum day plus fire flow or peak hour condition.

Based on results, the use of two 150mm watermains would result in a pressure of 32.4 psi at the building, while the use of two 200mm watermains would improve the pressure to more than 36.2 psi under maximum day plus fire flow conditions. Therefore, two 200mm watermains with a shut-off valve between them is proposed.

There no pressure reducing measures required as operating pressures are within 50 psi and 80 psi during maximum day conditions.

A review of the geotechnical report indicates that the soil sample taken from the borehole BH1 has high resistivity indicating a highly aggressive corrosive soil. An anode manufacturer was contacted to confirm the appropriate anode to be used on all ductile Iron (DI) bends, tees, valves, etc. All anodes shall be of Z-24-48 as per City standard drawing W44.

Table 1 : Water Demand Summary

Water Demand	Required Flow (L/sec)	Total Peak Flow (L/sec)		Does It Meet Requirements?
		Required (psi)	Designed (psi)	
Average Day	2.4	>40	59.7	Yes
Max Day	6.3	>20	69.8	Yes
Max Day +Fire Flow	156.4	>20	36.2	Yes
Peak Hour	9.7	50-80	59.7	Yes

5 Sanitary Sewer Design

The sanitary sewer system is designed based on a population flow, an allowance for ground floor commercial/retail areas within the buildings and an area-based infiltration allowance. The flows were calculated using City sewer design guidelines (SDG002) as follows:

Area

Gross site area = 0.305 ha

Number of Units

1-bedroom units = 104
Studio Units = 39
2-bedroom units = 115
3-bedroom units = 13

Residential Populations

143, 1-bedroom units (@ 1.4 persons per unit) = 145.6
39, studio units (@ 1.4 persons per unit) = 54.6
115, 2-bedroom units (@ 2.1 persons per unit) = 241.5
13, 3-bedroom units (@ 3.1 persons per unit) = 40.3
= 482.0

Residential Peaking Factor

Peak Factor = 1 + 14 / (4 + $(P/1000)^{0.5}$)* K, where K = 0.8
Peak Factor = 1 + 14 / (4 + $(463.2/1000)^{0.5}$) x 0.8 = 3.39

Domestic Sewage Flow

Average Domestic Flow (482.0x 280 L/cap/day x (1/86,400 sec/day) = 1.562 L/sec
Peak Domestic Flow (3.39 x 1.56) = 5.295 L/sec

Commercial/Retail Areas

Ground Floor Commercial Areas (m^2) = 1353

Commercial Sewage Flows

Average Daily Flows 1353 m^2 / 5 L/m^2 x (1/86,400 sec/day)	=	0.078 L/sec
Commercial Peaking Factor	=	1.0 x avg. day
Peak Commercial Flow = (0.08 L/sec) * 1.0	=	0.078 L/sec

Infiltration

Infiltration Allowance	=	0.33 L/ha/sec
Infiltration Flow (0.305 ha x 0.28 L/ha/sec)	=	0.101 L/sec

Total Peak Sewage Flow

Peak Sanitary Flow = 5.295 + 0.078 + 0.101	**=**	**5.47 L/sec**

The estimated peak sanitary flow rate from the proposed property at 2140 Baseline Road is **5.47 L/sec** based on City Design Guidelines.

The proposed building will have an independent sanitary sewer connection to the existing 300mm sanitary sewer on Gemini Way, with the connection approximately 30 metres west of Constellation Crescent. The 250mm sanitary sewer is proposed with a minimum 3.15% slope, having a capacity of 107.2 L/sec based on Manning's Equation under full flow conditions. Based on the OBC, the maximum permitted hydraulic load for a 250mm at 3% is 5,500 fixture units.

A sanitary manhole is proposed to be installed at the property line, for monitoring purposes.

5.1 Offsite Sanitary Sewer Analysis

The proposed sanitary sewer within the development site will discharge to a 300mm sanitary sewer on Gemini Way. An analysis of the existing sanitary infrastructure was conducted to determine the capacity of the existing system and determine if the existing infrastructure could handle the anticipated additional flows to the overall system due to the new development proposed at 2140 Baseline Road.

Existing Conditions

Area	= 22.1 hectares
Residential Density for Townhome	= 2.7 person/unit
Residential Density for 1-bedroom apartment	= 1.4 person/unit
Residential Density for 2-bedroom apartment	= 2.1 person/unit
Residential Density for 3-bedroom apartment	= 3.1 person/unit
Residential Density for 4-bedroom apartment	= 4.1 person/unit
Residential Population	= 973 persons
Average Residential Flow Allowance	= 280 L/person/day
Residential Peaking Factor	= Harmon Formula
Commercial Flow Allowance	= 28,000 L/ha/fay
Commercial Peaking Factor	= 1.5

To confirm adequate capacity is available in the downstream system a review of the as-constructed conditions was completed and the peak sewage rates were re-calculated based on current City Guidelines.

Figure A4 in Appendix A illustrates the off-site sanitary sewers and tributary drainage area. It consists of residential and commercial uses. Using the City's urban building GIS layer, it was determined that there is approximately 6.8 hectares (182 townhomes) of residential lands and 15.3 hectares of commercial land tributary to the outlet sewer (sanitary manhole # 18696). The proposed development at 2140 Baseline Road will contain 44 2-bedroom suites, 72 3-bedroom suites, and 36 4-bedroom suites. The sewage flows, based on current City Guidelines, were re-calculated as follows:

Townhomes	= 182
1-bedroom apartment	= 143
2-bedroom apartment	= 115
3-bedroom apartment	= 13
182-Townhomes x 2.7 person/unit	= 491.4 persons
143- 1 Bedroom apartments x 2.1 person/unit	= 300.3 persons
115- 2 Bedroom apartments x 3.1 person/unit	= 356.5 persons
13- 3 Bedroom apartments x 4.1 person/unit	= 53.3 persons
Residential Population = 491.4+92.4+223.2+147.6	= 973.4 persons

<u>Residential Sewage Flow</u>

Residential Flow Allowance	= 280 L/person/day
Correction Factor, K	= 0.8
Peak Factor = $1 + (14 / (4 + (P/1000)^{0.5})) * K$	
Peak Factor = $1 + (14 / (4 + (973.4/1000)^{0.5})) * 0.8$	
Peak Factor = 1 + (2.81) * 0.8	= 3.25
Avg. Domestic Flow = 973.4 x 280 L/person/day x (1/86,400 sec/day)	= 3.15 L/sec
Peak Domestic Flow = 3.15 L/sec x 3.25	= 10.25 L/sec

<u>Institutional Sewage Flow</u>

Commercial Flow Allowance	= 28,000 L/day/ha
Commercial Peaking Factor	= 1.5
Commercial Area	= 15.3 ha
Commercial Flow = 28,000 x 15.3 x (1/86,400 sec/day) x 1.5	= 7.4 L/sec

<u>Extraneous Flows</u>

Total Area	= 22.1 hectares
Extraneous Flow Allowance	= 0.33 L/ha/sec
Extraneous Flows = (0.33 x 22.1)	= 7.3 L/sec

<u>Total Sewage Flow</u>

Total Sanitary Flow = 10.3+7.4+7.3	= 25.0 L/sec

The re-calculated peak sewage flows under developed conditions for the existing system downstream of 2140 Baseline is calculated to be 25.0 L/sec including the newly proposed development at 2140 Baseline Road. It should be noted that the residential sanitary flow allowance is now 280 L/person/day as per Technical Bulletin ISTB-2018-01, and therefore the existing infrastructure is conservatively designed in accordance with today's standard guidelines.

The maximum percent (%) full capacity within with sanitary sewer system was determinized to be 69.0% between sewer runs 18693 and 18694, just two sewer sections downstream of the proposed sewer connection from site at 2140 Baseline Road. Existing sanitary sewer invert elevation data was taken from the City's website. It can be concluded that the existing sanitary sewer system can support the proposed development at 2140 Baseline Road.

6 Stormwater Management

6.1 Design Criteria

The storm sewer system is designed in conformance with the latest version of the City Design Guidelines (October 2012). Section 5 "Storm and Combined Sewer Design" and Section 8 "Stormwater Management".

The allowable release rate for the site is limited to 10.1 L/sec based on the requirements of "Stormwater Management Guidelines for the Pinecrest Creek/Westboro Area", JFSA June 2012. This guideline sets the target release rate from the site to a maximum 33.5 L/ha/sec. Flows in excess of this target rate will be detained onsite for up to the 100-year storm event.

The following additional SWM criteria are required as noted in the JFSA Pinecrest Creek/Westboro Area SWM Guidelines (June 2012) for our site, as it falls within the Pinecrest Creek Watershed, upstream of the ORP pipe inlet:

- Runoff Volume Reduction: On-site retention of 10 mm storm.
- Water Quality: 80% TSS removal.
- Quantity Control: 100-yr discharge not to exceed 33.5 L/ha/sec.
- Erosion Control: Detain 25mm to meet outflow not exceeding 5.8 L/ha/sec.

6.1.1 Minor System Design Criteria

- The storm sewers have been designed and sized based on the Rational Method and the Manning's Equation under free flow conditions for the 2-year storm using a 10-minute inlet time.
- Inflow rates into the minor system are limited to an allowable release rate as noted above.

6.1.2 Major System Design Criteria

- The major system has been designed to accommodate on-site detention with sufficient capacity to attenuate the 100-year design storm. Excess runoff above the 100-year event will flow overland offsite.
- On site storage is provided and calculated for up to the 100-year design storm. Refer to Appendix D for the calculations of the required on-site storage volumes.

- We calculated the required storage volumes based on the Modified Rational Method as identified in Section 8.3.10.3 of the City's Sewer Guidelines.

- The 100-year discharge rate from the site is limited to 33.5 L/ha/sec as per the Pinecrest Creek / Westboro Area SWM Guidelines (Table 3.1).

6.2 Runoff Coefficients

Average runoff coefficients for all catchments were calculated using PCSWMM's area weighting routine. This modelling software has a GIS engine which allows for catchment (or polygon) definition including attributes. The runoff coefficients for all catchments were area weighted to derive at average runoff coefficients based on hard surfaces (concrete or asphalt) having an imperviousness of 100%, soft surfaces (landscaping surfaces) having a zero percent imperviousness. The conversion from an imperviousness percent to a runoff coefficient was taken as C = (IMP*0.70) / 100 + 0.20, with the imperviousness (IMP) as a percentage.

The average runoff coefficient for the overall site area under post-development conditions was calculated as 0.81, whereas the pre-development average runoff coefficient was less than 0.20. Runoff coefficients for individual catchment ranged from 0.20 to 0.90. It should be noted that prior to 2008, the site contained an asphalt roadway, and it was after 2008 that Constellation Crescent and Gemini Way were re-configured into their current location.

The allowable release rate from the site was calculated based on the more restrictive of:

1) Established based on "Storm Water Management Guidelines for The Pinecrest Creek/Westboro Area, JFSA June 2012," at 33.5 L/ha/sec.

2) Established based on Section 8.3.7.3 of the SDG002, with a pre-development runoff coefficient for 2-year storm.

The pre-development runoff coefficient was determined to be 0.20 and in the 2-year event the onsite pre-development flow was 13.1 L/s. Based on the "Storm Water Management Guidelines for The Pinecrest Creek/Westboro Area, JFSA June 2012," with an allowable release rate is 33.5 L/ha/sec, an site area of 0.305-hectres, results in an allowable release rate is 10.1 L/sec. Therefore, the governing allowable release flow is based on the "Storm Water Management Guidelines for The Pinecrest Creek/Westboro Area, JFSA June 2012."

6.3 Time of Concentration

The time of concentration for the pre-development catchments were determined using the Airport Method (Federal Aviation Administration). The Airport Formula is suited well for undisturbed land and is typically used for drainage areas with a runoff coefficient of less than 0.40. From the MTO Drainage Manual the Airport Formula used is as follows:

$$\mathrm{Tc} = \frac{3.26 * (1.1 - C) * L^{0.5}}{Sw^{0.33}}$$

where:

Tc	=	Time of Concentration (minutes)
C	=	Runoff Coefficient
Sw	=	Watershed Slope (%)
L	=	Watershed Length (m)

The watershed length and slope that were used were determined by reference to the topographic survey. Detailed calculations for each catchment is provided in Table D1 of Appendix D for reference.

6.4 Pre-Development Conditions

The 0.30-hectare site is currently vacant, however prior to 2008 it was used as a connection roadway between Constellation Crescent and Baseline Road. From the existing ground elevations shown on the grading plan, storm runoff flows are in a northerly direction to catch basins on Constellation Crescent and Baseline Road. The pre-development runoff coefficient for the site was determined as 0.20.

Figure A2 in Appendix A illustrates the pre-development drainage conditions. Runoff from the site is directed southerly to catchbasins on Gemini Way, northerly to Baseline Road, or easterly to Constellation Crescent. Since external lands upstream of the site boundary drains towards the proposed site, it was necessary to expand the catchments areas tributary to the storm sewers on the adjacent streets. This was completed in order to compare the total peak flows under pre-development and post-development conditions. Also, catchment boundaries upstream, downstream and within the site boundary were separated for comparison purposes.

Using a time of concentration (T_C) of 10 minutes, the pre-development release rates from the site were determined for the 5-year and 100-year storms using the Rational Method as follows:

$Q_{PRE} = 2.78\ C\ I\ A$

where:

Q_{PRE}	=	Peak Discharge (L/sec)
C	=	Runoff Coefficient (C=0.20)
I	=	Average Rainfall Intensity for return period (mm/hr)
	=	998.071/ (T_C+6.053)^0.814 (5-year)
	=	1735.688/ (T_C+6.014)^0.820 (100-year)
Tc	=	Time of concentration (mins)
A	=	Drainage Area (hectares)

Table D2 summarizes the pre-development peak flows based on the time of concentrations determined using the Airport Formula. Table 1 below summarizes the 5-year and 100-year pre-development peak flows tributary to the storm sewers on Baseline Road or Constellation Crescent / Gemini Way for all catchments. Please note that pre-development catchments PRE-1 and PRE-2 were combined as they discharge to the same storm sewer.

Table 2: Summary of Pre-Development Flows

Return Period Storm	Peak Flow to Constellation / Gemini Storm Sewers (L/sec)			Peak Flow to Baseline Storm Sewers (L/sec)			Total Peak Flows (L/sec)
	Onsite Areas	External Areas	Combined Onsite + External Areas	Onsite Areas	External Areas	Combined Onsite + External Areas	
	1B,2A	1A,1C, 2B		3B	3A,3C		
2-year	7.8	57.0	64.9	5.1	25.0	30.2	95.0
5-year	10.6	78.3	88.9	7.0	34.2	41.1	130.1
100-year	22.8	168.5	191.2	14.9	73.3	88.2	279.5

6.5 Calculation of Allowable Release Rate

With the proposed changes in land use, the overall imperviousness of the site will increase. To control runoff from the site it is necessary to limit post-development flows to allowable capture rate for all storm return periods up to the 100-year event. The allowable release rate from the site is based on the requirements of the "Stormwater Management Guidelines for the Pinecrest Creek/Westboro Area", JFSA June 2012. The allowable release rate will be limited to 33.5 L/ha/sec or 10.1 L/sec for the 0.30-hectare parcel. To control runoff from the site it will be necessary to use an onsite inlet control device (ICD) and flow-controlled roof drains as noted in the proceeding sections.

6.6 Offsite Overland Flow Areas

Since there is a small amount of onsite drainage that will discharge over land directly to the right-of-way, it was necessary to subtract the peak flows from these areas, to ensure that no increase in runoff occurs under post development conditions. In addition, the 100-year discharge rate from the site needs to meet the allowable target rate of 10.1 L/sec.

The peak flows for drainage area PST-2B and PST-3B were estimated below to account for overland flow that will discharge offsite without being captured. For additional calculations of storm drainage areas please refer to Table D5 in Appendix D.

Using a post-development time of concentration (T_C) of 10 minutes and a runoff coefficient of 0.67 and 0.35, the 100-year uncontrolled flow rate, Q_{100UNC}, was determined using the Rational Method as follows:

Q_{100UNC} = $2.78\ C\ I_{100}\ A$

where:

Q_{100UNC} = Peak Discharge (L/s)
C = Runoff Coefficient
I_{100} = Rainfall Intensity (mm/h) for 100-year storm
A = Drainage Area (ha)
I_{100} = $1735.688 / (10 + 6.014)^{0.820} = 178.56$ mm/hr

(Area PST-2B) Q_{100UNC} = 2.78 x 0.67 x 125% x 178.56 x (0.0051) = 2.1 L/sec
(Area PST-3B) Q_{100UNC} = 2.78 x 0.35 x 125% x 178.56 x (0.0061) = 1.3 L/sec

The allowable release rate to the storm sewers (minor system) on Gemini Way is determined by subtracting the uncontrolled 100-year runoff from the allowable release rate as follows:

$Q_{REL} = Q_{ALLOW} - Q_{100UNC}$

The discharge rate to the Gemini Way storm sewer and the rates that will be used to determine storage requirements are:

$$
\begin{aligned}
Q_{REL} &= Q_{ALLOW} - Q_{100UNC} \\
&= Q_{ALLOW} - Q_{100UNC\text{-}PST\text{-}2B} - Q_{100UNC\text{-}PST\text{-}3B} \\
&= 10.1 - 2.1 - 1.3 \\
&= 6.6 \text{ L/sec}
\end{aligned}
$$

Therefore, the allowable discharge into the existing storm sewer (directly connected) from the site is **6.6 L/sec.**

6.7 Calculation of Post-Development Runoff

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

The estimation of peak flows under post-development conditions was completed using the Rational Method as noted below, with detailed calculations included in Table D4 and table D5 in Appendix D.

For catchments within the proposed site a time of concentration (TC) of 10 minutes was used as per the SDG002. For catchments outside of the site boundary, the same Tc which was used for the pre-development conditions was maintained. Peak 2-year, 5-year and 100-year storm flows using the Rational Method are noted below. Note that average runoff coefficients for all catchments were derived using the area-weighting command in PCSWMM.

$$
\begin{aligned}
I_{2} &= 732.951 / (Tc + 6.199)^{0.810} &&= 76.81 \text{ mm/hr} \\
I_{5} &= 998.071 / (Tc + 6.053)^{0.814} &&= 104.19 \text{ mm/hr} \\
I_{100} &= 1735.688 / (Tc + 6.014)^{0.820} &&= 178.56 \text{ mm/hr}
\end{aligned}
$$

$$
\begin{aligned}
Q_{2POST} &= 2.78 \times C_{AVG} \times 76.81 \text{ mm/hr} \times \text{Area} \\
Q_{5POST} &= 2.78 \times C_{AVG} \times 104.19 \text{ mm/hr} \times \text{Area} \\
Q_{100\,POST} &= 2.78 \times C_{AVG} * 25\% \times 178.56 \text{ mm/hr} \times \text{Area}
\end{aligned}
$$

Based on the storm drainage areas the post-development runoff rates are calculated and summarized in Table 2 below with detailed calculations provided in Table D5 of Appendix D.

Figure A3.1 in Appendix A illustrates the post-development drainage system and catchments. For the roof areas, individual catchments were created for roof drains. There are six (6) different roof levels that contain roof drains, with these being denoted as R1, R2 etc. Figure A3.2 illustrates the roof areas.

A roof drain calculation sheet was prepared, and is provided in Table D11 of Appendix D. This was completed to estimate the 5-year and 100-year discharge rates, and the resultant storage volumes that will occur based on the number of proposed drains. The discharge rate from the roof and the resultant 100-yr storage is 27.3 L/sec and 35.3 m^3. Additional information on the roof drains and storage on the roof is presented in proceeding sections of this report.

Table 3: Summary of Post-Development Flows

Area No.	Area (ha)	Runoff Coefficient			Release Rate (L/s)		
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr
PST-1A	0.0208	0.200	0.20	0.25	(2.5)	(3.1)	(6.6)
PST-1B	0.0629	0.680	0.68	0.85			
PST-1C	0.0342	0.840	0.84	1.00			
PST-1D	0.0112	0.900	0.90	1.00			
PST-1E (R1)	0.0298	0.900	0.90	1.00			
PST-1E (R2)	0.0609	0.900	0.90	1.00			
PST-1E (R3)	0.0178	0.900	0.90	1.00			
PST-1E (R4)	0.0382	0.900	0.90	1.00			
PST-1E (R5)	0.0093	0.900	0.90	1.00			
PST-1E (R6)	0.0066	0.900	0.90	1.00			
PST-3C	0.0228	0.640	0.64	0.80			
PST-1G	0.0690	0.680	0.68	0.85	10.0	13.6	29.1
PST-2A	0.1400	0.820	0.82	1.00	32.5	44.3	92.9
PST-2B	0.0051	0.670	0.67	0.84	0.7	1.0	2.1
PST-3A	0.0669	0.200	0.20	0.25	2.9	3.9	8.3
PST-3B	0.0061	0.350	0.35	0.44	0.5	0.6	1.3
PST-3D	0.1036	0.710	0.71	0.89	16.0	21.7	46.5
Total	0.705				65.1	88.2	187.0

Note:
1) *Release rates denoted in (brackets) are controlled rates.*
2) *Release rates highlighted yellow are uncontrolled rates.*

In summary the 2-year 5-year and 100-year post-development flows are 65 L/sec, 88 L/sec and 187 L/sec, respectively. Control of runoff will be achieved using 1) a single inlet control located just downstream of underground storage chambers, and 2) flow-controlled roof drains. These controls will be used to restrict the discharge rates from the site to **10.1 L/sec** for the 100-year storm. Table 3 below further identifies the peak flows to each storm sewer.

Table 4: Summary of Post-Development Flows

Return Period Storm	Peak Flow to Constellation / Gemini Storm Sewers (L/sec)			Peak Flow to Baseline Storm Sewers (L/sec)			Total Post-Dev Peak Flows (L/sec)
	Onsite Areas	External Areas	Combined Onsite + External Areas	Onsite Areas	External Areas	Combined Onsite + External Areas	
	1A,1B,1C, 1D,1E,1F,3C	1G,2A		3B	3A,3D		
2-year	2.5	42.6	45.0	1.2	18.9	20.1	65.1
5-year	3.1	57.9	61.0	1.6	25.6	27.2	88.2
100-year	6.6	122.1	128.7	3.4	54.9	58.3	187.0

A comparison between Tables 2 and 4 illustrates a reduction in peak flows to meet the allowable discharge rate of 10.1 L/sec from the site.

Table 5 below summarize the total pre-development peak flows to both storm sewer outlets, for all catchment areas and the catchments within the site only. By controlling post-development peak flows to the restrictive rate of 33.5 L/ha/sec the resultant flow reductions of 32% overall and 83% for the site are achieved.

Table 5: Comparison of Pre-Development and Post-Development Peak Flows

All Catchments				Site Only			
Return Period Storm	Total Peak Flow (L/sec)		% Reduction	Return Period Storm	Total Peak Flow (L/sec)		% Reduction
	Pre-Dev	Post-Dev			Pre-Dev	Post-Dev	
2-year	95.0	65.1	32%	2-year	13.0	2.5	81%
5-year	130.1	88.2	32%	5-year	17.6	3.1	83%
100-year	279.5	187.0	33%	100-year	37.7	6.6	82%

The control of onsite runoff requires the detention of approximately +/-150 cubic metres. This will be achieved in underground chambers and on the rooftop.

6.8 Storage Requirements

Runoff from the site and building roof will be restricted via inlet control devices (ICDs) or with flow-controlled roof drains. Table 6 below summarizes the controlled release rates, and storage requirements for the roof and surface areas. Calculation of the on-site storage has been supported by calculations provided in Appendix D.

A catchbasin capture analysis was considered to demonstrate that the catchbasin system is capable of collecting stormwater during a 100-year storm event and the underground storage system will be utilized as intended. As shown in Appendix A, Figure A3.1, the areas that contribute to the catchbasins are PST-1B and PST-1C. The respective flows for each area are 26.5 L/sec and 17.0 L/sec. Therefore, the total flow into the catchbasins is 43.5 L/sec. CB1 has a ponding depth of 0.2m, whereas CB2 has a ponding depth of 0.1m in the 100-year event. Based on Design Chart 4.19: “Inlet Capacity at Road Sag,” from the Appendix 7-A.9 of SDG002, the inlet capacity at a sag location was determined for CB1, and CB2 as 160 L/sec, and 60 L/sec respectively. Therefore, the catchbasins have a combined capture capacity of 220 L/sec, which is greater than the 100-year peak rate of 43.5 L/sec.

Table 6 - Summary of Storage Requirements

Area	[3]Release Rate (L/s)			Storage Required (m^3)			[1]Storage Provided (m3)	Control Location	Control Type
	2-yr	5-yr	100-yr	2-yr	5-yr	100-yr			
Roofs	n/a	18.6	27.3	n/a	15.2	35.3	71.9	Roof	Flow Controlled Roof Drains
Surface Areas (controlled)	2.5	3.1	6.6	5.2	71.2	149.5	162.7	STMH101	ICD
Surface Areas (un-controlled)	1.2	1.6	3.4	none	none	none	none	none	none
Totals	3.7	4.7	10.0	[2]52.3	271.4	[2]150.0	230.9		

Notes:
1-The Storage Provided on the Roof is based on the maximum prism volume of ponding at a 150mm depth. The storage provided for the Surface Areas (controlled) is provided in underground chambers.
2-The Storage Required Totals was determined with the Modified Rational Method for the entire area (roof & surface) using the controlled release rates for the Surface Areas.
3-The Release Rate Totals for the 2-yr, 5-yr and 100-yr are for Surface Areas only.

For the building roofs flow-controlled drains are necessary. An estimate of the controlled release rate and associated 100-year storage requirements was completed for the flat roof areas. Table D7 provides the estimated 5-year and 100-year storage requirements for the entire site based on the Modified Rational Method. A combined 100-year storage of 149.5 cubic metres is required based on the allowable discharge rate of 6.6 L/sec. This 6.6 L/sec discharge rate along with the uncontrolled overland flows of 3.4 L/sec results in a total of 10.0 L/sec.

In addition to the above analysis, reference from Table 3.2a (page 17) of the JFSA report indicates that for an imperviousness level of 85% (interpolated) the onsite storage requirements would be 475 m^3/ha. Based on a site area of 0.30 hectares, results in 142.5 m^3. This closely matches the +/-150 m^3 volume estimate from Table 6 above. This small increase above the 142.5m^3 is the result of the uncontrolled peak flows that needed to be subtracted from the allowable discharge rate.

During the 100-year event the following summarizes the estimated water depths on the roof and in the underground chambers. It should be noted that the entire 100-year volume will be contained within the chambers and no surface ponding will occur.

Table 7 - Summary of Storage Depths

Storm	Ponding Depths on Roof (mm)	Water Depth within Underground Chambers (m)
2-year	Not calculated	Not calculated
5-year	53 to 111	0.73
100-year	119 to 141	1.53

6.9 Inlet Control Divide (ICD) Requirements

Inlet control devices will be used to restrict runoff from entering the stormwater system. Inlet control devices for the roofs and surface areas will consist of flow-controlled area and/or roof drains. Table 8 below summarizes the type, release rate and head requirements for each inlet control location.

Table 8 - Summary of Flow Control

Control Location	Post-Dev Area No.	Max Flow (L/sec)	Max Head (m)	Type	Model	Number of Drains	Weir Position
Roof	R1-1 to R1-4, R2-1, R2-2	No weirs (6 drains)					
	R2-3, R2-4, R2-7toR4-1, R4-3 to R6-1	Full Flow	0.15	Flow Controlled Roof Drain	WATTS-ACCUTROL	15	Closed Position
	R2-5, R2-6	30GPM	0.15	Flow Controlled Roof Drain	WATTS-ACCUTROL	2	Full Position
	R4-2	1.26 each (or 20gpm)	0.15	Flow Controlled Roof Drain	WATTS-ACCUTROL	1	50% Position
STMH101	PST-1A to PST-1E	6.6	1.67	IPEX Tempest Inlet Control Device	IPEX LMF-75	n/a	n/a

6.10 Storm Sewer Design

The storm drainage areas are illustrated in Figure A3.1 in Appendix A. Drainage areas are shown on this drawing with average runoff coefficients calculated for each inlet. The maximum 100-year discharge rate to the storm sewer is 6.6 L/sec, with an additional 3.4 L/sec of overland flow from the site. A single 250mm storm sewer service (installed at minimum 2%) will be used. A 250mm sewer at 2% has a capacity of 88 L/sec. A 2-year storm design sheet was prepared to confirm adequate capacity is provided for the 2-year storm and is provided in Appendix D for reference.

6.11 Quality Control Measures

The site is located within the Pinecrest Creek subcatchment as identified in Figure 3.2 (Appendix H) taken from the Pinecrest Creek/Westboro Area SWM Guidelines (June 2012). As this area discharges directly to

Pinecrest Creek and is upstream of the ORP pipe inlet the following summarizes the specific additional quality and erosion control requirements.

- Runoff Volume Reduction: On-site retention of 10 mm storm.
- Water Quality: 80% TSS removal.
- Erosion Control: Detain 25mm to meet outflow not exceeding 5.8 L/ha/sec.

As a total suspended solids (TSS) removal efficiency of 80% is required, it is proposed to provide an oil grit separator for quality control. The following summarizes the design parameters used in the sizing of the Stormceptor manhole:

Table 9 – Design Parameters Used for Oil Grit Separator Sizing

Parameter	Value Used
Drainage Area	0.29 hectares
Imperviousness	89 %
TSS Removal Requirements	80 %
Runoff Volume Capture	85%
Flow attenuation upstream of OG separator (taken as 100-yr discharge & storage upstream of OG)	0.0066 m^3/s at 0.012234 ha.m 0.0033 m^3/s at 0.00617 ha.m
Particle distribution	fine

Output from the PCSWMM for Stormceptor program is provided in Appendix E for reference. A Stormceptor model STC300i is necessary to meet the required TSS removal of 80%. The STC300i will provide an approximate TSS removal of 91%.

To provide the necessary 10mm of volume reduction, the method outlined in Page 2 of Appendix D of the JFSA report was used. The following clarifies the methodology used.

<u>Volume Required to Infiltrate the 10mm storm</u>

Runoff Volume = 0.30 ha * (10mm – 1.57mm) * 10 m3/ha*mm
= 25.3 m^3

An additional depth of granular stone below the infiltration chambers and below the control device will be used to promote the infiltration of a runoff volume of 25.3 m^3. A design sheet provided from the manufacturer (ADS) for the Stormtech MC-3500 chambers requires twenty-two (22) chambers to provide the required volume. The granular footprint area under the chambers is 164.9 m^2. The required depth of an additional granular bed for infiltration of 25.3 m^3, is as follows is:

Depth Required (m) = Volume / (area *void ratio)
= 25.3 / (164.9 * 0.4)
= 0.38 m

This minimum depth and area of additional stone for infiltration is illustrated on the site servicing plan.

The water table elevation based on the geotechnical report by the Paterson Group Inc. dated January 03, 2019 is 81.50 metres. Further information in a July 25, 2019 memo, from the Paterson Group indicates that the groundwater table (GWT) will lower slightly around the building in the long-term. They confirmed that the seasonally high groundwater table of 81.50m will lower to 81.00m. Therefore, for the underground storage to stay at a minimum of 1m above the water table, the base elevation of the storage media must be 82.00 or higher. The invert elevation of the infiltration granular base was conservatively set at 82.536m at the downstream end. This is over 1.0m higher than the current groundwater table and 1.5m higher than the estimated long-term groundwater table.

Below the chamber base elevation of 82.536m, an additional infiltration basin 0.40m deep will be used for infiltration of the 10mm storm. Reference to the MOE's SMPDM was used to determine the effectiveness infiltration basin's infiltration capacity based on the native soil. Paterson Group confirmed a native soil infiltration rate of 20mm/hr.

Due to the location and depth of the infiltration basin minimal water quality treatment will be achieved. The basin will simply be utilized for infiltration (no treatment). The bottom area of infiltration required for full infiltration was determined using MOE Equation 4.3. Based on a retention time (Δt) of 24 hours, a soil infiltration rate of 20 mm/hr, the bottom area of the trench required is as follows:

$$A = (1000V)/(PN\Delta t)$$

where:

- A bottom area of trench (m^2)
- V runoff volume to be infiltrated m^3
- P infiltration rate of surrounding soil [20 mm/hr used]
- N porosity of the storage media [0.40 for clear stone]
- Δt retention time in hours [24 hours]

$$A = (1000 \times 25.3\ m3) / (20mm/hr \times 0.40 \times 24\ hrs)$$
$$A = 131.8\ m^2$$

The minimum area required for full infiltration of the 10mm storm is 131.8m^2. A total area of 164.9 m^2 will be provided (0.40m depth) below the underground chambers.

<u>Erosion Control Requirement for detaining 25mm storm to 5.8 L/ha/sec.</u>

A simplified approach was completed to determine the volume and peak flow that results from the 25mm storm based on this requirement. In a similar method as above the 25mm volume was determined as follows:

Erosion Control Volume, (ECV) = 0.30 ha * (25mm – 1.57mm) * 10 m^3/ha*mm
= 70.3 m^3

The total 25mm volume that would accumulate in the underground chambers was derived by subtracting the volume that was stored upstream of the chambers on the roof, and the volume in the infiltration basin below the chambers. The volume within the chambers would be

- Required Volume to meet ECV (entire site) 70.3 m^3
- Volume on roof only - 11.4 m^3
- Volume in infiltration basin below chambers = <u>- 26.4 m^3</u>
- Net Volume in Chambers to meet ECV = 33.6 m^3

The Manufacturers' Cumulative Storage Table was used (Appendix G) to determine the depth of water in the underground chambers that would occur based on the volume of 33.6 m^3. Based on the volume table this will occur at a depth of ±432mm (17 inch) above the bottom of the u/g chambers (bottom of trench).

Once the depth of water was determined based on the Cumulative Storage Table, the associated release rates based on an IPEX LMF 75 ICD was determined. In order to obtain a release rate of not more than 1.74 L/sec, the head on the orifice must be set at 0.12 metres below the water surface that occurs in the chambers during the 25mm storm. The following summarizes the approximate depth and release rate for erosion control volumes.

Table 9 - Summary of Erosion Control Volumes and Release Rates

Area	[1]Estimated Erosion Control Volume, ECV (m^3)	[2]Water Depth in Chambers at EVC (mm)	[3]Discharge Rate (L/sec
Entire Site	70.3	432	1.74
Notes: 1-Estimated based on 25mm storm. 2-Water Depths estimated based on Manufacturers Cumulative Volume Table at ECV. 3-Discharge Rates were based on Water Depths in Chambers and an IPEX LMF-75 Inlet Control Device			

The ICD was set at the appropriate elevation to ensure a discharge rate of not more than 1.74 L/sec at 0.43m above the bottom of the Chambers. Therefore, the centroid of the Tempest ICD is set at:

Orifice Elevation = 82.93 m + 0.40 m - 0.12 m
= 83.21 m

A release rate of 1.74 L/sec will be established based on the allowable 5.8 L/ha/sec occurring during the 25mm storm. For the site area of 0.30 ha, the allowable peak flow at 5.8 L/ha/sec would be 1.74 L/sec.

7 Erosion and Sediment Control

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

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

8 Conclusions

This report addresses site servicing and stormwater runoff from the proposed development located at the 2140 Baseline Road in the City of Ottawa. The proposed 0.305-hectare development by Baseline Constellation Partnership Inc. consists of a proposed 14-storey rental apartment building, which is comprised of 271 suites, and ground floor commercial areas.

The following summarizes the servicing requirements for the site:

- The allowable release rate for the site is limited to 10.1 L/sec based on the requirements of "Stormwater Management Guidelines for the Pinecrest Creek/Westboro Area", JFSA June 2012. This guideline sets the target release rate from the site to a maximum 33.5 L/ha/sec. This equates to a maximum discharge rate of 10.1 L/sec for the 0.30-hectare site. Peak flows more than this target rate will be detained onsite for up to the 100-year storm event.
- To meet the stringent stormwater requirements, underground chambers will be used which will have a single outlet manhole and flow control device (ICD). An IPEX LMF 75 will be used to control flows to 6.6 L/sec at 1.67m head. The total 100-year storage requirement for the site is 149.5m^3, of which 162.7 m^3 will be in provided in underground chambers and 35.3m^3 on the roof.
- In addition, flow from the building rooftops will be restricted to a total maximum flow rate of 27.3 L/sec using flow-controlled roof drains. Total required storage on these rooftops is estimated at 35.3 cubic meters for the 100-year storm. Roof storage provided will be coordinated with the architect and mechanical consultants. An estimate of total storage available on the roof areas is 71.9 m^3. Watts flow-controlled drains will be used to detain runoff for the majority of the roof areas. Roof drain requirements are summarized in Table 8 and on drawing C1. All drains shall pond to a maximum depth of 150mm.
- An infiltration basin below the underground chambers will be used for volume control of the 10mm storm. An area of approximately 164.9 m^2 will be used resulting in a volume 0f 26.4 m^3 using a clear stone void ratio of 0.40 and a granular depth of 0.40m. A minimum 24-hour drawdown time will be achieved based on a native soil infiltration rate of 20 mm/hr and volume of 26.4 m^3.
- An estimated peak sewage flow of 5.5 L/sec based on City Guidelines. A 250mm sewer lateral will be installed with a minimum slope of 3.15% having a full flow capacity of 107.2 L/sec.
- A review of the sanitary catchment areas tributary to the sanitary sewer system was completed to confirm that adequate capacity is available based on the proposed uses onsite. It was determined that adequate reserve capacity is available in the downstream sewer system to service the proposed development.
- The building will be serviced by two 200mm diameter PVC watermain's, with an isolation valve between the two watermain laterals. The two watermains will be connected directly from the building to the existing watermain on Gemini Way. The use of two parallel watermains is required as the water demand is greater than 50 m^3/day as noted in Section 4.3.1 of the City's Water Distribution Guidelines.
- Under maximum day plus fire flow conditions, the calculated pressure drop from the municipal watermain to the proposed building is from 37.3 psi to 36.2 psi at the building based on two (2) 200mm water services. In the event one (1) of the 200mm water services is under service or shut off, the estimated pressure drop through a single watermain would be from 37.3 psi to 32.4 psi. Under either of these scenarios, adequate flow and pressure is provided to the building. This meet the City of Ottawa's minimum pressure guideline of 20 psi. Therefore, the existing municipal

watermain along Gemini Way has adequate capacity to service the proposed building for both domestic and fire protection.

- The estimated fire flow requirement of 167 L/sec was completed based on the FUS. A review of the total combined flow from hydrants within a 150m distance from the building was completed to confirm that adequate fire flow is available.

Appendix A – Figures

Figure A1: Site Location Plan

Figure A2: Pre-Development Catchments

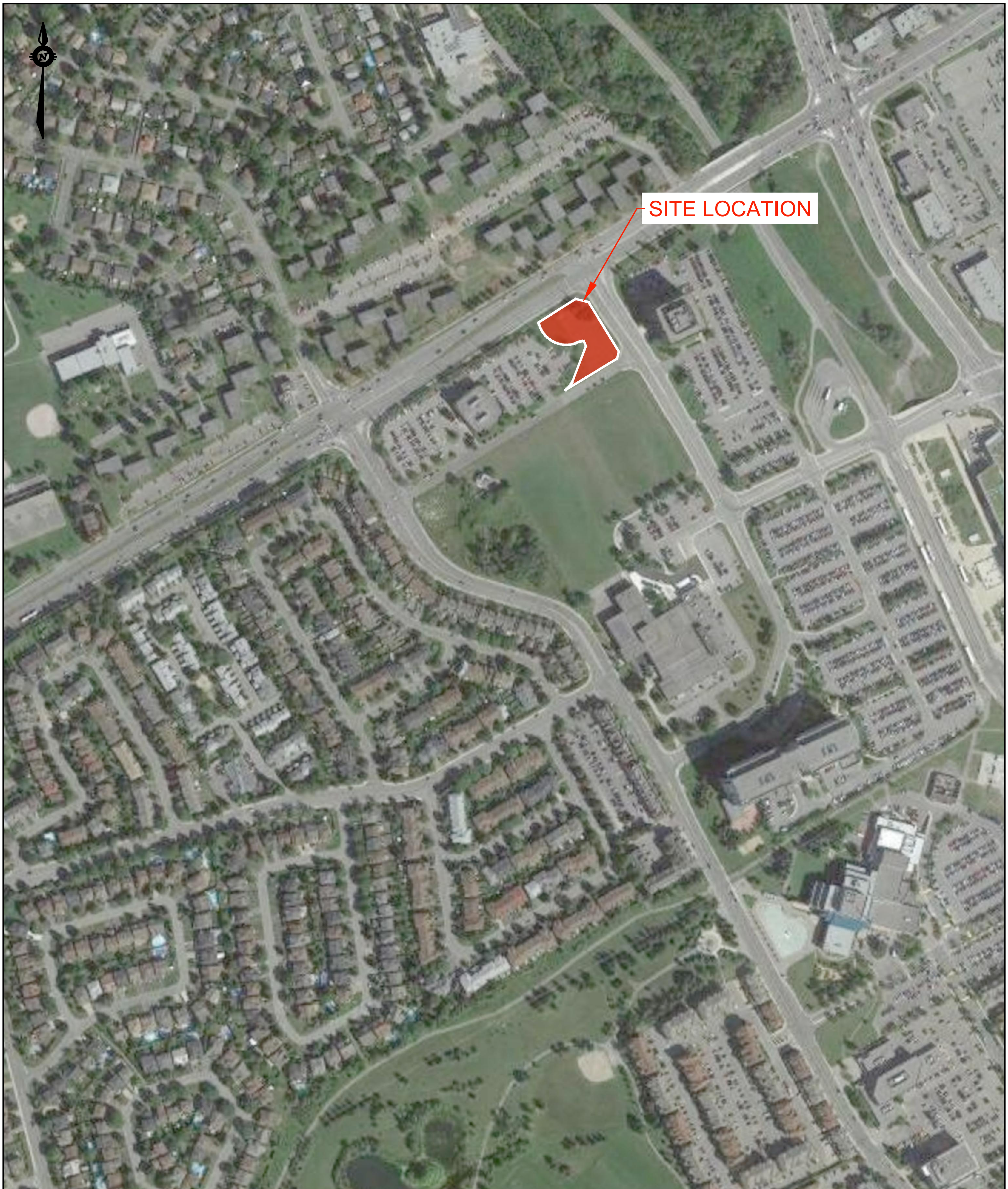
Figure A3.1: Post-Development Catchments

Figure A3.2: Roof Catchments

Figure A4: Offsite Sanitary Sewers

Figure A5: Fire Hydrant Locations

Figure A6: FUS Distances



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DRAWN MZG			SKETCH NO
DATE 13/12/18	SITE LOCATION PLAN		FIG A1
FILE NO OTT-00245012-A0			

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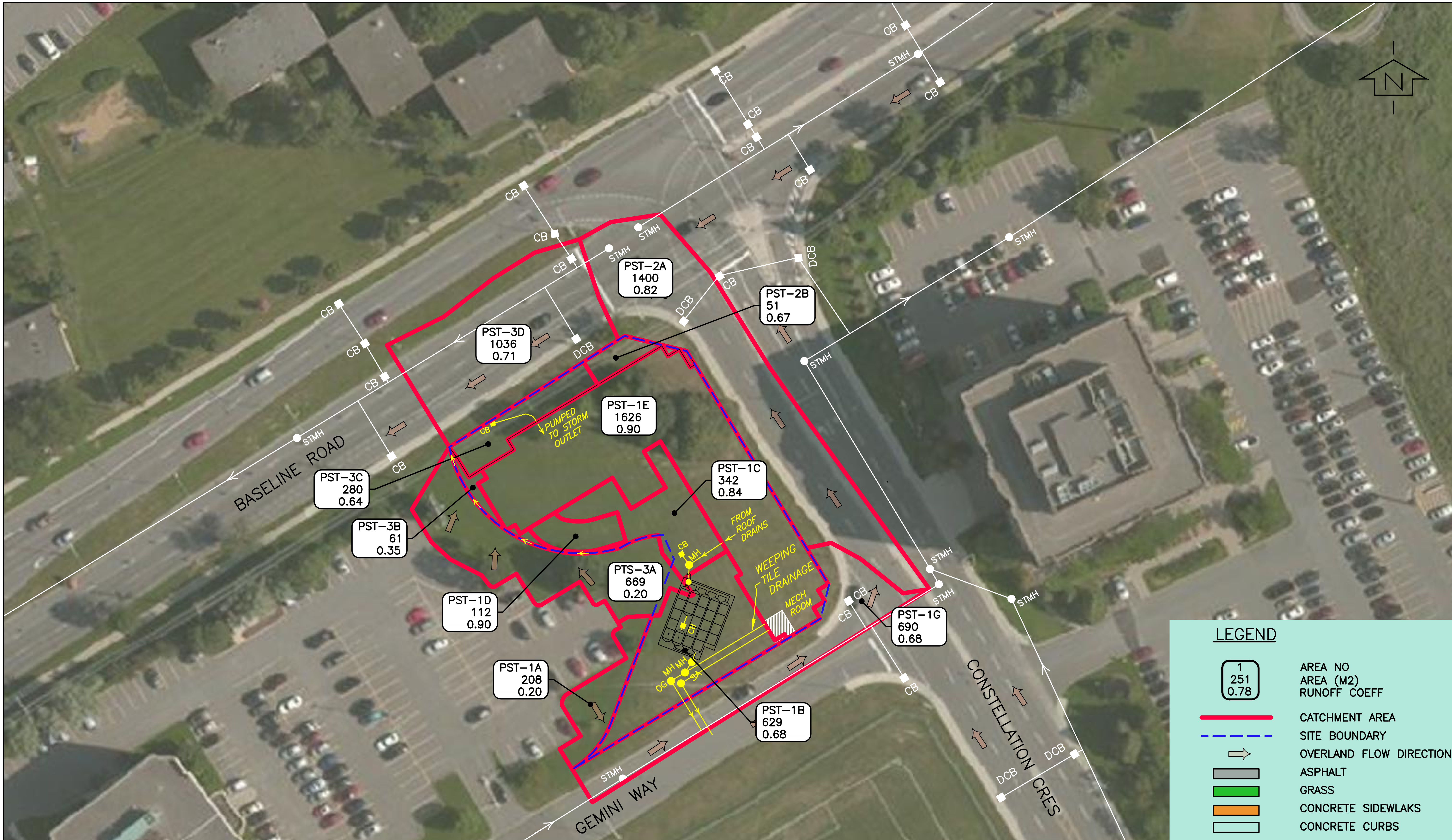
DESIGN	JLF	2140 BASELINE ROAD BASELINE CONSTELLATION PARTNERSHIP	SCALE	1:750
DRAWN	SAB		FIGURE NO	
DATE	DEC 2019	PRE–DEVELOPMENT CATCHMENTS	FIG A2	
FILE NO	245012			



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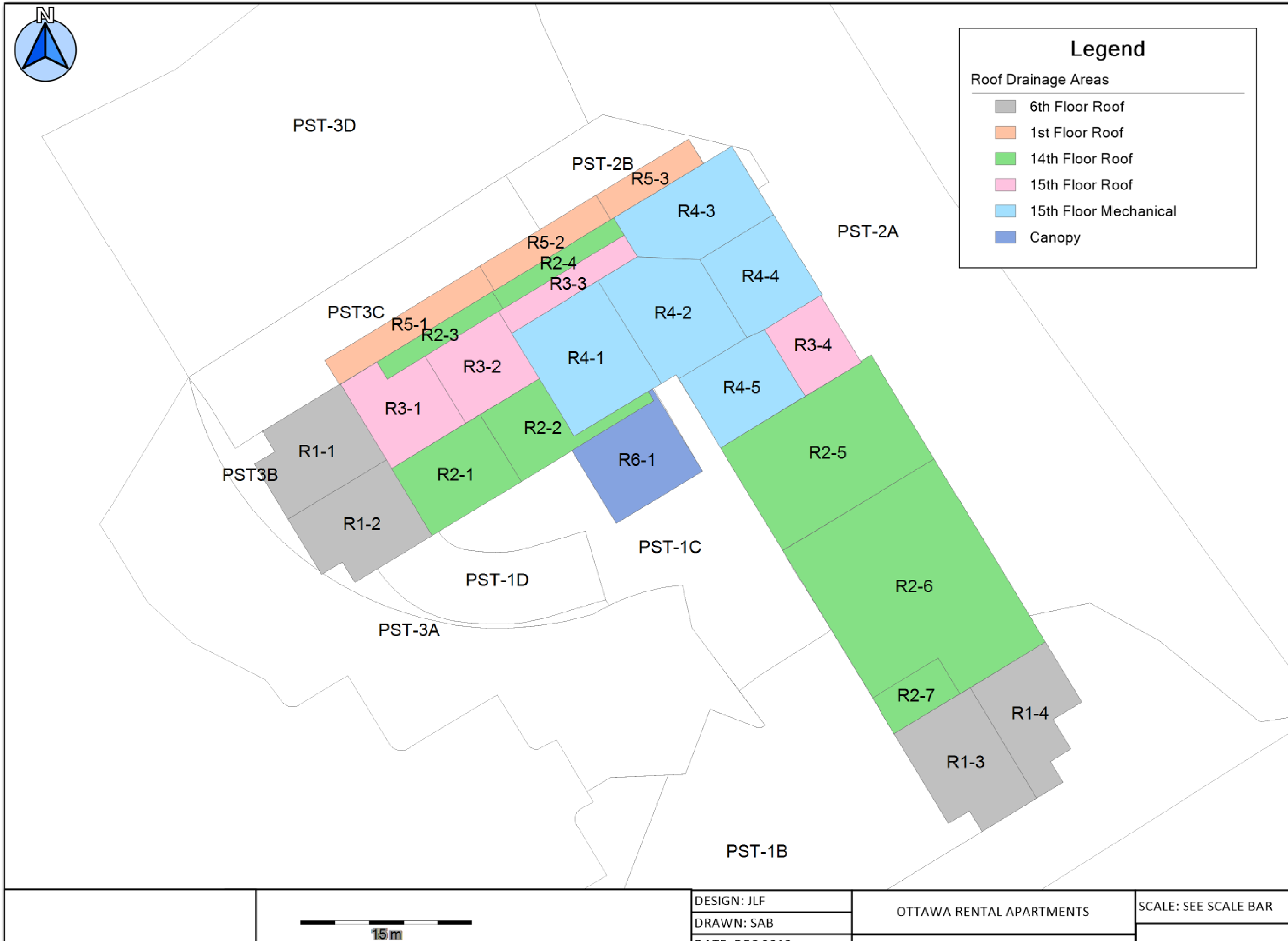
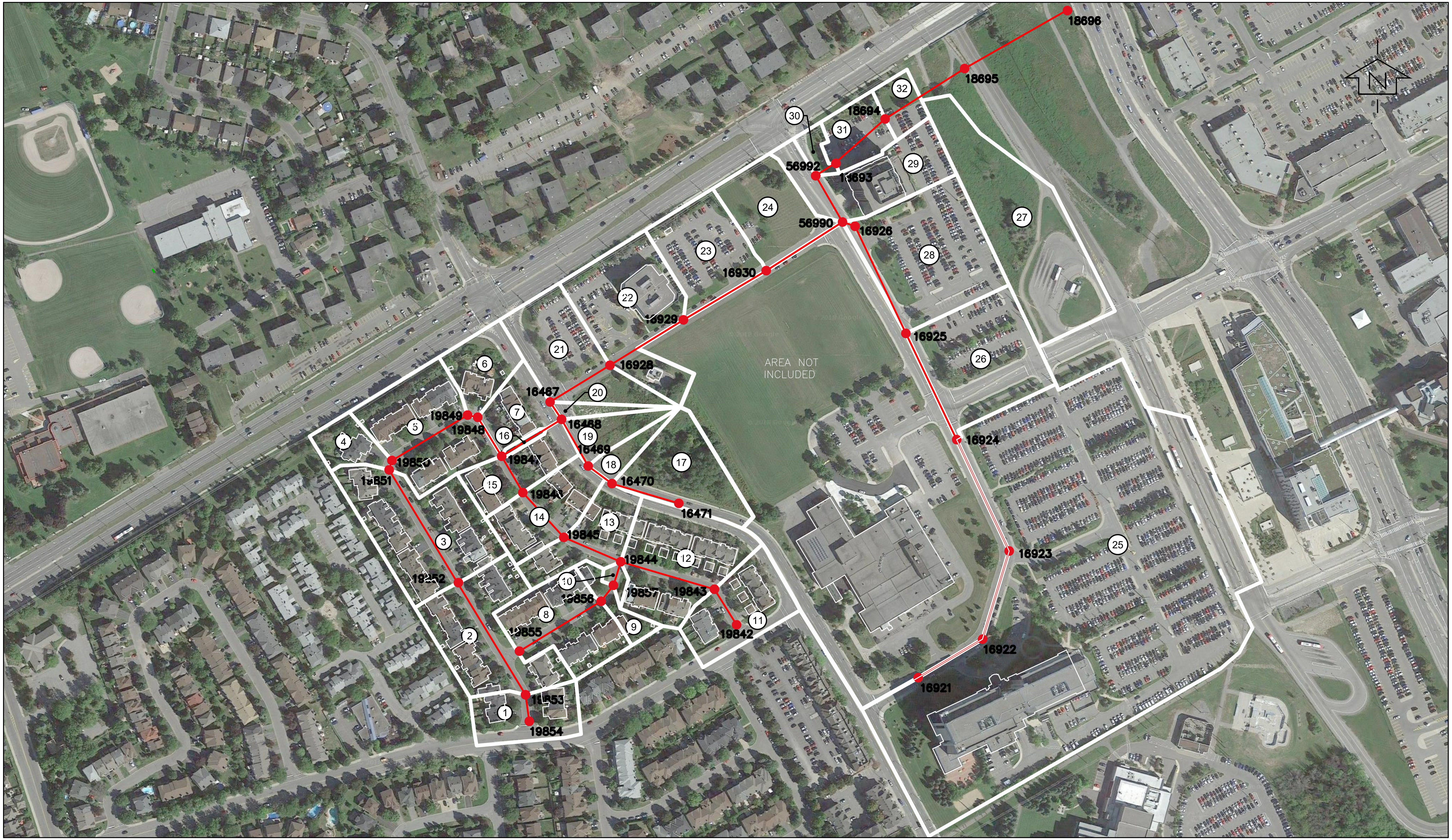
DESIGN JLF	2140 BASELINE ROAD	SCALE 1:750
DRAWN SAB	BASELINE CONSTELLATION PARTNERSHIP	FIGURE NO
DATE DEC 2019	POST-DEVELOPMENT CATCHMENTS	FIG A3.1
FILE NO 245012		



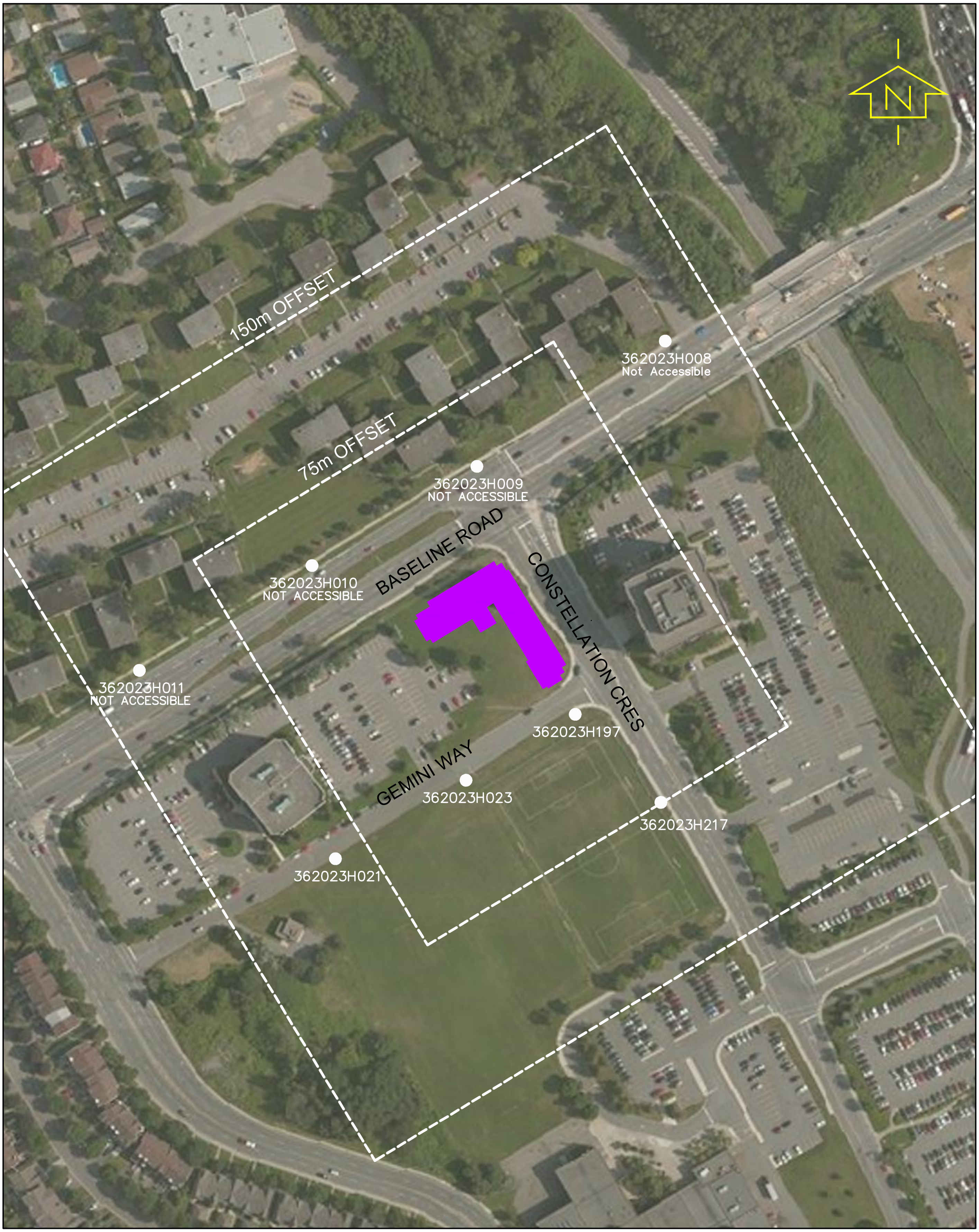
DESIGN: JLF	OTTAWA RENTAL APARTMENTS
DRAWN: SAB	
DATE: DEC 2019	ROOF CATCHMENTS
FILE No: 245012	

SCALE: SEE SCALE BAR

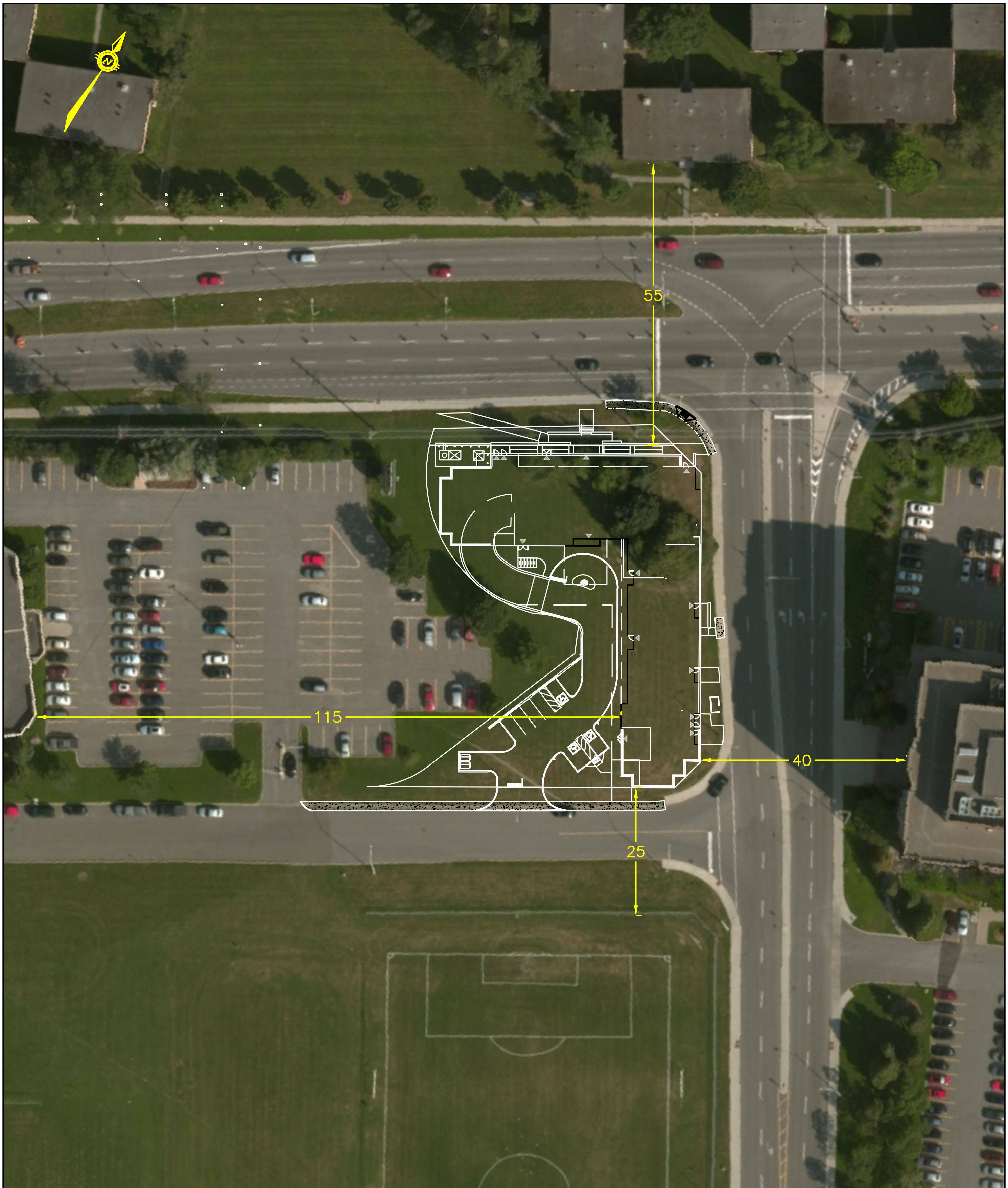
FIGURE A3.2



exp Services Inc. 100-2650 Queensview Drive Ottawa, ON K2B 8H6 www.exp.com	DESIGN JLF	2140 BASELINE ROAD BASELINE CONSTELLATION PARTNERSHIP	SCALE 1:3000	
	DRAWN SAB		FIGURE NO	
	DATE DEC 2019	OFFSITE SANITARY SEWERS	FIG A4	
	FILE NO 245012			



exp Services Inc. 100-2650 Queensview Drive Ottawa, ON K2B 8H6 **www.exp.com**	DESIGN JLF DRAWN SAB DATE DEC 2019 FILE NO 245012	2140 BASELINE ROAD BASELINE CONSTELLATION PARTNERSHIP FIRE HYDRANT LOCATIONS	SCALE 1: 2500 SKETCH NO FIG A5



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DESIGN JLF	2140 BASELINE ROAD	SCALE 1:1000	
DRAWN MZG	BASELINE CONSTELLATION PARTNERSHIP	SKETCH NO	
DATE 13/12/19	FIRE FLOW DISTANCES	FIG A6	
FILE NO OTT-00245012-A0			

Filename:
Last Saved:
Last Plotted:
Plotted by:

Appendix B – Sanitary Sewer Design Tables

Table B1: Sanitary Sewer Calculation Sheet

Table B2: Offsite Sanitary Sewer Calculation Sheet

Table B1: SANITARY SEWER CALCULATION SHEET

LOCATION				RESEDENTIAL AREAS AND POPULAITONS												COMMERCIAL			INDUSTRIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
					NUMBER OF UNITS							POPULATION				AREA (m^2)			AREA (ha)					AREA (ha)										
Street	U/S MH	D/S MH	Desc	Area (ha)	Singles	Studio	Towns	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	4-Bed Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor (per MOE)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
Gemini	Bldg	MH 200		0.3050		39		104	115	13		482	482	3.39	5.295	1353	1353	0.078						0.31	0.31	0.101	5.47	250	251.46	4.35	18.600	126.0	4%	2.53
	MH 200	main											482	3.39	5.295		1353	0.078							0.31	0.101	5.47	250	251.46	3.15	12.400	107.2	5%	2.15
				0.305		**39**		**104**	**115**	**13**		**482**												**0.305**										

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)	Peak Population Flow, (L/sec) =	P*q*M/86.4	
Commercial Avg. Daily Flow (L/m²/day) =	5.0		1.0	(when area <20%)	Peak Extraneous Flow, (L/sec) =	I*Ac	
					Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	
Institutianal Avg. Daily Flow (L/s/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	A_c = Cumulative Area (hectares)		
or L/gross ha/sec =	0.324		1.0	(when area <20%)	P = Population (thousands)		
Light Industrial Flow (L/gross ha/day) =	35,000						
or L/gross ha/sec =	0.40509	Residential Correction Factor, K =	0.80		Sewer Capacity, Qcap (L/sec) =	$1/N\ S^{1/2}\ R^{2/3}\ A_c$	
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		(Manning's Equation)		
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)			

Unti Type	Persons/Unit
Singles	3.4
Studio	1.4
Townhomes	2.7
1-bed Apt. Unit	1.4
2-bed Apt. Unit	2.1
3-bed Apt. Unit	3.1
4-bed Apt. Unit	4.1

Designed:	Project:
J. Fitzpatrick, P.Eng.	2140 Baseline Road
Checked:	Location:
B. Thomas, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
245012 Sanitary Design Sheet, Dec 2019.xlsx	**1 of 1**

Table B2: SANITARY SEWER CALCULATION SHEET

LOCATION				RESEDENTIAL AREAS AND POPULAITONS													COMMERCIAL			INDUSTRIAL			INSTITUTIONAL		INFILTRATION				SEWER DATA						
						NUMBER OF UNITS							POPULATION				AREA (ha)			AREA (ha)					AREA (ha)										
Street	U/S MH	D/S MH	Desc	Indv Area (ha)	Accu Area (ha)	Singles	Studio	Towns	1-Bed Apt.	2-Bed Apt.	3-Bed Apt.	4-Bed Apt.	INDIV	ACCU	Peak Factor	Peak Flow (L/sec)	INDIV	ACCU	Peak Flow (L/sec)	INDIV	ACCU	Peak Factor (per MOE)	AREA (Ha)	ACCU AREA (Ha)	INDIV	ACCU	INFILT FLOW (L/s)	TOTAL FLOW (L/s)	Nom Dia (mm)	Actual Dia (mm)	Slope (%)	Length (m)	Capacity (L/sec)	Q/Q_{CAP} (%)	Full Velocity (m/s)
Thornbury Cres	19854	19853	1	0.3743	0.37			8					21.6	21.60	3.70	0.26									0.3743	0.37	0.12	0.38	250	251.46	0.251	31.900	30.2	1.3%	0.61
Thornbury Cres	19853	19852	2	0.7619	1.14			18					48.6	70.20	3.63	0.83									0.7619	1.14	0.37	1.20	250	251.46	0.153	156.430	23.7	5.1%	0.48
Thornbury Cres	19852	19851	3	0.9265	2.06			29					78.3	148.50	3.55	1.71									0.9265	2.06	0.68	2.39	250	251.46	0.204	157.110	27.3	8.8%	0.55
Thornbury Cres	19851	19850	4	0.1892	2.25			3					8.1	156.60	3.55	1.80									0.1892	2.25	0.74	2.54	250	251.46	0.270	11.100	31.4	8.1%	0.63
Thornbury Cres	19850	19849	5	0.7531	3.01			22					59.4	216.00	3.51	2.46									0.7531	3.01	0.99	3.45	250	251.46	0.209	105.190	27.6	12.5%	0.55
Thornbury Cres	19849	19848	6	0.3004	3.31			4					10.8	226.80	3.50	2.57									0.3004	3.31	1.09	3.66	250	251.46	0.244	12.290	29.8	12.3%	0.60
Thornbury Cres	19848	19847	7	0.2730	3.58			6					16.2	243.00	3.49	2.75									0.2730	3.58	1.18	3.93	250	251.46	0.166	54.360	24.6	16.0%	0.49
Redding Way	19855	19856	8	0.5786	0.58			23					62.1	62.10	3.64	0.73									0.5786	0.58	0.19	0.92	250	251.46	0.167	114.020	24.7	3.7%	0.50
Redding Way	19856	19857	9	0.1309	0.71			1					2.7	64.80	3.63	0.76									0.1309	0.71	0.23	1.00	250	251.46	0.167	23.930	24.7	4.0%	0.50
Redding Way	19857	19844	10	0.0421	0.75									64.80	3.63	0.76									0.0421	0.75	0.25	1.01	250	251.46	0.171	29.320	24.9	4.1%	0.50
Thornbury Cres	19842	19843	11	0.5019	0.50			10					27	27.00	3.69	0.32									0.5019	0.50	0.17	0.49	250	251.46	0.180	49.990	25.6	1.9%	0.51
Thornbury Cres	19843	19844	12	0.7942	1.30			22					59.4	86.40	3.61	1.01									0.7942	1.30	0.43	1.44	250	251.46	0.215	116.230	28.0	5.1%	0.56
Thornbury Cres	19844	19845	13	0.3995	2.45			9					24.3	175.50	3.53	2.01									0.3995	2.45	0.81	2.82	250	251.46	0.177	73.530	25.4	11.1%	0.51
Thornbury Cres	19845	19846	14	0.4391	2.89			14					37.8	213.30	3.51	2.43									0.4391	2.89	0.95	3.38	250	251.46	0.194	72.230	26.6	12.7%	0.53
Thornbury Cres	19846	19847	15	0.3370	3.22			13					35.1	248.40	3.49	2.81									0.3370	3.22	1.06	3.87	250	251.46	0.125	80.210	21.3	18.2%	0.43
Thornbury Cres	19847	16468	16	0.0225	6.82									491.40	3.38	5.38									0.0225	6.82	2.25	7.63	250	251.46	0.191	83.620	26.4	28.9%	0.53
															3.80																				
Centrepointe Dr	16471	16471	17	0.5568	0.557										3.80		0.557	0.557	0.271						0.5568	0.557	0.18	0.45	250	251.46	0.193	83.000	26.5	1.7%	0.53
Centrepointe Dr	16471	16469	18	0.1145	0.671										3.80		0.115	0.671	0.326						0.1145	0.671	0.22	0.55	250	251.46	0.343	35.000	35.4	1.5%	0.71
Centrepointe Dr	16469	16468	19	0.2006	0.872										3.80		0.201	0.872	0.424						0.2006	0.872	0.29	0.71	300	299.36	0.311	64.300	53.6	1.3%	0.68
Centrepinte Dr	16468	16467	20	0.7690	8.5									491.4	3.38	5.38	0.769	1.6	0.798						0.7690	8.5	2.79	8.97	300	299.36	0.162	24.670	38.7	23.2%	0.49
Gemini Way	16467	16928	21	0.6521	9.1									491.4	3.38	5.38	0.652	2.3	1.115						0.6521	9.1	3.01	9.51	300	299.36	0.024	82.610	15.0	63.5%	0.19
Gemini Way	16928	16929	22	0.8329	10.0									491.4	3.38	5.38	0.833	3.1	1.520						0.8329	10.0	3.28	10.19	300	299.36	0.136	103.130	35.4	28.8%	0.45
Gemini Way	16929	16930	23	0.5604	10.5									491.4	3.38	5.38	0.560	3.7	1.792						0.5604	10.5	3.47	10.64	300	299.36	0.131	114.850	34.7	30.6%	0.44
Gemini Way	16930	56990	24	0.4975	11.0		39		104	115	13		482	973.4	3.25	10.25	0.498	4.2	2.034						0.4975	11.0	3.63	15.92	300	299.36	0.204	107.740	43.4	36.6%	0.55
Gemini Way	16921	16922	25	6.8141	6.8										3.80		6.814	6.8	3.312						6.8141	6.8	2.25	5.56	250	251.46	0.170	88.340	24.9	22.3%	0.50
Gemini Way	16922	16923			6.8																					6.8	2.25	2.25	250	251.46	0.201	109.640	27.1	8.3%	0.54
Gemini Way	16923	16924			6.8																					6.8	2.25	2.25	250	251.46	0.217	147.420	28.1	8.0%	0.57
Gemini Way	16924	16925	26	0.8776	7.7										3.80		0.878	7.7	3.739						0.8776	7.7	2.54	6.28	250	251.46	0.171	140.700	24.9	25.2%	0.50
Gemini Way	16925	16926	27,28	2.2755	10.0										3.80		2.276	10.0	4.845						2.2755	10.0	3.29	8.13	250	251.46	0.221	140.550	28.4	28.7%	0.57
Gemini Way	16926	56990			10.0																					10.0	3.29	3.29	250	251.46	0.121	16.580	21.0	15.7%	0.42
Constellation Dr	56990	56992	29	0.6071	21.6									973.4	3.25	10.25	0.607	14.8	7.174						0.6071	21.6	7.12	24.55	300	299.36	0.458	52.400	65.1	37.7%	0.82
Constellation Dr	56992	18693	30	0.0826	21.7									973.4	3.25	10.25	0.083	14.8	7.214						0.0826	21.7	7.15	24.62	300	299.36	0.471	27.610	66.0	37.3%	0.83
Constellation Dr	18693	18694	31	0.2582	21.9									973.4	3.25	10.25	0.258	15.1	7.340						0.2582	21.9	7.23	24.83	300	299.36	0.140	78.830	36.0	69.0%	0.45
Constellation Dr	18694	18695	32	0.1539	22.1									973.4	3.25	10.25	0.154	15.3	7.415						0.1539	22.1	7.29	24.95	300	299.36	0.337	112.730	55.8	44.7%	0.70
Constellation Dr	18695	18696			22.1									973.4	3.25	10.25		15.3	7.415							22.1	7.29	24.95	300	299.36	0.187	139.010	41.6	60.0%	0.52
				22.1			**39**	**182**	**104**	**115**	**13**		**973.4**												**22.077**										

Residential Avg. Daily Flow, q (L/p/day) =	280	Commercial Peak Factor =	1.5	(when area >20%)	Peak Population Flow, (L/sec) =	P*q*M/86.4	
Commercial Avg. Daily Flow (L/gross ha/day) =	28,000		1.0	(when area <20%)	Peak Extraneous Flow, (L/sec) =	I*Ac	
or L/gross ha/sec =	0.324				Residential Peaking Factor, M =	1 + (14/(4+P^0.5)) * K	
Institutianal Avg. Daily Flow (L/s/ha) =	28,000	Institutional Peak Factor =	1.5	(when area >20%)	A_c = Cumulative Area (hectares)		
or L/gross ha/sec =	0.324		1.0	(when area <20%)	P = Population (thousands)		
Light Industrial Flow (L/gross ha/day) =	35,000						
or L/gross ha/sec =	0.40509	Residential Correction Factor, K =	0.80		Sewer Capacity, Qcap (L/sec) =	$1/N\ S^{1/2}\ R^{2/3}\ A_c$	
Light Industrial Flow (L/gross ha/day) =	55,000	Manning N =	0.013		(Manning's Equation)		
or L/gross ha/sec =	0.637	Peak extraneous flow, I (L/s/ha) =	0.33	(Total I/I)			

Unti Type	Persons/Unit
Singles	3.4
Studio	1.4
Townhomes	2.7
Single Apt. Unit	1.4
2-bed Apt. Unit	2.1
3-bed Apt. Unit	3.1
4-bed Apt. Unit	4.1

Designed:	Project:
J. Fitzpatrick, P.Eng.	2140 Baseline Road
Checked:	Location:
B. Thomas, P.Eng.	Ottawa, Ontario
File Reference:	Page No:
245012 Offsite Sanitary Design Sheet, Dec 2019.xlsx	1 of 1

Appendix C – Water Servicing Design Tables

Table C1: Water Demand Chart

Table C2: Fire Flow Requirements based on Fire Underwriters Survey (FUS) 1999

Table C3: Estimated Water Pressure at Proposed Building

Table C4: Fire Flow Contributions Based on Hydrant Spacing

TABLE C1: Water Demand Chart

Location: 2140 Baseline Road
Project No: OTT-00245012
Designed by: J.Fitzpatrick
Checked By: B. Thomas
Date Revised: December 2019

Water Consumption

Residential = **350** L/cap/day
Commercial = 5.0 L/m^2/day

Population Densities

Single Family	3.4	person/unit
Semi-Detahced	2.7	person/unit
Duplex	2.3	person/unit
Townhome (Row)	2.7	person/unit
Bachelor Apartment	1.4	person/unit
1 Bedroom Apartment	1.4	person/unit
2 Bedroom Apartment	2.1	person/unit
3 Bedroom Apartment	3.1	person/unit
4 Bedroom Apartment	4.1	person/unit
Avg. Apartment	1.8	person/unit

Proposed Buildings	No. of Residential Units: Singles/Semis/Towns				No. of Residential Units: Apartments						Total Persons (pop)	Residential Demands in (L/sec)					Commercial						Total Demands (L/sec)		
	Single Family	Semi-Detached	Duplex	Townhome	Studio	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom	Avg Apt.		Avg. Day Demand (L/day)	Peaking Factors (x Avg Day) Max Day	Peaking Factors (x Avg Day) Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Area (m^2)	Avg Demand (L/day)	Peaking Factors (x Avg Day) Max Day	Peaking Factors (x Avg Day) Peak Hour	Max Day Demand (L/day)	Peak Hour Demand (L/day)	Avg Day (L/s)	Max Day (L/s)	Max Hour (L/s)
Residential Units					39	104	115	13			482.0	168,700	2.94	4.37	495,303	737,556	1,353	6,765.0	1.50	2.70	10,147.50	18,266	2.03	5.85	8.75
Total =					39	104	115	13			482.0	168,700			495,303	737,556							2.03	5.85	8.75

PEAKING FACTORS FROM MOECC TABLE 3-3 (Peaking Factors for Water Systems Servicing Fewer Than 500 persons)

Dwelling Units Serviced	Equiv Pop	Night Min Factor	Maximum Day Factor	Peak Hour Factor
10	30	0.10	9.50	14.30
50	150	0.10	4.90	7.40
100	300	0.20	3.60	5.40
150	450	0.30	3.00	4.50
167	500	0.40	2.90	4.30

TABLE C2: FIRE FLOW REQUIREMENTS BASED ON FIRE UNDERWRITERS SURVEY(FUS) 1999
PROJECT: 2140 Baseline Road

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

F = 220 * C * SQRT(A)

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

Task	Options	Multiplier	Input: Area	Input: % Used	Input: Area Used	Input	Value Used	Fire Flow Total (L/min)
Choose Building Frame (C)	Wood Frame	1.5				Non-combustible Construction	0.8	
	Ordinary Construction	1						
	Non-combustible Construction	0.8						
	Fire Resistive Construction	0.6						
Input Building Floor Areas (A)	Floor 14		1183.4					
	Floor 13		1183.4					
	Floor 12		1183.4					
	Floor 11		1183.4					
	Floor 10		1183.4	50%	592	100% of 2 largest floors + 50% of all floors above them up to eight	8323.9 m²	
	Floor 9		1183.4	50%	592			
	Floor 8		1183.4	50%	592			
	Floor 7		1183.4	50%	592			
	Floor 6		1481.4	50%	741			
	Floor 5		1481.4	50%	741			
	Floor 4		1481.4	50%	741			
	Floor 3		1481.4	50%	741			
	Floor 2		1481.4	100%	1,481			
	Floor 1 (Ground Floor Commercial)		1512.9	100%	1,513			
	Basement (At least 50% below grade, not included)		0					
Fire Flow (F) Total	F = 220 * C * SQRT(A)							16,057
Fire Flow (F) Total	Rounded to nearest 1,000							**16,000**

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 for Floors 2-14	Non-combustible	-25%	Limited Combustible	-15%	-2400	13,600
	Limited Combustible	-15%				
	Combustible	0%				
	Free Burning	15%				
	Rapid Burning	25%				
Choose Reduction Due to Sprinkler System	**Adequate** Sprinkler Conforms to NFPA13	-30%	Adequate Sprinkler Conforms to NFPA13	-30%	-4,080	9,520
	No Sprinkler	0%				
	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	Standard Water Supply for Fire Department Hose Line and for Sprinkler System	-10%	-1,360	8,160
	Not Standard Water Supply or Unavailable	0%				
	Fully Supervised Sprinkler System	-10%	Not Fully Supervised or N/A	0%	0	8,160
	Not Fully Supervised or N/A	0%				

Task	Exposures	Separation Dist (m)	Cond	Separation Conditon	Exposed Wall type	Exposed Wall Length: Length (m)	No of Storeys	Lenth-height Factor	Sub-Conditon	Charge (%)	Total Charge (%)	Total Exposure Charge (L/min)	Fire Flow Total (L/min)
Choose Structure Exposure Distance	Side 1 (west)	115	6	> 45.1	Type B	38	4	152	6	0%	11%	1,496	9,656
	Side 2 (east)	40	5	30.1 to 45	Type B	25	8	200	5E	5%			
	Front (north)	55	6	> 45.1	Type B	16	3	48	6	0%			
	Back (south)	25	4	20.1 to 30	Type B	15	15	30	4A	6%			
Obtain Required Fire Flow	Total Required Fire Flow, Rounded to the Nearest 1,000 L/min =												**10,000**
	Total Required Fire Flow, L/s =												**167**

Note: "Occupancies classified as C-3 (Combustible) in the occupancy classification list may be eligible for C-2 (Limited Combustible) classification, provided that the total square foot area containing combustible material does not exceed 10% of the total square foot area of the occupancy." (ISO, "Guide For Determination Of Needed Fire Flow," 2008)

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

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

Conditons for Separation

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

TABLE C3: ESTIMATED WATER PRESSURE AT PROPOSED BUILDING

Description	From	To	Demand (L/sec)	Pipe Length (m)	Pipe Dia (mm)	Dia (m)	Slope of HGL (m/m)	Head Loss (m)	Elev From (m)	Elev To (m)	*Elev Diff (m)	Pressure From kPa	(psi)	Pressure To kPa	(psi)	Pressure Drop (psi)
Avg Day Conditons																
Single 200mm watermain	Main	Basement	2.030	29 m	204	0.204	4.2E-05	0.0012	83.33	83.10	0.2	479.2	(69.5)	481.5	(69.8)	-0.3
Double 200mm watermain	Main	Basement	1.015	29 m	204	0.204	1.2E-05	0.0003	83.33	83.10	0.2	479.2	(69.5)	481.5	(69.8)	-0.3
Max Day Conditons																
Single 200mm watermain	Main	Basement	5.850	29 m	204	0.204	0.0003	0.0085	83.33	83.10	0.2	479.2	(69.5)	481.4	(69.8)	-0.3
Double 200mm watermain	Main	Basement	2.925	29 m	204	0.204	8.3E-05	0.0024	83.33	83.10	0.2	479.2	(69.5)	481.5	(69.8)	-0.3
Peak Hour Conditons																
Single 200mm watermain	Main	Basement	8.750	29 m	204	0.204	0.00063	0.0179	83.33	83.10	0.2	409.6	(59.4)	411.6	(59.7)	-0.3
Double 200mm watermain	Main	Basement	4.375	29 m	204	0.204	0.00017	0.005	83.33	83.10	0.2	409.6	(59.4)	411.8	(59.7)	-0.3
Max Day Plus Fireflow Conditons																
Single 200mm watermain	Main	Basement	172.9	29 m	204	0.204	0.15763	4.4925	83.33	83.10	0.2	257.5	(37.3)	215.7	(31.3)	6.1
Double 200mm watermain	Main	Basement	86.425	29 m	204	0.204	0.04366	1.2445	83.33	83.10	0.2	257.5	(37.3)	247.6	(35.9)	1.4
Max Day Plus Fireflow Conditons (Review of 150mm diameter)																
Single 150mm watermain	Main	Basement	172.9	29 m	150	0.150	0.70465	20.083	83.33	83.10	0.2	257.5	(37.3)	62.8	(9.1)	28.2
Double 150mm watermain	Main	Basement	86.425	29 m	150	0.150	0.19519	5.563	83.33	83.10	0.2	257.5	(37.3)	205.2	(29.8)	7.6

Water Demand Info

Average Demand =	2.03	L/sec
Max Day Demand =	5.85	L/sec
Peak Hr Deamand =	8.75	L/sec
Fireflow Requriement =	167	L/sec
Max Day Plus FF Demand =	172.9	L/sec

Pipe Lengths

From watermain to building =	29 m
Hazen Williams C Factor for Friction Loss in Pipe, C=	110

Boundary Conditon

	Min HGL	Max HGL	Peak Hour	Max Day Plus Fireflow	
HGL (m)	127.5	134.6	127.5	112.0	(From City of Ottawa)
Approx Ground Elev (m) =	85.75	85.75	85.75	85.75	
Pressure (m) =	41.75	48.85	41.75	26.25	
Pressure (Pa) =	409,568	479,219	409,568	257,513	
Pressure (psi) =	59.4	69.5	59.4	37.3	

TABLE C4: FIRE FLOW CONTRIBUTIONS BASED ON HYDRANT SPACING

Hydrant #	Location	[3]Straight Distance (m)	[1]Distance (m)	[2]Fire Flow Contribution (L/min)	Comment
362023H021	Gemini Way	113	175	0	
362023H023	Gemini Way	57	102	3800	
362023H197	Gemini Way	18	72	5700	
362023H217	Constellation Cres	75	75	3800	
Total Fireflow Available in L/min (L/sec) or L/sec				13,300 (222)	
FUS RFF in L/min or L/sec				10,000 (167)	
Meets Requreiment (Yes/No)				Yes	

Notes:

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

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

[3]Straight distance from hydrant ot closest part of building.

Appendix D – Stormwater Design Tables

TABLE D1: ESTIMATION OF CATCHMENT TIME OF CONCENTRATION UNDER PRE-DEVELOPMENT CONDITIONS

Catchment No.	Sub Catchment	Outlet Location	Area (ha)	Indiv Area (ha)	High Elev (m)	Low Elev (m)	Flow Path Length (m)	Indiv Slope	Avg. C	Time of Conc. Tc	Description
PRE-1		Storm Sewer ON Gemini Way	0.1625								
PRE-1A	1A			0.0208	86.40	86.32	6.7	1.2%	0.20	7.12	areas u/s site
PRE-1B	1B			0.0736	86.75	86.55	12.0	1.7%	0.20	8.59	within site
PRE-1C	1C			0.0682	86.55	86.47	4.0	2.0%	0.57	2.75	areas d/s site
PRE-2		Storm Sewer ON Constellation Dr	0.2302								
PRE-2A	2A			0.0903	86.50	86.14	12.8	2.8%	0.20	7.46	within site
PRE-2B	2B			0.1399	86.14	86.04	5.00	2.0%	0.80	1.74	areas d/s site
PRE-3		Storm Sewers on Baseline Rd	0.3100								
PRE-3A	3A			0.0688	86.32	86.17	8.40	1.8%	0.20	7.02	areas u/s site
PRE-3B	3B			0.1376	86.32	85.86	27.20	1.7%	0.20	12.87	within site
PRE-3C	3C			0.1036	85.45	85.11	17.00	2.0%	0.69	4.38	areas d/s site
totals			0.7027	0.7027							
		onsite areas only (1B, 2A,3B) ---->		0.3014							

TABLE D2: PRE-DEVELOPMENT RUNOFF CALCULATIONS

Area Description	Sub-Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr			Storm = 5 yr			Storm = 100 yr			Breakdown of Peak 100-yr Flows (L/sec)		
			I_5 (mm/hr)	Cavg	Q_{5PRE} (L/sec)	I_5 (mm/hr)	Cavg	Q_{5PRE} (L/sec)	I_{100} (mm/hr)	Cavg	Q_{100PRE} (L/sec)	U/S Site	Onsite	D/S Site
PRE-1														
PRE-1A	0.0208	7.12	90.01	0.20	1.0	122.54	0.20	1.4	210.1	0.25	3.0	3.0		
PRE-1B	0.0736	8.59	82.70	0.20	3.4	112.42	0.20	4.6	192.6	0.25	9.9		9.9	
PRE-1C	0.0682	2.75	124.22	0.57	13.4	170.21	0.57	18.4	292.7	0.71	39.5			39.5
sub-total	0.1625				17.8			24.4			52.4	3.0	9.9	39.5
PRE-2														
PRE-2A	0.0903	7.46	88.17	0.20	4.4	119.99	0.20	6.0	205.7	0.25	12.9		12.9	
PRE-2B	0.1399	1.74	136.86	0.80	42.6	187.99	0.80	58.5	323.6	1.00	125.9			125.9
sub-total	0.2302				47.0			64.5			138.8		12.9	125.9
PRE-3														
PRE-3A	0.0688	7.02	90.54	0.20	3.5	123.27	0.20	4.7	211.4	0.25	10.1	10.1		
PRE-3B	0.1376	12.87	67.31	0.20	5.1	91.22	0.20	7.0	156.0	0.25	14.9		14.9	
PRE-3C	0.1036	4.38	108.43	0.69	21.6	148.13	0.69	29.4	254.4	0.86	63.2			63.2
sub-total	0.3100				30.2			41.1			88.2	10.1	14.9	63.2
Total Site	0.7027				**95.0**			**130.1**			**279.5**	13.1	**37.7**	228.6

Notes

1) Intensity, I = 998.071/(Tc+6.035) $^{0.814}$ (5-year, City of 0ttawa)

2) Intensity, I = 1735.688/(Tc+6.014) $^{0.820}$ (100-year, City of Ottawa)

3) Cavg for 100-year is increased by 25% to a maximum of 1.0

Total 100-yr flow to Storm Sewer on Constellation Dr = 191.2

Total 100-yr flow to Storm Sewer on Baseline Rd = 88.2

TABLE D3: ALLOWABLE RUNOFF CALCULATIONS (SITE ONLY)

Area (onsite)	Area (ha)	Discharge Rate (L/ha/sec)	Q_{ALLOW} (L/sec)	Desc
PRE-1B	0.0736	33.5	2.5	
PRE-2A	0.0903	33.5	3.0	
PRE-3B	0.1376	33.5	4.6	
Total	0.3014	33.5	10.1	

Notes
1) Allowable Capture Rate is based on 5-year storm at Tc=10 minutes.
2) Intensity, I5 = 998.071/(Tc+6.035)^0.814 (5-year, City of 0ttawa)
3) Discharge rate based on "Stormwater Management Guidelines for the Pinecrest Creek/Westboro Area, JFSA June 2012"

TABLE D4: AVERAGE RUNOFF COEFFICIENTS (Post Development)

Runoff Coeffients $C_{ASPH/CONC}$ = 0.90 C_{ROOF} = 0.90 C_{GRASS} = 0.20

Area No.	Asphalt /Conc Areas (m²)	A * C_{ASPH}	Roof Areas (m²)	A * C_{ROOF}	Grassed Areas (m²)	A * C_{GRASS}	Sum AC	Total Area (m²)	C_{AVG} (see note)	Comment
PST-1A								208	0.20	Surface Area
PST-1B								629	0.68	Surface Area
PST-1C								342	0.84	Surface Area
PST-1D								112	0.90	Surface Area
PST-1E (R1)								298	0.90	Flat Roof (7th floors)
PST-1E (R2)								609	0.90	Flat Roof (14th floor)
PST-1E (R3)								178	0.90	Flat Roof (15th floor)
PST-1E (R4)								382	0.90	Flat Roof (15th Mech)
PST-1E (R5)								93	0.90	Flat Roof (1st floor)
PST-1E (R6)								66	0.90	Flat Roof (canopy)
PST-1G								690	0.68	Surface Area
PST-2A								1400	0.82	Surface Area
PST-2B								51	0.67	Surface Area
PST-3A								669	0.20	Surface Area
PST-3B								61	0.35	Surface Area
PST-3C								228	0.64	Surface Area
PST-3D								1036	0.71	Surface Area
Total								7,052		

Note: Cavg derived with area-weighting command in PCSWMM

TABLE D5: SUMMARY OF POST DEVELOPMENT RUNOFF (Uncontrolled and Controlled)

Area No	Area (ha)	Time of Conc, Tc (min)	Storm = 2 yr				Storm = 5 yr				Storm = 100 yr				Comments
			C_{AVG}	I_2 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_5 (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	C_{AVG}	I_{100} (mm/hr)	Q (L/sec)	Q_{CAP} (L/sec)	
PST-1A	0.0208	10	0.20	76.81	0.9		0.20	104.19	1.2		0.25	178.56	2.6		to CB1
PST-1B	0.0629	10	0.68	76.81	9.1		0.68	104.19	12.4		0.85	178.56	26.5		to CB1
PST-1C	0.0342	10	0.84	76.81	6.1		0.84	104.19	8.3		1.00	178.56	17.0		to CB2
PST-1D	0.0112	10	0.90	76.81	2.2		0.90	104.19	2.9		1.00	178.56	5.6		to trench drain
PST-1E (R1)	0.0298	10	0.90	76.81	5.7		0.90	104.19	7.8		1.00	178.56	14.8		flow controlled drains
PST-1E (R2)	0.0609	10	0.90	76.81	11.7	**(2.5)**	0.90	104.19	15.9	**(3.1)**	1.00	178.56	30.2	**(6.6)**	flow controlled drains
PST-1E (R3)	0.0178	10	0.90	76.81	3.4		0.90	104.19	4.6		1.00	178.56	8.8		flow controlled drains
PST-1E (R4)	0.0382	10	0.90	76.81	7.3		0.90	104.19	10.0		1.00	178.56	19.0		flow controlled drains
PST-1E (R5)	0.0093	10	0.90	76.81	1.8		0.90	104.19	2.4		1.00	178.56	4.6		flow controlled drains
PST-1E (R6)	0.0066	10	0.90	76.81	1.3		0.90	104.19	1.7		1.00	178.56	3.3		flow controlled drains
PST-3C	0.0228	4.67	0.64	106.11	4.3		0.64	144.71	5.9		0.80	248.83	12.6		to CB3
PST-1G	0.0690	10	0.68	76.81	10.0	**10.0**	0.68	104.19	13.6	**13.6**	0.85	178.56	29.1	**29.1**	uncontrolled offsite
PST-2A	0.1400	5.22	0.82	101.95	32.5	**32.5**	0.82	138.93	44.3	**44.3**	1.00	238.80	92.9	**92.9**	uncontrolled offsite
PST-2B	0.0051	10	0.67	76.81	0.7	**0.7**	0.67	104.19	1.0	**1.0**	0.84	178.56	2.1	**2.1**	uncontrolled offsite
PST-3A	0.0669	10	0.20	76.81	2.9	**2.9**	0.20	104.19	3.9	**3.9**	0.25	178.56	8.3	**8.3**	uncontrolled offsite
PST-3B	0.0061	10	0.35	76.81	0.5	**0.5**	0.35	104.19	0.6	**0.6**	0.44	178.56	1.3	**1.3**	uncontrolled offsite
PST-3D	0.1036	9.62	0.71	78.30	16.0	**16.0**	0.71	106.24	21.7	**21.7**	0.89	182.11	46.5	**46.5**	external areas to Storm
Totals	0.7052				116.5	**65.1**			158.2	**88.2**			325.3	**187.0**	
Total pre-development for comparison										*130.1*				*279.5*	

Notes

2-yr Storm Intensity, I = 732.951/(Tc+6.199)^0.810 (City of Ottawa)

5-yr Storm Intensity, I = 998.071/(Tc+6.035)^0.814 (City of Ottawa)

100-yr Storm Intensity, I = 1735.688/(Tc+6.014)&^0.820 (City of Ottawa)

Time of Concentration (min), Tc = ***10***

For Flows under column Qcap which are shown in brackets ***(0.0)*** *, denotes flows that are controlled*

	POST-DEV	PRE-DEV
Total 100-yr flow to Storm Sewer on Gemini / Constellation =	**130.8**	191.2
Total 100-yr flow to Storm Sewer on Baseline Rd =	**56.2**	88.2
Total 100-yr flows from site =	**10.0**	

TABLE D6: SUMMARY OF TOTAL STORAGE REQUIRED & PROVIDED

Area No.	Area (ha)	Release Rate (L/s)			Storage Required (m^3)			Storage Provided (m^3)					Control Method
		2-yr	5-yr	100-yr	2-yr	5-yr	100-yr	Roof	Surface Ponding	UG Chambers	UG CB/MHs	Total	
PST-1A	0.0208												Flow Controlled at STMH 101
PST-1B	0.0629												Flow Controlled at STMH 101
PST-1C	0.0342												Flow Controlled at STMH 101
PST-1D	0.0112												Flow Controlled at STMH 101
PST-1E (R1)	0.0298	2.5	3.1	6.6	52.1	71.2	149.5	35.3		162.7		198.0	Flow Controlled Roof Drains
PST-1E (R2)	0.0609												Flow Controlled Roof Drains
PST-1E (R3)	0.0178												Flow Controlled Roof Drains
PST-1E (R4)	0.0382												Flow Controlled Roof Drains
PST-1E (R5)	0.0093												Flow Controlled Roof Drains
PST-1E (R6)	0.0066												Flow Controlled Roof Drains
PST-3C	0.0228												Flow Controlled at STMH 101
PST-1G	0.0690	10.02	13.6	29.1									None
PST-2A	0.1400	32.54	44.3	92.9									None
PST-2B	0.0051	0.73	1.0	2.1									None
PST-3A	0.0669	2.86	3.9	8.3									None
PST-3B	0.0061	0.46	0.6	1.3									None
PST-3D	0.1036	16.01	21.7	46.5									None
Totals (all)=	**0.705**	**65.1**	**88.2**	**187.0**	**52.1**	**71.2**	**149.5**	**35.3**		**162.7**		**198.0**	
Totals (site) =	**0.305**	**3.6**	**4.7**	**10.0**	**52.1**	**71.2**	**149.5**	**35.3**		**162.7**		**198.0**	

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

Area No:	**Entire Site**	
C_{AVG} =	0.81	(2-yr)
C_{AVG} =	0.81	(5-yr)
C_{AVG} =	1.02	(100-yr, Max 1.0)
Time Interval =	10	(mins)
Drainage Area =	0.3049	(hectares)

Duration (min)	Release Rate = 2.5 (L/sec)					Release Rate = 3.1 (L/sec)					Release Rate = 6.6 (L/sec)				
	Return Period = 2 (years)					Return Period = 5 (years)					Return Period = 100 (years)				
	IDF Parameters, A = 732.951			, B =	0.810	IDF Parameters, A = 998.071				0.814	IDF Parameters, A = 1735.688				0.820
	($I = A/(T_c+C)$)			, C =	6.199	($I = A/(T_c+C)$)			, C =	6.053	($I = A/(T_c+C)$)			, 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	115.3	2.45	112.9	0.00	230.5	158.9	3.060	155.9	0.00	398.6	343.6	6.600	337.0	0.00
10	76.8	53.0	2.45	50.5	30.31	104.2	71.9	3.060	68.8	41.28	178.6	153.9	6.600	147.3	88.39
20	52.0	35.9	2.45	33.4	40.12	70.3	48.4	3.060	45.4	54.46	120.0	103.4	6.600	96.8	116.16
30	40.0	27.6	2.45	25.2	45.29	53.9	37.2	3.060	34.1	61.43	91.9	79.2	6.600	72.6	130.67
40	32.9	22.7	2.45	20.2	48.51	44.2	30.5	3.060	27.4	65.78	75.1	64.8	6.600	58.2	139.62
50	28.0	19.3	2.45	16.9	50.66	37.7	26.0	3.060	22.9	68.72	64.0	55.1	6.600	48.5	145.59
60	24.6	16.9	2.45	14.5	52.14	32.9	22.7	3.060	19.7	70.77	55.9	48.2	6.600	41.6	149.70
70	21.9	15.1	2.45	12.7	53.17	29.4	20.3	3.060	17.2	72.22	49.8	42.9	6.600	36.3	152.54
80	19.8	13.7	2.45	11.2	53.87	26.6	18.3	3.060	15.3	73.24	45.0	38.8	6.600	32.2	154.48
90	18.1	12.5	2.45	10.1	54.32	24.3	16.7	3.060	13.7	73.92	41.1	35.4	6.600	28.8	155.73
100	16.7	11.5	2.45	9.1	54.58	22.4	15.5	3.060	12.4	74.35	37.9	32.7	6.600	26.1	156.44
110	15.6	10.7	2.45	8.3	54.68	20.8	14.4	3.060	11.3	74.58	35.2	30.3	6.600	23.7	156.72
120	14.6	10.0	2.45	7.6	54.65	19.5	13.4	3.060	10.4	74.63	32.9	28.4	6.600	21.8	156.64
130	13.7	9.4	2.45	7.0	54.51	18.3	12.6	3.060	9.6	74.54	30.9	26.6	6.600	20.0	156.27
140	12.9	8.9	2.45	6.5	54.28	17.3	11.9	3.060	8.8	74.33	29.2	25.1	6.600	18.5	155.65
150	12.3	8.4	2.45	6.0	53.98	16.4	11.3	3.060	8.2	74.01	27.6	23.8	6.600	17.2	154.81
160	11.7	8.0	2.45	5.6	53.60	15.6	10.7	3.060	7.7	73.61	26.2	22.6	6.600	16.0	153.78
170	11.1	7.7	2.45	5.2	53.16	14.8	10.2	3.060	7.2	73.12	25.0	21.6	6.600	15.0	152.59
180	10.6	7.3	2.45	4.9	52.67	14.2	9.8	3.060	6.7	72.56	23.9	20.6	6.600	14.0	151.25
190	10.2	7.0	2.45	4.6	52.13	13.6	9.4	3.060	6.3	71.94	22.9	19.7	6.600	13.1	149.78
200	9.8	6.7	2.45	4.3	51.54	13.0	9.0	3.060	5.9	71.27	22.0	18.9	6.600	12.3	148.19
Max =					**54.68**					**74.63**					**156.72**

Notes

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

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

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

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

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

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

Area No: **Roof**

C_{AVG} = 0.90 (2-yr)

C_{AVG} = 0.90 (5-yr)

C_{AVG} = 1.00 (100-yr, Max 1.0)

Time Interval = 2 (mins)

Drainage Area = 0.1525 (hectares)

Duration (min)	Release Rate = 13.9 (L/sec); Return Period = 2 (years); IDF Parameters, A = 732.951, B = 0.810, C = 6.199 (I = A/(T_c+C))					Release Rate = 18.6 (L/sec); Return Period = 5 (years); IDF Parameters, A = 998.071, 0.814, C = 6.053 (I = A/(T_c+C))					Release Rate = 27.3 (L/sec); Return Period = 100 (years); IDF Parameters, A = 1735.688, 0.820, C = 6.014 (I = A/(T_c+C))				
	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)	Rainfall Intensity, I (mm/hr)	Peak Flow (L/sec)	Release Rate (L/sec)	Storage Rate (L/sec)	Storage (m^3)
0	167.2	63.8	13.92	49.9	0.00	230.5	87.9	18.566	69.4	0.00	398.6	169.0	27.254	141.7	0.00
2	133.3	50.9	13.92	36.9	4.43	182.7	69.7	18.566	51.1	6.14	315.0	133.5	27.254	106.3	12.76
4	111.7	42.6	13.92	28.7	6.89	152.5	58.2	18.566	39.6	9.51	262.4	111.2	27.254	84.0	20.16
6	96.6	36.9	13.92	22.9	8.26	131.6	50.2	18.566	31.6	11.39	226.0	95.8	27.254	68.6	24.68
8	85.5	32.6	13.92	18.7	8.97	116.1	44.3	18.566	25.7	12.35	199.2	84.5	27.254	57.2	27.45
10	76.8	29.3	13.92	15.4	9.23	104.2	39.8	18.566	21.2	12.71	178.6	75.7	27.254	48.4	29.07
12	69.9	26.7	13.92	12.7	9.18	94.7	36.1	18.566	17.6	12.65	162.1	68.7	27.254	41.5	29.87
14	64.2	24.5	13.92	10.6	8.89	86.9	33.2	18.566	14.6	12.27	148.7	63.1	27.254	35.8	30.07
16	59.5	22.7	13.92	8.8	8.43	80.5	30.7	18.566	12.1	11.65		0.0	27.254	-27.3	-26.16
18	55.5	21.2	13.92	7.2	7.83	75.0	28.6	18.566	10.0	10.84	128.1	54.3	27.254	27.0	29.21
20	52.0	19.9	13.92	5.9	7.11	70.3	26.8	18.566	8.2	9.89	120.0	50.9	27.254	23.6	28.32
22	49.0	18.7	13.92	4.8	6.31	66.1	25.2	18.566	6.7	8.81	112.9	47.9	27.254	20.6	27.20
24	46.4	17.7	13.92	3.8	5.43	62.5	23.9	18.566	5.3	7.63	106.7	45.2	27.254	18.0	25.88
26	44.0	16.8	13.92	2.9	4.48	59.3	22.6	18.566	4.1	6.36	101.2	42.9	27.254	15.6	24.40
28	41.9	16.0	13.92	2.1	3.48	56.5	21.6	18.566	3.0	5.02	96.3	40.8	27.254	13.6	22.78
30	40.0	15.3	13.92	1.4	2.44	53.9	20.6	18.566	2.0	3.62	91.9	38.9	27.254	11.7	21.05
32	38.3	14.6	13.92	0.7	1.35	51.6	19.7	18.566	1.1	2.16	87.9	37.3	27.254	10.0	19.21
34	36.8	14.0	13.92	0.1	0.23	49.5	18.9	18.566	0.3	0.66	84.3	35.7	27.254	8.5	17.28
36	35.4	13.5	13.92	-0.4	-0.93	47.6	18.2	18.566	-0.4	-0.89	81.0	34.3	27.254	7.1	15.27
38	34.1	13.0	13.92	-0.9	-2.11	45.8	17.5	18.566	-1.1	-2.48	77.9	33.0	27.254	5.8	13.19
40	32.9	12.5	13.92	-1.4	-3.32	44.2	16.9	18.566	-1.7	-4.10	75.1	31.9	27.254	4.6	11.05
Max =					**9.23**					**12.71**					**30.07**

Notes

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

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

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

4) Storage Rate = Peak Flow - Release Rate

5) Storage = Duration x Storage Rate

6) Maximium Storage = Max Storage Over Duration

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

Table D9: 5-year & 100-year Roof Design Sheet - For Roof Drains using Flow Controlled Roof Drains

Project: 2140 Baseline Rd
Location: City of Ottawa
Date:Dec 2019

Area #	Drain Type	Roof Drain Type	No Drains per Area	No of Weirs per Drain	Weir Position	Runoff Coeff (Cavg)		Drainage Area		5-year Event						100-year Event						Storage Required *(MRM)*		Maximium Storage Provided at Spill Elevation			
						5-year	100-year	m^2	ha	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)	5-year (m^3)	100-year (m^3)	Area Available for Storage (m^2)	Max Prism Depth (mm)	Max Prisim Volume (m^3)	Total Volume (m3)
R1-1	RD	RD2	1	no weir	1-None	0.90	0.90	73	0.0073	1.906	0	30.2	30.2	1.906	1.906	3.267	0	51.8	51.8	3.267	3.267			67	150	3.4	3.35
R1-2	RD	RD2	1	no weir	1-None	0.90	0.90	73	0.0073	1.905	0	30.2	30.2	1.905	1.905	3.264	0	51.7	51.7	3.264	3.264			68	150	3.4	3.40
R1-3	RD	RD2	1	no weir	1-None	0.90	0.90	83	0.0083	2.165	0	34.3	34.3	2.165	2.165	3.710	0	58.8	58.8	3.710	3.710			77	150	3.9	3.85
R1-4	RD	RD2	1	no weir	1-None	0.90	0.90	68	0.0068	1.770	0	28.1	28.1	1.770	1.770	3.034	0	48.1	48.1	3.034	3.034			61	150	3.1	3.05
R2-1	RD	RD2	1	no weir	1-None	0.90	0.90	62	0.0062	1.616	0	25.6	25.6	1.616	1.616	2.770	0	43.9	43.9	2.770	2.770			55	150	2.8	2.75
R2-2	RD	RD2	1	no weir	1-None	0.90	0.90	49	0.0049	1.277	0	20.2	20.2	1.277	1.277	2.189	0	34.7	34.7	2.189	2.189			38	150	1.9	1.90
R2-3	RD	RD1	1	1	2-Closed	0.90	0.90	21	0.0021	0.547	85	5.0	5.0	0.315	0.315	0.938	121	5.0	5.0	0.315	0.315	0.14	0.39	15	150	0.8	0.75
R2-4	RD	RD1	1	1	2-Closed	0.90	0.90	22	0.0022	0.574	86	5.0	5.0	0.315	0.315	0.983	121	5.0	5.0	0.315	0.315	0.15	0.42	16	150	0.8	0.80
R2-5	RD	RD1	1	1	6-Full	0.90	0.90	163	0.0163	4.249	95	19.1	19.1	1.202	1.202	7.282	120	24.1	24.1	1.520	1.520	2.00	4.07	156	150	7.8	7.80
R2-6	RD	RD1	1	1	6-Full	0.90	0.90	266	0.0266	6.934	106	21.3	21.3	1.343	1.343	11.884	133	26.7	26.7	1.683	1.683	4.07	8.00	228	150	11.4	11.40
R2-7	RD	RD1	1	1	2-Closed	0.90	0.90	25	0.0025	0.652	86	5.0	5.0	0.315	0.315	1.117	119	5.0	5.0	0.315	0.315	0.20	0.52	21	150	1.1	1.05
R3-1	RD	RD1	1	1	2-Closed	0.90	0.90	59	0.0059	1.538	68	5.0	5.0	0.315	0.315	2.636	135	5.0	5.0	0.315	0.315	0.24	1.91	52	150	2.6	2.60
R3-2	RD	RD1	1	1	2-Closed	0.90	0.90	52	0.0052	1.356	101	5.0	5.0	0.315	0.315	2.323	132	5.0	5.0	0.315	0.315	0.72	1.59	47	150	2.4	2.35
R3-3	RD	RD1	1	1	2-Closed	0.90	0.90	29	0.0029	0.756	91	5.0	5.0	0.315	0.315	1.296	123	5.0	5.0	0.315	0.315	0.27	0.67	24	150	1.2	1.20
R3-4	RD	RD1	1	1	2-Closed	0.90	0.90	39	0.0039	1.017	92	5.0	5.0	0.315	0.315	1.742	122	5.0	5.0	0.315	0.315	0.45	1.05	39	150	2.0	1.95
R4-1	RD	RD1	1	1	2-Closed	0.90	0.90	93	0.0093	2.424	111	5.0	5.0	0.315	0.315	4.155	141	5.0	5.0	0.315	0.315	1.71	3.55	85	150	4.3	4.25
R4-2	RD	RD1	1	1	4-1/2 open	0.90	0.90	87	0.0087	2.268	53	10.3	10.3	0.649	0.649	3.887	122	17.2	17.2	1.085	1.085	0.15	1.83	68	150	3.4	3.40
R4-3	RD	RD1	1	1	2-Closed	0.90	0.90	77	0.0077	2.007	109	5.0	5.0	0.315	0.315	3.440	140	5.0	5.0	0.315	0.315	1.30	2.75	67	150	3.4	3.35
R4-4	RD	RD1	1	1	2-Closed	0.90	0.90	62	0.0062	1.616	105	5.0	5.0	0.315	0.315	2.770	136	5.0	5.0	0.315	0.315	0.94	2.04	55	150	2.8	2.75
R4-5	RD	RD1	1	1	2-Closed	0.90	0.90	61	0.0061	1.590	105	5.0	5.0	0.315	0.315	2.725	136	5.0	5.0	0.315	0.315	0.92	2.00	54	150	2.7	2.70
R5-1	RD	RD1	1	1	2-Closed	0.90	0.90	40	0.0040	1.043	99	5.0	5.0	0.315	0.315	1.787	131	5.0	5.0	0.315	0.315	0.47	1.09	33	150	1.7	1.65
R5-2	RD	RD1	1	1	2-Closed	0.90	0.90	30	0.0030	0.782	90	5.0	5.0	0.315	0.315	1.340	122	5.0	5.0	0.315	0.315	0.28	0.70	26	150	1.3	1.30
R5-3	RD	RD1	1	1	2-Closed	0.90	0.90	24	0.0024	0.626	87	5.0	5.0	0.315	0.315	1.072	120	5.0	5.0	0.315	0.315	0.18	0.49	19	150	1.0	0.95
R6-1	RD	RD1	1	1	2-Closed	0.90	0.90	66	0.0066	1.728	102	5.0	5.0	0.315	0.315	2.961	132	5.0	5.0	0.315	0.315	1.04	2.24	66	150	3.3	3.32
Totals								**1,624**	**0.1624**	0.000		**294.28**		**18.57**	**18.57**	**72.57**		**431.98**		**27.25**	**27.25**	**15.24**	**35.31**	**1437**		**71.9**	**71.9**
Min											**0**				`		**0**										
Max											**111**						**141**										

Runoff Based on the Following:

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

Qyr(cont) = 13.9
V2yr = 11.4

Roof Drain Types

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

Roof Drains have Following Flow Rates: WATTS Flow Conttolled Drain

Weir Position		Flow (gpm) per depth							Max Flow Rate per Weir
		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

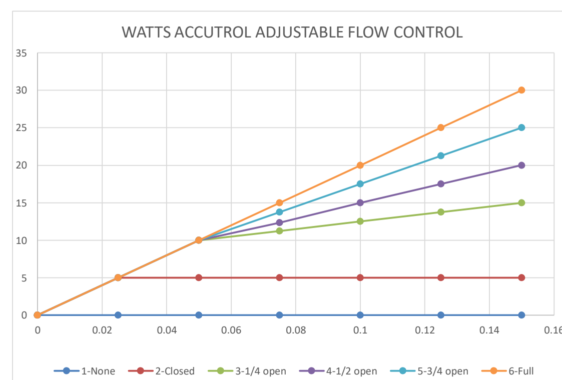


TABLE D10: 2-YEAR STORM SEWER CALCULATION SHEET

Return Period Storm =	**2-year**	(2-year, 5-year, 100-year)
Default Inlet Time=	10	(minutes)
Manning Coefficient =	0.013	(dimensionless)

From Node	To Node	AREA INFO				FLOW (UNRESTRICTED)							INDIV CAP FLOW (L/s)	CUMUL CAP FLOW (L/s)	SEWER DATA						Velocity (m/s)		Time in Pipe, Tt (min)	Hydraulic Ratios	
		Area No.	Area (ha)	∑ Area (ha)	Average R	Indiv. 2.78*A*R	Accum. 2.78*A*R	Tc (mins)	I (mm/h)	Indiv. Flow	Return Period	Q (L/s)			Dia (mm) Actual	Dia (mm) Nominal	Type	Slope (%)	Length (m)	Capacity, Q_{CAP} (L/sec)	Vf	Va		Q/Q_{CAP}	Va/Vf
CB 3	Building	PST-3C	0.0228	0.0228	0.64	0.041	0.041	10.00	76.81	3.12	2-year	3.1			201.2	200	PVC	1.40	7.00	39.41	1.24	0.61	0.19	0.08	0.49
Building	STMMH 102	R	0.1531	0.1759	0.90	0.383	0.424																		
		PST-1E	0.0071	0.1830	0.90	0.018	0.441																		
		PST-1D	0.0112	0.1942	0.90	0.028	0.469	10.00	76.81	2.15	2-year	36.1			251.5	250	PVC	2.00	4.40	85.42	1.71	1.21	0.06	0.42	0.71
CB 1	Stormtech	PST-1B	0.0629	0.0629	0.68	0.119	0.119																		
		PST-1A	0.0208	0.0837	0.20	0.012	0.130	10.00	76.81	0.89	2-year	10.0			447.9	450	POLY	1.00	1.00	281.52	1.79	0.56	0.03	0.04	0.31
CB 2	STMMH 102	PST-1C	0.0342	0.0342	0.84	0.080	0.080	10.00	76.81	6.13	2-year	6.1			201.2	200	PVC	2.00	2.70	47.10	1.48	0.86	0.05	0.13	0.58
STMMH 102	Stormtech			0.3121			0.549	10.06	76.57		2-year	42.1			610.0	600	PVC	1.00	3.50	641.68	2.17	1.04	0.06	0.07	0.48
Stormtech	STMMH 101			0.3121			0.680	10.12	76.36		2-year	51.9			251.5	250	PVC	1.00	2.20	60.40	1.21	1.21	0.03	0.86	1.00
STMMH 101	STMMH 100			0.3121			0.680	10.15	76.25		2-year	51.8	6.6	6.60	251.5	250	PVC	6.00	2.60	147.94	2.97	2.08	0.02	0.35	0.70
Building	STMMH 100	(weeping tiles)						10.00	76.81		2-year		*0.34	6.94	201.2	200	PVC	5.15	16.70	75.59	2.37	1.48	0.19	0.00	1.00
STMMH 100	OGS							10.17	76.17		2-year	51.8		6.94	251.5	250	PVC	2.50	3.40	95.50	1.92	1.35	0.04	0.54	0.71
OGS	Ex. 675mm St							10.21	76.01		2-year	51.8		6.94	251.5	250	PVC	4.65	11.90	130.24	2.61	1.85	0.11	0.40	0.71
TOTALS =			**0.31**			**0.680**																			

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)

Ottawa Rainfall Intensity Values from Sewer Design Guidelines, SDG002

	a	b	c
2-year	732.951	6.199	0.810
5-year	998.071	6.053	0.814
100-year	1735.688	6.014	0.820

Building Foundation Drain Allowance (L/sec) = **0.34** (From Section 6.5 of Geotech Report)

Designed:	Project:	
J. Fitzpatrick, P.Eng.	Baseline Constellation Partnership Inc.	
Checked:	Location:	
B. Thomas, P.Eng.	2140 Baseline Road	
Dwg Reference:	File Ref:	Sheet No:
FIGURE A3.1	**245012 Stormwater - Sewer Design Sheets, Dec 2019.xlsx**	1 of 1

Appendix E – Stormceptor Sizing

Detailed Report from PCSWMM for Stormceptor

STC 300i Product Sheet

STC 300i Standard Model Detail

Stormceptor®

FORTERRA™

Detailed Stormceptor Sizing Report – Baseline Road

Project Information & Location			
Project Name	2140 Baseline Rd	**Project Number**	245012
City	ottawa	**State/ Province**	Ontario
Country	Canada	**Date**	12/14/2018
Designer Information		**EOR Information (optional)**	
Name	jason fitzpatrick	**Name**	
Company	Exp Services	**Company**	
Phone #	613-688-1899	**Phone #**	
Email	jason.fitzpatrick@exp.com	**Email**	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Baseline Road
Recommended Stormceptor Model	STC 300
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	91
PSD	Fine Distribution
Rainfall Station	OTTAWA MACDONALD-CARTIER INT'L A

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary		
Stormceptor Model	**% TSS Removal Provided**	**% Runoff Volume Captured Provided**
STC 300	91	100
STC 750	95	100
STC 1000	95	100
STC 1500	95	100
STC 2000	96	100
STC 3000	96	100
STC 4000	97	100
STC 5000	97	100
STC 6000	98	100
STC 9000	98	100
STC 10000	98	100
STC 14000	99	100
StormceptorMAX	Custom	Custom

Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur.
Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour).
Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station

State/Province	Ontario	**Total Number of Rainfall Events**	4093
Rainfall Station Name	OTTAWA MACDONALD-CARTIER INT'L A	**Total Rainfall (mm)**	20978.1
Station ID #	6000	**Average Annual Rainfall (mm)**	567.0
Coordinates	45°19'N, 75°40'W	**Total Evaporation (mm)**	1681.9
Elevation (ft)	370	**Total Infiltration (mm)**	2299.5
Years of Rainfall Data	37	**Total Rainfall that is Runoff (mm)**	16996.7

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.

Drainage Area	
Total Area (ha)	0.291
Imperviousness %	89.0

Up Stream Storage	
Storage (ha-m)	Discharge (cms)
0.000	0.000
0.006	0.003
0.012	0.007

Water Quality Objective	
TSS Removal (%)	80.0
Runoff Volume Capture (%)	85.00
Oil Spill Capture Volume (L)	
Peak Conveyed Flow Rate (L/s)	
Water Quality Flow Rate (L/s)	

Up Stream Flow Diversion	
Max. Flow to Stormceptor (cms)	

Design Details	
Stormceptor Inlet Invert Elev (m)	
Stormceptor Outlet Invert Elev (m)	
Stormceptor Rim Elev (m)	
Normal Water Level Elevation (m)	
Pipe Diameter (mm)	
Pipe Material	
Multiple Inlets (Y/N)	No
Grate Inlet (Y/N)	No

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution		
Particle Diameter (microns)	Distribution %	Specific Gravity
20.0	20.0	1.30
60.0	20.0	1.80
150.0	20.0	2.20
400.0	20.0	2.65
2000.0	20.0	2.65

Site Name	Baseline Road

Site Details

Drainage Area	
Total Area (ha)	0.291
Imperviousness %	89.0

Surface Characteristics	
Width (m)	108.00
Slope %	2
Impervious Depression Storage (mm)	0.508
Pervious Depression Storage (mm)	5.08
Impervious Manning's n	0.015
Pervious Manning's n	0.25

Maintenance Frequency	
Maintenance Frequency (months) >	12

Infiltration Parameters	
Horton's equation is used to estimate infiltration	
Max. Infiltration Rate (mm/hr)	61.98
Min. Infiltration Rate (mm/hr)	10.16
Decay Rate (1/sec)	0.00055
Regeneration Rate (1/sec)	0.01

Evaporation	
Daily Evaporation Rate (mm/day)	2.54

Dry Weather Flow	
Dry Weather Flow (lps)	0

Winter Months	
Winter Infiltration	0

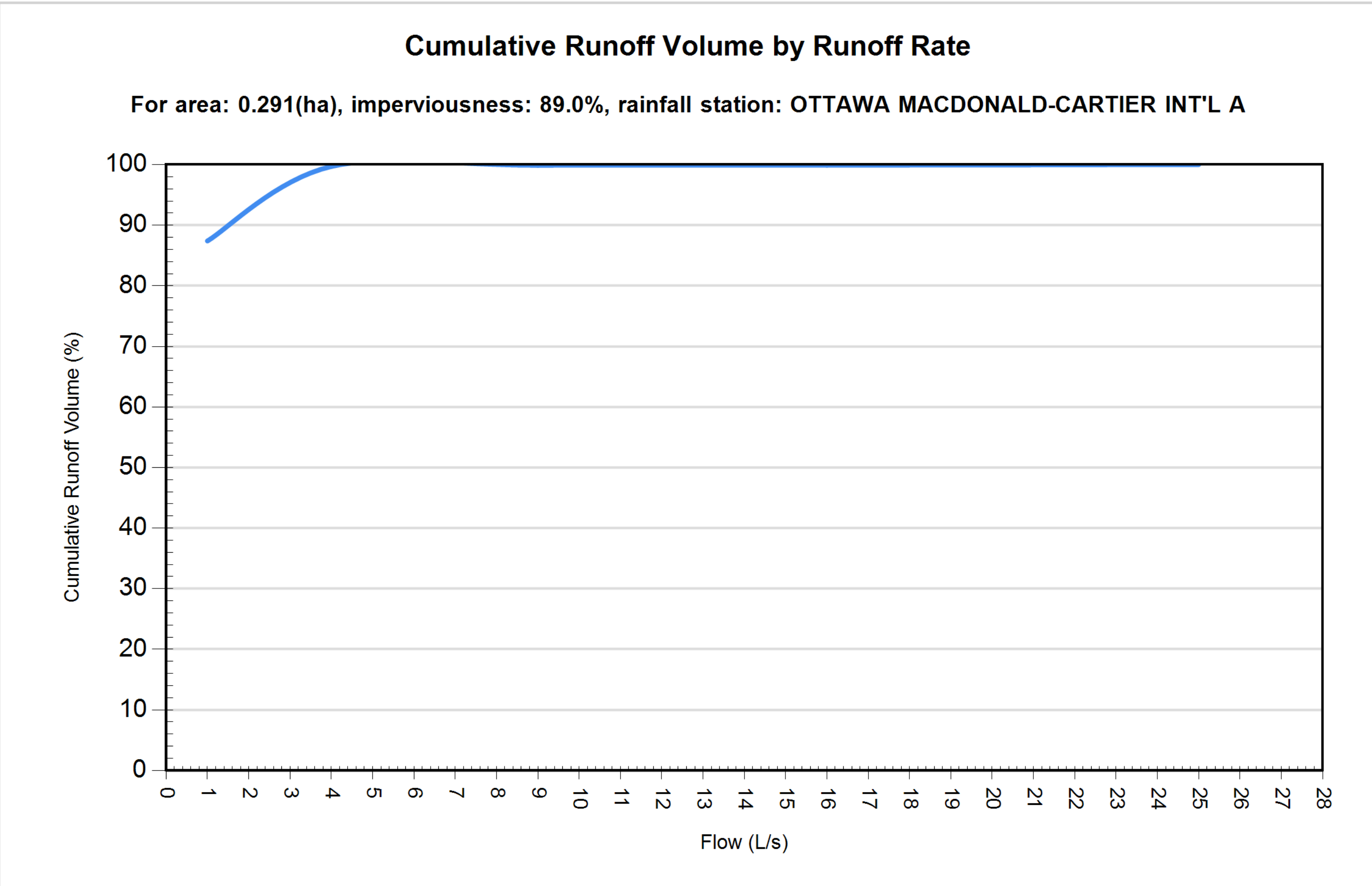
TSS Loading Parameters

TSS Loading Function	

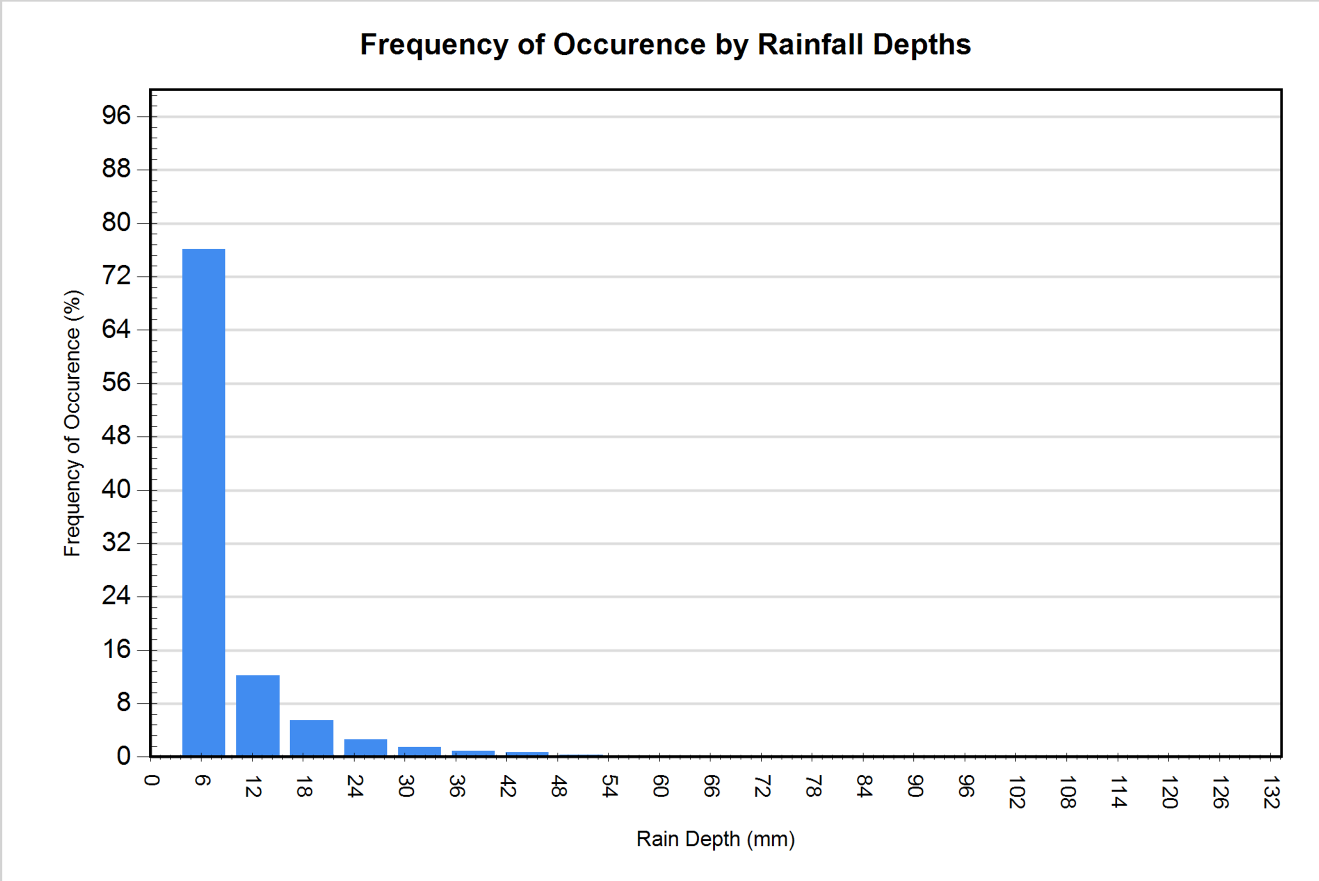
Buildup/Wash-off Parameters	
Target Event Mean Conc. (EMC) mg/L	
Exponential Buildup Power	
Exponential Washoff Exponent	

TSS Availability Parameters	
Availability Constant A	
Availability Factor B	
Availability Exponent C	
Min. Particle Size Affected by Availability (micron)	

Cumulative Runoff Volume by Runoff Rate			
Runoff Rate (L/s)	**Runoff Volume (m³)**	**Volume Over (m³)**	**Cumulative Runoff Volume (%)**
1	43455	6267	87.4
4	49538	172	99.7
9	49663	48	99.9
16	49681	29	99.9
25	49703	8	100.0

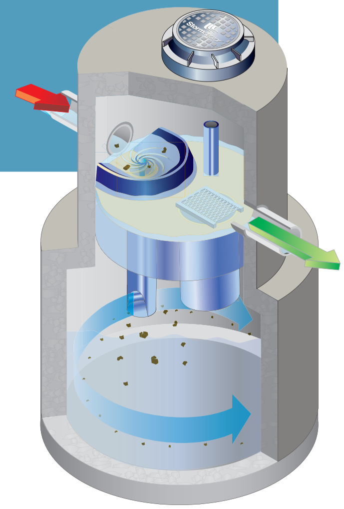


Rainfall Event Analysis				
Rainfall Depth (mm)	**No. of Events**	**Percentage of Total Events (%)**	**Total Volume (mm)**	**Percentage of Annual Volume (%)**
6.35	3113	76.1	5230	24.9
12.70	501	12.2	4497	21.4
19.05	225	5.5	3469	16.5
25.40	105	2.6	2317	11.0
31.75	62	1.5	1765	8.4
38.10	35	0.9	1206	5.8
44.45	28	0.7	1163	5.5
50.80	12	0.3	557	2.7
57.15	7	0.2	378	1.8
63.50	1	0.0	63	0.3
69.85	1	0.0	64	0.3
76.20	1	0.0	76	0.4
82.55	0	0.0	0	0.0
88.90	1	0.0	84	0.4
95.25	0	0.0	0	0.0
101.60	0	0.0	0	0.0
107.95	0	0.0	0	0.0
114.30	1	0.0	109	0.5
120.65	0	0.0	0	0.0
127.00	0	0.0	0	0.0



For Stormceptor Specifications and Drawings Please Visit:
http://www.imbriumsystems.com/technical-specifications

Stormceptor® STC



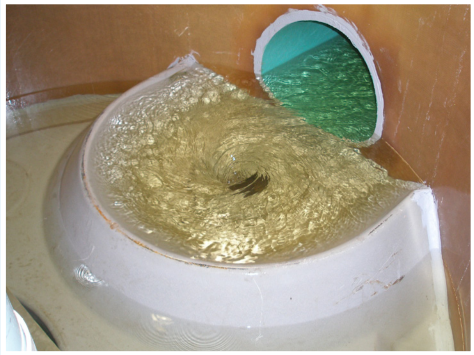
The calm *during* the storm

When it rains, oils, sediment and other contaminants are washed from paved surfaces directly into our storm drains and waterways. Non-point source pollution such as stormwater now accounts for 80% of water pollution in North America and governments are responding with demanding regulations to protect our water resources.

Removing more pollutants

Stormceptor removes more pollutants from stormwater than any other separator.

- Maintains continuous positive treatment of total suspended solids (TSS) year-round, regardless of flow rate
- Designed to remove a wide range of particle sizes, as well as free oils, heavy metals and nutrients that attach to fine sediment
- Can be designed to remove a specific particle size distribution (PSD)



A calm treatment environment

- Stormceptor slows incoming stormwater to create a non-turbulent treatment environment, allowing free oils and debris to rise, and sediment to settle
- Scour prevention technology ensures pollutants are captured and contained during all rainfall events, even extreme storms

Proven performance

With more than 20 years of industry experience, Stormceptor has been performance tested and verified by some of the most stringent technology evaluation programs in North America. Stormceptor has been performance verified through numerous verification programs, including;

- NJCAT
- Washington ECOLOGY
- EN858 Class 2

PCSWMM for Stormceptor – *Advanced online sizing & design software*

The most accurate, easy to use design tool available.

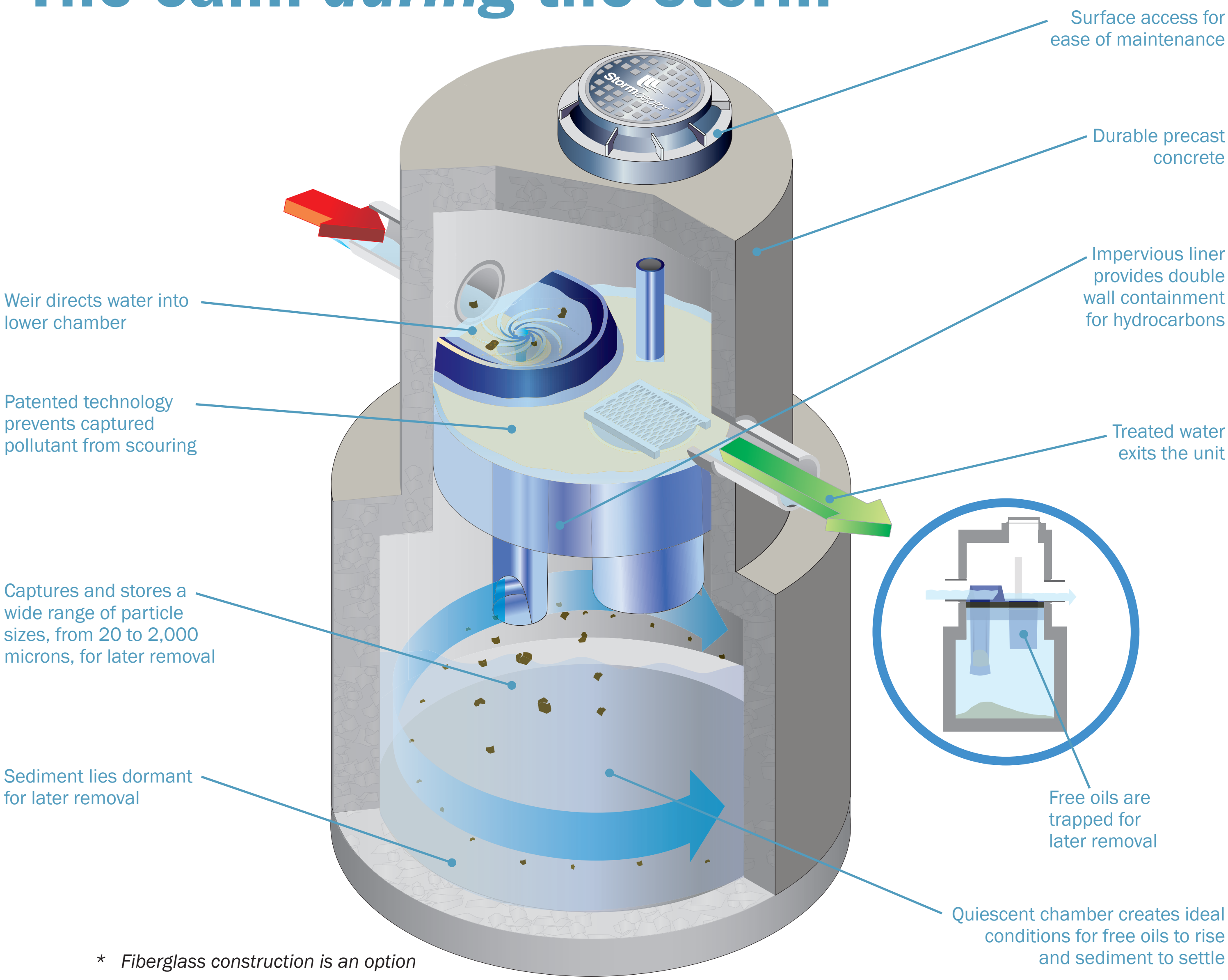
- This continuous simulation modeling software combines localized rainfall data from over 1,900 weather stations across North America allowing for region-specific design with a selection of particle sizes to design the best Stormceptor for your site
- Within a single project, multiple Stormceptor units can be sized and the information revisited as project parameters change
- Provides a summary report that includes projected performance calculations

www.imbriumsystems.com/PCSWMMforStormceptor

With over 40,000 units operating worldwide, Stormceptor performs and protects every day, in every storm.

Stormceptor® STC

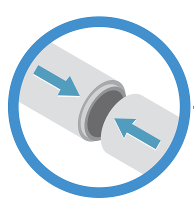
The calm *during* the storm



* *Fiberglass construction is an option*

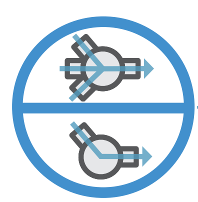
Easy to install

Small footprint saves time and money with limited disruption to your site.



Seamless

Minimal drop between inlet and outlet pipes makes Stormceptor ideal for retrofits and new development projects.



Flexible

Multiple inlets can connect to a single unit.

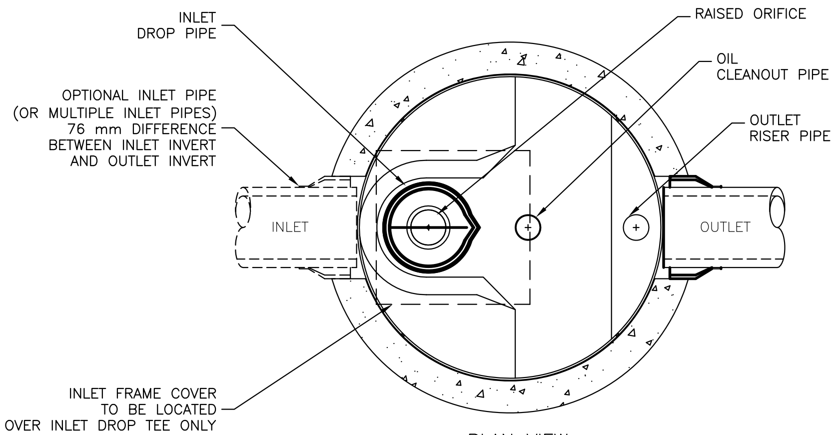
Can be used as a bend structure.

imbrium®

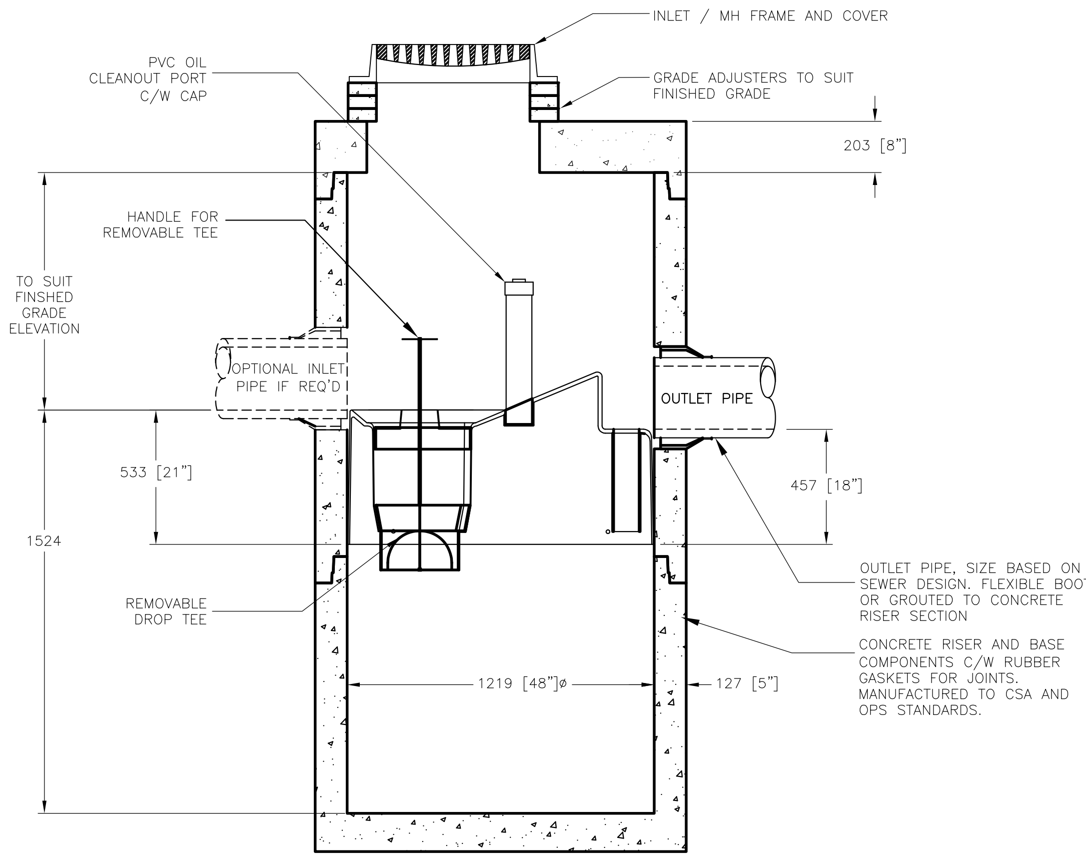
CANADA: (800) 565 4801 | USA: (888) 279 8826 | INTERNATIONAL: +1 (416) 960 9900

www.imbriumsystems.com

DRAWING NOT TO BE USED FOR CONSTRUCTION



PLAN VIEW



SECTION VIEW

Stormceptor®

imbrium®
WWW.IMBRIUMSYSTEMS.COM
7037 RIDGE ROAD, SUITE 350, HANOVER, MD 21076
USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

STC 300i
STANDARD MODEL

####

REV #	DATE	REVISION DESCRIPTION	BY

SHEET NUMBER 1 OF 1

DATE:######## SCALE: 30 PROJECT No.: ##### DRAWN: ### CHECKED: ###

\\AD.CONTECH-CPI.COM\ROOT\CORPORATE\MARKETING\IMBRIUM\CAD & PDF\STORMCEPTOR\CANADIAN\STC 300I.DWG 8/8/2016 9:17 AM

Appendix F – Correspondence

Correspondence from City of Ottawa

Correspondence from RVCA on Water Quality/Quality Requirements

Correspondence from Architect on Building Statistics

Correspondence from Quadrant Engineering on Emergency Generator

Correspondence from Quadrant Engineering on Underground Plumbing (Email and Dwg: M-100)

Correspondence from Architect on Roof Scuppers

Memo from Paterson Group on Soil Infiltration Rate & Ground Water Table

Jason Fitzpatrick

From:	Fraser, Mark <Mark.Fraser@ottawa.ca>
Sent:	Sunday, December 9, 2018 10:30 AM
To:	Jason Fitzpatrick
Cc:	Bruce Thomas
Subject:	RE: 2140 Baseline Road
Attachments:	2140 Baseline Dec 2018.pdf
Categories:	RECEIVED - ACTION REQUIRED

Hi Jason,

The following are boundary conditions, HGL, for hydraulic analysis at 2140 Baseline (zone 2W) assumed to be connected to the 203mm on Gemini Way (see attached PDF for location).

Minimum HGL = 127.5m
Maximum HGL = 134.6m
MaxDay + FireFlow (150 L/s) = 112.0m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

If you have any questions please let me know

Regards,

Mark Fraser
Project Manager, Planning Services
Development Review West Branch
City of Ottawa | Ville d'Ottawa
Planning, Infrastructure and Economic Development Department
110 Laurier Avenue West. 4th Floor, Ottawa ON, K1P 1J1
Tel:613.580.2424 ext. 27791
Fax: 613-580-2576
Mail: Code 01-14
Email: Mark.Fraser@ottawa.ca

From: Jason Fitzpatrick <jason.fitzpatrick@exp.com>
Sent: December 04, 2018 10:05 AM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Cc: Bruce Thomas <bruce.thomas@exp.com>
Subject: 2140 Baseline Road

Hi Mark,

We are updating our servicing report for 2140 Baseline Road and are requesting new hydraulic boundary conditions.

As per your previous comments 12, 14, and 15 the following summarizes our revised demands.

Average day	=	2.0 L/sec
Max day	=	5.8 L/sec
Peak hour	=	8.6 L/sec
RFF (FUS)	=	150 L/sec

On our previous submission our estimated population was 473 persons, and you had requested re-calculation of the demands using MOE peaking factors (i.e.. less than 500 persons)

We have therefore re-calculated the demands using the MOE peaking factors, for the now updated population of 445 persons.

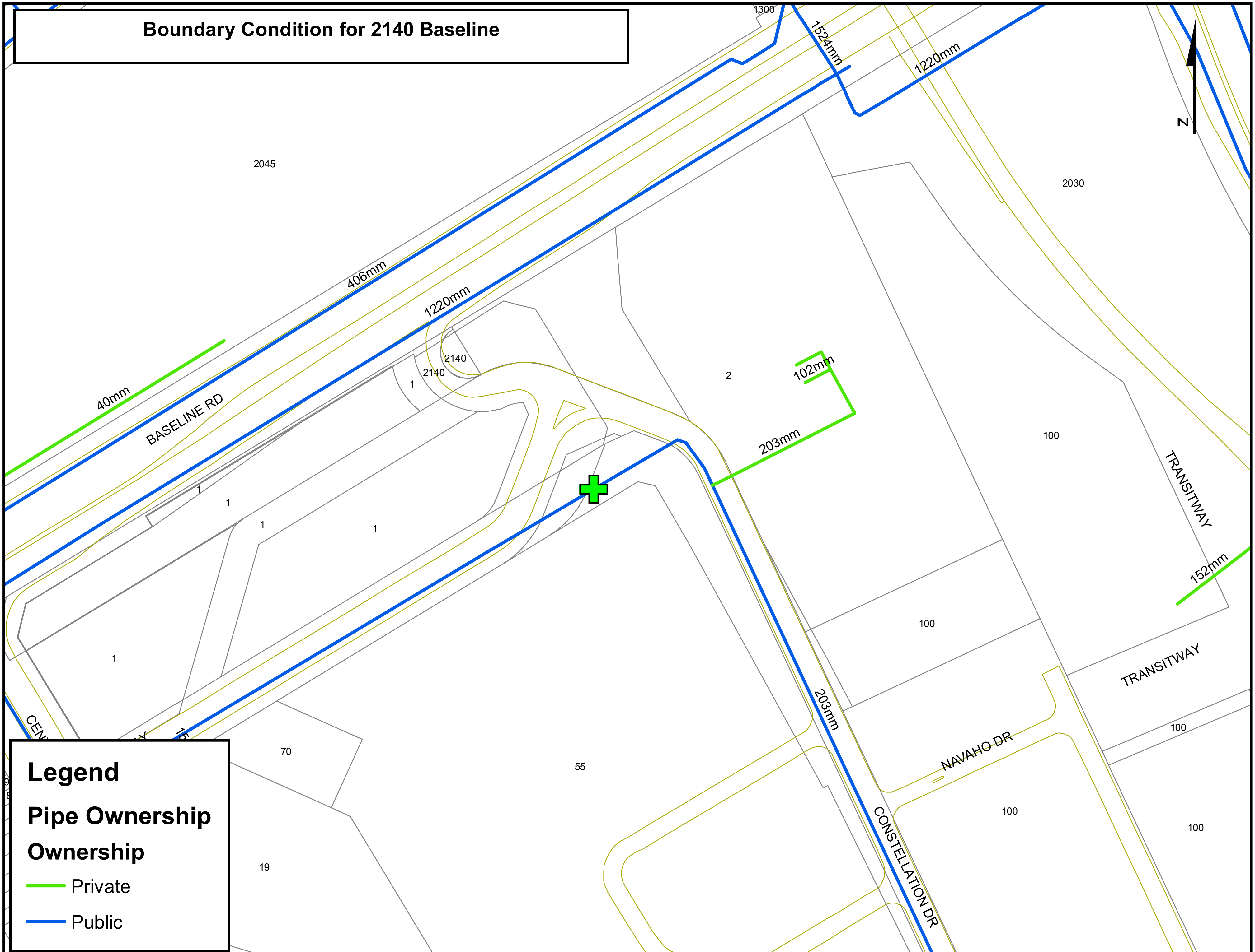
We have also looked at the demands for the ground floor commercial area as per your comment #21. If we apply the same principals to the water demands we get slightly higher demands of 2.4 L/sec, 6.4 L/sec, 9.3 L/sec. I've attached two tables which use: 1) unit demands for commercial based on floor area of 5,000 L/m2/day and 2) based on SDG002 Appendix 4-A for sewage rates and applied to water demands. These differences are minor and will not affect the results, as the fire flow requirements will govern the water service sizing. I will let you review and decide which method you prefer.

In addition, we have updated the fire flow calculation based on the FUS. The required fire flow based on this method worked out to the same as the OBC method.

Thanks

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

Boundary Condition for 2140 Baseline



Legend

Pipe Ownership

Ownership

- Private
- Public

Moe Ghadban

From: Eric Lalande <eric.lalande@rvca.ca>
Sent: Tuesday, March 5, 2019 2:16 PM
To: Bruce Thomas; Jason Fitzpatrick
Cc: Glen McDonald
Subject: RE: Request for SWM Criteria for 2140 Baseline Road

Hi Jason,

The SWW report provided as part of the Site Plan review accurately identified our Requirements for water quality (80% TSS) and as a result we had no objections and asked the City that the quality control measures be implemented through the site plan process. This requirement shouldn't change with a resubmission.

Is there anything else you require from our end?

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

From: Glen McDonald
Sent: Tuesday, March 05, 2019 2:08 PM
To: Eric Lalande <eric.lalande@rvca.ca>
Subject: FW: Request for SWM Criteria for 2140 Baseline Road

Yet another one, different site.

Glen

From: Jason Fitzpatrick <jason.fitzpatrick@exp.com>
Sent: Tuesday, March 05, 2019 12:45 PM
To: Glen McDonald <glen.mcdonald@rvca.ca>
Cc: Bruce Thomas <bruce.thomas@exp.com>
Subject: FW: Request for SWM Criteria for 2140 Baseline Road

Hi Glen,

This is another project, for which we require the CA's comment on.

Much appreciated.

Jason Fitzpatrick, P.Eng.
EXP | Project Engineer
t : +1.613.688.1899 | m : +1.613.302.7441 | e : jason.fitzpatrick@exp.com

---

From: Jason Fitzpatrick
Sent: Thursday, December 13, 2018 9:51 AM
To: Glen McDonald (glen.mcdonald@rvca.ca) <glen.mcdonald@rvca.ca>

Cc: Bruce Thomas <bruce.thomas@exp.com>
Subject: Request for SWM Criteria for 2140 Baseline Road

Hi Glen,

We are preparing a site servicing and stormwater report for a client who is proposing to construct a 14-storey student residence building at 2140 Baseline Road (Constellation Cres & Baseline Rd).

The proposed building will contain 1 level of u/g parking, ground floor commercial, a 14th floor amenity area, with the remaining floors being residential units (total 140 units).

We have submitted our first set of drawings and report to the City (File # D07-12-18-0084), and as a result have been asked to confirm the water quality control requirements with the RVCA.

We will be re-submitting a revised report and drawings shortly, and require confirmation of the SWM requirements.

Our intent is to provide the following SWM criteria as per the JFSA Pinecrest Creek/Westboro Area SWM Guidelines (June 2012) for our site, as it falls within the Pinecrest Creek Watershed, upstream of the ORP pipe inlet:

- Runoff Volume Reduction: On-site retention of 10mm storm.
- Water Quality 80% TSS removal.
- Quantity Control 100-yr discharge to not exceed 33.5 L/ha/sec.
- Erosion Detain 25mm to meet outflow not exceeding 5.8 L/ha/sec.

Please confirm if the following is appropriate, and/or if there are any additional requirements.

Much appreciated.

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

Jason Fitzpatrick

From: Martin Lariviere <mlariviere@apiconsultants.net>
Sent: Friday, May 31, 2019 9:45 AM
To: Jason Fitzpatrick
Cc: Bruce Thomas
Subject: Re: 2140 Baseline Road

Hello Jason,

I am confirming that the number of units listed below are correct as reflected on our site plan building statistics.

I am also confirming the commercial areas listed are correct.

Regards,

Martin Lariviere OAA

Architect
OAA, LEED AP BD+C, CPHD
Office: 905-337-7249 ext. 217
Email: mlariviere@apiconsultants.net
apidevelopmentconsultants.com
saplysarchitects.ca

On Fri, May 31, 2019 at 9:17 AM Jason Fitzpatrick <jason.fitzpatrick@exp.com> wrote:

> Hi Martin,
>
> Can you please respond to this email to confirm that we have used the appropriate unit numbers and building uses in our servicing report.
>
> This will be included in Appendix F – Correspondence, section of our report.
>
> From Page 5 and 9 of our report, we had used the following unit counts and retail/commercial areas for determining water demands and sewage flows as per City Design Guidelines:

Number of Units

2-bedroom units = 44

3-bedroom units = 72

4-bedroom units = 36

Commercial Areas

Ground Floor Restaurant/Dining Areas (m^2) = 350

Ground Floor Retail Areas (m^2) = 625

Regards

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

Bruce Thomas

Subject: FW: 2140 Baseline - Site Plan Comments

From: Anas Shaklab <ashaklab@quadrantengineering.ca>
Sent: Wednesday, June 12, 2019 2:18 PM
To: Bruce Thomas <bruce.thomas@exp.com>
Cc: Matt McElligott <mcelligott@fotenn.com>; Martin Lariviere <mlariviere@apiconsultants.net>
Subject: RE: 2140 Baseline - Site Plan Comments

Hello Bruce,

The building shall have a natural gas powered emergency generator operating as a self-contained unit in weatherproof sound attenuating enclosure placed on the roof. The generator will provide back up power for life safety (including fire pump) and non life safety systems. The genset will be sized around 125-225kVA.

Let me know should you require anything else.

Regards,
Shak

QUADRANT an Instaelectric Company
Anas Shaklab P.Eng.
Electrical Engineer
+ 1 (613) 567 14 87
2283 St. Laurent Blvd., Unit 203, Ottawa, ON K1G 5A2
www.quadrantengineering.ca

Bruce Thomas

Subject: FW: RE: 2140 Baseline 4th engineering review comments
Attachments: 18-035M M-100 Underground Plumbing.pdf

From: Sarith Lopez <slopez@quadrantengineering.ca>
Sent: Thursday, July 25, 2019 2:17 PM
To: Bruce Thomas <bruce.thomas@exp.com>
Cc: Jason Fitzpatrick <jason.fitzpatrick@exp.com>; Matt McElligott <mcelligott@fotenn.com>; Chuck Clark <cwc@quadrantengineering.ca>; Quadrant Engineering <mail@quadrantengineering.ca>
Subject: RE: RE: 2140 Baseline 4th engineering review comments

Thank you Bruce,

Please find attached the sketch and our comments below:

"We have reviewed the comments contained in City of Ottawa letter dated July 9, 2019 written by Ghislaine Miliu, P. Eng. Our reply is as follows.

***Item 1** in the May 1029 Reports section and item 2 in the May 2019 drawings section appear to be related. We have added a sump pit/pump system for the weeping tile and subslab drainage system, discharging to the dedicated storm pipe for that use. See drawing M-100 attached.*

We have also relocated the trench drain to in front of the garage door, where it is intended to go, instead of at the bottom of the ramp. This had a minor effect on the proposed sub-slab pipe layout.

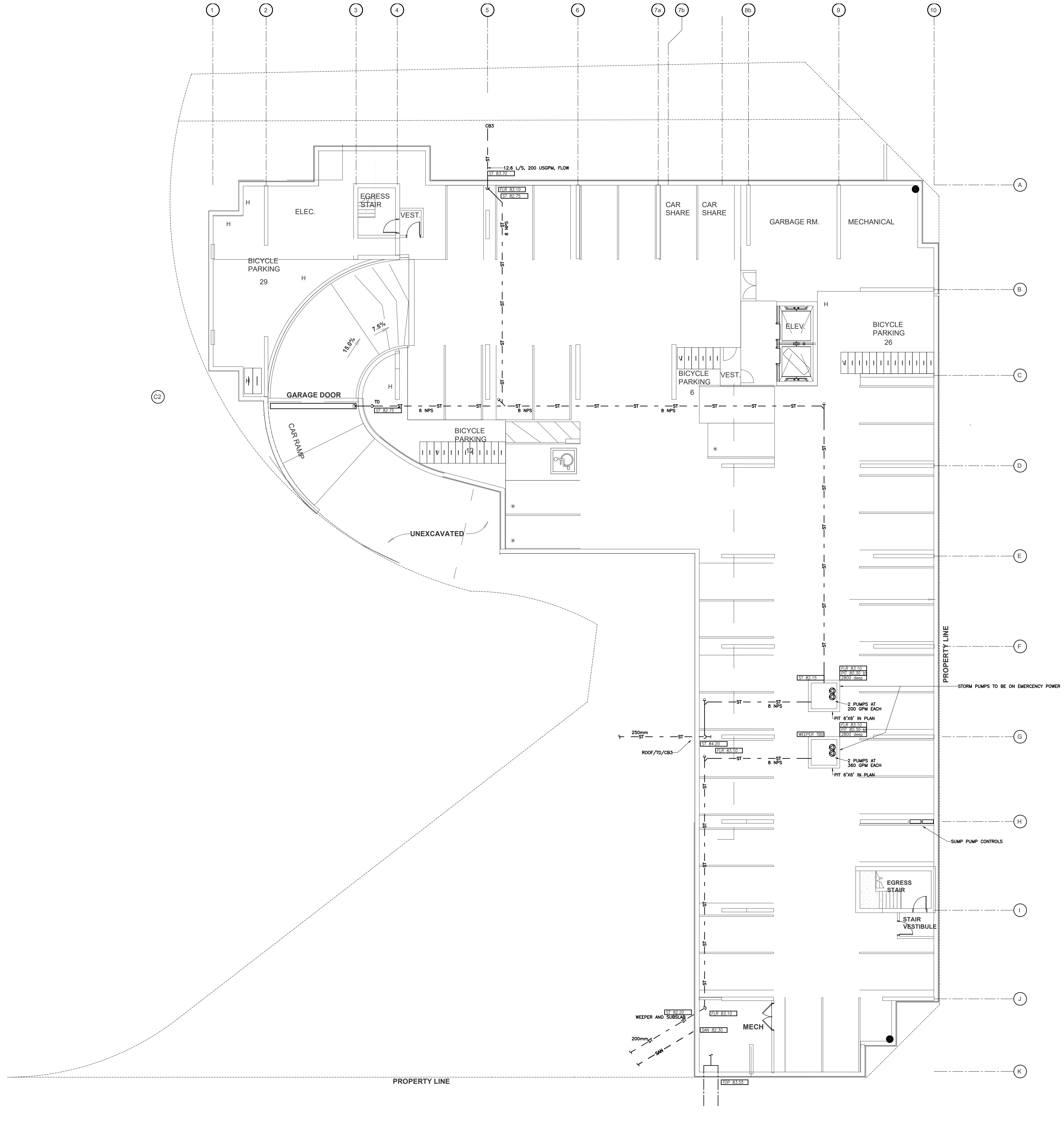
We have added pipe sizes for the storm piping, although these may be changed slightly as the design progresses."

If you have any questions, please don't hesitate to contact us

Best regards

QUADRANT
an Instaelectric Company

Sarith López
PMO
+ 1 (613) 567 14 87
2283 St. Laurent Blvd., Unit 203, Ottawa, ON K1G 5A2
www.quadrantengineering.ca



1	-	RESPONSE TO CITY	JUL 26 '19
No.	BY	DESCRIPTION	DDMMMYY

Revision / Issue Schedule

DO NOT SCALE DRAWINGS. USE ONLY DRAWINGS MARKED "ISSUED FOR CONSTRUCTION". VERIFY CONFIGURATIONS & DIMENSIONS ON SITE BEFORE BEGINNING WORK. NOTIFY ENGINEER IMMEDIATELY OF ANY ERRORS, OMISSIONS OR DISCREPANCIES.

DEVELOPMENT CONSULTANT:

ARCHITECT:

QUADRANT
an Instaelectric Company
2283 ST LAURENT BLVD. UNIT 203, OTTAWA, ONTARIO, K1G 5A2
TEL. (613) 567-1487 FAX. (613) 567-1493
E-Mail: mail@quadrantengineering.ca

PROJECT

OTTAWA STUDENT RESIDENCE

2140 Baseline Rd, Nepean
(Ottawa) ON, K2G 6E2

DRAWING TITLE

LEVEL P1 PARKING UNDERGROUND PLUMBING

BY	CHECK	ISSUED FOR
-	-	-

PROJECT NO.: 18-035
SCALE: 1 : 150
ISSUE DATE: -
SHEET NO.: M-100
SHEET REVISION: 2

CURRENT DATE
Thu, 25 Jul 2019, 13 30

Bruce Thomas

From: Martin Lariviere <mlariviere@apiconsultants.net>
Sent: Tuesday, July 23, 2019 12:25 PM
To: Bruce Thomas; Jason Fitzpatrick
Cc: Fernando Fabiani; Chuck Clark; JM-QEL mail
Subject: 18-012 Ottawa Student Res 2140 Baseline - Coordination Comments

Hi Bruce and Jason,

Our response below to the following comment in blue:

NEW City Comments July 2019
Drawings
Site Servicing Plan, 2140 Baseline Road, Ottawa Student Residence, Drawing No.: C1, prepared by exp Services Inc., Project No.: OTT-00245012-A0, Revision 5 dated June 2019.

2. Please update DWG C1 to specify the invert of the rooftop scuppers.
Please confirm that the elevation of the scuppers is higher than that of the 100-year water elevation stored on the rooftop.
Lastly, please provide correspondence with the Architect to confirm that they will include the scupper invert on their Architectural drawing set.

Scuppers to comply with OBC 7.4.10.4 - Inverts will be no more than 150mm above the low point of the roof. Max depth of controlled water is limited to 150mm. Also confirming that we will include scupper inverts on the architectural set.
API Coordination Comment July 23, 2019:

Thanks,

Martin Lariviere OAA

Architect
OAA, LEED AP BD+C, CPHD
Office: 905-337-7249 ext. 217
Email: mlariviere@apiconsultants.net
apidevelopmentconsultants.com
saplysarchitects.ca

patersongroup memorandum

consulting engineers

re: **Geotechnical Recommendations - Site Services**
Proposed Mixed-Use Development
2140 Baseline Road - Ottawa

to: exp Services Inc. - **Mr. Bruce Thomas** - bruce.thomas@exp.com

to: exp Services Inc. - **Mr. Jason Fitzpatrick** - jason.fitzpatrick@exp.com

cc: Fotenn - **Mr. Matt McElligott** - mcelligott@fotenn.ca

date: July 25, 2019

file: PG4184-MEMO.06

Further to your request, Paterson Group (Paterson) prepared the current memorandum to provide geotechnical input for the City of Ottawa site services comments issued by Ms. Ghislaine Miliu on July 9, 2019 for exp Services Inc. The following memorandum should be read in conjunction with our geotechnical Report PG4184-1 Revision 1 dated January 3, 2019 and our recent response memorandum report PG4184-MEMO.05 - Response to Engineering Comments, dated May 29, 2019.

Site Servicing and Stormwater Management Report

Item 1

Comment: *Based on the MOECP SWM Planning & Design Manual (March 2003), Section 4.6.6. "Infiltration basins are not suitable where the native soil has a percolation rate of less than 60 mm/h. If a site is acceptable based on the screening process, in situ percolation rates should be determines by a qualified soils specialist or a hydrogeologist."*

Response: Typical infiltration rates for the in situ silty clay soils in the Ottawa area of 20 mm/hour can be used for the subject site. If a site specific value is required, permeameter testing can be conducted for the silty clay layer by Paterson Group.

Site Servicing Plan - Drawings

Item 3

Comment: *Please document the elevation different between the bottom of the storage media of the underground storage system and the seasonally high groundwater elevation. The bottom of the storage media is required to be minimum 1m below the seasonally high groundwater table as per Ministry requirements. Please provide a memorandum from the Geotechnical engineer that confirms this requirement has been achieved.*

Response: The elevation of the bottom of the proposed storage media is 82.29 m. Based on our previous response memorandum report PG4184-MEMO.05, the current long-term groundwater table is estimated at an elevation of 81.5 m. However, it should be noted that a 0.5 m of post-development groundwater lowering will occur within the vicinity of the subject site. Therefore the post-development long-term groundwater table is estimated at an elevation of 81.0 m.

Based on the available information, the elevation of the base of the storage media at 82.29 m conforms to having 1 m of separation from the seasonally high groundwater table. Therefore, the design of the underground storage system is acceptable from a geotechnical perspective.

We trust that this information satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
July 25, 2019
F. I. ABOU-SEIDO
100156744
PROVINCE OF ONTARIO

Drew Petahtegoose, EIT

Faisal I. Abou-Seido, P.Eng.

Paterson Group Inc.

Head Office and Laboratory
154 Colonnade Road South
Ottawa - Ontario - K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

Northern Office and Laboratory
63 Gibson Street
North Bay - Ontario - P1B 8Z4
Tel: (705) 472-5331 Fax: (705) 472-2334

St. Lawrence Office
993 Princess Street
Kingston - Ontario - K7L 1H3
Tel: (613) 542-7381

Appendix G – Manufacturer Information

WATTS ACCUTROL Specification Sheet

IPEX Tempest Inlet Control Devices – Technical Manual

Stormtech MC-3500 Design Manual (Pages B16, B17)

Shop Drawings for Underground Chambers (by ADS – Total 5 pages)

Cumulative Volume Table for Underground Chambers (by ADS – Total 1 pages)

WATTS	Adjustable Accutrol Weir Tag: ____________	Adjustable Flow Control for Roof Drains

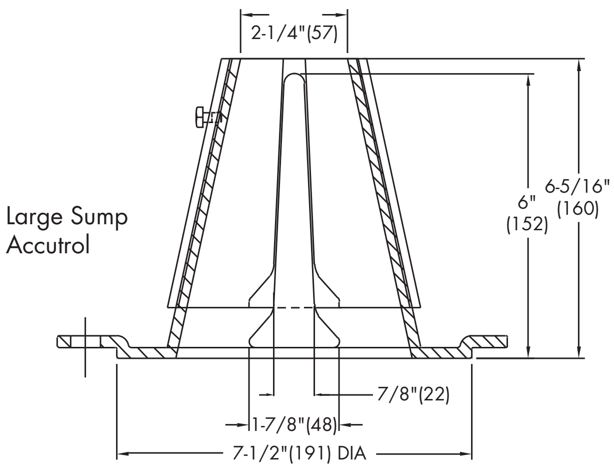
ADJUSTABLE ACCUTROL (for Large Sump Roof Drains only)

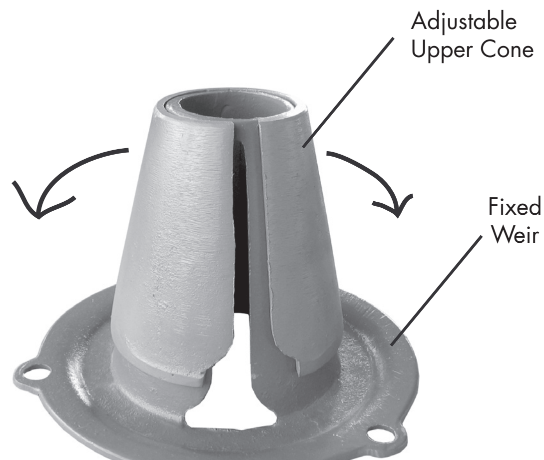
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the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

EXAMPLE:

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

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





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

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

Job Name ____________ Contractor ____________

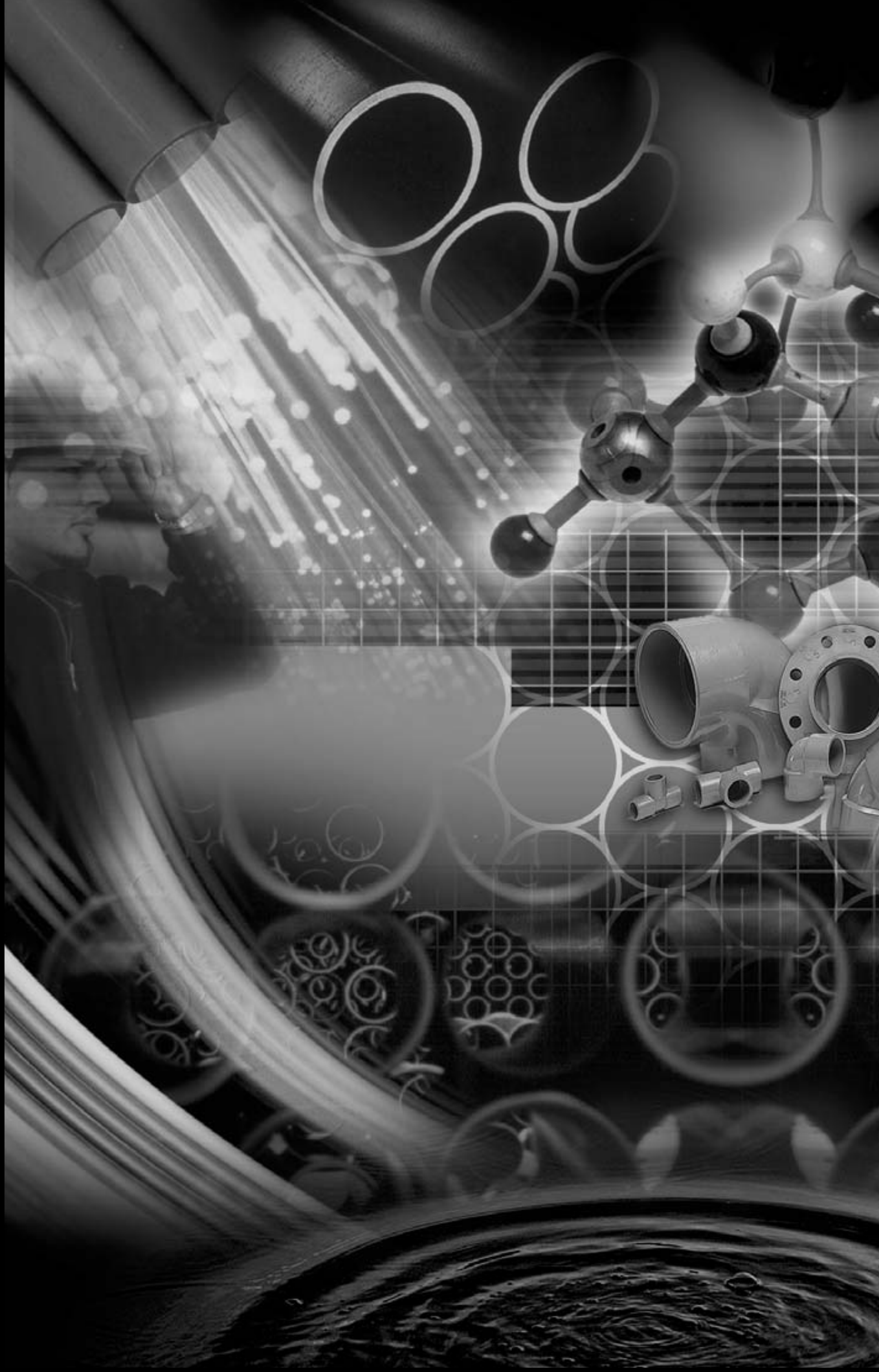
Job Location ____________ Contractor's P.O. No. ____________

Engineer ____________ Representative ____________

WATTS
A Watts Water Technologies Company

USA: Tel: (800) 338-2581 • Fax: (828) 248-3929 • Watts.com
Canada: Tel: (905) 332-4090 • Fax: (905) 332-7068 • Watts.ca
Latin America: Tel: (52) 81-1001-8600 • Fax: (52) 81-8000-7091 • Watts.com

Volume III: TEMPEST™ INLET CONTROL DEVICES



Municipal Technical Manual Series

SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

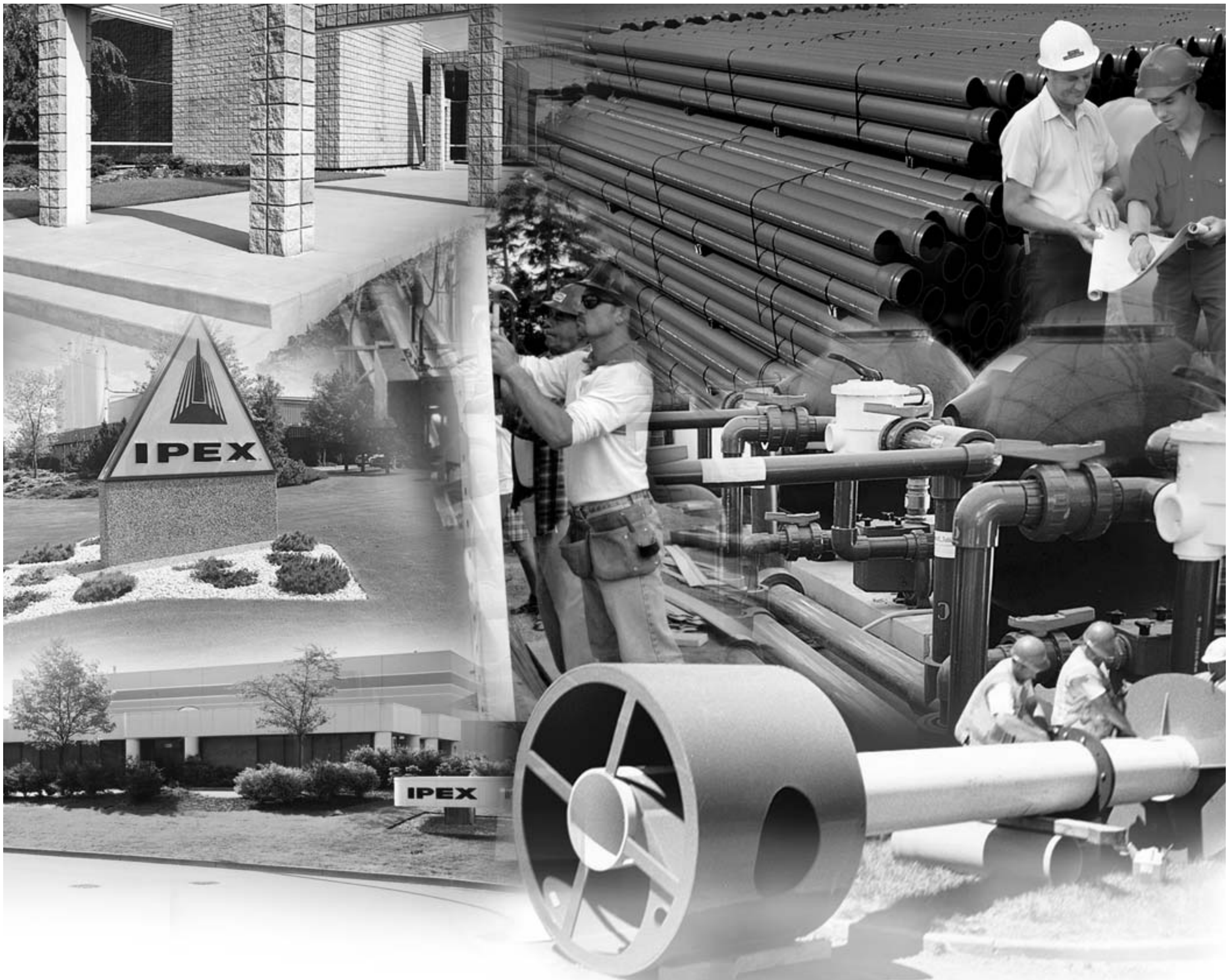
MHF (Medium to High Flow) ICD

IPEX

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition



About IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

CONTENTS

TEMPEST INLET CONTROL DEVICES Technical Manual

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

Purpose

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

Product Description

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

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

Product Function

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

Product Construction

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

Product Applications

Will accommodate both square and round applications:

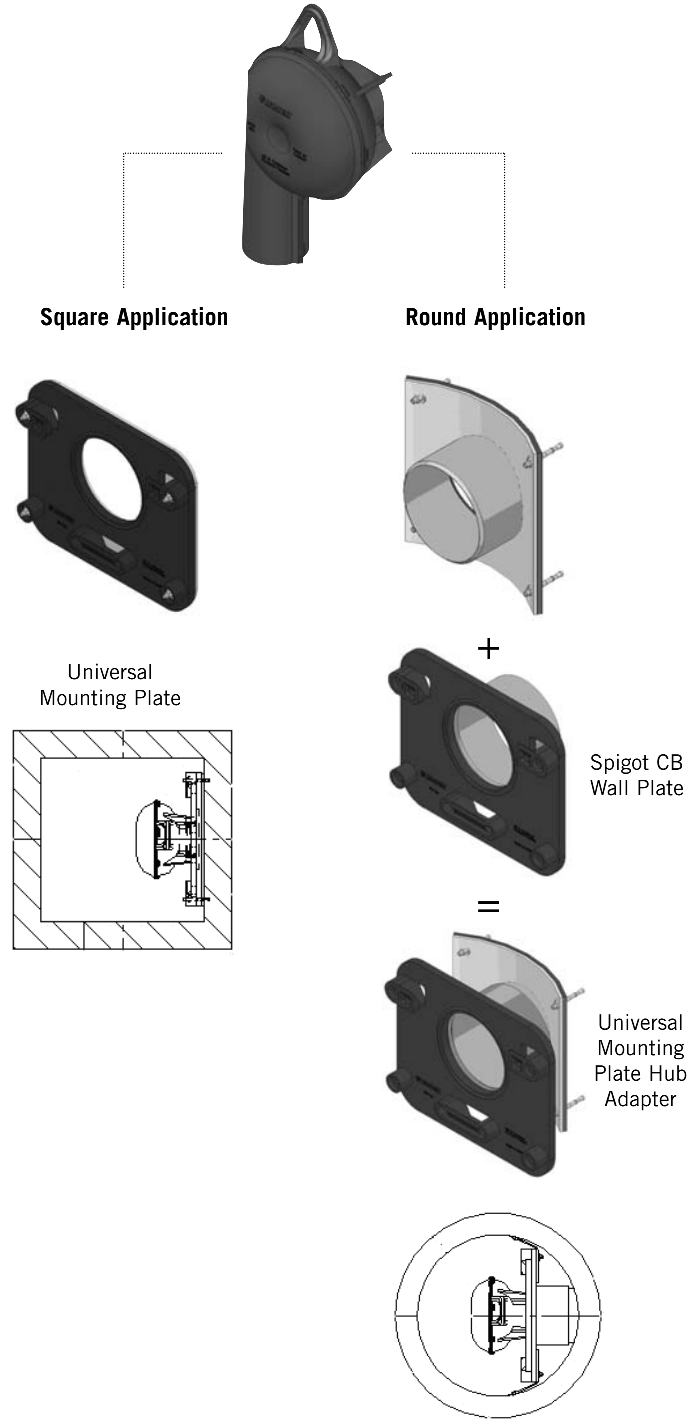


Chart 1: LMF 14 Preset Flow Curves

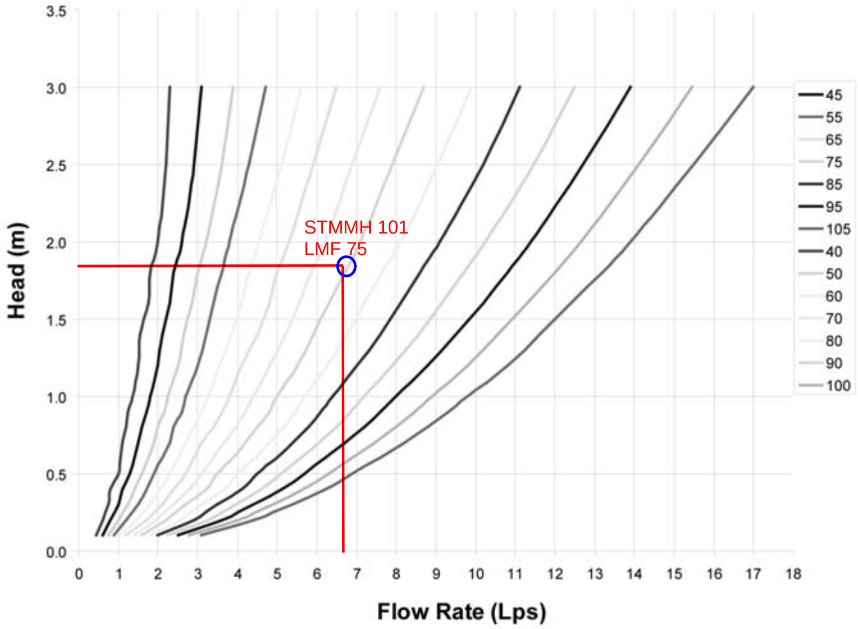
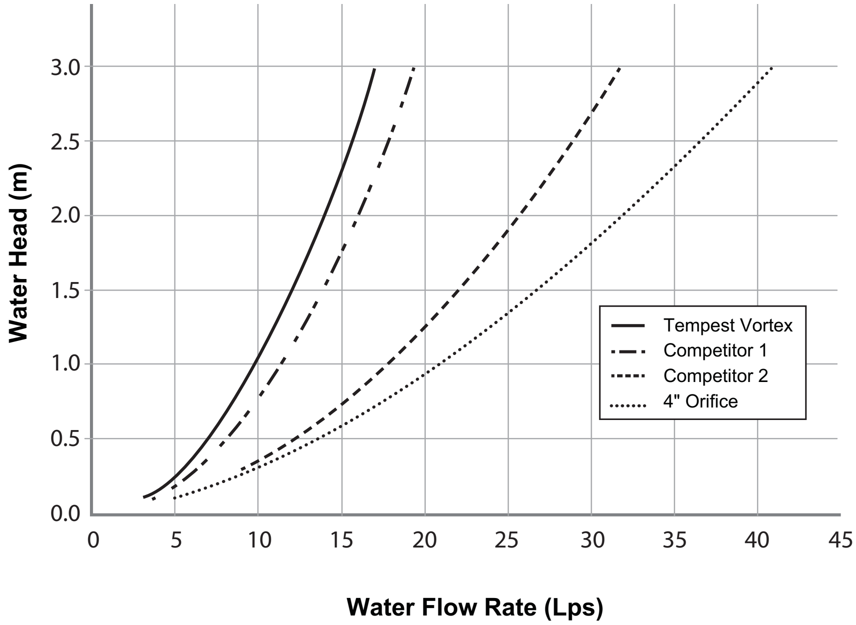


Chart 2: LMF Flow vs. ICD Alternatives



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

PRODUCT INSTALLATION

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

STEPS:

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

⚠ WARNING

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

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

STEPS:

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

⚠ WARNING

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

PRODUCT TECHNICAL SPECIFICATION

General

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

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

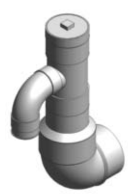
Product Description

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

Available in 5 preset flow curves, these ICDs have the ability to provide constant flow rates: 9lps (143 gpm) and greater

Product Function

TEMPEST HF (High Flow): designed to manage moderate to higher flows 15 L/s (240 gpm) or greater and prevent the propagation of odour and floatables. With this device, the cross-sectional area of the device is larger than the orifice diameter and has been designed to limit head losses. The HF ICD can also be ordered without flow control when only odour and floatable control is required.



TEMPEST HF (High Flow) Sump: The height of a sewer outlet pipe in a catch basin is not always conveniently located. At times it may be located very close to the catch basin floor, not providing enough sump for one of the other TEMPEST ICDs with universal back plate to be installed. In these applications, the HF Sump is offered. The HF Sump offers the same features and benefits as the HF ICD; however, is designed to raise the outlet in a square or round catch basin structure. When installed, the HF sump is fixed in place and not easily removed. Any required service to the device is performed through a clean-out located in the top of the device which can be often accessed from ground level.

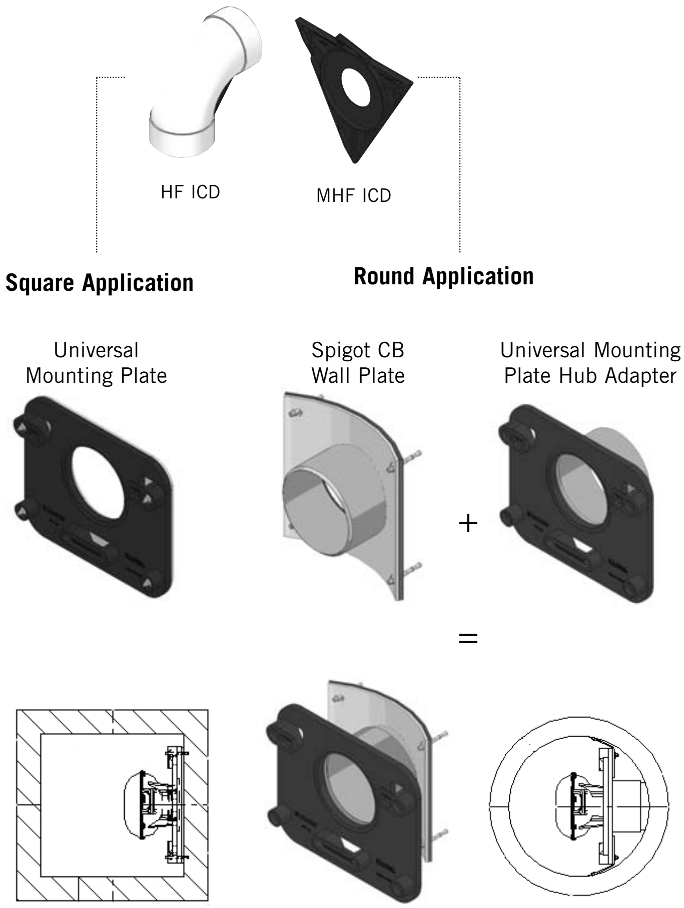
TEMPEST MHF (Medium to High Flow):
The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

The HF and MHF ICD's are available to accommodate both square and round applications:



The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:

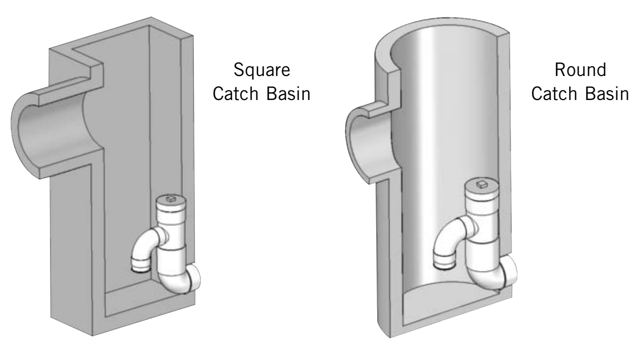
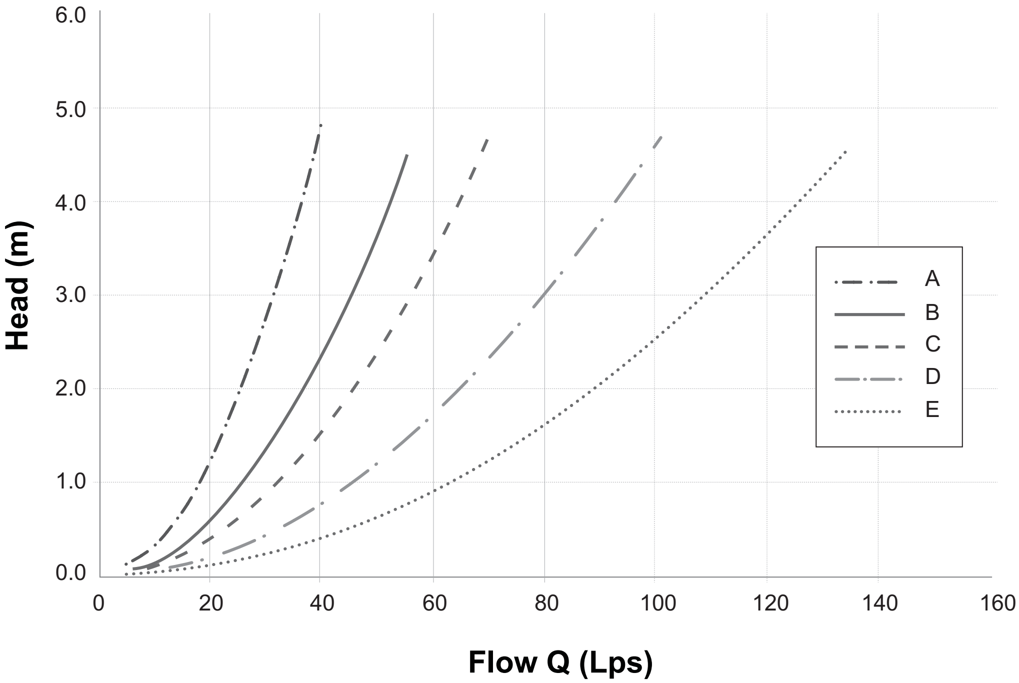


Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST HF or MHF ICD into a Square Catch Basin:

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

⚠ WARNING

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

Instructions to assemble a TEMPEST HF or MHF ICD into a Round Catch Basin:

STEPS:

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

⚠ WARNING

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

PRODUCT TECHNICAL SPECIFICATION

Instructions to assemble a TEMPEST HF Sump into a Square or Round Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, mastic tape and metal strapping
   - Material: (2) concrete anchor 3/8 x 3-1/2, (2) washers, (2) nuts, HF Sump pieces (2).
2. Apply solvent cement to the spigot end of the top half of the sump. Apply solvent cement to the hub of the bottom half of the sump. Insert the spigot of the top half of the sump into the hub of the bottom half of the sump.
3. Install the 8" spigot of the device into the outlet pipe. Use the mastic tape to seal the device spigot into the outlet pipe. You should use a level to be sure that the fitting is standing at the vertical.
4. Use an impact drill with a 3/8" concrete bit to make a series of 2 holes along each side of the body throat. The depth of the hole should be between 1-1/2" to 2-1/2". Clean the concrete dust from the 2 holes.
5. Install the anchors (2) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you hit the anchors. Remove the nuts from the ends of the anchors.
6. Cut the metal strapping to length and connect each end of the strapping to the anchors. Screw the nuts in place with a maximum torque of 40 N.m (30 lbf-ft). The device should be completely flush with the catch basin wall.

WARNING

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

General

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

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

SALES AND CUSTOMER SERVICE

Canadian Customers call IPEX Inc.
Toll free: (866) 473-9462
www.ipexinc.com

U.S. Customers call IPEX USA LLC
Toll free: (800) 463-9572
www.ipexamerica.com

About the IPEX Group of Companies

As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

Products manufactured by IPEX Inc. and distributed in the United States by IPEX USA LLC.

Tempest™ is a trademark of IPEX Branding Inc.

MNMNTPIP110817

IPEX

5.0 Cumulative Storage Volumes

StormTech

Tables 7 and **8** provide cumulative storage volumes for the MC-3500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

TABLE 7 – MC-3500 Incremental Storage Volume Per Chamber

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 9" (230 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
66 (1676)	0.00	178.96 (5.068)
65 (1651)	0.00	177.25 (5.019)
64 (1626)	0.00	175.54 (4.971)
63 (1600)	Stone 0.00	173.83 (4.922)
62 (1575)	Cover 0.00	172.11 (4.874)
61 (1549)	0.00	170.40 (4.825)
60 (1524)	0.00	168.69 (4.777)
59 (1499)	0.00	166.98 (4.728)
58 (1473)	0.00	165.27 (4.680)
57 (1448)	0.00	163.55 (4.631)
56 (1422)	0.00	161.84 (4.583)
55 (1397)	0.00	160.13 (4.534)
54 (1372)	109.95 (3.113)	158.42 (4.486)
53 (1346)	109.89 (3.112)	156.67 (4.436)
52 (1321)	109.69 (3.106)	154.84 (4.385)
51 (1295)	109.40 (3.098)	152.95 (4.331)
50 (1270)	109.00 (3.086)	151.00 (4.276)
49 (1245)	108.31 (3.067)	148.88 (4.216)
48 (1219)	107.28 (3.038)	146.55 (4.150)
47 (1194)	106.03 (3.003)	144.09 (4.080)
46 (1168)	104.61 (2.962)	141.52 (4.007)
45 (1143)	103.04 (2.918)	138.86 (3.932)
44 (1118)	101.33 (2.869)	136.13 (3.855)
43 (1092)	99.50 (2.818)	133.32 (3.775)
42 (1067)	97.56 (2.763)	130.44 (3.694)
41 (1041)	95.52 (2.705)	127.51 (3.611)
40 (1016)	93.39 (2.644)	124.51 (3.526)
39 (991)	91.16 (2.581)	121.47 (3.440)
38 (965)	88.86 (2.516)	118.37 (3.352)
37 (948)	86.47 (2.449)	115.23 (3.263)
36 (914)	84.01 (2.379)	112.04 (3.173)
35 (889)	81.49 (2.307)	108.81 (3.081)
34 (864)	78.89 (2.234)	105.54 (2.989)
33 (838)	76.24 (2.159)	102.24 (2.895)
32 (813)	73.52 (2.082)	98.90 (2.800)
31 (787)	70.75 (2.003)	95.52 (2.705)
30 (762)	67.92 (1.923)	92.12 (2.608)
29 (737)	65.05 (1.842)	88.68 (2.511)
28 (711)	62.12 (1.759)	85.21 (2.413)
27 (686)	59.15 (1.675)	81.72 (2.314)
26 (680)	56.14 (1.590)	78.20 (2.214)
25 (635)	53.09 (1.503)	74.65 (2.114)
24 (610)	49.99 (1.416)	71.09 (2.013)
23 (584)	46.86 (1.327)	67.50 (1.911)
22 (559)	43.70 (1.237)	63.88 (1.809)
21 (533)	40.50 (1.147)	60.25 (1.706)
20 (508)	37.27 (1.055)	56.60 (1.603)
19 (483)	34.01 (0.963)	52.93 (1.499)
18 (457)	30.72 (0.870)	49.25 (1.395)
17 (432)	27.40 (0.776)	45.54 (1.290)
16 (406)	24.05 (0.681)	41.83 (1.184)
15 (381)	20.69 (0.586)	38.09 (1.079)
14 (356)	17.29 (0.490)	34.34 (0.973)
13 (330)	13.88 (0.393)	30.58 (0.866)
12 (305)	10.44 (0.296)	26.81 (0.759)
11 (279)	6.98 (0.198)	23.02 (0.652)
10 (254)	3.51 (0.099)	19.22 (0.544)
9 (229)	0.00	15.41 (0.436)
8 (203)	0.00	13.70 (0.388)
7 (178)	0.00	11.98 (0.339)
6 (152)	Stone 0.00	10.27 (0.291)
5 (127)	Foundation 0.00	8.56 (0.242)
4 (102)	0.00	6.85 (0.194)
3 (76)	0.00	5.14 (0.145)
2 (51)	0.00	3.42 (0.097)
1 (25)	0.00	1.71 (0.048)

NOTE: Add 1.71 ft³ (0.030 m³) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

TABLE 8 – MC-3500 Incremental Storage Volume Per End Cap

Assumes 40% stone porosity. Calculations are based upon a 9” (230 mm) stone base under the chambers, 12” (300 mm) of stone above end caps, and 9” (230 mm) of spacing between end caps and 6” (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
66 (1676)	0.00	46.96 (1.330)
65 (1651)	0.00	46.39 (1.314)
64 (1626)	0.00	45.82 (1.298)
63 (1600)	Stone 0.00	45.25 (1.281)
62 (1575)	Cover 0.00	44.68 (1.265)
61 (1549)	0.00	44.11 (1.249)
60 (1524)	0.00	43.54 (1.233)
59 (1499)	0.00	42.98 (1.217)
58 (1473)	0.00	42.41 (1.201)
57 (1448)	0.00	41.84 (1.185)
56 (1422)	0.00	41.27 (1.169)
55 (1397)	0.00	40.70 (1.152)
54 (1372)	15.64 (0.443)	40.13 (1.136)
53 (1346)	15.64 (0.443)	39.56 (1.120)
52 (1321)	15.63 (0.443)	38.99 (1.104)
51 (1295)	15.62 (0.442)	38.41 (1.088)
50 (1270)	15.60 (0.442)	37.83 (1.071)
49 (1245)	15.56 (0.441)	37.24 (1.054)
48 (1219)	15.51 (0.439)	36.64 (1.037)
47 (1194)	15.44 (0.437)	36.02 (1.020)
46 (1168)	15.35 (0.435)	35.40 (1.003)
45 (1143)	15.25 (0.432)	34.77 (0.985)
44 (1118)	15.13 (0.428)	34.13 (0.966)
43 (1092)	14.99 (0.424)	33.48 (0.948)
42 (1067)	14.83 (0.420)	32.81 (0.929)
41 (1041)	14.65 (0.415)	32.13 (0.910)
40 (1016)	14.45 (0.409)	31.45 (0.890)
39 (991)	14.24 (0.403)	30.75 (0.871)
38 (965)	14.00 (0.396)	30.03 (0.850)
37 (948)	13.74 (0.389)	29.31 (0.830)
36 (914)	13.47 (0.381)	28.58 (0.809)
35 (889)	13.18 (0.373)	27.84 (0.788)
34 (864)	12.86 (0.364)	27.08 (0.767)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
33 (838)	12.53 (0.355)	26.30 (0.745)
32 (813)	12.18 (0.345)	25.53 (0.723)
31 (787)	11.81 (0.335)	24.74 (0.701)
30 (762)	11.42 (0.323)	23.93 (0.678)
29 (737)	11.01 (0.312)	23.12 (0.655)
28 (711)	10.58 (0.300)	22.29 (0.631)
27 (686)	10.13 (0.287)	21.45 (0.607)
26 (680)	9.67 (0.274)	20.61 (0.583)
25 (635)	9.19 (0.260)	19.75 (0.559)
24 (610)	8.70 (0.246)	18.88 (0.559)
23 (584)	8.19 (0.232)	18.01 (0.510)
22 (559)	7.67 (0.217)	17.13 (0.485)
21 (533)	7.13 (0.202)	16.24 (0.460)
20 (508)	6.59 (0.187)	15.34 (0.434)
19 (483)	6.03 (0.171)	14.43 (0.409)
18 (457)	5.46 (0.155)	13.52 (0.383)
17 (432)	4.88 (0.138)	12.61 (0.357)
16 (406)	4.30 (0.122)	11.69 (0.331)
15 (381)	3.70 (0.105)	10.76 (0.305)
14 (356)	3.10 (0.088)	9.83 (0.278)
13 (330)	2.49 (0.071)	8.90 (0.252)
12 (305)	1.88 (0.053)	7.96 (0.225)
11 (279)	1.26 (0.036)	7.02 (0.199)
10 (254)	0.63 (0.018)	6.07 (0.172)
9 (229)	0.00	5.12 (0.145)
8 (203)	0.00	4.55 (0.129)
7 (178)	0.00	3.99 (0.113)
6 (152)	Stone 0.00	3.42 (0.097)
5 (127)	Foundation 0.00	2.85 (0.081)
4 (102)	0.00	2.28 (0.064)
3 (76)	0.00	1.71 (0.048)
2 (51)	0.00	1.14 (0.032)
1 (25)	0.00	0.56 (0.016)

NOTE: Add 0.56 ft³ (0.016 m³) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	VIVEK SHARMA 647-463-9803 VIVEK.SHARMA@ADS-PIPE.COM
ADS SALES REP:	HASSAN ELMI 416-985-9757 HASSAN.ELMI@ADS-PIPE.COM
PROJECT NO:	S124529

ADVANCED DRAINAGE SYSTEMS, INC.

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2140 BASELINE ROAD

OTTAWA, ON

MC-3500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-3500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-3500 CHAMBER SYSTEM

1. STORMTECH MC-3500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 230 mm (9") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
10. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
11. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-3500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-3500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

For Reference: #17709
D07-12-18-0084

PROPOSED LAYOUT

22	STORMTECH MC-3500 CHAMBERS
12	STORMTECH MC-3500 END CAPS
305	STONE ABOVE (mm)
350	STONE BELOW (mm)
40	% STONE VOID
162.7	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
164.9	SYSTEM AREA (m²)
52.7	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS

86.611	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):
84.935	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):
84.783	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):
84.783	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):
84.783	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT):
84.478	TOP OF STONE:
84.173	TOP OF MC-3500 CHAMBER:
83.700	300 mm TOP MANIFOLD INVERT:
83.539	450 mm TOP MANIFOLD INVERT:
83.082	600 mm ISOLATOR ROW INVERT:
83.076	450 mm ISOLATOR MANIFOLD INVERT:
83.054	250 mm BOTTOM MANIFOLD INVERT:
83.030	BOTTOM OF MC-3500 CHAMBER:
82.680	BOTTOM OF STONE:

Final Elevations be updated during Shop Drawing submission.

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.

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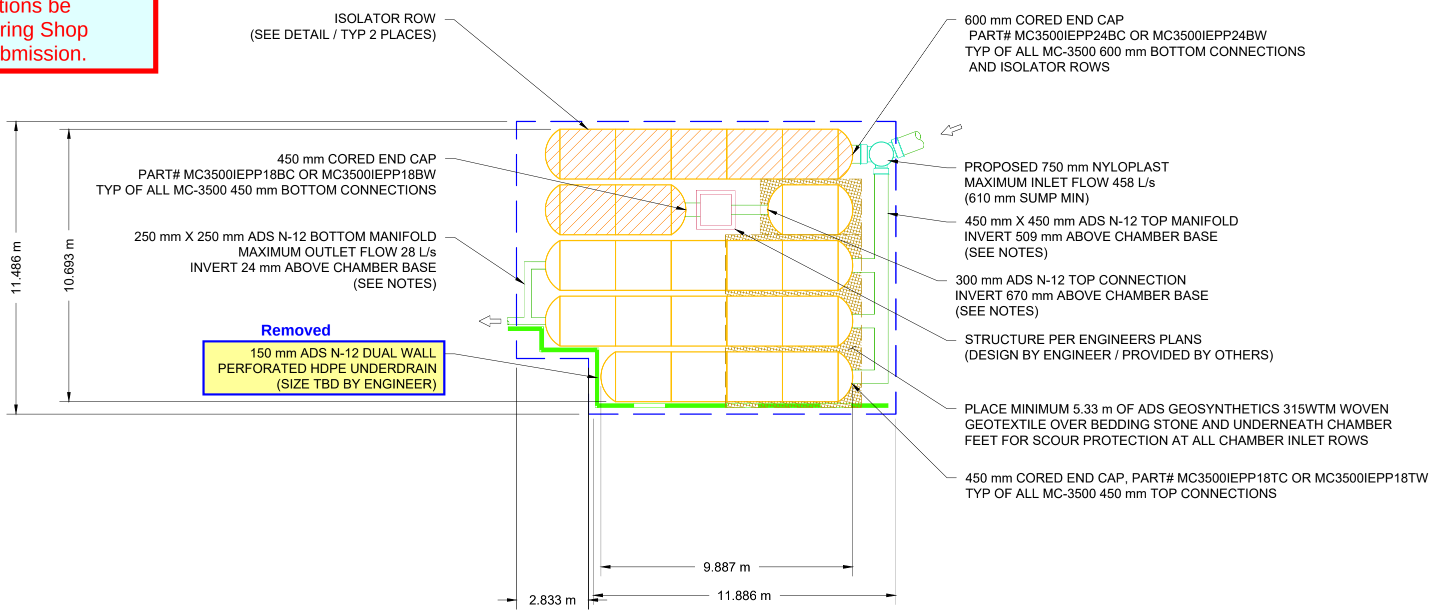

For Reference: #17709
D07-12-18-0084

2140 BASELINE ROAD
OTTAWA, ON

DATE: 3-14-19 DRAWN: MSY
PROJECT #: S124529 CHECKED: CJD

DATE	DRWN	CHKD	DESCRIPTION
06/03/19	RCT	JMQ	ADDED ENGINEERS PLAN REFERENCES
03/27/19	RCT	DAF	REVISED PER ENGINEER MARKUP
03/18/19	RCT	JMQ	REVISED PER ENGINEER MARKUP

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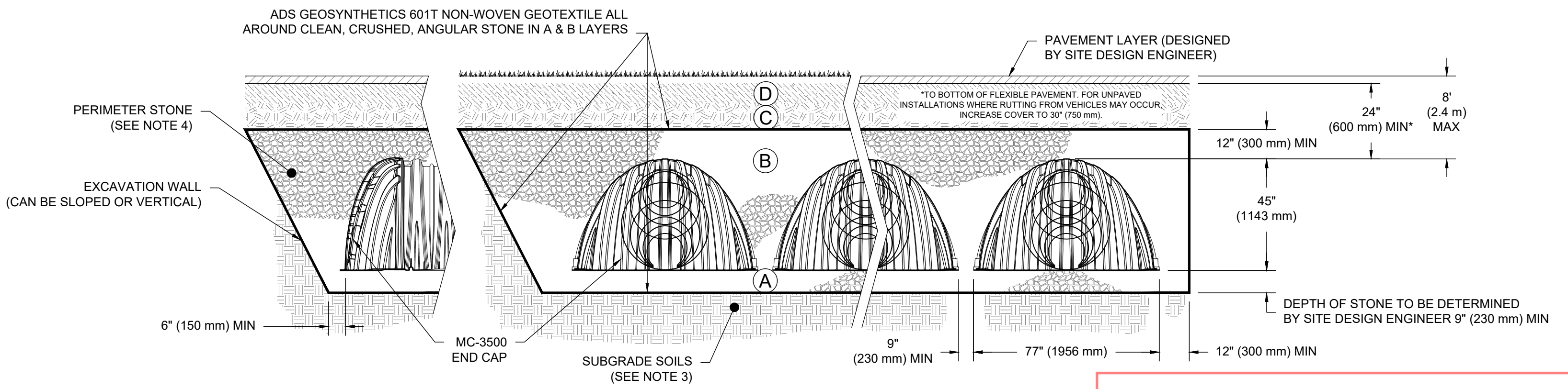
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SCALE = 1 : 200

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



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NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

For Reference: #17709
D07-12-18-0084

2140 BASELINE ROAD
OTTAWA, ON

DATE: 3-14-19 DRAWN: MSY
PROJECT #: S124529 CHECKED: CJD

DATE	DRWN	CHKD	DESCRIPTION
06/03/19	RCT	JMQ	ADDED ENGINEERS PLAN REFERENCES
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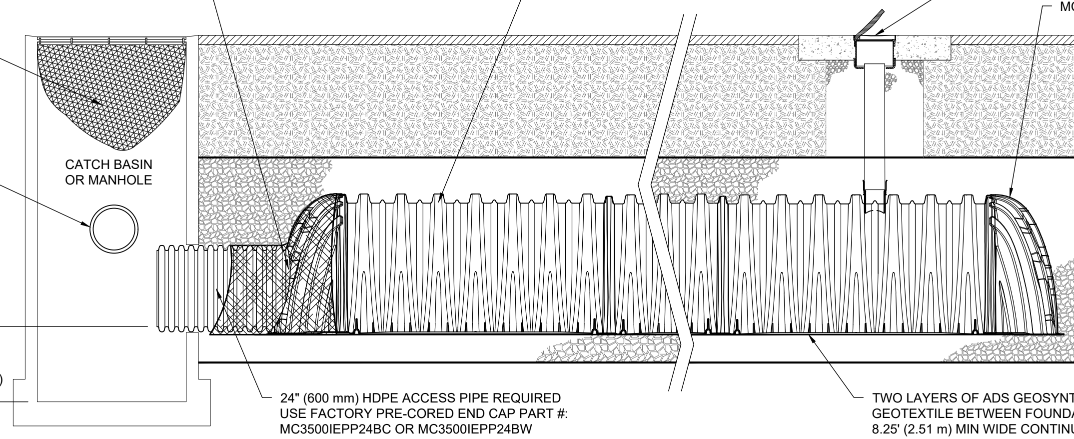


MC-3500 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

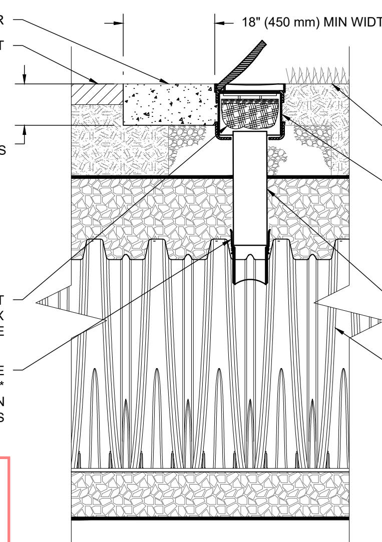
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

NOT FOR CONSTRUCTION
REFER TO SITE SERVICING PLAN DRAWING C1



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

MC-3500 6" INSPECTION PORT DETAIL

NTS

For Reference: #17709
D07-12-18-0084

2140 BASELINE ROAD
OTTAWA, ON

DATE: 3-14-19
DRAWN: MSY
PROJECT #: S124529
CHECKED: CJD

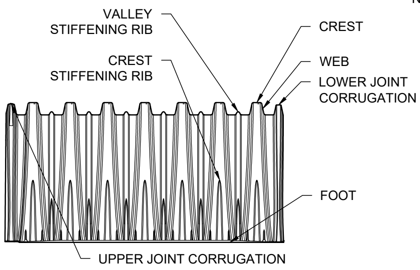
DATE	DRWN	CHKD	DESCRIPTION
03/18/19	RCT	JMQ	REVISED PER ENGINEER MARKUP
03/27/19	RCT	DAF	REVISED PER ENGINEER MARKUP
06/03/19	RCT	JMQ	ADDED ENGINEERS PLAN REFERENCES

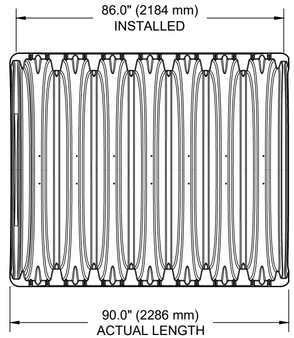
StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

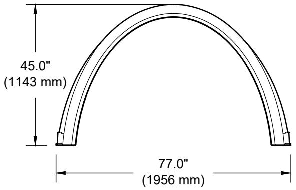
ADS
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

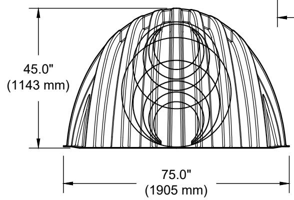
MC-3500 TECHNICAL SPECIFICATION

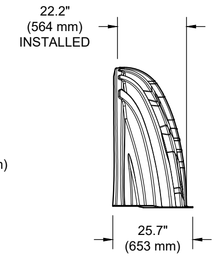
NTS











NOMINAL CHAMBER SPECIFICATIONS

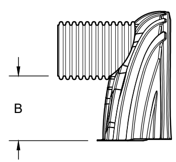
SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	178.9 CUBIC FEET	(5.06 m³)
WEIGHT	134 lbs.	(60.8 kg)

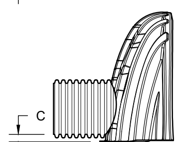
NOMINAL END CAP SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	46.0 CUBIC FEET	(1.30 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY

STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"





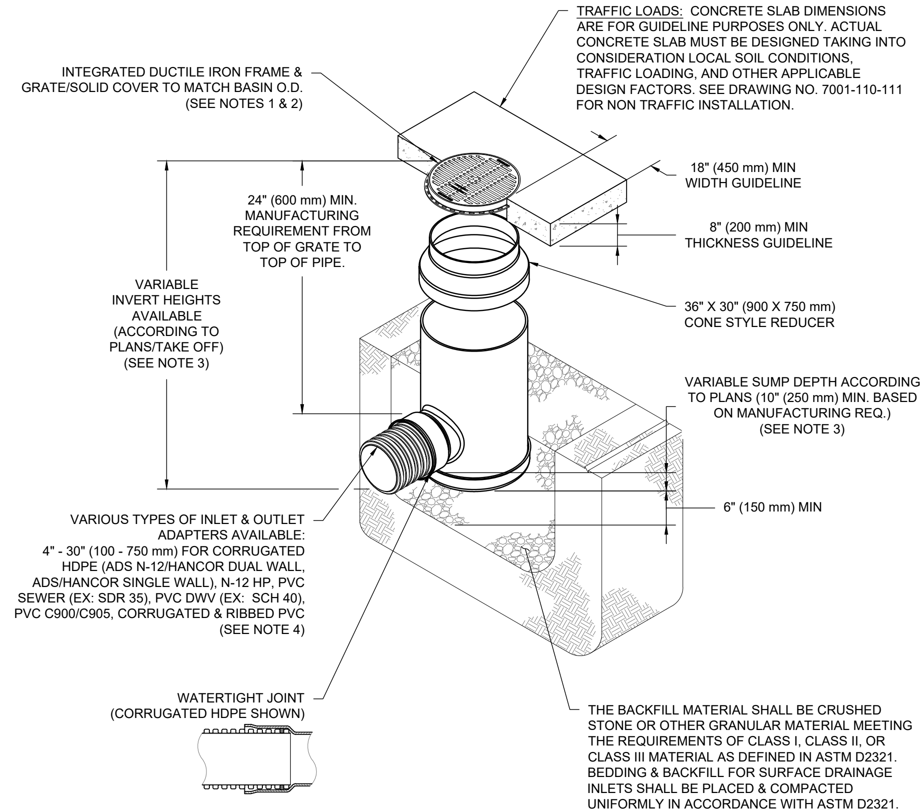
PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL

CUSTOM PRECORED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

36" (900 mm) NYLOPLAST DRAIN BASIN

NTS



NOTES

1. GRATES/SOLID COVER SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
2. FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05.
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS. RISERS ARE NEEDED FOR BASINS OVER 84" (2.13 m) DUE TO SHIPPING RESTRICTIONS. SEE DRAWING NO. 7001-110-065.
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS N-12/HANCOR DUAL WALL), N-12 HP, & PVC SEWER.
5. ADAPTERS CAN BE MOUNTED ON ANY ANGLE 0° TO 360°. TO DETERMINE MINIMUM ANGLE BETWEEN ADAPTERS SEE DRAWING NO. 7001-110-012.

GRATE OPTION	LOAD RATING	PART #	DWG #
PEDESTRIAN	MEETS H-20	3099CGP	7001-110-220
STANDARD	MEETS H-20	3099CGS	7001-110-221
SOLID COVER	MEETS H-20	3099CGC	7001-110-222
DOME	N/A	3099CGD	7001-110-223

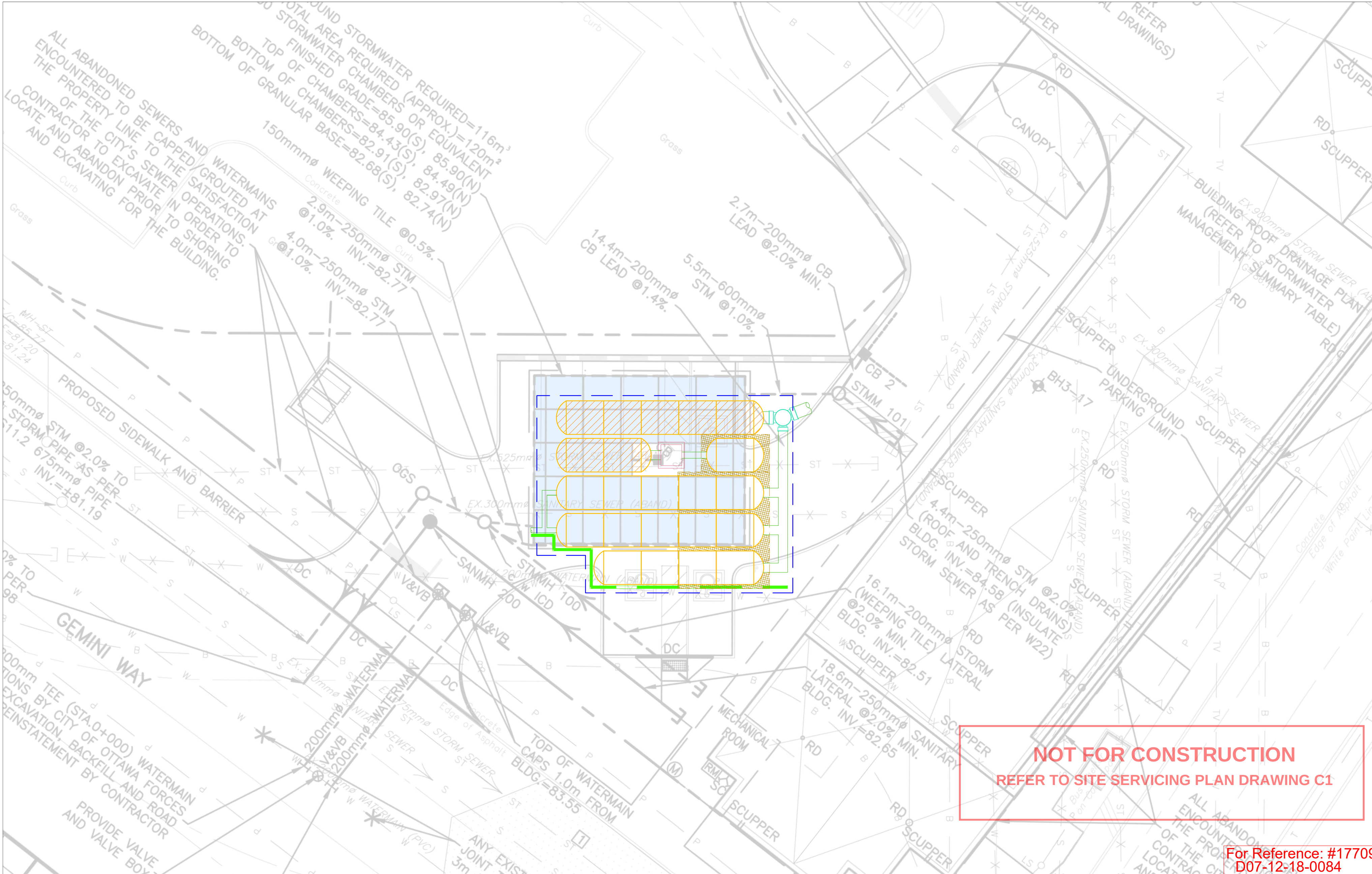
2140 BASELINE ROAD
OTTAWA, ON

DATE: 3-14-19 DRAWN: MSY
PROJECT #: S124529 CHECKED: CJD

DATE	DRWN	CHKD	DESCRIPTION
06/03/19	RCT	JMQ	ADDED ENGINEERS PLAN REFERENCES
03/27/19	RCT	DAF	REVISED PER ENGINEER MARKUP
03/18/19	RCT	JMQ	REVISED PER ENGINEER MARKUP

Nyloplast®
3130 VERONA AVE
BUFORD, GA 30518
PHN (770) 932-2443
FAX (770) 932-2490
www.nyloplast-us.com

ADS®
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026



NOT FOR CONSTRUCTION
REFER TO SITE SERVICING PLAN DRAWING C1

For Reference: #17709
D07-12-18-0084

Project: 2140 Baseline Road Rev2

StormTech — Detention • Retention • Water Quality — A division of ADS

Chamber Model -	MC-3500	
Units -	Metric	Click Here for Imperial
Number of Chambers -	22	
Number of End Caps -	12	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	82.68	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	350	mm
Area of system -	164.9	sq.meters

☑ Include Perimeter Stone in Calculations

Min. Area - 126.092 sq.meters

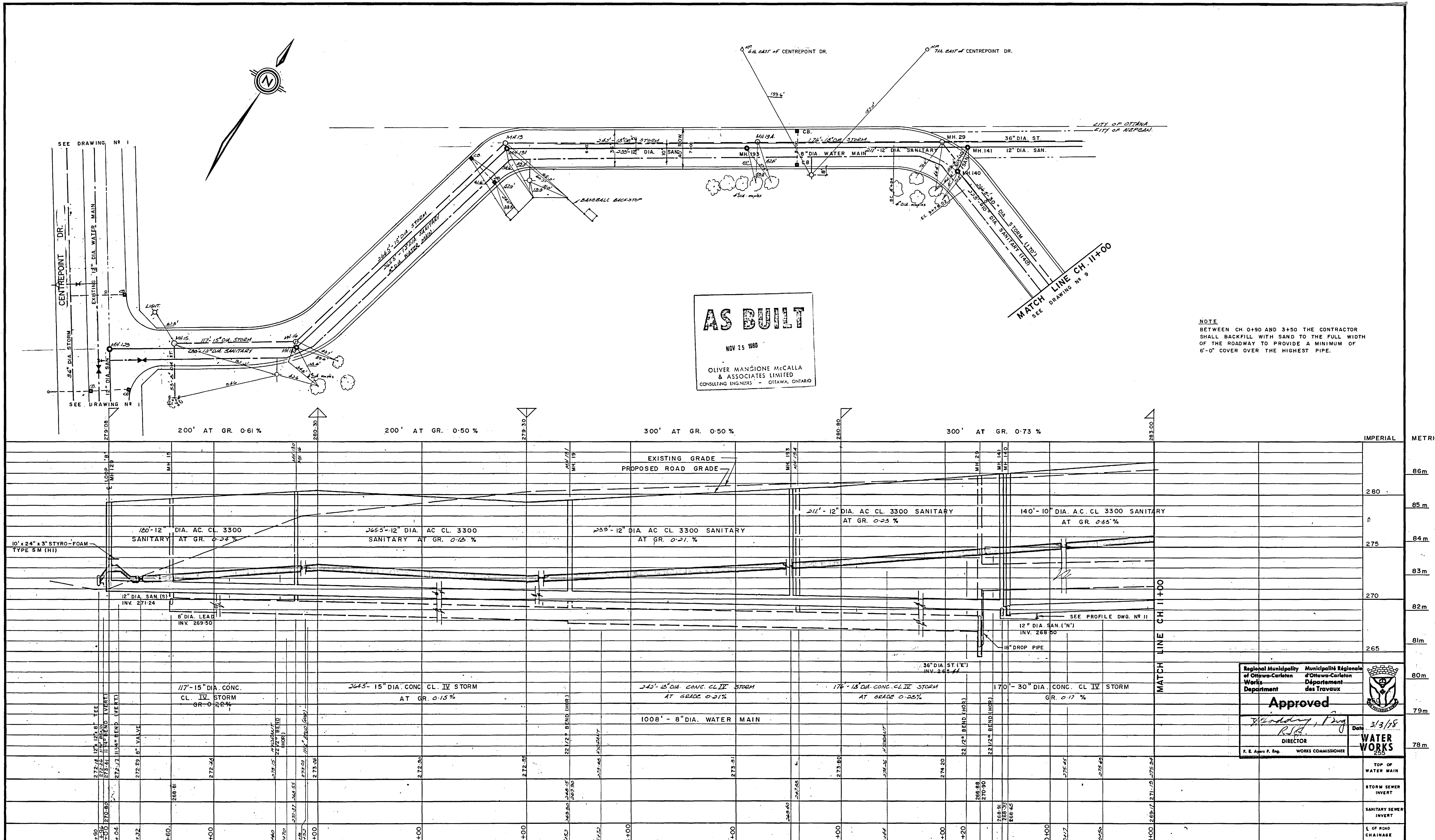
Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1803	0.00	0.00	0.00	0.00	1.675	1.67	163.04	84.48
1778	0.00	0.00	0.00	0.00	1.675	1.67	161.36	84.46
1753	0.00	0.00	0.00	0.00	1.675	1.67	159.69	84.43
1727	0.00	0.00	0.00	0.00	1.675	1.67	158.01	84.41
1702	0.00	0.00	0.00	0.00	1.675	1.67	156.34	84.38
1676	0.00	0.00	0.00	0.00	1.675	1.67	154.67	84.36
1651	0.00	0.00	0.00	0.00	1.675	1.67	152.99	84.33
1626	0.00	0.00	0.00	0.00	1.675	1.67	151.32	84.31
1600	0.00	0.00	0.00	0.00	1.675	1.67	149.64	84.28
1575	0.00	0.00	0.00	0.00	1.675	1.67	147.97	84.25
1549	0.00	0.00	0.00	0.00	1.675	1.67	146.29	84.23
1524	0.00	0.00	0.00	0.00	1.675	1.67	144.62	84.20
1499	0.00	0.00	0.04	0.00	1.660	1.70	142.94	84.18
1473	0.01	0.00	0.12	0.01	1.623	1.75	141.25	84.15
1448	0.01	0.00	0.18	0.01	1.596	1.79	139.50	84.13
1422	0.01	0.00	0.25	0.02	1.567	1.84	137.70	84.10
1397	0.02	0.00	0.43	0.02	1.494	1.95	135.87	84.08
1372	0.03	0.00	0.64	0.03	1.406	2.08	133.92	84.05
1346	0.04	0.00	0.78	0.04	1.349	2.16	131.85	84.03
1321	0.04	0.00	0.89	0.04	1.303	2.23	129.68	84.00
1295	0.04	0.00	0.98	0.05	1.263	2.29	127.45	83.98
1270	0.05	0.00	1.06	0.06	1.227	2.35	125.16	83.95
1245	0.05	0.01	1.14	0.06	1.194	2.40	122.81	83.92
1219	0.05	0.01	1.21	0.07	1.164	2.44	120.42	83.90
1194	0.06	0.01	1.27	0.07	1.136	2.48	117.98	83.87
1168	0.06	0.01	1.33	0.08	1.111	2.52	115.50	83.85
1143	0.06	0.01	1.39	0.09	1.086	2.56	112.98	83.82
1118	0.07	0.01	1.44	0.09	1.064	2.59	110.42	83.80
1092	0.07	0.01	1.49	0.10	1.042	2.62	107.83	83.77
1067	0.07	0.01	1.53	0.10	1.022	2.65	105.20	83.75
1041	0.07	0.01	1.57	0.10	1.003	2.68	102.55	83.72
1016	0.07	0.01	1.62	0.11	0.985	2.71	99.87	83.70
991	0.08	0.01	1.65	0.11	0.967	2.74	97.16	83.67
965	0.08	0.01	1.69	0.12	0.951	2.76	94.42	83.65
940	0.08	0.01	1.73	0.12	0.935	2.78	91.66	83.62
914	0.08	0.01	1.76	0.13	0.920	2.81	88.88	83.59
889	0.08	0.01	1.79	0.13	0.906	2.83	86.07	83.57
864	0.08	0.01	1.82	0.13	0.892	2.85	83.25	83.54
838	0.08	0.01	1.85	0.14	0.879	2.87	80.40	83.52
813	0.09	0.01	1.88	0.14	0.867	2.89	77.53	83.49
787	0.09	0.01	1.90	0.15	0.855	2.90	74.64	83.47
762	0.09	0.01	1.93	0.15	0.844	2.92	71.74	83.44
737	0.09	0.01	1.95	0.15	0.833	2.94	68.82	83.42
711	0.09	0.01	1.97	0.16	0.823	2.95	65.88	83.39
686	0.09	0.01	1.99	0.16	0.813	2.97	62.93	83.37
660	0.09	0.01	2.01	0.16	0.804	2.98	59.96	83.34
635	0.09	0.01	2.03	0.17	0.795	2.99	56.98	83.32
610	0.09	0.01	2.05	0.17	0.787	3.01	53.99	83.29
584	0.09	0.01	2.07	0.17	0.779	3.02	50.98	83.26
559	0.09	0.01	2.08	0.17	0.771	3.03	47.97	83.24
533	0.10	0.01	2.10	0.18	0.764	3.04	44.94	83.21
508	0.10	0.01	2.11	0.18	0.757	3.05	41.90	83.19
483	0.10	0.02	2.13	0.18	0.751	3.06	38.85	83.16
457	0.10	0.02	2.14	0.18	0.744	3.07	35.79	83.14
432	0.10	0.02	2.15	0.19	0.738	3.08	32.72	83.11
406	0.10	0.02	2.17	0.19	0.732	3.09	29.64	83.09
381	0.10	0.02	2.18	0.20	0.720	3.11	26.55	83.06
356	0.00	0.00	0.00	0.00	1.675	1.67	23.44	83.04
330	0.00	0.00	0.00	0.00	1.675	1.67	21.77	83.01
305	0.00	0.00	0.00	0.00	1.675	1.67	20.09	82.98
279	0.00	0.00	0.00	0.00	1.675	1.67	18.42	82.96
254	0.00	0.00	0.00	0.00	1.675	1.67	16.75	82.93
229	0.00	0.00	0.00	0.00	1.675	1.67	15.07	82.91
203	0.00	0.00	0.00	0.00	1.675	1.67	13.40	82.88
178	0.00	0.00	0.00	0.00	1.675	1.67	11.72	82.86
152	0.00	0.00	0.00	0.00	1.675	1.67	10.05	82.83
127	0.00	0.00	0.00	0.00	1.675	1.67	8.37	82.81
102	0.00	0.00	0.00	0.00	1.675	1.67	6.70	82.78
76	0.00	0.00	0.00	0.00	1.675	1.67	5.02	82.76
51	0.00	0.00	0.00	0.00	1.675	1.67	3.35	82.73
25	0.00	0.00	0.00	0.00	1.675	1.67	1.67	82.71

Appendix H – Background Information

As-Built Drawings (All 11x17 Reduction, Scale: NTS)

- **Plan & Profile – Re Alignment of Constellation Crescent (1 drawings)**
- **Plan & Profile – Constellation Crescent (1 drawing)**
- **Plan & Profile – Baseline Road and Constellation Crescent Intersection Modifications (3 drawings)**

Excerpt pages form "Stormwater Management Guidelines for the Pinecrest Creek / Westboro Area, JFSA, June 2012. (pages 12-19)



IMPERIAL

METRIC

No.		DATE	BY
5	'AS BUILT' 83-10-25	25/11/80	G.J.R.
4	ADDED LIMIT OF EXISTING WATER MAIN	31/01/80	S.W.K.
3	STORM AND W/M REVISION AS PER RMOC	8/3/78	R.J.D.
2	SANITARY REV. AS PER CITY OF OTTAWA		W.D.C.
1.	W/M REVISION AS PER R.M.O.C.	6/2/78	RJD

R E V I S I O N S

REGISTERED PROFESSIONAL ENGINEER J. B. MANGIONE PROVINCE OF ONTARIO

APP'D

DESIGN D.F.M.
DRAWN G.J.R.
CHECKED J.B.M.

CLIENT
CENTRAL MORTGAGE AND HOUSING CORPORATION

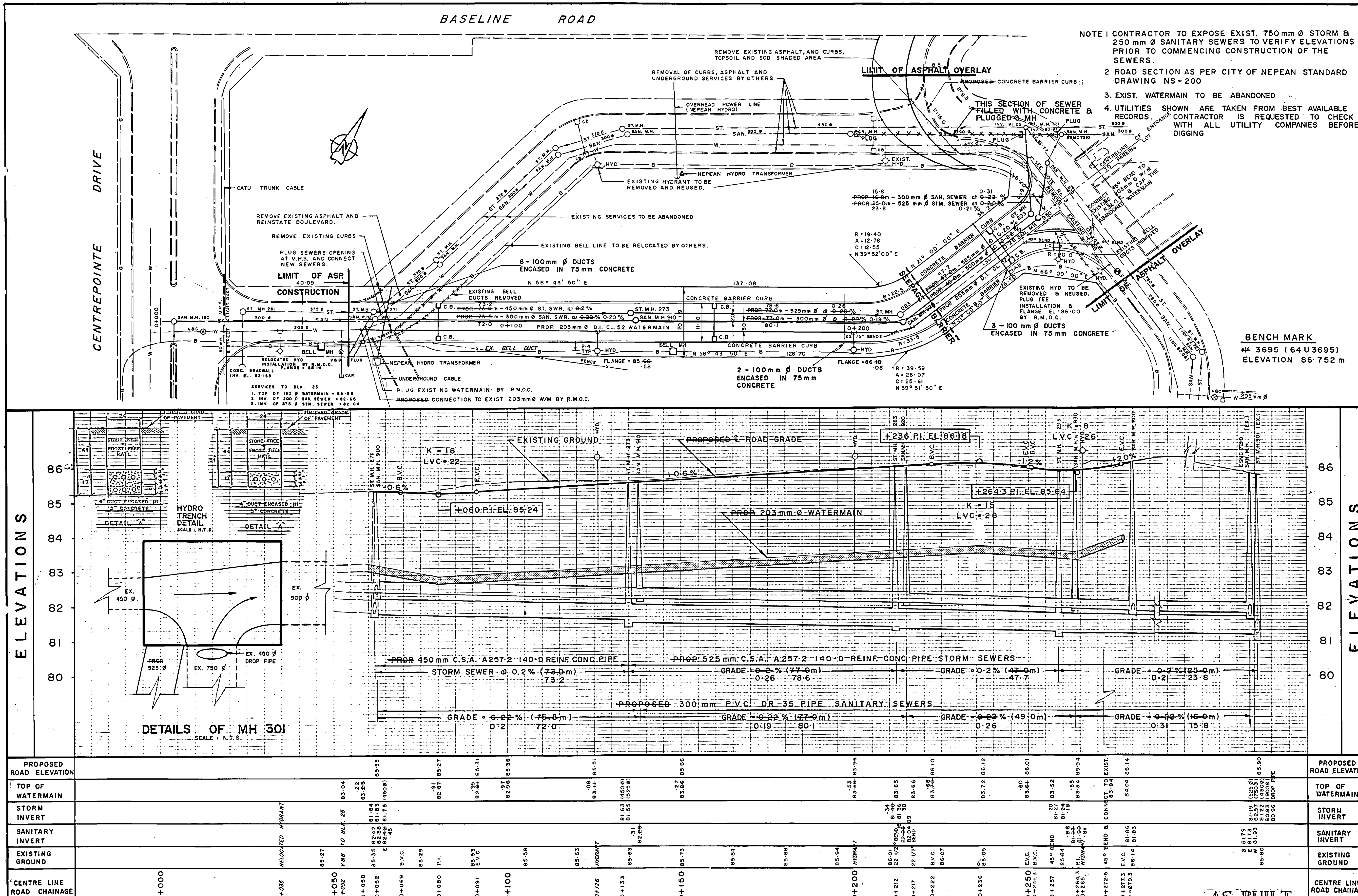
PROJECT
WOODROFFE DEMONSTRATION HOUSING PROJECT

N-306-3

TITLE
CONSTELLATION CRESENT
0 + 90 TO 11 + 00

OLIVER MANGIONE McCALLA & ASSOCIATES LIMITED
Consulting Engineers Ottawa

DATE AUGUST, 1977
SCALE HORIZONTAL 1":40' VERTICAL 1":4'
DRAWING No. 76-1483-8
REV. 5



NOTE 1. CONTRACTOR TO EXPOSE EXIST. 750 mm Ø STORM & 250 mm Ø SANITARY SEWERS TO VERIFY ELEVATIONS PRIOR TO COMMENCING CONSTRUCTION OF THE SEWERS.

2. ROAD SECTION AS PER CITY OF NEPEAN STANDARD DRAWING NS-200

3. EXIST. WATERMAIN TO BE ABANDONED

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

BENCH MARK
3695 (64 U 3695)
ELEVATION 86·752 m

7

NO.	DATE	REVISIONS	BY	NO.	DATE	REVISIONS	BY	NO.	DATE	REVISIONS	BY	NO.	DATE	REVISIONS	BY
1	9·9·88	GENERAL	D·N·	6	27·11·89	REVISED ROAD REALIGNMENT	D.N.	11	13·8·90	ISSUED FOR TENDER	D.N.				
2	27·9·88	AS PER R.M.O.C.	D·N·	7	29·11·89	DETAILS OF M.H. 301 ADDED	D.N.	12	14·8·90	HYDRO DUCTS ADDED	D.N.				
3	29·9·88	AS PER UTILITIES	D.N.	8	11·12·89	AS PER R.M.O.C.	D.N.	13	24·9·90	AS PER R.M.O.C. — HYD.	D.N.				
4	27·10·88	AS PER R.M.O.C. DWG NO. N-306-3	D.N.	9	15·3·90	AS PER C.M.H.C.	D.N.	14	21·11·90	" AS BUILT "	D.N.				
5	10·11·89	ROAD REALIGNMENT	D.N.	10	25·7·90	"AS BUILT" — BELL	D.N.								

SEPT. 12/90 D. NARAINE

Cecil D. Naraine Associates Limited
CONSULTING ENGINEERS MUNICIPAL - CIVIL

CANADA MORTGAGE AND HOUSING CORPORATION

RE ALIGNMENT OF CONSTELLATION CRESCENT

SCALE:	HORIZ. 1:500 VERT. 1:50
DESIGNED:	C.D.N.
DRAWN:	C.D.W.
CHECKED:	C.D.N.
DATE:	SEPT. 1988
DRWG. NO.	3042-101

This as-built has been prepared based in part upon information furnished by others. Dillon Consulting Limited cannot assure the accuracy of others' Information and thus Is not responsible for the accuracy of this as-built document or for any error or omission that may have been incorporated into it as a result. Those relying on this as-built document are advised to obtain independent verification of its accuracy before applying it for any purpose.

AS-BUILT

DILLON CONSULTING

NO.	REVISIONS	BY	D-M-Y
0	DESIGN CIRCULATION	GSH	21-JAN-08
1	ISSUED FOR FINAL REVIEW	GSH	22-MAY-08
2	FINAL DESIGN CIRCULATION	GSH	06-APR-09
3	ISSUED FOR MOE APPLICATION	GSH	27-APR-09
4	ISSUED FOR TENDER	GSH	27-MAY-09
5	ISSUED FOR CONSTRUCTION	GSH	28-JUL-09
6	AS-BUILT	LB	06-JAN-11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

BASELINE ROAD AND CONSTELLATION CRESCENT INTERSECTION MODIFICATION

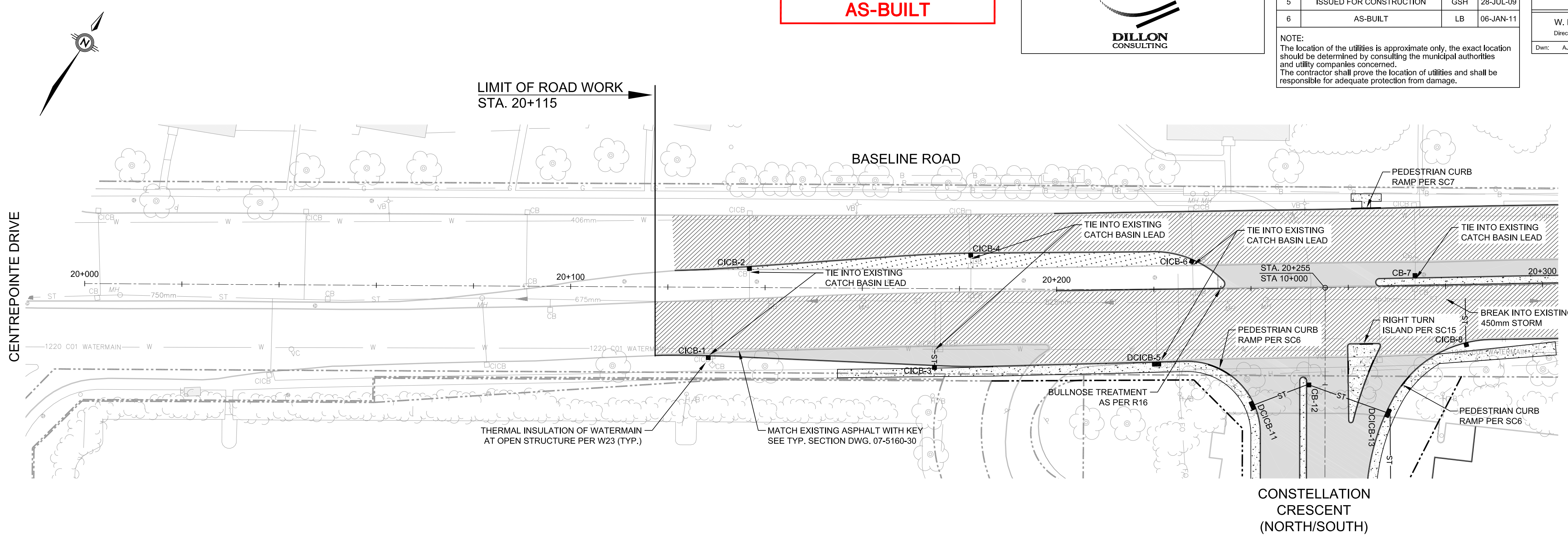
PLAN/PROFILE STA. 20+000 TO STA. 20+300 BASELINE ROAD

W. NEWELL, P.ENG.
Director Infrastructure Services

B. MASON, P.ENG.
Manager Construction Services West

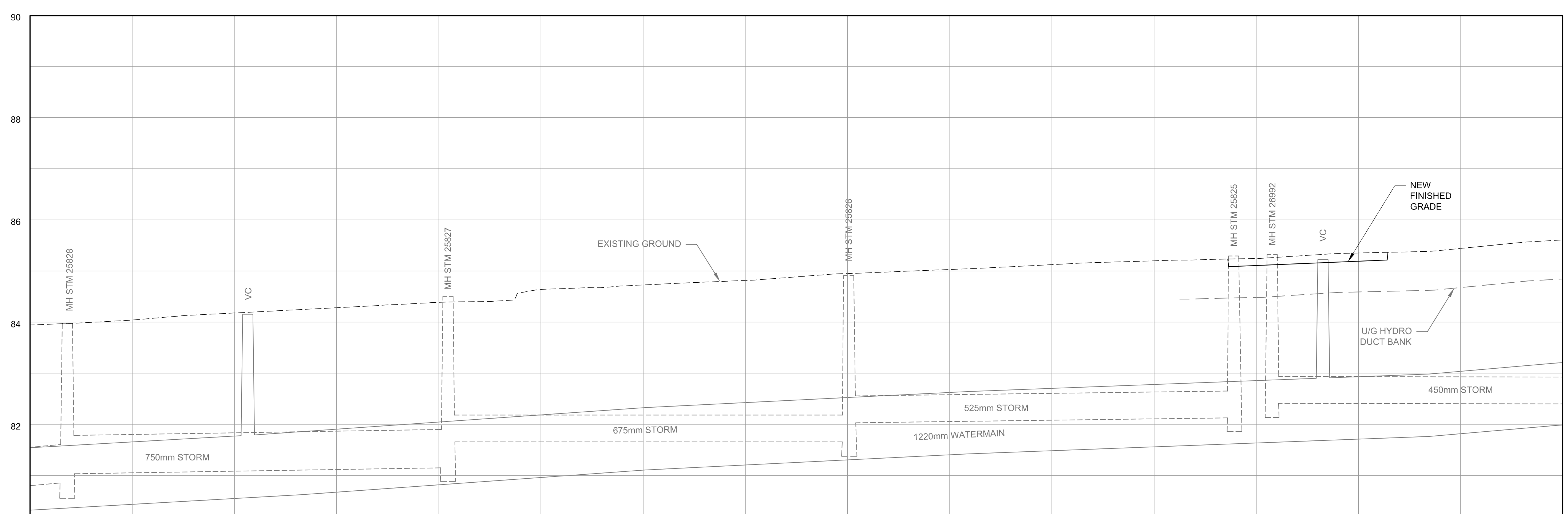
Dwn: AJM Chkd: GSH Des: LDM Chkd: GSH

CONTRACT NO. ISB07-5160
DWG. NO. 07-5160-08
SHEET 08 OF 30
Date: January 2011
Scale: 0 5 10m 1:500



GENERAL NOTES:

1. ALL NUMERICAL VALUES THAT ARE NOT STROKED OUT AND REPLACED IN ITALICS ON AS-BUILT DRAWINGS ARE CONSIDERED TO BE DESIGN VALUES ONLY AND NOT MEASURED IN THE FIELD.



	20+000		20+040		20+080		20+120		20+160		20+200		20+240		20+280	
TOP OF 1220 WATERMAIN		81.66	81.77 V.C.	81.91	82.04	82.18	82.32	82.42	82.52	82.62	82.70	82.78	82.86	V.C. 82.93		83.04	83.21
SANITARY INVERT																
STORM INVERT	74.5m - 750mm STORM SEWER				78.5m - 625mm STORM SEWER				75.4m - 525mm STORM SEWER					67.5m - 450mm STORM SEWER		
C/L PROFILE		84.04	84.18	84.28	84.39	84.64	84.73	84.81	84.95	85.03	85.12	85.20	85.24	85.09	85.35 85.20	85.44	85.61
STATION	20+000		20+040		20+080		20+120		20+160		20+200		20+240		20+280	

CATCH BASIN TABLE

NO.	STATION	OFFSET	TYPE: STRUCTURE	TYPE: GRATE TYPE	ELEVATION: GRATE	ELEVATION: LOW INVERT	
CICB-1	20+128.4	14.05(R)	705.010	S23	84.492m	~~82.09m~~	*83.22m*
CICB-2	20+136.7	4.35(L)	705.010	S23	84.675m	~~82.90m~~	*82.92m*
CICB-3	20+175.0	15.80(R)	705.010	S23	84.716m	~~82.51m~~	*83.33m*
CICB-4	20+182.2	7.39(L)	705.010	S23	84.977m	~~83.03m~~	*83.04m*
DCICB-5	20+220.5	14.93(R)	705.020	S23 x2	84.930m	~~82.74m~~	*83.70m*
CICB-6	20+228.0	6.13(L)	705.010	S23	85.180m	~~83.37m~~	*83.38m*
CB-7	20+273.8	1.81(L)	705.010	S19	85.314m	~~84.31m~~	*83.57m*
CICB-8	20+284.0	11.70(R)	705.010	S23	85.375m	~~82.83m~~	*83.29m*

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GENERAL NOTES:

1. ALL NUMERICAL VALUES THAT ARE NOT STROKED OUT AND REPLACED IN ITALICS ON AS-BUILT DRAWINGS ARE CONSIDERED TO BE DESIGN VALUES ONLY AND NOT MEASURED IN THE FIELD.

MAINTENANCE HOLE TABLE

NO.	STATION	OFFSET	TYPE			ELEVATION		
			TYPE	STRUCTURE	GRATE TYPE	GRATE	INVERT IN	INVERT OUT
MH-1	10+044.4	2.69(L)	STORM	M-4	S24.1	~~85.587~~ *85.47*	~~80.860~~ *80.78*	~~80.830~~ *80.78*
MH-2	10+054.7	4.10(L)	SANITARY	701.010	S24	~~85.737~~ *85.47*	~~81.770~~ *81.64*	~~81.745~~ *81.65*
MH-3	10+094.1	2.10(L)	STORM	M-5	S24.1	~~85.989~~ *85.90*	~~81.150~~ *E 82.62* *S 81.08*	~~80.920~~ *80.88*
MH-4	10+099.5	2.04(L)	STORM	M-4	S24.1	~~85.984~~ *85.90*	~~81.170~~ *81.21*	~~81.155~~ *81.21*
MH-5	10+100.8	4.42(L)	SANITARY	701.010	S24	~~85.977~~ *85.86*	~~81.830~~ *W 81.89* *S 82.02*	~~81.810~~ *81.88*

CATCH BASIN TABLE

NO.	STATION	OFFSET	TYPE		ELEVATION		
			STRUCTURE	GRATE TYPE	GRATE	INVERT OUT	
DCICB-11	10+024.1	14.52(R)	705.020	S23 x2	84.890m	~~82.85m~~	*82.85m*
CB-12	10+020.0	3.76(R)	705.010	S19	85.135m	~~82.54m~~	*83.54m*
DCICB-13	10+025.6	12.55(L)	705.020	S23 x2	85.006m	~~82.90m~~	*83.40m*
CICB-14	10+090.8	15.11(R)	705.010	S23	85.686m	83.49m	
CICB-15	10+110.2	14.03(R)	705.010	S23	85.663m	83.31m	5
DCICB-16	10+142.5	9.48(R)	705.020	S23 x2	85.637m	83.39m	
DCICB-17	10+142.2	8.14(L)	705.020	S23 x2	85.660m	83.31m	
CICB-18	10+302.7	7.29(R)	705.010	S23	85.768m	83.468m	
CICB-19	10+302.8	5.58(R)	705.010	S23	85.802m	83.502m	
CICB-20	10+340.0	6.01(L)	705.010	S23	85.933m	83.633m	
CICB-21	10+340.0	5.06(R)	705.010	S23	85.952m	83.652m	

DILLON CONSULTING

NO.	REVISIONS	BY	D-M-Y
0	DESIGN CIRCULATION	GSH	21-JAN-08
1	ISSUED FOR FINAL REVIEW	GSH	22-MAY-08
2	FINAL DESIGN CIRCULATION	GSH	06-APR-09
3	ISSUED FOR MOE APPLICATION	GSH	27-APR-09
4	ISSUED FOR TENDER	GSH	27-MAY-09
5	ISSUED FOR CONSTRUCTION	GSH	28-JUL-09
6	AS-BUILT	LB	06-JAN-11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

BASELINE ROAD AND CONSTELLATION CRESCENT INTERSECTION MODIFICATION

PLAN/PROFILE STA. 10+000 TO STA. 10+360 CONSTELLATION CRESCENT (NORTH/SOUTH)

W. NEWELL, P.ENG. Director Infrastructure Services

B. MASON, P.ENG. Manager Construction Services West

Dwn: AJM | Chkd: GSH | Des: LDM | Chkd: GSH

Ottawa

CONTRACT NO. ISB07-5160

DWG. NO. 07-5160-10

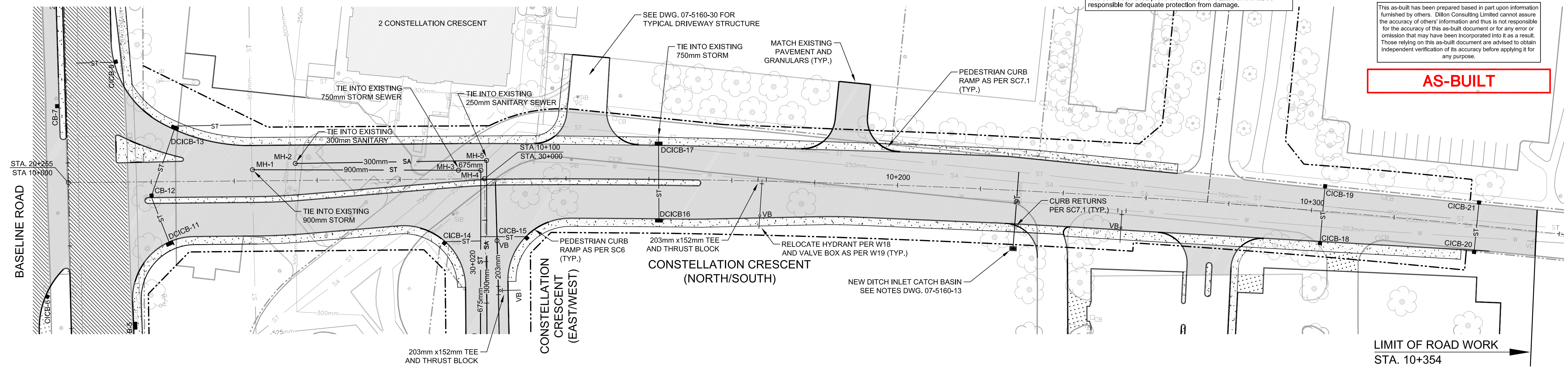
SHEET 10 OF 30

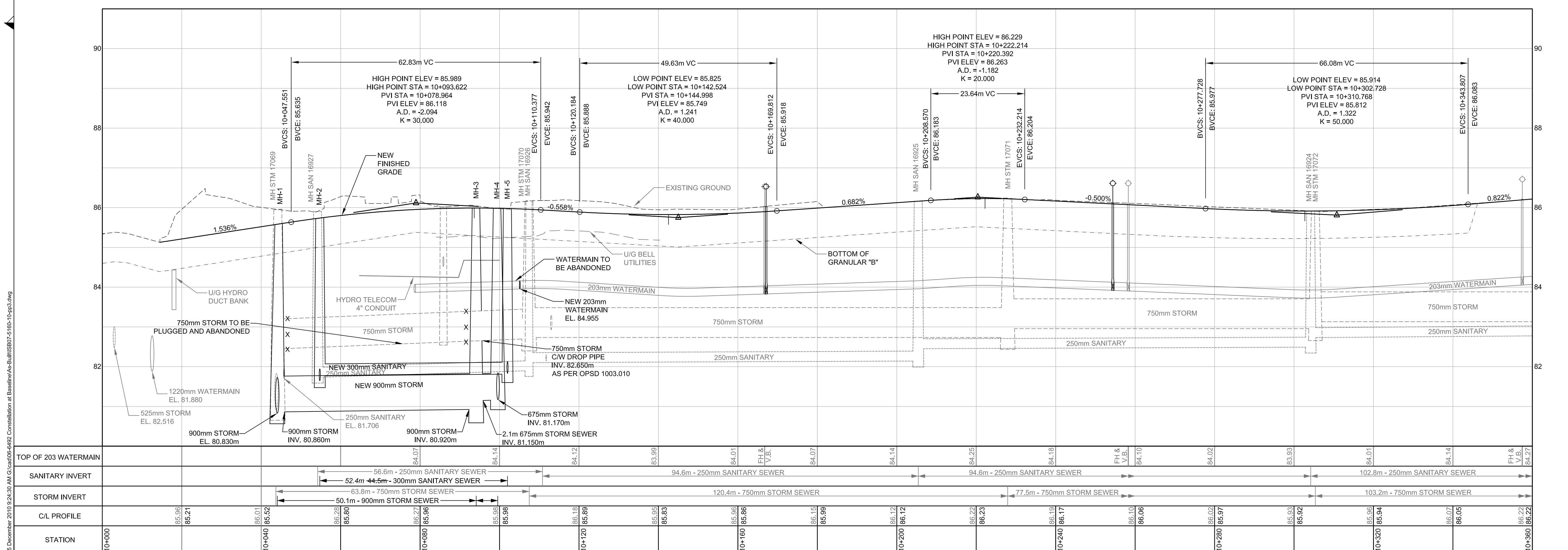
Date: January 2011

Scale: 0 5 10m 1:500

This as-built has been prepared based in part upon information furnished by others. Dillon Consulting Limited cannot assure the accuracy of others' information and thus is not responsible for the accuracy of this as-built document or for any error or omission that may have been incorporated into it as a result. Those relying on this as-built document are advised to obtain independent verification of its accuracy before applying it for any purpose.

AS-BUILT





15 December 2010 9:24:30 AM G:\cad\06-6492 Constellation at Baseline\As-Built\ISB07-5160-10-pp3.dwg

NO.	REVISIONS	BY	D-M-Y
0	DESIGN CIRCULATION	GSH	21-JAN-08
1	ISSUED FOR FINAL REVIEW	GSH	22-MAY-08
2	FINAL DESIGN CIRCULATION	GSH	06-APR-09
3	ISSUED FOR MOE APPLICATION	GSH	27-APR-09
4	ISSUED FOR TENDER	GSH	27-MAY-09
5	ISSUED FOR CONSTRUCTION	GSH	28-JUL-09
6	AS-BUILT	LB	06-JAN-11

NOTE:
The location of the utilities is approximate only, the exact location should be determined by consulting the municipal authorities and utility companies concerned.
The contractor shall prove the location of utilities and shall be responsible for adequate protection from damage.

DILLON CONSULTING

BASELINE ROAD AND CONSTELLATION CRESCENT INTERSECTION MODIFICATION

PLAN/PROFILE STA. 30+000 TO STA. 30+090 CONSTELLATION CRESCENT (EAST/WEST)

W. NEWELL, P.ENG. — Director Infrastructure Services

B. MASON, P.ENG. — Manager Construction Services West

Dwn: LDM | Chkd: GSH | Des: LDM | Chkd: GSH

Ottawa

CONTRACT NO. ISB07-5160

DWG. NO. 07-5160-11

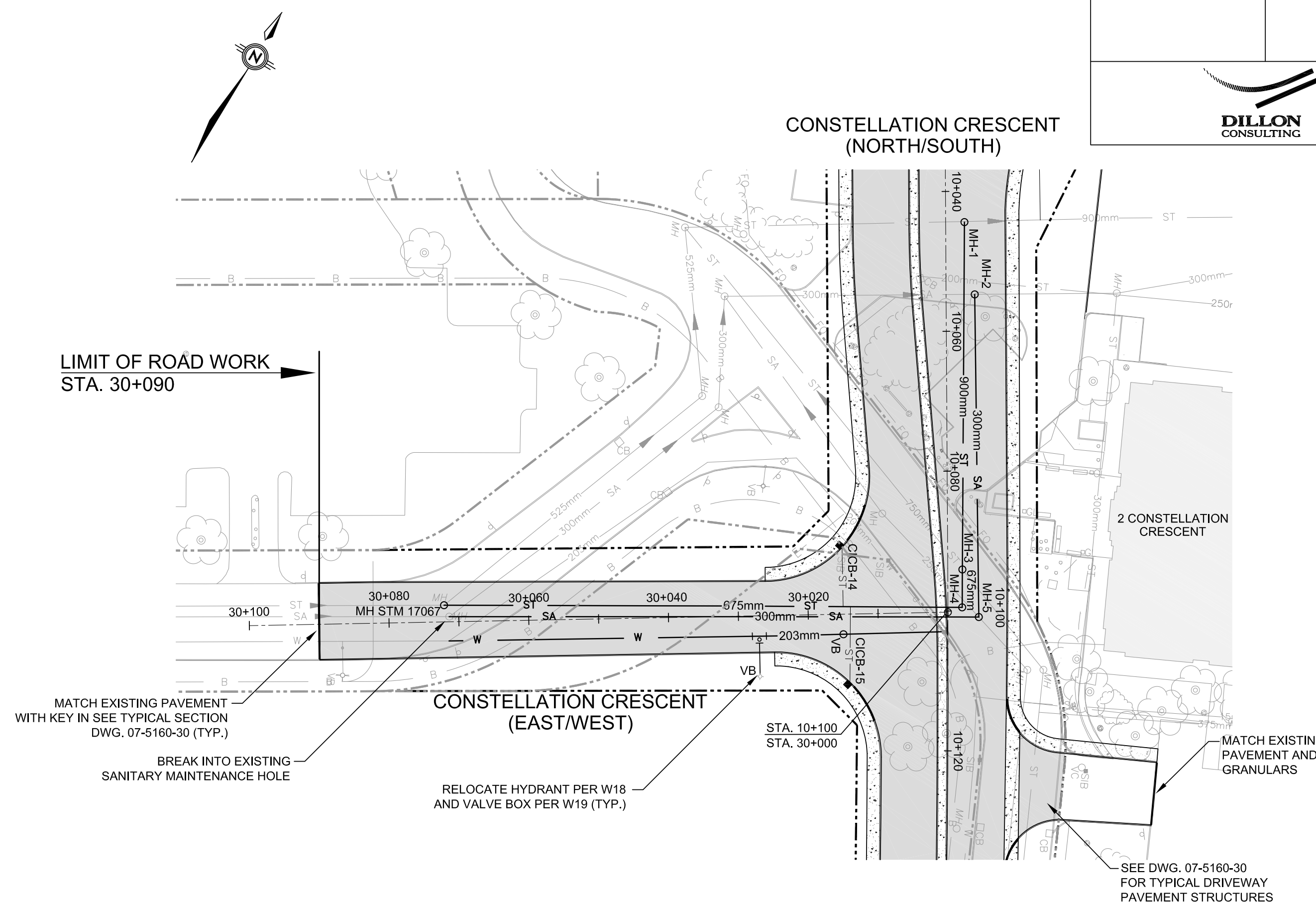
SHEET 11 OF 30

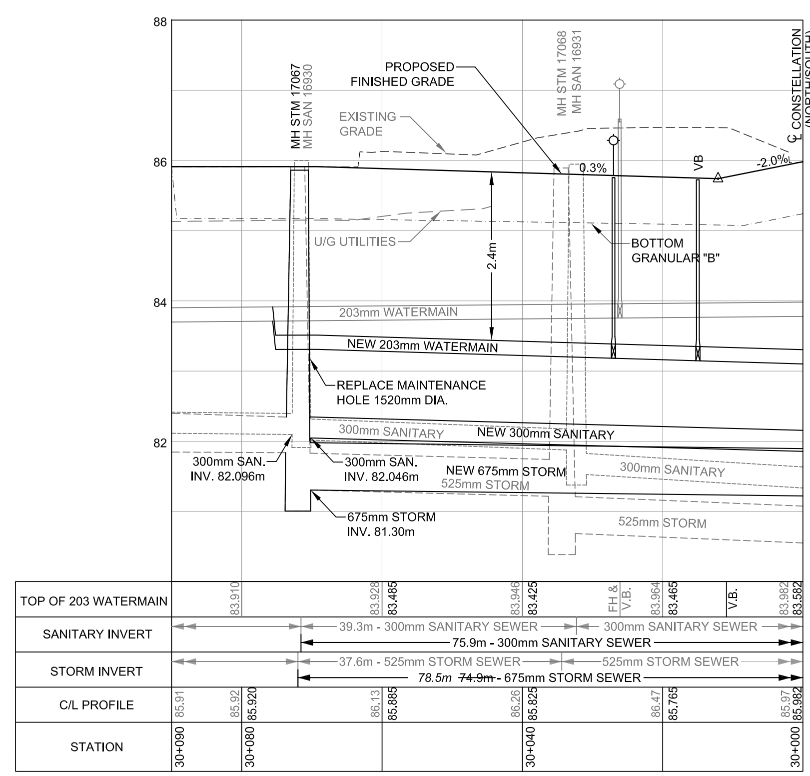
Date: January 2011

Scale: 0 5 10m 1:500

GENERAL NOTES:

1. ALL NUMERICAL VALUES THAT ARE NOT STROKED OUT AND REPLACED IN ITALICS ON AS-BUILT DRAWINGS ARE CONSIDERED TO BE DESIGN VALUES ONLY AND NOT MEASURED IN THE FIELD.





MAINTENANCE HOLE TABLE								
NO.	STATION	OFFSET	TYPE			ELEVATION		
			TYPE	STRUCTURE	GRATE TYPE	GRATE	INVERT IN	INVERT OUT
MHST 17067	30+072.1	2.06(L)	STORM	701.011	S24.1	85.861	~~81.837~~ *81.35*	~~81.300~~ *81.32*
MH-1	10+044.4	2.69(L)	STORM	M-4	S24.1	~~85.587~~ *85.47*	~~80.860~~ *80.78*	~~80.830~~ *80.78*
MH-2	10+054.7	4.10(L)	SANITARY	701.010	S24	~~85.737~~ *85.47*	~~81.770~~ *81.64*	~~81.745~~ *81.65*
MH-3	10+094.1	2.10(L)	STORM	M-5	S24.1	~~85.989~~ *85.90*	~~81.150~~ *E 82.62* *S 81.08*	~~80.920~~ *80.88*
MH-4	10+099.5	2.04(L)	STORM	M-4	S24.1	~~85.984~~ *85.90*	~~81.170~~ *81.21*	~~81.155~~ *81.21*
MH-5	10+100.8	4.42(L)	SANITARY	701.010	S24	~~85.977~~ *85.86*	~~81.830~~ *W 81.89* *S 82.02*	~~81.810~~ *81.88*

CATCH BASIN TABLE						
NO.	STATION	OFFSET	TYPE		ELEVATION	
			STRUCTURE	GRATE TYPE	GRATE	INVERT OUT
CICB-14	30+015.0	9.61m (R)	705.010	S23	85.686m	83.49m
CICB-15	30+014.1	9.66m (L)	705.010	S23	85.663m	83.31m (5)

This as-built has been prepared based in part upon information furnished by others. Dillon Consulting Limited cannot assure the accuracy of others' information and thus is not responsible for the accuracy of this as-built document or for any error or omission that may have been incorporated into it as a result. Those relying on this as-built document are advised to obtain independent verification of its accuracy before applying it for any purpose.

AS-BUILT

15 December 2010 9:27:11 AM G:\cad\06-6492 Constellation at Baseline\As-Built\ISB07-5160-11-pp4.dwg

Table 3.1: SWM Guidelines for the Pinecrest Creek / Westboro Study Area

Development Type		Runoff Volume Reduction	Water Quality	Water Quantity	
			TSS Removal	Flood Flow Management	Erosion Control
All Locations					
Residential Development *Not* Requiring Site Plan Control Approval					
1	all soil infiltration rates	Provision of a minimum depth of 300mm of amended topsoil over all front yard landscaped areas; and Direction/redirection of downspouts/roof drainage to landscaped areas to minimize runoff.	Inherent TSS removal from on-site retention in landscaped areas.	Not applicable	Not applicable
Draining to the Ottawa River					
Commercial/Institutional and Industrial Developments - <u>discharging directly to the Ottawa River</u> *					
2	a) sites with soil infiltration rates ≥ 1 mm/hour	Minimum on-site retention of the 10 mm design storm.	On-site removal of 80% of TSS.	As per City's Sewer Design Guideline(Section 8.3.7.3, revised Sept. 2008).	Not applicable
	b) site's soil infiltration rates < 1 mm/hour	If the entire property is underlain by native soils with infiltration rates less than 1 mm/hr, no infiltrating SWM measures may be used. A minimum depth of 300 mm of amended soil shall be provided below all front yard landscaped areas. A green roof and/or rain harvesting measures could be implemented to provide further runoff volume reduction.	On-site removal of 80% of TSS.	As per City's Sewer Design Guideline(Section 8.3.7.3, revised Sept. 2008).	Not applicable
Residential Development Requiring Site Plan Control Approval - <u>discharging directly to the Ottawa River</u>					
3	a) sites with soil infiltration rates ≥ 1 mm/hour	Minimum on-site retention of the 10 mm design storm.	Inherent TSS removal due to on-site retention of the first 10 mm rainfall.	As per City's Sewer Design Guideline(Section 8.3.7.3, revised Sept. 2008).	Not applicable
	b) site's soil infiltration rates < 1 mm/hour	If the entire property is underlain by native soils with infiltration rates less than 1 mm/hr, no infiltrating SWM measures may be used. A minimum depth of 300 mm of amended soil shall be provided below all front yard landscaped areas. A green roof and/or rain harvesting measures could be implemented to provide further runoff volume reduction.	Inherent TSS removal from on-site retention in landscaped areas.	As per City's Sewer Design Guideline(Section 8.3.7.3, revised Sept. 2008).	Not applicable
Draining to Pinecrest Creek					
Commercial/Institutional and Industrial Developments - <u>discharging upstream of the Ottawa River Parkway (ORP) pipe inlet</u> *					
4	a) sites with soil infiltration rates ≥ 1 mm/hour	Minimum on-site retention of the 10 mm design storm.	On-site removal of 80% of TSS.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Control (detain) the runoff from the 25 mm design storm such that the peak outflow from the site does not exceed 5.8 L/s/ha.
	b) site's soil infiltration rates < 1 mm/hour	If the entire property is underlain by native soils with infiltration rates less than 1 mm/hr, no infiltrating SWM measures may be used. A minimum depth of 300 mm of amended soil shall be provided below all front yard landscaped areas. A green roof and/or rain harvesting measures could be implemented to provide further runoff volume reduction.	On-site removal of 80% of TSS.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Control (detain) the runoff from the 25 mm design storm such that the peak outflow from the site does not exceed 5.8 L/s/ha.

Table 3.1: SWM Guidelines for the Pinecrest Creek / Westboro Study Area

Development Type		Runoff Volume Reduction	Water Quality	Water Quantity	
			TSS Removal	Flood Flow Management	Erosion Control
Commercial/Institutional and Industrial Developments - <u>discharging directly to Ottawa River Parkway (ORP) pipe</u> *					
5	a) sites with soil infiltration rates ≥ 1 mm/hour	Minimum on-site retention of the 10 mm design storm.	On-site removal of 80% of TSS.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Not applicable
	b) site's soil infiltration rates < 1 mm/hour	If the entire property is underlain by native soils with infiltration rates less than 1 mm/hr, no infiltrating SWM measures may be used. A minimum depth of 300 mm of amended soil shall be provided below all front yard landscaped areas. A green roof and/or rain harvesting measures could be implemented to provide further runoff volume reduction.	On-site removal of 80% of TSS.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Not applicable
Residential Development Requiring Site Plan Control Approval - <u>discharging upstream of Ottawa River Parkway (ORP) pipe inlet</u>					
6	a) sites with soil infiltration rates ≥ 1 mm/hour	Minimum on-site retention of the 10 mm design storm.	Inherent TSS removal due to on-site retention of the 10 mm and detention of the 25 mm design storms.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Control (detain) the runoff from the 25 mm design storm such that the peak outflow from the site does not exceed 5.8 L/s/ha.
	b) site's soil infiltration rates < 1 mm/hour	If the entire property is underlain by native soils with infiltration rates less than 1 mm/hr, no infiltrating SWM measures may be used. A minimum depth of 300 mm of amended soil shall be provided below all front yard landscaped areas. A green roof and/or rain harvesting measures could be implemented to provide further runoff volume reduction.	Inherent TSS removal due to on-site retention in landscaped areas and detention of the 25 mm design storm.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Control (detain) the runoff from the 25 mm design storm such that the peak outflow from the site does not exceed 5.8 L/s/ha.
Residential Development Requiring Site Plan Control Approval - <u>discharging directly to Ottawa River Parkway (ORP) pipe</u>					
7	a) sites with soil infiltration rates ≥ 1 mm/hour	Minimum on-site retention of the 10 mm design storm.	Inherent TSS removal due to on-site retention of the 10 mm design storm.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Not applicable
	b) site's soil infiltration rates < 1 mm/hour	If the entire property is underlain by native soils with infiltration rates less than 1 mm/hr, no infiltrating SWM measures may be used. A minimum depth of 300 mm of amended soil shall be provided below all front yard landscaped areas. A green roof and/or rain harvesting measures could be implemented to provide further runoff volume reduction.	Inherent TSS removal from on-site retention in landscaped areas.	The more stringent of the following criteria will govern: i) 1:100 year discharge from site not to exceed 33.5 L/s/ha); or ii) Requirements of City's Sewer Design Guideline (Section 8.3.7.3, revised Sept. 2008).	Not applicable

*Infiltration measures should not be used on sites or source areas where the land use or activity could generate higher concentrations of hydrocarbons, trace metals or toxicants than are found in typical stormwater runoff (e.g., vehicle refueling, handling areas for hazardous materials, etc.). This would include retail gasoline outlet sites due to the potential for spills. In addition, these measures should be sited so that they will not receive runoff from high traffic areas where large amounts of de-icing salts are used. The design of these systems shall be in accordance with the guidance in the Stormwater Management Planning and Design Manual (MOE, 2003) and the Low Impact Development Stormwater Management Planning and Design Guide (CVC & TRCA, 2010).

Note: For a mixed use property, if surface parking has been provided the site will be considered commercial. If surface parking has not been provided, the site will be considered residential for the purposes of applying the SWM criteria in this table.

3.3.5 Flood Control Requirements

Flood control criteria are specified based upon the catchment's receiving watercourse (Pinecrest Creek or the Ottawa River) or storm sewer (the Ottawa River Parkway (ORP) pipe or local storm sewer outlet). For example, there are no flood control requirements for discharge directly to the Ottawa River, whereas the limited capacity of the ORP pipe requires a higher level of control to avoid increasing flood risk. (Pinecrest Creek flows are conveyed by the ORP pipe from just south of Carling Avenue to the Ottawa River.)

Note: Flood control requirements are applied only to those developments requiring Site Plan Control**.**

3.3.5.1 Draining Directly to the Ottawa River:

Developments requiring Site Plan Control that are serviced by outfalls draining directly to the Ottawa River (shown in Figures 3.2 and 3.3) shall provide sufficient flood control storage to meet the most limiting downstream storm sewer capacity. Per the City's Sewer Design Guideline, the capacity of the downstream receiving system shall be assessed when connecting to an existing storm sewer. The allowable release rate to the existing system is to be confirmed with the City.

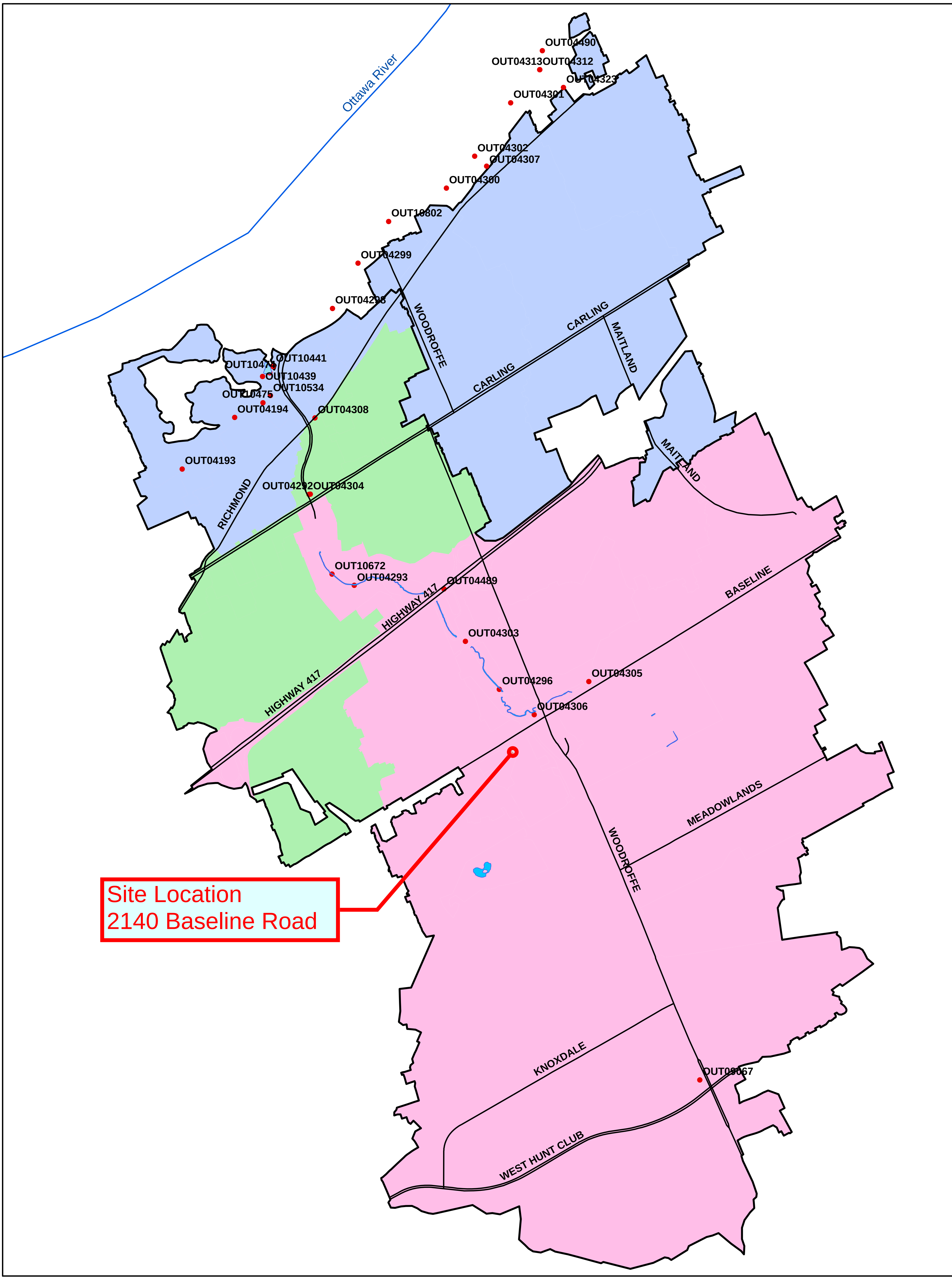
3.3.5.2 Draining to Pinecrest Creek:

Developments draining to Pinecrest Creek (either upstream of or directly into the ORP pipe) that require Site Plan Control shall provide sufficient flood control storage to address the most limiting downstream capacity (either the local sewer or the inlet to the ORP). The catchments that discharge to Pinecrest Creek upstream or directly into the ORP are identified in Figures 3.2 and 3.3.

To maintain existing peak flow and headwater conditions up to and including the 1:100 year storm at the inlet of the ORP pipe, all future development projects that require Site Plan Control approval shall control the 1:100-year discharge from the site to a maximum rate of 33.5 L/s/ha. This unit flow target has been set based on the hydrologic (SWMHYMO) modelling conducted for the Pinecrest Creek/Westboro Stormwater Management Retrofit Study (May 2011). From that modelling, the existing unit flow rate, at the ORP, for the critical design storm (24-hour 100-year SCS Type II) was found to be 33.5 L/s/ha.

Other flow restrictions, such as limiting storm sewer capacities, may also exist and should be identified by the proponent in consultation with the City.

The proponent shall, at the design stage, demonstrate that the proposed design can achieve the target release flow rates. For planning purposes, approximate on-site storage volumes to achieve the required control are provided below in Tables 3.2a and 3.2b. These approximate on-site storage volumes listed in Tables 3.2a and 3.2b were calculated using the SCS loss procedure and the Horton's Infiltration procedure, respectively. Designers should use the Horton's infiltration procedure for urban developments, unless otherwise directed by the City of Ottawa.



LEGEND:
- Ottawa Storm Sewer Outlets
- Arterial Roads
- OttawaRiver
- Areas Draining to the Ottawa River
- Areas Draining to the Ottawa River Parkway (ORP) Pipe
- Areas Draining to Pinecrest Creek

CLIENT: Ottawa

NOTES:
- The following background data were provided by the City of Ottawa

0 150 300 600 900 1,200 Meters

N

NOV 2011 REV. 1

BY: JFSA Water Resources and Environmental Consultants

PROJECT: SWM GUIDELINES FOR THE PINECREST CREEK/WESTBORO AREA

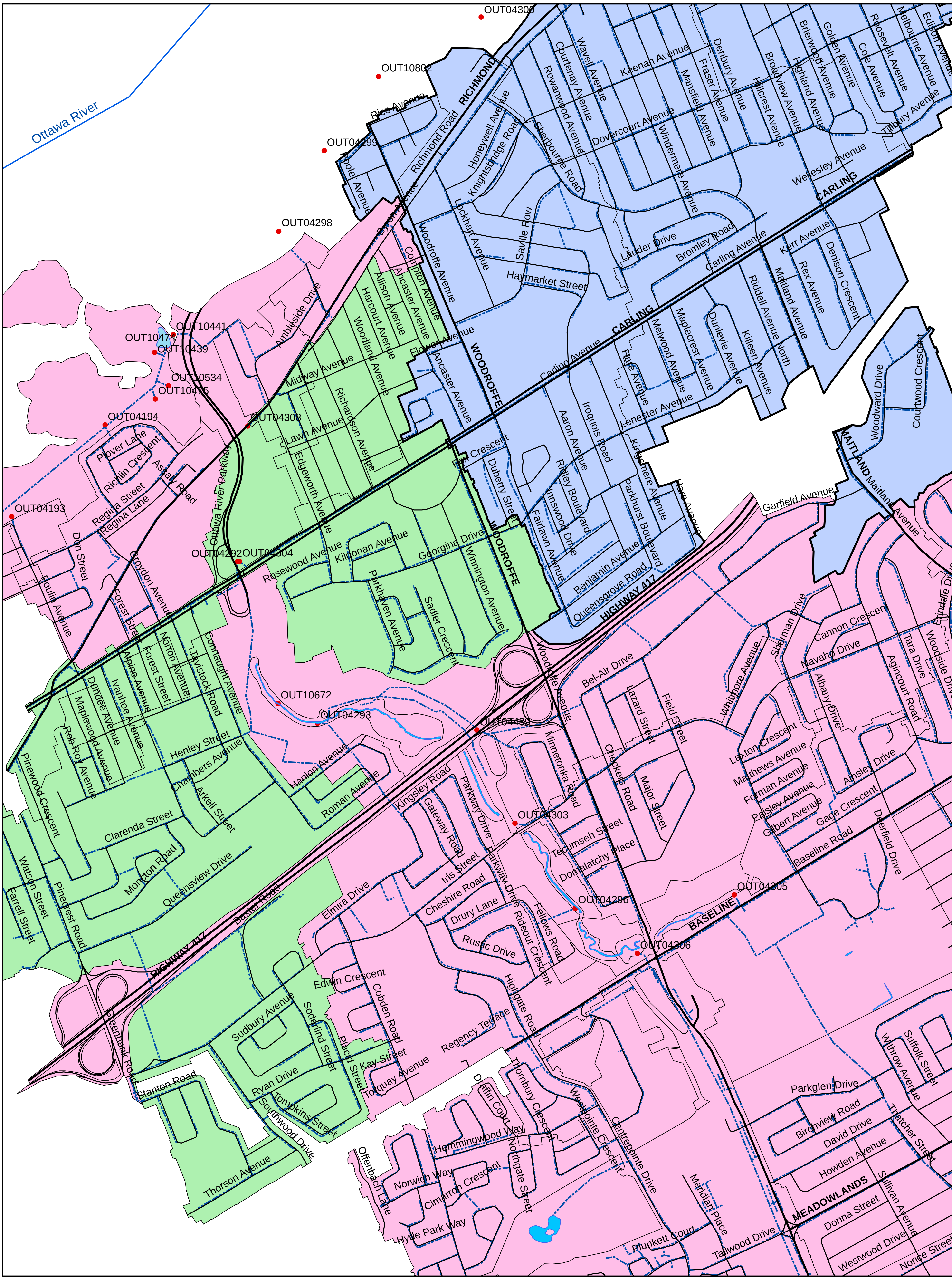
TITLE: Total Drainage Area and Divides for Pinecrest Creek, Ottawa River Parkway Pipe & the Ottawa River

PROJECT No. 741(02)

DESIGN	KM
GIS	KM
CHECK	JFS
REVIEW	JFS

FIGURE 3.2

MAP REF.: 741(02)\Design\Figures\DrainageAreas.mxd



LEGEND:

- Ottawa Storm Sewer Outlets
- Storm Sewers
- Roads
- Arterial Roads
- OttawaRiver
- Areas Draining to the Ottawa River
- Areas Draining to the Ottawa River Parkway (ORP) Pipe
- Areas Draining to Pinecrest Creek or the Ottawa River

CLIENT: Ottawa

BY: JFSA Water Resources and Environmental Consultants

NOTES:

- The following background data were provided by the City of Ottawa

PROJECT: SWM GUIDELINES FOR THE PINECREST CREEK/WESTBORO AREA

TITLE: Close-up of Drainage Divides for Pinecrest Creek, Ottawa River Parkway Pipe & the Ottawa River

0 75 150 300 450 600 Meters

N

JUNE 2012

REV. 0

PROJECT No. 741(02)

DESIGN	KM
GIS	KM
CHECK	JFS
REVIEW	JFS

FIGURE 3.3

MAP REF.: 741(02)\Design\Figures\DrainageAreas_Close-up.mxd

Table 3.2a: Approximate On-Site Storage Volume Requirements (SCS)

To control flows to 33.5 L/s/ha

Imperviousness		
50%	75%	95%
310 m^3/ha	420 m^3/ha	530 m^3/ha

Parameters: Ximp = 40 %, 65 % & 95% respectively
CN = 74, CN* = 63.9
SLPP = 1.0 %, SLPPI = 0.75%
All other parameters as per the City of Ottawa Sewer Design Guidelines (2004).

Table 3.2b: Approximate On-Site Storage Volume Requirements (Horton's)

To control flows to 33.5 L/s/ha

Imperviousness		
50%	75%	95%
380 m^3/ha	455 m^3/ha	540 m^3/ha

Parameters: Same as for Table 3.2a except for infiltration parameters.
Horton's infiltration parameters (f_0, fc and DCAY and F)
as per the City of Ottawa Sewer Design Guidelines (2004).

Note that the volume provided on-site to meet other design criteria (i.e., runoff volume control and/or erosion control) can provide a portion of the volume required to attenuate the 100-year storm as well. The designer will need to provide detailed calculations showing how the different storage volumes and control structures (typically orifices or weirs) will interact so that the volume that is being accounted for will act as effective storage during the 100-year storm. Furthermore, the storage volumes accounted for must be provided by permanent structures that will not be removed or modified over time. Refer to Appendix D for examples of these types of calculations within the sample approaches.

3.3.6 Runoff Volume and Erosion Control Requirements

Runoff volume control requirements are specified for the purposes of erosion mitigation only for those catchments that drain to the open portion of Pinecrest Creek located upstream of the ORP pipe.

3.3.6.1 Draining to Pinecrest Creek Upstream of the ORP Pipe (Erosion Mitigation):

The following runoff volume control criteria were determined from hydrologic and hydraulic analyses completed during the preparation of the Pinecrest/Centrepointe Stormwater Management Criteria Study (February 2010) and further analyses completed for the Pinecrest Creek/Westboro Stormwater Management Retrofit Study (May 2011). Catchments draining to Pinecrest Creek upstream of the ORP pipe are shown on Figures 3.2 and 3.3.

1) To mitigate the cumulative impacts of infill and redevelopment and not aggravate existing erosion within the creek corridor, future developments that require Site Plan Control approval shall retain,

capture or infiltrate the first 10 mm of rainfall. This 10 mm target can be partially achieved by the default initial abstraction (IA) values applicable in urban areas. The City of Ottawa Sewer Design Guidelines allows a designer to account for a 4.67 mm IA on all soft landscaped surfaces and a 1.57 mm IA on all hardscaped surfaces. A wide range of measures may be used to achieve this criterion, many of which are described in Appendix C.

2) In addition to the above, future developments that require Site Plan Control approval shall control site runoff from the 25 mm 4-hour Chicago design storm to a maximum peak flow of 5.8 L/s/ha. This peak flow target is based on releasing 25 mm of runoff over a 24 hour time period, using a peaking factor of 2 (i.e. assuming that the peak outflow is equal to twice the average outflow). A wide range of measures can be considered to achieve this criterion, many of which are described in Appendix C.

Note that, as outlined in Table 3.1, all developments draining to Pinecrest Creek upstream of the ORP pipe shall control site runoff from the 25 mm 4-hour Chicago storm to a peak unit outflow rate of 5.8 L/s/ha regardless of whether or not the first 10 mm of runoff volume will be retained on-site. The required on-site storage volume, to control the runoff of the 25mm storm, will vary from site to site based on the amount of volume retained or infiltrated.

3.3.7 Quality Control

The water quality control requirements noted here are based on the receiving watercourse and MOE guidelines with some qualifications as described below.

The equivalent of an enhanced level of treatment (TSS removal of 80%) is required for water quality control on ICI sites. While this requirement could, in some cases, be accomplished by means of conventional measures (i.e., end-of-pipe facilities such as oil and grit separators), it is anticipated that SWM measures that can provide runoff volume control for the first 10mm of rainfall will also contribute to achieving an enhanced level of treatment. Although an accepted equivalency for enhanced treatment is not available for volume control measures as of yet, the water quality benefit of such measures is demonstrated by local rainfall statistics which indicate that rainfalls of 10 mm or less occur comprise on average 61% of all events (these data were derived by the City of Ottawa based on the percent rank of consecutive day rainfall events recorded at the Experimental Farm from 1890 through 2008). It is therefore considered that the capture and retention of the 10 mm storm will provide a water quality control benefit.

- Future developments that require Site Plan Control approval shall capture, retain or infiltrate the first 10 mm of rainfall. This 10 mm target can be partially achieved by the default initial abstraction (IA) values applicable in urban areas. The City of Ottawa Sewer Design Guidelines allows a designer to account for a 4.67 mm IA on all soft landscaped surfaces and a 1.57 mm IA on all hardscaped surfaces.
- ICI developments will require measures over and above the retention of the first 10mm to achieve an enhanced level of treatment.
- Residential developments that require Site Plan Control approval will not require measures over and above the retention of the first 10 mm.

3.4 SWM Requirements for the Pinecrest Creek and Westboro Area: Development Requiring a Building Permit Only

In recognition of the relatively small scale of these types of developments and the need for a simple but effective means of achieving the benefits of reducing runoff volume, the minimum requirement for these sites is:

- Provision of a minimum depth of 0.30 m of amended topsoil over all landscaped areas; and
- Direction/redirection of downspouts/roof drainage to landscaped areas to minimize runoff.

Amended Topsoil:
Amended topsoil refers to topsoil with an organic content of 8 to 15% by weight, or 30 to 40% by volume (CVC & TRCA, 2010). To be most effective with regard to providing the optimal amount of infiltration on-site, the front-yard lot grading should be limited to a maximum of 2%, if possible while still meeting the surrounding existing grades.

Downspout Redirection:
Downspout redirection is the diversion of flow from rooftops (or impervious surfaces) to pervious areas. This prevents the routing of stormwater to impervious surfaces which drain directly to storm sewer systems. In order for downspout redirection to produce a measurable benefit, it requires a minimum flow path length of 5 m across a pervious surface before flowing onto an impervious surface, or into a storm sewer system. Discharge locations for roof downspouts should be a distance of at least 3 m away from building foundations and should be directed towards a pervious surface. If a pervious surface is not directly available around the immediate perimeter of the building, the downspout can run underground and discharge as a ‘pop-up’ outlet at the nearest pervious surface.

Appendix D provides further details on this approach and a specification to be included with building permit applications.

The above approach represents the minimum requirement for sites requiring a building permit application only. However, there are also many other measures that could be used to minimize runoff volume including: permeable paver driveways; infiltration trenches, rainwater harvesting, green roofs, rain gardens, etc. These measures necessarily require more information (e.g., site infiltration testing) and in some cases, considerable design effort by qualified professionals. ***While the use of these measures is not required to meet the minimum requirement, a sample design approach (refer to Appendix D) has been provided to illustrate how such measures could be applied to small scale/single lot development.***

3.5 Sample Approaches

Appendix D contains sample design approaches that demonstrate how these criteria can be achieved for the following types of development:

i) Commercial;
ii) Residential (town homes requiring Site Plan Control approval);
iii) Residential (condominium requiring Site Plan Control approval); and
iv) Residential (single lot requiring building permit only).

Appendix I – Drawings

Project Drawings (All 11x17 Reduction, Scale: NTS)

- **Site Plan. Drawing ASP100, Revision 3**
- **Topographic Survey, March 16, 2018**
- **Existing Conditions and Removals Plan, Drawing C0**
- **Site Servicing Plan, Drawing C1**
- **Grading Plan, Drawing C2**
- **Erosion & Sediment Control Plan, Drawing C3**
- **Storm Drainage Area Plan, Drawing C4**