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36 Years

4149 Strandherd Drive
Ottawa, Ontario

Servicing & Stormwater Management Report

Engineering excellence. Planning precision. Inspired landscapes.

SERVICING AND STORMWATER MANAGEMENT REPORT

4149 STRANDHERD DRIVE
OTTAWA, ONTARIO

Prepared By:

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

November 6, 2019

Novatech File: 117148
Ref: R-2019-187

NOVATECH
Engineers, Planners & Landscape Architects

November 6, 2019

Planning, Infrastructure and Economic Development Department
City of Ottawa
110 Laurier Avenue West
Ottawa, Ontario, K1P 1J1

Attention: Lily Xu, Manager (Acting) Development Services South

Dear Ms. Xu:

Reference: 4149 Strandherd Drive, Ottawa
Servicing and Stormwater Management Report
Our File No.: 117148

Please find enclosed the 'Servicing and Stormwater Management Report' for the above noted project. This report is prepared to support the Site Plan, Zoning Amendment and Official Plan Amendment Applications and is hereby submitted for review and approval.

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

Yours truly,

NOVATECH

Cara Ruddle, P.Eng.
Senior Project Manager | Land Development Engineering

cc: Geoff Publow, Myers Automotive Group

M:\2017\117148\DATA\Reports\Sev and SWM\117148- Servicing & SWM .docx

Table of Contents

References

- Novatech Engineering Consultants Ltd., Citi Gate Highway 416 Corporate Campus, Detailed Servicing Study and Stormwater Management Report (Phase 1), Dated January 9, 2015.
- Paterson Group, Geotechnical Investigation Proposed Commercial Development 4149 Strandherd Drive Ottawa, Ontario, Dated September 13, 2019

Appendices

Figures

1.0 INTRODUCTION

Novatech has been retained to prepare a Servicing and Stormwater Management Report for the proposed development located at 4149 Strandherd Drive, Ottawa, Ontario. This report will support a Site Plan, Zoning Amendment and Official Plan Amendment Applications for the subject development. **Figure 1** Key Plan shows the site location.

2.0 EXISTING CONDTIONS

The total site area is approximately 3.4 hectares in size and is located within the Citigate Development southeast of the intersection of Highway 416 and Strandherd Drive. The site is registered as Block 4 on Plan 4M-1538 within the Citi Gate Development and has a municipal address of 4149 Strandherd Drive. The site is bounded by a temporary storm pond and vacant land to the north, Strandherd Drive to the East, Dealership Drive to the South, and the O'Keefe Drain to the west. The topography of the site slopes westerly towards the O'Keefe Drain. **Figure 2** shows the existing site conditions.

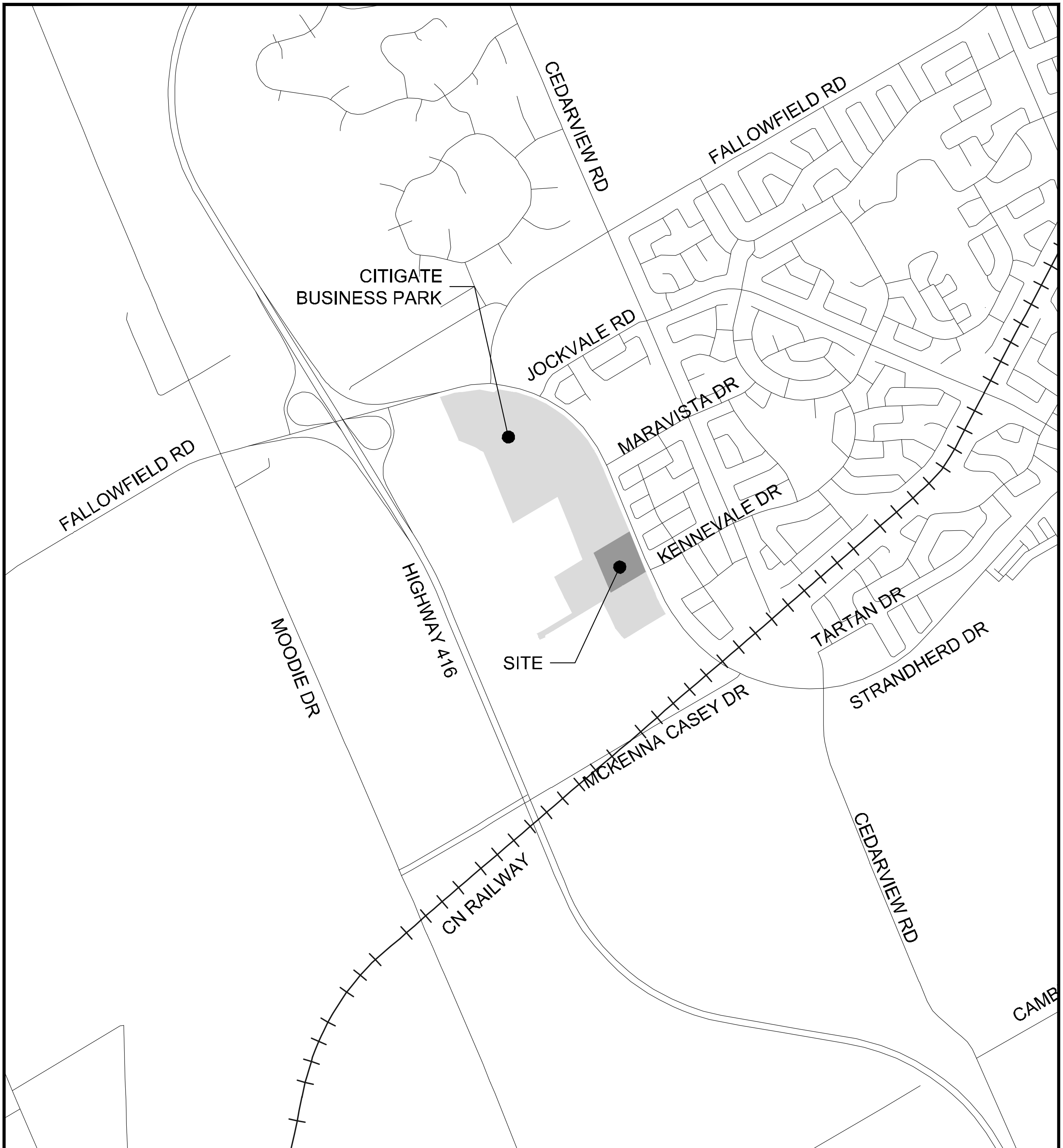
Some servicing infrastructure was constructed as part of the original Citi Gate Development for the individual blocks. A water quality oil grit separator unit (STC-4000) and a storm outlet structure to the O'Keefe Drain was constructed in the northeast corner of the site to service Block 4. Temporary infrastructure was also constructed to service the Citi Gate Development until future/permanent infrastructure is constructed together with the future Strandherd Drive road widening works. Part of the temporary servicing includes a sanitary lift station in the southeast corner of Block 4. There is also a temporary storm pond located along the north property line. The temporary sanitary lift station and pond will be removed as part of the Strandherd Drive road widening works.

3.0 PROPOSED DEVELOPMENT

It is proposed to develop the site with an automobile dealership, a 6-storey hotel, and a 5-storey office building. Access to the site will be provided with entrances on both Dealership Drive and Strandherd Drive. **Figure 3** shows the proposed development.

Since there are future road widening works proposed for Strandherd Drive, the site design will include an interim design for the existing Strandherd Drive and an ultimate design with the future Strandherd Drive alignment.

It should be noted that this report should be read in conjunction with the engineering drawing set. The engineering drawings include the following:



NOVATECH

Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

4149 STRANDHERD DRIVE

KEYPLAN

SCALE		
N.T.S		
DATE OCT 2019	JOB 117148	FIGURE FIGURE 1

SHT8X11.DWG - 216mmx279mm

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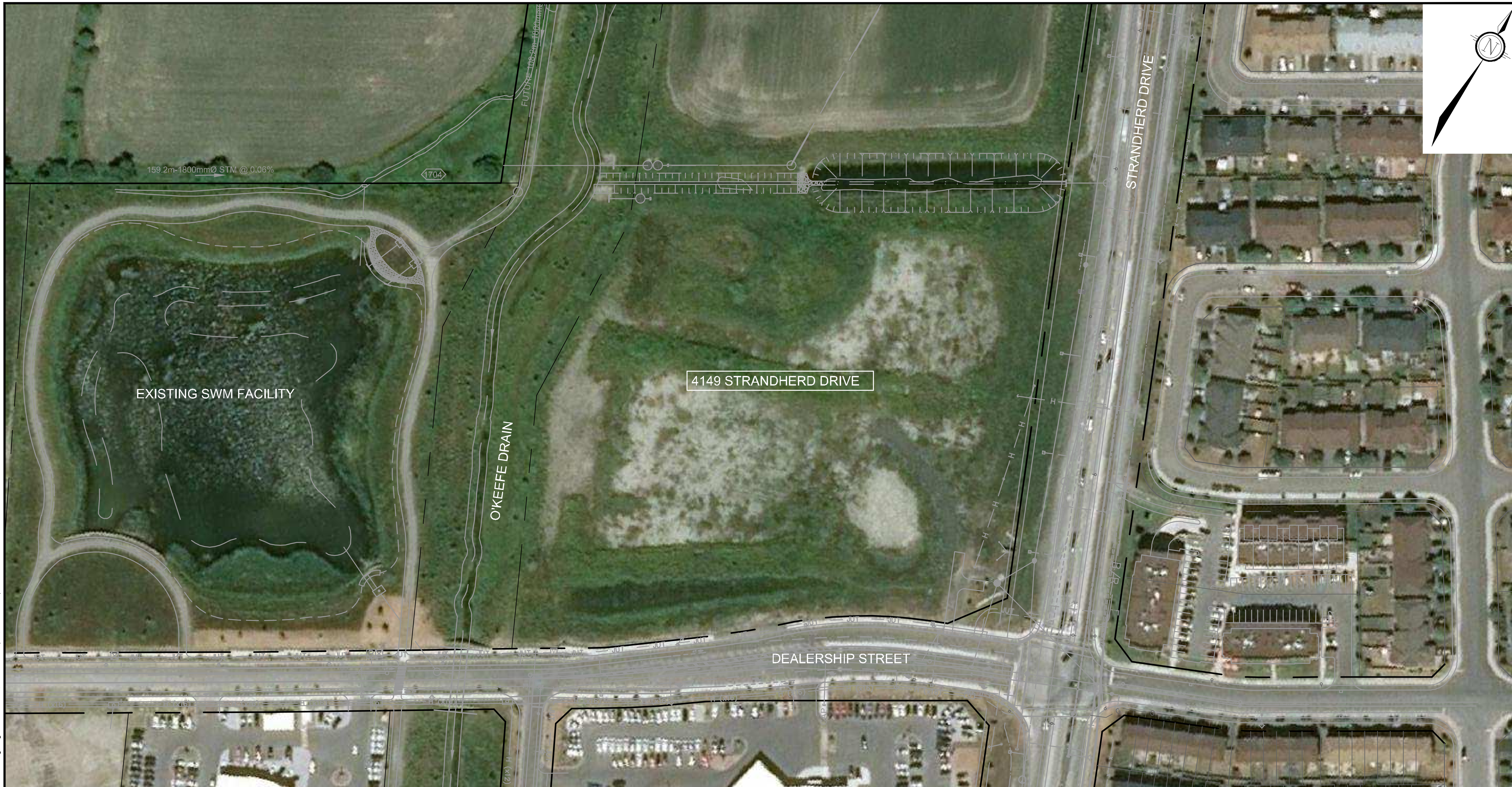

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

4149 STRANDHERD DRIVE

EXISTING CONDITIONS PLAN

SCALE 1 : 1500 (0 15 30 45 60)

DATE SEPT 2019 | JOB 117148 | FIGURE FIGURE 2

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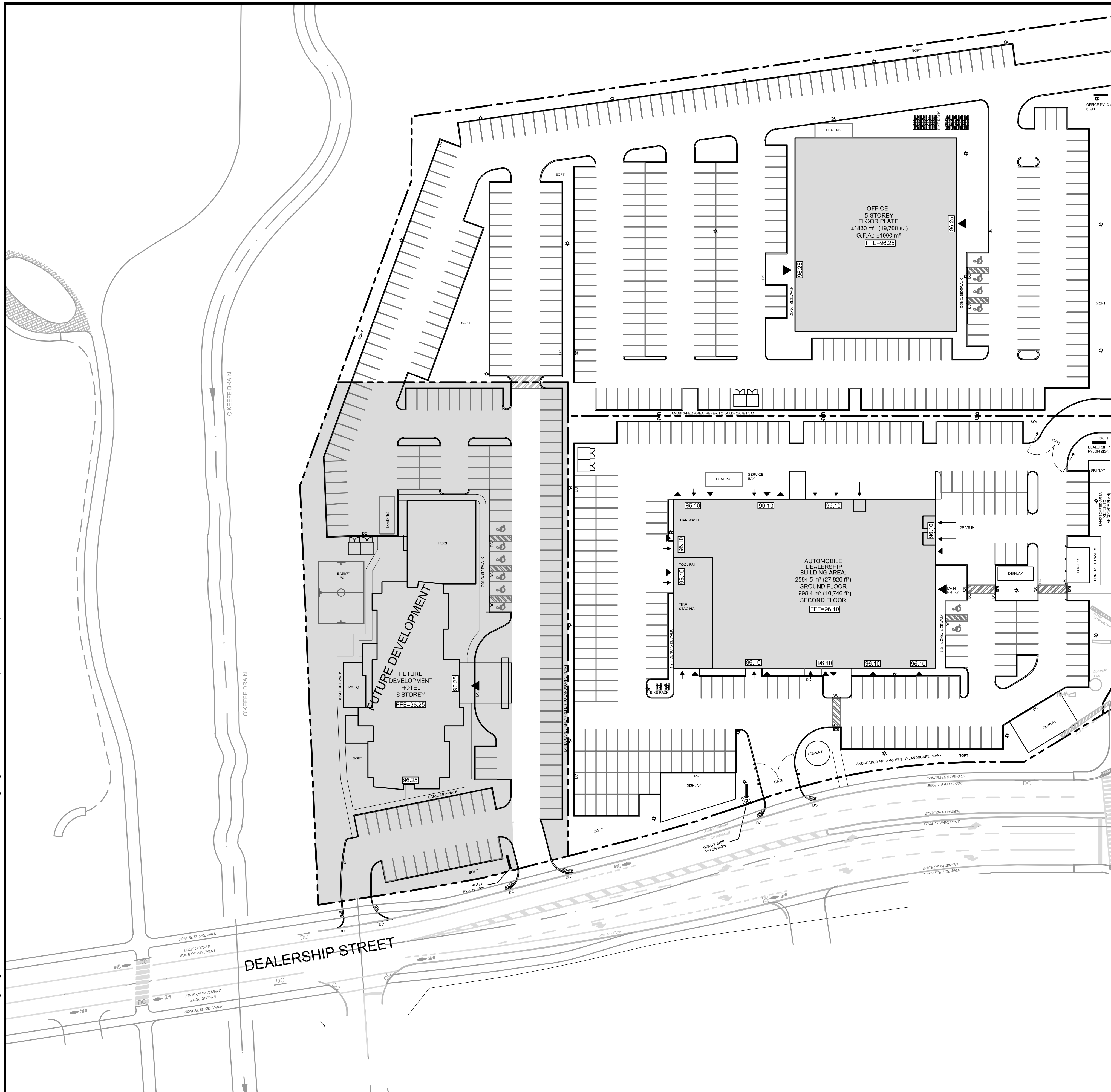

NOVATECH
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Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

4149 STRANDHERD DRIVE

PROPOSED SITE PLAN

SCALE 1 : 1000 (0 10 20 30 40)

DATE OCT 2019 | JOB 117148 | FIGURE FIGURE 3

	Cover Sheet
117148-ND	Notes and Details
117148-GP	General Plan of Services - Ultimate
117148-GPI	General Plan of Services - Interim
117148-GR	Grading Plan - Ultimate
117148-GRI	Grading Plan – Interim
117148-ESC	Erosion and Sediment Control Plan

4.0 SITE DESIGN AND CONSTRAINTS

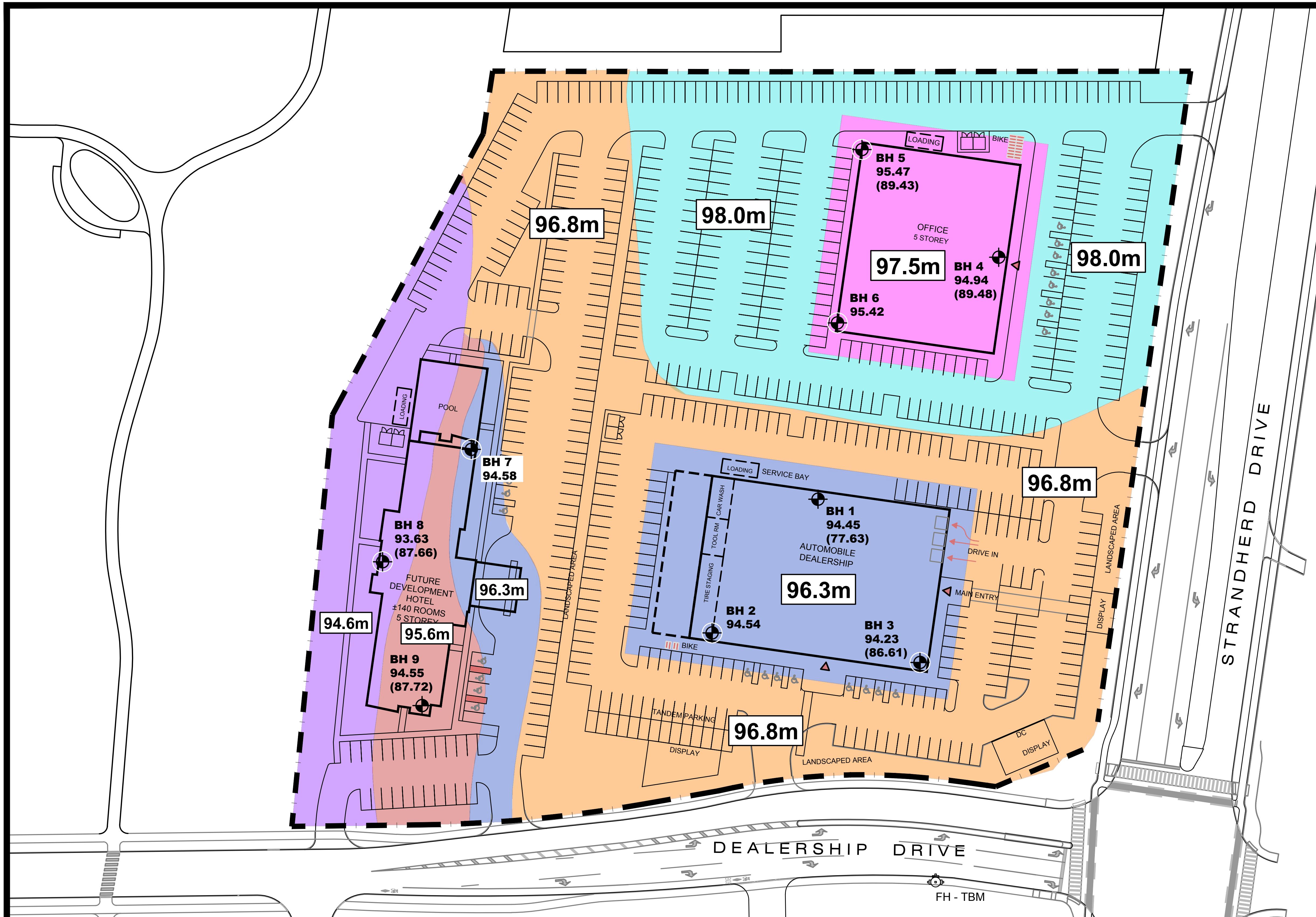
As indicated previously the subject site is part of the Citi Gate Development. Design criteria and information for the Citi Gate Development is provided in a report entitled '*Citi Gate 416 Corporate Campus, Detailed Servicing and Stormwater Management Report (Phase 1)*' prepared by Novatech, dated January 9, 2015 (Citi Gate Phase 1 Report). The Citi Gate Phase 1 Report provides design criteria for the interior sites and designed the overall servicing systems including sanitary sewers, watermain and stormwater management systems. Each system is discussed in more detail in the appropriate sections of this report.

A geotechnical investigation was completed for the subject development and a report provided entitled 'Geotechnical Investigation Proposed Commercial Development 4149 Strandherd Drive Ottawa, Ontario' prepared by Paterson Group dated September 13, 2019. The report indicates there are some issues to be considered in the grading and servicing design due to the native soils present such as seepage barriers along sewer trenches to prevent potential groundwater lowering and subdrains at catchbasins to provide adequate drainage of the parking areas. There is also a grade raise restriction for this site. A more detailed sketch was provided by Paterson Group subsequent to the issuance of their report. The Permissible Grade Raise Plan (dwg PG5045-2) is included for reference. It should also be noted that an Environmental Activity and Sector Registry (EASR) may be required depending on groundwater levels at the time of construction.

5.0 WATER SERVICING

There is an existing 250mm diameter watermain located within the Dealership Drive right-of-way and an existing 400mm diameter watermain located within the Strandherd Drive right-of-way. It is proposed to service the site with a 200mm diameter private watermain connecting to the existing 250mm diameter watermain along Dealership Drive as recommended in the Citi Gate Phase 1 Report. The proposed service will provide water servicing to all three (3) of the proposed buildings. Refer to the General Plan of Services (117148-GP) for further details.

Design criteria for the watermain design was taken from the Citi Gate Phase 1 Report (which references the City of Ottawa Water Distribution Guidelines) and the Ontario Building Code. The above design criteria was used to calculate the theoretical water demands for the existing and proposed development. The demand calculations are based on flow requirements from the different uses proposed which include: an automobile dealership, 6-storey hotel and 5-storey office building. A summary of the proposed development demands is provided in **Table 5.1**.



LEGEND:

- ⌖ BOREHOLE LOCATION
- 94.45 GROUND SURFACE ELEVATION (m)
- (77.63) PRACTICAL REFUSAL TO DCPT / AUGERING ELEVATION (m)

TBM - TOP SPINDLE OF FIRE HYDRANT. GEODETIC ELEVATION = 96.22m, PROVIDED BY STANTEC GEOMATICS LIMITED.

NOTE THAT THE ELEVATIONS AND AREAS PROVIDED HEREIN ARE BASED ON CURRENT SITE PLAN LAYOUT. SHOULD THE SITE PLAN LAYOUT BE REVISED, THIS PERMISSIBLE GRADE RAISE PLAN WILL REQUIRE REVISION

SCALE: 1:1000

0 10 20 30 40 50m 75m

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

MYERS AUTOMOTIVE GROUP

GEOTECHNICAL INVESTIGATION
PROP. COMMERCIAL DEVELOPMENT - 4149 STRANDHERD DRIVE

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:1000	Date: 09/2019
Drawn by: RCG	Report No.: PG5045-1
Checked by: NC	PG5045-2
Approved by: DJG	Revision No.:

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11x17

Table 5.1: Proposed Development Water Demand Summary

	Dealership	Hotel	Office	Totals
Floor Area (m^2)	N/A	N/A	8000	8000
No. Beds	N/A	170	N/A	170
Restaurant Seats	N/A	200	N/A	200
Carwash (cars/day)	55	N/A	N/A	55
Car Service (cars/day)	50	N/A	N/A	50
Employees	50	N/A	N/A	50
Total Daily Volume (Liters)	27,750	83,250	64,516	155,516
Avg. Day Demand (L/s)	0.321	0.732	0.747	1.80
Max Day Demand (L/s)	0.482	1.098	1.120	2.70
Peak Hour Demand (L/s)	0.867	1.977	2.016	4.86

The required fire demand was calculated using the Fire Underwriters Survey (FUS) Guidelines. The fire demand was calculated for each building in the proposed ultimate condition. The FUS calculations indicate that the proposed office building at 200 L/s is governing fire flow for the proposed development. This is based on assumptions in terms of the adjacent development and the potential proximity of any future buildings.

The proposed development is to be sprinklered with private hydrants on-site to provide fire protection. The hydrant locations are depicted on the General Plan of Services (117148-GP).

This water demand information was compared to the flows, and pressures calculated for the site within the Citigate Report. The 4149 Strandherd site is denoted as node 18. The Citi Gate Report assumed that the site would be connected to the existing 250mm diameter watermain under Dealership Drive, and would have a water demand of 50,000 l/ha/d. The values for node 18 were input into the hydraulic model EPANET for analyzing the performance of the proposed and existing watermain systems for three theoretical conditions: 1) High Pressure check under Average Day conditions 2) Peak Hour demand 3) Maximum Day + Fire Flow demand. Refer to **Table 5.2** for a summary of the design considerations, and **Table 5.3** for the results of the hydraulic water model within the Citi Gate Report.

Table 5.2: Citi Gate Design Summary

	Node 18
Total Daily Volume (Liters)	112,320
Avg. Day Demand (L/s)	1.30
Max Day Demand (L/s)	1.94
Peak Hour Demand (L/s)	3.50

Table 5.3: Citi Gate Water Analysis Results Summary

Condition	Service Connection Location	Demand (L/s)	Min/Max Allowable Operating Pressures (psi)	Phase 1 Limits of Design Operating Pressures (psi)
High Pressure	Node 18	1.30	80psi (Max)	84.5
Maximum Daily Demand and Fire Flow	Node 18	166	20psi (Min)	46.0
Peak Hour	Node 18	3.50	40psi (Min)	74.4

As can be seen in the above table the proposed design values and those assumed within the Citi Gate design are comparable. The available flows and pressures at node 18 were all above the minimum requirements during the Phase 1 and current design scenarios. Any differences within the flows can be accommodated in the existing system and it is anticipated that flows will not drop below the minimum allowable operation pressure.

It should be noted that due to the water pressures being above the maximum of 80 psi, it is suggested that a pressure reducing valve be installed at the property limits to prevent high pressures within the private watermain system.

Therefore, based on the preceding analysis it can be concluded that the watermain, as designed, will provide adequate system pressures for the fire flow + maximum day demand and peak hour demand. Refer to **Appendix A** for detailed model results, schematics of the model and boundary conditions.

6.0 SANITARY SERVICING

There is an existing 450mm diameter sanitary sewer along Dealership Drive and a 525mm diameter sanitary sewer along Strandherd Drive. It is proposed to service the development with a private 200mm diameter sanitary sewer connecting to the existing 450mm diameter sanitary sewer along Dealership Drive as recommended in the Citi Gate Phase 1 Report. Refer to the General Plan of Services (117148-GP) for more details.

The Citi Gate Phase 1 Report calculated sanitary flows for Block 4 based on the following criteria:

- Site Area = 3.39ha
- Design Sanitary Flow = 50,000L/ha/d (Commercial/Institutional Flow Rate)
- Peaking Factor =1.5
- Infiltration Rate = 0.28L/s/ha
- Outlet: 450mm Dealership Street sanitary sewer

The Sanitary Sewer Design Sheet provided in the Citi Gate Phase 1 Report shows the sanitary flows for the Block 4 area are calculated to be 3.89 L/s. A copy of the sanitary drainage area plans and sanitary sewer design sheet from the Citi Gate Phase 1 Report is included in **Appendix B** for reference.

The sanitary flows can be calculated based on the development proposal. The flows are calculated based on use and a total theoretical peak sanitary flow for the proposed development is calculated to be 3.9 l/s. This flow is equal to the flow as calculated in the Citi Gate Phase 1 Report therefore, the existing infrastructure has adequate capacity for the proposed development. Refer to **Appendix B**, for the detailed calculations and a sanitary sewer design sheet.

7.0 STORM SERVICING

A private storm sewer system (ranging in size from 300mm diameter to 900mm diameter) will be constructed to service the proposed development. The storm sewers are part of a stormwater management system where orifice controls are used to control the release of stormwater prior to outletting from the site. The underground storm sewer system will store as well as convey stormwater. As indicated in the Citi Gate Phase 1 Report, the private storm sewer system will outlet to the existing Stormceptor STC-4000 unit at the northwest corner of the site which outlets to the existing O'Keefe Drain. Refer to the General Plan of Services (117148-GP) for more details.

The storm sewers comprising the minor system have been design based on the criteria outlined in the Ottawa Sewer Design Guidelines using the principals of dual drainage. The design criteria used in sizing the storm sewers are summarized in **Table 7.1**. The corresponding Stormwater Management Plan (Drawing 117148-SWM) is provided in **Appendix E**.

Table 7.1: Storm Sewer Design Parameters

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

8.0 STORM DRAINAGE AND STORMWATER MANAGEMENT

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

8.1 Stormwater Management Criteria and Objectives

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

- Provide a dual drainage system (i.e. minor and major system flows);
- Maximize the use of rooftop and surface storage available on site;
- Control the runoff to the O'Keefe Drain to the allowable release rates Specified in **Section 8.1.1** using on-site storage;
- Ensure that no surface ponding will occur on the paved surfaces (i.e., private drive aisles or parking lots) during the 2-year storm event;
- Ensure that ponding is confined within the parking areas at a maximum depth of 0.35 m for both static ponding and dynamic flow;
- Provide on-site water quality control equivalent to an 'Enhanced' Level of Protection (80% long-term TSS removal), as required by the Conservation Authority; and,
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

8.1.1 Allowable Release Rate

As outlined in the Citi Gate Phase 1 Report the private sites to the east of the O'Keefe Drain are to be designed to provide sufficient on-site storage to ensure that peak flows are maintained to below pre-development levels at all stages of development. The per-hectare release rates and on-site storage requirements were estimated based on an average imperviousness of 85%. Refer to allowable release rates provided in **Table 8.1**; excerpts provided in **Appendix C**.

Table 8.1: Allowable Release Rates & Required On-Site Storage

Design Event	Release Rate*	
	(L/s/ha)	(L/s)
2-yr Event	20	64.6
5-yr Event	35	113.1
10-yr Event	45	145.4
25-yr Event	64	206.7
50-yr Event	75	242.3
100-yr Event	126	407.0

** Based on 85% imperviousness*

8.2 Proposed Conditions

Storm servicing for the site will be provided using a dual drainage system: Runoff will be stored and conveyed by underground storage chamber systems (minor system), while flows from large storm events which exceed the capacity of the minor system will be conveyed overland along defined overland flow routes (major system). Water quality treatment will be provided by the existing water quality unit (Stormceptor STC-4000) located in the northwest corner of the site. Runoff from the site will be controlled before discharging to the O'Keefe Drain.

8.2.1 Quantity Control

Peak flows to the O'Keefe Drain will be controlled using inlet control devices (ICDs) sized to restrict the flows from the site to the allowable release rates, specified in **Section 8.1.1**, for each storm event.

Underground Storage

As the allowable release rates for each storm event are quite restrictive, underground storage will be required to attenuate runoff from the site. Underground storage will be provided using Stormtech SC-740 arch-type chambers (or approved equivalent), which are covered in 50mm dia. (D_{50}) clearstone. The chambers will be installed under the parking areas immediately upstream the ICDs. A total of 256 storage chambers will provide 543 m^3 of storage. Refer to **Appendix D** for further details. The proposed layout of underground storage chambers is shown on the General Plan of Services (drawing 117148-GP). A Tideflex checkmate in-line check valve will be installed immediately upstream the outlet pipe to prevent backflow from the O'Keefe Drain (refer to **Appendix C**).

Surface Storage

The stage-storage curves for each inlet were calculated based on the proposed Grading Plan (drawing 117148-GR). The total surface storage at each inlet is provided in **Appendix D**. Approximately 826 m^3 of total surface storage is available within the low-points of the parking area. The parking areas have been designed to store runoff from storms that exceed the capacity of the underground storage chambers at each inlet. The site has been graded to ensure that ponding is confined within the parking areas at a maximum depth of 0.35 m (static ponding + dynamic flow). Overland flow paths have been provided to ensure that runoff from extreme storm events that exceed the available storage can be safely directed towards the O'Keefe Drain.

8.2.2 Quality Control

As previously discussed, a water quality unit was designed and constructed at the northwest corner of the site to achieve the Quality Control requirements. The installed treatment unit was a Stormceptor STC-4000. This unit was sized assuming a drainage area of 3.67 ha and an imperviousness of 85%. The proposed site has a drainage area of 3.26 ha and an imperviousness of 90%. The proposed site has a smaller drainage area, but higher imperviousness. When comparing the area x % impervious values the proposed site is less than what was previously allocated, as shown below:

Parameter	*Phase 1 Design:*	*Current Design:*
Drainage Area	3.67 ha	3.26 ha
% Impervious	85%	90%
Impervious Area	3.12 ha	2.93 ha

This reduced impervious area means that the Stormceptor STC-4000 will continue to provide an enhanced level of treatment corresponding to 80% long-term TSS removal. The previous design calculations for the Stormceptor STC-4000 have been included in **Appendix C.**

8.3 Hydrologic and Hydraulic Modelling

The *City of Ottawa Sewer Design Guidelines* (October 2012) requires hydrologic modeling for all dual drainage systems. The performance of the proposed storm drainage system for the site was evaluated using the PCSWMM hydrologic/ hydraulic model.

The PCSWMM model schematics and 100-year model output data are provided in **Appendix D**. Digital copies of the modeling files and model output for all storm events are provided on the enclosed CD.

8.3.1 Design Storms

The hydrologic analysis was completed using the following synthetic design storms: the 3-hour Chicago and the 12-hour SCS Type II storms for return periods of 2-year, 5-year, 10-year, 25-year, 50-year, 100-year and 100-year (+20%). The IDF parameters used to generate the design storms were taken from the *City of Ottawa Sewer Design Guidelines* (October 2012).

The 3-hour Chicago distribution generates the highest peak flows for both the minor and major systems and was determined to be the critical storm distribution for the design of the storm drainage system.

The proposed drainage system has also been stress tested using a 3-hour Chicago design storm that has a 20% higher intensity and total volume compared to the 100-year event.

8.3.2 Model Development

The PCSWMM model has been developed to account for both minor and major system flows from site, adhere to the allowable release rates and ensure no adverse impacts on the O'Keefe Drain. The results of the analysis were used to:

- Determine the total major and minor system runoff from the site;
- Determine the required underground storage volume;
- Calculate the storm sewer hydraulic grade line for the 100-year storm event; and,
- Evaluate overland flow depths and ponding volumes during the 100-year event.

Although the site is to be developed in three (3) phases (Buildings A, B, and C), the model was built assuming full build-out of the site and includes all three (3) phases of the proposed development. This was done to properly size the required underground storage chambers and ICDs, as they are to attenuate and control the runoff from all phases of development. ICDs in each phase were sized independently.

Infiltration

Infiltration losses for all catchment areas were modeled using Horton's infiltration equation, which defines the infiltration capacity of soil over the duration of a precipitation event using a decay function that ranges from an initial maximum infiltration rate to a minimum rate as the storm progresses. The default values as specified in the Sewer Design Guidelines were used for all catchments.

Horton's Equation:	Initial infiltration rate: f_o = 76.2 mm/hr
$f(t) = f_c + (f_o - f_c)e^{-k(t)}$	Final infiltration rate: f_c = 13.2 mm/hr
	Decay Coefficient: k = 4.14/hr

Depression Storage

The default values for depression storage in the City of Ottawa were used for all catchments.

- Depression Storage (pervious areas): 4.67 mm
- Depression Storage (impervious areas): 1.57 mm

The rooftops assumed to provide no depression storage (zero-impervious parameter).

Equivalent Width

'Equivalent Width' refers to the width of the sub-catchment flow path. This parameter (Table 5.1) is calculated as described in the *Sewer Design Guidelines, October 2012, Section 5.4.5.6*. The flow path lengths are shown on the PCSWMM model schematics provided in **Appendix D**.

Impervious Values

Runoff coefficients for each subcatchment area were determined based on the proposed site plan. Refer to the Stormwater Management Plan (117148-SWM) for details. Percent impervious values were calculated using the following formula:

$$\%imp = \frac{c - 0.2}{0.7}$$

Storm Drainage Areas

For modeling purposes, the site has been divided into subcatchments based on the drainage areas tributary to each inlet of the proposed storm sewer system. The subcatchment areas are shown on the Stormwater Management Area Plan (drawing 117148-SWM) in **Appendix E**.

The hydrologic modeling parameters for each subcatchment were developed based on the Site Plan (**Figure 3**) and the Stormwater Management Plan specified above. Subcatchment parameters are provided in **Appendix D**.

8.3.3 Minor System Design and Analysis

The following sections outline the model parameters and results of the PCSWMM model, pertaining to the minor system (storm sewers).

Inlet Controls

Inflows to the storm sewer were modeled based on the characteristics of each inlet. All the catchbasins in the parking area are located at low points. Inflows to the storm sewer are based on the ICD specified for the inlet and the maximum depth of ponding. ICDs have been sized to limit the outlet peak flows to the allowable release rates for each area. Details are outlined as follows in Table 8.2. ICD information is indicated on the General Plan of Services (drawing 117148-GP). Documentation on the Tempest LMF ICDs are provided in **Appendix C**.

Table 8.2: Orifice Parameters

Structure	ICD Size & Release Rate*						
	Tempest LMF ICD Size	T/G (m)	Orifice Invert (m)	100-year Head (m)	2-yearr Peak Flow (L/s)	5-year Peak Flow (L/s)	100-year Peak Flow (L/s)
CB05	Vortex 62	95.50	93.63	2.05	2.8	4.7	4.8
CB11	Vortex 70	95.50	93.88	1.89	3.6	5.6	5.9
CBMH01	Vortex 94	95.40	93.42	2.14	5.5	6.2	11.1
CBMH04	Vortex 94	95.60	93.59	2.22	6.9	10.9	11.3
CBMH09	Vortex 78	95.45	93.82	1.87	4.1	4.9	7.2
CBMH13	Vortex 70	95.45	93.90	1.79	3.7	5.5	5.7
CBMH15	Vortex 70	95.50	93.79	1.94	5.4	5.8	6.0
CBMH20	Vortex 70	95.40	93.97	1.57	2.9	3.3	5.3
CBMH23	Vortex 70	95.40	93.95	1.66	3.1	3.4	5.5

**From PCSWMM model.*

Roof Drains

The proposed rooftops were simulated in PCSWMM based on an outlet rating curve for the proposed Watts roof drains and using a storage node to represent the available storage provided by the roof surface. It has been assumed that the roofs will have one roof drain for every 250 m^3. The Watts roof drains are to be set at ¾ open, giving the flow rates outlined in **Table 8.3** for a single drain (converted from inches and gallons per minute). For modeling purposes, a single outlet link for each roof has been used.

Table 8.3: Watts Roof Drain Rating Curve

Head (m)	Controlled Flow Rate (L/s)			
	Single Drain*	Building 'A' (11 drains)	Building 'B' (6 drains)	Building 'C' (8 drains)
0.000	0.00	0.00	0.00	0.00
0.025	0.32	3.52	1.92	2.56
0.051	0.63	6.93	3.78	5.04
0.076	0.87	9.57	5.22	6.96
0.102	1.10	12.10	6.60	8.80
0.127	1.34	14.74	8.04	10.72
0.150	1.58	17.38	9.48	12.64
1.000	1.58	17.38	9.48	12.64

**Watts Flow Control Roof Drains Rating Curve (single drain)*

The available storage and flow rating curve for the roof drains has been multiplied by the number of drains on each roof, and the storage lumped into a single storage node. Approximately 195 m^3, 98 m^3, and 135 m^3 of storage can be provided by the Building A, B, and C rooftops, respectively. This assumes that storage is provided for 50% of the roof area. **Table 8.4** summarizes the controlled post-development design flows from the building rooftop, the maximum anticipated ponding depths, storage volumes required, and the storage volumes provided for the 5-year and 100-year storm events.

Table 8.4: Roof Drain Design Flow (4 Drains)

Area ID	Roof Drain Type	Setting	No. of Drains	1:5 - Year Event			1:100 - Year Event		
				Head (m)	Flow (L/s)	Vol (m^3)	Head (m)	Flow (L/s)	Vol (m^3)
Building 'A'	Watts Roof Drains - Adjustable	3/4 Open	11	0.09	13.3	39	0.15	17.4	105
Building 'B'	Watts Roof Drains - Adjustable	3/4 Open	6	0.09	7.2	19	0.15	9.5	51
Building 'C'	Watts Roof Drains - Adjustable	3/4 Open	8	0.09	9.6	26	0.15	12.6	71

As shown in **Table 8.4**, the roofs will provide sufficient storage for all storm events, with the exception of the stress test event. During the 100-year (+20%) event, flows exceeding the available storage will overflow through the scuppers and onto the ground surface below and will be conveyed to storm sewer inlets via the major system flow routes.

Peak Flows

The overall release rates from, the ICDs and rooftop outlets were added to determine the overall release rate from the site. The results of this analysis indicate that the allowable release rates will be met for each storm event. Refer to **Appendix D** for the modelled peak flows for each storm event.

The results of the PCSWMM analysis indicate that outflows from the proposed development will not exceed the allowable release rate for all storm events. The ICDs at each control structure were sized to control peak flows to the 2-year allowable release rate. As such, storm events exceeding the 2-year storm are overcontrolled. This results in higher storage requirements.

Hydraulic Grade Line

The results of the analysis were used to determine if there would be any surcharging from the storm sewer system during the 100-year storm event. **Appendix D** provides a summary of the 100-year HGL elevation at each storm manhole within the proposed development, as well as a summary of the HGL elevations for a 20% increase (rainfall intensity and total precipitation) in the 100-year design event. The results of the HGL analysis and the stress testing indicates that the storm sewer does not surcharge during the 100-year event and 100-year+20% storm event.

8.3.4 Major System Design and Analysis

The major system network was evaluated using the PCSWMM model to ensure that the ponding depths conform to City standards. A summary of ponding depths at each inlet for the 2-year, 5-year, 100-year and 100-year (+20%) events are provided in **Appendix D**. The maximum static and dynamic ponding depths are less than 0.35m during all events, thereby meeting the major system criteria.

9.0 EROSION AND SEDIMENT CONTROL

Temporary erosion and sediment control measures will be implemented during construction. Silt fence, mud mats and filter bags in catchbasins will be used as erosion and sediment control measures.

Erosion and sediment control measures should be inspected daily and after every rain event to determine maintenance, repair or replacement requirements. Sediments or granulars that enter site sewers shall be removed immediately by the contractor. These measures will be implemented prior to the commencement of construction and maintained in good order until vegetation has been established. Refer to the Erosion and Sediment Control Plan (drawing 117148-ESC) for additional information.

10.0 CONCLUSIONS AND RECOMMENDATIONS

- A private 200mm diameter watermain will connect to the existing private 250mm diameter watermain in Dealership Drive to service the proposed development. The existing and proposed watermain infrastructure will provide domestic flows and fire protection to service the proposed development.
- A private 200mm diameter sanitary sewer will connect to the existing 450mm diameter sanitary sewer along Dealership Drive to service the proposed development. The existing infrastructure has adequate capacity to service the proposed development.
- Runoff from the parking lots will be controlled with inlet control devices. There will be no surface ponding in the 2-year design event, and a maximum of 0.27m of surface ponding in the 100-year design event.
- Runoff from building rooftops will be controlled by Watts flow control roof drains prior to discharging to the proposed storm sewer network.
- The total post-development site flow will be approximately 63.6 L/s during the 2-year design event, which does not exceed the 2-year allowable release rate of 64.6 L/s. Storm events greater than the 2-year event are overcontrolled.
- Quality control of stormwater is provided from the existing Stormceptor STC-4000 located in the northwest corner of the site prior to outletting stormwater to the O'Keefe Drain. This unit was designed to provide an enhanced level of water quality treatment for the Block 4 site.
- An overland flow route is provided to the O'Keefe Drain.
- Erosion and sediment control measures will be implemented prior to and during construction.

NOVATECH

Prepared by:

Anthony Mestwarp, P.Eng.
Project Engineer
Land Development Engineering

Reviewed by:

Cara Ruddle, P.Eng.
Senior Project Manager
Land Development Engineering

Stormwater Design Prepared by:

Melanie Schroeder, B.A.Sc., E.I.T.
Water Resources

Stormwater Design Reviewed by:

Conrad Stang, M.A.Sc., P.Eng.
Project Manager, Water Resources

Appendix A:
Water Servicing Information

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Engineers, Planners & Landscape Architects

Proposed Development Conditions

	Office	Hotel	Dealership	Totals
Total Floor Area (m^2)	8000	N/A	N/A	
No. Beds	N/A	170	N/A	
Restaurant Seats	N/A	200	N/A	
Carwash	N/A	N/A	55	
Car Service	N/A	N/A	50	
Employees	N/A	N/A	50	
Lot Area (ha)			1.19	
Total Daily Volume (Liters)	64516.1	63250.0	27750	155516.1
Avg Day Demand (L/s)	0.747	0.732	0.321	1.80
Max Day Demand (L/s)	1.120	1.098	0.482	2.70
Peak Hour Demand (L/s)	2.016	1.977	0.867	4.86

Establishment	Daily Demand Volume		Source
Office:	75	l/9.3m² /day	Daily Demands from OBC Table 8.2.1.3
Hotel:	225	l/bed/day	City of Ottawa Sewer Design Guidelines
	125	l/restaurant seat/day	
Industrial/Commercial:	28000	l/ha/day	
Car Wash	400	l/veh/day	(Truck wash of 400 l/vehicle/d to achieve a conservative value)
Car Service:	40	l/car serviced/day	
Employee	75	l/person/day	
Retail:	6	l/parking space/day	
	40	l/employee/day	
	2000	l/toilet room/day	

Commercial / Industrial Peaking Factors City of Ottawa Water Distrubution Guidelines

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

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #:	117148
Project Name:	4149 Strandherd
Date:	9/18/2019
Input By:	Anthony Mestwarp
Reviewed By:	Project Manager

Legend: Input by User; No Information or Input Required

Building Description: Dealership

Non-combustible construction

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame		1.5	0.8	
		Ordinary construction		1		
		Non-combustible construction	Yes	0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	3583			
		Number of Floors/Storeys	1			
		Area of structure considered (m^2)			**3,583**	
	F	**Base fire flow without reductions**				**11,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	0%	**11,000**
		Limited combustible		-15%		
		Combustible	Yes	0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-4,400**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	30.1- 45 m		5%	**550**
		East Side	> 45.1m		0%	
		South Side	> 45.1m		0%	
		West Side	> 45.1m		0%	
				Cumulative Total	**5%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**7,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**117**
				or	USGPM	1,849
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	840

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #:	117148
Project Name:	4149 Strandherd
Date:	9/18/2019
Input By:	Anthony Mestwarp
Reviewed By:	Project Manager

Legend: Input by User; No Information or Input Required

Building Description: 6 Storey Hotel
Non-combustible construction

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame		1.5	0.8	
		Ordinary construction		1		
		Non-combustible construction	Yes	0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	1013			
		Number of Floors/Storeys	6			
		Area of structure considered (m^2)			**6,078**	
	F	**Base fire flow without reductions** $F = 220\ C\ (A)^{0.5}$				**14,000**
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	0%	**14,000**
		Limited combustible		-15%		
		Combustible	Yes	0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-5,600**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	> 45.1m		0%	**0**
		East Side	> 45.1m		0%	
		South Side	> 45.1m		0%	
		West Side	> 45.1m		0%	
				Cumulative Total	**0%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**8,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**133**
				or	USGPM	2,114
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2
		Required Volume of Fire Flow (m^3)			m^3	960

FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

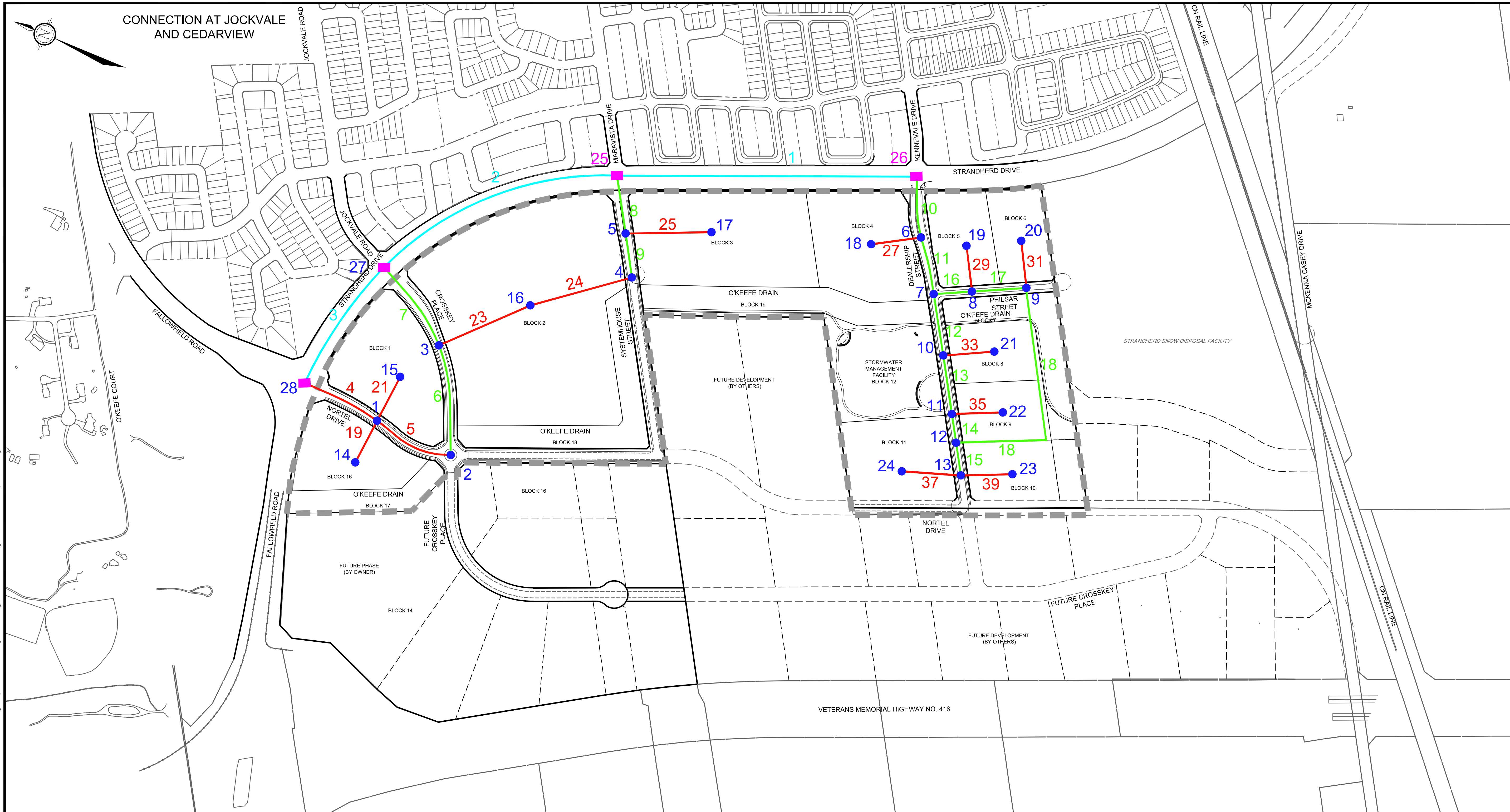
NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117148
Project Name: 4149 Strandherd
Date: 9/18/2019
Input By: Anthony Mestwarp
Reviewed By: Project Manager

Legend: Input by User; No Information or Input Required

Building Description: 5 Storey Office Building
Non-combustible construction

Step			Input		Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**			**Multiplier**		
	Coefficient related to type of construction C	Wood frame		1.5	0.8	
		Ordinary construction		1		
		Non-combustible construction	Yes	0.8		
		Modified Fire resistive construction (2 hrs)		0.6		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	1600			
		Number of Floors/Storeys	5			
		Area of structure considered (m^2)			**8,000**	
	F	**Base fire flow without reductions**				**16,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**			**Reduction/Surcharge**		
	(1)	Non-combustible		-25%	0%	**16,000**
		Limited combustible		-15%		
		Combustible	Yes	0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**			**Reduction**		
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-6,400**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**				**Surcharge**	
	(3)	North Side	20.1 - 30 m		10%	**2,400**
		East Side	> 45.1m		0%	
		South Side	30.1- 45 m		5%	
		West Side	> 45.1m		0%	
				Cumulative Total	**15%**	
Results						
6	**(1) + (2) + (3)**	**Total Required Fire Flow, rounded to nearest 1000L/min**			**L/min**	**12,000**
		(2,000 L/min < Fire Flow < 45,000 L/min)		or	L/s	**200**
				or	USGPM	3,170
7	**Storage Volume**	Required Duration of Fire Flow (hours)			Hours	2.5
		Required Volume of Fire Flow (m^3)			m^3	1800



LEGEND

9 — PROPOSED FEEDERMAIN (250mm dia) AND PIPE NUMBER	6 ● WATERMAIN NODE AND NUMBER
6 — PROPOSED DISTRIBUTION WATERMAIN (200mm dia) AND PIPE NUMBER	2 ■ RESERVOIR AND NUMBER (BOUNDARY CONDITION LOCATION)
5 — PROPOSED BACKBONE WATERMAIN (400mm dia) BY OTHERS AND PIPE NUMBER	3 — EXISTING DISTRIBUTION / FEEDERMAIN (300mm dia) AND PIPE NUMBER
	PHASE LINE (PHASE 1)

NOVATECH
ENGINEERING CONSULTANTS LTD.
ENGINEERS & PLANNERS
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada
K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Email: novainfo@novatech-eng.com

CITI GATE
416 CORPORATE CAMPUS

Water Servicing
(Phase 1)

SCALE	DATE	JOB	FIGURE
N.T.S	AUG 2014	109203-CG	FIG D1

SHT11X17.DWG - 279mmX432mm

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CITI GATE - 416 Corporate Campus
HYDRAULIC ANALYSIS

JOB NO. 109203

Table 2
Phase 1
Water Demand

Node	Block #	Area (ha)	Demand (L/s)		
			High Pressure (Average Day)	Max. Daily	Peak Hour
14	16	2.2	0.89	1.34	1.60
15	1	3.7	1.50	2.25	2.70
16	2	12.2	4.94	7.41	8.90
17	3	6.2	2.51	3.77	4.52
18	4	3.2	1.30	1.94	2.33
19	5	1.8	0.73	1.09	1.31
20	6	1.6	0.65	0.97	1.17
21	8	1.3	0.53	0.79	0.95
22	9	1.3	0.53	0.79	0.95
23	10	3.0	1.22	1.82	2.19
24	11	3.0	1.22	1.82	2.19
			16.00	24.00	28.80

Notes:

1. All water demand calculations based on the City of Ottawa Design Guidelines for Water Distribution Table 4.2.
2. Water Demand is based assuming all lands to be Industrial - Light with a demand of 35,000L/gross ha/d.
3. Peaking Factors: Maximum Daily Demand = 1.5 average daily demand (High Pressure); Peak Hour = 1.8 average daily

Prepared By:
NOVATECH ENGINEERING CONSULTANTS LTD.
Date: August 9, 2012
Rev: November 20, 2012
Rev: August 9, 2013
Rev: March 31, 2014
Rev: August 6, 2014

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CITI GATE - 416 Corporate Campus
HYDRAULIC ANALYSIS

JOB NO. 109203

Table 3
Phase 1
Peak Hour Check

Node	Block #	Elevation (m)	Demand (LPS)	Head (m)	Pressure (m)	Pressure (PSI)
1		95.0	0.0	148.1	53.1	75.3
2		96.0	0.0	148.0	52.1	73.8
3		96.2	0.0	148.0	51.8	73.4
4		95.7	0.0	147.7	52.0	73.7
5		96.1	0.0	147.7	51.7	73.2
6		94.1	0.0	147.5	53.4	75.8
7		93.9	0.0	147.5	53.6	76.0
8		93.5	0.0	147.5	54.1	76.7
9		92.4	0.0	147.5	55.1	78.1
10		94.0	0.0	147.5	53.5	75.9
11		94.0	0.0	147.5	53.5	75.9
12		93.8	0.0	147.5	53.7	76.1
13		94.0	0.0	147.5	53.5	75.9
14	16	96.0	1.6	148.1	52.1	73.9
15	1	96.0	2.7	148.1	52.1	73.9
16	2	97.2	8.9	147.7	50.5	71.7
17	3	97.1	4.5	147.7	50.6	71.8
18	4	95.1	2.3	147.5	52.4	74.4
19	5	94.5	1.3	147.5	53.0	75.2
20	6	93.5	1.2	147.5	54.0	76.6
21	8	95.0	1.0	147.5	52.5	74.5
22	9	95.0	1.0	147.5	52.5	74.4
23	10	95.0	2.2	147.5	52.5	74.4
24	11	95.3	2.2	147.5	52.2	74.0
25*		147.7	28.4	147.7	0.0	0.0
26*		147.6	18.2	147.6	0.0	0.0
27*		148.0	22.8	148.0	0.0	N/A
28*		148.2	-98.2	148.2	0.0	N/A

*** Boundary Condition**

Minimum Pressure (shaded: node 16, 71.7 PSI)

Prepared By:
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Date: August 9, 2012
Rev: November 20, 2012
Rev: August 9, 2013
Rev: March 31, 2014
Rev: July 18, 2014
Rev: August 6, 2014

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Table 4
Phase 1
High Pressure Check (Average Day)

Node	Block #	Elevation (m)	Demand (LPS)	Head (m)	Pressure (m)	Pressure (PSI)	Age (hrs)
1		95.0	0.0	154.6	59.6	84.5	1.2
2		96.0	0.0	154.7	58.7	83.3	0.9
3		96.2	0.0	154.7	58.5	82.9	0.3
4		95.7	0.0	154.7	59.0	83.6	0.5
5		96.1	0.0	154.7	58.6	83.2	0.3
6		94.1	0.0	154.7	60.6	85.9	0.4
7		93.9	0.0	154.7	60.8	86.2	0.7
8		93.5	0.0	154.7	61.2	86.8	1.4
9		92.4	0.0	154.7	62.3	88.3	2.4
10		94.0	0.0	154.7	60.7	86.0	1.2
11		94.0	0.0	154.7	60.7	86.0	2.0
12		93.8	0.0	154.7	60.9	86.3	4.8
13		94.0	0.0	154.7	60.7	86.0	5.0
14	16	96.0	0.9	154.6	58.6	83.1	2.3
15	1	96.0	1.5	154.6	58.6	83.1	2.6
16	2	97.2	4.9	154.7	57.5	81.5	1.1
17	3	97.1	2.5	154.7	57.6	81.7	1.4
18	4	95.1	1.3	154.7	59.6	84.5	1.7
19	5	94.5	0.7	154.7	60.2	85.3	3.3
20	6	93.5	0.7	154.7	61.2	86.7	4.5
21	8	95.0	0.5	154.7	59.7	84.6	3.9
22	9	95.0	0.5	154.7	59.7	84.6	4.6
23	10	95.0	1.2	154.7	59.7	84.6	6.2
24	11	95.3	1.2	154.7	59.4	84.2	6.2
25*		154.7	-5.5	154.7	0.0	0.0	N/A
26*		154.7	-6.2	154.7	0.0	0.0	N/A
27*		154.7	-66.9	154.7	0.0	N/A	N/A
28*		154.6	62.6	154.6	0.0	N/A	N/A

*** Boundary Condition**

Maximum Pressure
Maximum Time

Prepared By:
NOVATECH ENGINEERING CONSULTANTS LTD.
Date: August 9, 2012
Rev: November 20, 2012
Rev: August 9, 2013
Rev: March 31, 2014
Rev: August 6, 2014

Table 5E
Phase 1
Max Daily Demand and Fire at Node 18 - Block 4

Node	Elevation (m)	Demand (LPS)	Head (m)	Pressure (m)	Pressure (PSI)
1	95.0	0.0	145.3	50.3	71.3
2	96.0	0.0	144.9	49.0	69.5
3	96.2	0.0	144.8	48.6	68.9
4	95.7	0.0	143.3	47.6	67.4
5	96.1	0.0	143.2	47.1	66.8
6	94.1	0.0	132.1	38.0	53.8
7	93.9	0.0	132.0	38.1	54.1
8	93.5	0.0	132.0	38.6	54.7
9	92.4	0.0	132.0	39.6	56.2
10	94.0	0.0	132.0	38.0	53.9
11	94.0	0.0	132.0	38.0	53.9
12	93.8	0.0	132.0	38.2	54.2
13	94.0	0.0	132.0	38.0	53.9
14	96.0	1.3	145.3	49.3	69.8
15	96.0	2.3	145.3	49.3	69.8
16	97.2	7.4	143.9	46.7	66.2
17	97.1	3.8	143.2	46.1	65.4
18	95.1	166.2	127.6	32.5	46.0
19	94.5	1.1	132.0	37.5	53.2
20	93.5	1.0	132.0	38.5	54.6
21	95.0	0.8	132.0	37.0	52.5
22	95.0	0.8	132.0	37.0	52.5
23	95.0	1.8	132.0	37.0	52.5
24	95.3	1.8	132.0	36.7	52.1
25*	143.1	37.8	143.1	N/A	N/A
26*	141.5	-42.7	141.5	N/A	N/A
27*	144.9	-8.2	144.9	N/A	N/A
28*	145.5	-175.2	145.5	N/A	N/A

*** Boundary Condition**

(shaded) Minimum Pressure

Prepared By:
NOVATECH ENGINEERING CONSULTANTS LTD.
Date: August 9, 2012
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Rev: March 31, 2014
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Table 5
Phase 1
Max Daily Demand and Fire Flow Summary

	Node		Fire Flow	Pressure	
Fire Location	**Block #**	**Min Pressure**	(LPS)	(m)	(PSI)
14	16	14	164.3	39.2	55.6
15	1	15	164.3	36.2	51.4
16	2	16	164.3	36.4	51.6
17	3	17	164.3	35.0	49.7
18	4	18	164.3	32.5	46.0
19	5	19	164.3	23.1	32.8
20	6	20	164.3	22.2	31.5
21	8	21	164.3	22.9	32.4
22	9	22	164.3	20.8	29.5
23	10	23	164.3	18.1	25.7
24	11	24	164.3	17.8	25.2

Melanie Riddell

From: Melanie Riddell
Sent: July-16-14 10:10 AM
To: Mark Bowen
Subject: FW: Strandherd Drive - 416 Lands Watermain Boundary Conditions

Melanie E. Riddell, P.Eng.
Project Manager

NOVATECH
Engineers, Planners & Landscape Architects

240 Michael Cowpland Drive, Suite 200, Ottawa ON K2M 1P6

Tel: 613.254.9643 Cel: 613.276.7240 Fax: 613.254.5867

From: Shillington, Jeffrey [mailto:jeff.shillington@ottawa.ca]
Sent: May-26-14 4:02 PM
To: Melanie Riddell
Subject: FW: Strandherd Drive - 416 Lands Watermain Boundary Conditions

Attached are the updated boundary conditions that should be used in the Citi Gate design.

Regards,

Jeff Shillington, P.Eng.
Project Manager, Infrastructure Approvals, Suburban West
Planning and Growth Management Department
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

From: Rogers, Christopher
Sent: January 28, 2014 11:00 AM
To: Shillington, Jeffrey; Diduch, Roman
Subject: RE: Strandherd Drive - 416 Lands Watermain Boundary Conditions

Jeff,

Here are boundary conditions, based on existing system plus proposed Strandherd 406mm watermain, from Fallowfield/O'Keefe to Kennevale only, with connections at Fallowfield, Jockvale, Maravista and Kennevale.

Regards,

Chris

Strandherd at Kennevale
PKHR = 147.6m
Max HGL = 154.7m
MXDY+Fire (125 L/s) = 143.7m
MXDY+Fire (165 L/s) = 141.5m

Strandherd at Marivista
PKHR = 147.7m
Max HGL = 154.7m
MXDY+Fire (125 L/s) = 144.9m
MXDY+Fire (165 L/s) = 143.1m

Strandherd at Jockvale
PKHR = 148.0m
Max HGL = 154.7m
MXDY+Fire (125 L/s) = 146.3m
MXDY+Fire (165 L/s) = 144.9m

Strandherd at Fallowfield
PKHR = 148.2m
Max HGL = 154.6m
MXDY+Fire (125 L/s) = 146.7m
MXDY+Fire (165 L/s) = 145.5m

From: Shillington, Jeffrey
Sent: 2014/01/07 11:57
To: Diduch, Roman
Cc: Rogers, Christopher
Subject: FW: Strandherd Drive - 416 Lands Watermain Boundary Conditions

Roman,

Please see the email from Novatech. Could you please confirm that the previously provided boundary conditions are still applicable.

Thanks,

Jeff Shillington, P.Eng.
Project Manager, Infrastructure Approvals, Suburban West
Planning and Growth Management Department
City of Ottawa
tel: 580-2424 x 16960
email: jeff.shillington@ottawa.ca

From: Drew Blair [mailto:D.Blair@novatech-eng.com]
Sent: December 18, 2013 1:04 PM
To: Shillington, Jeffrey
Cc: Marc St.Pierre
Subject: Strandherd Drive - 416 Lands Watermain Boundary Conditions

Hi Jeff,

Can you please confirm the watermain boundary conditions that will be utililized for the Strandherd Drive - 416 Lands project we are currently working on. Roman had provided watermain boundary conditions in 2012 (see below) however there may be some changes to the system since then. As per the attached plan, there will be four connection points for the proposed 400mm backbone watermain on Strandherd Drive:

1) Strandherd at Kennevale (stub size from Kennevale to be confirmed)
2) Strandherd at Maravista (stub size from Maravista to be confirmed)
3) Strandherd at Jockvale (400mm stub from Claridge Lands to be confirmed)
4) Strandherd at Fallowfield (400mm watermain will have to extend up Fallowfield to connect to 400mm stub at O'Keefe Court entrance)

We appreciate your help in providing this boundary condition information in order that we can update the hydraulic analysis for the Strandherd Drive project.

Regards,

Drew

Drew D. Blair, P.Eng.
Project Engineer
****

Novatech Engineering Consultants Ltd.
200 - 240 Michael Cowpland Drive
Kanata, Ontario K2M 1P6

Tel: 613.254.9643
Fax: 613.254.5867

From: Diduch, Roman [mailto:Roman.Diduch@ottawa.ca]
Sent: November-21-12 8:55 AM
To: Mark Bowen
Subject: RE: 416 Business Park Required Boundary Conditions

Mark
The boundary locations for the 2012 condition should be for Cobble Hill instead of Strandherd. The Cobble Hill @ Kennevale HGL for 165l/s fire for current conditions should have been 137.5 not 147.5 m. For the future condition the locations were at Strandherd because of the proposed 406mm watermain.

Fire flows were located at Strandherd @ Marvista.

The corrected table is shown below.

	HGL (Meter)		
Current			
	Cedarview @ Jockvale	Cobble Hill @ Marvista	Cobble Hill@ Kennevale
Peak Hr	151.5	150.8	150.6
Max Day & 125 l/s fire	149.0	139.0	141.6
Max Day & 165 l/s fire	149.0	133.0	**137.5**
	Cedarview @ Jockvale	Strandherd@ Marvista	Strandherd@ Kennevale
Future			
Peak Hr	151.5	150.8	150.6
Max Day & 125 l/s fire	149.1	148.1	148.2
Max Day & 165 l/s fire	149.0	147.0	147.5

Watermain sizes for the business park are governed by fire flow conditions. A 250mm pipe is an acceptable size.

I apologize for any confusion created.

Roman Diduch, P.Eng

Program Manager
Infrastructure Policy Unit
Planning and Growth Management
110 Laurier Ave. W, 4th Floor, Ontario K1P 1J1

tel: 613-580-2424 ext 22625
fax: 613-580-2459

From: Mark Bowen [mailto:M.Bowen@novatech-eng.com]
Sent: November 19, 2012 3:18 PM
To: Diduch, Roman
Cc: Mike Petepiece; John Riddell
Subject: RE: 416 Business Park Required Boundary Conditions

Hi Roman,

Reviewing the boundary conditions of the "Peak Hr" and "Max Day & 165 l/s fire" conditions for the "current" and "future" watermain conditions listed below, the HGL at Cedar/Jockville and Strandherd/Kennevale is exactly the same and the Strandherd/Marvista boundary is similar. Currently there is no watermain on Strandherd between Kennevale and Marvista. Can you please confirm the conditions provided below are accurate? In addition can you please confirm the City will accept the design of a business park with a maximum proposed watermain size of 250mm, assuming the watermain meets all design criteria for performance (i.e. operating pressures)?

Mark Bowen
Junior Engineer
****
Novatech Engineering Consultants Ltd.

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

Tel: (613) 254-9643 x 231
Fax: (613) 254-5867

http://www.novatech-eng.com

From: Diduch, Roman [mailto:Roman.Diduch@ottawa.ca]
Sent: Thursday, August 09, 2012 1:05 PM
To: Mark Bowen
Subject: RE: 416 Business Park Required Boundary Conditions

These boundary conditions were created with a different model and updated conditions from that previously provided to IBI

	HGL (Meter)		
Current	Cedarview @ Jockvale	Strandherd@ Marvista	Strandherd@ Kennevale
Peak Hr	151.5	150.8	150.6
Max Day & 125 l/s fire	149.0	139.0	141.6
Max Day & 165 l/s fire	149.0	133.0	147.5
Future			
Peak Hr	151.5	150.8	150.6
Max Day & 125 l/s fire	149.1	148.1	148.2
Max Day & 165 l/s fire	149.0	147.0	147.5

Roman Diduch, P.Eng

Program Manager
Infrastructure Policy Unit
Planning and Growth Management
110 Laurier Ave. W, 4th Floor, Ontario K1P 1J1

tel: 613-580-2424 ext 22625
fax: 613-580-2459

From: Mark Bowen [mailto:M.Bowen@novatech-eng.com]
Sent: August 08, 2012 2:57 PM
To: Diduch, Roman
Cc: Tremblay, Marc (PGM); John Riddell
Subject: 416 Business Park Required Boundary Conditions
Importance: High

Hi Roman,

Marc Tremblay and John Riddell have requested that I contact you directly for the required watermain boundary conditions for the proposed 416 Business Park in Barrhaven. The attached NECL PDF highlights the limits of the proposed site and connection points to the existing watermain.

For your reference I've attached the previously issued watermain boundary conditions to IBI for the Conceptual Site Servicing Report for the Tartan Lands in west Barrhaven (IBI.pdf). The first page of the IBI.pdf shows the location of IBI's site in relation to the proposed site and Standherd Drive. The second page shows the proposed watermain within IBI's site and the connections to the existing watermain. The third page highlights the City provided watermain boundary conditions.

The proposed site will be construction in phases over several years; therefore, can you please provide the existing and future (400mm w/m) boundary conditions for the proposed connection points to Strandherd Drive.

FYI – preliminary fire flow calculations range from 125L/s to 165L/s.

We are working towards submitting to the City this Friday so a quick response would be greatly appreciated. Don't hesitate to call if you have questions.

Regards,

Mark Bowen
Junior Engineer
****
Novatech Engineering Consultants Ltd.

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

Tel: (613) 254-9643 x 231
Fax: (613) 254-5867

http://www.novatech-eng.com

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Appendix B:
Sanitary Servicing Information

Project No. 117148
Project Name: 4149 Strandherd Drive
Project Location: 4149 Stranherd Drive, Ottawa

NOVATECH
Engineers, Planners & Landscape Architects

Date: October 2019

Sanitary Sewer Design Sheet

LOCATION			COMMERCIAL / INDUTRIAL FLOW						TOTAL PEAK FLOW (l/s)	PIPE					
AREA ID	FROM	TO	AREA (ha)	ACCUM AREA (ha)	PEAK FACTOR	PEAK FLOW (l/s)	ACCUM PEAK FLOW (l/s)	INFIL. FLOW (l/s)		PIPE SIZE (mm)	PIPE SLOPE (%)	LENGTH (m)	CAPACITY (l/s)	VELOCITY (m/s)	Q/Qfull
C	Office	MH 1	1.440	1.440	1.5	1.12	1.12	0.48	1.60	200	2.00	26.6	46.3	1.5	3.4%
	MH 1	MH 2	0.000	1.440	1.5	0.00	1.12	0.48	1.60	200	2.00	21.7	46.3	1.5	3.4%
	MH 2	MH 3	0.000	1.440	1.5	0.00	1.12	0.48	1.60	200	0.50	85.5	23.2	0.7	6.9%
A	Dealership	MH 3	1.180	1.180	1.5	0.57	0.57	0.39	0.96	200	2.00	19.1	46.3	1.5	2.1%
B	Hotel	MH 3A	0.750	0.750	1.5	1.10	1.10	0.25	1.35	200	2.00	18.5	46.3	1.5	2.9%
B	Hotel	MH 3	0.000	0.750	1.5	0.00	1.10	0.25	1.35	200	2.00	15.0	46.3	1.5	2.9%
	MH 3	MH 4	0.000	3.370	1.5	0.00	2.79	1.11	3.90	200	0.50	60.6	23.2	0.7	16.8%
	MH 4	MH 5	0.000	3.370	1.5	0.00	2.79	1.11	3.90	200	1.00	10.9	32.8	1.0	11.9%

Design Parameters:

Ontario Building Code (Table 8.2.1.3)		
Office per each 9.3m2 of floor space	75	l/9.3m² /day
City of Ottawa Sewer Design Guidelines (Appendix 4-A)		
- Avg Flow per Bed Space	225	l/bed/day
- Avg Flow per Retaurant Seat	125	l/seat/day
- Car Wash	200	l/car/day
- Truck Wash	400	l/truck/day
-Car Serviced per day	40	l/car/day
Employees	75	l/person/day
- Avg Commercial Flow	28000	l/ha/day
- Extraneous Flows	0.33	l/s/ha
- ICI Peaking Factor	1.5	

Office			Hotel		Dealership		
Gross Floor Area per floor	1600	m²	Number of beds	170 *	Carwash	55	cars/day*
Floors	5		Restaurant Seats	200 **	Car Service	50	cars/day*
Total area	8000	m²			Employees	50	*
Flow	0.75	l/s	Flow	0.73	Flow	0.32	
Flow (28000 l/ha/day)	0.47	l/s	Flow (28000 l/ha/day)	0.24	Flow (28000 l/ha/day)	0.38	

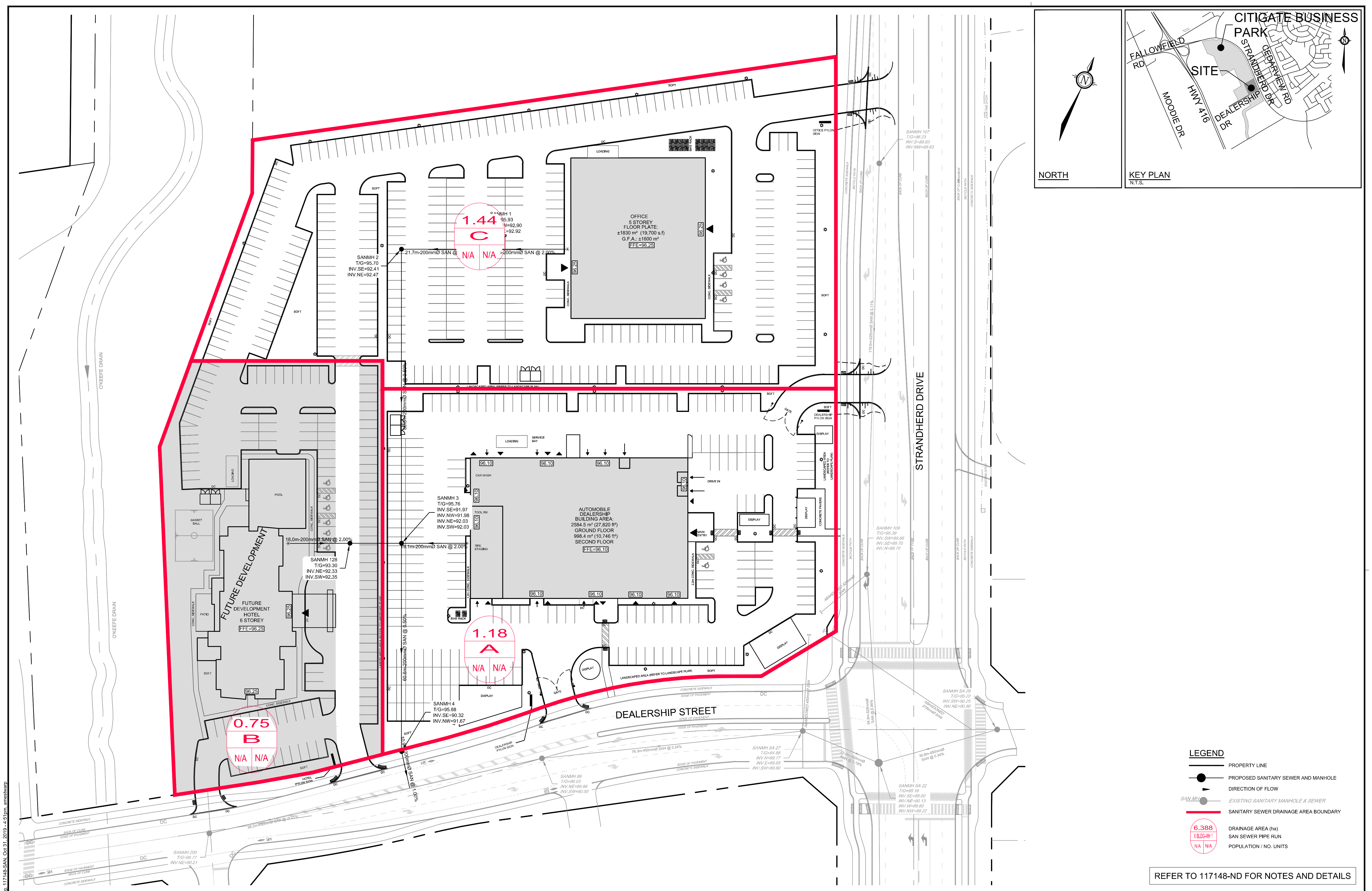
(Truck wash of 400 l/vehicle/d to achieve a conservative value)

* 113 rooms. Number of beds to be confirmed assumed 1.5 beds per room
** Zoning allows 300m², assumed seating will be 2/3 of the restaurant area with 1 seat per m²

* Based on a Dealership of simular proportions

DATE: 11/1/2019
PREPARED BY: NOVATECH

M:\2017\117148\DATA\Calculations\Sewer Calcs\SAN\117148 - San Design.xlsx



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

No.	REVISION	DATE	BY
1.	ISSUED FOR SITE PLAN APPLICATION	OCT 31/19	CJR

SCALE 1:500

DESIGN	ARM
CHECKED	CJR
DRAWN	ARM
CHECKED	CJR
APPROVED	JLS

FOR REVIEW ONLY

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

LOCATION
4149 STRANDHERD DRIVE, CITY OF OTTAWA
MYERS SITE PLAN

DRAWING NAME
SANITARY SEWER DRAINAGE AREA PLAN

PROJECT No. 117148
REV # 1
DRAWING No. 117148-SAN

M:\2017\117148\CAD\Design\117148-SAN.dwg 117148-SAN Oct 31, 2019 - 4:51pm ameistwarp

CITI GATE
416 CORPORATE CAMPUS

NOVATECH
Engineers, Planners & Landscape Architects

SANITARY SEWER DESIGN SHEET
Citi Gate 416 Corporate Campus
Phase 1 - As-Built

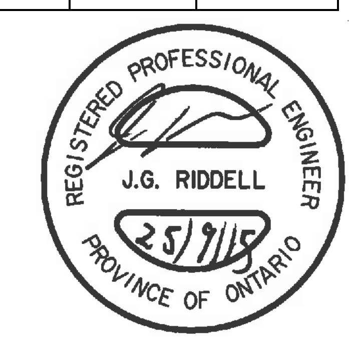
NOVATECH FILE NO.: 109203-0
CITY FILE NO.: D07-16-12-0023
DESIGNED BY: LAB
CHECKED BY: MER/MSP
PREPARED March 31, 2014
REVISED: August 10, 2014
REVISED: September 25, 2015 **AS-BUILT**

Location						Wastewater Flow Q(w)		Extraneous Flow Q(i)		Design Flow Q(d)	Proposed Sanitary Sewer						
Area I.D.	Street	Block Number	From MH	To MH	Area (ha)	Individual Peak Flow Rate 50,000 L/ha/d (L/s)	Cumulative Peak Flow Rate (L/s)	Individual Infiltration Rate 0.28 L/s/ha (L/s)	Cumulative Infiltration Rate (L/s)	Peak Design Flow (L/s)	Length (m)	Pipe Size (mm)	Type of Pipe	Grade %	Capacity (L/s)	Full Flow Velocity (m/s)	Percentage of Capacity
Sanitary Outlet A to Strandherd Drive at Maravista Drive Plan Reference: Sanitary Drainage Area Plan (109203-CG-SAN1)																	
A-1	Nortel Drive		201	203	0.40	0.35	0.35	0.11	0.11	0.46							
A-2	Nortel Drive	Block 1	201	203	3.49	3.03	3.38	0.98	1.09	4.47							
A-3	Nortel Drive	Block 16	201	203	2.50	2.17	5.55	0.70	1.79	7.34							
A-4	Nortel Drive		201	203	0.09	0.08	5.63	0.03	1.81	7.44	***36.0***	250	PVC	***0.53***	45.16	0.89	16%
A-5	Nortel Drive		203	205	0.13	0.11	5.74	0.04	1.85	7.59	***57.5***	250	PVC	***0.28***	32.83	0.65	23%
A-6	Nortel Drive	Block 17	205	101	1.17	1.02	6.75	0.33	2.18	8.93							
A-7	Nortel Drive		205	101	0.20	0.17	6.93	0.06	2.23	9.16	***37.3***	250	PVC	***0.21***	28.43	0.56	32%
A-9	Crosskey Place		101	207	0.92	0.80	7.73	0.26	7.54	15.27							
A-8	Crosskey Place	Block 14	101	207	18.03	15.65	23.38	5.05	5.05	28.43	***29.0***	300	PVC	***0.17***	41.59	0.57	68%
A-10	Nortel Drive	Block 15	207	209	7.98	6.93	30.30	2.23	9.77	40.08							
A-11	Nortel Drive		207	209	0.30	0.26	30.56	0.08	9.86	40.42	***106.5***	300	PVC	***0.27***	52.42	0.72	77%
A-12	Nortel Drive		209	211	0.31	0.27	30.83	0.09	9.95	40.78	***118.8***	300	PVC	***0.29***	54.33	0.74	75%
A-13	Nortel Drive		211	213	0.31	0.27	31.10	0.09	10.03	41.13	***114.6***	300	PVC	***0.22***	47.32	0.65	87%
A-14	Systemhouse Street		213	401	0.07	0.06	31.16	0.02	10.05	41.22	***26.4***	300	PVC	***0.23***	48.38	0.66	85%
A-15	Systemhouse Street		401	403	0.21	0.18	31.35	0.06	10.11	41.46	***86.8***	300	PVC	***0.28***	53.38	0.73	78%
A-16	Systemhouse Street		403	405	0.29	0.25	31.60	0.08	10.19	41.79	***118.8***	300	PVC	***0.32***	57.07	0.78	73%
A-17	Systemhouse Street	Block 18	405	407	2.29	1.99	33.59	0.64	10.83	44.42							
A-18	Systemhouse Street		405	407	0.20	0.17	33.76	0.06	10.89	44.65	***80.4***	375	PVC	***0.14***	68.44	0.60	65%
A-19	Systemhouse Street	Block 2	407	409	11.95	10.37	44.13	3.35	14.24	58.37							
A-20	Systemhouse Street	Block 3	407	409	5.28	4.58	48.72	1.48	15.71	64.43							
A-21	Systemhouse Street		407	409	0.30	0.26	48.98	0.08	15.80	64.77	***117.2***	375	PVC	***0.25***	91.46	0.80	71%
A-22	Systemhouse Street		409	101	0.16	0.14	49.11	0.04	15.84	64.96	***54.8***	375	PVC	***0.24***	89.61	0.79	72%
										64.96							
					56.58												

Notes:
1. Q(d) = Q(w) + Q(i) , where
2. Q(i) = 0.28 L/s/ha
3. Peaking Factor = 1.5

Q(d) = Design Flow (L/s)
Q(w) = Peak Wastewater Flow (L/s)
Q(i) = Extraneous Flow (L/s)

Legend
0.20 As-built pipe grade (%) or length (m)



CITI GATE 416 CORPORATE CAMPUS

NOVATECH Engineers, Planners & Landscape Architects

SANITARY SEWER DESIGN SHEET
Citi Gate 416 Corporate Campus
Phase 1 - As-Built

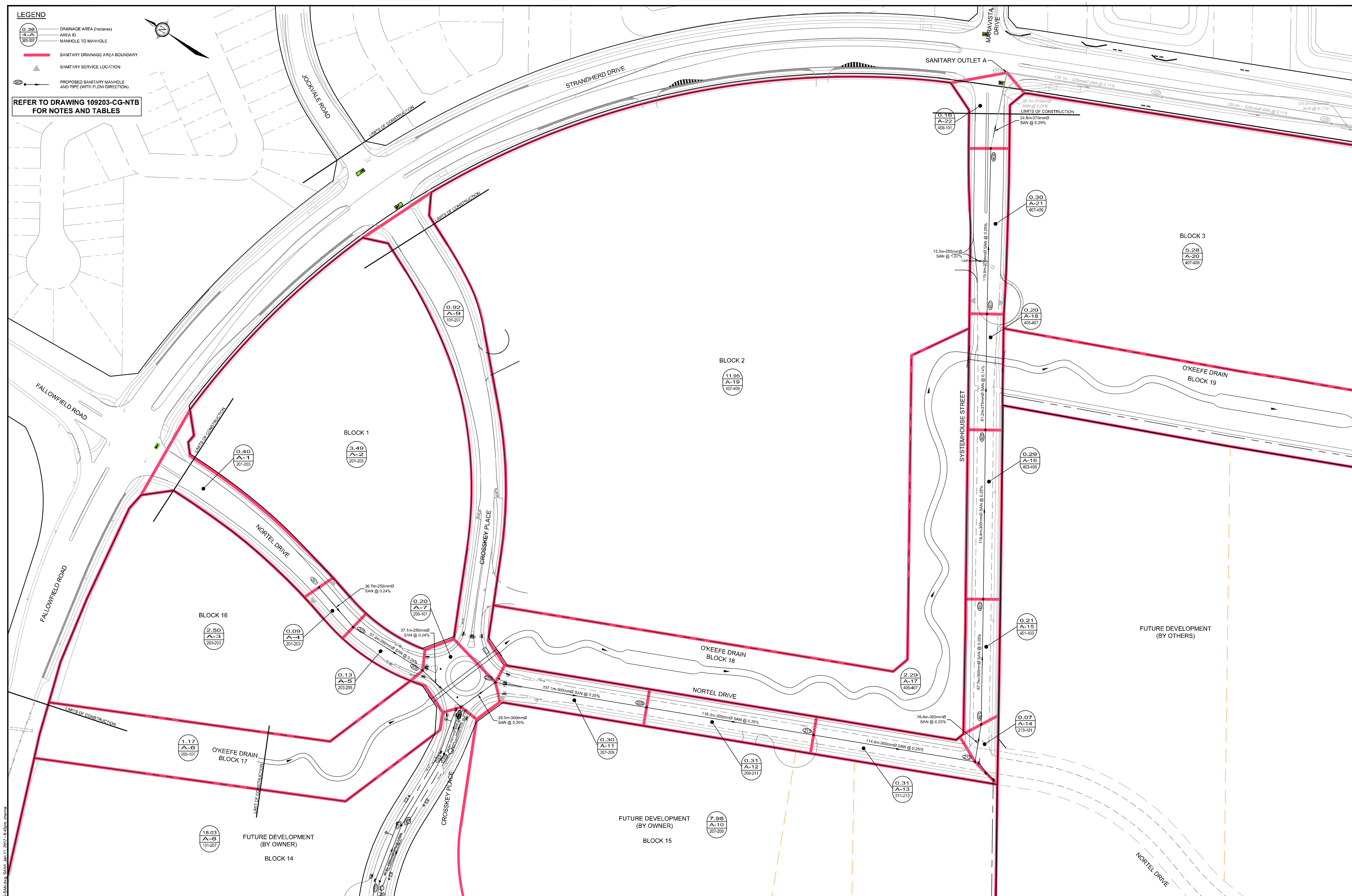
NOVATECH FILE NO.: 109203-0
CITY FILE NO.: D07-16-12-0023
DESIGNED BY: LAB
CHECKED BY: MER/MSP
DATE (Issued with report): March 31, 2014
REVISED : August 10, 2014
REVISED : September 25, 2015 **AS-BUILT**

Location						Wastewater Flow Q(w)		Extraneous Flow Q(i)		Design Flow Q(d)	Proposed Sanitary Sewer						
Area I.D.	**Street**	**Block Number**	**From MH**	**To MH**	**Area (ha)**	**Individual Peak Flow Rate 50,000 L/ha/d (L/s)**	**Cumulative Peak Flow Rate (L/s)**	**Individual Infiltration Rate 0.28 L/s/ha (L/s)**	**Cumulative Infiltration Rate (L/s)**	**Peak Design Flow (L/s)**	**Length (m)**	**Pipe Size (mm)**	**Type of Pipe**	**Grade %**	**Capacity (L/s)**	**Full Flow Velocity (m/s)**	**Percentage of Capacity**
Sanitary Outlet B to Strandherd Drive at Kennevale Drive Plan																	
Reference: Sanitary Drainage Area Plan (109203-CG-SAN2)																	
C-1	Nortel Drive	Lands Owned by Others	Fut	501	22.68	19.69	19.69	6.35	6.35	26.04	***4.0***	300	PVC	***0.20***	45.12	0.62	58%
B-1	Dealership Street	Lands Owned by Others	Fut	501	27.06	23.49	23.49	7.58	7.58	31.07	***12.5***	300	PVC	***0.20***	45.12	0.62	69%
B-2	Dealership Street	Block 11	501	503	2.72	2.36	45.54	0.76	14.69	60.23							
B-3	Dealership Street	Block 10	501	503	2.14	1.86	47.40	0.60	15.29	62.68							
B-4	Dealership Street		501	503	0.28	0.24	47.64	0.08	15.37	63.01	***119.5***	450	PVC	***0.14***	111.29	0.68	57%
B-5	Dealership Street	Block 9	503	505	1.84	1.60	49.24	0.52	15.88	65.12							
B-6	Dealership Street		503	505	0.29	0.25	49.49	0.08	15.96	65.45	***119.2***	450	PVC	***0.16***	118.97	0.72	55%
B-7	Dealership Street	Block 12 (SWM)	505	507	3.20	2.78	52.27	0.90	16.86	69.12							
B-8	Dealership Street	Block 8	505	507	1.64	1.42	53.69	0.46	17.32	71.01							
B-9	Dealership Street		505	507	0.20	0.17	53.86	0.06	17.37	71.24	***85.7***	450	PVC	***0.12***	103.03	0.63	69%
B-10	Dealership Street	Block 19	507	509	2.51	2.18	56.04	0.70	18.08	74.12							
B-11	Dealership Street		507	509	0.13	0.11	56.15	0.04	18.11	74.27	***55.9***	450	PVC	***0.16***	118.97	0.72	62%
B-12	Philsar Street	Block 6	603	601	1.62	1.41	1.41	0.45	0.45	1.86							
B-13	Philsar Street		603	601	0.23	0.20	1.61	0.06	0.52	2.12	***41.2***	250	PVC	***0.19***	27.04	0.53	8%
B-15	Philsar Street		601	509	0.19	0.16	1.77	0.05	0.57	2.34	***101.2***	250	PVC	***0.25***	31.02	0.61	8%
B-16	Dealership Street	Block 4	509	511	3.39	2.94	60.87	0.95	19.63	80.50							
B-17	Dealership Street		509	511	0.24	0.21	61.08	0.07	19.70	80.78	***99.5***	450	PVC	***0.17***	122.63	0.75	66%
B-14	Dealership Street	Block 5	511	513	2.14	1.86	62.93	0.60	20.30	83.23							
B-18	Dealership Street		511	513	0.20	0.17	63.11	0.06	20.36	83.46	***75.9***	450	PVC	***0.20***	133.02	0.81	63%
B-19	Outlet to Lift Station		513	515	0.04	0.03	63.14	0.01	20.37	**83.51**	***35.5***	450	PVC	***0.42***	192.76	1.17	43%
					72.74												

Notes:
1. Q(d) = Q(w) + Q(i) , where Q(d) = Design Flow (L/s)
2. Q(i) = 0.28 L/s/ha Q(w) = Peak Wastewater Flow (L/s)
3. Peaking Factor = 1.5 Q(i) = Extraneous Flow (L/s)

Legend:
0.20 As-built pipe grade (%) or length (m)

REGISTERED PROFESSIONAL ENGINEER
J.G. RIDDELL
25/9/15
PROVINCE OF ONTARIO



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

CITI GATE 416 CORPORATE CAMPUS

REGIONAL THE REGIONAL GROUP

No.	REVISION	DATE	BY
4.	ISSUED FOR SWM APPROVAL	AUG 10/14	MER
3.	ISSUED FOR APPROVAL	JUL 23/14	MER
2.	REV. PER CITY COMMENTS / ISS. FOR MOE APPROVAL	JUNE 27/14	MER
1.	ISSUED FOR CITY REVIEW	MAR 31/14	MER

SCALE 1:1000

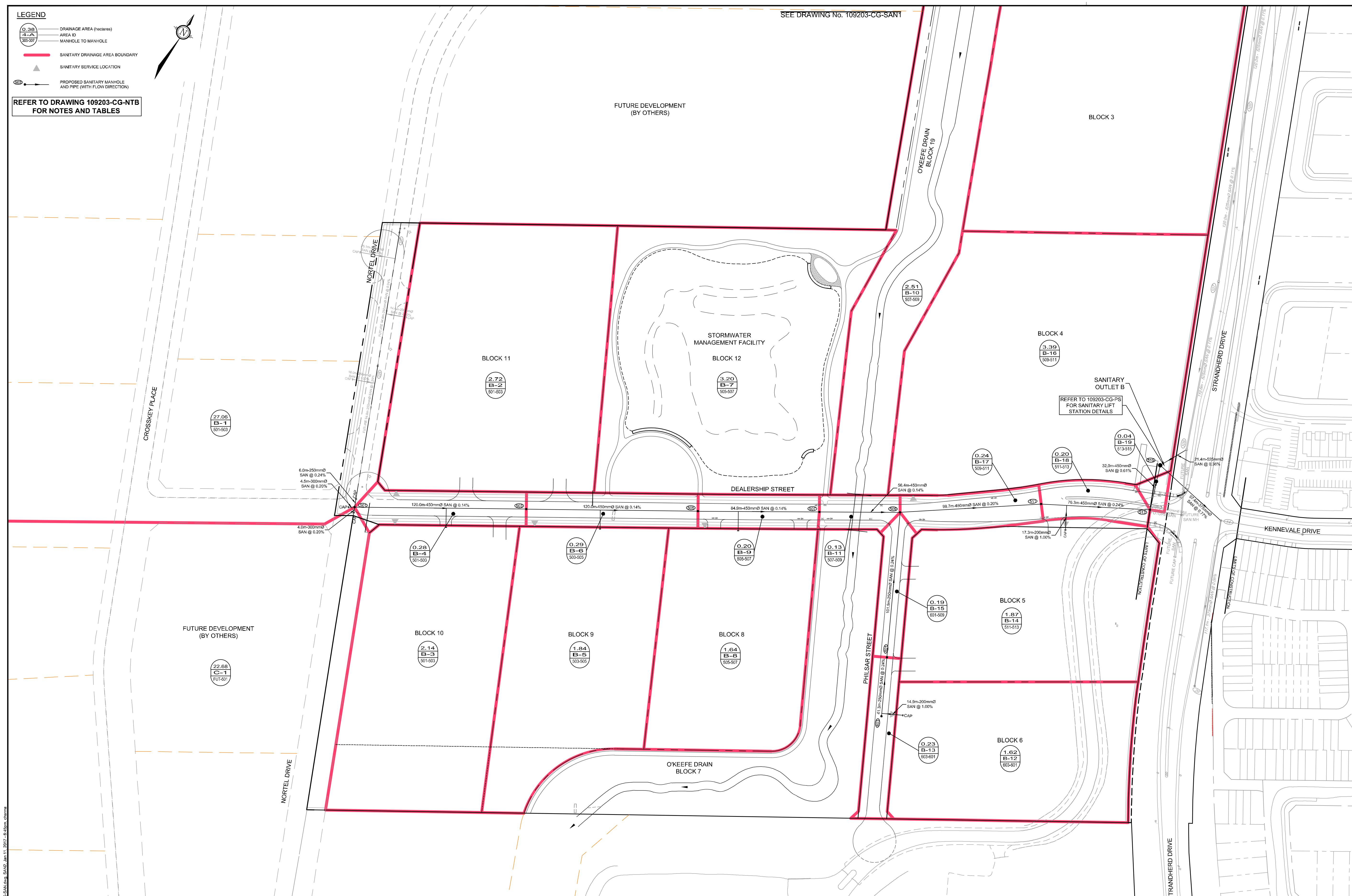
DESIGN LAB
CHECKED MER
DRAWN MTM/BET
CHECKED MER
APPROVED JGR

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

LOCATION
CITY OF OTTAWA
CITI GATE 416 CORPORATE CAMPUS

DRAWING NAME
SANITARY DRAINAGE AREA PLAN (OUTLET A)

PROJECT No. 109203-00
REV REV # 4
DRAWING No. 109203-CG-SAN1



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CITI GATE 416 CORPORATE CAMPUS
REGIONAL THE REGIONAL GROUP

No.	REVISION	DATE	BY
4.	ISSUED FOR SWM APPROVAL	AUG 10/14	MER
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SCALE 1:1000

DESIGN LAB
CHECKED MER
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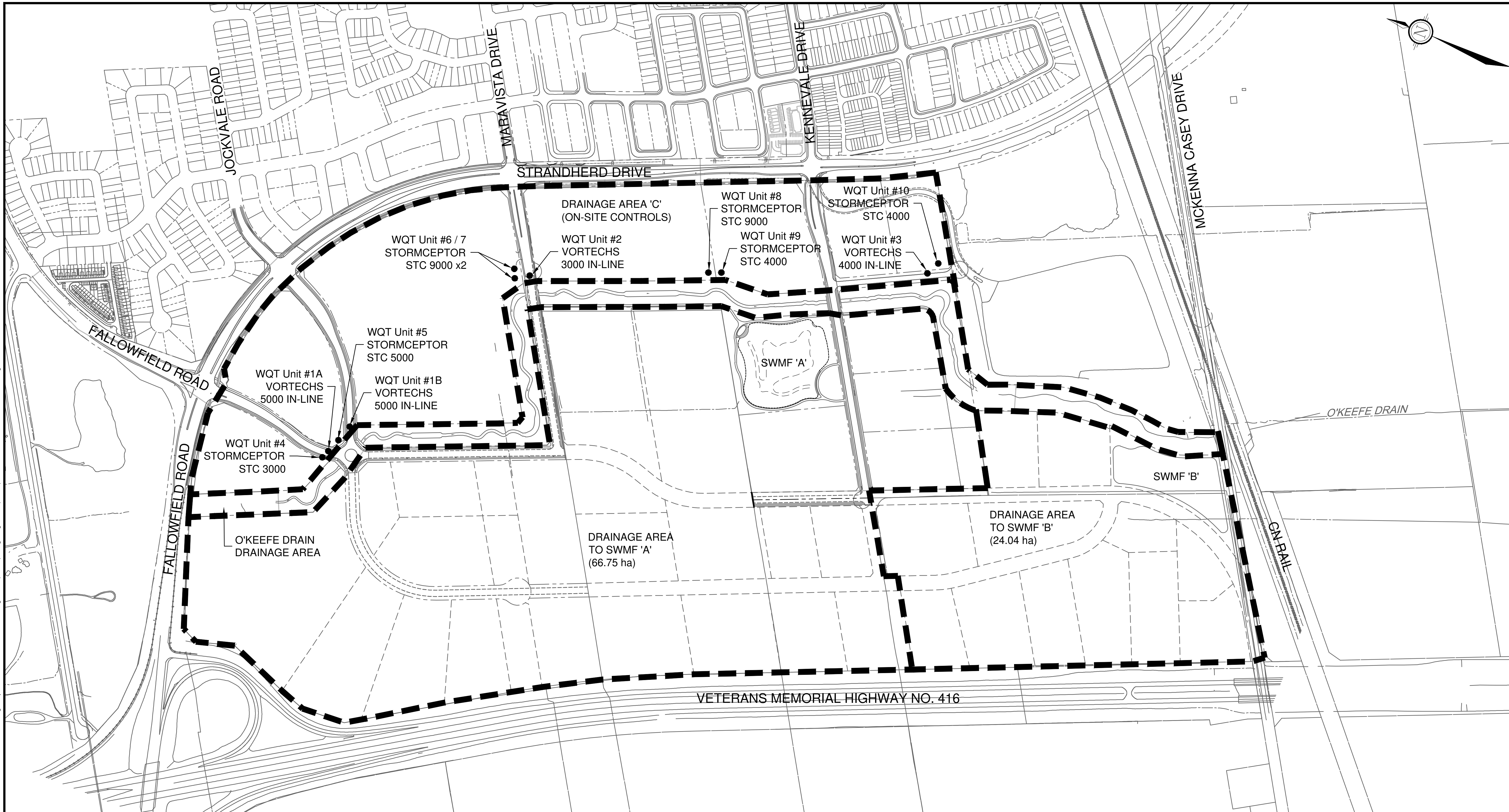
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY OF OTTAWA
CITI GATE 416 CORPORATE CAMPUS

DRAWING NAME
SANITARY DRAINAGE AREA PLAN (OUTLET B)

PROJECT No. 109203-00
REV # 4
DRAWING No. 109203-CG-SAN2

Appendix C:
Storm Servicing Information



LEGEND

DRAINAGE BOUNDARIES

WATER QUALITY TREATMENT UNIT LOCATION

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6

Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

CITI GATE 416
EMPLOYMENT LANDS

Post-Development Drainage
Areas A, B, and C

SCALE		
N.T.S		
DATE JAN 2015	JOB 109203	FIGURE FIGURE 1

SHT11X17.DWG - 279mmX432mm

M:\2009\109203\Citi Gate\CAD\Design\Figures\Design Brief\2014March31-Servicing Report\MOE-2015\109203-Figure 1 (MOE).dwg, Figure 1 (MOE), Jan 13, 2015 - 11:58am, cstang

Stormceptor®

Stormceptor Design Summary

PCSWMM for Stormceptor

Project Information

Date	06/12/2013
Project Name	Oil/Grit Separator #9
Project Number	109203 - Citi Gate (416) Lands
Location	Block 4

Designer Information

Company	Novatech Engineering Consultants Ltd.
Contact	Conrad Stang, M.A.Sc., P.Eng.

Notes

N/A

Drainage Area

Total Area (ha)	3.67
Imperviousness (%)	85

The Stormceptor System model STC 4000 achieves the water quality objective removing 80% TSS for a CLOCA (clay, silt and sand) particle size distribution.

Rainfall

Name	OTTAWA MACDONALD-CARTIER INT'L A
State	ON
ID	6000
Years of Records	1967 to 2003
Latitude	45°19'N
Longitude	75°40'W

Water Quality Objective

TSS Removal (%)	80

Upstream Storage

Storage (ha-m)	Discharge (L/s)
0	0

Stormceptor Sizing Summary

Stormceptor Model	TSS Removal %
STC 300	51
STC 750	66
STC 1000	66
STC 1500	67
STC 2000	74
STC 3000	75
STC 4000	**80**
STC 5000	80
STC 6000	83
STC 9000	87
STC 10000	86
STC 14000	89

Particle Size Distribution

Removing silt particles from runoff ensures that the majority of the pollutants, such as hydrocarbons and heavy metals that adhere to fine particles, are not discharged into our natural water courses. The table below lists the particle size distribution used to define the annual TSS removal.

CLOCA (clay, silt and sand)

Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s		Particle Size µm	Distribution %	Specific Gravity	Settling Velocity m/s
850	3.3	2.65	0.1465		50	3.9	2.65	0.0022
425	23.4	2.65	0.0698		36	2.6	2.65	0.0012
300	17.5	2.65	0.0439		22	1.3	2.65	0.0004
250	6.5	2.65	0.0335		12	1.9	2.65	0.0004
212	6.5	2.65	0.0259		9	0	2.65	0.0004
150	11.7	2.65	0.0145		6.5	1.3	2.65	0.0004
125	5.2	2.65	0.0105		3	1.3	2.65	0.0004
100	3.9	2.65	0.0070		1.5	1.3	2.65	0.0004
75	3.9	2.65	0.0040		1	4.5	2.65	0.0004

Stormceptor Design Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor version 1.0
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal.
- Only the STC 300 is adaptable to function with a catch basin inlet and/or inline pipes.
- Only the Stormceptor models STC 750 to STC 6000 may accommodate multiple inlet pipes.
- Inlet and outlet invert elevation differences are as follows:

Inlet and Outlet Pipe Invert Elevations Differences

Inlet Pipe Configuration	STC 300	STC 750 to STC 6000	STC 9000 to STC 14000
Single inlet pipe	75 mm	25 mm	75 mm
Multiple inlet pipes	75 mm	75 mm	Only one inlet pipe.

- Design estimates are based on stable site conditions only, after construction is completed.
- Design estimates assume that the storm drain is not submerged during zero flows. For submerged applications, please contact your local Stormceptor representative.
- Design estimates may be modified for specific spills controls. Please contact your local Stormceptor representative for further assistance.
- For pricing inquiries or assistance, please contact Imbrium Systems Inc., 1-800-565-4801.

VORTECHS SYSTEM® ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION
BASED ON AN AVERAGE PARTICLE SIZE OF 80 MICRONS
CITI GATE - 416 LANDS
OTTAWA, ON
MODEL 7000 OFF-LINE
BLOCK 4 - OGS #9

CONTECH ENGINEERED SOLUTIONS

Design Ratio[1] = $\frac{(3.67 \text{ hectares}) \times (0.85) \times (2.775)}{(4.7 \text{ m2})}$ **= 1.84**

Bypass occurs at an elevation of 0.76m (at approximately 23 l/s/m2)

Rainfall Intensity mm/hr	Operating Rate[2] % of capacity	Flow Treated (l/s)	% Total Rainfall Volume[3]	Rmvl. Effcy[4] (%)	Rel. Effcy (%)
0.5	1.4	4.3	10.7%	98.0%	10.5%
1.0	2.8	8.6	9.3%	98.0%	9.1%
1.5	4.1	12.9	10.3%	98.0%	10.1%
2.0	5.5	17.1	8.6%	98.0%	8.4%
2.5	6.9	21.4	6.7%	98.0%	6.6%
3.0	8.3	25.7	5.8%	96.9%	5.6%
3.6	9.6	30.0	5.0%	96.3%	4.8%
4.1	11.0	34.3	4.4%	95.3%	4.2%
4.6	12.4	38.6	2.3%	94.7%	2.2%
5.1	13.8	42.9	4.2%	93.8%	3.9%
6.4	17.2	53.6	7.4%	89.9%	6.6%
7.6	20.6	64.3	4.0%	87.3%	3.5%
8.9	24.1	75.0	3.5%	85.3%	3.0%
10.2	27.5	85.7	1.8%	83.8%	1.5%
11.4	31.0	96.4	3.8%	82.0%	3.1%
12.7	34.4	107.2	1.4%	80.0%	1.1%
19.1	51.6	160.7	4.3%	63.6%	2.7%
25.4	68.8	214.3	1.6%	51.0%	0.8%
38.1	103.2	321.5	1.2%	8.0%	0.1%
					88.0%

% rain falling at >38.1 mm/hr or bypassing treatment =	3.6%
Assumed removal efficiency for bypassed flows =	0.0%
Estimated reduction in efficiency[5] =	6.5%
Predicted Net Annual Load Removal Efficiency =	**82%**

1 - Design Ratio = (Total Drainage Area) x (Runoff Coefficient) x (Rational Method Conversion) / Grit Chamber Area
- The Total Drainage Area and Runoff Coefficient are specified by the site engineer.
- The rational method conversion based on the units in the above equation is 2.775.

2 - Operating Rate (% of capacity) = percentage of peak operating rate of 68 l/s/m^2.

3 - Based on 10 years of rainfall data from Canadian Station 6105976, Ottawa CDA, ON

4 - Based on Contech Construction Products laboratory verified removal of an average particle size of 80 microns (see Vortechs Guide).

5- Reduction due to use of 60-minute data for a site that has a time of concentration less than 30-minutes.

Calculated by:	JAK	12/6	Checked by:

8.5.2 Water Quantity

Public Roads

The storm sewers in the public right-of-ways will convey stormwater uncontrolled for storm events up to and including the 5-year storm event. For storm greater than the 5-year storm event, the public right-of-ways will provide approximately 100 m^3/ha of storage within the road sags.

While, peak flows from the right-of-ways will be higher than pre-development conditions, the SWM facility on the west-side of the O'Keefe Drain has been oversized to ensure that flows in the O'Keefe Drain do not exceed pre-development levels.

Private Sites

The private sites east of the O'Keefe Drain will be designed to provide sufficient on-site storage to ensure that peak flows in the O'Keefe Drain are maintained to below pre-development levels at all stages of development. Per hectare release rates and on-site storage requirements (based on 85% impervious) are shown in **Table 8.13**.

Table 8.13: SWM Targets for Areas East of the O'Keefe Drain

Design Event	Release Rate (L/s/ha)	On-Site Storage* (m^3/ha)
2-yr Event	20	179
5-yr Event	35	232
10-yr Event	45	267
25-yr Event	64	310
50-yr Event	75	333
100-yr Event	126	351

** Based on 85% imperviousness*

Site-specific SWM reports will be required as part of the site plan application and detailed design of each individual site to demonstrate that the design adheres to the release rates listed in **Table 8.13**. Storage requirements will vary based on the imperviousness of each site. The allowable release rates for each Block are summarized in **Table 8.14**.

Table 8.14: Allowable Release Rates for Areas East of the O'Keefe drain

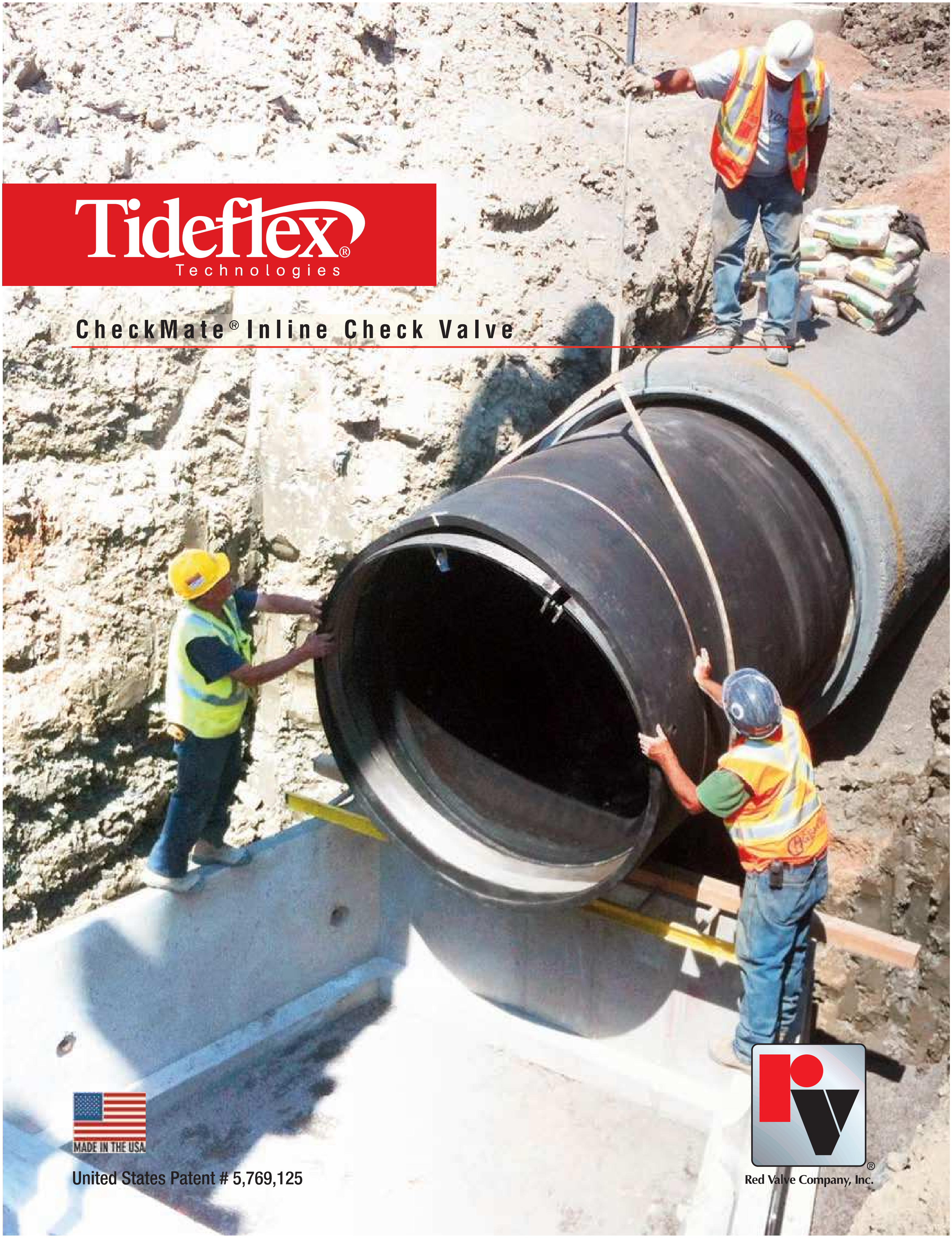
Block	Area (ha)	Allowable Release Rate (L/s)					
		2yr	5yr	10yr	25yr	50yr	100yr
Block 16	2.50	50	88	113	160	188	315
Block 1	3.51	70	123	158	225	263	442
Block 2	12.04	241	421	542	771	903	1,517
Block 3	5.30	106	186	239	339	398	668
Block 4	3.41	68	119	153	218	256	430
Blocks 5 & 6	3.49	70	122	157	223	262	440

Temperature Mitigation

Best-management practices for temperature mitigation are encouraged for development on the east side of the O'Keefe Drain. Examples of suitable BMPs are provided in **Section 9.2.5**.

Tideflex® Technologies

CheckMate® Inline Check Valve



MADE IN THE USA

United States Patent # 5,769,125

Red Valve Company, Inc.

CheckMate®: Your Final Move to Eliminate Backflow!

CHECKMATE® VALVE
Designed for Inline Service

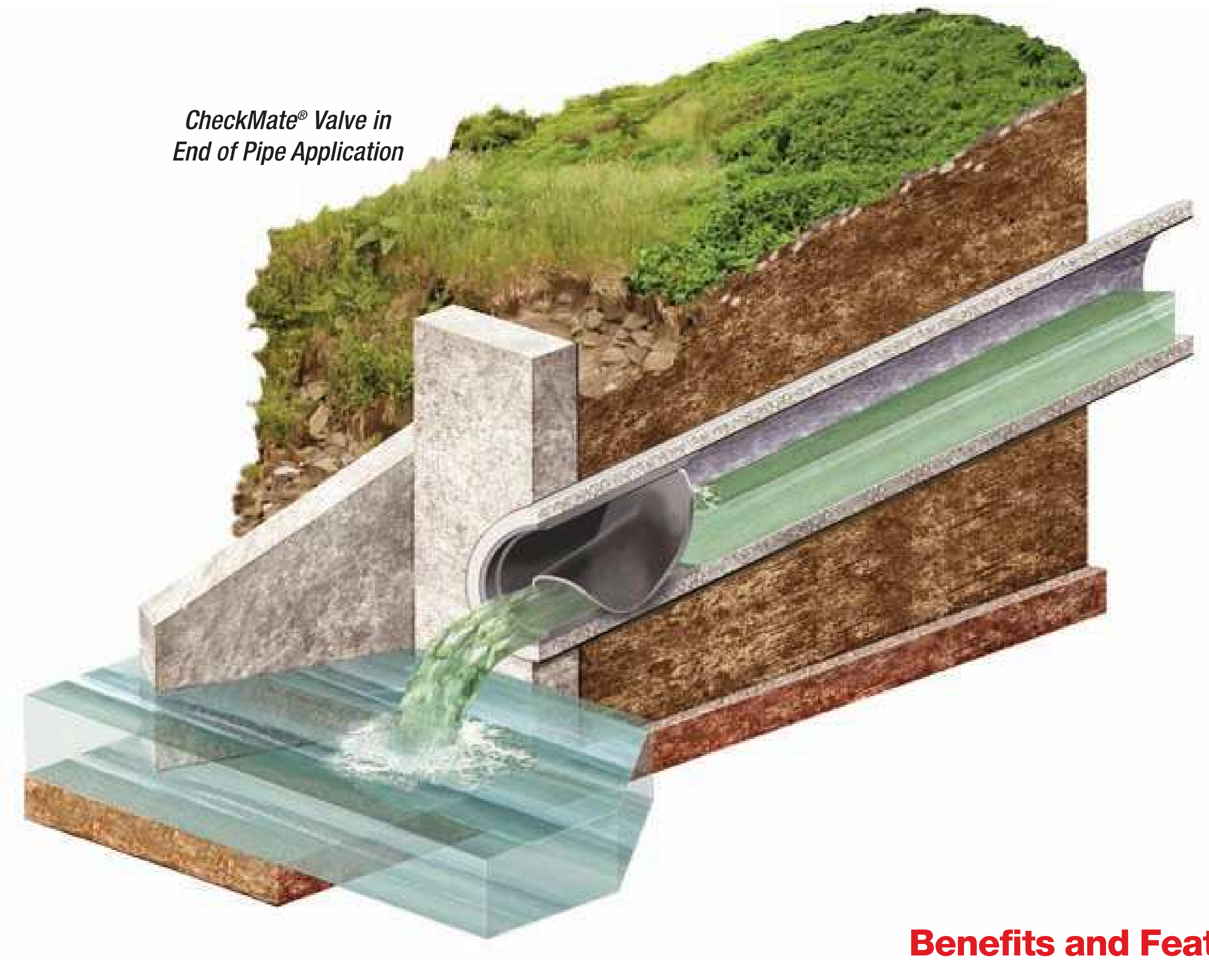
Dependable Backflow Prevention

The CheckMate® Inline Check Valve is the valve of choice for both municipal and industrial applications - including stormwater, wastewater, highway run-off, CSO, SSO and flood control. CheckMate® Valves prevent unwanted backflow that can cause surcharging and flooding.

CheckMate® Inline Check Valves have become the specified solution for residential and commercial areas where complete, dependable backflow prevention is necessary. The CheckMate® is not simply a molded part. Rather it is hand-fabricated, utilizing various natural and synthetic elastomers and fabric ply reinforcement to create a unibody construction. There are no mechanical parts or fasteners to catch debris, corrode, or fail, making the CheckMate® maintenance-free. With seven elastomers to select from, the CheckMate® can be custom engineered to resist chemicals, grease and oils typically found in stormwater, wastewater and industrial applications.

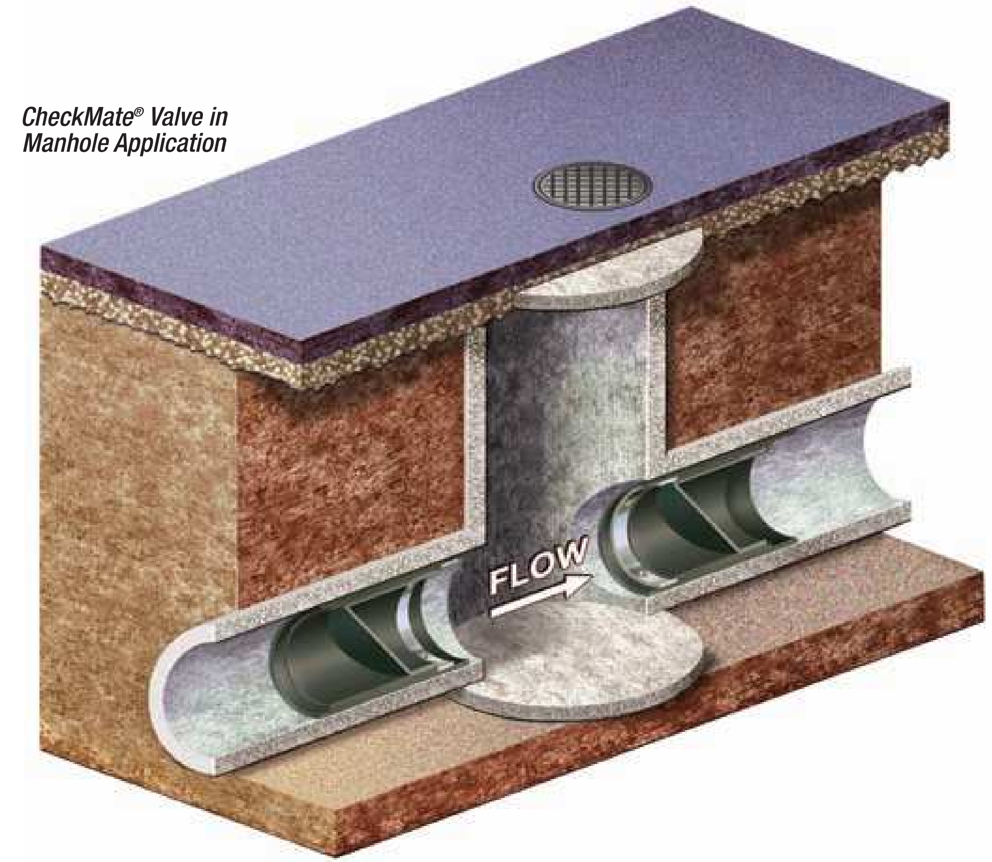
The CheckMate® Valve boasts extremely low headloss, allowing for near 100% flow capacity. Its inherent design makes it the most user-friendly inline check valve on the market today. From the upstream or downstream end of the pipe, simply insert the valve into position and clamp it into place. Typically no modification to the pipe or structure is required to install the CheckMate®. Because the CheckMate® is recessed inside of the pipe, additional permitting is not required. The result is savings in both installation time and operational cost.

CheckMate® Valve in End of Pipe Application



The valve can successfully withstand severe winter freezes, typhoons, hurricanes and flooding. The CheckMate® also minimizes damage to wetlands, beaches and residential areas, eliminates hydraulic surges to wastewater treatment plants and saves municipalities millions of dollars in maintenance and treatment costs.

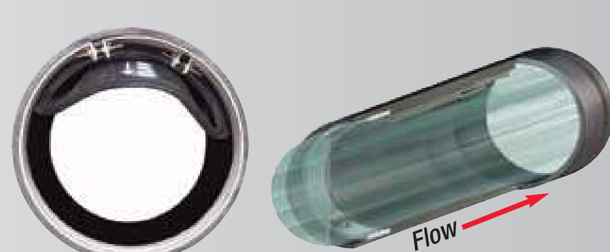
CheckMate® Valve in Manhole Application



Benefits and Features of CheckMate®:

- Extremely Low Headloss
- No Moving Mechanical Parts to Corrode, Catch Debris or Fail
- Heavy Duty Elastomer Unibody Construction
- Quick and Easy Installation
- Seals Around Debris
- Operates on Differential Pressure, Totally Passive
- Virtually No Maintenance
- Self-draining, 1" of Cracking Pressure
- Silent, Non-slamming
- Available in Sizes 3" (75 mm) to 78" (1950 mm)
- Extensive Independent Hydraulic Testing

For an animated demonstration of the CheckMate® in operation, please visit: **http://www.tideflex.com/checkmate.**



FULLY OPEN

FLOWING

FULLY CLOSED

Tideflex Technologies

CheckMate® Applications: Simply Versatile!

48” CheckMate® installed in a storm sewer drain to stop backflow from flooding a residential area.

24” CheckMate® is easily installed in a municipal sewer.

Residential and Municipal Sewers

CheckMate® Inline Check Valves have become a frequently specified solution for residential and municipal areas where complete, dependable backflow prevention is necessary. The CheckMate® Valve’s maintenance-free, passive operation provides years of trouble-free service.

CSO, SSO and Outfalls

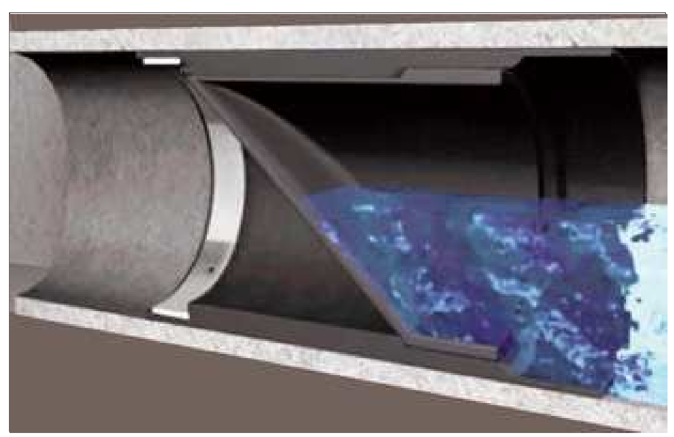
CheckMate® Valves are used for interceptor, manhole and outfall pipelines because they maximize pipeline storage and capacity while preventing water from backflowing into a sewage treatment plant. The CheckMate® Valve’s innovative inline design allows it to be easily installed without modifications to structures.

Stormwater, MS4, Highway Run-off and Site Drainage

CheckMate® Inline Check Valves are the valve of choice for both municipalities and commercial property owners to prevent costly flood damage and to maximize system storage. The CheckMate’s® low cracking pressure and headloss provide rapid drainage.

Flow Equalization Basins, Pump Stations and Effluent Discharge

CheckMate® Valves provide backflow prevention in between basins and also protect pumps and capital equipment. The CheckMate’s® low headloss characteristics maximize flow efficiency.



The CheckMate’s® rugged unibody construction prevents backflow.

48” CheckMate® installed at the Freedom Tower for stormwater drainage.

CHECKMATE® VALVE

Designed for Inline Service

48" CheckMate® Valve replacing a faulty flapgate in a CSO application.

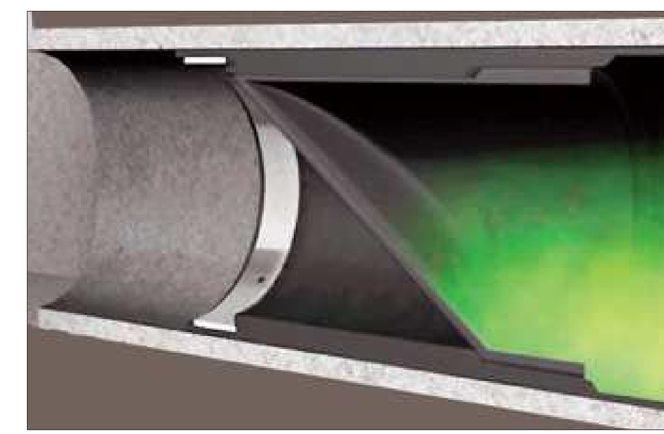
The CheckMate® is also easily installed by hand.

Odor Control

CheckMate® Inline Check Valves prevent sewer systems’ offending odors from escaping, while still allowing water to discharge when needed. The CheckMate® Valve is designed to eliminate the backflow of unwanted methane and hydrogen sulfide gases that typically result in complaints about odor from the general public.

Levees, Marinas and Wetlands

In low lying areas where headloss is at a premium, CheckMate® Valves efficiently drain with the added benefit of providing absolute backflow prevention.



The CheckMate® provides odor control.

Independent Hydraulic Testing

CheckMate® Inline Check Valves are independently tested to determine their hydraulic characteristics in both free and submerged discharge applications. Red Valve’s published hydraulic data is validated through this independent testing.

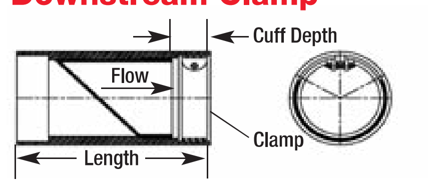
Tideflex Technologies

CheckMate® Configurations and Custom Designs

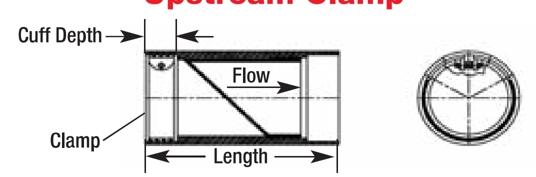
CHECKMATE® VALVE

Designed for Inline Service

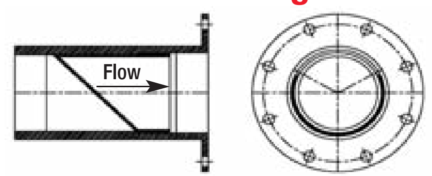
Downstream Clamp



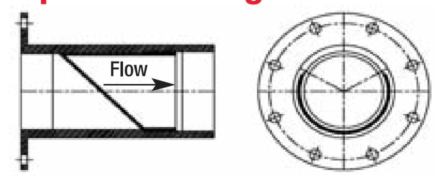
Upstream Clamp



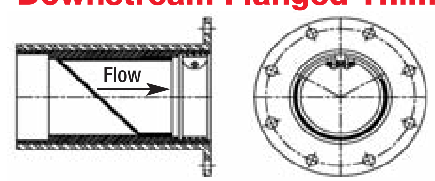
Downstream Flanged



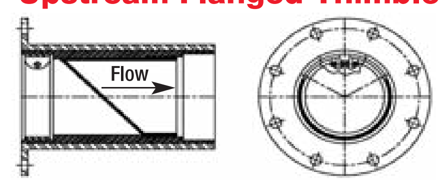
Upstream Flanged



Downstream Flanged Thimble Insert



Upstream Flanged Thimble Insert



CheckMates® can be made for any pipe I.D.
Built to fit in sizes from 3" to 78".

Flange shape and bolt pattern can be customized.
Flangeless thimble inserts are available.

	CHECKMATE® VALVE										
	NOMINAL PIPE SIZE I.D.		OVERALL LENGTH*		NUMBER OF CLAMPS	CUFF DEPTH		BACK PRESSURE RATING**		WEIGHT	
	Inches	Millimeters	Inches	Millimeters		Inches	Millimeters	Feet	Meters	lbs	Kg
Low Pressure	3	75	5.1	130	1	1.5	38	5	1.5	1.5	0.7
	4	100	7.9	201	1	1.5	38	5	1.5	1.5	0.7
Standard Pressure	3	75	5.1	130	1	1.5	38	85	26.0	3	1.4
	4	100	7.9	201	1	1.5	38	85	26.0	3	1.5
	5	125	9.5	241	1	1.5	38	83	25.3	4	2
	6	150	11.0	279	1	2.0	51	83	25.3	9	4
	7	175	12.8	325	1	2.0	51	79	24.1	11	5
	8	200	15.2	386	1	2.0	51	79	24.1	13	6
	9	225	15.4	391	1	2.0	51	75	22.9	17	8
	10	250	16.1	409	1	2.0	51	71	21.6	20	10
	12	300	19.8	503	1	2.0	51	68	20.1	37	17
	14	350	25.8	655	1	4.0	102	64	20.0	110	50
	16	400	28.6	726	1	4.0	102	60	18.3	133	52
	18	450	31.0	787	1	4.0	102	56	17.1	143	65
	20	500	42.1	1069	2	8.0	203	53	16.2	223	102
	24	600	47.5	1207	2	8.0	203	45	13.7	304	137
	30	750	54.9	1395	2	8.0	203	38	11.6	500	227
	36	900	62.3	1582	2	8.0	203	30	9.1	828	376
	42	1050	70.6	1793	2	8.0	203	26	7.9	1423	646
	48	1200	79.0	2007	2	8.0	203	23	7.0	1801	817
	54	1350	86.4	2195	2	8.0	203	17	5.2	2700	1225
	60	1500	96.8	2459	2	9.0	229	15	4.6	3315	1504
	72	1800	119.0	3023	3	12.0	305	13	4.0	6100	2767
	78	1950	119.0	3023	3	12.0	305	13	4.0	7000	3176

*Shorter lengths available.

**Back pressure measured from pipe invert.
Higher back pressure ratings available. Consult factory.

Elliptical Pipe CheckMate®

Arch Pipe CheckMate®

Rectangular Pipe CheckMate®

Elliptical, Arch and Rectangular Pipes

Elliptical, arch and rectangular pipes for drainage and flood prevention projects have become popular, particularly in high water table areas with shallow surface gradients. CheckMate® Inline Check Valves are the perfect solution for backflow prevention in elliptical, arch and rectangular pipes.

Upstream Flanged CheckMate®

Rubber Flanged

Rubber Flanged CheckMate® Valves can be manufactured with an integral rubber upstream or downstream flange. The flanged CheckMate® gets inserted into the host pipe then can be bolted to a mating flange or anchored to a concrete headwall. The flange can be circular with standard drilling; or circular, square or rectangular with custom flange drilling. The valve is supplied with retaining rings for mounting.

Thimble Inserts

A CheckMate® Thimble Insert is a CheckMate® Valve that is factory-installed, clamped, and pinned into flanged or plain end pipe. The thimble insert assembly can either be inserted into the I.D. of the host pipe, or can be mounted to a mating flange or concrete headwall and extend beyond the pipe. Plain end thimble inserts are inserted into the host pipe and non-shrink grout is placed between the thimble insert O.D. and host pipe I.D. to form the seal.

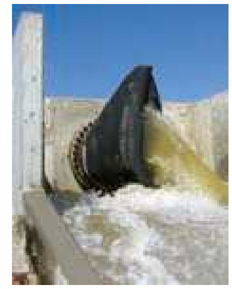
CheckMate® Thimble Insert

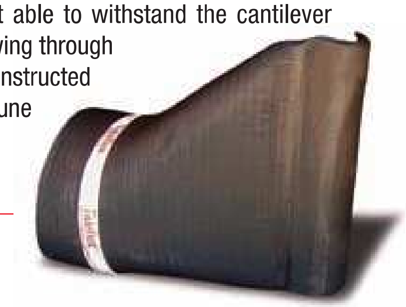
The best choice for the toughest applications.

In addition to the Checkmate® Inline Check Valve, Tideflex® Technologies offers a complete line of check valves.

TF-1 CHECK VALVES

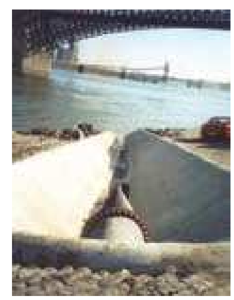
The Tideflex® TF-1 Curved Bill Check Valve is designed with enhanced sealing to improve headloss. The improved TF-1 design allows the valve to handle long-term water weight while maintaining structural integrity. The spine is at a greater vertical angle, making it able to withstand the cantilever effect when water is flowing through the valve. The TF-1 is constructed of rubber, making it immune to rust, corrosion and weathering.





SERIES 35-1 CHECK VALVES

The flat-bottom Series 35-1 features an integral rubber flange, allowing them to be mounted to flanged outfall pipes or directly to headwalls where the pipe is flush. The flange size drilling conforms to ANSI B16.10, Class 150#, or can be constructed with DIN, 2632 and other standards. The Series 35-1 Check Valve is furnished complete with steel or stainless steel backup rings for installation.



SERIES 39 CHECK VALVES

The Tideflex® Series 39 Inline Check Valve features a fabric-reinforced elastomer check sleeve housed in a cast iron body with ANSI 125/150 flanges, allowing for easy installation into any piping system. The valve's operation is silent, non-slamming and maintenance free. Sliding, rotating, swinging and plunging parts are completely eliminated. The body is equipped with flush ports and a clean-out port and can be epoxy coated.

Tideflex® Technologies

600 N. Bell Ave.
Carnegie, PA 15106

PHONE:
412/279-0044

FAX:
412/279-7878

www.tideflex.com

CMCV 060515

Conrad Stang

From: Rosiu, Cornel <Cornel.Rosiu@ipexna.com>
Sent: Friday, November 1, 2019 7:17 AM
To: Conrad Stang
Cc: Donnelly, Ryan
Subject: RE: Myers Site Plan (4149 Strandherd Drive) - Tempest LMF ICD Package Request
Attachments: 2019110101 Novatech - Myers Strandherd ICD Submittal.pdf

Conrad,

Please see attached ICD submittal

Regards,

Cornel Rosiu
IPEX Inc. - *Municipal Estimator, ON*
Cornel.Rosiu@ipexna.com
6810 Invader Crescent, Mississauga, ON, L5T 2B6 T: (905) 670-7676 x200

From: Conrad Stang <c.stang@novatech-eng.com>
Sent: October 31, 2019 1:57 PM
To: Rosiu, Cornel <Cornel.Rosiu@ipexna.com>
Cc: Donnelly, Ryan <Ryan.Donnelly@ipexna.com>
Subject: Myers Site Plan (4149 Strandherd Drive) - Tempest LMF ICD Package Request

Good Afternoon Cornel,

Can I please get a Tempest LMF ICD package based on the following head / release rates. This is for the proposed Myers Site Plan (dealership) at 4149 Strandherd Drive, Ottawa, ON.

Location	100-year (3-hour Chicago Storm)		Outlet Pipe Size (mm)	Structure
	Head (m)	Release Rate (L/s)		
CB05	2.05	4.8	250	600mm x 600mm CB
CB11	1.89	5.9	250	600mm x 600mm CB
CBMH01	2.14	11.1	375	1200mm dia. CBMH
CBMH04	2.22	11.3	525	1200mm dia. CBMH
CBMH09	1.87	7.2	375	1200mm dia. CBMH
CBMH13	1.79	5.7	375	1200mm dia. CBMH
CBMH15	1.94	6.0	450	1200mm dia. CBMH
CBMH20	1.57	5.3	450	1200mm dia. CBMH
CBMH23	1.66	5.5	450	1200mm dia. CBMH

Let me know if you need any additional information. Please let me know if you cannot provide the ICD package before the end of the day.

Kind regards,

Conrad

Conrad Stang, M.A.Sc., P.Eng., Project Manager | Water Resources
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 x310 | Fax: 613.254.5867
Email: c.stang@novatech-eng.com | Website: www.novatech-eng.com

TEMPEST Product Submittal Package

Date: November 1, 2019

Customer: Novatech

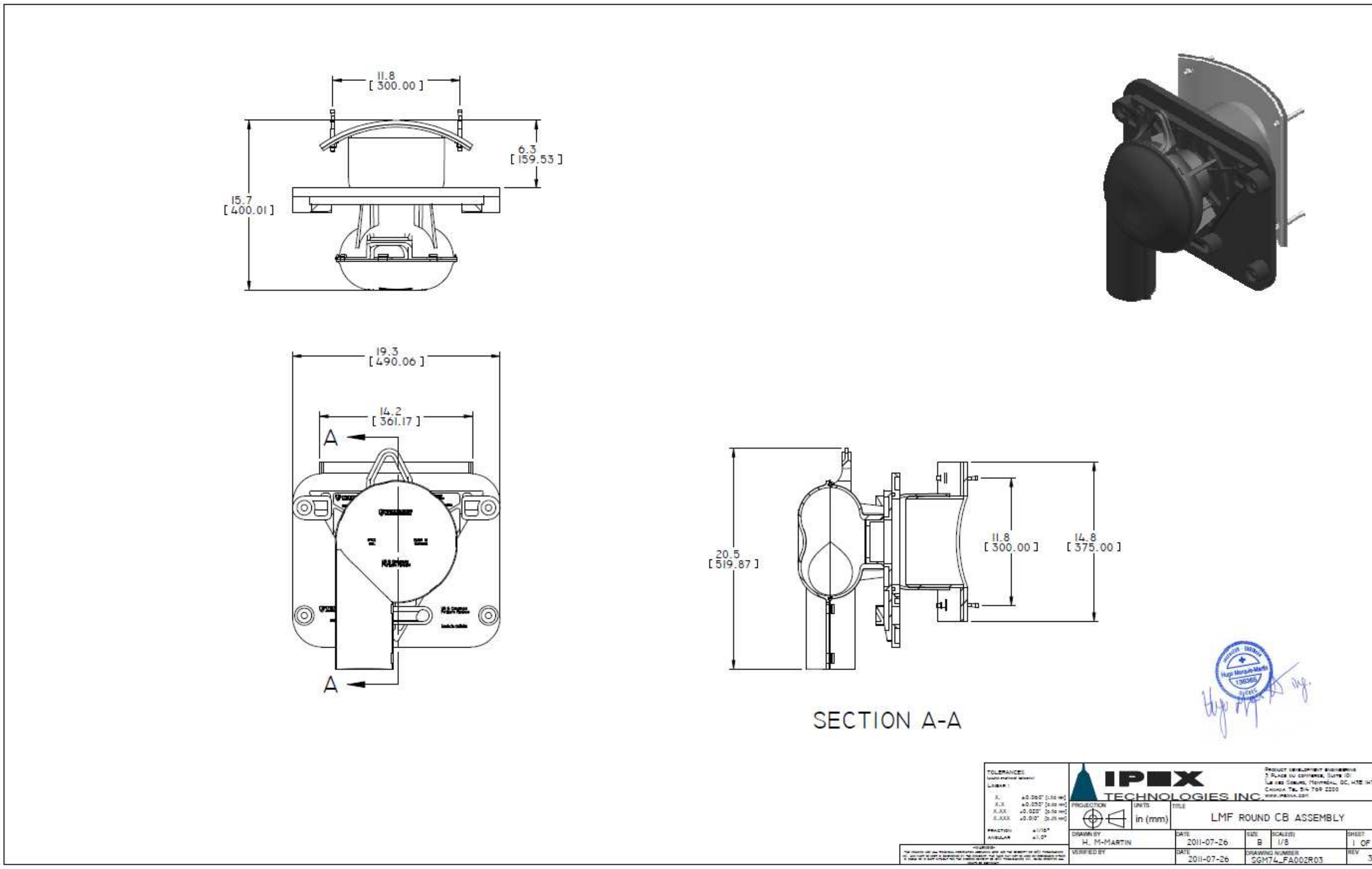
Contact: Conrad Stang

Location: Ottawa

Project Name: Strandherd Drive (Myers)

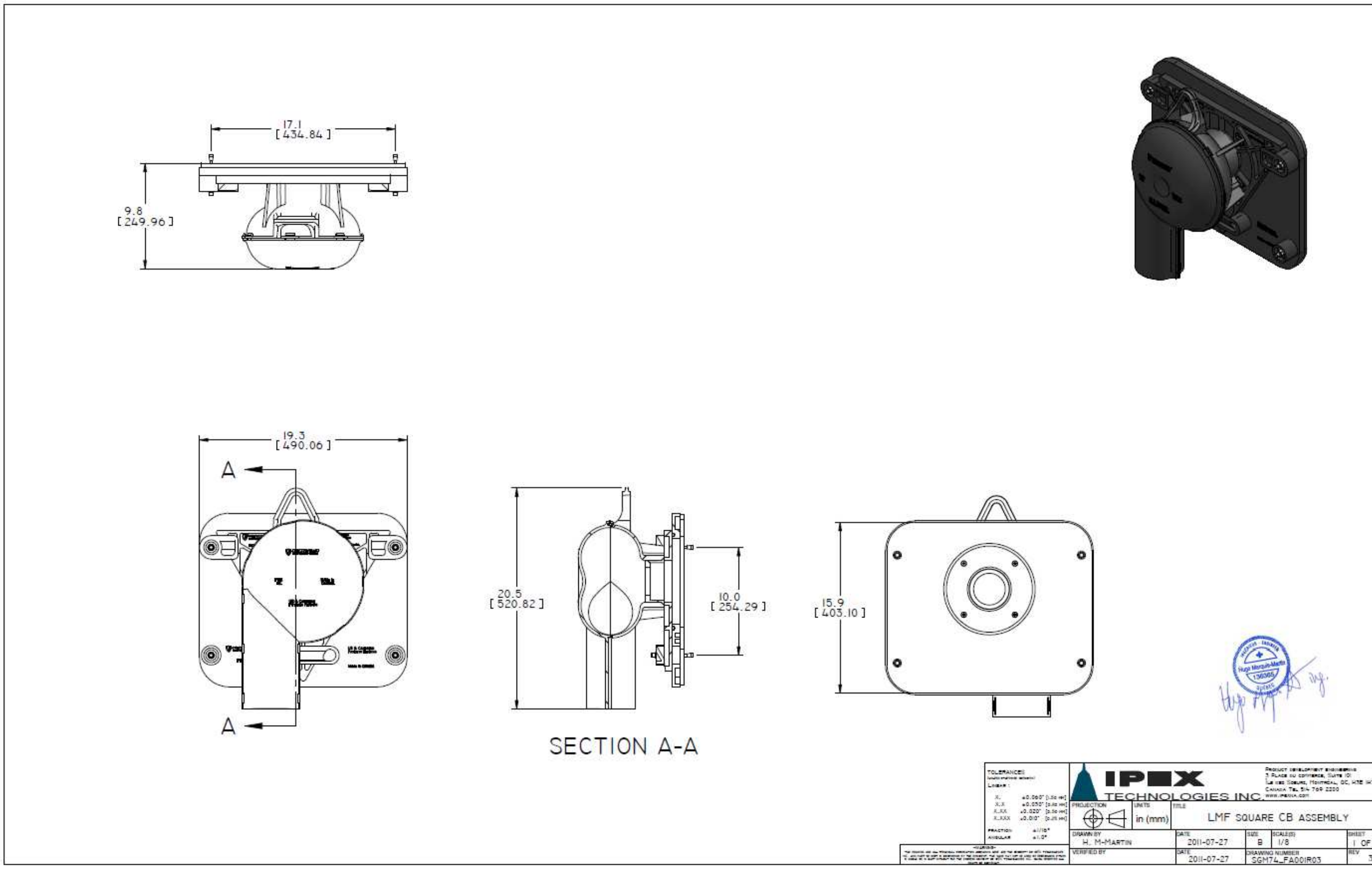
IPEX

Tempest LMF ICD Rd Shop Drawing



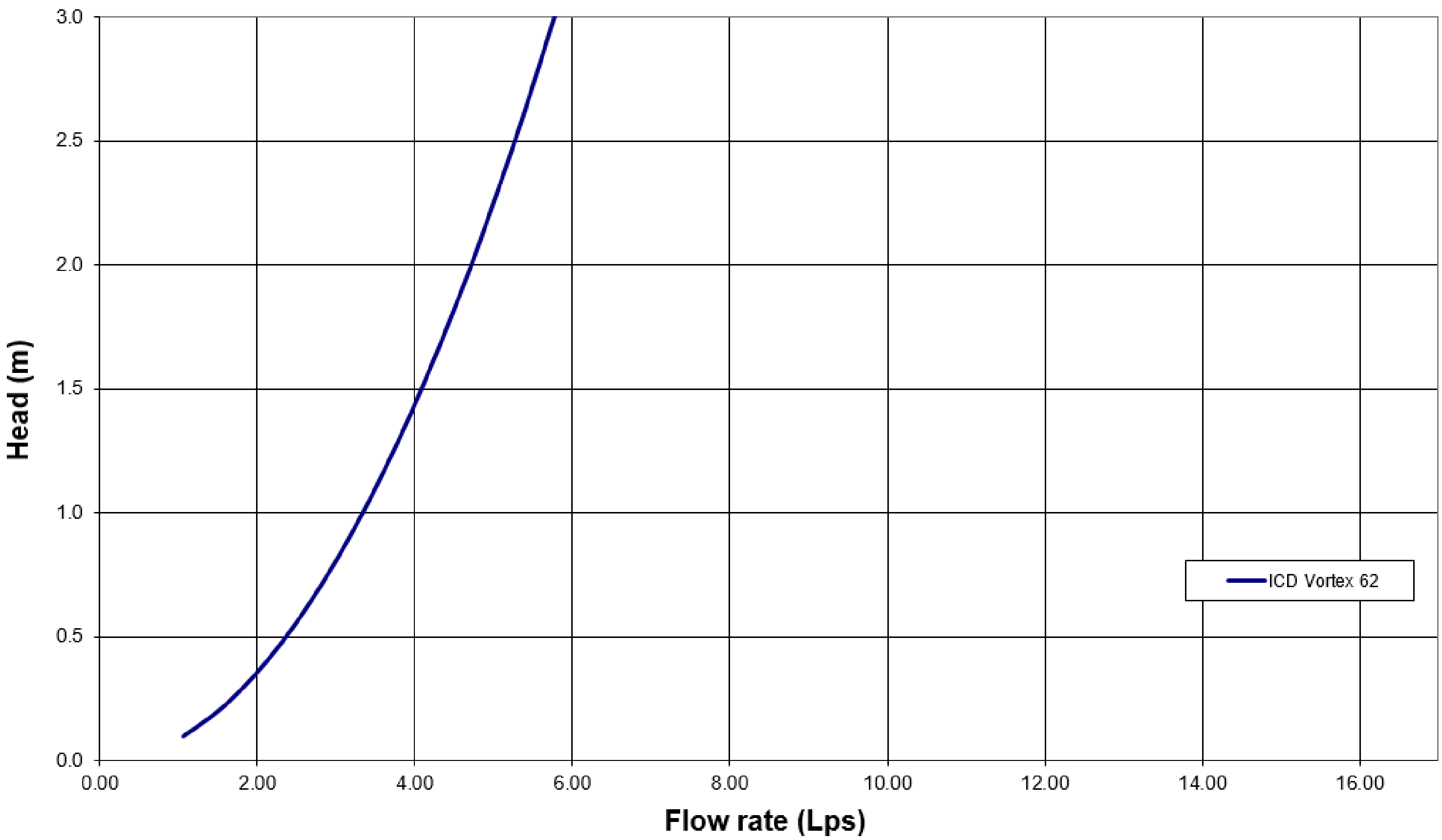
IPEX

<u>Tempest LMF ICD Sq</u> Shop Drawing



Tempest LMF ICD Flow Curve

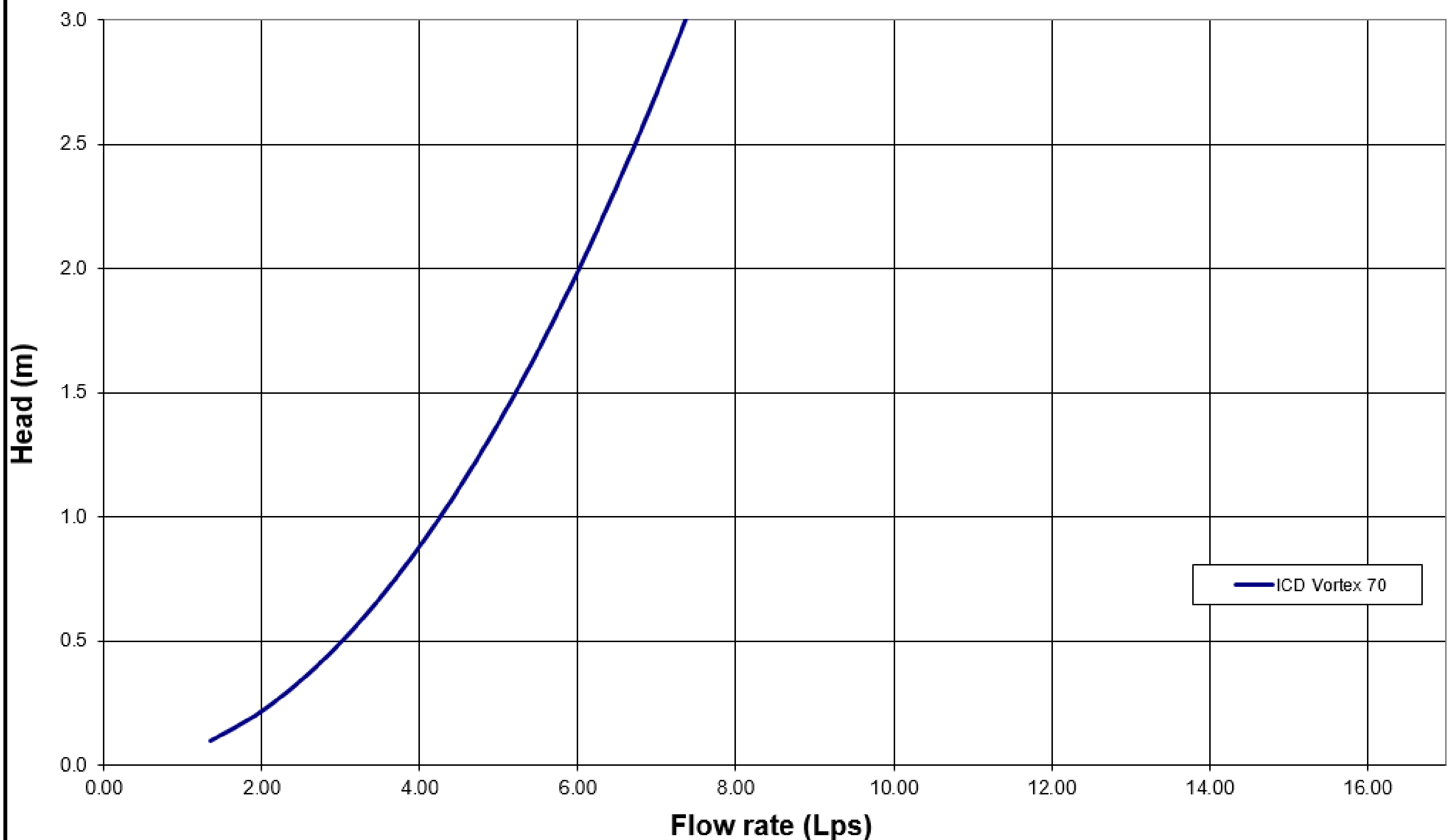
Flow: 4.8 L/s
Head: 2.05 m
CB05



IPEX

Tempest LMF ICD Flow Curve

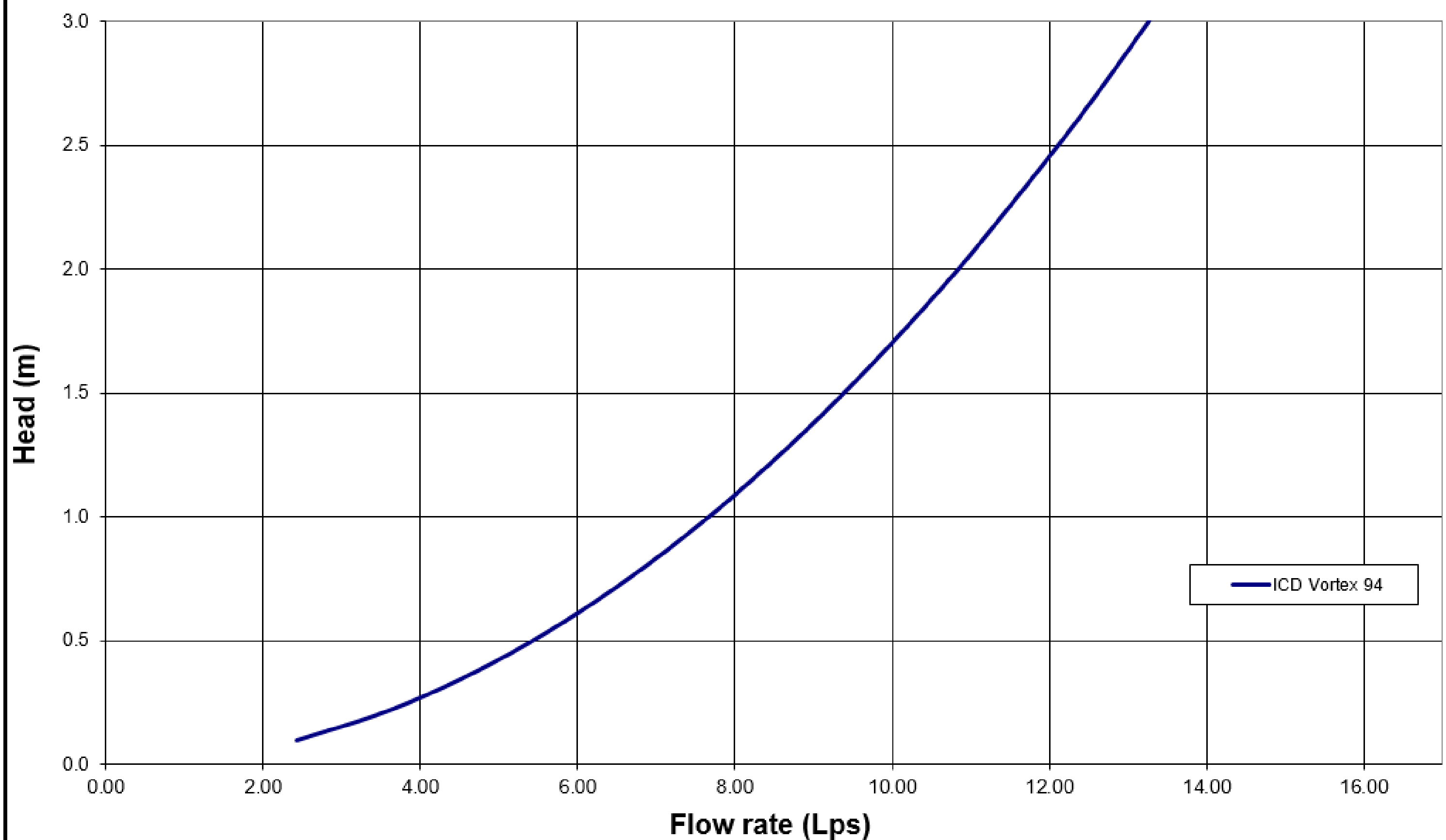
Flow: 5.9 L/s
Head: 1.89 m
CB11



IPEX

Tempest LMF ICD Flow Curve

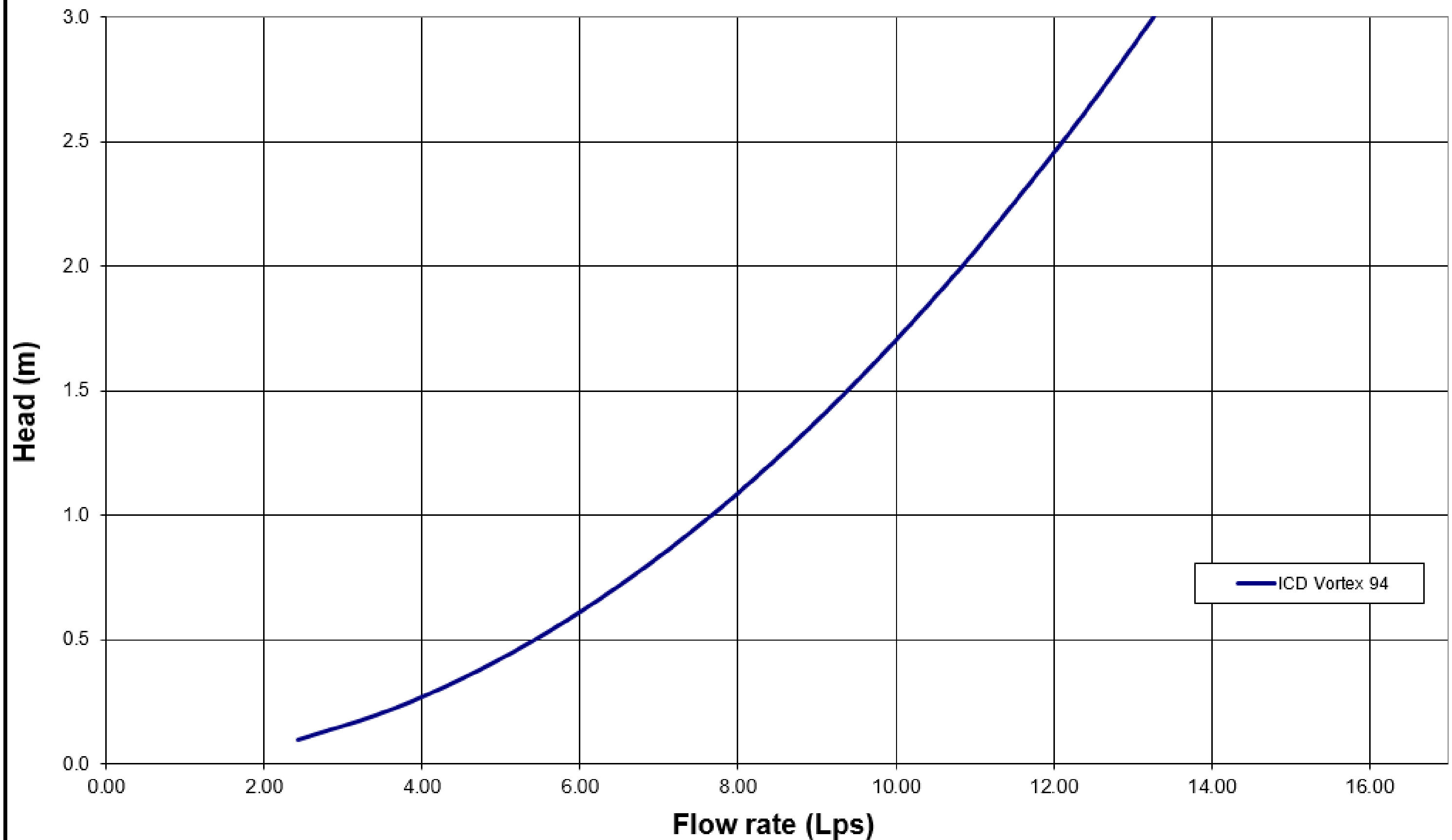
Flow: 11.1 L/s
Head: 2.14 m
CBMH01



IPEX

Tempest LMF ICD Flow Curve

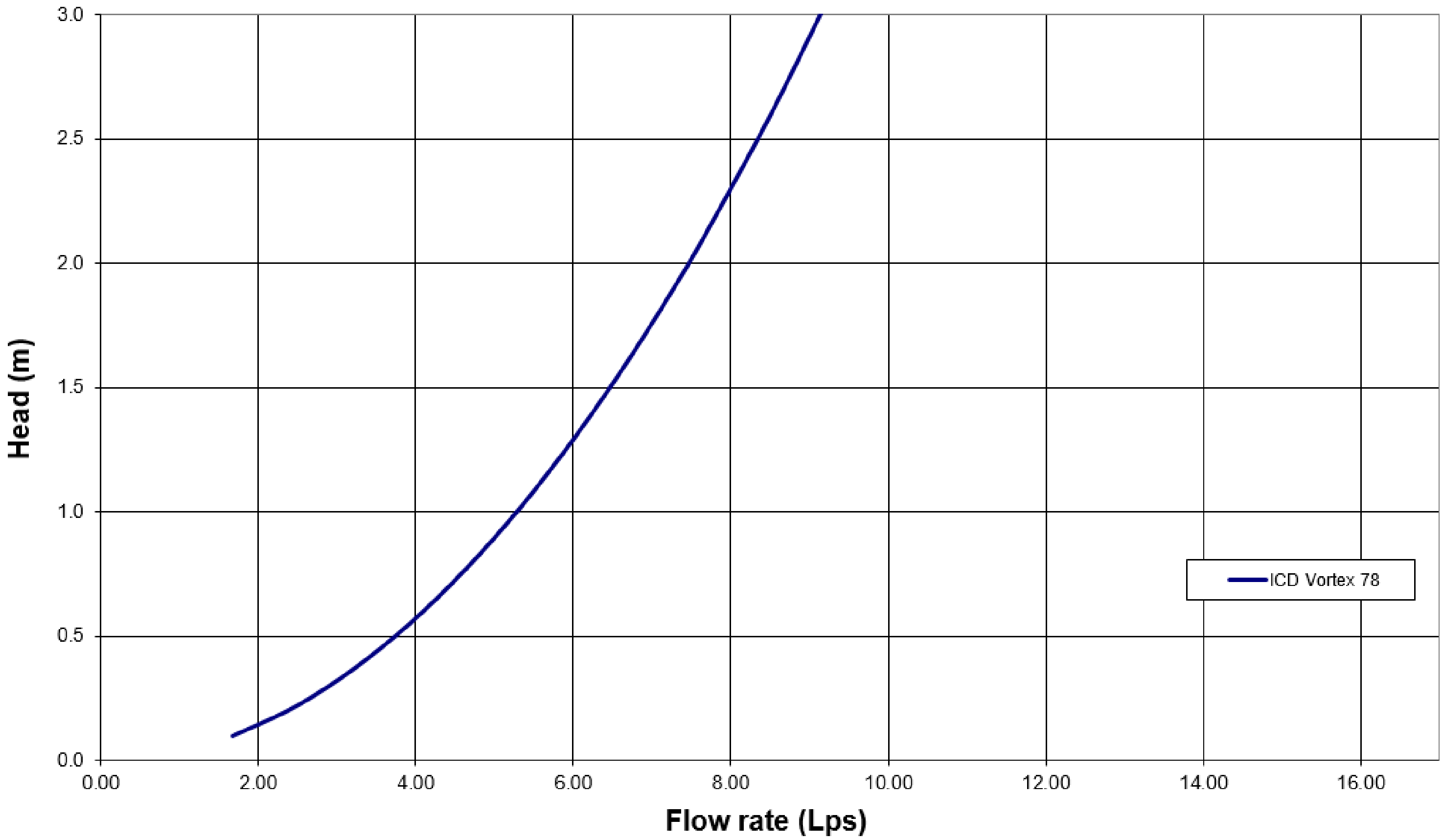
Flow: 11.3 L/s
Head: 2.22 m
CBMH04



IPEX

Tempest LMF ICD Flow Curve

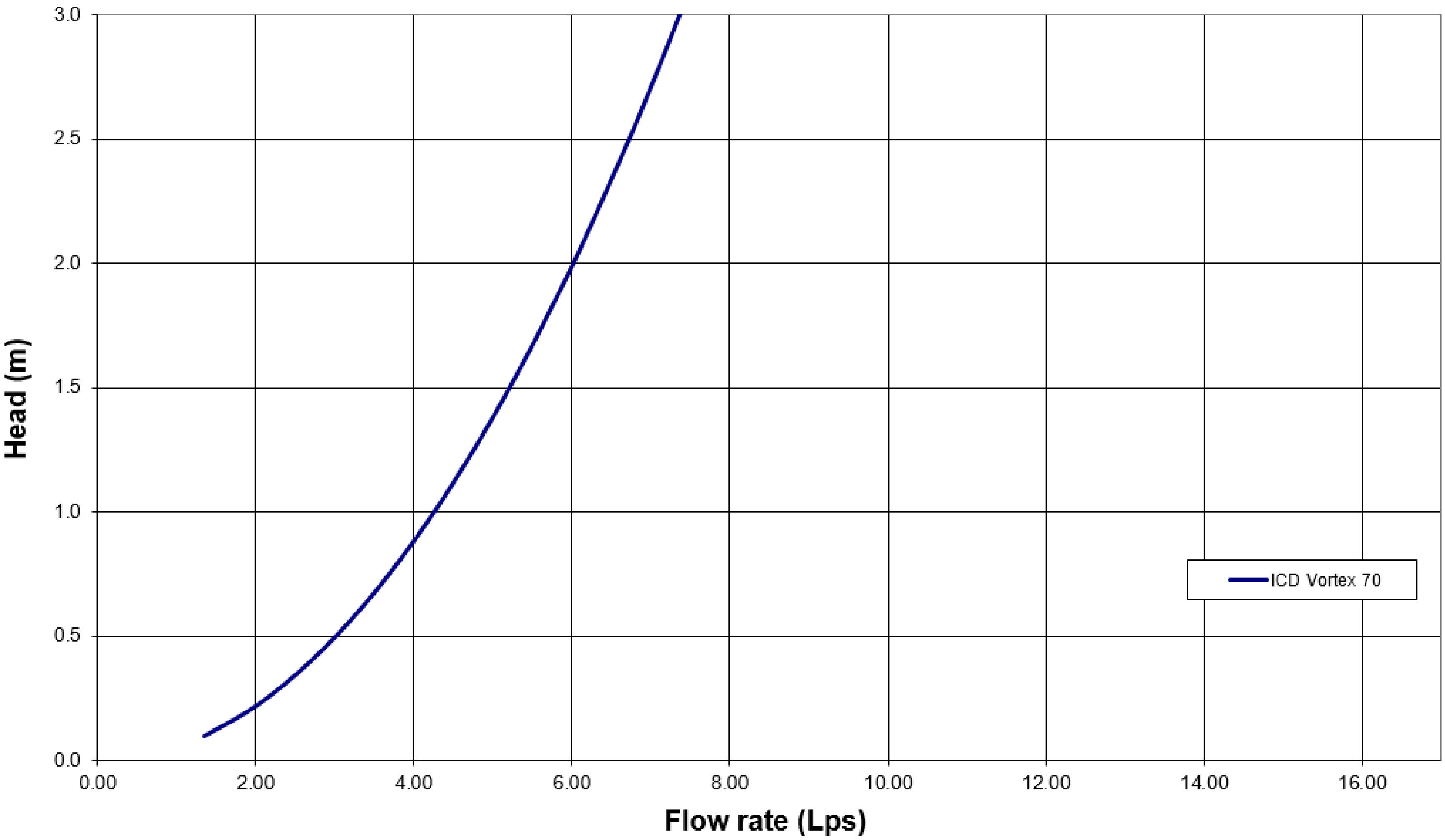
Flow: 7.2 L/s
Head: 1.87 m
CBMH09



IPEX

Tempest LMF ICD Flow Curve

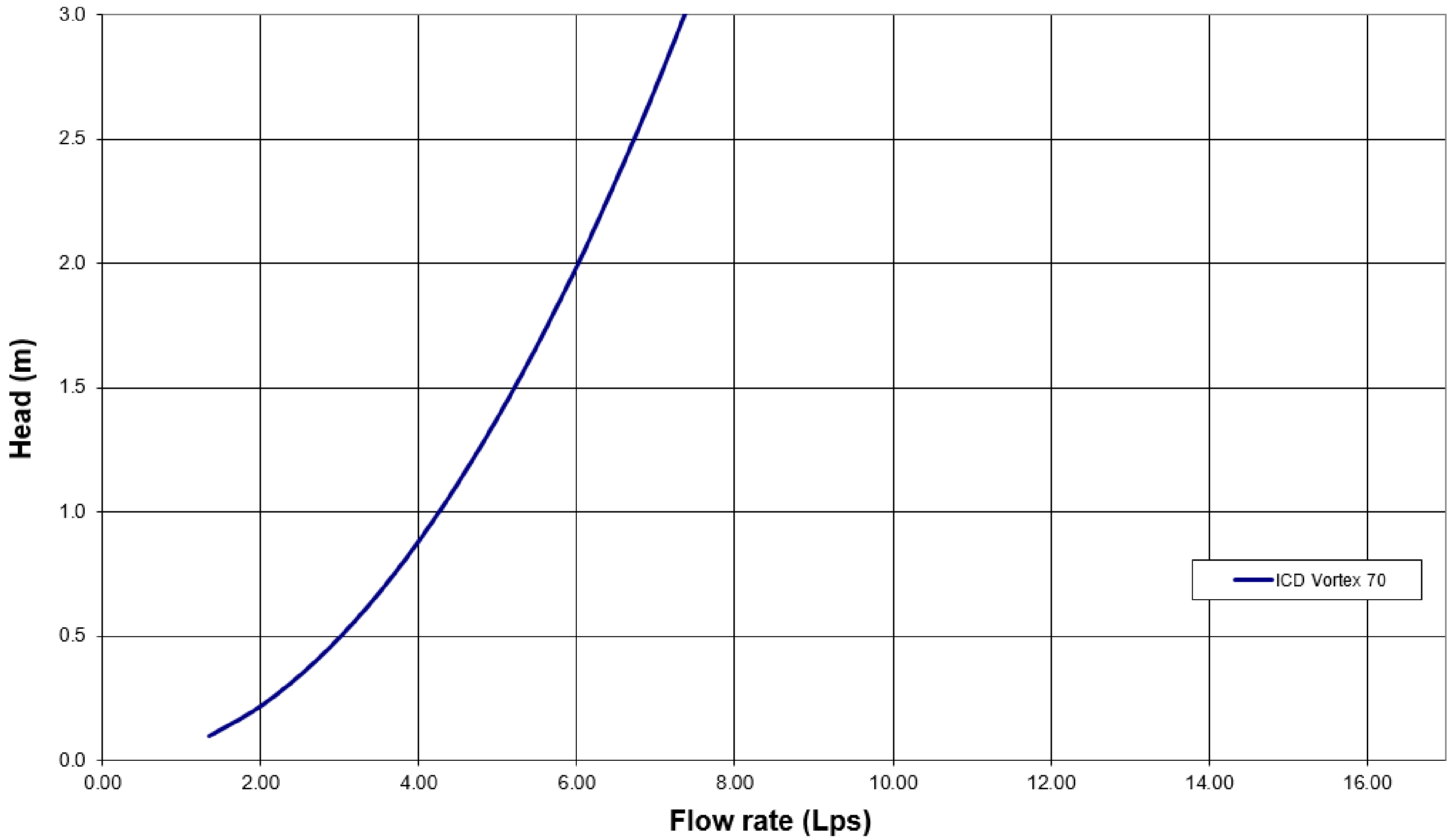
Flow: 5.7 L/s
Head: 1.79 m
CBMH13



IPEX

Tempest LMF ICD Flow Curve

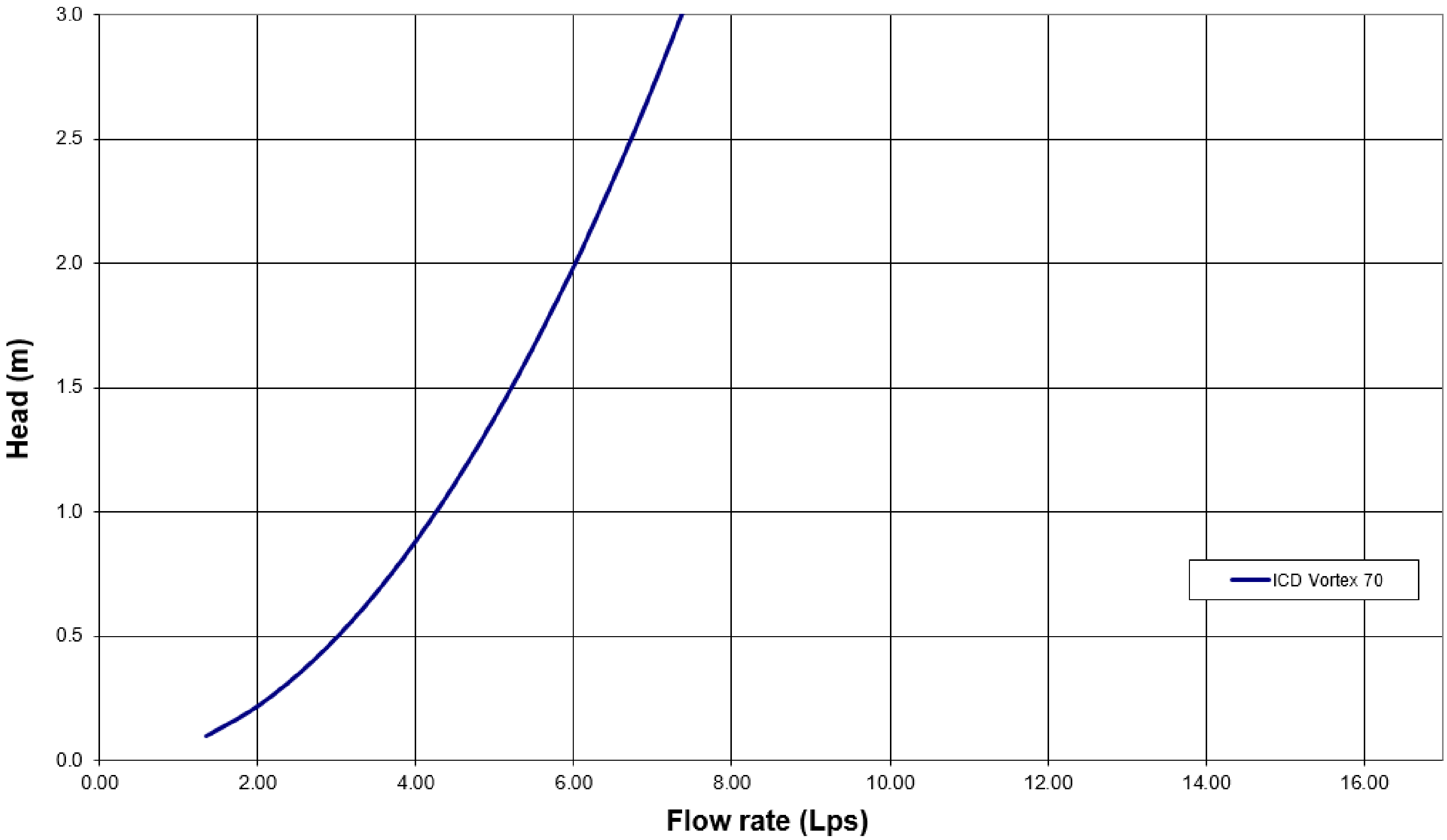
Flow: 6 L/s
Head: 1.94 m
CBMH15



IPEX

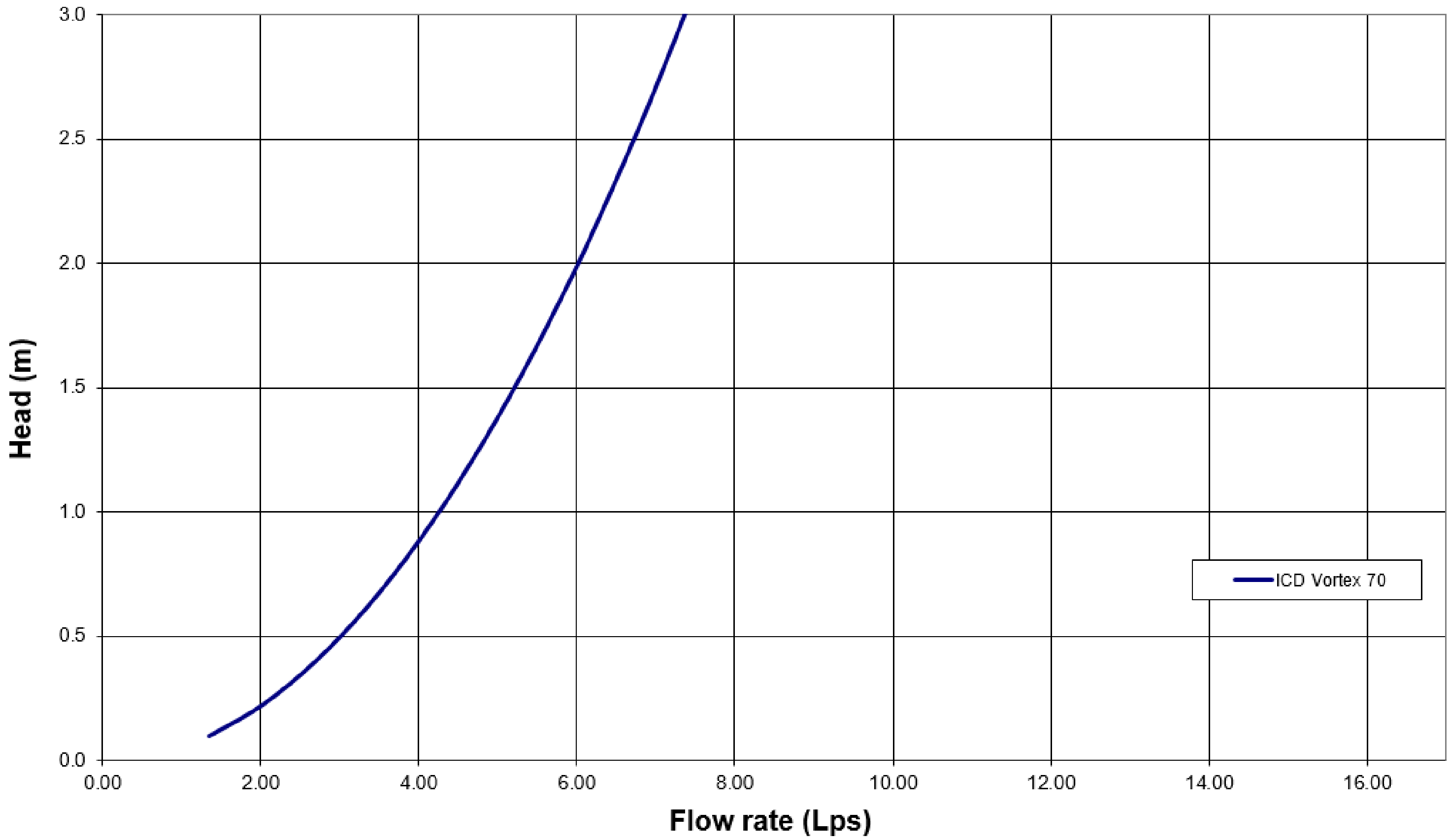
Tempest LMF ICD Flow Curve

Flow: 5.3 L/s
Head: 1.57 m
CBMH20



Tempest LMF ICD Flow Curve

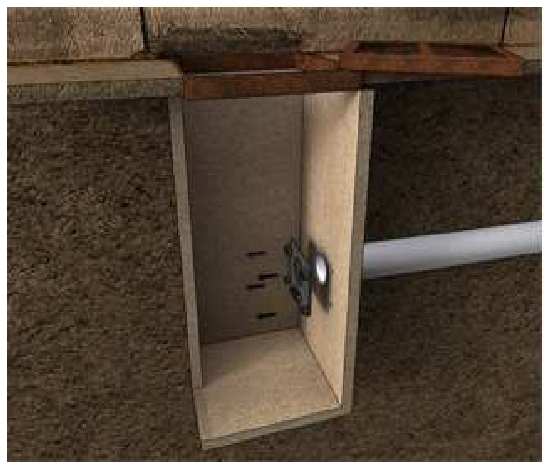
Flow: 5.5 L/s
Head: 1.66 m
CBMH23

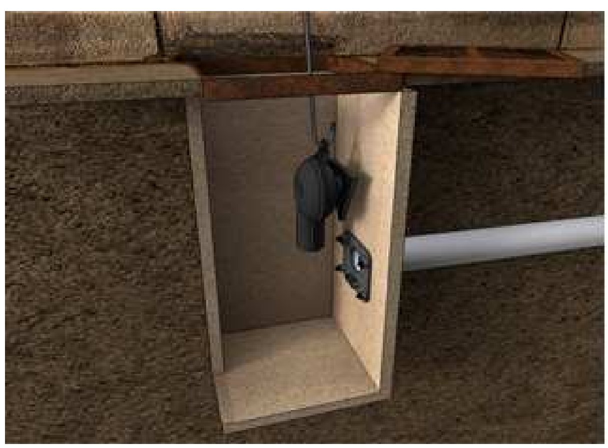


IPEX

Square CB Installation Notes:

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 3/8x3-1/2, (4) washers, (4) nuts
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. Put the nuts on the top of the anchors to protect the threads when you will hit the anchors with the hammer. Remove the nuts on the ends of the anchors
5. Install the wall mounting plate on the anchors and screw the nut 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 ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the LMF 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.

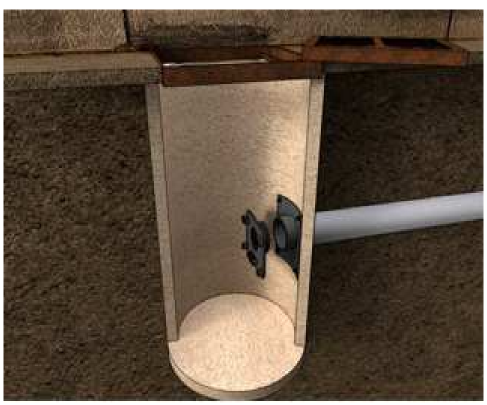




IPEX

Round CB Installation Notes: (Refer to square install notes above for steps 1 , 3, & 4)

2. Use 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.
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 lb-ft). There should be no gap between the CB spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate and the spigot of the spigot CB wall plate. 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 into the mounting plate and has created a seal.



CAUTION/WARNING/DISCLAIM:

- Verify that the inlet(s) pipe(s) is not protruding into the catch basin. If it is, cut it back so that the inlet pipe is flush with the catch basin wall.
- Any required cement in the installation must be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Please refer to the IPEX solvent cement guide to confirm required curing times or attend the IPEX **Online Solvent Cement Training Course**.
- Call your IPEX representative for more information or if you have any questions about our products.

IPEX TEMPEST Inlet Control Devices 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 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 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 must 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.

Appendix D:
Stormwater Management Modeling

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Subcatchment Parameters

NOVATECH
Engineers, Planners & Landscape Architects

Area ID	Catchment Area	Runoff Coefficient	Percent Impervious	No Depression	Equivalent Width	Average Slope
	(ha)	(C)	(%)	(%)	(m)	(%)
A01	0.09	0.83	90%	0%	53	2
A02	0.07	0.74	77%	0%	27	2
A03	0.08	0.87	96%	0%	62	2
A04	0.09	0.9	100%	0%	75	2
A05	0.06	0.84	91%	0%	35	2
A06	0.05	0.9	100%	0%	33	2
A07	0.09	0.8	86%	0%	60	2
A08	0.12	0.8	86%	0%	71	2
A09	0.15	0.9	100%	0%	100	2
A10	0.15	0.82	89%	0%	100	2
A11	0.26	0.9	100%	100%	65	2
B01	0.06	0.9	100%	0%	46	2
B02	0.08	0.87	96%	0%	53	2
B03	0.07	0.76	80%	0%	41	2
B04	0.09	0.84	91%	0%	60	2
B05	0.1	0.79	84%	0%	50	2
B06	0.06	0.76	80%	0%	40	2
B07	0.06	0.7	71%	0%	40	2
B08	0.13	0.9	100%	100%	65	2
C01	0.15	0.75	79%	0%	50	2
C02	0.13	0.74	77%	0%	76	2
C03	0.11	0.81	87%	0%	65	2
C04	0.05	0.86	94%	0%	38	2
C05	0.05	0.84	91%	0%	42	2
C06	0.09	0.88	97%	0%	60	2
C07	0.09	0.88	97%	0%	60	2
C08	0.06	0.76	80%	0%	30	2
C09	0.05	0.73	76%	0%	42	2
C10	0.09	0.87	96%	0%	69	2
C11	0.08	0.86	94%	0%	62	2
C12	0.08	0.74	77%	0%	50	2
C13	0.05	0.78	83%	0%	50	2
C14	0.08	0.78	83%	0%	62	2
C15	0.06	0.7	71%	0%	60	2
C16	0.18	0.9	100%	100%	45	2

4149 Strandherd Drive - Myers Site Plan (117148)
Catchbasin Information

NOVATECH
Engineers, Planners & Landscape Architects

CB / CBMH ID	TAG	STM Area ID	Drainage Area (ha)	Invert Elev. (m)	Rim Elev. (m)	Spill Elev. (m)	Ponding Volume (m^3)
CB01	CB	C14	0.08	93.70	95.40	95.70	42.2
CB02	CB	C15	0.06	93.74	95.40	95.63	23.1
CB03	CB	C07	0.09	94.05	95.55	95.85	44.8
CB04	CB	C03	0.11	94.34	95.60	95.82	27.8
CB05	CB	C10	0.09	93.63	95.50	95.80	48.4
CB06	CB	C04	0.05	94.26	95.60	95.79	12.3
CB07	CB	B04	0.09	94.13	95.45	95.74	29.1
CB08	CB	B01	0.06	94.22	95.45	95.71	22.0
CB09	CB	A01	0.09	94.04	95.60	95.80	21.7
CB10	CB	A04	0.09	94.36	95.50	95.73	18.6
CB11	CB	A09	0.15	93.88	95.50	95.78	40.9
CB12	CB	A07	0.09	94.14	95.50	95.65	7.9
CB13	CB	A05	0.06	94.43	95.50	95.71	9.3
CBMH01	CBMH	C12	0.08	93.42	95.40	95.58	10.1
CBMH02	CBMH	C13	0.05	93.57	95.40	95.60	12.8
CBMH04	CBMH	C09	0.05	93.59	95.60	95.87	25.8
CBMH05	CBMH	C08	0.06	93.65	95.60	95.90	39.4
CBMH06	CBMH	C01	0.15	93.89	95.60	95.90	49.3
CBMH07	CBMH	C02	0.13	94.05	95.60	95.85	33.2
CBMH09	CBMH	C11	0.08	93.82	95.45	95.68	20.3
CBMH10	CBMH	C06	0.09	93.89	95.55	95.73	12.4
CBMH11	CBMH	C05	0.05	94.08	95.60	95.76	7.4
CBMH13	CBMH	B03	0.07	93.90	95.45	95.73	33.2
CBMH14	CBMH	B02	0.08	93.98	95.45	95.72	20.7
CBMH15	CBMH	A10	0.15	93.79	95.50	95.77	79.4
CBMH16	CBMH	A02	0.07	94.00	95.50	95.66	35.0
CBMH17	CBMH	A03	0.08	94.21	95.50	95.76	35.0
CBMH20	CBMH	B05	0.10	93.97	95.40	95.60	15.0
CBMH21	CBMH	B06	0.06	94.10	95.45	95.57	4.7
CBMH22	CBMH	B07	0.06	94.29	95.45	95.55	3.1
CBMH23	CBMH	A08	0.12	93.95	95.40	95.61	28.5
CBMH24	CBMH	A06	0.05	94.08	95.50	95.68	12.3

4149 Strandherd Drive - Myers Site Plan (117148)
Summary of Underground and Surface Storage Provided

NOVATECH
Engineers, Planners & Landscape Architects

CB / CBMH ID	STM ID	Drainage Area (ha)	Elevations (m)			Depths (m)			Provided Storage (m^3)			StormTech STC-740 Storage Chambers	
			Invert	RIM	Ponding	CB	Ponding	Total	UG	Surface[1]	Total	Number	Storage (m^3)[2]
CB01	C14	0.08	93.70	95.40	95.70	1.70	0.30	2.00	0.0	42.2	42.2	0	0.0
CB02	C15	0.06	93.74	95.40	95.63	1.66	0.23	1.89	0.0	23.1	23.1	0	0.0
CB03	C07	0.09	94.05	95.55	95.85	1.50	0.30	1.80	0.0	44.8	44.8	0	0.0
CB04	C03	0.11	94.34	95.60	95.82	1.26	0.22	1.48	0.0	27.8	27.8	0	0.0
CB05	C10	0.09	93.63	95.50	95.80	1.87	0.30	2.17	16.9	48.4	65.3	8	16.9
CB06	C04	0.05	94.26	95.60	95.79	1.34	0.19	1.53	0.0	12.3	12.3	0	0.0
CB07	B04	0.09	94.13	95.45	95.74	1.32	0.29	1.61	0.0	29.1	29.1	0	0.0
CB08	B01	0.06	94.22	95.45	95.71	1.23	0.26	1.49	0.0	22.0	22.0	0	0.0
CB09	A01	0.09	94.04	95.60	95.80	1.56	0.20	1.76	0.0	21.7	21.7	0	0.0
CB10	A04	0.09	94.36	95.50	95.73	1.14	0.23	1.37	0.0	18.6	18.6	0	0.0
CB11	A09	0.15	93.88	95.50	95.78	1.62	0.28	1.90	29.6	40.9	70.5	14	29.6
CB12	A07	0.09	94.14	95.50	95.65	1.36	0.15	1.51	0.0	7.9	7.9	0	0.0
CB13	A05	0.06	94.43	95.50	95.71	1.07	0.21	1.28	0.0	9.3	9.3	0	0.0
CBMH01	C12	0.08	93.42	95.40	95.58	1.98	0.18	2.16	63.6	10.1	73.7	30	63.6
CBMH02	C13	0.05	93.57	95.40	95.60	1.83	0.20	2.03	0.0	12.8	12.8	0	0.0
CBMH04	C09	0.05	93.59	95.60	95.87	2.01	0.27	2.28	76.3	25.8	102.1	36	76.3
CBMH05	C08	0.06	93.65	95.60	95.90	1.95	0.30	2.25	0.0	39.4	39.4	0	0.0
CBMH06	C01	0.15	93.89	95.60	95.90	1.71	0.30	2.01	0.0	49.3	49.3	0	0.0
CBMH07	C02	0.13	94.05	95.60	95.85	1.55	0.25	1.80	0.0	33.2	33.2	0	0.0
CBMH09	C11	0.08	93.82	95.45	95.68	1.63	0.23	1.86	63.6	20.3	83.9	30	63.6
CBMH10	C06	0.09	93.89	95.55	95.73	1.66	0.18	1.84	0.0	12.4	12.4	0	0.0
CBMH11	C05	0.05	94.08	95.60	95.76	1.52	0.16	1.68	0.0	7.4	7.4	0	0.0
CBMH13	B03	0.07	93.90	95.45	95.73	1.55	0.28	1.83	46.6	33.2	79.8	22	46.6
CBMH14	B02	0.08	93.98	95.45	95.72	1.47	0.27	1.74	0.0	20.7	20.7	0	0.0
CBMH15	A10	0.15	93.79	95.50	95.77	1.71	0.27	1.98	63.6	79.4	143.0	30	63.6
CBMH16	A02	0.07	94.00	95.50	95.66	1.50	0.16	1.66	0.0	35.0	35.0	0	0.0
CBMH17	A03	0.08	94.21	95.50	95.76	1.29	0.26	1.55	0.0	35.0	35.0	0	0.0
CBMH20	B05	0.10	93.97	95.40	95.60	1.43	0.20	1.63	76.3	15.0	91.3	36	76.3
CBMH21	B06	0.06	94.10	95.45	95.57	1.35	0.12	1.47	0.0	4.7	4.7	0	0.0
CBMH22	B07	0.06	94.29	95.45	95.55	1.16	0.10	1.26	0.0	3.1	3.1	0	0.0
CBMH23	A08	0.12	93.95	95.40	95.61	1.45	0.21	1.66	106.0	28.5	134.5	50	106.0
CBMH24	A06	0.05	94.08	95.50	95.68	1.42	0.18	1.60	0.0	12.3	12.3	0	0.0
TOTAL		**2.69**		**-**			**-**		**542.5**	**825.7**	**1368.2**	**256**	**542.5**

[1] *Based on Grading Design / Autodesk Civil 3D (refer to Drawing 117148-SWM)*

[2] *Based on StormTech Site Calculator for STC-740*

**Highlighted CB's / CBMH's have ICDs / Underground storage*

Date: 10/31/2019
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4149 Strandherd Drive - Myers Site Plan (117148)
Summary of Underground and Surface Storage Provided

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Storage Provided by StormTech STC-740 Chambers		System Length (m)[1]	
Number	Storage (m^3)[1]	1 Row	2 Rows
1	2.1	3.27	3.27
2	4.2	5.44	3.27
3	6.3	7.61	5.44
4	8.4	9.78	5.44
5	10.6	11.95	7.61
6	12.7	14.12	7.61
7	14.8	16.29	9.78
8	16.9	18.46	9.78
9	19.0	20.63	11.95
10	21.2	22.80	11.95
11	23.3	24.97	14.12
12	25.4	27.14	14.12
13	27.5	29.31	16.29
14	29.6	31.48	16.29
15	31.8	33.65	18.46
16	33.9	35.82	18.46
17	36.0	37.99	20.63
18	38.1	40.16	20.63
19	40.2	42.33	22.80
20	42.4	44.50	22.80
21	44.5	46.67	24.97
22	46.6	48.84	24.97
23	48.7	51.01	27.14
24	50.8	53.18	27.14
25	53.0	55.35	29.31
26	55.1	57.52	29.31
27	57.2	59.69	31.48
28	59.3	61.86	31.48
30	63.6	66.20	33.65
36	76.3	79.22	40.16
40	84.8	87.90	44.50
50	106.0	109.60	55.35

[1] *Based on StormTech Site Calculator for STC-740*

- 150mm stone foundation

- 40% void ratio for surrounding stone

- 1 row; Width = 1.90m

- 2 rows; Width = 3.35m

- Includes end caps

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4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CB01	**C14**	**0.0**	**42.2**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.70	0.00	0.0	0.0
2.00	281.33	42.2	42.2
2.01	0.00	1.4	43.6
2.70	0.00	0.0	43.6

0x Stormtech STC-740 Storage Chambers (0 m3)
0.3m Static Ponding Depth (42.2 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB02	**C15**	**0.0**	**23.1**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.66	0.00	0.0	0.0
1.89	200.87	23.1	23.1
1.90	0.00	1.0	24.1
2.66	0.00	0.0	24.1

0x Stormtech STC-740 Storage Chambers (0 m3)
0.23m Static Ponding Depth (23.1 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB03	**C07**	**0.0**	**44.8**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.50	0.00	0.0	0.0
1.80	298.67	44.8	44.8
1.81	0.00	1.5	46.3
2.50	0.00	0.0	46.3

0x Stormtech STC-740 Storage Chambers (0 m3)
0.3m Static Ponding Depth (44.8 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CB04	**C03**	**0.0**	**27.8**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.26	0.00	0.0	0.0
1.48	252.73	27.8	27.8
1.49	0.00	1.3	29.1
2.26	0.00	0.0	29.1

0x Stormtech STC-740 Storage Chambers (0 m3)
0.22m Static Ponding Depth (27.8 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB05	**C10**	**16.9**	**48.4**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	44.47	16.9	16.9
0.77	0.00	0.2	17.1
1.87	0.00	0.0	17.1
2.17	322.67	48.4	65.5
2.18	0.00	1.6	67.1
2.87	0.00	0.0	67.1

8x Stormtech STC-740 Storage Chambers (16.9 m3)
0.3m Static Ponding Depth (48.4 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB06	**C04**	**0.0**	**12.3**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.34	0.00	0.0	0.0
1.53	129.47	12.3	12.3
1.54	0.00	0.6	12.9
2.34	0.00	0.0	12.9

0x Stormtech STC-740 Storage Chambers (0 m3)
0.19m Static Ponding Depth (12.3 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CB07	**B04**	**0.0**	**29.1**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.32	0.00	0.0	0.0
1.61	200.69	29.1	29.1
1.62	0.00	1.0	30.1
2.32	0.00	0.0	30.1

0x Stormtech STC-740 Storage Chambers (0 m3)
0.29m Static Ponding Depth (29.1 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB08	**B01**	**0.0**	**22.0**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.23	0.00	0.0	0.0
1.49	169.23	22.0	22.0
1.50	0.00	0.8	22.8
2.23	0.00	0.0	22.8

0x Stormtech STC-740 Storage Chambers (0 m3)
0.26m Static Ponding Depth (22 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB09	**A01**	**0.0**	**21.7**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.56	0.00	0.0	0.0
1.76	217.00	21.7	21.7
1.77	0.00	1.1	22.8
2.56	0.00	0.0	22.8

0x Stormtech STC-740 Storage Chambers (0 m3)
0.2m Static Ponding Depth (21.7 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CB10	**A04**	**0.0**	**18.6**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.14	0.00	0.0	0.0
1.37	161.74	18.6	18.6
1.38	0.00	0.8	19.4
2.14	0.00	0.0	19.4

0x Stormtech STC-740 Storage Chambers (0 m3)
0.23m Static Ponding Depth (18.6 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB11	**A09**	**29.6**	**40.9**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	77.89	29.6	29.6
0.77	0.00	0.4	30.0
1.62	0.00	0.0	30.0
1.90	292.14	40.9	70.9
1.91	0.00	1.5	72.4
2.62	0.00	0.0	72.4

14x Stormtech STC-740 Storage Chambers (29.6 m3)
0.28m Static Ponding Depth (40.9 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CB12	**A07**	**0.0**	**7.9**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.36	0.00	0.0	0.0
1.51	105.33	7.9	7.9
1.52	0.00	0.5	8.4
2.36	0.00	0.0	8.4

0x Stormtech STC-740 Storage Chambers (0 m3)
0.15m Static Ponding Depth (7.9 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CB13	**A05**	**0.0**	**9.3**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.07	0.00	0.0	0.0
1.28	88.57	9.3	9.3
1.29	0.00	0.4	9.7
2.07	0.00	0.0	9.7

0x Stormtech STC-740 Storage Chambers (0 m3)
0.21m Static Ponding Depth (9.3 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH01	**C12**	**63.6**	**10.1**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	167.37	63.6	63.6
0.77	0.00	0.8	64.4
1.98	0.00	0.0	64.4
2.16	112.22	10.1	74.5
2.17	0.00	0.6	75.1
2.98	0.00	0.0	75.1

30x Stormtech STC-740 Storage Chambers (63.6 m3)
0.18m Static Ponding Depth (10.1 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH02	**C13**	**0.0**	**12.8**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.83	0.00	0.0	0.0
2.03	128.00	12.8	12.8
2.04	0.00	0.6	13.4
2.83	0.00	0.0	13.4

0x Stormtech STC-740 Storage Chambers (0 m3)
0.2m Static Ponding Depth (12.8 m3)

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PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH04	**C09**	**76.3**	**25.8**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	200.79	76.3	76.3
0.77	0.00	1.0	77.3
2.01	0.00	0.0	77.3
2.28	191.11	25.8	103.1
2.29	0.00	1.0	104.1
3.01	0.00	0.0	104.1

36x Stormtech STC-740 Storage Chambers (76.3 m3)
0.27m Static Ponding Depth (25.8 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH05	**C08**	**0.0**	**39.4**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.95	0.00	0.0	0.0
2.25	262.67	39.4	39.4
2.26	0.00	1.3	40.7
2.95	0.00	0.0	40.7

0x Stormtech STC-740 Storage Chambers (0 m3)
0.3m Static Ponding Depth (39.4 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH06	**C01**	**0.0**	**49.3**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.71	0.00	0.0	0.0
2.01	328.67	49.3	49.3
2.02	0.00	1.6	50.9
2.71	0.00	0.0	50.9

0x Stormtech STC-740 Storage Chambers (0 m3)
0.3m Static Ponding Depth (49.3 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH07	**C02**	**0.0**	**33.2**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.55	0.00	0.0	0.0
1.80	265.60	33.2	33.2
1.81	0.00	1.3	34.5
2.55	0.00	0.0	34.5

0x Stormtech STC-740 Storage Chambers (0 m3)
0.25m Static Ponding Depth (33.2 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH09	**C11**	**63.6**	**20.3**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	167.37	63.6	63.6
0.77	0.00	0.8	64.4
1.63	0.00	0.0	64.4
1.86	176.52	20.3	84.7
1.87	0.00	0.9	85.6
2.63	0.00	0.0	85.6

30x Stormtech STC-740 Storage Chambers (63.6 m3)
0.23m Static Ponding Depth (20.3 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH10	**C06**	**0.0**	**12.4**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.66	0.00	0.0	0.0
1.84	137.78	12.4	12.4
1.85	0.00	0.7	13.1
2.66	0.00	0.0	13.1

0x Stormtech STC-740 Storage Chambers (0 m3)
0.18m Static Ponding Depth (12.4 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

Engineers, Planners & Landscape Architects

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH11	**C05**	**0.0**	**7.4**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.52	0.00	0.0	0.0
1.68	92.50	7.4	7.4
1.69	0.00	0.5	7.9
2.52	0.00	0.0	7.9

0x Stormtech STC-740 Storage Chambers (0 m3)
0.16m Static Ponding Depth (7.4 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH13	**B03**	**46.6**	**33.2**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	122.63	46.6	46.6
0.77	0.00	0.6	47.2
1.55	0.00	0.0	47.2
1.83	237.14	33.2	80.4
1.84	0.00	1.2	81.6
2.55	0.00	0.0	81.6

22x Stormtech STC-740 Storage Chambers (46.6 m3)
0.28m Static Ponding Depth (33.2 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH14	**B02**	**0.0**	**20.7**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.47	0.00	0.0	0.0
1.74	153.33	20.7	20.7
1.75	0.00	0.8	21.5
2.47	0.00	0.0	21.5

0x Stormtech STC-740 Storage Chambers (0 m3)
0.27m Static Ponding Depth (20.7 m3)

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH15	**A10**	**63.6**	**79.4**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	167.37	63.6	63.6
0.77	0.00	0.8	64.4
1.71	0.00	0.0	64.4
1.98	588.15	79.4	143.8
1.99	0.00	2.9	146.8
2.71	0.00	0.0	146.8

30x Stormtech STC-740 Storage Chambers (63.6 m3)
0.27m Static Ponding Depth (79.4 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH16	**A02**	**0.0**	**35.0**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.50	0.00	0.0	0.0
1.66	437.50	35.0	35.0
1.67	0.00	2.2	37.2
2.50	0.00	0.0	37.2

0x Stormtech STC-740 Storage Chambers (0 m3)
0.16m Static Ponding Depth (35 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH17	**A03**	**0.0**	**35.0**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.29	0.00	0.0	0.0
1.55	269.23	35.0	35.0
1.56	0.00	1.3	36.3
2.29	0.00	0.0	36.3

0x Stormtech STC-740 Storage Chambers (0 m3)
0.26m Static Ponding Depth (35 m3)

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH20	**B05**	**76.3**	**15.0**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	200.79	76.3	76.3
0.77	0.00	1.0	77.3
1.43	0.00	0.0	77.3
1.63	150.00	15.0	92.3
1.64	0.00	0.8	93.1
2.43	0.00	0.0	93.1

36x Stormtech STC-740 Storage Chambers (76.3 m3)
0.2m Static Ponding Depth (15 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH21	**B06**	**0.0**	**4.7**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.35	0.00	0.0	0.0
1.47	78.33	4.7	4.7
1.48	0.00	0.4	5.1
2.35	0.00	0.0	5.1

0x Stormtech STC-740 Storage Chambers (0 m3)
0.12m Static Ponding Depth (4.7 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH22	**B07**	**0.0**	**3.1**
Depth (m)	Equivalent Area (m^2)	Incremental Volume (m^3)	Total Volume (m^3)
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.16	0.00	0.0	0.0
1.26	62.00	3.1	3.1
1.27	0.00	0.3	3.4
2.16	0.00	0.0	3.4

0x Stormtech STC-740 Storage Chambers (0 m3)
0.1m Static Ponding Depth (3.1 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Storage Curves

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STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH23	**A08**	**106.0**	**28.5**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	278.95	106.0	106.0
0.77	0.00	1.4	107.4
1.45	0.00	0.0	107.4
1.66	271.43	28.5	135.9
1.67	0.00	1.4	137.3
2.45	0.00	0.0	137.3

50x Stormtech STC-740 Storage Chambers (106 m3)
0.21m Static Ponding Depth (28.5 m3)

STM ID	CB ID	Provided Storage	
		Underground	Surface
CBMH24	**A06**	**0.0**	**12.3**
Depth (m)	**Equivalent Area (m^2)**	**Incremental Volume (m^3)**	**Total Volume (m^3)**
0.00	0.00	0.0	0.0
0.76	0.00	0.0	0.0
0.77	0.00	0.0	0.0
1.42	0.00	0.0	0.0
1.60	136.67	12.3	12.3
1.61	0.00	0.7	13.0
2.42	0.00	0.0	13.0

0x Stormtech STC-740 Storage Chambers (0 m3)
0.18m Static Ponding Depth (12.3 m3)

4149 Strandherd Drive - Myers Site Plan (117148)
Estimated Roof Drains and Rating Curves (PCSWMM)

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Estimated Number of Roof Drains

Building	Area (ha)	Estimated Number of Roof Drains*
BLDG-A	0.26	11
BLDG-B	0.13	6
BLDG-C	0.18	8
TOTAL	**0.57**	**25**

Roof drain every 250m ^{2}

Watts Flow Control Roof Drain Rating Curves

Head (m)	Controlled Flow Rate (L/s)			
	Single Drain*	Area 'A' (11 drains)	Area 'B' (6 drains)	Area 'C' (8 drains)
0.000	0.00	0.00	0.00	0.00
0.025	0.32	3.52	1.92	2.56
0.051	0.63	6.93	3.78	5.04
0.076	0.87	9.57	5.22	6.96
0.102	1.10	12.10	6.60	8.80
0.127	1.34	14.74	8.04	10.72
0.150	1.58	17.38	9.48	12.64
1.000	1.58	17.38	9.48	12.64

**Watts Flow Control Roof Drains Rating Curve (single drain)*

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4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Results (Peak Flows)

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Scenario / Area	Drainage Area (ha)	Peak Flows[1] (L/s)						
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	100-yr (+20%)
Allowable Release Rate								
Allowable (L/s/ha)	**-**	***20.0***	***35.0***	***45.0***	***64.0***	***75.0***	***126.0***	**-**
Area 'A'	1.18	23.6	41.3	53.1	75.5	88.5	148.7	-
Area 'B'	0.65	13.0	22.8	29.3	41.6	48.8	81.9	-
Area 'C'	1.40	28.0	49.0	63.0	89.6	105.0	176.4	-
TOTAL (Allowable)	**3.23**	**64.6**	**113.1**	**145.4**	**206.7**	**242.3**	**407.0**	**-**
Proposed Conditions - Overall								
Area 'A'	1.18	23.4	28.1	29.6	32.8	34.1	34.7	34.8
Area 'B'	0.65	12.8	15.9	16.8	17.9	20.0	20.5	20.7
Area 'C'	1.40	27.5	36.1	39.9	45.3	46.4	47.1	47.3
TOTAL (Overall)	**3.23**	**63.6**	**80.1**	**86.3**	**96.0**	**100.6**	**102.3**	**102.8**
Difference (post - allowable)	-	*-1.0*	*-32.9*	*-59.1*	*-110.7*	*-141.7*	*-304.7*	-

[1] 3-hour Chicago Storm.

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4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Results (Peak Flows)

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Scenario / Area	Drainage Area (ha)	Peak Flows[1] (L/s)						
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	100-yr (+20%)
Proposed Conditions - Area 'A'								
Controlled ICD's	0.92	12.0	14.8	15.1	16.9	17.1	17.3	17.4
Controlled Roof Drains	0.26	11.4	13.3	14.5	15.9	17.0	17.4	17.4
TOTAL (Area 'A')	**1.18**	**23.4**	**28.1**	**29.6**	**32.8**	**34.1**	**34.7**	**34.8**
Difference (post - allowable)	-	*-0.2*	*-13.2*	*-23.5*	*-42.7*	*-54.4*	*-114.0*	-
Proposed Conditions - Area 'B'								
Controlled ICD's	0.52	6.6	8.7	9.0	9.3	10.9	11.1	11.2
Controlled Roof Drains	0.13	6.1	7.2	7.8	8.6	9.1	9.5	9.5
TOTAL (Area 'B')	**0.65**	**12.8**	**15.9**	**16.8**	**17.9**	**20.0**	**20.5**	**20.7**
Difference (post - allowable)	-	*-0.2*	*-6.9*	*-12.4*	*-23.7*	*-28.7*	*-61.4*	-
Proposed Conditions - Area 'C'								
Controlled ICD's	1.22	19.3	26.5	29.5	33.8	34.2	34.4	34.7
Controlled Roof Drains	0.18	8.2	9.6	10.4	11.5	12.3	12.6	12.6
TOTAL (Area 'C')	**1.40**	**27.5**	**36.1**	**39.9**	**45.3**	**46.4**	**47.1**	**47.3**
Difference (post - allowable)	-	*-0.5*	*-12.9*	*-23.1*	*-44.3*	*-58.6*	*-129.3*	-

[1] 3-hour Chicago Storm.

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Results (Ponding)

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CB / CBMH ID	Invert Elev. (m)	Rim Elev. (m)	Spill Elev. (m)	Ponding Depth (m)	HGL Elev. (m)[1]				Ponding Depth (m)				Spill Depth (m)			
					2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)	2-yr	5-yr	100-yr	100-yr (+20%)
CB01	93.70	95.40	95.70	0.30	93.96	94.10	95.56	95.60	0.00	0.00	0.16	0.20	0.00	0.00	0.00	0.00
CB02	93.74	95.40	95.63	0.23	93.97	94.10	95.56	95.64	0.00	0.00	0.16	0.24	0.00	0.00	0.00	0.01
CB03	94.05	95.55	95.85	0.30	94.43	95.64	95.81	95.84	0.00	0.09	0.26	0.29	0.00	0.00	0.00	0.00
CB04	94.34	95.60	95.82	0.22	94.46	95.64	95.81	95.83	0.00	0.04	0.21	0.23	0.00	0.00	0.00	0.01
CB05	93.63	95.50	95.80	0.30	94.32	95.53	95.68	95.73	0.00	0.03	0.18	0.23	0.00	0.00	0.00	0.00
CB06	94.26	95.60	95.79	0.19	94.45	94.68	95.69	95.75	0.00	0.00	0.09	0.15	0.00	0.00	0.00	0.00
CB07	94.13	95.45	95.74	0.29	94.66	95.53	95.69	95.72	0.00	0.08	0.24	0.27	0.00	0.00	0.00	0.00
CB08	94.22	95.45	95.71	0.26	94.66	95.53	95.69	95.72	0.00	0.08	0.24	0.27	0.00	0.00	0.00	0.01
CB09	94.04	95.60	95.80	0.20	95.36	95.60	95.73	95.75	0.00	0.00	0.13	0.15	0.00	0.00	0.00	0.00
CB10	94.36	95.50	95.73	0.23	95.36	95.60	95.73	95.74	0.00	0.10	0.23	0.24	0.00	0.00	0.00	0.01
CB11	93.88	95.50	95.78	0.28	94.60	95.60	95.77	95.79	0.00	0.10	0.27	0.29	0.00	0.00	0.00	0.01
CB12	94.14	95.50	95.65	0.15	94.48	94.61	95.61	95.63	0.00	0.00	0.11	0.13	0.00	0.00	0.00	0.00
CB13	94.43	95.50	95.71	0.21	94.52	94.61	95.61	95.68	0.00	0.00	0.11	0.18	0.00	0.00	0.00	0.00
CBMH01	93.42	95.40	95.58	0.18	93.96	94.10	95.56	95.60	0.00	0.00	0.16	0.20	0.00	0.00	0.00	0.02
CBMH02	93.57	95.40	95.60	0.20	93.96	94.10	95.56	95.61	0.00	0.00	0.16	0.21	0.00	0.00	0.00	0.01
CBMH04	93.59	95.60	95.87	0.27	94.43	95.64	95.81	95.84	0.00	0.04	0.21	0.24	0.00	0.00	0.00	0.00
CBMH05	93.65	95.60	95.90	0.30	94.43	95.64	95.81	95.84	0.00	0.04	0.21	0.24	0.00	0.00	0.00	0.00
CBMH06	93.89	95.60	95.90	0.30	94.43	95.64	95.81	95.84	0.00	0.04	0.21	0.24	0.00	0.00	0.00	0.00
CBMH07	94.05	95.60	95.85	0.25	94.43	95.64	95.81	95.84	0.00	0.04	0.21	0.24	0.00	0.00	0.00	0.00
CBMH09	93.82	95.45	95.68	0.23	94.45	94.68	95.69	95.69	0.00	0.00	0.24	0.24	0.00	0.00	0.01	0.01
CBMH10	93.89	95.55	95.73	0.18	94.45	94.68	95.69	95.70	0.00	0.00	0.14	0.15	0.00	0.00	0.00	0.00
CBMH11	94.08	95.60	95.76	0.16	94.45	94.68	95.69	95.72	0.00	0.00	0.09	0.12	0.00	0.00	0.00	0.00
CBMH13	93.90	95.45	95.73	0.28	94.66	95.53	95.69	95.72	0.00	0.08	0.24	0.27	0.00	0.00	0.00	0.00
CBMH14	93.98	95.45	95.72	0.27	94.66	95.53	95.69	95.72	0.00	0.08	0.24	0.27	0.00	0.00	0.00	0.00
CBMH15	93.79	95.50	95.77	0.27	95.36	95.60	95.73	95.75	0.00	0.10	0.23	0.25	0.00	0.00	0.00	0.00
CBMH16	94.00	95.50	95.66	0.16	95.36	95.60	95.73	95.75	0.00	0.10	0.23	0.25	0.00	0.00	0.07	0.09
CBMH17	94.21	95.50	95.76	0.26	95.36	95.60	95.73	95.75	0.00	0.10	0.23	0.25	0.00	0.00	0.00	0.00
CBMH20	93.97	95.40	95.60	0.20	94.46	94.57	95.54	95.60	0.00	0.00	0.14	0.20	0.00	0.00	0.00	0.00
CBMH21	94.10	95.45	95.57	0.12	94.46	94.57	95.54	95.59	0.00	0.00	0.09	0.14	0.00	0.00	0.00	0.02
CBMH22	94.29	95.45	95.55	0.10	94.46	94.57	95.54	95.58	0.00	0.00	0.09	0.13	0.00	0.00	0.00	0.03
CBMH23	93.95	95.40	95.61	0.21	94.48	94.61	95.61	95.63	0.00	0.00	0.21	0.23	0.00	0.00	0.00	0.02
CBMH24	94.08	95.50	95.68	0.18	94.48	94.61	95.61	95.63	0.00	0.00	0.11	0.13	0.00	0.00	0.00	0.00

[1] 3-hour Chicago Storm.

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4149 Strandherd Drive - Myers Site Plan (117148)
Summary of Hydraulic Grade Line (HGL) Elevations

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MH ID	Obvert Elevation (m)	T/G Elevation (m)	HGL Elevation[1] (m)	Surcharge (m)	Clearance from T/G (m)	HGL in Stress Test[1] (m)
MH03	94.10	96.67	93.40	0.00	3.27	93.40
MH08	94.20	96.52	93.56	0.00	2.96	93.56
MH12	94.23	96.61	93.65	0.00	2.96	93.65
MH18	94.30	96.76	93.77	0.00	2.99	93.77
MH19	94.39	96.45	93.79	0.00	2.66	93.79

[1] *3-hour Chicago Storm.*

4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Schematics

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Overall Model Schematic

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4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Schematics

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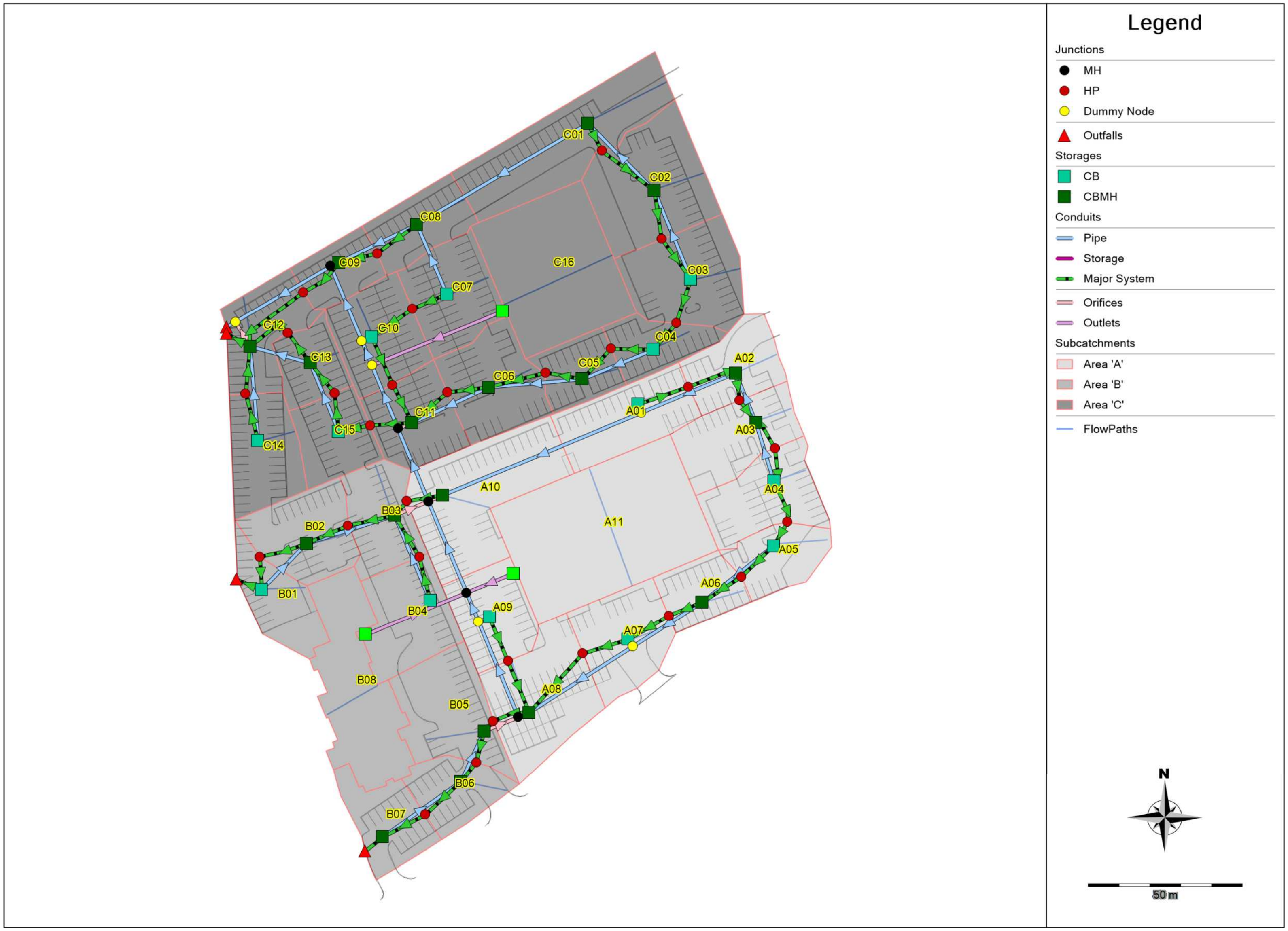
Subcatchments and Flow Paths



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4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Schematics

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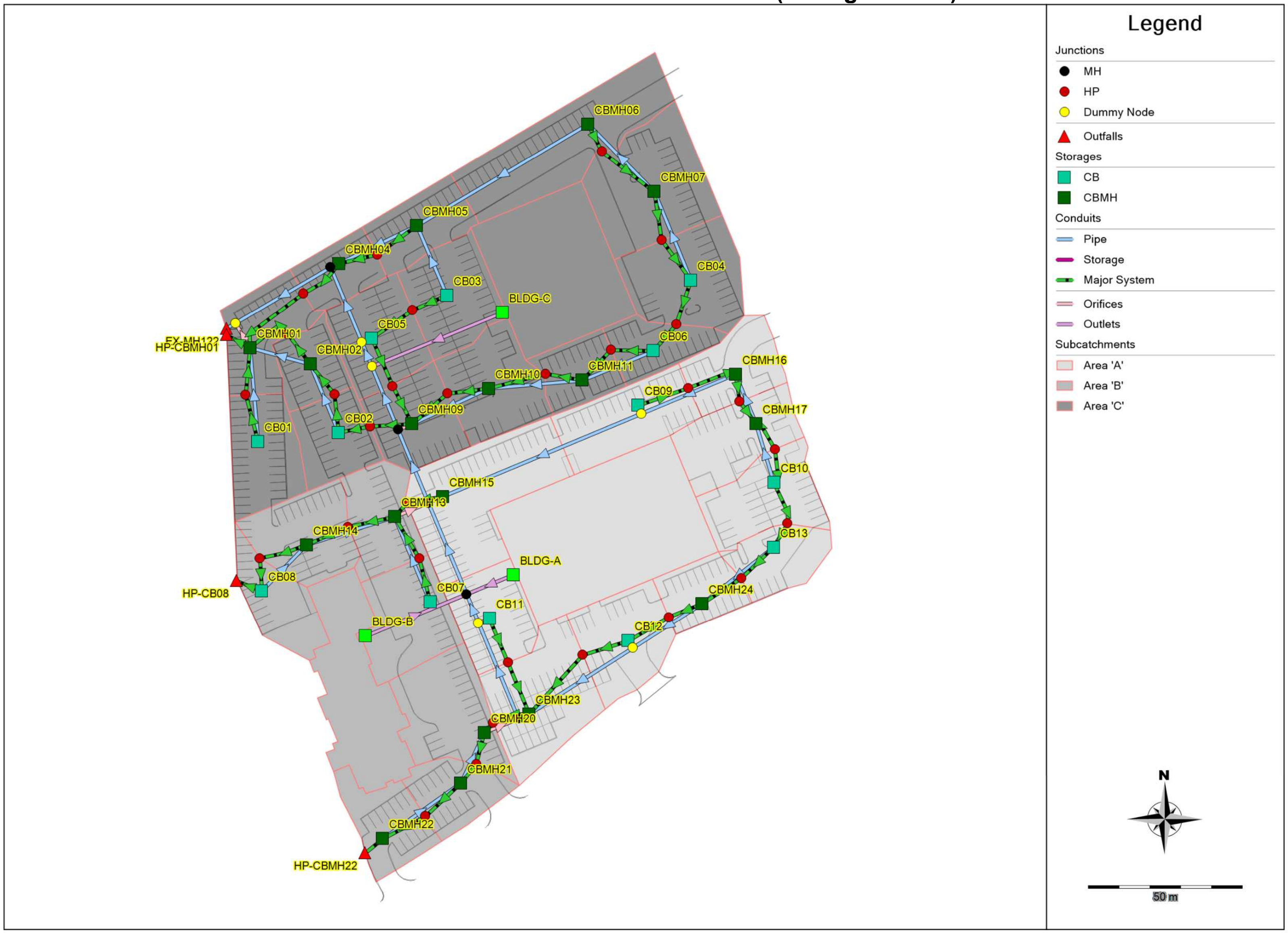
Catchbasins and Catchbasin Manholes (Storage Nodes)



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4149 Strandherd Drive - Myers Site Plan (117148)
PCSWMM Model Schematics

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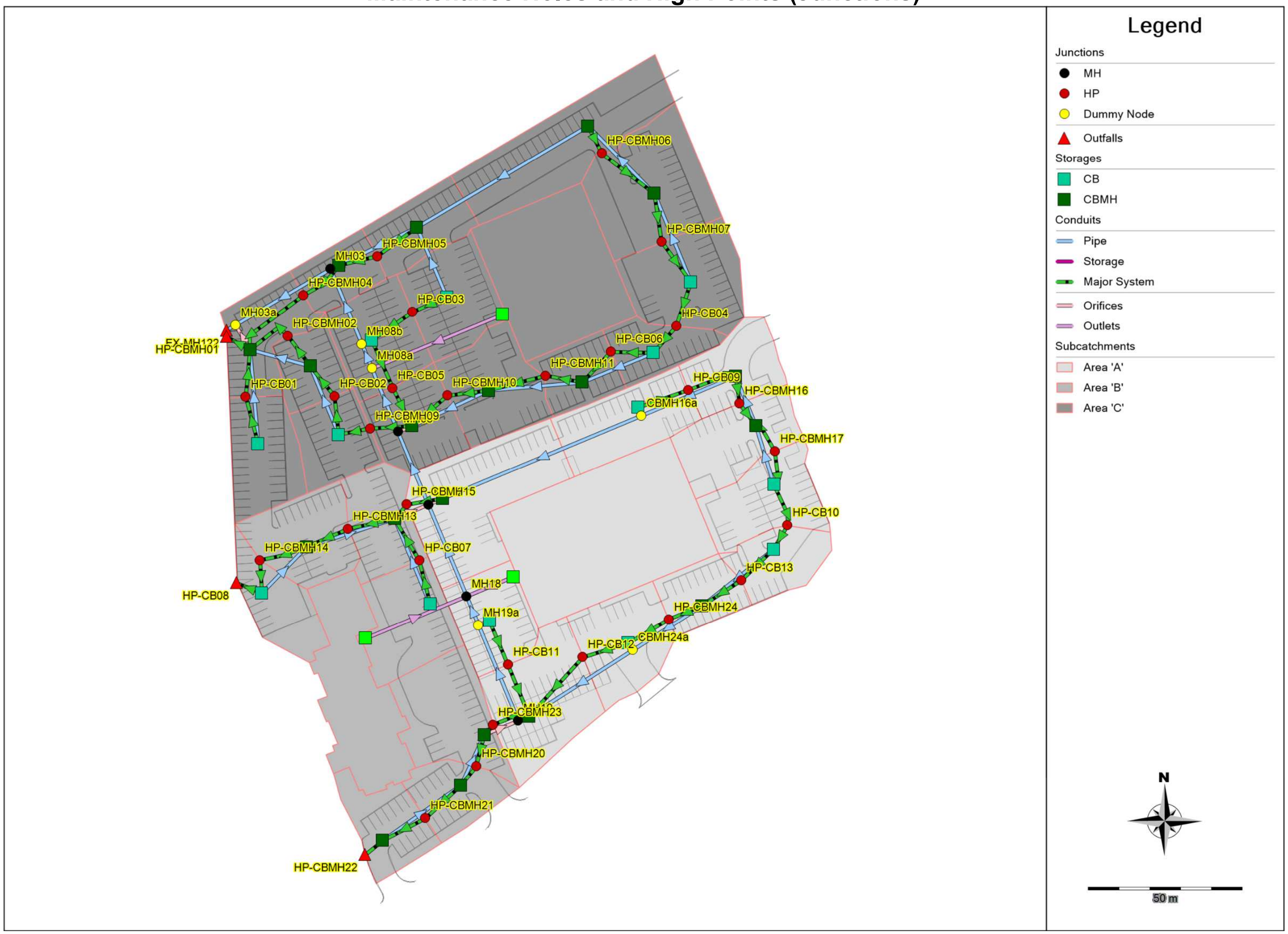
Maintenance Holes and High Points (Junctions)



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EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.013)

Element Count

Number of rain gages 1
Number of subcatchments ... 35
Number of nodes 79
Number of links 107
Number of pollutants 0
Number of land uses 0

Raingage Summary

Name	Data Source	Data Type	Recording Interval
Design_Storms	C3hr-100yr	INTENSITY	10 min.

Subcatchment Summary

Name	Area	Width	%Imperv	%Slope	Rain Gage	Outlet
A01	0.09	52.94	90.00	2.0000	Design_Storms	CB09
A02	0.07	26.67	77.10	2.0000	Design_Storms	CBMH16
A03	0.08	61.54	95.70	2.0000	Design_Storms	CBMH17
A04	0.09	75.00	100.00	2.0000	Design_Storms	CB10
A05	0.06	35.29	91.40	2.0000	Design_Storms	CB13
A06	0.05	33.33	100.00	2.0000	Design_Storms	CBMH24
A07	0.09	60.00	85.70	2.0000	Design_Storms	CB12
A08	0.12	70.59	85.70	2.0000	Design_Storms	CBMH23
A09	0.15	100.00	100.00	2.0000	Design_Storms	CB11
A10	0.15	100.00	88.60	2.0000	Design_Storms	CBMH15
A11	0.26	65.00	100.00	2.0000	Design_Storms	BLDG-A
B01	0.06	46.15	100.00	2.0000	Design_Storms	CB08
B02	0.08	53.33	95.70	2.0000	Design_Storms	CBMH14
B03	0.07	41.18	80.00	2.0000	Design_Storms	CBMH13
B04	0.09	60.00	91.40	2.0000	Design_Storms	CB07
B05	0.10	50.00	84.30	2.0000	Design_Storms	CBMH20
B06	0.06	40.00	80.00	2.0000	Design_Storms	CBMH21
B07	0.06	40.00	71.40	2.0000	Design_Storms	CBMH22
B08	0.13	65.00	100.00	2.0000	Design_Storms	BLDG-B
C01	0.15	50.00	78.60	2.0000	Design_Storms	CBMH06
C02	0.13	76.47	77.10	2.0000	Design_Storms	CBMH07
C03	0.11	64.71	87.10	2.0000	Design_Storms	CB04
C04	0.05	38.46	94.30	2.0000	Design_Storms	CB06
C05	0.05	41.67	91.40	2.0000	Design_Storms	CBMH11
C06	0.09	60.00	97.10	2.0000	Design_Storms	CBMH10
C07	0.09	60.00	97.10	2.0000	Design_Storms	CB03
C08	0.06	30.00	80.00	2.0000	Design_Storms	CBMH05
C09	0.05	41.67	75.70	2.0000	Design_Storms	CBMH04
C10	0.09	69.23	95.70	2.0000	Design_Storms	CB05
C11	0.08	61.54	94.30	2.0000	Design_Storms	CBMH09
C12	0.08	50.00	77.10	2.0000	Design_Storms	CBMH01
C13	0.05	50.00	82.90	2.0000	Design_Storms	CBMH02
C14	0.08	61.54	82.90	2.0000	Design_Storms	CB01
C15	0.06	60.00	71.40	2.0000	Design_Storms	CB02
C16	0.18	45.00	100.00	2.0000	Design_Storms	BLDG-C

Node Summary

Name	Type	Invert Elev.	Max. Depth	Ponded Area	External Inflow
CBMH16a	JUNCTION	93.93	2.57	0.0	
CBMH24a	JUNCTION	94.03	2.43	0.0	
HP-CB01	JUNCTION	95.70	1.00	0.0	
HP-CB02	JUNCTION	95.63	1.00	0.0	
HP-CB03	JUNCTION	95.85	1.00	0.0	
HP-CB04	JUNCTION	95.82	1.00	0.0	
HP-CB05	JUNCTION	95.80	1.00	0.0	
HP-CB06	JUNCTION	95.79	1.00	0.0	
HP-CB07	JUNCTION	95.74	1.00	0.0	
HP-CB09	JUNCTION	95.80	1.00	0.0	
HP-CB10	JUNCTION	95.73	1.00	0.0	
HP-CB11	JUNCTION	95.78	1.00	0.0	
HP-CB12	JUNCTION	95.65	1.00	0.0	
HP-CB13	JUNCTION	95.71	1.00	0.0	
HP-CBMH02	JUNCTION	95.60	1.00	0.0	
HP-CBMH04	JUNCTION	95.87	1.00	0.0	
HP-CBMH05	JUNCTION	95.90	1.00	0.0	
HP-CBMH06	JUNCTION	95.90	1.00	0.0	
HP-CBMH07	JUNCTION	95.85	1.00	0.0	

HP-CBMH09	JUNCTION	95.68	1.00	0.0
HP-CBMH10	JUNCTION	95.73	1.00	0.0
HP-CBMH11	JUNCTION	95.76	1.00	0.0
HP-CBMH13	JUNCTION	95.73	1.00	0.0
HP-CBMH14	JUNCTION	95.72	1.00	0.0
HP-CBMH15	JUNCTION	95.77	1.00	0.0
HP-CBMH16	JUNCTION	95.66	1.00	0.0
HP-CBMH17	JUNCTION	95.76	1.00	0.0
HP-CBMH20	JUNCTION	95.60	1.00	0.0
HP-CBMH21	JUNCTION	95.57	1.00	0.0
HP-CBMH23	JUNCTION	95.61	1.00	0.0
HP-CBMH24	JUNCTION	95.68	1.00	0.0
MH03	JUNCTION	93.20	3.47	0.0
MH03a	JUNCTION	93.13	4.54	0.0
MH08	JUNCTION	93.37	3.15	0.0
MH08a	JUNCTION	93.33	3.25	0.0
MH08b	JUNCTION	93.32	3.28	0.0
MH12	JUNCTION	93.48	3.13	0.0
MH18	JUNCTION	93.62	3.14	0.0
MH19	JUNCTION	93.71	2.74	0.0
MH19a	JUNCTION	93.64	3.05	0.0
EX-MH122	OUTFALL	93.12	0.90	0.0
HP-CB08	OUTFALL	95.71	1.00	0.0
HP-CBMH01	OUTFALL	95.58	1.00	0.0
HP-CBMH22	OUTFALL	95.55	1.00	0.0
BLDG-A	STORAGE	100.00	1.00	0.0
BLDG-B	STORAGE	100.00	1.00	0.0
BLDG-C	STORAGE	100.00	1.00	0.0
CB01	STORAGE	93.70	2.70	0.0
CB02	STORAGE	93.74	2.66	0.0
CB03	STORAGE	94.05	2.50	0.0
CB04	STORAGE	94.34	2.26	0.0
CB05	STORAGE	93.63	2.87	0.0
CB06	STORAGE	94.26	2.34	0.0
CB07	STORAGE	94.13	2.32	0.0
CB08	STORAGE	94.22	2.23	0.0
CB09	STORAGE	94.04	2.56	0.0
CB10	STORAGE	94.36	2.14	0.0
CB11	STORAGE	93.88	2.62	0.0
CB12	STORAGE	94.14	2.36	0.0
CB13	STORAGE	94.43	2.07	0.0
CBMH01	STORAGE	93.42	2.98	0.0
CBMH02	STORAGE	93.57	2.83	0.0
CBMH04	STORAGE	93.59	3.01	0.0
CBMH05	STORAGE	93.65	2.95	0.0
CBMH06	STORAGE	93.89	2.71	0.0
CBMH07	STORAGE	94.05	2.55	0.0
CBMH09	STORAGE	93.82	2.63	0.0
CBMH10	STORAGE	93.89	2.66	0.0
CBMH11	STORAGE	94.08	2.52	0.0
CBMH13	STORAGE	93.90	2.55	0.0
CBMH14	STORAGE	93.98	2.47	0.0
CBMH15	STORAGE	93.79	2.71	0.0
CBMH16	STORAGE	94.00	2.50	0.0
CBMH17	STORAGE	94.21	2.29	0.0
CBMH20	STORAGE	93.97	2.43	0.0
CBMH21	STORAGE	94.10	2.35	0.0
CBMH22	STORAGE	94.29	2.16	0.0
CBMH23	STORAGE	93.95	2.45	0.0
CBMH24	STORAGE	94.08	2.42	0.0

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Link Summary
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Name	From Node	To Node	Type	Length	%Slope	Roughness
104	CB02	CBMH02	CONDUIT	24.1	0.4988	0.0130
105	CBMH22	CBMH21	CONDUIT	31.0	0.3543	0.0130
109	CBMH21	CBMH20	CONDUIT	18.2	0.2752	0.0130
113	CBMH14	CBMH13	CONDUIT	30.1	0.2660	0.0130
115	CB08	CBMH14	CONDUIT	20.8	0.5281	0.0130
117	CB01	CBMH01	CONDUIT	30.6	0.4899	0.0130
120	CB07	CBMH13	CONDUIT	30.0	0.5000	0.0130
126	CB10	CBMH17	CONDUIT	20.1	0.4980	0.0130
131	MH19	MH19a	CONDUIT	33.5	0.2088	0.0130
131_(1)	MH18	MH12	CONDUIT	32.2	0.1865	0.0130
131_2	MH19a	MH18	CONDUIT	10.2	0.1963	0.0130
132	MH12	MH08	CONDUIT	25.7	0.1558	0.0130
19_1	MH03	MH03a	CONDUIT	35.8	0.1953	0.0130
19_2	MH03a	EX-MH122	CONDUIT	3.3	0.3021	0.0130
21_1	MH08	MH08a	CONDUIT	22.2	0.1803	0.0130
21_3	MH08a	MH08b	CONDUIT	8.6	0.1168	0.0130
21_4	MH08b	MH03	CONDUIT	26.4	0.1513	0.0130
25_(1)_(1)_1	CBMH24	CBMH24a	CONDUIT	26.7	0.1871	0.0130
25_(1)_(1)_2	CBMH24a	CBMH23	CONDUIT	39.9	0.2008	0.0130
31_1	CBMH16	CBMH16a	CONDUIT	33.0	0.2119	0.0130
31_2	CBMH16a	CBMH15	CONDUIT	69.9	0.2004	0.0130
33_(1)	CBMH06	CBMH05	CONDUIT	64.6	0.2476	0.0130
33_(1)_(2)	CBMH05	CBMH04	CONDUIT	28.0	0.2141	0.0130
49	CB04	CBMH07	CONDUIT	31.1	0.5151	0.0130
49_(1)	CBMH07	CBMH06	CONDUIT	30.7	0.2607	0.0130

55	CBMH10	CBMH09	CONDUIT	27.3	0.2561	0.0130
56	CB03	CBMH05	CONDUIT	24.7	0.4864	0.0130
64	CB06	CBMH11	CONDUIT	24.9	0.5213	0.0130
65	CBMH11	CBMH10	CONDUIT	30.6	0.3597	0.0130
68	CB09	CBMH16a	CONDUIT	2.9	0.3460	0.0130
73	CB13	CBMH24	CONDUIT	29.6	0.5074	0.0130
82	CBMH02	CBMH01	CONDUIT	20.2	0.3464	0.0130
93	CB12	CBMH24a	CONDUIT	2.8	0.3610	0.0130
98	CBMH17	CBMH16	CONDUIT	17.3	0.3474	0.0130
C10	CBMH06	HP-CBMH06	CONDUIT	2.0	-15.1717	0.0150
C11	HP-CBMH06	CBMH07	CONDUIT	2.0	15.1717	0.0150
C12	CBMH07	HP-CBMH07	CONDUIT	2.0	-12.5988	0.0150
C13	HP-CBMH07	CB04	CONDUIT	2.0	12.5988	0.0150
C14	CB04	HP-CB04	CONDUIT	2.0	-11.0672	0.0150
C15	HP-CB04	CB06	CONDUIT	2.0	11.0672	0.0150
C16	CB06	HP-CB06	CONDUIT	2.0	-9.5432	0.0150
C17	HP-CB06	CBMH11	CONDUIT	2.0	9.5432	0.0150
C18	CBMH11	HP-CBMH11	CONDUIT	2.0	-8.0257	0.0150
C19	HP-CBMH11	CBMH10	CONDUIT	2.0	10.5584	0.0150
C20	CBMH10	HP-CBMH10	CONDUIT	2.0	-9.0367	0.0150
C21	HP-CBMH10	CBMH09	CONDUIT	2.0	14.1393	0.0150
C22	CBMH09	HP-CBMH09	CONDUIT	2.0	-11.5768	0.0150
C23	HP-CBMH09	CB02	CONDUIT	2.0	14.1393	0.0150
C24	CB02	HP-CB02	CONDUIT	2.0	-11.5768	0.0150
C25	HP-CB02	CBMH02	CONDUIT	2.0	11.5768	0.0150
C26	CBMH02	HP-CBMH02	CONDUIT	2.0	-10.0504	0.0150
C27	HP-CBMH02	CBMH01	CONDUIT	2.0	10.0504	0.0150
C28	CBMH01	HP-CBMH01	CONDUIT	2.0	-9.0367	0.0150
C29	CB01	HP-CB01	CONDUIT	2.0	-15.1717	0.0150
C30	HP-CB01	CBMH01	CONDUIT	2.0	15.1717	0.0150
C31	CBMH05	HP-CBMH05	CONDUIT	2.0	-15.1717	0.0150
C32	HP-CBMH05	CBMH04	CONDUIT	2.0	15.1717	0.0150
C33	CBMH04	HP-CBMH04	CONDUIT	2.0	-13.6247	0.0150
C34	HP-CBMH04	CBMH01	CONDUIT	2.0	24.1771	0.0150
C35	CB03	HP-CB03	CONDUIT	2.0	-15.1717	0.0150
C36	HP-CB03	CB05	CONDUIT	2.0	17.7743	0.0150
C37	CB05	HP-CB05	CONDUIT	2.0	-15.1717	0.0150
C38	HP-CB05	CBMH09	CONDUIT	2.0	17.7743	0.0150
C39	CB09	HP-CB09	CONDUIT	2.0	-10.0504	0.0150
C40	HP-CB09	CBMH16	CONDUIT	2.0	15.1717	0.0150
C41	CBMH17	HP-CBMH17	CONDUIT	2.0	-13.1113	0.0150
C42	HP-CBMH17	CB10	CONDUIT	2.0	13.1113	0.0150
C43	CB10	HP-CB10	CONDUIT	2.0	-11.5768	0.0150
C44	HP-CB10	CB13	CONDUIT	2.0	11.5768	0.0150
C45	CB13	HP-CB13	CONDUIT	2.0	-10.5584	0.0150
C46	HP-CB13	CBMH24	CONDUIT	2.0	10.5584	0.0150
C47	CBMH24	HP-CBMH24	CONDUIT	2.0	-9.0367	0.0150
C48	HP-CBMH24	CB12	CONDUIT	2.0	9.0367	0.0150
C49	CB12	HP-CB12	CONDUIT	2.0	-7.5212	0.0150
C50	HP-CB12	CBMH23	CONDUIT	2.0	12.5988	0.0150
C51	CBMH23	HP-CBMH23	CONDUIT	2.0	-10.5584	0.0150
C52	HP-CB11	CBMH23	CONDUIT	2.0	19.3525	0.0150
C53	CB11	HP-CB11	CONDUIT	2.0	-14.1393	0.0150
C54	HP-CBMH15	CBMH13	CONDUIT	2.0	13.6247	0.0150
C55	CBMH15	HP-CBMH15	CONDUIT	2.0	-13.6247	0.0150
C56	HP-CBMH23	CBMH20	CONDUIT	2.0	10.5584	0.0150
C57	CBMH20	HP-CBMH20	CONDUIT	2.0	-10.0504	0.0130
C58	HP-CBMH20	CBMH21	CONDUIT	2.0	7.5212	0.0130
C59	CBMH21	HP-CBMH21	CONDUIT	2.0	-6.0108	0.0130
C60	HP-CBMH21	CBMH22	CONDUIT	2.0	6.0108	0.0130
C61	CBMH22	HP-CBMH22	CONDUIT	2.0	-5.0063	0.0130
C62	CB07	HP-CB07	CONDUIT	2.0	-14.6549	0.0150
C63	HP-CB07	CBMH13	CONDUIT	2.0	14.6549	0.0150
C64	CBMH13	HP-CBMH13	CONDUIT	2.0	-14.1393	0.0150
C65	HP-CBMH13	CBMH14	CONDUIT	2.0	14.1393	0.0150
C66	CBMH14	HP-CBMH14	CONDUIT	2.0	-13.6247	0.0150
C67	HP-CBMH14	CB08	CONDUIT	2.0	13.6247	0.0150
C68	CB08	HP-CB08	CONDUIT	2.0	-13.1113	0.0150
C69	CBMH16	HP-CBMH16	CONDUIT	2.0	-8.0257	0.0150
C70	HP-CBMH16	CBMH17	CONDUIT	2.0	8.0257	0.0150
CB05-ICD	CB05	MH08b	ORIFICE			
CB11-ICD	CB11	MH19a	ORIFICE			
CBMH01-ICD	CBMH01	MH03a	ORIFICE			
CBMH04-ICD	CBMH04	MH03	ORIFICE			
CBMH09-ICD	CBMH09	MH08	ORIFICE			
CBMH13-ICD	CBMH13	MH12	ORIFICE			
CBMH15-ICD	CBMH15	MH12	ORIFICE			
CBMH20-ICD	CBMH20	MH19	ORIFICE			
CBMH23-ICD	CBMH23	MH19	ORIFICE			
BLDG-A-OUT	BLDG-A	MH18	OUTLET			
BLDG-B-OUT	BLDG-B	MH18	OUTLET			
BLDG-C-OUT	BLDG-C	MH08a	OUTLET			

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Cross Section Summary
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Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels	Full Flow
104	CIRCULAR	0.25	0.05	0.06	0.25	1	42.00
105	CIRCULAR	0.30	0.07	0.07	0.30	1	57.56

109	CIRCULAR	0.38	0.11	0.09	0.38	1	91.98
113	CIRCULAR	0.38	0.11	0.09	0.38	1	90.43
115	CIRCULAR	0.25	0.05	0.06	0.25	1	43.22
117	CIRCULAR	0.25	0.05	0.06	0.25	1	41.62
120	CIRCULAR	0.45	0.16	0.11	0.45	1	201.61
126	CIRCULAR	0.25	0.05	0.06	0.25	1	41.97
131	CIRCULAR	0.68	0.36	0.17	0.68	1	384.10
131_(1)	CIRCULAR	0.68	0.36	0.17	0.68	1	362.99
131_2	CIRCULAR	0.68	0.36	0.17	0.68	1	372.42
132	CIRCULAR	0.75	0.44	0.19	0.75	1	439.49
19_1	CIRCULAR	0.90	0.64	0.23	0.90	1	800.10
19_2	CIRCULAR	0.90	0.64	0.23	0.90	1	995.10
21_1	CIRCULAR	0.82	0.53	0.21	0.82	1	609.48
21_3	CIRCULAR	0.82	0.53	0.21	0.82	1	490.65
21_4	CIRCULAR	0.82	0.53	0.21	0.82	1	558.35
25_(1)_(1)_1	CIRCULAR	0.45	0.16	0.11	0.45	1	123.32
25_(1)_(1)_2	CIRCULAR	0.45	0.16	0.11	0.45	1	127.75
31_1	CIRCULAR	0.45	0.16	0.11	0.45	1	131.24
31_2	CIRCULAR	0.45	0.16	0.11	0.45	1	127.63
33_(1)	CIRCULAR	0.45	0.16	0.11	0.45	1	141.88
33_(1)_(2)	CIRCULAR	0.53	0.22	0.13	0.53	1	198.99
49	CIRCULAR	0.25	0.05	0.06	0.25	1	42.68
49_(1)	CIRCULAR	0.38	0.11	0.09	0.38	1	89.52
55	CIRCULAR	0.38	0.11	0.09	0.38	1	88.74
56	CIRCULAR	0.25	0.05	0.06	0.25	1	41.48
64	CIRCULAR	0.25	0.05	0.06	0.25	1	42.94
65	CIRCULAR	0.30	0.07	0.07	0.30	1	58.00
68	CIRCULAR	0.25	0.05	0.06	0.25	1	34.98
73	CIRCULAR	0.25	0.05	0.06	0.25	1	42.36
82	CIRCULAR	0.30	0.07	0.07	0.30	1	56.91
93	CIRCULAR	0.25	0.05	0.06	0.25	1	35.73
98	CIRCULAR	0.30	0.07	0.07	0.30	1	57.00
C10	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C11	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C12	RECT_OPEN	1.00	3.00	0.60	3.00	1	50503.54
C13	RECT_OPEN	1.00	3.00	0.60	3.00	1	50503.54
C14	RECT_OPEN	1.00	3.00	0.60	3.00	1	47334.20
C15	RECT_OPEN	1.00	3.00	0.60	3.00	1	47334.20
C16	RECT_OPEN	1.00	3.00	0.60	3.00	1	43954.48
C17	RECT_OPEN	1.00	3.00	0.60	3.00	1	43954.48
C18	RECT_OPEN	1.00	3.00	0.60	3.00	1	40308.73
C19	RECT_OPEN	1.00	3.00	0.60	3.00	1	46233.34
C20	RECT_OPEN	1.00	3.00	0.60	3.00	1	42772.17
C21	RECT_OPEN	1.00	3.00	0.60	3.00	1	53502.02
C22	RECT_OPEN	1.00	3.00	0.60	3.00	1	48411.81
C23	RECT_OPEN	1.00	3.00	0.60	3.00	1	53502.02

C24	RECT_OPEN	1.00	3.00	0.60	3.00	1	48411.81
C25	RECT_OPEN	1.00	3.00	0.60	3.00	1	48411.81
C26	RECT_OPEN	1.00	3.00	0.60	3.00	1	45107.44
C27	RECT_OPEN	1.00	3.00	0.60	3.00	1	45107.44
C28	RECT_OPEN	1.00	3.00	0.60	3.00	1	42772.17
C29	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C30	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C31	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C32	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C33	RECT_OPEN	1.00	3.00	0.60	3.00	1	52519.53
C34	RECT_OPEN	1.00	3.00	0.60	3.00	1	69961.45
C35	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C36	RECT_OPEN	1.00	3.00	0.60	3.00	1	59986.43
C37	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C38	RECT_OPEN	1.00	3.00	0.60	3.00	1	59986.43
C39	RECT_OPEN	1.00	3.00	0.60	3.00	1	45107.44
C40	RECT_OPEN	1.00	3.00	0.60	3.00	1	55420.88
C41	RECT_OPEN	1.00	3.00	0.60	3.00	1	51520.40
C42	RECT_OPEN	1.00	3.00	0.60	3.00	1	51520.40
C43	RECT_OPEN	1.00	3.00	0.60	3.00	1	48411.81
C44	RECT_OPEN	1.00	3.00	0.60	3.00	1	48411.81
C45	RECT_OPEN	1.00	3.00	0.60	3.00	1	46233.34
C46	RECT_OPEN	1.00	3.00	0.60	3.00	1	46233.34
C47	RECT_OPEN	1.00	3.00	0.60	3.00	1	42772.17
C48	RECT_OPEN	1.00	3.00	0.60	3.00	1	42772.17
C49	RECT_OPEN	1.00	3.00	0.60	3.00	1	39021.15
C50	RECT_OPEN	1.00	3.00	0.60	3.00	1	50503.54
C51	RECT_OPEN	1.00	3.00	0.60	3.00	1	46233.34
C52	RECT_OPEN	1.00	3.00	0.60	3.00	1	62593.00
C53	RECT_OPEN	1.00	3.00	0.60	3.00	1	53502.02
C54	RECT_OPEN	1.00	3.00	0.60	3.00	1	52519.53
C55	RECT_OPEN	1.00	3.00	0.60	3.00	1	52519.53
C56	RECT_OPEN	1.00	3.00	0.60	3.00	1	46233.34
C57	RECT_OPEN	1.00	3.00	0.60	3.00	1	52047.05
C58	RECT_OPEN	1.00	3.00	0.60	3.00	1	45024.40
C59	RECT_OPEN	1.00	3.00	0.60	3.00	1	40250.57
C60	RECT_OPEN	1.00	3.00	0.60	3.00	1	40250.57
C61	RECT_OPEN	1.00	3.00	0.60	3.00	1	36733.45
C62	RECT_OPEN	1.00	3.00	0.60	3.00	1	54468.83
C63	RECT_OPEN	1.00	3.00	0.60	3.00	1	54468.83
C64	RECT_OPEN	1.00	3.00	0.60	3.00	1	53502.02
C65	RECT_OPEN	1.00	3.00	0.60	3.00	1	53502.02
C66	RECT_OPEN	1.00	3.00	0.60	3.00	1	52519.53
C67	RECT_OPEN	1.00	3.00	0.60	3.00	1	52519.53
C68	RECT_OPEN	1.00	3.00	0.60	3.00	1	51520.40
C69	RECT_OPEN	1.00	3.00	0.60	3.00	1	40308.73

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C70              RECT_OPEN           1.00     3.00     0.60     3.00        1 40308.73


*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
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****************
Analysis Options
****************
Flow Units ............... LPS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Infiltration Method ...... HORTON
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 10/16/2019 00:00:00
Ending Date .............. 10/17/2019 00:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:01:00
Wet Time Step ............ 00:05:00
Dry Time Step ............ 00:05:00
Routing Time Step ........ 2.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 4
Head Tolerance ........... 0.001500 m

**************************        Volume         Depth
Runoff Quantity Continuity     hectare-m            mm
**************************     ---------       -------
Total Precipitation ......         0.234        71.667
Evaporation Loss .........         0.000         0.000
Infiltration Loss ........         0.015         4.449
Surface Runoff ...........         0.217        66.611
Final Storage ............         0.004         1.137
Continuity Error (%) .....        -0.740


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.217         2.171
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........         0.000         0.000
External Outflow .........         0.217         2.173
Flooding Loss ............         0.000         0.000
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.000         0.000
Final Stored Volume ......         0.000         0.000
Continuity Error (%) .....        -0.083


***************************
Time-Step Critical Elements
***************************
Link 19_2 (56.26%)


********************************
Highest Flow Instability Indexes
********************************
Link C70 (1)
Link C69 (1)


*************************
Routing Time Step Summary
*************************
Minimum Time Step           :     0.50 sec
Average Time Step           :     1.69 sec
Maximum Time Step           :     2.00 sec
Percent in Steady State     :    -0.00
Average Iterations per Step :     2.01
Percent Not Converging      :     0.02


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Subcatchment Runoff Summary
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Subcatchment	Total Precip mm	Total Runon mm	Total Evap mm	Total Infil mm	Imperv Runoff mm	Perv Runoff mm	Total Runoff mm	Total Runoff 10^6 ltr	Peak Runoff LPS	Runoff Coeff
A01	71.67	0.00	0.00	4.39	63.25	3.20	66.45	0.06	43.97	0.927
A02	71.67	0.00	0.00	10.14	54.24	6.77	61.01	0.04	33.00	0.851
A03	71.67	0.00	0.00	1.88	67.22	1.41	68.63	0.05	39.43	0.958
A04	71.67	0.00	0.00	0.00	70.24	0.00	70.24	0.06	44.64	0.980
A05	71.67	0.00	0.00	3.77	64.24	2.77	67.00	0.04	29.38	0.935
A06	71.67	0.00	0.00	0.00	70.28	0.00	70.28	0.04	24.80	0.981
A07	71.67	0.00	0.00	6.28	60.20	4.52	64.72	0.06	43.67	0.903
A08	71.67	0.00	0.00	6.28	60.22	4.48	64.71	0.08	58.21	0.903
A09	71.67	0.00	0.00	0.00	70.28	0.00	70.28	0.11	74.40	0.981
A10	71.67	0.00	0.00	5.00	62.24	3.64	65.89	0.10	73.14	0.919
A11	71.67	0.00	0.00	0.00	72.12	0.00	72.12	0.19	128.91	1.006
B01	71.67	0.00	0.00	0.00	70.25	0.00	70.25	0.04	29.76	0.980
B02	71.67	0.00	0.00	1.88	67.25	1.40	68.65	0.05	39.43	0.958
B03	71.67	0.00	0.00	8.81	56.21	6.14	62.35	0.04	33.57	0.870
B04	71.67	0.00	0.00	3.77	64.22	2.78	66.99	0.06	44.07	0.935
B05	71.67	0.00	0.00	6.91	59.26	4.85	64.11	0.06	48.34	0.895
B06	71.67	0.00	0.00	8.80	56.19	6.19	62.38	0.04	28.81	0.870
B07	71.67	0.00	0.00	12.62	50.14	8.65	58.78	0.04	28.23	0.820
B08	71.67	0.00	0.00	0.00	71.91	0.00	71.91	0.09	64.48	1.003
C01	71.67	0.00	0.00	9.49	55.33	6.30	61.63	0.09	70.81	0.860
C02	71.67	0.00	0.00	10.10	54.16	6.97	61.13	0.08	61.93	0.853
C03	71.67	0.00	0.00	5.67	61.21	4.07	65.28	0.07	53.49	0.911
C04	71.67	0.00	0.00	2.49	66.24	1.86	68.10	0.03	24.59	0.950
C05	71.67	0.00	0.00	3.77	64.18	2.79	66.98	0.03	24.49	0.935
C06	71.67	0.00	0.00	1.27	68.23	0.95	69.18	0.06	44.45	0.965
C07	71.67	0.00	0.00	1.27	68.23	0.95	69.18	0.06	44.45	0.965
C08	71.67	0.00	0.00	8.82	56.23	6.08	62.31	0.04	28.72	0.869
C09	71.67	0.00	0.00	10.69	53.14	7.54	60.68	0.03	23.84	0.847
C10	71.67	0.00	0.00	1.88	67.22	1.41	68.63	0.06	44.36	0.958
C11	71.67	0.00	0.00	2.49	66.24	1.86	68.10	0.05	39.35	0.950
C12	71.67	0.00	0.00	10.09	54.16	7.00	61.15	0.05	38.14	0.853
C13	71.67	0.00	0.00	7.50	58.23	5.46	63.69	0.03	24.17	0.889
C14	71.67	0.00	0.00	7.51	58.21	5.39	63.60	0.05	38.65	0.887
C15	71.67	0.00	0.00	12.58	50.11	8.88	58.99	0.04	28.41	0.823
C16	71.67	0.00	0.00	0.00	72.12	0.00	72.12	0.13	89.24	1.006

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Node Depth Summary

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Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	hr:min	Reported Max Depth Meters
CBMH16a	JUNCTION	0.98	1.80	95.73	0	02:20	1.80
CBMH24a	JUNCTION	0.60	1.58	95.61	0	02:50	1.58
HP-CB01	JUNCTION	0.00	0.00	95.70	0	00:00	0.00
HP-CB02	JUNCTION	0.00	0.00	95.63	0	00:00	0.00
HP-CB03	JUNCTION	0.00	0.00	95.85	0	00:00	0.00
HP-CB04	JUNCTION	0.00	0.00	95.82	0	00:00	0.00
HP-CB05	JUNCTION	0.00	0.00	95.80	0	00:00	0.00
HP-CB06	JUNCTION	0.00	0.00	95.79	0	00:00	0.00
HP-CB07	JUNCTION	0.00	0.00	95.74	0	00:00	0.00
HP-CB09	JUNCTION	0.00	0.00	95.80	0	00:00	0.00
HP-CB10	JUNCTION	0.00	0.00	95.73	0	02:20	0.00
HP-CB11	JUNCTION	0.00	0.00	95.78	0	00:00	0.00
HP-CB12	JUNCTION	0.00	0.00	95.65	0	00:00	0.00
HP-CB13	JUNCTION	0.00	0.00	95.71	0	00:00	0.00
HP-CBMH02	JUNCTION	0.00	0.00	95.60	0	00:00	0.00
HP-CBMH04	JUNCTION	0.00	0.00	95.87	0	00:00	0.00
HP-CBMH05	JUNCTION	0.00	0.00	95.90	0	00:00	0.00
HP-CBMH06	JUNCTION	0.00	0.00	95.90	0	00:00	0.00
HP-CBMH07	JUNCTION	0.00	0.00	95.85	0	00:00	0.00
HP-CBMH09	JUNCTION	0.00	0.01	95.69	0	01:30	0.01
HP-CBMH10	JUNCTION	0.00	0.00	95.73	0	00:00	0.00
HP-CBMH11	JUNCTION	0.00	0.00	95.76	0	00:00	0.00
HP-CBMH13	JUNCTION	0.00	0.00	95.73	0	00:00	0.00
HP-CBMH14	JUNCTION	0.00	0.00	95.72	0	00:00	0.00
HP-CBMH15	JUNCTION	0.00	0.00	95.77	0	00:00	0.00
HP-CBMH16	JUNCTION	0.01	0.07	95.73	0	02:20	0.07
HP-CBMH17	JUNCTION	0.00	0.00	95.76	0	00:00	0.00
HP-CBMH20	JUNCTION	0.00	0.00	95.60	0	00:00	0.00
HP-CBMH21	JUNCTION	0.00	0.00	95.57	0	00:00	0.00
HP-CBMH23	JUNCTION	0.00	0.00	95.61	0	02:50	0.00
HP-CBMH24	JUNCTION	0.00	0.00	95.68	0	00:00	0.00
MH03	JUNCTION	0.10	0.20	93.40	0	01:46	0.20
MH03a	JUNCTION	0.09	0.19	93.32	0	01:46	0.19
MH08	JUNCTION	0.09	0.19	93.56	0	01:45	0.19
MH08a	JUNCTION	0.10	0.20	93.53	0	01:45	0.20
MH08b	JUNCTION	0.09	0.20	93.52	0	01:46	0.20
MH12	JUNCTION	0.09	0.17	93.65	0	01:45	0.17
MH18	JUNCTION	0.07	0.15	93.77	0	01:44	0.15
MH19	JUNCTION	0.05	0.08	93.79	0	01:45	0.08

MH19a	JUNCTION	0.06	0.14	93.78	0	01:45	0.14
EX-MH122	OUTFALL	0.09	0.19	93.31	0	01:46	0.19
HP-CB08	OUTFALL	0.00	0.00	95.71	0	00:00	0.00
HP-CBMH01	OUTFALL	0.00	0.00	95.58	0	00:00	0.00
HP-CBMH22	OUTFALL	0.00	0.00	95.55	0	00:00	0.00
BLDG-A	STORAGE	0.03	0.16	100.16	0	01:32	0.16
BLDG-B	STORAGE	0.02	0.15	100.15	0	01:30	0.15
BLDG-C	STORAGE	0.02	0.15	100.15	0	01:31	0.15
CB01	STORAGE	0.32	1.86	95.56	0	01:51	1.86
CB02	STORAGE	0.31	1.82	95.56	0	01:45	1.82
CB03	STORAGE	0.61	1.76	95.81	0	02:14	1.76
CB04	STORAGE	0.48	1.47	95.81	0	02:14	1.47
CB05	STORAGE	0.35	2.05	95.68	0	01:34	2.05
CB06	STORAGE	0.31	1.43	95.69	0	01:27	1.43
CB07	STORAGE	0.60	1.56	95.69	0	02:23	1.56
CB08	STORAGE	0.55	1.47	95.69	0	02:21	1.47
CB09	STORAGE	0.89	1.69	95.73	0	02:20	1.69
CB10	STORAGE	0.67	1.37	95.73	0	02:20	1.37
CB11	STORAGE	0.45	1.89	95.77	0	01:44	1.89
CB12	STORAGE	0.52	1.47	95.61	0	02:50	1.47
CB13	STORAGE	0.34	1.18	95.61	0	02:49	1.18
CBMH01	STORAGE	0.43	2.14	95.56	0	01:50	2.14
CBMH02	STORAGE	0.37	1.99	95.56	0	01:50	1.99
CBMH04	STORAGE	0.87	2.22	95.81	0	02:13	2.22
CBMH05	STORAGE	0.83	2.16	95.81	0	02:14	2.16
CBMH06	STORAGE	0.69	1.92	95.81	0	02:13	1.92
CBMH07	STORAGE	0.61	1.76	95.81	0	02:14	1.76
CBMH09	STORAGE	0.51	1.87	95.69	0	01:30	1.87
CBMH10	STORAGE	0.47	1.80	95.69	0	01:29	1.80
CBMH11	STORAGE	0.38	1.61	95.69	0	01:28	1.61
CBMH13	STORAGE	0.74	1.79	95.69	0	02:21	1.79
CBMH14	STORAGE	0.69	1.71	95.69	0	02:23	1.71
CBMH15	STORAGE	1.10	1.94	95.73	0	02:18	1.94
CBMH16	STORAGE	0.93	1.73	95.73	0	02:19	1.73
CBMH17	STORAGE	0.77	1.52	95.73	0	02:20	1.52
CBMH20	STORAGE	0.43	1.57	95.54	0	01:59	1.57
CBMH21	STORAGE	0.35	1.44	95.54	0	01:58	1.44
CBMH22	STORAGE	0.26	1.25	95.54	0	01:56	1.25
CBMH23	STORAGE	0.66	1.66	95.61	0	02:50	1.66
CBMH24	STORAGE	0.56	1.53	95.61	0	02:50	1.53

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Node Inflow Summary
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Node	Type	Maximum Lateral Inflow LPS	Maximum Total Inflow LPS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 ltr	Total Inflow Volume 10^6 ltr	Flow Balance Error Percent
CBMH16a	JUNCTION	0.00	146.39	0 01:05	0	0.231	-0.300
CBMH24a	JUNCTION	0.00	94.28	0 01:06	0	0.15	-0.249
HP-CB01	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB02	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB03	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB04	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB05	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB06	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB07	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB09	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB10	JUNCTION	0.00	3.67	0 02:20	0	0.00896	0.002
HP-CB11	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB12	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CB13	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH02	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH04	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH05	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH06	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH07	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH09	JUNCTION	0.00	12.88	0 01:30	0	0.0149	0.001
HP-CBMH10	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH11	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH13	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH14	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH15	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH16	JUNCTION	0.00	21.16	0 01:17	0	0.0353	-0.016
HP-CBMH17	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH20	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH21	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
HP-CBMH23	JUNCTION	0.00	0.72	0 02:50	0	0.00067	0.026
HP-CBMH24	JUNCTION	0.00	0.00	0 00:00	0	0	0.000 ltr
MH03	JUNCTION	0.00	91.13	0 01:46	0	1.99	-0.001
MH03a	JUNCTION	0.00	102.22	0 01:46	0	2.17	0.001
MH08	JUNCTION	0.00	62.36	0 01:45	0	1.43	0.001
MH08a	JUNCTION	0.00	75.00	0 01:45	0	1.56	-0.001
MH08b	JUNCTION	0.00	79.84	0 01:45	0	1.62	0.000
MH12	JUNCTION	0.00	55.17	0 01:45	0	1.26	-0.000
MH18	JUNCTION	0.00	43.53	0 01:44	0	0.744	-0.001
MH19	JUNCTION	0.00	10.82	0 02:24	0	0.357	0.010
MH19a	JUNCTION	0.00	16.69	0 01:57	0	0.463	-0.006

EX-MH122	OUTFALL	0.00	102.22	0	01:46	0	2.17	0.000	
HP-CB08	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	ltr
HP-CBMH01	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	ltr
HP-CBMH22	OUTFALL	0.00	0.00	0	00:00	0	0	0.000	ltr
BLDG-A	STORAGE	128.91	128.91	0	01:10	0.188	0.188	0.005	
BLDG-B	STORAGE	64.48	64.48	0	01:10	0.0935	0.0935	0.005	
BLDG-C	STORAGE	89.24	89.24	0	01:10	0.13	0.13	0.004	
CB01	STORAGE	38.65	38.65	0	01:10	0.0509	0.0518	0.150	
CB02	STORAGE	28.41	43.61	0	01:10	0.0354	0.0518	0.097	
CB03	STORAGE	44.45	68.59	0	01:09	0.0623	0.0706	0.217	
CB04	STORAGE	53.49	53.49	0	01:10	0.0718	0.0721	0.852	
CB05	STORAGE	44.36	44.36	0	01:10	0.0618	0.0618	0.005	
CB06	STORAGE	24.59	42.45	0	01:09	0.034	0.0348	0.196	
CB07	STORAGE	44.07	72.53	0	01:06	0.0603	0.0615	0.059	
CB08	STORAGE	29.76	40.87	0	01:09	0.0421	0.0444	0.083	
CB09	STORAGE	43.97	43.97	0	01:10	0.0598	0.0598	0.114	
CB10	STORAGE	44.64	44.64	0	01:10	0.0632	0.0663	0.116	
CB11	STORAGE	74.40	74.40	0	01:10	0.105	0.105	-0.457	
CB12	STORAGE	43.67	43.67	0	01:10	0.0582	0.0585	0.049	
CB13	STORAGE	29.38	29.38	0	01:10	0.0402	0.0509	0.682	
CBMH01	STORAGE	38.14	125.43	0	01:09	0.0489	0.185	-0.090	
CBMH02	STORAGE	24.17	67.00	0	01:10	0.0318	0.0859	0.050	
CBMH04	STORAGE	23.84	239.25	0	01:06	0.0303	0.377	-0.084	
CBMH05	STORAGE	28.72	300.50	0	01:06	0.0374	0.355	-0.203	
CBMH06	STORAGE	70.81	169.35	0	01:06	0.0924	0.244	-0.054	
CBMH07	STORAGE	61.93	108.90	0	01:06	0.0795	0.151	-0.142	
CBMH09	STORAGE	39.35	126.84	0	01:08	0.0545	0.187	0.044	
CBMH10	STORAGE	44.45	120.77	0	01:09	0.0623	0.135	-0.083	
CBMH11	STORAGE	24.49	73.25	0	01:09	0.0335	0.0705	0.053	
CBMH13	STORAGE	33.57	137.73	0	01:05	0.0436	0.203	-0.022	
CBMH14	STORAGE	39.43	68.14	0	01:05	0.0549	0.1	-0.053	
CBMH15	STORAGE	73.14	218.04	0	01:05	0.0988	0.313	0.038	
CBMH16	STORAGE	33.00	109.83	0	01:05	0.0427	0.173	-0.047	
CBMH17	STORAGE	39.43	82.41	0	01:05	0.0549	0.117	0.081	
CBMH20	STORAGE	48.34	102.47	0	01:10	0.0641	0.141	-0.024	
CBMH21	STORAGE	28.81	55.94	0	01:10	0.0374	0.0784	-0.080	
CBMH22	STORAGE	28.23	28.23	0	01:10	0.0353	0.0375	0.241	
CBMH23	STORAGE	58.21	152.02	0	01:10	0.0776	0.224	0.037	
CBMH24	STORAGE	24.80	53.89	0	01:06	0.0351	0.0897	-0.456	

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Node Surcharge Summary
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Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
CBMH16a	JUNCTION	13.03	1.353	0.767
CBMH24a	JUNCTION	9.74	1.131	0.849

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Node Flooding Summary
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No nodes were flooded.

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Storage Volume Summary
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Storage Unit	Average Volume 1000 m3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 m3	Max Pcnt Full	Time of Max Occurrence days	hr:min	Maximum Outflow LPS
BLDG-A	0.013	1	0	0	0.105	9	0	01:32	17.38
BLDG-B	0.006	1	0	0	0.051	8	0	01:30	9.48
BLDG-C	0.009	1	0	0	0.071	9	0	01:31	12.64
CB01	0.001	2	0	0	0.011	26	0	01:51	37.50
CB02	0.001	4	0	0	0.011	45	0	01:45	30.36
CB03	0.007	16	0	0	0.034	73	0	02:14	51.29
CB04	0.005	18	0	0	0.026	88	0	02:14	50.31
CB05	0.005	7	0	0	0.035	52	0	01:34	4.84
CB06	0.000	2	0	0	0.003	22	0	01:27	26.49
CB07	0.004	14	0	0	0.020	66	0	02:23	58.12
CB08	0.004	18	0	0	0.019	82	0	02:21	28.81
CB09	0.002	9	0	0	0.010	42	0	02:20	52.67
CB10	0.005	28	0	0	0.019	98	0	02:20	43.05
CB11	0.013	18	0	0	0.068	94	0	01:44	5.87
CB12	0.001	7	0	0	0.004	51	0	02:50	43.23
CB13	0.000	4	0	0	0.003	27	0	02:49	29.11
CBMH01	0.017	23	0	0	0.072	96	0	01:50	42.37
CBMH02	0.001	5	0	0	0.008	58	0	01:50	49.88
CBMH04	0.040	38	0	0	0.093	89	0	02:13	120.22
CBMH05	0.004	10	0	0	0.019	48	0	02:14	216.60
CBMH06	0.005	10	0	0	0.024	48	0	02:13	158.24

CBMH07	0.005	14	0	0	0.024	68	0	02:14	103.43
CBMH09	0.025	29	0	0	0.085	100	0	01:30	63.59
CBMH10	0.001	6	0	0	0.007	55	0	01:29	87.52
CBMH11	0.000	3	0	0	0.002	29	0	01:28	45.89
CBMH13	0.028	34	0	0	0.071	88	0	02:21	33.01
CBMH14	0.004	17	0	0	0.016	76	0	02:23	65.23
CBMH15	0.058	40	0	0	0.123	84	0	02:18	29.92
CBMH16	0.014	38	0	0	0.037	100	0	01:17	104.45
CBMH17	0.008	22	0	0	0.028	77	0	02:20	79.58
CBMH20	0.027	29	0	0	0.084	91	0	01:59	23.81
CBMH21	0.000	4	0	0	0.003	50	0	01:58	54.18
CBMH22	0.000	6	0	0	0.002	71	0	01:56	27.20
CBMH23	0.057	42	0	0	0.136	99	0	02:50	31.98
CBMH24	0.001	5	0	0	0.005	36	0	02:50	52.36

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Outfall Loading Summary
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Outfall Node	Flow Freq Pcnt	Avg Flow LPS	Max Flow LPS	Total Volume 10^6 ltr
EX-MH122	91.09	34.44	102.22	2.173
HP-CB08	0.00	0.00	0.00	0.000
HP-CBMH01	0.00	0.00	0.00	0.000
HP-CBMH22	0.00	0.00	0.00	0.000
System	22.77	34.44	0.00	2.173

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Link Flow Summary
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Link	Type	Maximum |Flow| LPS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
104	CONDUIT	30.36	0	01:10	0.62	0.72	1.00
105	CONDUIT	27.20	0	01:10	0.53	0.47	1.00
109	CONDUIT	54.18	0	01:10	0.49	0.59	1.00
113	CONDUIT	65.23	0	01:05	0.59	0.72	1.00
115	CONDUIT	28.81	0	01:05	0.59	0.67	1.00
117	CONDUIT	37.50	0	01:09	0.76	0.90	1.00
120	CONDUIT	58.12	0	01:06	0.42	0.29	1.00
126	CONDUIT	43.05	0	01:05	0.88	1.03	1.00
131	CONDUIT	10.82	0	02:24	0.40	0.03	0.16
131_(1)	CONDUIT	43.53	0	01:45	0.81	0.12	0.21
131_2	CONDUIT	16.72	0	01:57	0.46	0.04	0.22
132	CONDUIT	55.17	0	01:45	0.85	0.13	0.20
19_1	CONDUIT	91.13	0	01:46	0.87	0.11	0.22
19_2	CONDUIT	102.22	0	01:46	1.01	0.10	0.22
21_1	CONDUIT	62.36	0	01:45	0.65	0.10	0.24
21_3	CONDUIT	75.00	0	01:45	0.76	0.15	0.24
21_4	CONDUIT	79.84	0	01:46	0.93	0.14	0.22
25_(1)_(1)_1	CONDUIT	52.36	0	01:06	0.33	0.42	1.00
25_(1)_(1)_2	CONDUIT	94.13	0	01:06	0.59	0.74	1.00
31_1	CONDUIT	104.45	0	01:05	0.66	0.80	1.00
31_2	CONDUIT	146.02	0	01:05	0.92	1.14	1.00
33_(1)	CONDUIT	158.24	0	01:06	0.99	1.12	1.00
33_(1)_(2)	CONDUIT	216.60	0	01:06	1.00	1.09	1.00
49	CONDUIT	50.31	0	01:06	1.05	1.18	1.00
49_(1)	CONDUIT	103.43	0	01:06	0.94	1.16	1.00
55	CONDUIT	87.52	0	01:08	0.79	0.99	1.00
56	CONDUIT	51.29	0	01:07	1.04	1.24	1.00
64	CONDUIT	26.49	0	01:10	0.61	0.62	1.00
65	CONDUIT	48.78	0	01:09	0.69	0.84	1.00
68	CONDUIT	52.67	0	01:06	1.07	1.51	1.00
73	CONDUIT	29.11	0	01:06	0.90	0.69	1.00
82	CONDUIT	49.88	0	01:09	0.71	0.88	1.00
93	CONDUIT	43.23	0	01:05	0.88	1.21	1.00
98	CONDUIT	79.58	0	01:05	1.13	1.40	1.00
C10	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C11	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C12	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C13	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C14	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C15	CONDUIT	0.00	0	00:00	0.00	0.00	0.05
C16	CONDUIT	0.00	0	00:00	0.00	0.00	0.05
C17	CONDUIT	0.00	0	00:00	0.00	0.00	0.04
C18	CONDUIT	0.00	0	00:00	0.00	0.00	0.04
C19	CONDUIT	0.00	0	00:00	0.00	0.00	0.07
C20	CONDUIT	0.00	0	00:00	0.00	0.00	0.07
C21	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C22	CONDUIT	12.88	0	01:30	0.04	0.00	0.12
C23	CONDUIT	12.88	0	01:30	0.06	0.00	0.08
C24	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C25	CONDUIT	0.00	0	00:00	0.00	0.00	0.08

C26	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C27	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C28	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C29	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C30	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C31	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C32	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C33	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C34	CONDUIT	0.00	0	00:00	0.00	0.00	0.08
C35	CONDUIT	0.00	0	00:00	0.00	0.00	0.13
C36	CONDUIT	0.00	0	00:00	0.00	0.00	0.09
C37	CONDUIT	0.00	0	00:00	0.00	0.00	0.09
C38	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C39	CONDUIT	0.00	0	00:00	0.00	0.00	0.07
C40	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C41	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C42	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C43	CONDUIT	3.67	0	02:20	0.01	0.00	0.12
C44	CONDUIT	3.67	0	02:20	0.02	0.00	0.06
C45	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
C46	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
C47	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
C48	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
C49	CONDUIT	0.00	0	00:00	0.00	0.00	0.06
C50	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C51	CONDUIT	0.72	0	02:50	0.00	0.00	0.11
C52	CONDUIT	0.00	0	00:00	0.00	0.00	0.11
C53	CONDUIT	0.00	0	00:00	0.00	0.00	0.14
C54	CONDUIT	0.00	0	00:00	0.00	0.00	0.09
C55	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C56	CONDUIT	0.72	0	02:50	0.00	0.00	0.07
C57	CONDUIT	0.00	0	00:00	0.00	0.00	0.07
C58	CONDUIT	0.00	0	00:00	0.00	0.00	0.04
C59	CONDUIT	0.00	0	00:00	0.00	0.00	0.04
C60	CONDUIT	0.00	0	00:00	0.00	0.00	0.04
C61	CONDUIT	0.00	0	00:00	0.00	0.00	0.04
C62	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C63	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C64	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C65	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C66	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C67	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C68	CONDUIT	0.00	0	00:00	0.00	0.00	0.12
C69	CONDUIT	21.16	0	01:17	0.08	0.00	0.15
C70	CONDUIT	22.49	0	01:17	0.08	0.00	0.15
CB05-ICD	ORIFICE	4.84	0	01:34			1.00
CB11-ICD	ORIFICE	5.87	0	01:44			1.00
CBMH01-ICD	ORIFICE	11.09	0	01:50			1.00
CBMH04-ICD	ORIFICE	11.31	0	02:13			1.00
CBMH09-ICD	ORIFICE	7.20	0	01:30			1.00
CBMH13-ICD	ORIFICE	5.71	0	02:21			1.00
CBMH15-ICD	ORIFICE	5.96	0	02:18			1.00
CBMH20-ICD	ORIFICE	5.34	0	01:59			1.00
CBMH23-ICD	ORIFICE	5.50	0	02:50			1.00
BLDG-A-OUT	DUMMY	17.38	0	01:18			
BLDG-B-OUT	DUMMY	9.48	0	01:19			
BLDG-C-OUT	DUMMY	12.64	0	01:19			

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Flow Classification Summary
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Conduit	Adjusted /Actual Length	Dry	Up Dry	Down Dry	Sub Crit	Sup Crit	Up Crit	Down Crit	Norm Ltd	Inlet Ctrl
		---------- Fraction of Time in Flow Class ----------								
104	1.00	0.01	0.00	0.00	0.36	0.00	0.00	0.63	0.73	0.00
105	1.00	0.01	0.00	0.00	0.51	0.00	0.00	0.48	0.59	0.00
109	1.00	0.01	0.00	0.00	0.56	0.00	0.00	0.43	0.02	0.00
113	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.42	0.00
115	1.00	0.01	0.00	0.00	0.59	0.00	0.00	0.40	0.50	0.00
117	1.00	0.01	0.00	0.00	0.38	0.00	0.00	0.61	0.23	0.00
120	1.00	0.01	0.00	0.00	0.62	0.00	0.00	0.36	0.47	0.00
126	1.00	0.01	0.00	0.00	0.66	0.00	0.00	0.32	0.41	0.00
131	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.80	0.00
131_(1)	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
131_2	1.00	0.01	0.05	0.00	0.94	0.00	0.00	0.00	0.49	0.00
132	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
19_1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.06	0.00
19_2	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.21	0.00
21_1	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.55	0.00
21_3	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.12	0.00
21_4	1.00	0.01	0.00	0.00	0.00	0.00	0.00	0.99	0.00	0.00
25_(1)_(1)_1	1.00	0.01	0.01	0.00	0.97	0.00	0.00	0.00	0.28	0.00
25_(1)_(1)_2	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.25	0.00
31_1	1.00	0.01	0.03	0.00	0.96	0.00	0.00	0.00	0.21	0.00
31_2	1.00	0.01	0.01	0.00	0.98	0.00	0.00	0.00	0.19	0.00
33_(1)	1.00	0.01	0.00	0.00	0.60	0.00	0.00	0.39	0.06	0.00
33_(1)_(2)	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.14	0.00
49	1.00	0.01	0.00	0.00	0.44	0.00	0.00	0.55	0.41	0.00

49_(1)	1.00	0.01	0.00	0.00	0.52	0.00	0.00	0.46	0.34	0.00
55	1.00	0.01	0.00	0.00	0.99	0.00	0.00	0.00	0.56	0.00
56	1.00	0.01	0.00	0.00	0.54	0.00	0.00	0.45	0.55	0.00
64	1.00	0.01	0.00	0.00	0.43	0.00	0.00	0.56	0.67	0.00
65	1.00	0.01	0.00	0.00	0.48	0.00	0.00	0.50	0.61	0.00
68	1.00	0.01	0.00	0.00	0.79	0.00	0.00	0.20	0.01	0.00
73	1.00	0.01	0.02	0.00	0.60	0.00	0.00	0.36	0.51	0.00
82	1.00	0.01	0.00	0.00	0.39	0.00	0.00	0.60	0.02	0.00
93	1.00	0.01	0.00	0.00	0.72	0.00	0.00	0.27	0.01	0.00
98	1.00	0.01	0.00	0.00	0.72	0.00	0.00	0.26	0.32	0.00
C10	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C11	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C12	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C13	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C14	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C15	1.00	0.84	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C16	1.00	0.84	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C17	1.00	0.84	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C18	1.00	0.84	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C19	1.00	0.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C20	1.00	0.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C21	1.00	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C22	1.00	0.81	0.14	0.00	0.05	0.00	0.00	0.00	0.91	0.00
C23	1.00	0.86	0.09	0.00	0.05	0.00	0.00	0.00	0.94	0.00
C24	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C25	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C26	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C27	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C28	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C29	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C30	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C31	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C32	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C33	1.00	0.69	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C34	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C35	1.00	0.68	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C36	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C37	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C38	1.00	0.81	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C39	1.00	0.59	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C40	1.00	0.51	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C41	1.00	0.51	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C42	1.00	0.51	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C43	1.00	0.51	0.41	0.00	0.08	0.00	0.00	0.00	0.86	0.00
C44	1.00	0.78	0.15	0.00	0.08	0.00	0.00	0.00	0.92	0.00
C45	1.00	0.78	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C46	1.00	0.78	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C47	1.00	0.78	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C48	1.00	0.78	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C49	1.00	0.78	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C50	1.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C51	1.00	0.75	0.22	0.00	0.03	0.00	0.00	0.00	0.87	0.00
C52	1.00	0.75	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C53	1.00	0.80	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C54	1.00	0.67	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C55	1.00	0.51	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C56	1.00	0.86	0.11	0.00	0.03	0.00	0.00	0.00	0.89	0.00
C57	1.00	0.86	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C58	1.00	0.87	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C59	1.00	0.87	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C60	1.00	0.87	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C61	1.00	0.87	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C62	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C63	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C64	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C65	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C66	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C67	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C68	1.00	0.66	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C69	1.00	0.51	0.20	0.00	0.29	0.00	0.00	0.00	0.74	0.00
C70	1.00	0.51	0.20	0.00	0.29	0.00	0.00	0.00	0.73	0.00

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Conduit Surcharge Summary
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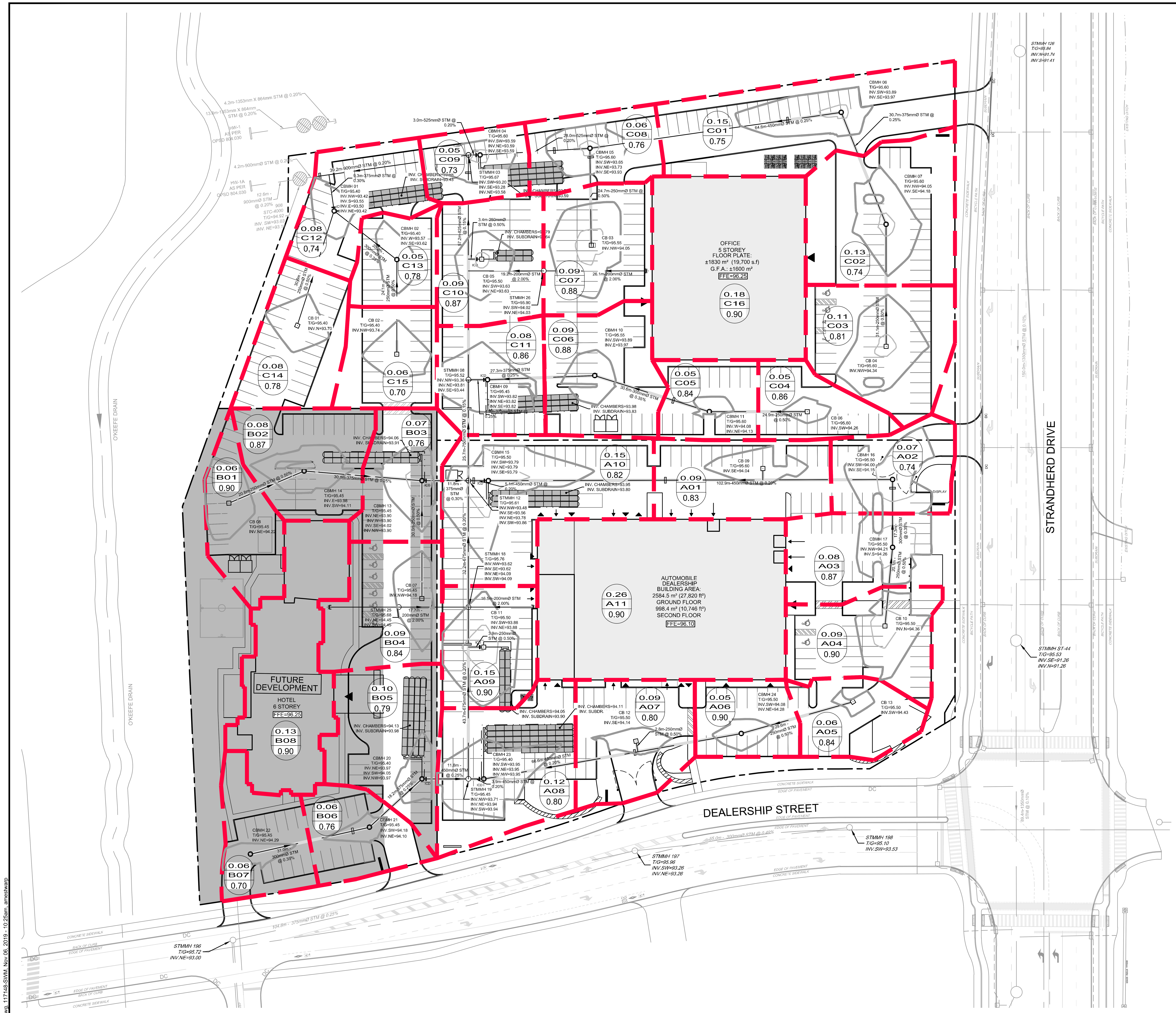
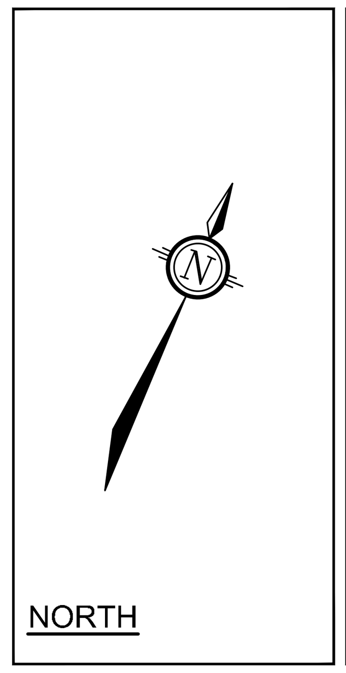
Conduit	--------- Hours Full -------- Both Ends	Upstream	Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
104	4.12	4.12	4.92	0.01	0.01
105	4.90	4.90	6.45	0.01	0.01
109	6.52	6.52	7.19	0.01	0.01
113	9.95	9.95	10.76	0.01	0.01
115	8.85	8.85	9.90	0.01	0.01
117	4.39	4.39	5.37	0.01	0.01
120	7.76	7.76	9.22	0.01	0.01
126	10.61	10.61	11.29	0.01	0.01
25_(1)_(1)_1	8.76	8.76	9.74	0.01	0.01
25_(1)_(1)_2	9.74	9.74	11.30	0.01	0.01

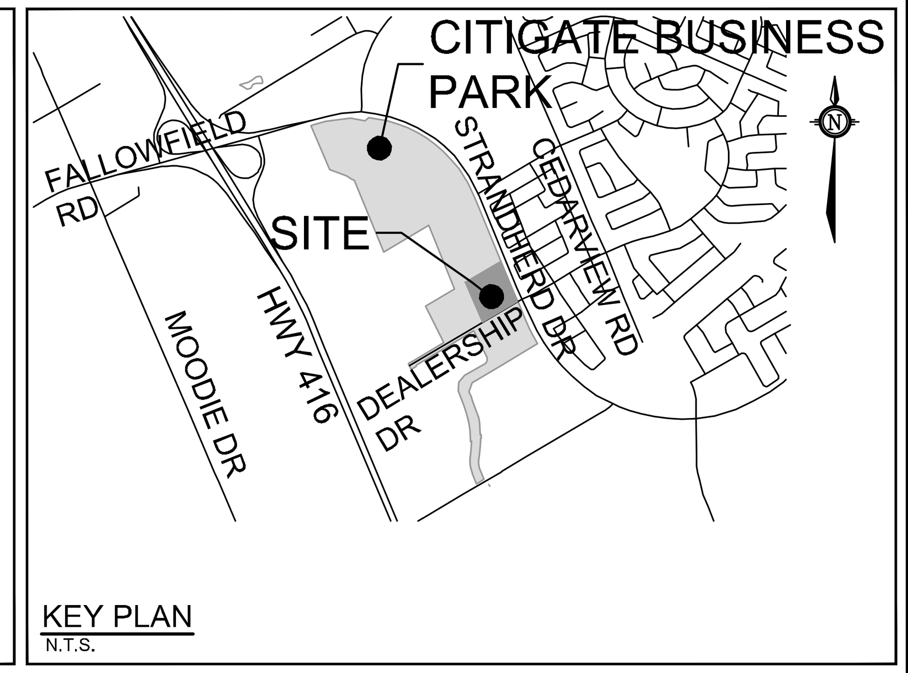
31_1	12.10	12.10	13.03	0.01	0.01
31_2	13.03	13.03	15.03	0.02	0.02
33_(1)	7.04	7.04	8.62	0.02	0.02
33_(1)_(2)	8.67	8.67	9.26	0.02	0.03
49	6.60	6.60	6.78	0.04	0.04
49_(1)	6.79	6.79	6.99	0.03	0.03
55	6.91	6.91	7.58	0.01	0.01
56	7.43	7.43	8.62	0.03	0.03
64	4.46	4.46	5.79	0.01	0.01
65	5.79	5.79	6.86	0.01	0.01
68	14.31	14.31	14.45	0.10	0.09
73	5.64	5.64	8.76	0.01	0.01
82	4.92	4.92	5.37	0.01	0.01
93	11.50	11.50	11.69	0.12	0.12
98	11.29	11.29	12.10	0.04	0.04

```
Analysis begun on:  Wed Oct 30 16:44:59 2019
Analysis ended on:  Wed Oct 30 16:45:02 2019
Total elapsed time: 00:00:03
```

Appendix E:
Stormwater Management Drawings







INLET CONTROL DEVICE TABLE:

LOCATION	TEMPEST LMF/MHF ICDs		MODEL NO.
	100-YR (3-HR CHICAGO STORM)		
	HEAD (m)	RELEASE RATE (L/S)	
CB 05	2.05	4.8	TEMPEST LMF VORTEX 62
CB 11	1.89	5.9	TEMPEST LMF VORTEX 70
CBMH01	2.14	11.1	TEMPEST LMF VORTEX 94
CBMH04	2.22	11.3	TEMPEST LMF VORTEX 94
CBMH09	1.87	7.2	TEMPEST LMF VORTEX 78
CBMH13	1.79	5.7	TEMPEST LMF VORTEX 70
CBMH15	1.94	6.0	TEMPEST LMF VORTEX 70
CBMH20	1.57	5.3	TEMPEST LMF VORTEX 70
CBMH23	1.66	5.5	TEMPEST LMF VORTEX 70

LEGEND

- PROPERTY LINE
- PROPOSED STORM SEWER AND MANHOLE
- DIRECTION OF FLOW
- PROPOSED CATCHBASIN MANHOLE
- PROPOSED CATCHBASIN
- STM MH — EXISTING STORM MANHOLE & SEWER
- CB 1 — EXISTING CATCHBASIN
- PROPOSED STORMTECH STC-740 UNDERGROUND STORAGE SYSTEM
- STORM SEWER DRAINAGE AREA BOUNDARY
- 100 YR PONDING AREA
- 5 YEAR PONDING AREA
- 0.085 / A-16 / 0.78 — DRAINAGE AREA (ha) / DRAINAGE AREA ID / RUNOFF COEFFICIENT

REFER TO 117148-ND FOR NOTES AND DETAILS

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

No.	REVISION	DATE	BY
1.	ISSUED FOR SITEPLAN APPLICATION	NOV 06/19	CJR

SCALE 1:500

DESIGN	ARM
CHECKED	CJR
DRAWN	ARM
CHECKED	CJR
APPROVED	JLS

FOR REVIEW ONLY

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

LOCATION
4149 STRANDHERD DRIVE, CITY OF OTTAWA
MYERS SITE PLAN

DRAWING NAME
STORMWATER MANAGEMENT PLAN

PROJECT No. 117148
REV: REV # 1
DRAWING No. 117148-SWM

PLANA1.DWG - 841mmx594mm

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Appendix F:
Development Servicing Study Checklist

4. Development Servicing Study Checklist

The following section describes the checklist of the required content of servicing studies. It is expected that the proponent will address each one of the following items for the study to be deemed complete and ready for review by City of Ottawa Infrastructure Approvals staff.

The level of required detail in the Servicing Study will increase depending on the type of application. For example, for Official Plan amendments and re-zoning applications, the main issues will be to determine the capacity requirements for the proposed change in land use and confirm this against the existing capacity constraint, and to define the solutions, phasing of works and the financing of works to address the capacity constraint. For subdivisions and site plans, the above will be required with additional detailed information supporting the servicing within the development boundary.

4.1 General Content

- N/A ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- ☒ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- ☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).

☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.

N/A ☐ Identification of potential impacts of proposed piped services on private services (such as wells and septic fields on adjacent lands) and mitigation required to address potential impacts.

N/A ☒ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:

- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

N/A ☒ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

N/A ☐ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

☒ Confirmation of adequate fire flow protection and confirmation that fire flow is calculated as per the Fire Underwriter's Survey. Output should show available fire flow at locations throughout the development.

☒ Provide a check of high pressures. If pressure is found to be high, an assessment is required to confirm the application of pressure reducing valves.

N/A ☐ Definition of phasing constraints. Hydraulic modeling is required to confirm servicing for all defined phases of the project including the ultimate design

☒ Address reliability requirements such as appropriate location of shut-off valves

N/A ☐ Check on the necessity of a pressure zone boundary modification.

- [X] Reference to water supply analysis to show that major infrastructure is capable of delivering sufficient water for the proposed land use. This includes data that shows that the expected demands under average day, peak hour and fire flow conditions provide water within the required pressure range
- [X] Description of the proposed water distribution network, including locations of proposed connections to the existing system, provisions for necessary looping, and appurtenances (valves, pressure reducing valves, valve chambers, and fire hydrants) including special metering provisions.
- N/A [ ] Description of off-site required feedermains, booster pumping stations, and other water infrastructure that will be ultimately required to service proposed development, including financing, interim facilities, and timing of implementation.
- [X] Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- [X] Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- [X] Summary of proposed design criteria (Note: Wet-weather flow criteria should not deviate from the City of Ottawa Sewer Design Guidelines. Monitored flow data from relatively new infrastructure cannot be used to justify capacity requirements for proposed infrastructure).
- [X] Confirm consistency with Master Servicing Study and/or justifications for deviations.
- N/A [ ] Consideration of local conditions that may contribute to extraneous flows that are higher than the recommended flows in the guidelines. This includes groundwater and soil conditions, and age and condition of sewers.
- [X] Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- [X] Verify available capacity in downstream sanitary sewer and/or identification of upgrades necessary to service the proposed development. (Reference can be made to previously completed Master Servicing Study if applicable)
- [X] Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.
- [X] Description of proposed sewer network including sewers, pumping stations, and forcemains.

N/A ☐ Discussion of previously identified environmental constraints and impact on servicing (environmental constraints are related to limitations imposed on the development in order to preserve the physical condition of watercourses, vegetation, soil cover, as well as protecting against water quantity and quality).

N/A ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.

N/A ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.

N/A ☐ Identification and implementation of the emergency overflow from sanitary pumping stations in relation to the hydraulic grade line to protect against basement flooding.

☐ Special considerations such as contamination, corrosive environment etc.

4.4 Development Servicing Report: Stormwater Checklist

☒ Description of drainage outlets and downstream constraints including legality of outlets (i.e. municipal drain, right-of-way, watercourse, or private property)

N/A ☐ Analysis of available capacity in existing public infrastructure.

☒ A drawing showing the subject lands, its surroundings, the receiving watercourse, existing drainage patterns, and proposed drainage pattern.

☒ Water quantity control objective (e.g. controlling post-development peak flows to pre-development level for storm events ranging from the 2 or 5 year event (dependent on the receiving sewer design) to 100 year return period); if other objectives are being applied, a rationale must be included with reference to hydrologic analyses of the potentially affected subwatersheds, taking into account long-term cumulative effects.

☒ Water Quality control objective (basic, normal or enhanced level of protection based on the sensitivities of the receiving watercourse) and storage requirements.

☒ Description of the stormwater management concept with facility locations and descriptions with references and supporting information.

N/A ☐ Set-back from private sewage disposal systems.

☒ Watercourse and hazard lands setbacks.

N/A ☐ Record of pre-consultation with the Ontario Ministry of Environment and the Conservation Authority that has jurisdiction on the affected watershed.

☒ Confirm consistency with sub-watershed and Master Servicing Study, if applicable study exists.

- [X] Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- [X] Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- [X] Calculate pre and post development peak flow rates including a description of existing site conditions and proposed impervious areas and drainage catchments in comparison to existing conditions.
- N/A [ ] Any proposed diversion of drainage catchment areas from one outlet to another.
- [X] Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- N/A [ ] If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100-year return period storm event.
- [ ] Identification of potential impacts to receiving watercourses
- N/A [ ] Identification of municipal drains and related approval requirements.
- [X] Descriptions of how the conveyance and storage capacity will be achieved for the development.
- [X] 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.
- N/A [ ] Inclusion of hydraulic analysis including hydraulic grade line elevations.
- [X] Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- N/A [ ] Identification of floodplains – proponent to obtain relevant floodplain information from the appropriate Conservation Authority. The proponent may be required to delineate floodplain elevations to the satisfaction of the Conservation Authority if such information is not available or if information does not match current conditions.
- N/A [ ] Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

The Servicing Study shall provide a list of applicable permits and regulatory approvals necessary for the proposed development as well as the relevant issues affecting each approval. The approval and permitting shall include but not be limited to the following:

☒ Conservation Authority as the designated approval agency for modification of floodplain, potential impact on fish habitat, proposed works in or adjacent to a watercourse, cut/fill permits and Approval under Lakes and Rivers Improvement Act. The Conservation Authority is not the approval authority for the Lakes and Rivers Improvement Act. Where there are Conservation Authority regulations in place, approval under the Lakes and Rivers Improvement Act is not required, except in cases of dams as defined in the Act.

☐ Application for Certificate of Approval (CofA) under the Ontario Water Resources Act.

N/A ☐ Changes to Municipal Drains.

N/A ☐ Other permits (National Capital Commission, Parks Canada, Public Works and Government Services Canada, Ministry of Transportation etc.)

4.6 Conclusion Checklist

☒ Clearly stated conclusions and recommendations

N/A ☐ Comments received from review agencies including the City of Ottawa and information on how the comments were addressed. Final sign-off from the responsible reviewing agency.

☒ All draft and final reports shall be signed and stamped by a professional Engineer registered in Ontario