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Development Servicing Study and Stormwater Management Report

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PROPOSED CAMP MART DEVELOPMENT AND PRIVATE ACCESS ROAD 20 & 30 FRANK NIGHBOR PLACE

DEVELOPMENT SERVICING STUDY AND STORMWATER MANAGEMENT REPORT

Prepared by:

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Suite 200, 240 Michael Cowpland Drive
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February 9, 2018
Revised April 23, 2018
Revised May 24, 2018
Revised June 29, 2018
Revised August 19, 2018

Ref: R-2018-011
Novatech File No. 117193

August 19, 2018

20 Frank Nighbor Inc.
11266 Fifth Line
Halton Hills, ON
L7G 4S6

Attention: Mr. Sunny Bains

Dear Sir:

Re: Development Servicing Study and Stormwater Management Report
Proposed Camp Mart Development and Private Access Road
20 & 30 Frank Nighbor Place, Ottawa, ON
Novatech File No.: 117193

Enclosed is a copy of the revised 'Development Servicing Study and Stormwater Management Report' for the proposed development located at 20 & 30 Frank Nighbor Place, in the City of Ottawa. This report addresses the approach to site servicing and stormwater management and is submitted in support of site plan control applications for both the Camp Mart site and the private access road.

Please contact the undersigned, should you have any questions or require additional information.

Yours truly,

NOVATECH

François Thauvette, P. Eng.
Senior Project Manager

FT/sm

cc: Santhosh Kuruvilla (City of Ottawa)
Shawn Hickey (SiteCast Construction Corp.)

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1.0 INTRODUCTION

The new Camp Mart Canada site is being proposed by 20 Frank Nighbor Inc. and Novatech has been retained to complete the site servicing and stormwater management design for this project. Also included as part of the development is the private access road immediately south of the subject site.

1.1 Purpose

This report addresses the approach to site servicing and stormwater management and is being submitted in support of site plan control applications for both the Camp Mart site and the associated private access road.

1.2 Location and Site Description

The Camp Mart site is located at 20 Frank Nighbor Place, in the City of Ottawa. The site is currently vacant and approximately 1.99 ha in area. The site is located immediately south of Highway 417, west of the Home Depot. Vacant lands are located between the subject site and the Carp River to the west. The legal description of the Camp Mart site is designated as Parts 4, 5, 6 & 13 on Plan 4R-30745, Part of Block 2 on Plan 4M-1012, City of Ottawa.

The new private access road is located immediately south of the subject site at 30 Frank Nighbor Place, and covers an approximate area of 0.09 hectares. The legal description of the private access road is designated as Parts 2, 3, 7 to 12 on Plan 4R-30745, Part of Block 2 on Plan 4M-1012, City of Ottawa.

Figure 1 – **Aerial Plan** provides an aerial view of the site.

1.3 Pre-Consultation Information

A pre-consultation meeting was held with the City of Ottawa on August 2, 2017, at which time the client was advised of the general submission requirements. The Mississippi Valley Conservation (MVC) was also consulted regarding the proposed development and a pre-consultation meeting has been requested with the Ministry of Environment and Climate Change (MOECC). Refer to **Appendix A** for a summary of the correspondence related to the proposed development.

1.4 Proposed Development

The proposed Camp Mart development will consist of a trailer sales and service building, including trailer display areas and a parking lot. The proposed building will be serviced by extending new services to the municipal sanitary sewer, storm sewer and watermain in an existing easement located south of the subject site. Construction will proceed as a single phase.

A new private access road will also be constructed as part of the proposed development, immediately south of the subject site. The access road will be extended off Frank Nighbor Place and will provide the necessary site access for large trailers and emergency vehicles (i.e. fire trucks).

1.5 Reference Material

[1] The 'Terry Fox Business Park – Stormwater Design Plan' (Ref. No. 91005-3), prepared by Novatech Engineering Consultants Ltd., on August 9, 1994.

[2] The Geotechnical Investigation Report (Ref. No. PG4409-1), prepared by Paterson Group on February 9, 2018.

2.0 SITE SERVICING – CAMP MART DEVELOPMENT

The objective of the site servicing design is to provide proper sewage outlets, a suitable domestic water supply and to ensure that appropriate fire protection is provided for the proposed development. The servicing criteria, expected sewage flows and water demands are to conform to the requirements of the City of Ottawa municipal design guidelines for sewer and water distribution systems and are to be consistent with the approach described in the 'Terry Fox Business Park – Stormwater Design Plan'[1]. Refer to the subsequent sections of the report for further details.

The City of Ottawa Servicing Study Guidelines for Development Applications requires that a Development Servicing Study Checklist be included to confirm that each applicable item is deemed complete and ready for review by City of Ottawa Infrastructure Approvals. A completed checklist is enclosed in **Appendix B** of the report.

2.1 Sanitary Sewage

The City of Ottawa Design Guidelines estimate the average daily sanitary sewage flow from industrial sites to be approximately 35,000 L/gross ha/day. The allowable average sewage flow from the subject site would therefore be approximately 0.81 L/s (or 35,000 L/ha/day x 1.99 ha).

The proposed building will be serviced by a new 200mm dia. sanitary service connected to the existing 450mm dia. sanitary sewer in the existing easement running along Frank Nighbor Place. The City of Ottawa design criteria were used to calculate the theoretical sanitary flows for the proposed development. The following design criteria were taken from Section 4 – 'Sanitary Sewer Systems' and Appendix 4-A - 'Daily Sewage Flow for Various Types of Establishments' of the City of Ottawa Sewer Design Guidelines:

- Design Population: 35-40 employees (use 40 in calculations)
- Average Daily Sewage Flows (Employees): 75 L/person/day
- Average Daily Sewage Flows (Service Bay): 40 L/vehicle/day
- Average Daily Sewage Flows (Service Bay Cleaning): 375 L/bay/day
- Average Daily Sewage Flows (Wash Bay): 400 L/vehicle/day
- Average number of vehicles serviced per day: 1 to 6 (use 6 in calculations)
- Average number of vehicles washed per day: 1 to 6 (use 6 in calculations)
- Commercial Peaking Factor = 1.5
- Infiltration Allowance: 0.28 L/s/ha x 1.99 ha site = 0.56 L/s

Table 1 identifies the theoretical sanitary flows for the proposed development based on the above design criteria.

Table 1: **Theoretical Post-Development Sanitary Flows**

Type of Use	Design Population (Employees/Vehicles/Bays)	Average Flow (L/s) [1]	Peaking Factor	Peak Flow (L/s)	Total Flow (L/s)
Office Staff	40 employees	0.10	1.5	0.15	0.15
Service Bay	6 vehicles	<0.01	1.5	0.02	0.02
Service Bay Cleaning	6 bays	0.08	1.5	0.12	0.12
Wash Bay	6 vehicles	0.08	1.5	0.12	0.12
Total	-	0.27	-	-	0.97[2]

[1]Average Flow based on an 8-hour work day
[2]Includes an infiltration allowance of 0.28 L/s/ha

As indicated in the table above, the calculated post-development average sewage flow is less than the allowable sewage flow calculated based on a rate of 35,000 L/gross ha/day.

A 200mm dia. sanitary gravity sewer at a minimum slope of 1.0% has a full flow conveyance capacity of 34.2 L/s and will have sufficient capacity to convey the theoretical sanitary flows.

2.2 Water

The proposed development will be serviced by a new 200mm dia. watermain connected to the existing 300mm dia. watermain in the existing easement running along Frank Nighbor Place. The proposed water service will be reduced to a 150mm dia. line before entering the building. The service has been sized to provide both the required domestic water demand and fire flow. A shut-off valve will be provided on the proposed watermain at the property line. The water meter will be in the mechanical room inside the building; while the remote meter will be located on the exterior face of the building near the main entrance.

To determine if the existing 300mm dia. municipal watermain has adequate capacity to accommodate the proposed development a hydraulic analysis was completed based on boundary conditions provided by the City of Ottawa.

2.2.1 Domestic Water Demand

The City of Ottawa design criteria were used to calculate the theoretical water demand for the proposed development. The following design criteria were taken from Section 4 – 'Water Distribution Systems' of the Ottawa Design Guidelines – Water Distribution and Table 3-3 from the MOE design guidelines for drinking water systems:

- Design Population: 35-40 employees (use 40 in calculations)
- Average Daily Water Demand: 75 L/person/day
- Maximum Day Demand Peaking Factor = 1.5 x Avg. Day Demand (City Water Table 4.2)
- Peak Hour Demand Peaking Factor = 1.8 x Max. Day Demand (City Water Table 4.2)
- Average Daily Water Demand (Service Bay): 40 L/vehicle/day
- Average Daily Water Demand (Service Bay Cleaning): 375 L/bay/day
- Average Daily Water Demand (Wash Bay): 400 L/vehicle/day
- Average number of vehicles serviced per day: 1 to 6 (use 6 in calculations)
- Average number of vehicles washed per day: 1 to 6 (use 6 in calculations)

The following design criteria were taken from Section 4.2.2 – 'Watermain Pressure and Demand Objectives' of the City of Ottawa Design Guidelines for Water Distribution:

- Normal operating pressure are to range between 345 kPa (50 psi) and 552 kPa (80 psi) under Max Day demands
- Minimum system pressures are to be 276 kPa (40 psi) under Peak Hour demands
- Minimum system pressures are to be 140 kPa (20 psi) under Max Day + Fire Flow demands

Table 2 identifies the theoretical domestic water demands for the development based on the above design criteria.

Table 2: **Theoretical Water Demand for Proposed Development**

Type of Use	Design Population (Employees/Vehicles/ Bays)	Average Day Demand (L/s)[3]	Max. Day Demand (L/s)	Peak Hour Demand (L/s)
Office Staff	40 employees	0.10	0.15	0.27
Service Bay	6 vehicles	0.003	0.004	0.008
Service Bay Cleaning	6 bays	0.08	0.12	0.22
Wash Bay	6 vehicles	0.08	0.12	0.22
Total	-	0.26	0.39	0.72

[3]Values taken from **Table 1** above.

2.2.1.1 Water Supply for Fire-Fighting

The proposed building will be fully sprinklered and supplied with a fire department siamese connection. The siamese connection will be located within 45m of the proposed on-site fire hydrant. The Fire Underwriters Survey (FUS) was used to estimate fire flow requirements for the proposed building. Non-combustible construction was used in the calculations based on information provided by the architect. Based on preliminary FUS calculations, the fire flow requirements for the building are expected to be in the order of 1,849 USGPM (or 7,000 L/min). The fire flow requirements include both sprinkler system and hose allowances in accordance with the OBC and NFPA 13. The sprinkler system will be designed by the fire protection (sprinkler) contractor as this process involves detailed hydraulic calculations based on building layout, pipe runs, head losses, fire pump requirements, etc. Booster pumps will not be required. Refer to **Appendix C** for a copy of the FUS fire flow calculations.

The hydraulic model EPANET was used to analyzing the performance of the proposed watermain for two theoretical conditions:

1) Maximum Day + Fire Flow Demand

2) Peak Hour Demand

A schematic representation of the hydraulic network depicts the node and pipe numbers used in the model. The model is based on hydraulic boundary conditions provided by the City of Ottawa. The model indicates that adequate pressure will exist throughout the watermain system under the specified design conditions. **Table 2A** and **Table 2B** summarize the hydraulic model results. Refer to **Appendix C** for City of Ottawa boundary conditions, the hydraulic modeling schematic and modeling results.

Table 2A: Maximum Day + Fire Flow Demand

Operating Condition	Minimum System Pressure	Maximum System Pressure
A Max Day demand of 0.4 L/s at Node J3 (Building) + a Fire Flow of 117 L/s at Node J4 (Hydrant)	A minimum system pressure of 492.66 kPa (71.45 psi) is available at Node J4 (Hydrant)	A maximum system pressure of 565.15 kPa (81.97 psi) is available at Nodes J1 and J2 (Hydrant Tee and Reducer)

Table 2B: Peak Hour Demand

Operating Condition	Minimum System Pressure	Maximum System Pressure
A Peak Hour demand of 0.72 L/s at Node J3 (Building)	A minimum system pressure of 604.30 kPa (87.65 psi) is available at Node J4 (Hydrant)	A maximum system pressure of 638.63 kPa (92.63 psi) is available at Nodes J1 and J2 (Hydrant Tee and Reducer)

The model indicates that the proposed 200mm dia. watermain will provide adequate system pressures for both 'Max Day + Fire Flow' and 'Peak Hour' conditions. Since the pressures will exceed 80 PSI (beyond the normal operating pressure range), the building will need to be equipped with a pressure reducing valve (PRV) per City of Ottawa Water Design Guidelines.

2.3 Storm Drainage and Stormwater Management

The proposed Camp Mart site will be serviced by connecting the proposed on-site storm sewer system to the existing 1050mm dia. storm sewer in the existing easement running along Frank Nighbor Place. The approach for the stormwater management design for the site is discussed in the subsequent sections of the report.

2.3.1 Stormwater Management Criteria and Objectives

The criteria and objectives for the proposed stormwater management design of the Camp Mart site are as follows:

- Provide a dual drainage system (i.e. minor system and emergency overland flow route, for events exceeding the 100-year design storm);
- Maximize the use of surface storage available on site;
- Control the post-development flows from the site to the maximum allowable release rate of 50 L/s/ha for both the 5-year and 100-year design storms, as defined in the 'Terry Fox Business Park – Stormwater Design Plan'[1].
- 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.
- Provide on-site water quality control equivalent to a 'Normal' Level of Protection (i.e., minimum 70% TSS removal) prior to releasing flows from the site towards the Carp River;
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

2.3.2 Pre-Development Conditions and Allowable Release Rate

The uncontrolled pre-development flows for the 1.99 ha site were calculated using the Rational Method to be 115.3 L/s during the 5-year design event and 247.0 L/s during the 100-year design event. Refer to **Appendix D** for detailed calculations. There are currently no water quantity or water quality control measures being provided on site.

The allowable release rate for the site, as specified in the 'Terry Fox Business Park – Stormwater Design Plan'[1], was calculated to be 99.5 L/s (50 L/s/ha x 1.99 ha). The site to be developed is located within 'Drainage Basin 1' as defined on Figure 2. Refer to **Appendix D** for excerpts from the 'Terry Fox Business Park – Stormwater Design Plan'[1].

2.3.3 Post-Development Conditions

The proposed building will be serviced by extending a new 200mm dia. storm service from the on-site storm sewer system. The on-site storm sewer system will outlet to the existing 1050mm dia. storm sewer, which discharges directly to the Carp River, approximately 210m to the west. Stormwater runoff from the site will be directed to various catchbasins and catch basin manholes located within the paved areas and/or towards landscape drains located within the grassed areas. To mitigate the stormwater related impacts due to the increase in imperviousness of the site, stormwater runoff will be attenuated using restrictor pipes installed within the on-site storm sewer system. Flows will be attenuated for storms up to and including the 100-year design event. Due to the existing grades, runoff from a very small portion of the site will sheet drain uncontrolled off site.

2.3.3.1 Area A-0 – Uncontrolled Runoff

The uncontrolled post-development flow from this very small sub-catchment area was calculated using the Rational Method to be approximately 6.1 L/s during the 5-year design event and 12.4 L/s during the 100-year design event. Refer to **Appendix D** for SWM calculations.

2.3.3.2 Area A-1 – Controlled Flow from Main Parking Lot and Display Area

The post-development flow from this sub-catchment area will be attenuated using a restrictor pipe grouted in place, inside the outlet pipe of CBMH 1. Stormwater runoff from this sub-catchment area will be temporarily stored within the grassed areas and on the paved parking lot prior to being discharged into the on-site storm sewer system. The site has been designed to ensure that no stormwater will pond on the private paved surfaces (i.e. drive aisles or parking lots) during the 2-year storm event.

Table 3A summarizes the post-development design flow from this sub-catchment area as well as the size of the restrictor pipe, the anticipated ponding elevations, storage volumes required and storage volume provided for the 2-year, 5-year and the 100-year design events.

Table 3A: Design Flow and Restrictor Pipe Table

Design Event	Sub-Catchment Area A-1				
	Restrictor Pipe (mm)	**Design Flow (L/s)**	**Ponding Elevation (m)**	**Storage Vol. Required (m³)**	**Max Storage Provided (m³)**
2-Year	101mm dia. pipe grouted inside a 375mm dia. outlet pipe	29.7 L/s	94.81 m	109.6 m³	631.9 m³
5-Year		30.3 L/s	94.89 m	167.2 m³	
100-Year		31.1 L/s	95.00 m	399.9 m³	

Refer to **Appendix D** for SWM calculations. As indicated in the table above, this sub-catchment area will provide sufficient storage for the 2-year, 5-year and 100-year design events. Furthermore, no stormwater will pond on the private paved surfaces (i.e. drive aisles or parking lots) during the 2-year storm event.

2.3.3.3 Area A-2– Controlled Flow from Building Roof, Rear Parking Lot & Display Area

The post-development flow from this sub-catchment area will be attenuated using a restrictor pipe grouted in place, inside the outlet pipe of CBMH 12. Stormwater runoff from this sub-catchment area will be temporarily stored within the grassed areas and on the paved parking lot prior to being discharged into the on-site storm sewer system. The site has been designed to ensure that no ponding will occur on the private paved surfaces (i.e. drive aisles or parking lots) during the 2-year storm event.

The building will be equipped with an emergency overflow outlet since it will be located upstream of the proposed restrictor pipe in CBMH 12. In an emergency event, stormwater from the roof will be able to outlet to the exterior surface, adjacent to the building where it will be conveyed to the downstream system via the emergency overland flow route shown on the Grading and Erosion & Sediment Control Plan.

Table 3B summarizes the post-development design flow from this sub-catchment area as well as the size of the restrictor pipe, the anticipated ponding elevations, storage volumes required and storage volume provided for the 2-year, 5-year and the 100-year design events.

Table 3B: Design Flow and Restrictor Pipe Table

Design Event	Sub-Catchment Area A-2				
	Restrictor Pipe (mm)	Design Flow (L/s)	Ponding Elevation (m)	Storage Vol. Required (m³)	Max Storage Provided (m³)
2-Year	135mm dia. pipe grouted inside a 375mm dia. outlet pipe	49.8 L/s	94.86 m	34.3 m³	204.8 m³
5-Year		50.6 L/s	94.91 m	59.2 m³	
100-Year		52.9 L/s	95.07 m	165.3 m³	

Refer to **Appendix D** for SWM calculations. As indicated in the table above, this sub-catchment area will provide sufficient storage for the 2-year, 5-year and 100-year design events. Furthermore, no stormwater will pond on the paved surfaces (i.e. drive aisles or parking lots) during the 2-year storm event.

Table 3C compares the post-development flows from the proposed Camp Mart site (Areas A-0, A-1 and A-2) to both the uncontrolled pre-development flows and to the allowable release rate specified by the City of Ottawa, for both the 5-year and the 100-year design events.

Table 3C: Stormwater Flow Comparison Table

Design Event	Drainage Areas A-0, A-1 and A-2						
	Pre-Development Conditions		Post-Development Conditions				
	Uncontrolled Flow (L/s)	Allowable Release Rate (L/s)	A-0 Flow (L/s)	A-1 Flow (L/s)	A-2 Flow (L/s)	Total Flow (L/s)	Reduction in Flow (L/s or %)[4]
5-Yr	115.3	99.5	6.1	30.3	50.6	87.0	28.3 or 25%
100-Yr	247.0	99.5	12.4	31.1	52.9	96.4	150.6 or 61%

[4]Reduced flow compared to pre-development uncontrolled conditions

As indicated in the table above, both the 5-year and 100-year post-development flows from the site will be less than the allowable release rate specified by the City of Ottawa. Furthermore, this represents significant reductions in total site flow rate when compared to the respective pre-development conditions. Refer to **Appendix D** for SWM calculations and the 5-year storm sewer design sheet.

2.3.3.4 Stormwater Quality Control

The subject site is located within the jurisdiction of the Mississippi Valley Conservation (MVC) and is tributary to the Carp River. A 'Normal' Level of Protection, equivalent to a long-term average removal of 70% Total Suspended Solids (TSS), with at least 85% of the total rainfall being captured and treated, is required.

To achieve this level of quality control protection, a new oil-grit separator unit (CDS Model PMSU 20_20_5) will be installed downstream of STM MH 1 on the storm sewer outlet pipe from the site. Stormwater runoff collected by the on-site storm sewer system (1.91 ha tributary area) will be directed through the proposed treatment unit. The contributing area includes the proposed paved parking areas, display areas, landscaped areas as well as the building roof.

As stated above, the proposed oil-grit separator has been sized to provide a 'Normal' Level of water quality treatment prior to discharging the stormwater into the municipal storm sewer and ultimately into the Carp River. Echelon Environmental and Contech Stormwater Solutions Inc. have modeled and analyzed the tributary area to provide a CDS unit capable of meeting the TSS removal requirements. The model parameters for the TSS removal were based on historical rainfall data for Ottawa from the Ontario Climate Centre. It was determined that a CDS Model PMSU 20_20_5 will exceed the target removal rate, providing a net annual 72.0% TSS removal. The CDS unit has a treatment capacity of approximately 31 L/s, a sediment storage capacity of 1.67m^3; an oil storage capacity of 376 L and will treat a net annual volume of approximately 90.9% for the tributary area.

The shallow flat grass swales on site will provide additional stormwater quality control by reducing flow velocities and thus promoting infiltration and the removal of suspended solids. The CB and CBMH structures will be equipped with sumps to promote additional settling of sediment. It is expected that the proposed treatment train approach will be used to provide the requisite level of water quality control.

Maintenance and Monitoring of the Storm Sewer and Stormwater Management Systems

It is recommended that the client implement a maintenance and monitoring program for both the on-site storm sewers and the stormwater management systems: The storm drainage system should be inspected routinely (at least annually); the restrictor pipes should be inspected to ensure they are free of debris; and the oil-grit separator should be inspected at regular intervals and maintained when necessary to ensure optimum performance. Refer to **Appendix F** for the CDS unit design parameters, sizing analysis, operation, design, performance and maintenance summary parameters as well as the annual TSS removal efficiency data.

3.0 SITE SERVICING – PRIVATE ACCESS ROAD

Municipal services, including a 450mm dia. sanitary sewer, a 300mm dia. watermain and a 1050mm dia. storm sewer, are located within an existing easement below the proposed access road. Although no new sanitary sewers, watermains or storm sewers are being proposed within the private access road, two (2) new catchbasins are being proposed to capture roadway drainage. The catchbasins will be interconnected and equipped with a vortex type inlet control device (ICD) to attenuate flows, prior to discharging them into the municipal storm sewer.

3.1 Storm Drainage and Stormwater Management

The approach for the stormwater management design of the private access road is discussed in the subsequent sections of the report.

3.1.1 Stormwater Management Criteria and Objectives

The criteria and objectives for the proposed stormwater management design of the private access road are as follows:

- Provide a dual drainage system (i.e. minor and major system flows);
- Maximize the use of surface storage available within the private roadway;
- Control the post-development flows from the private access road to the maximum allowable release rate of 50 L/s/ha for both the 5-year and 100-year design storms, as defined in the 'Terry Fox Business Park – Stormwater Design Plan'[1].
- Provide guidelines to ensure that site preparation and construction is in accordance with the current Best Management Practices for Erosion and Sediment Control.

3.1.2 Pre-Development Conditions and Allowable Release Rate

The uncontrolled pre-development flows for the 0.09 ha private access road were calculated using the Rational Method to be 5.2 L/s during the 5-year design event and 11.2 L/s during the 100-year design event. Refer to **Appendix D** for detailed calculations. There are currently no water quantity or water quality control measures being provided on site.

The allowable release rate for the private access road, as specified in the 'Terry Fox Business Park – Stormwater Design Plan'[1], was calculated to be 4.5 L/s (50 L/s/ha x 0.09 ha).

3.1.3 Post-Development Conditions

Storm drainage from the private access road will be directed into the existing 1050mm dia. storm sewer, which outlets directly to the Carp River, approximately 210m to the west. To mitigate the stormwater related impacts due to the increase in imperviousness, stormwater runoff will be attenuated using an inlet control device (ICD) installed within the outlet pipe of the inter-connected catchbasins within the private roadway. Flows will be attenuated for storms up to and including the 100-year design event.

3.1.3.1 Area A-4 – Controlled Flow from Private Access Road

The post-development flow from this sub-catchment area will be attenuated by installing an ICD within the outlet pipe of CB 1A. Stormwater runoff from this sub-catchment area will be temporarily stored on the paved roadway prior to being discharged into the municipal storm sewer.

Table 4 summarizes the post-development design flow from this sub-catchment area as well as the type of ICD, the anticipated ponding elevations, storage volumes required and storage volume provided for both the 5-year and the 100-year design events.

Table 4: Design Flow and Inlet Control Device Table

Design Event	Sub-Catchment Area A-4				
	ICD Type	Design Flow (L/s)	Ponding Elevation (m)	Storage Vol. Required (m³)	Max Storage Provided (m³)
5-Year	Tempest LMF 'Model 60' Vortex ICD	4.3 L/s	94.95 m	8.9 m³	38.9 m³
100-Year		4.4 L/s	95.01 m	23.3 m³	

Refer to **Appendix D** for SWM calculations and to **Appendix E** for ICD information. As indicated in the table above, this sub-catchment area will provide sufficient storage for both the 5-year and 100-year design events.

Table 4A compares the post-development flows from Area A-4 to both the uncontrolled pre-development flows and to the allowable release rate specified by the City of Ottawa, for both the 5-year and the 100-year design events.

Table 4A: Stormwater Flow Comparison Table

Design Event	Drainage Area A-4				
	Pre-Development Conditions		Post-Development Conditions		
	Uncontrolled Flow (L/s)	Allowable Release Rate (L/s)	A-3 Flow (L/s)	Total Flow (L/s)	Reduction in Flow (L/s or %)[4]
5-Yr	5.2	4.5	4.3	4.3	0.9 or 17%
100-Yr	11.2	4.5	4.4	4.4	6.8 or 61%

[4]Reduced flow compared to pre-development uncontrolled conditions

As indicated in the table above, both the 5-year and 100-year post-development flows from the private access road will be less than the allowable release rate specified by the City of Ottawa. Furthermore, this represents significant reductions in total site flow rate when compared to the respective pre-development conditions. Post-development flows will be reduced by approximately 0.9 L/s (or 17%) during the 5-year event and by as much as 6.8 L/s (or 61%) during the 100-year design event, when compared to current conditions.

4.0 SITE GRADING – CAMP MART DEVELOPMENT

The elevation of the existing site varies from approximately 94.50m up to approximately 96.50m. The existing site generally slopes from east to west towards the Carp River, which is located approximately 210m west of the subject site.

The finished floor elevation (FFE) of the proposed building will be set at an elevation of 95.50m, which corresponds to the FFE of the Home Depot building to the east. The building and general site elevations will work well with the grades along the property lines, the views from Hwy 417 to the north, the existing access road to the east and the private access road off Frank Nighbor Place to the south. The grades along the property line will need to slope down temporarily to match into the existing grades on the vacant parcel to the west. The grade on the adjacent property to the west will be raised in the future once it is developed. Refer to the enclosed Grading and Erosion & Sediment Control Plans for details.

Any excess fill material generated from the proposed site development is to be reviewed by the geotechnical engineer to determine suitability for use as general fill on the adjacent vacant lots. Filling on the adjacent lots is only permitted outside the regulatory floodline as defined by the MVC. Limits of the works are to be established on-site by an OLS.

4.1 Emergency Overland Flow Route

In the case of a major rainfall event exceeding the design storms provided for, the stormwater located within the subject site will overflow towards the lower downstream sub-catchment areas and ultimately flow towards the proposed private access road. The Camp Mart building floor elevation (95.50m) has been set to be a minimum of 0.3m above the major system overflow points. Runoff will ultimately be directed to the Carp River. The emergency overland flow route is shown on the enclosed Grading and Erosion & Sediment Control Plan.

5.0 SITE GRADING – PRIVATE ACCESS ROAD

The private access road will match into the elevations of Frank Nighbor Place and rise approximately 0.5m to work with the entrance of the proposed Camp Mart site. The proposed access road has been designed to work with the elevations of Frank Nighbor Place, the Camp Mart site, as well as future developments to the south and west. The elevation of the private access road, will also slightly increase the cover over the existing municipal services.

The grades adjacent to the private roadway will be maintained until the vacant lots are developed in the future. Refer to the enclosed Grading and Erosion & Sediment Control Plan for details.

5.1 Emergency Overland Flow Route

In the case of a major rainfall event exceeding the design storms provided for, the stormwater located within the eastern portion of the private roadway will overflow towards Frank Nighbor Place. Stormwater within the western portion of the private roadway will overflow and sheet drain towards the Carp River. The emergency overland flow route is shown on the enclosed Grading and Erosion & Sediment Control Plan.

6.0 GEOTECHNICAL INVESTIGATIONS – CAMP MART DEVELOPMENT AND PRIVATE ACCESS ROAD

A Geotechnical Investigation Report has been prepared by Paterson Group for the proposed project. Refer to the Geotechnical Report[2] for subsurface conditions, construction recommendations and geotechnical inspection requirements.

7.0 EROSION AND SEDIMENT CONTROL – CAMP MART DEVELOPMENT AND PRIVATE ACCESS ROAD

To mitigate erosion and to prevent sediment from entering the storm sewer system, temporary erosion and sediment control measures will be implemented on-site during construction in accordance with the Best Management Practices for Erosion and Sediment Control. This includes the following temporary measures:

- Filter bags will be placed under the grates of nearby catchbasins, manholes and will remain in place until vegetation has been established and construction is completed.
- Silt fencing will be placed per OPSS 577 and OPSD 219.110 along the surrounding construction limits;
- Mud mats will be installed at the site entrances.
- Street sweeping and cleaning will be performed, as required, to suppress dust and to provide safe and clean roadways adjacent to the construction site.
- On-site dewatering is to be directed to a sediment trap and/or gravel splash pad and discharged safely to an approved outlet as directed by the engineer.

The temporary erosion and sediment control measures will be implemented prior to construction and will remain in place during all phases of construction. Regular inspection and maintenance of the erosion control measures will be undertaken.

In addition, the following measures will provide permanent erosion and sediment control on the proposed **Camp Mart** site:

- Shallow flat-bottom grass drainage swales along the north and east property lines as well as within the curbed island in the main parking lot;
- A CDS type Oil/Grit Separator will be installed to provide water quality control prior to releasing stormwater from sub-catchment areas A-1 and A-2.

8.0 CONCLUSION – CAMP MART AND PRIVATE ACCESS ROAD

This report has been prepared in support of site plan control applications for the proposed **Camp Mart** development and associated **Private Access Road** located at 20 & 30 Frank Nighbor Place.

The conclusions specific to the **Camp Mart** development are as follows:

- The proposed building will be serviced by the municipal watermain, sanitary and storm sewers in the existing easement running along Frank Nighbor Place.
- The building will be sprinklered and supplied with a fire department siamese connection. The siamese connection will be located within 45m of the proposed on-site fire hydrant.
- The site flows from sub-catchment areas A-1 and A-2 will be controlled by small diameter restrictor pipes, grouted in place, inside the outlet pipes of CBMH 1 and CBMH 12 respectively.
- The total post-development site flow (from Areas A-0, A-1 and A-2) will be approximately 87.0 L/s during the 5-year design event and 96.4 L/s during the 100-year event, both less than the allowable release rate of 99.5 L/s. Post-development flows are being reduced by 28.3 L/s (or 25%) during the 5-year event and by as much as 150.6 L/s (or 61%) during the 100-year design event, when compared to current conditions.

- An oil / grit separator unit (CDS Model PMSU 20_20_5) will provide a 'Normal' Level of water quality control for the portion of the site discharging to the 1050mm dia. municipal storm sewer.
- Regular inspection and maintenance of the storm sewer system, including the restrictor pipes and CDS treatment unit is recommended to ensure that the storm drainage system is clean and operational.
- Erosion and sediment controls are to be provided both during construction and on a permanent basis.

The conclusions specific to the **Private Access Road** are as follows:

- The site flows from sub-catchment area A-4 will be controlled by a single Tempest LMF 'Model 60' Vortex ICD installed in the outlet pipe from CB 1A.
- The total post-development site flow (from Area A-4) will be approximately 4.3 L/s during the 5-year design event and 4.4 L/s during the 100-year event, both less than the allowable release rate of 4.5 L/s. Post-development flows are being reduced by 0.9 L/s (or 17%) during the 5-year event and by as much as 6.8 L/s (or 61%) during the 100-year design event, when compared to current conditions.
- Regular inspection and maintenance of the storm sewer system, including the ICD and roadway catchbasins is recommended to ensure that the storm drainage system is clean and operational.
- Erosion and sediment controls are to be provided both during construction and on a permanent basis.

It is recommended that the proposed site servicing and stormwater management design for both the **Camp Mart** development and **Private Access Road** be approved for implementation.

NOVATECH

Prepared by:

Reviewed by:

Stephen Matthews, B.A. (Env.)
Senior Design Technologist

François Thauvette, P. Eng.
Senior Project Manager
Land Development & Public-Sector Engineering

APPENDIX A

Correspondence

File Number: PC2017-0203

August 11, 2017

20 Frank Nighbor Place Pre-Consultation Meeting Minutes

Date: Wednesday August 2, 2017, 2:30pm to 4:00pm

Location: Room 3107E City Hall

Attendance:

Stream Shen (Planner, City of Ottawa)
Tim Newton on behalf of Mark Fraser (Project Manager, City of Ottawa)
Rosanna Baggs (Transportation Project Manager, City of Ottawa)
Riley Carter (Transportation Project Manager, City of Ottawa)
Seana Turkington (Planning Student, City of Ottawa)
Greg Winters (Project Manager, Novatech)
Jennifer Luong (Transportation Engineer, Novatech)
John Riddell (Novatech)
Robert Matthews (Architect, N45 Architect)
Cal Kirkpatrick (Owner, Colonnade BridgePort)
Sunny Bains (Purchaser, Camp Mart)
Jim Rose (Purchaser, Camp Mart)

Overview from Applicant:

1. The applicant is looking to subdivide 20 Frank Nighbor into 4 parcels through a part lot control application.
2. A private street will be developed for access to the 2 westerly parcels. There will be a joint-use and maintenance and easement agreements between the 4 proposed parcels for the private street.
3. Camp Mart is looking to purchase the 2 future parcels to the east and Colonnade is to retain the 2 future parcels to the west.
4. Camp Mart is looking to develop a RV dealership on the easterly parcel fronting Highway 417 and proposes an automobile storage yard on the other parcel to the south.
5. Camp Mart sales travel trailers not motor homes. If a client needs a truck as well, Camp Mart also sells them as combo purchase.
6. A future hotel may be located on the parcel proposed for automobile storage yard.
7. It is the opinion of the applicant that the tri-party OMB decision governing roadway modification and cost sharing no longer applies.

8. Servicing will be located under the proposed private road. No high level concerns.

9. There may be cut and fill arrangement to be made between the 4 future parcels which will required conservation authority approval.

Comments from City Staff:

Planning

10. The project will be subject to a Site Plan Control application, manager approval, with public consultation. Application form, timeline and fee can be found here: http://ottawa.ca/en/city-hall/planning-and-development/how-develop-property/development-application-review-process-2-1#site-plan-control

11. A lifting of holding by-law application is also required, information can be found here: http://ottawa.ca/en/city-hall/planning-and-development/how-develop-property/development-application-review-process-2-1#lifting-holding-law

12. When preparing plans and studies, please review and conform to the basic plans and studies requirements outlined here: http://ottawa.ca/en/city-hall/planning-and-development/how-develop-property/development-application-review-process-2-3

13. The proposed RV dealership is a permitted use under the zoning by-law. However, note that the sales of supply and servicing of vehicle must be clearly accessory and smaller in scale to the principle use of RV sales. The two should not function as a stand-alone entity as they are currently either not permitted (servicing) or not permitted adjacent to Highway 417 (supply retail store). Both need to meet the definition below.

    *Accessory means aiding or contributing in a secondary way to a principal use to carry out its function, and having regard to this definition: an **accessory use** is a land **use** that is **accessory** to a **principal use**.*

14. Storage yard for vehicles is currently not permitted under the zoning. A major zoning by-law amendment would be required to add it as a permitted use. Provision from exception 1414 also requires that all storage must be concealed or enclosed. Further rationale is needed on the appropriateness of the amendment.

15. Further information on Zoning By-law Amendment can be found here: http://ottawa.ca/en/city-hall/planning-and-development/how-develop-property/development-application-review-process-2-1#zoning-law-amendment

16. The part-lot control application to subdivide the land requires the four parcels to be considered one-lot for zoning purpose. Please provide rationale as part of the submission package on how the four parcels will meet zoning by-law section 93. If it does not meet the definition, the new extension and cul-de-sac will need to be developed to city standard and conveyed to the city as a public street in order to meet the frontage requirement under zoning by-law section 59.

17. Further information for Lifting of Part-lot control application can be found here: http://ottawa.ca/en/city-hall/planning-and-development/how-develop-property/development-application-review-process-2-1#lifting-part-lot-control
18. Hotel is a permitted use, but will be subject to a new pre-consultation and set of required list of plans and studies to assess the impact and to address planning, engineering and transportation concerns if the applicant wishes to develop it in the future.
19. The property is located along the scenic route entrance to Ottawa, please ensure that the proposal has a high level of urban design and landscaping along Highway 417.
20. Please increase the amount of landscaping within the site. Please break up the parking area into smaller groupings using landscaped islands.
21. Please create a direct pedestrian connection from the entrance to the front door of the building.
22. Please illustrate how loading will be accommodated within the site and to the building.
23. Please identify and provide a description of all easements on-site at the time of submission.
24. A building, land use and sign permit from MTO will be required.
25. The application will be subject to MOECC approval post site plan approval.
26. As you are aware a contribution to the Carp River Restoration Project (CRRP) is required based on the subject lands abutting and benefitting from the CRRP. Please contact Debbie Belfie, Project Manager for KWOG to confirm the amount of this contribution. The City will be collecting said payment as a condition of site plan approval.
27. Staff reserve the right to further comments at the time of submission. As the pre-consultation meeting is high level and not all detailed plans were available.
28. Please consult with Ward Councillor once the design is finalized.
29. The pre-consultation meeting comments and list of required plans and studies is valid for one year and will lapse on August 2, 2018.

Transportation

1. Please provide a transportation impact study for the area up to and including the Palladium and Silver Seven intersection.

Engineering

1. Given that the private street is aligning with the sewer easement, how will access be maintained to the 2 back parcels if repair is required? Consider increasing the right-of-way width.

Environmental

30. An Environmental Impact Statement is required. The EIS should refer to the findings of the Kanata West Owners Group's EIS which was completed by Kilgour (2014). It should also investigate potential habitat for other threatened and endangered species on the remainder of the property. The EIS should also address the watercourse setback policies (OP Section 4.7.3) because this stretch of Carp River has been identified as having unstable slopes and floodplain. The EIS should also refer to the findings and recommendations of the Carp River Watershed Subwatershed Study (2004).

31. Further details on the EIS requirements can be found in OP Section 4.7.8 and the EIS Guidelines:http://documents.ottawa.ca/sites/documents.ottawa.ca/files/documents/eis_guidelines2015_en.pdf

32. Please also contact the Ministry of Natural Resource and Forestry to determine any obligations under the Endangered Species Act and to identify which species to include in the study.

33. Please also contact the local Conservation Authority to determine if any permits or approvals are required under their regulations.

Please contact me at stream.shen@ottawa.ca or at 613-580-2424 ext. 24488 if you have any questions.

Sincerely,

Stream Shen MCIP RPP
Planner II
Development Review - West

APPLICANT'S STUDY AND PLAN IDENTIFICATION LIST

Legend: **S** indicates that the study or plan is required with application submission.
A indicates that the study or plan may be required to satisfy a condition of approval/draft approval.

For information and guidance on preparing required studies and plans refer to:

http://ottawa.ca/en/development-application-review-process-0/guide-preparing-studies-and-plans

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

S/A	Number of copies	PLANNING / DESIGN / SURVEY		S/A	Number of copies
	50	17.Draft Plan of Subdivision	18.Plan Showing Layout of Parking Garage		2
	30	19.Draft Plan of Condominium	20.Planning Rationale	S	3
S	15	21.Site Plan	22.Minimum Distance Separation (MDS)		3
	20	23.Concept Plan Showing Proposed Land Uses and Landscaping	24.Agrology and Soil Capability Study		5
	3	25.Concept Plan Showing Ultimate Use of Land	26.Cultural Heritage Impact Statement		3
S	15	27.Landscape Plan	28.Archaeological Resource Assessment Requirements: **S** (site plan) **A** (subdivision, condo)	S	3
S	2	29.Survey Plan	30.Shadow Analysis		3
S	3	31.Architectural Building Elevation Drawings (dimensioned)	32.Design Brief (includes the Design Review Panel Submission Requirements)		Available online
	6	33.Wind Analysis			

S/A	Number of copies	ENVIRONMENTAL		S/A	Number of copies
S	3	34.Phase 1 Environmental Site Assessment	35.Impact Assessment of Adjacent Waste Disposal/Former Landfill Site		6
A	3	36.Phase 2 Environmental Site Assessment (depends on the outcome of Phase 1)	37.Assessment of Landform Features		7
	4	38.Record of Site Condition	39.Mineral Resource Impact Assessment		4
	10	40.Tree Conservation Report	41.Environmental Impact Statement / Impact Assessment of Endangered Species	S	3
	4	42.Mine Hazard Study / Abandoned Pit or Quarry Study	43.Integrated Environmental Review (Draft, as part of Planning Rationale)		3

S/A	Number of copies	ADDITIONAL REQUIREMENTS		S/A	Number of copies
		44.	45.		

Meeting Date: 2017-Aug-02

Application Type: *Site Plan Control*

File Lead (Assigned Planner): Stream Shen

Infrastructure Approvals Project Manager: Mark Fraser

Site Address (Municipal Address): 20 Frank Nighbor

*Preliminary Assessment: 1☒ 2☐ 3☐ 4☐ 5☐

*One (1) indicates that considerable major revisions are required before a planning application is submitted, while five (5) suggests that proposal appears to meet the City's key land use policies and guidelines. **This assessment is purely advisory and does not consider technical aspects of the proposal or in any way guarantee application approval.**

It is important to note that the need for additional studies and plans may result during application review. If following the submission of your application, it is determined that material that is not identified in this checklist is required to achieve complete application status, in accordance with the Planning Act and Official Plan requirements, the Planning, Infrastructure and Economic Development Department *will notify you of outstanding material required within the required 30 day period. Mandatory pre-application consultation will not shorten the City's standard processing timelines, or guarantee that an application will be approved. It is intended to help educate and inform the applicant about submission requirements as well as municipal processes, policies, and key issues in advance of submitting a formal*

Francois Thauvette

From: Niall Oddie <NOddie@mvc.on.ca>
Sent: Wednesday, January 31, 2018 1:26 PM
To: Francois Thauvette
Cc: Nader Nakhaei
Subject: RE: MCV Pre-Consultation - Trailer Sales Site (20 Frank Nighbor Place)

Hi Francois,

Yes, the stormwater quality target for the Carp River is 'Normal' level of protection.

Regards

Niall Oddie MCIP, RPP | Environmental Planner | Mississippi Valley Conservation Authority
10970 Highway 7, Carleton Place, Ontario K7C 3P1
www.mvc.on.ca |t. 613 253 0006 ext. 229| f. 613 253 0122 | noddie@mvc.on.ca

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From: Francois Thauvette [mailto:f.thauvette@novatech-eng.com]
Sent: Wednesday, January 31, 2018 10:16 AM
To: Niall Oddie <NOddie@mvc.on.ca>
Subject: MCV Pre-Consultation - Trailer Sales Site (20 Frank Nighbor Place)

Hi Niall,

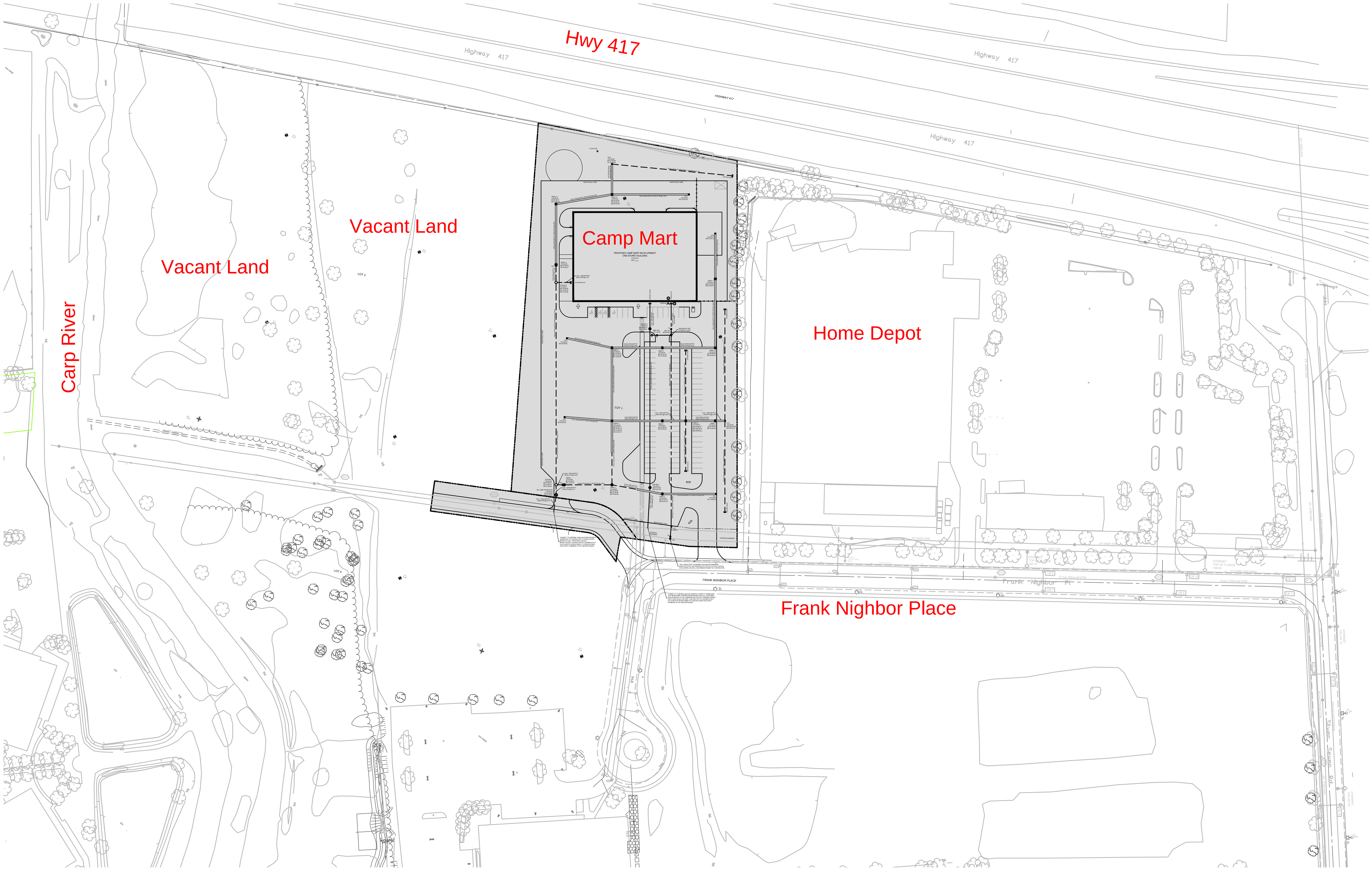
As discussed, we are working on the SWM design for a proposed Camp Mart (trailer sales) site at 20 Frank Nighbor Place in the City of Ottawa. The site is located immediately south of Hwy 417, between the Home Depot and the Carp River. Attached is a preliminary sketch of the site and overall area.

Please confirm if the stormwater quality target for the Carp River is a 'Normal' Level of Protection (i.e. 70% TSS removal). We need this information to size the proposed water quality treatment unit and to finalize our design.

We would also like to use this as a record of our pre-consultation with the MVC. Please let us know if you require anything else from us at this time.

Regards,

François Thauvette, P. Eng., Senior Project Manager | Land Development & Public Sector Engineering
NOVATECH Engineers, Planners & Landscape Architects



Hwy 417
Vacant Land
Vacant Land
Camp Mart
Carp River
Home Depot
Frank Nighbor Place

Francois Thauvette

From: Francois Thauvette
Sent: Wednesday, January 31, 2018 2:50 PM
To: 'Fraser, Mark'
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request & MOECC Pre-Consultation

Hi Mark,

We agree with the e-mail below and will complete the MOECC 'Pre-Submission Consultation Request Form' and submit it to the e-mail address specified below.

Regards,

François Thauvette, P. Eng., Senior Project Manager | Land Development & Public Sector Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 219 | Cell: 613.276.0310 | Fax: 613.254.5867

From: Fraser, Mark [mailto:Mark.Fraser@ottawa.ca]
Sent: Wednesday, January 31, 2018 1:17 PM
To: Francois Thauvette <f.thauvette@novatech-eng.com>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request & MOECC Pre-Consultation

Hi Francois,

Please accept this email as confirmation that the City is in agreement with the below opinion that this project will be subject to an Environmental Compliance Approval (ECA) for Sewage Works under Section 53 of the Ontario Water Resources Act as the approval exemptions set out under Ontario Regulation 525/98: *Approval Exemptions* are not satisfied.

O. Reg. 525/98: Approval Exemptions under the OWRA
3. *Subsections 53 (1) and (3) of the Act do not apply to the use, operation, establishment, alteration, extension or replacement of or a change in a storm water management facility that,*
(a) is designed to service one lot or parcel of land;
(b) discharges into a storm sewer that is not a combined sewer;
(c) does not service industrial land or a structure located on industrial land; and
(d) is not located on industrial land.

"**Industrial Land**" *means land used for the production, processing, repair, maintenance or storage of goods or materials, or the processing, storage, transfer or disposal of waste, but does not include land used primarily for the purpose of buying or selling,*
(a) goods or materials other than fuel, or
(b) services other than vehicle repair services;

The City is in agreement that the type of application required is a **Direct Submission for Industrial Sewage Works** and not Transfer of Review under Additional Works eligible as the works receive drainage from "*Industrial Land"*, where industrial land is defined by *Ontario Regulation 525/98*, and the works are private.

Please confirm you are in agreement with the above. Once concurrence has been provided you can proceed with the required pre-submission consultation with the local Ministry District Office in order to obtain clearance to proceed with the project under Direct Submission. Please note to request a pre-submission consultation with the Ministry the *Pre-Submission Consultation Request Form* is required to be completed and sent to the email MOECCOttawaSewage@ontario.ca.

Please note that the NEW Environmental Compliance Approval Application Form is required to be completed:
http://www.forms.ssb.gov.on.ca/mbs/ssb/forms/ssbforms.nsf/FormDetail?OpenForm&ACT=RDR&TAB=PROFILE&SRCH=&ENV=WWE&TIT=environmental+compliance+approval&NO=012-8551E

If you have any questions or require any clarification please let me know.

Regards,

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

From: Francois Thauvette [mailto:f.thauvette@novatech-eng.com]
Sent: January 31, 2018 11:47 AM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Cc: Newton, Tim <Tim.Newton@ottawa.ca>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request & MOECC Pre-Consultation

Hi Mark,

I am following up to see if the Camp Mart water demands have been sent off to the City's Water Division? We require the watermain boundary conditions as soon as possible to complete our design, which includes a hydraulic network analysis (required as part of the SPA submission).

We are also in the process of completing the new MOECC 'Pre-Submission Consultation Request Form' for the proposed Camp Mart development and it is our understanding that the City must confirm the applicable ECA process. Given the nature of the proposed commercial/light industrial development (i.e. trailer sales and service site), we believe the site will require an ECA (Direct submission). Please review and confirm if the City agrees with this assessment.

Regards,

François Thauvette, P. Eng., Senior Project Manager | Land Development & Public Sector Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 219 | Cell: 613.276.0310 | Fax: 613.254.5867

From: Francois Thauvette
Sent: Tuesday, January 30, 2018 8:34 AM
To: 'Fraser, Mark' <Mark.Fraser@ottawa.ca>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request

Hi Mark,

APPENDIX B

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).

- [x] 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.
- [x] Reference to geotechnical studies and recommendations concerning servicing.
- [x] 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
- [x] Availability of public infrastructure to service proposed development
- [x] Identification of system constraints
- [x] Identify boundary conditions
- [x] Confirmation of adequate domestic supply and pressure
- [x] 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.
- [x] 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
- [x] 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).
- N/A [ ] Confirm consistency with Master Servicing Study and/or justifications for deviations.
- [x] 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)
- N/A [ ] Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix 'C') format.
- N/A [ ] Description of proposed sewer network including sewers, pumping stations, and forcemains.

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)

☑ 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.

N/A ☐ Watercourse and hazard lands setbacks.

☑ 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).
- N/A [ ] 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.
- N/A [ ] 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:

NOTED ☐ 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

TBD ☐ 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

APPENDIX C

Water Demands, Boundary Conditions, Schematic of the Hydraulic Model, Hydraulic Modeling Results and FUS Calculations

Francois Thauvette

From:	Fraser, Mark <Mark.Fraser@ottawa.ca>
Sent:	Friday, February 2, 2018 4:06 PM
To:	Francois Thauvette
Subject:	RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request & MOECC Pre-Consultation
Attachments:	20 Frank Nighbor Place.docx; 20FrankNighbor-Lot1-WaterConnection.pdf; FUSv1-4.pdf; DSS&SWM_Excerpt-WaterDemandCalcs.pdf

Hi Francois,

Please find below boundary conditions for hydraulic analysis as requested based on the provided anticipated water demands:

Proposed Water Demands and Fire Flow Requirement:

Proposed Development Location: **20 Frank Nighbor**
Average Daily Demand = 0.27 L/s
Max Daily Demand = 2.46 L/s
Peak Hour Demand = 3.71 L/s
Fire Flow = 117 L/s

City of Ottawa Boundary Conditions:

The following are boundary conditions for hydraulic analysis (Pressure Zone 3W) at the specified connection point:

Specified Connection Point: Frank Nighbor (300mm dia.) [Connection 1]
Max HGL = 162.3m (95.9 psi)
PKHR = 157.6m (89.2 psi)
MXDY+FireFlow (7000 L/min.) = 158.6m (90.7 psi)

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

Please refer to City of Ottawa, *Ottawa Design Guidelines – Water Distribution*, First Edition, July 2010, WDG001 Clause 4.2.2 for watermain pressure and demand objectives.

Please include an electronic version of the modeling file.

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

Please note that the proposed water demands and identified connection point have not been reviewed and are subject to comment and revision upon submission and review of a development application.

If you have any questions or require any clarification please let me know.

Regards,

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

From: Fraser, Mark
Sent: January 31, 2018 11:56 AM
To: 'Francois Thauvette' <f.thauvette@novatech-eng.com>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request & MOECC Pre-Consultation

Hi Francois,

Please accept this email as confirmation that boundary conditions for hydraulic analysis have been requested from Infrastructure Planning based on the water demands provided for the subject development. Please note that it takes approximately 5-10 business days to receive and provide you with boundary conditions.

I will review and issue an email regarding this development being considered for an approval by the MOECC.

Regards,

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

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From: Francois Thauvette [mailto:f.thauvette@novatech-eng.com]
Sent: January 31, 2018 11:47 AM
To: Fraser, Mark <Mark.Fraser@ottawa.ca>
Cc: Newton, Tim <Tim.Newton@ottawa.ca>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request & MOECC Pre-Consultation

Hi Mark,

I am following up to see if the Camp Mart water demands have been sent off to the City's Water Division? We require the watermain boundary conditions as soon as possible to complete our design, which includes a hydraulic network analysis (required as part of the SPA submission).

We are also in the process of completing the new MOECC 'Pre-Submission Consultation Request Form' for the proposed Camp Mart development and it is our understanding that the City must confirm the applicable ECA process. Given the nature of the proposed commercial/light industrial development (i.e. trailer sales and service site), we believe the site will require an ECA (Direct submission). Please review and confirm if the City agrees with this assessment.

Regards,

François Thauvette, P. Eng., Senior Project Manager | Land Development & Public Sector Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 219 | Cell: 613.276.0310 | Fax: 613.254.5867

From: Francois Thauvette
Sent: Tuesday, January 30, 2018 8:34 AM
To: 'Fraser, Mark' <Mark.Fraser@ottawa.ca>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request

Hi Mark,

As requested, please find attached a sketch showing the proposed Camp Mart water service (highlighted in 'blue') and the connection point to the existing municipal watermain (shown within the 'red' revision cloud).

Regards,

François Thauvette, P. Eng., Senior Project Manager | Land Development & Public Sector Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 219 | Cell: 613.276.0310 | Fax: 613.254.5867

From: Fraser, Mark [mailto:Mark.Fraser@ottawa.ca]
Sent: Monday, January 29, 2018 3:28 PM
To: Francois Thauvette <f.thauvette@novatech-eng.com>
Subject: RE: 20 Frank Nighbor Place - Watermain Boundary Conditions Request

Hi Francois,

Please provide a drawing/sketch identifying the proposed connection point location.

Regards,

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

From: Francois Thauvette [mailto:f.thauvette@novatech-eng.com]
Sent: January 29, 2018 2:55 PM
To: Newton, Tim <Tim.Newton@ottawa.ca>
Cc: Fraser, Mark <Mark.Fraser@ottawa.ca>
Subject: 20 Frank Nighbor Place - Watermain Boundary Conditions Request

Hi Tim,

I am sending this e-mail to request the municipal WM boundary conditions for the existing 300mm dia. watermain in the easement (running along Frank Nighbor Place, south of the subject site). Based on preliminary calculations, using the City of Ottawa and MOE design guidelines for drinking water systems, the water demands for the proposed trailer sales site are as follows:

· Average Day Demand = 0.27 L/s (see attached excerpt from the DSS&SWM report)
· Max Day Demand = 2.46 L/s (Avg. Demand x 9.1, per MOE Table 3.3)
· Peak Hour Demand = 3.71 L/s (Avg. Demand x 13.7, per MOE Table 3.3)
· Fire Flow = 117 L/s (based on FUS calculations for a sprinklered building with non-combustible construction). Refer to the attached FUS calculations sheet.

Please review and provide municipal watermain boundary conditions.

Regards,

François Thauvette, P. Eng., Senior Project Manager | Land Development & Public Sector Engineering
NOVATECH Engineers, Planners & Landscape Architects
240 Michael Cowpland Drive, Suite 200, Ottawa, ON, K2M 1P6 | Tel: 613.254.9643 Ext: 219 | Cell: 613.276.0310 | Fax: 613.254.5867

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FUS - Fire Flow Calculations

As per 1999 Fire Underwriter's Survey Guidelines

NOVATECH
Engineers, Planners & Landscape Architects

Novatech Project #: 117193
Project Name: Camp Mart
Date: 24/01/2018
Input By: S. Matthews
Reviewed By: F. Thauvette

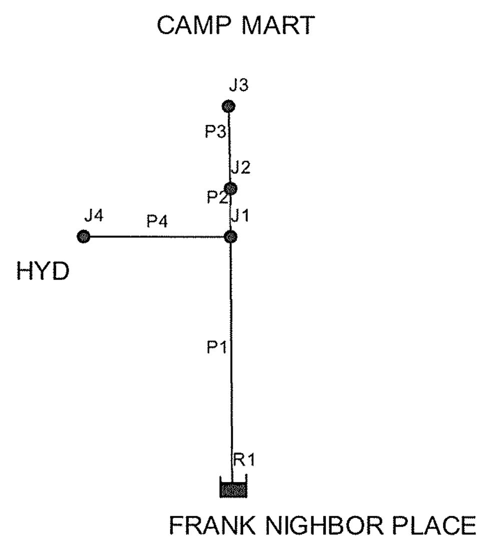
Legend: Input by User; No Information or Input Required

Building Description: RV Sales and Servicing, 1 Storey Building
Non-combustible construction

Step			Input	Multiplier Options	Value Used	Total Fire Flow (L/min)
Base Fire Flow						
1	**Construction Material**					
	Coefficient related to type of construction C	Wood frame		1.5	0.8	
		Ordinary construction		1		
		Non-combustible construction	Yes	0.8		
		Fire resistive construction (< 3 hrs)		0.7		
		Fire resistive construction (> 3 hrs)		0.6		
2	**Floor Area**					
	A	Building Footprint (m^2)	2685			
		Number of Floors/Storeys	1			
		Area of structure considered (m^2)			**2,685**	
	F	**Base fire flow without reductions**				**9,000**
		$F = 220\ C\ (A)^{0.5}$				
Reductions or Surcharges						
3	**Occupancy hazard reduction or surcharge**					
	(1)	Non-combustible		-25%	0%	**9,000**
		Limited combustible		-15%		
		Combustible	Yes	0%		
		Free burning		15%		
		Rapid burning		25%		
4	**Sprinkler Reduction**					
	(2)	Adequately Designed System (NFPA 13)	Yes	-30%	-30%	**-3,600**
		Standard Water Supply	Yes	-10%	-10%	
		Fully Supervised System	No	-10%		
				Cumulative Total	**-40%**	
5	**Exposure Surcharge (cumulative %)**					
	(3)	North Side	> 45.1m		0%	**1,350**
		East Side	30.1- 45 m		5%	
		South Side	> 45.1m		0%	
		West Side	20.1 - 30 m		10%	
				Cumulative Total	**15%**	
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

Camp Mart - 20 Frank Nighbor

Day 1, 12:00 AM



Camp Mart - 20 Frank Nighbor Place

Max Day + Fire Flow Demand
Network Table - Nodes

Node ID	Elevation m	Demand L/s	Head m	Pressure m	Pressure kPa	Pressure psi
Junc J1	92.5	0	150.11	57.61	565.15	81.97
Junc J2	92.5	0	150.11	57.61	565.15	81.97
Junc J3	95.5	0.39	150.11	54.61	535.72	77.70
Junc J4	96	117	146.22	50.22	492.66	71.45
Resvr R1	158.6	-117.39	158.6	0	0.00	0.00

Max Day + Fire Flow Demand
Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow L/s	Velocity m/s	Unit Headloss m/km
Pipe P1	100	200	110	117.39	3.74	84.92
Pipe P2	2	200	110	0.39	0.01	0
Pipe P3	14.7	150	100	0.39	0.02	0.01
Pipe P4	9.5	150	100	117	6.62	408.86

Camp Mart - 20 Frank Nighbor Place

Peak Hour Demand
Network Table - Nodes

Node ID	Elevation m	Demand L/s	Head m	Pressure m	Pressure kPa	Pressure psi
Junc J1	92.5	0	157.6	65.1	638.63	92.63
Junc J2	92.5	0	157.6	65.1	638.63	92.63
Junc J3	95.5	0.72	157.6	62.1	609.20	88.36
Junc J4	96	0	157.6	61.6	604.30	87.65
Resvr R1	157.6	-0.72	157.6	0	0.00	0.00

Peak Hour Demand
Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow L/s	Velocity m/s	Unit Headloss m/km
Pipe P1	100	200	110	0.72	0.02	0.01
Pipe P2	2	200	110	0.72	0.02	0.01
Pipe P3	14.7	150	100	0.72	0.04	0.03
Pipe P4	9.5	150	100	0	0	0

Camp Mart - 20 Frank Nighbor Place

Max HGL check
Network Table - Nodes

Node ID	Elevation m	Demand L/s	Head m	Pressure m	Pressure kPa	Pressure psi
Junc J1	92.5	0	162.3	69.8	684.74	99.31
Junc J2	92.5	0	162.3	69.8	684.74	99.31
Junc J3	95.5	0.72	162.3	66.8	655.31	95.04
Junc J4	96	0	162.3	66.3	650.40	94.33
Resvr R1	162.3	-0.72	162.3	0	0.00	0.00

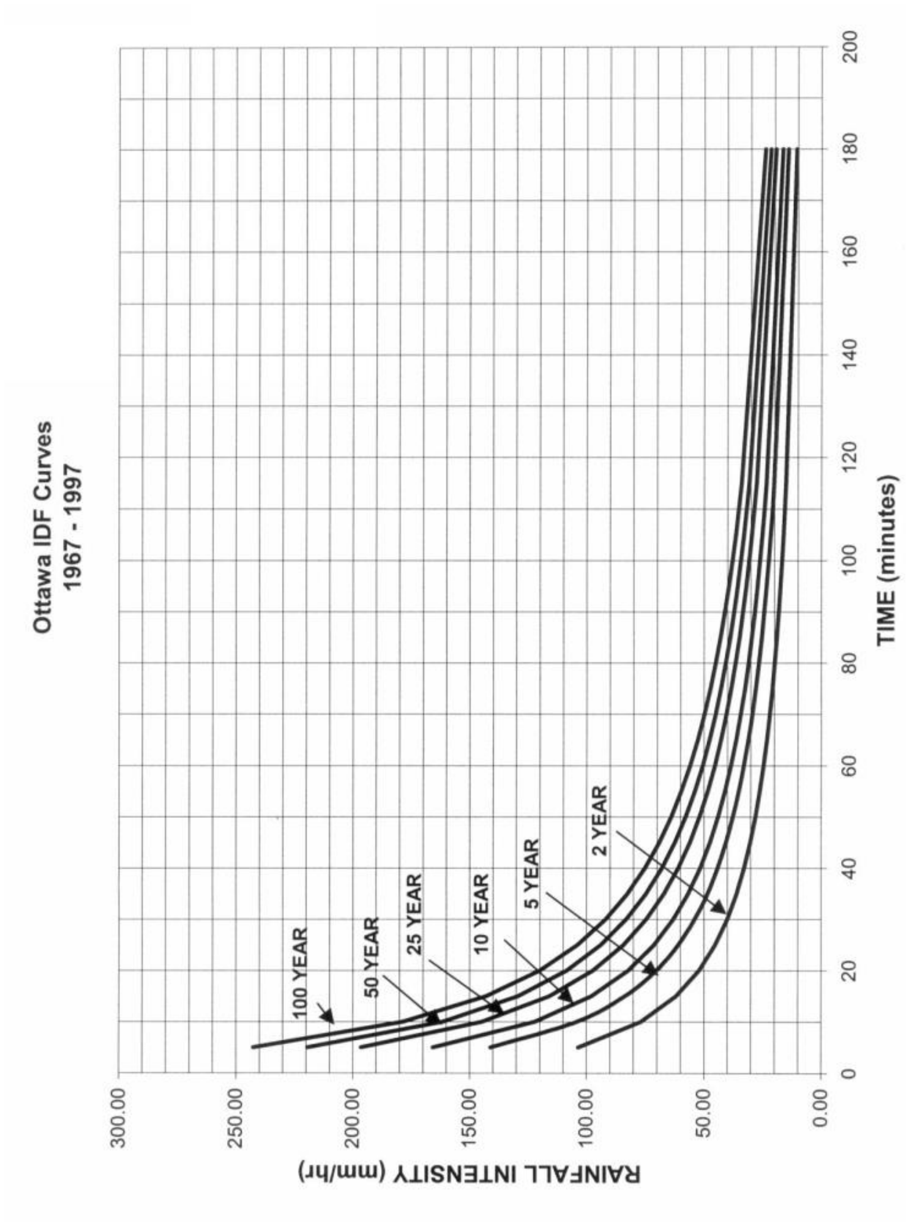
Max HGL check
Network Table - Links

Link ID	Length m	Diameter mm	Roughness	Flow L/s	Velocity m/s	Unit Headloss m/km
Pipe P1	100	200	110	0.72	0.02	0.01
Pipe P2	2	200	110	0.72	0.02	0.01
Pipe P3	14.7	150	100	0.72	0.04	0.03
Pipe P4	9.5	150	100	0	0	0

APPENDIX D

IDF Curves and SWM Calculations,
Storm Sewer Design Sheet,
Excerpts from the previous SWM Report

APPENDIX 5-A OTTAWA INTENSITY DURATION FREQUENCY (IDF) CURVE



RATIONAL METHOD

The Rational Method was used to determine the pre-development and post-development runoff for the site. The equation is as follows:

Q=2.78 CIA
Where:
Q is the runoff in L/s
C is the weighted runoff coefficient*
I is the rainfall intensity in mm/hr**
A is the area in hectares

*The weighted runoff coefficient is determined for each of the catchment areas as follows:

$$C = \frac{(A_{perv} \times C_{perv}) + (A_{imp} \times C_{imp})}{A_{tot}}$$

Where:
A_{perv} is the pervious area in hectares
C_{perv} is the pervious area runoff coefficient (C_{perv}=0.20)
A_{imp} is the impervious area in hectares
C_{imp} is the impervious area runoff coefficient (C_{imp}=0.90)
A_{tot} is the catchment area (A_{perv} + A_{imp}) in hectares

Note: Increase the C values above by 25% for the 1:100 year event (max. C_{imp}=1.0).

** The 1:5 year rainfall intensity for runoff being directed to the municipal sewer was determined to be 104.2 mm/hr based on a time of concentration of 10 minutes as specified by the City of Ottawa. The 1:100 year rainfall intensity used in the calculations below is 178.6 mm/hr.

PRE-DEVELOPMENT SAMPLE CALCULATIONS:

Drainage Area = 1.99 ha
Impervious Area = N/A
Pervious Area = 1.99 ha
Runoff Coefficient (C_{5yr}) = 0.20
Runoff Coefficient (C_{100yr}) = 0.25
Intensity (I_5) = 104.2 mm/hr
Intensity (I_{100}) = 178.6 mm/h

$$C\ 5yr = \frac{(0.0*0.90)+(1.99*0.20)}{1.99} = 0.20$$

$$C\ 100yr = \frac{(0.0*1.0)+(1.99*0.25)}{1.99} = 0.25$$

Q_5= 2.78 CIA
Q_5= 2.78 x 0.20 x 104.2 x 1.99
Q_5= 115.3 L/s

Q_{100}= 2.78 CIA
Q_{100}= 2.78 x 0.25 x 178.6 x 1.99
Q_{100}= 247.0 L/s

UNCONTROLLED POST-DEVELOPMENT SAMPLE CALCULATIONS (A-1):

Drainage Area (A-1) = 1.13 ha
Impervious Area = 0.84 ha
Pervious Area = 0.29 ha
Runoff Coefficient (C_{5yr}) = 0.72
Runoff Coefficient (C_{100yr}) = 0.81
Intensity (I_5) = 104.2 mm/hr
Intensity (I_{100}) = 178.6 mm/h

$$C\ 5yr = \frac{(0.84*0.90)+(0.29*0.20)}{1.13} = 0.72$$

$$C\ 100yr = \frac{(0.84*1.0)+(0.29*0.25)}{1.13} = 0.81$$

Q_5= 2.78 CIA
Q_5= 2.78 x 0.72 x 104.2 x 1.13
Q_5= 235.7 L/s

Q_{100}= 2.78 CIA
Q_{100}= 2.78 x 0.81 x 178.6 x 1.13
Q_{100}= 454.5 L/s

UNCONTROLLED POST-DEVELOPMENT SAMPLE CALCULATIONS (A-2):

Drainage Area (A-2) = 0.79 ha
Impervious Area = 0.49 ha
Pervious Area = 0.30 ha
Runoff Coefficient (C_{5yr}) = 0.63
Runoff Coefficient (C_{100yr}) = 0.72
Intensity (I_5) = 104.2 mm/hr
Intensity (I_{100}) = 178.6 mm/h

$$C\ 5yr = \frac{(0.49*0.90)+(0.30*0.20)}{0.79} = 0.63$$

$$C\ 100yr = \frac{(0.49*1.0)+(0.30*0.25)}{0.79} = 0.72$$

Q_5= 2.78 CIA
Q_5= 2.78 x 0.63 x 104.2 x 0.79
Q_5= 144.2 L/s

Q_{100}= 2.78 CIA
Q_{100}= 2.78 x 0.72 x 178.6 x 0.79
Q_{100}= 282.4 L/s

Proposed Camp Mart Development
20 Frank Nighbor Place

Pre - Development Site Flows									
Description	*A (ha)*	*A imp (ha) C=0.9*	*A grav (ha) C=0.6*	*A perv (ha) C=0.2*	C_5	C_{100}	Pre-Development Flows		Allowable
							5 year (L/s)	100 year (L/s)	50 L/s/ha
Site Area	1.99	0.00	0.00	1.99	0.20	0.25	115.3	247.0	99.5
							t_c=10mins	t_c=10mins	

Post - Development : Total Uncontrolled Site Flows									
Area	Description	*A (ha)*	*A imp (ha) C=0.9*	*A pavers (ha) C=0.7*	*A perv (ha) C=0.2*	C_5	C_{100}	Uncontrolled Flow (L/s)	
								5 year	100 year
A-0	Un-Controlled Direct Runoff	0.07	0.01	0.00	0.06	0.30	0.36	6.1	12.4
A-1	Controlled Parking Lot Area (CBMH 1)	1.13	0.84	0.00	0.29	0.72	0.81	235.8	453.1
A-2	Controlled Parking Lot Area (CBMH 12)	0.79	0.49	0.00	0.30	0.63	0.72	145.1	280.5
	Summed Area Check:	1.99						t_c=10mins	t_c=10mins

Post - Development : Total Flows for Controlled Site						
Area	Description	Flow (L/s)		Storage Required (m^3)		Provided (m^3)
		5 year	100 year	5 year	100 year	
A-0	Un-Controlled Direct Runoff	6.1	12.4	- - -	- - -	- - -
A-1	Controlled Parking Lot Area (CBMH 1)	30.3	31.1	167.2	399.9	631.9
A-2	Controlled Parking Lot Area (CBMH 12)	50.6	52.9	59.2	165.3	204.8
	Totals =	**87.0**	**96.4**	**226.4**	**565.2**	**836.7**
	Over-Controlled by:	12.5	3.1			

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A-0 Un-Controlled Direct Runoff

OTTAWA IDF CURVE

Area = 0.07 ha Qallow = 6.1 L/s
C = 0.30 Vol(max) = 0.0 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	8.24	2.16	0.65
10	104.19	6.08	0.00	0.00
15	83.56	4.88	-1.21	-1.08
20	70.25	4.10	-1.98	-2.38
25	60.90	3.56	-2.53	-3.79
30	53.93	3.15	-2.93	-5.28
35	48.52	2.83	-3.25	-6.83
40	44.18	2.58	-3.50	-8.41
45	40.63	2.37	-3.71	-10.02
50	37.65	2.20	-3.89	-11.66
55	35.12	2.05	-4.03	-13.31
60	32.94	1.92	-4.16	-14.98
65	31.04	1.81	-4.27	-16.66
70	29.37	1.71	-4.37	-18.35
75	27.89	1.63	-4.46	-20.05
90	24.29	1.42	-4.67	-25.19
105	21.58	1.26	-4.82	-30.39
120	19.47	1.14	-4.95	-35.62
135	17.76	1.04	-5.05	-40.87
150	16.36	0.96	-5.13	-46.15

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A-0 Un-Controlled Direct Runoff

OTTAWA IDF CURVE

Area = 0.07 ha Qallow = 12.4 L/s
C = 0.36 Vol(max) = 0.0 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	16.87	4.46	1.34
10	178.56	12.41	0.00	0.00
15	142.89	9.93	-2.48	-2.23
20	119.95	8.34	-4.08	-4.89
25	103.85	7.22	-5.20	-7.79
30	91.87	6.38	-6.03	-10.85
35	82.58	5.74	-6.67	-14.01
40	75.15	5.22	-7.19	-17.26
45	69.05	4.80	-7.61	-20.56
50	63.95	4.44	-7.97	-23.90
55	59.62	4.14	-8.27	-27.29
60	55.89	3.88	-8.53	-30.70
65	52.65	3.66	-8.75	-34.14
70	49.79	3.46	-8.95	-37.60
75	47.26	3.28	-9.13	-41.08
90	41.11	2.86	-9.56	-51.60
105	36.50	2.54	-9.88	-62.22
120	32.89	2.29	-10.13	-72.91
135	30.00	2.08	-10.33	-83.66
150	27.61	1.92	-10.49	-94.44

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:2 YEAR EVENT
AREA A-1 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area = 1.13 ha Qallow = 29.7 L/s
C = 0.72 Vol(max) = 109.6 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	103.57	234.37	204.67	61.40
10	76.81	173.80	144.10	86.46
15	61.77	139.77	110.07	99.07
20	52.03	117.74	88.04	105.65
25	45.17	102.21	72.51	108.76
30	40.04	90.61	60.91	109.65
35	36.06	81.60	51.90	108.99
40	32.86	74.37	44.67	107.21
45	30.24	68.43	38.73	104.57
50	28.04	63.45	33.75	101.26
55	26.17	59.22	29.52	97.42
60	24.56	55.57	25.87	93.14
65	23.15	52.39	22.69	88.49
70	21.91	49.59	19.89	83.52
75	20.81	47.10	17.40	78.29
90	18.14	41.06	11.36	61.32
105	16.13	36.51	6.81	42.90
120	14.56	32.95	3.25	23.42
135	13.30	30.09	0.39	3.14
150	12.25	27.72	-1.98	-17.78

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A-1 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area = 1.13 ha Qallow = 30.3 L/s
C = 0.72 Vol(max) = 167.2 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	319.48	289.18	86.75
10	104.19	235.78	205.48	123.29
15	83.56	189.08	158.78	142.90
20	70.25	158.97	128.67	154.41
25	60.90	137.80	107.50	161.25
30	53.93	122.03	91.73	165.12
35	48.52	109.79	79.49	166.93
40	44.18	99.99	69.69	167.25
45	40.63	91.94	61.64	166.43
50	37.65	85.21	54.91	164.72
55	35.12	79.48	49.18	162.30
60	32.94	74.55	44.25	159.29
65	31.04	70.25	39.95	155.80
70	29.37	66.47	36.17	151.90
75	27.89	63.11	32.81	147.64
90	24.29	54.96	24.66	133.18
105	21.58	48.84	18.54	116.80
120	19.47	44.05	13.75	99.03
135	17.76	40.20	9.90	80.20
150	16.36	37.03	6.73	60.53

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A-1 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area = 1.13 ha Qallow = 31.1 L/s
C = 0.81 Vol(max) = 399.9 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	615.68	584.58	175.37
10	178.56	452.96	421.86	253.12
15	142.89	362.49	331.39	298.25
20	119.95	304.28	273.18	327.82
25	103.85	263.43	232.33	348.50
30	91.87	233.05	201.95	363.50
35	82.58	209.48	178.38	374.60
40	75.15	190.62	159.52	382.86
45	69.05	175.16	144.06	388.97
50	63.95	162.24	131.14	393.41
55	59.62	151.25	120.15	396.50
60	55.89	141.79	110.69	398.49
65	52.65	133.55	102.45	399.56
70	49.79	126.30	95.20	399.86
75	47.26	119.88	88.78	399.49
90	41.11	104.29	73.19	395.22
105	36.50	92.58	61.48	387.35
120	32.89	83.45	52.35	376.89
135	30.00	76.09	44.99	364.46
150	27.61	70.04	38.94	350.47

Area A-1 Storage	Surface CBMH 1		Surface CBMH 2		Surface CBMH 3		Surface CB 1		Surface CB 2		Surface CBMH 4		Surface CBMH 5	
	Ponding		Ponding		Ponding		Ponding		Ponding		Ponding		Ponding	
Elevation (m)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)
94.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.65	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.70	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.75	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-
94.85	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
94.90	20.45	0.51	21.20	0.53	15.30	0.38	13.84	0.35	32.99	0.82	40.29	1.01	28.16	0.70
94.95	99.54	3.51	84.80	3.18	61.20	2.29	55.20	2.07	131.94	4.95	161.17	6.04	112.68	4.22
95.00	196.76	10.92	195.65	10.19	138.82	7.30	124.58	6.57	296.87	15.67	362.64	19.14	253.58	13.38
95.05	303.19	23.42	301.53	22.62	230.74	16.53	207.07	14.86	503.36	35.67	593.60	43.04	417.00	30.15

Area A-1 Storage	Surface CBMH 6		Surface CBMH 7		Surface CB 3		Surface CB 4		Surface CBMH 8		Surface CBMH 9		Surface CBMH 10		**Total Storage**
	Ponding		Ponding		Ponding		Ponding		Ponding		Ponding		Ponding		**Total**
Elevation (m)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	**Volume (m^3)**
94.50	0	0.00	-	-	0	0.00	-	-	-	-	-	-	-	-	**0**
94.55	43.32	1.08	-	-	87.69	2.19	-	-	-	-	-	-	-	-	**3.3**
94.60	73.84	4.01	-	-	183.86	8.98	-	-	-	-	-	-	-	-	**13.0**
94.65	99.71	8.35	-	-	248.47	19.79	-	-	-	-	-	-	-	-	**28.1**
94.70	125.49	13.98	-	-	312.70	33.82	-	-	-	-	-	-	-	-	**47.8**
94.75	151.46	20.90	-	-	377.24	51.07	-	-	-	-	-	-	-	-	**72.0**
94.80	177.62	29.13	-	-	442.84	71.57	-	-	-	-	-	-	-	-	**100.7**
94.85	203.97	38.67	0	0.00	508.73	95.36	0	0.00	0	0.00	0	0.00	0	0.00	**134.0**
94.90	230.50	49.53	19.14	0.48	575.05	122.45	32.95	0.82	31.33	0.78	28.21	0.71	19.16	0.48	**179.6**
94.95	257.23	61.73	74.70	2.82	641.90	152.88	131.79	4.94	127.27	4.75	100.03	3.91	73.87	2.80	**260.1**
95.00	284.15	75.26	166.62	8.86	708.98	186.65	296.54	15.65	265.34	14.56	206.86	11.58	146.27	8.31	**404.0**
95.05	311.26	90.15	272.18	19.83	763.08	223.45	507.31	35.75	445.70	32.34	364.62	25.87	252.03	18.27	**631.9**

101mm dia. Restrictor Pipe

1:100 Yr	
Flow (L/s) =	31.1
Head (m) =	2.07
Elevation (m) =	**95.00**
Outlet Pipe Dia.(mm) =	381
Volume (m3) =	399.9
1:5 Yr	
Flow (L/s) =	30.3
Head (m) =	1.96
Elevation (m) =	**94.89**
Outlet Pipe Dia.(mm) =	381
Volume (m3) =	167.2
1:2 Yr	
Flow (L/s) =	29.7
Head (m) =	1.88
Elevation (m) =	**94.81**
Outlet Pipe Dia.(mm) =	381
Volume (m3) =	109.6

Parking Lot Ponding Depth (cm)	
1:100 Yr	**15**
1:5 Yr	**4**

Restrictor Pipe - 1:100 yr Flow Check

Q=0.61xAx(2gh)^0.5

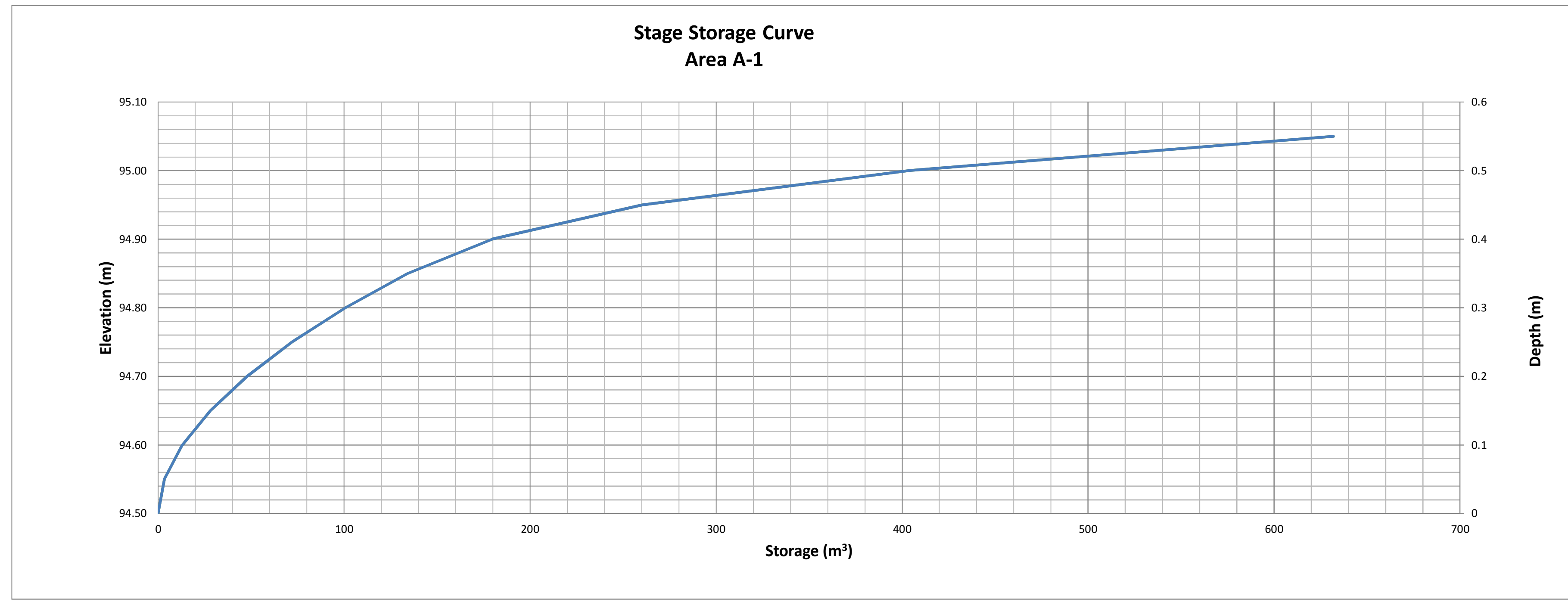
	1:100 yr	Flow Check
Q (m^3/s) =	0.0311	**0.0311**
g (m/s^2) =	9.81	9.81
h (m) =	**2.07**	2.07
A (m^2) =	**0.008001075**	**0.00801**
D (m) =	**0.100932081**	**0.10100**
D (mm) =	**101**	101.0

1:5 yr Flow Check

	1:5 yr
Q (m^3/s) =	0.0303
g (m/s^2) =	9.81
h (m) =	**1.96**
A (m^2) =	**0.00801**
D (m) =	**0.101**
D (mm) =	**101**

1:2 yr Flow Check

	1:5 yr
Q (m^3/s) =	0.0297
g (m/s^2) =	9.81
h (m) =	**1.88**
A (m^2) =	**0.00801**
D (m) =	**0.101**
D (mm) =	**101**



Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:2 YEAR EVENT
AREA A-2 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area = 0.79 ha; Qallow = 49.8 L/s
C = 0.63; Vol(max) = 34.3 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	103.57	144.25	94.45	28.34
10	76.81	106.97	57.17	34.30
15	61.77	86.03	36.23	32.61
20	52.03	72.47	22.67	27.20
25	45.17	62.91	13.11	19.66
30	40.04	55.77	5.97	10.75
35	36.06	50.22	0.42	0.89
40	32.86	45.77	-4.03	-9.67
45	30.24	42.12	-7.68	-20.74
50	28.04	39.06	-10.74	-32.23
55	26.17	36.45	-13.35	-44.06
60	24.56	34.20	-15.60	-56.15
65	23.15	32.24	-17.56	-68.47
70	21.91	30.52	-19.28	-80.98
75	20.81	28.99	-20.81	-93.65
90	18.14	25.27	-24.53	-132.47
105	16.13	22.47	-27.33	-172.17
120	14.56	20.28	-29.52	-212.53
135	13.30	18.52	-31.28	-253.38
150	12.25	17.06	-32.74	-294.62

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A-2 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area = 0.79 ha; Qallow = 50.6 L/s
C = 0.63; Vol(max) = 59.2 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	196.63	146.03	43.81
10	104.19	145.12	94.52	56.71
15	83.56	116.38	65.78	59.20
20	70.25	97.84	47.24	56.69
25	60.90	84.81	34.21	51.32
30	53.93	75.11	24.51	44.12
35	48.52	67.57	16.97	35.65
40	44.18	61.54	10.94	26.25
45	40.63	56.59	5.99	16.16
50	37.65	52.44	1.84	5.53
55	35.12	48.92	-1.68	-5.55
60	32.94	45.88	-4.72	-16.98
65	31.04	43.24	-7.36	-28.72
70	29.37	40.91	-9.69	-40.70
75	27.89	38.84	-11.76	-52.91
90	24.29	33.83	-16.77	-90.57
105	21.58	30.06	-20.54	-129.40
120	19.47	27.11	-23.49	-169.10
135	17.76	24.74	-25.86	-209.44
150	16.36	22.79	-27.81	-250.30

Camp Mart - 20 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A-2 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area = 0.79 ha; Qallow = 52.9 L/s
C = 0.72; Vol(max) = 165.3 m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	381.21	328.31	98.49
10	178.56	280.46	227.56	136.54
15	142.89	224.44	171.54	154.39
20	119.95	188.41	135.51	162.61
25	103.85	163.11	110.21	165.32
30	91.87	144.30	91.40	164.52
35	82.58	129.71	76.81	161.29
40	75.15	118.03	65.13	156.31
45	69.05	108.46	55.56	150.01
50	63.95	100.45	47.55	142.66
55	59.62	93.65	40.75	134.48
60	55.89	87.79	34.89	125.62
65	52.65	82.69	29.79	116.19
70	49.79	78.20	25.30	106.28
75	47.26	74.22	21.32	95.96
90	41.11	64.57	11.67	63.03
105	36.50	57.33	4.43	27.89
120	32.89	51.67	-1.23	-8.87
135	30.00	47.12	-5.78	-46.85
150	27.61	43.37	-9.53	-85.79

Area A-2 Storage	Surface CBMH 12		Surface CBMH 13		Surface CBMH 14		Surface CB 6		Surface CB 7		Total Storage
	Ponding		Ponding		Ponding		Ponding		Ponding		Total
Elevation (m)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	Area (m^2)	Volume (m^3)	**Volume (m^3)**
94.60	-	-	-	-	-	-	-	-	0	0.00	**0**
94.65	-	-	-	-	-	-	-	-	31.13	0.78	**0.8**
94.70	-	-	-	-	-	-	-	-	78.11	3.51	**3.5**
94.75	-	-	-	-	-	-	-	-	144.83	9.08	**9.1**
94.80	-	-	-	-	-	-	-	-	243.00	18.78	**18.8**
94.85	-	-	-	-	-	-	-	-	336.16	33.26	**33.3**
94.90	-	-	-	-	-	-	-	-	432.83	52.48	**52.5**
94.95	0	0.00	-	-	0	0.00	0	0.00	531.07	76.58	**76.6**
95.00	22.35	0.56	0	0.00	16.53	0.41	11.15	0.28	631.90	105.65	**106.9**
95.05	82.26	3.17	25.20	0.63	62.50	2.39	44.58	1.67	732.45	139.76	**147.6**
95.10	173.09	9.56	89.12	3.49	140.86	7.47	100.32	5.29	837.22	179.00	**204.8**

135mm dia. Restrictor Pipe

1:100 Yr
Flow (L/s) = 52.9
Head (m) = 1.87
Elevation (m) = **95.07**
Outlet Pipe Dia.(mm) = 381
Volume (m3) = 165.3

1:5 Yr
Flow (L/s) = 50.6
Head (m) = 1.71
Elevation (m) = **94.91**
Outlet Pipe Dia.(mm) = 381
Volume (m3) = 59.2

1:2 Yr
Flow (L/s) = 49.8
Head (m) = 1.66
Elevation (m) = **94.86**
Outlet Pipe Dia.(mm) = 381
Volume (m3) = 34.3

Parking Lot Ponding Depth	**(cm)**
1:100 Yr	**12**
1:5 Yr	**0**

Restrictor Pipe - 1:100 yr Flow Check

$Q=0.61xAx(2gh)^{0.5}$

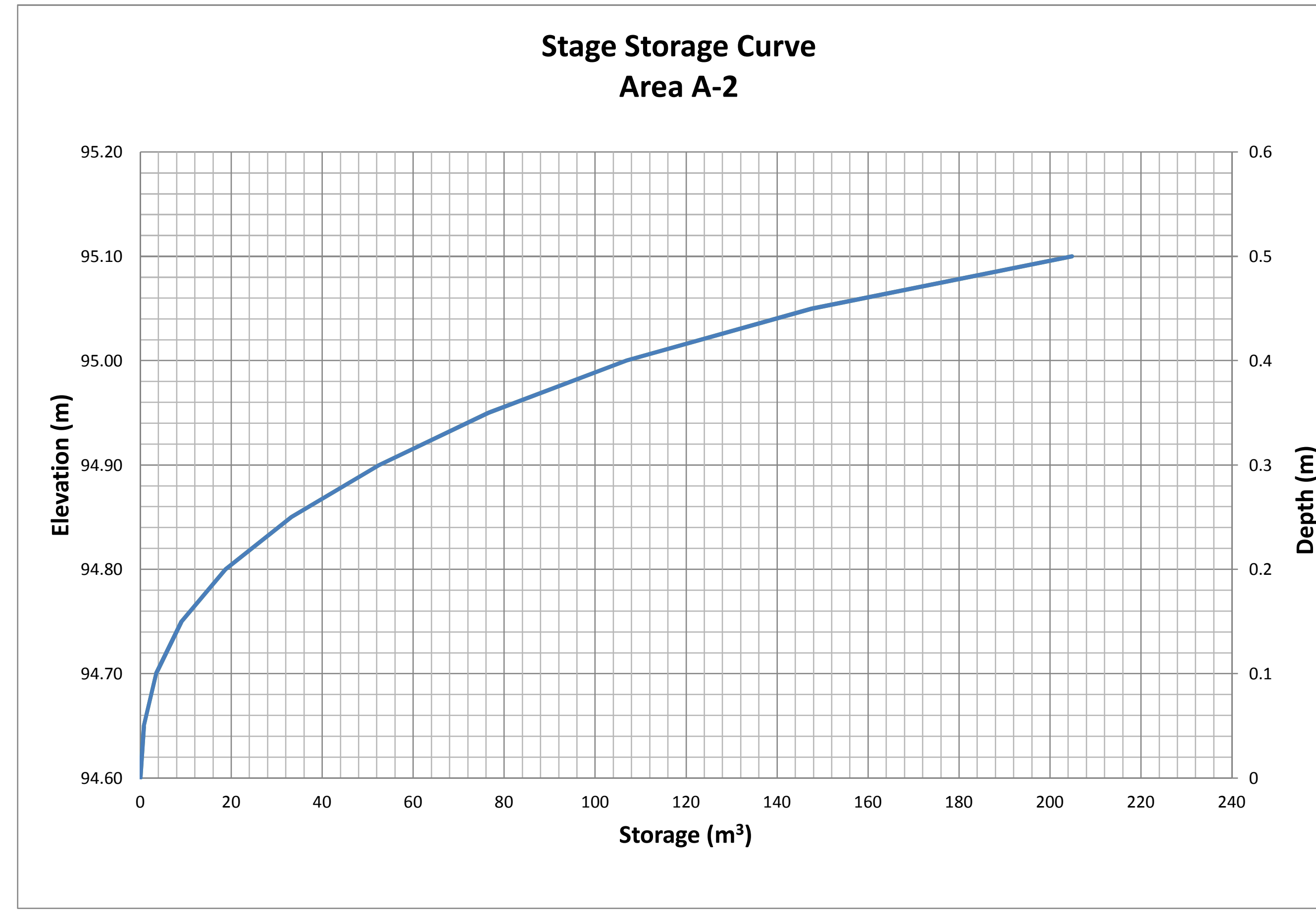
	1:100 yr	Flow Check
Q (m^3/s) =	0.0529	**0.0529**
g (m/s^2) =	9.81	9.81
h (m) =	**1.87**	1.87
A (m^2) =	**0.01431903**	**0.01431**
D (m) =	**0.135024277**	**0.13500**
D (mm) =	**135**	135.0

1:5 yr Flow Check

	1:5 yr
Q (m^3/s) =	0.0506
g (m/s^2) =	9.81
h (m) =	**1.71**
A (m^2) =	**0.01431**
D (m) =	**0.135**
D (mm) =	**135**

1:2 yr Flow Check

	1:5 yr
Q (m^3/s) =	0.0498
g (m/s^2) =	9.81
h (m) =	**1.66**
A (m^2) =	**0.01431**
D (m) =	**0.135**
D (mm) =	**135**



20 Frank Nighbor Place - Camp Mart Site
1:5 Year Storm Sewer Design Sheet

NOVATECH
Engineers, Planners & Landscape Architects

PROJECT : 117193
DESIGNED BY: SM
CHECKED BY: FST
DATE: August 19, 2018

AREA	FROM MH	TO MH	AREA (ha) C= 0.20	C = 0.60	C = 0.90	INDIV 2.78 AC	ACCUM 2.78 AC	TIME OF CONC. (min)	RAINFALL INTENSITY (mm/hr)	CONTROLLED FLOW* Q (L/s)	PEAK FLOW Q (L/s)	PROPOSED SEWER TYPE OF PIPE	PIPE SIZE (mm)	PIPE ID (mm)	GRADE (%)	LENGTH (m)	CAPACITY (L/s)	FULL FLOW VELOCITY (m/s)	TIME OF FLOW (min)	PERCENTAGE OF CAPACITY
A-2 Controlled	Building	CBMH 12			0.280	0.70	0.70	10.00	104.19		73.0	PVC	250	254.0	2.00	8.2	**87.7**	1.73	0.08	83%
								10.08												
A-2 Controlled	CB 7	CBMH 12	0.151		0.005	0.10	0.10	10.00	104.19		10.1	PVC	250	254.0	0.50	10.4	**43.9**	0.87	0.20	23%
								10.20												
A-2 Controlled	CB 6	CBMH 14	0.044		0.063	0.18	0.28	10.00	104.19		29.0	PVC	300	304.8	0.35	38.0	**59.7**	0.82	0.77	49%
A-2 Controlled	CBMH 14	CBMH 13	0.067		0.056	0.18	0.46	10.77	100.27		45.7	PVC	375	381.0	0.25	28.0	**91.5**	0.80	0.58	50%
A-2 Controlled	CBMH 13	CBMH 12	0.005		0.059	0.15	0.61	11.36	97.54		59.1	PVC	375	381.0	0.25	29.9	**91.5**	0.80	0.62	65%
A-2 Controlled	CBMH 12	STM MH 1	0.019		0.035	0.10	0.70	11.98	94.79		66.8	PVC	375	381.0	0.25	108.9	**91.5**	0.80	2.26	73%
								14.24												
Controlled Flow From A-2			**A-2 is controlled to 50.6 L/s by a 135mm dia. restrictor pipe in the outlet pipe of CBMH 12**							**50.6**	**50.6**	PVC	375	381.0	0.25	108.9	**91.5**	0.80	2.26	**55%**
A-1 Controlled	CB 5	CBMH 11	0.010		0.032	0.09	0.09	10.00	104.19		8.9	PVC	250	254.0	0.50	22.0	**43.9**	0.87	0.42	20%
A-1 Controlled	CBMH 11	CBMH 10	0.011		0.035	0.09	0.18	10.42	102.01		18.3	PVC	300	304.8	0.35	34.1	**59.7**	0.82	0.69	31%
A-1 Controlled	CBMH 10	CBMH 9	0.003		0.049	0.12	0.30	11.12	98.63		29.9	PVC	375	381.0	0.25	26.2	**91.5**	0.80	0.54	33%
A-1 Controlled	CBMH 9	CBMH 8	0.006		0.077	0.20	0.50	11.66	96.16		48.0	PVC	375	381.0	0.25	24.9	**91.5**	0.80	0.52	53%
								12.18												
A-1 Controlled	CB 4	CBMH 8			0.099	0.25	0.25	10.00	104.19		25.8	PVC	250	254.0	0.50	22.4	**43.9**	0.87	0.43	59%
								10.43												
A-1 Controlled	CBMH 8	CBMH 4	0.009		0.091	0.23	0.98	12.18	93.93		92.1	PVC	375	381.0	0.25	36.1	**91.5**	0.80	0.75	101%
								12.93												
A-1 Controlled	CB 3	CBMH 7	0.112			0.06	0.06	10.00	104.19		6.5	PVC	250	254.0	0.50	4.4	**43.9**	0.87	0.08	15%
A-1 Controlled	CBMH 7	CBMH 6			0.044	0.11	0.17	10.08	103.75		17.9	PVC	300	304.8	0.35	14.6	**59.7**	0.82	0.30	30%
A-1 Controlled	CBMH 6	CBMH 5	0.041			0.02	0.20	10.38	102.22		19.9	PVC	300	304.8	0.35	11.6	**59.7**	0.82	0.24	33%
A-1 Controlled	CBMH 5	CBMH 4			0.067	0.17	0.36	10.62	101.04		36.7	PVC	300	304.8	0.35	24.9	**59.7**	0.82	0.51	61%
								11.13												
A-1 Controlled	CB 2	CBMH 4			0.080	0.20	0.20	10.00	104.19		20.9	PVC	250	254.0	0.50	23.1	**43.9**	0.87	0.44	48%
								10.44												
A-1 Controlled	CBMH 4	CBMH 2	0.002		0.095	0.24	1.78	12.93	90.90		162.0	PVC	375	381.0	0.25	31.6	**91.5**	0.80	0.66	177%
								13.59												
A-1 Controlled	CB 1	CBMH 3	0.007		0.039	0.10	0.10	10.00	104.19		10.6	PVC	250	254.0	0.50	26.1	**43.9**	0.87	0.50	24%
A-1 Controlled	CBMH 3	CBMH 2	0.048		0.042	0.13	0.23	10.50	101.61		23.7	PVC	300	304.8	0.35	25.3	**59.7**	0.82	0.52	40%
								11.02												
A-1 Controlled	CBMH 2	CBMH 1	0.031		0.044	0.13	2.14	13.59	88.42		189.4	PVC	375	381.0	0.25	23.6	**91.5**	0.80	0.49	207%
A-1 Uncontrolled	CBMH 1	STM MH 1	0.014		0.044	0.12	2.26	14.08	86.66		195.9	PVC	375	381.0	0.25	4.0	**91.5**	0.80	0.08	214%
								14.16												
Controlled Flow From A-1			**A-1 is controlled to 30.3 L/s by a 101mm dia. restrictor pipe in the outlet pipe of CBMH 1**							**30.3**	**30.3**	PVC	375	381.0	0.25	4.0	**91.5**	0.80	0.08	**33%**
A-1 Uncontrolled	STM MH 1	CDS Unit					3.67	14.24	86.10	**80.9**	315.6	PVC	450	457.2	0.20	5.0	**133.0**	0.81	0.10	**61%**
Site Outlet	CDS Unit	Outlet Pipe					3.67	14.34	85.74	**80.9**	314.3	PVC	450	457.2	0.20	8.4	**133.0**	0.81	0.17	**61%**
								14.52												

NOTES:
1) Refer to Novatech DSS & SWM Report (R-2018-011) for storm drainage and stormwater details
2) Refer to Novatech Drawings 117193-GP1 and 117193-GP2 for storm structure designations, storm pipe details and control structure tables.

Private Site Access Road
30 Frank Nighbor Place

Pre - Development Site Flows									
Description	*A (ha)*	*A imp (ha) C=0.9*	*A grav (ha) C=0.6*	*A perv (ha) C=0.2*	C_5	C_{100}	Pre-Development Flows		Allowable
							5 year (L/s)	100 year (L/s)	50 L/s/ha
Site Area	0.09	0.00	0.00	0.09	0.20	0.25	5.2	11.2	4.5
							t_c=10mins	t_c=10mins	

Post - Development : Total Uncontrolled Site Flows									
Area	Description	*A (ha)*	*A imp (ha) C=0.9*	*A pavers (ha) C=0.7*	*A perv (ha) C=0.2*	C_5	C_{100}	Uncontrolled Flow (L/s)	
								5 year	100 year
A-4	Controlled Roadway Area (CB 1A)	0.09	0.06	0.00	0.03	0.67	0.75	17.4	33.5
	Summed Area Check:	0.09						t_c=10mins	t_c=10mins

Post - Development : Total Flows for Controlled Site						
Area	Description	Flow (L/s)		Storage Required (m^3)		Provided (m^3)
		5 year	100 year	5 year	100 year	
A-4	Controlled Roadway Area (CB 1A)	4.3	4.4	8.9	23.3	38.9
	Totals =	**4.3**	**4.4**	**8.9**	**23.3**	**38.9**
	Over-Controlled by:	0.2	0.1			

Private Access Road - 30 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:5 YEAR EVENT
AREA A-4 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area =	0.090	ha	Qallow =	4.3	L/s
C =	0.67		Vol(max) =	8.9	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	141.18	23.55	19.25	5.77
10	104.19	17.38	13.08	7.85
15	83.56	13.94	9.64	8.67
20	70.25	11.72	7.42	8.90
25	60.90	10.16	5.86	8.79
30	53.93	9.00	4.70	8.45
35	48.52	8.09	3.79	7.96
40	44.18	7.37	3.07	7.37
45	40.63	6.78	2.48	6.69
50	37.65	6.28	1.98	5.94
55	35.12	5.86	1.56	5.14
60	32.94	5.49	1.19	4.30
65	31.04	5.18	0.88	3.42
70	29.37	4.90	0.60	2.52
75	27.89	4.65	0.35	1.58
90	24.29	4.05	-0.25	-1.34
105	21.58	3.60	-0.70	-4.41
120	19.47	3.25	-1.05	-7.58
135	17.76	2.96	-1.34	-10.83
150	16.36	2.73	-1.57	-14.14

Private Access Road - 30 Frank Nighbor Place
Project No. 117193
REQUIRED STORAGE - 1:100 YEAR EVENT
AREA A-4 Controlled Flow-Parking Lot Storage

OTTAWA IDF CURVE

Area =	0.090	ha	Qallow =	4.4	L/s
C =	0.75		Vol(max) =	23.3	m3

Time (min)	Intensity (mm/hr)	Q (L/s)	Qnet (L/s)	Vol (m3)
5	242.70	45.54	41.14	12.34
10	178.56	33.51	29.11	17.46
15	142.89	26.81	22.41	20.17
20	119.95	22.51	18.11	21.73
25	103.85	19.49	15.09	22.63
30	91.87	17.24	12.84	23.11
35	82.58	15.50	11.10	23.30
40	75.15	14.10	9.70	23.28
45	69.05	12.96	8.56	23.10
50	63.95	12.00	7.60	22.80
55	59.62	11.19	6.79	22.40
60	55.89	10.49	6.09	21.92
65	52.65	9.88	5.48	21.37
70	49.79	9.34	4.94	20.76
75	47.26	8.87	4.47	20.10
90	41.11	7.71	3.31	17.90
105	36.50	6.85	2.45	15.43
120	32.89	6.17	1.77	12.76
135	30.00	5.63	1.23	9.95
150	27.61	5.18	0.78	7.03

Structures	Size (mm)	Area (m^2)	T/G	Inv IN	Inv OUT
CB 1A	600 x 600	0.36	94.85	-	93.10
CB 1B	600 x 600	0.36	94.85	-	93.20

Area A-4: Storage Table				Underground Storage	Surface @ CB 1A		Surface @ CB 1B		Total Storage		
Elevation (m)	System Depth (m)	CB 1A Volume (m^3)	CB 1B Volume (m^3)	Total Volume (m^3)	Ponding Area (m^2)	Volume (m^3)	Ponding Area (m^2)	Volume (m^3)	Ponding Volume (m^3)	**Total Volume (m^3)**	
93.10	0.00	-	-	-	-	-	-	-	-	**0**	
93.40	0.30	0.11	0.07	0.18	-	-	-	-	-	**0.2**	
93.80	0.70	0.25	0.22	0.47	-	-	-	-	-	**0.5**	
94.10	1.00	0.36	0.32	0.68	-	-	-	-	-	**0.7**	Design Head
94.40	1.30	0.47	0.43	0.90	-	-	-	-	-	**0.9**	-
94.70	1.60	0.58	0.54	1.12	-	-	-	-	-	**1.1**	-
94.85	1.75	0.63	0.59	1.22	0.0	0.00	0.0	0.00	-	**1.2**	1.65
94.90	1.80				36.26	0.91	27.22	0.68	1.6	**2.8**	1.70
94.95	1.85				105.75	4.46	79.12	3.34	7.8	**9.0**	1.75
95.00	1.90				168.78	11.32	126.66	8.48	19.8	**21.0**	1.80
95.05	1.95				234.54	21.40	186.19	16.30	37.7	**38.9**	1.85

Tempest LMF Model 60 Vortex ICD

1:100 Yr

Flow (L/s) =	4.4
Head (m) =	1.81
Elevation (m) =	**95.01**
Outlet Pipe Dia.(mm) =	203
Volume (m3) =	23.3

1:5 Yr

Flow (L/s) =	4.3
Head (m) =	1.75
Elevation (m) =	**94.95**
Outlet Pipe Dia.(mm) =	203
Volume (m3) =	8.9

Maximum Ponding Depth	**(cm)**
1:100 Yr	**16**
1:5 Yr	**10**

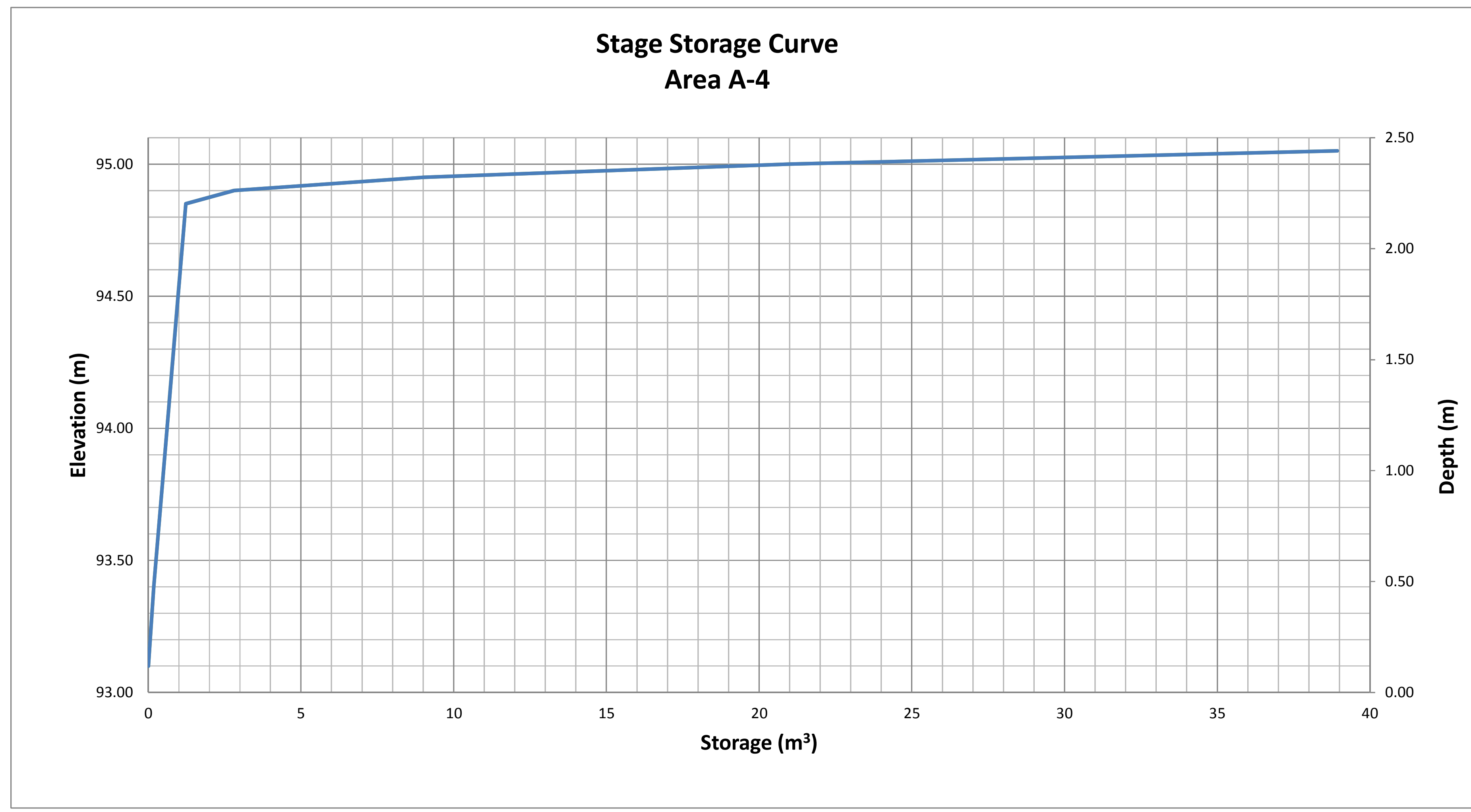
Orifice Size - 1:100 yr Flow Check

Q=0.62xAx(2gh)^0.5

	1:100 yr	Flow Check
Q (m^3/s) =	0.0044	**0.0044**
g (m/s^2) =	9.81	9.81
h (m) =	**1.81**	1.81
A (m^2) =	**0.001191385**	**0.00119**
D (m) =	**0.038947642**	**0.03900**
D (mm) =	**39**	39.0

1:5 yr Flow Check

	1:5 yr
Q (m^3/s) =	0.0043
g (m/s^2) =	9.81
h (m) =	**1.75**
A (m^2) =	**0.00119**
D (m) =	**0.039**
D (mm) =	**39**



NOVATECH

TERRY FOX BUSINESS PARK

STORMWATER DESIGN PLAN

RMOC FILE NO.: 15-90-18.07
MMA FILE NO.: 06T-90019

Prepared by:

NOVATECH ENGINEERING CONSULTANTS LTD.

August 4, 1994

6.0 PROPOSED STORMWATER DESIGN CRITERIA

The storm drainage of the site will be consistent with a dual drainage concept whereby the minor drainage system relies on roadway gutters, catchbasins and storm sewers to convey 1:5 year return period flows to the Carp River outlet. On-site controls will restrict release rates to 50 L/s/ha for each developable lot which is slightly in excess of the pre-development rate. The other half of the dual drainage system is the major system drainage which will convey flows in excess of the 1:5 year flows overland via roadways and drainage swales to the Carp River or control it on-site and release it at the 5 year pre-development rate. The hydrologic analysis has indicated that neither option will increase Carp River peak flows.

The principal elements or guidelines for the stormwater design plan are as follows:

- On-site flow restricted to 50 L/s/ha maximum by a combination of roof top storage, inlet control or other devices. Individual lot developers will be required to provide on-lot grading and drainage control to attenuate site drainage to the stipulated maximum for the 5 year design event.

- Roadway catchbasins with inlet capacity for the 1:5 year design event.

- Storm sewer pipe designed to convey post-development right-of-way (R.O.W.) flows for the 1:5 year design event and the on-site flows restricted to 50 L/s/ha maximum.

- The developer will have the option of controlling the 5 year - 100 year event and releasing it through the storm sewer (at 50 L/s/ha max.) or, alternatively, releasing it uncontrolled via the major system drainage network. This shall be a site specific consideration.

- Catchbasins/manholes shall contain sumps and will require regular maintenance. Sumps may have to be cleaned out more often than a conventional parking lot drainage network.

- Future lot developers shall submit stormwater management calculations which should either be based on the modified rational method or an appropriate stormwater management model such as OTTSWMM. Calculations which should be submitted in support of the design should include:

  i) Allowable run-off;
  ii) Post-development run-off;
  iii) Storage calculations (5 year);
  iv) Method of providing storage, including volume calculations, and
  v) Orifice and outlet weir calculations.

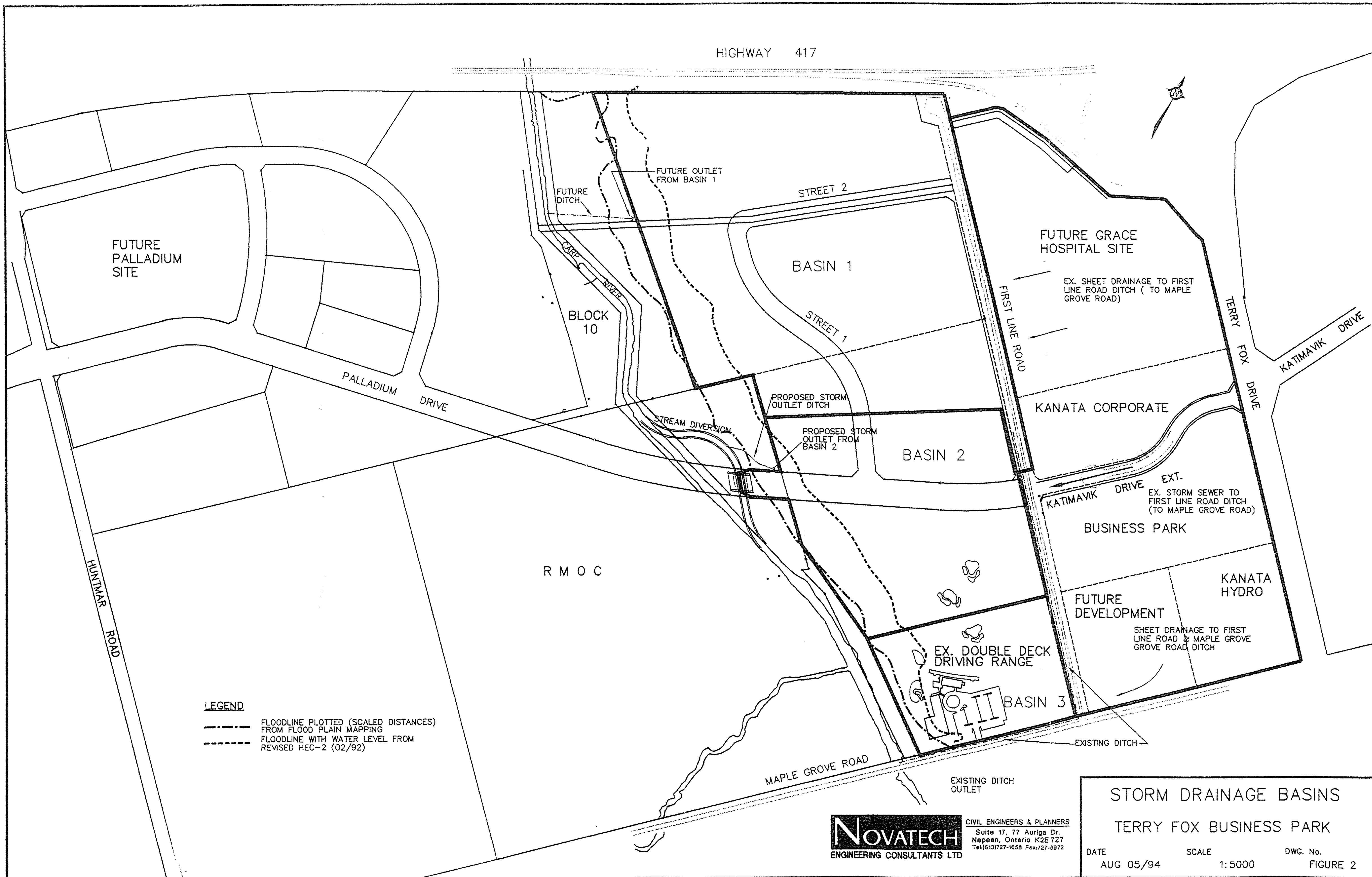
- Site grading should ensure that OSD's retain ponding without flooding buildings and maximum ponding depths in parking lots should be limited to between 0.25m and 0.30m.

- Site developments should incorporate feasible BMP's for improved water quality such as:

  - infiltration trenches or basins
  - sumps in catchbasins and catchbasin manholes
  - grassed swales

- If overland flow routes (major system) are incorporated in the design, then the overland major system slope should be 0.1% minimum as measured from summit to summit.

- Existing Katimavik Road storm drainage outlet culvert will be relocated to the existing First Line Road ditch south of future Palladium Drive. Some minor re-ditching along First Line Road may be required.



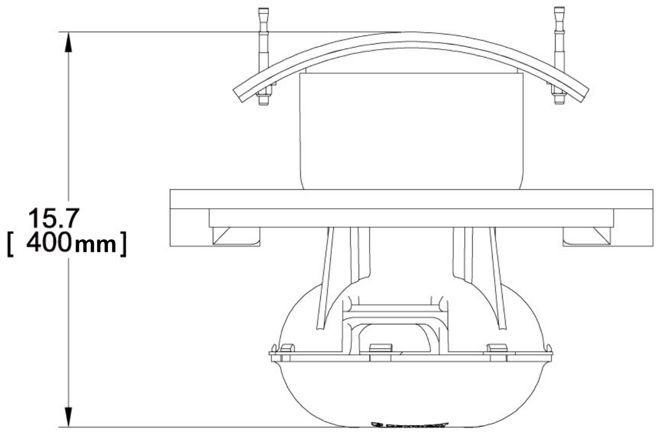
STORM DRAINAGE BASINS

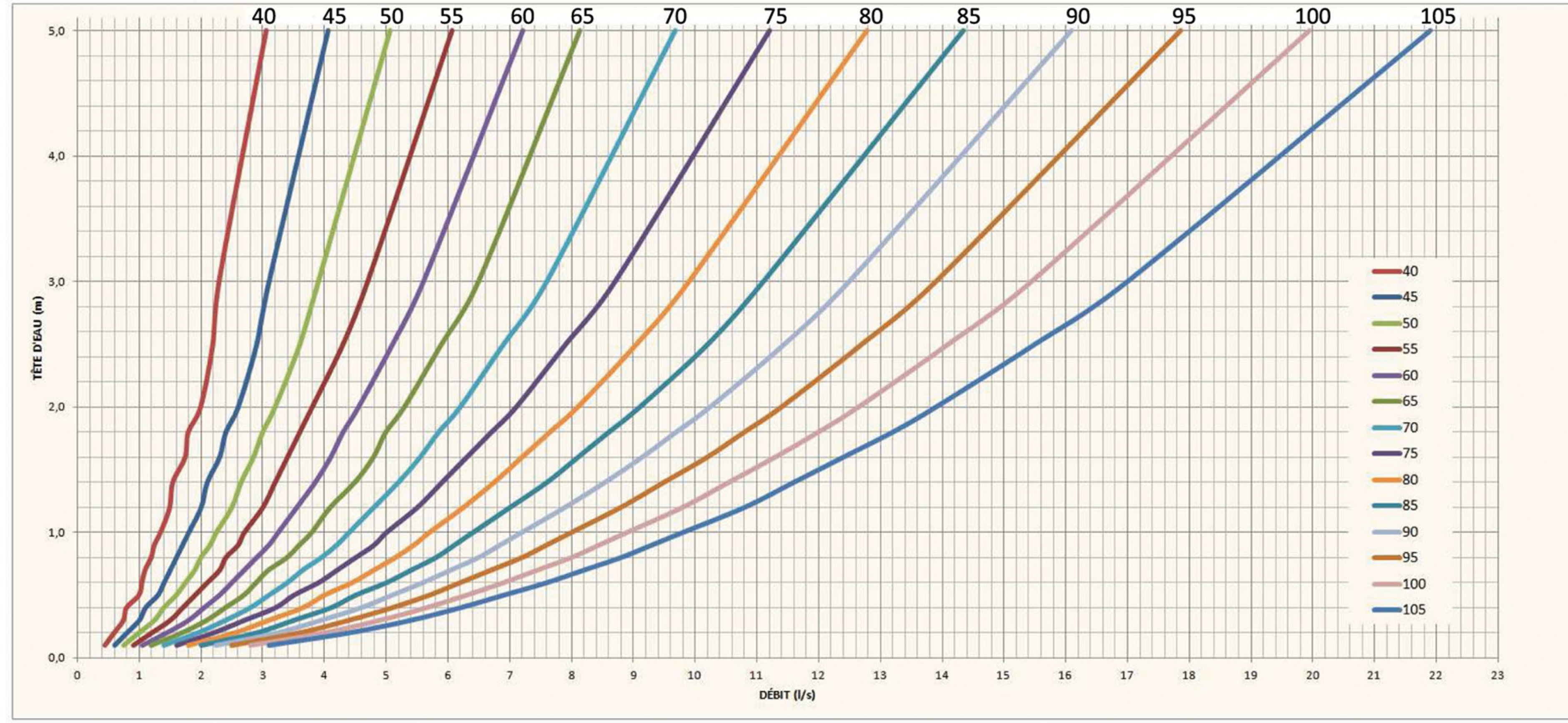
TERRY FOX BUSINESS PARK

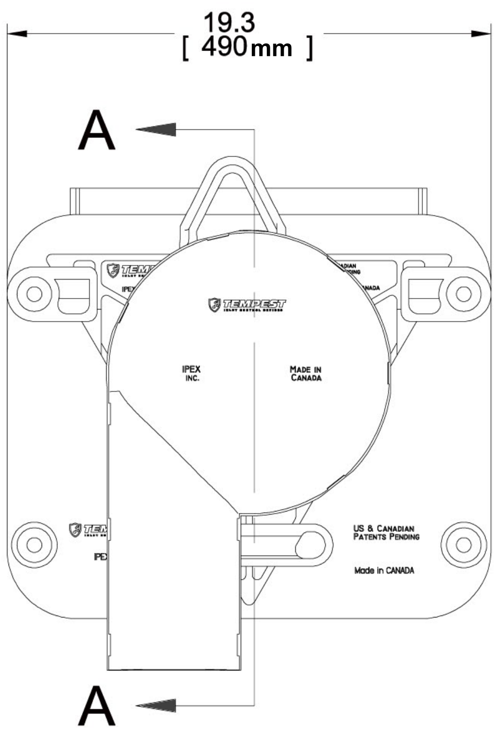
DATE	SCALE	DWG. No.
AUG 05/94	1:5000	FIGURE 2

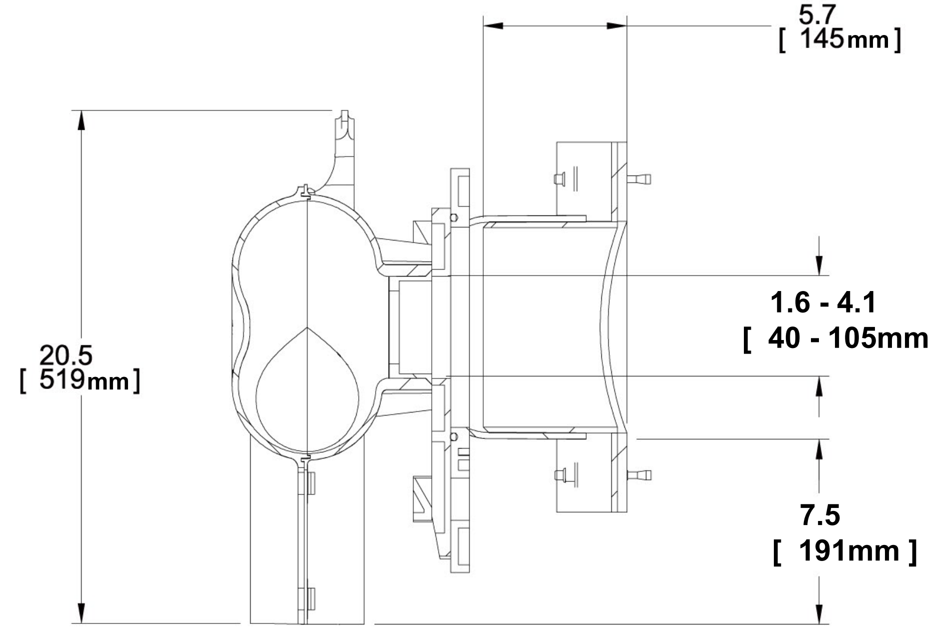
APPENDIX E

INLET CONTROL DEVICE (ICD) INFORMATION

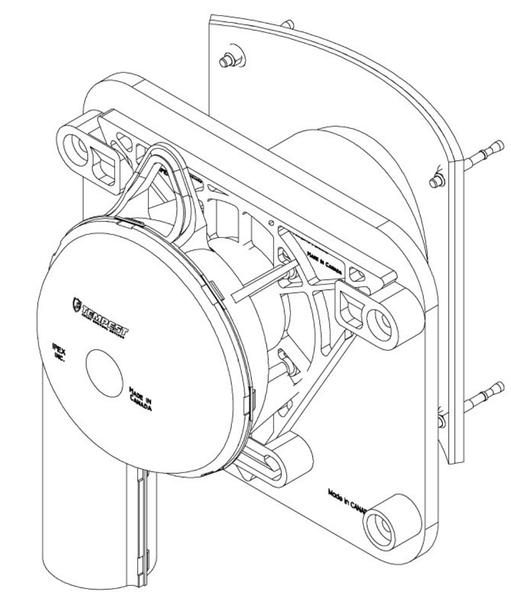








SECTION A-A



IPEX

Product development engineering
3 Place du commerce, Suite 101
Île des Soeurs, Montréal, QC, H3E 1H7
Canada Tel 514 769 2200
www.ipexna.com

PROJECTION	UNITS	TITLE	SIZE	SCALE(S)	
	in [mm]	Tempest LMF round CB assembly [VORTEX]	B	1/8	1-2014

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition

CONTENTS

TEMPEST INLET CONTROL DEVICES Technical Manual

About IPEX

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

Purpose

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

Product Description

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

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

Product Function

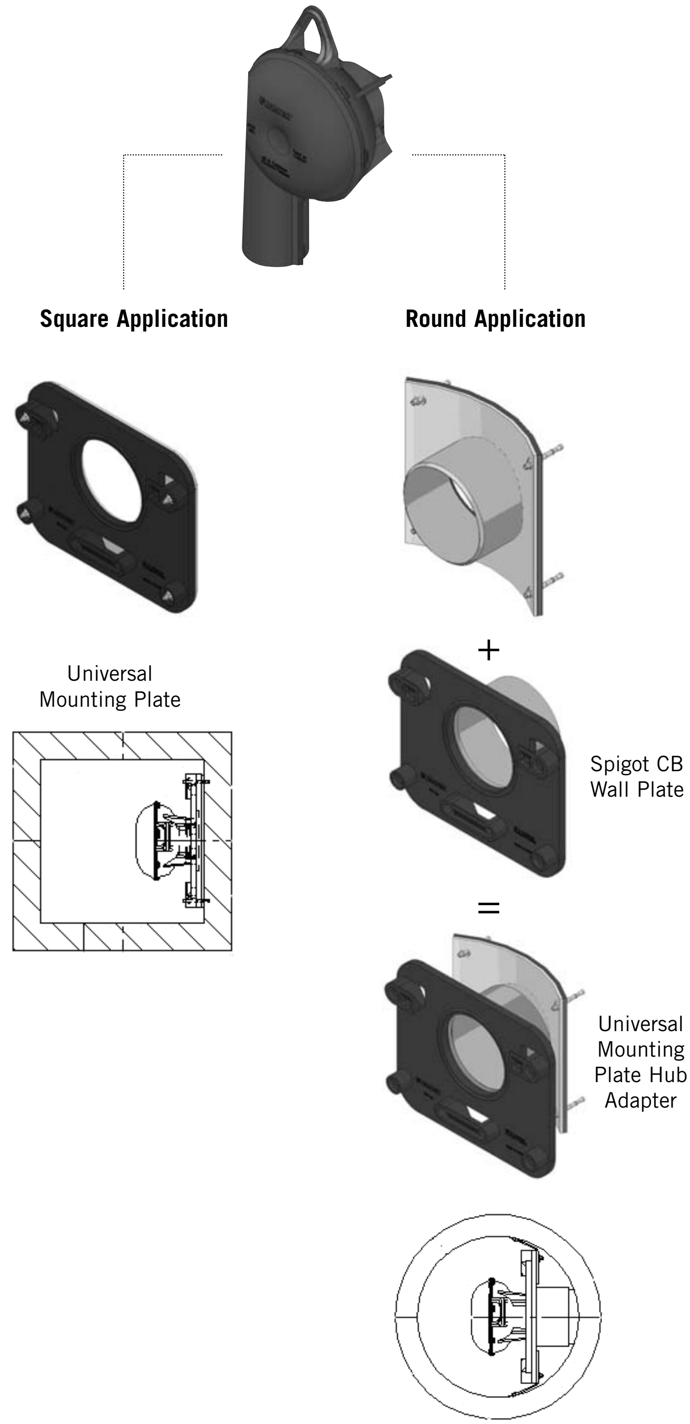
The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during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

Product Construction

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

Product Applications

Will accommodate both square and round applications:



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

Chart 1: LMF 14 Preset Flow Curves

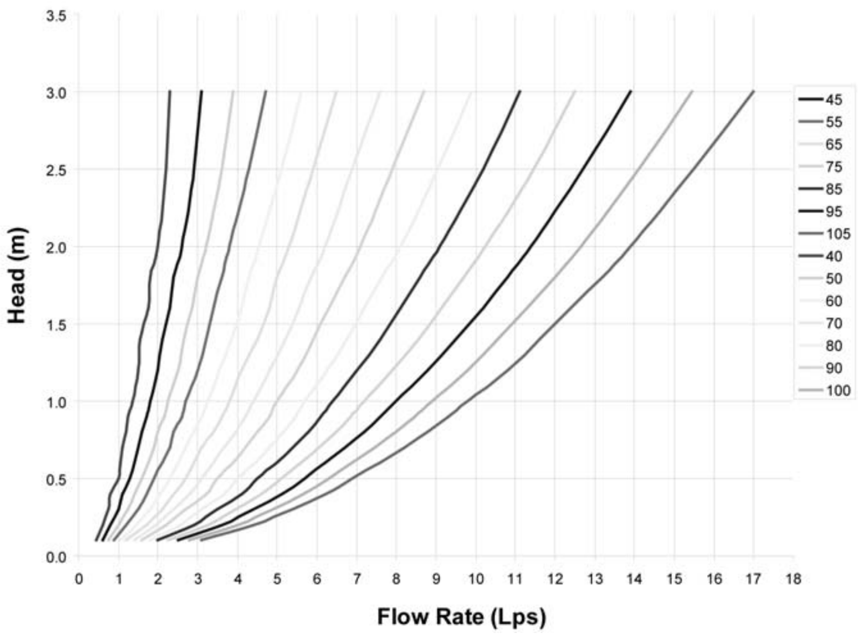
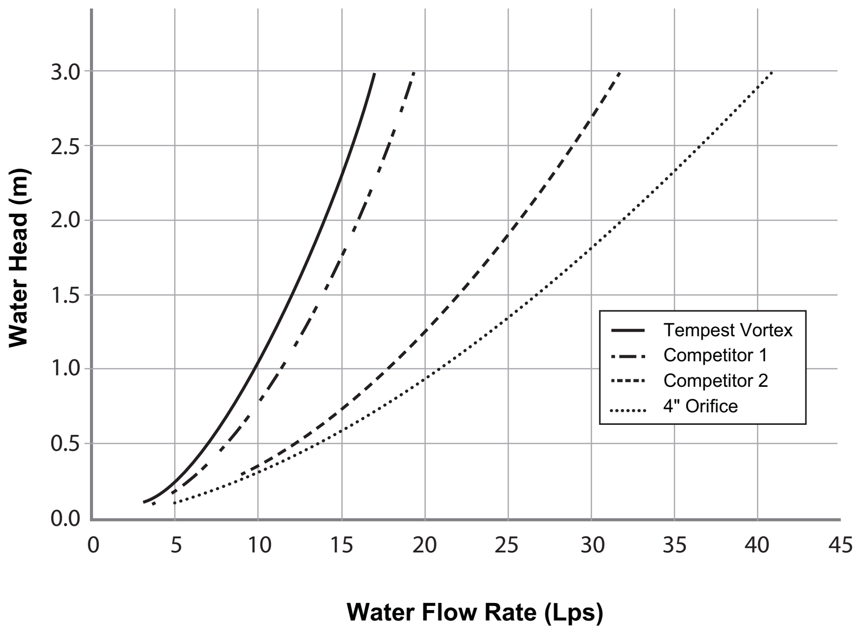


Chart 2: LMF Flow vs. ICD Alternatives



PRODUCT INSTALLATION

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

STEPS:

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

⚠ WARNING

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

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

STEPS:

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

⚠ WARNING

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

PRODUCT TECHNICAL SPECIFICATION

General

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

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

APPENDIX F

WATER QUALITY TREATMENT UNIT INFORMATION

CONTECH ENGINEERED SOLUTIONS

CDS ESTIMATED NET ANNUAL SOLIDS LOAD REDUCTION BASED ON THE RATIONAL RAINFALL METHOD BASED ON A FINE PARTICLE SIZE DISTRIBUTION

CDS TECHNOLOGIES

Project Name: 20 Frank Nighbor Place
Location: Kanata, ON
OGS #: OGS

Engineer: Novatech
Contact: Stephen Matthews
Report Date: 6-Feb-18

Area 1.91 ha
Weighted C 0.72
CDS Model 2020

Rainfall Station # 215
Particle Size Distribution FINE
CDS Treatment Capacity 31 l/s

Rainfall Intensity[1] (mm/hr)	Percent Rainfall Volume[1]	Cumulative Rainfall Volume	Total Flowrate (l/s)	Treated Flowrate (l/s)	Operating Rate (%)	Removal Efficiency (%)	Incremental Removal (%)
1.0	10.6%	19.8%	3.8	3.8	12.3	95.3	10.1
1.5	9.9%	29.7%	5.8	5.8	18.5	93.5	9.3
2.0	8.4%	38.1%	7.7	7.7	24.7	91.8	7.7
2.5	7.7%	45.8%	9.6	9.6	30.9	90.0	6.9
3.0	5.9%	51.7%	11.5	11.5	37.0	88.2	5.2
3.5	4.4%	56.1%	13.5	13.5	43.2	86.5	3.8
4.0	4.7%	60.7%	15.4	15.4	49.4	84.7	4.0
4.5	3.3%	64.0%	17.3	17.3	55.6	82.9	2.8
5.0	3.0%	67.1%	19.2	19.2	61.7	81.2	2.5
6.0	5.4%	72.4%	23.1	23.1	74.1	77.6	4.2
7.0	4.4%	76.8%	26.9	26.9	86.4	74.1	3.2
8.0	3.5%	80.3%	30.8	30.8	98.8	70.5	2.5
9.0	2.8%	83.2%	34.6	31.2	100.0	63.2	1.8
10.0	2.2%	85.3%	38.5	31.2	100.0	56.8	1.2
15.0	7.0%	92.3%	57.7	31.2	100.0	37.9	2.6
20.0	4.5%	96.9%	76.9	31.2	100.0	28.4	1.3
25.0	1.4%	98.3%	96.2	31.2	100.0	22.7	0.3
30.0	0.7%	99.0%	115.4	31.2	100.0	18.9	0.1
35.0	0.5%	99.5%	134.6	31.2	100.0	16.2	0.1
40.0	0.5%	100.0%	153.9	31.2	100.0	14.2	0.1
45.0	0.0%	100.0%	173.1	31.2	100.0	12.6	0.0
50.0	0.0%	100.0%	192.3	31.2	100.0	11.4	0.0
							78.5

Removal Efficiency Adjustment[2] = 6.5%

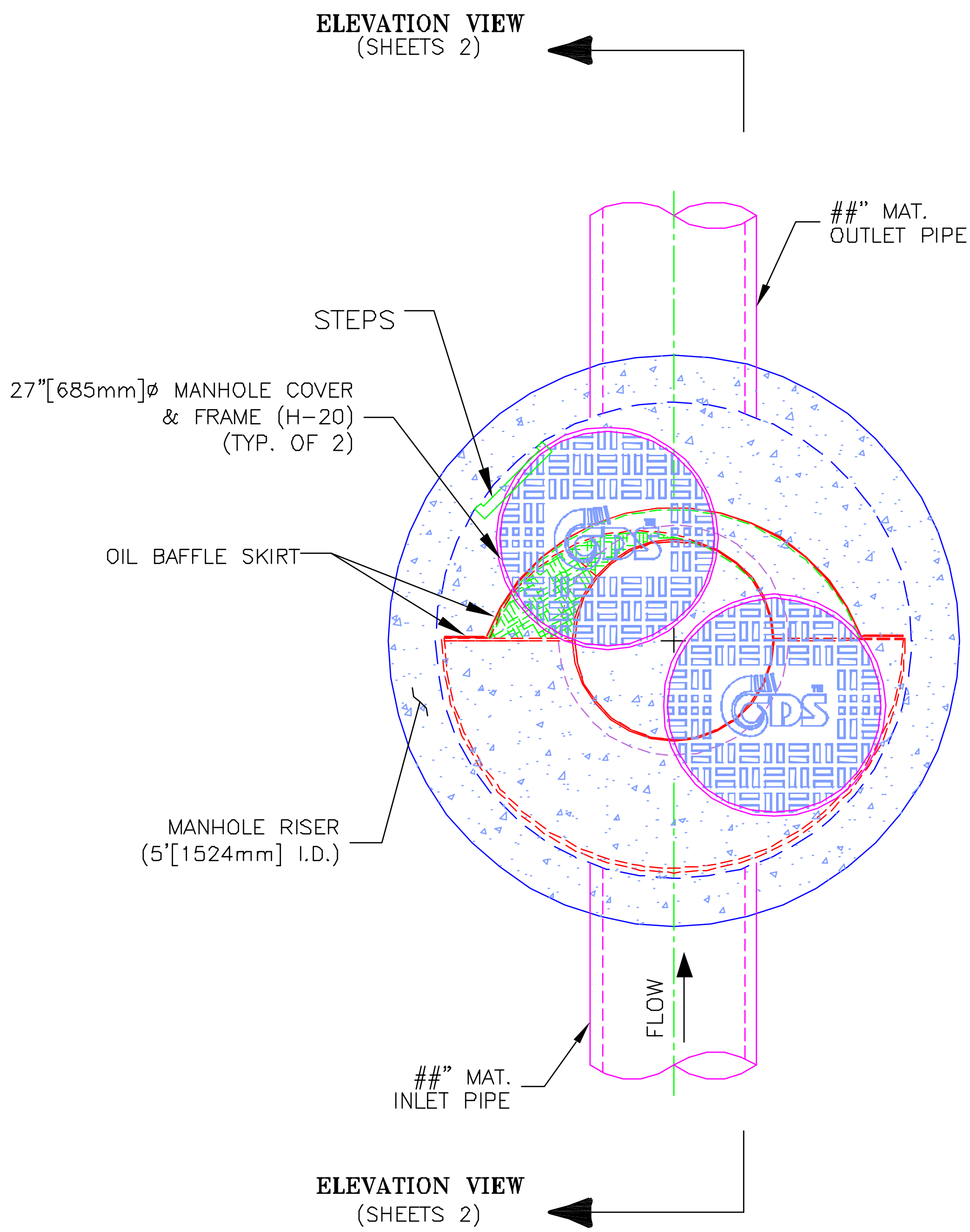
Predicted Net Annual Load Removal Efficiency = 72.0%

Predicted Annual Rainfall Treated = 90.9%

1 - Based on 42 years of hourly rainfall data from Canadian Station 6105976, Ottawa ON

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

PLAN VIEW

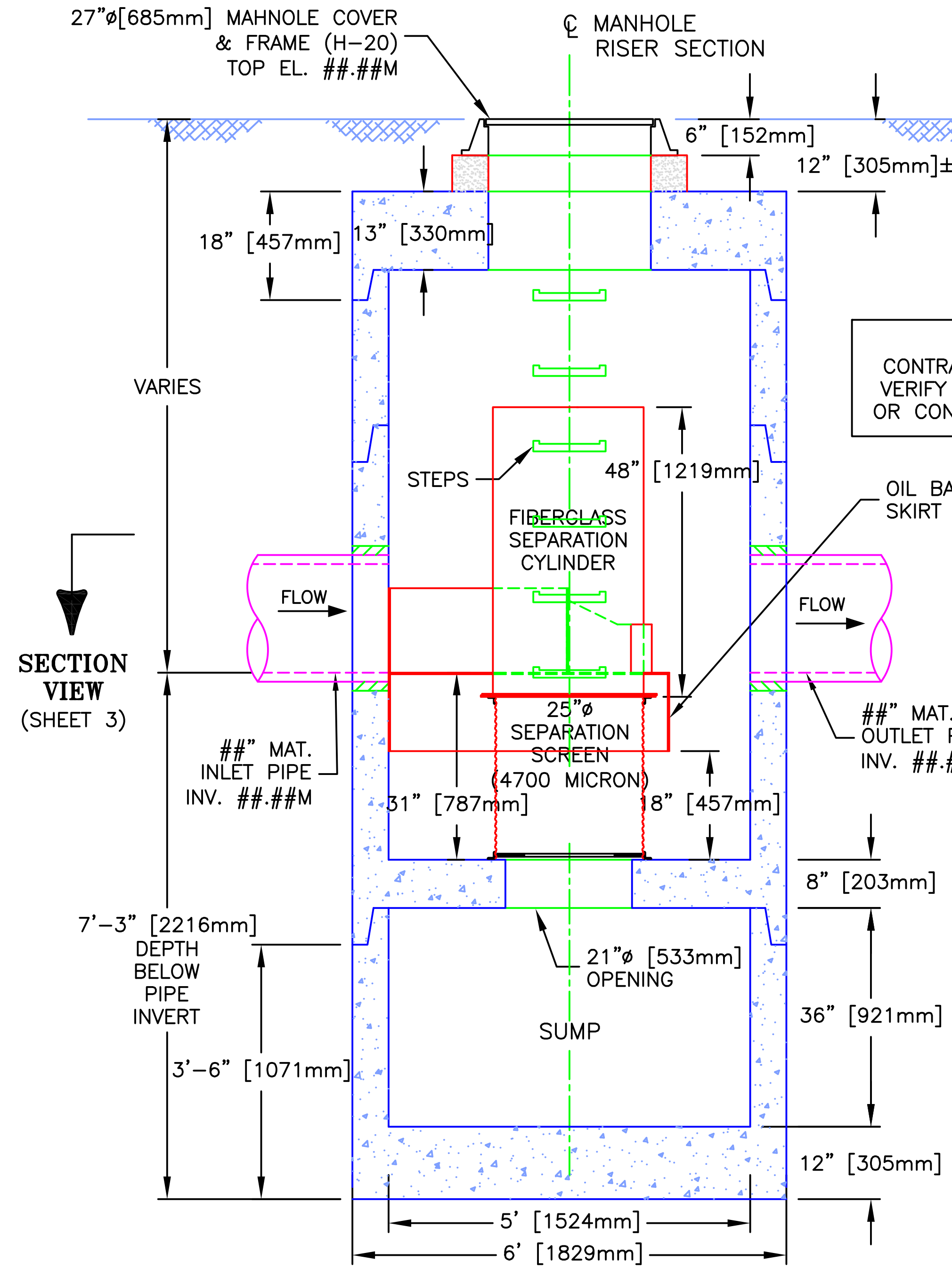


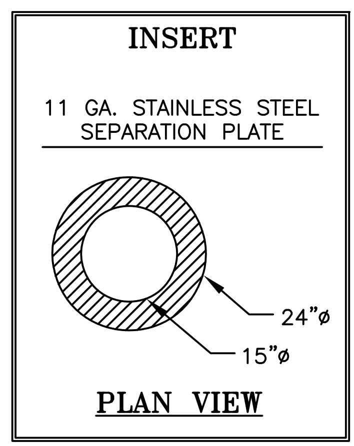
MODEL CDS20_20m, 31 L/s TREATMENT CAPACITY
STORM WATER TREATMENT UNIT

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

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

ELEVATION VIEW





MODEL CDS20_20m, 31 L/s TREATMENT CAPACITY STORM WATER TREATMENT UNIT

CONTECH STORMWATER SOLUTIONS

PROJECT NAME

CITY, STATE

JOB#	XX-##-###	SCALE 1" = 2.5'
DATE	##/##/##	SHEET
DRAWN	INITIALS	2
APPROV.		

Echelon Environmental 505 Hood Road, Unit 26, Markham, Ontario L3R 5V6 Tel: (905) 948-0000 Fax: (905) 948-0577

CONTECH®
CONSTRUCTION PRODUCTS INC.

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs. Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs. The pollutant removal capacity of the CDS system has been proven in lab and field testing.

Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.

Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall MethodTM and Probabalistic Method are used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125-microns (μm). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75-microns (μm).

Water Quality Flow Rate Method

In many cases, regulations require that a specific flow rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval (i.e. the six-month storm) or a water quality depth (i.e. 1/2-inch of rainfall).

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the treatment flow rate around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and reduces the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore they are variable based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabalistic Rational Method

The Probabalistic Rational Method is a sizing program CONTECH developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic rational method is an extension of the rational method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (i.e.: 2-year storm event). Under this method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus helping to prevent re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

CDS hydraulic capacity is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. As needed, the crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulics.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS unit (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This full-scale CDS unit was evaluated under controlled laboratory conditions of pumped influent and the controlled addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSD) of the test materials were analyzed using standard method "Gradation ASTM D-422 with Hydrometer" by a certified laboratory. UF Sediment is a mixture of three different U.S. Silica Sand products referred as: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (uniform coefficient Cu averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003). The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

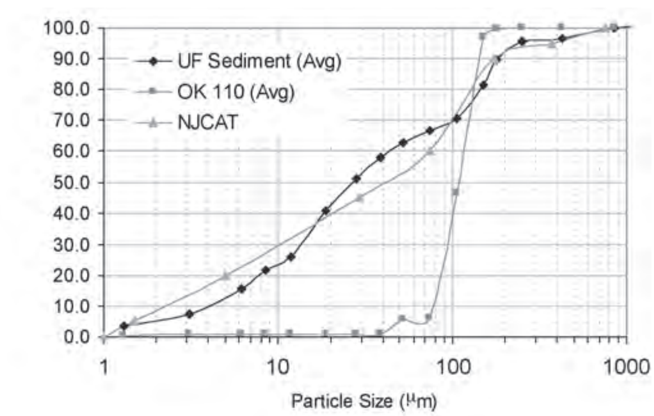


Figure 1. Particle size distributions for the test materials, as compared to the NJCAT/NJDEP theoretical distribution.

Tests were conducted to quantify the CDS unit (1.1 cfs (31.3-L/s) design capacity) performance at various flow rates, ranging from 1% up to 125% of the design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC – ASTM Standard Method D3977-97) and particle size distribution analysis.

Results and Modeling

Based on the testing data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve for the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation assuming sandy-silt type of inorganic components of SSC. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand).

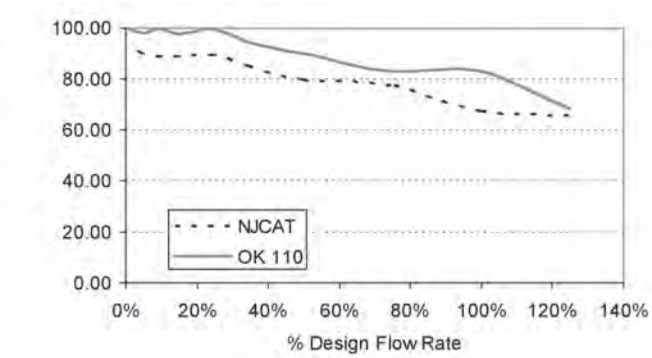


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (WADOE, 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). Supported by the laboratory data, the model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at 100% of design flow rate, for this particle size distribution (d50 = 125 μm).

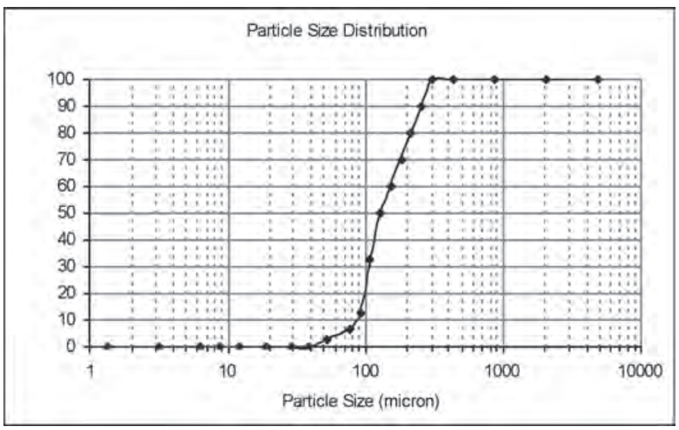


Figure 3. PSD with d50 = 125 microns, used to model performance for Ecology submittal.

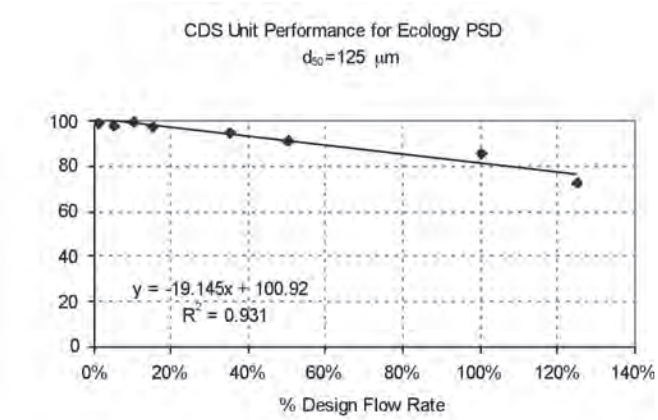


Figure 4. Modeled performance for CDS unit with 2400 microns screen, using Ecology PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit, e.g., unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant deposition and transport may vary from year to year and regular inspections will help insure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (i.e. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Additionally, installations should be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions to inlet and/or separation screen. The inspection should also identify evidence of vector infestation and accumulations of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If sorbent material is used for enhanced removal of hydrocarbons then the level of discoloration of the sorbent material should also

be identified during inspection. It is useful and often required as part of a permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (screen/cylinder) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained behind the screen. For units possessing a sizable depth below grade (depth to pipe), a single manhole access point would allow both sump cleanout and access behind the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump and/or when an appreciable level of hydrocarbons and trash has accumulated. If sorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Finer, silty particles at the top of the pile typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine if the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of the CDS systems should be done during dry weather conditions when no flow is entering the system. Cleanout of the CDS with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should be pumped out also if pollutant build-up exists in this area.

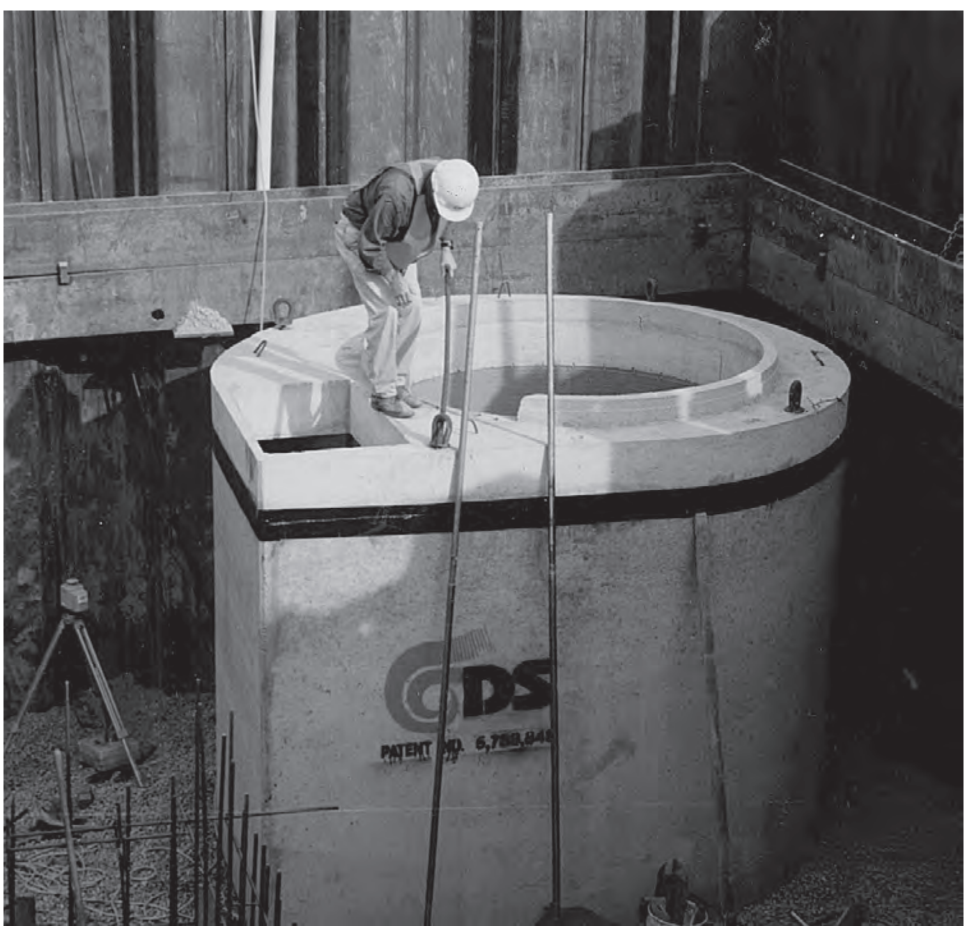
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use adsorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash can be netted out if you wish to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure proper safety precautions. Confined Space Entry procedures need to be followed. Disposal of all material removed from the CDS system should be done is accordance with local regulations. In many locations, disposal of evacuated sediments may be handled in the same manner as disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd3	m3
CDS2015-4	4	1.2	3.0	0.9	0.5	0.4
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



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CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than eighteen inches the system should be cleaned out. **Note: To avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

7

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

CONTECH CONSTRUCTION PRODUCTS INC.

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