Functional Servicing and Stormwater Management Report - *Circle K*

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Project Name:
Circle K Nepean
1545 Woodroffe Avenue, City of Ottawa

Project Number:
BRM-00606364-B0

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2021-04-22 Issued for Client Review
2021-04-27 Issued for Site Plan Application
2021-09-24 Re-issued for Site Plan Application
2021-12-03 Re-issued for Site Plan Application

Table of Contents

1. Introduction

EXP has been retained by Circle K to complete the Civil Engineering design for the development of a gas station and convenience store site in the City of Ottawa, at 1545 Woodroffe Avenue. This report will review the requirements for site servicing, grading and stormwater management for the proposed development. The location and aerial view of the site is shown in Figures 1 and 2.

1.1. Existing Site Information

The existing site is located at the at the northeast corner of Woodroffe Avenue and Medhurst Drive intersection in the City of Ottawa. Currently, the site is occupied by an existing ESSO gas station, car wash and convenience store, as well as an abandoned Tim Hortons location. The site is generally flat with sloping towards the existing catchbasins on the site. Externally, the site frontage slopes down slightly along Woodroffe Avenue towards the north. The site is abutted by residential areas to the north and east.

Figure 1 - Existing Site

Figure 2 - Existing Aerial

1.2. Proposed Development

The proposed Circle K site is approximately 0.82 Ha (8,210 m^2) in area and will be comprised of a Convenience Store/Retail Building, a Car Wash Building, and Fueling Area, as well as parking and landscaped areas. The proposed development is indicated in Figure 3 and details are summarized in Table 1.

Table 1 - Proposed Site Information

Location	Building	Site Area (m2)
A	C-Store, Car Wash (Building Areas)	646
B	Fueling Canopy	354
C	Landscape Open Space	1820
Remaining Site	Parking, Drive Aisles, Pedestrian Walkways and Loading Areas	5390
Total Site Area		**8210**

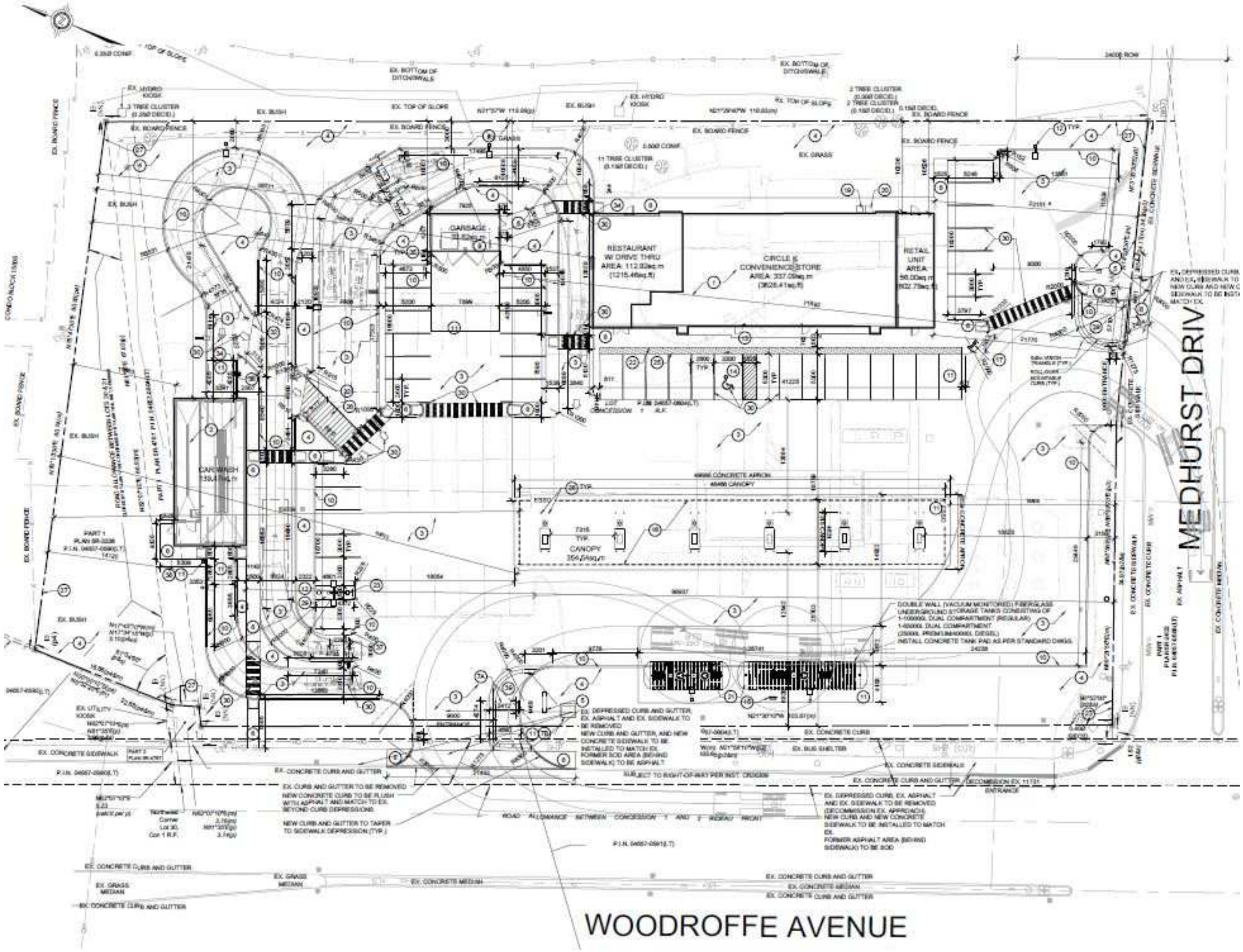


Figure 3 – Proposed Development

2. Sanitary Servicing

2.1. Sanitary Sewer System

Sanitary sewage outflow from the site is calculated using the current Engineering Design Criteria for the City of Ottawa. Sewage flows will be calculated based on use as a commercial site with an average design flow of 28,000 L/ha/day plus allowances for infiltration. Based on the site area of 0.82 hectares, the average estimated daily flow equates to 22,960 L/day or **0.27 l/s**.

In accordance with City Design Criteria, applying a peaking factor of 1.5, the peak sanitary discharge for the Circle-K site will be 1.5*0.27 l/s **= 0.41 l/s.** An infiltration allowance of 0.28 L/s/hectare will be required to be incorporated into the sanitary sewer discharge rate.

> *Therefore, the sanitary discharge rate = 0.41 litres/second + I/I (Site area) = (0.41 l/s) + (0.28 l/s/ha * 0.82 ha) = 0.64 litres/second.*

Estimated Car Wash Demand

A carwash is included in the proposed development which will discharge to the proposed sanitary sewer system on site. The sanitary discharge for the car wash is as follows:

- Carwash cycle water usage: Basic - 130 L, Full - 175 L, Premium - 290 L
- Average usage of 175 L / wash cycle
- Carwash cycle time: 2 minutes washing plus 2 minutes dry time = 4 minutes total

Therefore, peak carwash flow rate = 175 L per 4 minutes = 43.75 L/min or 0.73 litres/second

Peak Sanitary Demand

The total peak sanitary discharge is therefore 0.64 l/s + 0.73 l/s = **1.37 l/s**.

The sanitary sewage flow from the proposed Circle K site will discharge to the existing 300mm diameter PVC sanitary sewer main located within the Medhurst Drive ROW. Refer to Appendix D for the sanitary design sheet and drainage plan.

2.2. Sanitary Service Connection

Sewage flows from the building and the car wash facility will be collected in a series of 200mm diameter sewers and flow through the site, ultimately discharging by gravity to a proposed sampling sanitary manhole at the south frontage of Medhurst Drive. Due to the nature of the sewage, an oil and grease interceptor will be included prior to discharging flows from the restaurant portion of the building. The car wash facility also includes a water re-claim and treatment structure prior to discharging into the proposed sanitary system. The existing sanitary sewers, as well as the proposed sanitary sewer arrangement for the Circle K Development are shown on Drawing C-02 – Site Servicing Plan (see Appendix A).

2.3. Recommendations

The proposed sanitary sewage flows within the development will be conveyed via a series of 200mm diameter sewers, connecting to a proposed manhole located within the Medhurst Drive ROW immediately outside of the site. The proposed site is being reconstructed with similar facilities and functions as the existing site. Therefore, sanitary flows are expected to remain similar to the existing discharge from the site into the existing municipal sanitary sewer system. It is anticipated that the existing sanitary sewer will have adequate capacity to receive flows from the proposed development.

3. Water Distribution

3.1. Proposed Water Servicing System

Construction record drawings for the Medhurst Drive and Woodroffe Avenue area indicate that there is an existing 305 mm diameter watermain located along the frontage of the Medhurst Drive. There is also a 406 mm and a 1220 mm backbone watermain within the Woodroffe Avenue ROW. It is proposed that the site will be serviced via a new 100mm diameter water service for domestic flow, connected into the existing 305 mm diameter watermain on Medhurst Drive.

Car wash water consumption rate was calculated above as an average of 0.73 l/s. Water demands for the remainder of the proposed development were determined from the City of Ottawa Design Criteria, which recommends a water consumption for commercial uses as $28m^3$/ha/day.

Maximum daily demand and peak hour water demand estimates are based on the City's peaking factors of 1.5 and 1.8 respectively, for commercial use.

*Average daily water demand = (28 m^3/ha/day) * 0.82ha / 86400 *1000 = 0.27 litres/second*

Total Water Demand = 0.73 l/s (Car Wash) + 0.27 l/s (Domestic) = 1.0 l/s

*Maximum daily demand = (1.0 l/s) * (1.5) = 1.5 litres/second*

*Peak hour water demand = (1.5 l/s) * (1.8) =* ***2.7 litres/second***

A detailed Fire Flow calculation has been prepared using the recommendation for the Fire Underwriters Survey. The fire flow calculation indicates that the recommended fire flow for this proposed development will be **9,000 l/min (150 litres/sec).** Calculations for the required domestic and fire flow demand are provided in Appendix B.

The total water demand for the site is estimated as the maximum day water demand plus fire, resulting in a total demand of approximately (1.5 l/s + 150 l/s) **= 151.50 l/s** or (9,090 litres/min). Given the boundary condition results received on April 27, 2021 from Rubina Rasool (Refer to Appendix E), it is found the HGL at the connection to the 305mm watermain on Medhurst Drive ranges from 125.6m to 133.4m. Under the condition of Max Day use and Fire Flow, the HGL is 128.2m corresponding to 1,257.64 KPa which will suffice the pressure requirements outlined in Section 4.2.2.1, 4.2.2.2 and 4.2.2.3 of the City of Ottawa Water Design Guidelines with the proposed 150mm diameter water service for the subject site.

Currently, there is an existing fire hydrant located on the north side of Woodroffe Avenue adjacent the site for fire fighting purposes. A fire hydrant flow test has been conducted to confirm there is adequate pressure in the system for firefighting purposes. The hydrant test has been included in Appendix B and confirms there is a projected 29,045 l/min flow available at 140 kPa. In accordance with the City of Ottawa Water Design Guidelines Technical Bulletin ISTB 2018-02 Appendix I, a maximum contribution of 5,700 L/min from the existing fire hydrant is considered in meeting the fire flow demand. A new fire hydrant is proposed near the entrance at Medhurst Ave to provide an additional 5,700 L/min. The combined fire flow of 11,400 L/min provided by the existing and proposed fire hydrant will suffice the required fire flow demand of 9,000 L/min.

Refer to the Site Servicing Plan in Appendix A showing the extent of proposed water servicing to be installed.

3.2. Recommendations

The existing municipal watermain located within the Medhurst Drive ROW has enough capacity to support the proposed development for both domestic and fire flow purposes. There is adequate coverage from the existing fire hydrant and modifications or upgrades to the existing watermains located within the Medhurst and Woodroffe ROWs will not be required to support the proposed development.

4. Stormwater Management Analysis

Stormwater management design for this development was carried out in accordance with all applicable design standards including but not limited to:

- Ontario Ministry of the Environment - Stormwater Management Planning and Design Manual, March 2003
- Rideau Valley Conservation Authority (RVCA) Development Policies
- Pinecrest Creek/Westboro Area Subwatershed Study Area
- City of Ottawa Engineering Design Criteria, latest version

To design the facilities to meet these requirements, it is essential to select the appropriate modelling methodology for the storm system design. Due to the limited storage volume available within the minor sewer system for the site, an underground storage chamber will be essential to meet the stormwater quantity target and other requirements regarding the 100-yr HGL. The modified rational method is deemed inappropriate to accurately quantify the underground storage requirement. Thus, a model adopting Visual Otthymo 6.2 will be provided in the following section to support the stormwater management strategy for the development.

A portion of the north and northwest perimeter of the site will remain undisturbed, flowing uncontrolled to the west. The existing (0.043 ha) wooded area will remain, thus, will be omitted from the stormwater management analysis.

In the post-development condition, there are three uncontrolled areas EX1, EX2 and EX3 in which EX1 drains towards the Right-of-Way of Woodroffe Avenue, while EX2 and EX3 drain towards northeast property line and southeast property line respectively. It is noted that these uncontrolled areas are landscaping areas which follows the existing drainage pattern in the pre-development condition. The size of the uncontrolled areas have been reduced compared to the existing condition through the proposed grading practice, which will reduce the current uncontrolled flow to the Right-of-Way of Woodroffe Ave, Medhurst Dr and the existing swale along the northeast property line.

5.1. Allowable Release Rate

The existing 1050mm diameter storm sewer on Medhurst Drive has been designed to accommodate the stormwater flow from the subject site at a run-off co-efficient of 0.70.

There are multiple scenarios that must be considered for this site based on the information provided in the pre-consultation meeting with the City of Ottawa. The first is to limit the peak discharge to the more stringent of: (1a) the peak discharge from a 5-year storm considering a runoff coefficient of C=0.5 as per the City of Ottawa Design Guidelines, or (1b) 33.5L/s/ha as per the SWM Guidelines for the Pinecrest Creek / Westboro Area. The second scenario is to limit the peak discharge during the 25mm design storm such that the peak outflow does not exceed 5.8 L/s/ha as per the SWM Guidelines for the Pinecrest Creek / Westboro Area. This amounts to a peak discharge rate of 4.36 L/s during the 25mm design storm. Therefore, on-site stormwater detention is required to enable a controlled maximum discharge rate under the two scenarios.

Scenario #1

The allowable peak 5-year storm considering a runoff coefficient of C=0.5 is calculated using a model in VO 6.2 (Refer to Appendix C).

Scenario (1a)

Contributing Drainage Area = 0.751 ha

Runoff coefficient C = 0.50

Table 2: Allowable Release Rate

Storm Event (yr.)	Peak Flow (cms)
5	0.100

Scenario (1b)

33.5 L/s/ha x 0.751 ha = **25.16 L/s** in accordance with the SWM Guidelines for the Pinecrest Creek/Westboro Area.

Thus, the Pinecrest Creek / Westboro Area maximum discharge rate is the more stringent criteria and will be used to calculate maximum allowable site discharge rates.

Scenario #2

Based on the size of the site, the allowable storm discharge rate corresponds to a runoff of 5.8 L/s/ha x 0.751 ha = 4.36 L/s

A VO2 model has been prepared to analyze the stormwater management for the site. Refer to Appendix C for detailed output files.

5.2. Stormwater Quantity Management

As the development will change the site imperviousness, it is important to quantify this to determine the proposed storm runoff rates. Based on the post development surface conditions, the weighted runoff coefficient of the site is 0.762. Refer to Appendix C for detailed breakdown of the post-development run-off coefficient.

The development of this site would otherwise increase the rate of stormwater runoff, more than the allowable design flows as determined above. On-site quantity controls are required to protect the integrity of the surrounding areas. Storm water quantity will be controlled through an orifice tube located within the downstream end of the system to ensure that post development flows from the site will be controlled to the allowable release rate for storm events up to and including the 100-year storm event.

Stormwater Detention

Storage will be provided via underground pipe and manhole storage, as well as additional underground storage chambers to meet the volumes required per the findings of the quantity control analysis.

A total volume of 506 m^3 storage is required to meet post-development flows to allowable release rates (see Appendix C). The total volume available in the storm system including pipe and structures is approximately 72.80 m^3. Therefore, additional storage will be required elsewhere in the storm system. Table 6.3 below summarizes the available storage for this development. Detailed calculations are provided in Appendix C.

Table 3: Available Stormwater Storage without Additional storage measures

Pipe (m^3)	Catchbasin / Manholes (m^3)	Surface (m^3)	Total Storage (m^3)
52.30	20.50	-	**72.80**

As seen above, storage provided via pipe and storm structure storage was deemed to be insufficient to meet the storage volumes required per the findings of the quantity control analysis. Further, it is not recommended to provide surface storage due to site uses, and potential for stormwater contamination from fuel spills. Therefore, an underground storage system will be necessary to provide quantity control storage volume. Two options were explored including the use of oversized pipes and storage chambers. It was determined that the use of sub-surface storage chambers was more cost effective than the oversized pipe option, thus the use of sub-storage chambers was selected as the preferred underground storage option.

A subsurface stormwater storage system (i.e., Stormtech underground storage chambers) has been specified to provide overall site stormwater quantity control volume. The proposed Stormtech stormwater storage systems will provide a total storage volume of 440 m^3. Refer to Appendix C for Stormtech Storage Calculations. The layout of Stormtech subsurface stormwater detention facility is shown on the Site Servicing Plan, Drawing C02.

Outlet Control

The preferred method for restricting the stormwater discharge from the site into the storm system is through the installation of an inlet control device (ICD). It has been considered to adopt a typical orifice plate which is designed to release the specified flow of stormwater under the hydraulic head conditions present, based upon the formula:

$A = Q / [c \sqrt{} (2 g h)]$

Where:
A = Orifice Area (m^2)
Q = Allowable discharge (m^3)
c = 0.62 (orifice plate coefficient)
g = Gravitational Constant = 9.81 m/s^2
h = Height of water over the center of orifice (m)

The diameter of the orifice plate is calculated as 40mm which can potentially get plugged by debris. It is proposed to use a substitutional product Tempest LMF63 Flow Regulator by Ipex (Refer to Appendix F) which shares an equivalent rating curve with an orifice plate of 40mm diameter.

The post-development flows will be restricted by the Flow Regulator and released to the allowable discharge rates for all storm events. The controlled flow restriction will affect the required ponding of stormwater for on-site detention. Refer to Table 4 for required storage, as well as demonstration that post-development flows will be restricted to the allowable rate for all storm events up to the 100-year event. Based on the required storage provided in the VO model analysis, the corresponding water level elevation is found by tracing the corresponding elevations of the required storage volume on the rating curve. The Flow Regulator is proposed to be located dowmstream of MH2, as shown on Site Servicing Plan, drawing C-02 (Appendix A).

For the storm event of 25mm 4hr Chicago storm, the peak flow from the controlled areas is found at 0.003 cms at the time of 4.00 hrs with a used storage volume of 120 m^3. The corresponding water level elevation is calculated as 85.00 m while the invert of Flow Regulator is proposed to be 84.43 m. Since it has been demonstrated that the proposed Flow Regulator LMT63 has a similar rating curve to an 40mm diameter orifice plate, the release rate is calculated by substituting the water head and the area of 0.00126 m^2 (i.e. 40mm dia. orifice plate) into the equation $A = Q / [c \sqrt{} (2 g h)]$. The release rate is calculated as 2.56 L/s which corresponds to the outcome of the VO model of 0.003 cms.

For the storm event of 100-yr 3hr Chicago storm, the peak flow from the controlled areas is found at 0.005 cms at the time of 3.00 hrs with a used storage volume of 414 m^3. The water level elevation is calculated as 86.39 m. By substituting the water head and the area of 0.00126 m^3 into the equation $A = Q / [c \sqrt{} (2 g h)]$, the release rate is calculated as 4.81 L/s which is closed to the VO model outcome of 0.005 cms.

Table 4: Post-Development Controlled Peak Flow and Storage

Storm Event (yr.)	Allowable Release Rate (cms)	Controlled Peak Flow (cms)	Storage Required (m^3)	Water Level (m)	Storage Available (m^3)
25mm	0.00436	0.004	120	85.00	512.80
2	0.02516	0.006	165	85.22	
5		0.008	230	85.52	
100		0.019	414	86.39	
100 + 20%		0.023	506	87.39	

For detailed calculations see Appendix C.

Stormwater Detention Water Level

As noted in Technical Bulletin PIEDTB-2016-01, the hydraulic grade line in the storm sewer is to remain at least 0.3m below the underside of the adjacent building footing during the 100-yr storm event and also to remain below the underside of footing of the adjacent building during the stress test event (100-yr plus 20%). Thus, analyses were conducted using VO 6.2 under the two events 1) 100-yr storm and 2) stress test event (100-yr plus 20%). It is observed the water level during the 100-yr storm event is 86.39 which is 0.3m below the Car Wash USF elevation of 88.03. Also, the water level during the stress test event (100-yr plus 20%) is found of 87.39 which is lower than the USF elevations of the proposed car wash building and the convenience store.

Table 5: Post-Development Required Storage and Water Level

Storm Event (yr.)	Required Storage (m^3)	Water Level Elevation (m)	Car Wash USF Elevation (m)	C-Store USF Elevation (m)
100	414	86.39	88.03	88.06
100 + 20%	506	87.39		

5.3. Stormwater Quality Management

The stormwater quality control for the development will adhere to the Rideau Valley Conservation Authority stormwater management criteria. This target is achieved through the proposed stormwater management system.

The design of the onsite storm sewer drainage system will incorporate a stormwater quality treatment unit. Sizing calculations confirms that a model Stormceptor EF06 will provide 85% long-term TSS removal efficiency with 90% of the average annual runoff treated. The Stormceptor sizing is based on a 0.751 ha drainage area with runoff coefficient 0.761. The Stormceptor will be installed at the location shown on the Site Servicing Plan, drawing C-02, downstream of manhole MH2.

Refer to Appendix C for sizing calculation of the Stormceptor oil/grit separator model EF06.

Additionally, the Low Impact Development (L.I.D) feature in the form of “Enhanced Grass Swales” in the landscape areas will be included in the system to maximize the natural infiltration and retention of rainwater through site development and further enhance stormwater quality. Further LID features, such as infiltration trenches, permeable pavers or rainwater harvesting have been considered, however due to the site use would not be appropriate in this case given the potential for groundwater contamination.

5.4. Storm Conveyance

The subject site currently drains to existing 1050 diameter concrete storm sewer on Medhurst Drive. All outflow from the site will be directed via perimeter swales, catchbasins and roof drains and outlet south of the site utilizing the same receiving municipal sewer. There will be small areas around the perimeter of the site to drain uncontrolled to the municipal ROW to accommodate the proposed development.

The proposed grading will maintain the existing drainage patterns as much as possible to avoid drainage diversion. As shown in the site grading and site servicing drawings (Appendix A) this site has been designed to integrate both minor and major storm systems. The overall site grading ensures that the existing drainage pattern on adjacent properties have not been altered and stormwater runoff from the subject development has been self-contained.

Minor System: Storm Sewer

The site has been graded to contain the stormwater from the site, and to direct it through a series of catchbasins located throughout the site and roof water leaders on the building. These catchbasins and roof drains flow into an underground storm sewer system (minor system). The underground storm sewer has been designed to accommodate the 10-year peak storm event based on City of Ottawa Intensity Duration Frequency (IDF) curve with Time of Concentration of (Tc) 10 minutes, using Rational Method. Storm sewer sizing and gradients will maintain a minimum velocity of 0.9 m/sec and maximum 4.0 m/sec. The detailed design of the minor system is provided in Storm Design Sheet in Appendix C.

Major System: Overland Flow

In the event of a major storm, defined as storms larger than the 2-year event and up to the 100-year event, the outlet control provided in the system in the form of an orifice tube will utilize the available storm sewer infrastructure by allowing the system to back up, thus providing the required storage. Outlet controls in the sewer system are designed to restrict the post-development flows exiting from the system to an allowable release rate and effectively restrict the flows by detaining the water in the system to release it at an allowable release rate and will not have any impact on downstream overland flow capacity.

The controlled release rates of stormwater are directed to a Stormceptor to ensure that runoff from the site is treated to RVCA water quality requirements before it is released from the site.

In events larger than the 100-year return storm, the site has been graded to include an overland flow route. This route allows the stormwater to overtop the local highpoints and flow overland and off-site to Woodroffe Avenue, consistent with the existing overland flow route.

The major overland flow routes are shown on the Site Grading Plan, drawing C-01, in Appendix A.

5.5. Erosion Control

As this development requires site grading and excavation, there will be a potential for soil erosion and off-site release of sediment during the construction phase. Sediment Control in accordance with the City and CA standards are to be implemented during construction to ensure the quality of stormwater runoff during construction. It is essential that effective environmental and sedimentation controls be in place and maintained throughout the site during all construction activities. It is recommended that the following be implemented on a temporary basis to assist in achieving acceptable runoff quality during construction. Refer to Appendix A for Erosion and Sediment Control Plan Drawing C03.

- Installation and maintenance of silt fences around the entire perimeter of the site for the duration of the construction period.

- Provision of a mud mat construction entrance to control the tracking of sediment and debris onto adjacent streets.
- Installation and maintenance of catchbasin sediment barriers throughout the site and during all construction activities to reduce and trap sediment on site. Constant attention will be paid to maintaining them silt free. All catchbasin grates shall be covered with geo-textile filter fabric during the period of construction of the proposed works.
- Reduce stormwater drainage velocities where possible.
- All topsoil stockpiles to be surrounded with sediment control fencing.

To ensure the functionality of the erosion and sediment control measures, inspection and maintenance of the systems shall be performed on a weekly basis and after every rainfall event during construction. The sediment and erosion control measures shall not be removed until final asphalt paving and/or sodding are complete.

5.6. Water Balance

The water balance target for the development is to retain the first 10mm runoff through infiltration, evapotranspiration, and rainwater reuse as per RVCA's requirements. Various Low Impact Development (LID) measures were considered. The required water balance volume for the development area is 82.0 m^3. Due to the nature of the site, it is not recommended to provide any infiltration or other similar LID measures. However, landscape areas will provide some additional water balance benefit. Although the post-development water balance target has not been achieved across the entire site, the water balance will not significantly change from the pre-development conditions.

5. Utilities

The proposed development is located within a serviced area of the City of Ottawa with Gas, Hydro and Bell infrastructure existing within the adjacent municipal road allowances. During the detailed engineering design stage, consultation with each of the utilities will be necessary to provide the utilities with specific load requirements for the development and proposed service entry locations. This will allow each utility to assess if any upgrading of their distribution system in the area is required.

6. Conclusions

Grading, Drainage and Stormwater Management

The site will be graded in accordance with the appropriate design criteria and all surface runoff from the site will be directed to the underground stormwater management system. Provisions for an emergency overland flow route will be incorporated into the design and allow stormwater runoff to discharge from the site safely and appropriately.

Water Servicing

The provision of domestic and fire protection to the proposed development can be accomplished satisfactorily. It is proposed that the development be serviced off the existing 305mm diameter watermain located within the Medhurst Drive ROW. A 100mm water service connection will be tapped off the existing 305mm diameter watermain. The water service connection would enter the meter room of the C-store building.

Sanitary Servicing

Sanitary Servicing for the proposed development can be accomplished satisfactorily. The proposed sanitary sewage flows within the development will be conveyed via a series of 200mm diameter sewers connecting to a new manhole within the Medhurst Drive ROW immediately south of the site. Sanitary discharge will flow by gravity into the municipal sewer.

Utilities

Utilities can be provided satisfactorily. Hydro, communications, and gas infrastructure will be available adjacent to the property for connection from the municipal road right of way. Consultation with each of the utilities is underway to provide the utilities with specific load requirements for the development and proposed service connection points. This will allow each utility to assess if any upgrading of their distribution system in the area is required.

Sincerely,
EXP Services Inc

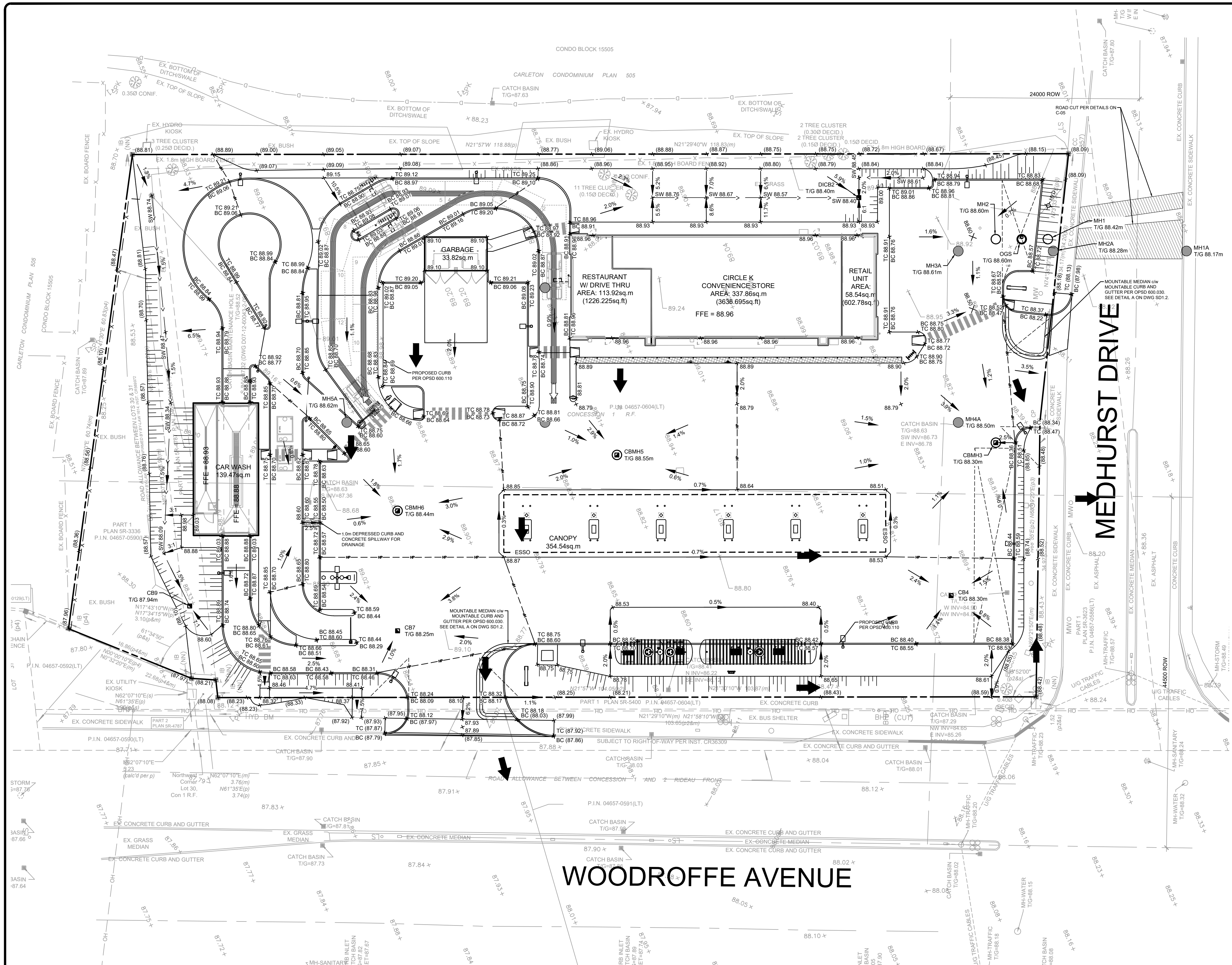
Jordan Stern, P.Eng.
Project Engineer

Crystal Frazao
Project Manager

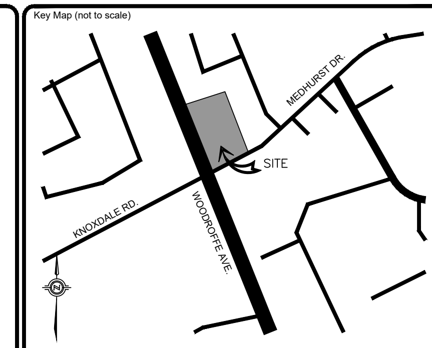
Appendix A – C-01, Site Grading Plan

C-02, Site Servicing Plan

C-03, Erosion and Sediment Control Plan



Key Map (not to scale)



LEGEND:

- IRON BAR
- BENCHMARK
- EX. FIRE HYDRANT
- EX. LIGHT POLE
- EX. LIGHT STANDARD
- EX. STORM MH
- EX. SANITARY MH
- EX. STORM CB
- EX. WATER VALVE
- EX. VALVE CHAMBER
- EX. BELL & HYDRO POLE
- EX. GUY WIRE AND ANCHOR
- EX. TRAFFIC SIGNAL
- EX. GAS VALVE
- EX. SIGN
- EX. TREE
- SUBJECT PROPERTY
- PROPERTY LINE
- EX. CONC. CURB
- EX. CENTERLINE OF DITCH
- EX. ROAD CENTERLINE
- EX. FENCE
- EX.CONTOUR
- NEW YARD LIGHT
- NEW STORM MH
- NEW SANITARY MH
- NEW STORM CB
- NEW STORM CBMH
- NEW CONC. CURB
- NEW CURB CUT/DEPRESSED CURB
- FIRE ROUTE SIGN
- NEW 1.8M HIGH WOOD FENCE
- ×100.00 EX. ELEVATION
- ×(100.00) EX. ELEVATION TO REMAIN
- ×100.00 NEW ELEVATION
- 2.0% NEW SLOPE
- MAX 3:1 SLOPING
- NEW SWALE
- OVERLAND FLOW

No.	REVISIONS	Date	By	App
E	RE-ISSUED FOR SPA	DEC 03 2021	ML	J.S
D	RE-ISSUED FOR SPA	SEPT 24 2021	ML	J.S
C	ISSUED FOR COORDINATION	AUG 18 2021	ML	J.S
B	ISSUED FOR SPA	APR 27 2021	LMB	J.S
A	ISSUED FOR COORDINATION	APR 21 2021	LMB	J.S

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Owner/Client:

CIRCLE K

Location:

1545 WOODROFFE AVE.
OTTAWA, ON

Title:

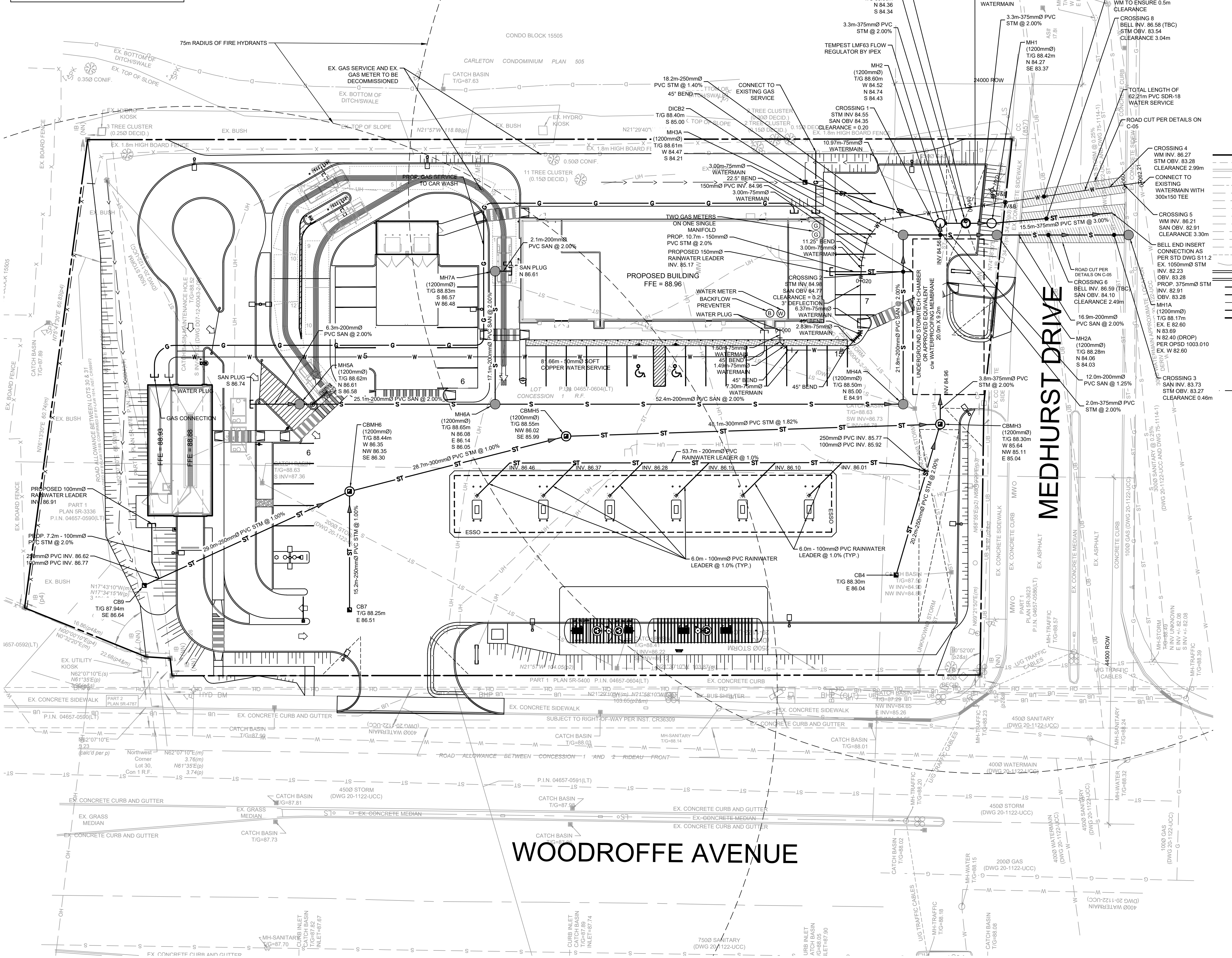
GRADING PLAN

Designed By: LMB	Drawn By: L.M.B	Checked By: J.S.
Scale: 1:250	Date: APRIL 2020	City Drawing No.:
Project No.: BRM00606364-B0		Drawing No.: C01

CITY # D07-12-21-0056

CITY DWG. # 17094

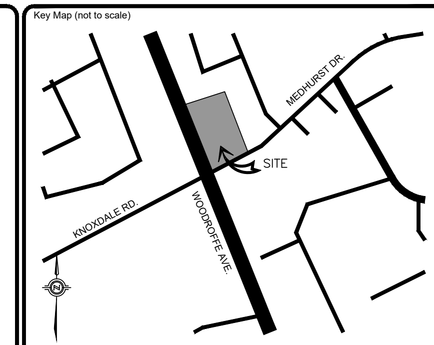
NOTE
ALL EXISTING UNDERGROUND INFRASTRUCTURE LOCATED WITHIN THE SITE BOUNDARY TO BE REMOVED. ALL EXISTING STORM, SANITARY AND WATERMAIN SERVICE CONNECTIONS TO BE CAPPED AT THE PROPERTY TO THE SATISFACTION OF THE CITY OF OTTAWA.



LEGEND:

	IRON BAR
BM	BENCHMARK
HYD	EX. FIRE HYDRANT
	EX. LIGHT POLE
LS	EX. LIGHT STANDARD
	EX. STORM MH
	EX. SANITARY MH
	EX. STORM CB
WV	EX. WATER VALVE
VC	EX. VALVE CHAMBER
BHP	EX. BELL & HYDRO POLE
	EX. GUY WIRE AND ANCHOR
	EX. TRAFFIC SIGNAL
	EX. GAS VALVE
	EX. SIGN
	EX. TREE
	SUBJECT PROPERTY
	PROPERTY LINE
	EX. CONC. CURB
	EX. CENTERLINE OF DITCH
	EX. ROAD CENTERLINE
X	EX. FENCE
ST	EX. STORM SEWER
S	EX. SANITARY SEWER
W	EX. WATER MAINS
G	EX. NATURAL GAS
OH	EX. OVERHEAD HYDRO
UH	EX. UNDERGROUND HYDRO
UB	EX. UNDERGROUND BELL
	EX. TRAFFIC CABLES
10.0m	EX.CONTOUR
	NEW CONC. CURB
	NEW CURB CUT/DEPRESSED CURB
ST	NEW STORM SEWER
S	NEW SANITARY SEWER
W	NEW WATERMAIN
G	NEW NATURAL GAS
UH	NEW UNDERGROUND HYDRO
W	NEW WATER METER
G	NEW GAS METER
	NEW YARD LIGHT
	NEW STORM MH
	NEW SANITARY MH
	NEW STORM CB
	NEW STORM CBMH
	FIRE ROUTE SIGN
X	NEW 1.8m HIGH WOOD F

Key Map (not to scale)



No.	REVISIONS	Date	By	App
E	RE-ISSUED FOR SPA	DEC 03 2021	ML	J.S
D	RE-ISSUED FOR SPA	SEPT 24 2021	ML	J.S
C	ISSUED FOR COORDINATION	AUG 18 2021	ML	J.S
B	ISSUED FOR SPA	APR 27 2021	LMB	J.S
A	ISSUED FOR COORDINATION	APR 22 2021	LMB	J.S

LICENSED PROFESSIONAL ENGINEER
J. D. STERN
100232894
Dec. 8/2021
PROVINCE OF ONTARIO

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Brampton, ON L6T 4V1
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exp.

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• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

Owner/Client:

CIRCLE K

Location:

1545 WOODROFFE AVE.
OTTAWA, ON

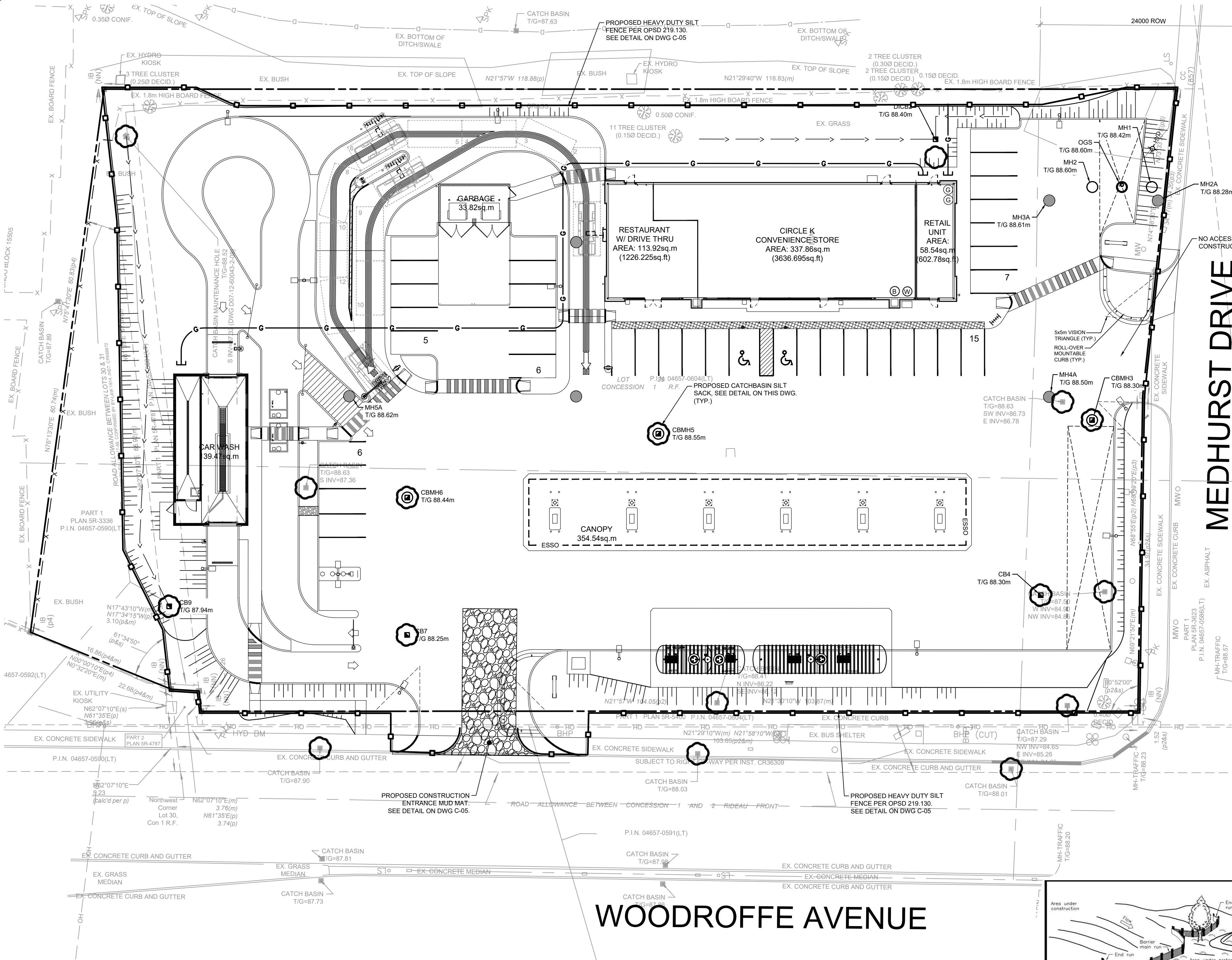
Title:

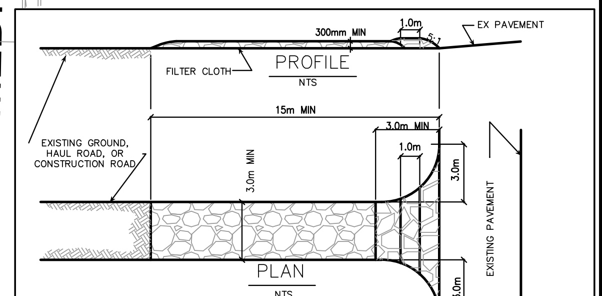
SERVICING PLAN

Designed By:	LMB	Drawn By:	L.M.B	Checked By:	J.S.
Scale:	1:250	Date:	APRIL 2020	City Drawing No.:	
Project No.:	BRM00606364-B0			Drawing No.:	C02

CITY DWG. # 17094

CITY # D07-12-21-0056





STONE SIZE – USE CLEAR CRUSHED 200mm STONE, RIP RAP, CRUSHED CONCRETE OR STEEL GRATING AS APPROVED BY THE MUNICIPALITY

LENGTH – AS REQUIRED, BUT NOT LESS THAN 15m

THICKNESS – NOT LESS THAN 300mm.

WIDTH – 3m MINIMUM, BUT NOT LESS THAN THE WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURES.

FILTER CLOTH – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING STONE.

MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PRIVATELY OWNED LANDS AND PUBLIC RIGHT–OF–WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PRIVATELY OWNED LANDS AND PUBLIC RIGHT–OF WAY WAY MUST BE REMOVED IMMEDIATELY.

WASHING – WHEELS SHALL BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTRANCE ONTO PUBLIC RIGHT–OF–WAY AND PRIVATELY OWNED LANDS. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.

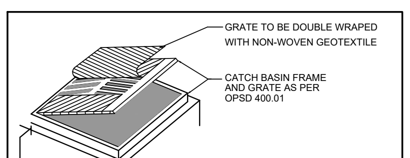
PERIODIC INSPECTION AND NEEDED MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

STONE MUD MAT DETAIL (TYP)

N.T.S.

EROSION AND SEDIMENT CONTROL NOTES:

1. CONTRACTOR TO INSTALL EROSION CONTROL MEASURES AS SHOWN PRIOR TO REMOVAL OF TEMPORARY ESC POND AND TEMPORARY DRAINAGE DITCHES AND MAINTAIN IN GOOD CONDITION UNTIL CONSTRUCTION IS COMPLETED AND VEGETATIVE COVER IS ESTABLISHED.
2. ALL SILT FENCING TO BE INSTALLED PRIOR TO ANY AREA GRADING, EXCAVATING OR DEMOLITION COMMENCING.
3. EROSION CONTROL FENCING TO BE INSTALLED AROUND BASE OF ALL STOCKPILES.
4. EROSION PROTECTION TO BE PROVIDED AROUND ALL STORM CBs and CBMHs. ENSURE POSITIVE DRAINAGE TOWARDS NEW CBs and CBMHs.
5. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS THE PROJECT PROGRESSES. CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRICTURES.
6. EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RE-STABILIZED.
7. NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE ENGINEER AND THE CITY OF OTTAWA.
8. CONTRACTOR TO CLEAN ROADWAY AND SIDEWALKS OF SEDIMENTS RESULTING FROM CONSTRUCTION TRAFFIC FROM THE SITE EACH DAY.
9. CONTRACTOR MUST REMOVE EROSION AND SEDIMENTATION FENCING PRIOR TO COMPLETION OF PROJECT. CONTRACTOR TO HAVE EROSION AND SEDIMENTATION FENCE INSPECTED WHEN VEGETATION HAS ESTABLISHED, BUT PRIOR TO FENCE BECOMING OVERGROWN. ENGINEER'S REPRESENTATIVE TO DETERMINE IF VEGETATION HAS REACHED THE CRITICAL POINT AND WILL THEN INSTRUCT CONTRACTOR TO REMOVE FENCE.
10. CONTRACTOR SHALL BE RESPONSIBLE FOR DUST CONTROL AND HAVE APPROPRIATE EQUIPMENT ON THE SITE TO IMPLEMENT DUST CONTROL MEASURES AT THE DISCRETION OF THE CITY OF OTTAWA.

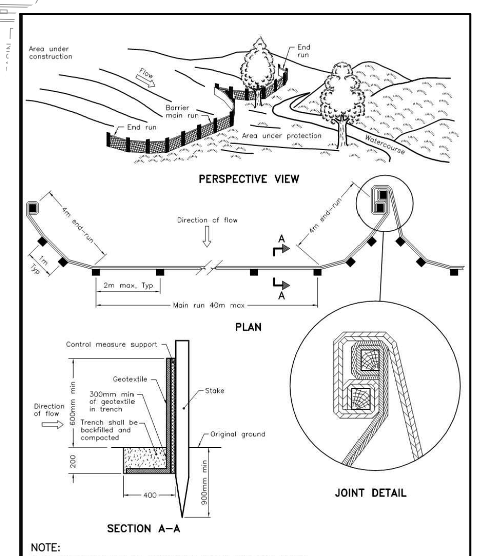


NOTES:

1. NON-WOVEN GEOTEXTILE TO HAVE A MINIMUM EQUIVALENT OPENING SIZE OF 0.15mm AND A MAXIMUM EQUIVALENT OPENING SIZE OF 0.25mm.
2. NON-WOVEN GEOTEXTILE TO BE REPLACED PERIODICALLY WHEN ACCUMULATED SEDIMENTS INTERFERES WITH DRAINAGE.

SILT TRAP DETAIL FOR CATCHBASINS

N.T.S.



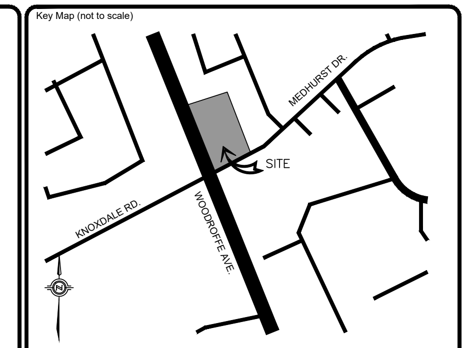
NOTE:
A All dimensions are in millimetres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING | Nov 2015 | Rev 2

HEAVY–DUTY SILT FENCE BARRIER

OPSD 219.130

Key Map (not to scale)



LEGEND:

- IRON BAR
- BENCHMARK
- EX. FIRE HYDRANT
- EX. LIGHT POLE
- EX. LIGHT STANDARD
- EX. STORM MH
- EX. SANITARY MH
- EX. STORM CB
- EX. WATER VALVE
- EX. VALVE CHAMBER
- EX. BELL & HYDRO POLE
- EX. GUY WIRE AND ANCHOR
- EX. TRAFFIC SIGNAL
- EX. GAS VALVE
- EX. SIGN
- EX. TREE
- SUBJECT PROPERTY
- PROPERTY LINE
- EX. CONC. CURB
- EX. CENTERLINE OF DITCH
- EX. ROAD CENTERLINE
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- NEW YARD LIGHT
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- NEW SANITARY MH
- NEW STORM CB
- NEW STORM CBMH
- NEW CONC. CURB
- NEW CURB CUT/DEPRESSED CURB
- FIRE ROUTE SIGN
- NEW 1.8m HIGH WOOD FENCE
- SILT SACK
- MUD MAT
- SILT FENCE

No.	REVISIONS	Date	By	App
E	RE-ISSUED FOR SPA	DEC 03 2021	ML	J.S
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Owner/Client:

CIRCLE K

Location:

1545 WOODROFFE AVE.
OTTAWA, ON

Title:

EROSION AND SEDIMENT CONTROL PLAN

Designed By: LMB | Drawn By: L.M.B | Checked By: J.S.

Scale: 1:250 | Date: APRIL 2020 | City Drawing No.:

Project No.: BRM00606364-B0 | Drawing No.: C03

CITY # D07-12-21-0056

CITY DWG. # 17094

Appendix B – Firefighting Water Design Calculations

Project Number: 606364-B0
Date: April 22, 2021
Preapared By: Jordan Stern, P.Eng.
Reviewed By: William Grandy, P.Eng

Circle-K Nepean
1545 Woodroffe Avenue, City of Ottawa

FIRE UNDERWRITERS SURVEY FIRE FLOW CALCULATIONS

$$F = 220C\sqrt{A}$$

F = the required fire flow in litres per minute

C = Coefficient related to the type of construction

A = the total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building considered

C Values

1.5 = wood frame construction (structure essentially all combustible)

1.0 = ordinary construction (brick or other masonry walls, combustible floor and interior)

0.8 = non-combustible construction (unprotected metal structural components, masonry or metal walls)

0.6 = fire resistive construction (fully protected frame, floors, roof)

Area ID	A (sq.m)	C	F (L/min)*	Occupancy Adjustment	F (adjusted)	Automatic Sprinkler Adjustment (%)	Exposure Increase (%)	F (final) (L/min)*
Proposed Building (Car Wash)	140.00	1.0	3000	25%	3750	0%	15%	4000
Proposed Building (C-Store)	640.00	1.0	6000	25%	7500	0%	15%	9000

Maximum Fire Flow Rate Req'd =	9000

*rounded to the nearest 1,000 L/min per the Fire Underwriters Survey procedure guidelines

LHS INC.

P.O. Box 712 Cobourg ON K9A 4R5
905-377-0715 / 1-866-622-4022
Email: info@lhsinc.com

Client	EXP Services Inc 1595 Clark Boulevard Brampton	**Site**	1545 Woodroffe Ave
		Site Contact **Phone**	

FIRE FLOW TEST

Fire Flow Date	**August 13, 2021 - 1:53 pm**
Site	**1545 Woodroffe Ave**
Static Hydrant	**Corner of Woodroffe at Medhurst**
Flow Hydrant	**1545 Woodroffe Ave**

Hydrant Colours

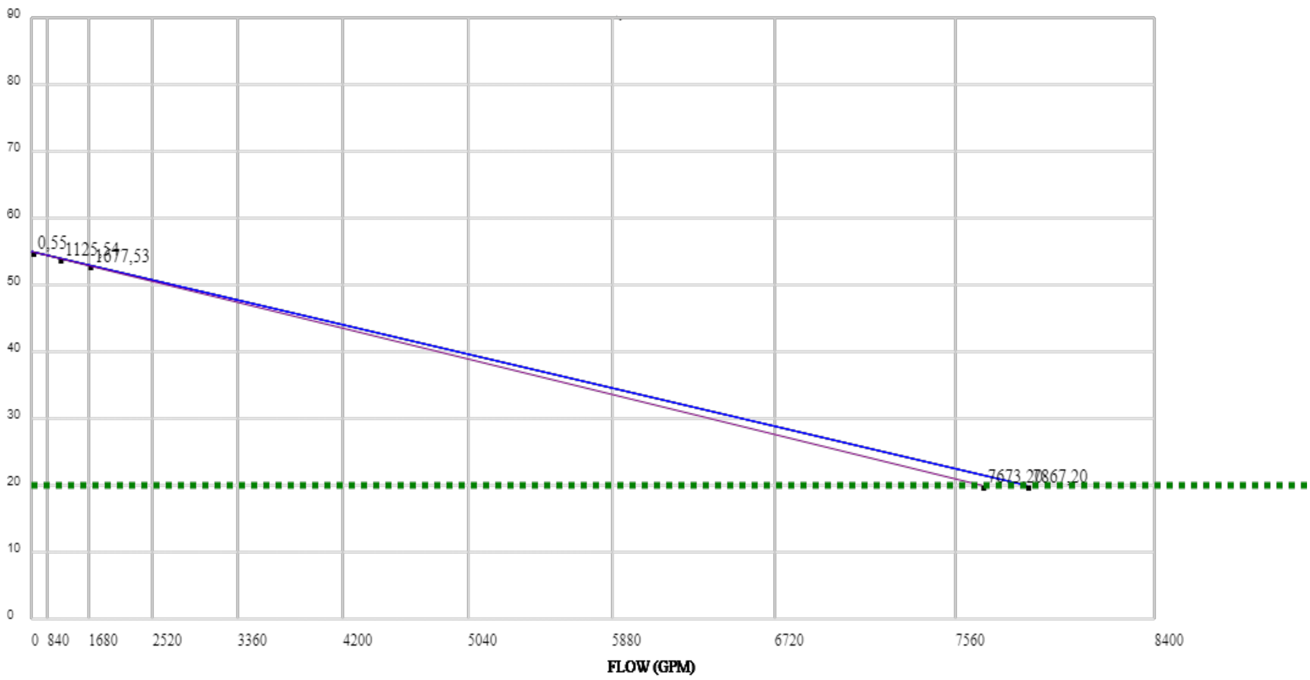
RED - C	0-500
ORANGE - B	500-1000
GREEN - A	1000-1500
BLUE - AA	>1500

Single Port

Static	55 psi
Residual 1	54 psi
Flow	45 psi
Observed	**1125 US GPM** 937 IMP GPM 4259 L / MIN
Projected @ 20psi	**7673 US GPM** 6389 IMP GPM 29045 l/min.

Two Port

Static	55 psi
Residual 2	53 psi
Flow 2 (x2)	25 psi
Observed	**1677 US GPM** 1397IMP GPM 6349 L / MIN
Projected @ 20psi	**7867 US GPM** 6551 IMP GPM 29780 l/min.



Appendix C – Stormwater Management Design Calculations

Available Storage

Water Level	AVAILABLE STORAGE					
	Pipe	Catch Basins	CBMH	Surface	Cultec	Total
(m)	(m3)	(m3)	(m3)		(m3)	(m3)
84.43	0.00	0.00	0.00		0.00	0.00
84.58	3.74	0.00	0.17		27.50	31.41
84.73	7.47	0.00	0.34		55.00	62.81
84.88	11.21	0.00	0.51		82.50	94.22
85.03	14.94	0.00	0.71		110.00	125.66
85.18	18.68	0.00	1.21		137.50	157.39
85.33	22.41	0.00	1.72		165.00	189.13
85.48	26.15	0.00	2.23		192.50	220.88
85.63	29.89	0.03	2.74		220.00	252.65
85.78	33.62	0.08	3.25		247.50	284.45
85.93	37.36	0.13	3.75		275.00	316.25
86.08	41.09	0.19	4.37		302.50	348.15
86.23	44.83	0.24	5.11		330.00	380.18
86.38	48.56	0.30	5.96		357.50	412.33
86.53	52.30	0.49	6.81		385.00	444.60
86.68	52.30	0.76	7.66		412.50	473.22
86.83	52.30	1.03	8.50		440.00	501.84
86.98	52.30	1.30	9.35		440.00	502.96
87.13	52.30	1.57	10.20		440.00	504.07
87.28	52.30	1.84	11.05		440.00	505.19
87.43	52.30	2.11	11.90		440.00	506.31
87.58	52.30	2.38	12.75		440.00	507.43
87.73	52.30	2.65	13.59		440.00	508.55
87.88	52.30	2.92	14.44		440.00	509.67
87.98	52.30	3.10	15.01		440.00	510.41
88.10	52.30	3.32	15.69		440.00	511.31
88.13	52.30	3.37	15.86		440.00	511.53
88.18	52.30	3.46	16.14		440.00	511.90
88.22	52.30	3.54	16.37		440.00	512.20
88.30	52.30	3.68	16.82	0.00	440.00	512.80

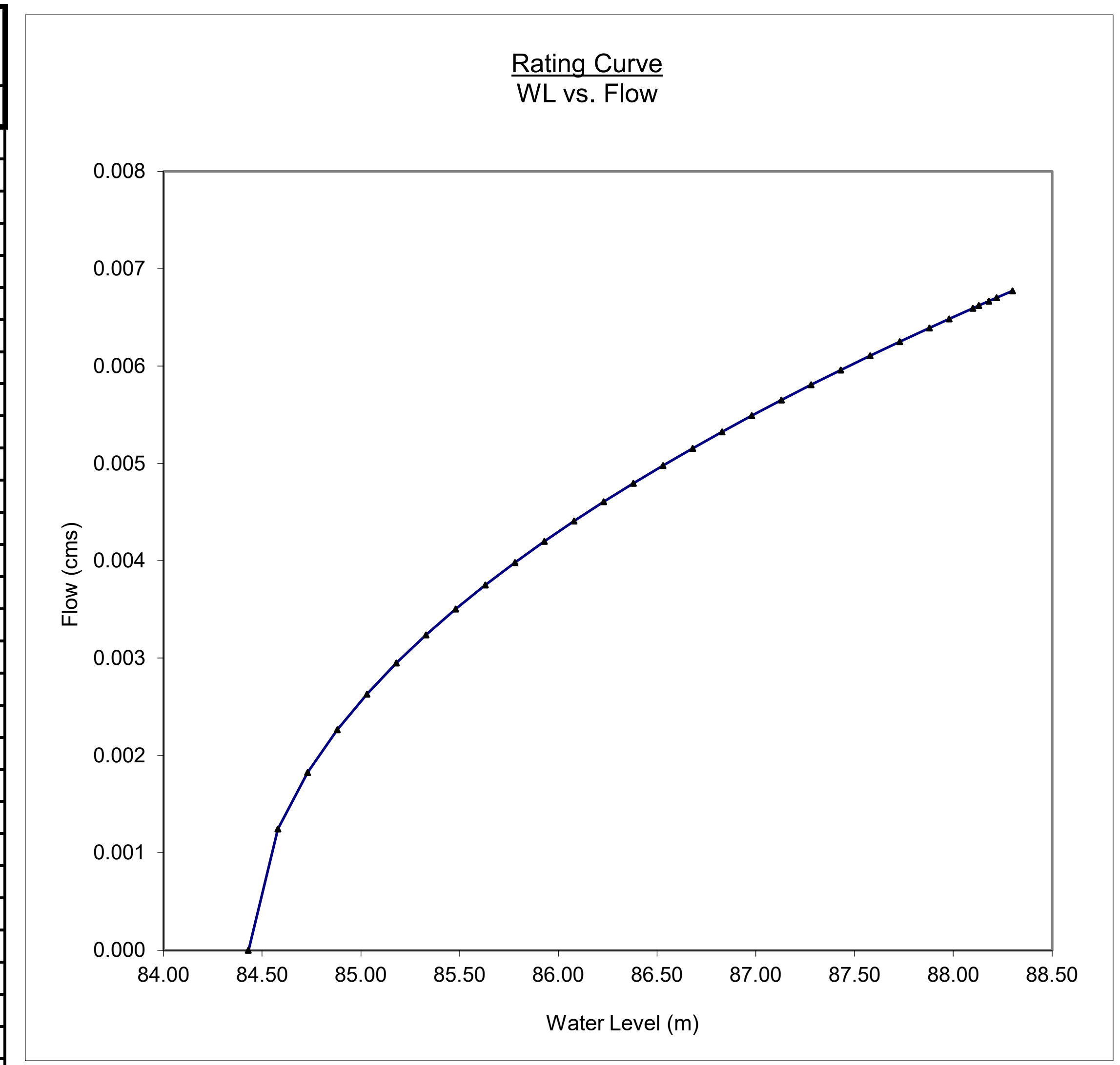
PROJECT NO. : BRM-00606364-B0
PROJECT NAME. : Circle K - Nepean
Date: August, 2021

CALCULATION Sheet : 2

Orifice Coefficient =	0.62	
Invert =	84.43	m
Orifice Plate =	40	mm

Water Level (m)	AVAILABLE STORAGE Pipe (m3)	Catch Basins (m3)	CBMH (m3)	Surface (m3)	Cultec (m3)	Total (m3)
84.43	0.00	0.00	0.00	0.00	0.00	0.00
84.58	3.74	0.00	0.17	0.00	27.50	31.41
84.73	7.47	0.00	0.34	0.00	55.00	62.81
84.88	11.21	0.00	0.51	0.00	82.50	94.22
85.03	14.94	0.00	0.71	0.00	110.00	125.66
85.18	18.68	0.00	1.21	0.00	137.50	157.39
85.33	22.41	0.00	1.72	0.00	165.00	189.13
85.48	26.15	0.00	2.23	0.00	192.50	220.88
85.63	29.89	0.03	2.74	0.00	220.00	252.65
85.78	33.62	0.08	3.25	0.00	247.50	284.45
85.93	37.36	0.13	3.75	0.00	275.00	316.25
86.08	41.09	0.19	4.37	0.00	302.50	348.15
86.23	44.83	0.24	5.11	0.00	330.00	380.18
86.38	48.56	0.30	5.96	0.00	357.50	412.33
86.53	52.30	0.49	6.81	0.00	385.00	444.60
86.68	52.30	0.76	7.66	0.00	412.50	473.22
86.83	52.30	1.03	8.50	0.00	440.00	501.84
86.98	52.30	1.30	9.35	0.00	440.00	502.96
87.13	52.30	1.57	10.20	0.00	440.00	504.07
87.28	52.30	1.84	11.05	0.00	440.00	505.19
87.43	52.30	2.11	11.90	0.00	440.00	506.31
87.58	52.30	2.38	12.75	0.00	440.00	507.43
87.73	52.30	2.65	13.59	0.00	440.00	508.55
87.88	52.30	2.92	14.44	0.00	440.00	509.67
87.98	52.30	3.10	15.01	0.00	440.00	510.41
88.10	52.30	3.32	15.69	0.00	440.00	511.31
88.13	52.30	3.37	15.86	0.00	440.00	511.53
88.18	52.30	3.46	16.14	0.00	440.00	511.90
88.22	52.30	3.54	16.37	0.00	440.00	512.20
88.30	52.30	3.68	16.82	0.00	440.00	512.80

Water Level (m)	Flow Through Orifice (cms)
84.43	0.000
84.58	0.001
84.73	0.002
84.88	0.002
85.03	0.003
85.18	0.003
85.33	0.003
85.48	0.004
85.63	0.004
85.78	0.004
85.93	0.004
86.08	0.004
86.23	0.005
86.38	0.005
86.53	0.005
86.68	0.005
86.83	0.005
86.98	0.005
87.13	0.006
87.28	0.006
87.43	0.006
87.58	0.006
87.73	0.006
87.88	0.006
87.98	0.006
88.10	0.007
88.13	0.007
88.18	0.007
88.22	0.007
88.30	0.007



PRE-DEVELOPMENT 5-YR STORM (C=0.5)

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===========================================================================================
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       V    V   I    SSSSS  U   U    A    L              (v 6.2.2005)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
```

Developed and Distributed by Smart City Water Inc


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                   *****  D E T A I L E D   O U T P U T *****


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DATE: 12/08/2021                           TIME: 05:08:03

USER:



COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------------------
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  ************************************************
  ** SIMULATION : 5-yr                          **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 998.071
| Ptotal= 42.51 mm |                          B=   6.053
--------------------                          C=   0.814
```

used in: INTENSITY = A / (t + B)^C

Duration of storm = 3.00 hrs
Storm time step = 10.00 min
Time to peak ratio = 0.33

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.17	3.68	1.00	104.19	1.83	6.69	2.67	3.51
0.33	4.58	1.17	32.04	2.00	5.63	2.83	3.22
0.50	6.15	1.33	16.34	2.17	4.87	3.00	2.98
0.67	9.61	1.50	10.96	2.33	4.30		
0.83	24.17	1.67	8.29	2.50	3.86		

| CALIB |
| STANDHYD (0001)| Area (ha)= 0.75
|ID= 1 DT= 5.0 min | Total Imp(%)= 38.50 Dir. Conn.(%)= 38.50

		IMPERVIOUS	PERVIOUS (i)
Surface Area	(ha)=	0.29	0.46
Dep. Storage	(mm)=	1.00	1.50
Average Slope	(%)=	1.00	2.00
Length	(m)=	70.76	40.00
Mannings n	=	0.013	0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	3.68	0.833	24.17	1.583	8.29	2.33	4.30
0.167	3.68	0.917	104.19	1.667	8.29	2.42	3.86
0.250	4.58	1.000	104.19	1.750	6.69	2.50	3.86
0.333	4.58	1.083	32.04	1.833	6.69	2.58	3.51
0.417	6.15	1.167	32.04	1.917	5.63	2.67	3.51
0.500	6.15	1.250	16.34	2.000	5.63	2.75	3.22
0.583	9.61	1.333	16.34	2.083	4.87	2.83	3.22
0.667	9.61	1.417	10.96	2.167	4.87	2.92	2.98
0.750	24.17	1.500	10.96	2.250	4.30	3.00	2.98

Max.Eff.Inten.(mm/hr)=	104.19	44.88
over (min)	5.00	15.00
Storage Coeff. (min)=	2.04 (ii)	11.77 (ii)
Unit Hyd. Tpeak (min)=	5.00	15.00
Unit Hyd. peak (cms)=	0.31	0.09

TOTALS

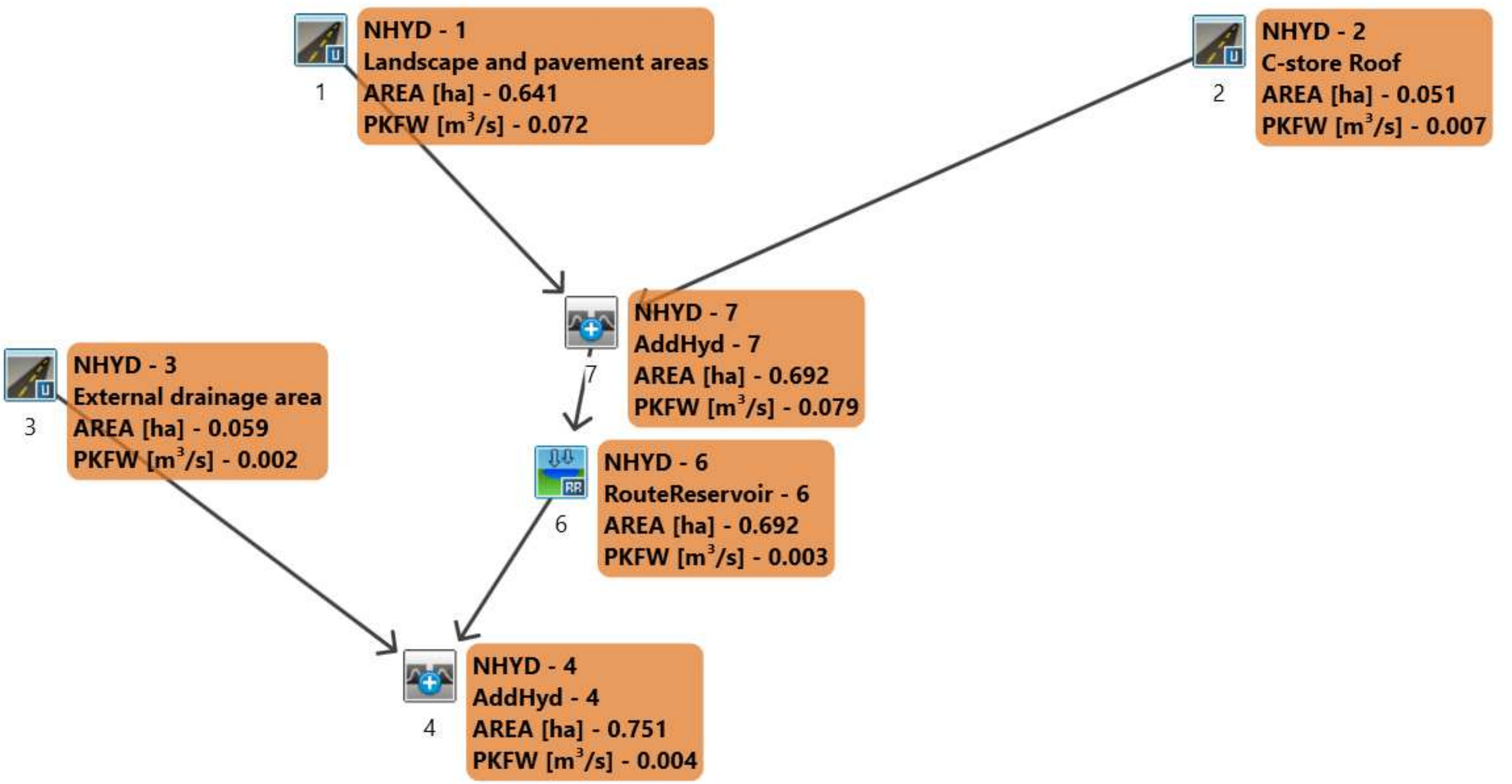
```
     PEAK FLOW       (cms)=       0.08          0.03           0.100 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.17            1.00
     RUNOFF VOLUME    (mm)=      41.51         19.60           28.03
     TOTAL RAINFALL   (mm)=      42.51         42.51           42.51
     RUNOFF COEFFICIENT   =       0.98          0.46            0.66

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

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

--------------------------------------------------------------------------------
```

POST-DEVELOPMENT 25mm DESIGN STORM



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

      V    V   I    SSSSS  U   U    A    L              (v 6.2.2005)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\LiMing\AppData\Local\Civica\VH5\90c30b05-cee4-4f42-8939-ca4273b1ea06\f87fcc
1e-eabf-45bf-a3bb-946d1162d74e\scena
  Summary filename:
C:\Users\LiMing\AppData\Local\Civica\VH5\90c30b05-cee4-4f42-8939-ca4273b1ea06\f87fcc
1e-eabf-45bf-a3bb-946d1162d74e\scena


DATE: 12/03/2021                           TIME: 03:35:27

USER:


COMMENTS: ____________________________________________________________


-----------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** SIMULATION : 25mm 4hr Chicago              **
  ************************************************


--------------------
|    READ STORM    |    Filename: C:\Users\LiMing\AppD
|                  |              ata\Local\Temp\
```

```
|                   |             c682fdf6-d70d-45bb-bfa5-1a6db47c5a88\b2416f6e
| Ptotal= 25.00 mm |    Comments: 25mm 4hr Chicago
--------------------
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.17    2.07 |  1.17    5.70 |  2.17    5.19 |  3.17    2.80
                 0.33    2.27 |  1.33   10.78 |  2.33    4.47 |  3.33    2.62
                 0.50    2.52 |  1.50   50.21 |  2.50    3.95 |  3.50    2.48
                 0.67    2.88 |  1.67   13.37 |  2.67    3.56 |  3.67    2.35
                 0.83    3.38 |  1.83    8.29 |  2.83    3.25 |  3.83    2.23
                 1.00    4.18 |  2.00    6.30 |  3.00    3.01 |  4.00    2.14

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

--------------------
| CALIB             |
| STANDHYD (  0001)|   Area    (ha)=   0.64
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.80   Dir. Conn.(%)=  80.80
--------------------
                             IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.12
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      65.37        40.00
     Mannings n          =      0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
                0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
                0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
                0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
                0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
                0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
                0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
                0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
                0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
                0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
                0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
                1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

     Max.Eff.Inten.(mm/hr)=      50.21         9.88
                over (min)        5.00        25.00
     Storage Coeff.  (min)=       2.61 (ii)   20.42 (ii)
     Unit Hyd. Tpeak (min)=       5.00        25.00
     Unit Hyd. peak  (cms)=       0.29         0.05
```

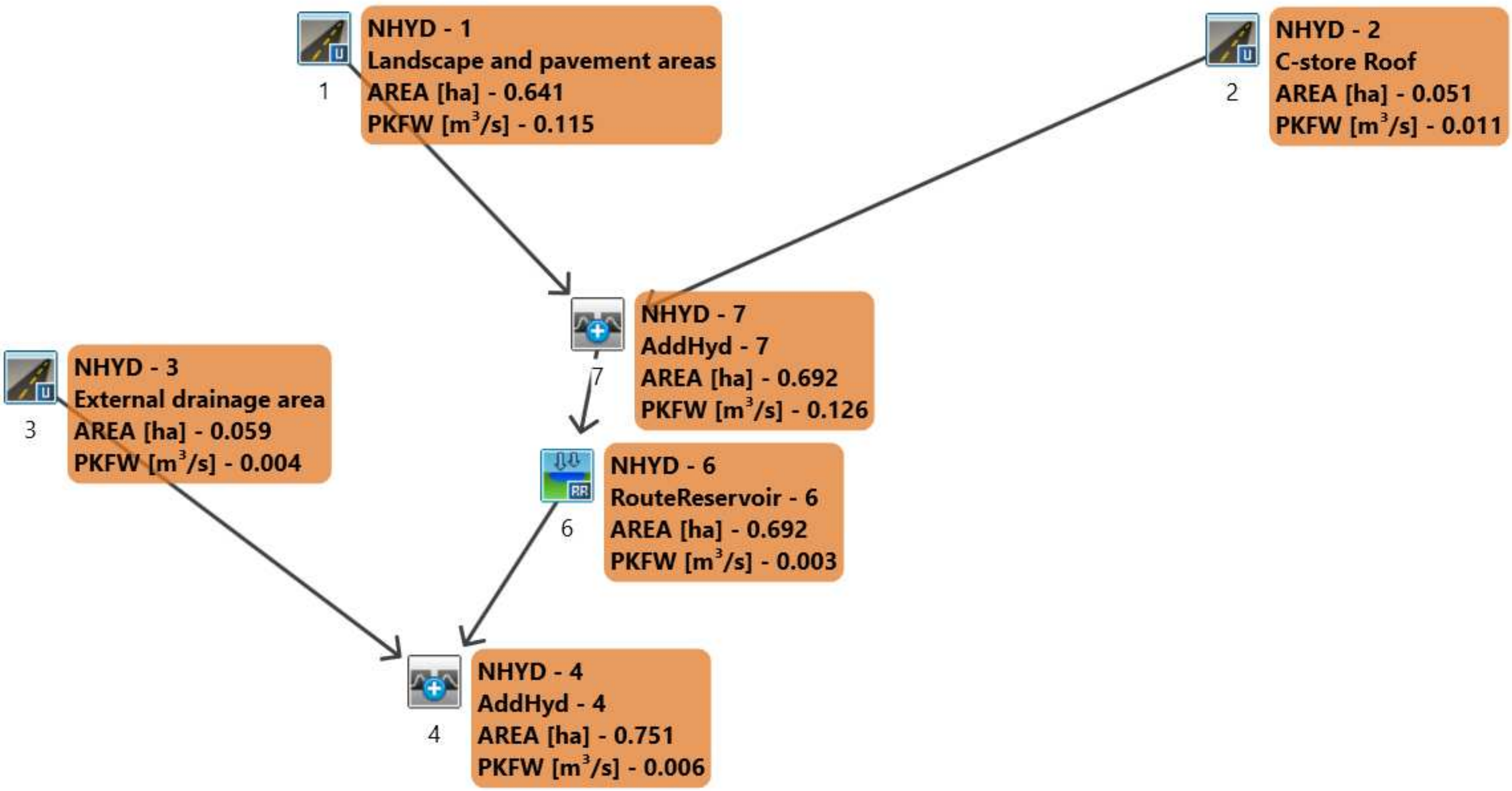
```
                                                            *TOTALS*
     PEAK FLOW       (cms)=       0.07          0.00          0.072 (iii)
     TIME TO PEAK    (hrs)=       1.50          1.83           1.50
     RUNOFF VOLUME    (mm)=      24.00          8.08          20.92
     TOTAL RAINFALL   (mm)=      25.00         25.00          25.00
     RUNOFF COEFFICIENT   =       0.96          0.32           0.84

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05          0.00
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      18.44         40.00
     Mannings n           =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
               0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
               0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
               0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
               0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
               0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
               0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
               0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
               0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
               0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
               0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
               1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

     Max.Eff.Inten.(mm/hr)=      50.21         14.26
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.22 (ii)     2.70 (ii)
```

```
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.29
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00         0.007 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.50          1.50
     RUNOFF VOLUME    (mm)=      24.00         8.08         23.83
     TOTAL RAINFALL   (mm)=      25.00        25.00         25.00
     RUNOFF COEFFICIENT   =       0.96         0.32          0.95

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

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

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


--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.64   0.072     1.50    20.92
      + ID2= 2 (  0002):     0.05   0.007     1.50    23.83
        ====================================================
        ID = 3 (  0007):     0.69   0.079     1.50    21.14

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0040     0.0220
                          0.0010     0.0030   |   0.0050     0.0380
                          0.0020     0.0060   |   0.0060     0.0500
                          0.0030     0.0130   |   0.0070     0.0510

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0007)      0.692      0.079      1.50      21.14
   OUTFLOW: ID= 1 (  0006)      0.692      0.003      4.00      20.04

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  3.62
                  TIME SHIFT OF PEAK FLOW        (min)=150.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0120

--------------------------------------------------------------------------------
```

```
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.50   Dir. Conn.(%)=  23.50
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.01         0.05
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      19.83        40.00
     Mannings n          =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.07 | 1.083    5.70 | 2.083    5.19 |  3.08    2.80
                0.167    2.07 | 1.167    5.70 | 2.167    5.19 |  3.17    2.80
                0.250    2.27 | 1.250   10.78 | 2.250    4.47 |  3.25    2.62
                0.333    2.27 | 1.333   10.78 | 2.333    4.47 |  3.33    2.62
                0.417    2.52 | 1.417   50.21 | 2.417    3.95 |  3.42    2.48
                0.500    2.52 | 1.500   50.21 | 2.500    3.95 |  3.50    2.48
                0.583    2.88 | 1.583   13.37 | 2.583    3.56 |  3.58    2.35
                0.667    2.88 | 1.667   13.37 | 2.667    3.56 |  3.67    2.35
                0.750    3.38 | 1.750    8.29 | 2.750    3.25 |  3.75    2.23
                0.833    3.38 | 1.833    8.29 | 2.833    3.25 |  3.83    2.23
                0.917    4.17 | 1.917    6.30 | 2.917    3.01 |  3.92    2.14
                1.000    4.18 | 2.000    6.29 | 3.000    3.01 |  4.00    2.14

     Max.Eff.Inten.(mm/hr)=      50.21         9.88
                over (min)        5.00        20.00
     Storage Coeff.  (min)=       1.27 (ii)   19.09 (ii)
     Unit Hyd. Tpeak (min)=       5.00        20.00
     Unit Hyd. peak  (cms)=       0.33         0.06
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00           0.002 (iii)
     TIME TO PEAK    (hrs)=       1.50         1.75            1.50
     RUNOFF VOLUME    (mm)=      24.00         8.08           11.62
     TOTAL RAINFALL   (mm)=      25.00        25.00           25.00
     RUNOFF COEFFICIENT   =       0.96         0.32            0.46

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

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

```
-------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0003):     0.06   0.002     1.50    11.62
      + ID2= 2 (  0006):     0.69   0.003     4.00    20.04
        ====================================================
        ID = 3 (  0004):     0.75   0.004     1.50    19.38

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
```

POST-DEVELOPMENT 2-YR STORM



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

      V    V   I    SSSSS  U   U    A    L              (v 6.2.2005)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```



```
                    *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\LiMing\AppData\Local\Civica\VH5\90c30b05-cee4-4f42-8939-ca4273b1ea06\4a1f51
69-4eeb-472b-ba17-5fca398f9fd2\scena
  Summary filename:
C:\Users\LiMing\AppData\Local\Civica\VH5\90c30b05-cee4-4f42-8939-ca4273b1ea06\4a1f51
69-4eeb-472b-ba17-5fca398f9fd2\scena


DATE: 12/03/2021                           TIME: 03:35:27

USER:



COMMENTS: ____________________________________________________________


------------------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : Chicago Design Storm - 2yr    **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 732.951
| Ptotal= 31.86 mm |                          B=   6.199
--------------------                          C=   0.810
```

```
                    used in:   INTENSITY =  A / (t + B)^C

                    Duration of storm  =  3.00 hrs
                    Storm time step    = 10.00 min
                    Time to peak ratio =  0.33

             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.17    2.81 |  1.00   76.81 |  1.83    5.09 |  2.67    2.68
             0.33    3.50 |  1.17   24.08 |  2.00    4.29 |  2.83    2.46
             0.50    4.69 |  1.33   12.36 |  2.17    3.72 |  3.00    2.28
             0.67    7.30 |  1.50    8.32 |  2.33    3.29 |
             0.83   18.21 |  1.67    6.30 |  2.50    2.95 |


-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   0.64
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.80   Dir. Conn.(%)=  80.80
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52         0.12
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      65.37        40.00
     Mannings n          =      0.013        0.250

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


                              ---- TRANSFORMED HYETOGRAPH ----
             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
            0.083    2.81 | 0.833   18.21 | 1.583    6.30 |  2.33    3.29
            0.167    2.81 | 0.917   76.80 | 1.667    6.30 |  2.42    2.95
            0.250    3.50 | 1.000   76.81 | 1.750    5.09 |  2.50    2.95
            0.333    3.50 | 1.083   24.08 | 1.833    5.09 |  2.58    2.68
            0.417    4.69 | 1.167   24.08 | 1.917    4.29 |  2.67    2.68
            0.500    4.69 | 1.250   12.36 | 2.000    4.29 |  2.75    2.46
            0.583    7.30 | 1.333   12.36 | 2.083    3.72 |  2.83    2.46
            0.667    7.30 | 1.417    8.32 | 2.167    3.72 |  2.92    2.28
            0.750   18.21 | 1.500    8.32 | 2.250    3.29 |  3.00    2.28

     Max.Eff.Inten.(mm/hr)=      76.81        26.60
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       2.20 (ii)    6.61 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.30         0.14
                                                            *TOTALS*
```

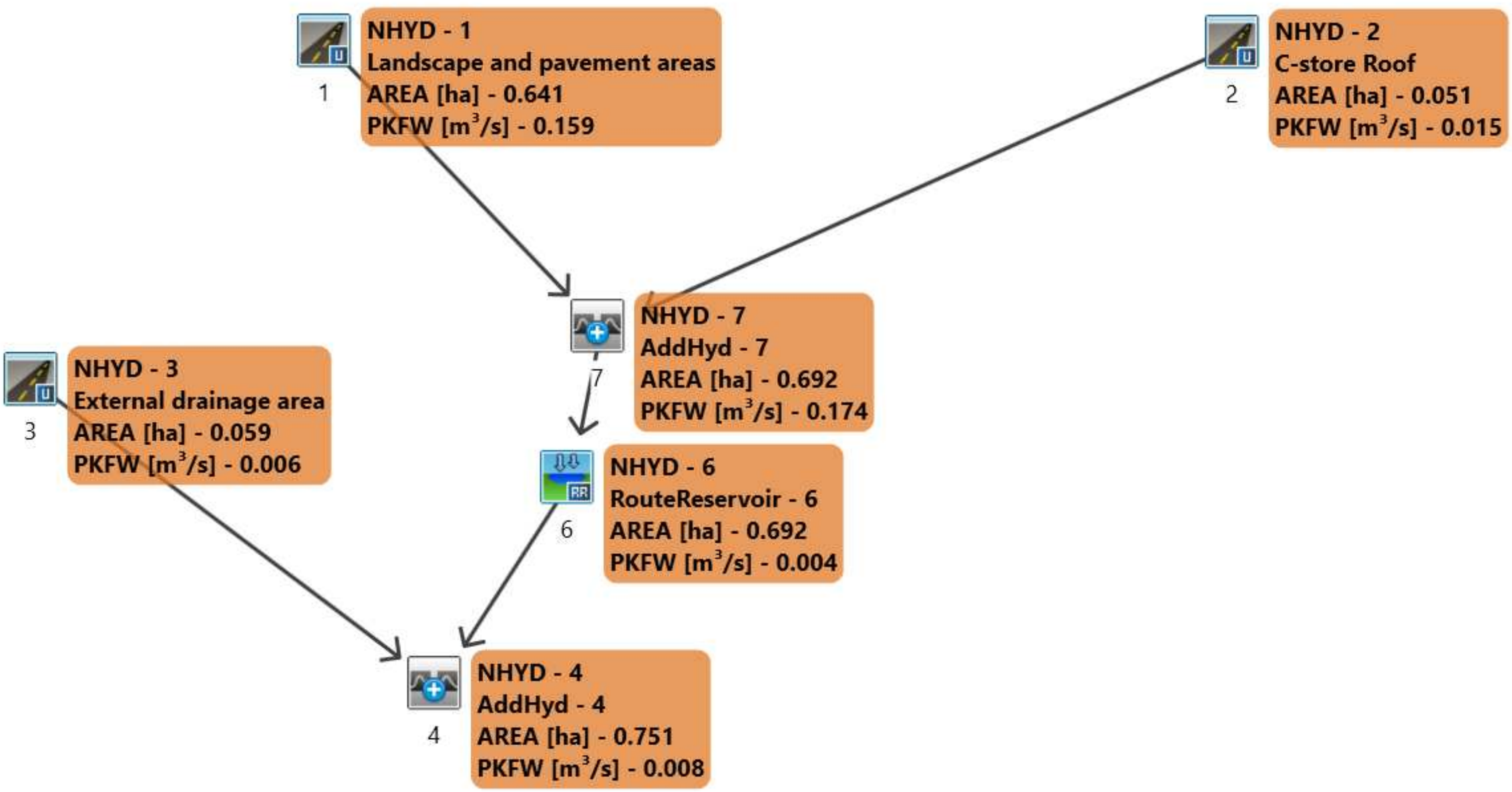
```
     PEAK FLOW       (cms)=       0.11          0.01          0.115 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.08           1.00
     RUNOFF VOLUME    (mm)=      30.86         12.26          27.28
     TOTAL RAINFALL   (mm)=      31.86         31.86          31.86
     RUNOFF COEFFICIENT   =       0.97          0.38           0.86

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05          0.00
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      18.44         40.00
     Mannings n           =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.81 | 0.833   18.21 | 1.583    6.30 |  2.33    3.29
               0.167    2.81 | 0.917   76.80 | 1.667    6.30 |  2.42    2.95
               0.250    3.50 | 1.000   76.81 | 1.750    5.09 |  2.50    2.95
               0.333    3.50 | 1.083   24.08 | 1.833    5.09 |  2.58    2.68
               0.417    4.69 | 1.167   24.08 | 1.917    4.29 |  2.67    2.68
               0.500    4.69 | 1.250   12.36 | 2.000    4.29 |  2.75    2.46
               0.583    7.30 | 1.333   12.36 | 2.083    3.72 |  2.83    2.46
               0.667    7.30 | 1.417    8.32 | 2.167    3.72 |  2.92    2.28
               0.750   18.21 | 1.500    8.32 | 2.250    3.29 |  3.00    2.28

     Max.Eff.Inten.(mm/hr)=      76.81         26.60
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.03 (ii)     2.28 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.30
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.01          0.00          0.011 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      30.86        12.26          30.67
     TOTAL RAINFALL   (mm)=      31.86        31.86          31.86
     RUNOFF COEFFICIENT   =       0.97         0.38           0.96

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

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.64   0.115     1.00    27.28
      + ID2= 2 (  0002):     0.05   0.011     1.00    30.67
        ====================================================
        ID = 3 (  0007):     0.69   0.126     1.00    27.53

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0040      0.0220
                          0.0010     0.0030   |   0.0050      0.0380
                          0.0020     0.0060   |   0.0060      0.0500
                          0.0030     0.0130   |   0.0070      0.0510

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0007)      0.692      0.126      1.00      27.53
   OUTFLOW: ID= 1 (  0006)      0.692      0.003      3.00      26.44

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.69
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0165

------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.50   Dir. Conn.(%)=  23.50
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.01         0.05
     Dep. Storage     (mm)=        1.00         1.50
     Average Slope     (%)=        1.00         2.00
     Length            (m)=       19.83        40.00
     Mannings n           =       0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.81 | 0.833   18.21 | 1.583    6.30 |  2.33    3.29
               0.167    2.81 | 0.917   76.80 | 1.667    6.30 |  2.42    2.95
               0.250    3.50 | 1.000   76.81 | 1.750    5.09 |  2.50    2.95
               0.333    3.50 | 1.083   24.08 | 1.833    5.09 |  2.58    2.68
               0.417    4.69 | 1.167   24.08 | 1.917    4.29 |  2.67    2.68
               0.500    4.69 | 1.250   12.36 | 2.000    4.29 |  2.75    2.46
               0.583    7.30 | 1.333   12.36 | 2.083    3.72 |  2.83    2.46
               0.667    7.30 | 1.417    8.32 | 2.167    3.72 |  2.92    2.28
               0.750   18.21 | 1.500    8.32 | 2.250    3.29 |  3.00    2.28

     Max.Eff.Inten.(mm/hr)=       76.81        21.72
                over (min)        5.00        15.00
     Storage Coeff.  (min)=        1.08 (ii)   14.07 (ii)
     Unit Hyd. Tpeak (min)=        5.00        15.00
     Unit Hyd. peak  (cms)=        0.34         0.08
                                                          *TOTALS*
     PEAK FLOW       (cms)=        0.00         0.00         0.004 (iii)
     TIME TO PEAK    (hrs)=        1.00         1.17          1.00
     RUNOFF VOLUME    (mm)=       30.86        12.26         16.50
     TOTAL RAINFALL   (mm)=       31.86        31.86         31.86
     RUNOFF COEFFICIENT   =        0.97         0.38          0.52

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

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
   ID1= 1 (  0003):     0.06   0.004     1.00    16.50
 + ID2= 2 (  0006):     0.69   0.003     3.00    26.44
   ====================================================
   ID = 3 (  0004):     0.75   0.006     1.00    25.66

NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
```

POST-DEVELOPMENT 5-YR STORM



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

      V    V   I    SSSSS  U   U    A    L             (v 6.2.2005)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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DATE: 12/03/2021                          TIME: 03:35:27

USER:



COMMENTS: ____________________________________________________________


-------------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** SIMULATION : Chicago Design Storm - 5yr    **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A= 998.071
| Ptotal= 42.51 mm |                          B=   6.053
--------------------                          C=   0.814
```

```
                  used in:   INTENSITY =  A / (t + B)^C

                  Duration of storm  =  3.00 hrs
                  Storm time step    = 10.00 min
                  Time to peak ratio =  0.33

          TIME    RAIN | TIME    RAIN |'  TIME    RAIN | TIME    RAIN
           hrs   mm/hr |  hrs   mm/hr |'   hrs   mm/hr |  hrs   mm/hr
          0.17    3.68 | 1.00  104.19 |  1.83    6.69 |  2.67    3.51
          0.33    4.58 | 1.17   32.04 |  2.00    5.63 |  2.83    3.22
          0.50    6.15 | 1.33   16.34 |  2.17    4.87 |  3.00    2.98
          0.67    9.61 | 1.50   10.96 |  2.33    4.30 |
          0.83   24.17 | 1.67    8.29 |  2.50    3.86 |


------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   0.64
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.80   Dir. Conn.(%)=  80.80
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52          0.12
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      65.37         40.00
     Mannings n          =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
          TIME    RAIN | TIME    RAIN |'  TIME    RAIN | TIME    RAIN
           hrs   mm/hr |  hrs   mm/hr |'   hrs   mm/hr |  hrs   mm/hr
         0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
         0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
         0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
         0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
         0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
         0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
         0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
         0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
         0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19         44.88
                over (min)        5.00         10.00
     Storage Coeff.  (min)=       1.95 (ii)     5.85 (ii)
     Unit Hyd. Tpeak (min)=       5.00         10.00
     Unit Hyd. peak  (cms)=       0.31          0.15
                                                           *TOTALS*
```

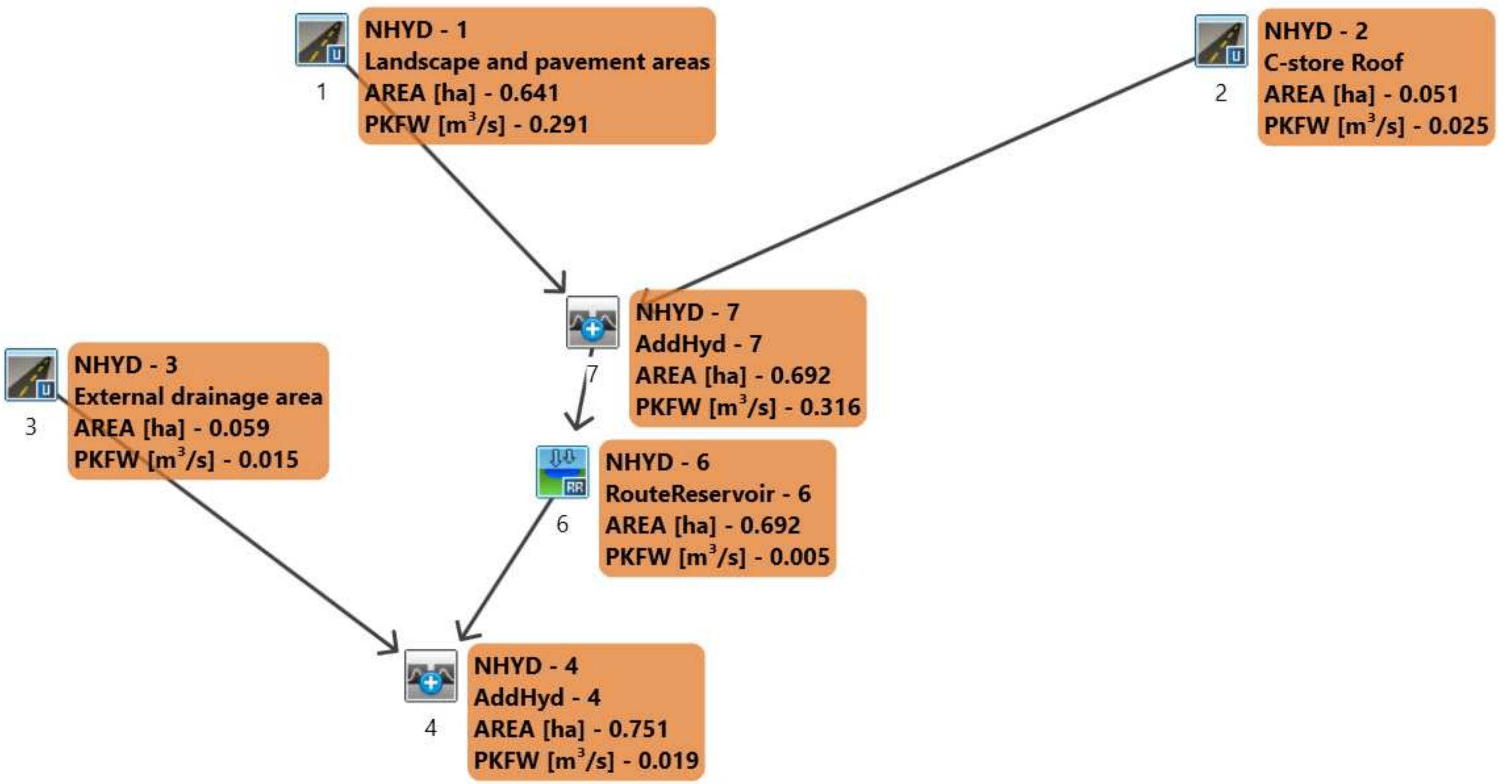
```
     PEAK FLOW       (cms)=       0.15         0.01          0.159 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08           1.00
     RUNOFF VOLUME    (mm)=      41.51        19.60          37.30
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.98         0.46           0.88

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB             |
| STANDHYD (  0002)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05         0.00
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      18.44        40.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                 0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                 0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                 0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                 0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                 0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                 0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                 0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                 0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        44.88
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.91 (ii)    2.02 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.31
                                                               *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00          0.015 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      41.51        19.60          41.29
     TOTAL RAINFALL   (mm)=      42.51        42.51          42.51
     RUNOFF COEFFICIENT   =       0.98         0.46           0.97

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

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.64   0.159     1.00    37.30
      + ID2= 2 (  0002):     0.05   0.015     1.00    41.29
        ====================================================
        ID = 3 (  0007):     0.69   0.174     1.00    37.60

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0040      0.0220
                          0.0010     0.0030   |   0.0050      0.0380
                          0.0020     0.0060   |   0.0060      0.0500
                          0.0030     0.0130   |   0.0070      0.0510

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0007)      0.692      0.174      1.00      37.60
   OUTFLOW: ID= 1 (  0006)      0.692      0.004      3.00      36.50

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  2.33
                  TIME SHIFT OF PEAK FLOW         (min)=120.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0230

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.50   Dir. Conn.(%)=  23.50
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.01         0.05
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      19.83        40.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    3.68 | 0.833   24.17 | 1.583    8.29 |  2.33    4.30
                 0.167    3.68 | 0.917  104.19 | 1.667    8.29 |  2.42    3.86
                 0.250    4.58 | 1.000  104.19 | 1.750    6.69 |  2.50    3.86
                 0.333    4.58 | 1.083   32.04 | 1.833    6.69 |  2.58    3.51
                 0.417    6.15 | 1.167   32.04 | 1.917    5.63 |  2.67    3.51
                 0.500    6.15 | 1.250   16.34 | 2.000    5.63 |  2.75    3.22
                 0.583    9.61 | 1.333   16.34 | 2.083    4.87 |  2.83    3.22
                 0.667    9.61 | 1.417   10.96 | 2.167    4.87 |  2.92    2.98
                 0.750   24.17 | 1.500   10.96 | 2.250    4.30 |  3.00    2.98

     Max.Eff.Inten.(mm/hr)=     104.19        44.88
                over (min)        5.00        15.00
     Storage Coeff.  (min)=       0.95 (ii)   10.68 (ii)
     Unit Hyd. Tpeak (min)=       5.00        15.00
     Unit Hyd. peak  (cms)=       0.34         0.09
                                                              *TOTALS*
     PEAK FLOW       (cms)=       0.00         0.00            0.006 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.17             1.00
     RUNOFF VOLUME    (mm)=      41.51        19.60            24.64
     TOTAL RAINFALL   (mm)=      42.51        42.51            42.51
     RUNOFF COEFFICIENT   =       0.98         0.46             0.58

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

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (  0003):      0.06   0.006     1.00    24.64
        + ID2= 2 (  0006):      0.69   0.004     3.00    36.50
          ====================================================
          ID = 3 (  0004):      0.75   0.008     1.00    35.57

      NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
```

POST-DEVELOPMENT 100-YR STORM



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

      V    V   I    SSSSS  U   U    A    L            (v 6.2.2005)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

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


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06-a899-4be6-82e0-51603667104e\scena


DATE: 12/03/2021                           TIME: 03:35:27

USER:


COMMENTS: ____________________________________________________________


---------------------------------------------------------------------------------------
-----------------------
  ************************************************
  ** SIMULATION : Chicago Design Storm - 100yr  **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1735.688
| Ptotal= 71.66 mm |                          B=   6.014
--------------------                          C=   0.820
```

```
                 used in:   INTENSITY =  A / (t + B)^C

                 Duration of storm  =  3.00 hrs
                 Storm time step    = 10.00 min
                 Time to peak ratio =  0.33

          TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
           hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
          0.17    6.05 |  1.00  178.56 |  1.83   11.06 |  2.67    5.76
          0.33    7.54 |  1.17   54.05 |  2.00    9.29 |  2.83    5.28
          0.50   10.16 |  1.33   27.32 |  2.17    8.02 |  3.00    4.88
          0.67   15.97 |  1.50   18.24 |  2.33    7.08 |
          0.83   40.65 |  1.67   13.74 |  2.50    6.35 |


------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   0.64
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.80   Dir. Conn.(%)=  80.80
--------------------
                               IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.52          0.12
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      65.37         40.00
     Mannings n          =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
          TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
           hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
         0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
         0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
         0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
         0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
         0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
         0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
         0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
         0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
         0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       105.42
               over (min)        5.00          5.00
     Storage Coeff.  (min)=       1.57 (ii)     4.72 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.33          0.22
                                                            *TOTALS*
```

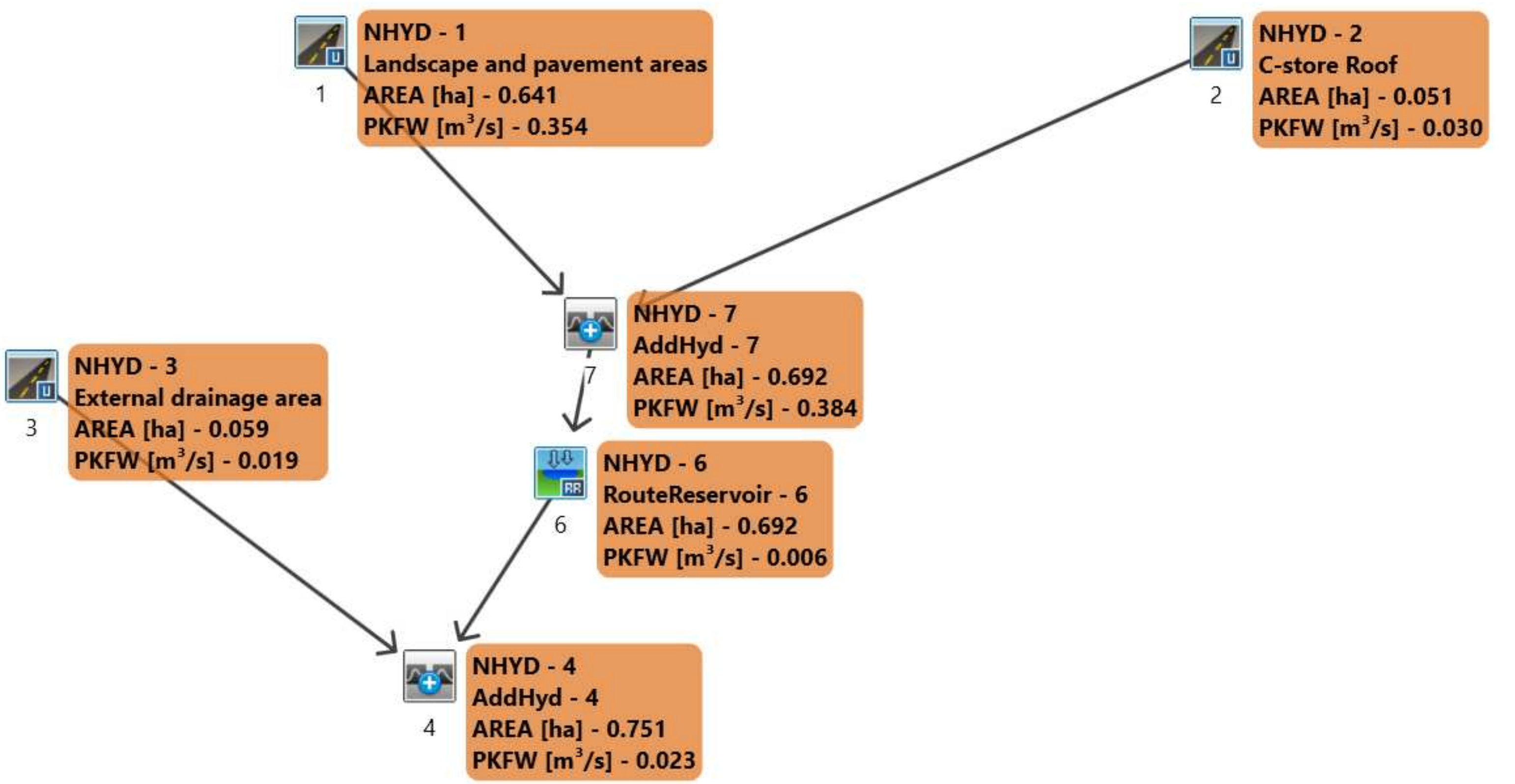
```
     PEAK FLOW       (cms)=       0.26          0.03          0.291 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.00           1.00
     RUNOFF VOLUME    (mm)=      70.66         42.81         65.31
     TOTAL RAINFALL   (mm)=      71.66         71.66         71.66
     RUNOFF COEFFICIENT   =       0.99          0.60           0.91

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

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

-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05          0.00
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      18.44         40.00
     Mannings n           =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
                0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
                0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
                0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
                0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
                0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
                0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
                0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
                0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56        105.42
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       0.73 (ii)     1.63 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.32
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.03          0.00          0.025 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      70.66        42.81          70.39
     TOTAL RAINFALL   (mm)=      71.66        71.66          71.66
     RUNOFF COEFFICIENT   =       0.99         0.60           0.98

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

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

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


--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.64   0.291     1.00    65.31
      + ID2= 2 (  0002):     0.05   0.025     1.00    70.39
        ====================================================
        ID = 3 (  0007):     0.69   0.316     1.00    65.69

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0040      0.0220
                          0.0010     0.0030   |   0.0050      0.0380
                          0.0020     0.0060   |   0.0060      0.0500
                          0.0030     0.0130   |   0.0070      0.0510

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0007)      0.692      0.316      1.00      65.69
   OUTFLOW: ID= 1 (  0006)      0.692      0.005      3.00      64.59

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.67
                   TIME SHIFT OF PEAK FLOW         (min)=120.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0414

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.50   Dir. Conn.(%)=  23.50
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.01         0.05
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      19.83        40.00
     Mannings n           =      0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    6.05 | 0.833   40.65 | 1.583   13.74 |  2.33    7.08
               0.167    6.05 | 0.917  178.56 | 1.667   13.74 |  2.42    6.35
               0.250    7.54 | 1.000  178.56 | 1.750   11.06 |  2.50    6.35
               0.333    7.54 | 1.083   54.05 | 1.833   11.06 |  2.58    5.76
               0.417   10.16 | 1.167   54.05 | 1.917    9.29 |  2.67    5.76
               0.500   10.16 | 1.250   27.32 | 2.000    9.29 |  2.75    5.28
               0.583   15.97 | 1.333   27.32 | 2.083    8.02 |  2.83    5.28
               0.667   15.97 | 1.417   18.24 | 2.167    8.02 |  2.92    4.88
               0.750   40.65 | 1.500   18.24 | 2.250    7.08 |  3.00    4.88

     Max.Eff.Inten.(mm/hr)=     178.56       105.42
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.77 (ii)    7.68 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.13
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.01         0.015 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08          1.00
     RUNOFF VOLUME    (mm)=      70.66        42.81         49.29
     TOTAL RAINFALL   (mm)=      71.66        71.66         71.66
     RUNOFF COEFFICIENT   =       0.99         0.60          0.69

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

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
```

```
  ID1= 1 (  0003):     0.06   0.015     1.00    49.29
+ ID2= 2 (  0006):     0.69   0.005     3.00    64.59
  ====================================================
  ID = 3 (  0004):     0.75   0.019     1.00    63.39

NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
```

POST-DEVELOPMENT 100-YR STORM + 20% STRESS TEST



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

      V    V   I    SSSSS  U   U    A    L             (v 6.2.2005)
      V    V   I    SS     U   U   A A   L
       V  V    I     SS    U   U  AAAAA  L
       V  V    I      SS   U   U  A   A  L
        VV     I    SSSSS  UUUUU  A   A  LLLLL

       OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
      O   O    T      T    H   H   Y Y   MM MM  O   O
      O   O    T      T    H   H    Y    M   M  O   O
       OOO     T      T    H   H    Y    M   M   OOO
Developed and Distributed by Smart City Water Inc
```

```
                   *****  D E T A I L E D   O U T P U T *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat

  Output  filename:
C:\Users\LiMing\AppData\Local\Civica\VH5\90c30b05-cee4-4f42-8939-ca4273b1ea06\4be1e7a9-404d-45bc-95d0-4b2260c10b49\scena
  Summary filename:
C:\Users\LiMing\AppData\Local\Civica\VH5\90c30b05-cee4-4f42-8939-ca4273b1ea06\4be1e7a9-404d-45bc-95d0-4b2260c10b49\scena


DATE: 12/03/2021                          TIME: 03:35:27

USER:



COMMENTS: ____________________________________________________________


----------------------------------------------------------------------------------------------------------
  ************************************************
  ** SIMULATION : Chicago Design Storm - 100yr  **
  ************************************************

--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2082.830
| Ptotal= 86.00 mm |                          B=   6.014
--------------------                          C=   0.820
```

```
                    used in:   INTENSITY =  A / (t + B)^C

                    Duration of storm  =  3.00 hrs
                    Storm time step    = 10.00 min
                    Time to peak ratio =  0.33

             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
             0.17    7.25 |  1.00  214.27 |  1.83   13.27 |  2.67    6.91
             0.33    9.05 |  1.17   64.86 |  2.00   11.14 |  2.83    6.34
             0.50   12.19 |  1.33   32.78 |  2.17    9.63 |  3.00    5.85
             0.67   19.16 |  1.50   21.89 |  2.33    8.50 |
             0.83   48.79 |  1.67   16.48 |  2.50    7.62 |


-------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0001)|   Area    (ha)=   0.64
|ID= 1 DT= 5.0 min |   Total Imp(%)=  80.80   Dir. Conn.(%)=  80.80
--------------------
                                IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=        0.52         0.12
     Dep. Storage     (mm)=        1.00         1.50
     Average Slope     (%)=        1.00         2.00
     Length            (m)=       65.37        40.00
     Mannings n           =       0.013        0.250

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


                                 ---- TRANSFORMED HYETOGRAPH ----
             TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
              hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
            0.083    7.25 | 0.833   48.79 | 1.583   16.48 |  2.33    8.50
            0.167    7.25 | 0.917  214.27 | 1.667   16.48 |  2.42    7.62
            0.250    9.05 | 1.000  214.27 | 1.750   13.27 |  2.50    7.62
            0.333    9.05 | 1.083   64.86 | 1.833   13.27 |  2.58    6.91
            0.417   12.19 | 1.167   64.86 | 1.917   11.14 |  2.67    6.91
            0.500   12.19 | 1.250   32.78 | 2.000   11.14 |  2.75    6.34
            0.583   19.16 | 1.333   32.78 | 2.083    9.63 |  2.83    6.34
            0.667   19.16 | 1.417   21.89 | 2.167    9.63 |  2.92    5.85
            0.750   48.79 | 1.500   21.89 | 2.250    8.50 |  3.00    5.85

     Max.Eff.Inten.(mm/hr)=     214.27       138.07
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.46 (ii)    4.39 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.33         0.23
                                                          *TOTALS*
```

```
     PEAK FLOW       (cms)=       0.31          0.05          0.354 (iii)
     TIME TO PEAK    (hrs)=       1.00          1.00           1.00
     RUNOFF VOLUME    (mm)=      85.00         55.21          79.27
     TOTAL RAINFALL   (mm)=      86.00         86.00          86.00
     RUNOFF COEFFICIENT   =       0.99          0.64           0.92

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

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

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   0.05
|ID= 1 DT= 5.0 min |   Total Imp(%)=  99.00   Dir. Conn.(%)=  99.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.05          0.00
     Dep. Storage     (mm)=       1.00          1.50
     Average Slope     (%)=       1.00          2.00
     Length            (m)=      18.44         40.00
     Mannings n           =      0.013         0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    7.25 | 0.833   48.79 | 1.583   16.48 |  2.33    8.50
                0.167    7.25 | 0.917  214.27 | 1.667   16.48 |  2.42    7.62
                0.250    9.05 | 1.000  214.27 | 1.750   13.27 |  2.50    7.62
                0.333    9.05 | 1.083   64.86 | 1.833   13.27 |  2.58    6.91
                0.417   12.19 | 1.167   64.86 | 1.917   11.14 |  2.67    6.91
                0.500   12.19 | 1.250   32.78 | 2.000   11.14 |  2.75    6.34
                0.583   19.16 | 1.333   32.78 | 2.083    9.63 |  2.83    6.34
                0.667   19.16 | 1.417   21.89 | 2.167    9.63 |  2.92    5.85
                0.750   48.79 | 1.500   21.89 | 2.250    8.50 |  3.00    5.85

     Max.Eff.Inten.(mm/hr)=     214.27        138.07
                over (min)        5.00          5.00
     Storage Coeff.  (min)=       0.68 (ii)     1.51 (ii)
     Unit Hyd. Tpeak (min)=       5.00          5.00
     Unit Hyd. peak  (cms)=       0.34          0.33
                                                                *TOTALS*
     PEAK FLOW       (cms)=       0.03          0.00            0.030 (iii)
```

```
     TIME TO PEAK    (hrs)=       1.00         1.00           1.00
     RUNOFF VOLUME    (mm)=      85.00        55.21          84.70
     TOTAL RAINFALL   (mm)=      86.00        86.00          86.00
     RUNOFF COEFFICIENT   =       0.99         0.64           0.98

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

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

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

--------------------
| ADD HYD  (  0007)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0001):     0.64   0.354     1.00    79.27
      + ID2= 2 (  0002):     0.05   0.030     1.00    84.70
        ====================================================
        ID = 3 (  0007):     0.69   0.384     1.00    79.67

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
-------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0006)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |   0.0040      0.0220
                          0.0010     0.0030   |   0.0050      0.0380
                          0.0020     0.0060   |   0.0060      0.0500
                          0.0030     0.0130   |   0.0070      0.0510

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0007)      0.692      0.384      1.00      79.67
   OUTFLOW: ID= 1 (  0006)      0.692      0.006      3.00      78.58

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  1.69
                  TIME SHIFT OF PEAK FLOW        (min)=120.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0506

-------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.06
|ID= 1 DT= 5.0 min |   Total Imp(%)=  23.50   Dir. Conn.(%)=  23.50
```

```
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.01         0.05
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       1.00         2.00
     Length            (m)=      19.83        40.00
     Mannings n          =       0.013        0.250

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


                               ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    7.25 | 0.833   48.79 | 1.583   16.48 |  2.33    8.50
                 0.167    7.25 | 0.917  214.27 | 1.667   16.48 |  2.42    7.62
                 0.250    9.05 | 1.000  214.27 | 1.750   13.27 |  2.50    7.62
                 0.333    9.05 | 1.083   64.86 | 1.833   13.27 |  2.58    6.91
                 0.417   12.19 | 1.167   64.86 | 1.917   11.14 |  2.67    6.91
                 0.500   12.19 | 1.250   32.78 | 2.000   11.14 |  2.75    6.34
                 0.583   19.16 | 1.333   32.78 | 2.083    9.63 |  2.83    6.34
                 0.667   19.16 | 1.417   21.89 | 2.167    9.63 |  2.92    5.85
                 0.750   48.79 | 1.500   21.89 | 2.250    8.50 |  3.00    5.85

     Max.Eff.Inten.(mm/hr)=     214.27       138.07
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.71 (ii)    6.92 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.14
                                                             *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.01           0.019 (iii)
     TIME TO PEAK    (hrs)=       1.00         1.08            1.00
     RUNOFF VOLUME    (mm)=      85.00        55.21           62.15
     TOTAL RAINFALL   (mm)=      86.00        86.00           86.00
     RUNOFF COEFFICIENT   =       0.99         0.64            0.72

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

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

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

--------------------
| ADD HYD  (  0004)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
```

```
          ID1= 1 (  0003):     0.06   0.019     1.00    62.15
        + ID2= 2 (  0006):     0.69   0.006     3.00    78.58
          ====================================================
          ID = 3 (  0004):     0.75   0.023     1.00    77.29

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------

 FINISH
=====================================================================================
=======================
```

Project Number: BRM-006060364-B0

Circle K Nepean - 1545 Woodroffe Avenue, Ottawa, ON

STORM SEWER DESIGN

CALCULATION Sheet :11

Date August 16, 2021

Q=0.0028*C*I*A (cms)
C : RUNOFF COEFFICIENT
i : RAINFALL INTENSITY
IDF Eqn : i = A / (B +T) ^C
A : AREA (ha)

City of Ottawa IDF Parameter	10 yr
A =	1174.184
B =	6.014
C =	0.816

See DWG C04 for Drainage Areas	MAINTENANCE HOLE FROM	MAINTENANCE HOLE TO	LENGTH (m)	Total Area, A_T	Com. C C_c	$C_c A_T$	TOTAL $C_c A_T$	FLOW TIME (min) TO	FLOW TIME (min) IN	I 10 yr (mm/h)	TOTAL Q (cms)	S (%)	D (mm)	Q FULL (cms)	V FULL (m/s)	Sec. Time (sec)	Accum. Time (sec)
Area 201	CAR WASH	CB9	6.80	0.014	0.95	0.013	0.013	10.00	0.12	122.14	0.005	2.00	100	0.007	0.93	0.12	10.12
Area 202	CB9	CBMH6	29.0	0.043	0.25	0.011	0.024	10.12	0.40	121.39	0.008	1.00	250	0.059	1.21	0.40	10.52
Area 203	CB7	CBMH6	15.2	0.050	0.83	0.042	0.042	10.00	0.21	122.14	0.014	1.00	250	0.059	1.21	0.21	10.21
Area 204	CBMH6	CBMH5	28.7	0.175	0.81	0.142	0.221	10.52	0.35	118.99	0.073	1.00	300	0.097	1.37	0.35	10.87
Area 205	CBMH5	CBMH3	48.1	0.068	0.85	0.058	0.278	10.87	0.43	116.98	0.091	1.82	300	0.130	1.85	0.43	11.30
Area 208	CANOPY	CB4	53.7	0.042	0.95	0.040	0.040	10.00	0.86	122.14	0.014	1.00	200	0.033	1.04	0.86	10.86
Area 207	CB4	CBMH3	20.2	0.094	0.80	0.075	0.115	10.86	0.20	117.05	0.038	2.00	250	0.084	1.71	0.20	11.05
Area 206	CBMH3	CHAMBER	3.8	0.119	0.89	0.106	0.499	11.30	0.03	114.58	0.160	2.00	375	0.248	2.25	0.03	11.33
	CHAMBER	MH2	3.8	0.000	0.00	0.000	0.499	11.33	0.03	114.43	0.160	2.00	375	0.248	2.25	0.03	11.36
Area 210	STORE	CBMH8	8.7	0.051	0.95	0.048	0.048	10.00	0.12	122.14	0.017	2.00	150	0.022	1.22	0.12	10.12
Area 209	CBMH8	MH2	17.7	0.036	0.38	0.014	0.062	10.12	0.20	121.41	0.021	1.43	250	0.071	1.45	0.20	10.32
-	MH2	STC EFO6	3.3			0.000	0.562	11.36	0.02	114.28	0.180	2.00	375	0.248	2.25	0.02	11.39
								Controlled Flow (See Calculation Sheet 10) =			0.026	2.00	375	0.248	2.25	0.02	11.39
-	STC EFO6	MH1	3.3					11.39	0.02	114.14	0.026	2.00	375	0.248	2.25	0.02	11.41
-	MH1	EX STM MH	15.5					11.41	0.09	114.01	0.026	3.00	375	0.304	2.75	0.09	11.50

STORMCEPTOR®
ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

12/08/2021

Province:	Ontario
City:	Ottawa
Nearest Rainfall Station:	OTTAWA CDA RCS
Climate Station Id:	6105978
Years of Rainfall Data:	20
Site Name:	
Drainage Area (ha):	0.75
Runoff Coefficient 'c':	0.76
Particle Size Distribution:	Fine
Target TSS Removal (%):	80.0
Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	19.33
Oil / Fuel Spill Risk Site?	Yes
Upstream Flow Control?	Yes
Upstream Orifice Control Flow Rate to Stormceptor (L/s):	23.00
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	Circle K -Nepean
Project Number:	57153
Designer Name:	Ming Li
Designer Company:	exp Services Inc.
Designer Email:	ming.li@exp.com
Designer Phone:	190-579-3980
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EFO4	75
EFO6	85
EFO8	91
EFO10	95
EFO12	98

Recommended Stormceptor EFO Model: EFO6

Estimated Net Annual Sediment (TSS) Load Reduction (%): 85

Water Quality Runoff Volume Capture (%): > 90

THIRD-PARTY TESTING AND VERIFICATION

►**Stormceptor® EF and Stormceptor® EFO** are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators** and performance has been third-party verified in accordance with the **ISO 14034 Environmental Technology Verification (ETV)** protocol.

PERFORMANCE

►**Stormceptor® EF and EFO** remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

PARTICLE SIZE DISTRIBUTION (PSD)

►The **Canadian ETV PSD** shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV ***Procedure for Laboratory Testing of Oil-Grit Separators*** for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

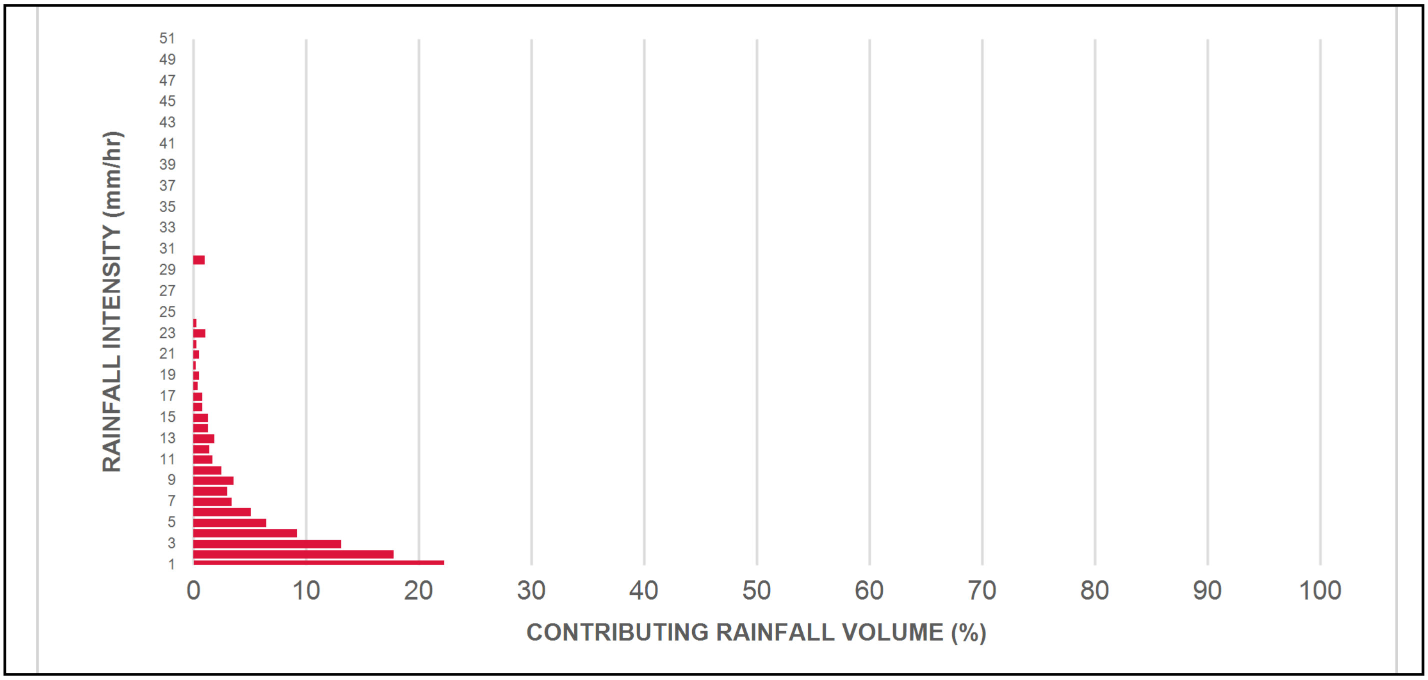
Particle Size (µm)	Percent Less Than	Particle Size Fraction (µm)	Percent
1000	100	500-1000	5
500	95	250-500	5
250	90	150-250	15
150	75	100-150	15
100	60	75-100	10
75	50	50-75	5
50	45	20-50	10
20	35	8-20	15
8	20	5-8	10
5	10	2-5	5
2	5	<2	5

Upstream Flow Controlled Results

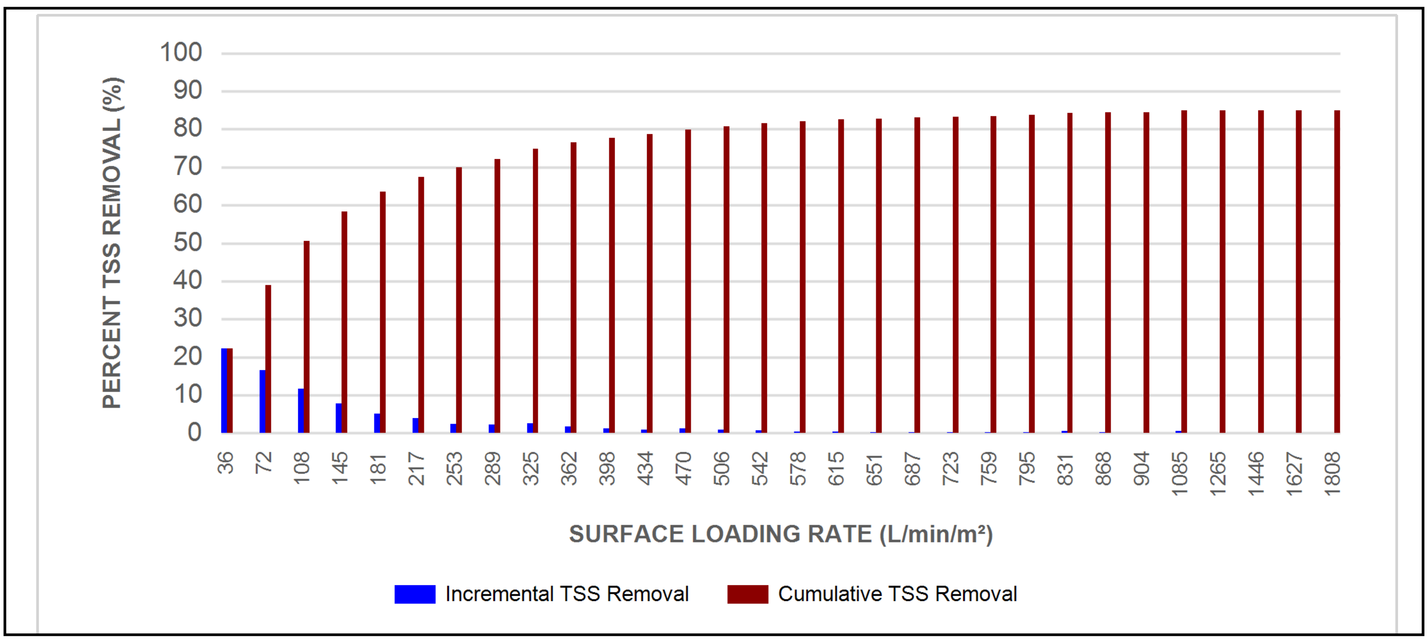
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	22.3	22.3	1.58	95.0	36.0	100	22.3	22.3
2	17.8	40.0	3.17	190.0	72.0	94	16.6	38.9
3	13.1	53.1	4.75	285.0	108.0	89	11.7	50.6
4	9.2	62.4	6.34	380.0	145.0	84	7.8	58.4
5	6.5	68.9	7.92	475.0	181.0	80	5.2	63.5
6	5.1	74.0	9.51	570.0	217.0	77	3.9	67.4
7	3.4	77.3	11.09	666.0	253.0	75	2.5	70.0
8	3.0	80.3	12.68	761.0	289.0	73	2.2	72.1
9	3.6	84.0	14.26	856.0	325.0	72	2.6	74.8
10	2.5	86.5	15.85	951.0	362.0	70	1.8	76.5
11	1.7	88.2	17.43	1046.0	398.0	69	1.2	77.7
12	1.4	89.6	19.02	1141.0	434.0	67	1.0	78.7
13	1.9	91.5	20.60	1236.0	470.0	66	1.2	79.9
14	8.5	100.0	22.18	1331.0	506.0	64	5.5	85.4
15	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
16	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
17	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
18	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
19	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
20	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
21	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
22	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
23	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
24	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
25	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
30	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
35	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
40	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
45	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
50	0.0	100.0	23.00	1380.0	525.0	63	0.0	85.4
Estimated Net Annual Sediment (TSS) Load Reduction =								**85 %**

Climate Station ID: 6105978 *Years of Rainfall Data*: 20

RAINFALL DATA FROM OTTAWA CDA RCS RAINFALL STATION



INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL



Maximum Pipe Diameter / Peak Conveyance

Stormceptor EF / EFO	Model Diameter		Min Angle Inlet / Outlet Pipes	Max Inlet Pipe Diameter		Max Outlet Pipe Diameter		Peak Conveyance Flow Rate	
	(m)	(ft)		(mm)	(in)	(mm)	(in)	(L/s)	(cfs)
EF4 / EFO4	1.2	4	90	609	24	609	24	425	15
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60
EF10 / EFO10	3.0	10	90	1828	72	1828	72	2830	100
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100

SCOUR PREVENTION AND ONLINE CONFIGURATION

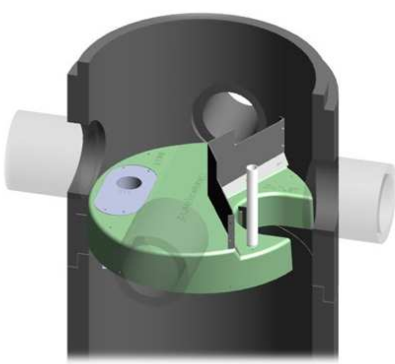
►**Stormceptor® EF and EFO** feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

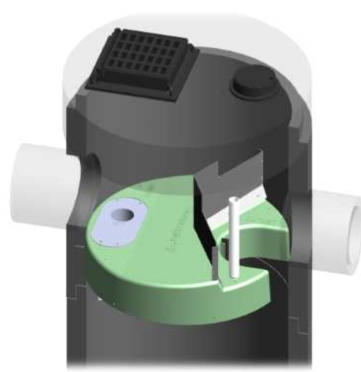
DESIGN FLEXIBILITY

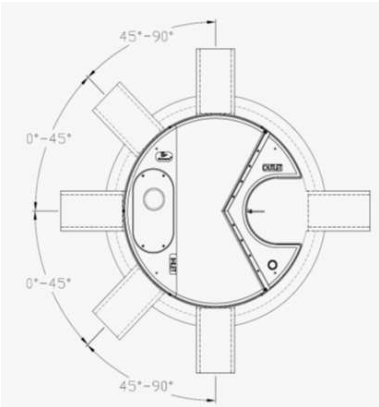
►**Stormceptor® EF** and **EFO** offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

OIL CAPTURE AND RETENTION

►While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid re-entrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.







INLET-TO-OUTLET DROP

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

0° - 45° : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90° : The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

HEAD LOSS

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

Pollutant Capacity

Stormceptor EF / EFO	Model Diameter		Depth (Outlet Pipe Invert to Sump Floor)		Oil Volume		Recommended Sediment Maintenance Depth *		Maximum Sediment Volume *		Maximum Sediment Mass **	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

*Increased sump depth may be added to increase sediment storage capacity

** Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft³)

Feature	Benefit	Feature Appeals To
Patent-pending enhanced flow treatment and scour prevention technology	Superior, verified third-party performance	Regulator, Specifying & Design Engineer
Third-party verified light liquid capture and retention for EFO version	Proven performance for fuel/oil hotspot locations	Regulator, Specifying & Design Engineer, Site Owner
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer
Minimal drop between inlet and outlet	Site installation ease	Contractor
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner

STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

STANDARD PERFORMANCE SPECIFICATION FOR
"OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators**

1.3 SUBMITTALS

1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.

1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.

1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

PART 2 – PRODUCTS

2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The minimum sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1	4 ft (1219 mm) Diameter OGS Units:	1.19 m^3 sediment / 265 L oil
	6 ft (1829 mm) Diameter OGS Units:	3.48 m^3 sediment / 609 L oil
	8 ft (2438 mm) Diameter OGS Units:	8.78 m^3 sediment / 1,071 L oil
	10 ft (3048 mm) Diameter OGS Units:	17.78 m^3 sediment / 1,673 L oil
	12 ft (3657 mm) Diameter OGS Units:	31.23 m^3 sediment / 2,476 L oil

PART 3 – PERFORMANCE & DESIGN

3.1 GENERAL

The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m^2.

3.4 LIGHT LIQUID RE-ENTRAINMENT SIMULATION TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of completed third-party Light Liquid Re-entrainment Simulation Testing in accordance with the Canadian ETV **Program's Procedure for Laboratory Testing of Oil-Grit Separators,** with results reported within the Canadian ETV or ISO 14034 ETV verification. This re-entrainment testing is conducted with the device pre-loaded with low density polyethylene (LDPE) plastic beads as a surrogate for light liquids such as oil and fuel. Testing is conducted on the same OGS unit tested for sediment removal to assess whether light liquids captured after a spill are effectively retained at high flow rates.

3.4.1 For an OGS device to be an acceptable stormwater treatment device on a site where vehicular traffic occurs and the potential for an oil or fuel spill exists, the OGS device must have reported verified performance results of greater than 99% cumulative retention of LDPE plastic beads for the five specified surface loading rates (ranging 200 L/min/m2 to 2600 L/min/m2) in accordance with the Light Liquid Re-entrainment Simulation Testing within the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators.**However, an OGS device shall not be allowed if the Light Liquid Re-entrainment Simulation Testing was performed with screening components within the OGS device that are effective at retaining the LDPE plastic beads, but would not be expected to retain light liquids such as oil and fuel.

Appendix D – Sanitary Design Calculations

City of Ottawa
1545 Woodroffe Ave - Circle K
Project Number: BRM-00606364-B0
Sanitary Sewer Design Calculations

DESIGNED BY : M. Li 18-Aug-21
REVISED BY:
CHECKED BY: J. Stern

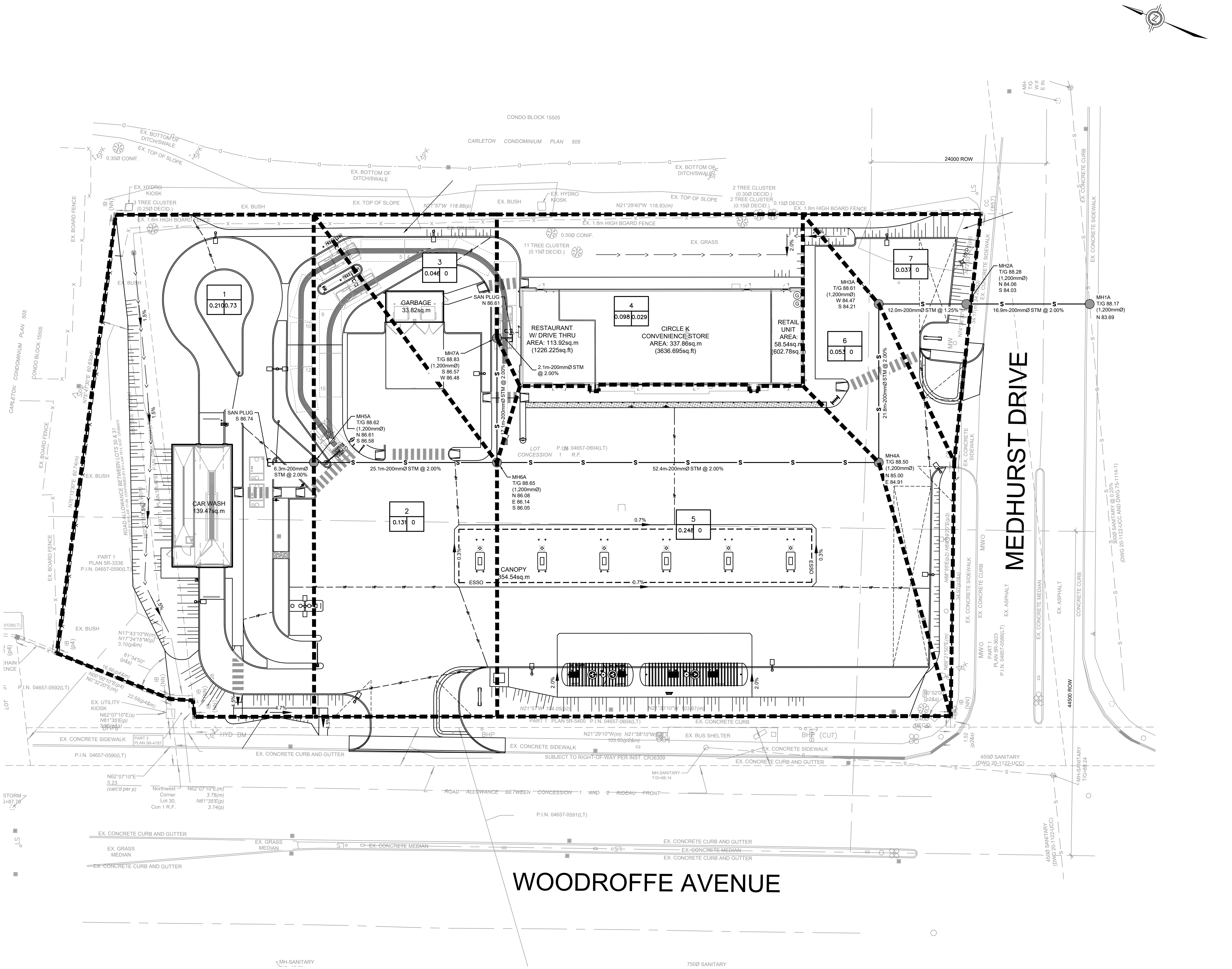
PIPE ROUGHNESS (n)			PEAKING FACTOR
< 600	=	0.013	1.50
≥ 600	=	0.013	
DESIGN VELOCITIES			P = Population in Thousands
MIN =	0.60	m/s	FLOW FACTOR (L/day/square metre)
MAX =	3.00	m/s	5
MAXIMUM PIPE CAPACITY			INFILTRATION RATE (L/sec/ha)
80%			0.26

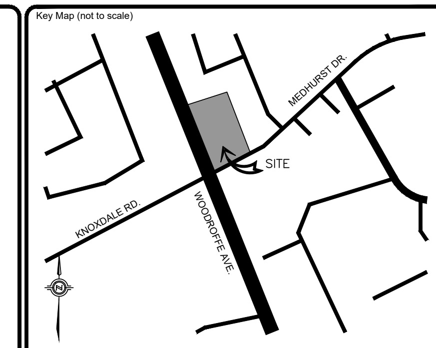
AREA	MANHOLE		Development Type	AREA		FLOW CHARACTERISTICS (L/sec)						PROPOSED SEWER DESIGN			CAPACITY (L/s)	ACTUAL VELOCITY PERMITTED FLOWING FULL (m/s)	PERCENT FULL (%)	ACTUAL VELOCITY (m/s)	ACTUAL DEPTH (m)	FROUDE NUMBER	DESIGN CHECKS	
	FROM	TO		INCREMENTAL (ha)	CUMMULATIVE (ha)	PEAK FACTOR	AVERAGE Q_{avg}	PEAK Q_{peak}	INFILTRATION Q_{inflit}	Foundation Q_{fdn}	TOTAL Q_{tot}	DIAMETRE (mm)	TYPE	GRADE (%)							MIN VELOCITY	MAX VELOCITY
										*Note 1												
1	CAR WASH	MH5A	Commercial	0.210	0.210	1.50	0.730	1.095	0.055	0.000	1.150	200	S. PVC	2.00	46.384	1.48	2.5%	0.59	0.02	1.33	OK	OK
2	MH5A	MH6A	Commercial	0.131	0.341	1.50	0.000	0.000	0.089	0.000	0.089	200	S. PVC	2.00	46.384	1.48	0.2%	0.11	0.00	0.70	OK	OK
4	STORE	MH7A	Commercial	0.098	0.098	1.50	0.029	0.044	0.025	0.000	0.069	200	S. PVC	2.00	46.384	1.48	0.1%	0.09	0.00	0.62	OK	OK
4	MH7A	MH6A	Commercial	0.046	0.144	1.50	0.000	0.000	0.037	0.000	0.037	200	S. PVC	2.00	46.384	1.48	0.1%	0.06	0.00	0.52	OK	OK
5	MH6A	MH4A	Commercial	0.248	0.733	1.50	0.000	0.000	0.191	0.000	0.191	200	S. PVC	2.00	46.384	1.48	0.4%	0.16	0.00	0.87	OK	OK
6	MH4A	MH3A	Commercial	0.053	0.786	1.50	0.000	0.000	0.204	0.000	0.204	200	S. PVC	2.00	46.384	1.48	0.4%	0.16	0.00	0.87	OK	OK
7	MH3A	MH2A	Commercial	0.037	0.823	1.50	0.000	0.000	0.214	0.000	0.214	200	S. PVC	1.25	36.670	1.17	0.6%	0.17	0.00	0.80	OK	OK
External	MH2A	MH1A	Commercial	0.000	0.823	1.50	0.000	0.000	0.214	0.000	0.214	200	S. PVC	2.00	46.384	1.48	0.5%	0.17	0.00	0.90	OK	OK

NOTES: 1) Foundation drains to the sanitary sewer system is not permitted for new developments. Therefore, no allowanace is made for foundation drain flow.
2) Total flow of 25.719 L/s is from External Sanitary Sewer Design Calculation

Design Parameters

Population Density		
Single Family Dwelling, " R "	3.5	per / unit
Extraneous Flow, Infiltration	0.26	L/ sec / ha
Foundation Drain	NA	L / sec / ha
Average Daily Flow, q	450	L / capita / day





LEGEND:

- IRON BAR
- BENCHMARK
- EX. FIRE HYDRANT
- EX. LIGHT POLE
- EX. LIGHT STANDARD
- EX. STORM MH
- EX. SANITARY MH
- EX. STORM CB
- EX. WATER VALVE
- EX. VALVE CHAMBER
- EX. BELL & HYDRO POLE
- EX. GUY WIRE AND ANCHOR
- EX. TRAFFIC SIGNAL
- EX. GAS VALVE
- EX. SIGN
- EX. TREE
- SUBJECT PROPERTY
- PROPERTY LINE
- EX. CONC. CURB
- EX. CENTERLINE OF DITCH
- EX. ROAD CENTERLINE
- EX. FENCE
- EX. STORM SEWER
- EX.CONTOUR
- NEW YARD LIGHT
- NEW STORM MH
- NEW SANITARY MH
- NEW STORM CB
- NEW STORM CBMH
- NEW CONC. CURB
- NEW CURB CUT/DEPRESSED CURB
- FIRE ROUTE SIGN
- NEW 1.8m HIGH WOOD FENCE
- DRAINAGE AREA BOUNDARY
- CATCHMENT I.D. / AREA (ha) | FACILITY FLOW

No.	REVISIONS	Date	By	App
C	RE-ISSUED FOR SPA	DEC 03 2021	ML	J.S
B	RE-ISSUED FOR SPA	SEPT 24 2021	ML	J.S
A	ISSUED FOR SPA	AUG 25 2021	ML	J.S

LICENSED PROFESSIONAL ENGINEER
J. D. STERN
100232894
Dec. 8/2021
PROVINCE OF ONTARIO

exp Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY • • INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

Owner/Client: CIRCLE K

Location:
1545 WOODROFFE AVE.
OTTAWA, ON

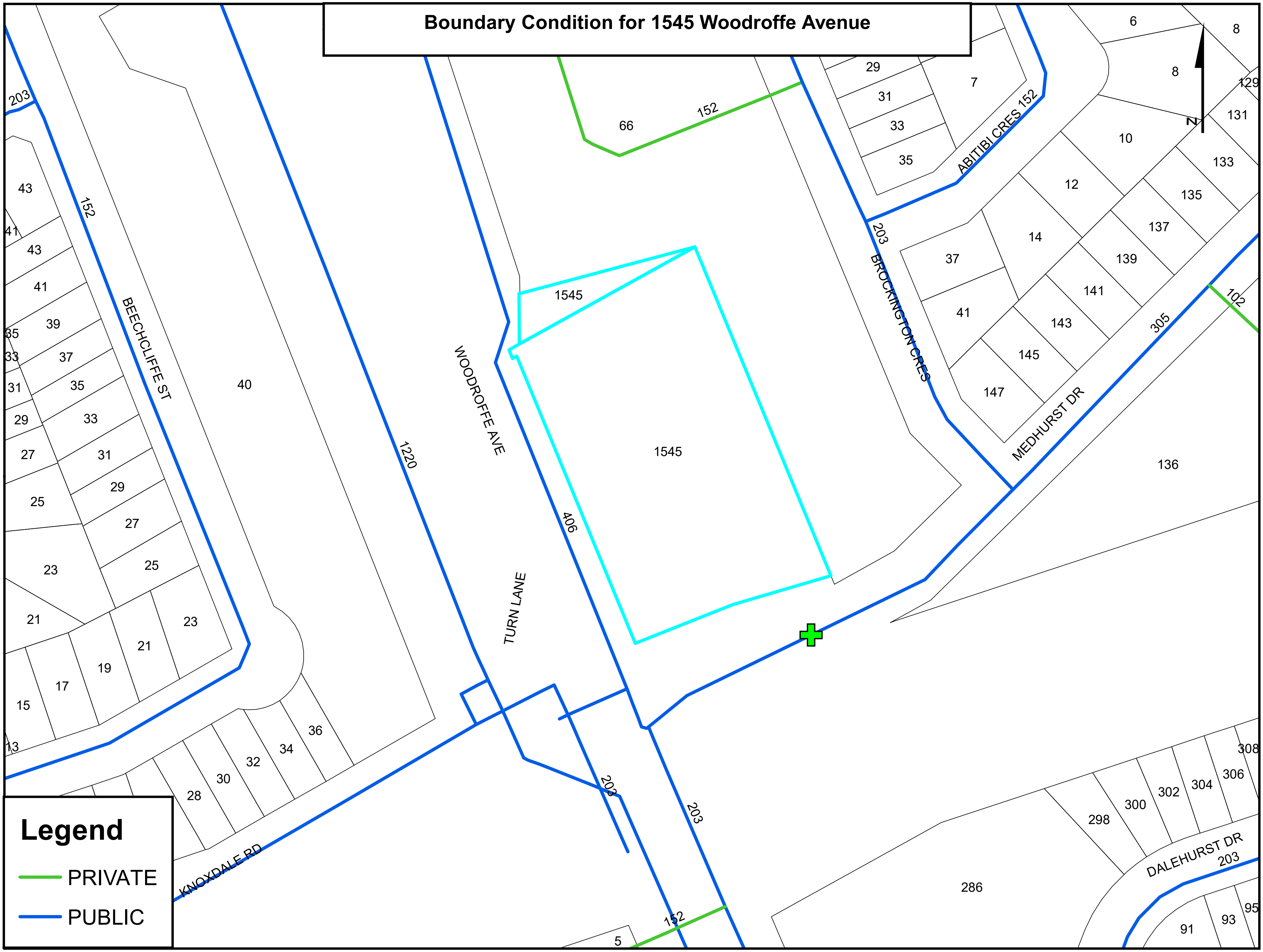
Title:
POST-DEVELOPMENT SANITARY DRAINAGE AREA PLAN

Designed By:	M.L.	Drawn By:	M.L.	Checked By:	J.S.
Scale:	1:250	Date:	APRIL 2020	City Drawing No.:	
Project No.:	BRM00606364-B0			Drawing No.:	C07

CITY # D07-12-21-0056
CITY DWG. # 17094

Appendix E – Watermain Boundary Condition Results

Boundary Condition for 1545 Woodroffe Avenue



Ming Li

From: Jordan Stern
Sent: Friday, December 3, 2021 8:45 AM
To: Ming Li
Subject: FW: 1545 Woodroffe Avenue - Site Plan Control
Attachments: 1545 Woodroffe April 2021.pdf

FYI

Jordan Stern, P.Eng.
EXP | Project Engineer, Central Ontario
t : +1.905.793.9800, 2359 | m : +1.647.406.8106 | e : jordan.stern@exp.com

From: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Sent: Tuesday, April 27, 2021 12:45 PM
To: Jordan Stern <Jordan.Stern@exp.com>
Cc: Crystal Frazao <Crystal.Frazao@exp.com>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: 1545 Woodroffe Avenue - Site Plan Control

Good afternoon,

The following are boundary conditions, HGL, for hydraulic analysis at 1545 Woodroffe (zone 2W2C) assumed to be connected to the 305mm on Medhurst Drive (see attached PDF for location).

Minimum HGL = 125.6m

Maximum HGL = 133.4m

Max Day + Fire Flow (150 L/s) = 128.2m

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

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

Rubina

--
Rubina Rasool, E.I.T.
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l’infrastructure et du développement économique
Development Review – East Branch

City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1 rubina.rasool@ottawa.ca

---

From: Rasool, Rubina
Sent: April 23, 2021 10:32 AM
To: Jordan Stern <Jordan.Stern@exp.com>
Cc: Crystal Frazao <Crystal.Frazao@exp.com>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: 1545 Woodroffe Avenue - Site Plan Control

Jordan,

I have received your request for water boundary conditions. Please allow for 5-10 business days for review.

Best,

Rubina
--
Rubina Rasool, E.I.T.
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review – East Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1 rubina.rasool@ottawa.ca

---

From: Jordan Stern <Jordan.Stern@exp.com>
Sent: April 22, 2021 9:31 PM
To: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Cc: Crystal Frazao <Crystal.Frazao@exp.com>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: 1545 Woodroffe Avenue - Site Plan Control

Rubina,

Please find attached, calculations and background information for sanitary, fire and domestic water demands accordingly.

Regards,

Jordan Stern, P.Eng.
EXP | Project Engineer, Central Ontario
t : +1.905.793.9800, 2359 | m : +1.647.406.8106 | e : jordan.stern@exp.com

exp.com | legal disclaimer
keep it green, read from the screen

From: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Sent: Thursday, April 22, 2021 3:24 PM

To: Jordan Stern <Jordan.Stern@exp.com>
Cc: Crystal Frazao <Crystal.Frazao@exp.com>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: 1545 Woodroffe Avenue - Site Plan Control

Hi Jordan,

I will also need the calculations provided for all the demands, especially the FUS.

Thank you,

Rubina

Rubina Rasool, E.I.T.
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review – East Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1 rubina.rasool@ottawa.ca

---

From: Jordan Stern <Jordan.Stern@exp.com>
Sent: April 22, 2021 2:49 PM
To: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Cc: Crystal Frazao <Crystal.Frazao@exp.com>; Gorni, Colette <colette.gorni@ottawa.ca>
Subject: RE: 1545 Woodroffe Avenue - Site Plan Control

Expected loads for the proposed development are as follows:

- Location of service will be the 305mm DI watermain on Medhurst Drive approximately 83m east of intersection with Woodroffe Avenue.
- Proposed development will be a fueling station, convenience store and car wash; the highest fire flow required (C-store) is 150 l/s as per the FUS, 1999.
- Average daily demand: 1.0 l/s (including average car wash consumption rates)
- Maximum daily demand: 1.5 l/s
- Maximum hourly daily demand: 2.7 l/s
- Fire protection will be provided by the existing fire hydrant on the north side of Woodroffe Avenue adjacent the site.
- Plan marking the location of the proposed connections – See attached draft Site Servicing Plan.
- Peak sanitary demands: 1.67 l/s (including car wash discharge).

Please let me know if there is anything else required prior to SPA submission and advise upon boundary conditions ASAP.

Thanks kindly,

Jordan Stern, P.Eng.
EXP | Project Engineer, Central Ontario
t : +1.905.793.9800, 2359 | m : +1.647.406.8106 | e : jordan.stern@exp.com

From: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Sent: Thursday, April 22, 2021 10:33 AM
To: Crystal Frazao <Crystal.Frazao@exp.com>
Cc: Jordan Stern <Jordan.Stern@exp.com>
Subject: RE: 1545 Woodroffe Avenue - Site Plan Control

Crystal,

The water boundary conditions are required to determine if there is appropriate water pressure for the proposed development. As the pre-consultation notes have indicated please provide the following:

- Location of service(s)
- Type of development and the amount of fire flow required (as per FUS, 1999).
- Average daily demand: ___ l/s
- Maximum daily demand: ___l/s
- Maximum hourly daily demand: ___ l/s
- Fire protection (Fire demand, Private Hydrant Locations)
- Plan marking the location of the proposed connections
- Include sanitary demands

Please forward this information to me. Note there is a 1-2 week turnaround time for water boundary conditions.

Furthermore, please allow staff 1-2 business days to respond to emails. We respectfully ask you for your patience.

Best,

Rubina

--
Rubina Rasool, E.I.T.
Project Manager
Planning, Infrastructure and Economic Development Department - Services de la planification, de l'infrastructure et du développement économique
Development Review – East Branch
City of Ottawa | Ville d'Ottawa
110 Laurier Avenue West Ottawa, ON | 110, avenue Laurier Ouest. Ottawa (Ontario) K1P 1J1 rubina.rasool@ottawa.ca

From: Crystal Frazao <Crystal.Frazao@exp.com>
Sent: April 21, 2021 9:12 AM
To: Rasool, Rubina <Rubina.Rasool@ottawa.ca>
Cc: Gorni, Colette <colette.gorni@ottawa.ca>; Jordan Stern <Jordan.Stern@exp.com>
Subject: FW: 1545 Woodroffe Avenue - Site Plan Control
Importance: High

Please see email below from our Civil engineer, can you please confirm?

Thanks,

Crystal Frazao
EXP | Project Manager
t : +1.905.793.9800 | m : +1.416.320.5545 | e : Crystal.Frazao@exp.com

From: Jordan Stern <Jordan.Stern@exp.com>
Sent: Tuesday, April 20, 2021 4:11 PM
To: colette.gorni@ottawa.ca
Cc: Crystal Frazao <Crystal.Frazao@exp.com>
Subject: 1545 Woodroffe Avenue - Site Plan Control

Hi Colette,

My name is Jordan Stern, I am the civil engineer working on the above referenced site plan application, file no. PC2018-0342.
The pre-con notes attached make reference to a boundary conditions request prior to first submission. This is found within the engineering section on page 4.

Can you please elaborate on what is required and/or how the City would like to receive this information?
Would an email listing the requested information be appropriate?

Please confirm or if you can direct me to the City engineer who could assist, that would be appreciated.

Thanks kindly,

exp.

Jordan Stern, P.Eng.
EXP | Project Engineer, Central Ontario
t : +1.905.793.9800, 2359 | m : +1.647.406.8106 | e : jordan.stern@exp.com

1595 Clark Boulevard
Brampton, ON L6T 4V1
CANADA

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Appendix F – Tempest Inlet Control Devices Technical Manual

Volume III: TEMPEST INLET CONTROL DEVICES

Municipal Technical Manual Series

SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

MHF (Medium to High Flow) ICD

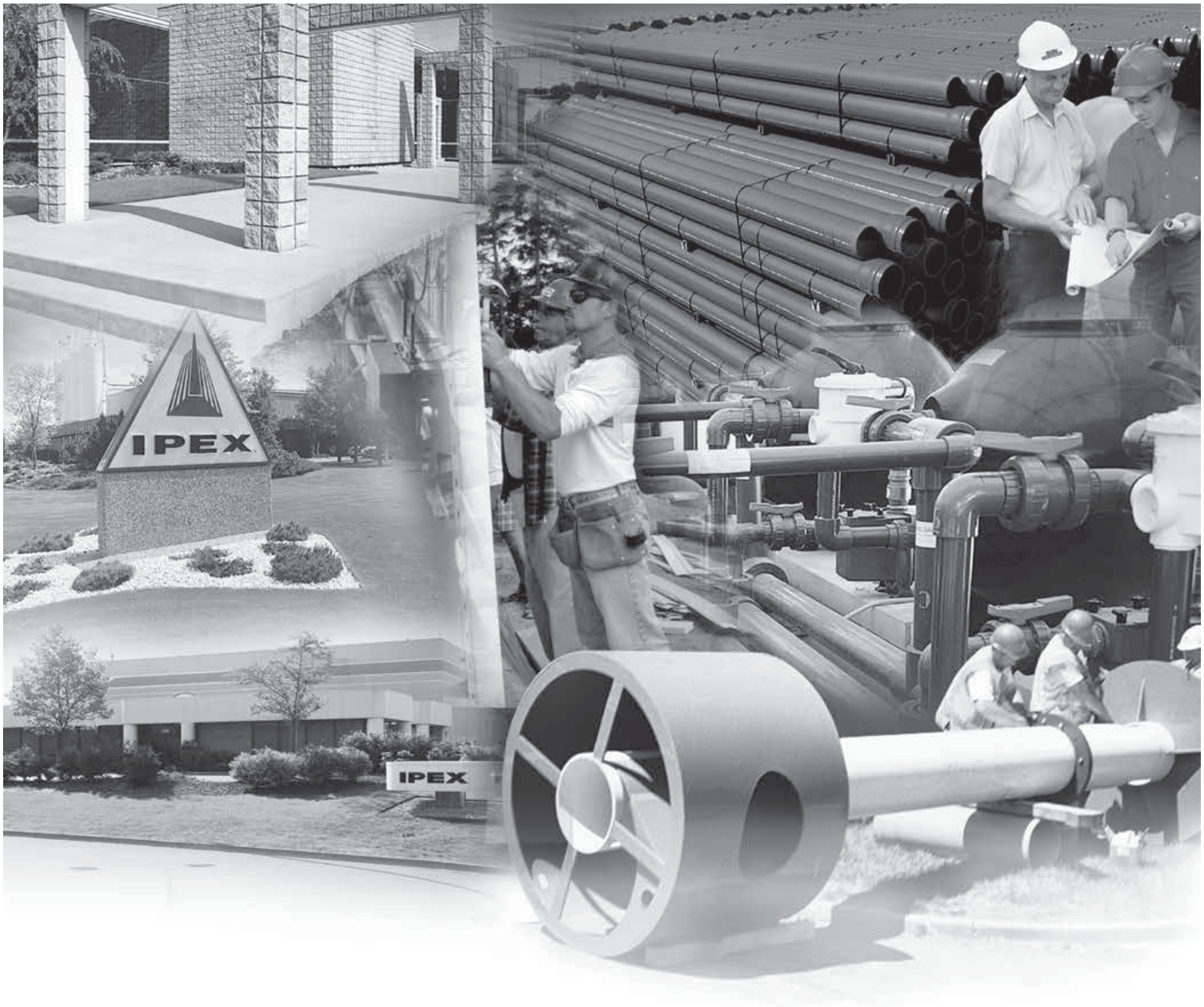
IPEX by aliaxis

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition

For information contact: IPEX, Marketing,
1425 North Service Road East, Oakville, Ontario, Canada, L6H 1A7



ABOUT IPEX

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

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

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

CONTENTS

TEMPEST INLET CONTROL DEVICES Technical Manual

About IPEX

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

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

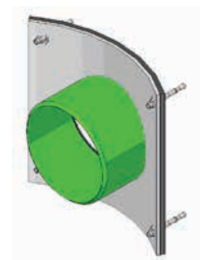
Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

Will accommodate both square and round applications:

Square Application

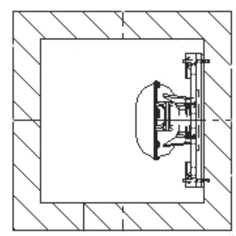
Round Application



+

Spigot CB Wall Plate

Universal Mounting Plate



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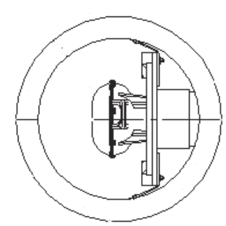
Universal Mounting Plate Hub Adapter



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

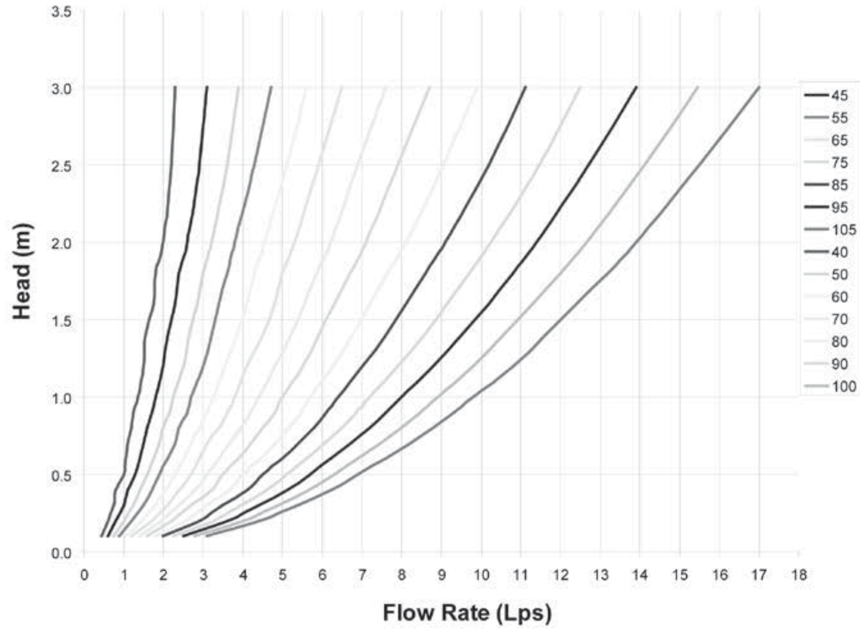
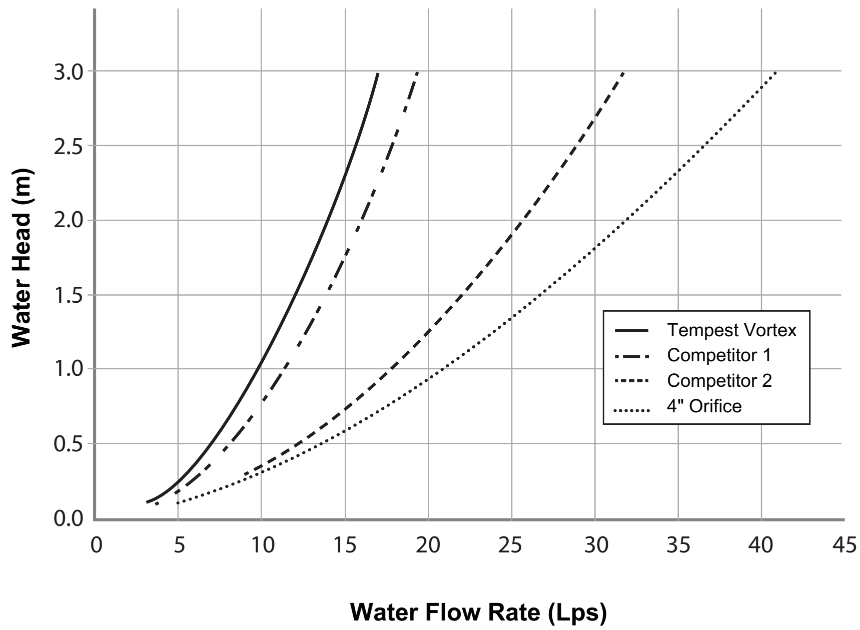


Chart 2: LMF Flow vs. ICD Alternatives



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

PRODUCT INSTALLATION

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

STEPS:

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

⚠ WARNING

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

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

STEPS:

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

⚠ WARNING

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

PRODUCT TECHNICAL SPECIFICATION

General

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

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

Product Description

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

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

Product Function

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

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

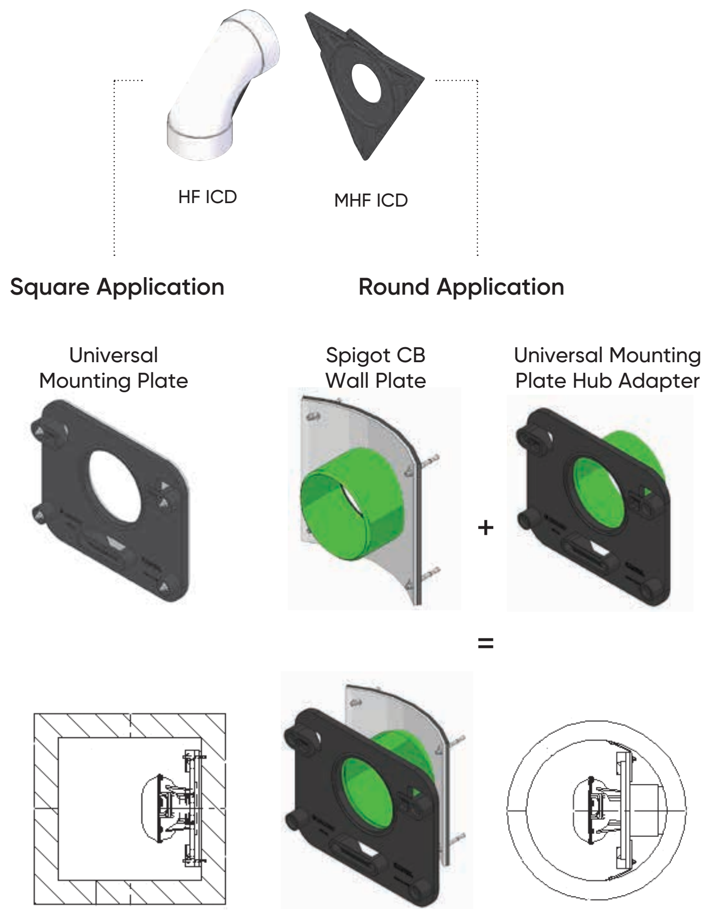
TEMPEST MHF (Medium to High Flow): The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

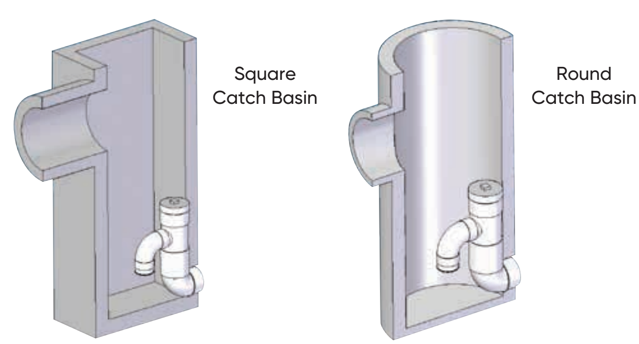
The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

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

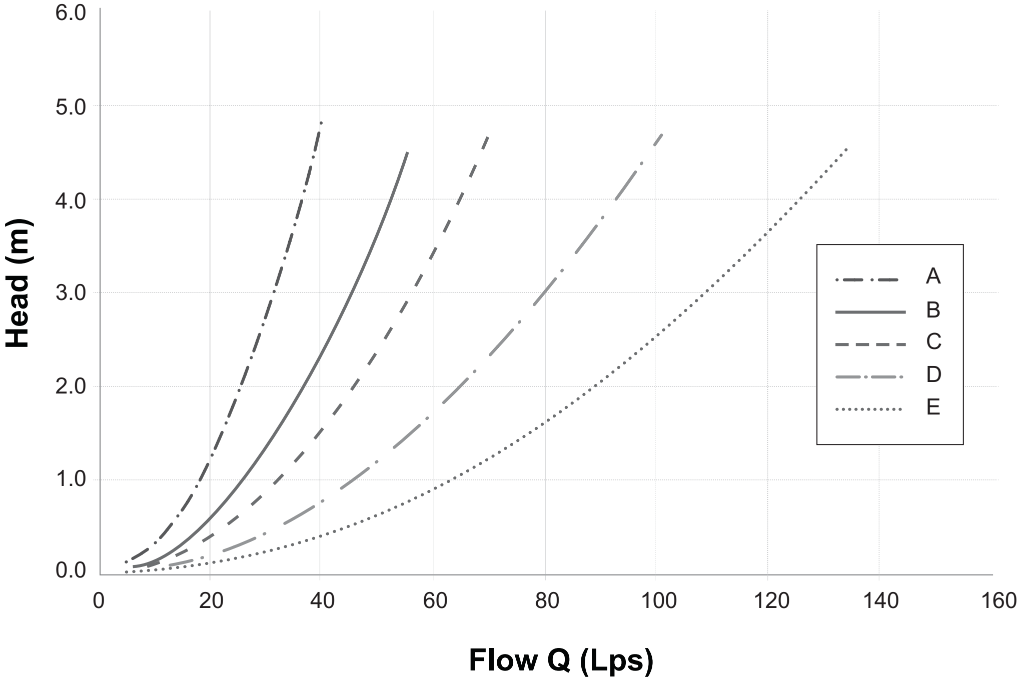


The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:



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

Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

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

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

⚠ WARNING

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

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

STEPS:

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

⚠ WARNING

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

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

STEPS:

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

WARNING

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

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 where specified. All ICD's will be IPEX Tempest or approved equal.

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

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

ICD's shall have no moving parts.

Materials

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

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

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

All hardware will be made from 304 stainless steel.

Dimensioning

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

Installation

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

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

NOTES

SALES AND CUSTOMER SERVICE

IPEX Inc.
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ipexna.com

About the IPEX Group of Companies

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

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Tempest™ is a trademark of IPEX Branding Inc.

IPEX by aliaxis

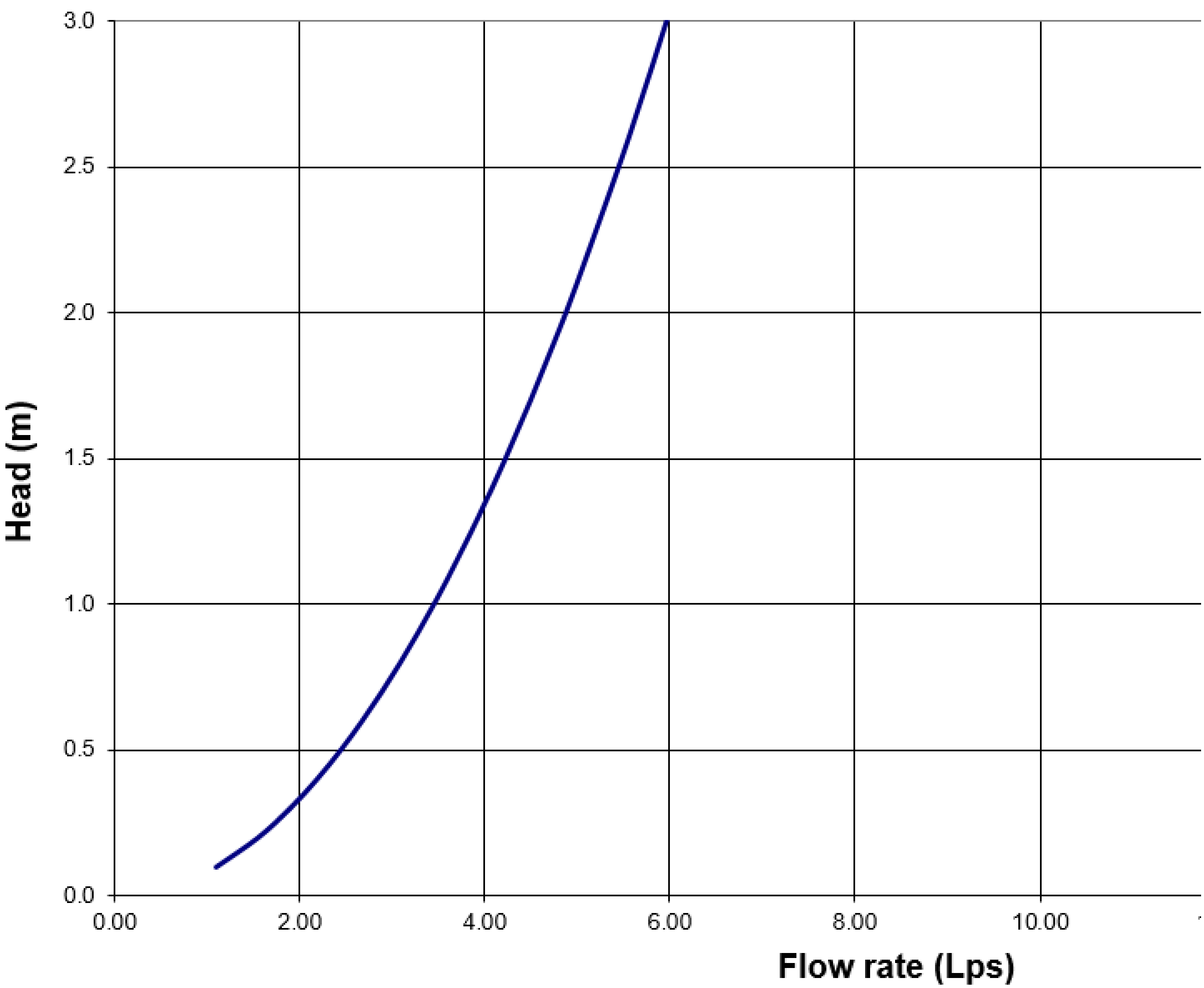
MNMNTPIP110817C

Ming Li

From: Rosiu, Cornel <Cornel.Rosiu@ipexna.com>
Sent: Wednesday, August 18, 2021 7:51 AM
To: Ming Li
Cc: Jordan Stern
Subject: RE: Tempest LMF sizing inquiry

Hello Ming,

I took a few points off your chart and plotted them in our LMF calculator, and they all came up with the same orifice: 63mm. What you need is the Tempest LMF63



Regards,

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

From: Ming Li <Ming.Li@exp.com>
Sent: August 17, 2021 8:52 PM
To: Rosiu, Cornel <Cornel.Rosiu@ipexna.com>
Cc: Jordan Stern <Jordan.Stern@exp.com>
Subject: Tempest LMF sizing inquiry

Hi Cornel,

I received your contact from my colleague Jessy and am wondering if you can help me with the Tempest LMF sizing.
We are currently working on a gas station site in Ottawa and the controlled flow is calculated based on a 40mm dia orifice plate which City will not support.
Can you please size a Tempest LMF flow regulator that has an equivalent rating curve as in the attached excel file?
The outlet pipe will be a 375mm PVC sewer.
Let me know if you need any further information and thank you very much.

exp.

Ming Li, M.A.Sc
EXP | CAD Designer, Central Ontario
t : +1.905.793.9800, 2436 | e : ming.li@exp.com
1595 Clark Boulevard
Brampton, ON L6T 4V1
CANADA

Appendix G – Correspondences

90. As per policy # 8 of the section 4.8.4 of the OP, "*Where a gasoline station site is being redeveloped and there is no change in use to a more sensitive use, the City will require that a letter of continued use from the Technical Standards and Safety Authority be provided. For instances where contamination extends onto a City right-of way, the City will require that an Off-Site Management Agreement and Remedial Action Plan be implemented to the satisfaction of the City prior to issuance of the building permit.*" Therefore, in coordination with the upcoming inputs from Rich Barker for the off-site contamination, and in addition to the requirements as indicated above, I would recommend requiring the submission of the following documents prior to issuing a building permit:

a. A Remedial Action Plan and/or a risk assessment/risk management plan to manage the existing contamination both on-site and off-site.

b. A site remediation report confirming the site clean up upon completion of the remedial and/or risk management activities.

c. A letter of continued use from the TSSA, or a copy of an up to date TSSA license for this gas station.

Feel free to contact Vahid Arasteh, Specialist (ERU), at vahid.arasteh@ottawa.ca for follow-up questions.

Urban Design

Urban design comments to be provided once available.

EXTERNAL AGENCIES:

RVCA

91. The RVCA has reviewed the above noted Site Plan Control application to construct a gas bar with 1 fuel island and 6 fuel pumps, a convenience store with a 337 sqm GFA, retail store with a 56 sqm GFA, a drive-through restaurant with a 113 sqm GFA, and a car wash with a 139 sqm GFA and have no objections.

Rogers

92. Rogers has no comment or concerns regarding this circulation. Please contact John Davin at 613-759-8588 or e-mail at johnj.davin@rci.rogers.com for Rogers Site Servicing if approved, or if you require additional information.

Hydro One

93. No concerns at this time. Our preliminary review considers issues affecting Hydro One's 'High Voltage Facilities and Corridor Lands' only.

Servicing study guidelines for development applications

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

- ☐ Executive Summary (for larger reports only).
- ☒ Date and revision number of the report.
- ☒ Location map and plan showing municipal address, boundary, and layout of proposed development.
- ☒ Plan showing the site and location of all existing services.
- ☒ Development statistics, land use, density, adherence to zoning and official plan, and reference to applicable subwatershed and watershed plans that provide context to which individual developments must adhere.
- ☒ Summary of Pre-consultation Meetings with City and other approval agencies.
- ☒ Reference and confirm conformance to higher level studies and reports (Master Servicing Studies, Environmental Assessments, Community Design Plans), or in the case where it is not in conformance, the proponent must provide justification and develop a defendable design criteria.
- ☒ Statement of objectives and servicing criteria.
- ☒ Identification of existing and proposed infrastructure available in the immediate area.
- ☒ Identification of Environmentally Significant Areas, watercourses and Municipal Drains potentially impacted by the proposed development (Reference can be made to the Natural Heritage Studies, if available).
- ☒ Concept level master grading plan to confirm existing and proposed grades in the development. This is required to confirm the feasibility of proposed stormwater management and drainage, soil removal and fill constraints, and potential impacts to neighbouring properties. This is also required to confirm that the proposed grading will not impede existing major system flow paths.
- ☒ 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.
- ☐ Proposed phasing of the development, if applicable.

☒ Reference to geotechnical studies and recommendations concerning servicing.

☒ All preliminary and formal site plan submissions should have the following information:
- Metric scale
- North arrow (including construction North)
- Key plan
- Name and contact information of applicant and property owner
- Property limits including bearings and dimensions
- Existing and proposed structures and parking areas
- Easements, road widening and rights-of-way
- Adjacent street names

4.2 Development Servicing Report: Water

☐ Confirm consistency with Master Servicing Study, if available

☒ Availability of public infrastructure to service proposed development

☒ Identification of system constraints

☒ Identify boundary conditions

☒ Confirmation of adequate domestic supply and pressure

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

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

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

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

☒ Check on the necessity of a pressure zone boundary modification.

☒ 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

- ☒ 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.
- ☐ 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.
- ☒ Confirmation that water demands are calculated based on the City of Ottawa Design Guidelines.
- ☒ Provision of a model schematic showing the boundary conditions locations, streets, parcels, and building locations for reference.

4.3 Development Servicing Report: Wastewater

- ☒ 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).
- ☒ Confirm consistency with Master Servicing Study and/or justifications for deviations.
- ☒ 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.
- ☒ Description of existing sanitary sewer available for discharge of wastewater from proposed development.
- ☒ 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)
- ☒ Calculations related to dry-weather and wet-weather flow rates from the development in standard MOE sanitary sewer design table (Appendix ‘C’) format.
- ☒ Description of proposed sewer network including sewers, pumping stations, and forcemains.
- ☒ 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).
- ☐ Pumping stations: impacts of proposed development on existing pumping stations or requirements for new pumping station to service development.
- ☐ Forcemain capacity in terms of operational redundancy, surge pressure and maximum flow velocity.
- ☐ 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.
- ☒ Set-back from private sewage disposal systems.
- ☒ 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.
- ☒ Storage requirements (complete with calculations) and conveyance capacity for minor events (1:5 year return period) and major events (1:100 year return period).
- ☒ Identification of watercourses within the proposed development and how watercourses will be protected, or, if necessary, altered by the proposed development with applicable approvals.
- ☒ 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.
- ☐ Any proposed diversion of drainage catchment areas from one outlet to another.
- ☒ Proposed minor and major systems including locations and sizes of stormwater trunk sewers, and stormwater management facilities.
- ☐ If quantity control is not proposed, demonstration that downstream system has adequate capacity for the post-development flows up to and including the 100 year return period storm event.
- ☒ Identification of potential impacts to receiving watercourses
- ☒ Identification of municipal drains and related approval requirements.
- ☒ Descriptions of how the conveyance and storage capacity will be achieved for the development.
- ☒ 100 year flood levels and major flow routing to protect proposed development from flooding for establishing minimum building elevations (MBE) and overall grading.

- ☒ Inclusion of hydraulic analysis including hydraulic grade line elevations.
- ☒ Description of approach to erosion and sediment control during construction for the protection of receiving watercourse or drainage corridors.
- ☒ 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.
- ☐ Identification of fill constraints related to floodplain and geotechnical investigation.

4.5 Approval and Permit Requirements: Checklist

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

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