Mario Polla

904 Mississauga Heights Drive

Stormwater Management Report

March 22, 2021

wsp

904 Mississauga Heights Drive

Stormwater Management Report

Mario Polla

Project No.: 20M-01451-00
Date: March 22, 2021

WSP
100 Commerce Valley Drive West
Thornhill, ON, Canada L3T 0A1

wsp.com

Revision History

FINAL

22 March 2021	Issue to Client			
Prepared by	Reviewed by	Approved By		
Tahmineh Sarabian, Project Engineer	Alyssa Mohino-Barrie, Project Manager	Alyssa Mohino-Barrie, Project Manager		

Signatures

Prepared by

March 22, 2021

Tahmineh Sarabian, P.Eng.
Project Engineer, Water Resources

Date

Alyssa Mohino-Barrie, P.Eng.
Project Manager, Water Resources

WSP Canada Inc prepared this report solely for the use of the intended recipient, Mario Polla, in accordance with the professional services agreement. The intended recipient is solely responsible for the disclosure of any information contained in this report. The content and opinions contained in the present report are based on the observations and/or information available to WSP Canada Inc. at the time of preparation. Apart from the City of Mississauga, who may rely on this report, should a third party make use of, relies on, or makes decisions in accordance with this report, said third party is solely responsible for such use, reliance or decisions. WSP Canada Inc does not accept responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken by said third party based on this report. This limitations statement is considered an integral part of this report.

The original of this digital file will be conserved by WSP Canada Inc for a period of not less than 10 years. As the digital file transmitted to the intended recipient is no longer under the control of WSP Canada Inc, its integrity cannot be assured. As such, WSP Canada Inc does not guarantee any modifications made to this digital file subsequent to its transmission to the intended recipient.

Contributors

Client

Owner	Mr. Mario Polla

WSP

Project Engineer, Water Resources	Tahmineh Sarabian, P.Eng
Project Manager, Water Resources	Alyssa Mohino-Barrie, P.Eng
Proof (non-technical) / Format	Melinda Nowak

Subconsultants

N/A

TABLE OF CONTENTS

Tables

Figures

Appendices

1 INTRODUCTION

1.1 Scope

WSP has been retained by Mario Polla to prepare a Stormwater Management (SWM) Report in support of the Zoning By-Law Amendment (ZBA) for the proposed development at 904 Mississauga Heights Drive, City of Mississauga, to add four single family detached homes and retain the existing home. This SWM report examines the potential water quality, quantity, balance, and erosion impacts of the proposed development and summarizes how each will be addressed in accordance with the City of Mississauga's Development Requirements (2020) and the Credit Valley Conservation (CVC) 2012 Stormwater Management Criteria.

1.2 Site Location

The property block is located between Mississauga Heights Drive and the Credit River. The property occupies an area of approximately 1.25 ha which includes an access road extending from Mississauga Heights Drive to the existing house located on the back third of the property. The existing house, which under proposed development is delineated as 'Lot D' with an area of approximately 0.2 ha, is not included as a part of the proposed development and is excluded from the analysis presented in this report. The project area under consideration therefore is the the remaining area of the property, approximately 1.06 ha, and is hereafter referred to as "the site" for the remainder of this report. The location of the proposed development is illustrated in **Figure 1**.

1.3 Stormwater Management Plan Objectives

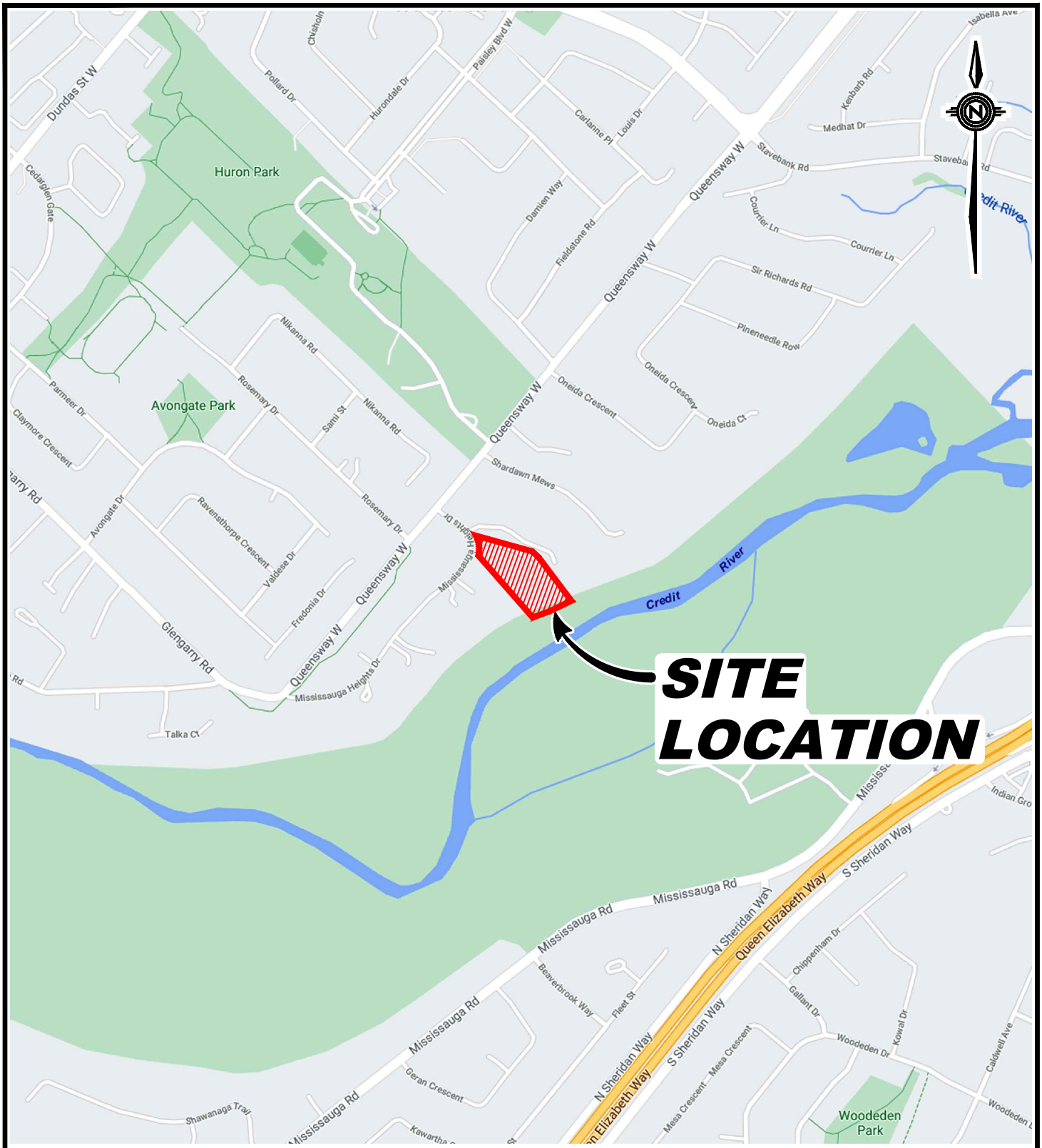
The objectives of the stormwater management plan are as follows:

- Determine the site-specific stormwater management requirements to ensure that the development is in conformance with the City of Mississauga and CVC SWM criteria
- Evaluate various stormwater management practices that meet the requirements of the City and the conservation authority and recommend a preferred strategy
- Prepare a stormwater management report documenting the strategy along with the technical information necessary for the justification and sizing of the proposed stormwater management facilities

1.4 Design Criteria

The City of Mississauga issued a Development Requirements Manual in 2020 to provide direction on the management of rainfall and runoff inside the City's jurisdiction. As the site is located within the Credit Valley Source Protection Area, Highly Vulnerable Aquifer (score: 6), it also falls under the jurisdiction of the Credit Valley Conservation (CVC). A summary of the stormwater management criteria applicable to the site is as follows:

- Runoff Volume Reduction: The City's Design Manual requires the first 5 mm of runoff shall be retained on-site and managed by way of infiltration, evapotranspiration or reuse.
- Water Quality: The City's Design Requirements specify that water quality control is to be implemented in accordance with the Approved Source Protection Plan (March 2019), the City's Stormwater Quality Control Strategy (January 1996) and the MECP (formerly MOE) Stormwater Management Practices Planning and Design Manual. Based on the MECP 's Manual, the long-term removal of 80% of the TSS loading is required.
- Erosion Control: As indicated in the CVC SWM Criteria (2012) long term erosion control is not required as the site does not discharge to a sensitive watercourse. According to the City of Mississauga Development Requirements Section 8, "erosion protection shall be provided at all outlets to prevent erosion of the watercourse and to the area adjacent to the headwall".
- Water Quantity Control and Discharge to Municipal Infrastructure: As stated in the City of Mississauga's Development Requirements, there are no specific quantity control requirements for the Credit River subwatershed. As the City's storm sewer system is designed to accommodate a 10-year storm, the release rate from the site to the storm sewer connection for events greater than the 10-year storm must not exceed the 10-year pre-development flow level or the receiving capacity of the storm sewer, whichever is less. Therefore, the post-development runoff shall be controlled from 100-year post-development to 10-year pre-development flows.



CLIENT

MARIO POLLA

TITLE

904 MISSISSAUGA HEIGHTS DRIVE

SITE LOCATION

wsp

Checked A.M.	Drawn AutoCAD/B.K.B.
Date MARCH 2021	Proj. No. 20M-01451-00
Scale AS SHOWN	Figure No. 1

FIGURE 1.dwg - 904 Mississauga Heights Dr - Site Location C:\Users\baileyb\BIM 360\WSP Canada projects (AMER)\Land Development Ontario\Project Files\20M-01451 904 Mississauga Heights Drive\SWM\CAD\FIGURES\ Mar 16, 2021 - 11:02am

2 PRE-DEVELOPMENT CONDITIONS

2.1 General

Under pre-development conditions, the 1.06 ha site is primarily covered by vegetated surfaces. The pre-development runoff coefficient is estimated at 0.31 for the 2-year event. During a site visit carried out on March 1, 2021, it was determined that there were no inlets to a storm sewer at the site and the only storm manhole that was evident on the record drawings had been abandoned. Based on visible site slopes and the obtained survey data (included in the FSR by WSP, submitted under separate cover) it was concluded that under the existing conditions, the site generally drains to the southeast via sheet flow and ultimately discharges to the Credit River. Based on preliminary information, the site does not receive overland runoff from the adjacent properties. The existing condition of the site is shown in **Figure 2**.

2.2 Rainfall Information

The rainfall intensity for the site was calculated using the following equation:

$$I = A / (B+T)^{C}$$

Where;

I = rainfall intensity in mm/hour

T = time of concentration in hours

A, B, and C = constant parameters (see below)

The parameters (A, B, C) for use in the City of Mississauga are summarized in **Table 2.1**.

Table 2.1: Rainfall Parameters

Return Period	2	5	10	25	50	100
A	610	820	1010	1160	1300	1450
B	4.60	4.60	4.60	4.60	4.70	4.90
C	0.78	0.78	0.78	0.78	0.78	0.78

Source: City of Mississauga's Development Requirements (2020)

2.3 Allowable Flow Rates

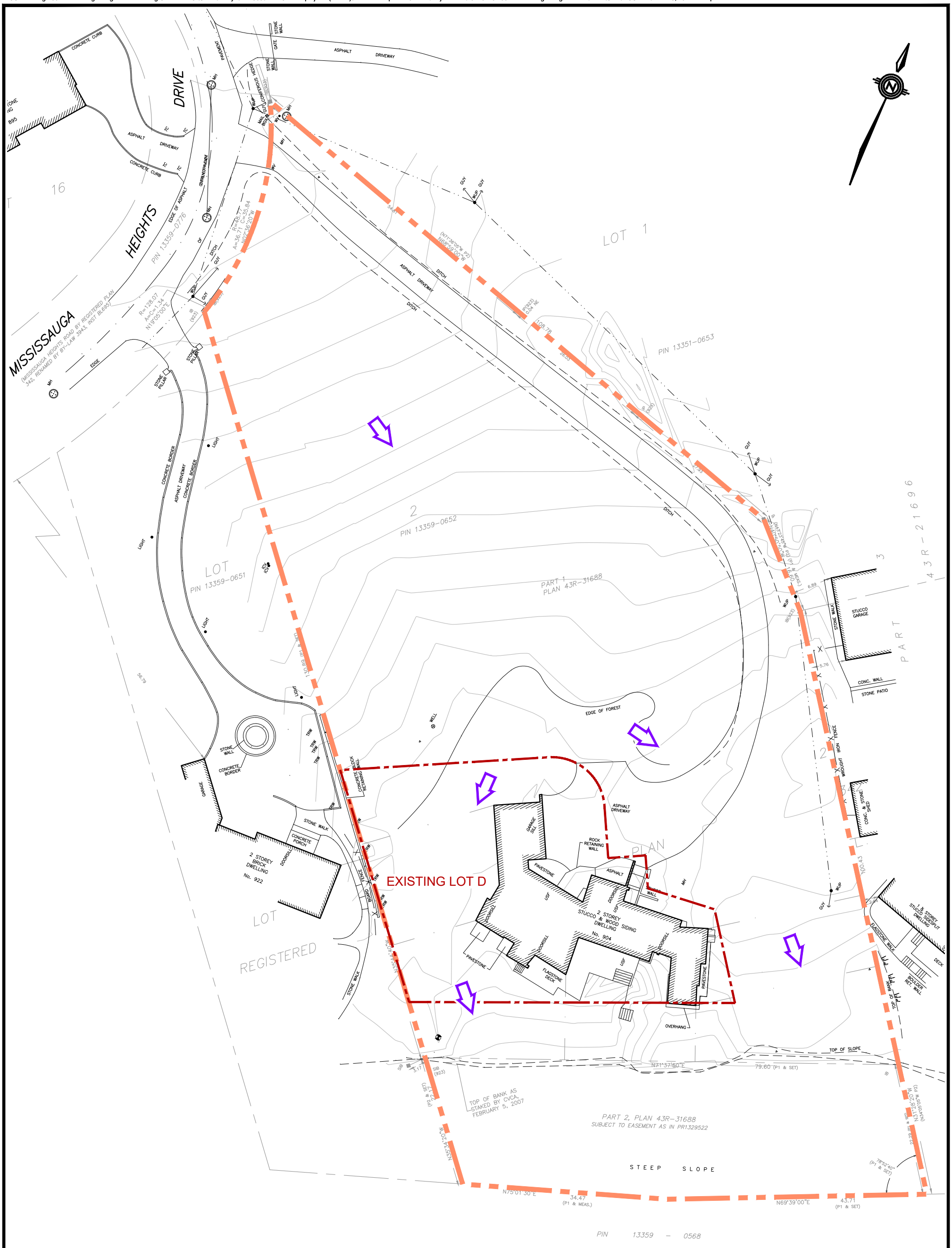
The site location is within the Credit River watershed. As stated in **Section 1.4**, there is no specific quantity control requirements for the Credit River subwatershed. The City of Mississauga requires that the site's post-development discharge rates for all storm events up to and including the 100-year storm do not exceed the 10-year pre-development flow rates.

The allowable flowrate for this site has been calculated to be 93 L/s. The calculated peak flow rates for the site under pre-development conditions are summarized in **Table 2.2**. Detailed calculations are contained within **Appendix A**.

Table 2.2: Pre-Development Peak Discharge Rates and Allowable Flow Rates

Return Period	Runoff Coefficient	Rainfall Intensity, I (mm/hr)	Existing Peak Flow Rate, Q (L/s)*	Allowable Flow Rate, Q (L/s)*
2	0.36	60	56	93
5	0.36	81	75	
10	0.36	99	93	
25	0.39	114	117	
50	0.43	127	143	
100	0.44	141	165	

*Area of 0.94 ha, C = 0.36 to 0.44 and time of concentration of 15 min



LEGEND

PROPERTY BOUNDARY

DRAINAGE DIRECTION

CLIENT: MARIO POLLA

TITLE: 904 MISSISSAUGA HEIGHTS DRIVE

EXISTING CONDITIONS

Checked: A.M.	Drawn: AutoCAD/B.K.B.
Date: MARCH 2021	Proj. No.: 20M-01451
Scale: AS SHOWN	Figure No.: 2

3 POST-DEVELOPMENT CONDITIONS

3.1 General

The proposed development consists of four residential lots, shared access road and landscaping areas. As detailed site plans were not available for this submission a general runoff coefficient of 0.55 was assigned to each lot as per the City of Mississauga's Development Plan's prescribed runoff coefficient for "residential-single family" lots. A more detailed land-use for each lot will be provided as part of the submission for site plan application. An area breakdown for the proposed site layout is provided below in **Table 3.1**. Refer to **Figure 3** for details of the post-development conditions.

Table 3.1: Proposed Land-Use Area Breakdown

Land-Use	Area (m^2)	2-Year Runoff Coefficient, C	Imperviousness
Lot A	1,380	0.55	40%
Lot B	1,727	0.55	40%
Lot C	1,600	0.55	40%
Lot D-Controlled	497	0.90	100%
Lot E	1,315	0.55	40%
Shared Landscaping-Easement Area	1,620	0.25	0%
Shared Road / Vehicular	1,246	0.90	100%
Total Development Area	**9,385**	**0.56**	**44%**

Under the proposed conditions, runoff from all areas are controlled with the exception of a total area of 1,732 m^2 (C=0.41) that is not going to be controlled. Runoff from all controlled areas will be directed to a subsurface infiltration chamber system. Details of the controlled and uncontrolled areas are provided in **Appendix A**.

FIGURE 3.dwg - 904 Mississauga Heights Dr - Proposed Conditions C:\Users\baileyb\BIM 360\WSP Canada projects (AMER)\Land Development Ontario\Project Files\20M-01451 904 Mississauga Heights Drive\SWM\CAD\FIGURES\ Mar 19, 2021 - 10:15am

STREET WIDTH
CURB TO CURB
7.5m (TYP.)

COMMON ELEMENT
CONDOMINIUM ROAD

150 CONC. CURB
(TYP.) ON BOTH SIDES

MH1
TOP 106.70
SE INV.104.23

25.6m - 250Ø STM @
1.0%

MH2
TOP 105.60
NW INV.103.97
SE INV.103.89

16m - 250Ø STM @ 0.5%

MH3
TOP 104.88
NW INV.103.81
SW INV.103.73

8.9m - 250Ø
STM @
0.5%

MH4
TOP 104.70
N INV.103.69
W INV.103.61

240mm ORIFICE
PLATE INV. 103.53

WATER QUALITY
TREATMENT UNIT
TOP 104.95
W INV.103.52
SE INV.103.44

7.9m - 375Ø
STM @ 0.5%

STORM
HEADWALL
INV. 103.40

LOT A
1,380
0.55

LOT B
1,727
0.55

LOT C
1,600
0.55

LOT D
1956m²

LOT E
1,315
0.55

CONTROLLED FLOW

4m DRAINAGE EASEMENT

STORMWATER TANK - 363.8m²
PROPOSED GROUND - 104.58
TOP OF SYSTEM - 104.08
BOTTOM OF SYSTEM - 103.17

EXISTING
BUILDING

3m DRAINAGE EASEMENT

FLOW DISPERSER RIP RAP
AT ELEV 103.00

TOB

TOB

TOB

SWALE

UNCONTROLLED
FLOW

VEGETATED BUFFER STRIP
TO TOP OF BANK

TOP OF BANK AS
STAKED BY CVCA,
FEBRUARY 5, 2007

PART 2, PLAN 43R-31688
SUBJECT TO EASEMENT AS IN PR1329522

STEEP SLOPE

PIN 13359 – 0568

PIN 13359-0776

PIN 13359-0651

PIN 13351-0653

MISSISSAUGA HEIGHTS ROAD BY REGISTERED PLAN 342, RENAMED BY BY-LAW 3943, INST BL695

DRIVE

HEIGHTS

MISSISSAUGA

LEGEND

- DEVELOPMENT BOUNDARY
- LOT BOUNDARY
- LOT A / 1,380 / 0.55 — LOT ID. / DRAINAGE AREA (m²) / RUNOFF COEFFICIENT
- TOTAL CONTROLLED : 7,653m²
- EX. GRADES TO REMAIN : 3,146m²
- UNCONTROLLED : 1,732m²

0 10 20 30m

CLIENT
MARIO POLLA

TITLE
904 MISSISSAUGA HEIGHTS DRIVE

PROPOSED CONDITIONS

wsp

Checked A.M.	Drawn AutoCAD/B.K.B.
Date MARCH 2021	Proj. No. 20M-01451
Scale AS SHOWN	Figure No. 3

3.2 Erosion Control

CVC does not specify long term erosion control for the Credit River subwatershed but requires that erosion control measures be provided at all outlet structures to protect against erosion. As such, flow diffuser riprap will be provided at the outlet where flows from the chamber system is discharged at-grade to be conveyed to the Credit River via sheet flow.

Short-term measures of erosion and sediment control during construction should be installed as part of the requirements by the City and CVC, the details of which will be outlined in the Erosion and Sediment Control Plan and in accordance with the Greater Golden Horseshoe Area Conservation Authorities' Erosion and Sediment Control Guidelines for Urban Construction (Dec. 2006). Some temporary measures include:

- Siltation control around the perimeter of the site
- Sediment traps on external catch basins adjacent to site
- Mud mats at site access points
- Regular maintenance of the above listed ESC measures

3.3 Water Quality Control

As outlined in **Section 1.4**, the Ontario Ministry of the Environment, Conservation and Parks requires 80% TSS removal from new developments.

A water quality treatment unit has been sized for the site to provide 80% TSS removal for the at-grade paved areas. An Imbrium (JF4-1-1) or its approved equivalent is recommended to provide the required level of treatment for all paved at-grade flows prior to discharge. The chamber system will also include isolator rows at the inlets to further provide water quality treatment of the runoff.

As rooftop areas are free of typical sediment-generating activities (e.g. vehicle traffic) runoff will leave them effectively unchanged and can be considered clean for the purposes of water quality assessment.

3.4 Runoff Reduction

As detailed in **Section 1.4**, the site will be required to provide retention and reuse for the first 5 mm of runoff from each rainfall event. It is assumed that the first 5 mm of stormwater falling on to the exposed soft landscaping will be retained by the soil and eventually returned to the atmosphere through evapotranspiration and will not generate

runoff. The total volume of 5 mm runoff from the site impervious areas is 21 m^3. The corresponding 5 mm stormwater runoff volume from the shared access road has been accounted for in the 21 m^3 runoff reduction volume. Runoff reduction calculations are provided in **Appendix A**.

The runoff reduction volume shall be provided as a sump in the infiltration chamber system. As hydrogeological and geotechnical investigations will be completed as part of the submission for the site plan application, an infiltration rate of 15 mm/hr is assumed for the site as a conservative measure. The infiltration chamber system sized for the site will allow for infiltration of 87 m^3 of runoff provided as a sump within the infiltration system. The sump volume is provided by placing an orifice plate at an elevation of 0.35 m from the internal bottom of the infiltration system (bottom of the clear stone). Infiltration drawdown time calculations determine that the sump volume will be infiltrated within 40 hrs. Detailed calculations of the infiltration drawdown time is provided in **Appendix A**.

3.5 Water Quantity Control

As discussed in **Section 2.3**, the allowable flow rate for the site is 93 L/s. This is equivalent to the peak runoff rate under pre-development conditions during a 10-year storm event using a runoff coefficient of 0.36.

A HydroCAD model of the project was constructed and utilized to determine the required stormwater storage volume and to calculate the discharge rates achieved by the proposed flow controls under all storm events. The modified rational method (an inherent subroutine of the HydroCAD software) has been used for the modelling exercise. Per the City's Design Requirements, the adjustment factors for runoff coefficients have been applied to the 25-, 50- and 100-year storms.

An infiltration chamber system has been designed for this site which will collect flows from the controlled at grade areas and the rooftops. Runoff from the controlled areas of the site is overcontrolled to compensate for the uncontrolled (1,732 m^2, C=0.41) areas and meet the allowable flow rate for the site.

The chamber system is designed to provide a total storage volume of 219 m^3. This includes the active water quantity storage volume and the sump volume. The chamber system has a base area of 364 m^2 and a height 0.91 m. A 240 mm orifice plate at an elevation of 0.35 m from the bottom of the 152 mm clear stone base layer (0.20 m from the top of the clear stone) provides flow control and establishes a sump volume of 87 m^3, below the outlet, to be infiltrated into the native soil media below the chamber

system. The sump volume is assumed full at the onset of the storm event and is therefore not considered as part of the active water quantity storage.

A summary of the modelling results is provided below in **Table 3.2**. Full HydroCAD modelling output is provided in **Appendix B**.

Table 3.2: Site Runoff Flow Rates Under the Proposed Conditions

Return Period (years)	Modelled post-development peak flow rate (L/s)	Utilized Storage (m^3)	Peak Water depth in Storage (m)	Allowable Flow Rate (L/s)
2	12	120	0.45	93
5	27	140	0.51	
10	41	156	0.55	
25	80	200	0.78	
50	89	211	0.86	
100	93	216	0.89	

4 HYDROGEOLOGY AND GROUNDWATER CHARACTERIZATION

Geotechnical and hydrogeological investigations will be carried out prior to site plan application. For this submission, conservative assumptions were made with respect to the native soil at the site and corresponding infiltration rate. Result of the geotechnical and hydrogeological investigations shall be discussed as part of the submission for the site plan application.

5 CONCLUSIONS

A stormwater management plan has been prepared to support the ZBA for the proposed development at 904 Mississauga Heights Drive in the City of Mississauga. The key points are summarized below.

Erosion Control

Erosion protection will be provided at the outlet through flow diffuser riprap. Temporary erosion control shall be provided during construction.

Water Quality

Stormwater runoff from proposed impervious roof areas is considered clean and expected to leave the site effectively unchanged in terms of water quality. Runoff from paved at grade areas will be treated for 80% TSS removal with use of an Imbrium JF4-1-1 sized for the site.

Runoff Reduction

A sump storage volume of 87 m^3 will be provided in the infiltration chamber system to allow for infiltration of the runoff reduction volume for the site.

Water Quantity

Runoff from all areas of the site will be directed to the proposed infiltration chamber system for quantity control. The chamber system will have a total storage volume of 219 m^3. A 240 mm orifice plate will control flows for all storm events up to and including the 100-year storm to the allowable flow rate of 93 L/s prior to discharging to the Credit River. An emergency overflow will be provided and shall discharge the water at-grade.

APPENDIX

A

Stormwater Management Calculations

In order to account for the increase in runoff due to saturation of the catchment surface that would occur for larger, less frequent sotrms, the adjustment factor below shall be used for pre and post development conditions:

	Adjustment Factor
• 10 – Year	1.0
• 25 – Year	1.1
• 50 – Year	1.2
• 100 – Year	1.25

Runoff coefficients calculated as per the City of Mississauga Development Requirements Manual (Jan 2020) Section 8.1.1.

Existing Conditions		Runoff Coefficients C, Return Period (Years)					
Land Use	Area (m^2)	2	5	10	25	50	100
Vegetated Area	7,855	0.25	0.25	0.25	0.28	0.30	0.31
Road/Vehicular Surfaces	1,033	0.90	0.90	0.90	0.99	1.08	1.13
Lot D- to be controlled	497	0.90	0.90	0.90	0.99	1.08	1.13
Lot D-Remaining As Is	1,459	0.51	0.51	0.51	0.57	0.62	0.64
Easement Area-Remaining As Is	1,687	0.25	0.25	0.25	0.28	0.30	0.31
Total Area	**12,531**	**0.33**	**0.33**	**0.33**	**0.36**	**0.39**	**0.41**
Total Development area	**9,385**	**0.36**	**0.36**	**0.36**	**0.39**	**0.43**	**0.44**

Run-off Coefficient: Unless otherwise demonstrated, the runoff co-efficients noted below are to be used.

	Run-Off Coeff.
- Residential – single family, semi-detached	0.55
- Compact or dense housing (e.g. townhouses)	0.65
- High-rise residential	0.90
- Industrial and Commercial	0.90
- Neighbourhood Park	0.30
- Permeable Pavements	0.50
- Sodded Area	0.25
- All Other Surfaces	0.90

Proposed Conditions		Runoff Coefficients C, Return Period (Years)					
Land Use*	Area (m^2)	2	5	10	25	50	100
Lot A	1,380	0.55	0.55	0.55	0.61	0.66	0.69
Lot B	1,727	0.55	0.55	0.55	0.61	0.66	0.69
Lot C	1,600	0.55	0.55	0.55	0.61	0.66	0.69
Lot D-Controlled	497	0.90	0.90	0.90	0.99	1.08	1.13
Lot E	1,315	0.55	0.55	0.55	0.61	0.66	0.69
Shared Landscaping-Easement Area	1,620	0.25	0.25	0.25	0.28	0.30	0.31
Shared Road/Vehicular	1,246	0.90	0.90	0.90	0.99	1.08	1.13
Easement Area-Excluded	1,687	0.25	0.25	0.25	0.28	0.30	0.31
Lot D (Excluded)	1,459	0.55	0.55	0.55	0.61	0.66	0.69
Total Development Area	**9,385**	**0.56**	**0.56**	**0.56**	**0.62**	**0.68**	**0.70**
Total Area Excluded	**3,146**	**0.39**	**0.39**	**0.39**	**0.43**	**0.47**	**0.49**

*2-year runoff coefficients of 0.55 for residential single family, semi-detached was assumed for each lot as per the City of Mississauga's Stormwater Management Guideline Section 8.1.1

Uncontrolled Area

Land Use*	Area (m^2)	2	5	10	25	50	100
Lot E	726	0.55	0.55	0.55	0.61	0.66	0.69
Shared Landscaping-Easment Area	909	0.25	0.25	0.25	0.28	0.30	0.31
ROW-Shared Road	97	0.90	0.90	0.90	0.99	1.08	1.13
Total Uncontrolled Area	**1,732**	**0.41**	**0.41**	**0.41**	**0.45**	**0.49**	**0.52**

Controlled Area

Land Use*	Area (m^2)	2	5	10	25	50	100
Lot A	1,380	0.55	0.55	0.55	0.61	0.66	0.69
Lot B	1,727	0.55	0.55	0.55	0.61	0.66	0.69
Lot C	1,600	0.55	0.55	0.55	0.61	0.66	0.69
Lot D-Controlled	497	0.90	0.90	0.90	0.99	1.08	1.13
Lot E	589	0.55	0.55	0.55	0.61	0.66	0.69
Shared Landscaping-Easement Area	711	0.25	0.25	0.25	0.28	0.30	0.31
Shared Road/Vehicular	1,149	0.90	0.90	0.90	0.99	1.08	1.13
Total Controlled Area	**7,653**	**0.60**	**0.60**	**0.60**	**0.66**	**0.72**	**0.75**

Calculation of existing runoff rate is undertaken using the Rational Method: Q = 0.0028 CIA

Where: Q = Peak flow rate (m^3/second)
C = Runoff coefficient
I = Rainfall intensity (mm/hour)
A = Catchment area (hectares)

Area, A 0.94 hectares
Runoff Coef, C* 0.36

$$I = \frac{a}{(t+b)^C}$$

Rainfall Intensity is calculated based on City of Mississauga Intensity-Duration-Frequency (IDF) Equations:

Where: I = Rainfall Intensity in mm/hr
T = Time of Concentration in minutes, use
a, b, c = Rainfall parameters used by City of Mississauga

Return Period (Years)	2	5	10	25	50	100
A	610	820	1010	1160	1300	1450
B	4.6	4.6	4.6	4.6	4.7	4.9
C	0.78	0.78	0.78	0.78	0.78	0.78
Runoff Coefficient C*	0.36	0.36	0.36	0.39	0.43	0.44
T (mins) **	15	15	15	15	15	15
T (hrs)	0.250	0.250	0.250	0.250	0.250	0.250
I (mm/hr)	60	81	99	114	127	141
Q (m^3/sec)	0.06	0.08	**0.09**	0.12	0.14	0.16
Q (litres/sec)	56	75	**93**	117	143	165

*Note that adjustment factors are aplpied to the runoff coefficent for larger, less frequent storms for 25-100 year events

** Note recommended minimum value for time of concentration for small sites (<2.0 ha) is 15 minutes.

The City of Mississauga Development Requirements Manual requires 'the first 5 mm of runoff shall be retained on-site and managed by way of infiltration, evapotranspiration, re-use or filtration. This is calculated as the product of impervious site area times 5 mm, excluding initial abstraction'.

- Section 8.3.2

The current area measurements and land use types for the site are as follows:

Land Use	Area (m^2)	Runoff C	Impervious
Lot A	1,380	0.55	40%
Lot B	1,727	0.55	40%
Lot C	1,600	0.55	40%
Lot D-Controlled	497	0.90	100%
Lot E	1,315	0.55	40%
Shared Landscaping-Easement Area	1,620	0.25	0%
Shared Road/Vehicular	1,246	0.90	100%
Total Site Area:	9,385	0.56	44%

Surface Type	Area[1] (m^2)	Initial Abstraction[2] (m)	Volume Abstracted (m^3)	5 mm Volume (m^3)	Water Balance (m^3)
Total Impervious	4,152	0.000	0.00	20.76	20.76
Total Pervious	5,233	0.005	26.17	26.17	0.00
Total Site Area:	**9,385**	-	**26.17**	**46.93**	**20.76**

[1]For the purpose of this submission, it was assumed that 60% of each lot area consists of pervious areas and the remaining 40% consist of all hard impervious surfaces.

[2] For the purposes of the water balance calculation it is assumed that the hard surfaces on the site can abstract 0 mm of rainfall, and that all soft landscaped areas can absorb 5 mm. More detailed area breakdown will be provided for the site plan application

Therefore, volume of runoff during a 5 mm storm event: 21 m^3

Discharge for a circular orifice is given by the following formula: $Q = Ca(2gh)^{0.5}$

Where: Q = Flow rate (m^3/second)

C = Discharge coefficient (unitless)

a = Submerged area (sqm)

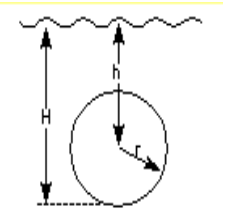
g = Gravitational constant (metres per second squared)

h = effective head (meters)

For an orifice opening in a vertical plane, the effective head is given by the following formulae:

Fully Submerged:

$$h = H - \max(r, TW)$$



Where: H = Head above invert level (metres)

r = Radius of orifice (meters)

TW = Tailwater depth above invert level (metres)

Variables:

C =	**0.6**	-	(Orifice Tube)
Orifice diameter =	**240**	mm	
r =	**120**	mm	
r =	**0.120**	m	
a =	**0.04524**	sqm	
g =	**9.81**	m/sec2	
H =	**0.70**	m	(Orifice invert depth 0.7 m from the top of the infiltration system
TW =	**0.00**	m	(0.00 = assume free discharge)
h =	**0.58**	m	

Calculation:

Q =	**0.09156**	m3/sec	
Q =	**91.56**	L/sec	(Maximum flow rate from the orifice)

	Stormwater Management Calculations	Project: 904 Mississauga Heights	No.: 20M-01451-00	
	Existing Offsite Discharge Rate	By: TS	Date: 2021-03-19	Page: 5
		Checked: AMB		

Measure	Variable	Value
Soil Infiltration Rate (m/hr)	q	0.015
Safetey Factor	S	2.5
Base Area of Infiltration (m²)	A	364
Void Ratio	n	0.71
Depth of infiltration system (m)	d	0.35
Perimeter of infiltration system (m)	P	81.1

$$Time\ To\ Drain = S\frac{n}{q} * \frac{A}{P} * \ln(\frac{d + \frac{A}{P}}{\frac{A}{P}})$$

Time to drain (hrs)= 40

The sump volume should be cleared within 72 hours in order to ensure the volume is available for subsequent storm events.
Based on the calculated infiltration time, the system will fully drain well before the 72 hour target

STANDARD PERFORMANCE SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV)

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: filtration surface area, 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, filtration treatment device 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 GENERAL

2.1.1 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the internal components. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of their installed placement for the entire length of the cartridge.

2.1.2 Pollutant Storage: The Filter device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter treatment device shall have been field tested in accordance with either TARP Tier II Protocol (TARP, 2003) and New Jersey Tier II Stormwater Test Requirements – Amendments to TARP Tier II Protocol (NJDEP, 2009) or Washington State Technology Assessment Protocol – Ecology (TAPE), 2011 or later version. The field test shall have been verified in accordance with ISO 14034:2016 Environmental Management – Environmental Technology Verification (ETV). See Section 3.2 of this specification for field test performance requirements.

3.2 FIELD TEST PERFORMANCE

The field test (as specified in section 3.1.1)shall have monitored a minimum of twenty (20) TARP or TAPE qualifying storm events, and report at **minimum** the following results:

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have ISO 14034 ETV verified load based median TSS removal efficiency of at least 85% and load based median SSC removal efficiency of at least 98%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, and an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce turbidity such that effluent turbidity is 15 NTU or lower.

3.2.5 Nutrients & Metals – The stormwater quality filter treatment device shall have ISO 14034 ETV Verified minimum load based removal efficiencies for the following:

3.2.5.1 Total Phosphorus (TP) Removal - Median TP removal efficiency of at least 49%.

3.2.5.2 Total Nitrogen (TN) Removal - Median TN removal efficiency of at least 39%.

3.2.5.3 Total Zinc (Zn) Removal - Median Zn removal efficiency of at least 69%.

3.2.5.4 Total Copper (Cu) Removal - Median Cu removal efficiency of at least 91%.

END OF SECTION

STANDARD OFFLINE
Jellyfish Filter Sizing Report

Project Information

Date	Tuesday, March 09, 2021
Project Name	904 Mississauga Heights Dr.
Project Number	
Location	Mississauga

Jellyfish Filter Design Overview

This report provides information for the sizing and specification of the Jellyfish Filter. When designed properly in accordance to the guidelines detailed in the Jellyfish Filter Technical Manual, the Jellyfish Filter will exceed the performance and longevity of conventional horizontal bed and granular media filters.

Please see ***www.ImbriumSystems.com*** *for more information.*

Jellyfish Filter System Recommendation

The Jellyfish Filter model JF4-1-1 is recommended to meet the water quality objective by treating a flow of 7.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 85 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	1	1	1.2	7.6	85

The Jellyfish Filter System

The patented Jellyfish Filter is an engineered stormwater quality treatment technology featuring unique membrane filtration in a compact stand-alone treatment system that removes a high level and wide variety of stormwater pollutants. Exceptional pollutant removal is achieved at high treatment flow rates with minimal head loss and low maintenance costs. Each lightweight Jellyfish Filter cartridge contains an extraordinarily large amount of membrane surface area, resulting in superior flow capacity and pollutant removal capacity.

Maintenance

Regular scheduled inspections and maintenance is necessary to assure proper functioning of the Jellyfish Filter. The maintenance interval is designed to be a minimum of 12 months, but this will vary depending on site loading conditions and upstream pretreatment measures. Quarterly inspections and inspections after all storms beyond the 5-year event are recommended until enough historical performance data has been logged to comfortably initiate an alternative inspection interval.

Please see ***www.ImbriumSystems.com*** *for more information.*

Thank you for the opportunity to present this information to you and your client.

Performance

Jellyfish efficiently captures a high level of Stormwater pollutants, including:

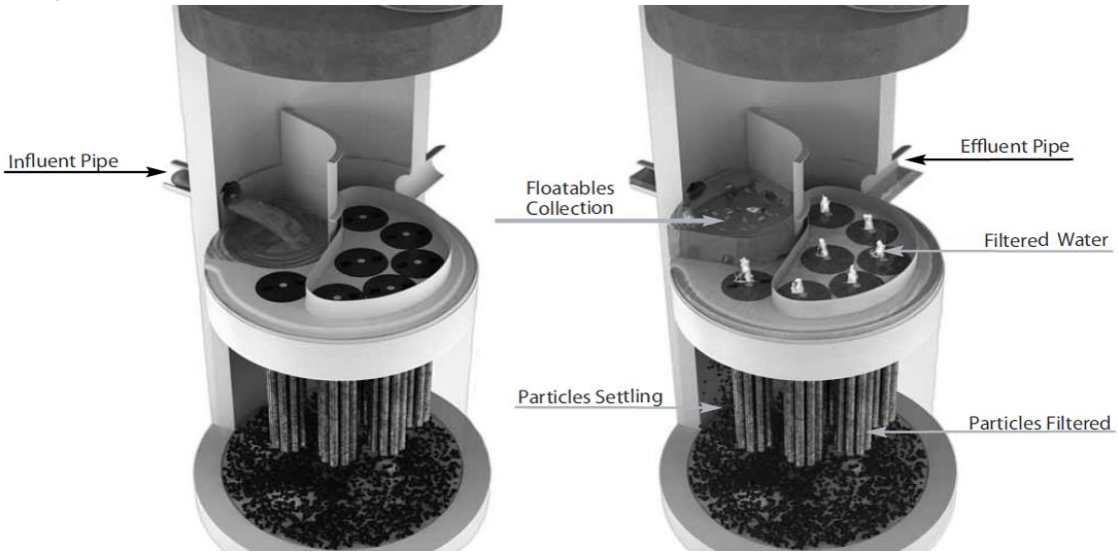
- ☑ 89% of the total suspended solids (TSS) load, including particles less than 5 microns
- ☑ 59% TP removal & 51% TN removal
- ☑ 90% Total Copper, 81% Total Lead, 70% Total Zinc
- ☑ Particulate-bound pollutants such as nutrients, toxic metals, hydrocarbons and bacteria
- ☑ Free oil, Floatable trash and debris

Field Proven Peformance

The Jellyfish filter has been field-tested on an urban site with 25 TARP qualifying rain events and field monitored according to the TARP field test protocol, demonstrating:

- A median TSS removal efficiency of 89%, and a median SSC removal of 99%;
- The ability to capture fine particles as indicated by an effluent d50 median of 3 microns for all monitotred storm events, and a median effluent turbidity of 5 NTUs;
- A median Total Phosphorus removal of 59%, and a median Total Nitrogen removal of 51%.

Jellyfish Filter Treatment Functions



Pre-treatment and Membrane Filtration

Project Information

Date:	Tuesday, March 09, 2021
Project Name:	904 Mississauga Heights Dr.
Project Number:	
Location:	Mississauga

Designer Information

Company:	WSP Canada Group Ltd.
Contact:	Tahmineh Sarabian
Phone #:	

Notes

Rainfall

Name:	TORONTO CENTRAL
State:	ON
ID:	100
Record:	1982 to 1999
Co-ords:	45°30'N, 90°30'W

Drainage Area

Total Area:	0.1426 ha
Runoff Coefficient:	0.9

Upstream Detention

Peak Release Rate:	n/a
Pretreatment Credit:	n/a

Design System Requirements

Flow Loading	90% of the Average Annual Runoff based on 18 years of TORONTO CENTRAL rainfall data:	**4 L/s**
Sediment Loading	Treating 90% of the average annual runoff volume, 857 m³, with a suspended sediment concentration of 60 mg/L.	**51 kg**

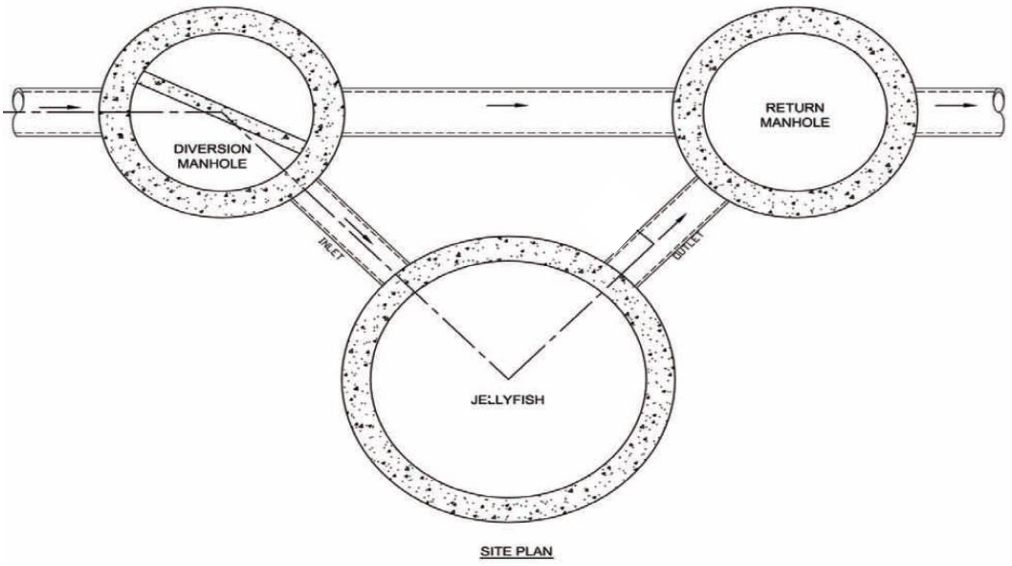
Recommendation

The Jellyfish Filter model JF4-1-1 is recommended to meet the water quality objective by treating a flow of 7.6 L/s, which meets or exceeds 90% of the average annual rainfall runoff volume based on 18 years of TORONTO CENTRAL rainfall data for this site. This model has a sediment capacity of 85 kg, which meets or exceeds the estimated average annual sediment load.

Jellyfish Model	Number of High-Flo Cartridges	Number of Draindown Cartridges	Manhole Diameter (m)	Wet Vol Below Deck (L)	Sump Storage (m³)	Oil Capacity (L)	Treatment Flow Rate (L/s)	Sediment Capacity (kg)
JF4-1-1	**1**	**1**	**1.2**	**2313**	**0.34**	**379**	**7.6**	**85**
JF4-2-1	2	1	1.2	2313	0.34	379	12.6	142
JF6-3-1	3	1	1.8	5205	0.79	848	17.7	199
JF6-4-1	4	1	1.8	5205	0.79	848	22.7	256
JF6-5-1	5	1	1.8	5205	0.79	848	27.8	313
JF6-6-1	6	1	1.8	5205	0.79	848	28.6	370
JF8-6-2	6	2	2.4	9252	1.42	1469	35.3	398
JF8-7-2	7	2	2.4	9252	1.42	1469	40.4	455
JF8-8-2	8	2	2.4	9252	1.42	1469	45.4	512
JF8-9-2	9	2	2.4	9252	1.42	1469	50.5	569
JF8-10-2	10	2	2.4	9252	1.42	1469	50.5	626
JF10-11-3	11	3	3.0	14456	2.21	2302	63.1	711
JF10-12-3	12	3	3.0	14456	2.21	2302	68.2	768
JF10-12-4	12	4	3.0	14456	2.21	2302	70.7	796
JF10-13-4	13	4	3.0	14456	2.21	2302	75.7	853
JF10-14-4	14	4	3.0	14456	2.21	2302	78.9	910
JF10-15-4	15	4	3.0	14456	2.21	2302	78.9	967
JF10-16-4	16	4	3.0	14456	2.21	2302	78.9	1024
JF10-17-4	17	4	3.0	14456	2.21	2302	78.9	1081
JF10-18-4	18	4	3.0	14456	2.21	2302	78.9	1138
JF10-19-4	19	4	3.0	14456	2.21	2302	78.9	1195
JF12-20-5	20	5	3.6	20820	3.2	2771	113.6	1280
JF12-21-5	21	5	3.6	20820	3.2	2771	113.7	1337
JF12-22-5	22	5	3.6	20820	3.2	2771	113.7	1394
JF12-23-5	23	5	3.6	20820	3.2	2771	113.7	1451
JF12-24-5	24	5	3.6	20820	3.2	2771	113.7	1508
JF12-25-5	25	5	3.6	20820	3.2	2771	113.7	1565
JF12-26-5	26	5	3.6	20820	3.2	2771	113.7	1622
JF12-27-5	27	5	3.6	20820	3.2	2771	113.7	1679

Jellyfish Filter Design Notes

- Typically the Jellyfish Filter is designed in an offline configuration, as all stormwater filter systems will perform for a longer duration between required maintenance services when designed and applied in off-line configurations. Depending on the design parameters, an optional internal bypass may be incorporated into the Jellyfish Filter, however note the inspection and maintenance frequency should be expected to increase above that of an off-line system. Speak to your local representative for more information.



Jellyfish Filter Typical Layout

- Typically, 18 inches (457 mm) of driving head is designed into the system, calculated as the difference in elevation between the top of the diversion structure weir and the invert of the Jellyfish Filter outlet pipe. Alternative driving head values can be designed as 12 to 24 inches (305 to 610mm) depending on specific site requirements, requiring additional sizing and design assistance.
- Typically, the Jellyfish Filter is designed with the inlet pipe configured 6 inches (150 mm) above the outlet invert elevation. However, depending on site parameters this can vary to an optional configuration of the inlet pipe entering the unit below the outlet invert elevation.
- The Jellyfish Filter can accommodate multiple inlet pipes within certain restrictions.
- While the optional inlet below deck configuration offers 0 to 360 degree flexibility between the inlet and outlet pipe, typical systems conform to the following:

Model Diameter (m)	Minimum Angle Inlet / Outlet Pipes	Minimum Inlet Pipe Diameter (mm)	Minimum Outlet Pipe Diameter (mm)
1.2	**62º**	**150**	**200**
1.8	59º	200	250
2.4	52º	250	300
3.0	48º	300	450
3.6	40º	300	450

- The Jellyfish Filter can be built at all depths of cover generally associated with conventional stormwater conveyance systems. For sites that require minimal depth of cover for the stormwater infrastructure, the Jellyfish Filter can be applied in a shallow application using a hatch cover. The general minimum depth of cover is 36 inches (915 mm) from top of the underslab to outlet invert.
- If driving head caclulations account for water elevation during submerged conditions the Jellyfish Filter will function effectively under submerged condtions.
- Jellyfish Filter systems may incorporate grated inlets depending on system configuration.
- For sites with water quality treatment flow rates or mass loadings that exceed the design flow rate of the largest standard Jellyfish Filter manhole models, systems can be designed that hydraulically connect multiple Jellyfish Filters in series or alternatively Jellyfish Vault units can be designed.

STANDARD SPECIFICATION
STORMWATER QUALITY – MEMBRANE FILTRATION TREATMENT DEVICE

PART 1 – GENERAL

1.1 WORK INCLUDED

Specifies requirements for construction and performance of an underground stormwater quality membrane filtration treatment device that removes pollutants from stormwater runoff through the unit operations of sedimentation, floatation, and membrane filtration.

1.2 REFERENCE STANDARDS

ASTM C 891: Specification for Installation of Underground Precast Concrete Utility Structures
ASTM C 478: Specification for Precast Reinforced Concrete Manhole Sections
ASTM C 443: Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM D 4101: Specification for Copolymer steps construction

CAN/CSA-A257.4-M92
Joints for Circular Concrete Sewer and Culvert Pipe, Manhole Sections and Fittings Using Rubber Gaskets

CAN/CSA-A257.4-M92
Precast Reinforced Circular Concrete Manhole Sections, Catch Basins and Fittings

Canadian Highway Bridge Design Code

1.3 SHOP DRAWINGS

Shop drawings for the structure and performance are to be submitted with each order to the contractor. Contractor shall forward shop drawing submittal to the consulting engineer for approval. Shop drawings are to detail the structure's precast concrete and call out or note the fiberglass (FRP) internals/components.

1.4 PRODUCT SUBSTITUTIONS

No product substitutions shall be accepted unless submitted 10 days prior to project bid date, or as directed by the engineer of record. Submissions for substitutions require review and approval by the Engineer of Record, for hydraulic performance, impact to project designs, equivalent treatment performance, and any required project plan and report (hydrology/hydraulic, water quality, stormwater pollution) modifications that would be required by the approving jurisdictions/agencies. Contractor to coordinate with the Engineer of Record any applicable modifications to the project estimates of cost, bonding amount determinations, plan check fees for changes to approved documents, and/or any other regulatory requirements resulting from the product substitution.

1.5 HANDLING AND STORAGE

Prevent damage to materials during storage and handling.

PART 2 – PRODUCTS

2.1 GENERAL

2.1.1 The device shall be a cylindrical or rectangular, all concrete structure (including risers), constructed from precast concrete riser and slab components or monolithic precast structure(s), installed to conform to ASTM C 891 and to any required state highway, municipal or local specifications; whichever is more stringent. The device shall be watertight.

2.1.2 Cartridge Deck The cylindrical concrete device shall include a fiberglass deck. The rectangular concrete device shall include a coated aluminum deck. In either instance, the insert shall be bolted and sealed watertight inside the precast concrete chamber. The deck shall serve as: (a) a horizontal divider between the lower treatment zone and the upper treated effluent zone; (b) a deck for attachment of filter cartridges such that the membrane filter elements of each cartridge extend into the lower treatment zone; (c) a platform for maintenance workers to service the filter cartridges (maximum manned weight = 450 pounds (204 kg)); (d) a conduit for conveyance of treated water to the effluent pipe.

2.1.3 Membrane Filter Cartridges Filter cartridges shall be comprised of reusable cylindrical membrane filter elements connected to a perforated head plate. The number of membrane filter elements per cartridge shall be a minimum of eleven 2.75-inch (70-mm) diameter elements. The length of each filter element shall be a minimum 15 inches (381 mm). Each cartridge shall be fitted into the cartridge deck by insertion into a cartridge receptacle that is permanently mounted into the cartridge deck. Each cartridge shall be secured by a cartridge lid that is threaded onto the receptacle, or similar mechanism to secure the cartridge into the deck. The maximum treatment flow rate of a filter cartridge shall be controlled by an orifice in the cartridge lid, or on the individual cartridge itself, and based on a design flux rate (surface loading rate) determined by the maximum treatment flow rate per unit of filtration membrane surface area. The maximum design flux rate shall be 0.21 gpm/ft² (0.142 lps/m²).

Each membrane filter cartridge shall allow for manual installation and removal. Each filter cartridge shall have filtration membrane surface area and dry installation weight as follows (if length of filter cartridge is between those listed below, the surface area and weight shall be proportionate to the next length shorter and next length longer as shown below):

Filter Cartridge Length (in / mm)	Minimum Filtration Membrane Surface Area (ft2 / m2)	Maximum Filter Cartridge Dry Weight (lbs / kg)
15	106 / 9.8	10.5 / 4.8
27	190 / 17.7	15.0 / 6.8
40	282 / 26.2	20.5 / 9.3
54	381 / 35.4	25.5 / 11.6

2.1.4 Backwashing Cartridges The filter device shall have a weir extending above the cartridge deck, or other mechanism, that encloses the high flow rate filter cartridges when placed in their respective cartridge receptacles within the cartridge deck. The weir, or other mechanism, shall collect a pool of filtered water during inflow events that backwashes the high flow rate cartridges when the inflow

event subsides. All filter cartridges and membranes shall be reusable and allow for the use of filtration membrane rinsing procedures to restore flow capacity and sediment capacity; extending cartridge service life.

2.1.5 Maintenance Access to Captured Pollutants The filter device shall contain an opening(s) that provides maintenance access for removal of accumulated floatable pollutants and sediment, removal of and replacement of filter cartridges, cleaning of the sump, and rinsing of the deck. Access shall have a minimum clear vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

2.1.6 Bend Structure The device shall be able to be used as a bend structure with minimum angles between inlet and outlet pipes of 90-degrees or less in the stormwater conveyance system.

2.1.7 Double-Wall Containment of Hydrocarbons The cylindrical precast concrete device shall provide double-wall containment for hydrocarbon spill capture by a combined means of an inner wall of fiberglass, to a minimum depth of 12 inches (305 mm) below the cartridge deck, and the precast vessel wall.

2.1.8 Baffle The filter device shall provide a baffle that extends from the underside of the cartridge deck to a minimum length equal to the length of the membrane filter elements. The baffle shall serve to protect the membrane filter elements from contamination by floatables and coarse sediment. The baffle shall be flexible and continuous in cylindrical configurations, and shall be a straight concrete or aluminum wall in rectangular configurations.

2.1.9 Sump The device shall include a minimum 24 inches (610 mm) of sump below the bottom of the cartridges for sediment accumulation, unless otherwise specified by the design engineer. Depths less than 24 inches may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

2.2 PRECAST CONCRETE SECTIONS

All precast concrete components shall be manufactured to a minimum live load of HS-20 truck loading or greater based on local regulatory specifications, unless otherwise modified or specified by the design engineer, and shall be watertight.

2.3 JOINTS All precast concrete manhole configuration joints shall use nitrile rubber gaskets and shall meet the requirements of ASTM C443, Specification C1619, Class D or engineer approved equal to ensure oil resistance. Mastic sealants or butyl tape are not an acceptable alternative.

2.4 GASKETS Only profile neoprene or nitrile rubber gaskets in accordance to CSA A257.3-M92 will be accepted. Mastic sealants, butyl tape or Conseal CS-101 are not acceptable gasket materials.

2.5 FRAME AND COVER Frame and covers must be manufactured from cast-iron or other composite material tested to withstand H-20 or greater design loads, and as approved by the

local regulatory body. Frames and covers must be embossed with the name of the device manufacturer or the device brand name.

2.6 DOORS AND HATCHES If provided shall meet designated loading requirements or at a minimum for incidental vehicular traffic.

2.7 CONCRETE All concrete components shall be manufactured according to local specifications and shall meet the requirements of ASTM C 478.

2.8 FIBERGLASS The fiberglass portion of the filter device shall be constructed in accordance with the following standard: ASTM D-4097: Contact Molded Glass Fiber Reinforced Chemical Resistant Tanks.

2.9 STEPS Steps shall be constructed according to ASTM D4101 of copolymer polypropylene, and be driven into preformed or pre-drilled holes after the concrete has cured, installed to conform to applicable sections of state, provincial and municipal building codes, highway, municipal or local specifications for the construction of such devices.

2.10 INSPECTION All precast concrete sections shall be inspected to ensure that dimensions, appearance and quality of the product meet local municipal specifications and ASTM C 478.

PART 3 – PERFORMANCE

3.1 GENERAL

3.1.1 Verification – The stormwater quality filter must be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV).

3.1.2 Function - The stormwater quality filter treatment device shall function to remove pollutants by the following unit treatment processes; sedimentation, floatation, and membrane filtration.

3.1.3 Pollutants - The stormwater quality filter treatment device shall remove oil, debris, trash, coarse and fine particulates, particulate-bound pollutants, metals and nutrients from stormwater during runoff events.

3.1.4 Bypass - The stormwater quality filter treatment device shall typically utilize an external bypass to divert excessive flows. Internal bypass systems shall be equipped with a floatables baffle, and must avoid passage through the sump and/or cartridge filtration zone.

3.1.5 Treatment Flux Rate (Surface Loading Rate) – The stormwater quality filter treatment device shall treat 100% of the required water quality treatment flow based on a maximum design treatment flux rate (surface loading rate) across the membrane filter cartridges of 0.21 gpm/ft² (0.142 lps/m²).

3.2 FIELD TEST PERFORMANCE

At a minimum, the stormwater quality filter device shall have been field tested and verified with a minimum 25 TARP qualifying storm events and field monitoring shall have been conducted according to the TARP 2009 NJDEP TARP field test protocol, and have received NJCAT verification.

3.2.1 Suspended Solids Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median TSS removal efficiency of 85% and a minimum median SSC removal efficiency of 95%.

3.2.2 Runoff Volume – The stormwater quality filter treatment device shall be engineered, designed, and sized to treat a minimum of 90 percent of the annual runoff volume determined from use of a minimum 15-year rainfall data set.

3.2.3 Fine Particle Removal - The stormwater quality filter treatment device shall have demonstrated the ability to capture fine particles as indicated by a minimum median removal efficiency of 75% for the particle fraction less than 25 microns, an effluent d_{50} of 15 microns or lower for all monitored storm events.

3.2.4 Turbidity Reduction - The stormwater quality filter treatment device shall have demonstrated the ability to reduce the turbidity from influent from a range of 5 to 171 NTU to an effluent turbidity of 15 NTU or lower.

3.2.5 Nutrient (Total Phosphorus & Total Nitrogen) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Phosphorus removal of 55%, and a minimum median Total Nitrogen removal of 50%.

3.2.6 Metals (Total Zinc & Total Copper) Removal - The stormwater quality filter treatment device shall have demonstrated a minimum median Total Zinc removal of 55%, and a minimum median Total Copper removal of 85%.

3.3 INSPECTION and MAINTENANCE

The stormwater quality filter device shall have the following features:

3.3.1 Durability of membranes are subject to good handling practices during inspection and maintenance (removal, rinsing, and reinsertion) events, and site specific conditions that may have heavier or lighter loading onto the cartridges, and pollutant variability that may impact the membrane structural integrity. Membrane maintenance and replacement shall be in accordance with manufacturer's recommendations.

3.3.2 Inspection which includes trash and floatables collection, sediment depth determination, and visible determination of backwash pool depth shall be easily conducted from grade (outside the structure).

3.3.3 Manual rinsing of the reusable filter cartridges shall promote restoration of the flow capacity and sediment capacity of the filter cartridges, extending cartridge service life.

3.3.4 The filter device shall have a minimum 12 inches (305 mm) of sediment storage depth, and a minimum of 12 inches between the top of the sediment storage and bottom of the filter cartridge tentacles, unless otherwise specified by the design engineer. Variances may have an impact on the total performance and/or longevity between cartridge maintenance/replacement of the device.

3.3.5 Sediment removal from the filter treatment device shall be able to be conducted using a standard maintenance truck and vacuum apparatus, and a minimum one point of entry to the sump that is unobstructed by filter cartridges.

3.3.6 Maintenance access shall have a minimum clear height that provides suitable vertical clear space over all of the filter cartridges. Filter cartridges shall be able to be lifted straight vertically out of the receptacles and deck for the entire length of the cartridge.

3.3.7 Filter cartridges shall be able to be maintained without the requirement of additional lifting equipment.

PART 4 – EXECUTION

4.1 INSTALLATION

4.1.1 PRECAST DEVICE CONSTRUCTION SEQUENCE

The installation of a watertight precast concrete device should conform to ASTM C 891 and to any state highway, municipal or local specifications for the construction of manholes, whichever is more stringent. Selected sections of a general specification that are applicable are summarized below.

4.1.1.1 The watertight precast concrete device is installed in sections in the following sequence:

- aggregate base
- base slab
- treatment chamber and cartridge deck riser section(s)
- bypass section
- connect inlet and outlet pipes
- concrete riser section(s) and/or transition slab (if required)
- maintenance riser section(s) (if required)
- frame and access cover

4.1.2 The precast base should be placed level at the specified grade. The entire base should be in contact with the underlying compacted granular material. Subsequent sections, complete with joint seals, should be installed in accordance with the precast concrete manufacturer's recommendations.

4.1.3 Adjustment of the stormwater quality treatment device can be performed by lifting the upper sections free of the excavated area, re-leveling the base, and re-installing the sections. Damaged sections and gaskets should be repaired or replaced as necessary to restore original condition and watertight seals. Once the stormwater quality treatment device has been constructed, any/all lift holes must be plugged watertight with mortar or non-shrink grout.

4.1.4 Inlet and Outlet Pipes Inlet and outlet pipes should be securely set into the device using approved pipe seals (flexible boot connections, where applicable) so that the structure is watertight, and such that any pipe intrusion into the device does not impact the device functionality.

4.1.5 Frame and Cover Installation Adjustment units (e.g. grade rings) should be installed to set the frame and cover at the required elevation. The adjustment units should be laid in a full bed of mortar with successive units being joined using sealant recommended by the manufacturer. Frames for the cover should be set in a full bed of mortar at the elevation specified.

4.2 MAINTENANCE ACCESS WALL
In some instances the Maintenance Access Wall, if provided, shall require an extension attachment and sealing to the precast wall and cartridge deck at the job site, rather than at the precast facility. In this instance, installation of these components shall be performed according to instructions provided by the manufacturer.

4.3 FILTER CARTRIDGE INSTALLATION Filter cartridges shall be installed in the cartridge deck only after the construction site is fully stabilized and in accordance with the manufacturer's guidelines and recommendations. Contractor to contact the manufacturer to schedule cartridge delivery and review procedures/requirements to be completed to the device prior to installation of the cartridges and activation of the system.

PART 5 – QUALITY ASSURANCE

5.1 FILTER CARTRIDGE INSTALLATION Manufacturer shall coordinate delivery of filter cartridges and other internal components with contractor. Filter cartridges shall be delivered and installed complete after site is stabilized and unit is ready to accept cartridges. Unit is ready to accept cartridges after is has been cleaned out and any standing water, debris, and other materials have been removed. Contractor shall take appropriate action to protect the filter cartridge receptacles and filter cartridges from damage during construction, and in accordance with the manufacturer's recommendations and guidance. For systems with cartridges installed prior to full site stabilization and prior to system activation, the contractor can plug inlet and outlet pipes to prevent stormwater and other influent from entering the device. Plugs must be removed during the activation process.

5.2 INSPECTION AND MAINTENANCE

5.2.1 The manufacturer shall provide an Owner's Manual upon request.

5.2.2 After construction and installation, and during operation, the device shall be inspected and cleaned as necessary based on the manufacturer's recommended inspection and maintenance guidelines and the local regulatory agency/body.

5.3 REPLACEMENT FILTER CARTRIDGES When replacement membrane filter elements and/or other parts are required, only membrane filter elements and parts approved by the manufacturer for use with the stormwater quality filter device shall be installed.

END OF SECTION

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:

1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

JELLYFISH STRUCTURE & DESIGN NOTES:

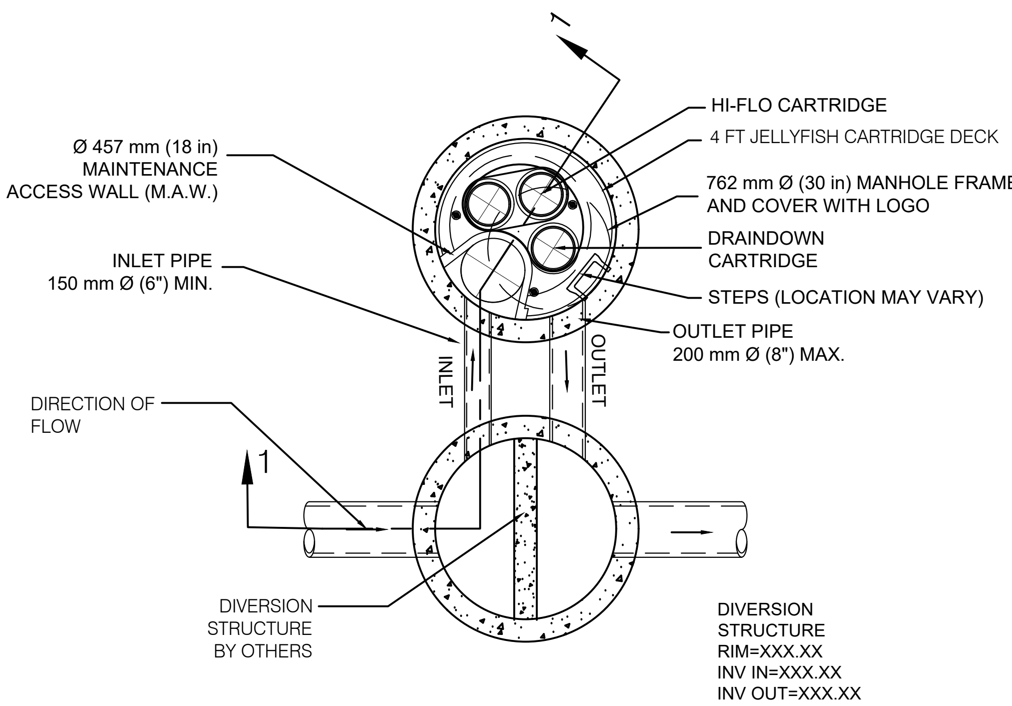
1. 457 MM Ø (18") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

INSTALLATION NOTES

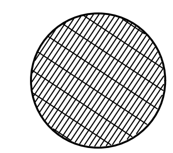
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

STANDARD OFFLINE JELLYFISH RECOMMENDED PIPE DIAMETERS			
MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MINIMUM OULTET PIPE DIAMETER (mm)
1.2	62	150	200
1.8	59	200	250
2.4	52	250	300
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

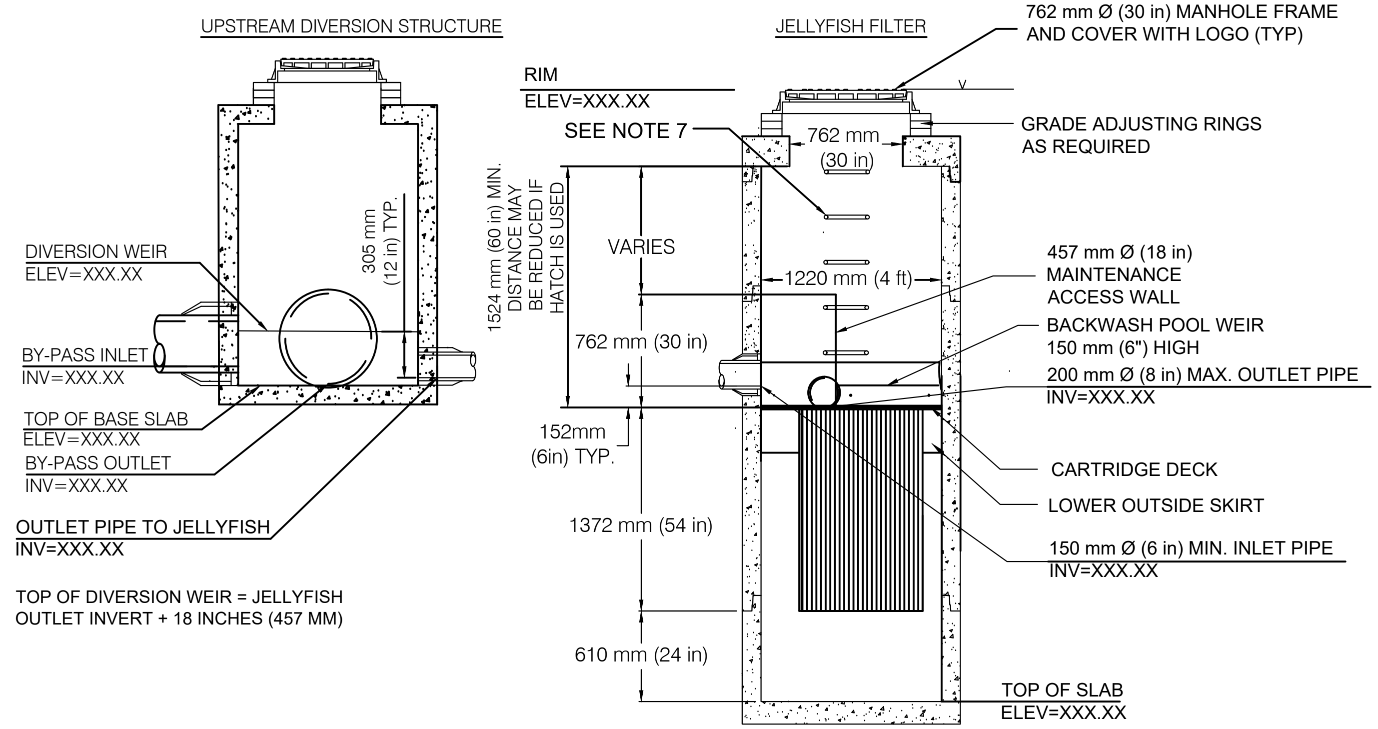
FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.



OFFLINE LAYOUT



XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



TOP OF DIVERSION WEIR = JELLYFISH OUTLET INVERT + 18 INCHES (457 MM)

CROSS SECTION 1-1

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1220 mm (48") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 12.7 L/s (0.54 CFS). TREATMENT FLOW RATE IS BASED ON 457 mm (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION				
CARTRIDGE DEPTH	54"	40"	27"	15"
OUTLET INVERT TO STRUCTURE BASE SLAB	90"	76"	63"	51"
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
MAX. CARTS HIGH-FLO/DRAINDOWN	2 / 1			
MAX. SEDIMENT CAPACITY (kg)	142	105	70	40
MAX. TREATMENT (L/s)	12.7	9.3	6.2	3.4

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
# OF CARTRIDGES REQUIRED (HF / DD)					*
CARTRIDGE SIZE (inches)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	NOTES	BY
#	#	#	#
#	#	#	#
#	#	#	#
1	08/01/2015	#	BSF
0	10/01/2014	INTIAL RELEASE	BSF
MARK	DATE	REVISION DESCRIPTION	BY

Jellyfish®

JF4 STANDARD

Scale = 1:50

www.imbriumsystems.com info@imbriumsystems.com

imbrium®
7037 Ridge Road, Suite 350, Hanover, MD 21076
USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

Jellyfish® Filter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING AUS NO. 2008/286748, U.S.A. NO. US 8,287,726, US 8,221,618, US 8,123,935, CA 2, 966,482, CA 2,834,542, CA 2,696,482, KR 10-1287539, NZ 583461, NZ 604227, ZA 2010/01068; OTHER INTERNATIONAL PATENTS PENDING

DATE: #####	
DESIGNED:	DRAWN: BSF
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 1 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF4 - OFFLINE DIVERSION MANHOLE.DWG 5/17/2017 1:57 PM

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:

ASTM C 891:	SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478:	SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990:	SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101:	SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY
0	10/01/2014	INITIAL RELEASE	BSF
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#

JELLYFISH FILTER SPECIFICATIONS

Jellyfish®

JF4 STANDARD

Scale = 1:50

www.imbriumsystems.com info@imbriumsystems.com

imbrium®
7037 Ridge Road, Suite 350, Hanover, MD 21076
USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

Jellyfish® Filter

DATE: #####	
DESIGNED:	DRAWN:
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 2 OF 2	

I:\IMBRIUM\PRODUCTS\JELLYFISH FILTER\40 DRAWINGS & DETAILS\STANDARD DETAILS\JELLYFISH FILTER - OFFLINE\JELLYFISH FILTER JF4 - OFFLINE DIVERSION MANHOLE.DWG 5/17/2017 1:57 PM

DRAWING NOT TO BE USED FOR CONSTRUCTION

GENERAL NOTES:
1. ALL DIMENSIONS INDICATED ARE IN MILLIMETERS (INCHES) UNLESS OTHERWISE SPECIFIED.
2. JELLYFISH STRUCTURE INLET AND OUTLET PIPE SIZE AND ORIENTATION SHOWN FOR INFORMATIONAL PURPOSES ONLY.
3. UNLESS OTHERWISE NOTED, BYPASS INFRASTRUCTURE, SUCH AS ALL UPSTREAM DIVERSION STRUCTURES, CONNECTING STRUCTURES, OR PIPE CONDUITS CONNECTING TO COMPLETE THE JELLYFISH SYSTEM SHALL BE PROVIDED AND ADDRESSED SEPARATELY.
4. DRAWING FOR INFORMATION PURPOSES ONLY. REFER TO ENGINEER'S SITE/UTILITY PLAN FOR STRUCTURE ORIENTATION.
5. NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD.

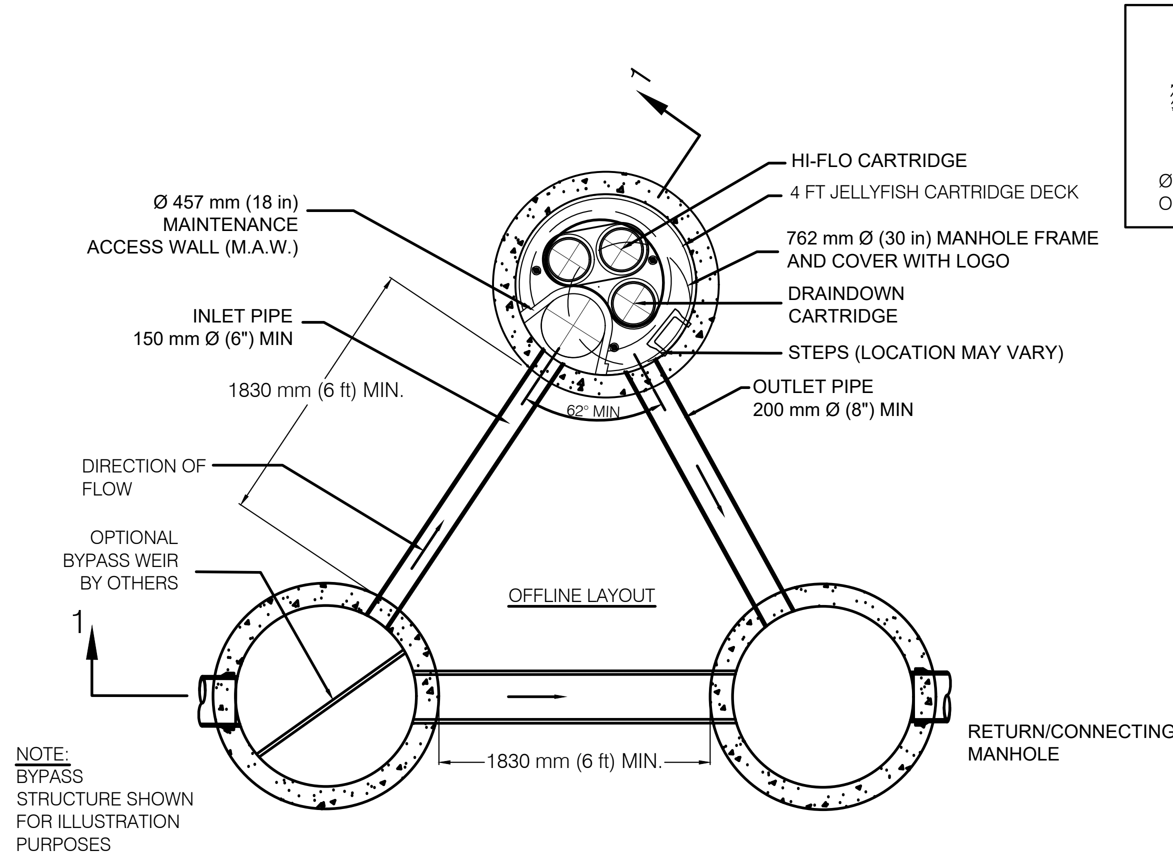
JELLYFISH STRUCTURE & DESIGN NOTES:
1. 457 MM Ø (18") MAINTENANCE ACCESS WALL TO BE USED FOR CLEANOUT AND ACCESS BELOW CARTRIDGE DECK.
2. CASTINGS OR DOORS OF THE JELLYFISH MANHOLE STRUCTURE TO EXTEND TO DESIGN FINISH GRADE. DEPTHS IN EXCESS OF 3.65 M (12') MAY REQUIRE THE DESIGN AND INSTALLATION OF INTERMEDIATE SAFETY GRATES OR OTHER STRUCTURAL ELEMENTS.
3. CASTINGS AND GRADE RINGS, OR DOORS AND DOOR RISERS, OR BOTH, SHALL BE GROUTED FOR WATERTIGHTNESS.
STRUCTURE SHALL MEET AASHTO HS-20, ASSUMING EARTH COVER OF 0' - 3', AND GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET AASHTO M306 LOAD RATING AND BE CAST WITH THE IMBRIUM LOGO.
4. ALL STRUCTURAL SECTIONS AND PARTS TO MEET OR EXCEED ASTM C-478, ASTM C-443, AND ASTM D-4097 CORRESPONDING TO AASHTO SPECIFICATIONS, AND ANY OTHER SITE OR LOCAL STANDARDS.
5. CONCRETE RISER SECTIONS FROM BOTTOM TO TOP WILL BE ADDED AS REQUIRED INCLUDING TRANSITION PIECES TO SMALLER DIAMETER RISERS FOR SURFACE ACCESSES WHERE WARRANTED BY SERVICING DEPTH.
6. IF MINIMUM DEPTH FROM TOP OF CARTRIDGE DECK TO BOTTOM OF STRUCTURAL TOP SLAB CANNOT BE ACHIEVED DUE TO PIPING INVERT ELEVATIONS OR OTHER SITE CONSTRAINTS. ALTERNATIVE HATCH CONFIGURATIONS MAY BE AVAILABLE. HATCH DOORS SHOULD BE SIZED TO PROVIDE FULL ACCESS ABOVE THE CARTRIDGES TO ACCOMMODATE MAINTENANCE.
7. STEPS TO BE APPROXIMATELY 330 MM (13") APART AND DIMENSIONS MUST MEET LOCAL STANDARDS. STEPS MUST BE INSTALLED AFTER CARTRIDGE DECK IS IN PLACE.
8. CONFIGURATION OF INLET AND OUTLET PIPE CAN VARY TO MEET SITE'S NEEDS.
9. IT IS THE RESPONSIBILITY OF OTHERS TO PROPERLY PROTECT THE TREATMENT DEVICE, AND KEEP THE DEVICE OFFLINE DURING CONSTRUCTION. FILTER CARTRIDGES SHALL NOT BE INSTALLED UNTIL THE PROJECT SITE IS CLEAN AND FREE OF DEBRIS, BY OTHERS. THE PROJECT SITE INCLUDES ANY SURFACE THAT CONTRIBUTES STORM DRAINAGE TO THE TREATMENT DEVICE. CARTRIDGES SHALL BE FURNISHED NEW, AT THE TIME OF FINAL ACCEPTANCE.
10. THIS DRAWING MUST BE VIEWED IN CONJUNCTION WITH THE STANDARD JELLYFISH SPECIFICATION, AND STORMWATER QUALITY FILTER TREATMENT JELLYFISH DOCUMENTS.

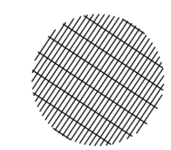
INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING CLUTCHES PROVIDED)
C. CONTRACTOR WILL INSTALL AND LEVEL THE STRUCTURE, SEALING THE JOINTS, LINE ENTRY AND EXIT POINTS (NON-SHRINK GROUT WITH APPROVED WATERSTOP OR FLEXIBLE BOOT)
D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.
E. CARTRIDGE INSTALLATION, BY IMBRIUM, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT IMBRIUM TO COORDINATE CARTRIDGE INSTALLATION WITH SITE STABILIZATION.

STANDARD OFFLINE JELLYFISH RECOMMENDED PIPE DIAMETERS

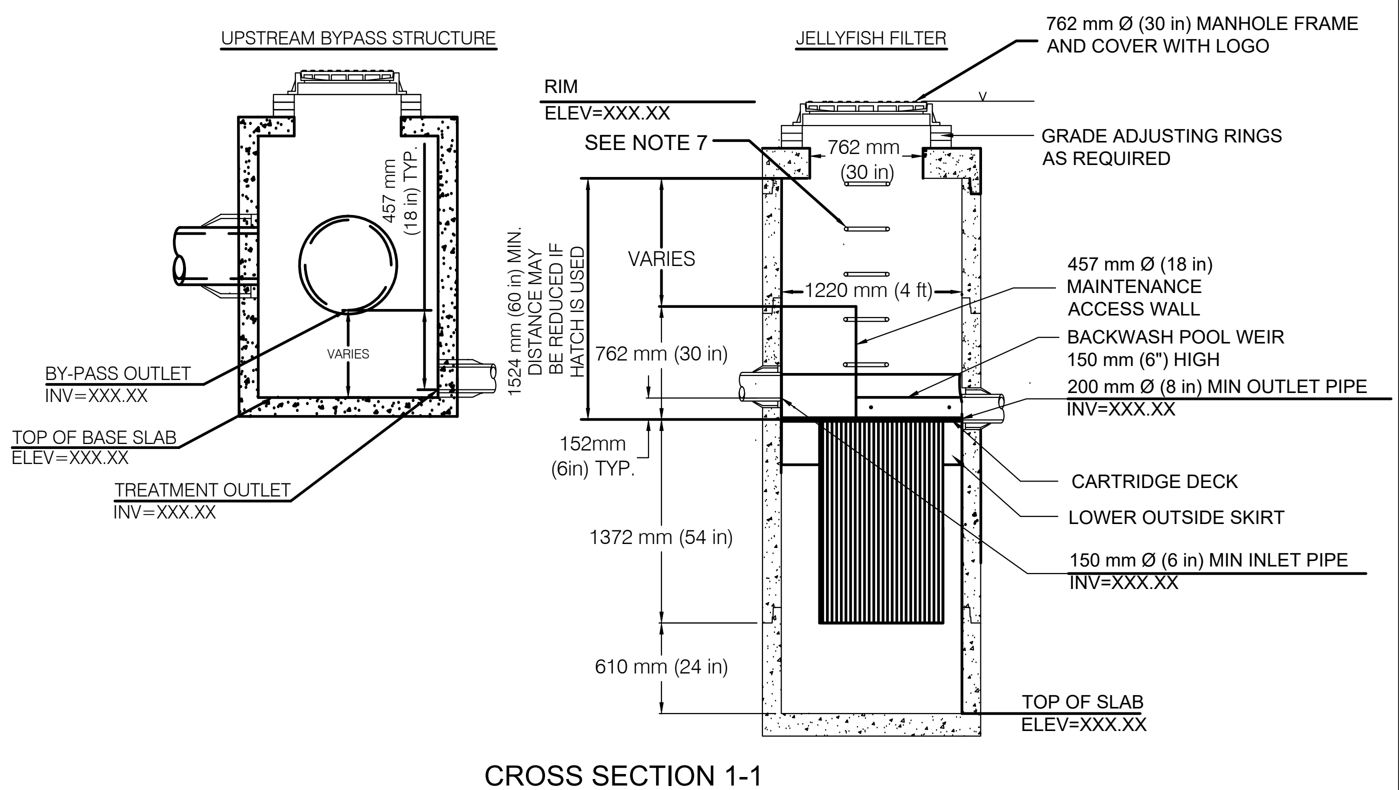
MODEL DIAMETER (m)	MINIMUM ANGLE INLET/OUTLET PIPES	MINIMUM INLET PIPE DIAMETER (mm)	MINIMUM OUTLET PIPE DIAMETER (mm)
1.2	62	150	200
1.8	59	200	250
2.4	52	250	300
3.0	48	300	450
3.6	40	300	450
CONTACT IMBRIUM SYSTEMS FOR ALTERNATE PIPE DIAMETERS			

FOR SITE SPECIFIC DRAWINGS PLEASE CONTACT YOUR LOCAL JELLYFISH FILTER REPRESENTATIVE. SITE SPECIFIC DRAWINGS ARE BASED ON THE BEST AVAILABLE INFORMATION AT THE TIME. SOME FIELD REVISIONS TO THE SYSTEM LOCATION OR CONNECTION PIPING MAY BE NECESSARY BASED ON AVAILABLE SPACE OR SITE CONFIGURATION REVISIONS. ELEVATIONS SHOULD BE MAINTAINED EXCEPT WHERE NOTED ON BYPASS STRUCTURE.





XXX.XX INFORMATION TO BE SUPPLIED BY ENGINEER OF RECORD



CROSS SECTION 1-1

JELLYFISH DESIGN NOTES

JELLYFISH TREATMENT CAPACITY IS A FUNCTION OF THE CARTRIDGE SELECTION AND THE NUMBER OF CARTRIDGES. THE STANDARD MANHOLE STYLE IS SHOWN. Ø1220 mm (48") MANHOLE JELLYFISH PEAK TREATMENT CAPACITY IS 12.7 L/s (0.54 CFS). TREATMENT FLOW RATE IS BASED ON 457 mm (18") OF HEAD PRESSURE.

CARTRIDGE SELECTION				
CARTRIDGE DEPTH	54"	40"	27"	15"
OUTLET INVERT TO STRUCTURE BASE SLAB	90"	76"	63"	51"
FLOW RATE HIGH-FLO / DRAINDOWN (L/s) (per cart)	5.09 / 2.55	3.68 / 1.84	2.55 / 1.27	1.41 / 0.71
SEDIMENT CAPACITY HIGH-FLO / DRAINDOWN (kg) (per cart)	57 / 28	42 / 21	28 / 14	16 / 8
MAX. CARTS HIGH-FLO/DRAINDOWN	2 / 1			
MAX. SEDIMENT CAPACITY (kg)	142	105	70	40
MAX. TREATMENT (L/s)	12.7	9.3	6.2	3.4

SITE SPECIFIC DATA REQUIREMENTS

JELLYFISH MODEL	*				
STRUCTURE ID					*
WATER QUALITY FLOW RATE (L/s)					*
PEAK FLOW RATE (L/s)					*
RETURN PERIOD OF PEAK FLOW (yrs)					*
# OF CARTRIDGES REQUIRED (HF / DD)					*
CARTRIDGE SIZE (inches)					*
PIPE DATA:	I.E.	MAT'L	DIA	SLOPE %	HGL
INLET #1	*	*	*	*	*
INLET #2	*	*	*	*	*
OUTLET	*	*	*	*	*

* PER ENGINEER OF RECORD

MARK	DATE	NOTES	BY
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#
1	08/01/2015	NOTES	BSF
0	10/01/2014	INITIAL RELEASE	BSF
		REVISION DESCRIPTION	

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.
If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

Jellyfish®
JF4 STANDARD
Scale = 1:50

info@imbriumsystems.com
www.imbriumsystems.com
imbrium
Jellyfish® Filter
7037 Ridge Road, Suite 350, Hanover, MD 21076
USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

DATE: #####	
DESIGNED:	DRAWN: BSF
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 1 OF 2	

\\AD.CONTECH-CPI.COM\ROOT\CORPORATE\MARKETING\IMBRIUM\CAD & PDF\JELLYFISH\JELLYFISH FILTER JF4 - OFFLINE.DWG 8/5/2016 9:14 AM

JELLYFISH® FILTER - SPECIFICATIONS

GENERAL

A. WORK INCLUDED: SPECIFIES REQUIREMENTS FOR CONSTRUCTION AND PERFORMANCE OF AN UNDERGROUND STORMWATER QUALITY, MEMBRANE FILTRATION, AND TREATMENT DEVICE THAT REMOVES POLLUTANTS FROM STORMWATER RUNOFF THROUGH THE UNIT OPERATIONS OF SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. REFERENCE STANDARDS:
ASTM C 891: SPECIFICATION FOR INSTALLATION OF UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES
ASTM C 478: SPECIFICATION FOR PRECAST REINFORCED CONCRETE MANHOLE SECTIONS
ASTM C 990: SPECIFICATION FOR JOINTS FOR CONCRETE MANHOLES USING PREFORMED FLEXIBLE JOINT SEALANTS
ASTM D 4101: SPECIFICATION FOR COPOLYMER STEPS CONSTRUCTION

C. SHOP DRAWINGS: SHOP DRAWINGS FOR THE STRUCTURE AND PERFORMANCE ARE TO BE SUBMITTED WITH EACH ORDER TO THE CONTRACTOR. CONTRACTOR SHALL FORWARD SHOP DRAWING SUBMITTAL TO THE CONSULTING ENGINEER FOR APPROVAL. SHOP DRAWINGS ARE TO DETAIL THE STRUCTURE PRECAST CONCRETE AND CALL OUT OR NOTE THE FIBERGLASS (FRP) INTERNALS/COMPONENTS.

D. PRODUCT SUBSTITUTIONS: NO PRODUCT SUBSTITUTIONS SHALL BE ACCEPTED UNLESS SUBMITTED 10 DAYS PRIOR TO PROJECT BID DATE, OR AS DIRECTED BY THE ENGINEER OF RECORD. SUBMISSIONS FOR SUBSTITUTIONS REQUIRE REVIEW AND APPROVAL BY THE ENGINEER OF RECORD, FOR HYDRAULIC PERFORMANCE, IMPACT TO PROJECT DESIGNS, EQUIVALENT TREATMENT PERFORMANCE, AND ANY REQUIRED PROJECT PLAN AND REPORT (HYDROLOGY/HYDRAULIC, WATER QUALITY, STORMWATER POLLUTION) MODIFICATIONS THAT WOULD BE REQUIRED BY THE APPROVING JURISDICTIONS/AGENCIES. CONTRACTOR TO COORDINATE WITH THE ENGINEER OF RECORD ANY APPLICABLE MODIFICATIONS TO THE PROJECT ESTIMATES OF COST, BONDING AMOUNT DETERMINATIONS, PLAN CHECK FEES FOR CHANGES TO APPROVED DOCUMENTS, AND/OR ANY OTHER REGULATORY REQUIREMENTS RESULTING FROM THE PRODUCT SUBSTITUTION.

E. HANDLING AND STORAGE: PREVENT DAMAGE TO MATERIALS DURING STORAGE AND HANDLING.

PRODUCTS

A. THE DEVICE SHALL BE A CYLINDRICAL OR RECTANGULAR, ALL CONCRETE STRUCTURE (INCLUDING RISERS), CONSTRUCTED FROM PRECAST CONCRETE RISER AND SLAB COMPONENTS OR MONOLITHIC PRECAST STRUCTURE(S), INSTALLED TO CONFORM TO ASTM C 891 AND TO ANY REQUIRED STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS; WHICHEVER IS MORE STRINGENT. THE DEVICE SHALL BE WATERTIGHT.

B. THE CYLINDRICAL CONCRETE DEVICE SHALL INCLUDE A FIBERGLASS CARTRIDGE DECK INSERT. THE RECTANGULAR CONCRETE DEVICE SHALL INCLUDE A COATED ALUMINUM INSERT. IN EITHER INSTANCE, THE INSERT SHALL BE BOLTED AND SEALED WATERTIGHT INSIDE THE PRECAST CONCRETE CHAMBER. THE INSERT SHALL SERVE AS: (A) A HORIZONTAL DIVIDER BETWEEN THE LOWER TREATMENT ZONE AND THE UPPER TREATED EFFLUENT ZONE; (B) A DECK FOR ATTACHMENT OF FILTER CARTRIDGES SUCH THAT THE MEMBRANE FILTER ELEMENTS OF EACH CARTRIDGE EXTEND INTO THE LOWER TREATMENT ZONE; (C) A PLATFORM FOR MAINTENANCE WORKERS TO SERVICE THE FILTER CARTRIDGES (MAXIMUM MANNED WEIGHT = 450 POUNDS); (D) A CONDUIT FOR CONVEYANCE OF TREATED WATER TO THE EFFLUENT PIPE.

C. MEMBRANE FILTER CARTRIDGES SHALL BE COMPRISED OF REUSABLE CYLINDRICAL MEMBRANE FILTER ELEMENTS CONNECTED TO A PERFORATED HEAD PLATE. THE NUMBER OF MEMBRANE FILTER ELEMENTS PER CARTRIDGE SHALL BE A MINIMUM OF ELEVEN 2.75-INCH (70-MM) OR GREATER DIAMETER ELEMENTS. THE LENGTH OF EACH FILTER ELEMENT SHALL BE A MINIMUM 15 INCHES (381 MM). EACH CARTRIDGE SHALL BE FITTED INTO THE CARTRIDGE DECK BY INSERTION INTO A CARTRIDGE RECEPTACLE THAT IS PERMANENTLY MOUNTED INTO THE CARTRIDGE DECK. EACH CARTRIDGE SHALL BE SECURED BY A CARTRIDGE LID THAT IS THREADED ONTO THE RECEPTACLE, OR SIMILAR MECHANISM TO SECURE THE CARTRIDGE INTO THE DECK. THE MAXIMUM TREATMENT FLOW RATE OF A FILTER CARTRIDGE SHALL BE CONTROLLED BY AN ORIFICE IN THE CARTRIDGE LID, OR ON THE INDIVIDUAL CARTRIDGE ITSELF, AND BASED ON A DESIGN FLUX RATE (SURFACE LOADING RATE) DETERMINED BY THE MAXIMUM TREATMENT FLOW RATE PER UNIT OF FILTRATION MEMBRANE SURFACE AREA. THE MAXIMUM FLUX RATE SHALL BE 0.21 GPM/FT2 (0.142 LPS/M2). EACH MEMBRANE FILTER CARTRIDGE SHALL ALLOW FOR MANUAL INSTALLATION AND REMOVAL.

D. ALL FILTER CARTRIDGES AND MEMBRANES SHALL BE REUSABLE AND ALLOW FOR THE USE OF FILTRATION MEMBRANE RINSING PROCEDURES TO RESTORE FLOW CAPACITY AND SEDIMENT CAPACITY; EXTENDING CARTRIDGE SERVICE LIFE.

E. ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. THE DEVICE SHALL INCLUDE A MINIMUM 24 INCHES (610 MM) OF SUMP BELOW THE BOTTOM OF THE CARTRIDGES FOR SEDIMENT ACCUMULATION, UNLESS OTHERWISE SPECIFIED BY THE DESIGN ENGINEER. DEPTHS LESS THAN 24" MAY HAVE AN IMPACT ON THE TOTAL PERFORMANCE AND/OR LONGEVITY BETWEEN CARTRIDGE MAINTENANCE/REPLACEMENT OF THE DEVICE.

G. ALL PRECAST CONCRETE COMPONENTS SHALL BE MANUFACTURED TO A MINIMUM LIVE LOAD OF HS-20 TRUCK LOADING OR GREATER BASED ON LOCAL REGULATORY SPECIFICATIONS, UNLESS OTHERWISE MODIFIED OR SPECIFIED BY THE DESIGN ENGINEER, AND SHALL BE WATERTIGHT.

H. GASKETS AND/OR SEALANTS TO PROVIDE WATER TIGHT SEAL BETWEEN CONCRETE JOINTS. JOINTS SHALL BE SEALED WITH PREFORMED JOINT SEALING COMPOUND CONFORMING TO ASTM C 990.

I. FRAME AND COVERS MUST BE MANUFACTURED FROM CAST-IRON OR OTHER COMPOSITE MATERIAL TESTED TO WITHSTAND H-20 OR GREATER DESIGN LOADS, AND AS APPROVED BY THE LOCAL REGULATORY BODY. FRAMES AND COVERS MUST BE EMBOSSED WITH THE NAME OF THE DEVICE MANUFACTURER OR THE DEVICE BRAND NAME.

J. DOOR AND HATCHES, IF PROVIDED SHALL MEET DESIGNATED LOADING REQUIREMENTS OR AT A MINIMUM FOR INCIDENTAL VEHICULAR TRAFFIC.

K. ALL CONCRETE COMPONENTS SHALL BE MANUFACTURED ACCORDING TO LOCAL SPECIFICATIONS AND SHALL MEET THE REQUIREMENTS OF ASTM C 478.

L. THE FIBERGLASS PORTION OF THE FILTER DEVICE SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING STANDARD: ASTM D-4097: CONTACT MOLDED GLASS FIBER REINFORCED CHEMICAL RESISTANT TANKS.

M. STEPS SHALL BE CONSTRUCTED ACCORDING TO ASTM D4101 OF COPOLYMER POLYPROPYLENE, AND BE DRIVEN INTO PREFORMED OR PRE-DRILLED HOLES AFTER THE CONCRETE HAS CURED, INSTALLED TO CONFORM TO APPLICABLE SECTIONS OF STATE, PROVINCIAL AND MUNICIPAL BUILDING CODES, HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF SUCH DEVICES.

N. ALL PRECAST CONCRETE SECTIONS SHALL BE INSPECTED TO ENSURE THAT DIMENSIONS, APPEARANCE AND QUALITY OF THE PRODUCT MEET LOCAL MUNICIPAL SPECIFICATIONS AND ASTM C 478.

PERFORMANCE

A. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL FUNCTION TO REMOVE POLLUTANTS BY THE FOLLOWING UNIT TREATMENT PROCESSES; SEDIMENTATION, FLOATATION, AND MEMBRANE FILTRATION.

B. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL REMOVE OIL, DEBRIS, TRASH, COARSE AND FINE PARTICULATES, PARTICULATE-BOUND POLLUTANTS, METALS AND NUTRIENTS FROM STORMWATER DURING RUNOFF EVENTS.

C. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TYPICALLY UTILIZE AN EXTERNAL BYPASS TO DIVERT EXCESSIVE FLOWS. INTERNAL BYPASS SYSTEMS SHALL BE EQUIPPED WITH A FLOATABLES BAFFLE, AND MUST PASS WATER OVER THE CARTRIDGE DECK, AND AVOID PASSAGE THROUGH THE SUMP AND/OR CARTRIDGE FILTRATION ZONE.

D. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL TREAT 100% OF THE REQUIRED WATER QUALITY TREATMENT FLOW BASED ON A MAXIMUM TREATMENT FLUX RATE (SURFACE LOADING RATE) ACROSS THE MEMBRANE FILTER CARTRIDGES NOT TO EXCEED 0.21 GPM/FT2 (0.142 LPS/M2).

E. AT A MINIMUM, THE STORMWATER QUALITY FILTER DEVICE SHALL HAVE BEEN FIELD TESTED AND VERIFIED WITH A MINIMUM 25 QUALIFYING STORM EVENTS AND FIELD MONITORING CONDUCTED ACCORDING TO THE TARP TIER II OR TAPE FIELD TEST PROTOCOL, AND HAVE RECEIVED NJCAT VERIFICATION.

F. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TSS REMOVAL EFFICIENCY OF 85% AND A MINIMUM MEDIAN SSC REMOVAL EFFICIENCY OF 95%.

G. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED THE ABILITY TO CAPTURE FINE PARTICLES AS INDICATED BY A MINIMUM MEDIAN REMOVAL EFFICIENCY OF 75% FOR THE PARTICLE FRACTION LESS THAN 25 MICRONS, AN EFFLUENT D50 OF 15 MICRONS OR LOWER FOR ALL MONITORED STORM EVENTS, AND AN EFFLUENT TURBIDITY OF 15 NTUS OR LOWER.

H. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL PHOSPHORUS REMOVAL OF 55%, AND A MINIMUM MEDIAN TOTAL NITROGEN REMOVAL OF 50%.

I. THE STORMWATER QUALITY FILTER TREATMENT DEVICE SHALL HAVE DEMONSTRATED A MINIMUM MEDIAN TOTAL ZINC REMOVAL OF 50%, AND A MINIMUM MEDIAN TOTAL COPPER REMOVAL OF 75%.

INSPECTION AND MAINTENANCE

A. DURABILITY OF MEMBRANES ARE SUBJECT TO GOOD HANDLING PRACTICES DURING INSPECTION AND MAINTENANCE (REMOVAL, RINSING, AND REINSERTION) EVENTS, AND SITE SPECIFIC CONDITIONS THAT MAY HAVE HEAVIER OR LIGHTER LOADING ONTO THE CARTRIDGES, AND POLLUTANT VARIABILITY THAT MAY IMPACT THE MEMBRANE STRUCTURAL INTEGRITY. MEMBRANE MAINTENANCE AND REPLACEMENT SHALL BE IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS.

B. INSPECTION WHICH INCLUDES TRASH AND FLOATABLES COLLECTION, SEDIMENT DEPTH DETERMINATION, AND VISIBLE DETERMINATION OF BACKWASH POOL DEPTH SHALL BE EASILY CONDUCTED FROM GRADE (OUTSIDE THE STRUCTURE).

C. MANUAL RINSING OF THE REUSABLE FILTER CARTRIDGES SHALL PROMOTE RESTORATION OF THE FLOW CAPACITY AND SEDIMENT CAPACITY OF THE FILTER CARTRIDGES, EXTENDING CARTRIDGE SERVICE LIFE.

D. SEDIMENT REMOVAL FROM THE FILTER TREATMENT DEVICE SHALL BE ABLE TO BE CONDUCTED USING A STANDARD MAINTENANCE TRUCK AND VACUUM APPARATUS, AND A MINIMUM ONE POINT OF ENTRY TO THE SUMP THAT IS UNOBSTRUCTED BY FILTER CARTRIDGES.

E. MAINTENANCE ACCESS SHALL HAVE A MINIMUM CLEAR HEIGHT OF 60" OVER ALL OF THE FILTER CARTRIDGES, OR BE ACCESSIBLE BY A HATCH OR OTHER MECHANISM THAT PROVIDES MINIMUM 60" VERTICAL CLEAR SPACE OVER ALL OF THE FILTER CARTRIDGES. FILTER CARTRIDGES SHALL BE ABLE TO BE LIFTED STRAIGHT VERTICALLY OUT OF THE RECEPTACLES AND DECK FOR THE ENTIRE LENGTH OF THE CARTRIDGE.

F. FILTER CARTRIDGES SHALL BE ABLE TO BE MAINTAINED WITHOUT THE USE OF ADDITIONAL LIFTING EQUIPMENT.

EXECUTION

A. THE INSTALLATION OF A WATERTIGHT PRECAST CONCRETE DEVICE SHOULD CONFORM TO ASTM C 891 AND TO ANY STATE HIGHWAY, MUNICIPAL OR LOCAL SPECIFICATIONS FOR THE CONSTRUCTION OF MANHOLES, WHICHEVER IS MORE STRINGENT. SELECTED SECTIONS OF A GENERAL SPECIFICATION THAT ARE APPLICABLE ARE SUMMARIZED BELOW.

B. THE WATERTIGHT PRECAST CONCRETE DEVICE IS INSTALLED IN SECTIONS IN THE FOLLOWING SEQUENCE:
- AGGREGATE BASE
- BASE SLAB
- TREATMENT CHAMBER AND CARTRIDGE DECK RISER SECTION(S)
- BYPASS SECTION
- CONNECT INLET AND OUTLET PIPES
- CONCRETE RISER SECTION(S) AND/OR TRANSITION SLAB (IF REQUIRED)
- MAINTENANCE RISER SECTION(S) (IF REQUIRED)
- FRAME AND ACCESS COVER

C. INLET AND OUTLET PIPES SHOULD BE SECURELY SET INTO THE DEVICE USING APPROVED PIPE SEALS (FLEXIBLE BOOT CONNECTIONS, WHERE APPLICABLE) SO THAT THE STRUCTURE IS WATERTIGHT, AND SUCH THAT ANY PIPE INTRUSION INTO THE DEVICE DOES NOT IMPACT THE DEVICE FUNCTIONALITY.

D. ADJUSTMENT UNITS (E.G. GRADE RINGS) SHOULD BE INSTALLED TO SET THE FRAME AND COVER AT THE REQUIRED ELEVATION. THE ADJUSTMENT UNITS SHOULD BE LAID IN A FULL BED OF MORTAR WITH SUCCESSIVE UNITS BEING JOINED USING SEALANT RECOMMENDED BY THE MANUFACTURER. FRAMES FOR THE COVER SHOULD BE SET IN A FULL BED OF MORTAR AT THE ELEVATION SPECIFIED.

E. IN SOME INSTANCES THE MAINTENANCE ACCESS WALL, IF PROVIDED, SHALL REQUIRE AN EXTENSION ATTACHMENT AND SEALING TO THE PRECAST WALL AND CARTRIDGE DECK AT THE JOB SITE, RATHER THAN AT THE PRECAST FACILITY. IN THIS INSTANCE, INSTALLATION OF THESE COMPONENTS SHALL BE PERFORMED ACCORDING TO INSTRUCTIONS PROVIDED BY THE MANUFACTURER.

F. FILTER CARTRIDGES SHALL BE INSTALLED IN THE CARTRIDGE DECK AFTER THE CONSTRUCTION SITE IS FULLY STABILIZED AND IN ACCORDANCE WITH THE MANUFACTURERS GUIDELINES AND RECOMMENDATIONS. CONTRACTOR TO CONTACT THE MANUFACTURER TO SCHEDULE CARTRIDGE DELIVERY AND REVIEW PROCEDURES/REQUIREMENTS TO BE COMPLETED TO THE DEVICE PRIOR TO INSTALLATION OF THE CARTRIDGES AND ACTIVATION OF THE SYSTEM.

G. MANUFACTURER SHALL COORDINATE DELIVERY OF FILTER CARTRIDGES AND OTHER INTERNAL COMPONENTS WITH CONTRACTOR. FILTER CARTRIDGES SHALL BE DELIVERED AND INSTALLED COMPLETE AFTER SITE IS STABILIZED AND UNIT IS READY TO ACCEPT CARTRIDGES. UNIT IS READY TO ACCEPT CARTRIDGES AFTER IS HAS BEEN CLEANED OUT AND ANY STANDING WATER, DEBRIS, AND OTHER MATERIALS HAVE BEEN REMOVED. CONTRACTOR SHALL TAKE APPROPRIATE ACTION TO PROTECT THE FILTER CARTRIDGE RECEPTACLES AND FILTER CARTRIDGES FROM DAMAGE DURING CONSTRUCTION, AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND GUIDANCE. FOR SYSTEMS WITH CARTRIDGES INSTALLED PRIOR TO FULL SITE STABILIZATION AND PRIOR TO SYSTEM ACTIVATION, THE CONTRACTOR CAN PLUG INLET AND OUTLET PIPES TO PREVENT STORMWATER AND OTHER INFLUENT FROM ENTERING THE DEVICE. PLUGS MUST BE REMOVED DURING THE ACTIVATION PROCESS.

H. THE MANUFACTURER SHALL PROVIDE AN OWNER'S MANUAL UPON REQUEST.

I. AFTER CONSTRUCTION AND INSTALLATION, AND DURING OPERATION, THE DEVICE SHALL BE INSPECTED AND CLEANED AS NECESSARY BASED ON THE MANUFACTURER'S RECOMMENDED INSPECTION AND MAINTENANCE GUIDELINES AND THE LOCAL REGULATORY AGENCY/BODY.

J. WHEN REPLACEMENT MEMBRANE FILTER ELEMENTS AND/OR OTHER PARTS ARE REQUIRED, ONLY MEMBRANE FILTER ELEMENTS AND PARTS APPROVED BY THE MANUFACTURER FOR USE WITH THE STORMWATER QUALITY FILTER DEVICE SHALL BE INSTALLED.

END OF SECTION

The design and information shown on this drawing is provided as a service to the project owner, engineer and contractor by Imbrium Systems ("Imbrium"). Neither this drawing, nor any part thereof, may be used, reproduced or modified in any manner without the prior written consent of Imbrium. Failure to comply is done at the user's own risk and Imbrium expressly disclaims any liability or responsibility for such use.

If discrepancies between the supplied information upon which the drawing is based and actual field conditions are encountered as site work progresses, these discrepancies must be reported to Imbrium immediately for re-evaluation of the design. Imbrium accepts no liability for designs based on missing, incomplete or inaccurate information supplied by others.

MARK	DATE	REVISION DESCRIPTION	BY
0	10/01/2014	INTIAL RELEASE	BSF
#	#	#	#
#	#	#	#
#	#	#	#
#	#	#	#

JELLYFISH FILTER SPECIFICATIONS

Jellyfish®

JF4 STANDARD

Scale = 1:50

www.imbriumsystems.com info@imbriumsystems.com

imbrium®
7037 Ridge Road, Suite 350, Hanover, MD 21076
USA 888-279-8826 CA 800-565-4801 INTL +1-416-960-9900

Jellyfish® Filter

THIS PRODUCT MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING AUS NO. 2008/286748, U.S.A. NO. US 8,287,726, US 8,221,618, US 8,123,935, CA 2, 966,482, CA 2,834,542,CA 2,696,482, KR 10-1287539, NZ 583461, NZ 604227, ZA 2010/01068; OTHER INTERNATIONAL PATENTS PENDING

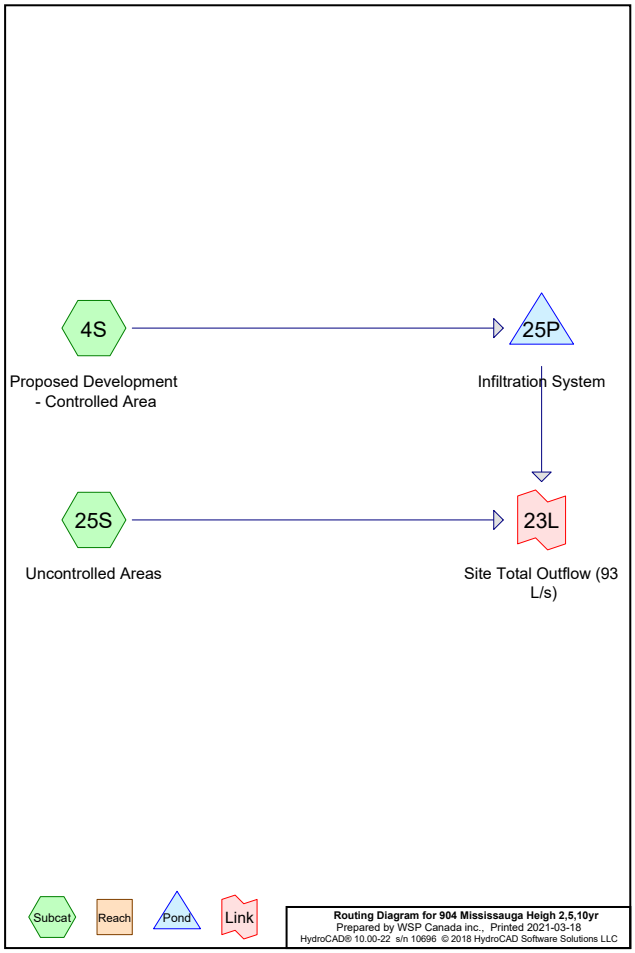
DATE: #####	
DESIGNED:	DRAWN:
CHECKED: BSF	APPROVED: SP
PROJECT #: #####	PROJECT NAME: #####
SHEET: 2 OF 2	

\\AD.CONTECH-CPI.COM\ROOT\CORPORATE\MARKETING\IMBRIUM\CAD & PDF\JELLYFISH\JELLYFISH FILTER JF4 - OFFLINE.DWG 8/5/2016 9:14 AM

APPENDIX

B

Hydrologic Model Output (HydroCAD)



Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.7653	0.60	Total Controlled (4S)
0.1732	0.41	Total uncontrolled (25S)
0.9385	**0.56**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.9385	Other	4S, 25S
0.9385		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	0.7653	0.7653	Total Controlled	4S
0.0000	0.0000	0.0000	0.0000	0.1732	0.1732	Total uncontrolled	25S
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.9385**	**0.9385**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Proposed Runoff Area=7,653.0 m² 0.00% Impervious Runoff Depth=12 mm
Tc=15.0 min C=0.60 Runoff=0.0433 m³/s 0.094 Ml

Subcatchment25S: Uncontrolled Runoff Area=1,732.0 m² 0.00% Impervious Runoff Depth=8 mm
Tc=15.0 min C=0.41 Runoff=0.0067 m³/s 0.014 Ml

Pond 25P: Infiltration System Peak Elev=0.447 m Storage=120.3 m³ Inflow=0.0433 m³/s 0.094 Ml
Discarded=0.0015 m³/s 0.033 Ml Primary=0.0096 m³/s 0.024 Ml Outflow=0.0111 m³/s 0.057 Ml

Link 23L: Site Total Outflow (93 L/s) Inflow=0.0123 m³/s 0.038 Ml
Primary=0.0123 m³/s 0.038 Ml

Total Runoff Area = 0.9385 ha Runoff Volume = 0.108 Ml Average Runoff Depth = 12 mm
100.00% Pervious = 0.9385 ha 0.00% Impervious = 0.0000 ha

Summary for Subcatchment 4S: Proposed Development - Controlled Area

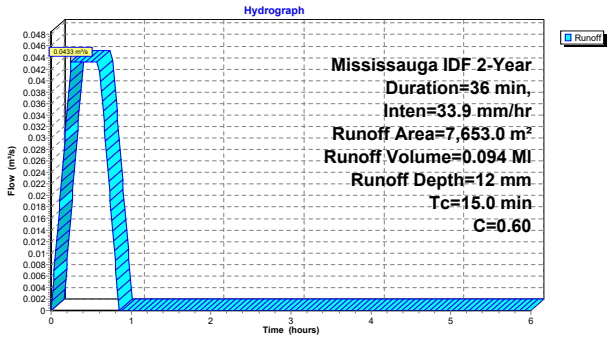
Runoff = 0.0433 m³/s @ 0.25 hrs, Volume= 0.094 Ml, Depth= 12 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 2-Year Duration=36 min, Inten=33.9 mm/hr

Area (m²)	C	Description
7,653.0	0.60	Total Controlled
7,653.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 4S: Proposed Development - Controlled Area



Summary for Subcatchment 25S: Uncontrolled Areas

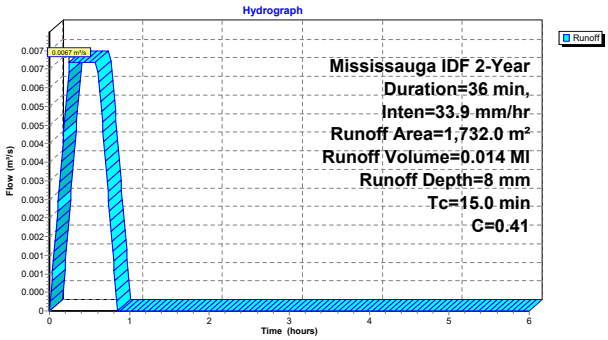
Runoff = 0.0067 m³/s @ 0.25 hrs, Volume= 0.014 Ml, Depth= 8 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 2-Year Duration=36 min, Inten=33.9 mm/hr

Area (m²)	C	Description
1,732.0	0.41	Total uncontrolled
1,732.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 25S: Uncontrolled Areas



Summary for Pond 25P: Infiltration System

Inflow Area = 0.7653 ha, 0.00% Impervious, Inflow Depth = 12 mm for 2-Year event
Inflow = 0.0433 m³/s @ 0.25 hrs, Volume= 0.094 Ml
Outflow = 0.0111 m³/s @ 0.79 hrs, Volume= 0.057 Ml, Atten= 74%, Lag= 32.2 min
Discarded = 0.0015 m³/s @ 0.00 hrs, Volume= 0.033 Ml
Primary = 0.0096 m³/s @ 0.79 hrs, Volume= 0.024 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.200 m Surf.Area= 363.8 m² Storage= 38.1 m³
Peak Elev= 0.447 m @ 0.79 hrs Surf.Area= 363.8 m² Storage= 120.3 m³ (82.2 m³ above start)

Plug-Flow detention time= 248.9 min calculated for 0.019 Ml (20% of inflow)
Center-of-Mass det. time= 107.5 min (133.0 - 25.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	71.0 m³	**13.41 mW x 27.13 mL x 0.91 mH Field A** 332.6 m³ Overall - 155.2 m³ Embedded = 177.4 m³ x 40.0% Voids
#2A	0.152 m	148.0 m³	**Brentwood StormTank 18"** x 812 Inside #1 Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³ Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³ 28 Rows of 29 Chambers
		218.9 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.000 m	**15.00 mm/hr Exfiltration over Surface area**
#2	Primary	0.352 m	**240 mm Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.0015 m³/s @ 0.00 hrs HW=0.200 m (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.0015 m³/s)

Primary OutFlow Max=0.0096 m³/s @ 0.79 hrs HW=0.447 m (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.0096 m³/s @ 0.58 m/s)

Pond 25P: Infiltration System - Chamber Wizard Field A

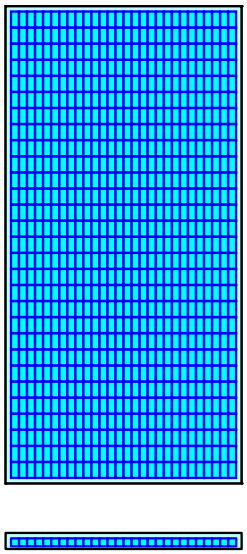
Chamber Model = Brentwood StormTank 18" (Brentwood Industries StormTank)
Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³
Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³

29 Chambers/Row x 0.91 m Long = 26.52 m Row Length +305 mm End Stone x 2 = 27.13 m Base Length
28 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 13.41 m Base Width
152 mm Base + 457 mm Chamber Height + 305 mm Cover = 0.91 m Field Height

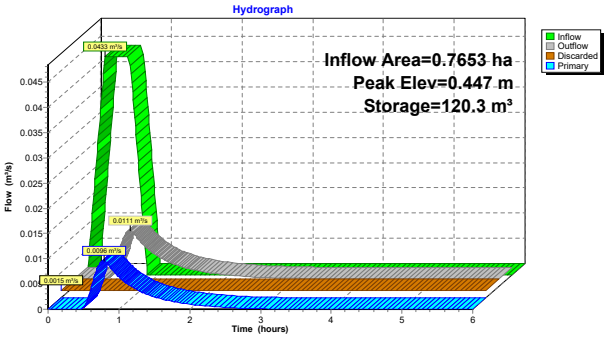
812 Chambers x 0.18 m³ = 147.99 m³ Chamber Storage
812 Chambers x 0.19 m³ = 155.20 m³ Displacement

332.61 m³ Field - 155.20 m³ Chambers = 177.40 m³ Stone x 40.0% Voids = 70.96 m³ Stone Storage

Chamber Storage + Stone Storage = 218.95 m³ = 0.219 Ml
Overall Storage Efficiency = 65.8%
Overall System Size = 27.13 m x 13.41 m x 0.91 m



Pond 25P: Infiltration System

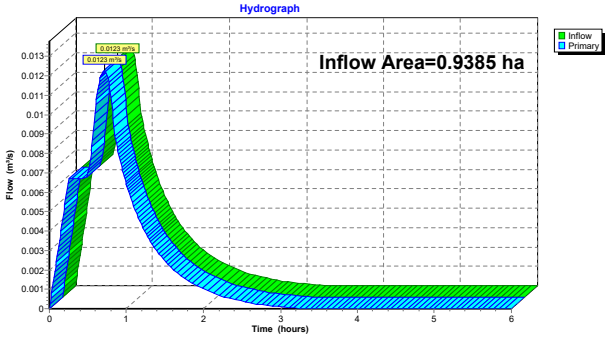


Summary for Link 23L: Site Total Outflow (93 L/s)

Inflow Area = 0.9385 ha, 0.00% Impervious, Inflow Depth = 4 mm for 2-Year event
Inflow = 0.0123 m³/s @ 0.71 hrs, Volume= 0.038 Ml
Primary = 0.0123 m³/s @ 0.71 hrs, Volume= 0.038 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 23L: Site Total Outflow (93 L/s)



Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Proposed Runoff Area=7,653.0 m² 0.00% Impervious Runoff Depth=16 mm
Tc=15.0 min C=0.60 Runoff=0.0582 m³/s 0.126 Ml

Subcatchment25S: Uncontrolled Runoff Area=1,732.0 m² 0.00% Impervious Runoff Depth=11 mm
Tc=15.0 min C=0.41 Runoff=0.0090 m³/s 0.019 Ml

Pond 25P: Infiltration System Peak Elev=0.505 m Storage=140.0 m³ Inflow=0.0582 m³/s 0.126 Ml
Discarded=0.0015 m³/s 0.033 Ml Primary=0.0225 m³/s 0.054 Ml Outflow=0.0240 m³/s 0.087 Ml

Link 23L: Site Total Outflow (93 L/s) Inflow=0.0272 m³/s 0.074 Ml
Primary=0.0272 m³/s 0.074 Ml

Total Runoff Area = 0.9385 ha Runoff Volume = 0.145 Ml Average Runoff Depth = 15 mm
100.00% Pervious = 0.9385 ha 0.00% Impervious = 0.0000 ha

Summary for Subcatchment 4S: Proposed Development - Controlled Area

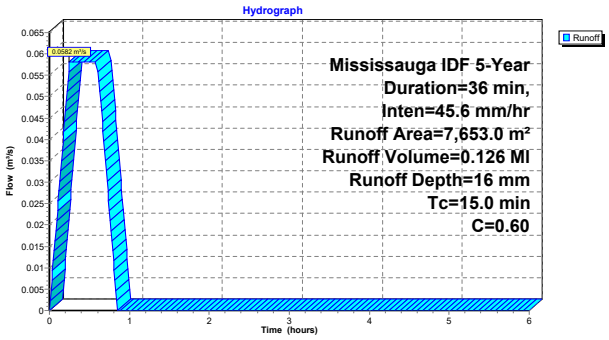
Runoff = 0.0582 m³/s @ 0.25 hrs, Volume= 0.126 Ml, Depth= 16 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 5-Year Duration=36 min, Inten=45.6 mm/hr

Area (m²)	C	Description
7,653.0	0.60	Total Controlled
7,653.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 4S: Proposed Development - Controlled Area



Summary for Subcatchment 25S: Uncontrolled Areas

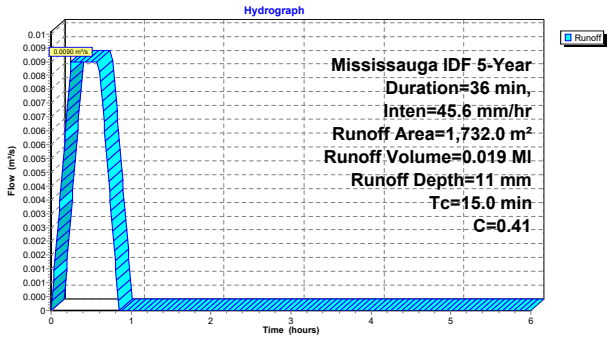
Runoff = 0.0090 m³/s @ 0.25 hrs, Volume= 0.019 Ml, Depth= 11 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 5-Year Duration=36 min, Inten=45.6 mm/hr

Area (m²)	C	Description
1,732.0	0.41	Total uncontrolled
1,732.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 25S: Uncontrolled Areas



Summary for Pond 25P: Infiltration System

Inflow Area = 0.7653 ha, 0.00% Impervious, Inflow Depth = 16 mm for 5-Year event
Inflow = 0.0582 m³/s @ 0.25 hrs, Volume= 0.126 Ml
Outflow = 0.0240 m³/s @ 0.75 hrs, Volume= 0.087 Ml, Atten= 59%, Lag= 29.8 min
Discarded = 0.0015 m³/s @ 0.00 hrs, Volume= 0.033 Ml
Primary = 0.0225 m³/s @ 0.75 hrs, Volume= 0.054 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.200 m Surf.Area= 363.8 m² Storage= 38.1 m³
Peak Elev= 0.505 m @ 0.75 hrs Surf.Area= 363.8 m² Storage= 140.0 m³ (101.8 m³ above start)

Plug-Flow detention time= 143.3 min calculated for 0.049 Ml (39% of inflow)
Center-of-Mass det. time= 81.8 min (107.3 - 25.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	71.0 m³	**13.41 mW x 27.13 mL x 0.91 mH Field A** 332.6 m³ Overall - 155.2 m³ Embedded = 177.4 m³ x 40.0% Voids
#2A	0.152 m	148.0 m³	**Brentwood StormTank 18"** x 812 Inside #1 Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³ Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³ 28 Rows of 29 Chambers
		218.9 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.000 m	**15.00 mm/hr Exfiltration over Surface area**
#2	Primary	0.352 m	**240 mm Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.0015 m³/s @ 0.00 hrs HW=0.200 m (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.0015 m³/s)

Primary OutFlow Max=0.0225 m³/s @ 0.75 hrs HW=0.505 m (Free Discharge)
└**2=Orifice/Grate** (Orifice Controls 0.0225 m³/s @ 0.74 m/s)

Pond 25P: Infiltration System - Chamber Wizard Field A

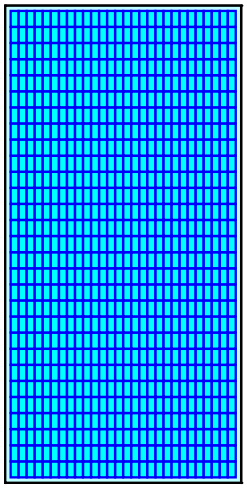
Chamber Model = Brentwood StormTank 18" (Brentwood Industries StormTank)
Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³
Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³

29 Chambers/Row x 0.91 m Long = 26.52 m Row Length +305 mm End Stone x 2 = 27.13 m Base Length
28 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 13.41 m Base Width
152 mm Base + 457 mm Chamber Height + 305 mm Cover = 0.91 m Field Height

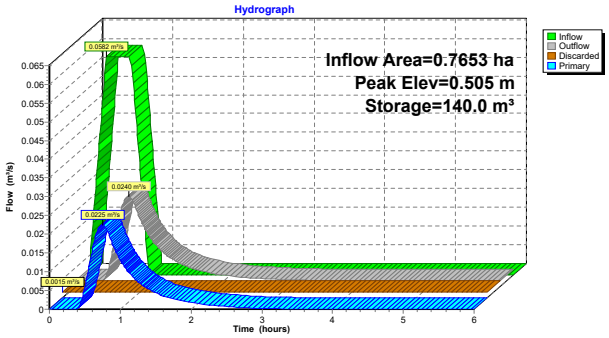
812 Chambers x 0.18 m³ = 147.99 m³ Chamber Storage
812 Chambers x 0.19 m³ = 155.20 m³ Displacement

332.61 m³ Field - 155.20 m³ Chambers = 177.40 m³ Stone x 40.0% Voids = 70.96 m³ Stone Storage

Chamber Storage + Stone Storage = 218.95 m³ = 0.219 Ml
Overall Storage Efficiency = 65.8%
Overall System Size = 27.13 m x 13.41 m x 0.91 m



Pond 25P: Infiltration System

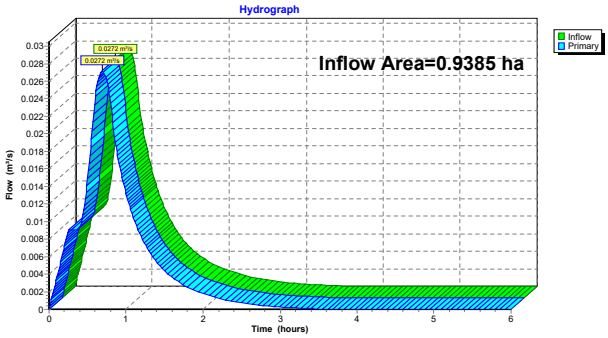


Summary for Link 23L: Site Total Outflow (93 L/s)

Inflow Area = 0.9385 ha, 0.00% Impervious, Inflow Depth = 8 mm for 5-Year event
Inflow = 0.0272 m³/s @ 0.69 hrs, Volume= 0.074 Ml
Primary = 0.0272 m³/s @ 0.69 hrs, Volume= 0.074 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 23L: Site Total Outflow (93 L/s)



Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Proposed Runoff Area=7,653.0 m² 0.00% Impervious Runoff Depth=20 mm
Tc=15.0 min C=0.60 Runoff=0.0717 m³/s 0.155 Ml

Subcatchment25S: Uncontrolled Runoff Area=1,732.0 m² 0.00% Impervious Runoff Depth=14 mm
Tc=15.0 min C=0.41 Runoff=0.0111 m³/s 0.024 Ml

Pond 25P: Infiltration System Peak Elev=0.552 m Storage=155.6 m³ Inflow=0.0717 m³/s 0.155 Ml
Discarded=0.0015 m³/s 0.033 Ml Primary=0.0339 m³/s 0.083 Ml Outflow=0.0355 m³/s 0.115 Ml

Link 23L: Site Total Outflow (93 L/s) Inflow=0.0407 m³/s 0.107 Ml
Primary=0.0407 m³/s 0.107 Ml

Total Runoff Area = 0.9385 ha Runoff Volume = 0.179 Ml Average Runoff Depth = 19 mm
100.00% Pervious = 0.9385 ha 0.00% Impervious = 0.0000 ha

Summary for Subcatchment 4S: Proposed Development - Controlled Area

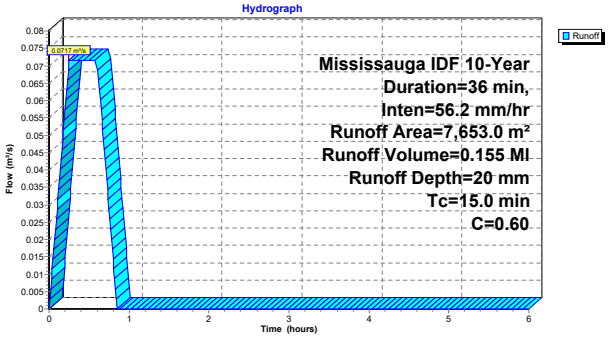
Runoff = 0.0717 m³/s @ 0.25 hrs, Volume= 0.155 Ml, Depth= 20 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 10-Year Duration=36 min, Inten=56.2 mm/hr

Area (m²)	C	Description
7,653.0	0.60	Total Controlled
7,653.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 4S: Proposed Development - Controlled Area



Summary for Subcatchment 25S: Uncontrolled Areas

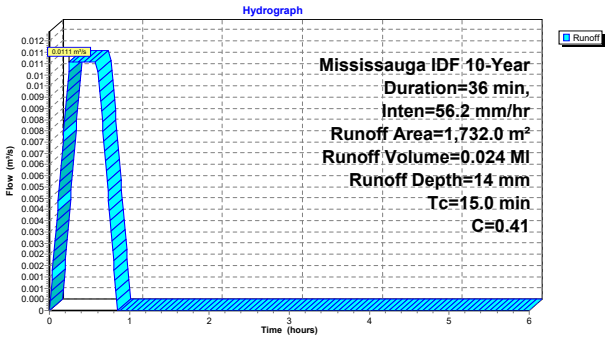
Runoff = 0.0111 m³/s @ 0.25 hrs, Volume= 0.024 Ml, Depth= 14 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 10-Year Duration=36 min, Inten=56.2 mm/hr

Area (m²)	C	Description
1,732.0	0.41	Total uncontrolled
1,732.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 25S: Uncontrolled Areas



Summary for Pond 25P: Infiltration System

Inflow Area = 0.7653 ha, 0.00% Impervious, Inflow Depth = 20 mm for 10-Year event
Inflow = 0.0717 m³/s @ 0.25 hrs, Volume= 0.155 Ml
Outflow = 0.0355 m³/s @ 0.73 hrs, Volume= 0.115 Ml, Atten= 51%, Lag= 28.6 min
Discarded = 0.0015 m³/s @ 0.00 hrs, Volume= 0.033 Ml
Primary = 0.0339 m³/s @ 0.73 hrs, Volume= 0.083 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.200 m Surf.Area= 363.8 m² Storage= 38.1 m³
Peak Elev= 0.552 m @ 0.73 hrs Surf.Area= 363.8 m² Storage= 155.6 m³ (117.5 m³ above start)

Plug-Flow detention time= 106.6 min calculated for 0.077 Ml (50% of inflow)
Center-of-Mass det. time= 68.8 min (94.3 - 25.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	71.0 m³	**13.41 mW x 27.13 mL x 0.91 mH Field A** 332.6 m³ Overall - 155.2 m³ Embedded = 177.4 m³ x 40.0% Voids
#2A	0.152 m	148.0 m³	**Brentwood StormTank 18"** x 812 Inside #1 Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³ Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³ 28 Rows of 29 Chambers
		218.9 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.000 m	**15.00 mm/hr Exfiltration over Surface area**
#2	Primary	0.352 m	**240 mm Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.0015 m³/s @ 0.00 hrs HW=0.200 m (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.0015 m³/s)

Primary OutFlow Max=0.0339 m³/s @ 0.73 hrs HW=0.552 m (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.0339 m³/s @ 0.84 m/s)

Pond 25P: Infiltration System - Chamber Wizard Field A

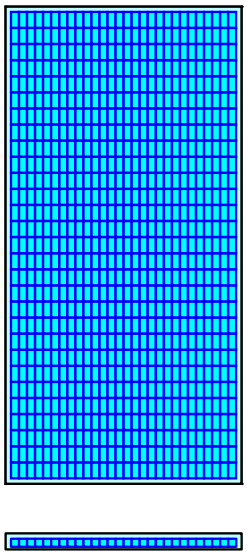
Chamber Model = Brentwood StormTank 18" (Brentwood Industries StormTank)
Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³
Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³

29 Chambers/Row x 0.91 m Long = 26.52 m Row Length +305 mm End Stone x 2 = 27.13 m Base Length
28 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 13.41 m Base Width
152 mm Base + 457 mm Chamber Height + 305 mm Cover = 0.91 m Field Height

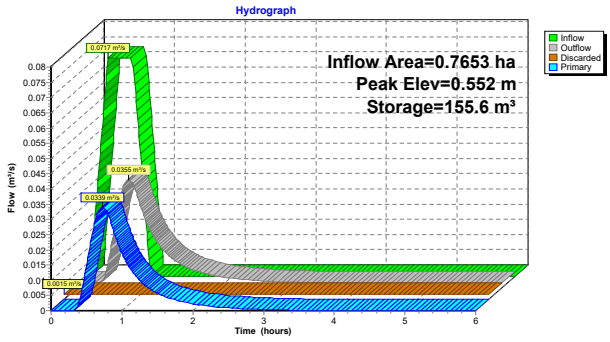
812 Chambers x 0.18 m³ = 147.99 m³ Chamber Storage
812 Chambers x 0.19 m³ = 155.20 m³ Displacement

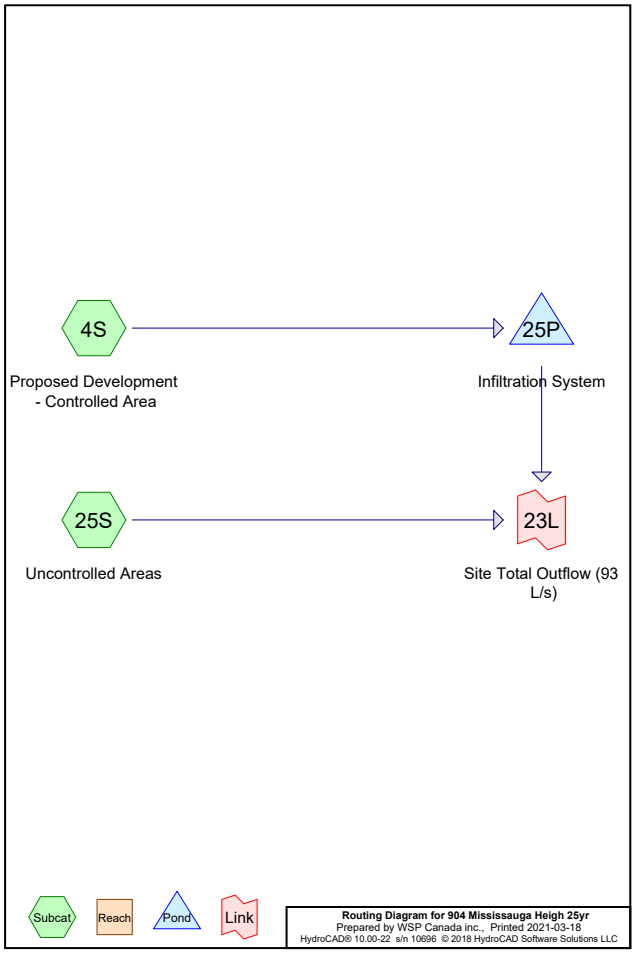
332.61 m³ Field - 155.20 m³ Chambers = 177.40 m³ Stone x 40.0% Voids = 70.96 m³ Stone Storage

Chamber Storage + Stone Storage = 218.95 m³ = 0.219 Ml
Overall Storage Efficiency = 65.8%
Overall System Size = 27.13 m x 13.41 m x 0.91 m



Pond 25P: Infiltration System





Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.7653	0.66	Total Controlled (4S)
0.1732	0.45	Total uncontrolled (25S)
0.9385	**0.62**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.9385	Other	4S, 25S
0.9385		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	0.7653	0.7653	Total Controlled	4S
0.0000	0.0000	0.0000	0.0000	0.1732	0.1732	Total uncontrolled	25S
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.9385**	**0.9385**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Proposed Runoff Area=7,653.0 m² 0.00% Impervious Runoff Depth=26 mm
Tc=15.0 min C=0.66 Runoff=0.0905 m³/s 0.196 Ml

Subcatchment25S: Uncontrolled Runoff Area=1,732.0 m² 0.00% Impervious Runoff Depth=17 mm
Tc=15.0 min C=0.45 Runoff=0.0140 m³/s 0.030 Ml

Pond 25P: Infiltration System Peak Elev=0.629 m Storage=177.4 m³ Inflow=0.0905 m³/s 0.196 Ml
Discarded=0.0015 m³/s 0.033 Ml Primary=0.0476 m³/s 0.123 Ml Outflow=0.0491 m³/s 0.156 Ml

Link 23L: Site Total Outflow (93 L/s) Inflow=0.0562 m³/s 0.153 Ml
Primary=0.0562 m³/s 0.153 Ml

Total Runoff Area = 0.9385 ha Runoff Volume = 0.226 Ml Average Runoff Depth = 24 mm
100.00% Pervious = 0.9385 ha 0.00% Impervious = 0.0000 ha

Summary for Subcatchment 4S: Proposed Development - Controlled Area

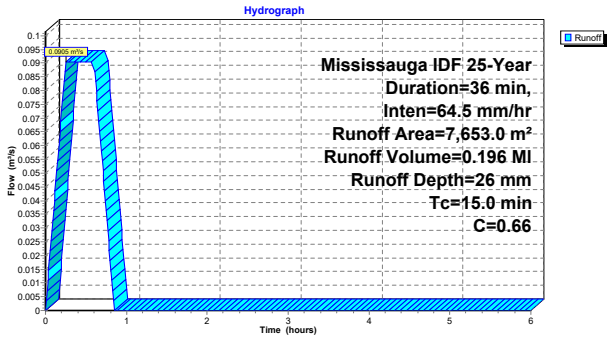
Runoff = 0.0905 m³/s @ 0.25 hrs, Volume= 0.196 Ml, Depth= 26 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 25-Year Duration=36 min, Inten=64.5 mm/hr

Area (m²)	C	Description
7,653.0	0.66	Total Controlled
7,653.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 4S: Proposed Development - Controlled Area



Summary for Subcatchment 25S: Uncontrolled Areas

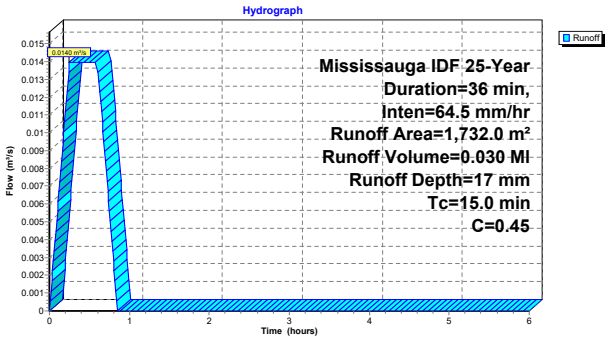
Runoff = 0.0140 m³/s @ 0.25 hrs, Volume= 0.030 Ml, Depth= 17 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 25-Year Duration=36 min, Inten=64.5 mm/hr

Area (m²)	C	Description
1,732.0	0.45	Total uncontrolled
1,732.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 25S: Uncontrolled Areas



Summary for Pond 25P: Infiltration System

Inflow Area = 0.7653 ha, 0.00% Impervious, Inflow Depth = 26 mm for 25-Year event
Inflow = 0.0905 m³/s @ 0.25 hrs, Volume= 0.196 Ml
Outflow = 0.0491 m³/s @ 0.71 hrs, Volume= 0.156 Ml, Atten= 46%, Lag= 27.9 min
Discarded = 0.0015 m³/s @ 0.00 hrs, Volume= 0.033 Ml
Primary = 0.0476 m³/s @ 0.71 hrs, Volume= 0.123 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.200 m Surf.Area= 363.8 m² Storage= 38.1 m³
Peak Elev= 0.629 m @ 0.71 hrs Surf.Area= 363.8 m² Storage= 177.4 m³ (139.3 m³ above start)

Plug-Flow detention time= 82.8 min calculated for 0.117 Ml (60% of inflow)
Center-of-Mass det. time= 58.3 min (83.8 - 25.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	71.0 m³	**13.41 mW x 27.13 mL x 0.91 mH Field A** 332.6 m³ Overall - 155.2 m³ Embedded = 177.4 m³ x 40.0% Voids
#2A	0.152 m	148.0 m³	**Brentwood StormTank 18"** x 812 Inside #1 Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³ Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³ 28 Rows of 29 Chambers
		218.9 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.000 m	**15.00 mm/hr Exfiltration over Surface area**
#2	Primary	0.352 m	**240 mm Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.0015 m³/s @ 0.00 hrs HW=0.200 m (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.0015 m³/s)

Primary OutFlow Max=0.0476 m³/s @ 0.71 hrs HW=0.628 m (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.0476 m³/s @ 1.05 m/s)

Pond 25P: Infiltration System - Chamber Wizard Field A

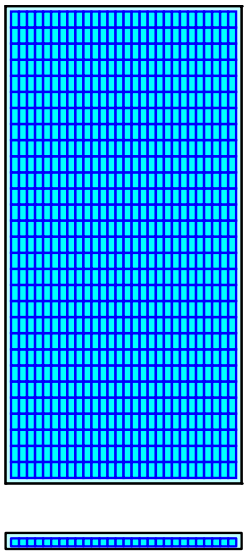
Chamber Model = Brentwood StormTank 18" (Brentwood Industries StormTank)
Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³
Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³

29 Chambers/Row x 0.91 m Long = 26.52 m Row Length +305 mm End Stone x 2 = 27.13 m Base Length
28 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 13.41 m Base Width
152 mm Base + 457 mm Chamber Height + 305 mm Cover = 0.91 m Field Height

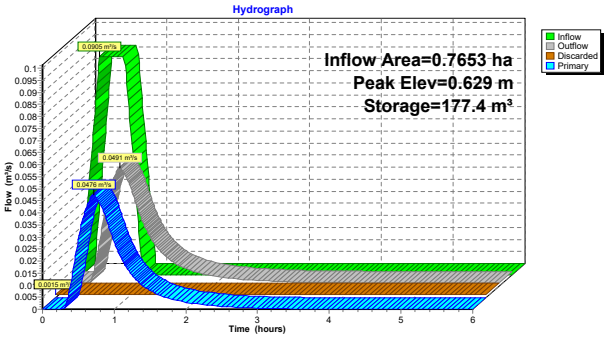
812 Chambers x 0.18 m³ = 147.99 m³ Chamber Storage
812 Chambers x 0.19 m³ = 155.20 m³ Displacement

332.61 m³ Field - 155.20 m³ Chambers = 177.40 m³ Stone x 40.0% Voids = 70.96 m³ Stone Storage

Chamber Storage + Stone Storage = 218.95 m³ = 0.219 MI
Overall Storage Efficiency = 65.8%
Overall System Size = 27.13 m x 13.41 m x 0.91 m



Pond 25P: Infiltration System

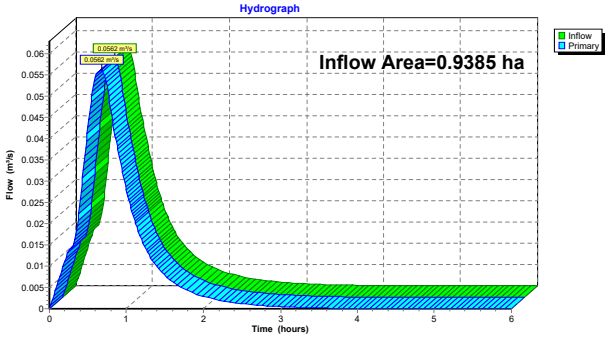


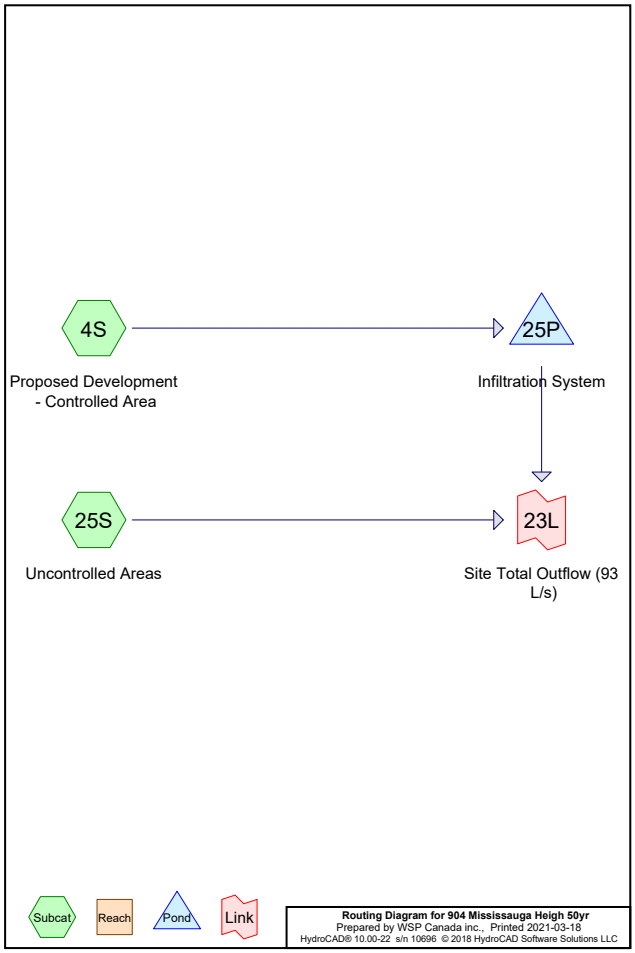
Summary for Link 23L: Site Total Outflow (93 L/s)

Inflow Area = 0.9385 ha, 0.00% Impervious, Inflow Depth = 16 mm for 25-Year event
Inflow = 0.0562 m³/s @ 0.68 hrs, Volume= 0.153 MI
Primary = 0.0562 m³/s @ 0.68 hrs, Volume= 0.153 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 23L: Site Total Outflow (93 L/s)





Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.7653	0.72	Total Controlled (4S)
0.1732	0.49	Total uncontrolled (25S)
0.9385	**0.68**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.9385	Other	4S, 25S
0.9385		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	0.7653	0.7653	Total Controlled	4S
0.0000	0.0000	0.0000	0.0000	0.1732	0.1732	Total uncontrolled	25S
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.9385**	**0.9385**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Proposed Runoff Area=7,653.0 m² 0.00% Impervious Runoff Depth=31 mm
Tc=15.0 min C=0.72 Runoff=0.1105 m³/s 0.239 Ml

Subcatchment25S: Uncontrolled Runoff Area=1,732.0 m² 0.00% Impervious Runoff Depth=21 mm
Tc=15.0 min C=0.49 Runoff=0.0170 m³/s 0.037 Ml

Pond 25P: Infiltration System Peak Elev=0.769 m Storage=197.8 m³ Inflow=0.1105 m³/s 0.239 Ml
Discarded=0.0015 m³/s 0.033 Ml Primary=0.0655 m³/s 0.165 Ml Outflow=0.0670 m³/s 0.198 Ml

Link 23L: Site Total Outflow (93 L/s) Inflow=0.0777 m³/s 0.202 Ml
Primary=0.0777 m³/s 0.202 Ml

Total Runoff Area = 0.9385 ha Runoff Volume = 0.275 Ml Average Runoff Depth = 29 mm
100.00% Pervious = 0.9385 ha 0.00% Impervious = 0.0000 ha

Summary for Subcatchment 4S: Proposed Development - Controlled Area

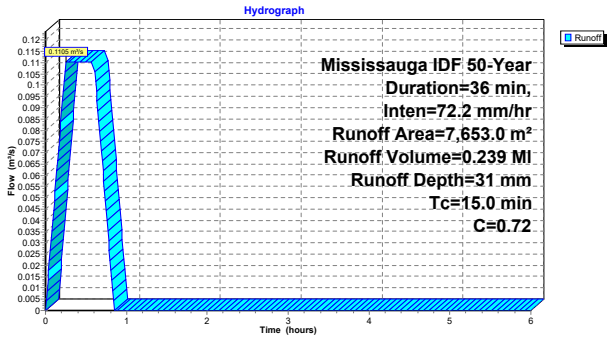
Runoff = 0.1105 m³/s @ 0.25 hrs, Volume= 0.239 Ml, Depth= 31 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 50-Year Duration=36 min, Inten=72.2 mm/hr

Area (m²)	C	Description
7,653.0	0.72	Total Controlled
7,653.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 4S: Proposed Development - Controlled Area



Summary for Subcatchment 25S: Uncontrolled Areas

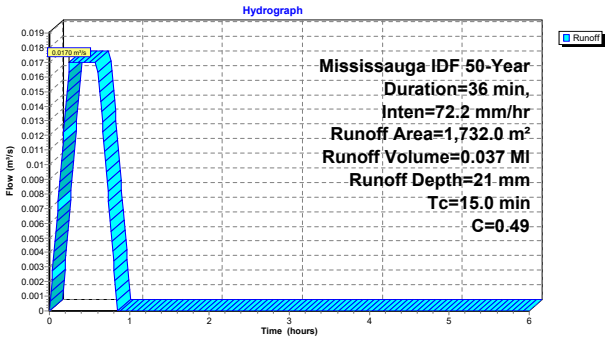
Runoff = 0.0170 m³/s @ 0.25 hrs, Volume= 0.037 Ml, Depth= 21 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 50-Year Duration=36 min, Inten=72.2 mm/hr

Area (m²)	C	Description
1,732.0	0.49	Total uncontrolled
1,732.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 25S: Uncontrolled Areas



Summary for Pond 25P: Infiltration System

Inflow Area = 0.7653 ha, 0.00% Impervious, Inflow Depth = 31 mm for 50-Year event
Inflow = 0.1105 m³/s @ 0.25 hrs, Volume= 0.239 Ml
Outflow = 0.0670 m³/s @ 0.70 hrs, Volume= 0.198 Ml, Atten= 39%, Lag= 26.9 min
Discarded = 0.0015 m³/s @ 0.00 hrs, Volume= 0.033 Ml
Primary = 0.0655 m³/s @ 0.70 hrs, Volume= 0.165 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.200 m Surf.Area= 363.8 m² Storage= 38.1 m³
Peak Elev= 0.769 m @ 0.70 hrs Surf.Area= 363.8 m² Storage= 197.8 m³ (159.7 m³ above start)

Plug-Flow detention time= 68.8 min calculated for 0.160 Ml (67% of inflow)
Center-of-Mass det. time= 51.1 min (76.6 - 25.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	71.0 m³	**13.41 mW x 27.13 mL x 0.91 mH Field A** 332.6 m³ Overall - 155.2 m³ Embedded = 177.4 m³ x 40.0% Voids
#2A	0.152 m	148.0 m³	**Brentwood StormTank 18"** x 812 Inside #1 Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³ Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³ 28 Rows of 29 Chambers
		218.9 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.000 m	**15.00 mm/hr Exfiltration over Surface area**
#2	Primary	0.352 m	**240 mm Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.0015 m³/s @ 0.00 hrs HW=0.200 m (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.0015 m³/s)

Primary OutFlow Max=0.0655 m³/s @ 0.70 hrs HW=0.769 m (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.0655 m³/s @ 1.45 m/s)

Pond 25P: Infiltration System - Chamber Wizard Field A

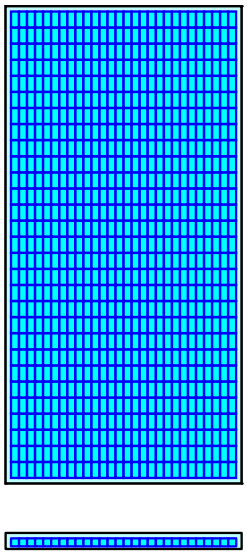
Chamber Model = Brentwood StormTank 18" (Brentwood Industries StormTank)
Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³
Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³

29 Chambers/Row x 0.91 m Long = 26.52 m Row Length +305 mm End Stone x 2 = 27.13 m Base Length
28 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 13.41 m Base Width
152 mm Base + 457 mm Chamber Height + 305 mm Cover = 0.91 m Field Height

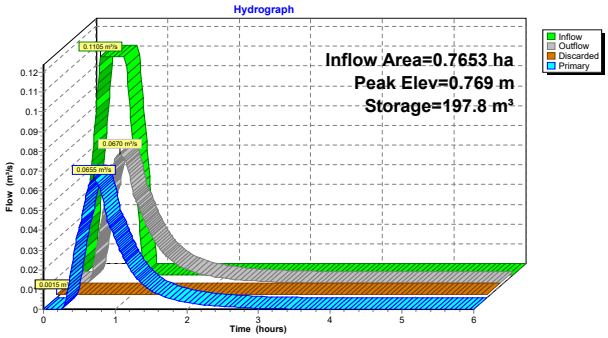
812 Chambers x 0.18 m³ = 147.99 m³ Chamber Storage
812 Chambers x 0.19 m³ = 155.20 m³ Displacement

332.61 m³ Field - 155.20 m³ Chambers = 177.40 m³ Stone x 40.0% Voids = 70.96 m³ Stone Storage

Chamber Storage + Stone Storage = 218.95 m³ = 0.219 MI
Overall Storage Efficiency = 65.8%
Overall System Size = 27.13 m x 13.41 m x 0.91 m



Pond 25P: Infiltration System

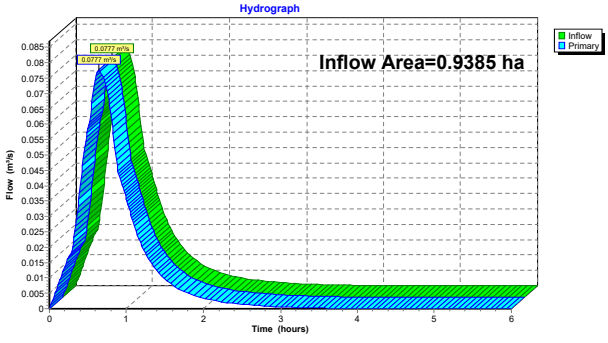


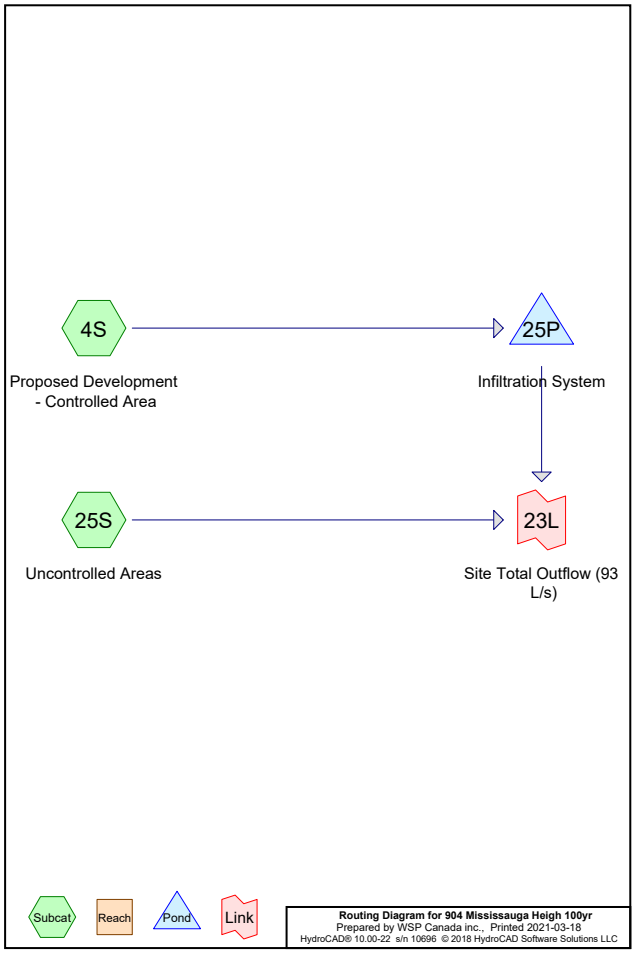
Summary for Link 23L: Site Total Outflow (93 L/s)

Inflow Area = 0.9385 ha, 0.00% Impervious, Inflow Depth = 22 mm for 50-Year event
Inflow = 0.0777 m³/s @ 0.65 hrs, Volume= 0.202 MI
Primary = 0.0777 m³/s @ 0.65 hrs, Volume= 0.202 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 23L: Site Total Outflow (93 L/s)





Area Listing (all nodes)

Area (hectares)	C	Description (subcatchment-numbers)
0.7653	0.75	Total Controlled (4S)
0.1732	0.52	Total uncontrolled (25S)
0.9385	**0.71**	**TOTAL AREA**

Soil Listing (all nodes)

Area (hectares)	Soil Group	Subcatchment Numbers
0.0000	HSG A	
0.0000	HSG B	
0.0000	HSG C	
0.0000	HSG D	
0.9385	Other	4S, 25S
0.9385		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (hectares)	HSG-B (hectares)	HSG-C (hectares)	HSG-D (hectares)	Other (hectares)	Total (hectares)	Ground Cover	Subcatchment Numbers
0.0000	0.0000	0.0000	0.0000	0.7653	0.7653	Total Controlled	4S
0.0000	0.0000	0.0000	0.0000	0.1732	0.1732	Total uncontrolled	25S
0.0000	**0.0000**	**0.0000**	**0.0000**	**0.9385**	**0.9385**	**TOTAL AREA**	

Time span=0.00-6.00 hrs, dt=0.01 hrs, 601 points
Runoff by Rational method, Rise/Fall=1.0/1.0 xTc
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment4S: Proposed Runoff Area=7,653.0 m² 0.00% Impervious Runoff Depth=36 mm
Tc=15.0 min C=0.75 Runoff=0.1279 m³/s 0.276 Ml

Subcatchment25S: Uncontrolled Runoff Area=1,732.0 m² 0.00% Impervious Runoff Depth=25 mm
Tc=15.0 min C=0.52 Runoff=0.0201 m³/s 0.043 Ml

Pond 25P: Infiltration System Peak Elev=0.893 m Storage=215.9 m³ Inflow=0.1279 m³/s 0.276 Ml
Discarded=0.0015 m³/s 0.033 Ml Primary=0.0780 m³/s 0.203 Ml Outflow=0.0795 m³/s 0.235 Ml

Link 23L: Site Total Outflow (93 L/s) Inflow=0.0931 m³/s 0.246 Ml
Primary=0.0931 m³/s 0.246 Ml

Total Runoff Area = 0.9385 ha Runoff Volume = 0.320 Ml Average Runoff Depth = 34 mm
100.00% Pervious = 0.9385 ha 0.00% Impervious = 0.0000 ha

Summary for Subcatchment 4S: Proposed Development - Controlled Area

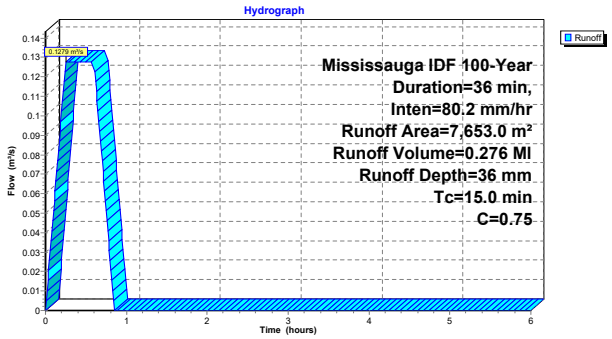
Runoff = 0.1279 m³/s @ 0.25 hrs, Volume= 0.276 Ml, Depth= 36 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 100-Year Duration=36 min, Inten=80.2 mm/hr

Area (m²)	C	Description
7,653.0	0.75	Total Controlled
7,653.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 4S: Proposed Development - Controlled Area



Summary for Subcatchment 25S: Uncontrolled Areas

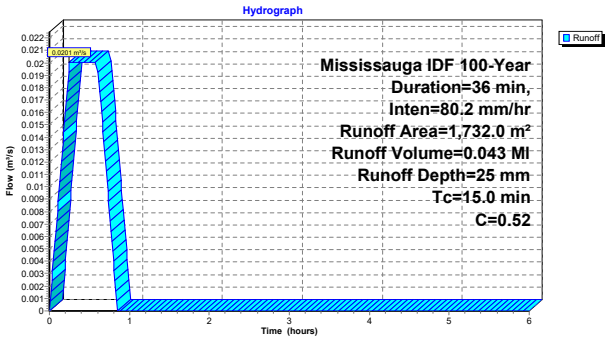
Runoff = 0.0201 m³/s @ 0.25 hrs, Volume= 0.043 Ml, Depth= 25 mm

Runoff by Rational method, Rise/Fall=1.0/1.0 xTc, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs
Mississauga IDF 100-Year Duration=36 min, Inten=80.2 mm/hr

Area (m²)	C	Description
1,732.0	0.52	Total uncontrolled
1,732.0		100.00% Pervious Area

Tc (min)	Length (meters)	Slope (m/m)	Velocity (m/sec)	Capacity (m³/s)	Description
15.0					**Direct Entry,**

Subcatchment 25S: Uncontrolled Areas



Summary for Pond 25P: Infiltration System

Inflow Area = 0.7653 ha, 0.00% Impervious, Inflow Depth = 36 mm for 100-Year event
Inflow = 0.1279 m³/s @ 0.25 hrs, Volume= 0.276 Ml
Outflow = 0.0795 m³/s @ 0.69 hrs, Volume= 0.235 Ml, Atten= 38%, Lag= 26.7 min
Discarded = 0.0015 m³/s @ 0.00 hrs, Volume= 0.033 Ml
Primary = 0.0780 m³/s @ 0.69 hrs, Volume= 0.203 Ml

Routing by Stor-Ind method, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs / 3
Starting Elev= 0.200 m Surf.Area= 363.8 m² Storage= 38.1 m³
Peak Elev= 0.893 m @ 0.69 hrs Surf.Area= 363.8 m² Storage= 215.9 m³ (177.7 m³ above start)

Plug-Flow detention time= 60.8 min calculated for 0.197 Ml (71% of inflow)
Center-of-Mass det. time= 46.8 min (72.3 - 25.5)

Volume	Invert	Avail.Storage	Storage Description
#1A	0.000 m	71.0 m³	**13.41 mW x 27.13 mL x 0.91 mH Field A** 332.6 m³ Overall - 155.2 m³ Embedded = 177.4 m³ x 40.0% Voids
#2A	0.152 m	148.0 m³	**Brentwood StormTank 18"** x 812 Inside #1 Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³ Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³ 28 Rows of 29 Chambers
		218.9 m³	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	0.000 m	**15.00 mm/hr Exfiltration over Surface area**
#2	Primary	0.352 m	**240 mm Vert. Orifice/Grate** C= 0.600

Discarded OutFlow Max=0.0015 m³/s @ 0.00 hrs HW=0.200 m (Free Discharge)
↑**1=Exfiltration** (Exfiltration Controls 0.0015 m³/s)

Primary OutFlow Max=0.0780 m³/s @ 0.69 hrs HW=0.893 m (Free Discharge)
↑**2=Orifice/Grate** (Orifice Controls 0.0780 m³/s @ 1.72 m/s)

Pond 25P: Infiltration System - Chamber Wizard Field A

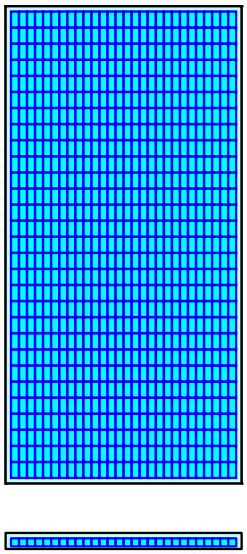
Chamber Model = Brentwood StormTank 18" (Brentwood Industries StormTank)
Inside= 457 mmW x 457 mmH => 0.199 m² x 0.91 mL = 0.18 m³
Outside= 457 mmW x 457 mmH => 0.209 m² x 0.91 mL = 0.19 m³

29 Chambers/Row x 0.91 m Long = 26.52 m Row Length +305 mm End Stone x 2 = 27.13 m Base Length
28 Rows x 457 mm Wide + 305 mm Side Stone x 2 = 13.41 m Base Width
152 mm Base + 457 mm Chamber Height + 305 mm Cover = 0.91 m Field Height

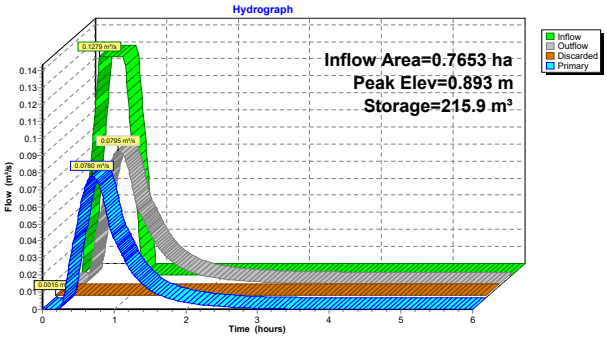
812 Chambers x 0.18 m³ = 147.99 m³ Chamber Storage
812 Chambers x 0.19 m³ = 155.20 m³ Displacement

332.61 m³ Field - 155.20 m³ Chambers = 177.40 m³ Stone x 40.0% Voids = 70.96 m³ Stone Storage

Chamber Storage + Stone Storage = 218.95 m³ = 0.219 MI
Overall Storage Efficiency = 65.8%
Overall System Size = 27.13 m x 13.41 m x 0.91 m



Pond 25P: Infiltration System

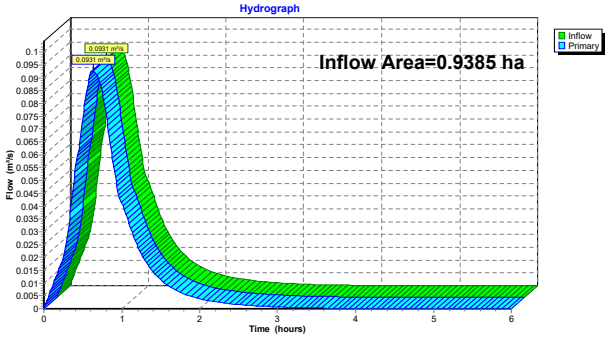


Summary for Link 23L: Site Total Outflow (93 L/s)

Inflow Area = 0.9385 ha, 0.00% Impervious, Inflow Depth = 26 mm for 100-Year event
Inflow = 0.0931 m³/s @ 0.63 hrs, Volume= 0.246 MI
Primary = 0.0931 m³/s @ 0.63 hrs, Volume= 0.246 MI, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 23L: Site Total Outflow (93 L/s)



Summary for Link 23L: Site Total Outflow (93 L/s)

Inflow Area = 0.9385 ha, 0.00% Impervious, Inflow Depth = 11 mm for 10-Year event
Inflow = 0.0407 m³/s @ 0.67 hrs, Volume= 0.107 Ml
Primary = 0.0407 m³/s @ 0.67 hrs, Volume= 0.107 Ml, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-6.00 hrs, dt= 0.01 hrs

Link 23L: Site Total Outflow (93 L/s)