Stormwater Management & Servicing Report

Simcoe County Housing Corporation

125 Simcoe Road
Town of Bradford
County of Simcoe

PEARSON ENGINEERING

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(Revised April 2022)

December 2021

20055

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Stormwater Management & Servicing Report
125 Simcoe Road, Bradford

1. Introduction

PEARSON Engineering Ltd. has been retained by MCL Architects on behalf of Simcoe County Housing Corporation (Client) to prepare a Stormwater Management and Servicing (SWM) Report in support of the proposed 4-storey residential building with ground floor commercial space with associated parking located at 125 Simcoe Road in the Town of Bradford (Town), County of Simcoe (County).

The subject property is approximately 0.99 ha in size and currently consists of vacant land and is bound by Marshview Boulevard to the south, Simcoe Road to the west and existing recreational lands to the north and east. The existing Simcoe Street storm sewer outlets through the property while the existing site drains overland to the southeast sloping towards the existing storm sewer outlet channel. The location of the site can be seen on Figure 1.

1.1. Terms of Reference

The intent of this SWM Report is to:

- Identify the existing site characteristics including any external drainage conditions;
- Illustrate the design of the stormwater conveyance and detention system, capable of accommodating both minor and major storm flows from the site;
- Incorporate the appropriate Best Management Practices for controlling on-site erosion and sedimentation during construction while ultimately ensuring that the post-development release of stormwater is of adequate quality; and
- Summarize this design in a technically comprehensive and concise manner.

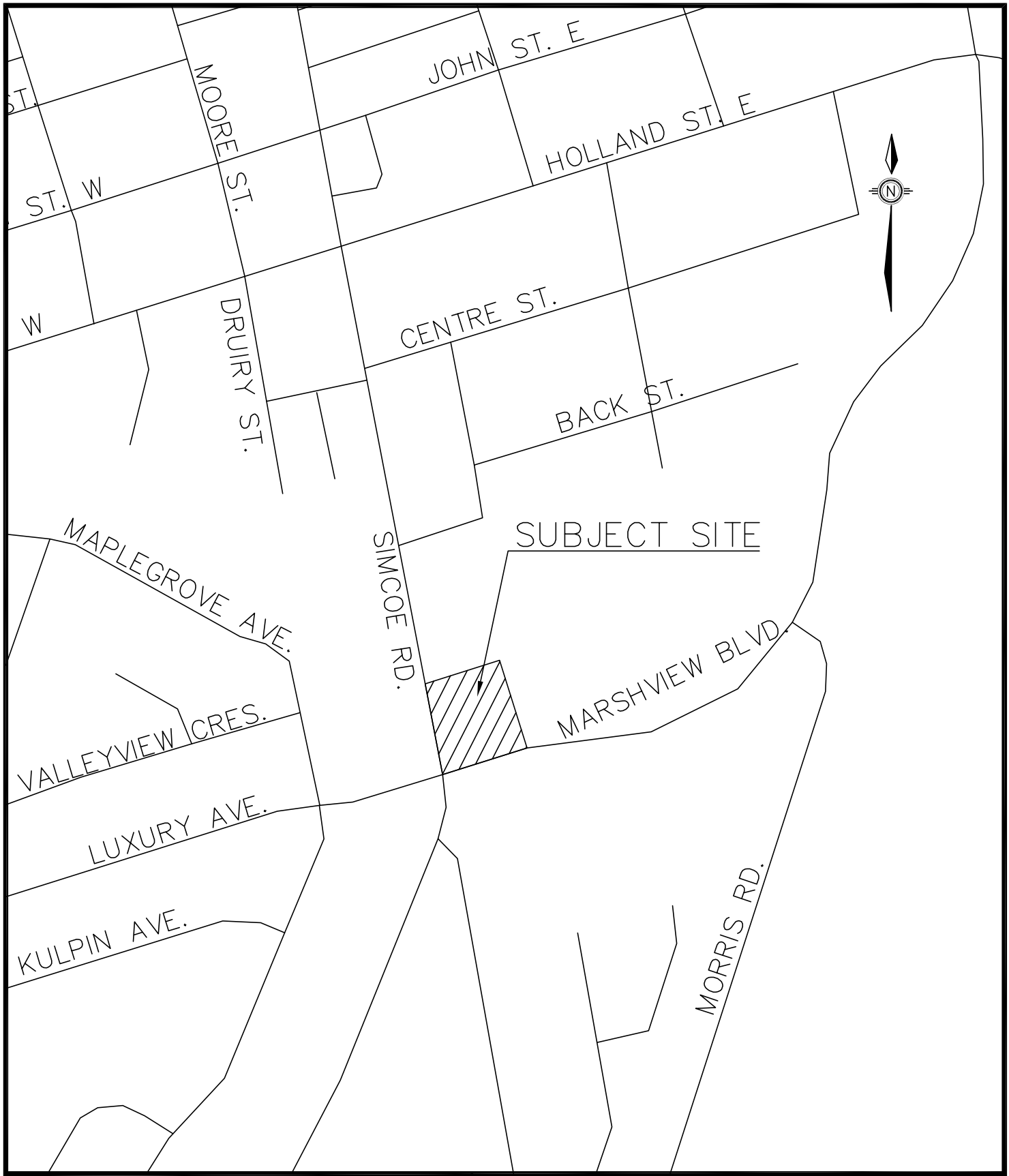
2. Design Population

The proposed building is to have 50 apartment units with approximately 1,686 m^2 of commercial retail space. Based on the Town of Bradford Standards and population density of the buildings, a design population of 3.36 persons per unit was selected. This results in a maximum projected design population of 168 persons for the residential units.

3. Water Supply and Distribution

3.1. Water Servicing Design Criteria

The site is to have a projected total population of 168 persons and approximately 1,686 m^2 of commercial space. Utilizing the Ministry of the Environment, Conservation, and Parks (MECP) and Town of Bradford Guidelines for domestic water use of 300 L/capita/day, an Average Day Demand (ADD) of 0.58 L/s was calculated. A Peak Rate factor of 4.50 was used in calculating the Peak Hour Demand (PHD) of 2.63 L/s for the development. Calculations for the domestic water requirements for the site can be found in Appendix A.



COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

SITE LOCATION PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE	NTS	PROJECT #	20055
DRAWN BY	AA	VERT SCALE		DRAWING #	FIG 1
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	2

A flow test was completed on the municipal water system fronting the site by Vipond which produced a discharge of 1,066 gallons per minute (GPM) with a residual pressure of 98 psi. Fire flow calculations have been completed as per the Fire Underwriters Survey (FUS) which resulted in a required flow of 2,376 GPM. By extrapolating the fire flow results, the existing water distribution system can supply the required fire flow at a residual pressure of approximately 84 psi. Therefore, the existing watermain's flow availability and residual pressures are expected to be sufficient to service the proposed development. Detailed calculations and flow test results can be seen in Appendix A.

3.2. Internal Water Distribution System

The water system for this Project is intended for domestic and firefighting use. There is an existing municipal 300 mm diameter watermain on the west side of Simcoe Road. The site will be serviced by connecting into the 300 mm watermain with a proposed 150 mm diameter water service. The 150 mm water service will split at the property line into a 150 mm diameter fire service and a 100 mm diameter domestic service and connect to the proposed building at the mechanical room location, to meet both domestic and fire flow requirements.

The site is further than 45 m minimum setback to existing fire hydrants. Therefore, a fire hydrant is proposed for the site to provide adequate firefighting coverage. Refer to the Site Servicing Plans for the proposed fire hydrant locations for the project.

4. Sanitary Servicing

4.1. Sanitary Design Criteria

The site is to have a potential total population of 168 persons and approximately 1,686 m^2 of commercial space. Utilizing the MECP and Town of Bradford Guidelines for domestic sewer use of 300 L/cap/d, an Average Daily Flow (ADF) of 0.58 L/s. was calculated. Using a Peaking Factor of 4.00 for this project and an infiltration allowance of 0.38 L/s/ha, a Peak Flow of 2.71 L/s is calculated for the entire development. The proposed sanitary system will drain to the existing 450 mm diameter sanitary sewer on Simcoe Road which runs south to north in front of the site and has a capacity of 230 L/s at 0.65%. The proposed peak flow is 1.1% of the existing capacity and therefore the existing 450 mm diameter sanitary sewer is sufficient to convey the sanitary design flows. Sanitary design flow calculations can be found in Appendix B.

4.2. Internal Sanitary Sewer System

The Project's sanitary sewer system will convey flow via a 200 mm gravity sanitary sewer from the site and connect to an existing maintenance hole on Simcoe Road. The proposed sanitary sewer system for the site can be seen on the Site Servicing Plan in Appendix I.

It is proposed that the sanitary sewers be constructed in accordance with the Town of Bradford and the MECP guidelines to service the Project and will be designed to meet minimum design grades and the required minimum and maximum velocities under flow conditions.

5. Stormwater Management

A key component of the development is the need to address environmental and related SWM issues. These are examined in a framework aimed at meeting the Town, Lake Simcoe Region Conservation Authority (LSRCA) and the Ministry of the Environment, Conservation, and Parks (MECP) requirements. This report focuses on the necessary measures to satisfy the MECP's SWM requirements.

It is understood the objectives of the SWM plan are to:

- Protect life and property from flooding and erosion.
- Maintain water quality for ecological integrity, recreational opportunities etc.
- Protect and maintain groundwater flow regime(s).
- Protect aquatic and fishery communities and habitats.
- Maintain and protect significant natural features.
- Incorporate Low Impact Development (LID) practices to promote infiltration and reduce phosphorus levels to downstream watercourses.

5.1. Analysis Methodology

The design of the SWM Facilities for this site has been conducted in accordance with:

- The Ministry of the Environment Stormwater Management Planning and Design Manual, March 2003
- Bradford West Gwillimbury, Engineering Design Criteria Manual, September 2015
- Lake Simcoe Region Conversation Authority Technical Guidelines for Stormwater Management Submissions, September 2016

In order to design the facilities to meet these requirements, it is essential to select the appropriate modeling methodology for the storm system design. Given the size of the site, the Modified Rational Method is appropriate for the design for the SWM system.

5.2. Existing Drainage Conditions

The existing Project site currently consists of a vacant lot. The majority of the site's stormwater flows from west to east overland at approximately 1% to 2%. An existing 1050 mm diameter storm sewer that conveys flows from the Simcoe Road Branch catchment area runs underneath the site and outlets to a headwall in the middle of the site. The outlet follows a ditch that drains to the east to the channel beside Marshview Boulevard. The flows will ultimately outlet to a Stormwater Management Pond southeast of Marshview Drive approximately 150 m east of the site.

Any flows in excess of the 1050 mm storm sewer will travel as overland to the low spot on Simcoe Road just north of Marshview Boulevard in front of the site. From this location, existing overland flows would top the sidewalk and high point at Marshview Boulevard and be conveyed through the site easterly as well as easterly on Marshview Boulevard. Details of existing storm drainage conditions are shown on Drawing STM-1 in Appendix I.

Given the size of the site, the Modified Rational Method will be used to determine the pre-development peak flows. IDF curve parameters were taken from the Town of Bradford Design Criteria Manual to determine the storm intensity values. The pre-development peak flows for the site can be seen in Table 1 below. Detailed calculations can be found in Appendix C.

Table 1: Pre-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Total Flow (m^3/s)	0.08	0.10	0.11	0.13	0.15	0.16

5.3. Proposed Drainage Conditions

The post-development storm drainage for the project will generally follow pre-development conditions, ultimately outletting to the channel adjacent to Marshview Boulevard. The proposed drainage from the rooftop area will be conveyed to Stormtech SC-740 underground storage chambers in the parking lot area east of the proposed building designed to infiltrate the roof runoff. The majority of the parking lot has been graded to direct stormwater towards the proposed permeable paver areas complete with perforated subdrain connecting to the storm sewer. A 100 mm diameter orifice tube and Stormtech SC-740 underground storage chambers are provided for quantity control and are designed as an off-line system. Stormwater will flow through an OGS treatment unit before outletting to the drainage channel to the south. A small portion east of the proposed parking lot will drain uncontrolled to Marshview SWM pond.

The site's storm sewer was sized for the 5-year storm event using the rational method. In the event of a storm greater than the 5-year event, the storm sewer will surcharge, forcing stormwater towards the surface. The orifice tube was sized to store the 2 and 5 year storm events underground. A 6.0 m wide major storm control weir is located in the southeast corner of the parking lot which will convey storm runoff greater than the 10-year storm southerly to the adjacent channel. In the event of a storm greater than the 100-year storm or if the orifice tube becomes blocked, the site has been graded to allow stormwater to be conveyed southerly towards the existing drainage channel without negatively impacting the proposed building. The proposed post-development storm drainage patterns can be found on Drawing STM-2 in Appendix I.

5.4. Existing Drainage Channel

An existing 1050mm diameter storm sewer currently conveys flows from the Simcoe Road Branch catchment area and runs through the project site, outletting to a headwall in the middle of the site. Stormwater is then conveyed through a channel that drains to the east to the existing channel adjacent to Marshview Boulevard. The LSRCA has provided an existing floodline elevation 220.58 for the outlet channel. The existing floodline provides an approximate top area of 700 m^2, and bottom area of 35 m^2, the limits of which can be seen on drawing SK-3 in Appendix C.

It is proposed to relocate the 1050 mm storm sewer southerly and construct a new outlet channel in order to accommodate the proposed development. The following design parameters for the proposed channel were discussed with LSRCA in 2021:

- The proposed channel length is equal to the existing channel length.
- The proposed flood area will be greater than the existing area.

An incremental cut-fill volume was not calculated as the proposed channel area is almost double the existing area and therefore will provide significantly more flood storage volume. The proposed floodline area can be seen on drawing SK-1 in Appendix C which demonstrates that the proposed channel conforms with the design originally discussed with LSRCA.

5.5. External Storm Drainage

The Simcoe Road Branch catchment area drains through a 1050 mm diameter pipe which crosses the project site and outlets to a channel, ultimately draining to the downstream Marshview SWM Pond. In order to accommodate the proposed development its proposed to relocate the 1050 mm storm sewer southerly and construct a new outlet channel. The proposed storm sewer relocation will not affect drainage from Simcoe Road.

The catchment area draining to the 1050 mm was determined using the drawing Watershed Plan and Significant Features from the Morris Road Drain SWM Report completed by K. Smart Associates in July 2015 which resulted in an area of 23.3 hectares. An imperviousness of 45% was calculated using aerial imagery for the area. A Visual OTTHYMO model was created to calculate the peak flow which resulted in a 100-year flow of 3.99 m^3/s and a Regional Flow of 2.98 m^3/s.

Currently, any flows in excess of the 1050 mm storm sewer will travel as overland to the low spot on Simcoe Road just north of Marshview Boulevard in front of the site. From this location, existing overland flows would top the sidewalk and high point at Marshview Boulevard and be conveyed through the site easterly as well as easterly on Marshview Boulevard. An overtopping calculation was completed at this low point adjacent to the project site to determine the depth of flow required for any overland flows to be conveyed around the proposed building. Peak flows will overtop the sidewalk at elevation 224.30, and the highpoint at the intersection of Simcoe Road and Marshview Boulevard at an elevation of 224.42. Based on calculations in Appendix C, the overtopping elevation to convey the full 100 year flow is 224.54 which assumes the 1050 mm storm sewer is completely blocked.

5.6. Stormwater Quantity Control

The proposed development will increase the imperviousness of the site and as such the post-development peak flows will increase. It is important to quantify the increase in stormwater runoff rates and attenuate these increases. The calculated post-development runoff coefficient of 0.72 is greater than the pre-development runoff coefficient of 0.33.

Considerations were taken to reduce post-development peak flows to pre-development values. A 100 mm diameter orifice tube is proposed downstream of MH2, causing stormwater to back up into the stormwater underground storage chambers. Calculations in Appendix C demonstrate that 186 m^3 is required to control the 100-year storm event to pre-development values. Underground storage chambers containing a total of 177 m^3 are proposed, with the remaining 9 m^3 through above grade parking lot storage for a total quantity storage of 186 m^3.

Table 2 below summarizes post-development peak flows, and by comparing with Table 1 it can be seen that the post-development flows for all storm events are smaller than or equal to the pre-development peak flows.

Table 2: Post-Development Peak Flows

	2 Year Storm	5 Year Storm	10 Year Storm	25 Year Storm	50 Year Storm	100 Year Storm
Area Draining to Storm Controls (m^3/s)	0.16	0.22	0.25	0.29	0.32	0.36
Controlled Flow (m^3/s)	0.02	0.03	0.04	0.08	0.11	0.13
Uncontrolled Area (m^3/s)	0.02	0.02	0.02	0.03	0.03	0.03
Total Flow (m^3/s)	**0.04**	**0.05**	**0.06**	**0.11**	**0.14**	**0.16**

5.7. Volume Control

Since the project site meets the definition of Major Development as per LSRCA Guidelines, considerations were taken to meet the volume control criteria detailed in section 2.2.2. The LSRCA guidelines state that for a new development that creates 0.50 ha or more of impervious surfaces, 25 mm of runoff over the total impervious area of the site is to be retained and treated on site, with flexible alternatives if this criterion cannot be met. As the site's impervious area is 7,116 m^2, the 25 mm storm event over the site's impervious area results in a total volume of 178 m^3.

The storage is to be provided within 42 m^3 of StormTech SC-740 underground infiltration tanks controlling runoff from the rooftop and 139 m^3 of filtration storage located within the proposed permeable pavers to control runoff from the concrete and asphalt surfaces, resulting in a total of 181 m^3 of storage. Therefore, the proposed design meets the LSRCA guidelines. Refer to Appendix C for quantity control and volume control calculations. The StormTech system information can be found in Appendix F.

5.8. Stream Erosion Control

As the site is located near an existing watercourse, LSRCA guidelines state that erosion control is typically completed for sites located upstream of a known erosion site, if the site drains to a first or second order headwater stream, or as part of Master Drainage Plan for a Secondary Planning Area.

However, as the site is less than 2.00 ha, no additional erosion control is proposed.

5.9. Stormwater Quality Control

The MECP in March 2003 issued a "Stormwater Management Planning and Design Manual". This manual has been adopted by a variety of agencies including the Town of Bradford. The development's Stormwater Quality Control objective is to provide Enhanced Protection quality control as stated in the MECP manual. To achieve enhanced protection, permanent and temporary control of erosion and sediment transport are proposed using a treatment train approach and are discussed in the following sections.

5.9.1. Permanent Quality Control

The development's active parking facilities pose a risk to stormwater quality through the collection of grit, salt, sand and oils on the paved surfaces. Stormwater from the parking lot area will be receive pretreatment from the proposed permeable pavers by filtering through and draining into a perforated pipe located within the stone storage layer beneath the pavers.

The catchbasins include sumps which will settle larger sediment particles. Heavy metals have an affinity to adsorb to sediment particles in runoff and the OGS unit is proposed to remove accumulated sediment from the stormwater. Stormwater will be conveyed by the storm sewer system and will flow through an oil/grit separator (OGS) unit prior to draining to channel located to the South. A CDS-5-C treatment unit is the proposed OGS which will treat the post-development flows with a TSS removal rate of approximately 60%. Regular inspections and proper maintenance of the proposed OGS unit will ensure the TSS removal rate will be achieved as well as protect the downstream watercourse from oil, grease, and heavy metals. Detailed information regarding the OGS unit can be seen in Appendix G.

The MECP standard stipulates a Total Suspended Solids (TSS) removal of at least 80% for the enhanced protection level according to Table 3.2 in the MECP SWM Planning & Design Manual. As the OGS unit can only provide a maximum of 60% TSS removal, the remaining 20% will be treated using LID features. The rooftop will receive 80% TSS removal with the proposed infiltration chambers and the pavers have been sized to filter a storage volume equivalent to enhanced protection level as per table 3.2. As the rooftop will drain to infiltration chambers, and all remaining impervious surfaces will drain to permeable pavers, underground storage, and OGS unit in series, the quality control objective for the project has been met. Refer to calculations in Appendix C for more details.

5.9.2. Quality Control during Construction

During construction, earth grading and excavation will create the potential for soil erosion and sedimentation. It is imperative that effective environmental and sedimentation controls are in place and maintained throughout the duration of construction activities to ensure the stormwater runoff's quality.

Therefore, the following recommendations shall be implemented and maintained during construction to achieve acceptable stormwater runoff quality:

- Installation of silt fence along the entire perimeter of the site to reduce sediment migration onto surrounding properties;
- Filter cloth will be placed on the catchbasins on public streets along the property frontage.
- Installation of a construction entrance mat to minimize transportation of sediment onto roadways;
- The contractor will be responsible for maintaining dust suppression and mud tracking to level deemed appropriate by the consultant and/or town staff
- Restoration of exposed surfaces with vegetative and non-vegetative material as soon as construction schedules permit. The duration in which surfaces are disturbed/exposed shall not exceed 30 days;
- Reduce stormwater drainage velocities where possible; and
- Minimize the amount of existing vegetation removed.

The Environmental Protection and Removals Plan has been included in Appendix I.

6. Water Balance

Since the post-development state will increase the imperviousness of the site, considerations were taken in regard to groundwater recharge. A water budget was completed as per LSRCA guidelines. Under pre-development conditions, the project site had an annual recharge volume of 1,362 m^3. With the increased imperviousness of the site, this recharge will be reduced to 584 m^3, resulting in a deficit volume of 778 m^3.

In order to infiltrate an additional 778 m^3 annually, a yearly rainfall depth of 461.5 mm from the rooftop is required to be infiltrated resulting in an equivalent depth of 4 mm and a storage volume of 7 m^3. However, it is proposed to provide retention for the first 25 mm of rainfall over the roof area to meet LSRCA volume control criteria required storage volume of 42 m^3.

StormTech underground infiltration chambers are proposed to be utilized to meet the volume requirement by providing a storage volume of 42 m^3. As per the Geotechnical Report, the groundwater elevation is 220.40 which provides a separation of 1.0 m to the bottom of chamber elevation of 221.40. The Geotechnical Report also provides an estimated infiltration rate of 25 mm/hr for the native soils which is expected to be sufficient for rooftop infiltration. A summary of water balance calculations can be seen in Table 4 below. Detailed water balance calculations have been provided in Appendix E.

Table 4: Water Balance Calculations Summary

Characteristic	Site		
	Pre-Development	Post-Development	Change (Pre to Post)
Inputs (Volumes)			
Precipitation (m^3/yr)	9,569	9,569	0.0%
Run-On (m^3/yr)	0	0	0.0%
Other Inputs (m^3/yr)	0	0	0.0%
Total Inputs (m^3/yr)	**9,569**	**9,569**	**0.0%**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	5,323	7,475	40.4%
Net Surplus (m^3/yr)	5,323	7,475	40.4%
Evapotranspiration (m^3/yr)	4,246	2,094	-50.7%
Infiltration (m^3/yr)	1,362	584	-57.1%
Rooftop Infiltration (m^3/yr)	0	778	0.0%
Total Infiltration (m^3/yr)	1,362	1,362	0.0%
Runoff Pervious Areas (m^3/yr)	1,362	584	-57.1%
Runoff Impervious Areas (m^3/yr)	2,599	5,528	112.7%
Total Runoff (m^3/yr)	3,961	6,112	54.3%
Total Outputs (m^3/yr)	**9,569**	**9,569**	**0.0%**

Note: Tabulated values taken from calculation sheets in Appendix E.

7. Phosphorus Budget

7.1. Phosphorous Budget Tool

Local conservation authorities have determined the importance of reducing phosphorus levels in water courses in this area. The reduction was based on conservative values derived by the LSRCA using data contained within the MECP's Lake Simcoe Phosphorous Loading Development Tool. As such, best efforts are to be employed in order to reduce phosphorus levels to pre-development levels or better. The existing site generates approximately 0.12 kg of phosphorus annually and the proposed Project will generate approximately 1.32 kg of phosphorus annually if uncontrolled. Best efforts will be used in order to reduce the phosphorus loading as much as is reasonably possible.

To minimize the amount of phosphorus discharged from the site, a treatment train approach is to be utilized. Rooftop runoff will be conveyed to an underground infiltration system, which will infiltrate the equivalent of the first 25 mm over the total rooftop area. Stormwater from the parking areas will drain to permeable paver areas acting as a filter for the storm runoff prior to entering the storm sewer system. The permeable pavers be wrapped in an impermeable liner and will contain a perforated pipe at the base of the clear stone layer, directing treated flows to the storm sewer system. A catch basin within the permeable pavers includes a sump which will settle larger particles. Permeable pavers are to be lined with an impermeable liner and therefore will not negatively impact groundwater quality.

Stormwater conveyed through the storm sewer will then flow through an OGS unit and outlet on the southern side of the site to the channel. According to the LSRCA Standards, the typical phosphorus reduction is 45% for permeable pavers, 20% for OGS units, and 60% for underground infiltration chambers.

The following Table 3 details the anticipated phosphorus loadings for the pre and post-development conditions.

Table 3: Phosphorus Loadings

	Total P (kg)
Pre-Development	0.12
Uncontrolled Post-Development	1.35
Controlled Post-Development	0.53

Detailed calculations can be found in Appendix D.

7.2. Phosphorous Offsetting Policy

The LSRCA has implemented a Phosphorous Offsetting Policy in September 2017 which has a goal that all new development must reduce 100% of the phosphorous leaving the property. A fee of $87,500 per annual kg is required for anything above a net 0 kg of phosphorous running off the site. Therefore, the required fee for the proposed development is as follows:

LSPOP Fee = $35,770 x 2.5 x 0.53 kg x 1.15 = **$54,504**

Refer to Appendix D for detailed phosphorous budget calculations.

8. Conclusions

The proposed development will connect to the existing watermain and sanitary sewer on Simcoe Road to service the project.

Quantity control for the development is provided in the Stormtech underground storage units and surface ponding allowing post development peak flows to be released at pre-development values through an orifice tube and control weir.

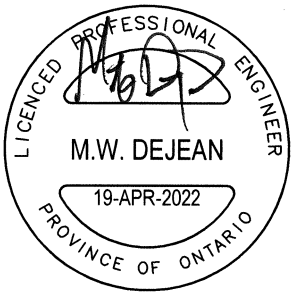
External drainage from the Simcoe Road Branch catchment area will safely overtop the curb in an emergency situation and is not expected to negatively affect the proposed building.

A treatment train approach is implemented consisting of rooftop infiltration, permeable pavers, and an oil/grit separator to obtain quality control for the site and reduce phosphorus levels leaving the site.

Water balance for the site is achieved by infiltration of runoff from the rooftop.

All of which is respectfully submitted,

Pearson Engineering Ltd.



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Appendix A

Water Servicing Calculations

County of Simcoe Affordable Housing - Orillia
Water Flow Calculations

Design Criteria

Demand per capita (Q):	300	L/cap/d
Peak Rate Factor (Max. Hour)	4.50	(Table 3-3: Peaking Factors for Drinking-Water Systems Serving Fewer than 500 People,
Max. Day Factor	3.00	MOE Design Guidelines for Drinking-Water Systems)

Site Data

Description	**Density**		**Units**		**Flow Rate**		**Peaking Factors**	
Apartments	3.36	people/unit	50	units	300	L/cap/d	MAX DAY FACTOR*	3.00
Commercial	1,686	m^2	1	units	28,000	L/ha/d	PEAK RATE FACTOR*	4.50

Calculate Population

Pop. Apartments	=	3.36	x	50
Pop. Total	=	168	people	

Calculate Commercial Flows

Proposed $Q_{Commercial}$	=	0.1686	x	28,000
	=	4,721	L/day	
	=	0.05	L/s	

Calculate Average Day Demand (ADD)

ADD	=	300	x	168
ADD	=	50,400	L/day	
ADD	=	0.58	L/s	

Calculate Max Day Flow

MDF	=	0.58	x	3.00
MDF	=	1.75	L/s	

Calculate Peak Hour Demand

PHD	=	0.58	x	4.50
PHD	=	2.63	L/s	

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County of Simcoe Affordable Housing
Fire Flow Calculations

Location:	125 Simcoe Road	
OBC Occupancy:	Residential Occupancies - Class C	
Building Foot Print:	1,687 m^2	
# of Stories:	4	4 Storey Apartment Building - 50 Units

Project: County of Simcoe Affordable Housing
Project Number: 20055

Construction Class	Charge
Wood Frame	1.5
Ordinary	1.0
Non-Combustible	0.8
Fire Resistive	0.6

Construction Class: Non-Combustible

Automated Sprinkler Protection		Credit	Total
NFPA 13 sprinkler standard	Yes	30%	
Standard Water Supply	No	10%	30%
Fully Supervised System	No	10%	

Contents	Charge
Non-Combustible	-25%
Limited Combustible	-15%
Combustible	0%
Free Burning	15%
Rapid Burning	25%

Contents Factor: Non-Combustible **Charge:** -25%

Exposure 1 (north) Ex. Residential	Distance to Exposure Building (m) / Length - Height	16.3	15%
Exposure 2 (east) Ex. Residential	Distance to Exposure Building (m) / Length - Height	>45.1	0%
Exposure 3 (south) Ex. Residential	Distance to Exposure Building (m) / Length - Height	>45.1	0%
Exposure 4 (west) Ex. Residential	Distance to Exposure Building (m) / Length - Height	>45.1	0%

Separation	Charge
0 - 3.0 m	25%
3.1 - 10.0 m	20%
10.1 - 20.0 m	15%
20.1 - 30.0 m	10%
30.1 - 45.0 m	5%
> 45.1 m	0%

Total: 15% *no more than 75%

Are Buildings Contigious? Yes

Fire Resistant Building: Are vertical openings and exterior vertical communications protected with a minimum one (1) hr rating?

Calculations: *C* = 0.8 Non-Combustible

RFF = 220 x C x √A *A* = 6,749 m²

Where: *RFF* = required fire flow in liters per minute
C = Coefficient related to the type of construction
A = the total floor area in square meters (excluding basements in building considered

RFF = 14,459 L/min
Round to Nearest 1000 L/min RFF = 14,000 L/min *Must be > 2000 L/min or < 45,000 L/min

Correction Factors:

Occupancy		-3,500	L/min
Fire Flow Adjusted for Occupancy	**E =**	10,500	L/min
Reduction For Sprinkler	**F =**	3,150	L/min
Fire Flow w/ Sprinkler Reduction		7,350	L/min
Exposure Charge	**G =**	1,575	L/min
Fire Flow w/ Exposure Charge		8,925	L/min

As per "Water Supply for Public Fire Protection" pg.20 note H:
RFF = **E - F + G**

E	F	G
10,500	3,150	1,575

RFF= 5,950 L/min - 0 L/min + 1488 L/min
RFF = 8,925 L/min

Required Fire Flow: **RFF =** 8,925 L/min

Round to Nearest 1,000 L/min **RFF = 9,000 L/min**

RFF= 2,376 GPM

RFF = 150 L/s

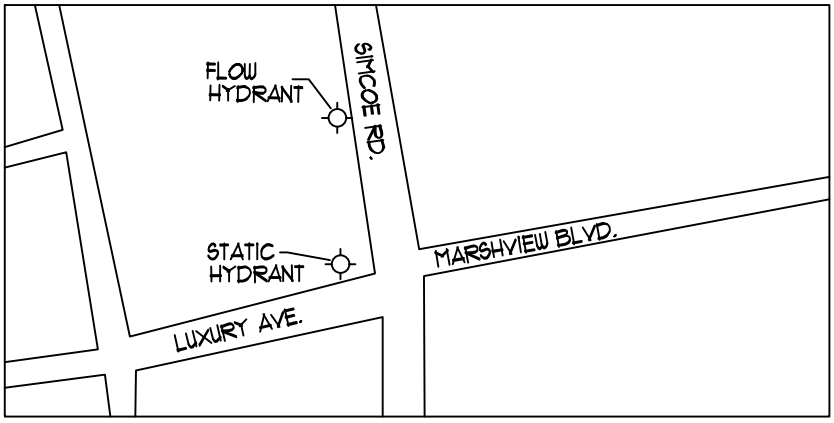
FLOW TEST RESULTS

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945
POWERED BY API Group

DATE : OCTOBER 27,2021 TIME : 1:30 PM

LOCATION : 112 SIMCOE STREET
BRADFORD
ONTARIO

TEST BY : VIPOND INC. AND LOCAL PUC



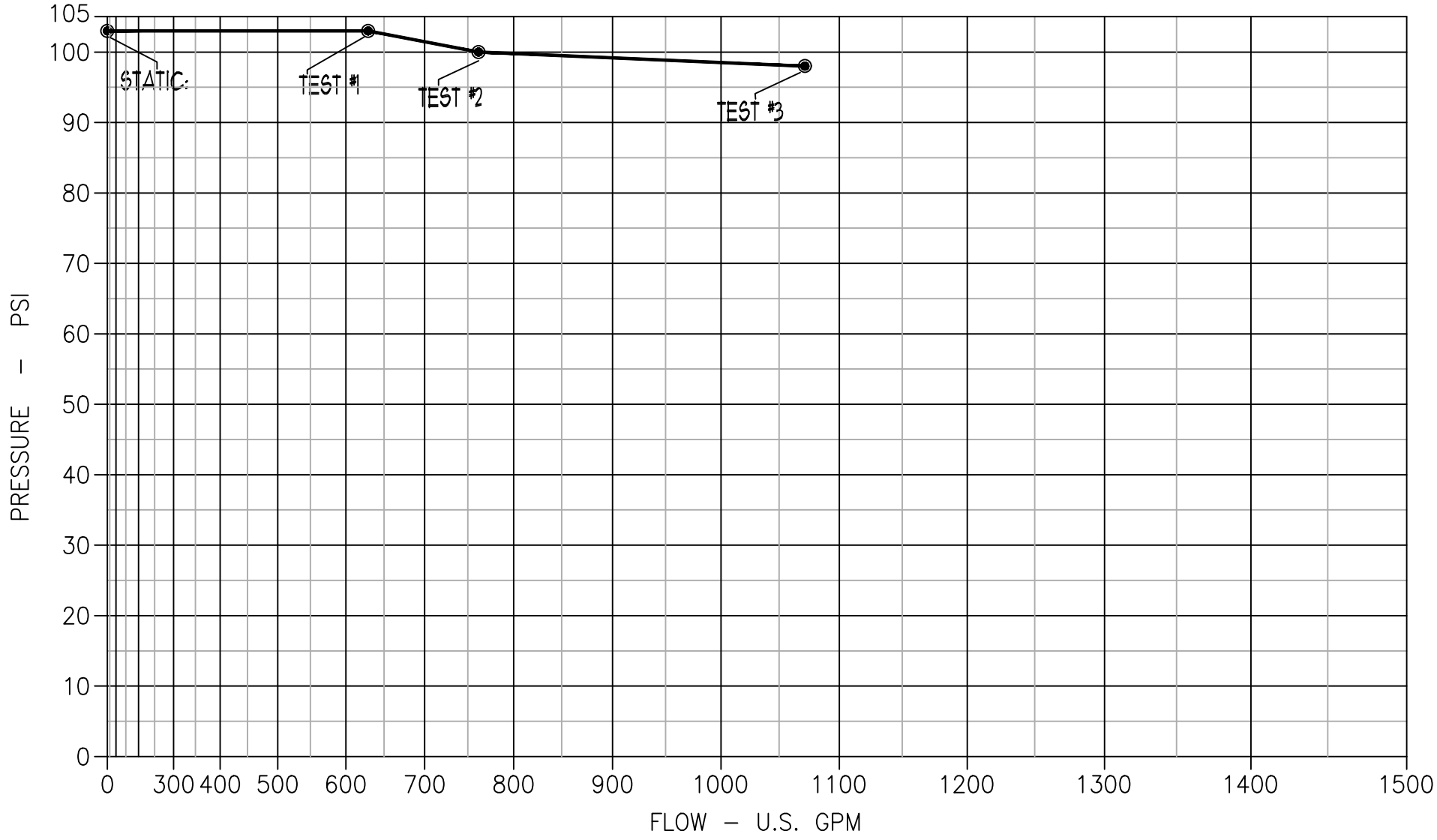
STATIC PRESSURE : 103 PSI UNDERGROUND TYPE & SIZE : N/A

TEST NO.	NO. OF NOZZLES	NOZZLE DIAMETER (INCHES)	DISCHARGE CO-EFFICIENT	RESIDUAL PRESSURE (PSI)	PITOT PRESSURE (PSI)	DISCHARGE (U.S.G.P.M)
1	1	1 3/4"	0.995	103	50	630
2	1	2 1/2"	0.90	100	20	754
3	2	2 1/2"	0.90	98	10	1066

FIRST FOR FIRE, LIFE SAFETY & SECURITY
VIPOND INC
est. 1945
POWERED BY API Group

112 SIMCOE STREET		BY :	LEN K.
BRADFORD		VIPOND OFFICE :	BARRIE
ONTARIO		TEST BY :	VIPOND & PUC
		DATE :	OCT 27,2021

STATIC:		RESIDUAL:		FLOW:
103 PSI	TEST#1	103 PSI	@	630 GPM
	TEST#2	100 PSI	@	754 GPM
	TEST#3	98 PSI	@	1066 GPM



Appendix B

Sanitary Servicing Calculations

County of Simcoe Affordable Housing - Bradford
Sanitary Flow Calculations

Design Criteria:

Flow per Capita (Q):	300	L/cap/d	
Peak Flow:	$Qp = P * Q * M / 86400 + I * A$		
Peaking Factor (Harmon Formula):	$M = 1 + (14 / (4 + (P / 1000) ^ 0.5))$		Where: $1.5 \le M \le 4.0$
Infiltration Allowance (I):	0.10	L/s/ha	

Site Data:

Description	**Density**		**50**		**Flow Rate**	
Apartments	3.36	people/unit	50	units	300	L/cap/d
Commercial	1,686	m^2	1	units	28,000	L/ha/d

Calculate Population

Pop. Apartments	=	3.36	x	50
Pop.	=	168	people	

Calculate Commercial Flows

Proposed $Q_{Commercial}$	=	0.1686	x	28,000
	=	4,721	L/day	
	=	0.05	L/s	

Calculate Average Daily Flows

ADF	=	300	x	168
ADF	=	50,400	L/day	
ADF	=	0.58	L/s	

Calculate Peaking Factor

$$M = 1 + \frac{14}{4 + \left(\frac{168}{1{,}000}\right)^{0.5}} + 0.10 * 0.12$$

M	=	4.19
		Use Max Peaking Factor 4

Calculate Peak Flow

Qp	=	(0.58+0.05)	x	4.00
	=	2.55	L/s	
Infiltration Allowance	=	0.10	x	3.81
	=	0.38	L/s	
Qp (Inc. Infiltration Allowance)	=	2.93	L/s	
	=	0.0029	m3/s	
	ADF	55.1	m3/day	

Pipe Diameter	200 mm
Pipe Slope	2 %
Full Velocity	1.48 m/s
Full Flow	0.0464 m3/s

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County of Simcoe Affordable Housing - Bradford
Sanitary Sewer Design Sheet

n=0.013

Q_p=(P/1000)*Q*M/86.4

M = 1+(14/(4+(P/1000)^0.5)) (1.5<="M"<=4)

Q_i = 20,000 L/d/ha = 0.2 L/s/ha

$Q_{Total} = Q_p + Q_i$

FILE: 20055

CONTRACT/PROJECT: County of Simcoe Affordable Housing

DATE: 19-Apr-22

AREA NO.	MANHOLE		Qp	LENGTH	LENGTH (ACC.)	Qi	TOTAL Q	D	S	Q FULL	V FULL	PERCENT FULL
	FROM	TO	(l/s)	(m)	(m)	(l/s)	(l/s)	(mm)	(%)	(l/s)	(m/s)	(%)
1	SAN CAP	SAN MH1	2.55	10.2	10.2	0.38	2.93	150	2.00	21.54	1.22	13.61
	SAN MH1	EX.. SAN MH		12.5	22.7		2.93	150	2.00	21.54	1.22	13.61

Appendix C

Stormwater Management Calculations

County of Simcoe Affordable Housing, Bradford
Calculation of Runoff Coefficients

Runoff Coefficient	=	0.20	0.95	0.95	0.60	0.95		Weighted
Surface Cover	=	Grass	Asphalt	Building	Gravel	Concrete		Runoff Coefficient
PRE DEVELOPMENT	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)		
1	10257	7325	0	0	2463	469		0.33
Pre Total	10257	7325	0	0	2463	469		0.33
POST DEVELOPMENT	Total Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)	Area (m^2)		
1	1686	0	0	1686	0	0		0.95
2	1837	133	1379	0	0	325		0.90
3	1257	108	1049	0	0	100		0.89
4	1018	151	830	0	0	37		0.84
5	1709	228	1291	0	0	190		0.85
6	2202	2051	0	0	0	151		0.25
7	547	469	56	0	0	22		0.31
Post Total	10257	3141	4605	1686	0	825		0.72

requirements, where applicable, to assist in determining the most appropriate method to calculate T_c.

In cases where undeveloped lands dictate the time of concentration used in Modified Rational Method design, the urban time of concentration (usually smaller) shall be used and the contributing rural area reduced to a factor of:

$(T_c \text{ urban} / T_c \text{ rural})^{0.5}$

Computer analyses are best suited to large urban areas, rural areas and designing municipal SWM facilities.

The minimum and maximum duration of design storms are 4 hours and 24 hours respectively. Hyetographs of the following design storms selected by the Town (distribution based on the Toronto-Pearson data and a 10 minute discretization) are provided in Appendix J – Design Storms:

- 24 hour SCS
- 4 hour Chicago distribution
- 24 hour Chicago distribution (where requested).

The Town, LSRCA or NVCA may request other design storm lengths and distributions for evaluation during the pre-consultation process.

The following are the A, B, C values for the Chicago Design Storms to be used in the equation:

Intensity = A / (t+B) ^C, as indicated in the following

Return Period	**2 Year**	**5 Year**	**10 Year**	**25 Year**	**50 Year**	**100 Year**
A	789.070	980.848	1118.790	1284.892	1405.794	1443.947
B	6.205	6.013	6.018	6.008	6.012	5.273
C	0.823	0.806	0.800	0.793	0.788	0.776

C2.02 Safety Features

The Town prefers not to unnecessarily require fencing around pond blocks, but instead to allow for casual public access. Accordingly, public safety must be kept paramount in the design of SWM facilities. Table 8 (following page) summarizes pond design criteria.

The Town may elect to require fencing along any residential lot that abuts stormwater facilities. However, fencing around the perimeter of pond blocks will only be considered by the Town when reviewing submissions where there are extenuating circumstances which prevent the above requirements from being met. Specific approval will be required from the Town for consideration of fenced facilities.

County of Simcoe Affordable Housing, Bradford
Pre-Development Peak Flows

Town of Bradford West Gwillimbury

Storm Event (yrs)	Coeff A	Coeff B	Coeff C
2	**789.070**	**6.205**	**0.823**
5	**980.848**	**6.013**	**0.806**
10	**1118.790**	**6.018**	**0.800**
25	**1284.892**	**6.008**	**0.793**
50	**1405.794**	**6.012**	**0.788**
100	**1443.947**	**5.273**	**0.776**

Modified Rational Method
$Q = C_i CIA / 360$

Where:

Q -	Flow Rate (m^3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

Catchment Area	Area 1	
Area	1.03	ha
Runoff Coefficient	0.33	
Time of Concentration	10	min
Return Rate	2	year
Rainfall Intensity	79.7	mm/hr
Pre-Development Peak Flow	0.08	m^3/s
Return Rate	5	year
Rainfall Intensity	104.9	mm/hr
Pre-Development Peak Flow	0.10	m^3/s
Return Rate	10	year
Rainfall Intensity	121.6	mm/hr
Pre-Development Peak Flow	0.11	m^3/s
Return Rate	25	year
Rainfall Intensity	142.5	mm/hr
Pre-Development Peak Flow	0.13	m^3/s
Return Rate	50	year
Rainfall Intensity	158.1	mm/hr
Pre-Development Peak Flow	0.15	m^3/s
Return Rate	100	year
Rainfall Intensity	174.1	mm/hr
Pre-Development Peak Flow	0.16	m^3/s

County of Simcoe Affordable Housing, Bradford
Post-Development Peak Flows

Town of Bradford West Gwillimbury

Storm Event (yrs)	Coeff A	Coeff B	Coeff C
2	**789.070**	**6.205**	**0.823**
5	**980.848**	**6.013**	**0.806**
10	**1118.790**	**6.018**	**0.800**
25	**1284.892**	**6.008**	**0.793**
50	**1405.794**	**6.012**	**0.788**
100	**1443.947**	**5.273**	**0.776**

Modified Rational Method
$Q = C_i CIA / 360$

Where:

Q -	Flow Rate (m^3/s)
Ci -	Peaking Coefficient
C -	Rational Method Runoff Coefficient
I -	Storm Intensity (mm/hr)
A -	Area (ha.)

Catchment Area	Area Draining to Storm Controls Areas 1 - 5	Uncontrolled Area Area 6 & 7	Total Site Peak Flow Area 1 - 7
Area	0.75 ha	0.27 ha	1.03 ha
Runoff Coefficient	0.89	0.26	0.72
Time of Concentration	10 min	10 min	10 min
Return Rate	2 year	2 year	2 year
Rainfall Intensity	79.7	79.7	79.7
Post-Development Peak Flow	0.15 m^3/s	0.02 m^3/s	0.16 m^3/s
Return Rate	5 year	5 year	5 year
Rainfall Intensity	104.9	104.9	104.9
Post-Development Peak Flow	0.19 m^3/s	0.02 m^3/s	0.22 m^3/s
Return Rate	10 year	10 year	10 year
Rainfall Intensity	121.6	121.6	121.6
Post-Development Peak Flow	0.23 m^3/s	0.02 m^3/s	0.25 m^3/s
Return Rate	25 year	25 year	25 year
Rainfall Intensity	142.5	142.5	142.5
Post-Development Peak Flow	0.26 m^3/s	0.03 m^3/s	0.29 m^3/s
Return Rate	50 year	50 year	50 year
Rainfall Intensity	158.1	158.1	158.1
Post-Development Peak Flow	0.29 m^3/s	0.03 m^3/s	0.32 m^3/s
Return Rate	100 year	100 year	100 year
Rainfall Intensity	174.1	174.1	174.1
Post-Development Peak Flow	0.32 m^3/s	0.03 m^3/s	0.36 m^3/s

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Stage-Storage-Discharge Table

Elevation (m)	Area (m^2)	Volume (m^3)	Cum. Vol. (m^3)	Orifice Head (m)	Orifice Flow (m^3/s)	Weir Head (m)	Weir Flow (m^3/s)	Total Flow (m^3/s)
220.83	0	20	19.7	0.19	0.012	0.000	0.000	0.012
220.90	0	20	39.3	0.26	0.014	0.000	0.000	0.014
221.00	0	20	59.0	0.36	0.017	0.000	0.000	0.017
221.10	0	20	78.7	0.46	0.019	0.000	0.000	0.019
221.20	0	20	98.3	0.56	0.021	0.000	0.000	0.021
221.30	0	20	118.0	0.66	0.023	0.000	0.000	0.023
221.40	0	20	137.7	0.76	0.024	0.000	0.000	0.024
221.50	0	20	157.3	0.86	0.026	0.000	0.000	0.026
221.57	0	20	177.0	0.93	0.027	0.000	0.000	0.027
221.60	0	0	177.0	0.96	0.027	0.000	0.000	0.027
221.70	0	0	177.0	1.06	0.029	0.000	0.000	0.029
221.80	0	0	177.0	1.16	0.030	0.000	0.000	0.030
221.90	0	0	177.0	1.26	0.031	0.000	0.000	0.031
222.00	0	0	177.0	1.36	0.032	0.000	0.000	0.032
222.10	0	0	177.0	1.46	0.034	0.000	0.000	0.034
222.20	0	0	177.0	1.56	0.035	0.000	0.000	0.035
222.30	0	0	177.0	1.66	0.036	0.000	0.000	0.036
222.40	0	0	177.0	1.76	0.037	0.000	0.000	0.037
222.50	0	0	177.0	1.86	0.038	0.000	0.000	0.038
222.60	0	0	177.0	1.96	0.039	0.000	0.000	0.039
222.70	1	0	177.1	2.06	0.040	0.000	0.000	0.040
222.71	6	0	177.1	2.07	0.040	0.000	0.000	0.040
222.72	13	0	177.2	2.08	0.040	0.000	0.000	0.040
222.73	23	0	177.4	2.09	0.040	0.000	0.000	0.040
222.74	34	0	177.7	2.10	0.040	0.000	0.000	0.040
222.75	47	0	178.1	2.11	0.040	0.000	0.000	0.040
222.76	61	1	178.6	2.12	0.041	0.000	0.000	0.041
222.77	75	1	179.3	2.13	0.041	0.000	0.000	0.041
222.78	89	1	180.1	2.14	0.041	0.000	0.000	0.041
222.79	104	1	181.1	2.15	0.041	0.000	0.000	0.041
222.80	112	1	182.1	2.16	0.041	0.010	0.010	0.051
222.81	123	1	183.3	2.17	0.041	0.020	0.029	0.070
222.82	134	1	184.6	2.18	0.041	0.030	0.053	0.094
222.83	142	1	186.0	2.19	0.041	0.040	0.082	0.123
222.84	148	1	187.4	2.20	0.041	0.050	0.114	0.155
222.85	153	2	188.9	2.21	0.041	0.060	0.150	0.191

Orifice Tube 1	
Diameter	100 mm
Invert Elevation	220.59
Orifice Constant	0.80
Orifice Centroid	220.64
Orifice Flow Formula	$0.80\pi(D/2000)^2 \times (2 \times 9.81 \times H)^{0.5}$

Major Storm Control Weir	
Width	6.00 m
Invert of Weir	222.79 m
Weir Flow Formula	$1.7WH^{1.5}$

County of Simcoe Affordable Housing, Bradford
Major System Stage-Discharge Table

Elevation	Weir 1		Weir 2		Total Flow
	Head	Flow	Head	Flow	
(m)	(m)	(m^3/s)	(m)	(m^3/s)	(m^3/s)
224.30	0.00	0.0000	0.00	0.0000	0.000
224.31	0.01	0.0010	0.00	0.0000	0.001
224.32	0.02	0.0059	0.00	0.0000	0.006
224.33	0.03	0.0161	0.00	0.0000	0.016
224.34	0.04	0.0331	0.00	0.0000	0.033
224.35	0.05	0.0579	0.00	0.0000	0.058
224.36	0.06	0.0913	0.00	0.0000	0.091
224.37	0.07	0.1342	0.00	0.0000	0.134
224.38	0.08	0.1874	0.00	0.0000	0.187
224.39	0.09	0.2516	0.00	0.0000	0.252
224.40	0.10	0.3274	0.00	0.0000	0.327
224.41	0.11	0.4155	0.00	0.0000	0.416
224.42	0.12	0.5325	0.00	0.0000	0.532
224.43	0.13	0.6669	0.01	0.0012	0.668
224.44	0.14	0.8197	0.02	0.0066	0.826
224.45	0.15	0.9916	0.03	0.0182	1.010
224.46	0.16	1.1832	0.04	0.0374	1.221
224.47	0.17	1.3953	0.05	0.0653	1.461
224.48	0.18	1.6287	0.06	0.1031	1.732
224.49	0.19	1.8838	0.07	0.1515	2.035
224.50	0.20	2.1614	0.08	0.2116	2.373
224.51	0.21	2.4621	0.09	0.2840	2.746
224.52	0.22	2.7866	0.10	0.3696	3.156
224.53	0.23	3.1353	0.11	0.4690	3.604
224.54	0.24	3.5089	0.12	0.5830	4.092

Weir 1	
Width	13.40 m
Invert Elevation	224.30

Weir 2	
Width	8.50 m
Invert Elevation	224.42

Notes:

1. Weir 1 conveys flow to the Major System Overland Flow Channel, and Weir 2 is the high point at the intersection of Simcoe Road and Marshview Drive which conveys flow to Marshview Drive.
2. Peak flows for the 100 year and Regional storms are 3.99 m3/s and 2.98 m3/s, respectively, which were calculated using a Visual OTTHYMO model created for the Simcoe Road Branch catchment area.
3. The average width taken at 50% of the total head elevation was used to calculate flow to approximate a rectangular weir.
4. The existing 1050mm storm sewer has a capacity of approximately 1.93 m3/s at 0.5%. If the storm sewer is full, the remaining 2.06 m3/s in the 100 year would have an overtopping elevation of 224.49.
5. Assuming 50% blockage in the storm sewer, the 100 year overtopping elevation would be approximately 224.52.
6. In the unlikely event the 1050mm storm sewer becomes completely blocked, the overtopping depth would be approximately 224.54.

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Quantity Control Volume Calculations

DATE:	18-Apr-22
FILE:	20055
CONTRACT/PROJECT:	125 Simcoe Road
COMPLETED BY:	MJWP

Modified Rational Method Parameters

Pre Development Area (ha)	Post Development Area (ha)	Time of Concentration (min)	Time Increments (min)	Pre-Development Runoff Coefficient	Post-Development Runoff Coefficient
1.03	0.75	10	1	0.33	0.89

Note: Refer to page Calculation of Runoff Coefficients for detailed calculations of Modified Rational Method parameters.

Pre-Development Runoff Rate

	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
C	0.33	0.33	0.33	0.33	0.33	0.33
C_i	1.00	1.00	1.00	1.10	1.20	1.25
I	79.72	104.91	121.64	142.50	158.06	174.11
A	1.03	1.03	1.03	1.03	1.03	1.03
Q	0.08	0.10	0.11	0.15	0.18	0.20

Note: Q= 0.00278CCiIA

Rainfall Station	Bradford

SWM Pond Design Input

Storm Event (yrs)	Chicago Storm Coefficient A	Chicago Storm Coefficient B	Chicago Storm Coefficient C	Allowable Outflow (m3/s)	Post Development Runoff Coefficient
2	789.070	6.205	0.82	0.023	0.89
5	980.848	6.013	0.81	0.027	0.89
10	1118.790	6.018	0.80	0.040	0.89
25	1284.892	6.008	0.79	0.079	0.98
50	1405.794	6.012	0.79	0.107	1.00
100	1443.947	5.273	0.78	0.129	1.00

Results

Storm Event (yrs)	Storage (m^3)	Time (min)
2	119	62
5	169	74
10	178	60
25	184	40
50	186	34
100	186	30

Note: Storage volume calculated as per Hydrology Handbook, Second Edition, American Society of Civil Engineers, 1996

Time (min)	2 Year Intensity mm/hr	2 Year Inflow m^3/s	2 Year Outflow m^3/s	2 Year Storage m^3	Difference	5 Year Intensity mm/hr	5 Year Inflow m^3/s	5 Year Outflow m^3/s	5 Year Storage m^3	Difference	10 Year Intensity mm/hr	10 Year Inflow m^3/s	10 Year Outflow m^3/s	10 Year Storage m^3	Difference	25 Year Intensity mm/hr	25 Year Inflow m^3/s	25 Year Outflow m^3/s	25 Year Storage m^3	Difference	50 Year Intensity mm/hr	50 Year Inflow m^3/s	50 Year Outflow m^3/s	50 Year Storage m^3	Difference	100 Year Intensity mm/hr	100 Year Inflow m^3/s	100 Year Outflow m^3/s	100 Year Storage m^3	Difference
1	155.34	0.29	0.02	10	13	204.08	0.38	0.03	14	17	235.38	0.44	0.04	13	20	274.35	0.56	0.08	8	24	302.97	0.63	0.11	3	27	347.30	0.72	0.13	1	30
2	139.58	0.26	0.02	23	11	183.29	0.34	0.03	31	14	211.59	0.39	0.04	33	16	246.82	0.50	0.08	32	20	272.76	0.57	0.11	30	22	309.64	0.65	0.13	31	24
3	126.98	0.24	0.02	33	9	166.72	0.31	0.03	45	12	192.60	0.36	0.04	49	13	224.83	0.46	0.08	52	16	248.61	0.52	0.11	52	18	280.18	0.58	0.13	55	19
4	116.64	0.22	0.02	42	7	153.16	0.28	0.03	57	10	177.06	0.33	0.04	62	11	206.82	0.42	0.08	68	14	228.83	0.48	0.11	70	15	256.44	0.53	0.13	74	16
5	108.01	0.20	0.02	50	6	141.85	0.26	0.03	67	9	164.08	0.30	0.04	73	10	191.77	0.39	0.08	82	12	212.29	0.44	0.11	85	13	236.85	0.49	0.13	90	13
6	100.67	0.19	0.02	56	6	132.25	0.25	0.03	75	7	153.07	0.28	0.04	83	8	179.00	0.37	0.08	94	10	198.24	0.41	0.11	97	11	220.38	0.46	0.13	103	11
7	94.35	0.18	0.02	62	5	124.00	0.23	0.03	83	7	143.59	0.27	0.04	92	7	168.00	0.34	0.08	104	9	186.13	0.39	0.11	108	10	206.31	0.43	0.13	115	10
8	88.85	0.17	0.02	67	4	116.81	0.22	0.03	90	6	135.33	0.25	0.04	99	7	158.41	0.32	0.08	113	8	175.58	0.37	0.11	118	8	194.15	0.40	0.13	125	8
9	84.01	0.16	0.02	71	4	110.50	0.21	0.03	95	5	128.07	0.24	0.04	106	6	149.98	0.31	0.08	120	7	166.30	0.35	0.11	126	7	183.50	0.38	0.13	133	7
10	79.72	0.15	0.02	75	3	104.91	0.19	0.03	101	5	121.64	0.23	0.04	111	5	142.50	0.29	0.08	127	6	158.06	0.33	0.11	134	6	174.11	0.36	0.13	140	6
11	75.89	0.14	0.02	79	3	99.91	0.19	0.03	105	4	115.88	0.22	0.04	117	5	135.82	0.28	0.08	133	5	150.69	0.31	0.11	140	6	165.75	0.35	0.13	147	6
12	72.44	0.13	0.02	82	3	95.41	0.18	0.03	110	4	110.71	0.21	0.04	122	4	129.80	0.27	0.08	139	5	144.06	0.30	0.11	146	5	158.25	0.33	0.13	152	5
13	69.32	0.13	0.02	85	3	91.35	0.17	0.03	114	4	106.03	0.20	0.04	126	4	124.36	0.25	0.08	144	4	138.05	0.29	0.11	151	4	151.49	0.32	0.13	157	4
14	66.48	0.12	0.02	87	2	87.65	0.16	0.03	117	3	101.77	0.19	0.04	130	4	119.40	0.24	0.08	148	4	132.59	0.28	0.11	155	4	145.36	0.30	0.13	162	4
15	63.89	0.12	0.02	90	2	84.27	0.16	0.03	121	3	97.88	0.18	0.04	133	3	114.87	0.23	0.08	152	4	127.59	0.27	0.11	159	4	139.76	0.29	0.13	165	3
16	61.52	0.11	0.02	92	2	81.17	0.15	0.03	124	3	94.30	0.18	0.04	137	3	110.71	0.23	0.08	155	3	123.00	0.26	0.11	163	3	134.63	0.28	0.13	169	3
17	59.33	0.11	0.02	94	2	78.32	0.15	0.03	126	3	91.01	0.17	0.04	140	3	106.88	0.22	0.08	159	3	118.77	0.25	0.11	166	3	129.92	0.27	0.13	172	3
18	57.30	0.11	0.02	96	2	75.68	0.14	0.03	129	2	87.97	0.16	0.04	143	3	103.33	0.21	0.08	161	3	114.85	0.24	0.11	169	3	125.57	0.26	0.13	174	2
19	55.42	0.10	0.02	97	2	73.23	0.14	0.03	132	2	85.14	0.16	0.04	145	2	100.04	0.20	0.08	164	2	111.22	0.23	0.11	171	2	121.53	0.25	0.13	176	2
20	53.68	0.10	0.02	99	1	70.95	0.13	0.03	134	2	82.51	0.15	0.04	148	2	96.98	0.20	0.08	167	2	107.84	0.22	0.11	174	2	117.78	0.25	0.13	178	2
21	52.05	0.10	0.02	100	1	68.83	0.13	0.03	136	2	80.06	0.15	0.04	150	2	94.12	0.19	0.08	169	2	104.68	0.22	0.11	176	2	114.29	0.24	0.13	180	1
22	50.52	0.09	0.02	102	1	66.84	0.12	0.03	138	2	77.77	0.14	0.04	152	2	91.45	0.19	0.08	171	2	101.72	0.21	0.11	177	2	111.03	0.23	0.13	181	1
23	49.10	0.09	0.02	103	1	64.98	0.12	0.03	140	2	75.62	0.14	0.04	154	2	88.94	0.18	0.08	172	2	98.95	0.21	0.11	179	1	107.97	0.23	0.13	183	1
24	47.75	0.09	0.02	104	1	63.23	0.12	0.03	142	2	73.59	0.14	0.04	156	2	86.58	0.18	0.08	174	1	96.34	0.20	0.11	180	1	105.09	0.22	0.13	184	1
25	46.49	0.09	0.02	105	1	61.58	0.11	0.03	143	2	71.69	0.13	0.04	158	2	84.36	0.17	0.08	175	1	93.89	0.20	0.11	181	1	102.39	0.21	0.13	185	1
26	45.30	0.08	0.02	106	1	60.02	0.11	0.03	145	1	69.89	0.13	0.04	159	1	82.26	0.17	0.08	177	1	91.57	0.19	0.11	182	1	99.84	0.21	0.13	185	0
27	44.17	0.08	0.02	107	1	58.55	0.11	0.03	146	1	68.19	0.13	0.04	161	1	80.28	0.16	0.08	178	1	89.37	0.19	0.11	183	1	97.43	0.20	0.13	186	0
28	43.11	0.08	0.02	108	1	57.16	0.11	0.03	148	1	66.59	0.12	0.04	162	1	78.40	0.16	0.08	179	1	87.30	0.18	0.11	184	1	95.15	0.20	0.13	186	0
29	42.10	0.08	0.02	109	1	55.84	0.10	0.03	149	1	65.06	0.12	0.04	163	1	76.62	0.16	0.08	180	1	85.33	0.18	0.11	184	0	92.99	0.19	0.13	186	0
30	41.14	0.08	0.02	110	1	54.59	0.10	0.03	150	1	63.61	0.12	0.04	165	1	74.93	0.15	0.08	181	1	83.45	0.17	0.11	185	0	90.94	0.19	0.13	186	0
31	40.23	0.07	0.02	111	1	53.40	0.10	0.03	151	1	62.23	0.12	0.04	166	1	73.32	0.15	0.08	181	1	81.67	0.17	0.11	185	0	88.98	0.19	0.13	186	0
32	39.36	0.07	0.02	111	1	52.26	0.10	0.03	152	1	60.92	0.11	0.04	167	1	71.78	0.15	0.08	182	1	79.97	0.17	0.11	185	0	87.13	0.18	0.13	186	0
33	38.53	0.07	0.02	112	1	51.18	0.09	0.03	153	1	59.67	0.11	0.04	168	1	70.32	0.14	0.08	182	0	78.35	0.16	0.11	186	0	85.35	0.18	0.13	186	0
34	37.74	0.07	0.02	113	1	50.14	0.09	0.03	154	1	58.47	0.11	0.04	169	1	68.92	0.14	0.08	183	0	76.81	0.16	0.11	186	0	83.66	0.17	0.13	185	0
35	36.98	0.07	0.02	113	1	49.16	0.09	0.03	155	1	57.33	0.11	0.04	169	1	67.59	0.14	0.08	183	0	75.33	0.16	0.11	185	0	82.05	0.17	0.13	185	-1
36	36.26	0.07	0.02	114	0	48.21	0.09	0.03	156	1	56.23	0.10	0.04	170	1	66.31	0.14	0.08	183	0	73.91	0.15	0.11	185	0	80.50	0.17	0.13	184	-1
37	35.57	0.07	0.02	114	0	47.31	0.09	0.03	157	1	55.19	0.10	0.04	171	1	65.08	0.13	0.08	184	0	72.55	0.15	0.11	185	0	79.02	0.16	0.13	184	-1
38	34.91	0.06	0.02	115	0	46.44	0.09	0.03	158	1	54.18	0.10	0.04	172	1	63.91	0.13	0.08	184	0	71.25	0.15	0.11	185	0	77.60	0.16	0.13	183	-1
39	34.27	0.06	0.02	115	0	45.60	0.08	0.03	159	1	53.22	0.10	0.04	172	1	62.78	0.13	0.08	184	0	70.00	0.15	0.11	184	0	76.23	0.16	0.13	182	-1
40	33.66	0.06	0.02	116	0	44.80	0.08	0.03	159	1	52.29	0.10	0.04	173	1	61.69	0.13	0.08	184	0	68.80	0.14	0.11	184	-1	74.92	0.16	0.13	181	-1
41	33.07	0.06	0.02	116	0	44.03	0.08	0.03	160	1	51.40	0.10	0.04	173	1	60.65	0.12	0.08	184	0	67.64	0.14	0.11	183	-1	73.66	0.15	0.13	180	-1
42	32.50	0.06	0.02	116	0	43.29	0.08	0.03	161	1	50.54	0.09	0.04	174	0	59.65	0.12	0.08	184	0	66.53	0.14	0.11	183	-1	72.45	0.15	0.13	179	-1
43	31.96	0.06	0.02	117	0	42.58	0.08	0.03	161	1	49.71	0.09	0.04	174	0	58.68	0.12	0.08	183	0	65.46	0.14	0.11	182	-1	71.28	0.15	0.13	178	-1
44	31.43	0.06	0.02	117	0	41.89	0.08	0.03	162	1	48.92	0.09	0.04	175	0	57.75	0.12	0.08	183	0	64.42	0.13	0.11	181	-1	70.16	0.15	0.13	177	-1
45	30.93	0.06	0.02	117	0	41.23	0.08	0.03	162	1	48.15	0.09	0.04	175	0	56.85	0.12	0.08	183	0	63.43	0.13	0.11	181	-1	69.07	0.14	0.13	176	-1
46	30.44	0.06	0.02	117	0	40.59	0.08	0.03	163	0	47.41	0.09	0.04	176	0	55.98	0.11	0.08	183	0	62.46	0.13	0.11	180	-1	68.03	0.14	0.13	174	-1
47	29.97	0.06	0.02	118	0	39.97	0.07	0.03	163	0	46.69	0.09	0.04	176	0	55.14	0.11	0.08	182	0	61.53	0.13	0.11	179	-1	67.01	0.14	0.13	173	-1
48	29.51	0.05	0.02	118	0	39.37	0.07	0.03	164	0	46.00	0.09	0.04	176	0	54.33	0.11	0.08	182	0	60.63	0.13	0.11	178	-1	66.04	0.14	0.13	172	-1
49	29.07	0.05	0.02	118	0	38.80	0.07	0.03	164	0	45.33	0.08	0.04	177	0	53.54	0.11	0.08	182	0	59.76	0.12	0.11	177	-1	65.09	0.14	0.13	170	-1
50	28.65	0.05	0.02	118	0	38.24	0.07	0.03	164	0	44.68	0.08	0.04	177	0	52.78	0.11	0.08	181	0	58.92	0.12	0.11	176	-1	64.17	0.13	0.13	169	-2
51	28.23	0.05	0.02	118	0	37.70	0.07	0.03	165	0	44.05	0.08	0.04	177	0	52.05	0.11	0.08	181	-1	58.11	0.12	0.11	175	-1	63.29	0.13	0.13	167	-2
52	27.83	0.05	0.02	119	0	37.17	0.07	0.03	165	0	43.44	0.08	0.04	177	0	51.34	0.10	0.08	180	-1	57.32	0.12	0.11	174	-1	62.43	0.13	0.13	166	-166
53	27.45	0.05	0.02	119	0	36.66	0.07	0.03	166	0	42.85	0.08	0.04	177	0	50.64	0.10	0.08	180	-1	56.55	0.12	0.11	173	-1	61.60	0.13	0.00	0	0
54	27.07	0.05	0.02	119	0	36.17	0.07	0.03	166	0	42.28	0.08	0.04	177	0	49.97	0.10	0.08	179	-1	55.80	0.12	0.11	172	-1	60.79	0.13	0.00	0	0
55	26.70	0.05	0.02	119	0	35.69	0.07	0.03	166	0	41.72	0.08	0.04	178	0	49.32	0.10	0.08	178	-1	55.08	0.11	0.11	170	-1	60.00	0.13	0.00	0	0
56	26.35	0.05	0.02	119	0	35.23	0.07	0.03	166	0	41.18	0.08	0.04	178	0	48.69	0.10	0.08	178	-1	54.38	0.11	0.11	169	-1	59.24	0.12	0.00	0	0
57	26.01	0.05	0.02	119	0	34.77	0.06	0.03	167	0	40.66	0.08	0.04	178	0	48.08	0.10	0.08	177	-1	53.70	0.11	0.11	168	-1	58.50	0.12	0.00	0	0
58	25.67	0.05	0.02	119	0	34.34	0.06	0.03	167	0	40.15	0.07	0.04	178	0	47.48	0.10	0.08	176	-1	53.04	0.11	0.11	167	-1	57.78	0.12	0.00	0	0
59	25.35	0.05	0.02	119	0	33.91	0.06	0.03	167	0	39.66	0.07	0.04	178	0	46.90	0.10	0.08	175	-1	52.39	0.11	0.11	165	-1	57.08	0.12	0.00	0	0
60	25.03	0.05	0.02	119	0	33.50	0.06	0.03	167	0	39.18	0.07	0.04	178	0	46.34	0.09	0.08	175	-1	51.77	0.11	0.11	164	-164	56.41	0.12	0.00	0	0
61	24.73	0.05	0.02	119	0	33.09	0.06	0.03	167	0	38.71	0.07	0.04	178	0	45.79	0.09	0.08	174	-1	51.16	0.11	0.00	0	0	55.74	0.12	0.00	0	0
62	24.43	0.05	0.02	119	0	32.70	0.06	0.03	168	0	38.25	0.07	0.04	178	0	45.25	0.09	0.08	173	-1	50.56	0.11	0.00	0	0	55.10	0.11	0.00	0	0
63	24.14	0.04	0.02	119	0	32.32	0.060	0.03	168	0	37.81	0.070	0.04	178	0	44.73	0.091	0.079	172	-1	49.99	0.104	0.000	0	0	54.47	0.114	0.000	0	0
64	23.85	0.04	0.02	119	0	31.94	0.059	0.03	168	0	37.37	0.069	0.04	178	0	44.22	0.090	0.079	171	-1	49.42	0.103	0.000	0	0	53.86	0.112	0.000	0	0
65	23.58	0.04	0.02	119	0	31.58	0.059	0.03	168	0	36.95	0.069	0.04	177	0	43.73	0.089	0.0790	170	-1	48.87	0.102	0.000	0	0	53.27	0.111	0.000	0	0
66	23.31	0.04	0.02	119	0	31.23	0.058	0.03	168	0	36.54	0.068	0.04	177	0	43.25	0.088	0.0790	170	-1	48.34	0.101	0.000	0	0	52.68	0.110	0.000	0	0
67	23.05	0.04	0.02	119	0	30.88	0.057	0.03	168	0	36.14	0.067	0.04	177	0	42.78	0.087	0.0790	169	-1	47.82	0.100	0.000	0	0	52.12	0.109	0.000	0	0
68	22.79	0.04	0.02	119	0	30.54	0.057	0.03	168	0	35.75	0.066	0.04	177	0	42.32	0.086	0.0790	168	-1	47.31	0.099	0.000	0	0	51.56	0.108	0.000	0	0
69	22.54	0.04	0.02	119	0	30.22	0.056	0.03	168	0	35.37	0.066	0.04	177	0	41.87	0.085	0.0790	167	-1	46.81	0.098	0.000	0	0	51.03	0.106	0.000	0	0

= Maximum Storage Volume

County of Simcoe Affordable Housing, Bradford
Swale Capacity Calculations

1.0% Sloped Swale

Required Flow	=	3.99	m^3/s	*based on information for Morris Road Drain, Simcoe Road branch
Left Bank Slope	=	33.30	%	
Right Bank Slope	=	33.30	%	
Bottom Width	=	2.00	m	
Longitudinal Slope	=	1.00	%	
Manning's "n"	=	0.030		
Assumed Depth of Flow	=	0.60	m	
Left Bank Length	=	1.80	m	
Right Bank Length	=	1.80	m	
Top Width	=	5.60		
Wetted Area	=	2.281	sq.m.	
Wetted Perimeter	=	5.798	m	
Hydraulic Radius	=	0.393		
Velocity	=	1.790	m/s	
Flow Passing	=	4.08	m^3/s	

County of Simcoe Affordable Housing, Bradford
Permeable Pavers Sizing Calculations

Infiltration volumes from MOE Stormwater Management Planning and Design Manual to size Permeable Pavers Table 3.2 Water Quality Storage Requirements are as follows:

Design Area Total	=	0.75	ha		
Total Imperviousness	=	89%			
Storage Volume	=	40.9	m^3/ha		(Enhanced 80% long-term S.S. removal)
Area 1 Storage Volume Required	=	0.75		x	40.9
	=	30.7	m^3		

Required storage volume calculated over 25 mm of the total impervious area on the site as per the LSRCA Volume Control:

Storage Volume	=	5430		x	0.0250
Area Storage Volume Required	=	135.7	m^3		

Therefore, the storage required with 25 mm over the total impervious area on the site governs.
Note: The building area was excluded as it is draining to an underground infiltration gallery sized for the 25 mm storm.

Find Storage Volume provided in Permeable Pavers:

Area of Pavers (A)	=	536.3	m^2		
Depth of Trench (d)	=	0.65	m		
Storage Volume (V)	=	0.4(A x d)			
	=	139.4	m^3		

		Required		**Provided**	
Area Storage Volume	=	135.7	m^3	139.4	m^3

The required volume will be provided in the permeable pavers, resulting in a total storage of 160.9 m^3.

Use Equation 4.12 to find Area of Permeable Pavers:

Area Design Volume (V)	=	139.4	m^3
Depth of Controlling Filter Medium (d)	=	0.50	m
Coefficient of Permeability of the Controlling Filter Media (k)	=	45.0	mm/hr
Operating Head of Water On the Filter (h)	=	0.15	m
Design Drawdown Time (t)	=	24	hr
Surface Area Of Filter (A)	=	$\frac{1000Vd}{k(h+d)t}$	
	=	99.3	m^2

		Required		**Provided**	
Area 1 Surface Area	=	96.7	m^2	536.3	m^2

Q= 0.0028*C*I*A (cms)
C=RUNOFF COEFFICIENT
I-RAINFALL INT A/(Time+B)^C
A=AREA (ha)

County of Simcoe Affordable Housing, Bradford
Storm Sewer Pipe Design Sheet
5-Year Storm Event

Date: 18-Apr-22
File: 20055
Contract/Project: 125 Simcoe Road

Areas	MANHOLE		LENGTH	INCREMENT			TOTAL CA	FLOW TIME (min)		I	TOTAL Q	S	D	Q FULL	V FULL	PERCENT FULL
	FROM	TO	(m)	C	A	CA		TO	IN	(mm/h)	(cms)	(%)	(mm)	(cms)	(m/s)	(%)
Area 2	CB1	CBMH1	34.4	0.92	0.17	0.16	0.16	10.00	0.42	104.91	0.05	1.00	300	0.10	1.37	47.1
Area 3	CBMH1	MH1	26.1	0.90	0.11	0.10	0.26	10.42	0.20	102.74	0.07	2.50	300	0.15	2.16	47.7
Area 4	CB2	MH1	2.9	0.93	0.09	0.08	0.34	10.00	0.04	104.91	0.10	0.50	375	0.12	1.12	79.7
-	MH1	MH2	35.7	0.00	0.00	0.00	0.59	10.62	0.47	101.74	0.17	0.50	450	0.20	1.27	83.3
Area 5	CB3	MH2	4.9	0.95	0.17	0.16	0.16	10.00	0.06	104.91	0.05	1.00	300	0.10	1.37	48.7
Area 1	STM CAP	OVERFLOW CBMH1	24.9	0.17	0.95	0.16	0.16	10.00	0.21	104.91	0.05	2.00	300	0.14	1.94	34.4
-	OVERFLOW CBMH1	MH3	13.6	0.00	0.00	0.00	0.16	10.21	0.07	103.79	0.05	5.40	300	0.22	3.18	20.7
-	MH3	MH2	10.1	0.00	0.00	0.00	0.16	10.29	0.16	103.42	0.05	0.60	300	0.07	1.06	34.7
-	MH2	OGS	8.5	0.00	0.00	0.00	0.92	11.09	0.10	99.48	0.04	1.00	300	0.10	1.37	26.9
-	OGS	CHANNEL	15.2	0.00	0.00	0.00	0.92	11.19	0.13	99.00	0.04	2.10	300	0.14	1.98	18.6

SIGNIFICANT FEATURES

1. MORRIS ROAD BRANCH
2. BACK STREET BRANCH
3. EDWARD STREET BRANCH
4. SIMCOE ROAD BRANCH
5. LINE 6 BRANCH
6. REID BRANCH
7. SPLIT MARSH/DIVERSION BRANCH (PART OF OPTION 6)
8. EXISTING STORM WATER MANAGEMENT (SWM) SITE
9. AREAS OF POSSIBLE FUTURE DEVELOPMENT
10. POSSIBLE FUTURE SWM SITES
11. SOUTH EAST ARTERIAL ROAD (SEAR) CORRIDOR

PLAN LEGEND

- MAJOR WATERSHED
- INTERMEDIATE WATERSHED
- MAIN MORRIS ROAD DRAIN
- BRANCH DRAIN LOCATIONS
- ARTERIAL (SEAR) CORRIDOR
- SPLIT MARSH/DIVERSION BRANCH (PART OF OPTION 6)
- (11) LOCATIONS OF SIGNIFICANT FEATURES

MORRIS ROAD DRAIN

WATERSHED PLAN AND SIGNIFICANT FEATURES

(FORMERLY MORRIS ROAD COMPONENT OF THE BRADFORD MARSH SMALL DRAINAGE SCHEME)

TOWN OF BRADFORD–WEST GWILLIMBURY

SCALE

0 150 300m

1:15000

(ON 11"x17")

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==========================================================================================================

       V    V   I    SSSSS  U   U    A    L              (v 6.2.2010)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

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


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\avarghese\AppData\Local\Civica\VH5\2f7a3306-231b-4826-a584-8feb757f6eb8\528d8edc-
  Summary filename: C:\Users\avarghese\AppData\Local\Civica\VH5\2f7a3306-231b-4826-a584-8feb757f6eb8\528d8edc-


DATE: 04-13-2022                          TIME: 03:10:41

USER:



COMMENTS: _____________________________________________________________


----------------------------------------------------------------------------------------------------------
  ***********************************************
  ** SIMULATION : 100yr 24hr SCS                **
  ***********************************************


--------------------
|    READ STORM    |    Filename: C:\Users\avarghese\AppD
|                  |              ata\Local\Temp\
|                  |              447bf2e1-c0f0-410b-9491-d1d5f66003be\f6b2c85b
| Ptotal=121.50 mm |    Comments: 100yr_24hr_scs
--------------------
```

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.00	1.22	6.00	2.43	12.00	7.90	18.00	1.82
0.17	1.22	6.17	2.43	12.17	7.90	18.17	1.82
0.33	1.22	6.33	2.43	12.33	7.90	18.33	1.82
0.50	1.22	6.50	2.43	12.50	7.90	18.50	1.82
0.67	1.22	6.67	2.43	12.67	7.90	18.67	1.82
0.83	1.22	6.83	2.43	12.83	7.90	18.83	1.82
1.00	1.22	7.00	2.43	13.00	7.90	19.00	1.82
1.17	1.22	7.17	2.43	13.17	7.90	19.17	1.82
1.33	1.22	7.33	2.43	13.33	7.90	19.33	1.82
1.50	1.22	7.50	2.43	13.50	7.90	19.50	1.82
1.67	1.22	7.67	2.43	13.67	7.90	19.67	1.82
1.83	1.22	7.83	2.43	13.83	7.90	19.83	1.82
2.00	1.22	8.00	4.25	14.00	3.64	20.00	1.22
2.17	1.22	8.17	4.25	14.17	3.64	20.17	1.22
2.33	1.22	8.33	4.25	14.33	3.64	20.33	1.22
2.50	1.22	8.50	4.25	14.50	3.64	20.50	1.22
2.67	1.22	8.67	4.25	14.67	3.64	20.67	1.22
2.83	1.22	8.83	4.25	14.83	3.64	20.83	1.22
3.00	1.22	9.00	4.25	15.00	3.64	21.00	1.22
3.17	1.22	9.17	4.25	15.17	3.64	21.17	1.22
3.33	1.22	9.33	4.25	15.33	3.64	21.33	1.22
3.50	1.22	9.50	4.25	15.50	3.64	21.50	1.22
3.67	1.22	9.67	4.25	15.67	3.64	21.67	1.22
3.83	1.22	9.83	4.25	15.83	3.64	21.83	1.22
4.00	2.43	10.00	30.98	16.00	2.43	22.00	1.22
4.17	2.43	10.17	30.98	16.17	2.43	22.17	1.22
4.33	2.43	10.33	30.98	16.33	2.43	22.33	1.22
4.50	2.43	10.50	30.98	16.50	2.43	22.50	1.22
4.67	2.43	10.67	30.98	16.67	2.43	22.67	1.22
4.83	2.43	10.83	30.98	16.83	2.43	22.83	1.22
5.00	2.43	11.00	30.98	17.00	2.43	23.00	1.22
5.17	2.43	11.17	30.98	17.17	2.43	23.17	1.22
5.33	2.43	11.33	30.98	17.33	2.43	23.33	1.22
5.50	2.43	11.50	30.98	17.50	2.43	23.50	1.22
5.67	2.43	11.67	30.98	17.67	2.43	23.67	1.22
5.83	2.43	11.83	30.98	17.83	2.43	23.83	1.22

```
--------------------
| CALIB            |
| STANDHYD (  0001)|   Area    (ha)=  23.29
|ID= 1 DT= 5.0 min |   Total Imp(%)=  45.00   Dir. Conn.(%)=  30.00
--------------------
                          IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=      10.48         12.81
     Dep. Storage     (mm)=       1.00          5.00
     Average Slope     (%)=       1.00          2.00
     Length            (m)=     394.04         40.00
     Mannings n             =     0.013         0.250

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

---- TRANSFORMED HYETOGRAPH ----

TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr	TIME hrs	RAIN mm/hr
0.083	1.22	6.083	2.43	12.083	7.90	18.08	1.82
0.167	1.22	6.167	2.43	12.167	7.90	18.17	1.82
0.250	1.22	6.250	2.43	12.250	7.90	18.25	1.82
0.333	1.22	6.333	2.43	12.333	7.90	18.33	1.82
0.417	1.22	6.417	2.43	12.417	7.90	18.42	1.82
0.500	1.22	6.500	2.43	12.500	7.90	18.50	1.82
0.583	1.22	6.583	2.43	12.583	7.90	18.58	1.82
0.667	1.22	6.667	2.43	12.667	7.90	18.67	1.82
0.750	1.21	6.750	2.43	12.750	7.90	18.75	1.82
0.833	1.22	6.833	2.43	12.833	7.90	18.83	1.82
0.917	1.21	6.917	2.43	12.917	7.90	18.92	1.82
1.000	1.22	7.000	2.43	13.000	7.90	19.00	1.82
1.083	1.21	7.083	2.43	13.083	7.90	19.08	1.82
1.167	1.22	7.167	2.43	13.167	7.90	19.17	1.82
1.250	1.22	7.250	2.43	13.250	7.90	19.25	1.82
1.333	1.22	7.333	2.43	13.333	7.90	19.33	1.82
1.417	1.22	7.417	2.43	13.417	7.90	19.42	1.82
1.500	1.22	7.500	2.43	13.500	7.90	19.50	1.82
1.583	1.22	7.583	2.43	13.583	7.90	19.58	1.82
1.667	1.22	7.667	2.43	13.667	7.90	19.67	1.82
1.750	1.22	7.750	2.43	13.750	7.90	19.75	1.82
1.833	1.22	7.833	2.43	13.833	7.90	19.83	1.82
1.917	1.22	7.917	2.43	13.917	7.90	19.92	1.82
2.000	1.22	8.000	2.43	14.000	7.90	20.00	1.82
2.083	1.22	8.083	4.25	14.083	3.65	20.08	1.22
2.167	1.22	8.167	4.25	14.167	3.64	20.17	1.22
2.250	1.21	8.250	4.25	14.250	3.64	20.25	1.22
2.333	1.22	8.333	4.25	14.333	3.64	20.33	1.22
2.417	1.21	8.417	4.25	14.417	3.64	20.42	1.22
2.500	1.22	8.500	4.25	14.500	3.64	20.50	1.22
2.583	1.21	8.583	4.25	14.583	3.64	20.58	1.22
2.667	1.22	8.667	4.25	14.667	3.64	20.67	1.22
2.750	1.21	8.750	4.25	14.750	3.64	20.75	1.22
2.833	1.22	8.833	4.25	14.833	3.64	20.83	1.22
2.917	1.21	8.917	4.25	14.917	3.64	20.92	1.22
3.000	1.22	9.000	4.25	15.000	3.64	21.00	1.22
3.083	1.21	9.083	4.25	15.083	3.64	21.08	1.22
3.167	1.22	9.167	4.25	15.167	3.64	21.17	1.22
3.250	1.21	9.250	4.25	15.250	3.64	21.25	1.22
3.333	1.22	9.333	4.25	15.333	3.64	21.33	1.22
3.417	1.21	9.417	4.25	15.417	3.64	21.42	1.22
3.500	1.22	9.500	4.25	15.500	3.64	21.50	1.22
3.583	1.21	9.583	4.25	15.583	3.64	21.58	1.22
3.667	1.22	9.667	4.25	15.667	3.64	21.67	1.22
3.750	1.21	9.750	4.25	15.750	3.64	21.75	1.22
3.833	1.22	9.833	4.25	15.833	3.64	21.83	1.22
3.917	1.21	9.917	4.25	15.917	3.64	21.92	1.22
4.000	1.22	10.000	4.25	16.000	3.64	22.00	1.22
4.083	2.43	10.083	30.98	16.083	2.43	22.08	1.22
4.167	2.43	10.167	30.98	16.167	2.43	22.17	1.22
4.250	2.43	10.250	30.98	16.250	2.43	22.25	1.22
4.333	2.43	10.333	30.98	16.333	2.43	22.33	1.22
4.417	2.43	10.417	30.98	16.417	2.43	22.42	1.22
4.500	2.43	10.500	30.98	16.500	2.43	22.50	1.22
4.583	2.43	10.583	30.98	16.583	2.43	22.58	1.22
4.667	2.43	10.667	30.98	16.667	2.43	22.67	1.22
4.750	2.43	10.750	30.98	16.750	2.43	22.75	1.22
4.833	2.43	10.833	30.98	16.833	2.43	22.83	1.22
4.917	2.43	10.917	30.98	16.917	2.43	22.92	1.22
5.000	2.43	11.000	30.98	17.000	2.43	23.00	1.22
5.083	2.43	11.083	30.98	17.083	2.43	23.08	1.22
5.167	2.43	11.167	30.98	17.167	2.43	23.17	1.22
5.250	2.43	11.250	30.98	17.250	2.43	23.25	1.22

5.333	2.43	11.333	30.98	17.333	2.43	23.33	1.22
5.417	2.43	11.417	30.98	17.417	2.43	23.42	1.22
5.500	2.43	11.500	30.98	17.500	2.43	23.50	1.22
5.583	2.43	11.583	30.98	17.583	2.43	23.58	1.22
5.667	2.43	11.667	30.98	17.667	2.43	23.67	1.22
5.750	2.43	11.750	30.98	17.750	2.43	23.75	1.22
5.833	2.43	11.833	30.98	17.833	2.43	23.83	1.22
5.917	2.43	11.917	30.98	17.917	2.43	23.92	1.22
6.000	2.43	12.000	30.98	18.000	2.43	24.00	1.21

Max.Eff.Inten.(mm/hr)=	30.98	28.05	
over (min)	10.00	25.00	
Storage Coeff. (min)=	9.29 (ii)	21.03 (ii)	
Unit Hyd. Tpeak (min)=	10.00	25.00	
Unit Hyd. peak (cms)=	0.12	0.05	
			TOTALS
PEAK FLOW (cms)=	0.60	0.92	1.518 (iii)
TIME TO PEAK (hrs)=	12.00	12.00	12.00
RUNOFF VOLUME (mm)=	120.50	66.70	82.84
TOTAL RAINFALL (mm)=	121.50	121.50	121.50
RUNOFF COEFFICIENT =	0.99	0.55	0.68

(i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
CN* = 69.0 Ia = Dep. Storage (Above)
(ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
THAN THE STORAGE COEFFICIENT.
(iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2010)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\avarghese\AppData\Local\Civica\VH5\2f7a3306-231b-4826-a584-8feb757f6eb8\1617914f-
  Summary filename: C:\Users\avarghese\AppData\Local\Civica\VH5\2f7a3306-231b-4826-a584-8feb757f6eb8\1617914f-


DATE: 04-13-2022                          TIME: 03:10:41

USER:


COMMENTS: _____________________________________________________________


  ************************************************
  ** SIMULATION : 100yr 4hr CHI                  **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                10.0
    [ Ptot= 80.70 mm ]
    fname : C:\Users\avarghese\AppData\Local\Temp\447bf2e1-c0f0-410b-9491-d1d5f66003be\eabffff7-8c92-4790-b77e
    remark: 100yr_4hr_chi
*
 *  CALIB STANDHYD       0001  1  5.0   23.29    3.99  1.33  48.70 0.60   0.000
    [I%=30.0:S%= 2.00]
*
```

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

       V    V   I    SSSSS  U   U    A    L             (v 6.2.2010)
       V    V   I    SS     U   U   A A   L
        V  V    I     SS    U   U  AAAAA  L
        V  V    I      SS   U   U  A   A  L
         VV     I    SSSSS  UUUUU  A   A  LLLLL

        OOO   TTTTT  TTTTT  H   H  Y   Y  M   M   OOO    TM
       O   O    T      T    H   H   Y Y   MM MM  O   O
       O   O    T      T    H   H    Y    M   M  O   O
        OOO     T      T    H   H    Y    M   M   OOO
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                  *****  S U M M A R Y   O U T P U T  *****


  Input   filename: C:\Program Files (x86)\Visual OTTHYMO 6.2\VO2\voin.dat
  Output  filename: C:\Users\avarghese\AppData\Local\Civica\VH5\2f7a3306-231b-4826-a584-8feb757f6eb8\999b2967-
  Summary filename: C:\Users\avarghese\AppData\Local\Civica\VH5\2f7a3306-231b-4826-a584-8feb757f6eb8\999b2967-


DATE: 04-13-2022                          TIME: 03:10:42

USER:


COMMENTS: _____________________________________________________________


  ************************************************
  ** SIMULATION : Hazel                          **
  ************************************************

  W/E COMMAND             HYD ID   DT    AREA  ' Qpeak Tpeak   R.V. R.C.   Qbase
                                  min     ha   '  cms   hrs     mm          cms

      START @  0.00 hrs
      --------------------
    READ STORM                60.0
    [ Ptot=212.00 mm ]
    fname : C:\Users\avarghese\AppData\Local\Temp\447bf2e1-c0f0-410b-9491-d1d5f66003be\ba502d42-6aac-416f-b711
    remark: hazel-hr
*
 ** CALIB STANDHYD       0001  1  5.0   23.29    2.98 10.00 165.09 0.78   0.000
    [I%=30.0:S%= 2.00]
*
```

3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA
NO.	REVISION NOTE	DATE	BY

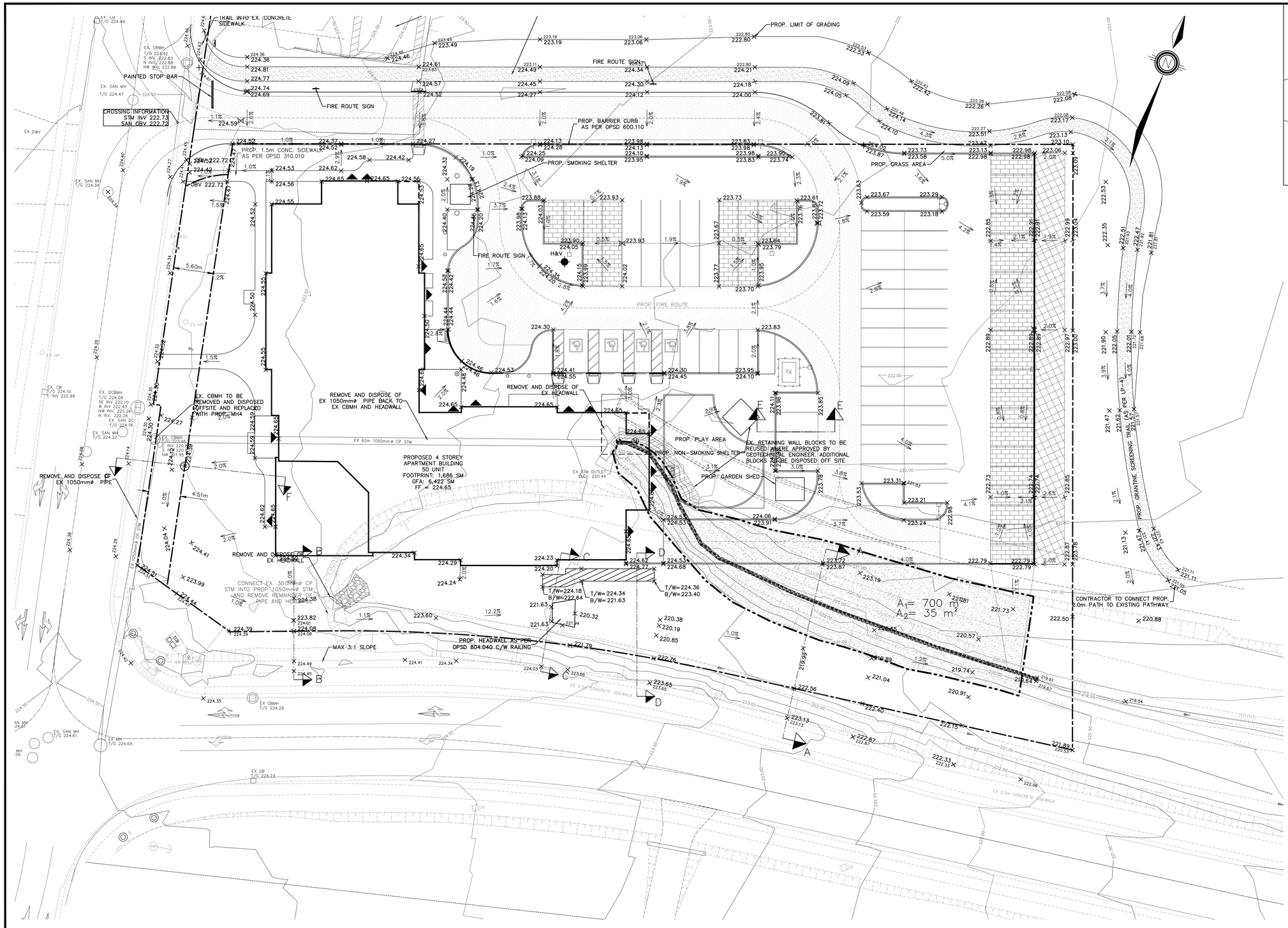
BENCHMARK: ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE TOWN OF BRADFORD BENCHMARK N° 848154 HAVING A PUBLISHED ELEVATION OF 237.913 METRES.

COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

SITE GRADING SKETCH 1
(2:1 SLOPES ONLY)

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE 1:250	PROJECT #	20055
DRAWN BY	AA	VERT SCALE	DRAWING #	SK-1
CHECKED BY	MWD	DATE JUNE 2020	REVISION #	3



NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

BENCHMARK: ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE TOWN OF BRADFORD BENCHMARK N° 848154 HAVING A PUBLISHED ELEVATION OF 237.913 METRES.

COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

SITE GRADING SKETCH 3
(EXISTING CHANNEL)

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE 1:250	PROJECT # 20055
DRAWN BY	AA	VERT SCALE	DRAWING # SK-3
CHECKED BY	MWD	DATE JUNE 2020	REVISION # 3

Appendix D

Phosphorous Budget Calculations

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Phosphorus Budget - LSRCA

West Holland River	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Phosphorus Export (kg/ha/year)	0.36	1.32	0.12	0.26

Pre-Development Condition

	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Area (ha)	0.00	0.00	1.03	0.00
Total P (kg)	0.00	0.00	0.12	0.00

Total Pre-Development P (kg) **0.12**

Post-Development Condition (Uncontrolled):

	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Area (ha):	0.00	1.03	0.00	0.00
Total P (kg) :	0.00	1.35	0.00	0.00

Total Uncontrolled Post-Development (kg): **1.35**

Post-Development Condition (Controlled):

Uncontrolled Area :	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Area (ha):	0.00	0.05	0.22	0.00
Total P (kg) :	0.00	0.07	0.03	0.00

Total Uncontrolled (kg): **0.10**

Area from Rooftop Draining to Infiltration	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Area (ha):	0.00	0.17	0.00	0.00
Total P (kg) :	0.00	0.22	0.00	0.00

Soakaway Infiltration

Total P (kg):	0.22
Soakaway Infiltration Proficiency (%):	60
P Removed (kg):	0.13
P Remaining (kg):	0.09

Area Draining to Permeable Pavers	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Area (ha):	0.00	0.58	0.00	0.00
Total P (kg) :	0.00	0.77	0.00	0.00

Sand or Media Filters

Total P (kg):	0.77
Sand or Media Filters Proficiency (%):	45
P Removed (kg):	0.35
P Remaining (kg):	0.42

OGS

Total P (kg):	0.42
OGS Proficiency (%):	20
P Removed (kg):	0.08
P Remaining (kg):	0.34

Total Post-Development P (kg): **0.53**

Appendix E

Water Balance Calculations

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Pre-Development Water Balance

Catchment Designation	Site				
	Grassed	Paved	Building	Total	
Area	7325	2932	0	10257	
Pervious Area	7325	0	0	7325	
Impervious Area	0	2932	0	2932	
Infiltration Factors					
Topography Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Rolling Land)
Soil Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Medium combinations of clay and loam)
Land Cover Infiltration Factor	0.1	0	0		
MOE Infiltration Factor	0.5	0	0		
Actual Infiltration Factor	0.5	0	0		
Run-Off Coeffiecient	0.5	1	1		
Runoff from Impervious Surfaces	0	0.95	0.95		
Inputs (per Unit Area)					
Precipitation	932.9	932.9	932.9	932.9	(Precipitation values from Environment Canada)
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	932.9	932.9	932.9	932.9	
Outputs (per Unit Area)					
Precipitation Surplus	371.9	886.3	886.3	518.9	
Net Surplus	371.9	886.3	886.3	518.9	
Evapotranspiration	561.0	46.6	46.6	414.0	
Infiltration	186.0	0.0	0.0	132.8	
Rooftop Infiltration	0.0	0.0	0.0	0.0	
Total Infiltration	186.0	0.0	0.0	132.8	
Runoff Pervious Areas	186.0	0.0	0.0	132.8	
Runoff Impervious Areas	0.0	886.3	886.3	253.4	
Total Runoff	186.0	886.3	886.3	386.2	
Total Outputs	932.9	932.9	932.9	932.9	
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0	
Inputs (Volumes)					
Precipitation	6833	2736	0	9569	
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	6833	2736	0	9569	
Outputs (Volumes)					
Precipitation Surplus	2724	2599	0	5323	
Net Surplus	2724	2599	0	5323	
Evapotranspiration	4109	137	0	4246	
Infiltration	1362	0	0	1362	
Rooftop Infiltration	0	0	0	0	
Total Infiltration	1362	0	0	1362	
Runoff Pervious Areas	1362	0	0	1362	
Runoff Impervious Areas	0	2599	0	2599	
Total Runoff	1362	2599	0	3961	
Total Outputs	6833	2736	0	9569	
Difference (Inputs - Outputs)	0	0	0	0	

Note: Highlighted cells are input cells.

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Post-Development Water Balance (No Infiltration)

Catchment Designation	Site				
	Grassed	Paved	Building	Total	
Area	3141	5430	1686	10257	
Pervious Area	3141	0	0	3141	
Impervious Area	0	5430	1686	7116	
Infiltration Factors					
Topography Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Rolling Land)
Soil Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Medium combinations of clay and loam)
Land Cover Infiltration Factor	0.1	0	0		
MOE Infiltration Factor	0.5	0	0		
Actual Infiltration Factor	0.5	0	0		
Run-Off Coeffiecient	0.5	1	1		
Runoff from Impervious Surfaces	0	0.95	0.95		
Inputs (per Unit Area)					
Precipitation	932.9	932.9	932.9	932.9	(Precipitation values from Environment Canada)
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	932.9	932.9	932.9	932.9	
Outputs (per Unit Area)					
Precipitation Surplus	371.9	886.3	886.3	728.8	
Net Surplus	371.9	886.3	886.3	728.8	
Evapotranspiration	561.0	46.6	46.6	204.1	
Infiltration	186.0	0.0	0.0	56.9	
Rooftop Infiltration	0.0	0.0	0.0	0.0	
Total Infiltration	186.0	0.0	0.0	56.9	
Runoff Pervious Areas	186.0	0.0	0.0	56.9	
Runoff Impervious Areas	0.0	886.3	886.3	614.9	
Total Runoff	186.0	886.3	886.3	671.8	
Total Outputs	932.9	932.9	932.9	932.9	
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0	
Inputs (Volumes)					
Precipitation	2930	5065	1573	9569	
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	2930	5065	1573	9569	
Outputs (Volumes)					
Precipitation Surplus	1168	4812	1495	7475	
Net Surplus	1168	4812	1495	7475	
Evapotranspiration	1762	253	79	2094	
Infiltration	584	0	0	584	
Rooftop Infiltration	0	0	0	0	
Total Infiltration	584	0	0	584	
Runoff Pervious Areas	584	0	0	584	
Runoff Impervious Areas	0	4812	1495	6307	
Total Runoff	584	4812	1495	6891	
Total Outputs	2930	5065	1573	9569	
Difference (Inputs - Outputs)	0	0	0	0	

Note: Highlighted cells are input cells.

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Post-Development Water Balance (With Infiltration)

Catchment Designation	Site				
	Grassed	Paved	Building (w. Infil.)	Total	
Area	3141	5430	1686	10257	
Pervious Area	3141	0	0	3141	
Impervious Area	0	5430	1686	7116	
Infiltration Factors					
Topography Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Rolling Land)
Soil Infiltration Factor	0.2	0	0		(From MOE Table 3.1 for Medium combinations of clay and loam)
Land Cover Infiltration Factor	0.1	0	0		
MOE Infiltration Factor	0.5	0	0		
Actual Infiltration Factor	0.5	0	0		
Run-Off Coeffiecient	0.5	1	1		
Runoff from Impervious Surfaces	0	0.95	0.95		
Inputs (per Unit Area)					
Precipitation	932.9	932.9	932.9	932.9	(Precipitation values from Environment Canada)
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	932.9	932.9	932.9	932.9	
Outputs (per Unit Area)					
Precipitation Surplus	371.9	886.3	886.3	728.8	
Net Surplus	371.9	886.3	886.3	728.8	
Evapotranspiration	561.0	46.6	46.6	204.1	
Infiltration	186.0	0.0	0.0	56.9	
Rooftop Infiltration	0.0	0.0	**461.5**	75.9	Depth of rainfall over the rooftop required to be infiltrated to achieve water balance.
Total Infiltration	186.0	0.0	461.5	132.8	
Runoff Pervious Areas	186.0	0.0	0.0	56.9	
Runoff Impervious Areas	0.0	886.3	424.8	539.0	
Total Runoff	186.0	886.3	424.8	595.9	
Total Outputs	932.9	932.9	932.9	932.9	
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0	
Inputs (Volumes)					
Precipitation	2930	5065	1573	9569	
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	2930	5065	1573	9569	
Outputs (Volumes)					
Precipitation Surplus	1168	4812	1495	7475	
Net Surplus	1168	4812	1495	7475	
Evapotranspiration	1762	253	79	2094	
Infiltration	584	0	0	584	
Rooftop Infiltration	0	0	778	778	
Total Infiltration	584	0	778	1362	
Runoff Pervious Areas	584	0	0	584	
Runoff Impervious Areas	0	4812	716	5528	
Total Runoff	584	4812	716	6112	
Total Outputs	2930	5065	1573	9569	
Difference (Inputs - Outputs)	0	0	0	0	

Note: Highlighted cells are input cells.

County of Simcoe Affordable Housing, Bradford
Water Balance Calculations

Annual Rainfall Depth Required:

Required Rainfall Depth	=	461.5	mm	(From Post-Development Water Balance (w. Infiltration))

Find Percent of Annual Rainfall that Req'd Rainfall Depth represents:

Annual Rainfall for Study Area	=	932.9	mm
% Annual Rainfall	=	461.5 / 932.9	mm / mm
	=	49%	

From MOE Figure C-2, 49% of annual rainfall occurs for storm events of 4 mm or less.

Find storage volume required for rainfall events of 4 mm to rooftop infiltration gallery:

Roof Top Area	=	1,686	m^2		
Rainfall Depth	=	4	mm		
Storage Volume Required	=	A		x	D
	=	1,686		x	4
	=	7	m^3		

It is proposed to provide storage volume for the 25 mm storm in the rooftop infiltration gallery:

Roof Top Area	=	1,686	m^2		
Rainfall Depth	=	25	mm		
Storage Volume Required	=	A		x	D
	=	1,686		x	25
	=	42	m^3		

Minimum infiltration volume to achieve 80% TSS Removal as per MECP Table 3.2 is as follows:

Design Area Total	=	0.17	ha		
Total Imperviousness	=	100%			
Storage Volume	=	45.0	m^3/ha		(Enhanced 80% long-term S.S. removal)
Storage Volume Required	=	0.17		x	45.0
	=	7.6	m^3		
Storage Volume Provided	=	42	m^3		

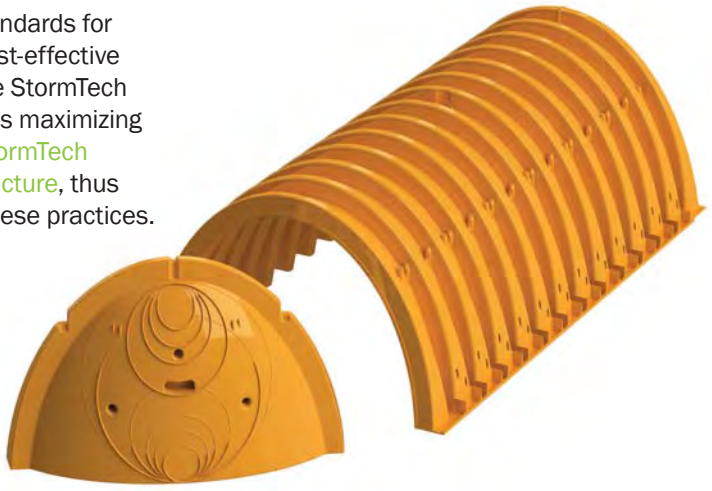
Therefore, the water balance is achieved.

Appendix F

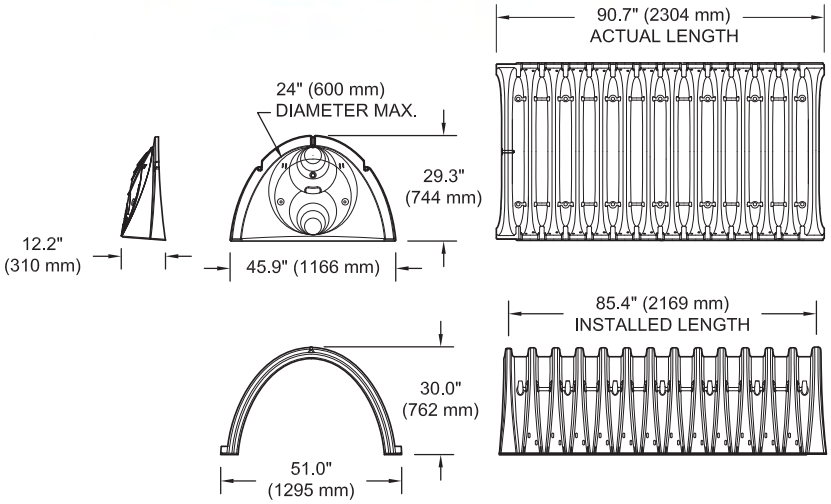
StormTech Underground Storage Chamber Information

STORMTECH SC-740 CHAMBER

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for private (commercial) and public applications. StormTech chambers can also be used in conjunction with Green Infrastructure, thus enhancing the performance and extending the service life of these practices.



STORMTECH SC-740 CHAMBER
(not to scale)



Nominal Chamber Specifications

Size (L x W x H)
85.4" x 51" x 30"
2,170 mm x 1,295 mm x 762 mm

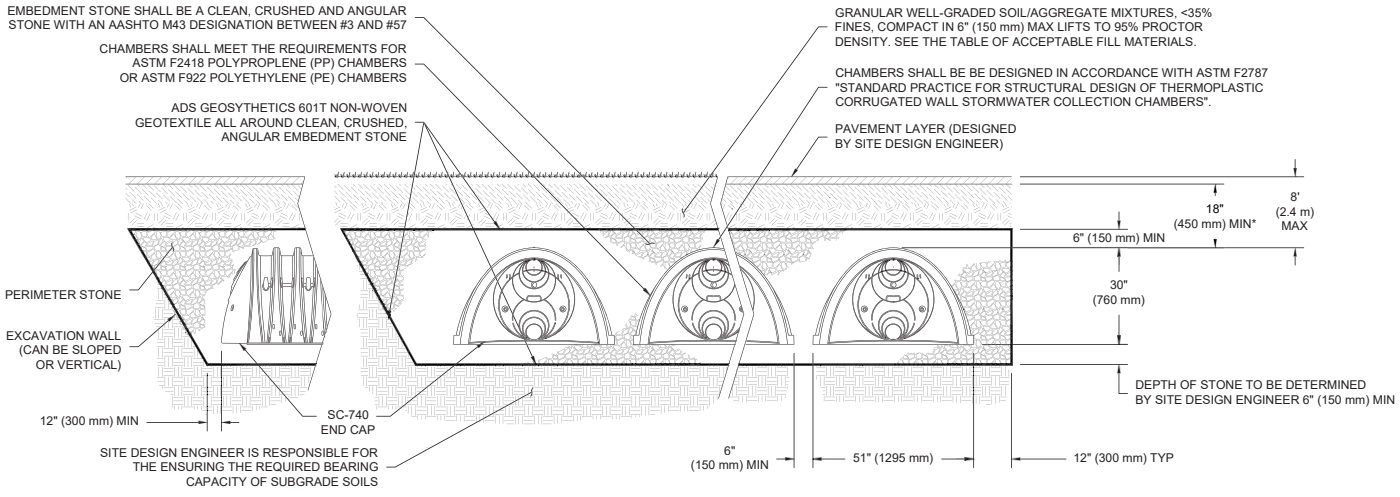
Chamber Storage
45.9 ft³ (1.30 m³)

Min. Installed Storage*
74.9 ft³ (2.12 m³)

Weight
74.0 lbs (33.6 kg)

Shipping
30 chambers/pallet
60 end caps/pallet
12 pallets/truck

*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 24" (600 mm).

SC-740 CUMULATIVE STORAGE VOLUMES PER CHAMBER

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under Chambers.

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	↑	45.90 (1.300)	74.90 (2.121)
41 (1041)		45.90 (1.300)	73.77 (2.089)
40 (1016)	Stone	45.90 (1.300)	72.64 (2.057)
39 (991)	Cover	45.90 (1.300)	71.52 (2.025)
38 (965)		45.90 (1.300)	70.39 (1.993)
37 (940)	↓	45.90 (1.300)	69.26 (1.961)
36 (914)		45.90 (1.300)	68.14 (1.929)
35 (889)		45.85 (1.298)	66.98 (1.897)
34 (864)		45.69 (1.294)	65.75 (1.862)
33 (838)		45.41 (1.286)	64.46 (1.825)
32 (813)		44.81 (1.269)	62.97 (1.783)
31 (787)		44.01 (1.246)	61.36 (1.737)
30 (762)		43.06 (1.219)	59.66 (1.689)
29 (737)		41.98 (1.189)	57.89 (1.639)
28 (711)		40.80 (1.155)	56.05 (1.587)
27 (686)		39.54 (1.120)	54.17 (1.534)
26 (660)		38.18 (1.081)	52.23 (1.479)
25 (635)		36.74 (1.040)	50.23 (1.422)
24 (610)		35.22 (0.977)	48.19 (1.365)
23 (584)		33.64 (0.953)	46.11 (1.306)
22 (559)		31.99 (0.906)	44.00 (1.246)
21 (533)		30.29 (0.858)	1.85 (1.185)
20 (508)		28.54 (0.808)	39.67 (1.123)
19 (483)		26.74 (0.757)	37.47 (1.061)
18 (457)		24.89 (0.705)	35.23 (0.997)
17 (432)		23.00 (0.651)	32.96 (0.939)
16 (406)		21.06 (0.596)	30.68 (0.869)
15 (381)		19.09 (0.541)	28.36 (0.803)
14 (356)		17.08 (0.484)	26.03 (0.737)
13 (330)		15.04 (0.426)	23.68 (0.670)
12 (305)		12.97 (0.367)	21.31 (0.608)
11 (279)		10.87 (0.309)	18.92 (0.535)
10 (254)		8.74 (0.247)	16.51 (0.468)
9 (229)		6.58 (0.186)	14.09 (0.399)
8 (203)		4.41 (0.125)	11.66 (0.330)
7 (178)		2.21 (0.063)	9.21 (0.264)
6 (152)	↑	0 (0)	6.76 (0.191)
5 (127)		0 (0)	5.63 (0.160)
4 (102)	Stone	0 (0)	4.51 (0.128)
3 (76)	Foundation	0 (0)	3.38 (0.096)
2 (51)		0 (0)	2.25 (0.064)
1 (25)	↓	0 (0)	1.13 (0.032)

Note: Add 1.13 ft³ (0.032 m³) of storage for each additional inch (25 mm) of stone foundation.

STORAGE VOLUME PER CHAMBER FT³ (M³)

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-740 Chamber	45.9 (1.3)	74.9 (2.1)	81.7 (2.3)	88.4 (2.5)

Note: Assumes 6" (150 mm) stone above chambers, 6" (150 mm) row spacing and 40% stone porosity.

AMOUNT OF STONE PER CHAMBER

ENGLISH TONS (yds³)	Stone Foundation Depth		
	6"	12"	16"
SC-740	3.8 (2.8)	4.6 (3.3)	5.5 (3.9)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
SC-740	3,450 (2.1)	4,170 (2.5)	4,490 (3.0)

Note: Assumes 6" (150 mm) of stone above and between chambers.

VOLUME EXCAVATION PER CHAMBER YD³ (M³)

	Stone Foundation Depth		
	6 (150)	12 (300)	18 (450)
SC-740	5.5 (4.2)	6.2 (4.7)	6.8 (5.2)

Note: Assumes 6" (150 mm) of row separation and 18" (450 mm) of cover. The volume of excavation will vary as depth of cover increases.

Working on a project?
Visit us at www.stormtech.com
and utilize the StormTech Design Tool

For more information on the StormTech SC-740 Chamber and other ADS products, please contact our Customer Service Representatives at 1-800-821-6710

*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

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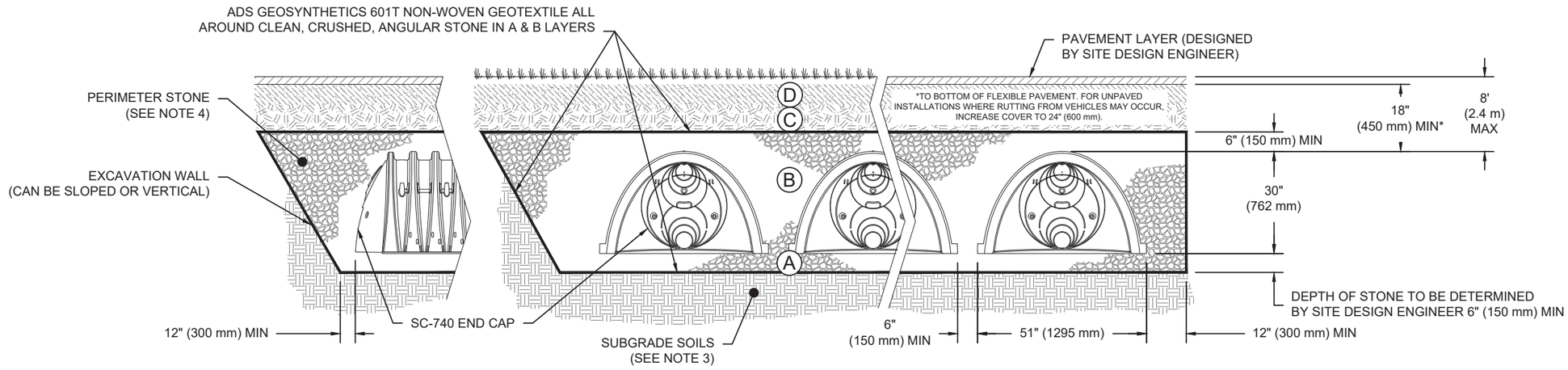
ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER.	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 18" (450 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 12" (300 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 6" (150 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS. ROLLER GROSS VEHICLE WEIGHT NOT TO EXCEED 12,000 lbs (53 kN). DYNAMIC FORCE NOT TO EXCEED 20,000 lbs (89 kN).
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 6" (150 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. SC-740 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 2".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

SC-740
STANDARD CROSS SECTION
DATE: 05-10-19 | DRAWN: KR | CHECKED: KR | PROJECT #:

DATE	DRWN	CHKD	DESCRIPTION

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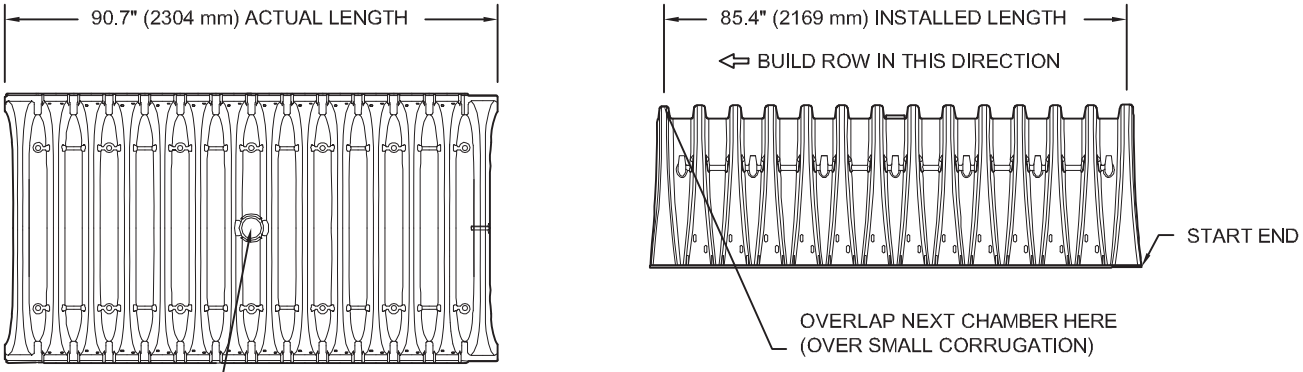
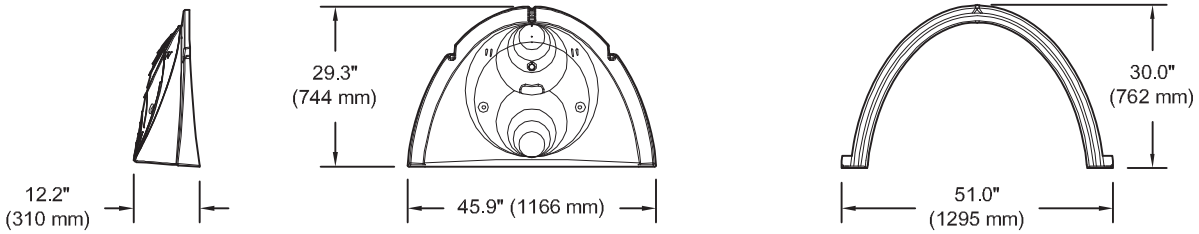
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SC-740 TECHNICAL SPECIFICATION

NTS

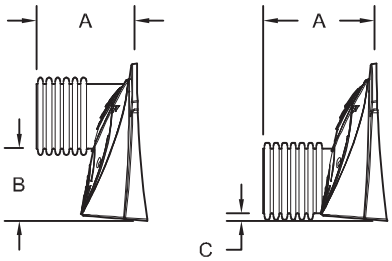




NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m³)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m³)
WEIGHT	75.0 lbs.	(33.6 kg)

*ASSUMES 6" (152 mm) STONE ABOVE, BELOW, AND BETWEEN CHAMBERS



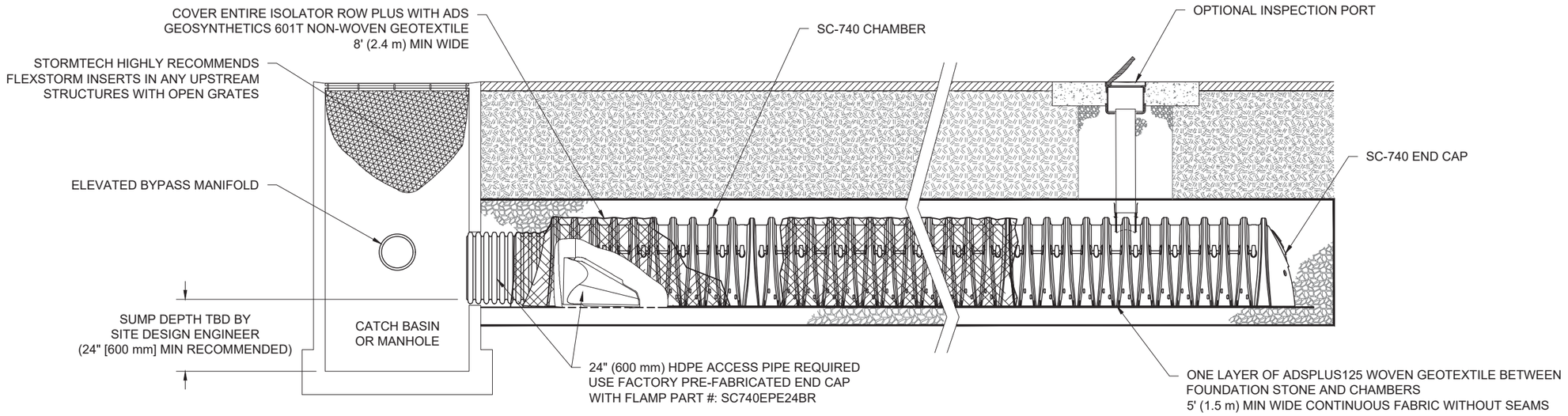
STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	—
SC740EPE06B / SC740EPE06BPC			—	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	—
SC740EPE08B / SC740EPE08BPC			—	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	—
SC740EPE10B / SC740EPE10BPC			—	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	—
SC740EPE12B / SC740EPE12BPC			—	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	—
SC740EPE15B / SC740EPE15BPC			—	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	—
SC740EPE18B / SC740EPE18BPC			—	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	—	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL



SC-740 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

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

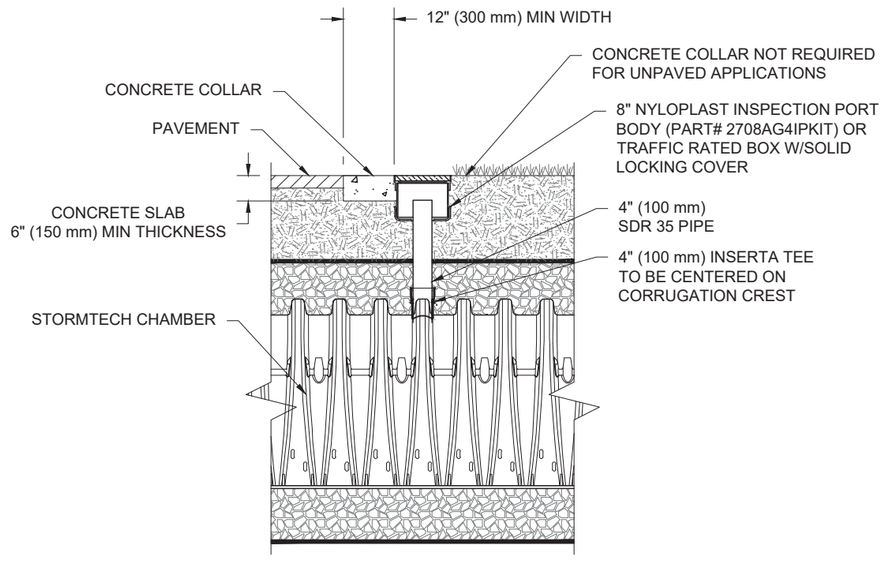
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

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

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

NOTES

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



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION CREST.

4" PVC INSPECTION PORT DETAIL (SC SERIES CHAMBER)
NTS

SC-740
ISOLATOR ROW PLUS DETAILS
DATE: 08/26/20 DRAWN: ALI
PROJECT #: ---- CHECKED: ALI

DATE	DRWN	CHKD	DESCRIPTION

StormTech
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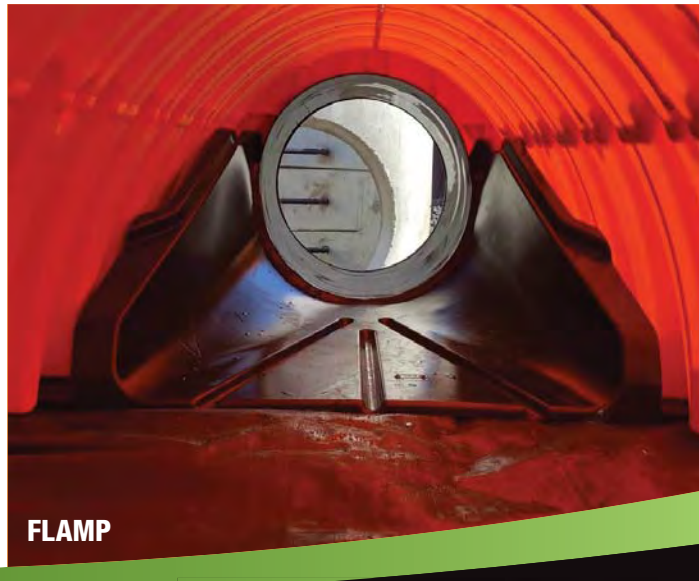
Isolator® Row PLUS O&M Manual


SC-740


MC-3500


FLAMP

THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS®

ADS®

THE ISOLATOR® ROW PLUS

INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row PLUS is a technique to inexpensively enhance Total Suspended Solids (TSS) and Total Phosphorus (TP) removal with easy access for inspection and maintenance.

THE ISOLATOR ROW PLUS

The Isolator Row PLUS is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row PLUS and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row PLUS protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row PLUS chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row PLUS is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole not only provides access to the Isolator Row PLUS but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row PLUS bypass through a manifold to the other chambers. This is achieved with either an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row PLUS row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row PLUS. After Stormwater flows through the Isolator Row PLUS and into the rest of the StormTech chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

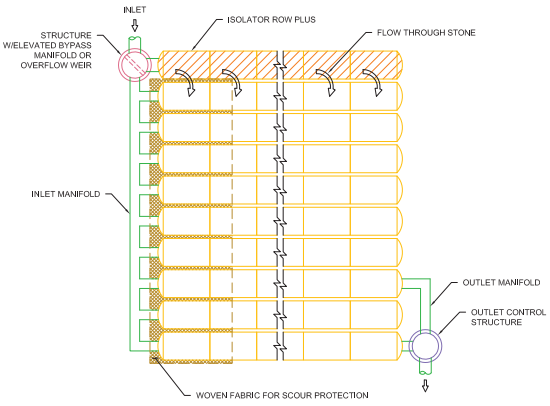
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus that is attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance over time by enhancing outflow of solid debris that would otherwise collect at an end of the chamber. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row PLUS may be part of a treatment train system. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row PLUS is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row PLUS.

Looking down the Isolator Row PLUS from the manhole opening, ADS PLUS Fabric is shown between the chamber and stone base.

StormTech Isolator Row PLUS with Overflow Spillway (not to scale)



ISOLATOR ROW PLUS INSPECTION/MAINTENANCE

INSPECTION

The frequency of inspection and maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row PLUS should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row PLUS incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row PLUS, clean-out should be performed.

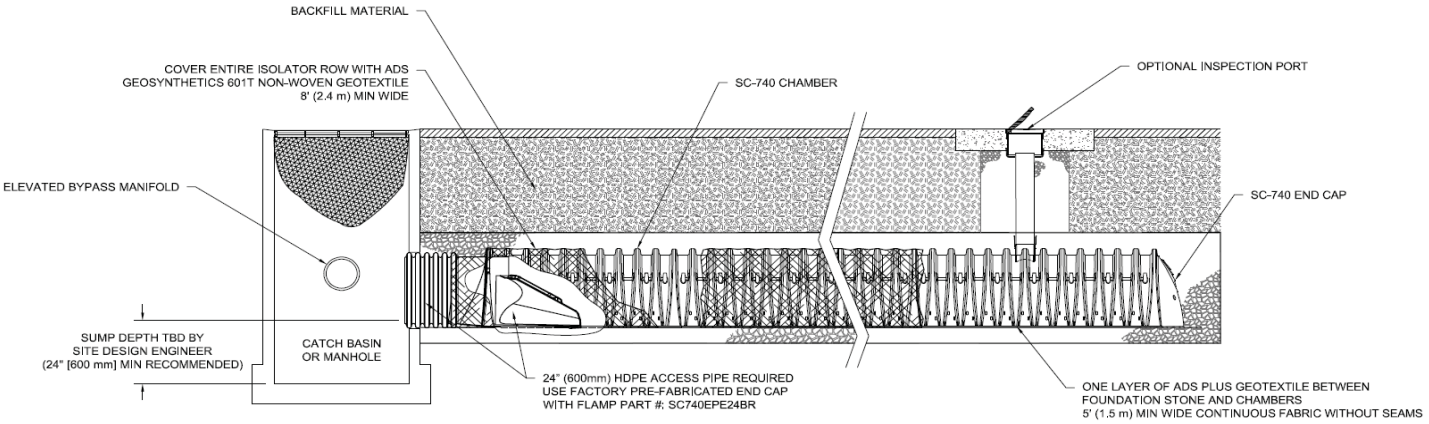
MAINTENANCE

The Isolator Row PLUS was designed to reduce the cost of periodic maintenance. By “isolating” sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row PLUS while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45” are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row PLUS up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Row PLUS that have ADS PLUS Fabric (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row PLUS (not to scale)

Note: Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-4500 chamber models and is not required over the entire Isolator Row PLUS.



ISOLATOR ROW PLUS STEP BY STEP MAINTENANCE PROCEDURES

STEP 1

Inspect Isolator Row PLUS for sediment.

A) Inspection ports (if present)
   i. Remove lid from floor box frame
   ii. Remove cap from inspection riser
   iii. Using a flashlight and stadia rod,measure depth of sediment and record results on maintenance log.
   iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.

B) All Isolator Row PLUS
   i. Remove cover from manhole at upstream end of Isolator Row PLUS
   ii. Using a flashlight, inspect down Isolator Row PLUS through outlet pipe
      1. Mirrors on poles or cameras may be used to avoid a confined space entry
      2. Follow OSHA regulations for confined space entry if entering manhole
   iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2. If not, proceed to Step 3.

STEP 2

Clean out Isolator Row PLUS using the JetVac process.

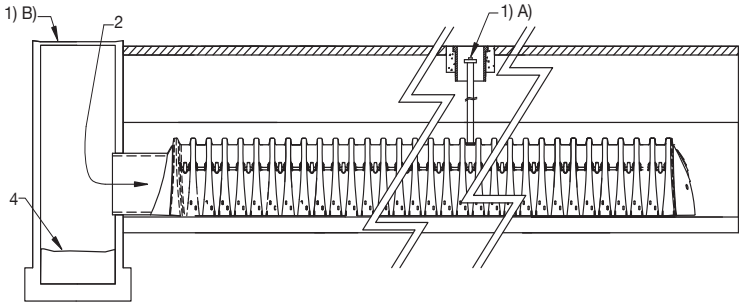
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

STEP 3

Replace all caps, lids and covers, record observations and actions.

STEP 4

Inspect & clean catch basins and manholes upstream of the StormTech system.



SAMPLE MAINTENANCE LOG

Date	Stadia Rod Readings		Sediment Depth (1)–(2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/11	6.3 ft	none		New installation. Fixed point is CI frame at grade	DJM
9/24/11		6.2	0.1 ft	Some grit felt	SM
6/20/13		5.8	0.5 ft	Mucky feel, debris visible in manhole and in Isolator Row PLUS, maintenance due	NV
7/7/13	6.3 ft		0	System jetted and vacuumed	DJM

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SC-310/SC-740/DC-780

StormTech Construction Guide

REQUIRED MATERIALS AND EQUIPMENT LIST

- Acceptable fill materials per Table 1
- ADS Plus and non-woven geotextile fabrics
- StormTech solid end caps and pre-cored end caps
- StormTech chambers
- StormTech manifolds and fittings

IMPORTANT NOTES:

A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.

B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

C. Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation

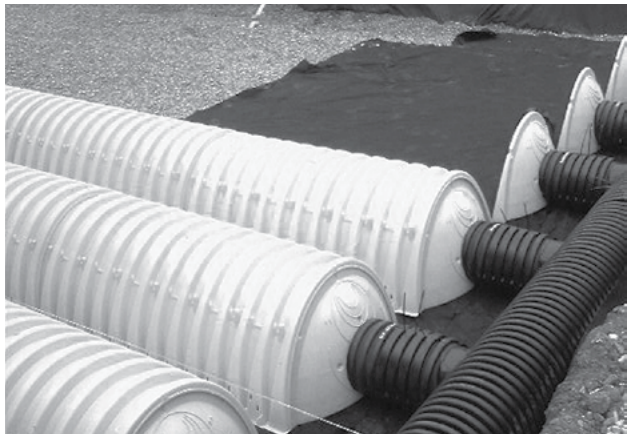
Excavate bed and prepare subgrade per engineer's plans.

Place non-woven geotextile over prepared soils and up excavation walls. Install underdrains if required.

Place clean, crushed, angular stone foundation 6" (150 mm) min. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

Install manifolds and lay out ADS PLUS fabric at inlet rows [min. 12.5 ft (3.8 m)] at each inlet end cap. Place a continuous piece along entire length of Isolator® PLUS Row(s).



Align the first chamber and end cap of each row with inlet pipes. Contractor may choose to postpone stone placement around end chambers and leave ends of rows open for easy inspection of chambers during the backfill process.

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between rows.

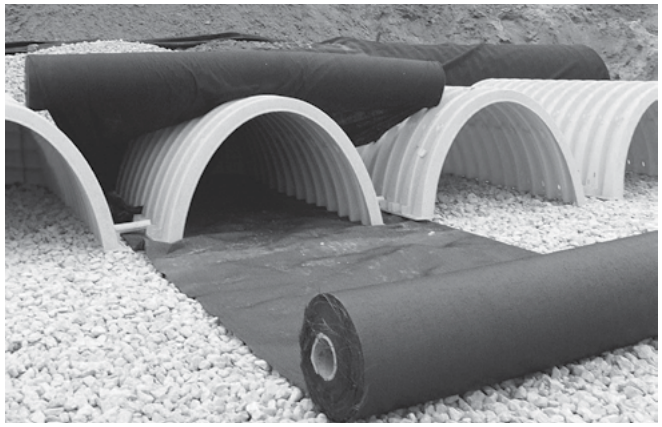
Attaching the End Caps

Lift the end of the chamber a few inches off the ground. With the curved face of the end cap facing outward, place the end cap into the chamber’s end corrugation.

Prefabricated End Caps

24” (600 mm) inlets are the maximum size that can fit into a SC-740/DC-780 end cap and must be prefabricated with a 24” (600 mm) pipe stub. SC-310 chambers with a 12” (300 mm) inlet pipe must use a prefabricated end cap with a 12” (300 mm) pipe stub. When used on an Isolator Row PLUS, these end caps will contain a welded FLAMP (flared end ramp) that will lay on top of the ADS PLUS fabric (shown above)

Isolator Row PLUS



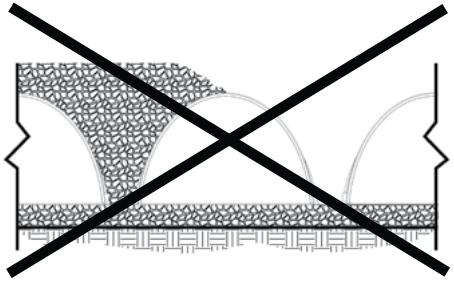
Place a continuous layer of ADS PLUS fabric between the foundation stone and the Isolator Row PLUS chambers, making sure the fabric lays flat and extends the entire width of the chamber feet. Drape a strip of ADS non-woven geotextile over the row of chambers (not required over DC-780). This is the same type of non-woven geotextile used as a separation layer around the angular stone of the StormTech system.

Initial Anchoring of Chambers – Embedment Stone

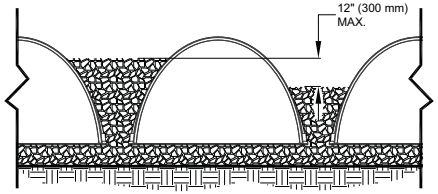
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers – Embedment Stone

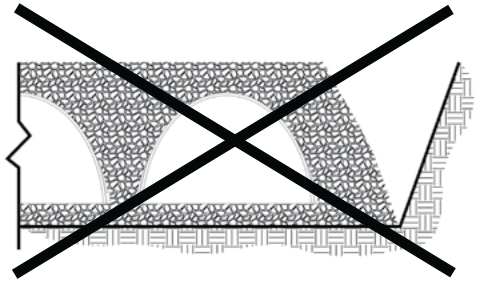


UNEVEN BACKFILL

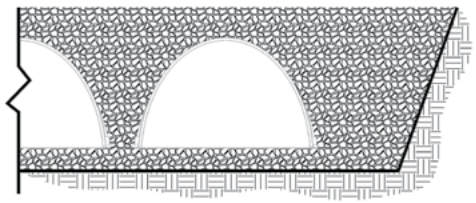


EVEN BACKFILL

Backfill chambers evenly. Stone column height should never differ by more than 12” (300 mm) between adjacent chamber rows or between chamber rows and perimeter.



PERIMETER NOT BACKFILLED



PERIMETER FULLY BACKFILLED

Perimeter stone must be brought up evenly with chamber rows. Perimeter must be fully backfilled, with stone extended horizontally to the excavation wall.

Backfill - Embedment Stone & Cover Stone

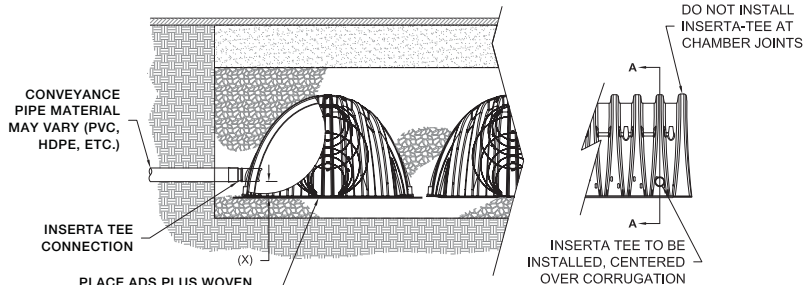
Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. **Only after chambers have been backfilled to top of chamber and with a minimum 6" (150 mm) of cover stone on top of chambers can small dozers be used over the chambers for backfilling remaining cover stone.**

Small dozers and skid loaders may be used to finish grading stone backfill in accordance with ground pressure limits in Table 2. They must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends that the contractor inspect chambers before placing final backfill. Any chambers damaged by construction shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24" (600 mm) min. where edges meet. Compact each lift of backfill as specified in the site design engineer's drawings. Roller travel parallel with rows.

Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
SC-310	6" (150 mm)	4" (100 mm)
SC-740	10" (250 mm)	4" (100 mm)
DC-780	10" (250 mm)	4" (100 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 36, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON.		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

StormTech Isolator Row PLUS Detail

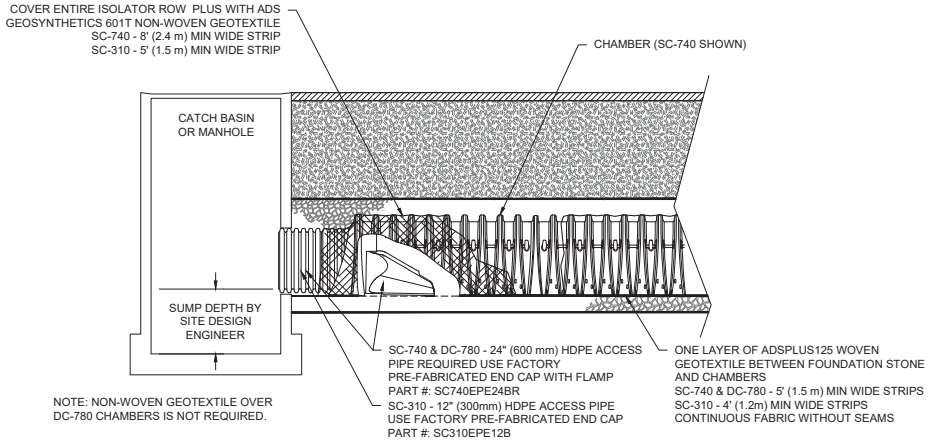


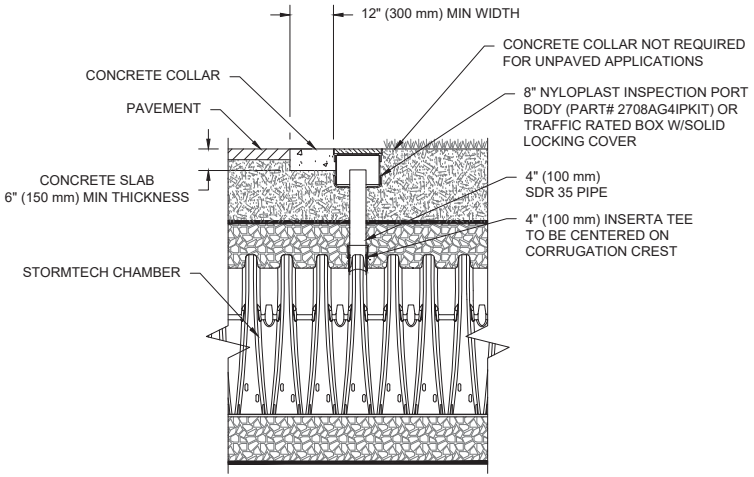
Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 18" (450 mm) above the top of the chamber. Note that pavement subbase may be part of the 'C' layer.	Granular well-graded soil/ aggregate mixtures, <35% fines or processed aggregate. Most pavement subbase materials can be used in lieu of this layer.	AASHTO M45 A-1, A-2-4, A-3 or AASHTO M431 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	Begin compaction after min. 12" (300 mm) of material over the chambers is reached. Compact additional layers in 6" (150 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials. Roller gross vehicle weight not to exceed 12,000 lbs (53 kN). Dynamic force not to exceed 20,000 lbs (89 kN)
(B) **Embedment Stone:** Embedment Stone surrounding chambers from the foundation stone to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	No compaction required.
(A) **Foundation Stone:** Foundation Stone below the chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	Place and compact in 6" (150 mm) lifts using two full coverages with a vibratory compactor.[2,3]

PLEASE NOTE:

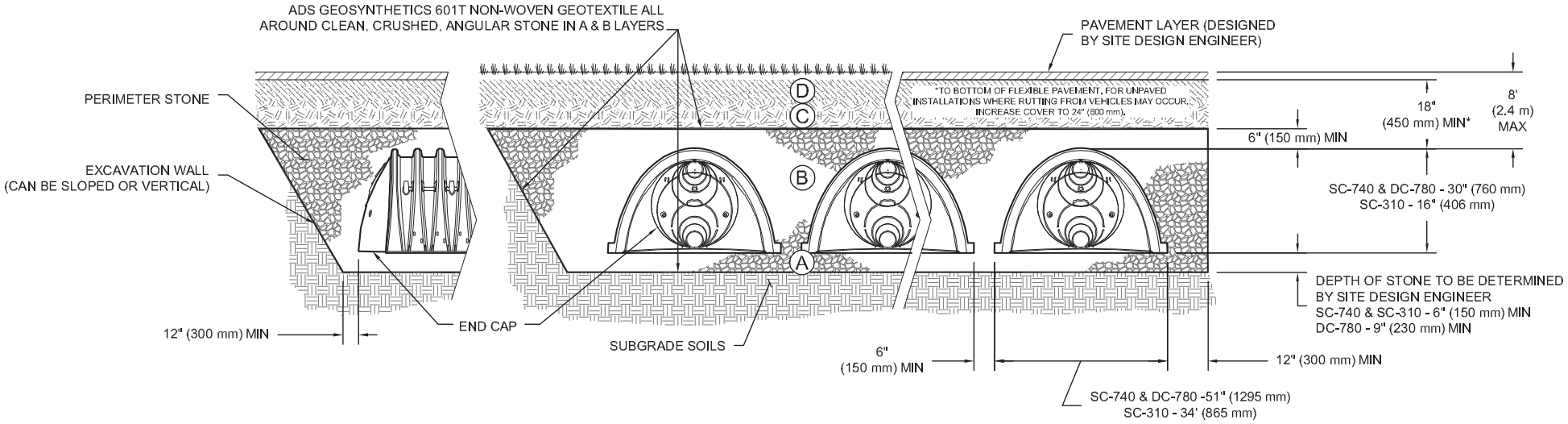
1. ***The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".***
2. ***StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.***
3. ***Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.***

Figure 1- Inspection Port Detail



NOTE:
INSPECTION PORTS MAY BE CONNECTED THROUGH ANY CHAMBER CORRUGATION CREST.

Figure 2 - Fill Material Locations



NOTES:

1. ***36" (900 mm) of stabilized cover materials over the chambers is required for full dump truck travel and dumping.***
2. ***During paving operations, dump truck axle loads on 18" (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.***
3. ***Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.***
4. ***Mini-excavators (< 8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.***
5. ***Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.***
6. ***Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.***

Table 2 - Maximum Allowable Construction Vehicle Loads[5]

Material Location	Fill Depth over Chambers in. [mm]	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs [kN]	Max Wheel Load for Loaders lbs [kN]	Track Width in. [mm]	Max Ground Pressure psf [kPa]	Max Drum Weight or Dynamic Force lbs [kN]
Ⓓ **Final Fill Material**	36" [900] Compacted	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	3420 [164] 2350 [113] 1850 [89] 1510 [72] 1310 [63]	38,000 [169]
Ⓒ **Initial Fill Material**	24" [600] Compacted	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2480 [119] 1770 [85] 1430 [68] 1210 [58] 1070 [51]	20,000 [89]
	24" [600] Loose/Dumped	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2245 [107] 1625 [78] 1325 [63] 1135 [54] 1010 [48]	20,000 [89] Roller gross vehicle weight not to exceed 12,000 lbs. [53 kN]
	18" [450]	32,000 [142]	16,000 [71]	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	2010 [96] 1480 [71] 1220 [58] 1060 [51] 950 [45]	20,000 [89] Roller gross vehicle weight not to exceed 12,000 lbs. [53 kN]
Ⓑ **Embedment Stone**	12" [300]	16,000 [71]	NOT ALLOWED	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	1540 [74] 1190 [57] 1010 [48] 910 [43] 840 [40]	20,000 [89] Roller gross vehicle weight not to exceed 12,000 lbs. [53 kN]
	6" [150]	8,000 [35]	NOT ALLOWED	12" [305] 18" [457] 24" [610] 30" [762] 36" [914]	1070 [51] 900 [43] 800 [38] 760 [36] 720 [34]	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ **Final Fill Material**	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows until 36" (900mm) compacted cover is reached.[4]	Roller travel parallel to rows only until 36" (900 mm) compacted cover is reached.
Ⓒ **Initial Fill Material**	Excavator positioned off bed recommended. Small excavator allowed over chambers. Small dozer allowed.	Asphalt can be dumped into paver when compacted pavement subbase reaches 18" (450 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 6" (150 mm) stone under tracks at all times. Equipment must push parallel to rows at all times.	Use dynamic force of roller only after compacted fill depth reaches 12" (300 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ **Embedment Stone**	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 6" (150 mm) cover stone is in place.	No rollers allowed.
Ⓐ **Foundation Stone**	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

17.0 Standard Limited Warranty

STANDARD LIMITED WARRANTY OF STORMTECH LLC ("STORMTECH"): PRODUCTS

(A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."

(B) The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty. StormTech's liability specifically excludes the cost of removal and/or installation of the Products.

(C) **THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**

(D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. **UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.**

(E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

(F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.

(G) **THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS; LABOR AND MATERIALS; OVERHEAD COSTS; OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR; ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS; FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING; OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS, WHETHER THE CLAIM IS BASED UPON CONTRACT, TORT, OR OTHER LEGAL THEORY.**

StormTech®
Detention • Retention • Water Quality
An ADS company
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888.892.2694 fax 866.328.8401
www.stormtech.com

ADS GEOSYNTHETICS 0601T NONWOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 6.0 oz (0601T) nonwoven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 6.0 oz (0601T) is a needle-punched nonwoven geotextile made of 100% polypropylene staple fibers, which are formed into a random network for dimensional stability. ADS Geosynthetics 6.0 oz (0601T) resists ultraviolet deterioration, rotting, biological degradation, naturally encountered basics and acids. Polypropylene is stable within a pH range of 2 to 13. ADS Geosynthetics 6.0 oz (0601T) conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	UNIT	M.A.R.V. (Minimum Average Roll Value)
Weight (Typical)	ASTM D 5261	oz/yd^2 (g/m^2)	6.0 (203)
Grab Tensile	ASTM D 4632	lbs (kN)	160 (0.711)
Grab Elongation	ASTM D 4632	%	50
Trapezoid Tear Strength	ASTM D 4533	lbs (kN)	60 (0.267)
CBR Puncture Resistance	ASTM D 6241	lbs (kN)	410 (1.82)
Permittivity*	ASTM D 4491	sec^{-1}	1.5
Water Flow*	ASTM D 4491	gpm/ft^2 ($l/min/m^2$)	110 (4480)
AOS*	ASTM D 4751	US Sieve (mm)	70 (0.212)
UV Resistance	ASTM D 4355	%/hrs	70/500

PACKAGING	
Roll Dimensions (W x L) – ft	12.5 x 360 / 15 x 300
Square Yards Per Roll	500
Estimated Roll Weight – lbs	195

* At the time of manufacturing. Handling may change these properties.

ADS GEOSYNTHETICS 315W WOVEN GEOTEXTILE

Scope

This specification describes ADS Geosynthetics 315W woven geotextile.

Filter Fabric Requirements

ADS Geosynthetics 315W is manufactured using high tenacity polypropylene yarns that are woven to form a dimensionally stable network, which allows the yarns to maintain their relative position. ADS Geosynthetics 315W resists ultraviolet deterioration, rotting and biological degradation and is inert to commonly encountered soil chemicals. ADS Geosynthetics 315W conforms to the physical property values listed below:

Filter Fabric Properties

PROPERTY	TEST METHOD	ENGLISH M.A.R.V. (Minimum Average Roll Value)	METRIC M.A.R.V. (Minimum Average Roll Value)
Tensile Strength (Grab)	ASTM D-4632	315 lbs	1400 N
Elongation	ASTM D-4632	15%	15%
CBR Puncture	ASTM D-6241	900 lbs	4005 N
Puncture	ASTM D-4833	150 lbs	667 N
Mullen Burst	ASTM D-3786	600 psi	4134 kPa
Trapezoidal Tear	ASTM D-4533	120 lbs	533 N
UV Resistance (at 500 hrs)	ASTM D-4355	70%	70%
Apparent Opening Size (AOS)*	ASTM D-4751	40 US Std. Sieve	0.425 mm
Permittivity	ASTM D-4491	.05 sec^{-1}	.05 sec^{-1}
Water Flow Rate	ASTM D-4491	4 gpm/ft^2	163 $l/min/m^2$
Roll Sizes		12.5' x 360' 15.0' x 300' 17.5' x 258'	3.81 m x 109.8 m 4.57 m x 91.5 m 5.33 m x 78.6 m

*Maximum average roll value.

Appendix G

Oil/Grit Separator Details & Maintenance Manual

CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

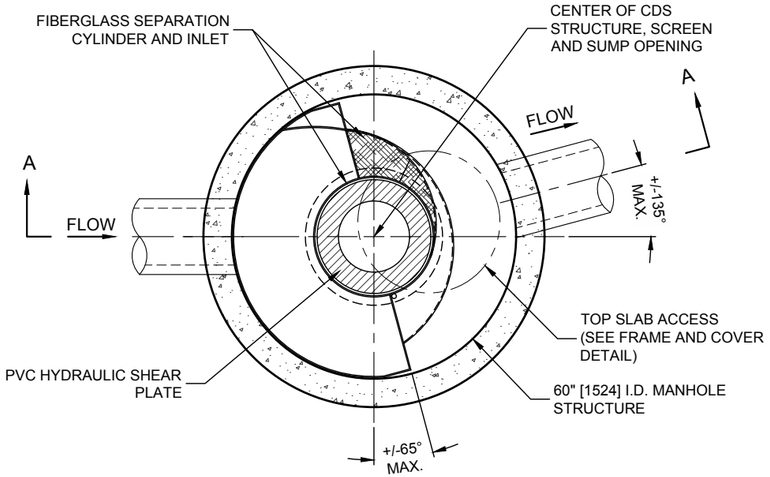
Area =	0.72	ha	**Upstream Storage:**			**Engineer:**	**Pearson Engineering**
C:	0.88		Storage	170	m^3	**Contact:**	T. Arkell
CDS Model:	CDS 5					**Date:**	15-Dec-21
Flowrate:	42.5	l/s					
IDF Data:	Newmarket					**Project:**	125 Simcoe Road
PSD:	ETV					**Location:**	Bradford, ON
						OGS ID:	OGS

Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	4.04	70.21	9688	9688	**100.00**	4.04	4.04	0.00	100.00
2-M	0.17	6.39	66.58	15296	15296	**99.75**	6.39	6.39	0.00	100.00
3-M	0.25	8.34	63.89	20014	20014	**98.17**	8.34	8.34	0.00	100.00
4-M	0.33	10.12	61.69	24344	24344	**95.04**	10.12	10.12	0.00	100.00
5-M	0.42	11.49	60.20	27731	27731	**90.91**	11.49	11.49	0.00	100.00
6-M	0.50	12.86	58.72	31117	31117	**86.47**	12.86	12.86	0.00	100.00
7-M	0.58	13.89	57.78	33693	33693	**82.01**	13.89	13.89	0.00	100.00
8-M	0.67	14.91	56.85	36269	36269	**77.67**	14.91	14.91	0.00	100.00
9-M	0.75	15.94	55.91	38845	38845	**73.64**	15.94	15.94	0.00	100.00
10-M	0.83	16.75	55.30	40902	40902	**69.90**	16.75	16.75	0.00	100.00
11-M	0.92	17.56	54.68	42959	42959	**66.40**	17.56	17.56	0.00	100.00
1-Yr	1	18.37	54.06	45016	45016	**63.21**	18.37	18.37	0.00	100.00
2-Yr	2	25.02	50.17	62393	62393	**39.35**	25.02	25.02	0.00	100.00
5-Yr	5	29.38	48.23	74158	74158	**18.13**	29.38	29.38	0.00	100.00
10-Yr	10	46.85	40.14	122485	125057	**9.52**	46.85	42.48	4.37	97.94
25-Yr	25	80.41	27.25	186213	251116	**3.92**	80.41	42.48	37.93	74.15
50-Yr	50	112.11	18.75	243471	440897	**1.98**	112.11	42.48	69.64	55.22
100-Yr	100	133.00	15.41	259141	553456	**1.00**	133.00	42.48	90.53	46.82
Average Annual TSS Removal Efficiency [%]:					**60**	Ave. Ann. T. Volume [%]:				**99**

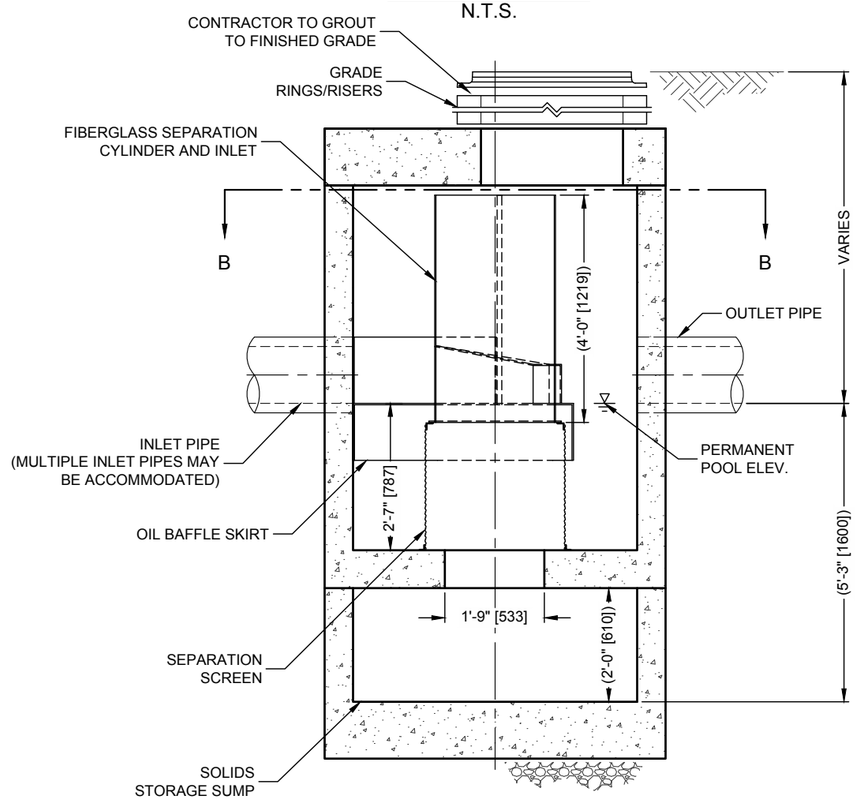
NOTE:
1) TSS Removal Rate Based on ETV Testing

ECHELON ENVIRONMENTAL

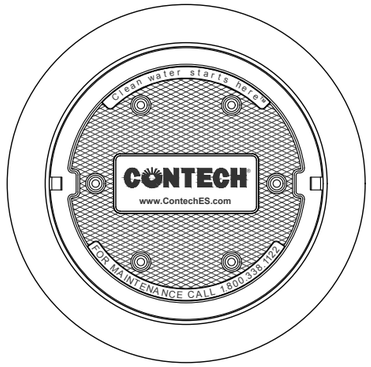
CDS TECHNOLOGIES



PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.



FRAME AND COVER
(DIAMETER VARIES)
N.T.S.

CDS-5-C DESIGN NOTES

THE STANDARD CDS-5-C CONFIGURATION IS SHOWN.

SITE SPECIFIC DATA REQUIREMENTS

STRUCTURE ID	
WATER QUALITY FLOW RATE (CFS OR L/s)	*
PEAK FLOW RATE (CFS OR L/s)	*
RETURN PERIOD OF PEAK FLOW (YRS)	*
SCREEN APERTURE (2400 OR 4700)	*

PIPE DATA:	I.E.	MATERIAL	DIAMETER
INLET PIPE 1	*	*	*
INLET PIPE 2	*	*	*
OUTLET PIPE	*	*	*

RIM ELEVATION	*

ANTI-FLOTATION BALLAST	WIDTH	HEIGHT
	*	*

NOTES/SPECIAL REQUIREMENTS:

* PER ENGINEER OF RECORD

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.ContechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION. CASTINGS SHALL MEET HS20 (AASHTO M 306) AND BE CAST WITH THE CONTECH LOGO.
6. IF REQUIRED, PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

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 CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

CDS-5-C
ONLINE CDS
STANDARD DETAIL

◆ Verification Statement ◆ Verification Statement ◆ Verification Statement ◆

VERIFICATION STATEMENT

GLOBE Performance Solutions

Verifies the performance of

Stormceptor® EF and EFO Oil-Grit Separators

Developed by Imbrium Systems, Inc.,
Whitby, Ontario, Canada

Registration: GPS-ETV_VR2020-11-15_Imbrium-SC

In accordance with

ISO 14034:2016

Environmental management —
Environmental technology verification (ETV)

John D. Wiebe, PhD
Executive Chairman
GLOBE Performance Solutions

November 15, 2020
Vancouver, BC, Canada

Verification Body
GLOBE Performance Solutions
404 – 999 Canada Place | Vancouver, B.C | Canada |V6C 3E2

Technology description and application

The Stormceptor® EF and EFO are treatment devices designed to remove oil, sediment, trash, debris, and pollutants attached to particulates from Stormwater and snowmelt runoff. The device takes the place of a conventional manhole within a storm drain system and offers design flexibility that works with various site constraints. The EFO is designed with a shorter bypass weir height, which accepts lower surface loading rate into the sump, thereby reducing re-entrainment of captured free floating light liquids.

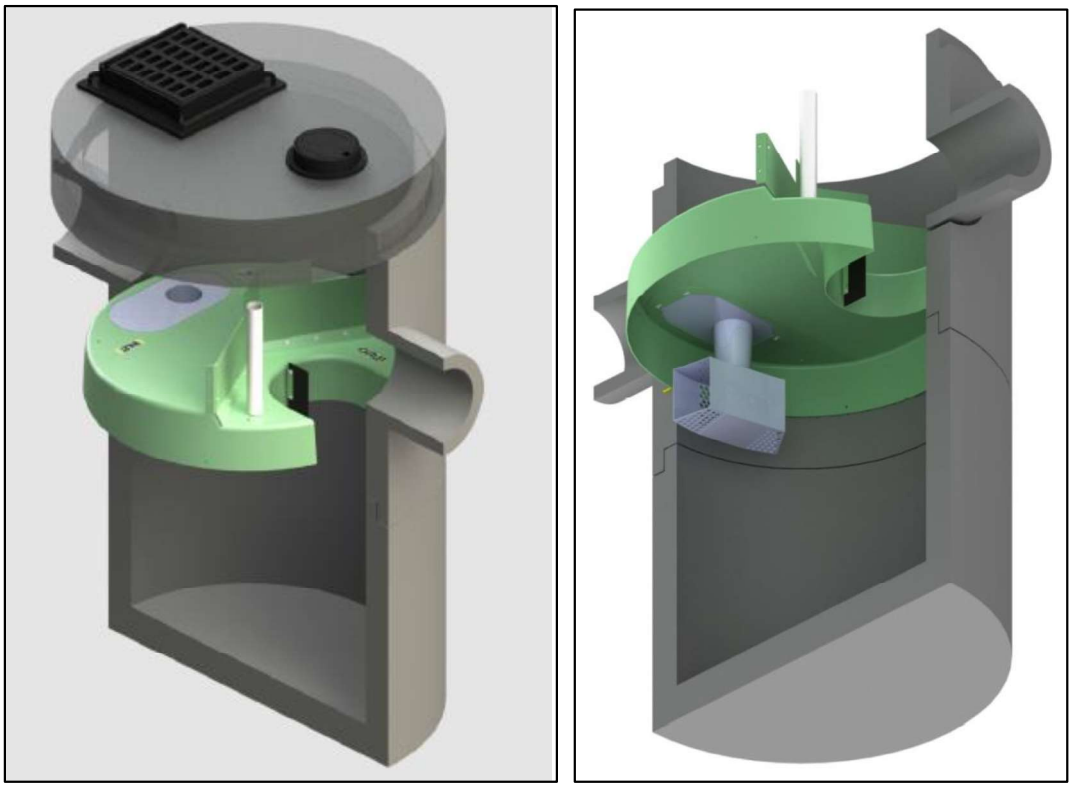


Figure 1. Graphic of typical inline Stormceptor® unit and core components.

Stormwater and snowmelt runoff enters the Stormceptor® EF/EFO's upper chamber through the inlet pipe(s) or a surface inlet grate. An insert divides the unit into lower and upper chambers and incorporates a weir to reduce influent velocity and separate influent (untreated) from effluent (treated) flows. Influent water ponds upstream of the insert's weir providing driving head for the water flowing downwards into the drop pipe where a vortex pulls the water into the lower chamber. The water diffuses at lower velocities in multiple directions through the drop pipe outlet openings. Oil and other floatables rise up and are trapped beneath the insert, while sediments undergo gravitational settling to the sump's bottom. Water from the sump can exit by flowing upward to the outlet riser onto the top side of the insert and downstream of the weir, where it discharges through the outlet pipe.

Maximum flow rate into the lower chamber is a function of weir height and drop pipe orifice diameter. The Stormceptor® EF and EFO are designed to allow a surface loading rate of 1135 L/min/m^2 (27.9 gal/min/ft^2) and 535 L/min/m^2 (13.1 gal/min/ft^2) into the lower chamber, respectively. When prescribed surface loading rates are exceeded, ponding water can overtop the weir height and bypass the lower treatment chamber, exiting directly through the outlet pipe. Hydraulic testing and scour testing demonstrate that the internal bypass effectively prevents scour at all bypass flow rates. Increasing the bypass flow rate does not increase the orifice-controlled flow rate into the lower treatment chamber where sediment is stored. This internal bypass feature allows for in-line installation, avoiding the cost of

additional bypass structures. During bypass, treatment continues in the lower chamber at the maximum flow rate. The Stormceptor® EFO's lower design surface loading rate is favorable for minimizing re-entrainment and washout of captured light liquids. Inspection of Stormceptor® EF and EFO devices is performed from grade by inserting a sediment probe through the outlet riser and an oil dipstick through the oil inspection pipe. The unit can be maintained by using a vacuum hose through the outlet riser.

Performance conditions

The data and results published in this Technology Fact Sheet were obtained from the testing program conducted on the Imbrium Systems Inc.'s Stormceptor® EF4 and EFO4 Oil-Grit Separators, in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014). The Procedure was prepared by the Toronto and Region Conservation Authority (TRCA) for Environment Canada's Environmental Technology Verification (ETV) Program. A copy of the Procedure may be accessed on the Canadian ETV website at www.etvcanada.ca.

Performance claim(s)

Capture test [a]:

During the capture test, the Stormceptor® EF4 OGS device, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 46, 44, and 49 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Stormceptor® EFO4, with a false floor set to 50% of the manufacturer's recommended maximum sediment storage depth and a constant influent test sediment concentration of 200 mg/L, removes 70, 64, 54, 48, 42, 40, and 34 percent of influent sediment by mass at surface loading rates of 40, 80, 200, 400, 600, 1000, and 1400 L/min/m^2, respectively.

Scour test [a]:

During the scour test, the Stormceptor® EF4 and Stormceptor® EFO4 OGS devices, with 10.2 cm (4 inches) of test sediment pre-loaded onto a false floor reaching 50% of the manufacturer's recommended maximum sediment storage depth, generate corrected effluent concentrations of 4.6, 0.7, 0, 0.2, and 0.4 mg/L at 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2, respectively.

Light liquid re-entrainment test[a]:

During the light liquid re-entrainment test, the Stormceptor® EFO4 OGS device with surrogate low-density polyethylene beads preloaded within the lower chamber oil collection zone, representing a floating light liquid volume equal to a depth of 50.8 mm over the sedimentation area, retained 100, 99.5, 99.8, 99.8, and 99.9 percent of loaded beads by mass during the 5-minute duration surface loading rates of 200, 800, 1400, 2000, and 2600 L/min/m^2.

[a] The claim can be applied to other units smaller or larger than the tested unit as long as the untested units meet the scaling rule specified in the Procedure for Laboratory of Testing of Oil Grit Separators (Version 3.0, June 2014)

Performance results

The test sediment consisted of ground silica (1 – 1000 micron) with a specific gravity of 2.65, uniformly mixed to meet the particle size distribution specified in the testing procedure. The *Procedure for Laboratory Testing of Oil Grit Separators* requires that the three sample average of the test sediment particle size distribution (PSD) meet the specified PSD percent less than values within a boundary threshold of 6%. The comparison of the average test sediment PSD to the CETV specified PSD in Figure 2 indicates that the test sediment used for the capture and scour tests met this condition.

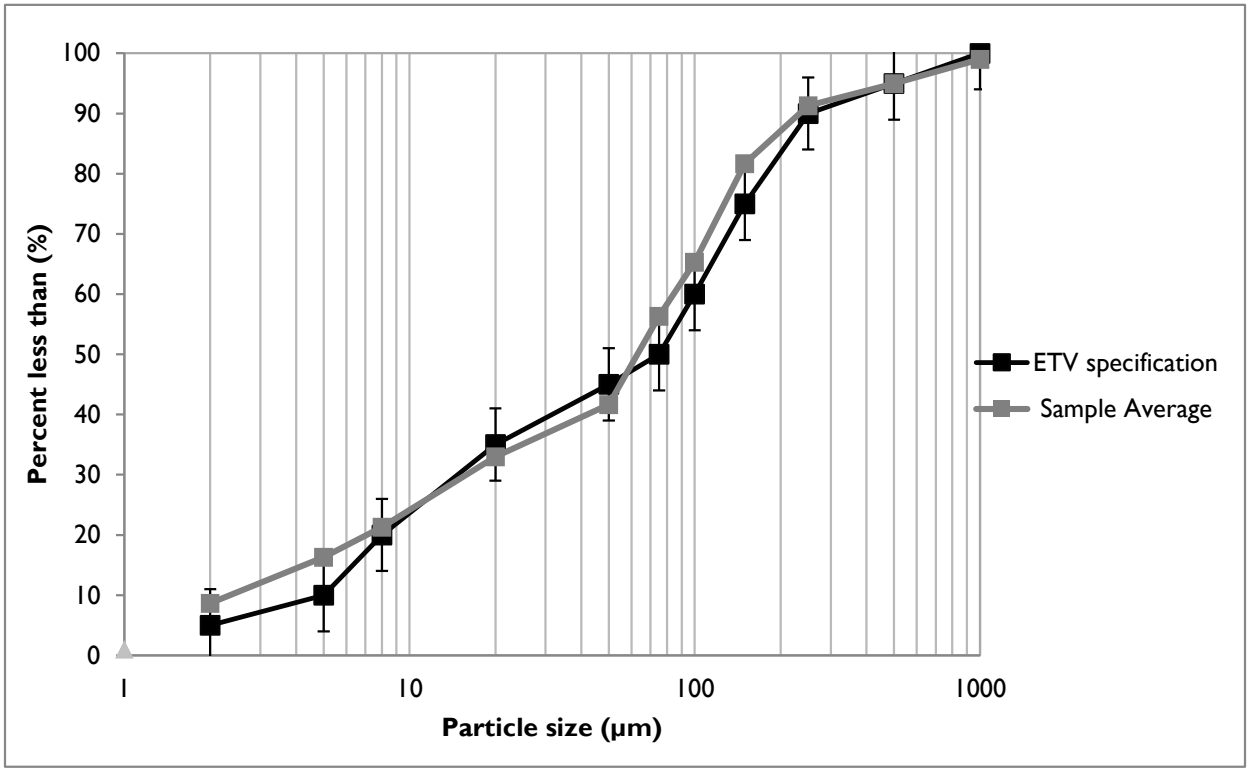


Figure 2. The three sample average particle size distribution (PSD) of the test sediment used for the capture and scour test compared to the specified PSD.

The capacity of the device to retain sediment was determined at seven surface loading rates using the modified mass balance method. This method involved measuring the mass and particle size distribution of the injected and retained sediment for each test run. Performance was evaluated with a false floor simulating the technology filled to 50% of the manufacturer's recommended maximum sediment storage depth. The test was carried out with clean water that maintained a sediment concentration below 20 mg/L. Based on these conditions, removal efficiencies for individual particle size classes and for the test sediment as a whole were determined for each of the tested surface loading rates (Table 1). Since the EF and EFO models are identical except for the weir height, which bypasses flows from the EFO model at a surface loading rate of 535 L/min/m^2 (13.1 gpm/ft^2), sediment capture tests at surface loading rates from 40 to 400 L/min/m^2 were only performed on the EF unit. Surface loading rates of 600, 1000, and 1400 L/min/m^2 were tested on both units separately. Results for the EFO model at these higher flow rates are presented in Table 2.

In some instances, the removal efficiencies were above 100% for certain particle size fractions. These discrepancies are not unique to any one test laboratory and may be attributed to errors relating to the blending of sediment, collection of representative samples for laboratory submission, and laboratory

analysis of PSD. Due to these errors, caution should be exercised in applying the removal efficiencies by particle size fraction for the purposes of sizing the tested device (see Bulletin # CETV 2016-11-0001). The results for "all particle sizes by mass balance" (see Table 1 and 2) are based on measurements of the total injected and retained sediment mass, and are therefore not subject to blending, sampling or PSD analysis errors.

Table 1. Removal efficiencies (%) of the EF4 at specified surface loading rates

Particle size fraction (µm)	**Surface loading rate (L/min/m²)**						
	40	80	200	400	600	1000	1400
>500	90	58	58	100*	86	72	100*
250 - 500	100*	100*	100	100*	100*	100*	100*
150 - 250	90	82	26	100*	100*	67	90
105 - 150	100*	100*	100*	100*	100*	100*	100
75 - 105	100*	92	74	82	77	68	76
53 - 75	Undefined [a]	56	100*	72	69	50	80
20 - 53	54	100*	54	33	36	40	31
8 - 20	67	52	25	21	17	20	20
5 – 8	33	29	11	12	9	7	19
<5	13	0	0	0	0	0	4
All particle sizes by mass balance	**70.4**	**63.8**	**53.9**	**47.5**	**46.0**	**43.7**	**49.0**

[a] An outlier in the feed sample sieve data resulted in a negative removal efficiency for this size fraction.
* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 101 and 171% (average 128%). See text and Bulletin # CETV 2016-11-0001 for more information.

Table 2. Removal efficiencies (%) of the EFO4 at surface loading rates above the bypass rate of 535 L/min/m²

Particle size fraction (µm)	**Surface loading rate (L/min/m²)**		
	600	1000	1400
>500	89	83	100*
250 - 500	90	100*	92
150 - 250	90	67	100*
105 - 150	85	92	77
75 - 105	80	71	65
53 - 75	60	31	36
20 - 53	33	43	23
8 - 20	17	23	15
5 – 8	10	3	3
<5	0	0	0
All particle sizes by mass balance	**41.7**	**39.7**	**34.2**

* Removal efficiencies were calculated to be above 100%. Calculated values ranged between 103 and 111% (average 107%). See text and Bulletin # CETV 2016-11-0001 for more information.

Figure 3 compares the particle size distribution (PSD) of the three sample average of the test sediment to the PSD of the sediment retained by the EF4 at each of the tested surface loading rates. Figure 4 shows the same graph for the EFO4 unit at surface loading rates above the bypass rate of 535 L/min/m².

As expected, the capture efficiency for fine particles in both units was generally found to decrease as surface loading rates increased.

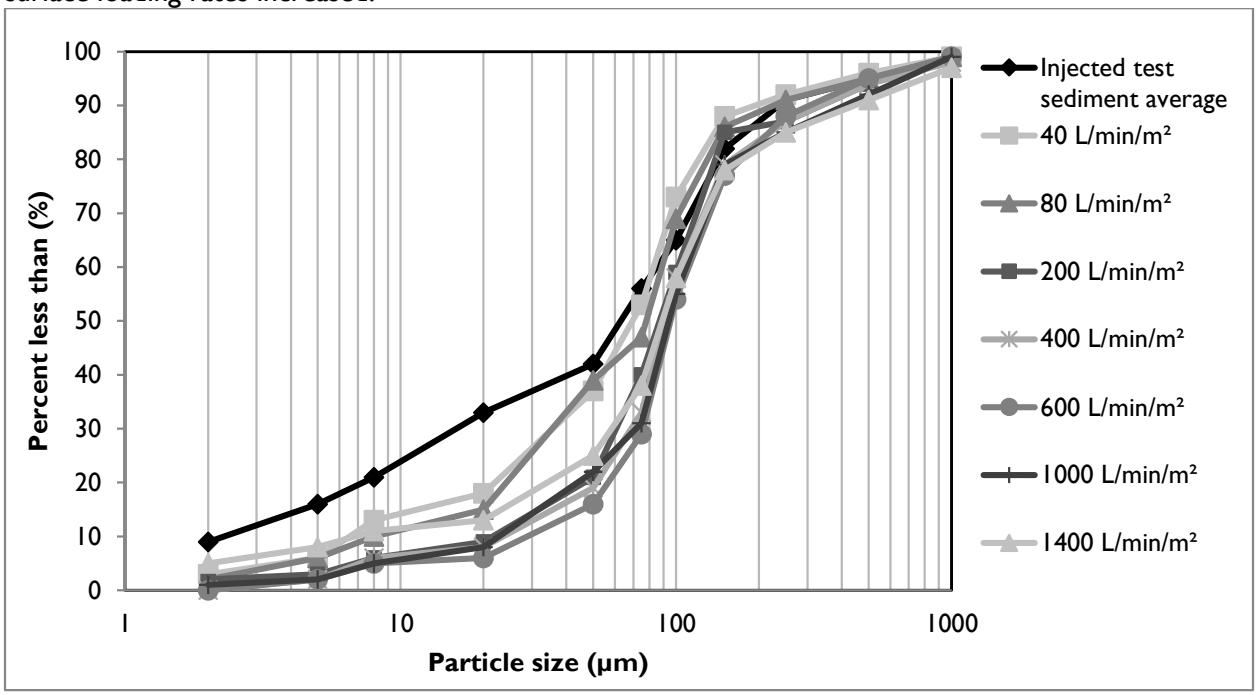


Figure 3. Particle size distribution of sediment retained in the EF4 in relation to the injected test sediment average.

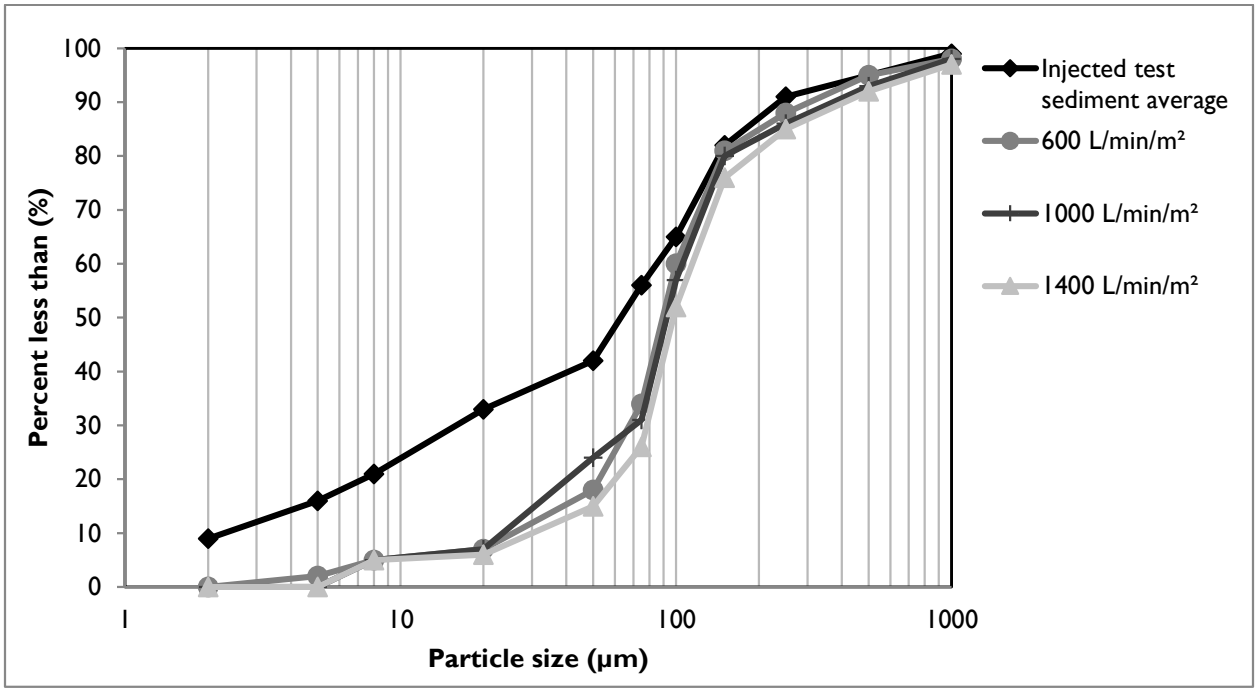


Figure 4. Particle size distribution of sediment retained in the EFO4 in relation to the injected test sediment average at surface loading rates above the bypass rate of 535 L/min/m^2

Table 4 shows the results of the sediment scour and re-suspension test for the EF4 unit. The EFO4 was not tested as it was reasonably assumed that scour rates would be lower given that flow bypass occurs at a lower surface loading rate. The scour test involved preloading 10.2 cm of fresh test sediment into

the sedimentation sump of the device. The sediment was placed on a false floor to mimic a device filled to 50% of the maximum recommended sediment storage depth. Clean water was run through the device at five surface loading rates over a 30 minute period. Each flow rate was maintained for 5 minutes with a one minute transition time between flow rates. Effluent samples were collected at one minute sampling intervals and analyzed for Suspended Sediment Concentration (SSC) and PSD by recognized methods. The effluent samples were subsequently adjusted based on the background concentration of the influent water. Typically, the smallest 5% of particles captured during the 40 L/min/m^2 sediment capture test is also used to adjust the concentration, as per the method described in Bulletin # CETV 2016-09-0001. However, since the composites of effluent concentrations were below the Reporting Detection Limit of the Laser Diffraction PSD methodology, this adjustment was not made. Results showed average adjusted effluent sediment concentrations below 5 mg/L at all tested surface loading rates.

It should be noted that the EF4 starts to internally bypass water at 1135 L/min/m^2, potentially resulting in the dilution of effluent concentrations, which would not normally occur under typical field conditions because the field influent concentration would contain a much higher sediment concentration than during the lab test. Recalculation of effluent concentrations to account for dilution at surface loading rates above the bypass rate showed sediment effluent concentrations to be below 1.6 mg/L.

Table 4. Scour test adjusted effluent sediment concentration.

Run	Surface loading rate (L/min/m^2)	Run time (min)	Background sample concentration (mg/L)	Adjusted effluent suspended sediment concentration (mg/L) [a]	Average (mg/L)
1	200	1:00	<RDL	11.9	4.6
		2:00		7.0	
		3:00		4.4	
		4:00		2.2	
		5:00		1.0	
		6:00		1.2	
2	800	7:00	<RDL	1.1	0.7
		8:00		0.9	
		9:00		0.6	
		10:00		1.4	
		11:00		0.1	
		12:00		0	
3	1400	13:00	<RDL	0	0
		14:00		0.1	
		15:00		0	
		16:00		0	
		17:00		0	
		18:00		0	
4	2000	19:00	1.2	0.2	0.2
		20:00		0	
		21:00		0	
		22:00		0.7	
		23:00		0	
		24:00		0.4	

5	2600	25:00	1.6	0.3	0.4
		26:00		0.4	
		27:00		0.7	
		28:00		0.4	
		29:00		0.2	
		30:00		0.4	

[a] The adjusted effluent suspended sediment concentration represents the actual measured effluent concentration minus the background concentration. For more information see Bulletin # CETV 2016-09-0001.

The results of the light liquid re-entrainment test used to evaluate the unit's capacity to prevent re-entrainment of light liquids are reported in Table 5. The test involved preloading 58.3 L (corresponding to a 5 cm depth over the collection sump area of 1.17m^2) of surrogate low-density polyethylene beads within the oil collection skirt and running clean water through the device continuously at five surface loading rates (200, 800, 1400, 2000, and 2600 L/min/m^2). Each flow rate was maintained for 5 minutes with approximately 1 minute transition time between flow rates. The effluent flow was screened to capture all re-entrained pellets throughout the test.

Table 5. Light liquid re-entrainment test results for the EFO4.

Surface Loading Rate (L/min/m2)	Time Stamp	Amount of Beads Re-entrained			
		Mass (g)	Volume (L)[a]	% of Pre-loaded Mass Re-entrained	% of Pre-loaded Mass Retained
200	62	0	0	0.00	100
800	247	168.45	0.3	0.52	99.48
1400	432	51.88	0.09	0.16	99.83
2000	617	55.54	0.1	0.17	99.84
2600	802	19.73	0.035	0.06	99.94
Total Re-entrained		295.60	0.525	0.91	--
Total Retained		32403	57.78	--	99.09
Total Loaded		32699	58.3	--	--

[a] Determined from bead bulk density of 0.56074 g/cm^3

Variances from testing Procedure

The following minor deviations from the *Procedure for Laboratory Testing of Oil-Grit Separators* (Version 3.0, June 2014) have been noted:

1. During the capture test, the 40 L/min/m^2 and 80 L/min/m^2 surface loading rates were evaluated over 3 and 2 days respectively due to the long duration needed to feed the required minimum of 11.3 kg of test sediment into the unit at these lower flow rates. Pumps were shut down at the end of each intermediate day, and turned on again the following morning. The target flow rate was re-established within 30 seconds of switching on the pump. This procedure may have allowed sediments to be captured that otherwise may have exited the unit if the test was continuous. On the basis of practical considerations, this variance was approved by the verifier prior to testing.

2. During the scour test, the coefficient of variation (COV) for the lowest flow rate tested (200 L/min/m^2) was 0.07, which exceeded the specified limit of 0.04 target specified in the OGS Procedure. A pump capable of attaining the highest flow rate of 3036 L/min had difficulty maintaining the lowest flow of 234 L/min but still remained within +/- 10% of the target flow and is viewed as having very little impact on the observed results. Similarly, for the light liquid re-entrainment test the COV for the flow rate of the 200 L/min/m^2 run was 0.049, exceeding the limit of 0.04, but is believed to introduce negligible bias.

3. Due to pressure build up in the filters, the runs at 1000 L/min/m^2 for the Stormceptor® EF4 and 1000 and 1400 L/min/m^2 for the Stormceptor® EFO4 were slightly shorter than the target. The run times were 54, 59 and 43 minutes respectively, versus targets of 60 and 50 minutes. The final feed samples were timed to coincide with the end of the run. Since >25 lbs of sediment was fed, the shortened time did not invalidate the runs.

Verification

The verification was completed by the Verification Expert, Toronto and Region Conservation Authority, contracted by GLOBE Performance Solutions, using the International Standard ***ISO 14034:2016 Environmental management -- Environmental technology verification (ETV)***. Data and information provided by Imbrium Systems Inc. to support the performance claim included the following: Performance test report prepared by Good Harbour Laboratories, and dated September 8, 2017; the report is based on testing completed in accordance with the Procedure for Laboratory Testing of Oil-Grit Separators (Version 3.0, June 2014).

What is ISO14034:2016 Environmental management – Environmental technology verification (ETV)?

ISO 14034:2016 specifies principles, procedures and requirements for environmental technology verification (ETV), and was developed and published by the *International Organization for Standardization (ISO)*. The objective of ETV is to provide credible, reliable and independent verification of the performance of environmental technologies. An environmental technology is a technology that either results in an environmental added value or measures parameters that indicate an environmental impact. Such technologies have an increasingly important role in addressing environmental challenges and achieving sustainable development.

For more information on the Stormceptor® EF and EFO OGS please contact:

Imbrium Systems, Inc.
407 Fairview Drive
Whitby, ON
L1N 3A9, Canada
Tel: 416-960-9900
info@imbriumsystems.com

For more information on ISO 14034:2016 / ETV please contact:

GLOBE Performance Solutions
World Trade Centre
404 – 999 Canada Place
Vancouver, BC
V6C 3E2 Canada
Tel: 604-695-5018 / Toll Free: 1-855-695-5018
etv@globeperformance.com

Appendix H

MacMat Information

MACCAFERRI

TECHNICAL DATA SHEET

Rev: 05, Issue Date 10.22.2012

MACMAT® 10.4 & 20.4

TURF REINFORCEMENT MATS

Product Description

MACMAT® 10.4 and MACMAT® 20.4 are Turf Reinforcement Mats (TRMs). These permanent erosion control mats are composed of UV stabilized nylon monofilaments processed into a three dimensional matrix. MacMat® 10.4 and 20.4 have a high roughness, yet also contain 95% voids which are easily filled with soil by mechanical means, or naturally through accretion and sedimentation in channels. This creates the environment for vegetation to develop through the voids in the TRM.

MacMat® 10.4 and 20.4 conform to the following certifiable minimum average roll values when tested in accordance with appropriate ASTM methods.

Mechanical Properties	**Test Method**	**Units**	**Typical Roll Values**	
			10.4	**20.4**
Tensile Strength	ASTM 5035, mod.	kN/m	2.3	3.5
Thickness	ASTM D 5199	mm	10	18
Mass/Unit Area	ASTM D 5261	g/m^2	270	406
UV Stability	ASTM D G53, ASTM D 1682, mod.	% strength retained	80	80
Performance Properties[1]		**Units**	**Typical Roll Values**	
Permissible Velocity Product Only	**--**	m/s	6.1	
30 minute, vegetated	--	m/s	5.8	
50 hour, vegetated	--	m/s	4.2	
Permissible Shear Stress Product Only	**--**	kN/m^2	0.32	0.53
30 minute, vegetated	--	kN/m^2	0.38	0.48
50 hour, vegetated	--	kN/m^2	0.29	0.38
[1]Performance Properties determined by independent laboratory testing.				
Physical Properties		**Units**	**Typical Value**	
			N10	**N20**
Roll Dimensions (width x length)	--	m	2.44x51.5	2.44x34.3
Roll Area	--	m^2	125	83.6
Estimated Roll Diameter	--	cm	111	109
Estimated Roll Weight	--	kg	36	34

Tolerance - Roll length: 1%; Roll width: 4%; Weight +/- 10%

Maccaferri reserves the right to amend product specifications without notice and specifiers are requested to check as to the validity of the specifications they are using.

400 Collier MacMillan Drive, Unit B
Cambridge, ON N1R 7H7
Tel: 519-623-9990
Fax: 519-623-1309

MACCAFERRI CANADA LTD.

email: info@maccaferri.ca
website: www.maccaferri.ca

Halifax, NS tel: 902-468-8615
Montréal, QC tel: 450-420-1845
Calgary, AB tel: 403-244-6556
Edmonton, AB tel: 780-447-2719
Vancouver, BC tel: 604-683-4824

General MacMat Installation

MacMat is packaged in rolls that are easy to ship, store and install. No heavy equipment is needed for installation of matting and a roll can be handled by one or two workers.

Site Preparation

Whether slope or channel, the site must be shaped to the design specifications (grade, geometry, density of soil, etc.) and then dressed to be free of soil clods, clumps, rocks, or vehicle imprints of any significant size that would prevent the MacMat® from lying flush to surface contours.

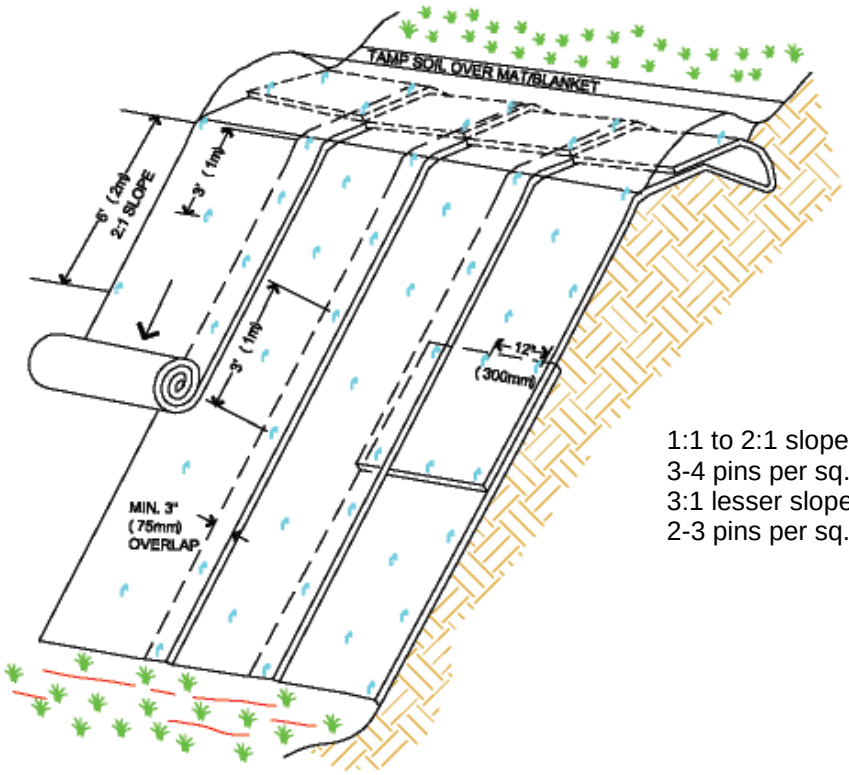
Anchor Trench

Anchor trenches are required to securely fasten the MacMat to the ground surface. In channel applications, the initial anchor trench is installed at the beginning of the channel and intermediate check slots are spaced at approximately 7.5m* intervals downstream depending on flow conditions and whether you soil fill or not. The MacMat® is installed into the bottom of the trench and fastened with pins spaced 1m apart. The anchor trench / intermediate check slots are then backfilled and compacted in a manner as to not damage the MacMat®.

** In lieu of excavated check slots, a double row of pins [or a number 1 or 2 rebar pinned across the mat] may be used at 7.5m intervals.*

MacMat® Installation

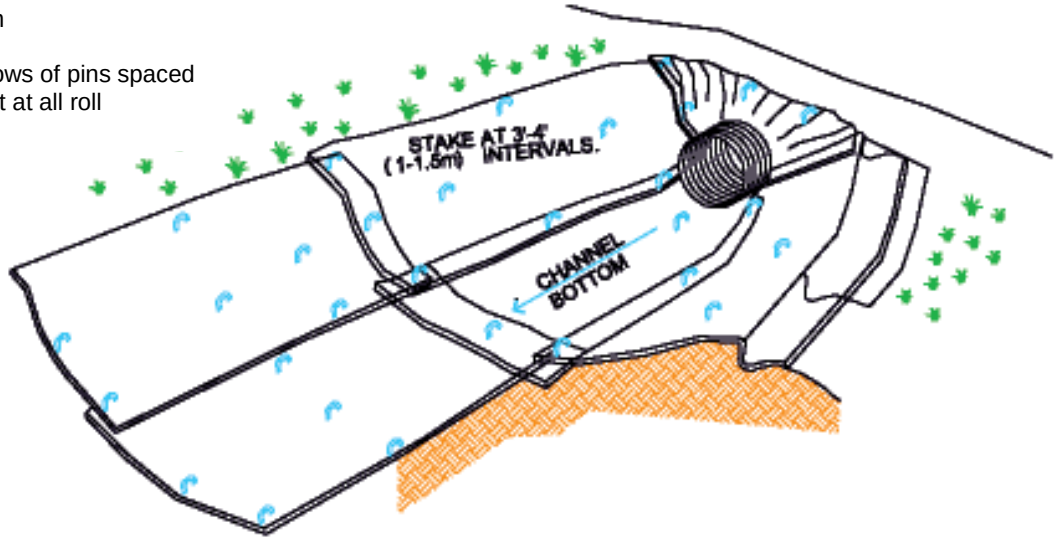
Roll the MacMat® down the slope or channel. The overlap between rolls is 75mm - 100mm. The splice between rolls is between 600mm - 900mm. Shingle the roll in the direction of water flow. Install pins down the center of each mat, staggering them between the outside pins with a spacing interval of 1m - 1.5m. Pins pattern will vary depending upon application, soil type, slope or channel slope, geometry, etc. A rule of thumb for estimating the amount of pins required for a project is:



1:1 to 2:1 slopes
3-4 pins per sq. m
3:1 lesser slopes
2-3 pins per sq. m

High flow channel
3-4 pins per sq. m
Low flow channel
2-3 pins per sq. m

Always install 2 rows of pins spaced 0.5m x 0.5m apart at all roll splice locations.



Anchoring Devices

Typically 150mm x 25mm x 150mm metal staples are used. When surface soil conditions are loose, use 200mm x 25mm x 200mm or 300mm x 25mm x 300mm metal staples, or 200mm - 450mm metal pins with 38mm diameter washer. Drive staples or pins flush with the ground surface.

Soil Filling

There are two options when installing MacMat®-soil filling or non-soil filling. Soil filling MacMat® accelerates performance because the MacMat®, soil and the new vegetation interact together to resist shear forces when water is flowing though the channel or on top of a slope. If soil filling is utilized, spread 12mm -20mm of fine soil into the mat to completely fill it. A typical condition where non-soil filling is used would be to collect sediment when water is flowing through the channel from an up-gradient source.

Seeding

For non-soil filling applications, broadcast seed or hydroseed over the installed MacMat®. Make sure hydromulch occurs after seeding to ensure the seed reaches the topsoil. If soil filling, seed after filling is completed. You may also seed before and after soil filling to create a better established root structure and increase vegetation strength. Check with your local seeding consultant to verify appropriate seed and fertilizer mixture.

Sod Installation

If covering MacMat® with sod, soil filling is required. Place sod in the direction of water flow. Periodically install a row or two perpendicular to the flow to reduce the possibility of water flowing along the seams of the sod. In most cases, you should pin the sod down to prevent movement.

Headquarters: 400 Collier MacMillan Drive, Unit B Cambridge, ON, N1R 7H7 tel: 519-623-9990 / fax: 519-623-1309	**MACCAFERRI INC.** e-mail: info@maccaferri.ca Website: www.maccaferri.ca	Halifax, NS Montréal, QC Edmonton, AB Calgary, AB Vancouver, BC	tel: 902-468-8615 tel: 450-420-1845 tel: 780-447-2719 tel: 403-244-6556 tel: 604-683-4824

Appendix I

Pearson Engineering Drawings

NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

BENCHMARK: ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE TOWN OF BRADFORD BENCHMARK N° 848154 HAVING A PUBLISHED ELEVATION OF 237.913 METRES.

LICENSED PROFESSIONAL ENGINEER
G. M. PEARSON
100061886
4/20/22
PROVINCE OF ONTARIO

COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

SITE GRADING PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE	1:250	PROJECT #	20055
DRAWN BY	AA	VERT SCALE		DRAWING #	SG-1
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	3

OPEN CUT TRENCH WITHIN THE MUNICIPAL ROW TO BE COMPLETED TO THE SATISFACTION OF THE TOWN INCLUDING:

- ROADWAY RESTORATION TO 2.0m BEYOND THE TRENCH LIMITS IN ALL DIRECTIONS AND ENTIRE PAVEMENT WIDTH (IE. CURB TO CURB)
- TRENCH TO BE BACKFILLED USING UNSHRINKABLE FILL TO UNDERSIDE OF GRANULAR
- GRANULAR TYPES AND MAKEUPS TO BE MATCHED TO EXISTING FINISH GRADE
- A 0.3m LAP JOINT WHERE CONNECTING TO EXISTING ASPHALT INCLUDING THE JOINTS BEING ROUTE AND FILLED WITH HOT RUBBERIZED SEALING COMPOUND ASTM D-1190-52T

STM AND SAN PIPES < 600mm TO BE PVC
STM AND SAN PIPES ≥600mm TO BE CONC.
WM PIPES TO BE PVC

SANITARY FORCEMAIN DEPTH OF COVER ASSUMED TO BE 1.8m. CONTRACTOR TO VERIFY PRIOR TO ORDERING PARTS

BENCHMARK: ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE TOWN OF BRADFORD BENCHMARK N° 848154 HAVING A PUBLISHED ELEVATION OF 237.913 METRES.

NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

LICENSED PROFESSIONAL ENGINEER
G. M. PEARSON
100061986
4/20/22
PROVINCE OF ONTARIO

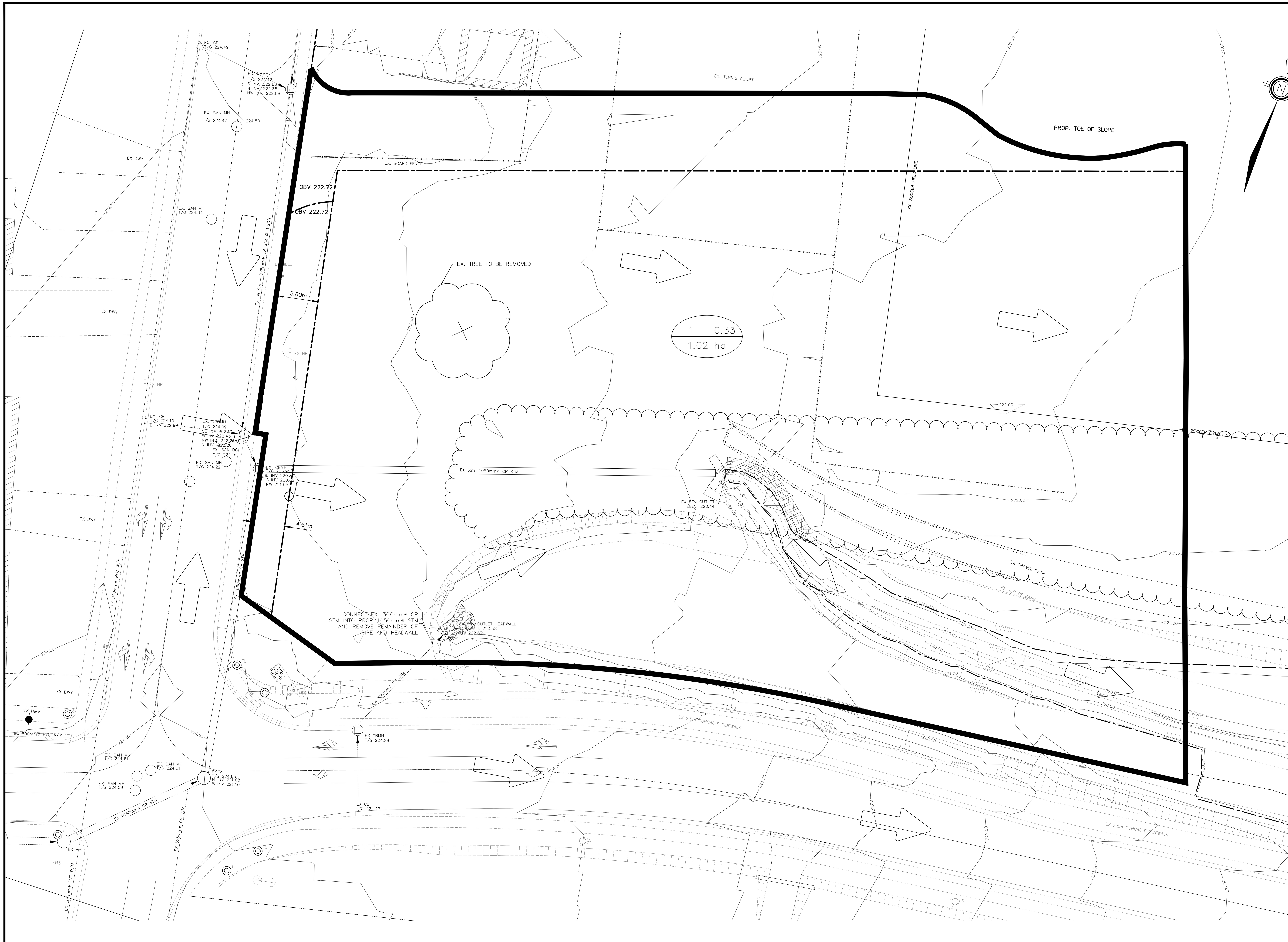
COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

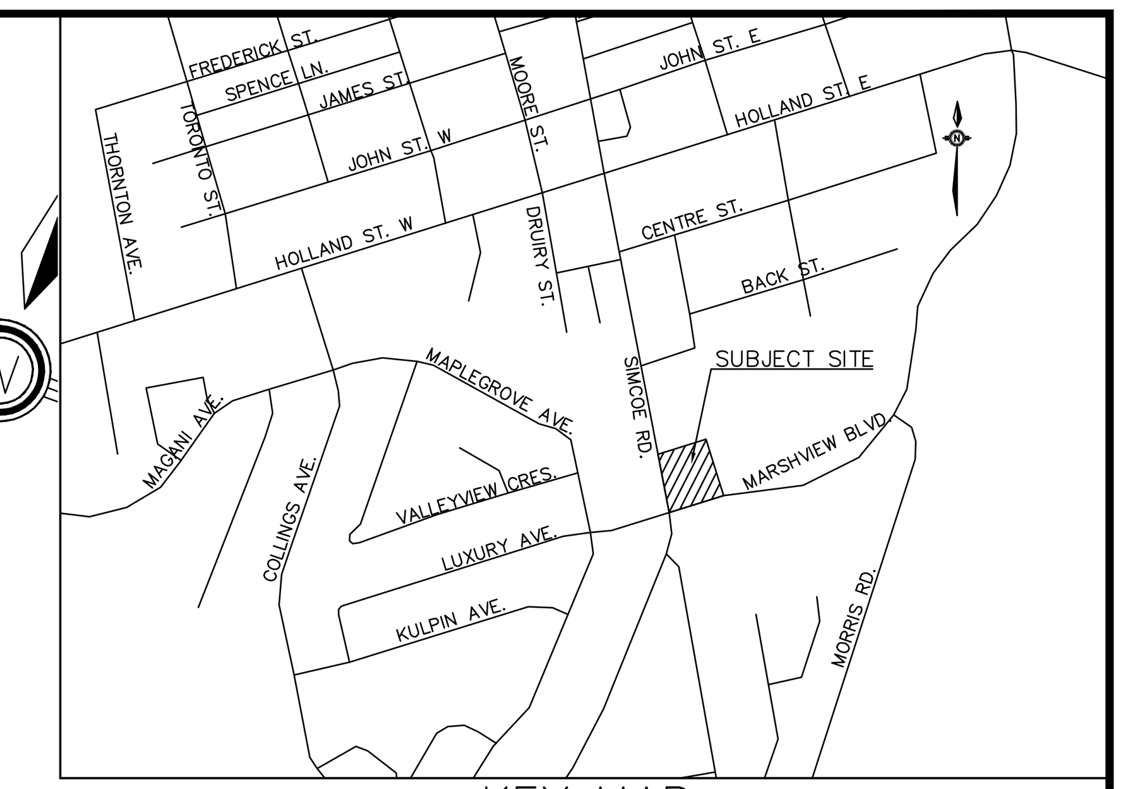
SITE SERVICING PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE	1:250	PROJECT #	20055
DRAWN BY	AA	VERT SCALE		DRAWING #	SS-1
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	3

P:\Autodesk Vault\Working Folders\20055 – MCL, Simcoe County Affordable Housing, BWG\Engineering\20055 – BASE_Rev.dwg Layout: SS-1 Plotted Apr 20, 2022 @ 2:50pm by jpearce © PEARSON ENGINEERING LTD.





KEY MAP
NTS

CB CATCH BASIN

DCB DOUBLE CATCH BASIN

CBMH CATCH BASIN

MH STORM MANHOLE

OVERLAND FLOW DIRECTION

CATCHMENT AREA 1 | 0.75 RUNOFF COEFFICIENT
1.00 ha
AREA IN HECTARES

CATCHMENT BOUNDARY

EX. LSRCA FLOODLINE ELEVATION = 220.58

NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

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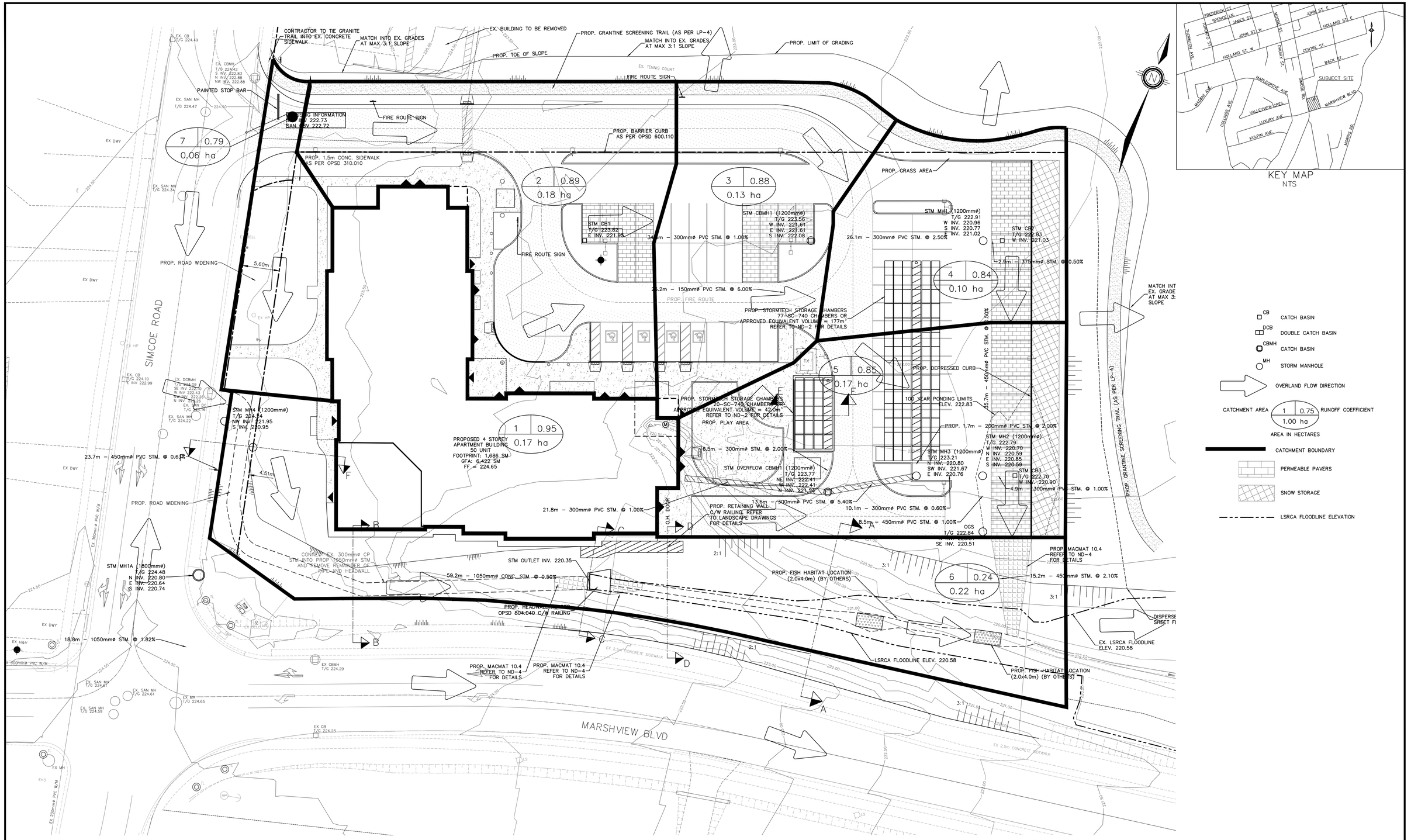
LICENSED PROFESSIONAL ENGINEER
G. M. PEARSON
100061986
4/20/22
PROVINCE OF ONTARIO

COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

PRE DEVELOPMENT STORM CATCHMENT PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE	1:250	PROJECT #	20055
DRAWN BY	AA	VERT SCALE		DRAWING #	STM–1
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	3



NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

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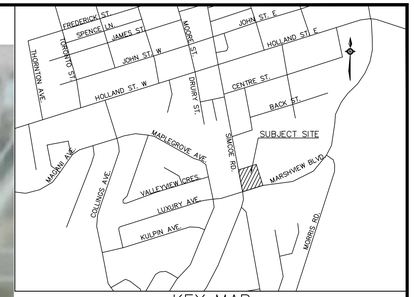
LICENSED PROFESSIONAL ENGINEER
G. M. PEARSON
100061986
21/12/22
PROVINCE OF ONTARIO

COUNTY OF SIMCOE AFFORDABLE HOUSING – BRADFORD WEST GWILLIMBURY, 125 SIMCOE ROAD

POST DEVELOPMENT STORM CATCHMENT PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE	1:250
DRAWN BY	AA	VERT SCALE	
CHECKED BY	MWD	DATE	JUNE 2020
PROJECT #	20055		
DRAWING #	STM-2		
REVISION #	3		



KEY MAP
NTS

EXTERNAL CATCHMENT
AREA TAKEN FROM MORRIS ROAD
DRAIN DRAWINGS DATED JULY 24, 2015
COMPLETED BY K.SMART ASSOCIATES LTD.

NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

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LICENSED PROFESSIONAL ENGINEER
G. M. PEARSON
100061986
4/22/22
PROVINCE OF ONTARIO

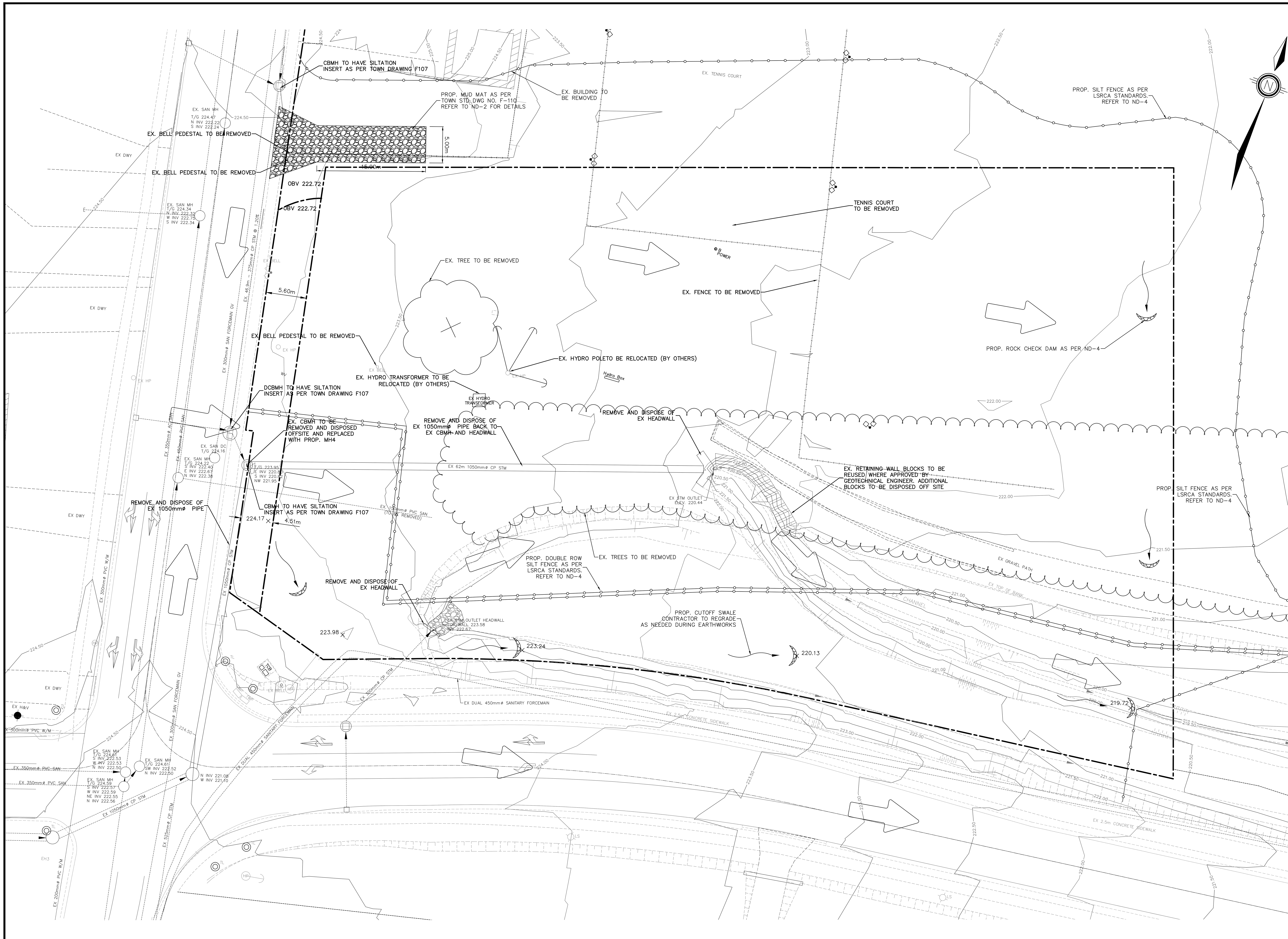
COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

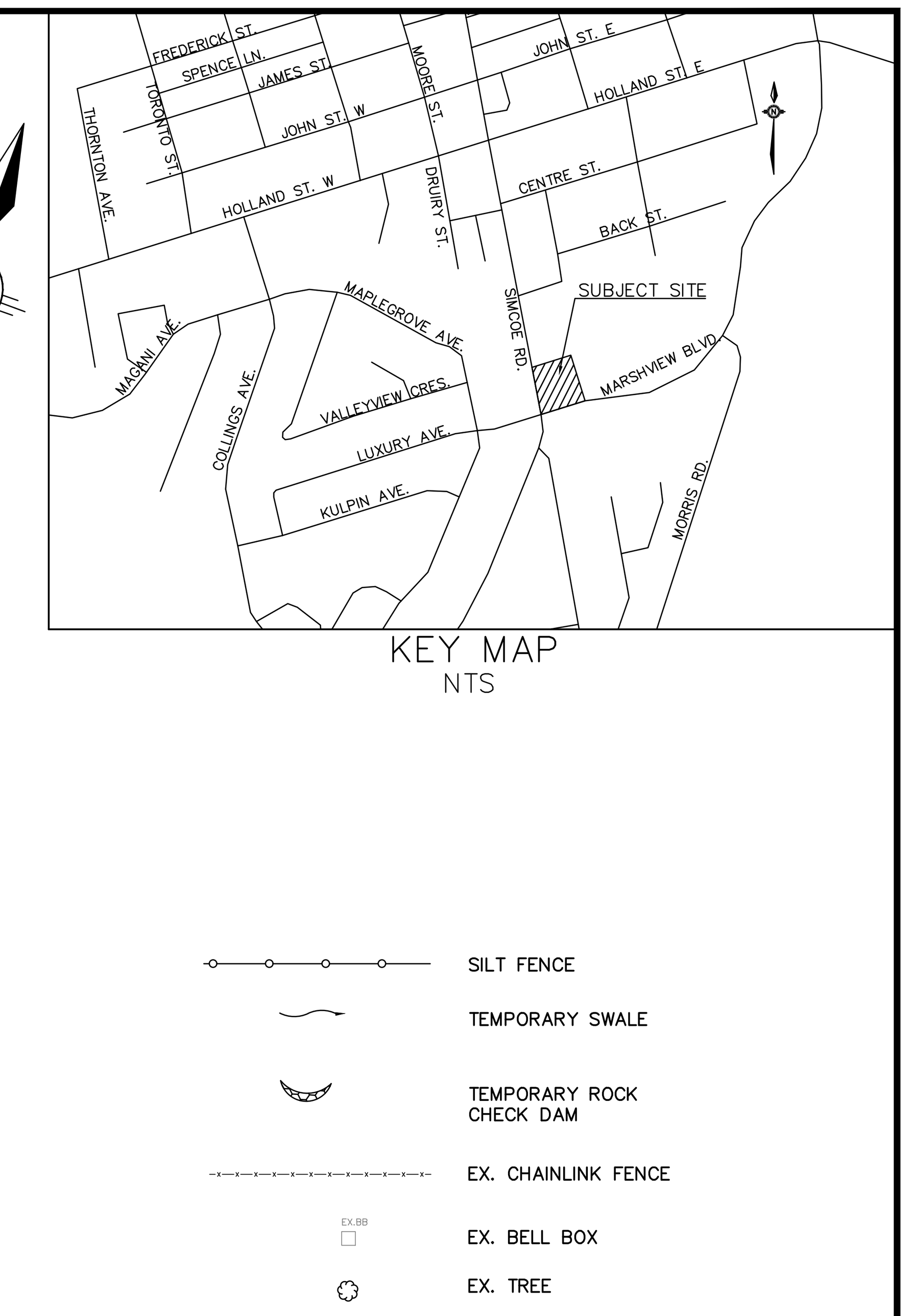
EXTERNAL STORM
CATCHMENT PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY AA	HORIZ SCALE 1:1500	PROJECT #	20055
DRAWN BY AA	VERT SCALE	DRAWING #	STM-3
CHECKED BY MWD	DATE JUNE 2020	REVISION #	3

P:\Autodesk Vault\Working Folders\20055 - MCL, Simcoe County Affordable Housing, BWG\Engineering\20055 - EXTERNAL CATCHMENT PLAN STM-3.dwg Layout:STM-3 Plotted: Apr 20, 2022 @ 3:16pm by jpearce @ PEARSON ENGINEERING LTD.





1. ENGINEER TO BE NOTIFIED PRIOR TO INITIATION OF ANY ON SITE WORKS.
2. SILT FENCE AND CONSTRUCTION ACCESS MATS TO BE INSTALLED PRIOR TO THE COMMENCEMENT OF ANY WORKS ONSITE.
3. VEGETATION REMOVAL MAY COMMENCE AFTER ALL SILT FENCE IS INSTALLED AND APPROVED BY THE ENGINEER.
4. EROSION CONTROL MEASURES TO BE MAINTAINED AS DIRECTED BY THE ENGINEER DURING THE CONSTRUCTION PERIOD. ADDITIONAL CONTROL MEASURES MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
5. ALL DISTURBED GROUND LEFT INACTIVE FOR MORE THAN 30 DAYS SHALL BE STABILIZED WITH SEED, SOD, MULCH OR OTHER ADEQUATE COVERING, AS INSTRUCTED BY THE ENGINEER.
6. THERE IS TO BE STOCKPILING OF MATERIAL ON SITE. CONTRACTOR TO REMOVE SOIL IMMEDIATELY.
7. CONTRACTOR RESPONSIBLE FOR MUD TRACKING, PREVENTION AND MAINTENANCE ON SURROUNDING ROADS. ONGOING STREET SWEEPING AND DUST CONTROL ARE THE RESPONSIBILITY OF THE DEVELOPER AND MUST BE KEPT UNDER CONTROL ON ALL ROADWAYS TO THE SATISFACTION OF THE TOWN.
8. FILTER CLOTH WILL BE PLACED ON THE CATCHBASINS ON PUBLIC STREETS ALONG THE PROPERTY FRONTAGE.
9. THE LEVEL OF EFFORT REQUIRED FOR THE IMPLEMENTATION OF DUST CONTROL MEASURES WILL VARY DEPENDING ON LEVEL OF ACTIVITY, EXTENT OF PRECIPITATION, SOIL TYPE AND STAGE OF CONSTRUCTION. APPROPRIATE SCHEDULE AND APPLICATION RELATES FOR DUST CONTROLS WILL BE DETERMINED BY THE CONTRACTOR BASED ON THEIR PREFERRED METHOD OF DUST SUPPRESSION. AT ALL TIMES THE CONTRACTOR WILL BE RESPONSIBLE FOR MAINTAINING DUST SUPPRESSION AND MUD TRACKING TO LEVEL DEEMED APPROPRIATE BY THE CONSULTANT AND/OR TOWN STAFF.
10. DURING EXTREME DY SPELLS OR WITH DUST PRONE SANDY SOILS, ADDITIONAL CONTINGENCY MEASURES MAY BE REQUIRED. THE USE OF CALCIUM CHLORIDE APPLICATION ON HAUL ROUTES AND UNVEGETATED AREAS IN LIE OF A WATER APPLICATION TO ENHANCE THE LONGEVITY OF DIST SUPPRESSION.

NO.	REVISION NOTE	DATE	BY
3.	2ND SUBMISSION	04/20/22	JP
2.	1ST SUBMISSION	12/15/21	AA
1.	REVISED FOR COUNCIL REPORT	04/30/21	AA

BENCHMARK: ELEVATIONS SHOWN HEREON ARE GEODETIC AND ARE REFERRED TO THE TOWN OF BRADFORD BENCHMARK N° 848154 HAVING A PUBLISHED ELEVATION OF 237.913 METRES.

LICENSED PROFESSIONAL ENGINEER G. M. PEARSON 100061986 4/20/22 PROVINCE OF ONTARIO

COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

ENVIRONMENTAL PROTECTION AND REMOVALS PLAN

PEARSON ENGINEERING
PEARSONENG.COM PH. 705.719.4785

DESIGNED BY	AA	HORIZ SCALE	1:250	PROJECT #	20055
DRAWN BY	AA	VERT SCALE		DRAWING #	EPR–1
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	3