Stormwater Management & Servicing Report

Simcoe County Housing Corporation

125 Simcoe Road
Town of Bradford
County of Simcoe

PEARSON ENGINEERING

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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.

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 H.

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 storm pipe that picks up flows from Simcoe Road 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. The flows will ultimately outlet to a Stormwater Management Pond southeast of Marshview Drive approximately 150 m east of the site. Details of existing storm drainage conditions are shown on Drawing STM-1 in Appendix H.

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)	0.07	0.10	0.11	0.14	0.18	0.20

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 H.

5.4. 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 170 m^3 is required to control the 100-year storm event to pre-development values. Underground storage chambers containing a total of 160 m^3 are proposed, with the remaining 12 m^3 through above grade parking lot storage located around CB2 and CB3 for a total quantity storage of 172 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
Controlled Area (m^3/s)	0.02	0.03	0.04	0.08	0.11	0.13
Uncontrolled Area (m^3/s)	0.03	0.04	0.05	0.06	0.06	0.07
Total Flow (m^3/s)	**0.05**	**0.07**	**0.09**	**0.14**	**0.17**	**0.20**

5.5. 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. The 25 mm storm event over the site's impervious area is a total volume of 171 m^3.

The storage is to be provided within 42 m^3 of StormTech SC-750 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.

5.6. 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.

5.7. 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.

5.7.1. 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. The LSRCA guidelines state that an OGS unit can only provide a maximum of 50% TSS removal, leaving the remaining 30% to 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.

5.7.2. 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;
- Installation of a construction entrance mat to minimize transportation of sediment onto roadways;
- 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 H.

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 1308 m^3. With the increased imperviousness of the site, this recharge will be reduced to 583 m^3, resulting in a deficit volume of 725 m^3.

In order to infiltrate an additional 725 m^3 annually, a yearly rainfall depth of 430.0 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. This percentage of annual rainfall occurs for rain events of 7 mm or less. 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. 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)	9,295	9,296	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)	**9,295**	**9,296**	**0.0%**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	5,214	7,219	39.5%
Net Surplus (m^3/yr)	5,214	7,219	39.5%
Evapotranspiration (m^3/yr)	4,082	2,076	-49.1%
Infiltration (m^3/yr)	1,308	583	-55.4%
Rooftop Infiltration (m^3/yr)	0	725	0.0%
Total Infiltration (m^3/yr)	1,308	1,308	0.0%
Runoff Pervious Areas (m^3/yr)	1,308	583	-55.4%
Runoff Impervious Areas (m^3/yr)	2,599	5,329	105.1%
Total Runoff (m^3/yr)	3,906	5,912	51.3%
Total Outputs (m^3/yr)	**9,295**	**9,296**	**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 and 60% for underground infiltration chambers.

Even though the LSRCA guidelines state that the OGS unit receives 0% phosphorous removal, it will assist in the capture of sediment and therefore inherently provide some reduction in phosphorous levels. 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	1.32
Controlled Post-Development	0.78

Detailed calculations can be found in Appendix D.

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.

A treatment train approach is implemented consisting of 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

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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	

Appendix B

Sanitary Servicing Calculations

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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 ≤ M ≤ 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	x	4.00
	=	2.33	L/s	
Infiltration Allowance	=	0.10	x	3.81
	=	0.38	L/s	
Qp (Inc. Infiltration Allowance)	=	2.71	L/s	

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	9964	7032	0	0	2463	469		0.33
Pre Total	9964	7032	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	1705	133	1247	0	0	325		0.89
3	1137	108	929	0	0	100		0.88
4	985	151	797	0	0	37		0.84
5	1709	228	1291	0	0	190		0.85
6	2643	2492	0	0	0	151		0.24
7	98	20	56	0	0	22		0.79
Post Total	9964	3133	4320	1686	0	825		0.71

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
$Q = C_iCIA / 360$

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	1.00	ha
Runoff Coefficient	0.33	
Time of Concentration	10	min
Return Rate	2	year
Peaking Coefficient (C_i)	1.00	
Rainfall Intensity	79.7	mm/hr
Pre-Development Peak Flow	0.07	m^3/s
Return Rate	5	year
Peaking Coefficient (C_i)	1.00	
Rainfall Intensity	104.9	mm/hr
Pre-Development Peak Flow	0.10	m^3/s
Return Rate	10	year
Peaking Coefficient (C_i)	1.00	
Rainfall Intensity	121.6	mm/hr
Pre-Development Peak Flow	0.11	m^3/s
Return Rate	25	year
Peaking Coefficient (C_i)	1.10	
Rainfall Intensity	142.5	mm/hr
Pre-Development Peak Flow	0.14	m^3/s
Return Rate	50	year
Peaking Coefficient (C_i)	1.20	
Rainfall Intensity	158.1	mm/hr
Pre-Development Peak Flow	0.18	m^3/s
Return Rate	100	year
Peaking Coefficient (C_i)	1.25	
Rainfall Intensity	174.1	mm/hr
Pre-Development Peak Flow	0.20	m^3/s

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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	Controlled Area Areas 1 - 5		Uncontrolled Area Area 6 & 7	
Area	0.72	ha	0.27	ha
Runoff Coefficient	0.88		0.52	
Time of Concentration	10	min	10	min
Return Rate	2	year	2	year
Peaking Coefficient (C_i)	1.00		1.00	
Rainfall Intensity	79.7		79.7	
Post-Development Peak Flow	0.14	m^3/s	0.03	m^3/s
Return Rate	5	year	5	year
Peaking Coefficient (C_i)	1.00		1.00	
Rainfall Intensity	104.9		104.9	
Post-Development Peak Flow	0.19	m^3/s	0.04	m^3/s
Return Rate	10	year	10	year
Peaking Coefficient (C_i)	1.00		1.00	
Rainfall Intensity	121.6		121.6	
Post-Development Peak Flow	0.22	m^3/s	0.05	m^3/s
Return Rate	25	year	25	year
Peaking Coefficient (C_i)	1.10		1.10	
Rainfall Intensity	142.5		142.5	
Post-Development Peak Flow	0.25	m^3/s	0.06	m^3/s
Return Rate	50	year	50	year
Peaking Coefficient (C_i)	1.20		1.20	
Rainfall Intensity	158.1		158.1	
Post-Development Peak Flow	0.28	m^3/s	0.06	m^3/s
Return Rate	100	year	100	year
Peaking Coefficient (C_i)	1.25		1.25	
Rainfall Intensity	174.1		174.1	
Post-Development Peak Flow	0.31	m^3/s	0.07	m^3/s

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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	18	17.8	0.28	0.015	0.000	0.000	0.015
220.90	0	18	35.6	0.35	0.016	0.000	0.000	0.016
221.00	0	18	53.3	0.45	0.019	0.000	0.000	0.019
221.10	0	18	71.1	0.55	0.021	0.000	0.000	0.021
221.20	0	18	88.9	0.65	0.022	0.000	0.000	0.022
221.30	0	18	106.7	0.75	0.024	0.000	0.000	0.024
221.40	0	18	124.4	0.85	0.026	0.000	0.000	0.026
221.50	0	18	142.2	0.95	0.027	0.000	0.000	0.027
221.57	0	18	160.0	1.02	0.028	0.000	0.000	0.028
221.60	0	0	160.0	1.05	0.029	0.000	0.000	0.029
221.70	0	0	160.0	1.15	0.030	0.000	0.000	0.030
221.80	0	0	160.0	1.25	0.031	0.000	0.000	0.031
221.90	0	0	160.0	1.35	0.032	0.000	0.000	0.032
222.00	0	0	160.0	1.45	0.034	0.000	0.000	0.034
222.10	0	0	160.0	1.55	0.035	0.000	0.000	0.035
222.20	0	0	160.0	1.65	0.036	0.000	0.000	0.036
222.30	0	0	160.0	1.75	0.037	0.000	0.000	0.037
222.40	0	0	160.0	1.85	0.038	0.000	0.000	0.038
222.50	0	0	160.0	1.95	0.039	0.000	0.000	0.039
222.60	0	0	160.0	2.05	0.040	0.000	0.000	0.040
222.70	1	0	160.1	2.15	0.041	0.000	0.000	0.041
222.71	6	0	160.1	2.16	0.041	0.000	0.000	0.041
222.72	13	0	160.2	2.17	0.041	0.000	0.000	0.041
222.73	23	0	160.4	2.18	0.041	0.000	0.000	0.041
222.74	34	0	160.7	2.19	0.041	0.000	0.000	0.041
222.75	47	0	161.1	2.20	0.041	0.000	0.000	0.041
222.76	61	1	161.6	2.21	0.041	0.000	0.000	0.041
222.77	75	1	162.3	2.22	0.041	0.000	0.000	0.041
222.78	89	1	163.1	2.23	0.042	0.000	0.000	0.042
222.79	104	1	164.1	2.24	0.042	0.000	0.000	0.042
222.80	112	1	165.1	2.25	0.042	0.010	0.010	0.052
222.81	123	1	166.3	2.26	0.042	0.020	0.029	0.071
222.82	134	1	167.6	2.27	0.042	0.030	0.053	0.095
222.83	142	1	169.0	2.28	0.042	0.040	0.082	0.124
222.84	148	1	170.4	2.29	0.042	0.050	0.114	0.156
222.85	153	2	171.9	2.30	0.042	0.060	0.150	0.192

Orifice Tube 1	
Diameter	100 mm
Invert Elevation	220.50
Orifice Constant	0.80
Orifice Centroid	220.55
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	$1.7WH^{1.5}$

PEARSON ENGINEERING

County of Simcoe Affordable Housing, Bradford
Quantity Control Volume Calculations

DATE:	16-Dec-21
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
1.00	0.72	10	1	0.33	0.88

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	1.00	1.00	1.00	1.00	1.00	1.00
Q	0.07	0.10	0.11	0.14	0.18	0.20

Note: Q= 0.00278CC$_i$IA

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	0.025	0.88
5	980.848	6.013	0.81	0.028	0.88
10	1118.790	6.018	0.80	0.043	0.88
25	1284.892	6.008	0.79	0.080	0.97
50	1405.794	6.012	0.79	0.111	1.00
100	1443.947	5.273	0.78	0.133	1.00

Results

Storm Event (yrs)	Storage (m^3)	Time (min)
2	108	55
5	155	67
10	160	53
25	167	37
50	168	31
100	170	28

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
1	155.34	0.27	0.02	8	12	204.08	0.36	0.03	12	16	235.38	0.42	0.04	11	19
2	139.58	0.25	0.02	21	10	183.29	0.32	0.03	29	13	211.59	0.37	0.04	29	15
3	126.98	0.22	0.02	31	8	166.72	0.29	0.03	42	11	192.60	0.34	0.04	45	13
4	116.64	0.21	0.02	39	7	153.16	0.27	0.03	53	9	177.06	0.31	0.04	57	11
5	108.01	0.19	0.02	46	6	141.85	0.25	0.03	63	8	164.08	0.29	0.04	68	9
6	100.67	0.18	0.02	52	5	132.25	0.23	0.03	71	7	153.07	0.27	0.04	77	8
7	94.35	0.17	0.02	58	5	124.00	0.22	0.03	78	6	143.59	0.25	0.04	85	7
8	88.85	0.16	0.02	62	4	116.81	0.21	0.03	84	6	135.33	0.24	0.04	92	6
9	84.01	0.15	0.02	66	4	110.50	0.20	0.03	90	5	128.07	0.23	0.04	98	5
10	79.72	0.14	0.02	70	3	104.91	0.19	0.03	95	4	121.64	0.22	0.04	103	5
11	75.89	0.13	0.02	73	3	99.91	0.18	0.03	99	4	115.88	0.20	0.04	108	4
12	72.44	0.13	0.02	76	3	95.41	0.17	0.03	103	4	110.71	0.20	0.04	113	4
13	69.32	0.12	0.02	79	2	91.35	0.16	0.03	107	3	106.03	0.19	0.04	117	4
14	66.48	0.12	0.02	81	2	87.65	0.15	0.03	110	3	101.77	0.18	0.04	120	3
15	63.89	0.11	0.02	83	2	84.27	0.15	0.03	113	3	97.88	0.17	0.04	124	3
16	61.52	0.11	0.02	85	2	81.17	0.14	0.03	116	3	94.30	0.17	0.04	127	3
17	59.33	0.10	0.02	87	2	78.32	0.14	0.03	119	2	91.01	0.16	0.04	129	3
18	57.30	0.10	0.02	89	2	75.68	0.13	0.03	121	2	87.97	0.16	0.04	132	2
19	55.42	0.10	0.02	90	1	73.23	0.13	0.03	123	2	85.14	0.15	0.04	134	2
20	53.68	0.09	0.02	92	1	70.95	0.13	0.03	125	2	82.51	0.15	0.04	137	2
21	52.05	0.09	0.02	93	1	68.83	0.12	0.03	127	2	80.06	0.14	0.04	139	2
22	50.52	0.09	0.02	94	1	66.84	0.12	0.03	129	2	77.77	0.14	0.04	140	2
23	49.10	0.09	0.02	96	1	64.98	0.11	0.03	131	2	75.62	0.13	0.04	142	2
24	47.75	0.08	0.02	97	1	63.23	0.11	0.03	133	1	73.59	0.13	0.04	144	1
25	46.49	0.08	0.02	98	1	61.58	0.11	0.03	134	1	71.69	0.13	0.04	145	1
26	45.30	0.08	0.02	98	1	60.02	0.11	0.03	135	1	69.89	0.12	0.04	147	1
27	44.17	0.08	0.02	99	1	58.55	0.10	0.03	137	1	68.19	0.12	0.04	148	1
28	43.11	0.08	0.02	100	1	57.16	0.10	0.03	138	1	66.59	0.12	0.04	149	1
29	42.10	0.07	0.02	101	1	55.84	0.10	0.03	139	1	65.06	0.12	0.04	150	1
30	41.14	0.07	0.02	101	1	54.59	0.10	0.03	140	1	63.61	0.11	0.04	151	1
31	40.23	0.07	0.02	102	1	53.40	0.09	0.03	141	1	62.23	0.11	0.04	152	1
32	39.36	0.07	0.02	103	1	52.26	0.09	0.03	142	1	60.92	0.11	0.04	153	1
33	38.53	0.07	0.02	103	0	51.18	0.09	0.03	143	1	59.67	0.11	0.04	154	1
34	37.74	0.07	0.02	104	0	50.14	0.09	0.03	144	1	58.47	0.10	0.04	154	1
35	36.98	0.07	0.02	104	0	49.16	0.09	0.03	145	1	57.33	0.10	0.04	155	1
36	36.26	0.06	0.02	105	0	48.21	0.09	0.03	146	1	56.23	0.10	0.04	156	1
37	35.57	0.06	0.02	105	0	47.31	0.08	0.03	146	1	55.19	0.10	0.04	156	1
38	34.91	0.06	0.02	105	0	46.44	0.08	0.03	147	1	54.18	0.10	0.04	157	0
39	34.27	0.06	0.02	106	0	45.60	0.08	0.03	148	1	53.22	0.09	0.04	157	0
40	33.66	0.06	0.02	106	0	44.80	0.08	0.03	148	1	52.29	0.09	0.04	158	0
41	33.07	0.06	0.02	106	0	44.03	0.08	0.03	149	1	51.40	0.09	0.04	158	0
42	32.50	0.06	0.02	107	0	43.29	0.08	0.03	149	1	50.54	0.09	0.04	158	0
43	31.96	0.06	0.02	107	0	42.58	0.08	0.03	150	0	49.71	0.09	0.04	159	0
44	31.43	0.06	0.02	107	0	41.89	0.07	0.03	150	0	48.92	0.09	0.04	159	0
45	30.93	0.05	0.02	107	0	41.23	0.07	0.03	151	0	48.15	0.09	0.04	159	0
46	30.44	0.05	0.02	107	0	40.59	0.07	0.03	151	0	47.41	0.08	0.04	159	0
47	29.97	0.05	0.02	107	0	39.97	0.07	0.03	152	0	46.69	0.08	0.04	160	0
48	29.51	0.05	0.02	108	0	39.37	0.07	0.03	152	0	46.00	0.08	0.04	160	0
49	29.07	0.05	0.02	108	0	38.80	0.07	0.03	152	0	45.33	0.08	0.04	160	0
50	28.65	0.05	0.02	108	0	38.24	0.07	0.03	153	0	44.68	0.08	0.04	160	0
51	28.23	0.05	0.02	108	0	37.70	0.07	0.03	153	0	44.05	0.08	0.04	160	0
52	27.83	0.05	0.02	108	0	37.17	0.07	0.03	153	0	43.44	0.08	0.04	160	0
53	27.45	0.05	0.02	108	0	36.66	0.06	0.03	153	0	42.85	0.08	0.04	160	0
54	27.07	0.05	0.02	108	0	36.17	0.06	0.03	154	0	42.28	0.07	0.04	160	0
55	26.70	0.05	0.02	108	0	35.69	0.06	0.03	154	0	41.72	0.07	0.04	160	0
56	26.35	0.05	0.02	108	0	35.23	0.06	0.03	154	0	41.18	0.07	0.04	160	0
57	26.01	0.05	0.02	108	0	34.77	0.06	0.03	154	0	40.66	0.07	0.04	160	0
58	25.67	0.05	0.02	108	0	34.34	0.06	0.03	154	0	40.15	0.07	0.04	160	0
59	25.35	0.04	0.02	108	0	33.91	0.06	0.03	155	0	39.66	0.07	0.04	160	0
60	25.03	0.04	0.02	108	0	33.50	0.06	0.03	155	0	39.18	0.07	0.04	159	0
61	24.73	0.04	0.02	108	0	33.09	0.06	0.03	155	0	38.71	0.07	0.04	159	0
62	24.43	0.04	0.02	108	0	32.70	0.06	0.03	155	0	38.25	0.07	0.04	159	0
63	24.14	0.04	0.02	108	0	32.32	0.057	0.03	155	0	37.81	0.067	0.04	159	0
64	23.85	0.04	0.02	107	0	31.94	0.056	0.03	155	0	37.37	0.066	0.04	159	0
65	23.58	0.04	0.02	107	0	31.58	0.056	0.03	155	0	36.95	0.065	0.04	158	0
66	23.31	0.04	0.02	107	0	31.23	0.055	0.03	155	0	36.54	0.065	0.04	158	0
67	23.05	0.04	0.02	107	0	30.88	0.055	0.03	155	0	36.14	0.064	0.04	158	0
68	22.79	0.04	0.02	107	0	30.54	0.054	0.03	155	0	35.75	0.063	0.04	158	0
69	22.54	0.04	0.02	107	0	30.22	0.053	0.03	155	0	35.37	0.063	0.04	157	0

Time (min)	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	274.35	0.53	0.08	5	23	302.97	0.61	0.11	0	26	347.30	0.70	0.13	-2	29
2	246.82	0.48	0.08	29	19	272.76	0.55	0.11	26	21	309.64	0.62	0.13	27	23
3	224.83	0.44	0.08	47	15	248.61	0.50	0.11	47	17	280.18	0.56	0.13	49	18
4	206.82	0.40	0.08	63	13	228.83	0.46	0.11	64	14	256.44	0.51	0.13	68	15
5	191.77	0.37	0.08	76	11	212.29	0.43	0.11	78	12	236.85	0.48	0.13	83	13
6	179.00	0.35	0.08	87	9	198.24	0.40	0.11	90	10	220.38	0.44	0.13	96	11
7	168.00	0.33	0.08	96	8	186.13	0.37	0.11	100	9	206.31	0.41	0.13	106	9
8	158.41	0.31	0.08	104	7	175.58	0.35	0.11	109	8	194.15	0.39	0.13	115	8
9	149.98	0.29	0.08	112	6	166.30	0.33	0.11	117	7	183.50	0.37	0.13	123	7
10	142.50	0.28	0.08	118	6	158.06	0.32	0.11	124	6	174.11	0.35	0.13	130	6
11	135.82	0.26	0.08	124	5	150.69	0.30	0.11	130	5	165.75	0.33	0.13	136	5
12	129.80	0.25	0.08	129	4	144.06	0.29	0.11	135	5	158.25	0.32	0.13	141	4
13	124.36	0.24	0.08	133	4	138.05	0.28	0.11	140	4	151.49	0.30	0.13	146	4
14	119.40	0.23	0.08	137	4	132.59	0.27	0.11	144	4	145.36	0.29	0.13	149	3
15	114.87	0.22	0.08	141	3	127.59	0.26	0.11	147	3	139.76	0.28	0.13	153	3
16	110.71	0.22	0.08	144	3	123.00	0.25	0.11	150	3	134.63	0.27	0.13	156	3
17	106.88	0.21	0.08	147	3	118.77	0.24	0.11	153	2	129.92	0.26	0.13	158	2
18	103.33	0.20	0.08	149	2	114.85	0.23	0.11	156	2	125.57	0.25	0.13	161	2
19	100.04	0.19	0.08	152	2	111.22	0.22	0.11	158	2	121.53	0.24	0.13	163	2
20	96.98	0.19	0.08	154	2	107.84	0.22	0.11	160	2	117.78	0.24	0.13	164	1
21	94.12	0.18	0.08	156	2	104.68	0.21	0.11	161	1	114.29	0.23	0.13	166	1
22	91.45	0.18	0.08	157	2	101.72	0.20	0.11	163	1	111.03	0.22	0.13	167	1
23	88.94	0.17	0.08	159	1	98.95	0.20	0.11	164	1	107.97	0.22	0.13	168	1
24	86.58	0.17	0.08	160	1	96.34	0.19	0.11	165	1	105.09	0.21	0.13	168	1
25	84.36	0.16	0.08	162	1	93.89	0.19	0.11	166	1	102.39	0.21	0.13	169	0
26	82.26	0.16	0.08	163	1	91.57	0.18	0.11	167	1	99.84	0.20	0.13	169	0
27	80.28	0.16	0.08	164	1	89.37	0.18	0.11	167	0	97.43	0.20	0.13	169	0
28	78.40	0.15	0.08	164	1	87.30	0.18	0.11	168	0	95.15	0.19	0.13	170	0
29	76.62	0.15	0.08	165	1	85.33	0.17	0.11	168	0	92.99	0.19	0.13	169	0
30	74.93	0.15	0.08	166	1	83.45	0.17	0.11	168	0	90.94	0.18	0.13	169	0
31	73.32	0.14	0.08	166	0	81.67	0.16	0.11	168	0	88.98	0.18	0.13	169	0
32	71.78	0.14	0.08	167	0	79.97	0.16	0.11	168	0	87.13	0.17	0.13	169	-1
33	70.32	0.14	0.08	167	0	78.35	0.16	0.11	168	0	85.35	0.17	0.13	168	-1
34	68.92	0.13	0.08	167	0	76.81	0.15	0.11	168	0	83.66	0.17	0.13	167	-1
35	67.59	0.13	0.08	167	0	75.33	0.15	0.11	168	0	82.05	0.16	0.13	167	-1
36	66.31	0.13	0.08	167	0	73.91	0.15	0.11	167	0	80.50	0.16	0.13	166	-1
37	65.08	0.13	0.08	167	0	72.55	0.15	0.11	167	-1	79.02	0.16	0.13	165	-1
38	63.91	0.12	0.08	167	0	71.25	0.14	0.11	166	-1	77.60	0.16	0.13	164	-1
39	62.78	0.12	0.08	167	0	70.00	0.14	0.11	166	-1	76.23	0.15	0.13	163	-1
40	61.69	0.12	0.08	167	0	68.80	0.14	0.11	165	-1	74.92	0.15	0.13	162	-1
41	60.65	0.12	0.08	167	0	67.64	0.14	0.11	164	-1	73.66	0.15	0.13	161	-1
42	59.65	0.12	0.08	167	0	66.53	0.13	0.11	163	-1	72.45	0.15	0.13	159	-1
43	58.68	0.11	0.08	166	0	65.46	0.13	0.11	163	-1	71.28	0.14	0.13	158	-1
44	57.75	0.11	0.08	166	0	64.42	0.13	0.11	162	-1	70.16	0.14	0.13	157	-1
45	56.85	0.11	0.08	166	0	63.43	0.13	0.11	161	-1	69.07	0.14	0.13	155	-1
46	55.98	0.11	0.08	165	0	62.46	0.13	0.11	160	-1	68.03	0.14	0.13	154	-2
47	55.14	0.11	0.08	165	-1	61.53	0.12	0.11	159	-1	67.01	0.13	0.13	152	-152
48	54.33	0.11	0.08	164	-1	60.63	0.12	0.11	157	-1	66.04	0.13	0.00	0	0
49	53.54	0.10	0.08	164	-1	59.76	0.12	0.11	156	-1	65.09	0.13	0.00	0	0
50	52.78	0.10	0.08	163	-1	58.92	0.12	0.11	155	-1	64.17	0.13	0.00	0	0
51	52.05	0.10	0.08	162	-1	58.11	0.12	0.11	154	-1	63.29	0.13	0.00	0	0
52	51.34	0.10	0.08	162	-1	57.32	0.11	0.11	153	-1	62.43	0.13	0.00	0	0
53	50.64	0.10	0.08	161	-1	56.55	0.11	0.11	151	-1	61.60	0.12	0.00	0	0
54	49.97	0.10	0.08	160	-1	55.80	0.11	0.11	150	-150	60.79	0.12	0.00	0	0
55	49.32	0.10	0.08	160	-1	55.08	0.11	0.00	0	0	60.00	0.12	0.00	0	0
56	48.69	0.09	0.08	159	-1	54.38	0.11	0.00	0	0	59.24	0.12	0.00	0	0
57	48.08	0.09	0.08	158	-1	53.70	0.11	0.00	0	0	58.50	0.12	0.00	0	0
58	47.48	0.09	0.08	157	-1	53.04	0.11	0.00	0	0	57.78	0.12	0.00	0	0
59	46.90	0.09	0.08	156	-1	52.39	0.11	0.00	0	0	57.08	0.11	0.00	0	0
60	46.34	0.09	0.08	155	-1	51.77	0.10	0.00	0	0	56.41	0.11	0.00	0	0
61	45.79	0.09	0.08	154	-1	51.16	0.10	0.00	0	0	55.74	0.11	0.00	0	0
62	45.25	0.09	0.08	153	-1	50.56	0.10	0.00	0	0	55.10	0.11	0.00	0	0
63	44.73	0.087	0.080	153	-1	49.99	0.100	0.000	0	0	54.47	0.109	0.000	0	0
64	44.22	0.086	0.080	152	-1	49.42	0.099	0.000	0	0	53.86	0.108	0.000	0	0
65	43.73	0.085	0.0805	151	-1	48.87	0.098	0.000	0	0	53.27	0.107	0.000	0	0
66	43.25	0.084	0.0805	150	-1	48.34	0.097	0.000	0	0	52.68	0.106	0.000	0	0
67	42.78	0.083	0.0805	148	-1	47.82	0.096	0.000	0	0	52.12	0.105	0.000	0	0
68	42.32	0.082	0.0805	147	-1	47.31	0.095	0.000	0	0	51.56	0.103	0.000	0	0
69	41.87	0.081	0.0805	146	-1	46.81	0.094	0.000	0	0	51.03	0.102	0.000	0	0

= Maximum Storage Volume

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	=	0.72	ha		
Total Imperviousness	=	88%			
Storage Volume	=	40.6	m^3/ha		(Enhanced 80% long-term S.S. removal)
Area 1 Storage Volume Required	=	0.72	x	40.6	
	=	29.3	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	=	5145	x	0.0250
Area Storage Volume Required	=	128.6	m^3	

Note: Therefore, the storage required with 12.5 mm over the total impervious area on the site governs.

Find Storage Volume provided in Permeable Pavers:

Area of Pavers (A)	=	535.0	m^2
Depth of Trench (d)	=	0.75	m
Storage Volume (V)	=	0.4(A x d)	
	=	160.5	m^3

		Required		Provided	
Area Storage Volume	=	128.6	m^3	160.5	m^3

The required volume will be provided in the permeable pavers, resulting in a total storage of 38.0 m^3.

Use Equation 4.12 to find Area of Permeable Pavers:

Area Design Volume (V)	=	160.5	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) = $\frac{1000Vd}{k(h+d)t}$

= 114.3 m^2

		Required		Provided	
Area 1 Surface Area	=	91.6	m^2	535.0	m^2

PEARSON ENGINEERING

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: 16-Dec-21
File: 20055
Contract/Project: 125 Simcoe Road

Areas	MANHOLE FROM	MANHOLE TO	LENGTH (m)	INCREMENT C	INCREMENT A	INCREMENT CA	TOTAL CA	FLOW TIME (min) TO	FLOW TIME (min) IN	I (mm/h)	TOTAL Q (cms)	S (%)	D (mm)	Q FULL (cms)	V FULL (m/s)	PERCENT FULL (%)
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	0.14	104.91	0.05	4.80	300	0.21	3.00	22.2
-	OVERFLOW CBMH1	MH3	13.6	0.00	0.00	0.00	0.16	10.14	0.07	104.18	0.05	5.40	300	0.22	3.18	20.8
-	MH3	MH2	10.1	0.00	0.00	0.00	0.16	10.21	0.16	103.81	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

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	1.00	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	1.00	0.00	0.00
Total P (kg) :	0.00	1.32	0.00	0.00
Total Uncontrolled Post-Development (kg):		**1.32**		

Post-Development Condition (Controlled):

Uncontrolled Area :	Cropland	High Intensity Residential	Hay / Pasture	Open Water
Area (ha):	0.00	0.27	0.00	0.00
Total P (kg) :	0.00	0.36	0.00	0.00
Total Uncontrolled (kg):		**0.36**		

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	0.46	0.00	0.00
Total P (kg) :	0.00	0.60	0.00	0.00

Sand or Media Filters	
Total P (kg):	0.60
Sand or Media Filters Proficiency (%):	45
P Removed (kg):	0.27
P Remaining (kg):	0.33

Total Post-Development P (kg): **0.78**

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	7032	2932	0	9964
Pervious Area	7032	0	0	7032
Impervious Area	0	2932	0	2932
Infiltration Factors				
Topography Infiltration Factor	0.2	0	0	
Soil Infiltration Factor	0.2	0	0	
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
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	523.3
Net Surplus	371.9	886.3	886.3	523.3
Evapotranspiration	561.0	46.6	46.6	409.6
Infiltration	186.0	0.0	0.0	131.2
Rooftop Infiltration	0.0	0.0	0.0	0.0
Total Infiltration	186.0	0.0	0.0	131.2
Runoff Pervious Areas	186.0	0.0	0.0	131.2
Runoff Impervious Areas	0.0	886.3	886.3	260.8
Total Runoff	186.0	886.3	886.3	392.0
Total Outputs	932.9	932.9	932.9	932.9
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0
Inputs (Volumes)				
Precipitation	6560	2736	0	9295
Run-On	0	0	0	0
Other Inputs	0	0	0	0
Total Inputs	6560	2736	0	9295
Outputs (Volumes)				
Precipitation Surplus	2615	2599	0	5214
Net Surplus	2615	2599	0	5214
Evapotranspiration	3945	137	0	4082
Infiltration	1308	0	0	1308
Rooftop Infiltration	0	0	0	0
Total Infiltration	1308	0	0	1308
Runoff Pervious Areas	1308	0	0	1308
Runoff Impervious Areas	0	2599	0	2599
Total Runoff	1308	2599	0	3906
Total Outputs	6560	2736	0	9295
Difference (Inputs - Outputs)	0	0	0	0

(From MOE Table 3.1 for Rolling Land)

(From MOE Table 3.1 for Medium combinations of clay and loam)

(Precipitation values from Environment Canada)

Note: Highlighted cells are input cells.

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

Catchment Designation	Site			
	Grassed	Paved	Building	Total
Area	3133	5145	1686	9964
Pervious Area	3133	0	0	3133
Impervious Area	0	5145	1686	6831
Infiltration Factors				
Topography Infiltration Factor	0.2	0	0	
Soil Infiltration Factor	0.2	0	0	
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
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	724.5
Net Surplus	371.9	886.3	886.3	724.5
Evapotranspiration	561.0	46.6	46.6	208.4
Infiltration	186.0	0.0	0.0	58.5
Rooftop Infiltration	0.0	0.0	0.0	0.0
Total Infiltration	186.0	0.0	0.0	58.5
Runoff Pervious Areas	186.0	0.0	0.0	58.5
Runoff Impervious Areas	0.0	886.3	886.3	607.6
Total Runoff	186.0	886.3	886.3	666.1
Total Outputs	932.9	932.9	932.9	932.9
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0
Inputs (Volumes)				
Precipitation	2923	4800	1573	9296
Run-On	0	0	0	0
Other Inputs	0	0	0	0
Total Inputs	2923	4800	1573	9296
Outputs (Volumes)				
Precipitation Surplus	1165	4560	1495	7219
Net Surplus	1165	4560	1495	7219
Evapotranspiration	1758	240	79	2076
Infiltration	583	0	0	583
Rooftop Infiltration	0	0	0	0
Total Infiltration	583	0	0	583
Runoff Pervious Areas	583	0	0	583
Runoff Impervious Areas	0	4560	1495	6054
Total Runoff	583	4560	1495	6637
Total Outputs	2923	4800	1573	9296
Difference (Inputs - Outputs)	0	0	0	0

(From MOE Table 3.1 for Rolling Land)
(From MOE Table 3.1 for Medium combinations of clay and loam)
(Precipitation values from Environment Canada)

Note: Highlighted cells are input cells.

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

Catchment Designation	Site				Notes
	Grassed	Paved	Building (w. Infil.)	Total	
Area	3133	5145	1686	9964	
Pervious Area	3133	0	0	3133	
Impervious Area	0	5145	1686	6831	
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	724.5	
Net Surplus	371.9	886.3	886.3	724.5	
Evapotranspiration	561.0	46.6	46.6	208.4	
Infiltration	186.0	0.0	0.0	58.5	
Rooftop Infiltration	0.0	0.0	**430.0**	72.8	Depth of rainfall over the rooftop required to be infiltrated to achieve water balance.
Total Infiltration	186.0	0.0	430.0	131.2	
Runoff Pervious Areas	186.0	0.0	0.0	58.5	
Runoff Impervious Areas	0.0	886.3	456.3	534.8	
Total Runoff	186.0	886.3	456.3	593.3	
Total Outputs	932.9	932.9	932.9	932.9	
Difference (Inputs - Outputs)	0.0	0.0	0.0	0.0	
Inputs (Volumes)					
Precipitation	2923	4800	1573	9296	
Run-On	0	0	0	0	
Other Inputs	0	0	0	0	
Total Inputs	2923	4800	1573	9296	
Outputs (Volumes)					
Precipitation Surplus	1165	4560	1495	7219	
Net Surplus	1165	4560	1495	7219	
Evapotranspiration	1758	240	79	2076	
Infiltration	583	0	0	583	
Rooftop Infiltration	0	0	725	725	
Total Infiltration	583	0	725	1308	
Runoff Pervious Areas	583	0	0	583	
Runoff Impervious Areas	0	4560	769	5329	
Total Runoff	583	4560	769	5912	
Total Outputs	2923	4800	1573	9296	
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 = 430.0 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

$$\% \text{ Annual Rainfall} = \frac{430.0 \text{ mm}}{932.9 \text{ mm}}$$

= 46%

From MOE Figure C-2, 46% 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	

Therefore, the water balance is achieved.

Appendix F

StormTech Underground Storage Chamber Information

StormTech®

Detention • Retention • Water Quality

A division of ADS

Product Catalog

This catalog is not intended to provide requirements for design or installation of StormTech chambers. Refer to the appropriate "StormTech Design Manual" and "StormTech Construction Guide" for design and installation specifications.

U.S. GREEN BUILDING COUNCIL MEMBER

StormTech Subsurface Stormwater Management

Table of Contents

StormTech has thousands of chamber systems in service throughout the world. All StormTech chambers are designed to meet the most stringent industry performance standards for superior structural integrity. The StormTech system is designed primarily to be used under parking lots, roadways and heavy earth loads saving valuable land and protecting water resources for commercial and municipal applications. In our continuing desire to answer designers' challenges, StormTech has expanded the family of products providing engineers, developers, regulators and contractors with additional site specific flexibility.

Advanced Structural Performance for Greater Long-Term Reliability

StormTech developed a state of the art chamber design through:

- Collaboration with world-renowned experts of buried drainage structures to develop and evaluate the structural testing program and product design
- Designing chambers to exceed American Association of State Highway and Transportation Officials (AASHTO) LRFD design specifications for HS-20 live loads and deep burial earth loads
- Subjecting the chambers to rigorous full scale testing, under severe loading conditions to verify the AASHTO safety factors for live load and deep burial applications
- Designing chambers to conform to the product requirements of ASTM F2418 (polypropylene chambers) and ASTM F2922 (polyethylene chambers) and design requirements of ASTM F2787 ensuring both the assurance of product quality and safe structural design

Our Chambers Provide...

- Large capacity that *fits very tight footprints* providing developers with more useable land for development.
- *A proven attenuation alternative* to cumbersome large diameter metal pipe or snap together plastic crates and unreliable multi-layer systems.
- Provides the *strength* of concrete vaults at a very competitive price.
- The robust *continuous true elliptical arch design* which effectively transfers loads to the surrounding backfill providing the long-term safety factor required by AASHTO. Offers developers a cost-effective underground system that will perform as designed for decades.
- *Designed in accordance with the AASHTO LRFD Bridge Design Specifications* providing engineers with a structural performance standard for live and long-term dead loads.
- *Polypropylene and polyethylene* resins tested using ASTM standards to ensure long and short-term structural properties.
- *Injection molded* for uniform wall thickness and repeatable quality.
- Third party *tested and patented Isolator Row* for less frequent maintenance, water quality and long-term performance.
- Incorporates *traditional manifold/header designs* using conventional hydraulic equations that can easily verify flow equalization and scour velocity.
- *Open chamber design* requiring only one chamber model to construct each row assuring ease of construction and no repeating end walls to obstruct access or flow.

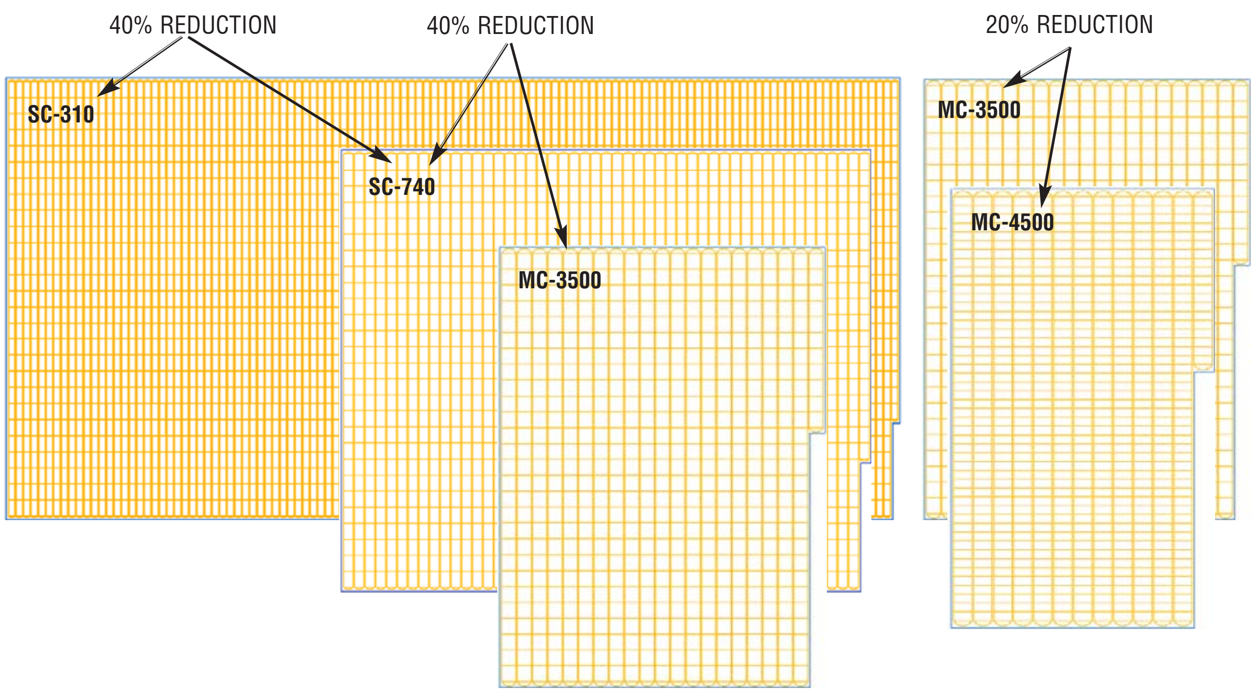
StormTech offers a variety of chamber sizes (SC-310, SC-740, DC-780, MC-3500 and MC-4500) so the consulting design engineer can choose the chamber that is best suited for the site conditions and regulatory requirements. StormTech has thousands of chamber systems in service worldwide. We provide plan layout and cost estimate services at no charge for consulting engineers and developers.

StormTech Subsurface Stormwater Management

PRODUCT SPECIFICATIONS	SC-310	SC-740	DC-780	MC-3500	MC-4500
Height, in. (mm)	16 (406)	30 (762)	30 (762)	45 (1143)	60 (1524)
Width, in. (mm)	34 (864)	51 (1295)	51 (1295)	77 (1956)	100 (2540)
Length, in. (mm)	90.7 (2300)	90.7 (2300)	90.7 (2300)	90 (2286)	52 (1321)
Installed Length, in. (mm)	85.4 (2170)	85.4 (2170)	85.4 (2170)	86.0 (2184)	48.3 (1227)
Bare Chamber Storage, cf (cm)	14.7 (0.42)	45.9 (1.30)	46.2 (1.30)	109.9 (3.11)	106.5 (3.01)
Stone above, in. (mm)	6 (152)	6 (152)	6 (152)	12 (305)	12 (305)
Minimum Stone below, in. (mm)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)
Row Spacing, in. (mm)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)
Minimum Installed Storage, cf (cm)	**31.0 (0.88)**	**74.9 (2.12)**	**78.4 (2.22)**	**178.9 (5.06)**	**162.6 (4.60)**
Storage Per Unit Area, cf/sf (cm/sm)	1.31 (0.39)	2.21 (0.67)	2.32 (0.70)	3.48 (1.06)	4.45 (1.35)

***NOTE**: Spec sheets for our RC-310 and RC-750, recycled chambers, are available upon request.*

Example: Footprint Comparison – 100,000 CF Project



StormTech and LEED

List of LEED Credits that StormTech may contribute towards:

SUSTAINABLE SITES

- **SS Credit 5.1 - Site Development: Protect or Restore Habitat**
  Utilizing StormTech System beneath roadways, surface parking, walkways, etc. may reduce overall site disturbance
- **SS Credit 5.2 - Site Development: Maximize Open Space**
  Utilizing StormTech System can increase overall open space and may reduce overall site disturbance
- **SS Credit 6.1 - Stormwater Design: Quantity Control**
  Design StormTech System per local or LEED stormwater quantity requirements, whichever is more stringent
- **SS Credit 6.2 - Stormwater Design: Quality Control**
  Use of Isolator Row provides sediment removal, and can also promote infiltration and groundwater recharge
- **SS Credit 7.1 - Heat Island Effect: Non-Roof**
  Use of StormTech System may eliminate need for above ground detention ponds, thus reducing thermal impacts of stormwater runoff

Water Efficiency

- **WE Credit 1 - Water Efficient Landscaping**
  Utilize StormTech System to store captured rainwater for landscape irrigation
- **WE Credit 2 - Innovative Wastewater Technologies**
  Utilize StormTech System to store captured rainwater to reduce potable water demand.
- **WE Credit 3 - Water Use Reduction**
  Utilize StormTech System to store captured rainwater and allow reuse for non-potable applications

Materials and Resources

- **MR Credit 4 – Recycled Content**
  Utilize recycled concrete as the backfill material for the StormTech System.
- **MR Credit 5 – Regional Materials**
  Stone backfill material for the StormTech System will apply if extracted within 500 miles of project site.

Innovation & Design

- **ID Credit 1 – Innovation in Design**
  Utilize StormTech System to substantially exceed a performance credit

StormTech SC-310 Chamber

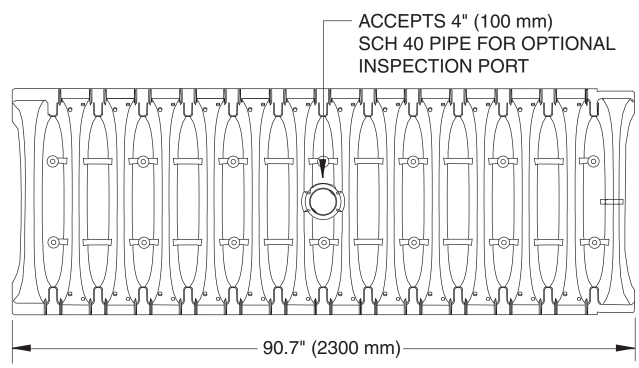
Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots thus maximizing land usage for commercial and municipal applications.

StormTech SC-310 Chamber (not to scale)

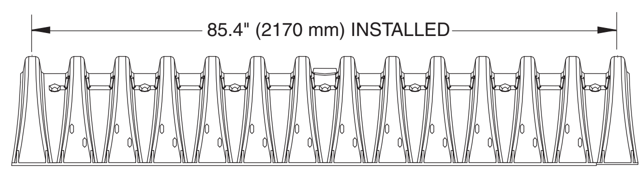
Nominal Chamber Specifications

Size (L x W x H)	85.4" x 34.0" x 16.0" (2170 x 864 x 406 mm)
Chamber Storage	14.7 ft³ (0.42 m³)
Min. Installed Storage*	31.0 ft³ (0.88 m³)
Weight	37.0 lbs (16.8 kg)

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

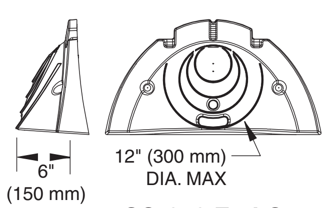


SC-310 Chamber

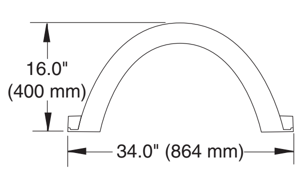


Shipping

- 41 chambers/pallet
- 108 end caps/pallet
- 18 pallets/truck



SC-310 End Cap



StormTech SC-310 Chamber

SC-310 Cumulative Storage Volumes Per Chamber

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

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft^3 (m^3)	Total System Cumulative Storage ft^3 (m^3)
28 (711)	↑ 14.70 (0.416)	31.00 (0.878)
27 (686)	14.70 (0.416)	30.21 (0.855)
26 (680)	Stone 14.70 (0.416)	29.42 (0.833)
25 (610)	Cover 14.70 (0.416)	28.63 (0.811)
24 (609)	14.70 (0.416)	27.84 (0.788)
23 (584)	↓ 14.70 (0.416)	27.05 (0.766)
22 (559)	14.70 (0.416)	26.26 (0.748)
21 (533)	14.64 (0.415)	25.43 (0.720)
20 (508)	14.49 (0.410)	24.54 (0.695)
19 (483)	14.22 (0.403)	23.58 (0.668)
18 (457)	13.68 (0.387)	22.47 (0.636)
17 (432)	12.99 (0.368)	21.25 (0.602)
16 (406)	12.17 (0.345)	19.97 (0.566)
15 (381)	11.25 (0.319)	18.62 (0.528)
14 (356)	10.23 (0.290)	17.22 (0.488)
13 (330)	9.15 (0.260)	15.78 (0.447)
12 (305)	7.99 (0.227)	14.29 (0.425)
11 (279)	6.78 (0.192)	12.77 (0.362)
10 (254)	5.51 (0.156)	11.22 (0.318)
9 (229)	4.19 (0.119)	9.64 (0.278)
8 (203)	2.83 (0.081)	8.03 (0.227)
7 (178)	1.43 (0.041)	6.40 (0.181)
6 (152)	↑ 0	4.74 (0.134)
5 (127)	0	3.95 (0.112)
4 (102)	0	3.16 (0.090)
3 (76)	Stone Foundation 0	2.37 (0.067)
2 (51)	0	1.58 (0.046)
1 (25)	↓ 0	0.79 (0.022)

Note: Add 0.79 cu. ft. (0.022 m^3) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft^3 (m^3)

	Bare Chamber Storage	Chamber and Stone Stone Foundation Depth in. (mm)		
	ft^3 (m^3)	6 (150)	12 (300)	18 (450)
StormTech SC-310	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

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

Amount of Stone Per Chamber

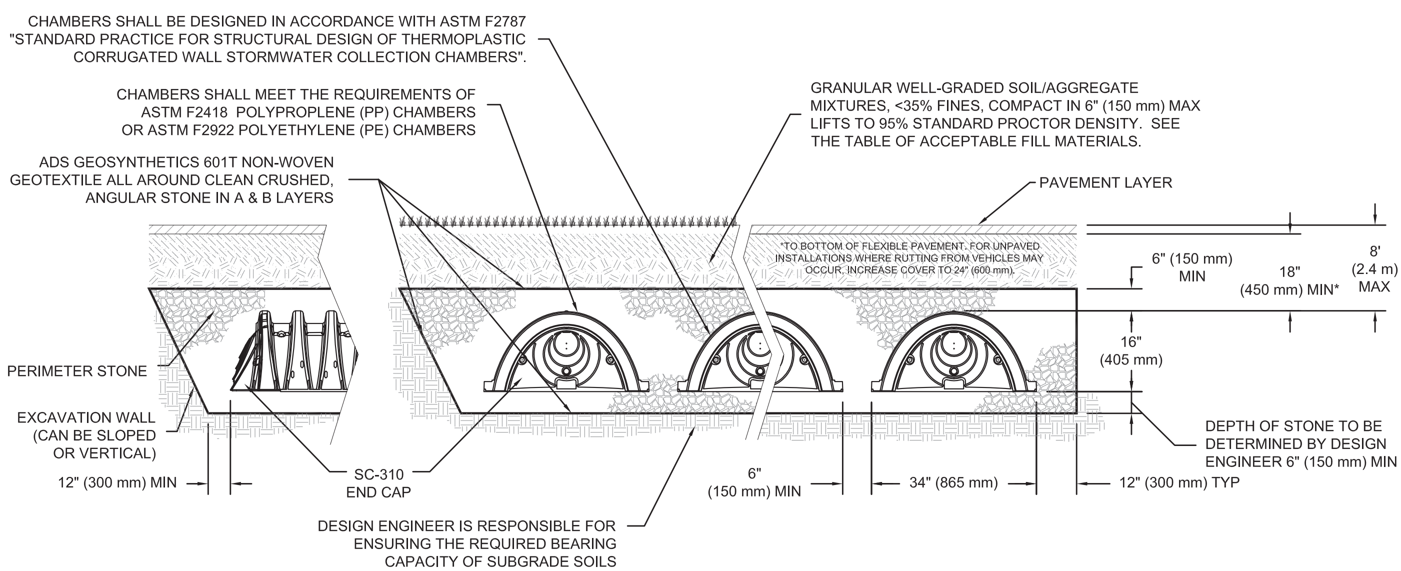
	Stone Foundation Depth		
ENGLISH TONS (yds^3)	**6"**	**12"**	**18"**
StormTech SC-310	2.1 (1.5 yd^3)	2.7 (1.9 yd^3)	3.4 (2.4 yd^3)
METRIC KILOGRAMS (m^3)	**150 mm**	**300 mm**	**450 mm**
StormTech SC-310	1830 (1.1 m^3)	2490 (1.5 m^3)	2990 (1.8 m^3)

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

Volume of Excavation Per Chamber yd^3 (m^3)

	Stone Foundation Depth		
	6" (150 mm)	**12" (300 mm)**	**18" (450 mm)**
StormTech SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

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



THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

StormTech SC-310-3 Chamber

The proven strength and durability of the SC-310-3 Chamber allows for a design option for sites where limited cover, limited space, high water table and escalated aggregate cost are a factor. The SC-310-3 has a minimum cover requirement of 16" (400 mm) to bottom of pavement and reduces the spacing requirement between chambers by 50% to 3" (76 mm). This provides a reduced footprint overall and allows the designer to offer a traffic bearing application yet comply with water table separation regulations.

StormTech SC-310-3 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	85.4" x 34.0" x 16.0" (2170 x 864 x 406 mm)
Chamber Storage	14.7 ft³ (0.42 m³)
Min. Installed Storage*	29.3 ft³ (0.83 m³)
Weight	37.0 lbs (16.8 kg)

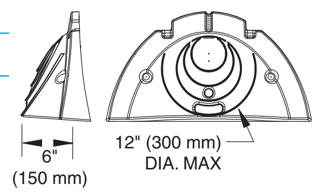
*Assumes 6" (150 mm) stone above and below chambers, 3" (76 mm) row spacing and 40% stone porosity.

Shipping

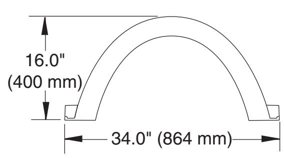
41 chambers/pallet

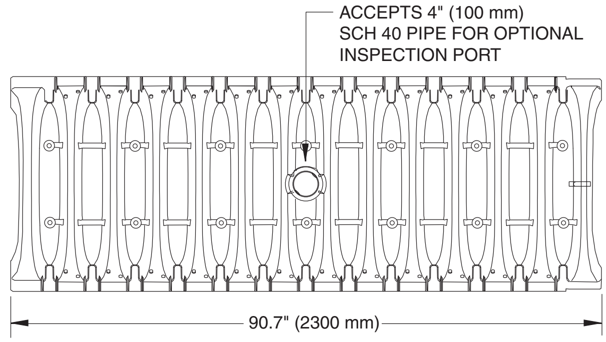
108 end caps/pallet

18 pallets/truck

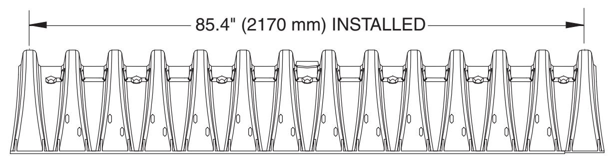


SC-310 End Cap

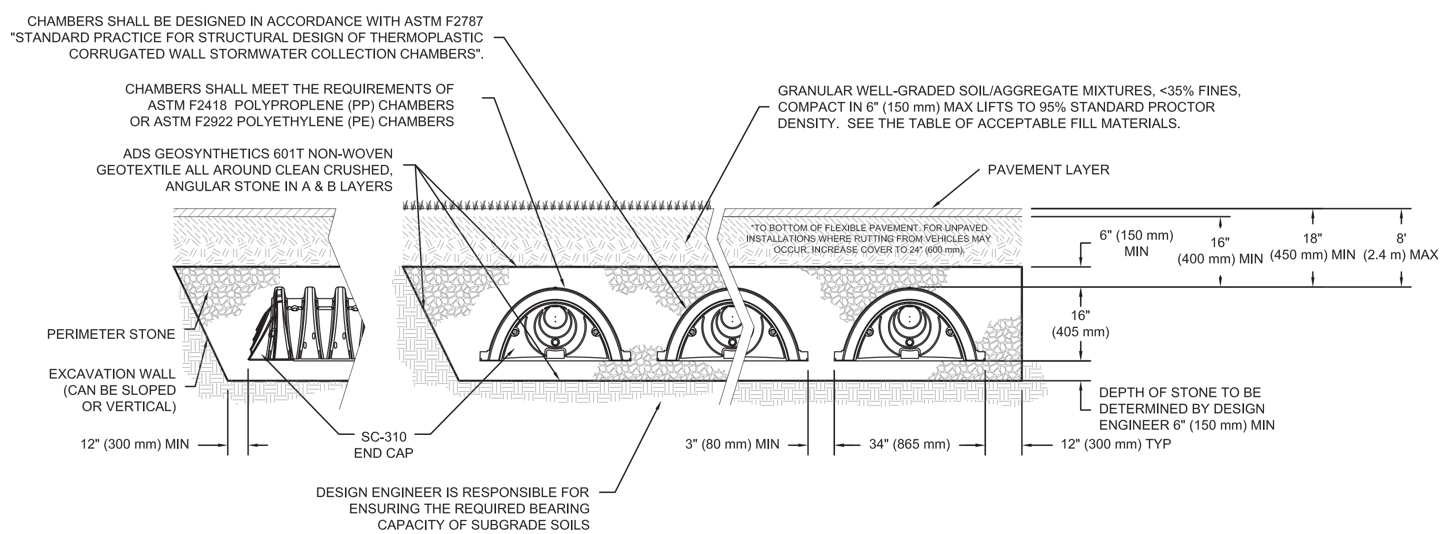




SC-310 Chamber



Typical Cross Section Detail



THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

StormTech Subsurface Stormwater Management

Table of Contents

StormTech has thousands of chamber systems in service throughout the world. All StormTech chambers are designed to meet the most stringent industry performance standards for superior structural integrity. The StormTech system is designed primarily to be used under parking lots, roadways and heavy earth loads saving valuable land and protecting water resources for commercial and municipal applications. In our continuing desire to answer designers' challenges, StormTech has expanded the family of products providing engineers, developers, regulators and contractors with additional site specific flexibility.

Advanced Structural Performance for Greater Long-Term Reliability

StormTech developed a state of the art chamber design through:

- Collaboration with world-renowned experts of buried drainage structures to develop and evaluate the structural testing program and product design
- Designing chambers to exceed American Association of State Highway and Transportation Officials (AASHTO) LRFD design specifications for HS-20 live loads and deep burial earth loads
- Subjecting the chambers to rigorous full scale testing, under severe loading conditions to verify the AASHTO safety factors for live load and deep burial applications
- Designing chambers to conform to the product requirements of ASTM F2418 (polypropylene chambers) and ASTM F2922 (polyethylene chambers) and design requirements of ASTM F2787 ensuring both the assurance of product quality and safe structural design

Our Chambers Provide...

- Large capacity that *fits very tight footprints* providing developers with more useable land for development.
- *A proven attenuation alternative* to cumbersome large diameter metal pipe or snap together plastic crates and unreliable multi-layer systems.
- Provides the *strength* of concrete vaults at a very competitive price.
- The robust *continuous true elliptical arch design* which effectively transfers loads to the surrounding backfill providing the long-term safety factor required by AASHTO. Offers developers a cost-effective underground system that will perform as designed for decades.
- *Designed in accordance with the AASHTO LRFD Bridge Design Specifications* providing engineers with a structural performance standard for live and long-term dead loads.
- *Polypropylene and polyethylene* resins tested using ASTM standards to ensure long and short-term structural properties.
- *Injection molded* for uniform wall thickness and repeatable quality.
- Third party *tested and patented Isolator Row* for less frequent maintenance, water quality and long-term performance.
- Incorporates *traditional manifold/header designs* using conventional hydraulic equations that can easily verify flow equalization and scour velocity.
- *Open chamber design* requiring only one chamber model to construct each row assuring ease of construction and no repeating end walls to obstruct access or flow.

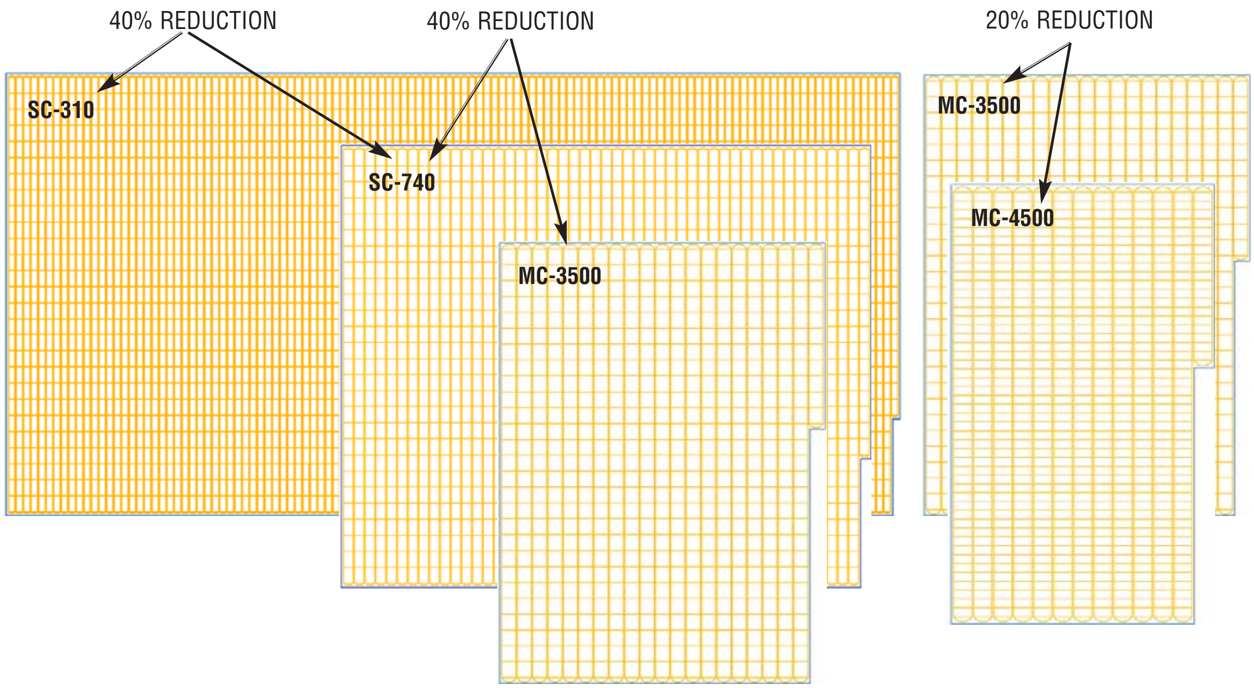
StormTech offers a variety of chamber sizes (SC-310, SC-740, DC-780, MC-3500 and MC-4500) so the consulting design engineer can choose the chamber that is best suited for the site conditions and regulatory requirements. StormTech has thousands of chamber systems in service worldwide. We provide plan layout and cost estimate services at no charge for consulting engineers and developers.

StormTech Subsurface Stormwater Management

PRODUCT SPECIFICATIONS	SC-310	SC-740	DC-780	MC-3500	MC-4500
Height, in. (mm)	16 (406)	30 (762)	30 (762)	45 (1143)	60 (1524)
Width, in. (mm)	34 (864)	51 (1295)	51 (1295)	77 (1956)	100 (2540)
Length, in. (mm)	90.7 (2300)	90.7 (2300)	90.7 (2300)	90 (2286)	52 (1321)
Installed Length, in. (mm)	85.4 (2170)	85.4 (2170)	85.4 (2170)	86.0 (2184)	48.3 (1227)
Bare Chamber Storage, cf (cm)	14.7 (0.42)	45.9 (1.30)	46.2 (1.30)	109.9 (3.11)	106.5 (3.01)
Stone above, in. (mm)	6 (152)	6 (152)	6 (152)	12 (305)	12 (305)
Minimum Stone below, in. (mm)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)
Row Spacing, in. (mm)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)
Minimum Installed Storage, cf (cm)	**31.0 (0.88)**	**74.9 (2.12)**	**78.4 (2.22)**	**178.9 (5.06)**	**162.6 (4.60)**
Storage Per Unit Area, cf/sf (cm/sm)	1.31 (0.39)	2.21 (0.67)	2.32 (0.70)	3.48 (1.06)	4.45 (1.35)

***NOTE**: Spec sheets for our RC-310 and RC-750, recycled chambers, are available upon request.*

Example: Footprint Comparison – 100,000 CF Project



StormTech and LEED

List of LEED Credits that StormTech may contribute towards:

SUSTAINABLE SITES

- **SS Credit 5.1 - Site Development: Protect or Restore Habitat**
  Utilizing StormTech System beneath roadways, surface parking, walkways, etc. may reduce overall site disturbance
- **SS Credit 5.2 - Site Development: Maximize Open Space**
  Utilizing StormTech System can increase overall open space and may reduce overall site disturbance
- **SS Credit 6.1 - Stormwater Design: Quantity Control**
  Design StormTech System per local or LEED stormwater quantity requirements, whichever is more stringent
- **SS Credit 6.2 - Stormwater Design: Quality Control**
  Use of Isolator Row provides sediment removal, and can also promote infiltration and groundwater recharge
- **SS Credit 7.1 - Heat Island Effect: Non-Roof**
  Use of StormTech System may eliminate need for above ground detention ponds, thus reducing thermal impacts of stormwater runoff

Water Efficiency

- **WE Credit 1 - Water Efficient Landscaping**
  Utilize StormTech System to store captured rainwater for landscape irrigation
- **WE Credit 2 - Innovative Wastewater Technologies**
  Utilize StormTech System to store captured rainwater to reduce potable water demand.
- **WE Credit 3 - Water Use Reduction**
  Utilize StormTech System to store captured rainwater and allow reuse for non-potable applications

Materials and Resources

- **MR Credit 4 – Recycled Content**
  Utilize recycled concrete as the backfill material for the StormTech System.
- **MR Credit 5 – Regional Materials**
  Stone backfill material for the StormTech System will apply if extracted within 500 miles of project site.

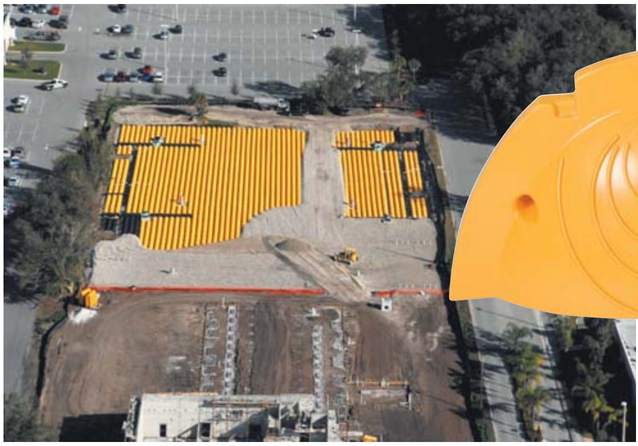
Innovation & Design

- **ID Credit 1 – Innovation in Design**
  Utilize StormTech System to substantially exceed a performance credit

StormTech SC-310 Chamber

SC-310 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 commercial and municipal applications.

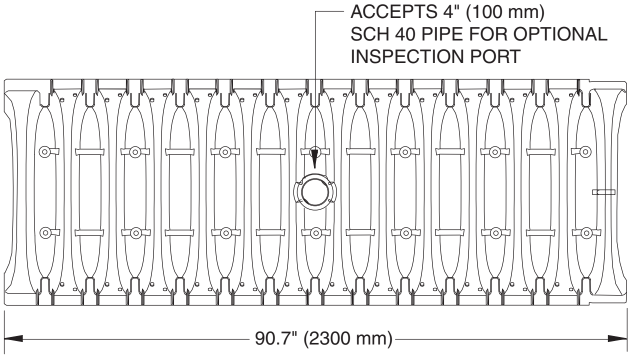


StormTech SC-310 Chamber (not to scale)

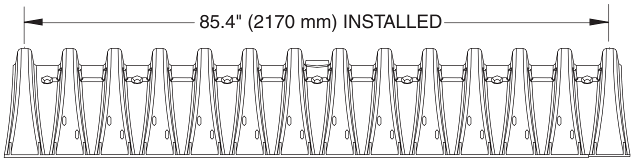
Nominal Chamber Specifications

Size (L x W x H)	85.4" x 34.0" x 16.0" (2170 x 864 x 406 mm)
Chamber Storage	14.7 ft³ (0.42 m³)
Min. Installed Storage*	31.0 ft³ (0.88 m³)
Weight	37.0 lbs (16.8 kg)

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



SC-310 Chamber

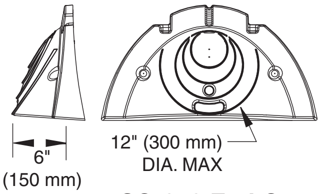


Shipping

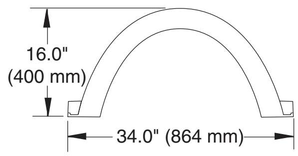
41 chambers/pallet

108 end caps/pallet

18 pallets/truck



SC-310 End Cap



StormTech SC-310 Chamber

SC-310 Cumulative Storage Volumes Per Chamber

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

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	↑ 14.70 (0.416)	31.00 (0.878)
27 (686)	14.70 (0.416)	30.21 (0.855)
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24 (609)	14.70 (0.416)	27.84 (0.788)
23 (584)	↓ 14.70 (0.416)	27.05 (0.766)
22 (559)	14.70 (0.416)	26.26 (0.748)
21 (533)	14.64 (0.415)	25.43 (0.720)
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15 (381)	11.25 (0.319)	18.62 (0.528)
14 (356)	10.23 (0.290)	17.22 (0.488)
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8 (203)	2.83 (0.081)	8.03 (0.227)
7 (178)	1.43 (0.041)	6.40 (0.181)
6 (152)	↑ 0	4.74 (0.134)
5 (127)	0	3.95 (0.112)
4 (102)	0	3.16 (0.090)
3 (76)	Stone Foundation 0	2.37 (0.067)
2 (51)	0	1.58 (0.046)
1 (25)	↓ 0	0.79 (0.022)

Note: Add 0.79 cu. ft. (0.022 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 Stone Foundation Depth in. (mm) 6 (150)	12 (300)	18 (450)
StormTech SC-310	14.7 (0.4)	31.0 (0.9)	35.7 (1.0)	40.4 (1.1)

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

Amount of Stone Per Chamber

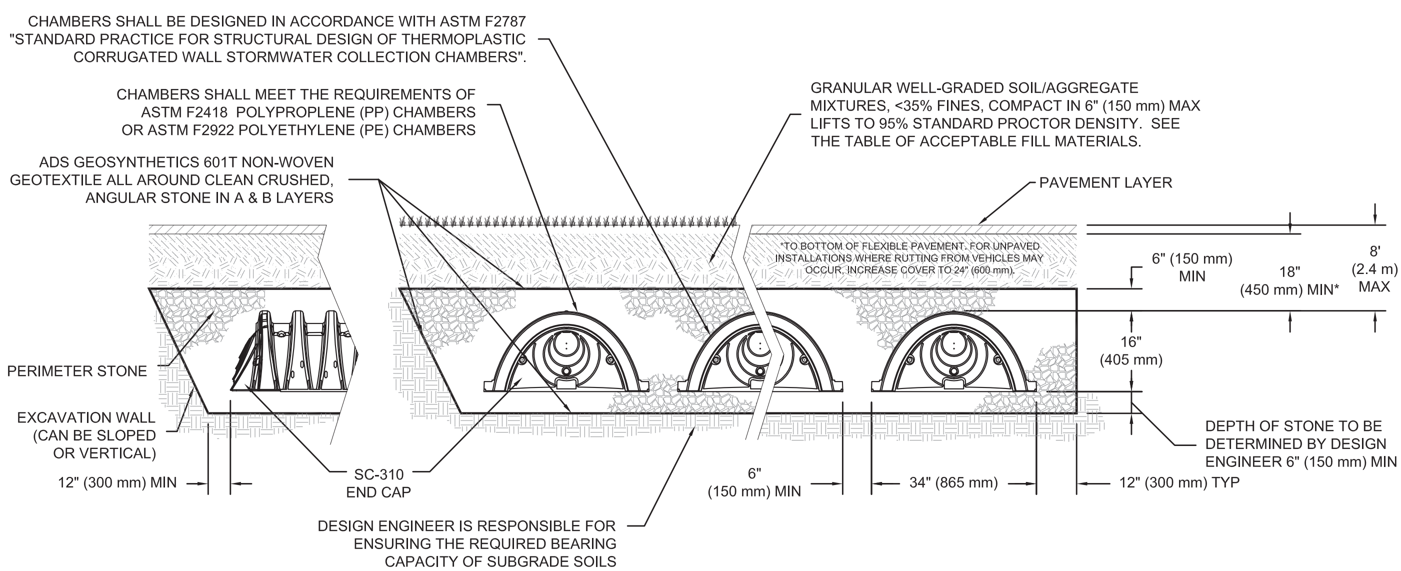
	Stone Foundation Depth		
ENGLISH TONS (yds³)	**6"**	**12"**	**18"**
StormTech SC-310	2.1 (1.5 yd³)	2.7 (1.9 yd³)	3.4 (2.4 yd³)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
StormTech SC-310	1830 (1.1 m³)	2490 (1.5 m³)	2990 (1.8 m³)

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

Volume of Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth 6" (150 mm)	12" (300 mm)	18" (450 mm)
StormTech SC-310	2.9 (2.2)	3.4 (2.6)	3.8 (2.9)

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



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StormTech SC-310-3 Chamber

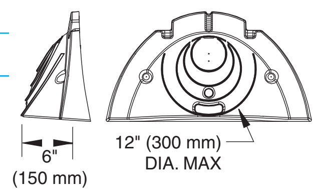
The proven strength and durability of the SC-310-3 Chamber allows for a design option for sites where limited cover, limited space, high water table and escalated aggregate cost are a factor. The SC-310-3 has a minimum cover requirement of 16" (400 mm) to bottom of pavement and reduces the spacing requirement between chambers by 50% to 3" (76 mm). This provides a reduced footprint overall and allows the designer to offer a traffic bearing application yet comply with water table separation regulations.

StormTech SC-310-3 Chamber (not to scale)

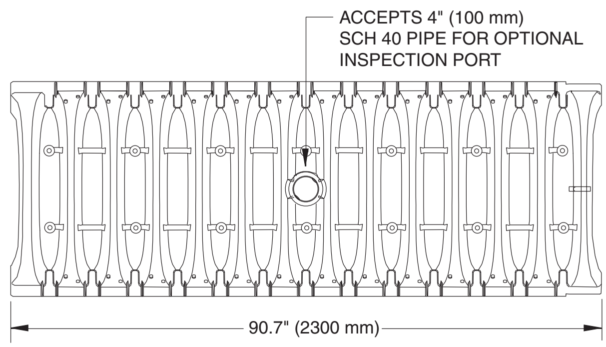
Nominal Chamber Specifications

Size (L x W x H)	85.4" x 34.0" x 16.0" (2170 x 864 x 406 mm)
Chamber Storage	14.7 ft³ (0.42 m³)
Min. Installed Storage*	29.3 ft³ (0.83 m³)
Weight	37.0 lbs (16.8 kg)

*Assumes 6" (150 mm) stone above and below chambers, 3" (76 mm) row spacing and 40% stone porosity.



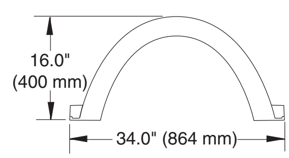
SC-310 End Cap

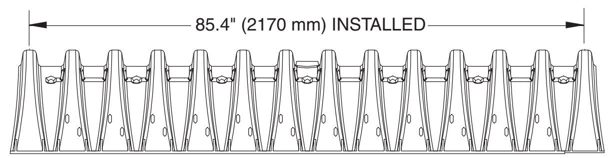


SC-310 Chamber

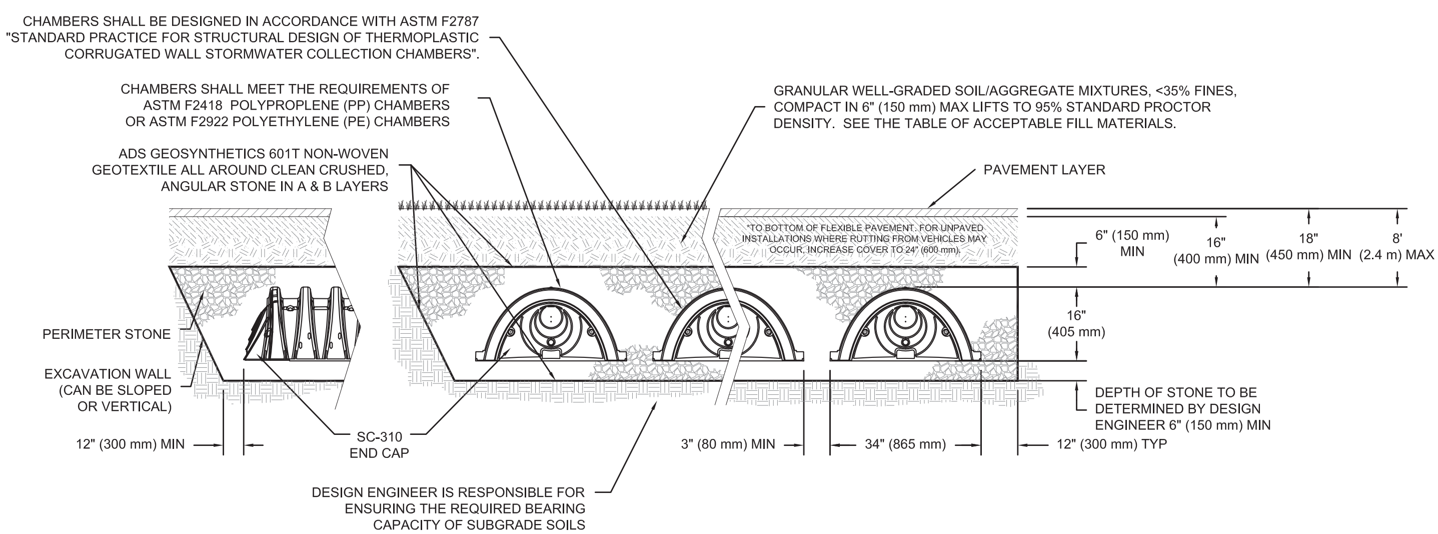
Shipping

- 41 chambers/pallet
- 108 end caps/pallet
- 18 pallets/truck





Typical Cross Section Detail



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StormTech SC-310-3 Chamber

SC-310-3 Cumulative Storage Volume Per Chamber

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

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	14.7 (0.416)	29.34 (0.831)
27 (686)	14.7 (0.416)	28.60 (0.810)
26 (660)	Stone Cover 14.7 (0.416)	27.87 (0.789)
25 (635)	14.7 (0.416)	27.14 (0.769)
24 (610)	14.7 (0.416)	26.41 (0.748)
23 (584)	14.7 (0.416)	25.68 (0.727)
22 (559)	14.7 (0.416)	24.95 (0.707)
21 (533)	14.64 (0.415)	24.18 (0.685)
20 (508)	14.49 (0.410)	23.36 (0.661)
19 (483)	14.22 (0.403)	22.47 (0.636)
18 (457)	13.68 (0.387)	21.41 (0.606)
17 (432)	12.99 (0.368)	20.25 (0.573)
16 (406)	12.17 (0.345)	19.03 (0.539)
15 (381)	11.25 (0.319)	17.74 (0.502)
14 (356)	10.23 (0.290)	16.40 (0.464)
13 (330)	9.15 (0.260)	15.01 (0.425)
12 (305)	7.99 (0.226)	13.59 (0.385)
11 (279)	6.78 (0.192)	12.13 (0.343)
10 (254)	5.51 (0.156)	10.63 (0.301)
9 (229)	4.19 (0.119)	9.11 (0.258)
8 (203)	2.83 (0.080)	7.56 (0.214)
7 (178)	1.43 (0.040)	5.98 (0.169)
6 (152)	0	4.39 (0.124)
5 (127)	0	3.66 (0.104)
4 (102)	Stone Foundation 0	2.93 (0.083)
3 (76)	0	2.19 (0.062)
2 (51)	0	1.46 (0.041)
1 (25)	0	0.73 (0.021)

Note: Add 0.73 ft³ (0.021 m³) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume per Chamber ft³ (m³)

	Bare Chamber Storage	Chamber and Stone Volume Stone Foundation Depth in. (mm)		
	ft³ (m³)	6 (150)	12 (300)	18 (450)
SC-310-3	14.7 (0.42)	29.3 (0.83)	33.7 (0.95)	38.1 (1.08)

Note: Assumes 6" (150 mm) of stone above chambers, 3" (76 mm) row spacing and 40% stone porosity.

Volume of Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6" (150)	12" (300)	18" (450)
SC-310-3	2.6 (2.0)	3.0 (2.3)	3.4 (2.6)

Note: Assumes 3" (76 mm) of row separation, 6" (150 mm) of stone above the chambers and 16" (400 mm) of cover. The volume of excavation will vary as depth of cover increases.

Amount of Stone Per Chamber

	Stone Foundation Depth		
ENGLISH TONS (yd³)	**6"**	**12"**	**18"**
SC-310-3	1.9 (1.4)	2.5 (1.8)	3.1 (2.2)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
SC-310-3	1724 (1.0)	2268 (1.3)	2812 (1.7)

Note: Assumes 6" (150 mm) of stone above chambers and 3" (76 mm) row spacing.

Cover ft (m)	Minimum Required Bearing Resistance for Service Loads ksf (kPa) 3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
1.5 (0.46)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)	15 (381)	15 (381)
2 (0.61)	6 152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)	15 (381)	15 (381)
2.5 (0.76)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)
3 (0.91)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)
3.5 (1.07)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)
4 (1.22)	6 152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)
4.5 (1.37)	6 152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)
5 (1.52)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)
5.5 (1.68)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)
6 (1.83)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)
6.5 (1.98)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)
7 (2.13)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)
7.5 (2.29)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)
8 (2.44)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)	15 (381)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the sub-grade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

StormTech SC-310-3 Chamber

SC-310-3 Cumulative Storage Volume Per Chamber

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

Depth of Water in System Inches (mm)		Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	↑	14.7 (0.416)	29.34 (0.831)
27 (686)		14.7 (0.416)	28.60 (0.810)
26 (660)	Stone	14.7 (0.416)	27.87 (0.789)
25 (635)	Cover	14.7 (0.416)	27.14 (0.769)
24 (610)		14.7 (0.416)	26.41 (0.748)
23 (584)	↓	14.7 (0.416)	25.68 (0.727)
22 (559)		14.7 (0.416)	24.95 (0.707)
21 (533)		14.64 (0.415)	24.18 (0.685)
20 (508)		14.49 (0.410)	23.36 (0.661)
19 (483)		14.22 (0.403)	22.47 (0.636)
18 (457)		13.68 (0.387)	21.41 (0.606)
17 (432)		12.99 (0.368)	20.25 (0.573)
16 (406)		12.17 (0.345)	19.03 (0.539)
15 (381)		11.25 (0.319)	17.74 (0.502)
14 (356)		10.23 (0.290)	16.40 (0.464)
13 (330)		9.15 (0.260)	15.01 (0.425)
12 (305)		7.99 (0.226)	13.59 (0.385)
11 (279)		6.78 (0.192)	12.13 (0.343)
10 (254)		5.51 (0.156)	10.63 (0.301)
9 (229)		4.19 (0.119)	9.11 (0.258)
8 (203)		2.83 (0.080)	7.56 (0.214)
7 (178)		1.43 (0.040)	5.98 (0.169)
6 (152)	↑	0	4.39 (0.124)
5 (127)		0	3.66 (0.104)
4 (102)	Stone Foundation	0	2.93 (0.083)
3 (76)		0	2.19 (0.062)
2 (51)		0	1.46 (0.041)
1 (25)	↓	0	0.73 (0.021)

Note: Add 0.73 ft³ (0.021 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 Volume Stone Foundation Depth in. (mm)		
		6 (150)	12 (300)	18 (450)
SC-310-3	14.7 (0.42)	29.3 (0.83)	33.7 (0.95)	38.1 (1.08)

Note: Assumes 6" (150 mm) of stone above chambers, 3" (76 mm) row spacing and 40% stone porosity.

Volume of Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6" (150)	12" (300)	18" (450)
SC-310-3	2.6 (2.0)	3.0 (2.3)	3.4 (2.6)

Note: Assumes 3" (76 mm) of row separation, 6" (150 mm) of stone above the chambers and 16" (400 mm) of cover. The volume of excavation will vary as depth of cover increases.

Amount of Stone Per Chamber

	Stone Foundation Depth		
ENGLISH TONS (yd³)	**6"**	**12"**	**18"**
SC-310-3	1.9 (1.4)	2.5 (1.8)	3.1 (2.2)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
SC-310-3	1724 (1.0)	2268 (1.3)	2812 (1.7)

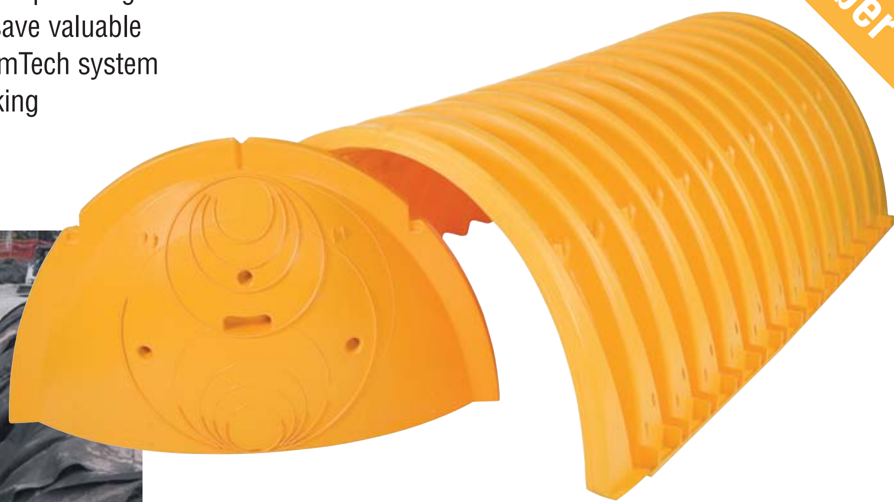
Note: Assumes 6" (150 mm) of stone above chambers and 3" (76 mm) row spacing.

Cover ft (m)	Minimum Required Bearing Resistance for Service Loads ksf (kPa) 3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
1.5 (0.46)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)	15 (381)	15 (381)
2 (0.61)	6 152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)	15 (381)	15 (381)
2.5 (0.76)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)
3 (0.91)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)
3.5 (1.07)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)
4 (1.22)	6 152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)
4.5 (1.37)	6 152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)
5 (1.52)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)
5.5 (1.68)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)
6 (1.83)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)
6.5 (1.98)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)
7 (2.13)	6 (152)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)
7.5 (2.29)	6 (152)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)
8 (2.44)	6 (152)	6 (152)	6 (152)	9 (229)	9 (229)	9 (229)	9 (229)	12 (305)	12 (305)	12 (305)	15 (381)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

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 commercial and municipal applications.



StormTech SC-740 Chamber (not to scale)

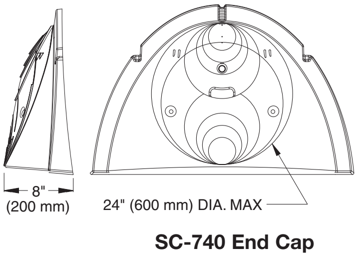
Nominal Chamber Specifications

Size (L x W x H)	85.4" x 51.0" x 30.0" (2170 x 1295 x 762 mm)
Chamber Storage	45.9 ft^3 (1.30 m^3)
Min. Installed Storage*	74.9 ft^3 (2.12 m^3)
Weight	74.0 lbs (33.6 kg)

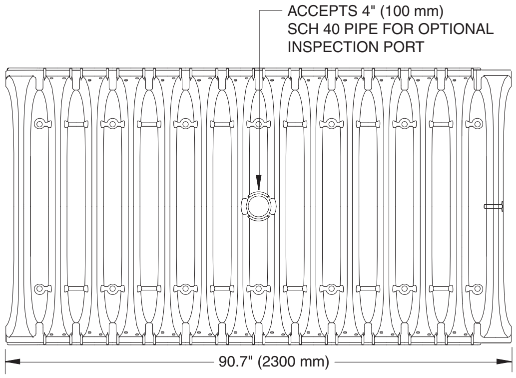
*Assumes 6" (150 mm) stone above, below and between chambers and 40% stone porosity.

Shipping

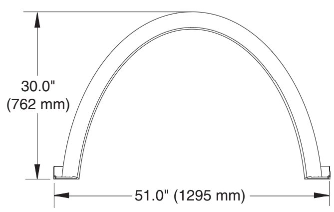
- 30 chambers/pallet
- 60 end caps/pallet
- 12 pallets/truck

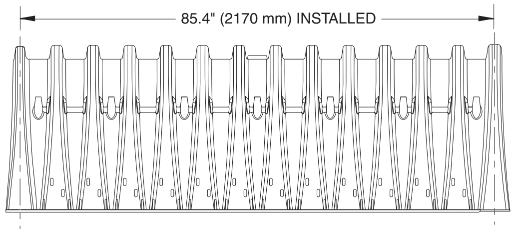


SC-740 End Cap



SC-740 Chamber





StormTech SC-740 Chamber

SC-740 Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 6" (150 mm) Stone Base Under the 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 (948)	↓ 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)	41.85 (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)

SC-740 Cumulative Storage Volumes Per Chamber (cont.)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage Ft³ (m³)	Total System Cumulative Storage Ft³ (m³)
8 (203)	4.41 (0.125)	11.66 (0.330)
7 (178)	2.21 (0.063)	9.21 (0.264)
6 (152)	↑ 0	6.76 (0.191)
5 (127)	0	5.63 (0.160)
4 (102)	Stone Foundation 0	4.51 (0.125)
3 (76)	0	3.38 (0.095)
2 (51)	0	2.25 (0.064)
1 (25)	↓ 0	1.13 (0.032)

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

Storage Volume Per Chamber ft³ (m³)

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

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

Amount of Stone Per Chamber

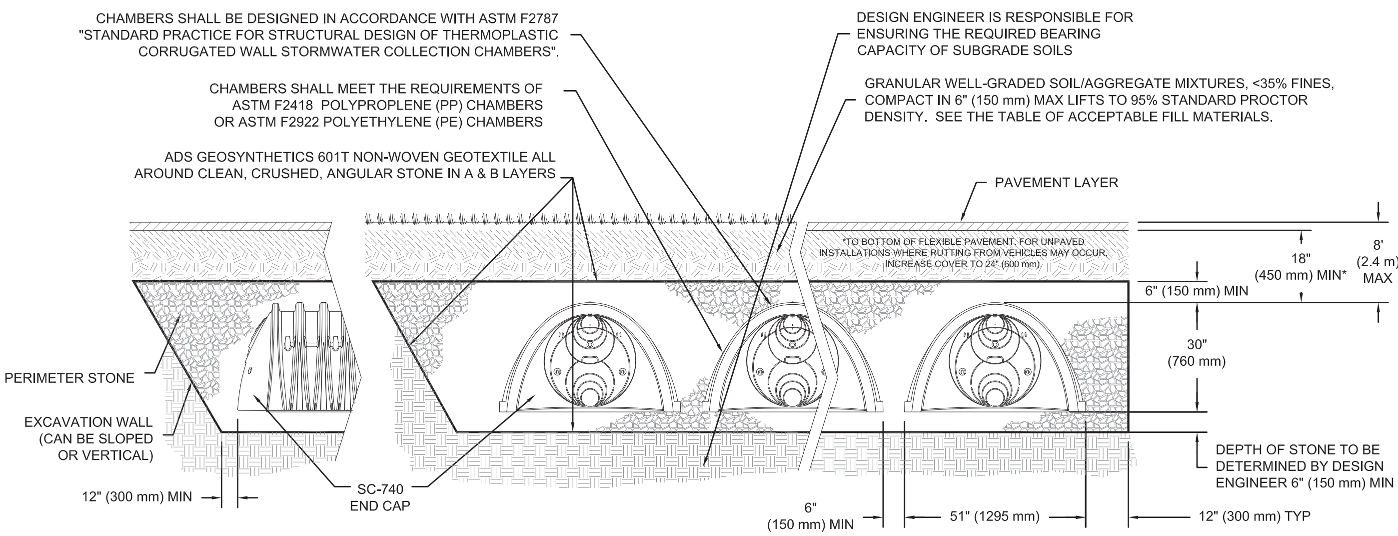
	Stone Foundation Depth		
ENGLISH TONS (yd³)	**6"**	**12"**	**18"**
StormTech SC-740	3.8 (2.8 yd³)	4.6 (3.3 yd³)	5.5 (3.9 yd³)
METRIC KILOGRAMS (m³)	**150 mm**	**300 mm**	**450 mm**
StormTech SC-740	3450 (2.1 m³)	4170 (2.5 m³)	4490 (3.0 m³)

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

Volume of Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth		
	6" (150 mm)	**12" (300 mm)**	**18" (450 mm)**
StormTech 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. Volume of excavation will vary as depth of cover increases.

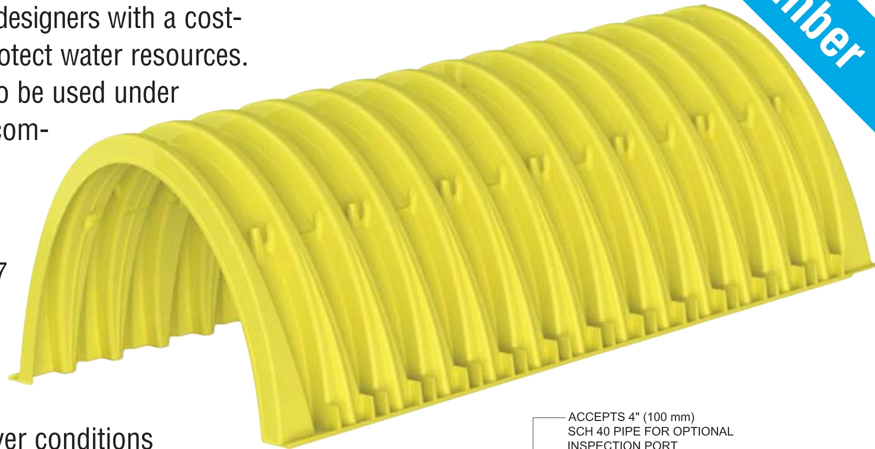


THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

StormTech DC-780 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 commercial and municipal applications.

- 12' Deep Cover applications.
- Designed in accordance with ASTM F 2787 and produced to meet the ASTM F 2418 product standard.
- AASHTO safety factors provided for AASHTO Design Truck (H20) and deep cover conditions



StormTech DC-780 Chamber (not to scale)

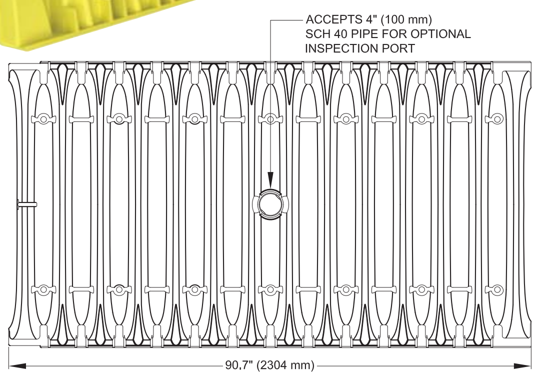
Nominal Chamber Specifications

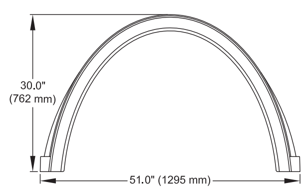
Size (L x W x H)	85.4" x 51.0" x 30.0" (2169 x 1295 x 762 mm)
Chamber Storage	46.2 ft³ (1.3 m³)
Min. Installed Storage*	78.4 ft³ (2.2 m³)

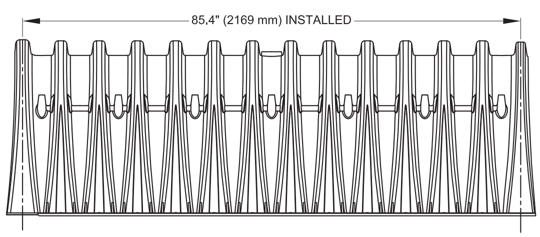
* Assumes 9" (230 mm) stone below, 6" (150 mm) stone above, 6" (150 mm) row spacing and 40% stone porosity.

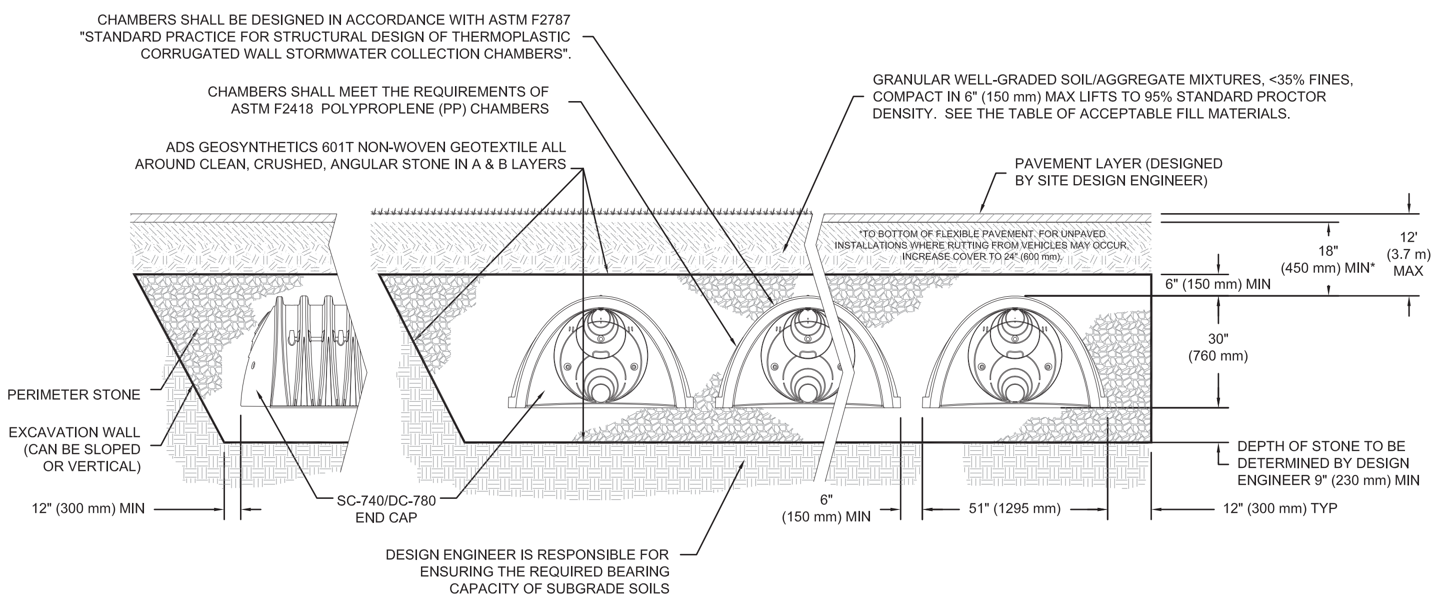
Shipping

- 24 chambers/pallet
- 60 end caps/pallet
- 12 pallets/truck









THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

StormTech DC-780 Chamber

DC-780 Cumulative Storage Volumes Per Chamber

Assumes 40% Stone Porosity. Calculations are Based Upon a 9" (230 mm) Stone Base Under the Chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
45 (1143)	↑ 46.27 (1.310)	78.47 (2.222)
44 (1118)	46.27 (1.310)	77.34 (2.190)
43 (1092)	Stone 46.27 (1.310)	76.21 (2.158)
42 (1067)	Cover 46.27 (1.310)	75.09 (2.126)
41 (1041)	46.27 (1.310)	73.96 (2.094)
40 (1016)	↓ 46.27 (1.310)	72.83 (2.062)
39 (991)	46.27 (1.310)	71.71 (2.030)
38 (965)	46.21 (1.309)	70.54 (1.998)
37 (940)	46.04 (1.304)	69.32 (1.963)
36 (914)	45.76 (1.296)	68.02 (1.926)
35 (889)	45.15 (1.278)	66.53 (1.884)
34 (864)	44.34 (1.255)	64.91 (1.838)
33 (838)	43.38 (1.228)	63.21 (1.790)
32 (813)	42.29 (1.198)	61.43 (1.740)
31 (787)	41.11 (1.164)	59.59 (1.688)
30 (762)	39.83 (1.128)	57.70 (1.634)
29 (737)	38.47 (1.089)	55.76 (1.579)
28 (711)	37.01 (1.048)	53.76 (1.522)
27 (686)	35.49 (1.005)	51.72 (1.464)
26 (660)	33.90 (0.960)	49.63 (1.405)
25 (635)	32.24 (0.913)	47.52 (1.346)
24 (610)	30.54 (0.865)	45.36 (1.285)
23 (584)	28.77 (0.815)	43.18 (1.223)
22 (559)	26.96 (0.763)	40.97 (1.160)
21 (533)	25.10 (0.711)	38.72 (1.096)
20 (508)	23.19 (0.657)	36.45 (1.032)
19 (483)	21.25 (0.602)	34.16 (0.967)
18 (457)	19.26 (0.545)	31.84 (0.902)
17 (432)	17.24 (0.488)	29.50 (0.835)
16 (406)	15.19 (0.430)	27.14 (0.769)
15 (381)	13.10 (0.371)	24.76 (0.701)
14 (356)	10.98 (0.311)	22.36 (0.633)
13 (330)	8.83 (0.250)	19.95 (0.565)
12 (305)	6.66 (0.189)	17.52 (0.496)
11 (279)	4.46 (0.126)	15.07 (0.427)

DC-780 Cumulative Storage Volumes Per Chamber (cont.)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
10 (254)	2.24 (0.064)	12.61 (0.357)
9 (229)	↑ 0	10.14 (0.287)
8 (203)	0	9.01 (0.255)
7 (178)	0	7.89 (0.223)
6 (152)	Stone 0	6.76 (0.191)
5 (127)	Foundation 0	5.63 (0.160)
4 (102)	0	4.51 (0.128)
3 (76)	0	3.38 (0.096)
2 (51)	0	2.25 (0.064)
1 (25)	↓ 0	1.13 (0.032)

Note: Add 1.13 cu. ft. (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 Volume- Stone Foundation Depth inches (millimeters) 9 (230)	12 (300)	18 (450)
StormTech DC-780	46.2 (1.3)	78.4 (2.2)	81.8 (2.3)	88.6 (2.5)

Note: Assumes 40% porosity for the stone, the bare chamber volume, 6" (150 mm) stone above, and 6" (150 mm) row spacing.

Amount of Stone Per Chamber

	Stone Foundation Depth		
ENGLISH TONS (YD³)	**9"**	**12"**	**18"**
StormTech DC-780	4.2 (3.0 yd³)	4.7 (3.3 yd³)	5.6 (3.9 yd³)
METRIC KILOGRAMS (M³)	**230 mm**	**300 mm**	**450 mm**
StormTech DC-780	3810 (2.3 m³)	4264 (2.5 m³)	5080 (3.0 m³)

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

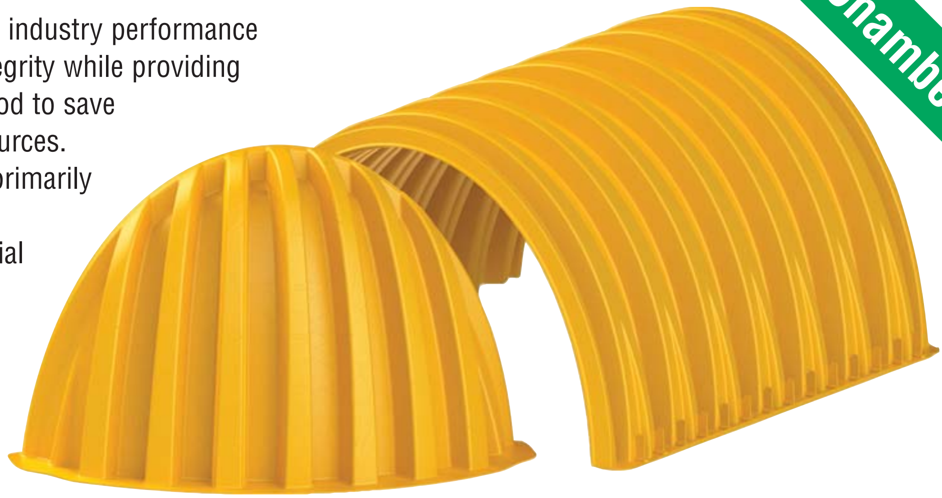
Volume of Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth 9" (230 mm)	12" (300 mm)	18" (450 mm)
StormTech DC-780	5.9 (4.5)	6.3 (4.8)	6.9 (5.3)

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

StormTech MC-3500 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 commercial and municipal applications.



StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90" (2286 mm) x 77" (1956 mm) x 45" (1143 mm)
Chamber Storage	109.9 ft^3 (3.11 m^3)
Min. Installed Storage*	178.9 ft^3 (5.06 m^3)
Weight	134 lbs (60.8 kg)

* This assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal End Cap Specifications

Size (L x W x H)	26.5" (673 mm) x 71" (1803 mm) x 45.1" (1145 mm)
End Cap Storage	14.9 ft^3 (0.42 m^3)
Min. Installed Storage*	46.0 ft^3 (1.30 m^3)
Weight	49 lbs (22.2 kg)

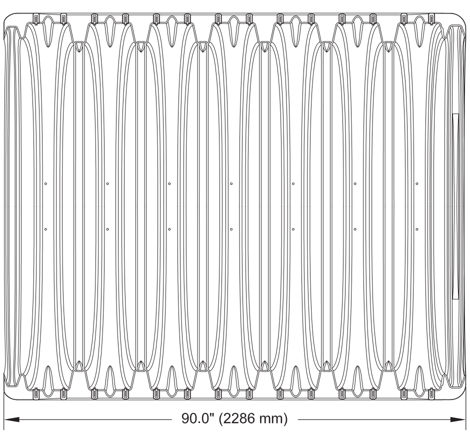
*This assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 6" (150 mm) of stone perimeter, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

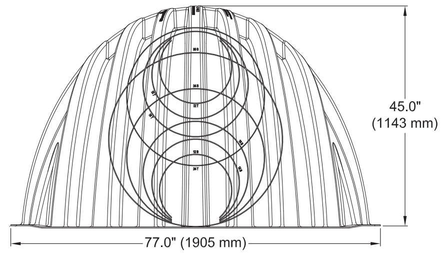
Shipping

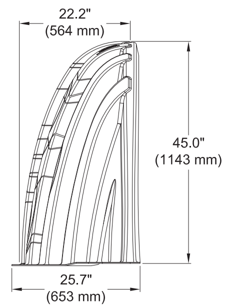
15 chambers/pallet

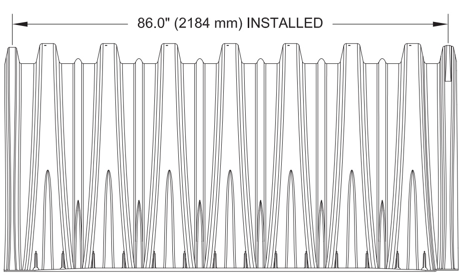
16 end caps/pallet

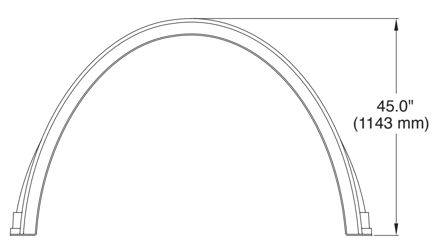
7 pallets/truck











StormTech MC-3500 Chamber

Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm) 9 (230)	12 (300)	15 (375)	18 (450)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (0.42)	46.0 (1.33)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

NOTE: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 6" (150 mm) stone perimeter.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth 9"	12"	15"	18"
MC-3500	9.1 (6.4 yd³)	9.7 (6.9 yd³)	10.4 (7.3 yd³)	11.1 (7.8 yd³)
End Cap	4.1 (2.9 yd³)	4.3 (3.0 yd³)	4.5 (3.2 yd³)	4.7 (3.3 yd³)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-3500	8220 (4.9 m³)	8831 (5.3 m³)	9443 (5.6 m³)	10054 (6.0 m³)
End Cap	3699 (2.2 m³)	3900 (2.3 m³)	4100 (2.5 m³)	4301 (2.6 m³)

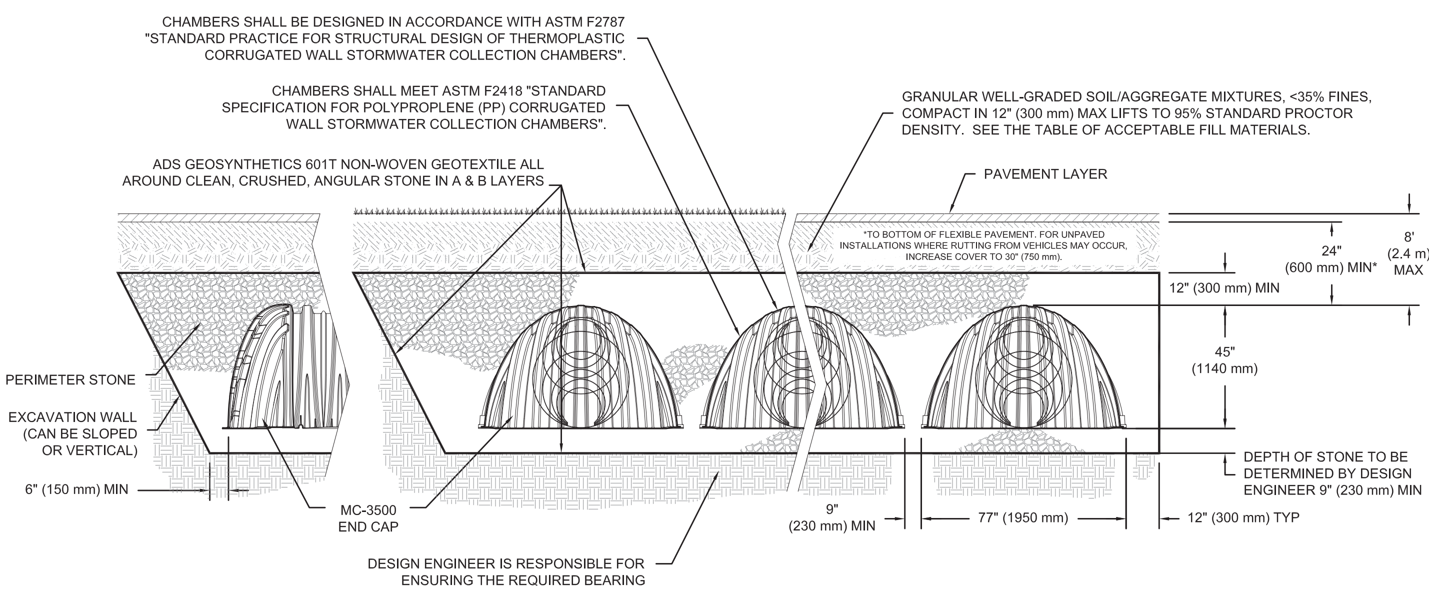
NOTE: Assumes 12" (300 mm) of stone above, and 9" (230 mm) row spacing, and 6" (150 mm) of perimeter stone in front of end caps.

Volume of Excavation Per Chamber/End Cap in yd³ (m³)

	Stone Foundation Depth 9" (230 mm)	12" (300 mm)	15" (375 mm)	18" (450 mm)
MC-3500	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
End Cap	4.1 (3.1)	4.2 (3.2)	4.4 (3.3)	4.5 (3.5)

NOTE: Assumes 9" (230 mm) of separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

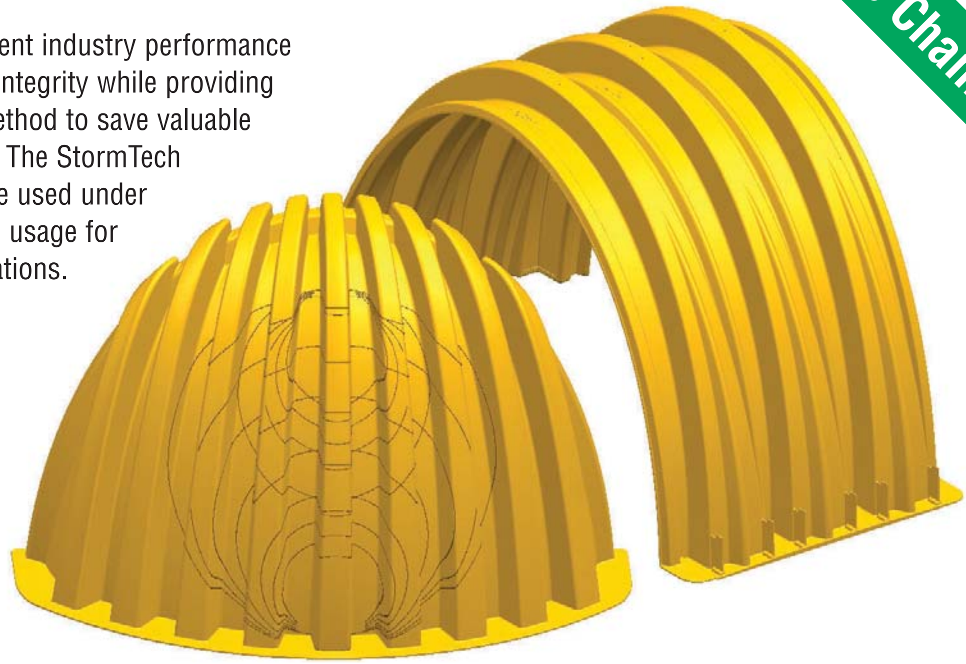
General Cross Section



THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

StormTech MC-4500 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 commercial and municipal applications.



StormTech MC-4500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	52" (1321 mm) x 100" (2540 mm) x 60" (1524 mm)
Chamber Storage	106.5 ft^3 (3.01 m^3)
Min. Installed Storage*	162.6 ft^3 (4.60 m^3)
Nominal Weight	120 lbs (54.4 kg)

* This assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below chambers, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

StormTech MC-4500 End Cap (not to scale)

Nominal End Cap Specifications

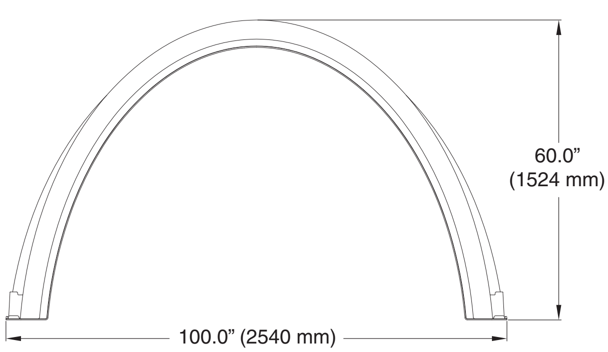
Size (L x W x H)	35.1" (891 mm) x 90.2" (2291 mm) x 59.4" (1509 mm)
End Cap Storage	35.7 ft^3 (1.01 m^3)
Min. Installed Storage*	108.7 ft^3 (3.08 m^3)
Nominal Weight	120 lbs (54.4 kg)

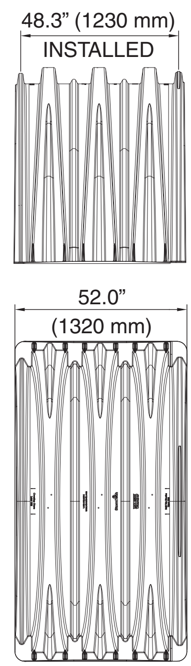
*This assumes a minimum of 12" (300 mm) of stone above, 9" (230 mm) of stone below, 12" (300 mm) of stone perimeter, 9" (230 mm) of stone between chambers/end caps and 40% stone porosity.

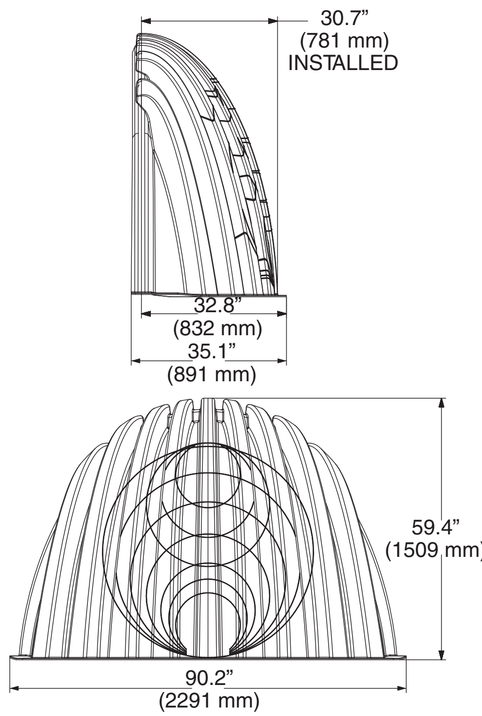
Shipping

7 chambers/pallet

11 pallets/truck







StormTech MC-4500 Chamber

Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
	ft³ (m³)	9 (230)	12 (300)	15 (375)	18 (450)
MC-4500 Chamber	106.5 (3.02)	162.6 (4.60)	166.3 (4.71)	169.9 (4.81)	173.6 (4.91)
MC-4500 End Cap	35.7 (1.01)	108.7 (3.08)	111.9 (3.17)	115.2 (3.26)	118.4 (3.35)

NOTE: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter.

Amount of Stone Per Chamber

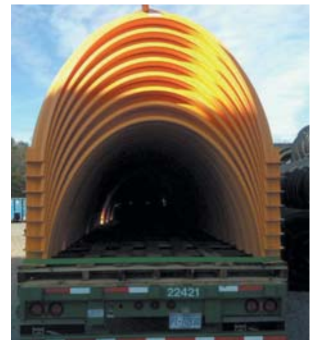
ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
End Cap	9.6 (6.8)	10.0 (7.1)	10.4 (7.4)	10.9 (7.7)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-4500	6681 (4.0)	7117 (4.2)	7552 (4.5)	7987 (4.7)
End Cap	8691 (5.2)	9075 (5.4)	9460 (5.6)	9845 (5.9)

NOTE: Assumes 12" (300 mm) of stone above, 9" (230 mm) row spacing, and 12" (300 mm) of perimeter stone in front of end caps.

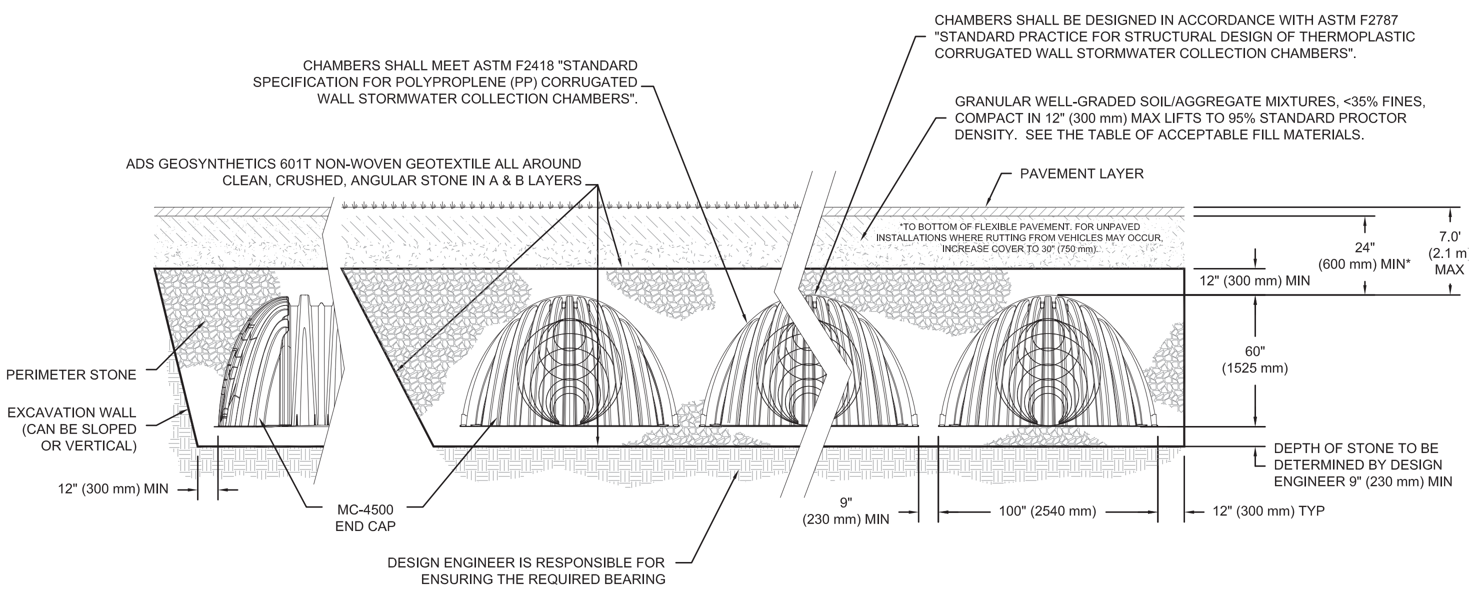
Volume of Excavation Per Chamber/End Cap in yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15" (380 mm)	18" (450 mm)
MC-4500	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
End Cap	9.3 (7.1)	9.6 (7.3)	9.9 (7.6)	10.2 (7.8)

NOTE: Assumes 9" (230 mm) of separation between chamber rows, 12" (300 mm) of perimeter in front of end caps, and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.



General Cross Section



THE INSTALLED CHAMBER SYSTEM SHALL PROVIDE THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS SECTION 12.12 FOR EARTH AND LIVE LOADS, WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.

StormTech Isolator™ Row

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

The Isolator Row is a row of StormTech chambers 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 stormwater rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3, and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row, protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

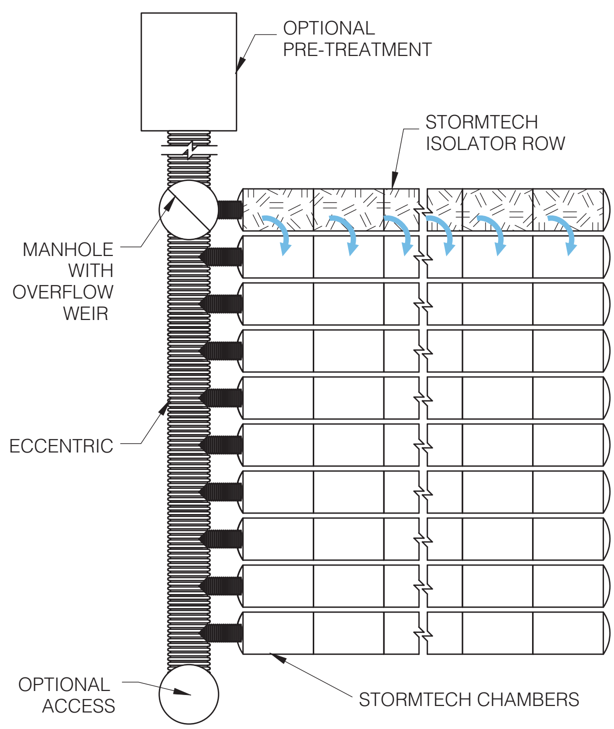
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for stormwater filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain 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 DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row, but typically includes a high flow weir such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row crest the weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating stormwater prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins and oil-water separators or can be innovative storm water treatment devices. 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 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.

StormTech Isolator Row with Overflow Spillway
(not to scale)



StormTech Isolator Row

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.

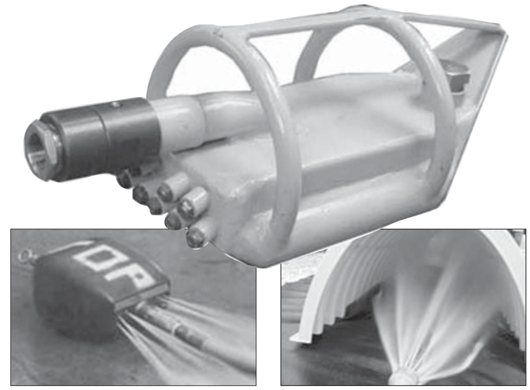
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row 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, clean-out should be performed.

MAINTENANCE

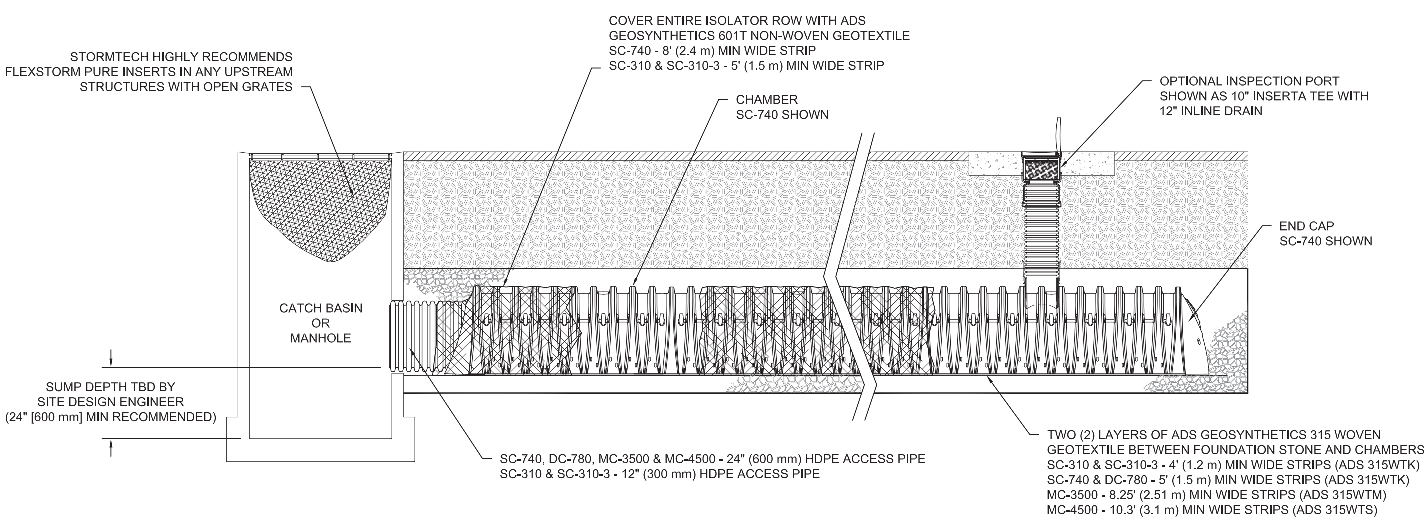
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via 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.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the jetvac process. The jetvac process utilizes a high pressure water nozzle to propel itself down the Isolator Row 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. Most jetvac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The jetvac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



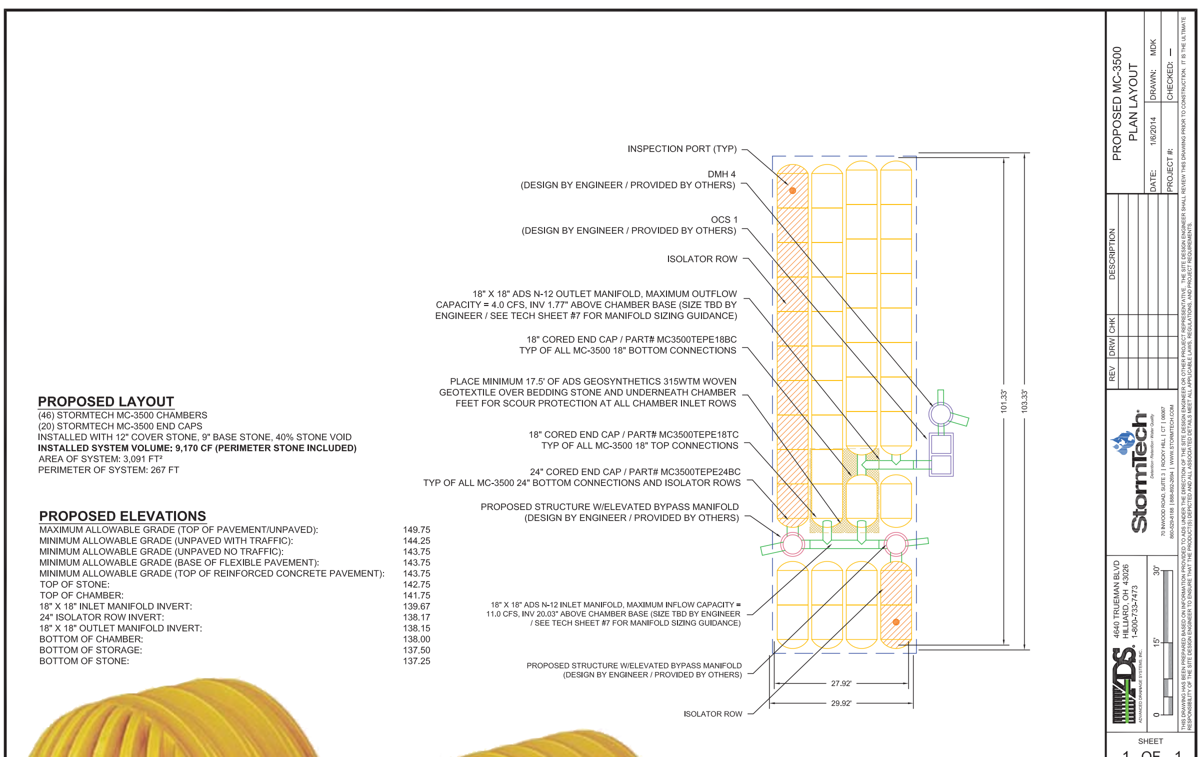
*NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 & MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

A Family of Products and Services

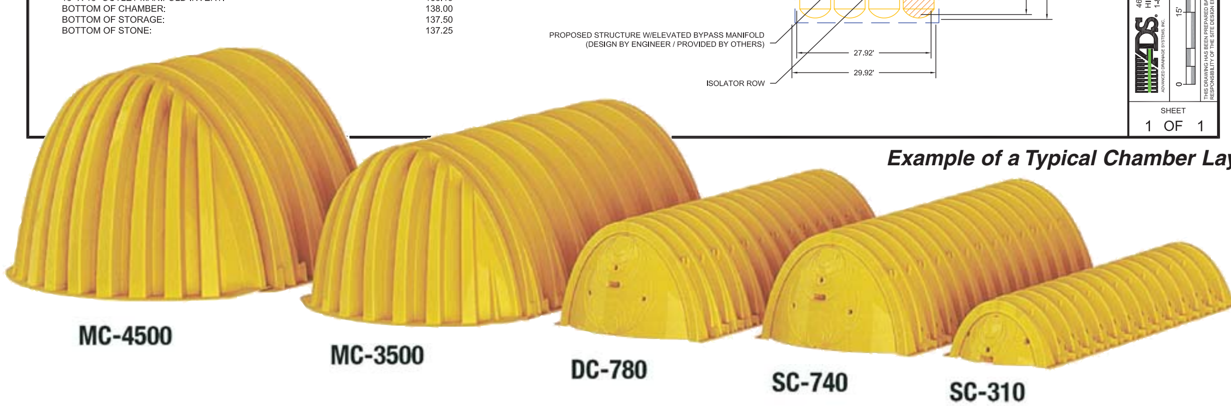
- MC-4500 Chambers and End Caps
- MC-3500 Chambers and End Caps
- SC-310 Chambers and End Caps
- SC-310-3 Chambers and End Caps
- DC-780 Chambers and End Caps
- SC-740 Chambers and End Caps
- SC, DC and MC Fabricated End Caps
- Fabricated Manifold Fittings
- Patented Isolator™ Row for Maintenance and Water Quality
- Inserta Tee Connections
- Nyloplast Basins and Inline Drains
- Flexstorm Inserts
- In-House System Layout Assistance
- On-Site Educational Seminars
- Worldwide Technical Sales Group
- Centralized Product Applications Department
- Research and Development Team
- Technical Literature, O&M Manuals and Detailed CAD drawings all downloadable via our Web Site

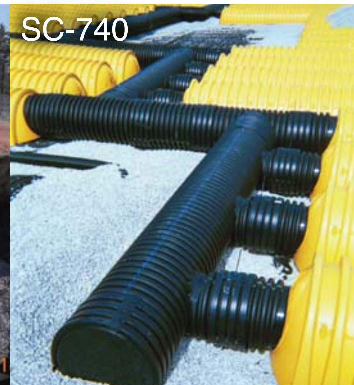
StormTech provides state of the art products and services that meet or exceed industry performance standards and expectations. We offer designers, regulators, owners and contractors the highest quality products and services for stormwater management that "Saves Valuable Land and Protects Water Resources."

Please contact one of our inside Technical Service professionals or Engineered Product Managers (EPMs) to discuss your particular application. A wide variety of technical support material is available from our website at **www.stormtech.com.** For any questions, please call StormTech at **888-892-2694**.



Example of a Typical Chamber Layout





StormTech®

Detention • Retention • Water Quality

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Appendix G

Oil/Grit Separator Details & Maintenance Manual

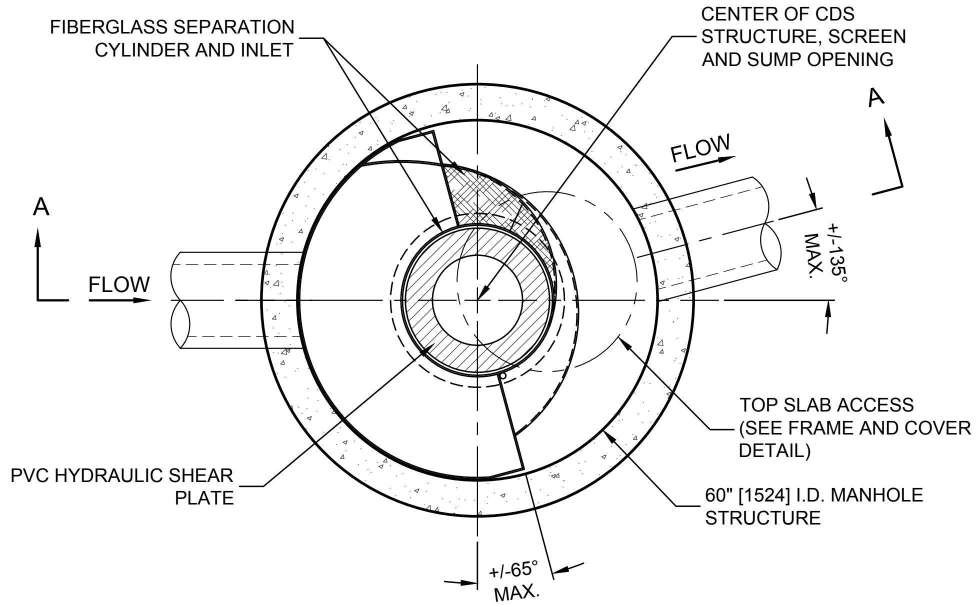
CDS Average Annual Efficiency For TSS Removal & Total Annual Volume Treated

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

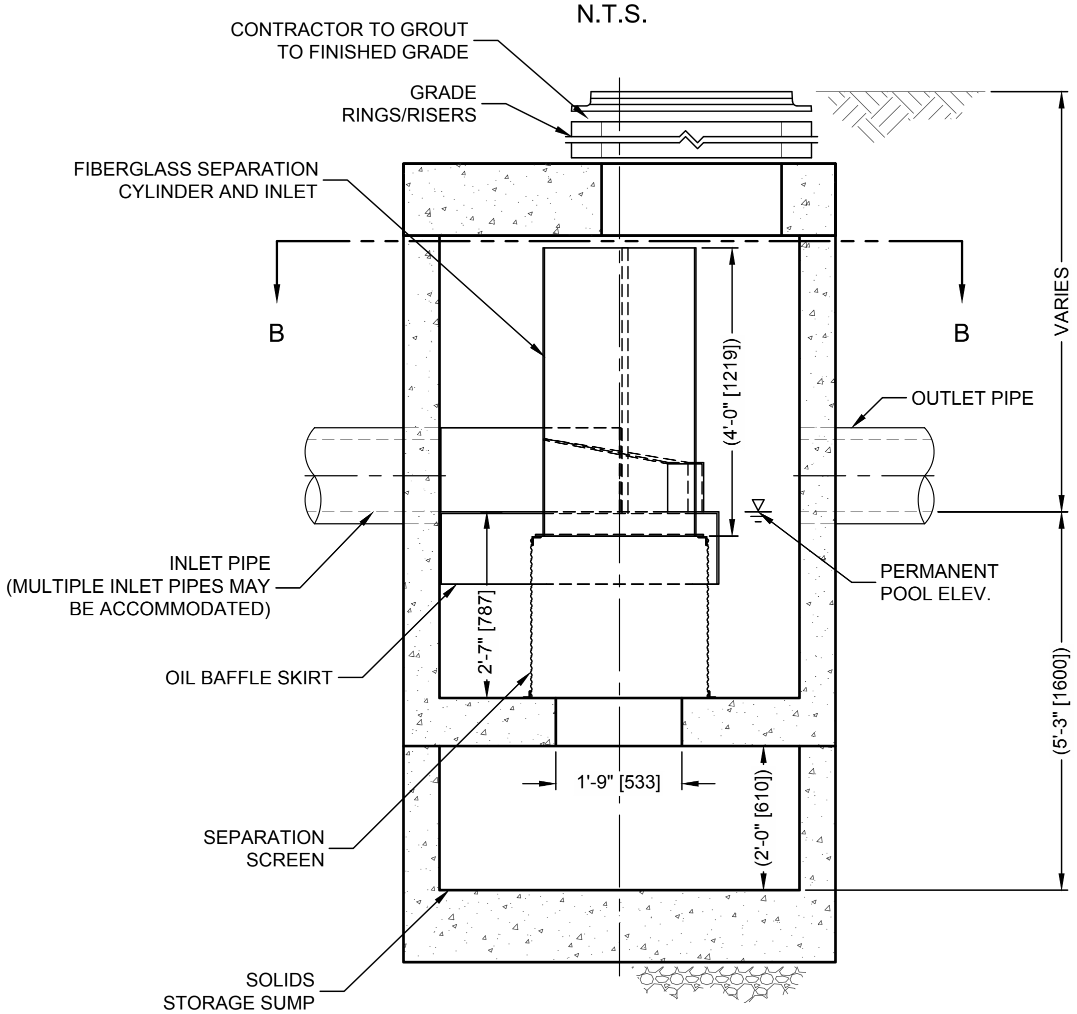
Return	Period	Peak Flow	TSS Percentage Captured	Treated Flow Volume	Total Flow Volume	Annual Exceedance Probability	System Flow	CDS Flow	By-Pass Flow	Volume Percentage Treated
month / yr	Yr	l/s	%	litres	litres	%	l/s	l/s	l/s	%
1-M	0.08	4.04	70.21	9688	9688	**100.00**	4.04	4.04	0.00	100.00
2-M	0.17	6.39	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



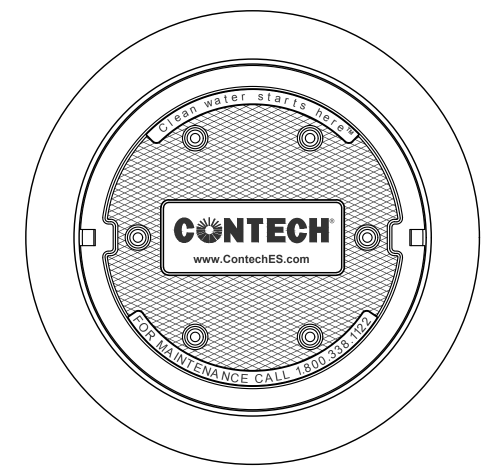
PLAN VIEW B-B
N.T.S.



ELEVATION A-A
N.T.S.

CDS-5-C DESIGN NOTES

THE STANDARD CDS-5-C CONFIGURATION IS SHOWN.



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

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.

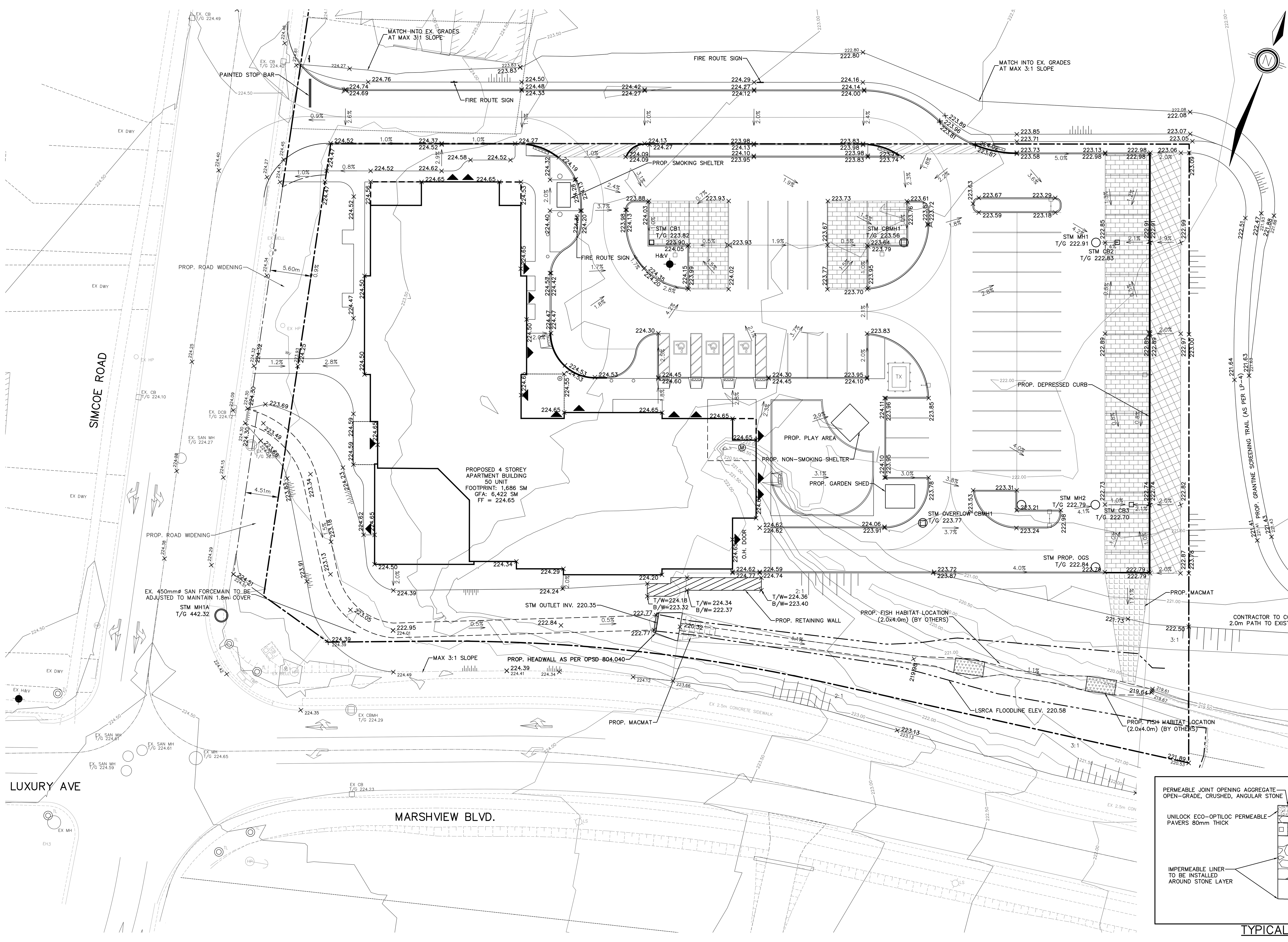
CONTECH ENGINEERED SOLUTIONS LLC
www.ContechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

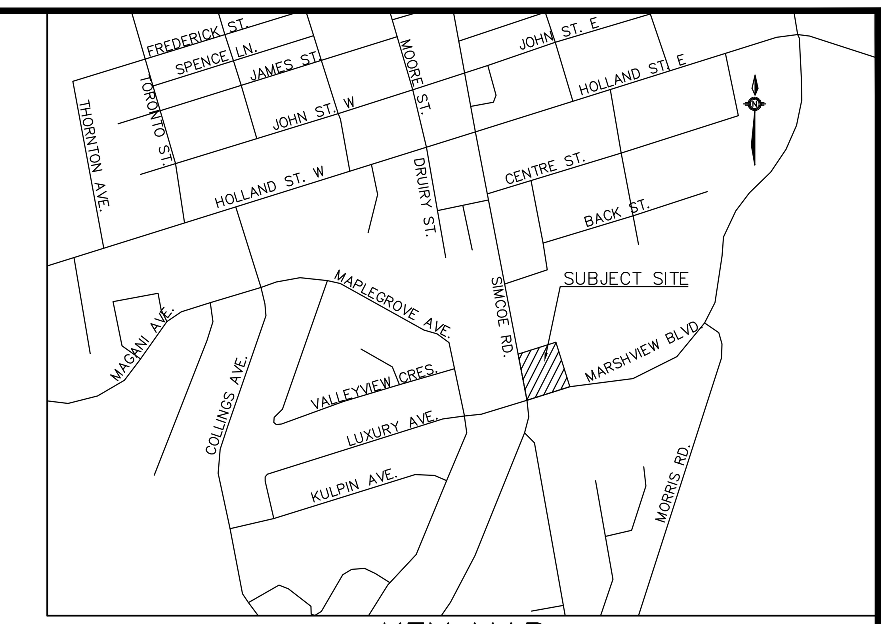
CDS-5-C
ONLINE CDS
STANDARD DETAIL

I:\STORMWATER\COMMOPS\22 CDS\40 STANDARD DRAWINGS\NJDEP SIZING\CDS-C (ONLINE)\DWG\DWG WITHOUT FLOWS\CDS-5-C DTL.DWG 2/12/2018 10:31 AM

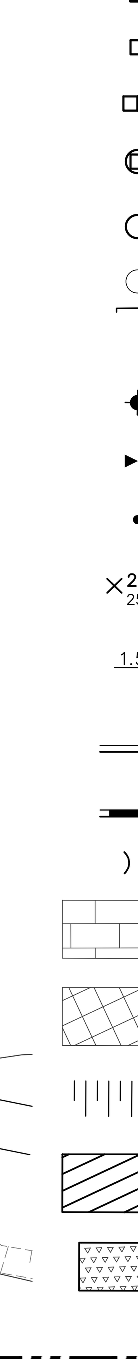
Appendix H

Pearson Engineering Drawings



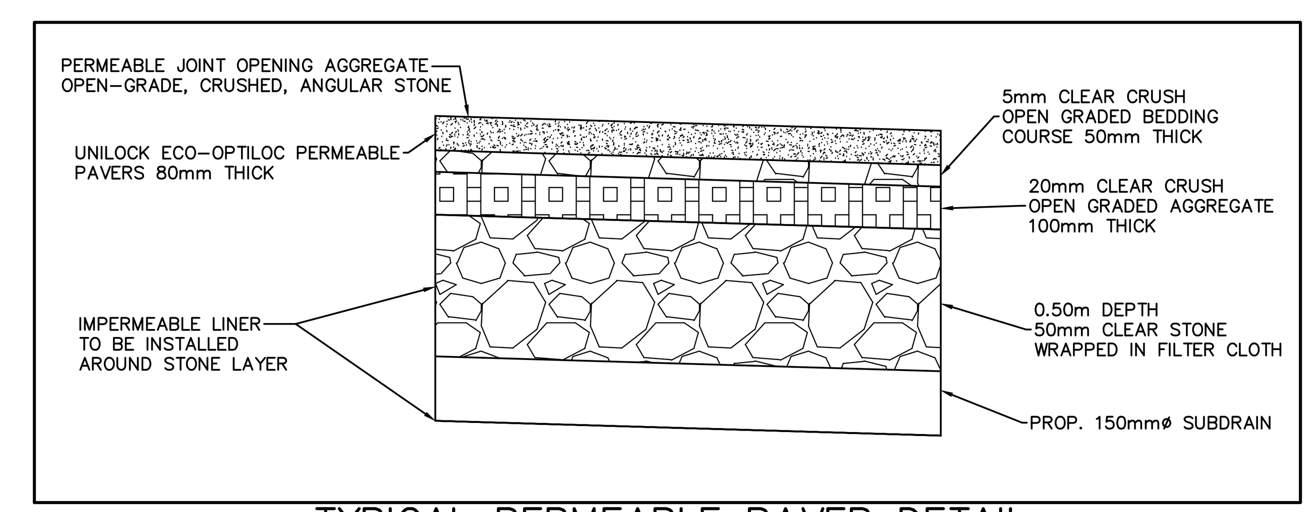


KEY MAP
NTS



LEGEND

- CB CATCH BASIN
- DCB DOUBLE CATCH BASIN
- CBMH CATCH BASIN
- MH STORM MANHOLE
- MH SANITARY MANHOLE
- SERVICE CAP
- HYD. FIRE HYDRANT
- VB WATER VALVE
- CS CURB STOP W/ SERVICE
- 254.63 PROPOSED ELEVATION
- 254.09 EXISTING ELEVATION
- 1.5% PROPOSED DIRECTION AND GRADE
- BACK OF CURB
- EDGE OF PAVEMENT
- CURB CUT LOCATION
- HIGH POINT
- PERMEABLE PAVERS
- SNOW STORAGE
- 3:1 MAX SLOPE
- PROP. RETAINING WALL
- PROP. FISH HABITAT LOCATION
- LSRCA FLOODLINE ELEVATION



TYPICAL PERMEABLE PAVER DETAIL
N.T.S

NO.	REVISION NOTE	DATE	BY
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
12/16/21
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 #	2

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

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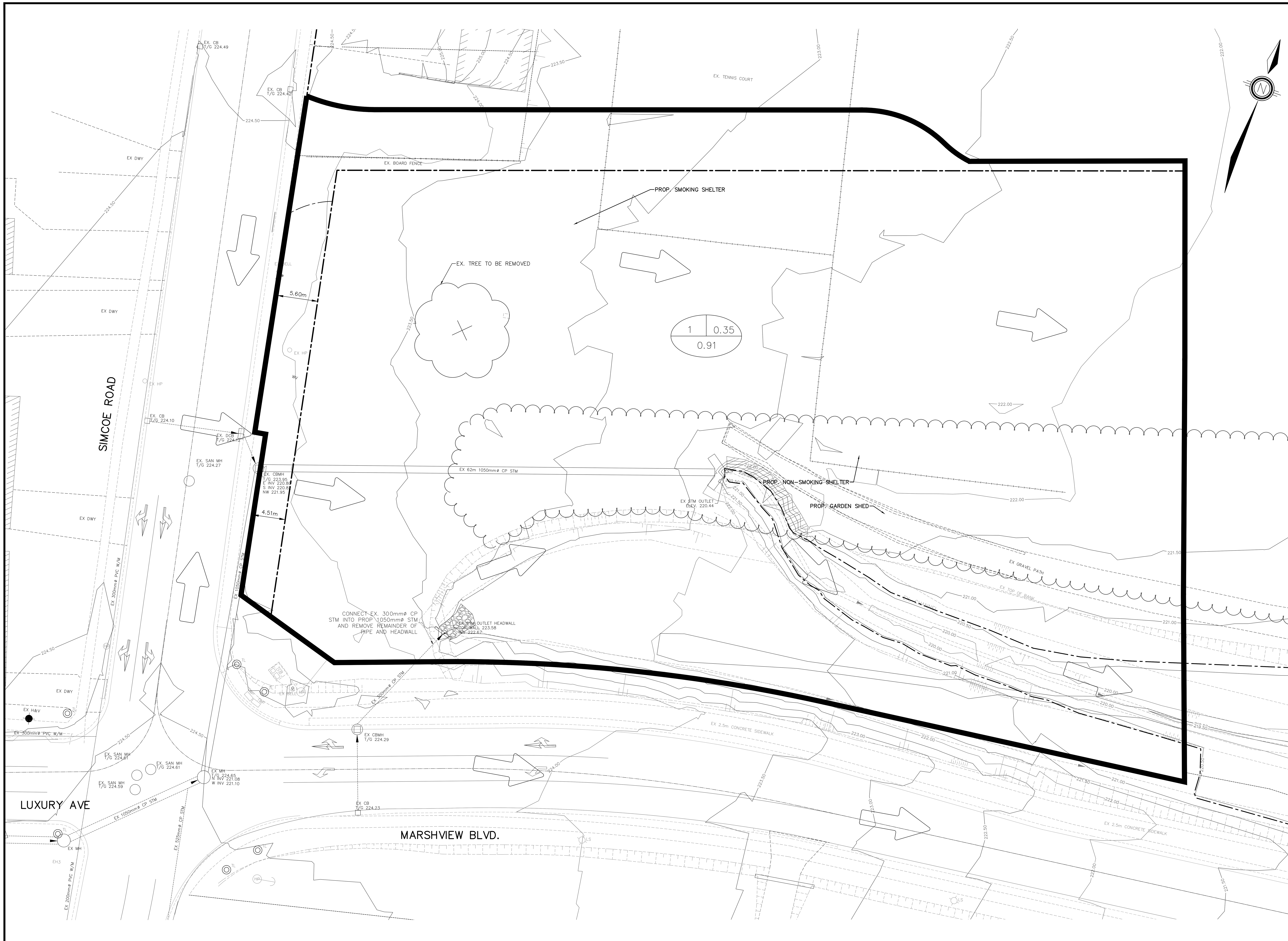
LICENSED PROFESSIONAL ENGINEER G. M. PEARSON 100061986 12/16/21 PROVINCE OF ONTARIO

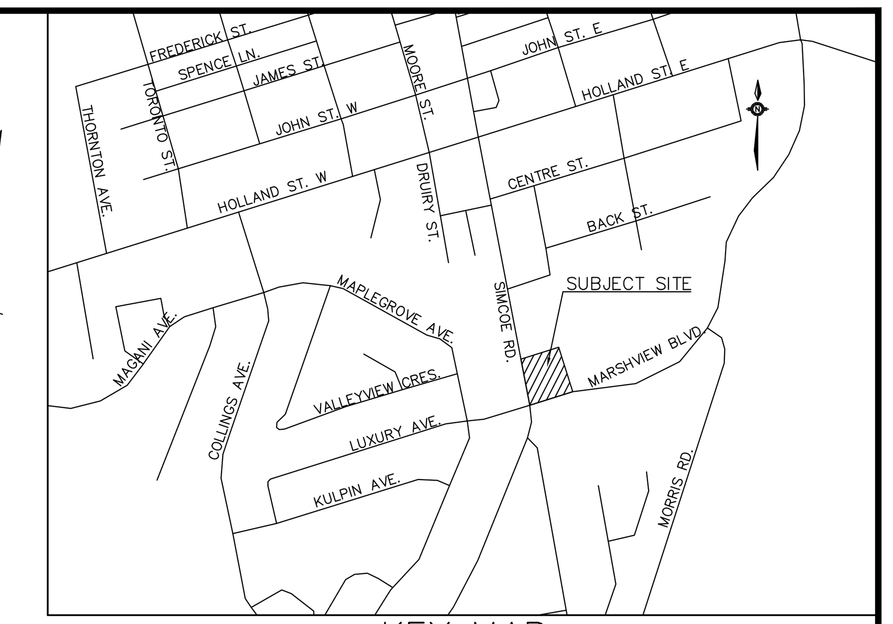
COUNTY OF SIMCOE
AFFORDABLE HOUSING – BRADFORD
WEST GWILLIMBURY, 125 SIMCOE ROAD

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 #	2





KEY MAP
NTS

LEGEND

- CB — CATCH BASIN
- DCB — DOUBLE CATCH BASIN
- CBMH — CATCH BASIN
- MH — STORM MANHOLE
- OVERLAND FLOW DIRECTION
- CATCHMENT AREA (1 | 0.75, 1.00 ha) RUNOFF COEFFICIENT, AREA IN HECTARES
- CATCHMENT BOUNDARY
- EX. LSRCA FLOODLINE ELEVATION = 220.58

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12/16/21
PROVINCE OF ONTARIO

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

PRE DEVELOPMENT STORM CATCHMENT PLAN

PEARSON ENGINEERING
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CHECKED BY MWD	DATE JUNE 2020	REVISION #	2

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12/16/21
PROVINCE OF ONTARIO

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

POST DEVELOPMENT STORM CATCHMENT PLAN

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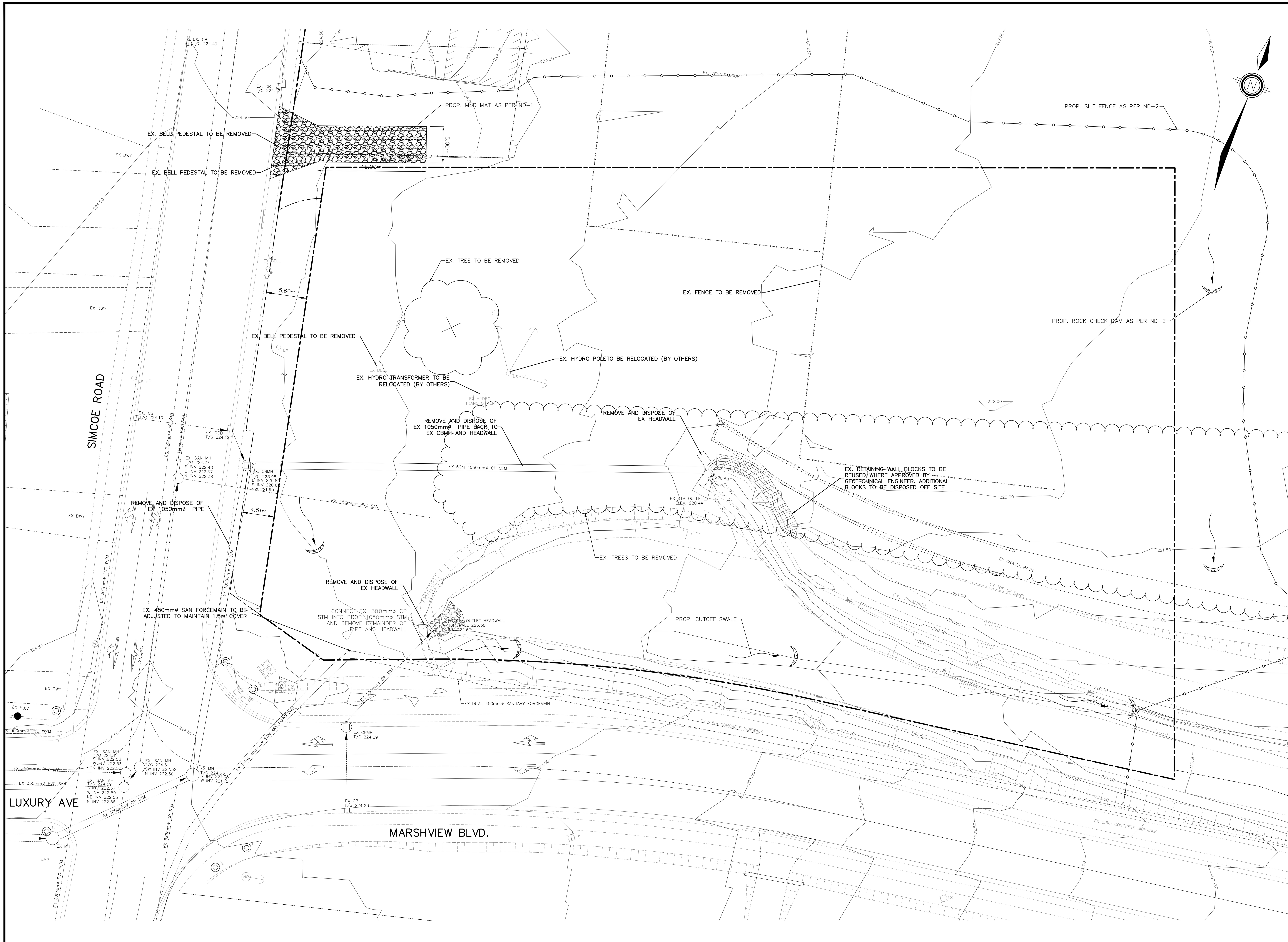
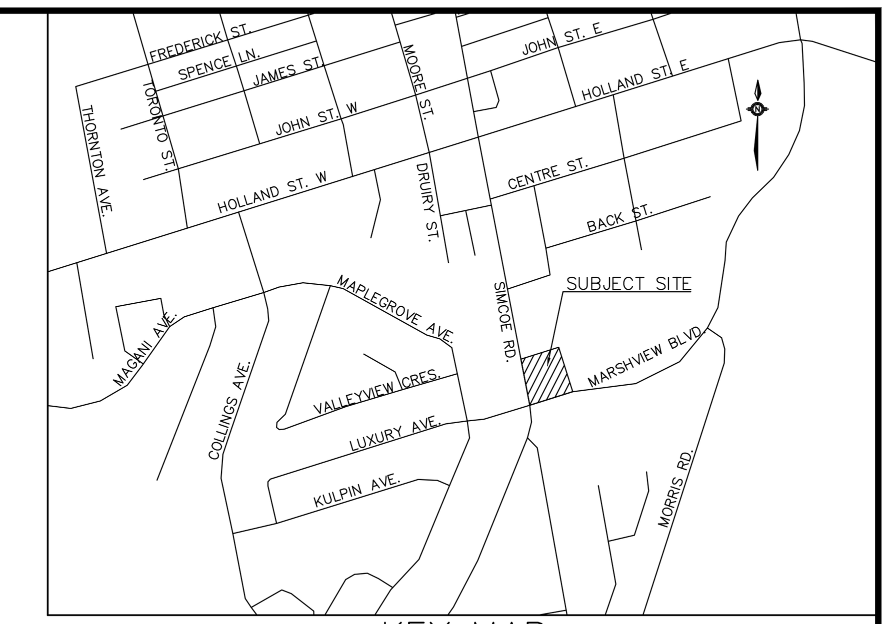
DRAWN BY	AA	VERT SCALE		DRAWING #	STM-2
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	2





KEY MAP
NTS

LEGEND

- SILT FENCE
- TEMPORARY SWALE
- TEMPORARY ROCK CHECK DAM
- EX. CHAINLINK FENCE
- EX. BELL BOX
- EX. TREE

SEQUENCE OF CONSTRUCTION

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. COMMENCE WITH EARTH EXCAVATION AND SITE SERVICING (TO BE REMOVED FROM SITE – NO STOCKPILE).
5. 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.
6. 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.

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12/16/21
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

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DRAWN BY	AA	VERT SCALE		DRAWING #	EPR–1
CHECKED BY	MWD	DATE	JUNE 2020	REVISION #	2