FUNCTIONAL SERVICING REPORT
In Support of Site Plan Approval

62 Mill Street
Residential Development

Township of Uxbridge, Ontario

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File Number: 20128

Prepared For:

Mosaik (Uxbridge) Inc.

1.	Issued For SPA 1st Submission	2021/06/28
No.	**Revision**	**Date**

EXECUTIVE SUMMARY

This Functional Servicing Report has been prepared on behalf of Mosaik (Uxbridge) Inc. the registered owner of the subject land. The servicing strategy for the proposed development is summarized as follows:

Water Servicing:

The proposed development will be serviced from the existing 300 mm diameter watermain located on the north side of Mill Street. Two connections will be made from the site, a 100 mm domestic line and a 150 mm fire line. A water meter room is located within the property. The water demand of maximum day plus fire flow for the proposed development is 6,104 L/min.

Sanitary Servicing:

The proposed development will be serviced by a new 200 mm diameter sanitary connection to the existing 300 mm diameter sanitary sewer located within Mill Street. The peak sanitary design flow for the proposed site is 1.73 L/s.

Stormwater Servicing:

Under proposed conditions, the stormwater flows shall be collected and controlled to be discharged to the existing storm sewer system on Mill Street.

An internal storm sewer network and a 375 mm diameter storm sewer extension is proposed along Mill Street to service the site. Due to the proposed demand from the site, an 82 m section of storm sewer on Mill Street will be upgraded to convey the increased flow.

Quantity:

The proposed development shall control minor flows to the downstream storm sewer capacity. Major flows exceeding the minor system capacity shall be provided safe conveyance overland along Mill Street towards the existing Mill Pond. A 40mm extended detention volume shall also be provided as required by the Uxbridge Brook Watershed Plan that will be released over 24 hours. This will be achieved through two proposed Stormtech chamber storage systems and a multi-stage outlet structure prior to discharge from the site. The outlet structure shall consist of a vortex unit for the extended detention flow and a weir to control higher flows.

Quality:

Quality control will be provided by the proposed Isolator Row Plus units installed within the Stormtech chamber systems that provide the required 80% TSS removal. Along with that, the proposed infiltration volume, that has been designed to infiltrate the 25mm storm event will also promote stormwater quality from the site and achieve the applicable criteria.

Phosphorus treatment has also been provided by the 25mm infiltration, which equates to the retention of 95% of annual rainfall volume.

Water Balance:

Water balance shall be provided by the proposed infiltration galleries within the proposed Stormtech Chamber systems. Infiltration shall occur within a proposed infiltration depth below the outlet invert as well as infiltration occurring when the extended detention storage is engaged. The total infiltration volume has the capacity to infiltrate the 25mm storm event, which satisfies the post-to-pre water balance requirement as well as the preferred water balance approach as outlined by the LSRCA.

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1.0 INTRODUCTION

1.1 Background

This Functional Servicing Report has been prepared on behalf of Mosaik (Uxbridge) Inc. in support of the Site Plan Approval for the proposed 1.51 ha site. The Subject site is municipally known as 62 Mill Street, in the Township of Uxbridge. The purpose of this report is to demonstrate that the existing infrastructure within Mill Street, can accommodate the proposed development.

The subject site is located on the southeast corner of Mill Street and Pond Street. The site is bounded by single family residential housing, with Elgin Park to the south and Mill Pond located to the east. The proposed development consists of single-family residential housing, with a proposed population of 84. The existing site contains a single residential house to be relocated within the site. A shed, trees, and some vegetation are also existing to the site.

2.0 WATER SUPPLY

2.1 Existing Water Supply

The existing water supply for 62 Mill Street is a 300 mm watermain located on the north side of Mill Street. The existing building is directly serviced by a connection to this watermain. There are two existing fire hydrants within the vicinity of the site. The first is located adjacent from the site at the corner of Mill Street and Pond Street. The second hydrant is located at the south end of the site on water street.

2.2 Proposed Water Supply

The proposed development will be serviced by two connections, a 100 mm domestic line and a 150 mm fire line that tie into the existing 300mm watermain. The connections will enter a water meter room located near the entrance of the site prior to distribution. Within the site there are three proposed hydrants.

The water demands for the site area as follows:

Residential:

- Average Day Demand = 30,576 L/day = 21 L/min
- Maximum Hour Demand = 149,822 L/day = 157 L/min
- Maximum Day Demand = 226,262 L/day = 104 L/min

The Fire Underwriter's Survey (FUS) guidelines were used to calculate the fire flow requirements of the residential site. As per the FUS, a simplified fire flow calculation may be used for residential dwellings, not exceeding two storeys in height. For the single dwellings, a fire flow of 6,000 L/s, was adopted in the water demand calculations. Therefore, the maximum day plus fire flow demand for the site results in **6,104 L/min** (6,000 + 104).

The Region of Durham's design criteria dictates the following system pressure requirements:

- Maximum pressure during the minimum hourly demand = 700 kPa
- Minimum pressure during maximum hour demand = 140 kPa
- Minimum Fire Flow pressure during maximum day demand plus fire flow = 140 kPa.

The existing watermain infrastructure, therefore, shall require the capacity to supply 6,104 L/min of flow, while maintaining a residual pressure of 140 kPa. Refer to **Appendix A** for the supporting calculations of the proposed water supply system, including water demand and fire flow calculations.

3.0 SANITARY SERVICING

3.1 Existing Sanitary Servicing

Existing servicing for the site was not noted during a utility investigation. It is assumed that the existing site has a direct sanitary line to the existing 300 mm sanitary sewer located on Mill street. Existing sanitary demand for the site is calculated to be 0.06 L/s.

3.2 Proposed Sanitary Servicing

The proposed development will be serviced by a new 200 mm diameter sanitary connection to the existing 300 mm diameter sanitary sewer located within Mill Street. Within the site a 200mm PVC sanitary sewer will be constructed to gather flows from the 24 proposed lots. A sanitary control manhole will be installed 1.5 m to the property line of the site.

Based on the Region of Durham standards, the peak sanitary design flow for the proposed site is 1.73 L/s. This value includes the infiltration rate of 0.26 L/s/ha. Refer to **Servicing Plan C-2** for the existing and proposed sanitary sewer layout. Refer to **Appendix B** for supporting calculations.

4.0 STORMWATER SERVICING

4.1 Existing Stormwater Drainage

The existing site currently consists of one residential home, a gravel driveway, vacant grass land and tree/vegetation cover. There is an existing 300mm storm sewer connected to a 375mm storm sewer running west to east along Mill Street on the east side of the site. This existing sewer connects into an existing 375mm storm sewer on Bascom Street running south to north. A series of existing catch basins collect the flows that direct it to the storm system.

The existing site is comprised of 3 primary drainage areas (Refer to **Drawing SWM-1 – Pre-Development Drainage Plan**). The existing drainage areas are summarized in **Table 4.1**. Area

101 and 102 represent areas that are draining to the north towards Mill Street in existing conditions. Area 101 eventually drains towards the east along Mill Street, while Area 102 drains west along Mill Street. Area 103 represents the area draining towards the south to Water Street. The existing Mill Pond is also located in the vicinity of the area towards the east of the site.

Based on the Township's specified criteria, the pre-development site characteristics are as follows:

Table 4.1 – Pre-Development Drainage Areas

Area	Area (ha)	Runoff Coefficient
101	0.68	0.29
102	0.21	0.29
103	0.63	0.30

4.2 Allowable Release Rate

Based on the site's surrounding infrastructure and Township of Uxbridge guidelines, the site shall control post-development peak runoff flows from minor storms, which includes the 2 to 5-year storm events, to the downstream storm sewer capacity. During larger/major events up the 100-year storm event, the site shall ensure safe conveyance of overland flows such that Mill Street has adequate capacity to convey major system flows to the outlet at Mill Pond.

The allowable minor system discharge from the site has been determined based on the most critical downstream storm sewer leg, where the combined flows of both the site and all upstream external contributing peak flows shall not exceed 75% of the most critical downstream storm sewer capacity, as per Township of Uxbridge standards. This flow has been calculated based on the storm sewer design sheet of the downstream storm sewer system during a 5-year storm event. The HGL during larger storms have also been checked to determine the resulting overland flows from the site and ensure a safe HGL is maintained during major storms. The allowable flow is summarized in **Table 4.2** below. Refer to **Appendix C** for the storm sewer design sheet.

Table 4.2 – Allowable Release Rate

5-year Minor System Allowable Release Rate (L/s)	115

4.3 Proposed Stormwater Servicing

The proposed development shall be serviced by a proposed internal storm sewer network that extends into and along Mill Street draining towards the east to connect into the existing storm sewer system on the east of the site on Mill Street. An existing catch basin near the intersection of Mill Street and Water Street shall be replaced with a catch basin manhole (CBMH202), which will then be used to connect a proposed 375mm storm sewer that will service the site. The existing storm sewers downstream of this replaced CBMH202 shall be replaced with proposed 375mm storm sewers up to Bascom Street. This includes the existing 300mm storm sewer length and 375mm storm sewer length immediately downstream of CBMH202. This is proposed both to increase the capacity of the storm sewer, and to maintain the integrity of the system. Based on CCTV inspection, some poor conditions have been identified in these sewers and should therefore be replaced.

Under post-development conditions, the proposed development is divided into two drainage areas. 1.33 ha of area is proposed to be controlled that shall be directed towards the Mill Street storm infrastructure, while 0.19ha of area shall remain uncontrolled due to grading constraints. Refer to Drawing **SWM-2** for the **Post-Development Minor Storm Drainage Plan**.

Two Stormtech chamber systems, equipped with both infiltration and quantity storage, have been proposed on-site to provide the quantity, quality, extended detention and water balance controls. The stormwater flows within the site shall be collected via the internal storm network and first be directed to one of the two proposed chamber systems. A high point is proposed on the site that shall determine the overland flow direction on the site and to which series of catch basins the flows shall be captured by. This determines which chamber storage system the flows shall be directed towards. Refer to Drawing **SWM-3 – Post-Development Major Storm**

Drainage Plan for the drainage areas showing the overland flow split demonstrating the corresponding areas drainage to each chamber system. Refer also to Drawing **C-1** for the **Grading Plan**.

Because of the grading of the site, the south portion of the development shall direct runoff to the storage system on the south of the site, which consists of Area 302, and the controlled north portion of the site shall direct runoff to the north chamber system, which consists of Areas 301, 303 and 304. Once the capacity of the system is filled, flows will then be released towards the downstream/north portion of the internal storm system. Both storage systems have been sized to provide the equivalent proportionate storage volume required for their contributing drainage areas. The site's storm outlet shall consist of a multi-stage outlet structure consisting of a Hydrovex vortex unit and a weir. This outlet structure shall ensure all extended detention flows are controlled to the required release rate and the 2-year to the 100-year storm flows are controlled accordingly as well. The discharged flows are then be directed to the storm sewer system proposed along Mill Street and eventually enter the existing storm sewer system on Bascom Street. The proposed storm sewer system has been sized to convey the 5-year storm event. Refer to **Appendix C** for the storm sewer design sheet and to Drawing **SWM-4** for the **Catchment Area Storm Drainage Plan**.

Refer also to **Drawing C2 – Servicing Plan** for the existing and proposed storm sewer layout.

The proposed north and south Stormtech chambers shall be equipped with an Isolator Row Plus to provide the required quality control. The proposed infiltration volumes within the chambers will also provide the additional quality treatment for the storm runoff.

4.4 Proposed Stormwater Management

4.4.1 Quantity Control and 40mm Extended Detention

As mentioned above, peak runoff rates resulting from the 2 to the 5-year minor storm events under post-development conditions will be controlled to the downstream minor storm system capacity. Major storms from the 10-year up to the 100-year event shall have the peak runoff controlled such that overland flow along Mill Street will have the capacity to safely convey the flows to outlet to the existing pond. All uncontrolled areas have been accounted for when determining the post-development flows and storage requirements.

As per the Uxbridge Brook Watershed Plan dated February 1997, the development is also required to provide 24 hours extended detention of the 4-hour 40mm Chicago storm event. This volume shall also be detained and released at the required controlled rate.

The total measured impervious area of the controlled drainage area of the site is 7480m^2. Therefore, the required 40mm extended detention volume is **299m^3**. When released over 24 hours, the required design release rate is **3.46 L/s**. A **Hydrovex 50 VHV-1** vortex unit is proposed at the control manhole, CTLMH101, to provide the required control to achieve this release rate. Since this provided storage will be split into two storage facilities, the corresponding impervious areas & volumes required are summarized in **Table 4.4.1-1** below.

Table 4.4.1-1 – 40mm Storm Event Volume Requirements

Area ID	Impervious Area (ha)	40mm Volume Required (m^3)	40mm Volume Provided (m^3)
301 + 303 + 304	4488	179.3	184.0
302	2992	119.7	121.6
Total	**7480**	**299**	**305.6**

The two storage chamber volumes have been sized so that each chamber system provides the equivalent storage corresponding to the proportionate incoming runoff resulting from the 40mm storm event. Therefore, each of the systems will fill at the same time and the storage will be evenly distributed. The south chamber system will be upstream of the north chamber system and will also have a proposed vortex unit set at the same release rate of 3.46 L/s, installed in a weir wall in MH106, to maintain the steady flow downstream that is being discharged at the same rate. A **Hydrovex 75 VHV-1** is proposed for this south chamber outlet. Flows exceeding the storage capacity of this system will begin to overtop the weir and bypass downstream. The north chamber system shall receive flows captured in the north controlled portion and the flows discharged from the upstream storm system. The control manhole shall be placed downstream of this north system which will consist of a weir wall installed within the manhole. The weir wall will consist of the proposed **Hydrovex 50 VHV-1** vortex unit to control the extended detention volume to 3.46 L/s, and a weir at a higher elevation to provide control for storms exceeding the 40mm event. Refer to **Appendix C** for the Hydrovex unit sizing chart.

Controls shall also be provided to ensure the release rates during the 2-year to the 100-year storm achieve the applicable criteria. This will be achieved by installing a multi-stage outlet consisting of the Hydrovex 50-VHV-1 vortex unit mentioned above, and a 0.10m bottom width weir with 3:1 side slopes and a height of 0.20m installed above the extended detention water level for storms of higher intensity. Based on this outlet structure and the allowable flow rates, the required storage has been determined for each of the storm events. **Table 4.4.1-2** below provides the post-development release rates and associated storage requirements for the site.

Table 4.4.1-2 – Post-Development Peak Flows and Storage Summary

Storm Event	Controlled Release Rate (L/s)	Uncontrolled Area Release Rate (L/s)	Total Site Release Rate (L/s)	Allowable Release Rate (L/s)	Total Storage Required (m^3)	Total Storage Provided (m^3)
2-year	**3.46**	17.2	**21**	**115**	**249**	**305.6**
5-year	**7**	24.0	**31**	**115**	**305**	**305.6**
10-year	**14**	28.3	**42**	Conveyance	**305**	**305.6**
25-year	**33**	37.2	**70**	Conveyance	**305**	**305.6**
100-year	**92**	51.2	**143**	Conveyance	**305**	**305.6**

As demonstrated in **Table 4.4.1-2** above, the provided **305.6m^3** of storage is adequate in dissipating the peak runoff flows to the allowable flow rates to the minor system. All total flows during the 2-year to the 25-year storm event resulted in flows under the allowable **115 L/s** flow to the minor storm system. In addition to this, the storage provides adequate capacity to reduce peak flows during the 100-year storm to **92 L/s** into the downstream minor storm system (excluding the uncontrolled flow that will drain overland since this is a major storm). This resulting flow is lower than the allowable minor system capacity of **115 L/s**. Therefore, this provides additional conservative control for the runoff from the 100-year storm event entering the minor storm system.

The proposed controlled release rates in **Table 4.4.1-2** are based on the head on the outlet structure and resulting flows. The second control/weir is set at an elevation that is above the top of the chamber system to ensure the entire extended detention volume is captured and released at the desired release rate. After the storage is filled, the water level will begin to rise and eventually engage the weir control. The higher the water level, the high the released flow from the site, which is how the flows from the 5-year to the 100-year storm event are determined. At a given point, the required storage is equal or below the provided storage flows at the corresponding release rate. Therefore, the HGL of the storm flows will not rise higher than the design HGL on the outlet due to the provided storage volume and controls all applicable storm flows to the set release rate. During the 100-year storm, the water level is designed such that it shall not rise higher than 0.18m above the proposed weir bottom. Refer to **Appendix C** for stormwater management storage calculations, and the outlet structure design calculations and associated head. Refer also to **Appendix D** for the Stormtech chamber storage system drawings and specifications.

Overland flows resulting from major storms have also been calculated to compare to the downstream road conveyance capacity on Mill Street. This was based on an HGL analysis calculated for the downstream storm sewer system. Based on the analysis, the system will be surcharged during the 100-year storm event and will therefore result in some overland flow. A total overland flow of **0.21 m^3/s** was calculated.

Mill Street therefore shall demonstrate the capacity to convey the required 0.21 m^3/s. A critical pinch point along Mill Street has been identified that provides the smallest cross-sectional area and resulting flow capacity. This was used to determine the minimum road conveyance capacity. Based on the calculations, this critical point has the capacity to provide **0.41 m^3/s**. Therefore, the road has sufficient capacity to convey the 100-year major storm flows, satisfying quantity control requirements. Refer to **Appendix C** for road conveyance capacity calculations.

4.4.2 Quality Control

4.4.2.1 TOTAL SUSPENDED SOLIDS

The proposed development shall target an enhanced level of quality control (80% TSS removal) for the site. Quality control will be provided by a treatment train approach utilizing the proposed Isolator Row Plus within the Stormtech chamber systems and the proposed infiltration volume.

Both the north and south Stormtech chamber system will be equipped with an Isolator Row Plus which has been verified to achieve the 80% TSS removal when acting alone and is also ETV certified. Specifications for the Isolator Row Plus and the ETV certification have been provided in **Appendix D**.

In addition, the proposed infiltration volumes shall also provide additional quality treatment for the storm flows. The storage chambers on-site have been designed to infiltrate a total volume of 187m^3, which is equivalent to the 25mm storm event. This equates to 95% of annual rainfall. Based on the MOE 2003 SWM Manual, infiltration is one of the contemplated strategies to provide quality control for storm water run-off. When infiltration is used alone to provide enhanced water quality, about 30 m^3/ha must be provided on-site (interpolated from MOE Table 3.2) for a site with an impervious percentage of 53%, which is the calculated imperviousness for the drainage area into the two Stormtech chamber systems. The area draining into the infiltration is 1.33 ha, and the infiltration capacity requirement to provide enhanced quality control through infiltration alone would be 30 m^3/ha x 1.33ha = 40m^3. Therefore, the proposed infiltration galleries provide more infiltration capacity than required to achieve 80% TSS for the contributing drainage area. Therefore, the Isolator Row Plus units along with the infiltration will provide adequate treatment to achieve the 80% TSS removal quality control criteria.

4.4.2.2 PHOSPHOROUS CONTROL

The proposed development shall make efforts to control post-development phosphorus loading to pre-development levels as per LSRCA standards. The development shall also adhere to the LSRCA's Phosphorus Offsetting Policy. A phosphorus calculation has been prepared to determine the pre- and post-development phosphorus loading from the site. The pre-development conditions of the site have been considered as low-intensity development, which has a phosphorus coefficient of 0.13 kg/ha. Given the 1.51ha site, the resulting phosphorus loading was 0.20 kg/yr.

Under proposed conditions, the site is comprised of high intensity residential development. The resulting phosphorus loading under post-development conditions without mitigation is 1.85 kg/yr. Treatment mitigation shall be provided by the proposed 25mm infiltration volume for the controlled portion of the site, which is equivalent to infiltrating the 25mm storm event. Accounting for uncontrolled areas, the total treatment mitigation on-site shall provide 90% removal of the total phosphorus concentration. The resulting phosphorus loading is **0.18 kg/yr**. 1.65 kg/yr of phosphorus is removed which is approximately 90% phosphorus removal. The post-development phosphorus loading was calculated to be lower than the pre-development levels and therefore phosphorus treatment criteria is achieved. Refer to **Appendix D** for the phosphorus loading calculations.

It is noted that the Stormtech Isolator Row Plus likely provides some phosphorus removal but has conservatively not been accounted for. This is based upon how it has been documented that phosphorus binds to TSS and some of it would have been removed via settling within the Stormtech Isolator Rows.

4.4.3 Water Balance and Volume Control

The proposed development shall make efforts to provide water balance such that post-development runoff volumes do not exceed the pre-development levels. As per the LSRCA Stormwater Management guidelines, the preferred water balance approach shall provide best efforts to retain the 25mm storm event if feasible. Water balance for the proposed development has been provided by the infiltration galleries within the two proposed Stormtech Chamber systems. These systems have been placed in the most optimal locations identified in the site to promote water retention and infiltration.

The Stormtech chamber systems have been sized and designed to infiltrate the 25mm storm event from all incoming impervious areas. However, some of this volume shall be within the extended detention volume along with the dead storage below the outlet invert. This is because when the extended detention storage volume is full, infiltration shall be occurring at the same time since the flow rate of the extended detention is very low. This results in a large amount of infiltration occurring at the same time. It is proposed to have an infiltration depth of 0.54m and 0.28m for the corresponding north and south infiltration galleries below their associated vortex outlet control unit. This results in 68.3m^3 and 40.4m^3 of dead storage below the north and south gallery flow control inverts. This volume, along with additional infiltration occurring while the extended detention volume is engaged shall provide the desired infiltration of the 25mm storm.

The infiltration rate in relation to the extended detention storage volumes within the systems is determined by the footprint of the chamber system and the infiltration rate as provided by the Geotechnical Investigation by Soil Engineers Inc. and Haddad Geotechnical Inc. As per the recent investigation prepared by Soil Engineers Inc., the infiltration rate is 30 mm/hr. However, this was based on a grain size analysis and not on testing. Haddad Geotechnical Inc. prepared percolation testing for the area, which resulted in a factored design infiltration rate of 20 mm/hr, which we believe is a more accurate representation of the infiltration rate for the site and has therefore been used for our calculations. The footprint areas for the north and south infiltration galleries are 201.3m^2 and 251.7m^2 respectively. Given the 20 mm/hr infiltration rate, the infiltration flow when the extended detention volume is engaged is 1.12 L/s and 1.40 L/s respectively. When calculated together, the total volume of infiltration occurring when the 40mm extended detention is full equals to 43.8m^3 and 34.4m^3 for the north and south galleries. Therefore, the total infiltration volume provided by the site is 68.3+40.4+43.8+34.4 = **187m^3**. This is equivalent to the runoff resulting from the 25mm storm event.

We believe this design approach was the optimal approach for several reasons. First of all, the 40mm event is equivalent to 100% of annual rainfall, meaning that the site is storing 100% of rainfall events. Providing much more than this volume has minimal benefit and is impractical. Therefore, it is proposed to allocate some of the dead storage to storage in the extended detention volume that will be infiltrating while the system is in operation. This also promotes a healthier system and preserves the longevity and proper function of the system. Because of the low 3.46 L/s extended detention rate, water would be sitting in the infiltration depth for long periods of time. The greater the infiltration depth, the longer the runoff will remain on the infiltration surface. This heavy loading on the infiltration surface reduces the performance of the soils quicker and can lead to clogging much sooner. Proposing a smaller infiltration depth will promote long-term function of the infiltration. This proposed design therefore provides the desired 25mm infiltration while also promoting infiltration functionality.

The drawdown times of the two storage systems are calculated based on the sum of the drawdown times of the infiltration depth as well as the infiltration occurring within the extended detention storage. In the north gallery, the drawdown time of the infiltration depth is 26.5 hours and the drawdown time of the remaining volume is 10.9 hours, which results in a total drawdown time of 37.4 hours. In the south gallery, the drawdown time of the infiltration depth is 12.5 hours and the drawdown time of the remaining volume is 6.8 hours, which results in a total drawdown time of 19.3 hours. Therefore, both infiltration galleries are below the maximum drawdown time requirement of 48 hours. An annual water balance calculation has been prepared and included in **Appendix F** along with related infiltration gallery calculations.

The south chamber system maintains a minimum 1m separation from the seasonal high groundwater level, however the north chamber system has a separation of about 0.5m during the seasonal high groundwater levels. It is notable that most of the time the groundwater should be lower and adequate separation is maintained. The functionality of the system is still expected to be maintained year-round. Therefore, the total water balance infiltration volume equals to 25mm for the site and the preferred approach as outlined by the LSRCA criteria is achieved for the development.

5.0 CONCLUSIONS

Based on the assessment provided above, we've demonstrated that the proposed site development can be serviced by the existing infrastructure and meets the Township, Regional and LSRCA standards.

We trust the information provided in the report meets with your requirements. Should there be any questions or comments, please feel free to contact the undersigned.

Sincerely,

Counterpoint Engineering Inc.

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Appendix A

Water Demand Calculations

Counterpoint Engineering Inc.

RESIDENTIAL WATER DEMAND CALCULATIONS

Project: **62 Mill Street**
Project No: **20128**
Client: **Mosaik (Uxbridge) Inc.**
Location: **Uxbridge Ontario**

Average Daily Demand:	364	L/(cap*d)	
Maximum Day Peaking Factor:	4.9		(See Note 1)
Peak Hour Peaking Factor:	7.4		(See Note 2)
Population Density (Singles)	3.5	ppu	(See Note 3)
Population Density (Towns)	3	ppu	(See Note 3)

Modelled Area	**Number of Units**	**Population**	**Average Day Demand (L/min)**	**Maximum Day Demand (L/min)**	**Maximum Hour Demand (L/min)**
Singles	24	84	21	104	157
Street & Condominium Towns	0	0	0	0	0
Total	**24**	**84**	**21**	**104**	**157**
Total (L/day)			**30,576**	**149,822**	**226,262**
Total (gpm)			**5.6**	**27.5**	**41.5**

Notes:

1. For population less than 500 per 2008 MOE Watermain Design Guidelines, Table 3-3.
2. For population less than 500 per 2008 MOE Watermain Design Guidelines, Table 3-3.
3. Persons per unit for singles and townhouses per section 2.0 Region of Durham Design Specifications for Sanitary Sewers.

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - Lot 1

Fire Underwriters Survey

Project : **62 Mill Street**
Project No: **20128**
Client: **Mosaik (Uxbridge) Inc.**
Location: **Uxbridge, Ontario**

Guide for Determination of Required Flow Copyright I.S.O

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

where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

1) **Fire Flow**

Type of Construction: OC
C= 1
A*= 320 m^2
F= 3,935 **L/min**

Note: Exterior walls are proposed brick and/or stone with wood frame. Assumes windows are adequately protected. Assume two-storeys.

2) **Occupancy Reduction/Surcharge**

Contents Factor: LC
Reduction/Surcharge of -15% = -590 L/min
F= **3935L/min** **-590** **L/min** = 3,345 **L/min**

3) **System Type Reduction**

NFPA 13 Sprinkler:	NO	0%
Standard Water Supply:	NO	0%
Fully Supervised:	NO	0%
Total		0%

Reduction of 0% L/min = 0 L/min
F= **3345L/min -** **0** **L/min** = 3,345 **L/min**

4) **Separation Charge**

Building Face	Dist(m)	Charge
North	40	5%
East	17	15%
South	27	10%
West	27	10%
Total		40%

40% **of** **3,345** **L/min** = 1,338 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **3345L/min +** **1338L/min** = 4,683 **L/min** (2,000L/min<F<45,000L/min)

F=	5,000	**L/min**
F=	83	**L/s**
F=	1,321	**gpm**

(round to the nearest 1,000L/min)
Note: Minimum recommended fire flow for conitguous buildings is **8,000 L/min**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - Lot 17

Fire Underwriters Survey

Project : **62 Mill Street**
Project No: **20128**
Client: **Mosaik (Uxbridge) Inc.**
Location: **Uxbridge, Ontario**

Guide for Determination of Required Flow Copyright I.S.O

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

where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).
A = The total floor area in square metres (including all storeys, but excluding basements at least 50 percent below grade) in the building being considered.

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

1) **Fire Flow**

Type of Construction: OC
C= 1
A*= 320 m^2
F= 3,935 **L/min**

Note: Exterior walls are proposed brick and/or stone with wood frame. Assumed two-storey house.

2) **Occupancy Reduction/Surcharge**

Contents Factor: LC
Reduction/Surcharge of -15% = -590 L/min
F= **3935L/min** **-590** **L/min** = 3,345 **L/min**

3) **System Type Reduction**

NFPA 13 Sprinkler: NO 0%
Standard Water Supply: NO 0%
Fully Supervised: NO 0%
Total 0%
Reduction of 0% L/min = 0 L/min
F= **3345L/min -** **0** **L/min** = 3,345 **L/min**

4) **Separation Charge**

Building Face	Dist(m)	Charge
North	2.5	25%
East	25	10%
South	2.5	25%
West	38	5%
Total		65%

65% **of** **3345.2** **L/min** **=** 2,174 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= **3345L/min +** **2174L/min** **=** 5,520 **L/min** (2,000L/min<F<45,000L/min)

F=	6,000	**L/min**
F=	100	**L/s**
F=	1,585	**gpm**

(round to the nearest 1,000L/min)
Note: Minimum recommended fire flow for conitguous buildings is **8,000 L/min**

Counterpoint Engineering Inc.

REQUIRED FIRE FLOW WORKSHEET - Lot 24

Fire Underwriters Survey

Project : **62 Mill Street**
Project No: **20128**
Client: **Mosaik (Uxbridge) Inc.**
Location: **Uxbridge, Ontario**

Guide for Determination of Required Flow Copyright I.S.O

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

where

F = the required fire flow in litres per minute.
C = coefficient related to the type of construction.
= 1.5 for wood frame construction (structure essentially all combustible).
= 1.0 for ordinary construction (brick or other masonry walls, combustible floor and interior).
= 0.8 for non-combustible construction (unprotected metal structural components, masonry or metal walls).
= 0.6 for fire-resistive construction (fully protected frame, floors, roof).

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

Type of Construction		Class Factor
WF	Wood Frame	1.5
OC	Ordinary Construction	1.0
NC	Non-Combustible	0.8
FC	Fire-Resistive	0.6

Area Notes for Fire Resistive Buildings (from FUS manual, 1999):

If Vertical Openings are inadequately protected (less than 1-hour fire rating): Area is the total of the two largest adjoining floors (above ground level) plus 50% of the area of each of the next 8 adjoining floors above that.

If Vertical Openings are adequately protected (at least 1-hour fire rating): Area is the total of the largest floor (above ground level) plus 25% of the area of each of the next 2 immediately adjoining floors above that.

Contents		% Reduction
NC	Non-Combustible	25
LC	Limited Combustible	15
C	Combustible	0
FB	Free Burning	15
RB	Rapid Burning	25

1) **Fire Flow**

Type of Construction:	OC	
C=	1	
A*=	340	m^2
F=	4,057	**L/min**

Note: Exterior walls are proposed brick and/or stone with wood frame. Assumed two-storey house.

2) **Occupancy Reduction/Surcharge**

Contents Factor:		LC				
Reduction/Surcharge of		-15%		=	-608	L/min
F=	4057L/min	-608	L/min	=	3,448	**L/min**

3) **System Type Reduction**

NFPA 13 Sprinkler:		NO	0%			
Standard Water Supply:		NO	0%			
Fully Supervised:		NO	0%			
Total			0%			
Reduction of		0%	L/min	=	0	L/min
F=	3448L/min -	0	L/min	=	3,448	**L/min**

4) **Separation Charge**

Building Face	Dist(m)	Charge
North	2.5	25%
East	25	10%
South	46	0%
West	35	5%
Total		40%

40% **of** 3448.1 **L/min** **=** 1,379 **L/min**

(max exposure charge can be 75%)

Separation	Charge	Separation	Charge
0 to 3m	25%	20.1 to 30 m	10%
3.1 to 10m	20%	30.1 to 45m	5%
10.1 to 20m	15%		

F= 3448L/min + 1379L/min **=** 4,827 **L/min** (2,000L/min<F<45,000L/min)

F=	5,000	**L/min**
F=	83	**L/s**
F=	1,321	**gpm**

(round to the nearest 1,000L/min)
Note: Minimum recommended fire flow for conitguous buildings is **8,000 L/min**

Appendix B

Sanitary Design Flow Calculations

Counterpoint Engineering Inc.

REGIONAL MUNICIPALITY OF DURHAM
EXISTING SANITARY SEWER DESIGN SHEET (METRIC)

PROJECT: **62 Mill Street**
PROJECT No.: **20128**
MUNICIPALITY: **Uxbridge**

DESIGNED BY: S. Corley
CHECKED BY: J. Liang
MANNINGS "n": 0.013
DATE: 06/22/2021

	RESIDENTIAL				COMMERCIAL			INDUSTRIAL	INSTITUTIONAL	FLOW IN LITRES PER SECOND						EXISTING SEWER				PRESENT CONDITION
MAINTENANCE No.	GROSS AREA (ha)	POP. DENSITY UNITS	POP.	PEAK FLOW FACTOR	LOT AREA (ha)	FLOOR SPACE INDEX (See Note 7)	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	RESIDENTIAL FLOW		COMM. 2.08 l/s	INDUS. 2.08 l/s	INSTIT. 1.30 l/s	TOTAL FLOW l/s	PIPE SIZE (Nom) (mm)	SLOPE %	CAPACITY Q (Act Pipe) l/s	VELOCITY V (Act Pipe) m/s	SURCHARGED %
										INFIL. * 0.26 l/s	SEWAGE 0.0042 l/s									
Mill Street		1	4																	
			4	3.80							0.06				0.06	200	0.50	24.48	0.75	0%

NOTES:

INFILTRATION 0.26L/s - 22.5 m3/ha/day
0.52 L/s - 45.0 m3/ha/day
INDUSTRIAL 1.04L/s - 90.0 m3/ha/day
FLOW RATES 2.08L/s - 180 m3/ha/day

Counterpoint Engineering Inc.

REGIONAL MUNICIPALITY OF DURHAM
SANITARY SEWER DESIGN SHEET (METRIC)

PROJECT: **62 Mill Street**
PROJECT No.: **20128**
MUNICIPALITY: **Uxbridge**

DESIGNED BY: S. Corley
CHECKED BY: J. Liang
MANNINGS "n": 0.013
DATE: 06/22/2021

	RESIDENTIAL				COMMERCIAL			INDUSTRIAL	INSTITUTIONAL	FLOW IN LITRES PER SECOND						PROPOSED SEWER				PRESENT CONDITION
										RESIDENTIAL FLOW										
MAINTENANCE No.	GROSS AREA (ha)	POP. DENSITY UNITS	POP.	PEAK FLOW FACTOR	LOT AREA (ha)	FLOOR SPACE INDEX (See Note 7)	FLOOR AREA (ha)	LOT AREA (ha)	LOT AREA (ha)	INFIL. * 0.26 l/s	SEWAGE 0.0042 l/s	COMM. 2.08 l/s	INDUS. 2.08 l/s	INSTIT. 1.30 l/s	TOTAL FLOW l/s	PIPE SIZE (Nom) (mm)	SLOPE %	CAPACITY Q (Act Pipe) l/s	VELOCITY V (Act Pipe) m/s	SURCHARGED %
Mill Street	1.51	24	84																	
	1.51		**84**	**3.80**						**0.39**	**1.34**				**1.73**	**200**	**0.50**	**24.48**	**0.75**	**7%**

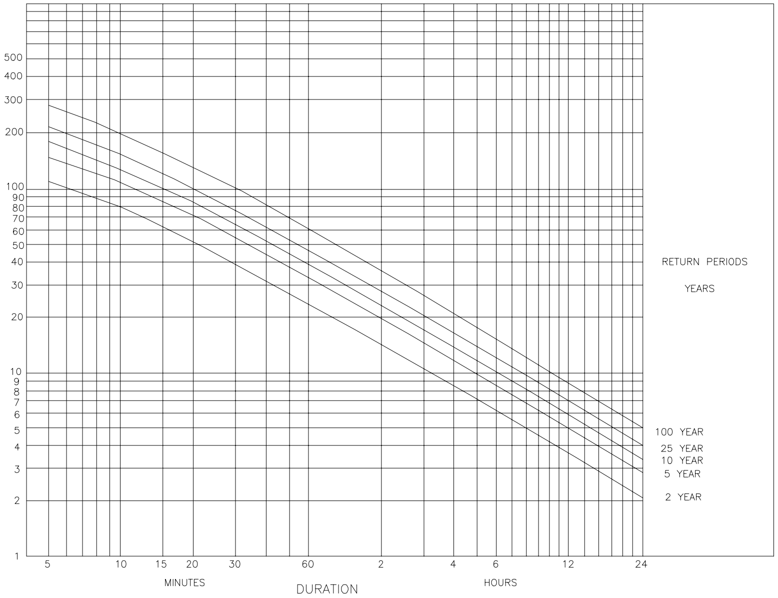
NOTES:

INFILTRATION 0.26L/s - 22.5 m3/ha/day
0.52 L/s - 45.0 m3/ha/day
INDUSTRIAL 1.04L/s - 90.0 m3/ha/day
FLOW RATES 2.08L/s - 180 m3/ha/day

Mosaik (Uxbridge) Inc.
File Number: 20128

Appendix C

Stormwater Management Design Calculations



1. EQUATION FOR TYPICAL INTENSITY–DURATION–FREQUENCY CURVES: T–TIME(MINUTES)
I – INTENSITY (mm/hr)

$$I_2 \quad \frac{645}{(T+5)^{0.786}} \qquad I_5 \quad \frac{904}{(T+5)^{0.788}} \qquad I_{10} \quad \frac{1065}{(T+5)^{0.788}} \qquad I_{25} \quad \frac{1234}{(T+4)^{0.787}} \qquad I_{100} \quad \frac{1799}{(T+5)^{0.810}}$$

2. THE ABOVE EQUATION ARE ONLY VALID FOR T=10 MINUTES TO 1440 MINUTES

APPROVED

REVISION

DATE OF REVISION

TOWNSHIP OF UXBRIDGE

RAINFALL INTENSITY DURATION CURVES

DATE OF ISSUE
MARCH 1989

DRAWING No.
US–600

Counterpoint Engineering Inc.

PRELIMINARY 5-YEAR STORM SEWER CALCULATION SHEET (RATIONAL METHOD)

Prepared by: SDS
Date: 24-Jun-21
Submission: 1st SPA Submission

Project: **Mill Street**
Project No: 20128
Client: 0
Location: Township of Uxbridge

Rainfall Data: a, b, c values	
	5 -YEAR
a	904
b	5
c	0.788

Manning's Roughness Coefficient (All pipes)= **0.013**
Design Return Frequency (years)= **5**

🟩 - Top end of sewer run
🟦 - Junction with 2 or more inletting pipes (not including RLCB/CBs)

Definitions:
Q = 2.78 AIR, where
Q = Peak Flow in Litres per second (L/s)
Tc= Time of concentration
A = Areas in hectares (ha)
I = Rainfall Intensity (mm/h)
I = a / (Td + b)^c (see above for regression contants)
C = Runoff Coefficient

1	2	3	4	5	6	8		9	10	11	12	13	14	16	17	22	23	24	25	26	28
Identification			**Pipe Properties**			**Drainage Area**					**Total Flow**					**Hydraulic Properties**					
Location	**U/S Structure**	**D/S Structure**	**Diameter (nominal)**	**Length Pipe**	**Slope Pipe**	**Area**	**Accum. Area**	**Runoff Coeff.**	**A x C**	**Accum. A x C**	**Rainfall Intensity**	**Time of Conc. (Tc)**	**Accum Area Flow**	**Accum Ctld Flow**	**Total Flow**	**Pipe Capacity**	**Velocity**	**D/S Tc**	**Ratio Q/Q full**	**Cap. Check**	**Notes**
			(mm)	(m)	(%)	(ha)	(ha)	C	(ha)	(ha)	mm/hr	(min)	(l/s)	(l/s)	(l/s)	(l/s)	(m/s)	(min)	(%)		
Street 1	MH107	MH106	300	4.53	2.05	0.12	0.12	0.60	0.072	0.072	106.5	10.09	21.4	0.0	21.4	137.8	1.42	10.16	16%	OK	
Street 1	MH106	MH105	375	65.37	1.01	0.42	0.54	0.60	0.250	0.323	104.7	10.42	93.8	0.0	93.8	165.9	1.62	11.11	57%	OK	
Street 1	MH105	MH104	375	49.31	1.40	0.40	0.94	0.60	0.241	0.563	99.4	11.47	155.6	0.0	155.6	195.0	2.05	11.88	80%	OK	
Street 1	CTLMH101	MH102	375	50.79	1.10	0.08	1.40	0.60	0.046	0.841	94.5	12.57	220.8	0.0	220.8	173.1	2.09	12.99	128%	Not OK	
Street 1	MH102	MH101	375	8.36	1.15	0.11	1.51	0.60	0.066	0.908	92.7	12.99	233.8	0.0	233.8	176.8	2.22	13.06	132%	Not OK	
Mill Street	MH101	CBMH202	375	78.96	1.11	--	1.51	--	--	0.908	92.4	13.06	233.1	0.0	233.1	173.7	2.21	13.66	134%	Not OK	
Mill Street	CBMH202	MH201	375	17.83	1.10	0.42	1.93	0.45	0.188	1.096	90.1	13.66	274.2	0.0	274.2	192.1	2.40	13.80	143%	Not OK	
Mill Street	MH201	Ex. MH101	375	9.04	1.10	0.07	2.00	0.45	0.029	1.125	89.0	13.95	278.1	0.0	278.1	191.9	2.44	14.02	145%	Not OK	
Bascom	Ex. MH101	Structure - (65)	375	40.21	3.37	0.03	2.02	0.45	0.013	1.138	88.7	14.02	280.6	0.0	280.6	335.6	3.30	14.23	84%	OK	
Bascom	Structure - (65)	Structure - (64)	375	10.17	3.37	0.80	2.82	0.45	0.360	1.498	88.0	14.23	366.1	0.0	366.1	335.6	3.21	14.28	109%	Not OK	

SWM DESIGN CALCULATIONS
DRAINAGE AREAS AND RUNOFF COEFFICIENT CALCULATIONS

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.

Last Revised: 24-Jun-21

Adjustment Ratio:	1	1.1	1.25
Runoff Coefficients:	**2 to 10-year**	**25-year**	**100-year**
Landscaped/Grass:	0.25	0.28	0.31
Gravel:	0.50	0.55	0.63
Pavement:	0.95	1.00	1.00
Roof:	0.95	1.00	1.00

Runoff Coefficients based on Township of Uxbridge Design Standards

PRE DEVELOPMENT CONDITIONS

Area 101 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
6222	314	31	210	6778	0.68

Area 101 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	50-Year	100-Year
	0.29	0.31	0.34	0.35

Area 102 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
1728	351	0	0	2079	0.21

Area 102 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	50-Year	100-Year
	0.29	0.32	0.35	0.37

Area 103 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
5293	857	0	134	6284	0.63

Area 103 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	50-Year	100-Year
	0.30	0.33	0.36	0.37

POST DEVELOPMENT CONDITIONS

Minor System Drainage Areas:

Area 201 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
5776	0	3666	3814	13257	1.33

Area 201 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	100-Year
	0.64	0.68	0.70

Area 202 Uncontrolled Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
1391	0	484	0	1875	0.19

Area 202 Uncontrolled Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	100-Year
	0.43	0.46	0.49

SWM DESIGN CALCULATIONS
DRAINAGE AREAS AND RUNOFF COEFFICIENT CALCULATIONS

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Adjustment Ratio:	1	1.1	1.25
Runoff Coefficients:	**2 to 10-year**	**25-year**	**100-year**
Landscaped/Grass:	0.25	0.28	0.31
Gravel:	0.50	0.55	0.63
Pavement:	0.95	1.00	1.00
Roof:	0.95	1.00	1.00

Runoff Coefficients based on Township of Uxbridge Design Standards

Major System Drainage Areas:

Area 301 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
4039	0	2430	2511	8980	0.90

Area 301 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	100-Year
	0.64	0.67	0.69

Area 302 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
1400	0	1568	1402	4370	0.44

Area 302 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	100-Year
	0.73	0.77	0.78

Area 303 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
1010	0	0	0	1010	0.10

Area 303 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	100-Year
	0.25	0.28	0.31

Area 304 Properties:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Total Area (ha)
773	0	0	0	773	0.08

Area 304 Runoff Coefficients for Corresponding Storms:

Storm Event:	2 to 10-Year	25-Year	100-Year
	0.25	0.28	0.31

Post-Development Area 201 Imperviousness:

Grass (m^2)	Gravel (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)	Imperviousness
0.00	0.50	1.00	1.00		
5776	0	3666	3814	13257	0.56

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SWM DESIGN CALCULATIONS
40mm Chicago Storm Extended Detention Calculations - Storage and Flow

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.

Last Revised: 24-Jun-21

Drainage Area Contributing to Storage Facility (Area 201):

Grass (m^2)	Pavement (m^2)	Roof (m^2)	Total Area (m^2)
6570	3666	3814	14050

Total Impervious Area = **7480** **m^2**

40mm Extended Detention Volume = **299** **m^3**

Volume to be stored for 24 hours. Therefore:
Required Extended Detention Flow = 299m3 / 24hrs
= 12.5 m^3/hr
= **3.46 L/s**

Rational Method - Post Development

Uncontrolled Area 202 Release Rate

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128

Event:		2	years
ABC's:	a	645	
	b	5	
	c	0.786	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.43	
Site Area	A	0.19	ha
Intensity $[i=a/(t+b)^c]$	i	76.76	mm/hr
Flow [Q=CiA/360]	Q	0.02	m^3/s
		17.2	l/s

Event:		5	years
ABC's:	a	904	
	b	5	
	c	0.788	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.43	
Site Area	A	0.19	ha
Intensity $[i=a/(t+b)^c]$	i	107.01	mm/hr
Flow [Q=CiA/360]	Q	0.02	m^3/s
		24.0	l/s

Event:		10	years
ABC's:	a	1065	
	b	5	
	c	0.788	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.43	
Site Area	A	0.19	ha
Intensity $[i=a/(t+b)^c]$	i	126.06	mm/hr
Flow [Q=CiA/360]	Q	0.03	m^3/s
		28.3	l/s

Event:		25	years
ABC's:	a	1234	
	b	4	
	c	0.787	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.46	
Site Area	A	0.19	ha
Intensity $[i=a/(t+b)^c]$	i	154.64	mm/hr
Flow [Q=CiA/360]	Q	0.04	m^3/s
		37.2	l/s

Event:		100	years
ABC's:	a	1799	
	b	5	
	c	0.81	
Time of Concentration:	t	10	min
Runoff Coefficient:	C	0.49	
Site Area	A	0.19	ha
Intensity $[i=a/(t+b)^c]$	i	200.63	mm/hr
Flow [Q=CiA/360]	Q	0.05	m^3/s
		51.2	l/s

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SWM DESIGN CALCULATIONS
Storage Calculations for 100-Year Storm Event

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Rainfall Data

Location:	**Township of Uxbridge, ON**	a	**1799**
Event	**100-year**	b	**5**
		c	**0.81**

Site Data

Area (ha)	**1.33**
Runoff Coefficient	**0.70**
AC	0.93
Tc (min)	**10**
Time Increment (min)	**5**
Release Rate (l/s)	**92**
Storage Required (m^3)	**305**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	201	0.52	311	55	256	
15	159	0.41	369	83	287	
20	133	0.34	411	110	301	
25	114	0.30	443	138	305	********
30	101	0.26	469	165	304	
35	91	0.23	491	193	299	
40	82	0.21	510	220	290	
45	76	0.20	527	248	279	
50	70	0.18	542	276	267	
55	65	0.17	556	303	253	
60	61	0.16	568	331	238	
65	58	0.15	580	358	222	
70	54	0.14	591	386	205	
75	52	0.13	601	413	187	
80	49	0.13	610	441	169	
85	47	0.12	619	468	150	
90	45	0.12	627	496	131	
95	43	0.11	635	523	111	
100	41	0.11	642	551	91	
105	40	0.10	650	579	71	
110	39	0.10	657	606	50	
115	37	0.10	663	634	29	
120	36	0.09	669	661	8	

Counterpoint Engineering Inc.
8395 Jane Street, Suite 100 Vaughan, Ontario L4K 5Y2
TEL: (905) 326-1404 FAX: (905) 326-1405
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ENGINEERING

SWM DESIGN CALCULATIONS
Storage Calculations for 2-Year Storm Event

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Rainfall Data

Location:	**Township of Uxbridge, ON**	a	**645**
Event	**2-year**	b	**5**
		c	**0.786**

Site Data

Area (ha)	**1.33**
Runoff Coefficient	**0.64**
AC	0.86
Tc (min)	**10**
Time Increment (min)	**5**
Release Rate (l/s)	**3.46**
Storage Required (m^3)	**242**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)
10	77	0.18	109	2	107
15	61	0.15	131	3	128
20	51	0.12	147	4	142
25	45	0.11	159	5	154
30	39	0.09	169	6	163
35	36	0.08	177	7	170
40	32	0.08	185	8	176
45	30	0.07	191	9	182
50	28	0.07	197	10	187
55	26	0.06	203	11	191
60	24	0.06	207	12	195
65	23	0.05	212	13	199
70	22	0.05	216	15	202
75	21	0.05	220	16	205
80	20	0.05	224	17	207
85	19	0.04	228	18	210
90	18	0.04	231	19	212
95	17	0.04	234	20	214
100	17	0.04	237	21	216
105	16	0.04	240	22	218
110	15	0.04	243	23	220
115	15	0.04	246	24	222
120	15	0.03	248	25	223

SWM DESIGN CALCULATIONS
Storage Calculations for Controlled Drainage Area - 5-Year Storm

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Rainfall Data

Location:	**Township of Uxbridge, ON**	a	**904**
Event	**5-year**	b	**5**
		c	**0.788**

Site Data

Area (ha)	**1.33**
Runoff Coefficient	**0.64**
AC	0.86
Tc (min)	**10**
Time Increment (min)	**5**
Release Rate (l/s)	**7.0**
Storage Required (m^3)	**305**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	**Rainfall Intensity**	**Storm Runoff**	**Runoff Volume**	**Released Volume**	**Storage Volume**
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)
10	107	0.25	153	4	148
15	85	0.20	182	6	176
20	72	0.17	204	8	196
25	62	0.15	221	10	211
30	55	0.13	235	13	222
35	49	0.12	247	15	232
40	45	0.11	257	17	240
45	41	0.10	266	19	247
50	38	0.09	274	21	253
55	36	0.09	282	23	259
60	34	0.08	288	25	263
65	32	0.08	295	27	267
70	30	0.07	301	29	271
75	29	0.07	306	31	275
80	27	0.06	311	33	278
85	26	0.06	316	36	281
90	25	0.06	321	38	283
95	24	0.06	325	40	285
100	23	0.05	329	42	288
105	22	0.05	333	44	289
110	21	0.05	337	46	291
115	21	0.05	341	48	293
120	20	0.05	344	50	294

SWM DESIGN CALCULATIONS
Storage Calculations for Controlled Drainage Area - 10-Year Storm

Project Name: 62 Mill Street
Prepared by: J.L.
Municipality: Uxbridge, ON
Project No.: 20128
Last Revised: 24-Jun-21
Date: 24-Jun-21

Rainfall Data

Location:	**Township of Uxbridge, ON**	a	**1065**
Event	**10-year**	b	**5**
		c	**0.788**

Site Data

Area (ha)	**1.33**
Runoff Coefficient	**0.64**
AC	0.86
Tc (min)	**10**
Time Increment (min)	**5**
Release Rate (l/s)	**14**
Storage Required (m^3)	**305**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)
10	126	0.30	180	8	171
15	100	0.24	215	13	202
20	84	0.20	240	17	224
25	73	0.17	260	21	239
30	65	0.15	277	25	251
35	58	0.14	291	29	261
40	53	0.13	303	34	269
45	49	0.12	313	38	275
50	45	0.11	323	42	281
55	42	0.10	332	46	285
60	40	0.09	340	51	289
65	37	0.09	347	55	292
70	35	0.08	354	59	295
75	34	0.08	361	63	297
80	32	0.08	367	67	299
85	31	0.07	372	72	301
90	29	0.07	378	76	302
95	28	0.07	383	80	303
100	27	0.06	388	84	304
105	26	0.06	393	88	304
110	25	0.06	397	93	305
115	24	0.06	402	97	305 ********
120	24	0.06	406	101	305

SWM DESIGN CALCULATIONS
Storage Calculations for Controlled Drainage Area - 25-Year Storm

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Rainfall Data

Location:	Township of Uxbridge, ON	a	1234
Event	25-year	b	4
		c	0.787

Site Data

Area (ha)	1.33
Runoff Coefficient	0.68
AC	0.91
Tc (min)	10
Time Increment (min)	5
Release Rate (l/s)	33
Storage Required (m^3)	**305**

The Rational Equation:

$$Q = \frac{(C)(i)(A)}{360}$$

where,

Q = the design flow (m^3/s)
C = the site specific runoff coefficient
A = the drainage area (ha)
i = rainfall intensity (mm/hr)

Time	Rainfall Intensity	Storm Runoff	Runoff Volume	Released Volume	Storage Volume	
(min)	(mm/hr)	(m^3/s)	(m^3)	(m^3)	(m^3)	
10	155	0.39	234	20	214	
15	122	0.31	276	30	246	
20	101	0.26	306	40	266	
25	87	0.22	330	50	280	
30	77	0.19	349	60	289	
35	69	0.17	366	70	296	
40	63	0.16	380	79	301	
45	58	0.15	393	89	303	
50	53	0.13	404	99	305	
55	50	0.13	415	109	305	********
60	47	0.12	424	119	305	
65	44	0.11	433	129	304	
70	42	0.11	442	139	303	
75	40	0.10	449	149	300	
80	38	0.10	457	159	298	
85	36	0.09	464	169	295	
90	35	0.09	470	179	292	
95	33	0.08	477	189	288	
100	32	0.08	483	199	284	
105	31	0.08	488	209	280	
110	30	0.07	494	218	275	
115	29	0.07	499	228	271	
120	28	0.07	504	238	266	

SWM DESIGN CALCULATIONS
SWM Storage Outlet Structure Calculation

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.

Last Revised: 24-Jun-21

Return Period	Elevation	Tail Water Elevation	Q_{TARGET}	$H_{HYDROVEX}$	H_{WEIR}	Head Difference to TW	$Q_{HYDROVEX}$*	Q_{WEIR}	$Q_{TOTAL\_PROVIDED}$	Required Storage	Storage Provided
	[m]	[m]	[m³/s]	[m]	[m]	[m]	[m³/s]	[m³/s]	[m³/s]	[m³]	[m³]
100YR*	**272.64**	270.94	**N/A**	1.705	0.185	1.705	0.004	0.088	**0.092**	305	299
25YR*	**272.58**	270.94	**N/A**	1.635	0.115	1.635	0.004	0.030	**0.033**	305	299
10YR*	**272.53**	270.94	**N/A**	1.593	0.073	1.593	0.004	0.011	**0.014**	305	299
5YR*	**272.50**	270.94	**0.115**	1.563	0.043	1.563	0.004	0.003	**0.007**	305	299
2YR*	**272.46**	270.94	**0.115**	1.520	0.000	1.520	0.003	0.000	**0.003**	242	299
40mm Extended Detention*	**272.46**	270.94	**0.003**	1.520	0.000	1.520	0.003	0.000	**0.003**	299	299

*Hydrovex flows based on flow-head chart.

**Minor flows from the 5-year storm and lower shall be controlled to downstream the storm sewer capacity of 115 L/s (which results in 75% full flow of critical downstream pipe).

The remainder of flows during major storms shall be provided safe conveyance downstream along Mill Street to be outletted at the existing Mill Pond. It has been determined that the existing Mill Street road cross section has adequate capacity to convey the resulting overland flow from a 100-year storm. Therefore, the design criteria is met. Road capacity calculations have been provided in Appendix C.

Reference Points	Elevations (m)
Top of Storage Elevation:	272.64
Bottom of Storage Elevation:	227.70
Weir Invert Bottom:	272.46
Hydrovex Invert Bottom:	270.94
Max Head:	1.70

Weir (in weir wall)			
Bottom Width(m):	Height(m):	Side Slope:	
0.10	**0.20**	**3 :1**	
		INV.=	**272.46m**

Hydrovex 50 VHV-1	
INV.=	**270.94m**

Weir equation: **$Q = BxC_dxH^{3/2}$** $C_d = 1.7$

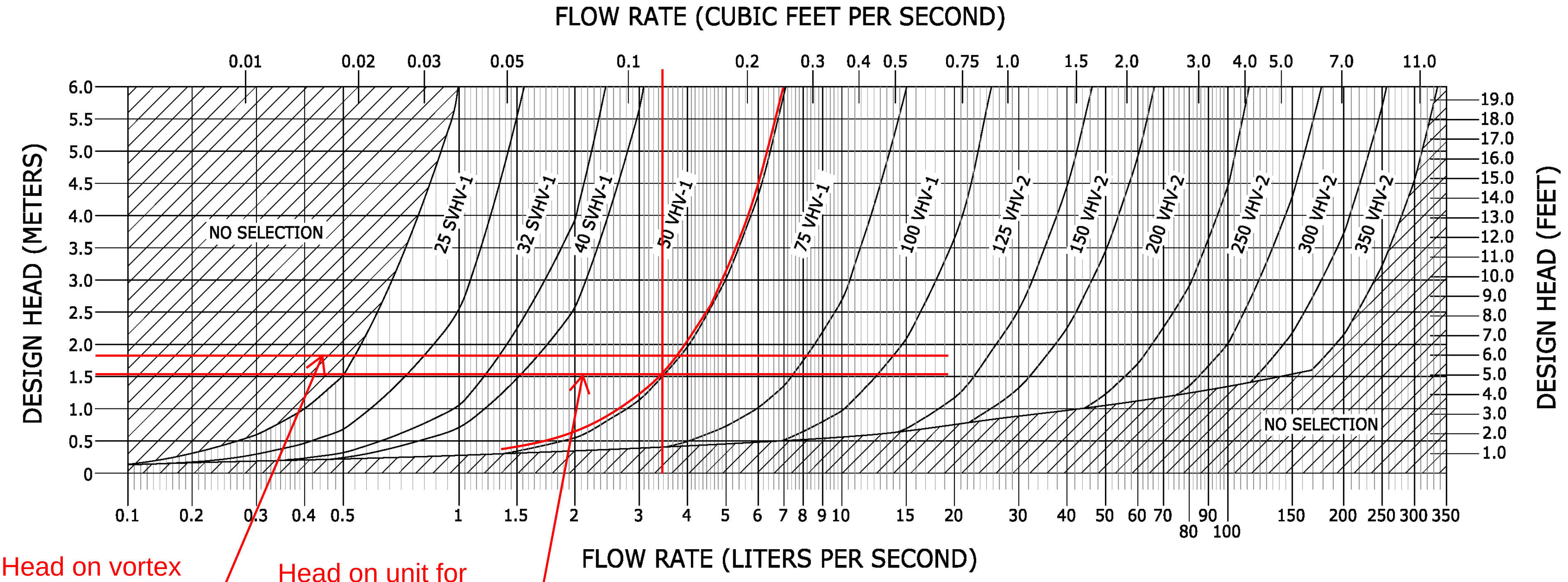
where:
q=flow rate (m^3/s)
h= head on the weir (m)
b=width of the weir (m)
g=9.81 (m/s^2) gravity
C_d = coefficient of discharge

Orifice equation: **$Q = C_dxAx(2gH)^{0.5}$** $C_d = 0.6$, $A=(1/4*\pi*D^2)$

where:
q=flow rate (m^3/s)
h= head on the weir (m)
a= area of orifice (m^2)
g=9.81 (m/s^2) gravity
C_d = coefficient of discharge

Hydrovex Vortex Unit Sizing for North Storage Chambers

Figure 3 : HYDROVEX® VHV/SVHV Selection Chart



Head on vortex unit during 100-year storm

Head on unit for extended detention volume

Hydrovex Vortex Unit Sizing for South Storage Chambers

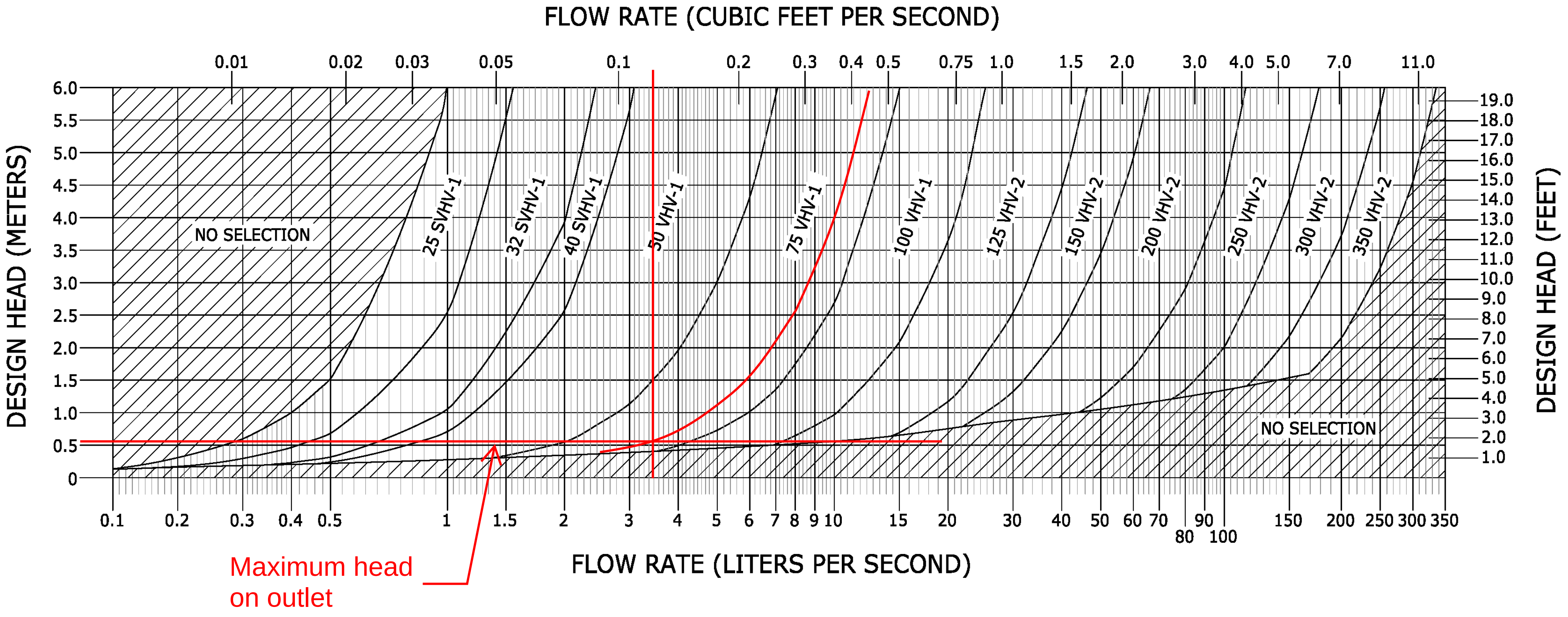


Figure 3 : HYDROVEX® VHV/SVHV Selection Chart

SWM DESIGN CALCULATIONS
Overland Flow Capacity for Mill Street Pinch Point

Project Name: 62 Mill Street
Municipality: Uxbridge, ON
Project No.: 20128
Date: 23-Jun-21

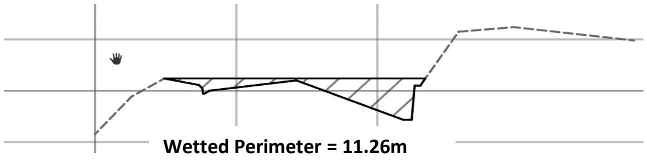
Prepared by: J.L.
Checked by:
Last Revised: 23-Jun-21

Capacity of Mill Street Road Capacity at Pinch Point
(Part A)

Input Parameters:

Road Cross Section Paved Slope	0.02	m/m	(1.7% Slope)
Road Cross Section Paved Width	8.0	m	
Bottom Width, b	0.00		
Flow Depth on High Point Above Curb, H	**0.16**	m	
Effective Flow Depth On The Road	**0.08**	m	
High Point Curb Invert Elevation (Weir Location)	**269.06**	m	
Low Point Curb Invert (Sag) Elevation	**268.90**		
Weir Discharge Coefficient C_w	**1.60**		

Road Sag Cross Section



Wetted Perimeter = 11.26m

Computed Values:

Weir Bottom (Wetted) Width, B	**11.26**	m
Water Surface Elevation at High Point	269.22	m
Water Surface Elevation at Low Point	269.22	m
Ponding Depth on Low Point (Sag)	0.322	m
Capacity, Q	**0.41**	m^3/s
Target Q (Total 100-year overland flow based on HGL Analysis):	**0.21**	m^3/s

Weir equation: $Q = B x C_w x H^{3/2}$

where:
C_w = weir discharge coefficient
B= bottom width (m)
Q= flow rate (m^3/s)
H= head on the weir (m)

Therefore, there is sufficient capacity in the road to provide safe uncontrolled major flow conveyance.

Appendix D

Stormwater Management Quality Control Calculations & Stormtech Chamber System Specifications and Certification

PROJECT INFORMATION

ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS™
Advanced Drainage Systems, Inc.

SiteASSIST™
FOR STORMTECH INSTRUCTIONS, DOWNLOAD THE INSTALLATION APP

20128_MILL STREET (NORTH)

UXBRIDGE, CANADA

MC-4500 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101.
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 75 mm (3").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF MC-4500 CHAMBER SYSTEM

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 230 mm (9") SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE WELL GRADED BETWEEN ¾" AND 2" (20-50 mm).
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 300 mm (12") BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
2. THE USE OF EQUIPMENT OVER MC-4500 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADER, DUMP TRUCK, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY USING THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

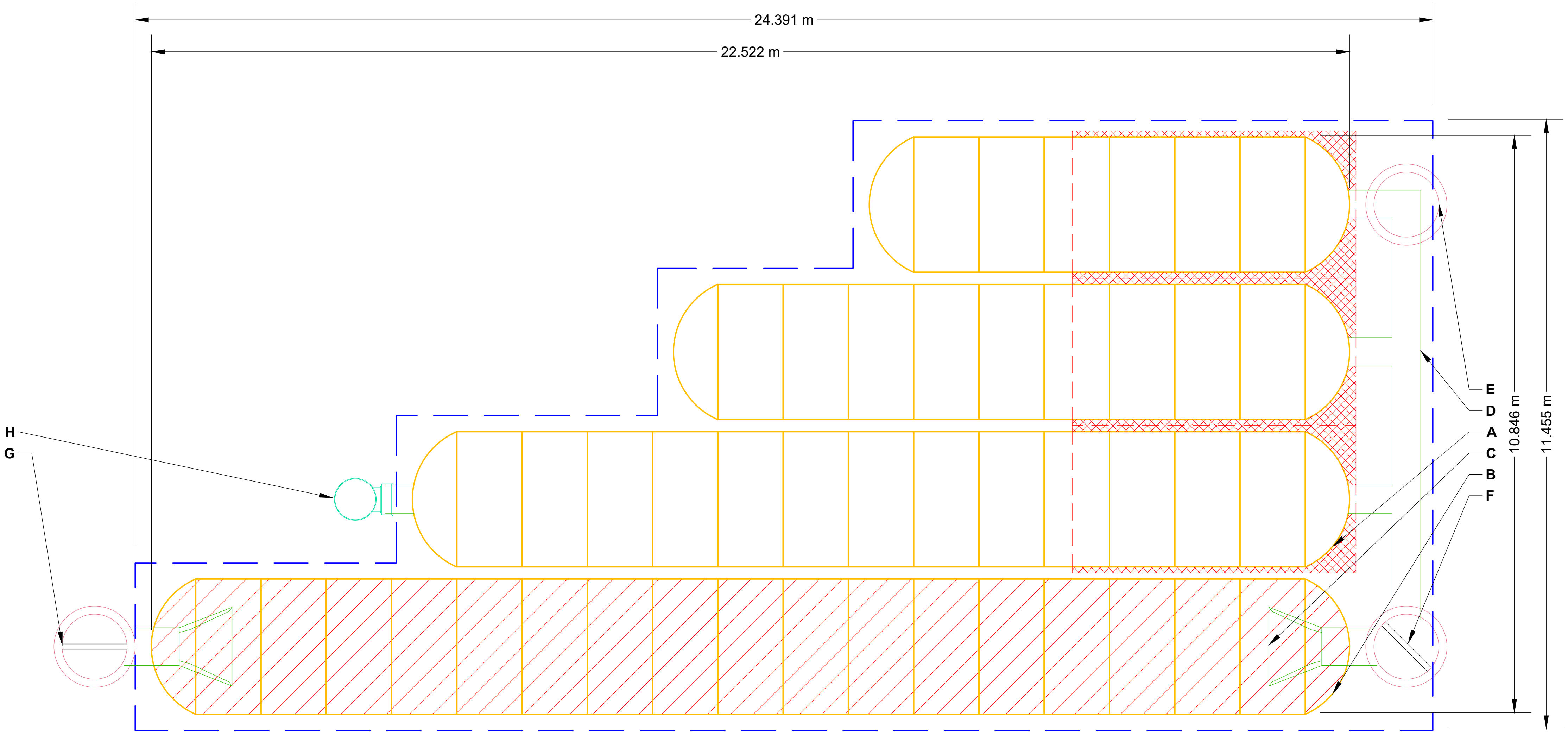
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT	
45	STORMTECH MC-4500 CHAMBERS
8	STORMTECH MC-4500 END CAPS
305	STONE ABOVE (mm)
229	STONE BELOW (mm)
40	STONE VOID
252.5	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
201.3	SYSTEM AREA (m^2)
71.7	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	274.286
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	272.915
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	272.762
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	272.762
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	272.762
TOP OF STONE:	272.457
TOP OF MC-4500 CHAMBER:	272.153
600 mm ISOLATOR ROW PLUS INVERT:	270.686
600 mm ISOLATOR ROW PLUS INVERT:	270.686
450 mm x 450 mm BOTTOM MANIFOLD INVERT:	270.679
450 mm BOTTOM CONNECTION INVERT:	270.679
450 mm BOTTOM CONNECTION INVERT:	270.679
BOTTOM OF MC-4500 CHAMBER:	270.629
BOTTOM OF STONE:	270.400

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	450 mm BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP18B / TYP OF ALL 450 mm BOTTOM CONNECTIONS	50 mm	
PREFABRICATED END CAP	B	600 mm BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 600 mm BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS	57 mm	
FLAMP	C	INSTALL FLAMP ON 600 mm ACCESS PIPE / PART#: MC450024RAMP (TYP 2 PLACES)		
MANIFOLD	D	450 mm x 450 mm BOTTOM MANIFOLD, ADS N-12	50 mm	
CONCRETE STRUCTURE	E	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		113 L/s OUT
CONCRETE STRUCTURE W/WEIR	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		467 L/s IN
CONCRETE STRUCTURE W/WEIR	G	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		
NYLOPLAST (OUTLET)	H	750 mm DIAMETER (DESIGN BY ENGINEER)		113 L/s OUT



▨	ISOLATOR ROW PLUS (SEE DETAIL)
▩	PLACE MINIMUM 5.334 m OF ADSPLUS175 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS
─	BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

20128_MILL STREET (NORTH)
UXBRIDGE, CANADA

DATE:
DRAWN: SS
PROJECT #:
CHECKED: N/A

REV	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 100

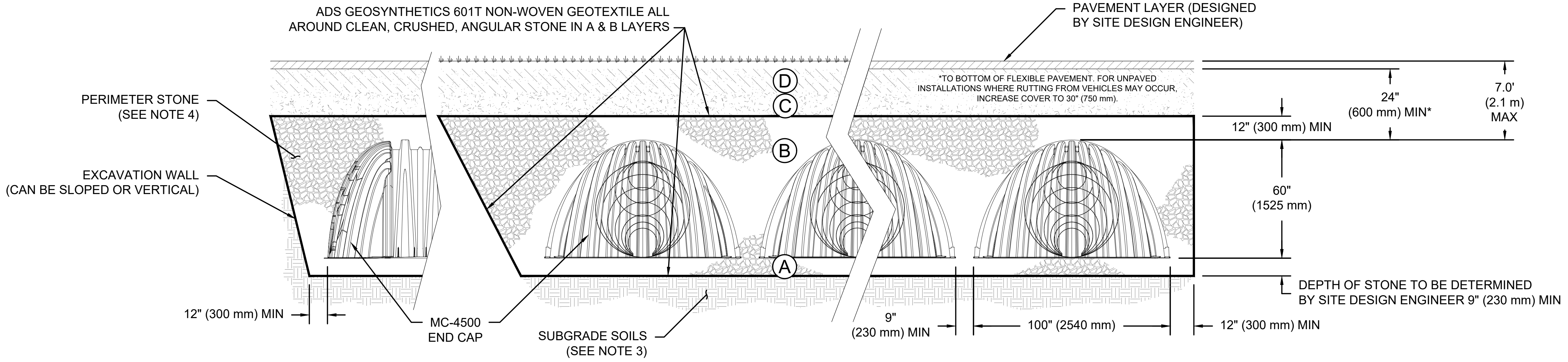
SHEET
2 OF 6

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

MATERIAL LOCATION		DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

PLEASE NOTE:

1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

20128_MILL STREET (NORTH)
UXBRIDGE, CANADA

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REV	DRW	CHK	DESCRIPTION

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HILLIARD, OH 43026
1-800-733-7473

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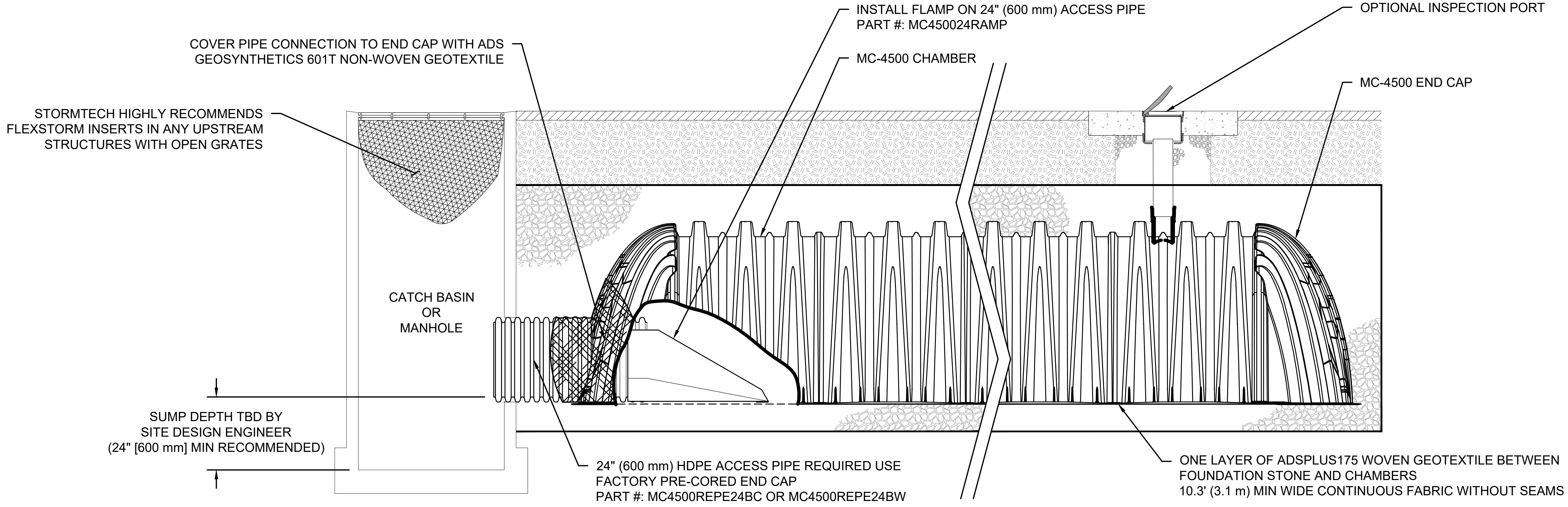

MC-4500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

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

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

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

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

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

20128_MILL STREET (NORTH)
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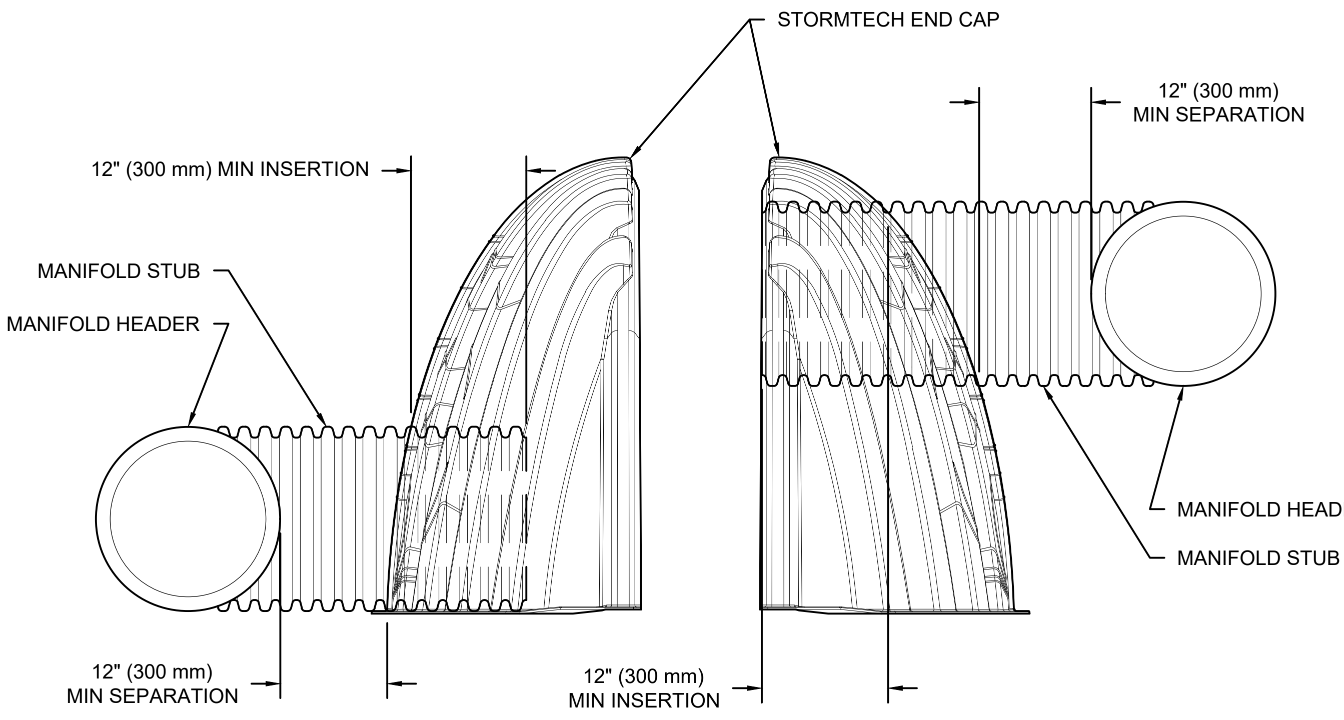
MC-SERIES END CAP INSERTION DETAIL

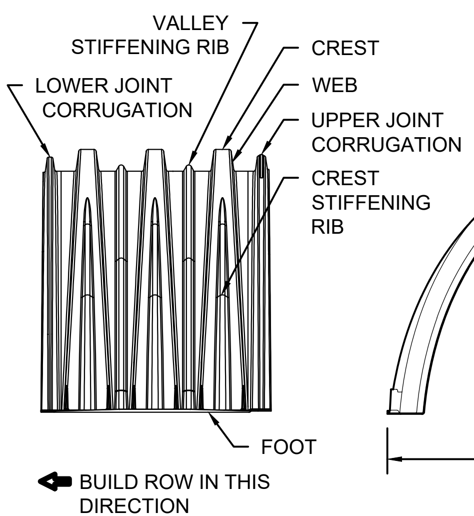
NTS

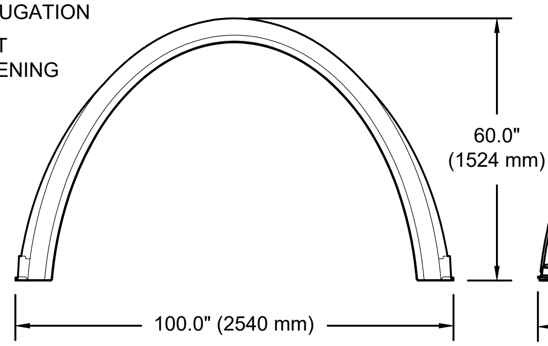


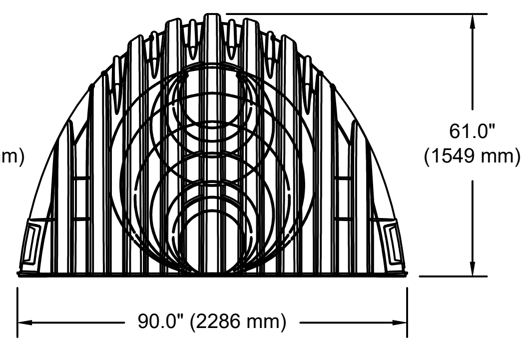
NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL
FOR A PROPER FIT IN END CAP OPENING.

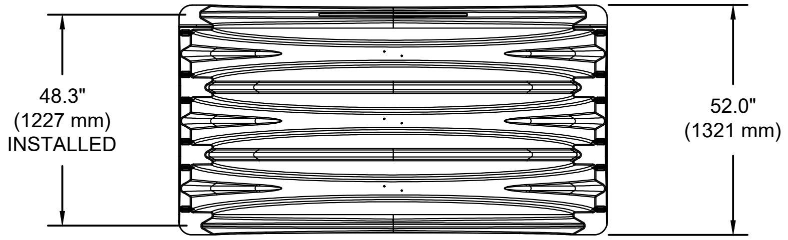
MC-4500 TECHNICAL SPECIFICATION

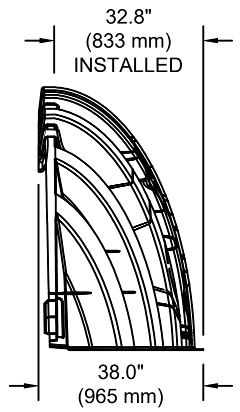
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT (NOMINAL)	125.0 lbs.	(56.7 kg)

NOMINAL END CAP SPECIFICATIONS

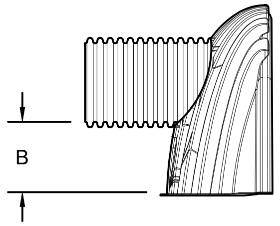
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

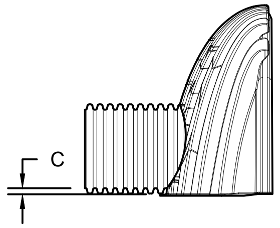
*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC4500IEPP18TW			
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC4500IEPP24TW			
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL





CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-4500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

20128_MILL STREET (NORTH)
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REV	DRW	CHK	DESCRIPTION

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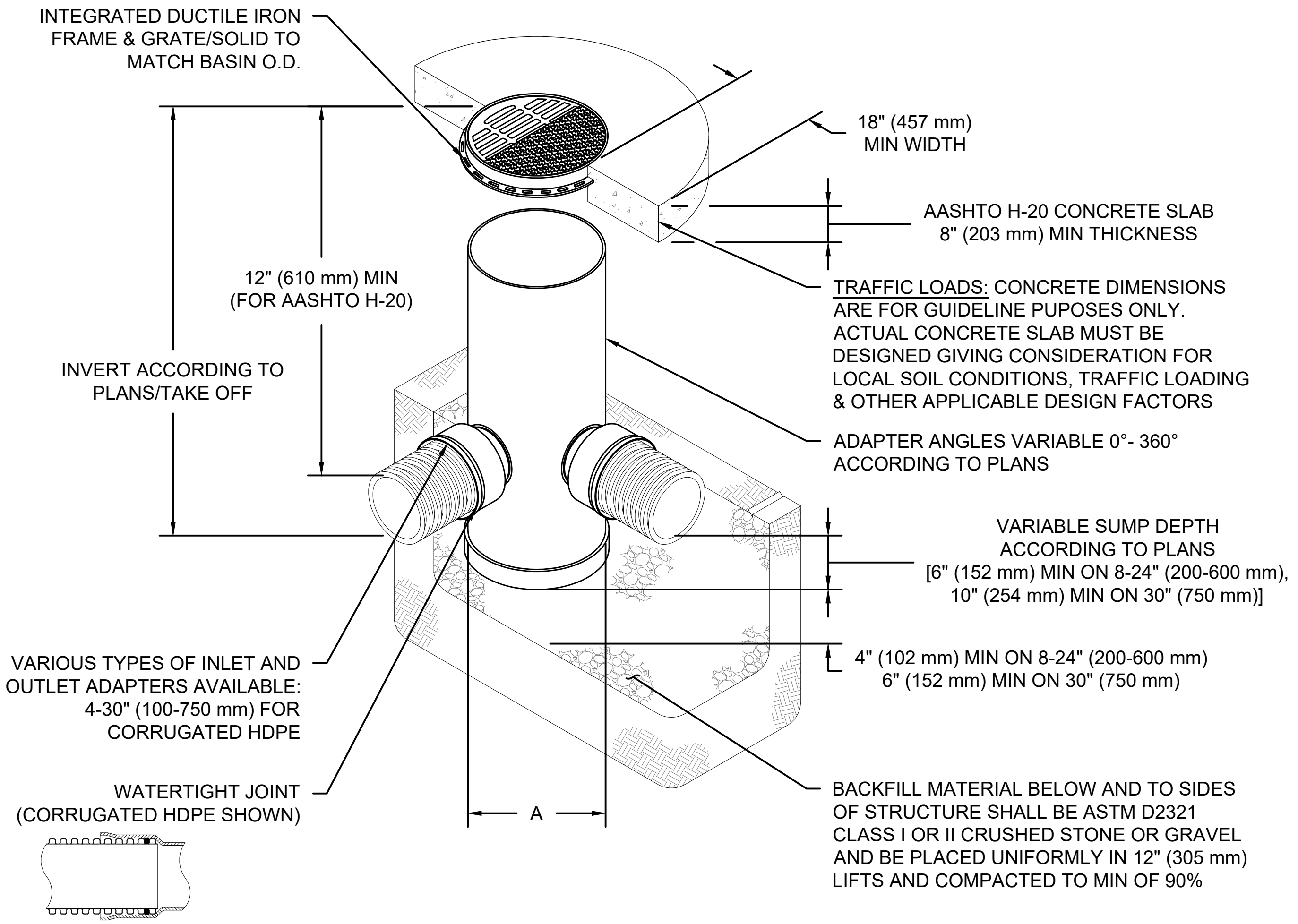
NYLOPLAST DRAIN BASIN

NTS



NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

20128_MILL STREET (NORTH)
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REV	DRW	CHK	DESCRIPTION

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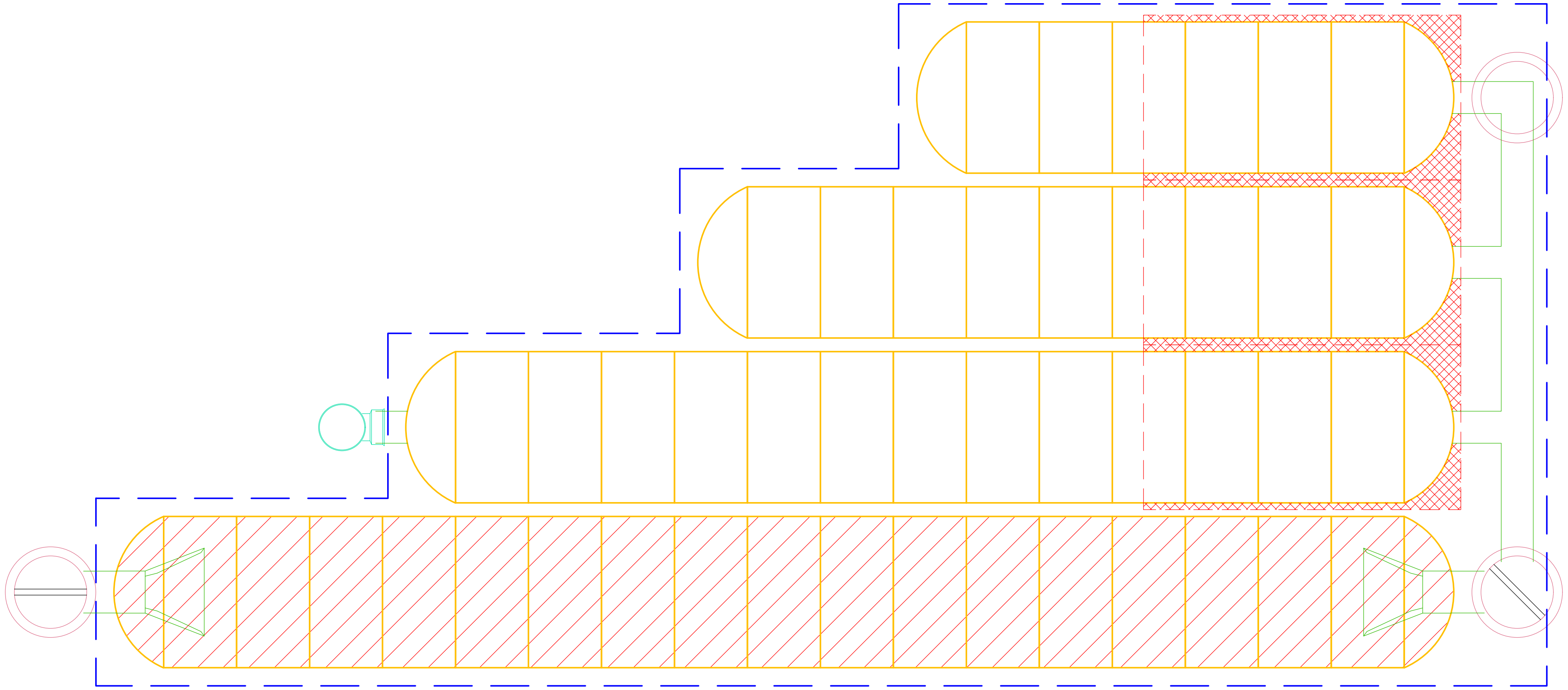

Project:

Chamber Model - MC-4500
Units - **Metric** Click Here for Imperial
Number of Chambers - 45
Number of End Caps - 8
Voids in the stone (porosity) - 40 %
Base of Stone Elevation - 270.40 m
Amount of Stone Above Chambers - 305 mm
Amount of Stone Below Chambers - 229 mm

☑ Include Perimeter Stone in Calculations

201.3 sq.meters Min. Area - 178.099 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End Cap and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
2057	0.00	0.00	0.00	0.00	2.044	2.04	252.38	272.46
2032	0.00	0.00	0.00	0.00	2.044	2.04	250.34	272.44
2007	0.00	0.00	0.00	0.00	2.044	2.04	248.30	272.41
1981	0.00	0.00	0.00	0.00	2.044	2.04	246.25	272.38
1956	0.00	0.00	0.00	0.00	2.044	2.04	244.21	272.36
1930	0.00	0.00	0.00	0.00	2.044	2.04	242.16	272.33
1905	0.00	0.00	0.00	0.00	2.044	2.04	240.12	272.31
1880	0.00	0.00	0.00	0.00	2.044	2.04	238.08	272.28
1854	0.00	0.00	0.00	0.00	2.044	2.04	236.03	272.26
1829	0.00	0.00	0.00	0.00	2.044	2.04	233.99	272.23
1803	0.00	0.00	0.00	0.00	2.044	2.04	231.94	272.21
1778	0.00	0.00	0.00	0.00	2.044	2.04	229.90	272.18
1753	0.00	0.00	0.05	0.00	2.022	2.08	227.85	272.16
1727	0.00	0.00	0.15	0.01	1.982	2.14	225.78	272.13
1702	0.00	0.00	0.21	0.01	1.956	2.18	223.64	272.10
1676	0.01	0.00	0.27	0.01	1.932	2.21	221.46	272.08
1651	0.01	0.00	0.34	0.02	1.900	2.26	219.25	272.05
1626	0.01	0.00	0.58	0.02	1.804	2.40	216.99	272.03
1600	0.02	0.00	0.85	0.03	1.693	2.57	214.58	272.00
1575	0.02	0.00	1.02	0.04	1.622	2.68	212.01	271.98
1549	0.03	0.01	1.16	0.04	1.564	2.76	209.34	271.95
1524	0.03	0.01	1.28	0.05	1.513	2.84	206.57	271.93
1499	0.03	0.01	1.39	0.06	1.468	2.91	203.73	271.90
1473	0.03	0.01	1.48	0.06	1.426	2.97	200.82	271.88
1448	0.03	0.01	1.57	0.07	1.388	3.03	197.85	271.85
1422	0.04	0.01	1.66	0.07	1.352	3.08	194.82	271.83
1397	0.04	0.01	1.73	0.08	1.318	3.13	191.74	271.80
1372	0.04	0.01	1.81	0.09	1.286	3.18	188.61	271.77
1346	0.04	0.01	1.88	0.09	1.256	3.23	185.43	271.75
1321	0.04	0.01	1.94	0.10	1.227	3.27	182.20	271.72
1295	0.04	0.01	2.01	0.11	1.199	3.31	178.93	271.70
1270	0.05	0.01	2.07	0.11	1.173	3.35	175.62	271.67
1245	0.05	0.01	2.12	0.12	1.148	3.39	172.27	271.65
1219	0.05	0.02	2.18	0.12	1.124	3.42	168.88	271.62
1194	0.05	0.02	2.23	0.13	1.101	3.46	165.45	271.60
1168	0.05	0.02	2.28	0.13	1.079	3.49	161.99	271.57
1143	0.05	0.02	2.33	0.14	1.058	3.52	158.50	271.55
1118	0.05	0.02	2.37	0.14	1.037	3.55	154.98	271.52
1092	0.05	0.02	2.42	0.15	1.018	3.58	151.42	271.50
1067	0.05	0.02	2.46	0.15	0.998	3.61	147.84	271.47
1041	0.06	0.02	2.50	0.16	0.980	3.64	144.23	271.44
1016	0.06	0.02	2.54	0.16	0.962	3.67	140.59	271.42
991	0.06	0.02	2.58	0.17	0.945	3.69	136.92	271.39
965	0.06	0.02	2.62	0.17	0.928	3.72	133.22	271.37
940	0.06	0.02	2.65	0.18	0.912	3.74	129.51	271.34
914	0.06	0.02	2.69	0.18	0.897	3.77	125.76	271.32
889	0.06	0.02	2.72	0.19	0.882	3.79	122.00	271.29
864	0.06	0.02	2.75	0.19	0.868	3.81	118.21	271.27
838	0.06	0.02	2.78	0.19	0.855	3.83	114.40	271.24
813	0.06	0.02	2.81	0.19	0.842	3.85	110.57	271.22
787	0.06	0.03	2.84	0.20	0.828	3.87	106.73	271.19
762	0.06	0.03	2.87	0.20	0.816	3.89	102.86	271.17
737	0.06	0.03	2.89	0.21	0.804	3.90	98.97	271.14
711	0.06	0.03	2.92	0.21	0.794	3.92	95.07	271.11
686	0.07	0.03	2.94	0.21	0.782	3.94	91.15	271.09
660	0.07	0.03	2.96	0.22	0.772	3.95	87.21	271.06
635	0.07	0.03	2.99	0.22	0.762	3.97	83.26	271.04
610	0.07	0.03	3.01	0.22	0.752	3.98	79.29	271.01
584	0.07	0.03	3.03	0.22	0.745	3.99	75.31	270.99
559	0.07	0.03	3.05	0.23	0.735	4.01	71.32	270.96
533	0.07	0.03	3.07	0.23	0.726	4.02	67.31	270.94
508	0.07	0.03	3.08	0.23	0.719	4.03	63.29	270.91
483	0.07	0.03	3.10	0.23	0.711	4.04	59.26	270.89
457	0.07	0.03	3.12	0.24	0.704	4.05	55.21	270.86
432	0.07	0.03	3.13	0.24	0.697	4.06	51.16	270.83
406	0.07	0.03	3.14	0.24	0.691	4.07	47.09	270.81
381	0.07	0.03	3.16	0.24	0.686	4.08	43.02	270.78
356	0.07	0.03	3.17	0.24	0.680	4.09	38.94	270.76
330	0.07	0.03	3.18	0.24	0.674	4.10	34.85	270.73
305	0.07	0.03	3.19	0.25	0.668	4.11	30.75	270.71
279	0.07	0.03	3.20	0.25	0.664	4.11	26.64	270.68
254	0.07	0.03	3.22	0.25	0.656	4.13	22.52	270.66
229	0.00	0.00	0.00	0.00	2.044	2.04	18.40	270.63
203	0.00	0.00	0.00	0.00	2.044	2.04	16.35	270.61
178	0.00	0.00	0.00	0.00	2.044	2.04	14.31	270.58
152	0.00	0.00	0.00	0.00	2.044	2.04	12.27	270.56
127	0.00	0.00	0.00	0.00	2.044	2.04	10.22	270.53
102	0.00	0.00	0.00	0.00	2.044	2.04	8.18	270.50
76	0.00	0.00	0.00	0.00	2.044	2.04	6.13	270.48

Active Storage

Inv: 270.94

Infiltration/dead Storage

PROJECT INFORMATION

ENGINEERED PRODUCT MANAGER	
ADS SALES REP	
PROJECT NO.	

ADS
Advanced Drainage Systems, Inc.

SiteASSIST™
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20128_MILL STREET (SOUTH)

UXBRIDGE, CANADA

SC-740 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-740.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16a, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 550 LBS/IN/IN. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2418 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-740 SYSTEM

1. STORMTECH SC-740 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-740 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

USE OF A DOZER TO PUSH EMBEDMENT STONE BETWEEN THE ROWS OF CHAMBERS MAY CAUSE DAMAGE TO THE CHAMBERS AND IS NOT AN ACCEPTABLE BACKFILL METHOD. ANY CHAMBERS DAMAGED BY THE "DUMP AND PUSH" METHOD ARE NOT COVERED UNDER THE STORMTECH STANDARD WARRANTY.

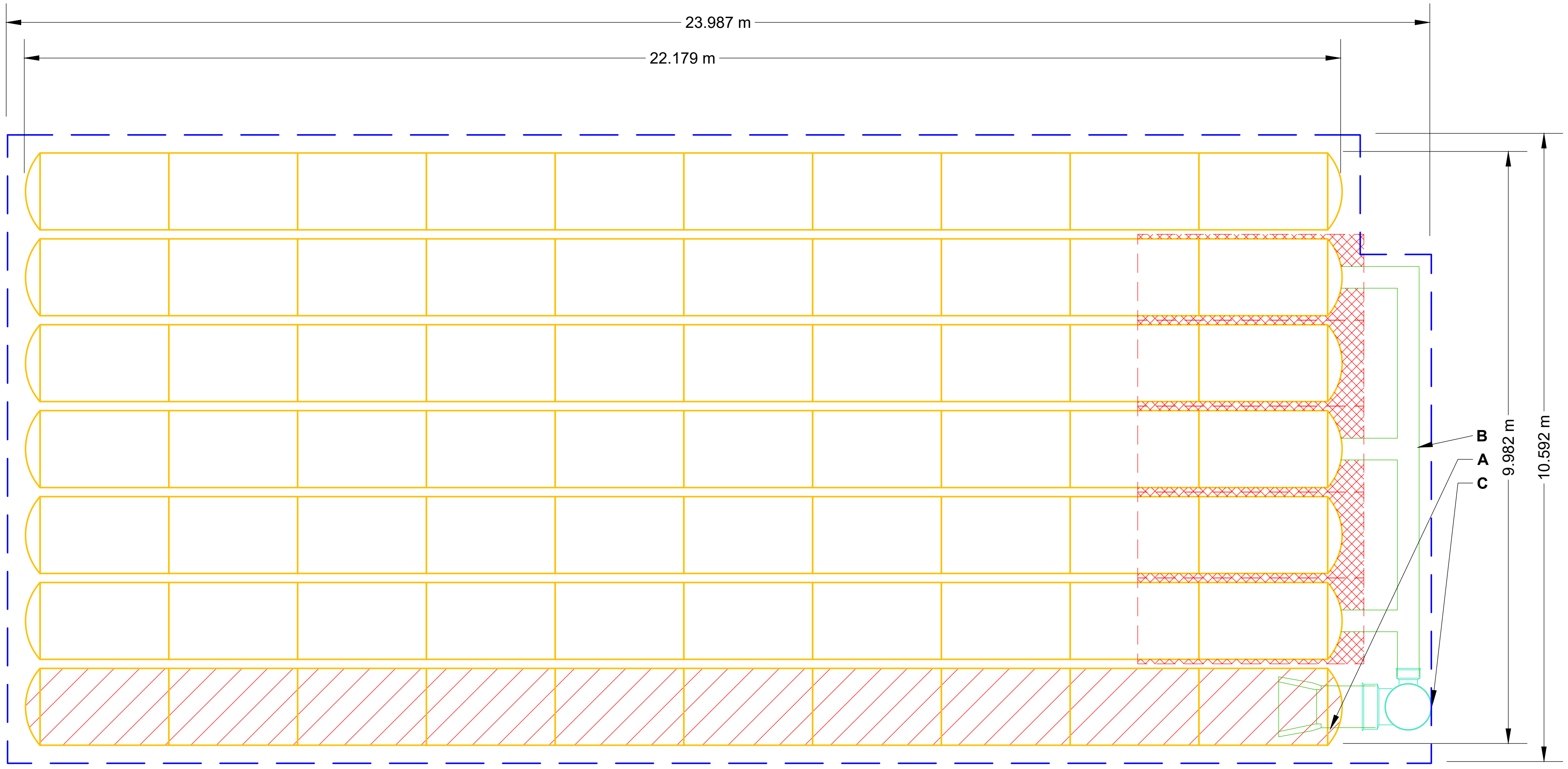
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

PROPOSED LAYOUT	
70	STORMTECH SC-740 CHAMBERS
14	STORMTECH SC-740 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	STONE VOID
162.0	INSTALLED SYSTEM VOLUME (m^3) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)
251.7	SYSTEM AREA (m^2)
69.2	SYSTEM PERIMETER (m)

CONCEPTUAL ELEVATIONS	
MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	3.353
MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	1.524
MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	1.372
MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	1.372
MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	1.372
TOP OF STONE:	1.067
TOP OF SC-740 CHAMBER:	0.914
300 mm x 300 mm TOP MANIFOLD INVERT:	0.470
600 mm ISOLATOR ROW PLUS INVERT:	0.155
BOTTOM OF SC-740 CHAMBER:	0.152
BOTTOM OF STONE:	0.000

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	600 mm BOTTOM PREFABRICATED END CAP, PART#: SC740EPE24BR / TYP OF ALL 600 mm ISOLATOR ROW PLUS CONNECTIONS	3 mm	
MANIFOLD	B	300 mm x 300 mm TOP MANIFOLD, ADS N-12	318 mm	
NYLOPLAST (INLET W/ ISO PLUS ROW)	C	750 mm DIAMETER (610 mm SUMP MIN)		161 L/s IN



▨ ISOLATOR ROW PLUS
(SEE DETAIL)

▩ PLACE MINIMUM 3.810 m OF ADSPLUS125 WOVEN GEOTEXTILE OVER
BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR
PROTECTION AT ALL CHAMBER INLET ROWS

— BED LIMITS

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH NOTE #6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

20128_MILL STREET (SOUTH)
UXBRIDGE, CANADA

DRAWN: SS
CHECKED: N/A
DATE:
PROJECT #:

REV	DRW	CHK	DESCRIPTION

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Chamber System
888-892-2694 | WWW.STORMTECH.COM

ADS
4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

SCALE = 1 : 100

SHEET
2 OF 6

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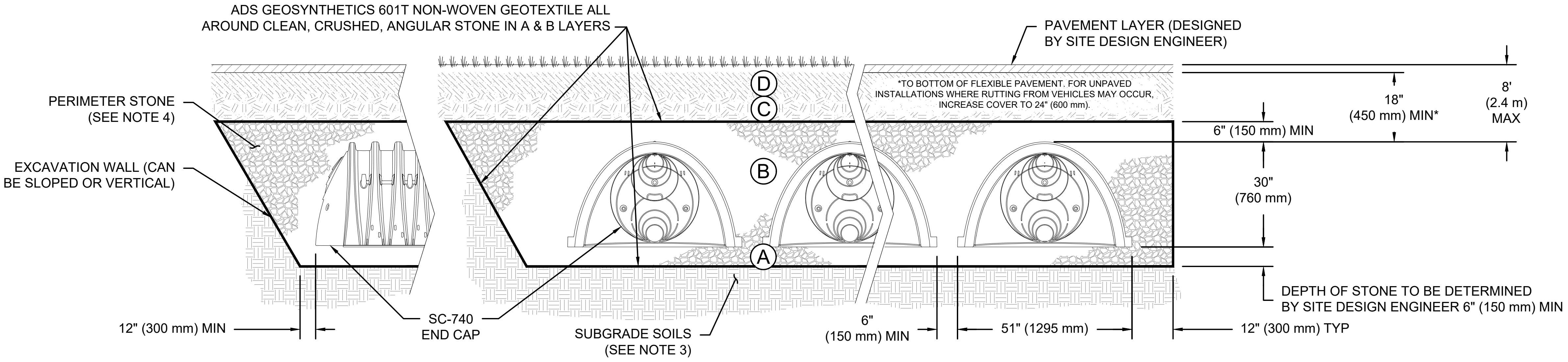
ACCEPTABLE FILL MATERIALS: STORMTECH SC-740 CHAMBER SYSTEMS

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

PLEASE NOTE:

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



NOTES:

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

20128_MILL STREET (SOUTH)
UXBRIDGE, CANADA

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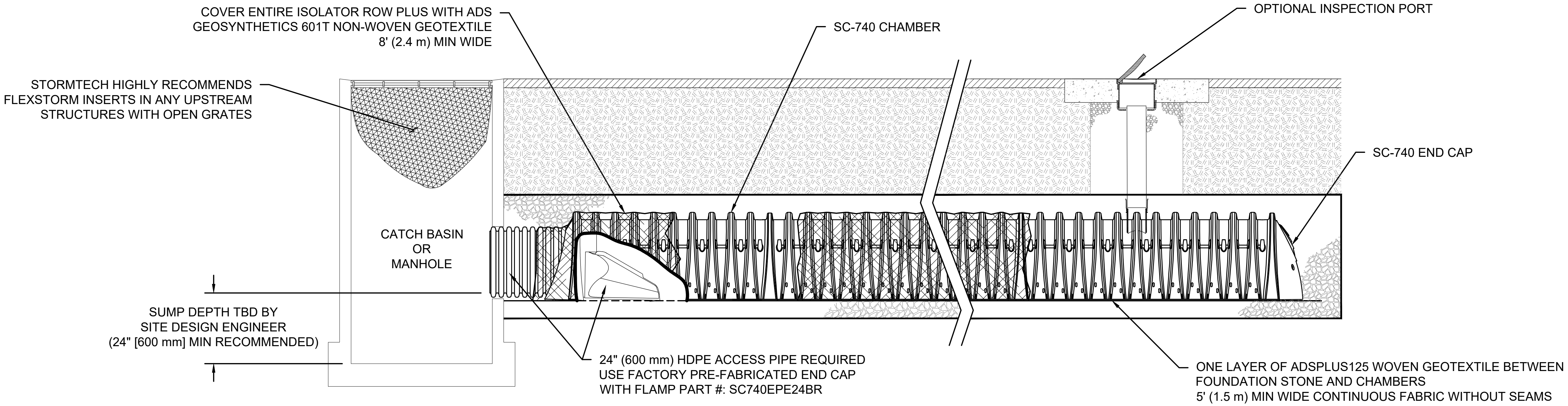

SC-740 ISOLATOR ROW PLUS DETAIL

NTS

INSPECTION & MAINTENANCE

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

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

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

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

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.

2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.

20128_MILL STREET (SOUTH)
UXBRIDGE, CANADA

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SHEET
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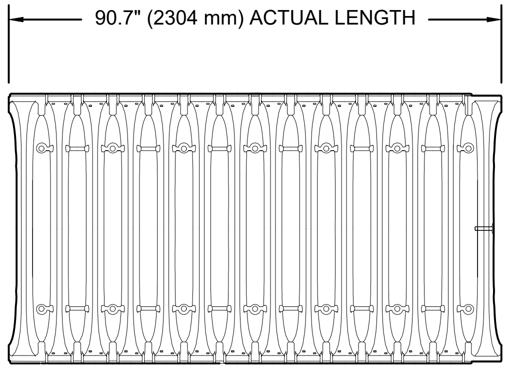
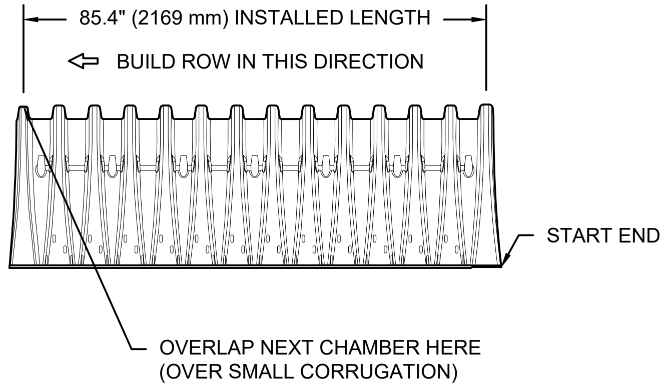
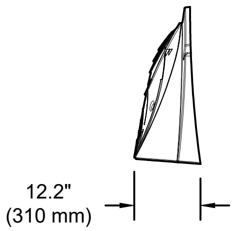
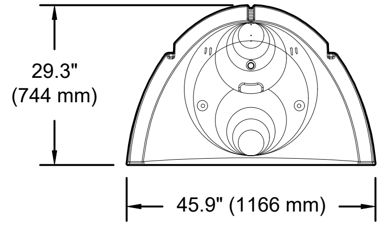
SC-740 TECHNICAL SPECIFICATION

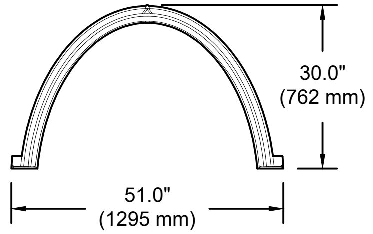
NTS







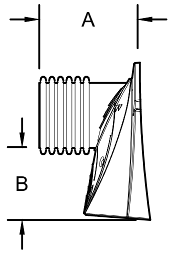


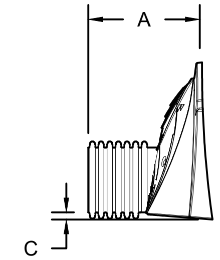


NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	51.0" X 30.0" X 85.4"	(1295 mm X 762 mm X 2169 mm)
CHAMBER STORAGE	45.9 CUBIC FEET	(1.30 m^3)
MINIMUM INSTALLED STORAGE*	74.9 CUBIC FEET	(2.12 m^3)
WEIGHT	75.0 lbs.	(33.6 kg)

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





PRE-FAB STUB AT BOTTOM OF END CAP WITH FLAMP END WITH "BR"
PRE-FAB STUBS AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PRE-FAB STUBS AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
PRE-CORED END CAPS END WITH "PC"

PART #	STUB	A	B	C
SC740EPE06T / SC740EPE06TPC	6" (150 mm)	10.9" (277 mm)	18.5" (470 mm)	---
SC740EPE06B / SC740EPE06BPC			---	0.5" (13 mm)
SC740EPE08T /SC740EPE08TPC	8" (200 mm)	12.2" (310 mm)	16.5" (419 mm)	---
SC740EPE08B / SC740EPE08BPC			---	0.6" (15 mm)
SC740EPE10T / SC740EPE10TPC	10" (250 mm)	13.4" (340 mm)	14.5" (368 mm)	---
SC740EPE10B / SC740EPE10BPC			---	0.7" (18 mm)
SC740EPE12T / SC740EPE12TPC	12" (300 mm)	14.7" (373 mm)	12.5" (318 mm)	---
SC740EPE12B / SC740EPE12BPC			---	1.2" (30 mm)
SC740EPE15T / SC740EPE15TPC	15" (375 mm)	18.4" (467 mm)	9.0" (229 mm)	---
SC740EPE15B / SC740EPE15BPC			---	1.3" (33 mm)
SC740EPE18T / SC740EPE18TPC	18" (450 mm)	19.7" (500 mm)	5.0" (127 mm)	---
SC740EPE18B / SC740EPE18BPC			---	1.6" (41 mm)
SC740EPE24B*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)
SC740EPE24BR*	24" (600 mm)	18.5" (470 mm)	---	0.1" (3 mm)

ALL STUBS, EXCEPT FOR THE SC740EPE24B/SC740EPE24BR ARE PLACED AT BOTTOM OF END CAP SUCH THAT THE OUTSIDE DIAMETER OF THE STUB IS FLUSH WITH THE BOTTOM OF THE END CAP. FOR ADDITIONAL INFORMATION CONTACT STORMTECH AT 1-888-892-2694.

* FOR THE SC740EPE24B/SC740EPE24BR THE 24" (600 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 1.75" (44 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL

20128_MILL STREET (SOUTH)
UXBRIDGE, CANADA

DATE:
DRAWN: SS
PROJECT #:
CHECKED: N/A

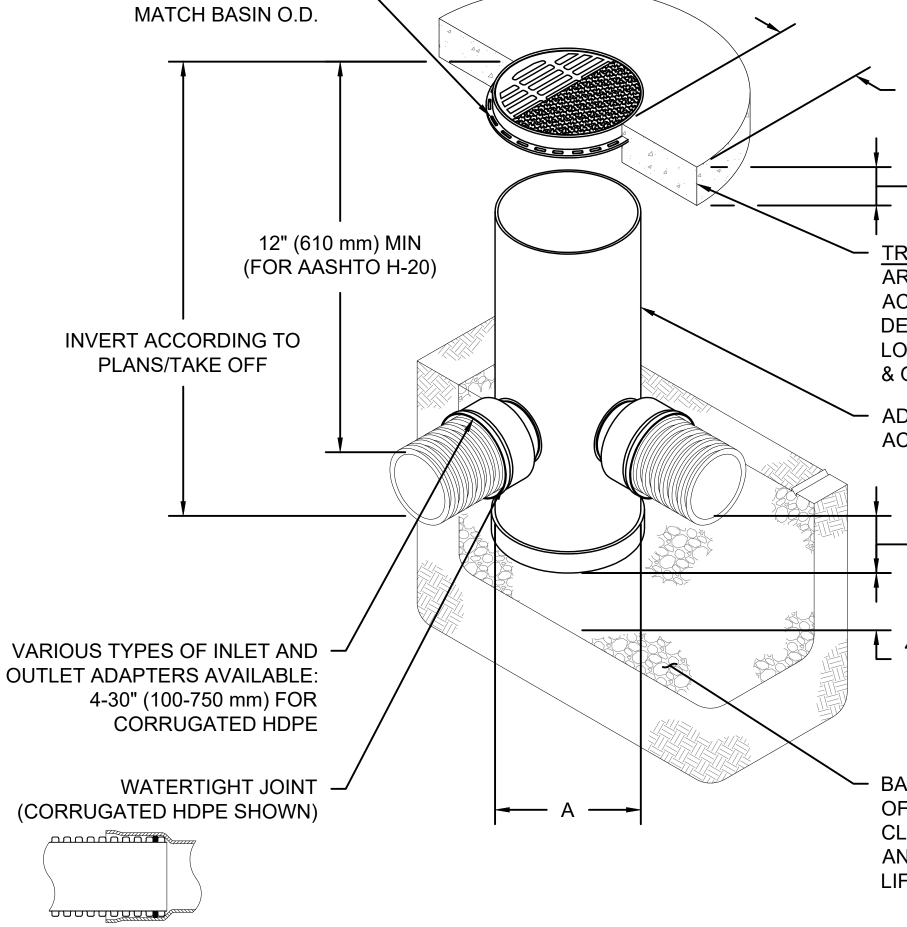
REV	DRW	CHK	DESCRIPTION

StormTech®
Chamber System
888-892-2694 | WWW.STORMTECH.COM

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473

NYLOPLAST DRAIN BASIN

NTS



INTEGRATED DUCTILE IRON FRAME & GRATE/SOLID TO MATCH BASIN O.D.

12" (610 mm) MIN (FOR AASHTO H-20)

INVERT ACCORDING TO PLANS/TAKE OFF

VARIOUS TYPES OF INLET AND OUTLET ADAPTERS AVAILABLE: 4-30" (100-750 mm) FOR CORRUGATED HDPE

WATERTIGHT JOINT (CORRUGATED HDPE SHOWN)

18" (457 mm) MIN WIDTH

AASHTO H-20 CONCRETE SLAB 8" (203 mm) MIN THICKNESS

TRAFFIC LOADS: CONCRETE DIMENSIONS ARE FOR GUIDELINE PUPOSES ONLY. ACTUAL CONCRETE SLAB MUST BE DESIGNED GIVING CONSIDERATION FOR LOCAL SOIL CONDITIONS, TRAFFIC LOADING & OTHER APPLICABLE DESIGN FACTORS

ADAPTER ANGLES VARIABLE 0°- 360° ACCORDING TO PLANS

VARIABLE SUMP DEPTH ACCORDING TO PLANS [6" (152 mm) MIN ON 8-24" (200-600 mm), 10" (254 mm) MIN ON 30" (750 mm)]

4" (102 mm) MIN ON 8-24" (200-600 mm) 6" (152 mm) MIN ON 30" (750 mm)

BACKFILL MATERIAL BELOW AND TO SIDES OF STRUCTURE SHALL BE ASTM D2321 CLASS I OR II CRUSHED STONE OR GRAVEL AND BE PLACED UNIFORMLY IN 12" (305 mm) LIFTS AND COMPACTED TO MIN OF 90%

NOTES

1. 8-30" (200-750 mm) GRATES/SOLID COVERS SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
2. 12-30" (300-750 mm) FRAMES SHALL BE DUCTILE IRON PER ASTM A536 GRADE 70-50-05
3. DRAIN BASIN TO BE CUSTOM MANUFACTURED ACCORDING TO PLAN DETAILS
4. DRAINAGE CONNECTION STUB JOINT TIGHTNESS SHALL CONFORM TO ASTM D3212 FOR CORRUGATED HDPE (ADS & HANCOR DUAL WALL) & SDR 35 PVC
5. FOR COMPLETE DESIGN AND PRODUCT INFORMATION: **WWW.NYLOPLAST-US.COM**
6. TO ORDER CALL: **800-821-6710**

A	PART #	GRATE/SOLID COVER OPTIONS		
8" (200 mm)	2808AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
10" (250 mm)	2810AG	PEDESTRIAN LIGHT DUTY	STANDARD LIGHT DUTY	SOLID LIGHT DUTY
12" (300 mm)	2812AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
15" (375 mm)	2815AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
18" (450 mm)	2818AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
24" (600 mm)	2824AG	PEDESTRIAN AASHTO H-10	STANDARD AASHTO H-20	SOLID AASHTO H-20
30" (750 mm)	2830AG	PEDESTRIAN AASHTO H-20	STANDARD AASHTO H-20	SOLID AASHTO H-20

20128_MILL STREET (SOUTH)

UXBRIDGE, CANADA

DATE:

DRAWN: SS

PROJECT #:

CHECKED: N/A

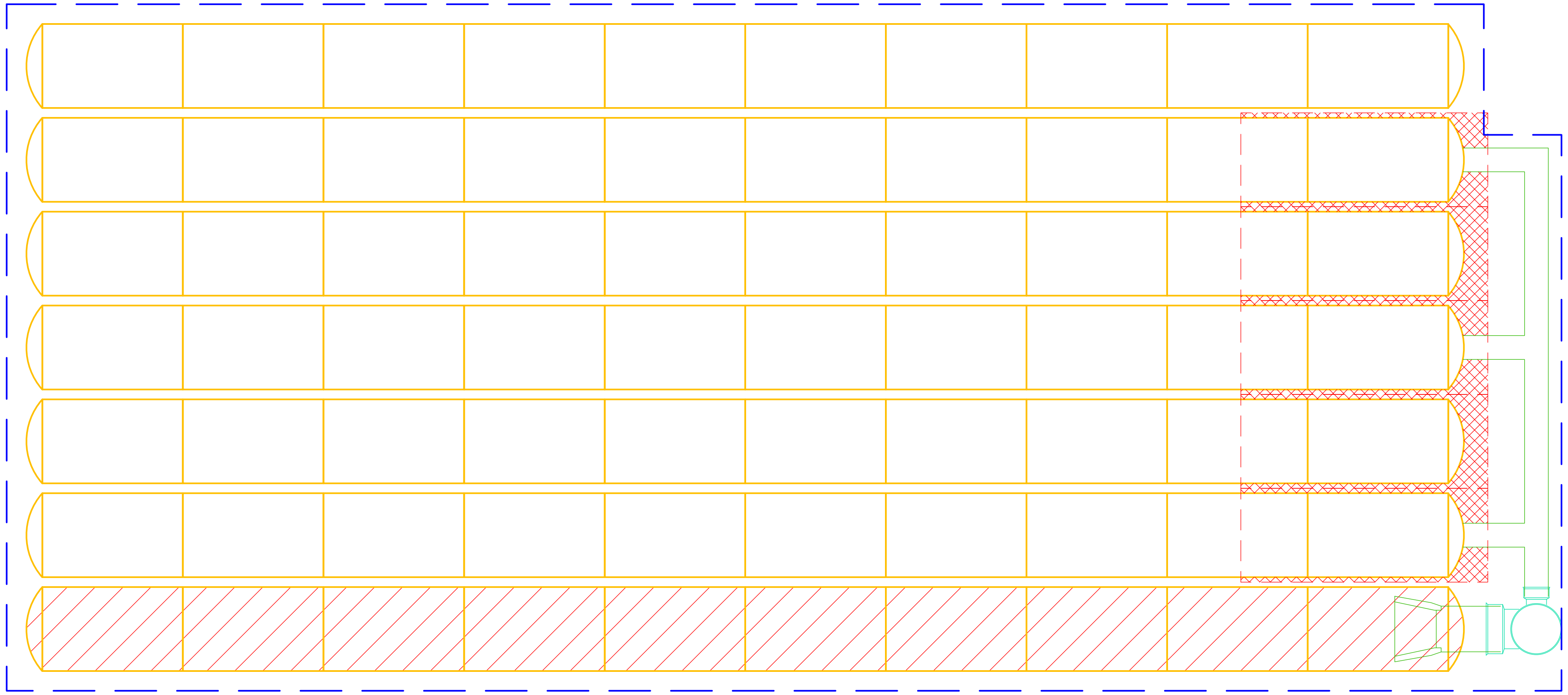
REV	DRW	CHK	DESCRIPTION

Nyloplast®

770-932-2443 | WWW.NYLOPLAST-US.COM

ADS

4640 TRUEMAN BLVD
HILLIARD, OH 43026
1-800-733-7473



Project:

StormTech
Detention • Retention • Water Quality
A division of ADS

Chamber Model - SC-740
Units - **Metric** Click Here for Imperial
14
Number of chambers - 70
Voids in the stone (porosity) - 40 %
Base of Stone Elevation - 274.00 m
Amount of Stone Above Chambers - 152 mm
Amount of Stone Below Chambers - 152 mm

☑ Include Perimeter Stone in Calculations

251.7 sq.meters Min. Area - 219.799 sq.meters

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Total Chamber *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch & St *(cubic meters)*	Cumulative Chamber *(cubic meters)*	Elevation *(meters)*
1067	0.00	0.00	2.56	2.56	162.044	275.07
1041	0.00	0.00	2.56	2.56	159.487	275.04
1016	0.00	0.00	2.56	2.56	156.930	275.02
991	0.00	0.00	2.56	2.56	154.373	274.99
965	0.00	0.00	2.56	2.56	151.816	274.97
940	0.00	0.00	2.56	2.56	149.259	274.94
914	0.00	0.11	2.51	2.62	146.702	274.92
889	0.00	0.32	2.43	2.75	144.080	274.89
864	0.01	0.56	2.33	2.89	141.329	274.87
838	0.02	1.20	2.08	3.28	138.437	274.84
813	0.02	1.59	1.92	3.51	135.161	274.82
787	0.03	1.88	1.80	3.69	131.651	274.79
762	0.03	2.13	1.71	3.83	127.963	274.77
737	0.03	2.34	1.62	3.96	124.128	274.74
711	0.04	2.51	1.55	4.06	120.167	274.71
686	0.04	2.69	1.48	4.17	116.105	274.69
660	0.04	2.88	1.40	4.29	111.936	274.66
635	0.04	3.02	1.35	4.37	107.650	274.64
610	0.04	3.14	1.30	4.44	103.280	274.61
584	0.05	3.26	1.25	4.51	98.841	274.59
559	0.05	3.37	1.21	4.58	94.331	274.56
533	0.05	3.47	1.17	4.64	89.752	274.54
508	0.05	3.57	1.13	4.70	85.111	274.51
483	0.05	3.68	1.09	4.76	80.409	274.49
457	0.05	3.75	1.06	4.81	75.646	274.46
432	0.05	3.83	1.02	4.86	70.838	274.43
406	0.06	3.91	0.99	4.91	65.981	274.41
381	0.06	3.98	0.96	4.95	61.075	274.38
356	0.06	4.05	0.94	4.99	56.127	274.36
330	0.06	4.11	0.91	5.02	51.138	274.33
305	0.06	4.17	0.89	5.06	46.113	274.31
279	0.06	4.23	0.87	5.09	41.053	274.28
254	0.06	4.27	0.85	5.12	35.961	274.26
229	0.06	4.32	0.83	5.15	30.842	274.23
203	0.06	4.36	0.81	5.17	25.696	274.21
178	0.06	4.38	0.81	5.18	20.524	274.18
152	0.00	0.00	2.56	2.56	15.342	274.16
127	0.00	0.00	2.56	2.56	12.785	274.13
102	0.00	0.00	2.56	2.56	10.228	274.10
76	0.00	0.00	2.56	2.56	7.671	274.08
51	0.00	0.00	2.56	2.56	5.114	274.05
25	0.00	0.00	2.56	2.56	2.557	274.03

Active Storage

Inv: 274.276

Infiltration/dead Storage

StormTech® Isolator® Row Plus

The StormTech Isolator Row Plus is an enhancement to our proven water quality treatment system. This updated system is both a NJCAT and ETV verified water quality treatment device that can be incorporated into any system layout.

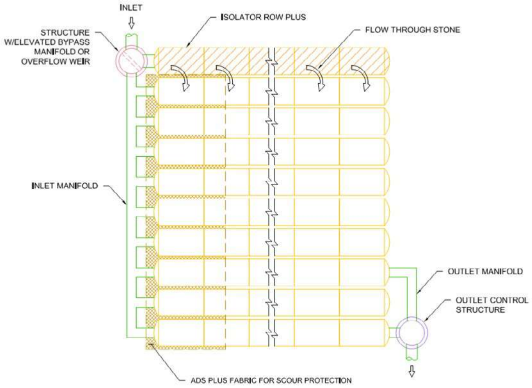
Features

- Isolator Row Plus is now ETV verified. As a Manufactured Treatment Device it achieves over 81% TSS removal per the ISO 14034:2016 ETV standard and the Canadian Environmental Technology Verification Process.
- A patented Flamp™ (Flared End Ramp) provides a smooth transition from pipe invert to fabric bottom. The FLAMP is attached to the inlet pipe inside the chamber end cap and improves chamber function over time by distributing sediment and debris that would otherwise collect at the inlet. It also serves to improve the fluid and solid flow back into the inlet pipe during maintenance and cleaning.
- Proprietary ADS Plus fabric maintains durability and sediment removal while allowing for higher water quality flow rates. A single layer of ADS Plus fabric is placed between the angular base stone and the Isolator Row Plus chambers.

Technology Descriptions

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume or a flow basis. Considered an LID (low impact development) technology, the Isolator Row Plus can be part of the treatment train design for water quality. An upstream manhole not only provides access to the Isolator Row Plus but includes a high/low concept such that stormwater flow rates or volumes that exceed the capacity of the Isolator Row Plus bypass through a manifold to the other chambers. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. Stormwater is then either infiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

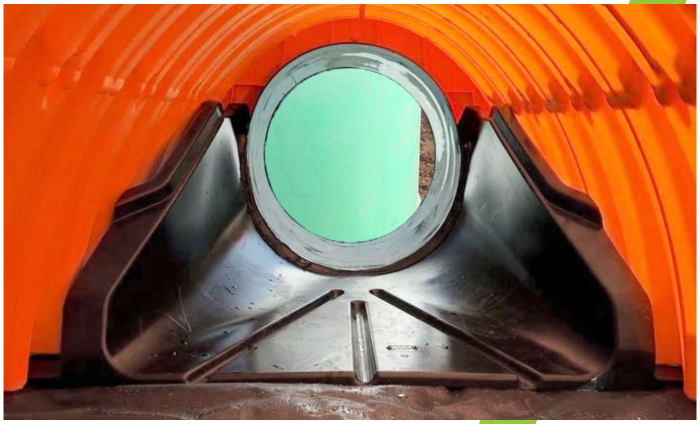
Schematic of the StormTech Isolator Row PLUS System



Summary of Verified Claims[1]

Maximum Treatment Flow Rate (MTFR) (L/s/m^2)	2.8
Effective Filtration Treatment Area (m^2)	5.06
Test Sediment Size (microns)	1-1000
Mean Particle Concentration (mg/L)	200
TSS Removal Efficiency	81%

[1] Verification of StormTech SC-740 Isolator Row PLUS test results in accordance with the ISO 14034:2016 ETV standard. The full Verification Statement for the StormTech SC-740 Isolator Row PLUS can be downloaded from the VerifiGlobal website

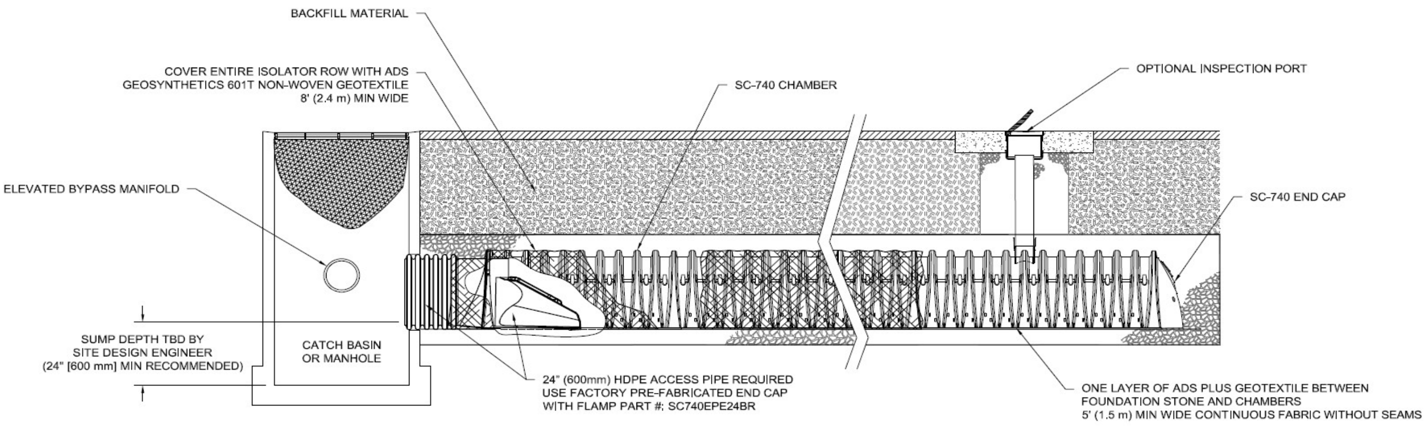


ads-pipecanada.ca

519-699-0222

StormTech Isolator Row Plus (not to scale)

Note: Non-woven fabric is only required over the chambers for the SC-310 and SC-740 chamber models.



Maintenance

The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By “isolating” sediment to just one row of the StormTech system, 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. Maintenance is accomplished with the JetVac process. The JetVac® process utilizes a high-pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediment. 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.

	Chamber Storage	Chamber Footprint	Treatment Rate
SC-160LP	0.42 m³ (15.0 cf)	1.06 m² (11.45 sf)	3.11 L/s (0.11 cfs)
SC-310	0.88 m³ (31.0 cf)	1.64 m² (17.7 sf)	4.53 L/s (0.16 cfs)
SC-740	2.12 m³ (74.9 cf)	2.58 m² (27.8 sf)	7.36 L/s (0.26 cfs)
DC-780	2.22 m³ (78.4 cf)	2.58 m² (27.8 sf)	7.36 L/s (0.26 cfs)
MC-3500	4.96 m³ (175.0 cf)	3.99 m² (42.9 sf)	11.32 L/s (0.40 cfs)
MC-4500	4.60 m³ (162.6 cf)	2.80 m² (30.1 sf)	7.93 L/s (0.28 cfs)

Installation

Installation of the stormwater treatment unit(s) shall be preformed per manufacture’s installation instructions. Such instructions can be obtained by calling Advanced Drainage systems at 888-367-7473 or by logging on to www.ads-pipe.com or www.stormtech.com.

ads-pipecanada.ca

519-699-0222

Verification Statement

StormTech Isolator® Row PLUS
Registration number: (V-2020-10-01)
Date of issue: (2020-October-27)

Technology type	Stormwater Filtration Device	
Application	Stormwater filtration technology to remove sediments, nutrients, heavy metals, and organic contaminants from stormwater runoff	
Company	StormTech, LLC.	
Address	520 Cromwell Avenue, Rocky Hill, CT 06067 USA	**Phone** +1-888-892-2694
Website	www.stormtech.com	
E-mail	info@stormtech.com	

Verified Performance Claims

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Based on the laboratory testing conducted, the verified performance claims are as follows:

Total Suspended Solids (TSS) Removal Efficiency - The StormTech Isolator® Row PLUS achieved 82% ± 1% removal efficiency of suspended sediment concentration (SCC) at a 95% confidence level.

Average Loading Rate - Based on the reported flow rate data and the effective sedimentation and filtration treatment area of the test unit, the average loading rate of the test unit was 4.15 ± 0.03 GPM/ft^2 at a 95% confidence level.

Maximum Treatment Flow Rate (MTFR) - Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 gpm/ ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.

Detention Time and Volume - The StormTech Isolator Row PLUS detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 and a detention time of 2.2 minutes.

Maximum Sediment Storage Depth and Volume - The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.

Effective Sedimentation/Filtration Treatment Areas - The Effective Sedimentation Area (ESA) and the Effective Filtration Treatment Area (EFTA) increase as the size of the system increases. For the two overlapping StormTech SC-740 chambers tested, the ESA and the ratio of ESA/EFTA were 54.5 ft^2 and 1.0, respectively.

Sediment Mass Load Capacity - The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs ± 0.8 lbs (2.91 ±0.01 lbs/ ft^2) following a total sediment loading of 195.2 lbs.

Technology Application

The StormTech "Isolator® Row PLUS" is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers covered in a non-woven geotextile fabric with a single layer of proprietary woven fabric at the bottom that serves as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal. The following features make the Isolator® Row PLUS effective as a water quality solution:

- Enhanced infiltration Surface Area
- Runoff Volume Reduction
- Peak Flow Reduction
- Sediment/Pollutant Removal
- Internal Water Storage (IWS)
- Water Temperature Cooling (Thermal Buffer).

Technology Description

The Isolator® Row PLUS (shown in Figures 1 and 2) is the first row of StormTech chambers that is surrounded with filter fabric and connected to a closely located manhole for easy access. The Isolator® Row PLUS provides for settling and filtration of sediment as stormwater rises in the chamber and ultimately passes through the filter fabric. The open-bottom chambers allow stormwater to flow out of the chambers, while sediment is captured in the Isolator® Row PLUS.

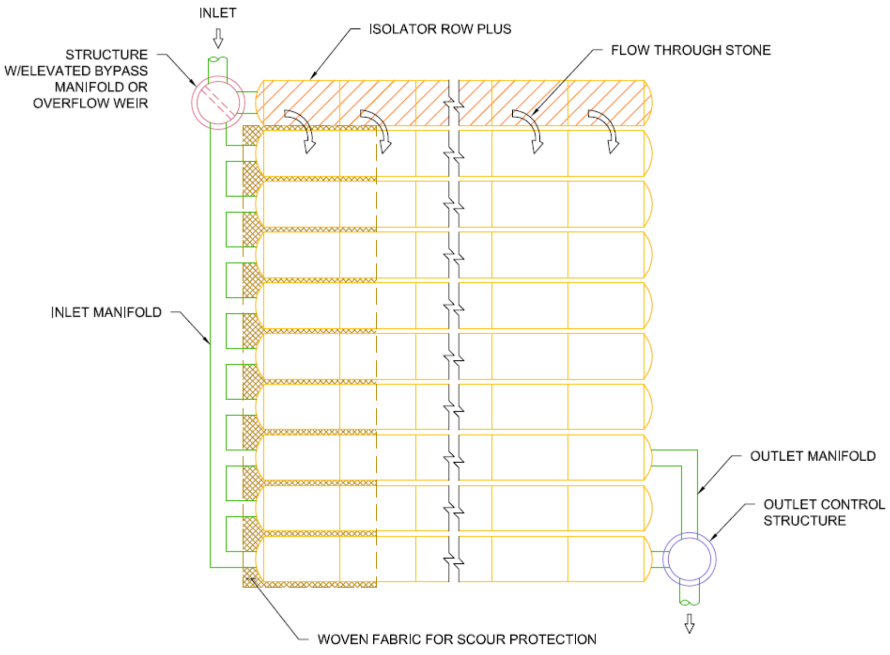


Figure 1: Schematic of the StormTech Isolator® Row PLUS System

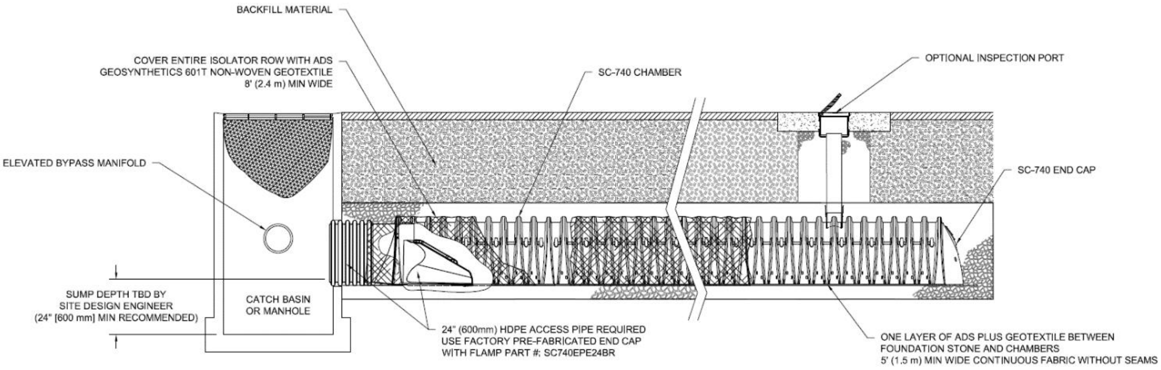


Figure 2: Isolator® Row PLUS Detail

A single layer of proprietary Advanced Drainage Systems (ADS) PLUS fabric is placed between the angular base stone and the Isolator Row PLUS chamber. The geotextile provides the means for stormwater filtration and provides a durable surface for maintenance operations. A 6 oz. non-woven fabric is placed over the chambers.

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

StormTech developed and owns the Isolator® Row PLUS technology and has filed a number of patent applications relating to the Isolator® Row PLUS system.[1]

Description of Test Procedure for the StormTech Isolator® Row PLUS

In January 2020, two overlapping StormTech SC-740 Isolator® Row PLUS commercial size chambers were installed at the Mid-Atlantic Storm Water Research Center (MASWRC, a subsidiary of BaySaver), in Mount Airy, Maryland, to evaluate the performance of the Isolator® Row PLUS system for Total Suspended Solid (TSS) removal (Figure 3) All testing and data collection procedures were supervised by Boggs Environmental Consultants, Inc. (BEC), who was hired by ADS for third party oversight, and were in accordance with the *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device (January 2013)*.

Prior to the start of testing, a Quality Assurance Project Plan (QAPP), revision dated January 09, 2020, was submitted and approved by the New Jersey Corporation for Advanced Technology (NJCAT), c/o Center for Environmental Systems, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ 07030.

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[1] (U.S. Provisional Application No. 62/753,050, filed October 30, 2018; U.S. Non-Provisional Application No. 16/670,628, filed October 31, 2019; International Application No. PCT/US2019/059283, filed October 31, 2019; U.S. Application No. 16/938,482, filed July 24, 2020; U.S. Application No. 16/938,657, filed July 24, 2020; PCT International Application No. PCT/US2020/043543, filed July 24, 2020; PCT International Application No. PCT/US2020/043557, filed July 24, 2020.

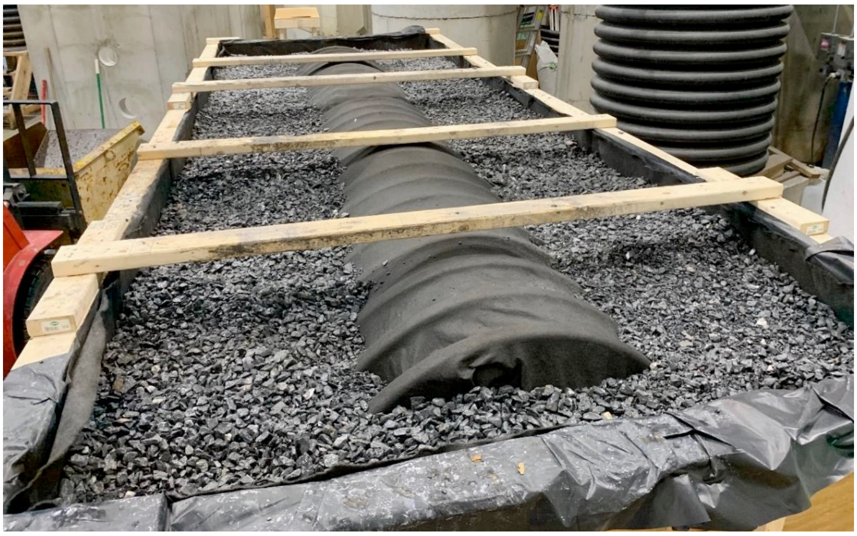

Figure 3: StormTech "Isolator® Row PLUS" Test Set-up at MASWRC

Verification Results

The verification process for the StormTech Isolator® Row PLUS technology was conducted by GHL in accordance with the VerifiGlobal Verification Plan for the StormTech "Isolator® Row PLUS" Technology – 2020-09-09. The technology performance claims verified by GHL are summarized at the front of this Verification Statement and in Table 6 on Page 8 under the heading "Verification Summary".

Particle size distribution analysis was performed by ECS Mid-Atlantic, LLC of Frederick, MD in accordance with ASTM D422-63(2007). ECS is accredited by the American Association of State Highways and Transportation Officials (AASHTO).

ASTM D422-63(2007) is a sieve and hydrometer method where the larger particles, > 75 microns, are measured using a standard sieve stack while the smaller particles are measured based on their settling time using a hydrometer.

The PSD meets the requirements of NJDEP, which is generally accepted as representative of the type of particle sizes an OGS would be designed to treat. Actual PSD is site and rainfall event specific, so it was necessary to choose a standard PSD to make testing and comparison manageable.

Table 1 shows the NJDEP PSD specification. Table 2 and Figure 4 show the incoming material PSD as determined by ECS Mid-Atlantic and confirmed by the verifier.

Table 1: NJDEP PSD Specification

Particle Size (µm)	NJDEP Minimum Specification
1000	98
500	93
250	88
150	73
100	58
75	48
50	43
20	33
8	18
5	8
2	3
d_{50}	< 75 µm

Table 2 – Particle Size Distribution (PSD) of Test Sediment

Mesh (mm)	US Sieve Size	Sample ID		
		PSD A	PSD B	PSD C
		Percent Finer		
9.525	0.375	100.0	100.0	100.0
4.750	#4	100.0	100.0	100.0
4.000	#5	100.0	100.0	100.0
2.360	#8	100.0	100.0	100.0
2.000	#10	100.0	100.0	100.0
1.180	#16	100.0	100.0	100.0
1.000	#18	100.0	100.0	100.0
0.500	#35	100.0	100.0	100.0
0.425	#40	93.3	93.0	93.6
0.250	#60	90.3	89.8	90.2
0.150	#100	79.3	78.1	78.1
0.125	#120	73.6	71.7	71.7
0.106	#140	68.4	65.2	64.8
0.090	#170	60.2	58.3	57.5
0.075	#200	52.0	50.9	50.3
0.053	#270	48.0	48.3	47.8
0.045	**Hydrometer**	46.6	46.7	46.7
0.032		42.8	42.9	41.0
0.021		37.1	37.2	35.3
0.0125		25.7	25.7	25.8
0.0090		20.1	20.1	19.2
0.0064		16.3	16.4	14.5
0.0032		8.8	8.7	7.8
0.0014		3.8	3.7	3.8

The suspended sediment concentration analysis was completed by Fredericktowne Labs Inc., Meyersville, MD. Fredericktown Labs is accredited by the Maryland Department of Environment as Maryland Certified Water Quality Laboratory. The analysis procedure was ASTM D3977-97, Suspended Sediment Concentration. The sampling procedure and submission of samples to the test lab were overseen by the independent observer, Boggs Environmental Consultants, Inc.

All test data and calculations were detailed in the report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020, which was submitted to and verified by the New Jersey Corporation for Advanced Technology (NJCAT).

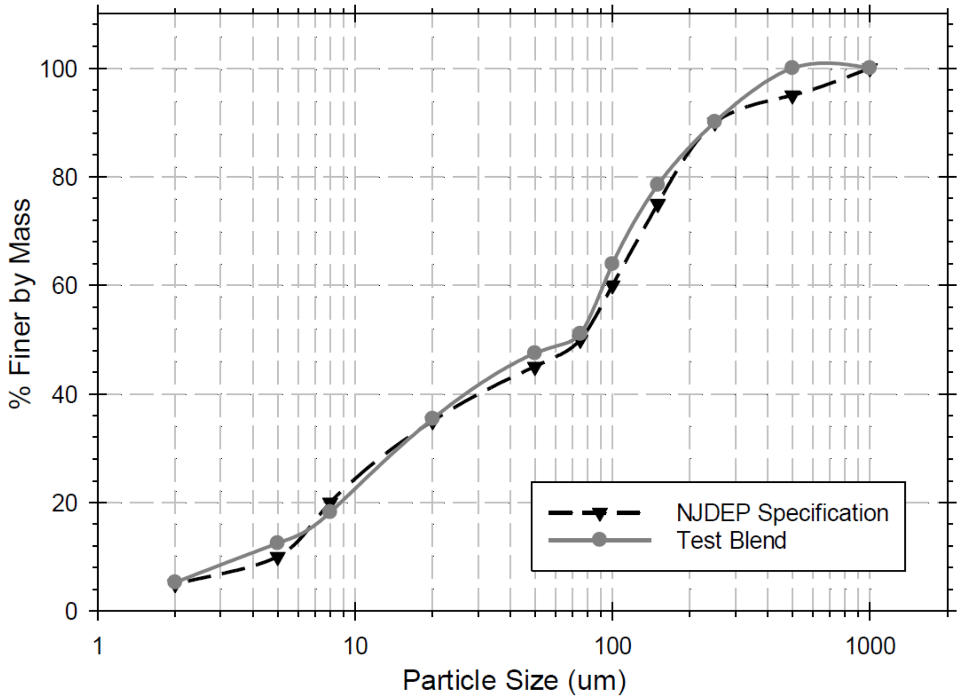

Figure 4– Particle Size Distribution (PSD)

The data in Table 3 (Flow Rate and Temperature) and Table 4 (Removal Efficiency) form the basis for the verified technology performance claim, specifically, flow rate, sediment captured and removal efficiency.

Table 3: Flow Rate and Temperature Summary

Run	Max Flow (gpm)	Min Flow (gpm)	Average Flow (gpm)	Flow COV	Flow Compliance (COV< 0.1)	Maximum Temperature (Fahrenheit)	NJDEP Temperature Compliance (< 80 F)
1	232.8	223.9	226.3	0.0078	Y	48.2	Y
2	228.9	218.6	220.8	0.0104	Y	51.5	Y
3	229.4	220.0	227.2	0.0094	Y	44.7	Y
4	230.2	218.7	223.2	0.0138	Y	40.5	Y
5	228.7	216.9	222.2	0.0103	Y	44.7	Y
6	227.6	217.0	224.2	0.0115	Y	46.7	Y
7	229.7	221.9	226.4	0.0092	Y	44.6	Y
8	230.3	222.2	226.8	0.0089	Y	43.5	Y
9	233.2	218.4	225.6	0.0136	Y	45.5	Y
10	232.2	219.7	228.4	0.0126	Y	44.7	Y
11	226.9	219.2	224.1	0.0088	Y	52.4	Y
12	232.2	222.1	226.9	0.0107	Y	48.5	Y
13	234.7	221.2	226.1	0.0109	Y	48.5	Y
14	231.9	223.4	228.7	0.0103	Y	45.6	Y
15	236.8	224.1	231.4	0.0131	Y	52.2	Y
16	232.5	221.3	229.0	0.0137	Y	47.8	Y

Table 4: Removal Efficiency Results

Run	Average Influent TSS (mg/L)	Influent Water Volume (gal)	Adjusted Average Effluent TSS (mg/L)	Effluent Water Volume (gal)	Adjusted Average Drain Down TSS (mg/L)	Drain Down Water Volume (gal)	Single Run Removal Efficiency (%)	Mass of Captured Sediment (g)	Cumulative Removal Efficiency (%)
1	203	7166	46	6881	34	285	77.8	4282	77.8
2	199	6993	32	6639	27	354	84.0	4415	80.8
3	207	7197	37	6793	27	403	82.6	4654	81.4
4	217	7068	33	6635	29	433	84.9	4923	82.3
5	215	7037	39	6593	29	444	82.2	4705	82.3
6	207	7097	40	6643	31	454	81.2	4504	82.1
7	198	7169	37	6693	30	476	81.6	4386	82.0
8	201	7184	37	6716	32	468	81.6	4473	82.0
9	205	7147	38	6675	30	472	81.8	4539	82.0
10	203	7235	38	6759	31	476	81.4	4523	81.9
11	208	7096	38	6624	30	472	81.8	4567	81.9
12	209	7185	41	6709	30	476	80.7	4584	81.8
13	198	7162	41	6680	32	482	79.7	4277	81.6
14	200	7242	43	6757	34	485	78.8	4318	81.4
15	196	7329	41	6842	32	487	79.5	4320	81.3
16	202	7254	44	6769	31	485	78.9	4384	81.2
Avg.	**204.2**	**7160**	**39**	**6713**	**31**	**447**	**81.2**	**4491**	**N/A**
Cumulative Mass Removed (g)							**71854**		
Cumulative Mass Removed (lb)							**158.4**		
Total Mass Loaded (lb)							**195.2**		
Cumulative Removal Efficiency (%)							**81.2**		

Quality Assurance

Performance verification of the StormTech Isolator® Row PLUS technology was performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. This included reviewing all data sheets and calculated values, as well as overall management of the test system, quality control and data integrity.

Additional information on quality control measures taken can be found in section 5 of the QAPP for StormTech Isolator Row New Jersey Department of Environmental Protection Testing, Rev. 1/9/2020.

Specific QA/QC measures reviewed by the verifier are summarized in Table 5 below.

Table 5. Validation of QA/QC Procedures

QC Parameter	Acceptance Criteria
Independence of observer	Confirmed in letter from Boggs Environmental Consultants, Inc. to NJCAT
Consistency of procedure	Daily logs confirm proper procedure
Existence of QAPP	Confirmed. “QAPP For StormTech Isolator Row New Jersey Department of Environmental Protection Testing”, Rev. 1/9/2020*)*
Use of appropriate sample analysis method – ASTM D3799	Confirmed by method reference on lab reports from Fredericktowne Labs Inc.
Test method appropriate for the technology	Used industry stakeholder approved protocol: *New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids*

	Removal by a Filtration Manufactured Treatment Device (January 2013)
Test parameters stayed within required limits	Confirmed in report “NJCAT TECHNOLOGY VERIFICATION Isolator® Row PLUS StormTech, LLC”, July 2020
Third party verified data	All testing was observed and reviewed by Boggs Environmental Consultants, Inc.

Variance

Performance claims regarding structural load limitations were not verified as they are outside the scope of the performance testing that was conducted in accordance with the ‘Quality Assurance Project Plan (QAPP) for StormTech Isolator Row, New Jersey Department of Environmental Protection Testing’, revision dated January 09, 2020.

Verification Summary

The StormTech “Isolator® Row PLUS” is a stormwater treatment technology designed for use under parking lots, roadways and heavy earth loads while providing a superior and durable structural system. The technology comprises a row of chambers wrapped in woven geotextile fabric with two layers at the bottom that serve as a filter strip, providing surface area for infiltration and runoff reduction with enhanced suspended solids and pollutant removal.

The StormTech Isolator® Row PLUS technology was tested at the Mid-Atlantic Storm Water Research Center (MASWRC), under the supervision of Boggs Environmental Consultants, Inc. The performance test results for two overlapping StormTech Isolator® Row PLUS chambers (commercial unit model SC-740) were verified by Good Harbour Laboratories Inc. (GHL), following the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. Table 6 summarizes the verification results in relation to the technology performance parameters that were identified in the Verification Plan to determine the efficacy of the StormTech Isolator® Row PLUS technology.

Table 6 - Summary of Verification Results Against Performance Parameters

Parameters	Verified Claims	Accuracy
Total Suspended Solids (TSS) Removal Efficiency	Based on the laboratory testing conducted, the StormTech Isolator® Row PLUS achieved an average 82% removal efficiency of SSC	± 1% (95% confidence level)
Average Loading Rate	Based on the laboratory testing parameters, the StormTech Isolator® Row PLUS maintained a loading rate of 4.15 GPM/sf	±0.03 GPM/sf (95% confidence level)
Maximum Treatment Flow Rate (MTFR)	Although the MTFR varies among the StormTech Isolator® Row PLUS model sizes and the number of chambers, the design surface loading rate remains the same (4.13 GPM/ft^2 of treatment surface area). The test unit consisted of two overlapping StormTech SC-740 chambers with a nominal MTFR of 225 GPM (0.501 CFS) and an effective filtration treatment area (EFTA) of approximately 54.5 ft^2.	± 1.4 GPM (95% confidence level)
Detention Time and Volume	Detention time and wet volume varies with model size. The unit tested had a wet volume of approximately 65.1 ft^3 (based on	N/A

	physical measurement) and a detention time of 2.2 minutes.	
Maximum Sediment Storage Depth and Volume	The sediment storage volume and depth vary according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the maximum sediment storage volume is 2.3 ft^3 at a sediment depth of 0.5 inches.	N/A
Effective Sedimentation/ Filtration Treatment Area	The effective sedimentation and filtration treatment area increases as the size of the chamber increases. Under the tested conditions using 2 overlapping chambers, the treatment area was 54.5 ft^2	The sedimentation /filtration area was determined from the actual physical dimensions of the test unit*
Sediment Mass Load Capacity	The sediment mass load capacity varies according to the StormTech Isolator® Row PLUS model sizes and system configuration. For the two overlapping StormTech SC-740 chambers tested, the mass loading capture was 158.4 lbs (2.91 lbs/ ft^2) following a total sediment loading of 195.2 lbs	± 0.8 lbs (±0.01 lbs/ft^2) (95% confidence level)

*Note: These numbers are determined based on physical measurement or a dimensional drawing, which is standard practice. Highly accurate measurements are not practical.

In conclusion, the StormTech Isolator® Row PLUS is a viable technology that can be used to remove contaminants from stormwater runoff via filtration. This technology has proven effective at removing suspended sediment from stormwater through in-lab testing using an industry recognized laboratory protocol.

By extension of sediment removal, this technology should also remove particle bound nutrients, heavy metals, and a wide variety of organic contaminants. Performance is a function of pollutant properties, hydraulic retention time, filter media, pre-treatment, and flow rate, such that proper design of the system is critical to achieving the desired results.

What is ISO 14034?

The purpose of environmental technology verification is to provide a credible and impartial account of the performance of environmental technologies. Environmental technology verification is based on a number of principles to ensure that verifications are performed and reported accurately, clearly, unambiguously and objectively. The International Organization for Standardization (ISO) standard for environmental technology verification (ETV) is ISO 14034, which was published in November 2016.

Benefits of ETV

ETV contributes to protection and conservation of the environment by promoting and facilitating market uptake of innovative environmental technologies, especially those that perform better than relevant alternatives. ETV is particularly applicable to those environmental technologies whose innovative features or performance cannot be fully assessed using existing standards. Through the provision of objective evidence, ETV provides an independent and impartial confirmation of the performance of an environmental technology based on reliable test data. ETV aims to strengthen the credibility of new, innovative technologies by supporting informed decision-making among interested parties.

For more information on the StormTech "Isolator® Row PLUS" technology, contact:	For more information on VerifiGlobal, contact:
StormTech, LLC. 520 Cromwell Avenue, Rocky Hill, CT 06067 USA t: +1-888-892-2694 e: info@stormtech.com w: www.stormtech.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www. verifiglobal.com
Signed for StormTech: *Original signed by:* Greg Spires Greg Spires, P.E. General Manager	Signed for VerifiGlobal: *Original signed by:* Thomas Bruun Thomas Bruun, Managing Director *Original signed by:* John Neate John Neate, Managing Director

NOTICE: Verifications are based on an evaluation of technology performance under specific, predetermined operational conditions and parameters and the appropriate quality assurance procedures. VerifiGlobal and the Verification Expert, Good Harbour Laboratories, make no expressed or implied warranties as to the performance of the technology and do not certify that a technology will always operate as verified. The end user is solely responsible for complying with any and all applicable regulatory requirements. Mention of commercial product names does not imply endorsement.

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Ontario

MINISTRY OF THE ENVIRONMENT

Database Version: **V 2.0 Release Update**
Update Date: **30-Mar-12**

Project DEVELOPMENT Summary

DEVELOPMENT: **62 Mill Street**
Subwatershed: **Pefferlaw-Uxbridge Brook**

Total Pre-Development Area (ha):	**1.51**	Total Pre-Development Phosphorus Load (kg/yr):	**0.20**

Pre-Development Land Use	**Area (ha)**	**P coeff. (kg/ha)**	**P Load (kg/yr)**
Low Intensity Development	1.51	0.13	0.20

POST-DEVELOPMENT LOAD

Post-Development Land Use	**Area (ha)**	**P coeff. (kg/ha)**	**Best Management Practice applied with P Removal Efficiency**		**P Load (kg/yr)**
High Intensity - Residential	0.06	1.32	NONE	0%	0.08
			Uncontrolled Road		
High Intensity - Residential	1.33	1.32	Treatment Train Approach	95%	0.09
			The infiltration gallery has been sized to capture and infiltrate the 25mm storm from contricuting drainage, which is equivalent to 95% of annual rainfall. Therefore, this volume is not discharged downstream and will not have a phosphorus load.		
Low Intensity Development	0.12	0.13	NONE	0%	0.02
			Uncontrolled grass area.		

Post-Development Area Altered: **1.51**
Total Pre-Development Area: **1.51**
Unaffected Area: **0**

	P Load (kg/yr)
Pre-Development:	**0.20**
Post-Development:	**1.85**
Change (Pre - Post):	**-1.65**
	843% Net Increase in Load
Post-Development (with BMPs):	**0.18**
Change (Pre - Post):	**0.01**
	7% Net Reduction in Load

DEVELOPMENT:	**62 Mill Street**
Subwatershed:	**Pefferlaw-Uxbridge Brook**

CONSTRUCTION PHASE LOAD

SUMMARY WITH IMPLEMENTATION OF BMPs	**P Load (kg/yr)**
Pre-Development:	**0.20**
Construction Phase Amortized Over 8 Years :	to be determined
Post-Development:	**0.18**
Post-Development + Amortized Construction:	**to be determined**
Pre-Development Load - Post-Development Load:	**0.01**
Conclusion:	**7% Reduction in Load**
Pre-Development Load - (Post-Development + Amortized Construction Load):	**to be determined**
Conclusion:	**to be determined**

Based on a comparison of Pre-Development and Post-Development loads, and in consideration of Construction Phase loads, the Ministry would encourage the Municipality to:

Appendix E

Water Balance Calculations

Summary of Inputs for Water Balance Calculation

Precipitation (mm/yr)	**831**	Based on Uxbridge Brook Subwatershed Data	
Evapotranspiration (mm/yr)	**560**	Based on Uxbridge Brook Subwatershed Data	
Topography Infiltration Factor	**0.20**	Pre-development site (Grass)	
Soil Infiltration Factor	**0.40**	Pre-development site (Grass)	
Land Cover Infiltration Factor	**0.10**	Pre-development site (Grass)	
MOE Infiltration Factor	**0.70**	Pre-development site (Grass)	
Topography Infiltration Factor	**0.20**	Post- Development	
Soil Infiltration Factor	**0.30**	Post- Development	
Land Cover Infiltration Factor	**0.10**	Post- Development	
MOE Infiltration Factor	**0.60**	Post- Development	

*Adjusted for compaction

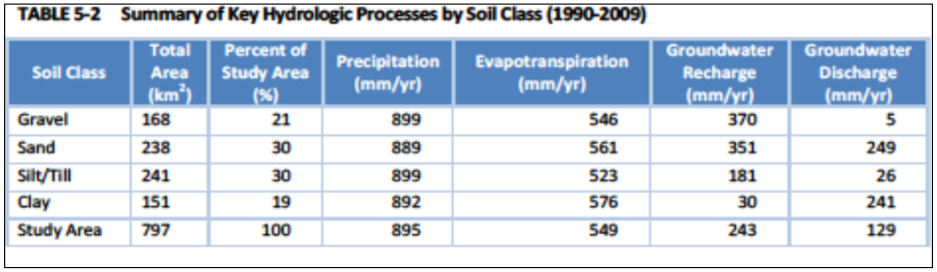

TABLE 5-2 Summary of Key Hydrologic Processes by Soil Class (1990-2009)

Soil Class	Total Area (km^2)	Percent of Study Area (%)	Precipitation (mm/yr)	Evapotranspiration (mm/yr)	Groundwater Recharge (mm/yr)	Groundwater Discharge (mm/yr)
Gravel	168	21	899	546	370	5
Sand	238	30	889	561	351	249
Silt/Till	241	30	899	523	181	26
Clay	151	19	892	576	30	241
Study Area	797	100	895	549	243	129

Table extracted from chapter 5 of "City of Barrie Tier Three Recharge Estimations Using Mike SHE, Technical Memorandum" Prepared for Lake Simcoe Conservation Authority, by AquaResource, June 2012.

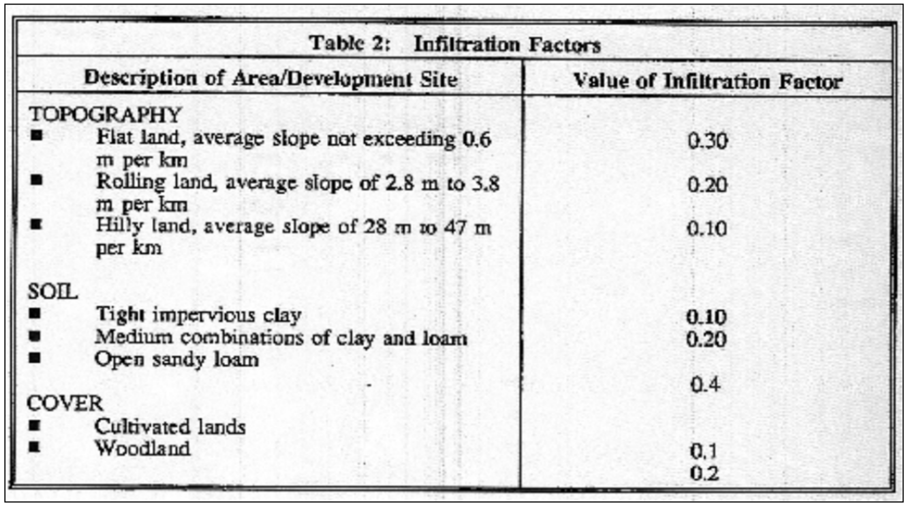

Table 2: Infiltration Factors

Description of Area/Development Site	Value of Infiltration Factor
TOPOGRAPHY	
■ Flat land, average slope not exceeding 0.6 m per km	0.30
■ Rolling land, average slope of 2.8 m to 3.8 m per km	0.20
■ Hilly land, average slope of 28 m to 47 m per km	0.10
SOIL	
■ Tight impervious clay	0.10
■ Medium combinations of clay and loam	0.20
■ Open sandy loam	0.4
COVER	
■ Cultivated lands	0.1
■ Woodland	0.2

Table extracted from chapter 4 of "MOEE Hydrogeological technical Information requirements for Land Development Applications" MOE, April 1995.

SWM DESIGN CALCULATIONS
Water Balance/ Water Budget Assessment

Project Name: 62 Mill Street
Municipality: Township of Uxbridge
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Catchment Designation	**Site**				
	Pre-Development	**Post-Development**	**Change (Pre- to Post-)**	**Post-Development with Mitigation**	**Change (Pre- to Post- with Mitigation)**
Inputs (Volumes)					
Precipitation (m^3/yr)	12,582	12,582	0.0%	12,582	0.0%
Run-on (m^3/yr)	0	0	0.0%	0	0.0%
Other Inputs (m^3/yr)	0	0	0.0%	0	0.0%
Total Inputs (m^3/yr)	**12,582**	**12,582**	**0.0%**	**12,582**	**0.0%**
Outputs (Volumes)					
Precipitation Surplus (m^3/yr)	4,253	7,571	78.0%	7,571	78.0%
Evapotranspiration (m^3/yr)	8,329	5,011	-39.8%	5,012	-39.8%
Infiltration (m^3/yr)	2,807	1,167	-58.4%	1,167	-58.4%
Infiltration Measures (m^3/yr)	0	0	0.0%	4,893	N/A
Total Infiltration (m^3/yr)	2,807	1,167	-58.4%	6,060	115.9%
Runoff Pervious Areas (m^3/yr)	1,203	778	-35.3%	778	-35.3%
Runoff Impervious Areas (m^3/yr)	243	5,626	2211.3%	733	201.1%
Total Runoff (m^3/yr)	1,446	6,404	342.8%	1,511	4.5%
Total Outputs (m^3/yr)	**12,582**	**12,582**	**0.0%**	**12,582**	**0.0%**

SWM DESIGN CALCULATIONS
Water Budget - Pre-Development

Project Name: 62 Mill Street
Municipality: Township of Uxbridge
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Catchment Designation	**Site Area**		
	Pervious	**Impervious**	**Total**
Area (m^2)	14,796	345	**15,141**
Pervious Area (m^2)	14,796	0	**14,796**
Impervious Area (m^2)	0	345	**345**
Inputs (per Unit Area)			
Precipitation (mm/yr)	831	831	**831**
Run-on (mm/yr)	0	0	**0**
Other Inputs (mm/yr)	0	0	**0**
Outputs (per Unit Area)			
Precipitation Surplus (mm/yr)	271	706	**281**
Evapotranspiration (mm/yr)	560	125	**550**
Infiltration (mm/yr)	190	0	**185**
Infiltration Measures (mm/yr)	0	0	**0**
Total Infiltration (mm/yr)	190	0	**185**
Runoff Pervious Areas (mm/yr)	81	0	**79**
Runoff Impervious Areas (mm/yr)	0	706	**16**
Total Runoff (mm/yr)	81	706	**96**
Total Outputs (mm/yr)	**831**	**831**	**831**
Difference (Inputs-Outputs)	**0**	0	**0**
Inputs (Volumes)			
Precipitation (m^3/yr)	12,296	286	**12,582**
Run-on (m^3/yr)	0	0	**0**
Other Inputs (m^3/yr)	0	0	**0**
Total Inputs (m3/yr)	**12,296**	**286**	**12,582**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	4,010	243	**4,253**
Net Surplus (m^3/yr)	4,010	243	**4,253**
Evapotranspiration (m^3/yr)	8,286	43	**8,329**
Infiltration (m^3/yr)	2,807	0	**2,807**
Infiltration Measures (m^3/yr)	0	0	**0**
Total Infiltration (m^3/yr)	2,807	0	**2,807**
Runoff Pervious Areas (m^3/yr)	1,203	0	**1,203**
Runoff Impervious Areas (m^3/yr)	0	243	**243**
Total Runoff (m^3/yr)	1,203	243	**1,446**
Total Outputs (m^3/yr)	**12,296**	**286**	**12,582**
Difference (Inputs-Outputs)			**0**

SWM DESIGN CALCULATIONS
Water Budget - Post-Development (No Mitigation)

Project Name: 62 Mill Street
Municipality: Township of Uxbridge
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Catchment Designation	**Site Area**		
	Pervious	**Impervious**	**Total**
Area (m^2)	7,176	7,965	**15,141**
Pervious Area (m^2)	7,176	0	**7,176**
Impervious Area (m^2)	0	7,965	**7,965**
Infiltration Factors			
MOE Infiltration Factor	0.60		
Run-off from Impervious Surfaces			
Inputs (per Unit Area)			
Precipitation (mm/yr)	831	831	**831**
Run-on (mm/yr)	0	0	**0**
Other Inputs (mm/yr)	0	0	**0**
Outputs (per Unit Area)			
Precipitation Surplus (mm/yr)	271	706	**500**
Evapotranspiration (mm/yr)	560	125	**331**
Infiltration (mm/yr)	163	0	**77**
Infiltration Measures (mm/yr)	0	0	**0**
Total Infiltration (mm/yr)	163	0	**77**
Runoff Pervious Areas (mm/yr)	108	0	**51**
Runoff Impervious Areas (mm/yr)	0	706	**372**
Total Runoff (mm/yr)	108	706	**423**
Total Outputs (mm/yr)	**831**	**831**	**831**
Difference (Inputs-Outputs)	**0**	0	**0**
Inputs (Volumes)			
Precipitation (m^3/yr)	5,963	6,619	**12,582**
Run-on (m^3/yr)	0	0	**0**
Other Inputs (m^3/yr)	0	0	**0**
Total Inputs (m3/yr)	**5,963**	**6,619**	**12,582**
Outputs (Volumes)			
Precipitation Surplus (m^3/yr)	1,945	5,626	**7,571**
Net Surplus (m^3/yr)	1,945	5,626	**7,571**
Evapotranspiration (m^3/yr)	4,018	993	**5,011**
Infiltration (m^3/yr)	1,167	0	**1,167**
Infiltration Measures (m^3/yr)	0	0	**0**
Total Infiltration (m^3/yr)	1,167	0	**1,167**
Runoff Pervious Areas (m^3/yr)	778	0	**778**
Runoff Impervious Areas (m^3/yr)	0	5,626	**5,626**
Total Runoff (m^3/yr)	778	5,626	**6,404**
Total Outputs (m^3/yr)	**5,963**	**6,619**	**12,582**
Difference (Inputs-Outputs)			**0**

Note:

- Evaporation from impervious area assumed to be 15% of precipitation

SWM DESIGN CALCULATIONS
Water Budget - Post-Development (With Mitigation)

Project Name: 62 Mill Street
Municipality: Township of Uxbridge
Project No.: 20128
Date: 24-Jun-21

Prepared by: J.L.
Last Revised: 24-Jun-21

Catchment Designation	**Area 301 + 303 + 304 (North), excluding uncontrolled area**			**Area 302 (South)**			**Area 202 (Uncontrolled)**			
	Pervious	**Impervious**	**Total Area 201**	**Pervious**	**Impervious**	**Total Area 203**	**Pervious**	**Impervious**	**Total Area**	**Total**
Area (m^2)	4,403	4,488	**8,891**	1,383	2,992	4,376	1,391	484	1,875	**15,141**
Pervious Area (m^2)	4,403	0	**4,403**	1,383	0	1,383	1,391	0	1391	**7,177**
Impervious Area (m^2)	0	4,488	**4,488**	0	2,992	2,992		484	484	**7,964**
Infiltration Factors										
MOE Infiltration Factor	0.60			0.60			0.60			
Run-off from Impervious Surfaces										
Inputs (per Unit Area)										
Precipitation (mm/yr)	831	831	831	831	831	831	831	831	831	**831**
Run-on (mm/yr)	0	0	0	0	0	0	0	0	0	**0**
Other Inputs (mm/yr)	0	0	0	0	0	0	0	0	0	**0**
Outputs (per Unit Area)										
Precipitation Surplus (mm/yr)	271	706	491	271	706	569	271	706	383	**500**
Evapotranspiration (mm/yr)	560	125	340	560	125	262	560	125	448	**331**
Infiltration (mm/yr)	163	0	81	163	0	51	163	0	121	**77**
Infiltration Measures (mm/yr)	0	643	324	0	671	459	0	0	0	**323**
Total Infiltration (mm/yr)	163	643	405	163	671	510	163	0	121	**400**
Runoff Pervious Areas (mm/yr)	108	0	54	108	0	34	108	0	80	**51**
Runoff Impervious Areas (mm/yr)	0	64	32	0	35	24	0	706	182	**48**
Total Runoff (mm/yr)	108	64	86	108	35	58	108	706	263	**100**
Total Outputs (mm/yr)	**831**	**831**	831	**831**	**831**	831	**831**	**831**	831	**831**
Difference (Inputs-Outputs)	**0**	0	0	0	0	0			0	**0**
Inputs (Volumes)										
Precipitation (m^3/yr)	3,659	3,730	7,388	1,150	2,487	3,636	1,156	402	1,558	**12,582**
Run-on (m^3/yr)	0	0	0	0	0	0	0	0	0	**0**
Other Inputs (m^3/yr)	0	0	0	0	0	0	0	0	0	**0**
Total Inputs (m3/yr)	**3,659**	**3,730**	**7,388**	**1,150**	**2,487**	**3,636**	**1,156**	**402**	**1,558**	12,582
Outputs (Volumes)										
Precipitation Surplus (m^3/yr)	1,193	3,170	4,363	375	2,114	2,489	377	342	719	**7,571**
Net Surplus (m^3/yr)	1,193	3,170	4,363	375	2,114	2,489	377	342	719	**7,571**
Evapotranspiration (m^3/yr)	2,465	559	3,025	775	373	1,148	779	60	839	**5,012**
Infiltration (m^3/yr)	716	0	716	225	0	225	226	0	226	**1,167**
Infiltration Measures (m^3/yr)	0	2,885	2,885	0	2,008	2,008	0	0	0	**4,893**
Total Infiltration (m^3/yr)	716	2,885	3,601	225	2,008	2,233	226	0	226	**6,060**
Runoff Pervious Areas (m^3/yr)	477	0	477	150	0	150	151	0	151	**778**
Runoff Impervious Areas (m^3/yr)	0	285	285	0	106	106	0	342	342	**733**
Total Runoff (m^3/yr)	477	285	763	150	106	256	151	342	493	**1,511**
Total Outputs (m^3/yr)	**3,659**	**3,730**	7,388	**1,150**	**2,487**	**3,636**	1,156	402	**1,558**	12,582
Difference (Inputs-Outputs)			**0**			**0**			**0**	0

Note:
- Evaporation from impervious area assumed to be 15% of precipitation

Counterpoint Engineering

Water Balance

As per Township of Uxbridge Standards

62 Mill Street, Uxbridge, Ontario

Infiltration Volume Provided

North Infiltration Gallery (Based on Stormtech chambers design):

Infiltration Dimensions:	Volume =	**112.0**	**m^3**
	Depth =	**0.53**	**m**

LID Feature Volume:	**112.0**	**m^3**
Contributing Impervious Area:	4480	m^2
Equivalent Depth Captured:	**25.0**	**mm**
% of Annual Rainfall Volume captured:	**95%**	

Drawdown Time:

Infiltration rate based on Hydrogeological Assessment:	50 mm/hr.	= 0.050 m/hr
Design infiltration rate (with 2.5 safety factor):	20 mm/hr.	= 0.020 m/hr

Drawdown Time = Depth/Infiltration Rate

**Note: Infiltration occurs within extended detention volume as well. Therefore, the infiltration drawdown time shall also include for this volume depth and ensure all water balance flows can be infiltrated within 48 hours.*

Drawdown Time = *(of depth below invert)*	0.53 m / 0.020m/hr =	**26.5**	**hrs**

Drawdown time of volume within extended detention:

Extended detention volume =		179.3	m^3
Footprint area for infiltration =		201.3	m^3
Infiltration rate of extended detention volume =		1.12	L/s
Extended Detention release rate =		3.46	L/s
Total storage outlet release rate =	3.46 l/s + 1.12 L/s =	4.58	L/s
Extended Detention Infiltration Volume Drawdown time =		**10.9**	**hrs**
Total Drawdown Time =		**37.4**	**hrs**

Drawdown time is less the 48 hrs, therefore MOE drawdown time is met.

Counterpoint Engineering

Water Balance

As per Township of Uxbridge Standards

62 Mill Street, Uxbridge, Ontario

Infiltration Volume Provided

South Infiltration Gallery (Based on Stormtech chambers design):

Infiltration Dimensions: Volume = **75.0 m^3**
Depth below invert = **0.25 m**

LID Feature Volume: **75.0 m^3**
Contributing Impervious Area: 2992 m^2

Equivalent Depth Captured: **25.1 mm**
% of Annual Rainfall Volume captured: **95%**

Drawdown Time:

Infiltration rate based on Hydrogeological Assessment: 50 mm/hr. = 0.050 m/hr
Design infiltration rate (with 2.5 safety factor): 20 mm/hr. = 0.020 m/hr

Drawdown Time = Depth/Infiltration Rate
**Note: Infiltration occurs within extended detention volume as well. Therefore, the infiltration drawdown time shall also include for this volume depth and ensure all water balance flows can be infiltrated within 48 hours.*

Drawdown Time = 0.25 m / 0.020m/hr = **12.5** **hrs**
(of depth below invert)

Drawdown time of volume within extended detention:
Extended detention volume = 119.7 m^3
Footprint area for infiltration = 251.7 m^3
Infiltration rate of extended detention volume = 1.40 L/s
Extended Detention release rate = 3.46 L/s
Total storage outlet release rate = 3.46 l/s + 1.40 L/s = 4.86 L/s

Extended Detention Infiltration Volume Drawdown time = **6.8** **hrs**

Total Drawdown Time = **19.3** **hrs**

Drawdown time is less the 48 hrs, therefore MOE drawdown time is met.

Appendix F

Hydrogeological Assessment and Infiltration Letter

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE 100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

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June 28, 2021

Mosaik (Uxbridge) Inc.
2235 Sheppard Avenue East, Suite 903
North York, Ontario
M2J 5B5

Attention: Mr. Paul Bailey

Re: Infiltration Assessment Based on Interpretation From Grain Size Analysis, Proposed Residential Development
62 Mill Street
Township of Uxbridge

Dear Sir:

As requested, we have completed the Infiltration Rate and Percolation T-time estimates for shallow subsoil based on findings from representative soil samples that underwent laboratory grain size analysis from the Geotechnical Report (Soil Engineers Ltd. Reference No. 2011-S193) and Hydrogeological Assessment Report (Soil Engineers Ltd. Reference No. 2104-W092) in support of proposed Low Impact Development (LID) stormwater management planning at the captioned development site. Our assessment and findings are presented in this letter report.

The subject site is located at 62 Mill Street, in the Township of Uxbridge, at the location shown on Drawing 1. A proposed residential development is intended for construction at the subject site, where a LID infrastructure will be implemented to address the stormwater management planning for the proposed residential development.

For this study, six (6) soil samples underwent laboratory grain size analysis, for textural soil classification with the resulting soil gradation plots used to estimate the soil's percolation T-times and infiltration rates. The approximate locations, where the six (6) soil samples were tested are shown on Drawing No. 2, enclosed. The results for the grain size analysis performed in laboratory are enclosed for your reference, Figures 1 to 6.

In accordance with the guidelines from Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation Authority (CVC), the infiltration rates are based on "Low Impact Development Stormwater Management Planning and Design Guide, Table C1", as provided below.

Hydraulic Conductivity, K_{fs} (cm/Sec)	**Percolation Time, T (min/cm)**	**Infiltration Rate, 1/T (mm/hr)**
0.1	2	300
0.01	4	150
0.0001	8	75
0.00001	12	50
0.000001	20	30
0.0000001	50	12

Kfs – field saturated hydraulic conductivity
Source: Ontario Ministry of Municipal Affairs and Housing (OMMAH). 1997; Supplementary Guidelines to the Ontario Building Code 1997, SG-6 Percolation Time and Soil Description.

Test Results

The results from the soil grain size analyses for the collected sub soil samples are summarized in Table 2:

Table 2: Estimated Hydraulic Conductivities, Percolation times and Infiltration Rates

Borehole No.	**Sample No. and Depth (m)**	**Soil Type**	**Soil Grain Size Permeability Estimation (cm/sec)**	**Estimated T Time (min/cm)**	**Estimated Infiltration Rate (mm/hr)**
102	**7** (±6.3m)	Silt, some sand to sandy, traces of clay and gravel	10^{-5} (Figure 1) (GS)	20 (GS)	30 (GS)
104	**4** (±2.5m)	Silt, some sand to sandy, traces of clay and gravel	10^{-5} (Figure 1) (GS)	20 (GS)	30 (GS)
106	**5** (±3.3 m)	Silt, some sand to sandy, traces of clay and gravel	10^{-5} (Figure 1) (GS)	20 (GS)	30 (GS)

GS – Soil grain Size Distribution

Borehole/ Monitoring Well No.	Sample No. and Depth (m)	Soil Type	Soil Grain Size Permeability Estimation (cm/sec)	Estimated T Time (min/cm)	Estimated Infiltration Rate (mm/hr)
201	**6** (±4.8 m)	Fine to Medium Sand, some silt, trace of clay, coarse sand and gravel	10^{-3} (Figure 2) (GS)	8 (GS)	75 (GS)
202	**5** (±3.3 m)	Sandy Silt, a trace of clay	10^{-4} (Figure 3) (GS)	12 (GS)	50 (GS)
203	**7** (±6.3 m)	Silt Till, some sand, traces of clay and gravel	10^{-5} (Figure 4) (GS)	20 (GS)	30 (GS)

GS – Soil grain Size Distribution

Soil grain size analyses plots (Figures 1 to 4) for the native silt, fine to medium sand, and sandy silty subsoil, encountered at the target depths, were used to estimate the T-Times and infiltration rates. The infiltration rates were interpolated as presented in Table 2.

As per the draft hydrogeological assessment report the shallow groundwater levels are at the depths, ranging from ±3.20 to ±4.25 m below the prevailing ground surface, at the elevations ranging from 269.67 to 272.23 masl.

Soil exhibiting these infiltration characteristics are generally considered as suitable for the designs of conventional LID infiltration infrastructure, as the subsoil meets the minimum 15 mm/hr infiltration rates required for conventional LID infrastructure design, such as infiltration galleries, soak away pits, or similar technology that would be implemented as part of stormwater management planning for the proposed site development. Other methods, such as the thickening of topsoil within landscaped areas should be also considered to meet the LID planning objectives for stormwater management design throughout portions of the proposed development site as an alternative means for addressing LID infrastructure.

Any infiltration infrastructure at the site should include an overflow valve to divert any excessive runoff to a grassed swale, or into the municipal storm sewer, should a high intensity rainfall runoff event not be adequately accommodated by the proposed holding tank, infiltration trench, or infiltration gallery completed for the proposed development.

We trust that this correspondence addresses your current needs and ask that you contact the undersigned should you have any questions or require additional information.

Yours truly,
SOIL ENGINEERS LTD.

Bhawandeep S. Brar

Bhawandeep S. Brar, B.Sc.

GR O'Brien

PROFESSIONAL GEOSCIENTIST
GAVIN R. O'BRIEN
PRACTISING MEMBER
1267
June 28, 2021
ONTARIO

Gavin O'Brien, M.Sc., P.Geo.
BB/GO:

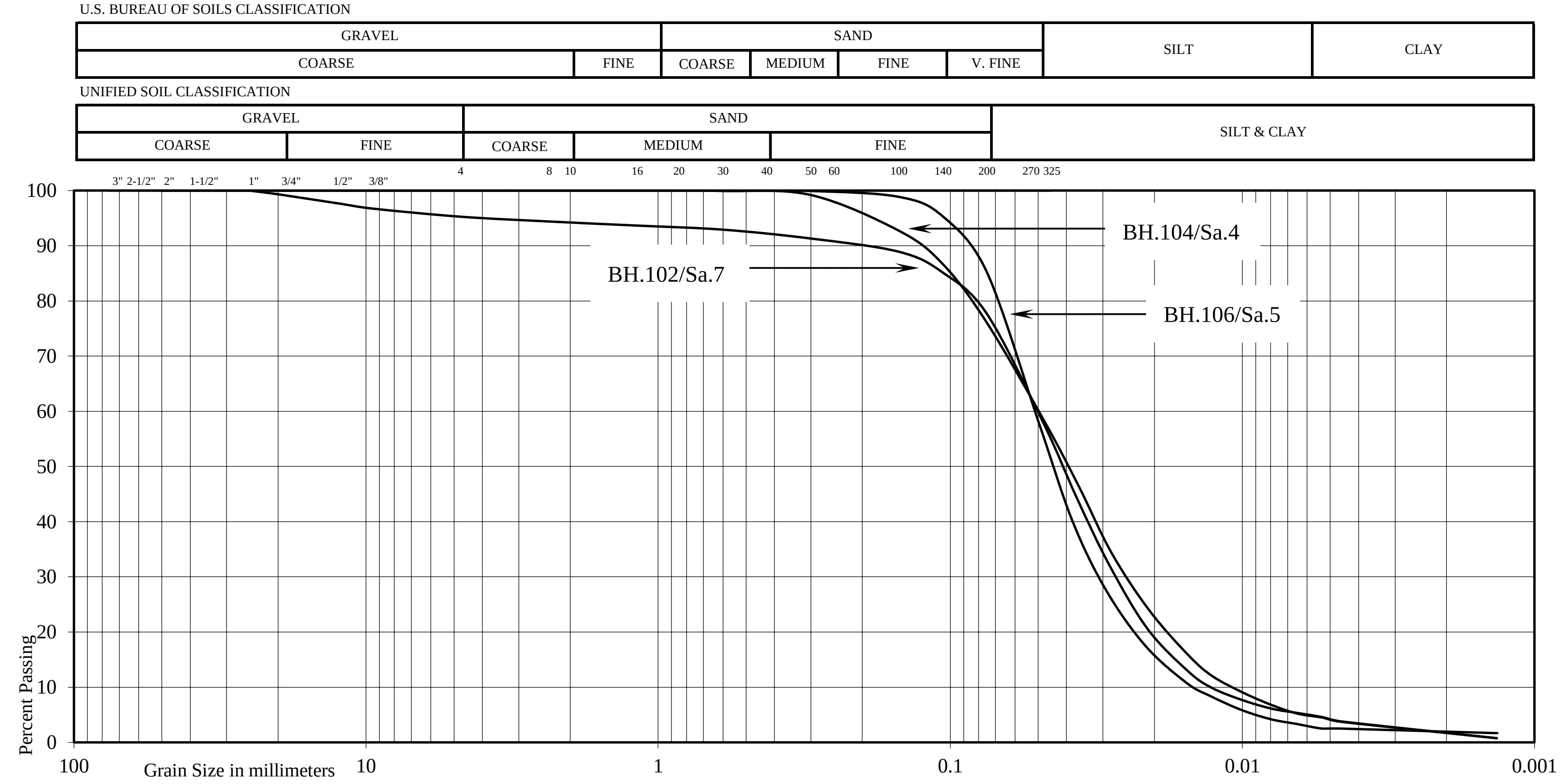
ENCLOSURES

Grain Size Distribution Graphs	Figures 1 to 4
Site Location Plan	Drawing No. 1
Soil Sample Testing Locations	Drawing No. 2

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2011-S193



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Borehole No:	102	104	106
Sample No:	7	4	5
Depth (m):	6.3	2.5	3.3
Elevation (m):	267.7	274.9	272.0

BH./Sa.	102/7	104/4	106/5
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	17	10	20
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-5}	10^{-5}

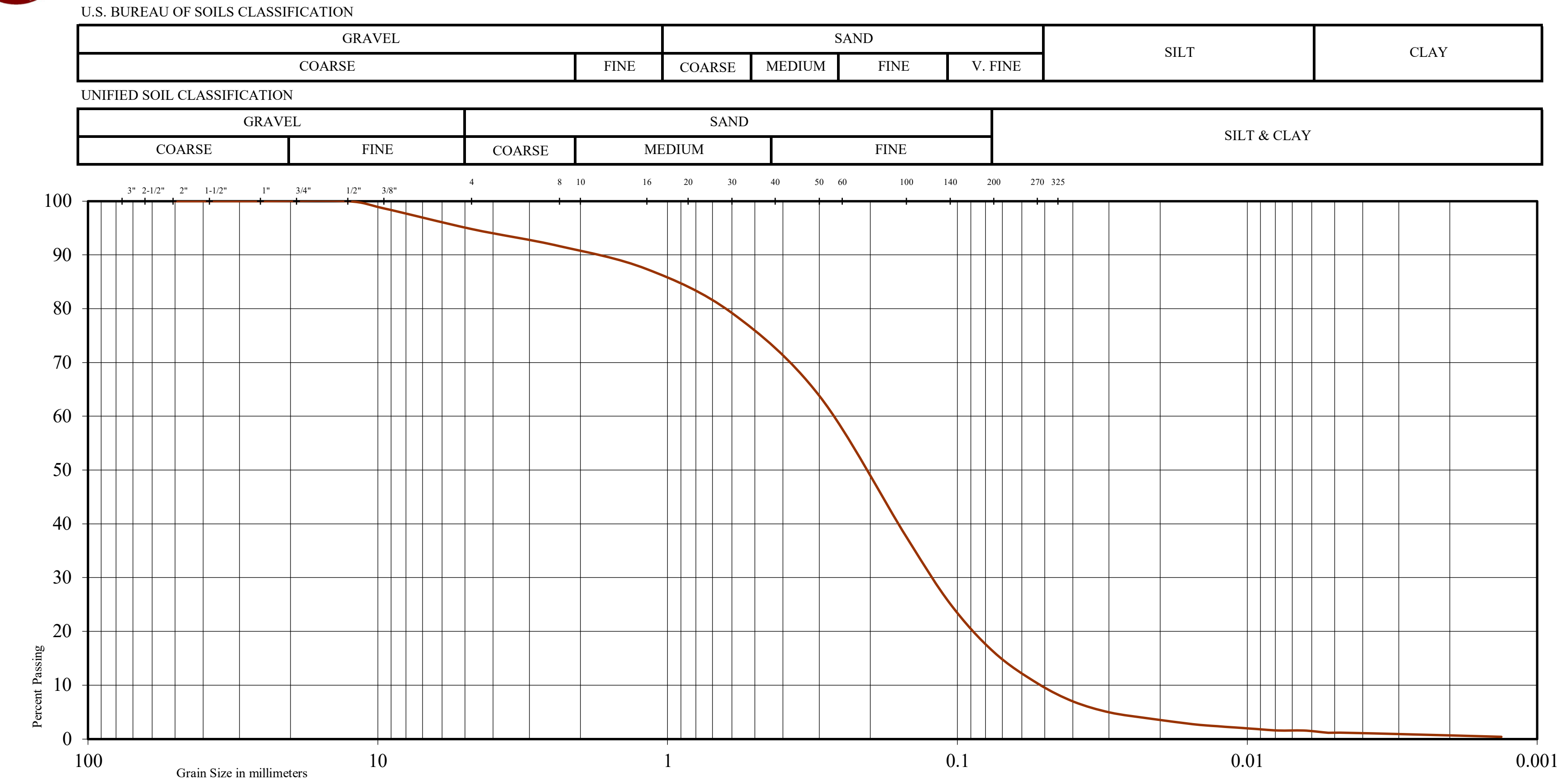
Classification of Sample [& Group Symbol]: SILT, some sand to sandy, traces of clay and gravel

Figure: 1

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2104-W092



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Borehole No: 201

Sample No: 6

Depth (m):

Elevation (m):

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = -

Estimated Permeability (cm./sec.) = 10^{-3}

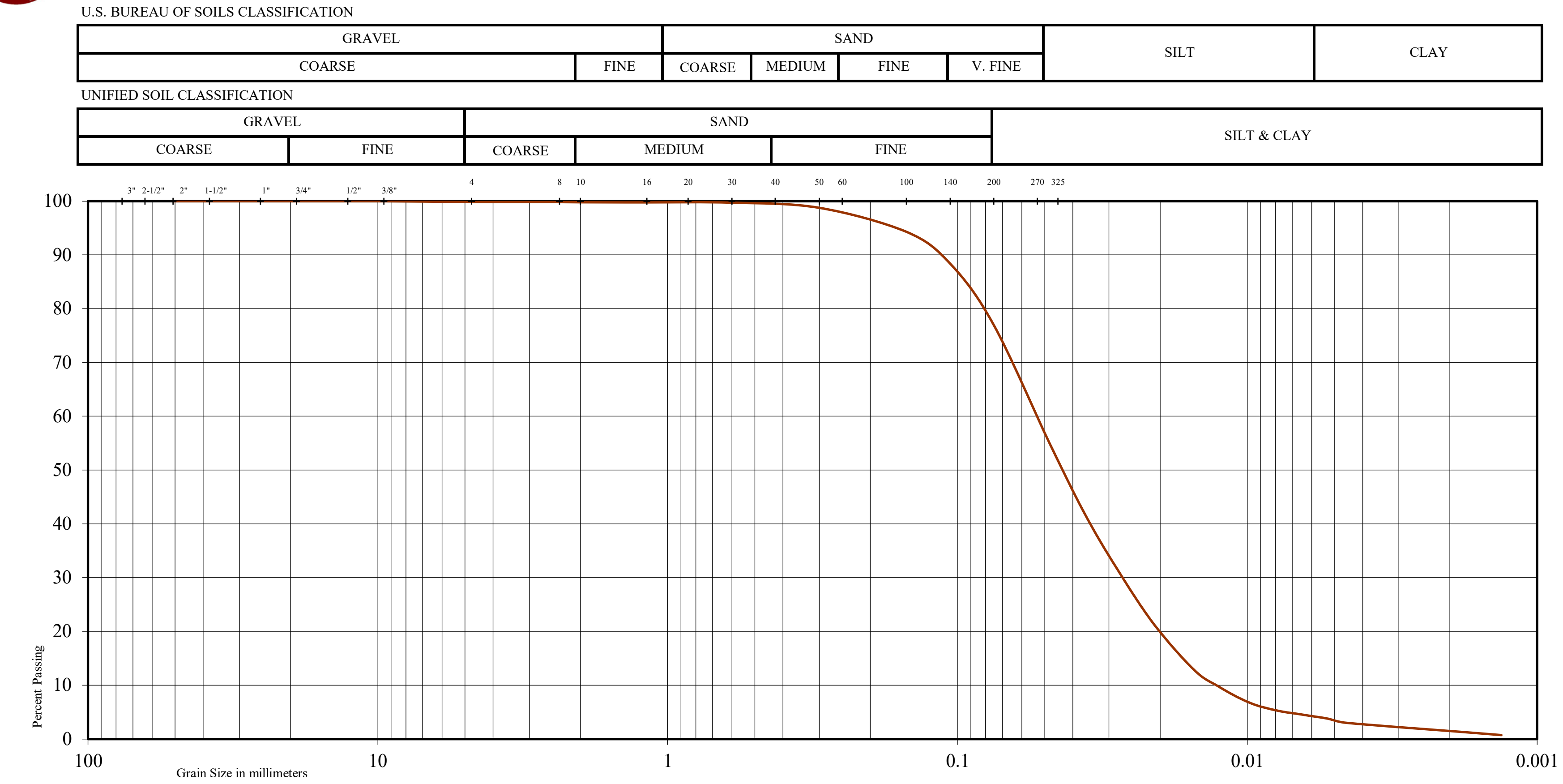
Classification of Sample [& Group Symbol]: FINE TO MEDIUM SAND
some silt, traces of clay, coarse sand and gravel

Figure: 2

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2104-W092



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Liquid Limit (%) = -

Plastic Limit (%) = -

Borehole No: 202

Plasticity Index (%) = -

Sample No: 5

Moisture Content (%) = -

Depth (m):

Estimated Permeability

Elevation (m):

(cm./sec.) = 10^{-4}

Classification of Sample [& Group Symbol]: SANDY SILT

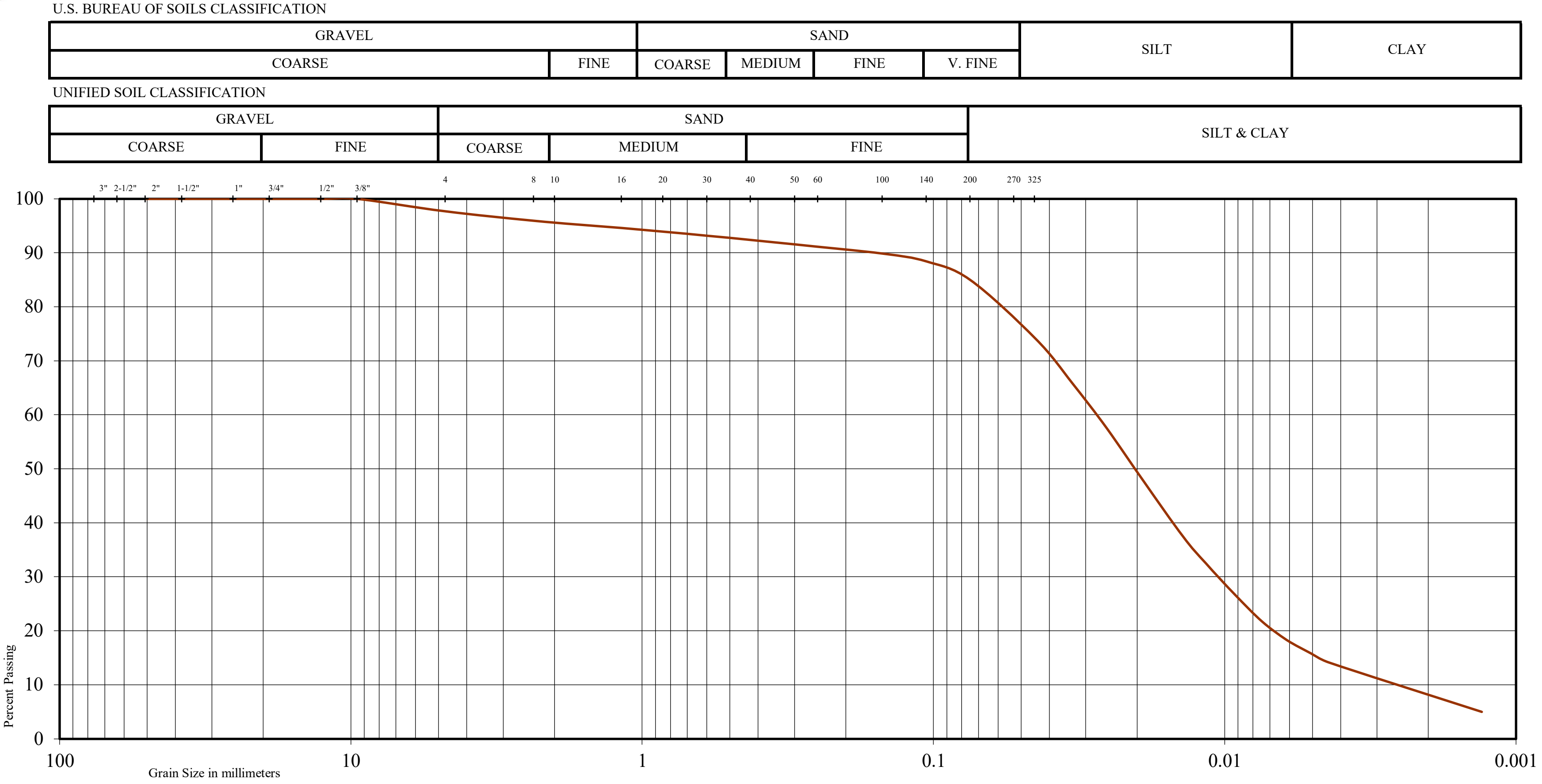
a trace of clay

Figure: 3

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

Reference No: 2104-W092



Project:	Proposed Residential Development		
Location:	62 Mill Street, Township of Uxbridge	Liquid Limit (%) =	-
		Plastic Limit (%) =	-
Borehole No:	203	Plasticity Index (%) =	-
Sample No:	7	Moisture Content (%) =	-
Depth (m):		Estimated Permeability	
Elevation (m):		(cm./sec.) =	10^{-5}

Classification of Sample [& Group Symbol]: SILT, TILL
some sand, traces of clay and gravel

Figure: 4

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

N

🟥 Approximate Boundary of Subject Site

🟦 Waterbody

→ Watercourse

━ Major Road

— Local Road

Soil Engineers Ltd.

Title: Site Location Plan

Project:
Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

Date: June 28, 2021

Scale:
0 10 20 40 60 80 100
Metres

Drawing No. 1

Source: Ontario Ministry of Natural Resources and Forestry
© Queen's Printer for Ontario, 2021

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

C:\GIS2021\2104-W092

N

▭	Approximate Boundary of Subject Site
⊕	Borehole
⊕	Borehole with Monitoring Well
🟦	Waterbody
—	Local Road

Soil Engineers Ltd.

Title: Borehole and Monitoring Well Location Plan

Project:

Hydrogeological Assessment
Proposed Development
62 Mill Street
Township of Uxbridge

Reference No. 2104-W092

Date: June 28, 2021

Scale:
0 5 10 20 30 40 50
Metres

Drawing No. 2

Source: Ontario Ministry of Natural Resources and Forestry

HADDAD GEOTECHNICAL INC.
Geotechnical & Environmental Engineers

February 3, 2020

Project: 19-14185

2373521 Ontario Corp.
3 Young Street
Uxbridge, Ontario
L9P 1B9

Attention: Mr. Scott Addison

Re: Addendum No. 1 – Safety Factor for Infiltration Rates
Supplementary Geotechnical Investigation for
Stormwater Management Design
62 Mill Street
Uxbridge, Ontario

Dear Mr. Addison:

Further to our report, “Supplementary Geotechnical Investigation for Stormwater Management Design”, dated January 23, 2020, we present the following recommendations for safety correction factor for calculating design infiltration rates for the proposed stormwater management facilities at the subject property.

1. Our boreholes conducted on the site to date have indicated the presence of consistent subsoil conditions, comprising sand and silt. he results of in-situ percolation testing conducted at three locations on the site as part of our recent investigation resulted in coefficient of permeability (hydraulic conductivity), k, of the natural sand and silt soils to range from 2.1 x 10^{-4} cm/sec to 1.3 x 10^{-4} cm/sec with an average of 1.7 x 10^{-4} cm/sec. An infiltration rate of 50 mm/hr was recommended to be applicable at all locations and depth ranges explored.

2. The document, “Low Impact Development Stormwater Management Planning and Design Guide” requires that measured infiltration rates be divided by a factor of safety, selected from Table C2 in Appendix “C” of the Design Guide (see below) to determine the design infiltration rate, to account for variation due to disturbed or soil completion during construction.

3. In light of the consistent soil conditions and small variation in measured infiltration rates, the ratio of mean infiltration rates is determined to be approximate 1.0. On this basis the safety correction factor, as in Table C2 is determined to be 2.5.

TABLE C2: Safety correction factors for calculating design infiltration rates

Ratio of Mean Infiltration rates	Safety Correction Factor
1 of less	2.5
1.1 to 4.0	3.5
4.1 to 8.0	4.5
8.1 to 16.0	6.5
16.1 or greater	8.5

4. On this basis, the design infiltration rate for subsurface infiltration facilities is determined to be 50 / 2.5 = 20 mm/hour.

We trust that the information presented in this report satisfies your present requirements. Should you require further information, please contact our office.

HADDAD GEOTECHNICAL INC.

D. Graham Fisher, M.E.Sc., P.Eng.

LICENSED PROFESSIONAL ENGINEER
D. G. FISHER
14260400
3-2-20
PROVINCE OF ONTARIO

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2373521 Ontario Corp. -1 hard copy, 1 pdf
file: 1914815.sgi.a1.safety factor infiltration.

Soil Engineers Ltd.
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

A REPORT TO
BAZIL DEVELOPMENTS INC.

PROPOSED RESIDENTIAL DEVELOPMENT

62 MILL STREET
TOWN OF UXBRIDGE

REFERENCE NO. 2011-S193

JANUARY 2021

DISTRIBUTION

3 Copies	- Bazil Developments Inc.
1 Copy	- Soil Engineers Ltd. (Richmond Hill)
1 Copy	- Soil Engineers Ltd. (Newmarket)

TABLE OF CONTENTS

TABLES

ENCLOSURES

1.0 INTRODUCTION

In accordance with written authorization dated November 25, 2020, from Mr. Paul Bailey of Bazil Developments Inc., a geotechnical investigation was carried out at a land parcel located at 62 Mill Street in the Town of Uxbridge.

The purpose of this investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils for the design and construction of a new development. The geotechnical findings and resulting recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The Township of Uxbridge is situated on Peterborough Drumlin Field, where lacustrine sand, silt, clay and water-laid reworked till in Lake Schomberg (glacial lake) has modified the drumlinized stratigraphy in places.

The subject property is a residential lot of approximately 2.9 acres in area, located on the south side of Mill Street, between Water Street and Joseph Street in the Township of Uxbridge. The existing site gradient drops slightly in the north and east direction, having the grade difference of almost 6 m across the property.

The property will be developed for residential uses. Details of the development, however, is not available at the time of report preparation.

3.0 FIELD WORK

The field work, consisting of six (6) sampled boreholes, extending to a depth of 6.6 m, was performed on December 9 and 10, 2020. The borehole locations are presented on the Borehole Location Plan, Drawing No. 1, enclosed.

The boreholes were advanced at intervals to the sampling depths by a track-mounted, continuous-flight power-auger machine equipped for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed “List of Abbreviations and Terms”, were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or ‘N’ values) of the subsoil. The field work was supervised and the findings were recorded by a Geotechnical Technician. The relative density of the non-cohesive strata and the consistency of the cohesive strata are inferred from the ‘N’ values. Split-spoon samples were recovered for soil classification and laboratory testing.

The field work was supervised and the findings were recorded by a Geotechnical Technician. The ground elevation of each borehole location was determined using hand-held Global Navigation Satellite System survey equipment (Trimble Geoexplorer 6000).

4.0 SUBSURFACE CONDITIONS

The investigation has revealed that beneath a layer of topsoil and earth fill in places, the site is underlain by strata of sand and silt. Detailed descriptions of the encountered subsurface conditions from boreholes are presented on the Borehole Logs, comprising Figures 1 to 6, inclusive. The revealed stratigraphy is plotted on the Subsurface Profiles, Drawing No. 2. The engineering properties of the disclosed soils are discussed herein.

4.1 **Topsoil** (All Boreholes)

Topsoil, approximately 20 to 38 cm thick, was encountered at the ground surface of the boreholes. Thicker topsoil layer may be encountered beyond the borehole location, especially in the low-lying areas.

The topsoil is dark brown in colour, indicating appreciable amounts of roots and humus. These materials are unstable and compressible under loads, which has to be removed for site development. It can only be reused for general landscaping purposes.

Due to its humus content, the topsoil may produce volatile gases and generate an offensive odour under anaerobic conditions. Therefore, it must not be buried below any structures or deeper than 1.2 m below the finished grade, so that it will not have an adverse impact on the environmental well-being of the developed areas.

4.2 **Earth Fill** (Boreholes 101, 103, 104 and 105)

A layer of earth fill, consisting of sand and silt, or silty clay, with topsoil and rootlets, was encountered below the topsoil at various borehole locations. It extends to a depth between 0.8 and 1.8 m from the prevailing ground surface.

The obtained ‘N’ values range from 2 to 8 blows per 30 cm penetration, showing the fill is loose. It is not suitable for supporting any structure sensitive to movement.

4.3 **Sand** (All Boreholes, except Borehole 105)

Beneath the topsoil or earth fill, the native sand deposit was encountered at a depth between 0.2 m and 1.5 m from grade. It is fine or fine to medium grained, with occasional silt seams and layers. The deposit extends to a depth between 1.0 m and 5.5 m from the existing ground surface.

The obtained ‘N’ values range from 3 to 43, with a median of 18 blows per 30 cm of penetration, showing the deposit is generally compact to dense in relative density, with loose spots near the existing ground surface.

The natural water content values of the sand samples range from 3% to 16%, with a median of 8%, showing moist to wet conditions, being generally moist. The wet samples may be contributed by the silt layers in the deposit or the saturated sand at the lower stratigraphy.

The engineering properties of the sand deposit are deduced:

- Moderate frost susceptibility.
- High water erodibility, the fine particles are susceptible to migration through small openings under seepage pressure.
- The shear strength is dependent on the internal friction and soil density.
- In excavation, the sand will slough, run with seepage and boil with a piezometric head of about 0.3 m.
- A good pavement-supportive material, with an estimated California Bearing Ratio (CBR) value of 12% to 15%.

4.4 **Silt** (All Boreholes)

The silt deposit was encountered below the earth fill or sand deposit, at a depth between 1.0 and 5.5m from the prevailing ground surface. It consists of fine sand seams, with trace amount of clay. Grain size analyses were performed on selected samples and the results are presented on Figure 7.

The obtained ‘N’ values range from 13 to 52, with a median of 23 blows per 30 cm of penetration, indicating the silt deposit is compact to very dense, being generally compact in relative density.

The natural water content values of the soil samples range from 11% to 23%, with a median of 19%, showing moist to wet, being generally in very moist or wet conditions.

The engineering properties of the silt deposit are deduced:

- Highly frost susceptible and high soil adfreezing potential.

- High water erodibility, the fine particles are susceptible to migration through small openings under seepage pressure.
- The soil has a high capillarity and water retention capacity.
- The shear strength is density dependent and is susceptible to impact disturbance.
- In excavation, the silt will slough, run with seepage and boil with a piezometric head of about 0.4 m.
- A poor pavement-supportive material, with an estimated CBR value of 3%.

4.5 Compaction Characteristics of the Revealed Soils

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied. As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	Determined Natural Water Content (%)	Water Content (%) for Standard Proctor Compaction	
		100% (optimum)	Range for 95% or +
Earth Fill	9 to 23	10 to 12	6 to 15
Sand	3 to 16 (median 8)	9	5 to 12
Silt	11 to 23 (median 19)	12	7 to 15

Based on the above findings, the majority of the sand deposit is suitable for 95% + Standard Proctor compaction. Where wet material is contacted, it should be stockpiled to allow draining of excess water or aerated by spreading thinly on the ground during the dry and warm weather, before placement and compaction.

The existing earth fill must be subexcavated, sorted free of organics or deleterious material, aerated, before reuse for structural backfill.

5.0 GROUNDWATER CONDITIONS

The boreholes were checked for the presence of groundwater and cave-in occurrence upon completion of drilling. The recorded data are plotted on the Borehole Logs and summarized in Table 2.

Table 2 - Groundwater Level and Cave-in Depth in Boreholes

Borehole No.	Borehole Depth (m)	Ground Elevation (m)	Recorded Groundwater/Cave-In* Level on Completion	
			Depth (m)	**Elevation (m)**
101	6.6	272.8	3.1*	269.7*
102	6.6	274.0	4.8*	269.2*
103	6.6	276.9	4.5	272.4
104	6.6	277.4	4.6	272.8
105	6.6	276.5	4.8*	271.7*
106	6.6	275.3	3.1*	272.2*

Free groundwater or wet cave-in was recorded in the boreholes, at a depth of 3.1 m to 4.8 m from the prevailing ground surface, or between El. 269.2 m and 272.8 m. It represents the groundwater regime at the site at the time of investigation. The groundwater regime appears to be draining in the east direction and is subject to seasonal fluctuation.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation has revealed that beneath a layer of topsoil and earth fill in places, the site is underlain by strata of sand and silt, generally compact to dense in relative density, with loose spots near the existing ground surface. The groundwater regime is apparent in the boreholes, between El. 269.2 m and 272.8 m. It appears to be draining in the east direction and is subject to seasonal fluctuation.

The property will be developed for residential uses. Details of the development, however, is not available at the time of report preparation. It is assumed that the development will consist of low-rise structures with basement.

The geotechnical findings which warrant special consideration are presented below:

1. The topsoil is unsuitable for engineering applications. It must be removed for site development and it can be reused for general landscaping purposes only.
2. After demolition of the existing structures and underground utilities, the cavities must be backfilled with selected on-site material, free of organics and compacted properly in layers.
3. For site grading, it is generally more economical to place an engineered fill for house footings, underground services and pavement construction. Weathered soil and earth fill should be subexcavated, sorted free of organic or other deleterious material, if any, prior to be reused for structural backfill.

4. The basement structures must be founded at least 1.0 m above the highest groundwater level or otherwise, the underground structure will have to be waterproofed or provided with underfloor subdrains for dewatering.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 <u>Site Preparation</u>

The existing buildings on site will be demolished for site development. After removal of the building foundation and underground utilities, the cavities must be backfilled with selected on-site material, free of organics and compacted properly in layers.

For site grading, it is generally more economical to place an engineered fill for house footings, underground services and pavement construction. Prior to site grading, the topsoil must be removed. The weathered soil and earth fill can be upgraded to engineered fill. The engineering requirements for a certifiable fill for pavement construction, municipal services, slab-on-grade, and house footings are presented below:

1. All the existing topsoil must be removed, and the subgrade must be inspected and proof-rolled prior to any fill placement. Badly weathered soils and the existing earth fill should also be subexcavated, sorted free of topsoil inclusions and deleterious materials, if any, aerated and properly compacted in layers.
2. Inorganic soils must be used, and they must be uniformly compacted in 20 cm thick lifts to at least 98% Standard Proctor dry density (SPDD), up to the proposed finished grade. The soil moisture must be properly controlled near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% of the Standard Proctor compaction.
3. If imported fill is to be used, it should be inorganic soils, free of deleterious or any material with environmental issue (contamination). Any potential imported earth fill from off site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before it is hauled to the site.
4. Placement of engineered fill shall be free of any frozen material.
5. If the engineered fill is to be left over the winter months, adequate earth cover, or equivalent, must be provided for protection against frost action.

6. The engineered fill must extend over the entire graded area; the engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented by qualified surveyors.
7. Where the ground is wet due to subsurface water seepage, an appropriate subdrain scheme must be implemented prior to the fill placement.
8. Where the fill is to be placed on sloping ground, the face of the sloping ground must be flattened or benched so that it is suitable for safe operation of the compactor and the required compaction can be obtained.
9. The fill operation must be inspected on a full-time basis by a technician under the direction of a geotechnical engineer.
10. The footing and underground services subgrade must be inspected by the geotechnical consulting firm that inspected the engineered fill placement. This is to ensure that the foundations are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
11. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of the excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for re-certification.
12. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the strip footings and the upper section of the foundation walls constructed on engineered fill will require continuous reinforcement, as designed by a structural engineer, to properly distribute the stress induced by the abrupt differential settlement (estimated to be 15± mm).
13. In sewer construction, the engineered fill is considered to have the same structural proficiency as a natural inorganic soil.

6.2 **Foundations**

Details of the proposed development is not available for review at the time of this report preparation. It is assumed that the development will consist of low-rise structures with basement.

The proposed structures can be constructed on conventional spread and strip footings founded on the native soil or engineered fill. The following bearing pressures are recommended for the design of conventional footings:

- Maximum Soil Bearing Pressure at Serviceability Limit State (SLS) = 150 kPa
- Factored Ultimate Soil Bearing Pressure at Ultimate Limit State (ULS) = 250 kPa

The total and differential settlements of footing designing for SLS are estimated at 25 mm and 20 mm, respectively.

One must be aware that the recommended pressures are given as a guide for foundation design. The footing subgrade must be assessed by a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that the subgrade conditions are compatible with the design of the foundations.

Footings exposed to weathering, or in unheated areas, should have at least 1.5 m of earth cover for protection against frost action.

It should be noted that if groundwater seepage is encountered during footing excavations, or where the subgrade of the foundations is found to be wet, the subgrade should be protected by a concrete mud-slab immediately after exposure. This will prevent construction disturbance and costly rectification.

The foundations should meet the requirements specified in the latest Ontario Building Code, and the structure should be designed to resist an earthquake force using Site Classification ‘D’ (stiff soil).

6.3 Basement Structure

Continuous groundwater is apparent in the sand or silt deposit, between El. 269.2 m and 272.8 m. It is subject to seasonal fluctuation.

The basement floor should be founded at least 1.0 m above the highest groundwater level unless it is waterproofed and designed for hydrostatic uplift pressure. In conventional design, the perimeter walls of the basement structures should be provided with a drainage board and subdrain system at the wall base.

Where groundwater is evident within 1.0 m from the basement floor, underfloor weepers should be provided below the basement floor at 5 m centres. In addition, a 6-mil polyethylene sheet should be provided between the granular bedding and the concrete slab.

The underground structure should be designed for the lateral earth pressure using the soil parameters provided in Section 6.8.

The slab should be constructed on a granular base, not less than 20 cm thick, consisting of 19-mm Crusher-Run Limestone (CRL), or equivalent, compacted to its maximum SPDD. The subgrade for slab-on-grade construction should consist of sound natural soil or properly compacted inorganic earth fill.

The exterior grade should slope away from the building structures to prevent ponding of water adjacent to the buildings.

6.4 **Underground Services**

The subgrade for the underground services should consist of sound natural soils or properly compacted, organic-free earth fill. Where earth fill or weathered soil is encountered, it should be subexcavated and replaced with the bedding material, compacted to at least 95% SPDD.

A Class ‘B’ bedding, consisting of compacted 19-mm CRL, is recommended for the construction of the underground services. Subject to the site condition at the time of construction, a Class ‘A’ concrete bedding should be used where water bearing soil is encountered or ground dewatering is necessary. Alternatively, 19-mm clear stone or high-performance gravel, wrapped with geotextile fabric filter, can be used for the pipe bedding in saturated soils.

The pipe joints into manholes and catch basins should be leak-proof, or wrapped with an appropriate waterproof membrane. Openings to subdrains and catch basins should be shielded with a fabric filter to prevent blockage by silting.

In order to prevent pipe floatation when the sewer trench is deluged with water, a soil cover of at least two times the diameter of the pipe should be in place at all times after completion of the pipe installation.

The on-site subsoil has moderate corrosivity to buried metal. All metal fittings for the underground services should be protected against soil corrosion. In determining the mode of protection, an electrical resistivity of 4500 ohm·cm should be used. This, however, should be confirmed by testing the soil along the service pipe alignment at the time of site service construction.

6.5 Backfilling in Trenches and Excavated Areas

The on-site inorganic soils can be used for backfilling service trenches and excavated areas. Wet soils should be stockpiled to drain away the excess moisture or spread in thin layers to allow aeration prior to placement and compaction.

The backfill in service trenches should be compacted to at least 95% SPDD. In the zone within 1.0 m below the road subgrade, the backfill should be compacted with the water content at 2% to 3% drier than the optimum, and the compaction should be increased to at least 98% SPDD. This is to provide the required stiffness for pavement construction. The lift of each backfill layer should either be limited to a thickness of 20 cm, or the thickness should be determined by test strips.

Any narrow trenches for service crossing should be cut at 1V:2H or flatter, so that the backfill can be effectively compacted. Otherwise, soil arching will prevent the achievement of proper compaction. In normal construction practice, the problem areas of settlement largely occur adjacent to manholes, catch basins, service crossings, foundation walls and columns. In areas which are inaccessible to a heavy compactor, light duty compactor can be used on imported sand backfill.

One must be aware of the possible consequences during trench backfilling and exercise caution as described below:

- When construction is carried out in freezing winter weather, allowance should be made for these following conditions. Despite stringent backfill monitoring, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in-situ soils have a water content on the dry side of the optimum, it would be impossible to wet the soils due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as in a narrow vertical trench section, or when the trench box is removed. The above will invariably cause backfill settlement that may become evident within 1 to several years, depending on the depth of the trench which has been backfilled.
- In areas where the underground services construction is carried out during the winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to final surfacing of the new pavement and the slab-on-grade.

- To backfill a deep trench, one must be aware that future settlement is to be expected, unless the side of the cut is flattened to at least 1V:1.5+H, and the lifts of the fill and its moisture content are stringently controlled; i.e., lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 95% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand. In a trench stabilized by a trench box, the void left after the removal of the box will be filled by the backfill. It is necessary to backfill this sector with sand, and the compacted backfill must be flooded for 1 day, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section.
- In areas where groundwater movement is expected in the sand fill mantle, anti-seepage collars (OPSD 802.095) should be provided. This can be confirmed during construction.

6.6 Driveways, Sidewalks, Interlocking Stone Pavement

Due to the frost susceptible characteristics of the subgrade soils, heaving of the sidewalk and pavement is anticipated during cold weather and the structures should be designed to tolerate the movement.

In order to minimize frost heaving, the driveways at the garage entrances should be backfilled with non-frost-susceptible granular material, with a recommended frost taper at 1V:1H towards the pavement of driveway.

Interlocking stone pavement and landscaping structures in areas which are sensitive to frost-induced ground movement must be constructed on a free-draining, non-frost-susceptible granular material such as Granular ‘B’. The material should extend to 0.3 to 1.2 m below the slab or pavement surface, depending on the degree of tolerance to movement, and be provided with positive drainage, such as weeper subdrains connected to manholes or catch basins. Alternatively, the landscaping structures and interlocking stone pavement should be properly insulated with 50-mm Styrofoam, or equivalent.

6.7 Pavement Design

After site grading, the road subgrade is anticipated to consist of a mixture of sand and silt, having an estimated CBR value of 5% to 10%. The pavement design for local residential road and driveway is presented in Table 3.

Table 3 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL-3
Asphalt Binder	50	HL-8
Granular Base	150	OPSS Granular ‘A’ or equivalent
Granular Sub-base	300	OPSS Granular ‘B’ or equivalent

Prior to the placement of granular bases for road pavement, the subgrade should be proof-rolled. Any soft subgrade identified must be subexcavated and replaced by properly compacted inorganic earth fill. In the zone within 1.0 m below the pavement subgrade, the backfill should be compacted to at least 98% SPDD, with the water content at 2% to 3% drier than the optimum. This is to provide adequate stability for the pavement construction. In the lower zone, a 95% SPDD is considered adequate.

All the granular bases should be compacted to 100% SPDD.

The subgrade will suffer a strength regression if water is allowed to saturate the mantle. The following measures should, therefore, be incorporated in the construction procedures and road design:

- If the pavement construction does not immediately follow the trench backfilling, the subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.
- Lot areas adjacent to the roads should be properly graded to prevent ponding of large amounts of water. Otherwise, the water will seep into the subgrade mantle and induce a regression of the subgrade strength with costly consequences for the pavement construction.
- In extreme cases during the wet seasons, if soft or weak subgrade is identified, it can be replaced by compacted granular material to compensate for the inadequate strength of the soft or weak subgrade. This can be assessed during construction.
- Fabric filter-encased curb subdrains will be required by the Municipality.

6.8 Soil Parameters

The recommended soil parameters for the project design are given in Table 4.

Table 4 - Soil Parameters

Unit Weight and Bulk Factor	**Unit Weight (kN/m^3)**		**Estimated Bulk Factor**	
	Bulk	**Submerged**	**Loose**	**Compacted**
Existing Earth Fill	20.5	10.5	1.25	0.95
Sand and Silt	21.0	11.0	1.25	1.00
Lateral Earth Pressure Coefficients		**Active K_a**	**At Rest K_0**	**Passive K_p**
Compacted Earth Fill		0.35	0.50	3.00
Native Sand or Silt		0.30	0.45	3.30
Estimated Coefficients of Permeability/Percolation Time			**K (cm/sec)**	**T (min/cm)**
Native Sand			10^{-3}	10
Native Silt			10^{-5}	35
Coefficients of Friction				
Between Concrete and Granular Base				0.50
Between Concrete and Sound Native Soils				0.35

6.9 Excavation

Excavation in excess of 1.2 m should be carried out in accordance with Ontario Regulation 213/91. The types of soils are classified in Table 5.

Table 5 - Classification of Soils for Excavation

Material	Type
Earth Fill, Drained Sand or Silt	3
Saturated Soils	4

The groundwater regime is apparent in the boreholes, between El. 269.2 m and 272.8 m. The groundwater yield in shallow excavation above the groundwater regime is anticipated to be slow in rate and limited in quantity; it can be drained to sump pits and removed by conventional pumping. Any excavation extending into the saturated soils will require dewatering from closely spaced sump wells or well points.

Prospective contractors can be asked to assess the in situ subsurface conditions for soil cuts by digging test pits to 0.5 m below the service trench subgrade. These test pits can be allowed to remain open for a period of 4 hours to assess the trenching conditions.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of Bazil Developments Inc., and for review by their designated consultants and government agencies. The material in the report reflects the judgement of Kin Fung Li, P.Eng., and Bennett Sun, P.Eng., in light of the information available to it at the time of preparation.

Use of this report is subject to the conditions and limitations of the contractual agreement. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

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LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0	Field vane test in borehole; the number denotes the sensitivity to remoulding
△	Laboratory vane test
□	Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres

1lb = 0.454 kg

1 inch = 25.4 mm

1ksf = 47.88 kPa

JOB NO.: 2011-S193

LOG OF BOREHOLE: 101

FIGURE NO.: 1

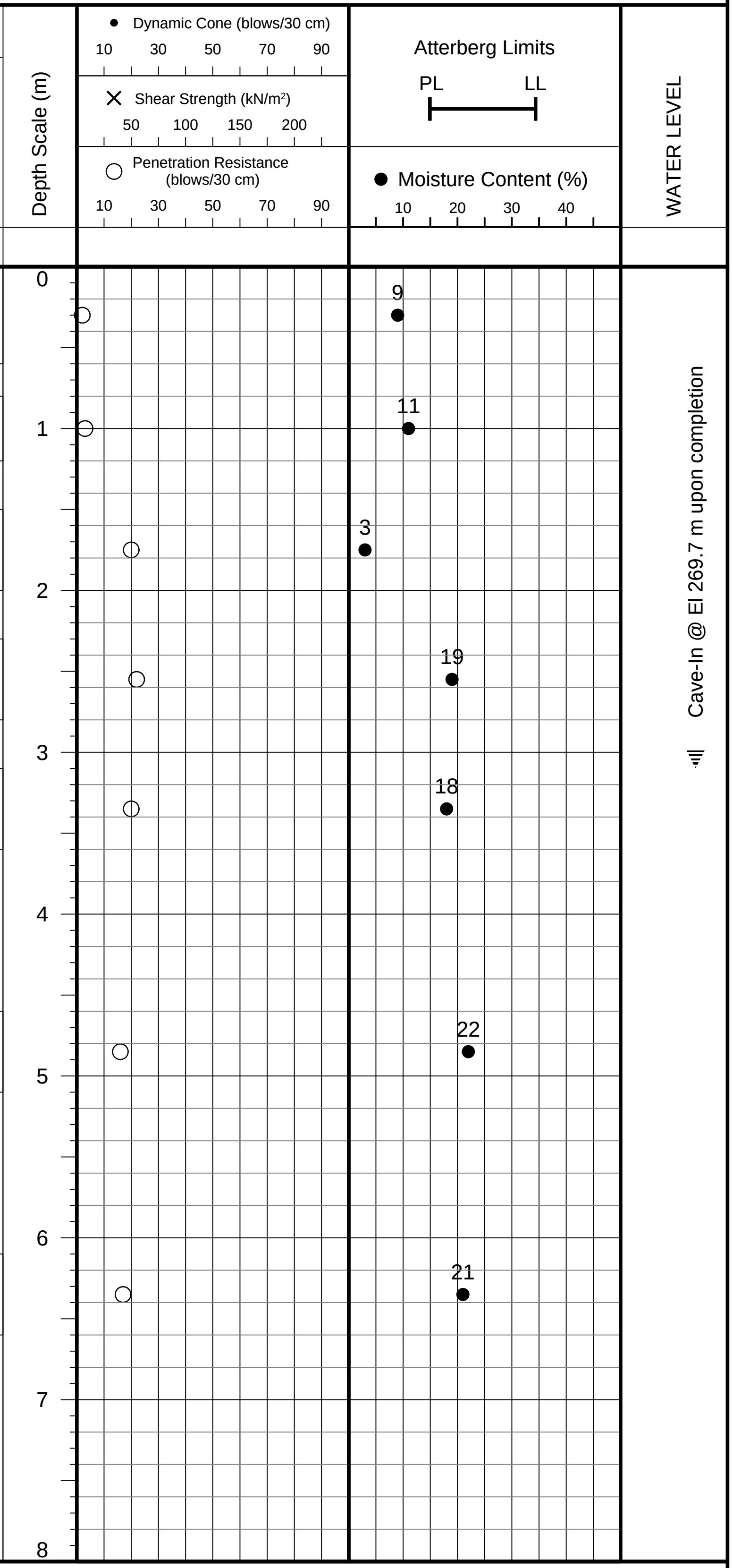
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight Auger

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

DRILLING DATE: December 9, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	N-Value
272.8	Ground Surface			
0.0	**28 cm TOPSOIL**			
	EARTH FILL brown silty sand occ. rootlet and organic inclusions	1	DO	2
		2	DO	3
271.3 1.5	Brown, compact **SAND** fine grained occ. silt seams and layers	3	DO	20
270.4 2.4	Compact **SILT** a trace of clay occ. sand seams and layers	4	DO	22
		5	DO	20
	brown grey	6	DO	16
		7	DO	17
266.2 6.6	**END OF BOREHOLE**			



Soil Engineers Ltd.

JOB NO.: 2011-S193

LOG OF BOREHOLE: 102

FIGURE NO.: 2

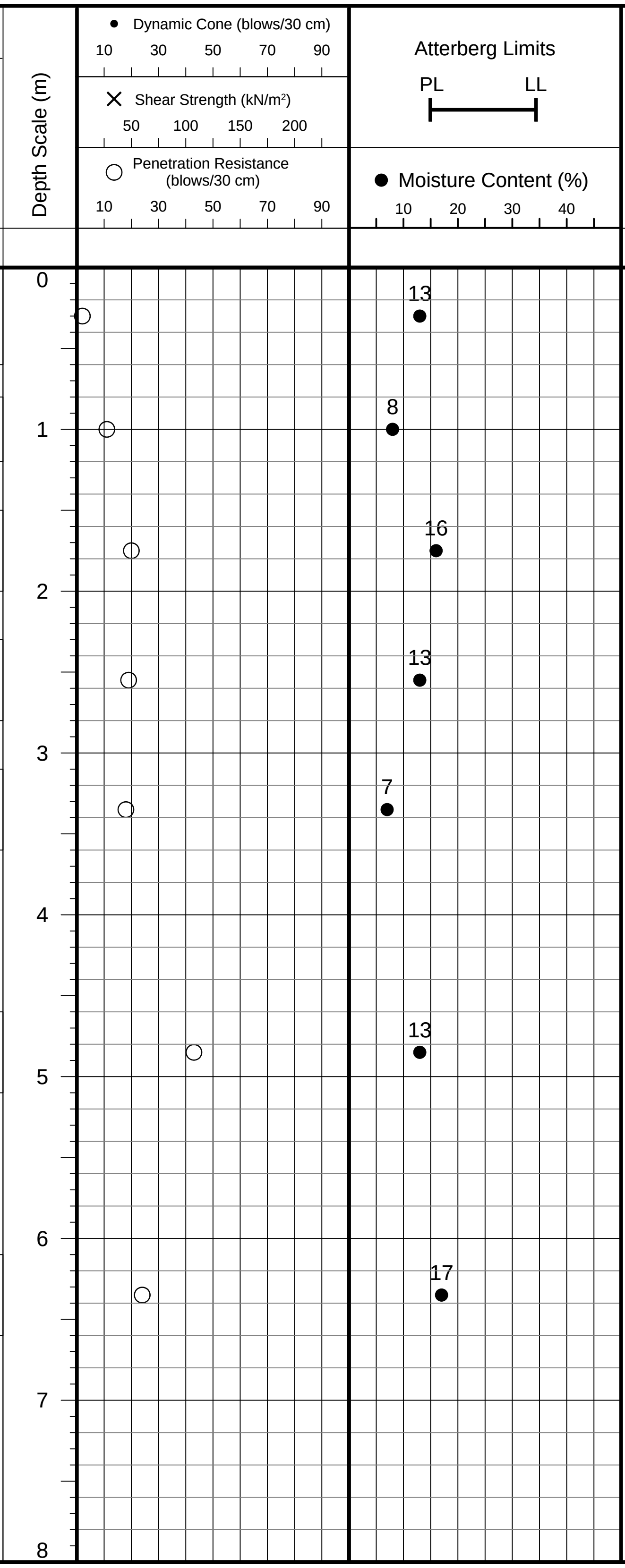
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight Auger

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

DRILLING DATE: December 9, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
274.0	Ground Surface			
0.0	**38 cm TOPSOIL**	1	DO	2
	Brown, very loose to dense **SAND** weathered fine grained, fine to medium grained below 4 m occ. silt seams and layers	2	DO	11
		3	DO	20
		4	DO	19
		5	DO	18
		6	DO	43
268.5 5.5	Grey, compact **SILT** a trace of clay occ. sand seams and layers	7	DO	24
267.4 6.6	**END OF BOREHOLE**			



WATER LEVEL

Cave-In @ El 269.2 m upon completion

Soil Engineers Ltd.

JOB NO.: 2011-S193

LOG OF BOREHOLE: 103

FIGURE NO.: 3

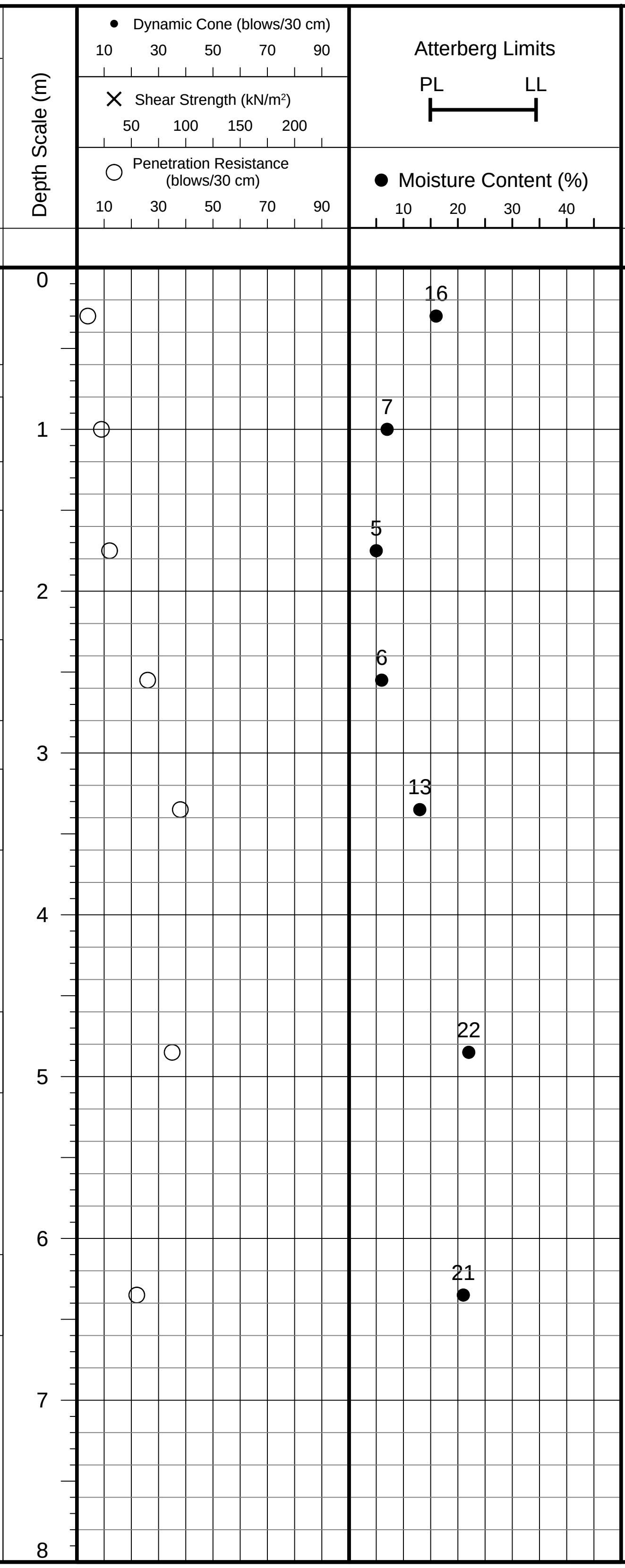
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight Auger

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

DRILLING DATE: December 9, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
276.9	Ground Surface			
0.0	**30 cm TOPSOIL**			
	EARTH FILL dark brown to brown sand and silt occ. topsoil and rootlet inclusions	1	DO	4
275.9 1.0	Brown, compact **SAND** fine grained occ. silt seams and layers	2	DO	9
		3	DO	12
274.4 2.5	Brown, compact to dense **SILT** a trace of clay occ. sand seams and layers	4	DO	26
		5	DO	38
		6	DO	35
		7	DO	22
270.3 6.6	**END OF BOREHOLE**			



WATER LEVEL

W.L. @ El. 272.4 m upon completion ∇

Soil Engineers Ltd.

JOB NO.: 2011-S193

LOG OF BOREHOLE: 104

FIGURE NO.: 4

PROJECT DESCRIPTION: Proposed Residential Development

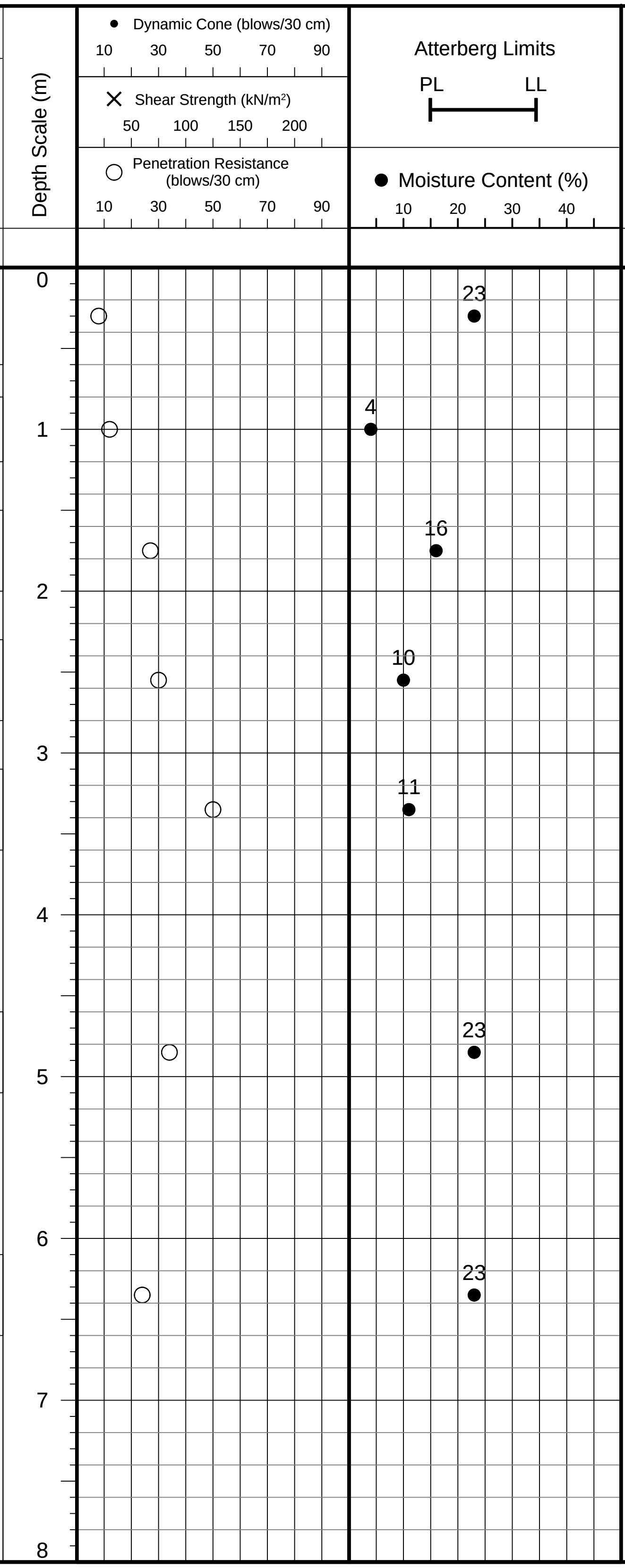
METHOD OF BORING: Flight Auger

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

DRILLING DATE: December 9, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value	Moisture Content (%)	WATER LEVEL
277.4	Ground Surface					
0.0	**25 cm TOPSOIL**	1	DO	8	23	
	EARTH FILL dark brown silty clay with sand occ. topsoil and rootlet inclusions					
276.6 0.8	Brown, compact **SAND**	2	DO	12	4	
275.9 1.5	fine grained occ. silt seams and layers Brown, compact to very dense	3	DO	27	16	
	SILT a trace of clay occ. sand seams and layers	4	DO	30	10	
		5	DO	50	11	
		6	DO	34	23	∇
		7	DO	24	23	
270.8 6.6	**END OF BOREHOLE**					

W.L. @ El. 272.8 m upon completion



Soil Engineers Ltd.

JOB NO.: 2011-S193

LOG OF BOREHOLE: 105

FIGURE NO.: 5

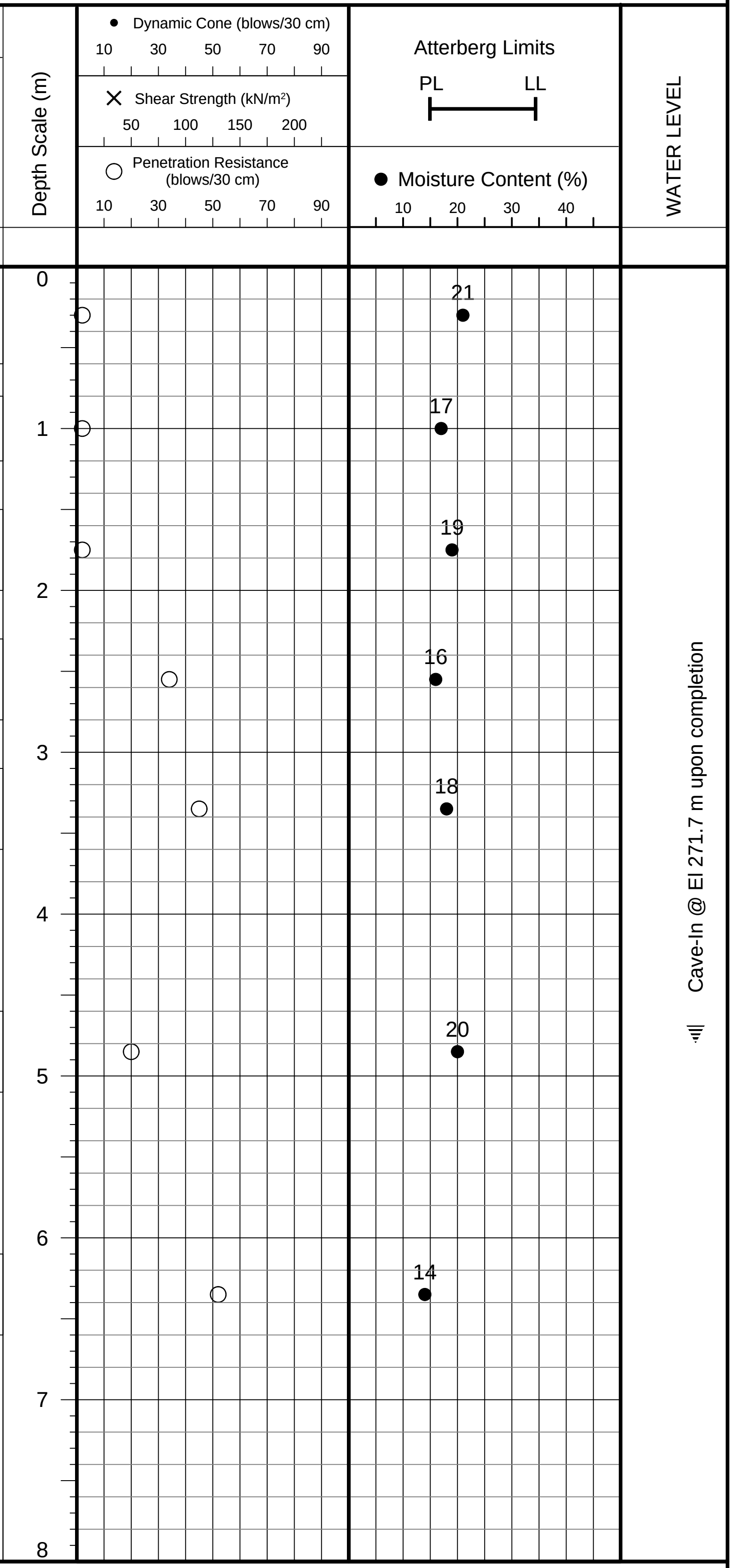
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight Auger

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

DRILLING DATE: December 10, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
276.5	Ground Surface			
0.0	**23 cm TOPSOIL**			
	EARTH FILL dark brown silty clay with sand layers occ. topsoil and rootlet inclusions	1	DO	2
		2	DO	2
		3	DO	2
274.7 1.8	Brown, compact to very dense weathered **SILT** a trace of clay occ. sand seams and layers			
		4	DO	34
		5	DO	45
		6	DO	20
		7	DO	52
269.9 6.6	**END OF BOREHOLE**			



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JOB NO.: 2011-S193

LOG OF BOREHOLE: 106

FIGURE NO.: 6

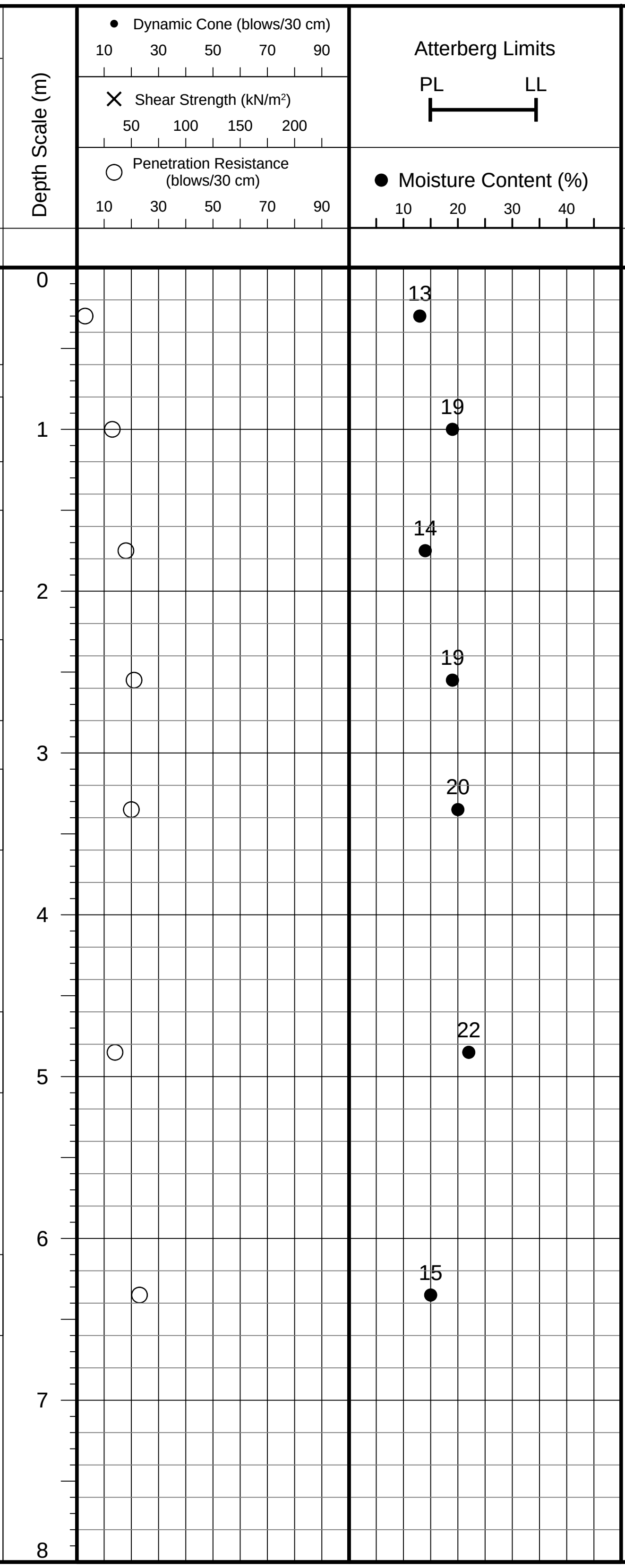
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Flight Auger

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

DRILLING DATE: December 10, 2020

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value
275.3	Ground Surface			
0.0	**20 cm TOPSOIL**			
	Brown, very loose, weathered **SAND** fine grained	1	DO	3
274.3 1.0	Compact **SILT** a trace of clay occ. sand seams and layers	2	DO	13
		3	DO	18
		4	DO	21
		5	DO	20
		6	DO	14
	brown grey			
		7	DO	23
268.7 6.6	**END OF BOREHOLE**			



WATER LEVEL

Cave-In @ El 272.2 m upon completion

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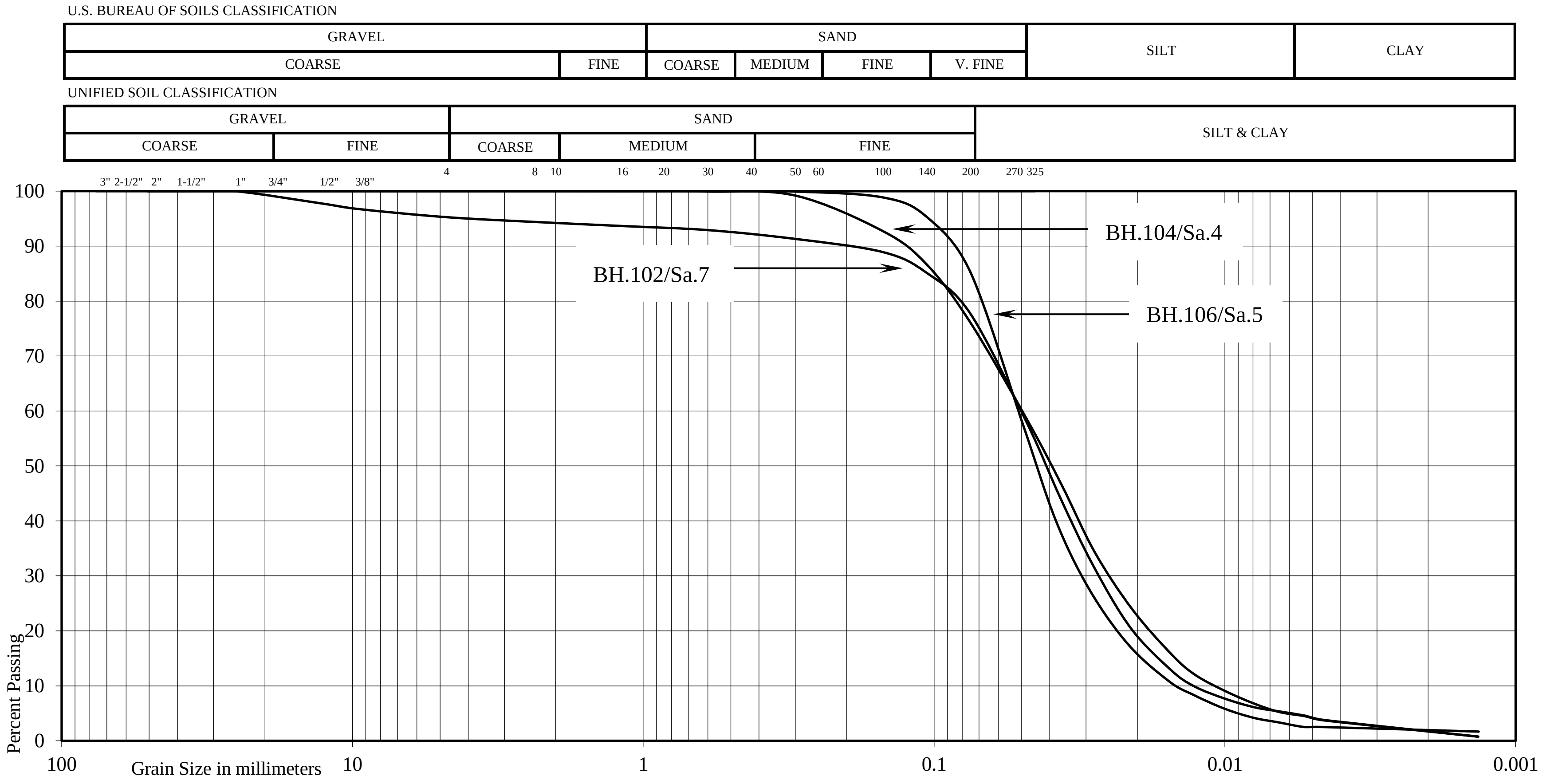
GRAIN SIZE DISTRIBUTION

Reference No: 2011-S193



Project: Proposed Residential Development

Location: 62 Mill Street, Township of Uxbridge

Borehole No:	102	104	106
Sample No:	7	4	5
Depth (m):	6.3	2.5	3.3
Elevation (m):	267.7	274.9	272.0

BH./Sa.	102/7	104/4	106/5
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	17	10	20
Estimated Permeability (cm./sec.) =	10^{-5}	10^{-5}	10^{-5}

Classification of Sample [& Group Symbol]: SILT, some sand to sandy, traces of clay and gravel

Figure: 7

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CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

Borehole Location Plan

SITE: 62 Mill Street, Township of Uxbridge

DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 1
SCALE: 1:1000
REF. NO.: 2011-S193
DATE: January 2021
REV -

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GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE

SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

JOB NO.: 2011-S193
REPORT DATE: January 2021
PROJECT DESCRIPTION: Proposed Residential Development

PROJECT LOCATION: 62 Mill Street, Township of Uxbridge

LEGEND

▩ FILL ⁘ SAND ▥ SILT ▤ TOPSOIL

≡ CAVE-IN ▽ WATER LEVEL (END OF DRILLING)