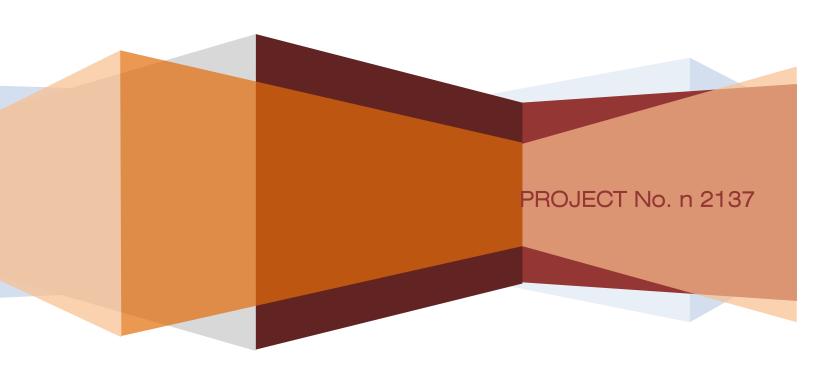
PROPOSED 2 STOREY SHOELESS JOE'S RESTAURANT AT 1144 HUGEL AVENUE, MIDLAND TOWN OF MIDLAND, ONTARIO

Servicing and Stormwater Management Report



Prepared By:



T: 905-597-5937 F: 1.866.340.5265 https://www.narchitecture.com

July 02, 2025

Table of Contents

1.0	INTRODUCTION	4
2.0	STUDY AREA	4
3.0	PROPOSED DEVELOPMENT	
4.0	OBJECTIVES OF STORMWATER DRAINAGE AND SITE SERVICING	
5.0	EXISTING TOPOGRAPHY AND DRAINAGE PATTERN	
6.0	STORMWATER MANAGEMENT CRITERIA	
7.0	STORMWATER MANAGEMENT STUDY	
7.1	Comparison Existing Land Use and Proposed Conditions	6
7.2	Runoff Coefficients	7
7.3	Peak Flow Rates	7
7.4	Peak Flow As per As Built Survey	8
7.5	Post-development Proposed Drainage Pattern and Peak Runoff Flow Rate	8
7.6	Uncontrolled Flow	9
7.7	Comparison of Existing and Proposed Runoff Rates	9
7.8	Quantity Control	10
7.8	8.1 Existing Controlled Discharge Rate	
7.8	8.2 Allowable Discharge Rate	
	8.3 Proposed Orifice Control Flow	
	8.4 Storage for Quantity Control	
7.9	Water Quality Control	11
7.10) Water Balance	11
7.1	10.1 Water Balance Quantity Calculation	11
7.1	10.2 Stormwater Infiltration Chamber	
7.1	10.3 Permeability and Drawdown Calculation for Storm Chamber	12
7.11	Erosion and Sediment Control during Construction	13
8.0	MINOR SYSTEM DRAINAGE	14
9.0	MAJOR SYSTEM DRAINAGE	
10.0	WATER DEMAND AND SERVICE CONNECTIONS	
11.0	SANITARY DEMAND AND SERVICE CONNECTIONS	
13.0	SUMMARY & CONCLUSIONS	16

List of Tables

Table 1 – Comparison between Existing and Proposed Condition Land Use

Table 2 – Runoff Coefficients

Table 3 – Composite Runoff Coefficients

Table 4 – IDF Parameters

Table 5 – Peak Flow as per As Built Survey

Table 6 – Post-development Peak Flow

Table 7 – Uncontrolled Flow

Table 8 – Comparison between Existing and Post-development Flow

Table 9 – Onsite Detention Storage

Table 10 – TSS removal from all LID BMP

Table 11 -Water Balance Volume

List of Figures

Figure 1: Site Location Plan

Figure 2: Site Existing Conditions

List of Appendix

Appendix a - Figures

Appendix B - Flow Analysis

Appendix C - Storm Drainage Design Sheet

Appendix D - Orifice Pipe Sizing, Onsite Detention Storage

Appendix E - OGS Sizing Summary

Appendix F - Stormwater Infiltration Chamber

Appendix G - Water Demand & Fire Flow Calculations

Appendix H - Sanitary Demand & Capacity Analysis

Appendix I - Approved Site Servicing & Grading Plan

Appendix J - Roof Storage

Appendix K- Limiting Condition of Assumptions

Revision No.	Date of Issue	Comments
01	March 01, 2023	Issued for SPA-1
02	May 17, 2023	Re-issued for SPA -1
03	July 02, 2025	Issued for SPA-2

1.0 INTRODUCTION

n Engineering Inc. is retained by the owner of the property to undertake the servicing and stormwater management design for the proposed property development. The purpose of this report is to present the storm water management, sanitary sewage disposal, water distribution and appropriate measures to mitigate the impact of storm runoff from the proposed development and also analyze existing condition of the storm sewer to ensure the ability and accommodation for the post-development.

2.0 STUDY AREA

Site is located at north side of Hugel Avenue in the Town of Midland nearest major intersection is Hugel Avenue and County Road 93. The total area of the property is approximately 0.74 ha. The Key Plan is shown in Figure 1.

A legal and topographic survey has been prepared by F.S. Surveying Inc., dated 14th of April 2022, which identifies the site as part of the east-half of Lot 106 and part of Lot 107 Concession 1, formerly the Township of Tiny, now Town of Midland, County of Simcoe.

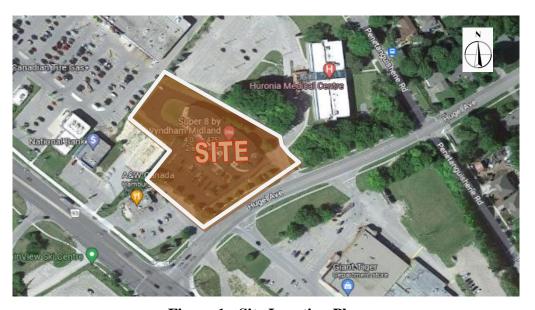


Figure 1 - Site Location Plan

3.0 PROPOSED DEVELOPMENT

The proponent for this site has proposed the addition to the pre-existing structure, while maintaining the current site grades. Comprehensive full-scale plans for site servicing, grading, and storm drainage have been submitted independently.

4.0 OBJECTIVES OF STORMWATER DRAINAGE AND SITE SERVICING

The report outlines proposed stormwater management (SWM) strategies that adhere to design guidelines and pre-consultation feedback from the Town of Midland. The study includes the following:

Page | 4 Project No. n2137

- Identifying the current site's runoff coefficient based on approved site servicing and grading plan acquired from Town;
- Identifying the site's post-development runoff coefficient;
- Assessing the change in "storm water" flow from pre-development to post-development conditions;
- Evaluating the existing "storm water" quality and quantity measures;
- Proposing alterations to the "storm water" quantity and quality control measures if necessary;
- Additionally, the report will discuss new site servicing requirements for water supply and sanitation;
- The proposed site servicing, grading, and erosion and sediment control plans will be submitted separately as full-scale drawings alongside the report.



Figure 2 - Site Existing Condition

5.0 EXISTING TOPOGRAPHY AND DRAINAGE PATTERN

The site encompasses a total area of roughly 0.74 hectares and comprises of a building, parking lot, and grassed area. Stormwater management on the site is currently facilitated by a Stormwater Management System, as delineated in Figure DR-101A attached in Appendix A. As per the approved Site Servicing Plan, the site is serviced by the following connections:

- A 300 mm diameter Storm Sewer that is linked to a Manhole (MH) located on the Town's right-of-way;
- A 100 mm diameter PVC pipe that is connected to the Town's 200 mm diameter Water Main, serving Domestic Water;
- A 150 mm diameter PVC pipe that is connected to the Town's 200 mm diameter Water Main, serving Fire Water;
- A 150 mm diameter Sanitary Sewer that is connected to a Manhole (MH) situated on the Town's right-of-way.

Page | 5

6.0 STORMWATER MANAGEMENT CRITERIA

StormWater Management Criteria for proposed development site determined based on following guidelines and manuals:

- Town of Midland, Engineering Development Design Standard, Revision April 2024;
- Severn Sound Remedial Action Plan Urban Stormwater management Strategy, December 1998;
- Ministry of the Environment Stormwater Management Planning and Design Manual, March 2003;
- Ministry of Environment, Design Guidelines for drinking-Water System, 2008;
- Ministry of Environment, Design Guidelines for the sewage Works, 2008;
- Ministry of Environment, Conservation and Parks V.1.1 July 28, 2022, Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains
- 1991 Toronto Rainfall data from 16 Rain Gauge Stations;
- South Georgian Bay Lake Simcoe Source Protection Plan.

The criteria for proposed development are summarized below:

- Water Quantity Control As per Town of Midland, Engineering Development Design Standard, post development flows from 2 years to 100 years frequency storm shall not exceed the pre development runoff from the same frequency storm;
- Water Quality Control –Stormwater discharged from the post development site are required to meet a minimum 80% TSS removal or an enhanced (Level 1) of protection;
- Water Balance As per pre consultation comment the site is located within the well head protection area Q2 (WHPA-A2) and policy LUP-12 in the Approved South Georgian Bay Lake Simcoe Protection Plan would apply.
- Erosion and Sediment Control During Construction The erosion potential of the study area to assessed using methods described in the MOE (2003) Manual, OPSS and OPSD of temporary erosion and sediment control measures suitable for construction sites close to major roads.

7.0 STORMWATER MANAGEMENT STUDY

7.1 Comparison Existing Land Use and Proposed Conditions

Land use under the proposed development was compared to land-use under existing conditions to assess the changes in runoff flows on the site. The comparison presented in Table 1.

Page | 6 Project No. n2137

LAND USE TYPE	PAVED AREA	ROOF AREA	GRASS AREA	GRAVEL AREA	TOTAL AREA
Existing Condition (m²)	4210.27	1265.50	1981.71	0.00	7457.48
Existing Condition (%)	56%	17%	27%	0%	100%
Proposed Condition (m²)	4867.50	1530.58	946.07	113.33	7457.48
Proposed Condition (%)	65%	21%	13%	2%	100%
Increase/Decrease (%)	8.8%	3.6%	-13.9%	1.5%	

Table 1 – Comparison between Existing and Proposed Condition Land Use

7.2 Runoff Coefficients

Runoff parameters used for site under existing and proposed conditions are as per MECP-Design Criteria for sanitary, storm sewer and force main, dated July 28, 2022 as shown in Table 2.

Table 2 – Runoff Coefficients

Land Use	Runoff Coefficient
Grasses area , parkland	0.15 - 0.35
Impervious Area(Asphalt, Concrete)	0.90-1.00
Impervious Area (Roof Area)	0.90- 1.00
Gravel	0.60- 0.70

Pre-development composite runoff coefficients are calculated based on existing land use and presented in Appendix B (Calculation Sheet 1). Post development catchment area is shown in DR 102 in Appendix A. Calculations for pre-development and post-development imperviousness are given in Appendix B and summarized below:

Table 3 – Composite Runoff Coefficients

Drainage Area	Runoff coefficient 'C'	Runoff coefficient 'C'
	(Post-development- based on As Built Survey)	(Post-development)
Site	0.76	0.85

7.3 Peak Flow Rates

Given the size and characteristics of the site and catchment areas, the rational method used to calculate the peak flows from the subject site under pre-development and post-development conditions. The rainfall-runoff relationship is as follows:

Q = 0.0028CIA

Page | 7 Project No. n2137

Where:

 $Q = Flow in m^3/s;$

A = Effective area of drainage basin in hectares (ha);

C = runoff coefficient; and

I = Rainfall intensity in mm/hr.

$$I = \frac{A}{(t+C)^B}$$

Where,

A, B, & C = Constant

t = Storm Duration (min)

Rainfall intensities were calculated using the rainfall intensity-duration-frequency (IDF) rainfall curve. The IDF values were obtained from the Town of Midland, Engineering Development Design Standard, as shown in Table 4.

Table 4 – IDF Parameters

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	807.440	1135.400	1387.000	1676.200	1973.100	2193.100
В	6.750	7.500	7.970	8.300	9.000	9.040
С	0.828	0.841	0.852	0.858	0.868	0.871

7.4 Peak Flow As per As Built Survey

Peak flows as per as built survey, calculated based on the existing land-use pattern. The calculations are presented in calculation Sheet 1, Appendix B. The results are summarized in Table 5.

Table 5 – Post -development Peak Flow (As per As built Survey)

2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
99.79	131.02	151.96	178.04	197.92	217.59

(Unit of measurement L/sec)

7.5 Post-development Proposed Drainage Pattern and Peak Runoff Flow Rate

The proposed site development includes a mix of paved and grassed areas as well as a building. Proposed site grades designed to ensure that vehicular access will be unimpeded as well as provide surface storage for rainfall events. For the proposed development condition, the site is divided into sub-catchments as shown in Figure DR 102 (Appendix A). Runoff from these sub-catchments flows through existing inlets as presented in Site Servicing Plan (Drawing C2).

Post-development peak flow are calculated and presented in Calculation Sheet 2, Appendix B. The results are summarized in Table 6.

Page | 8 Project No. n2137

Table 6 – Post-development Peak Flow (Proposed)

2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
111.02	145.77	169.07	198.08	220.21	242.09

(Unit of measurement L/sec)

7.6 Uncontrolled Flow

Approved grading plan indicates that grassed area along property line left uncontrolled. Due to the grading limitation, drainage area UC1 as shown in figure DR102 is considered to be uncontrolled area. The uncontrolled flow is deducted from allowable flow to be discharge into the municipal storm system. The calculation of flow for the cumulated uncontrolled is shown on calculation sheet 3 Appendix B and the results are summarized below in Table 7.

Table 7 – Uncontrolled Flow

2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
1.85	2.48	2.94	3.47	3.89	4.24

(Unit of measurement L/sec)

7.7 Comparison of Existing and Proposed Runoff Rates

Flow rates under different storm events calculated for both existing and proposed conditions using the Rational Method. Catchment areas and hydrologic parameters determined using the available landuse information and topographic maps (as shown in Figures DR-101A and DR-102 in Appendix A).

The primary goal of the drainage and hydrologic analysis is to examine the effect of the development on local storm drainage. This analysis used to create goals for the storm water management design. Table 8 presents the peak flow rates comparison for both existing and proposed conditions calculated for the entire site, while the detailed flow calculations are presented in Appendix B. It should be noted that the post-development flows in Tables 6 and 8 are to address the impact of the development only, and do not represent the final stormwater management design flows.

Table 8 – Comparison between Existing and Post-development Flow

CODITIONS/FLOW (L/SEC)	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years
FLOW AS PER AS BUILT SURVEY	99.79	131.02	151.96	178.04	197.92	217.59
POST-DEVELOPMENT CONDITION	111.02	145.77	169.07	198.08	220.21	242.09
INCREASE(DESCREASE)	11.23	14.75	17.11	20.04	22.28	24.50

Page | 9 Project No. n2137

7.8 Quantity Control

7.8.1 Existing Controlled Discharge Rate

As per Approved Site Servicing Plan (prepared by Schad Engineering dated September 2005) – the stormwater flow from the Site to municipal Storm Sewer is being controlled by a 124mm diameter Orifice Plate. Existing controlled flow from the site based on 124mm Orifice Plate and 246.50 HWL are calculate and included in Appendix D as Table 1A.

7.8.2 Allowable Discharge Rate

Allowable discharges (2 to 100 years) are calculated by deducting the uncontrolled flows from the existing controlled flow mentioned in section 7.8.1. Detail calculations are provided in Appendix D.

Allowable flow from the site = Designed Controlled flow – Uncontrolled flow

7.8.3 Proposed Orifice Control Flow

Stormwater discharge from the site proposed to be controlled by orifice plate of 118mm dia. orifice plate. This Orifice proposed to replace existing 124mm diameter. For location of the proposed Orifice – refer Drawing C2. Orifice sizing calculations are attached in Appendix D as Table 1B.

7.8.4 Storage for Quantity Control

Required detention storage calculated based on proposed controlled flow and presented in Appendix D (Table 2A–2F). Allowable discharge rate, controlled flow rate and required detention storage is summarized in Table 9. The detention storage required based on 100 years rainfall event will be the maximum storage to be provided for the proposed development. Storage calculations are attached in Appendix D and summarized below in Table 9.

Table 9 – On-site Detention Storage:

Description	Quantity (m ³)
Required Storage	214.87
Catch Basin and Manhole	11.99
Pipes	29.87
Surface Ponding	141.71
Roof Top Storage (Refer Appendix J for details)	7.64
Stormwater Detention Chamber	31.41
Total Detention Storage Proposed	222.62

Page | 10 Project No. n2137

7.9 Water Quality Control

Quality control proposed to be achieved by using soft landscaped areas and an Oil/Grit Separator (OGS). The summary of total TSS removal from all Low Impact Development (LID) Best Management Practices (BMP) as shown in Table 10.

As per the attached Detailed Stormceptor Sizing Report (Appendix E) for the proposed site indicates that Stormceptor STC 1000 is will adequate to provide 80% of TSS removal. However, as per the servicing plan for super 8 motel provided by the Town, Stormceptor Model STC -1500 was designed – will provide adequate capacity to address the additional flow quality control from the site. Hence, existing Stormceptor model STC-1500 is used for quality control.

Surface Type	Treatment Method	Area(m ²)	Effective TSS Removal	% Area of Site	Overall TSS Removal (%)
Landscape	Inherent	946.1	80	12.69	10.15
Rooftop	Inherent	1530.6	80	20.52	16.42
Asphalt/Concrete Pavement	OGS(STC- 1500)	4867.5	80	65.27	52.22
Gravel	Inherent	113.3	80	1.52	1.22
Total		7457.5		100.00	80.00

Table 10-TSS removal from all LID BMP

7.10 Water Balance

7.10.1 Water Balance Quantity Calculation

According to the Town's pre consultation comment, the property is located within the Wellhead Protection Area Q2 (WHPA-A2) and policy LUP-12 in the Approved South Georgian Bay Lake Simcoe Source Protection Plan would apply.

A Hydrogeological investigation was carried out for the site by Fisher engineering. Please refer to Hydrogeological investigation report prepared by Fisher Engineering dated 3rd May 2023 section 9 and Appendix F for water balance analysis detail. The summary of the water balance quantity is as below:

As per section 9 of the Hydrogeological investigation report, the average annual precipitation for the site is 1040.60 mm/year with an adjusted potential evapotranspiration of 613.74mm/year giving a water surplus of 408.86mm/year.

Post- Development Recharge:

Deficit in Infiltration: 247 m³/yr

Total Area: 7457.48m²

Deficit in Infiltration: $247 \times 1000 / (7457.48) = 33.12 \text{ mm/yr}$

Page | 11 Project No. n2137

Annual precipitation percentage require for precipitation depth is calculated as:

Annual precipitation for the site = 1040.60 mm/yr

% Annual Rainfall = 33.12/1040.60 = 3.19%

Based on % of total annual rainfall depth vs. daily rainfall amount curve derived from 1991 Toronto rainfall data from 16 rain gauge stations (Attached in Appendix F), statistically 100% of average rainfall event depths are 40mm and less, which means that if the proposed infiltration facility can capture 40mm rainfall event, it will capture 100% of total annual rainfall volume.

For 3.19% annual rainfall event the daily rainfall depth is 1.00 mm. Therefore, require quantity for water balance = 7457.48*(1.0/1000) m³ = 7.45 m³

7.10.2 Stormwater Infiltration Chamber

To accommodate the necessary retention storage a storm water infiltration chamber (Model SC-310 or eq.) is proposed. Sizing and outlet location of the infiltration chamber was selected in a manner to ensure that sufficient retention volume is provided. Volume of water proposed to be retained by the stormwater infiltration chamber unit has been provided by the manufacturer. Location of the chamber is shown in Drawing C 2. Required and proposed storage capacity of stormwater infiltration chamber is summarized in Table 11 and the details are presented in Appendix F.

Table 11: Water Balance Volume

Description	Volume (m ³)
Total volume of Chamber (m³)	39.83
Volume provided for Detention (m³)	31.41
Required Volume for Retention (m ³)	7.45
Volume Provided for Retention (m ³)	8.42

7.10.3 Permeability and Drawdown Calculation for Storm Chamber

The site was evaluated for potential application of infiltration based area. The Hydrogeological investigation carried out for the project by Fisher Engineering dated 3rd May 2023 provides the data regarding water table and permeability of underlying soils.

As per Hydrogeological investigation report section 10 by Fisher Engineering, the estimated infiltration rate using factor of safety of 2.0 is 150 mm/hr.

The proposed storm water chamber (Model SC-310) bottom elevation will be 244.26 m and surface elevation will be 245.77 m at this elevation, the infiltration rate is 150 mm/hr.

The proposed water balance volume to be infiltrated is 8.42 m³. The Ministry of Environment's Stormwater Management and Planning Manual, March 2003 method of

Page | 12 Project No. n2137

infiltration will be implemented. The infiltration of this remainder volume of runoff will be through a pervious bottom of an underground device.

This Manual sizes the bottom area of the infiltration device by applying the following equation:

$$A = \frac{1000 V}{Pn\Delta t}$$

Where A = Bottom area of the infiltration trench (m^2)

V = Runoff volume to be infiltrated (m³)

P = Percolation rate of surrounding native soil (mm / hr.)

n = Porosity of the storage media (0.4 for storm chambers)

 Δt = Retention time (48 hours)

The above equation assumes that all of the infiltration occurs through the bottom of the device.

The retention time in the underground device is calculated on the conservative side, namely 48 hours.

Substituting the known values in the above equation:

$$A = (1000 \times 8.42 \text{m}^3) / (150 \text{ mm per hour } \times 0.40 \times 48 \text{hours}) = 2.92 \text{ m}^2$$

It is proposed to provide an open bottom storm chamber with an available bottom surface area of 104.73m². The maximum draw down time considering safety correction factors for the provided storm chamber will be 1.34 hrs.

Hence, proposed storm chamber with a retention volume of 8.42m³ for infiltration will satisfy water balance volume recharge requirement for the well head protection area Q2 (WHPA-A2) and policy LUP-12 in the Approved South Georgian Bay Lake Simcoe Source Protection Plan.

7.11 Erosion and Sediment Control during Construction

During Site construction, various temporary measures will be implemented to prevent the discharge of sediment laden Stormwater from the Site. These measures include silt fencing, catch basin buffers and mud-mats.

In addition to the above, the following "good housekeeping" measures are recommended:

 All exposed soil shall be stabilized as soon as possible with a seed and mulch application as directed by the Engineer.

Page | 13 Project No. n2137

- No construction activity or machinery shall intrude beyond the silt/snow fence or limit of construction area. All construction vehicles shall leave the site at designated locations as shown on the plans.
- Stockpiles of soil shall be set back from any watercourse and stabilized against erosion as soon as possible. A set back of at least 15m from any top-of-bank, watercourse or pond is required.
- Cleaning and repairs of mud-mats and any other temporary sediment control measures shall be completed as deemed necessary through regular inspection.
- Sediment/slit shall be removed from the sediment control devices after storm events and deposited in areas as approved by the engineer.
- All re-graded areas within the development which are not occupied by buildings, roadways, sidewalks, or driveways shall be top-soiled and sodded/seeded immediately after completion of final grading operations as directed by the engineer.

8.0 MINOR SYSTEM DRAINAGE

The minor storm drainage system (designed for the 2-year storm event) conveys stormwater to the existing municipal storm sewer system (refer to Drawing C2). Based on the approved plans, the analysis indicates that certain sections of the minor storm sewer—specifically from CB7 to STM MH4, Roof to STM MH4, and STM MH4 to STM MH5— flow exceed their capacity under existing conditions (refer to Storm Sewer Design Chart , Appendix C). Therefore, these segments are proposed to be replaced with upsized storm sewers. The storm sewer analysis for the post-development condition is provided in Appendix C.

9.0 MAJOR SYSTEM DRAINAGE

The overland flow impact on the building is not anticipated since the grading of the site designed for runoff from greater than 100 years rainfall event proposed to flow as overland flow through the south entrance without any impact to proposed buildings and adjacent site. Overland flow direction presented in Grading Plan (Drawing C1).

10.0 WATER DEMAND AND SERVICE CONNECTIONS

Water Demand

According to Town's design standards watermain design criteria, average demand for the commercial development is 450 L /Cap/ day.

Page | 14 Project No. n2137

Average Daily Demand for Restaurant = 0.01 L/s

Max. Daily demand peak factor =2.0

Max. Hourly Peak Factor = 4.5

Max. Day Demand = 1.37 L/s

Max. Hourly Demand = 3.08 L/s

The anticipated water demand for this development is 3.08 L/s for domestic use. Please refer Appendix G for water demand calculations.

As per servicing plan provided by Town for super 8 Motel, the existing motel is serviced by 100 mm watermain which is adequate for water service for additional restaurant. Therefore, the additional restaurant is proposed to be served by the existing 100mm domestic water supply.

Fire Flow Demand:

As per Fire Underwriter Survey, Fire flow demand calculated and presented in Appendix G.

Required Fire Flow: 33 L/Sec

A flow and pressure test will be performed on the nearest hydrant to the site, prior to building permit application to determine compliance with the minimum requirement for suppression outlined in the FUS.

As per servicing plan provided by Town for super 8 Motel, the existing motel is serviced by 150 mm fire watermain which is adequate for fire water service for additional restaurant. Therefore, the additional restaurant is proposed to be served by the existing 150mm fire water supply.

11.0 SANITARY DEMAND AND SERVICE CONNECTIONS

Sanitary Design Flow:

Sanitary design flow is calculated as per Town of Midland, Engineering Development Design Standard. The detail calculation are attached in Appendix H and summarized as below:

The average daily flow for commercial development = 2.5 L/day.m² of floor area. Maximum design flows are to be determined using average daily flow and the Harmon Peaking Factor.

Harmon's Peaking Factor is calculated based on the formula:

$$M = 1 + \frac{14}{4 + P^{0.50}}$$

Where M= ratio of peak flow to average flow

P = tributary population in thousands

Page | 15 Project No. n2137

Inflow/ Infiltration allowance is 0.23 l/sec/ha

The peak sanitary design flow from the proposed development is:

```
Total Flow = Infiltration + design flow
Total flow = (0.172 + 0.69) L/s = 0.86 L/s = 0.000868 m<sup>3</sup>/sec
```

Sanitary Service Connection

By considering the min velocity of 0.75 m/sec the size of pipe is as below:

Q = AV
$$\rightarrow$$
 0.000868 = A x 0.75
A = 0.00115 m² \rightarrow D= 38.39 mm \rightarrow D= 50 mm

As per servicing plan provided by Town for super 8 Motel, the existing motel is serviced by 150 mm sanitary sewer pipe which is adequate for flow generated by additional restaurant. Therefore, the additional restaurant is proposed to be served by the existing 150mm sanitary service connection.

13.0 SUMMARY & CONCLUSIONS

This analysis presents a detailed stormwater management control plan addressing both quantity and quality controls required to meet all design criteria. Drainage boundaries have been established to estimate flows to the proposed drainage collection system for the site in order to develop a comprehensive drainage and stormwater management plan for the proposed development. There will be no negative impact or increase in stormwater peak flows under proposed controlled conditions. The drainage summary of our findings and drainage analysis for the subject property is as follows:

- Stormwater management design was performed for the subject site to provide flow quantity and quality control;
- The hydrologic and hydraulic analysis presented in this report addresses the existing and proposed site conditions;
- External agencies' criteria were collected and reviewed during the course of the study and all other available information was retrieved and reviewed;
- Impervious areas were calculated under both existing and proposed conditions and as expected, a significant increase in impervious areas was found;
- Preliminary design was performed for the proposed storm sewer network to convey the minor system runoff;
- Recommended quantity control measures for the site will be achieved through the use of a orifice plate;

Page | 16 Project No. n2137

- Adequate stormwater runoff storage for large design storms will be achieved through storage in manhole, catchbasin, pipes, storm chamber and surface ponding;
- An Oil/Grit Separator recommended to ensure the required water quality control will be achieved;
- Adequate Erosion and Sediment Control measures have been proposed; and
- These measures will provide the necessary quantity and quality control to meet the criteria provided by the Town of Midland.

We trust that this proposed stormwater management plan will provide appropriate service to the proposed site.

Respectfully Submitted,

n Engineering Inc

A.S.ZIAUDDIN 100233432 02.07.2025

Abu. S. Ziauddin M. Eng P. Eng. Municipal Project Manager

Lakhnoth Unadhvaya

Lekhnath Upadhyaya- EIT-M.Eng MUNICIPAL PROJECT DESIGNER

Page | 17 Project No. n2137

Appendix A Figures





CHECKED BY: AZ PROJECT NO.:

21-37 **AS PER SURVEY PLAN** PRE-DEVELOPMENT **DRAINAGE PLAN**

DRAWING NO.: SCALE: 1:1000

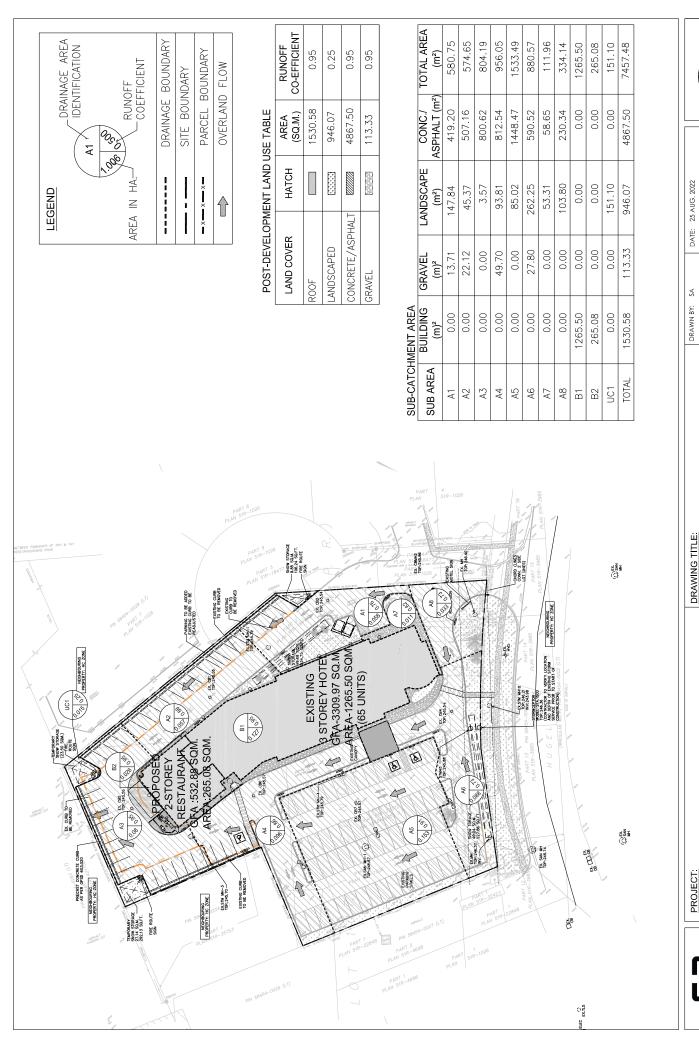
DR-101A

MIDLAND, ONTARIO

1144 HUGEL AVE RESTAURANT

n Engineering Inc

SHOELESS JOE'S





POST-DEVELOPMENT DRAINAGE PLAN

DRAWING NO. SCALE: 1:1000 21-37 CHECKED BY: AZ PROJECT NO.:

DR-102

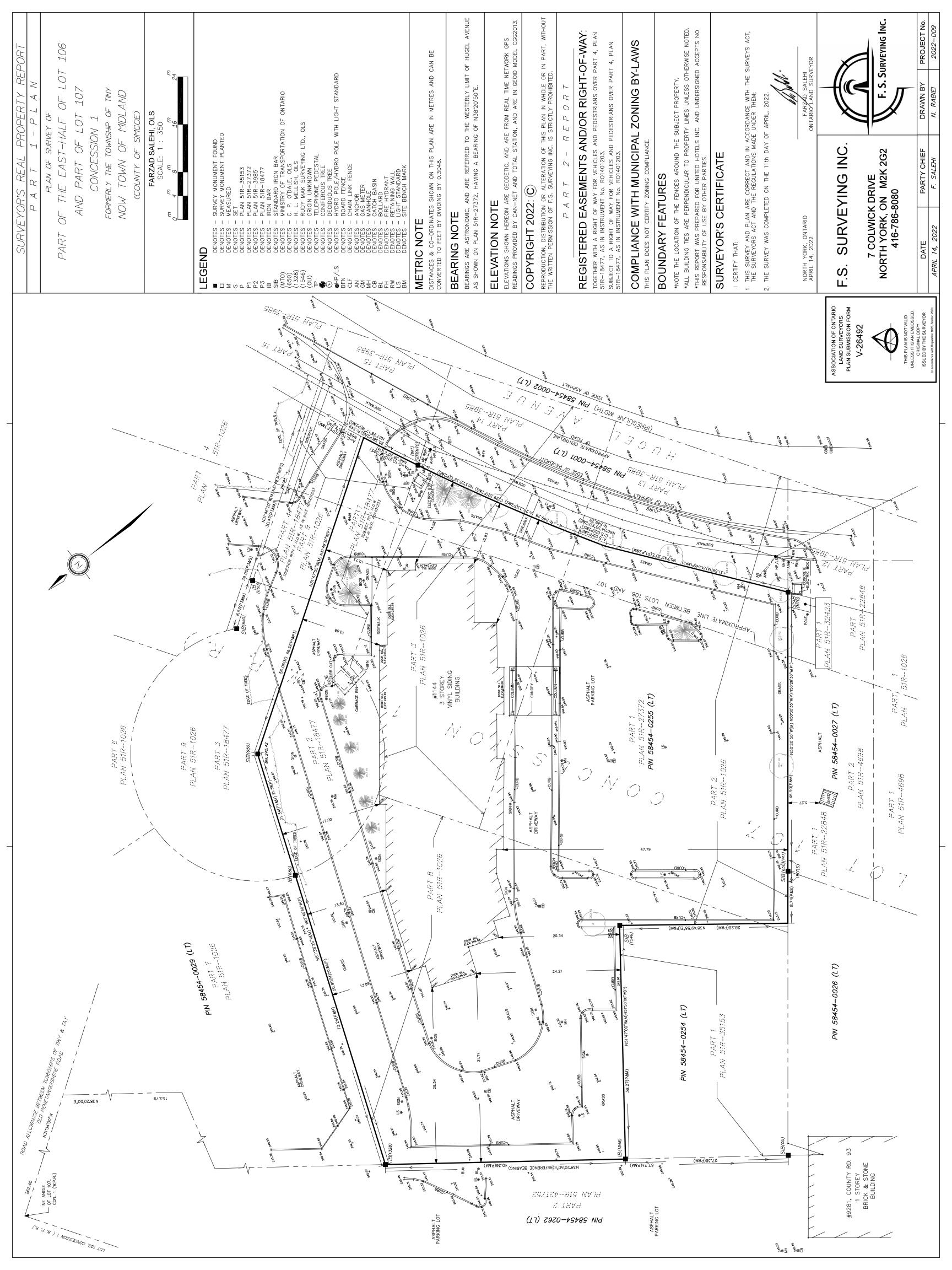
PROJECT NORTH

n Engineering Inc

MIDLAND, ONTARIO

1144 HUGEL AVE RESTAURANT

SHOELESS JOE'S



Appendix B Flow Analysis



Calculation Sheet 1

(Based on As Built Topographic Survey)

Project:	SHOELESS JOE'S RESTAURANT	
Address:	1144 HUGEL AVENUE	
Town/Township/City	TOWN OF MIDLAND	
Project No.	n2137	
Proposed Development Area (m ²)	7457.48	

POST-DEVELOPMENT RUNOFF COFFICENT(AS PER AS BUILT SURVEY)

AREA TYPE	AREA (M ²)	RUNOFF COEFFICIENT "C"	AREA x C
ROOF	1265.50	0.95	1202.23
LANDSCAPED AREA	1981.71	0.25	495.43
CONC./ASPHALT	4210.27	0.95	3999.76
		ΣΑΚΕΑ Χ С	5697.41
	WEIGH	ITED AVERAGE "C"	0.76
	AR	EA "A" (Hectares)	0.75

Rainfall Intensity:

$$i = \frac{A}{\left(t + B\right)^C}$$

Where:

i = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

C = coefficient

t =Time of concentration (min)

15.00

Design Flow:

$$Q = 0.0028 \, xAxCxI$$

Where:

Q= design flow (m3/s)

c = runoff coefficient (dimensionless)

i = average rainfall intensity (mm/hr)

A = drainage area (ha)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
Α	807.440	1135.400	1387.000	1676.200	1973.100	2193.100
В	6.750	7.500	7.970	8.300	9.000	9.040
С	0.828	0.841	0.852	0.858	0.868	0.871
t (mins)	15.00	15.00	15.00	15.00	15.00	15.00
i (mm/hr)	63.05	82.79	96.02	112.50	125.06	137.49
Weighted Avg. C	0.76	0.76	0.76	0.76	0.76	0.76
Q (I/sec)	99.79	131.02	151.96	178.04	197.92	217.59
Pre-development Flow(m³/sec)	0.100	0.131	0.152	0.178	0.198	0.218

Last updated 7/3/2025



Calculation Sheet 2

n Engineering Inc

Project:	SHOELESS JOE'S RESTAURANT	
Address:	1144 HUGEL AVENUE	
Town/Township/City	TOWN OF MIDLAND	
Project No.	n2137	
Proposed Development Area (m ²)	7457.48	

POST DEVELOPMENT RUNOFF COFFICENT

AREA TYPE	AREA (M ²)	RUNOFF COEFFICIENT "C"	AREA x C
ROOF	1530.58 0.95		1454.05
LANDSCAPED AREA	946.07	0.25	236.52
CONC./ASPHALT	4867.50	0.95	4624.13
GRAVEL	113.33	0.60	68.00
		ΣΑΡΕΑ Χ С	6382.69
	WEIGH	TED AVERAGE "C"	0.85
	ARI	EA "A" (Hectares)	0.75

Rainfall intensity:

$$i = \frac{A}{\left(t + B\right)^{C}}$$

Where:

i = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

C = coefficient

t =Time of concentration (min)

15.00

Design Flow:

$$Q = 0.0028 \, xAxCxI$$

Where:

Q= Design flow (m^3/s)

c = Runoff coefficient (dimensionless)

i = Average rainfall intensity (mm/hr)

A = Drainage area (ha)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
A	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
В	6.750	7.500	7.970	8.300	9.000	9.040
С	0.828	0.841	0.852	0.858	0.868	0.871
t (mins)	15.00	15.00	15.00	15.00	15.00	15.00
i (mm/hr)	63.05	82.79	96.02	112.50	125.06	137.49
Weighted Avg. C	0.85	0.85	0.85	0.85	0.85	0.85
Q (I/sec)	111.02	145.77	169.07	198.08	220.21	242.09
Q(m³/sec)	0.111	0.146	0.169	0.198	0.220	0.242

Design Sheet Last updated 7/3/2025



Calculation Sheet 3

(Uncontrolled Flow)

n Engineering Inc

Project:	SHOELESS JOE'S RESTAURANT	
Address:	1144 HUGEL AVENUE	
Town/Township/City	TOWN OF MIDLAND	
Project No.	n2137	
Proposed Development Area (m ²)	7457.48	

POST DEVELOPMENT RUNOFF COFFICENT (Uncontrolled)

AREA TYPE	AREA (M ²)	RUNOFF COEFFICIENT "C"	AREA x C
ROOF	0.00	0.95	0.00
LANDSCAPED AREA	151.10	0.25	37.78
CONC./ASPHALT	0.00	0.95	0.00
		ΣΑΡΕΑ Χ С	37.78
	WEIGH	ITED AVERAGE "C"	0.25
	ARI	EA "A" (Hectares)	0.02

Rainfall intensity: $i = \frac{A}{(t+B)^C}$

Where:

I = Rainfall Intensity (mm/hr)

A = coefficient

B = coefficient

C = coefficient

t =Time of concentration (min) 15.00

Design Flow:

$$Q = 0.0028 \, xAxCxI$$

Where:

Q= design flow (m3/s)

C = runoff coefficient (dimensionless)

I = average rainfall intensity (mm/hr)

A = drainage area (ha)

Return Period (Years)	2 -Years	5-Years	10 -Years	25 -Years	50 -Years	100-Years
Α	807.44	1135.40	1387.00	1676.20	1973.10	2193.10
В	6.750	7.500	7.970	8.300	9.000	9.040
С	0.781	0.766	0.760	0.757	0.751	0.759
t (mins)	15.00	15.00	15.00	15.00	15.00	15.00
l (mm/hr)	176.64	236.56	279.75	330.24	371.17	403.96
С	0.25	0.25	0.25	0.25	0.25	0.25
Q (I/sec)	1.85	2.48	2.94	3.47	3.89	4.24
Q(m³/sec)	0.002	0.002	0.003	0.003	0.004	0.004

Appendix C Storm Drainage Design Sheet



L.U. 03-Jul-25 PREPARED BY: DATE PREPARED

Storm Sewer Design Chart

	g Full	RANT	터		
)	Circular Drains Flowing Full	ELESS JOE'S RESTAURANT	1144 HUGEL AVENUE	TOWN OF MIDLAND	

· Drains Flowing Full OE'S RESTAURANT UGEL AVENUE OF MIDLAND
--

807.44 6.75 0.83

а ပ

Constants 2 -yrs IDF CURVE

			Remark							Storm sewer To Remain						Sewer Upsized	Sewer Upsized	Sewer Upsized	Storm sewer	To Remain
0.83			% FLOW		%9 †	46%	%9	%09	%85	74%	%69	74%	10%	10%	%66	<i>%11</i> %	47%	%08	Orifice	Flow
3			TIME	SECT. (min)	0.33	0.12	0.03	29.0	20.0	0.54	0.28	50.0	80.0	0.03	69.0	0.12	0.11	75.0	0.03	60.0
	_		MATION	(m/s)	1.012	1.012	1.012	1.143	1.012	1.143	1.012	1.012	1.617	1.617	1.171	1.143	1.617	1.557	1.143	1.143
		Hydraulics	N INFOR	Q full (m ³ /s)	0.050	0.050	0.050	0.081	0.050	0.081	0.050	0.050	0.114	0.114	0.083	0.081	0.114	0.248	0.081	0.081
		Hyc	R DESIG	length (m)	20.0	7.0	2.0	46.0	4.0	37.0	17.0	3.0	8.0	2.5	44.0	8.0	11.0	35.0	2.0	6.0
			STORM SEWER DESIGN INFORMATION	slope (%)	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	1.00	1.00	0.53	0.50	1.00	0.54	0.50	0.50
			STOR	size (mm)	250	250	250	300	250	300	250	052	300	300	300	300	300	450	00ε	300
		ology	Peak Flow (m ³ /sec)	Q _{2-yrs}	0.023	0.023	0.003	0.049	0.029	090.0	0.034	0.037	0.011	0.011	0.082	0.063	0.054	0.198	0.258	0.258
j	SNOL	Hydrology	Rainfall Intensity,	\mathbf{I}_2	161.20	161.20	161.20	161.10	161.20	161.06	161.20	161.20	161.20	161.18	161.09	161.20	161.20	160.89	160.77	160.76
n2137	ENT CONDI		. و	(mm)	15.00	15.00	15.00	15.33	15.00	15.44	15.00	15.00	15.00	15.08	15.36	15.00	15.00	15.99	16.36	16.39
Project No. n2137	POST DEVELOPMENT CONDITIONS		ACC.	ΣA x R	0.05	0.05	0.01	0.11	0.06	0.13	80.0	80.0	0.03	0.03	0.18	0.14	0.12	0.44	0.58	0.58
	POST		4	AXK	0.05	0.05	0.01		90.0	0.02	80.0	80.0	0.03			0.14	0.12			
			Runoff Coeff.	"R"	88.0	88.0	0.62		0.73	0.73	0.95	98.0	0.95			0.91	0.95			
			Outlet	đ	EX. STM MH1	PIPE	PIPE	EX. CBMH2	PIPE	EX. STMH5	EX. STM MH3	PIPE	STORM CHAMBER	EX. STM MH3	EX. STM MH4	EX. STM MH4	EX. STM MH4	EX. STM MH5	STORMCEPTOR STA 1500	EX.STM MH10
	min		THE TOTAL PROPERTY.	Captured by	EX. CB1	EX.CB2	EX.CB3	EX. STM MH1	EX.CB4	EX. CBMH2	EX. CB5	EX. CB6	ROOF	STORM CHAMBER	EX. STM MH3	EX. CB7	ROOF	EX. STM MH4	EX. STM MH5	STORMCEPTOR STA 1500
	15.00 min		Total Area	(m ²)	574.65	580.75	111.96		880.57	334.14	804.19	956.05	265.08			1533.49	1265.50			
	Tc (start):	Catchments	175	Catchment ID	A2	Al	A7	Conveyance	A6	A8	A3	A4	B1	Conveyance	Conveyance	A5	B1	Conveyance	Conveyance	Conveyance

Note: Highlighted sections of sewer proposed to be upgraded.

Appendix D
Orifice Pipe Sizing
Onsite Detention Storage



Table 1A Orifice Sizing Calculations SHOELESS JOE'S RESTAURANT AS PER APPROVED SITE SERVICING PLAN

7.0 1 2.1 7.1 1 1.0 1 2.5 0.1 1 0 2.1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						
Project:	SHOELESS JOE'S RESTAURANT					
Address:	1144 HUGEL AVENUE					
Town/Township/City	TOWN OF MIDLAND					
Project No.	n2137					
Proposed Development Area (m²)	7457.48					

Orifice Location	STMH5	
Orifice Type	Orifice Plate	
Orifice Invert Elevation	244.660	m
Min. Ground Elevation	246.300	m
Orifice Center Elevation	244.722	
Diameter of Orifice Pipe	124	mm
Area of Orifice (A)	0.01207016	m^2
Coefficient of Discharge (C _d)	0.63	
Gravitational Constant	9.81	

Orifice Flow Equation: $Q = C_d A_o \sqrt{2gH}$

Where:

 $Q = Flow (m^3/sec)$

 $A_o = Orifice area (m^2)$

g = Gravitational Constant

H = Center line head (m)

 C_d = coefficient of discharge, dimensionless, typically between 0.6 and 0.85, depending on the orifice geometry

	2 years	5 years	10 years	25 years	50 years	100 years
Ponding Depth (m)	0.00	0.08	0.10	0.15	0.18	0.20
Water Elevation	246.30	246.38	246.40	246.45	246.48	246.50
Upstearm Head (m)	1.578	1.658	1.678	1.728	1.758	1.778
Designed Controlled Discharge (L/sec)	42.31	43.37	43.63	44.28	44.66	44.91
Discharge Velocity (m/sec)	3.51	3.59	3.61	3.67	3.70	3.72
Post Development Flow - As per As built survey (L/sec)	99.79	131.02	151.96	178.04	197.92	217.59

Note: As per Approved Site Servicing and Grading plan prepared by Schad Engineering dated september 2005, the designed orifice controlled flow is calculated using ex. 124mm orifice plate with a HWL 246.50.



Table 1B Orifice Sizing Calculations SHOELESS JOE'S RESTAURANT

Post Development Conditions

Project:	SHOELESS JOE'S RESTAURANT
Address:	1144 HUGEL AVENUE
Town/Township/City	TOWN OF MIDLAND
Project No.	n2137
Proposed Development Area (m ²)	7457.48

Orifice Location	STMH5	
Orifice Type	Orifice Plate	
Orifice Invert Elevation	243.940	m
Min. Ground Elevation	245.540	m
Orifice Center Elevation	243.999	
Diameter of Orifice Pipe	118	mm
Area of Orifice (A)	0.01093034	m^2
Coefficient of Discharge (C _d)	0.63	
Gravitational Constant	9.81	

Orifice Flow Equation: $Q = C_d A_o \sqrt{2gH}$

Where:

 $Q = Flow (m^3/sec)$

 $A_o = Orifice area (m^2)$

g = Gravitational Constant

H = Center line head (m)

 C_d = coefficient of discharge, dimensionless, typically between 0.6 and 0.85, depending on the orifice geometry

	2 years	5 years	10 years	25 years	50 years	100 years
Ponding Depth (m)	0.00	0.02	0.08	0.18	0.21	0.24
Water Elevation	245.52	245.56	245.62	245.72	245.75	245.78
Upstearm Head (m)	1.521	1.561	1.621	1.721	1.751	1.778
Controlled Discharge (L/sec)	37.62	38.11	38.83	40.01	40.36	40.67
Discharge Velocity (m/sec)	3.44	3.49	3.55	3.66	3.69	3.72
Uncontrolled Flow (L/sec)	1.85	2.48	2.94	3.47	3.89	4.24
Designed Controlled Flow (L/sec)	42.31	43.37	43.63	44.28	44.66	44.91
Allowable Flow (L/sec)	40.46	40.89	40.70	40.81	40.76	40.67
Detention Storage Required (m³)	66.57	81.16	110.34	164.09	186.11	214.87
Storage Used in MH (m ³)	11.99	11.99	11.99	11.99	11.99	11.99
Storage Used in Pipe (m³)	29.87	29.87	29.87	29.87	29.87	29.87
Roof Storage (m ³)	7.64	7.64	7.64	7.64	7.64	7.64
Storage Tank	31.41	31.41	31.41	31.41	31.41	31.41
Storage Ponding Used (m ³)	0.00	11.80	47.24	106.28	123.98	141.71
Proposed Available Storage	73.27	85.07	120.51	179.55	197.25	222.62



On-Site Avaiable Storage Calculator SHOELESS JOE'S RESTAURANT

Table 3A - Available Storage (100 years)

Project:	SHOELESS JOE'S RESTAURANT
Address:	1144 HUGEL AVENUE
own/Township/City	TOWN OF MIDLAND
Project No.:	n2137

CB/CBMH				HWL	245.78]
Description	Length/dia. (m)	Width (m)	Top Elevation	Lowest Invert Elevation	Height (m)	Volume (m ³)
EX.CB1	0.6	0.6	245.55	244.52	1.03	0.37
EX.CB2	0.6	0.6	245.54	244.44	1.10	0.40
EX.CB3	0.6	0.6	245.78	244.38	1.40	0.50
EX.CB4	0.6	0.6	245.54	244.04	1.50	0.54
EX.CB5	0.6	0.6	245.56	244.50	1.06	0.38
EX.CB6	0.6	0.6	245.57	244.37	1.20	0.43
EX.CB7	0.6	0.6	245.57	244.23	1.34	0.48
EX.MH1	1.2		245.79	244.43	1.35	1.52
EX.CBMH2	1.2		245.86	244.13	1.65	1.86
EX. MH3	1.2		245.7	244.37	1.41	1.59
EX. MH4	1.2		245.79	244.16	1.62	1.83
EX. MH5	1.2		245.88	243.94	1.84	2.08
		TOTAL	•	•	•	11.99

PIPES

FROM MH	TO MH	Length	DIA	Volume
EX. CB1	EX. STM MH1	20.0	250	1.00
EX. STM MH1	EX. CBMH2	46.0	300	3.25
EX.CB2	PIPE	7.0	250	0.35
EX.CB3	PIPE	250.0	250	12.56
EX. CBMH2	EX. STMH5	37.0	300	2.61
EX.CB4	PIPE	4.0	250	0.20
EX. CB5	EX. STM MH3	17.0	250	0.85
ROOF	STORM CHAMBER	8.0	300	0.57
STORM CHAMBER	EX. STM MH3	2.5	300	0.18
EX. STM MH3	EX. STM MH4	44.0	300	3.11
EX. CB6	PIPE	3.0	250	0.15
EX. CB7	EX. STM MH4	8.0	300	0.57
ROOF	EX. STM MH4	11.0	300	0.78
EX. STM MH4	EX. STM MH5	35.0	450	3.69
		TOTAL		29.87

PONDING AREA

Ponding Location	Inlet Elevation	Ponding Depth (m)	Ponding Area (m²)	Ponding Volume (m ³)
EX.CB1	245.55	0.23	201.20	15.07
EX.CB2	245.54	0.24	274.27	21.45
EX.CB4	245.54	0.24	261.27	20.43
EX. CB5	245.56	0.22	399.92	28.64
Ex. CB6	245.57	0.21	420.11	28.70
EX.CB7	245.57	0.21	401.44	27.42
	141.71			

ROOF STORAGE

Location	Area (m ²)	Depth (mm)	Volume (m ³)
R1	265.08	28.82	7.64
	7.64		
C4 XX7 4 C1	1		

Storm Water Chamber

Manufacture	Model	Size	Volume (m ³)			
ADS	SC-310	19.34X5.42 m	31.41			
	31.41					
Total Available Vol	222.62					
Maximum Required	214.87					



4.463

On-Site Storage Calculator

71

21.96

0.039

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2A - 2 Yea	rs Storage		Post - Development Condition				
		Equat	·				
R=	0.85	•		I = Rainfall Intensity (mm/hr)			
<i>A</i> =	0.75	ha	$i = \frac{A}{(t+B)^C}$	T = Time of Concentration (hr)			
Q release =	0.038	m ³ /s	$(t+B)^{C}$	A=	807.44		
	37.62	L/s		B=	6.75		
					0.828		
			-	Max. Storage Required (m ³)	66.57		
t _c	i ₂	Q ₂	Q _{stored}	Peak Volume	Comments		
(min)	(mm/hr)	(m³/s)	(m³/s)	(m ³)	• • • • • • • • • • • • • • • • • • •		
15	63.05	0.111	0.073	66.063			
16	60.75	0.107	0.069	66.573	***		
17	58.62	0.103	0.066	66.916			
18	56.65	0.100	0.062	67.110			
19	54.83	0.097	0.059	67.169			
20	53.12	0.094	0.056	67.106			
21	51.53	0.091	0.053	66.934			
22	50.04	0.088	0.051	66.661			
23	48.65	0.086	0.048	66.297			
24	47.33	0.083	0.046	65.849			
25	46.10	0.081	0.044	65.323			
26	44.93	0.079	0.041	64.726			
31	39.94	0.070	0.033	60.843			
36	36.03	0.063	0.026	55.790			
41	32.88	0.058	0.020	49.879			
46	30.28	0.053	0.016	43.315			
51	28.09	0.049	0.012	36.238			
56	26.22	0.046	0.009	28.749			
61	24.61	0.043	0.006	20.922			
66	23.20	0.041	0.003	12.812			

0.001



On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2B - 5 Years Storage

Post - Development Condition

Equation of IDF: 0.85 I = Rainfall Intensity (mm/hr) T = Time of Concentration (hr) 0.75 ha 0.038 m³/s Q_{release} = A= 1135.4 38.11 L/s B= 7.5

	C= 0.841			0.841	
				Max. Storage Required (m ³)	100.65
t _c	i ₅	Q_5	Q _{stored}	Peak Volume	Comments
(min)	(mm/hr)	(m³/s)	(m³/s)	(m³)	Comments
15	82.79	0.147	0.109	97.946	
16	79.81	0.142	0.104	99.410	
17	77.07	0.137	0.099	100.647	***
18	74.52	0.132	0.094	101.680	
19	72.14	0.128	0.090	102.529	
20	69.93	0.124	0.086	103.213	
21	67.86	0.120	0.082	103.745	
22	65.92	0.117	0.079	104.141	
23	64.10	0.114	0.076	104.410	
24	62.38	0.111	0.073	104.565	
25	60.77	0.108	0.070	104.613	
26	59.24	0.105	0.067	104.564	
27	57.79	0.103	0.064	104.424	
28	56.42	0.100	0.062	104.200	
29	55.11	0.098	0.060	103.898	



On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2C - 10 Years Storage

38.83 L/s

Post - Development Condition

Equation of IDF: R = 0.85 I = Rainfall Intensity (mm/hr) A = 0.75 ha I = Rainfall Intensity (mm/hr) $Q_{release} = 0.039 \text{ m}^3/\text{s}$ I = Time of Concentration (min)A = 975.865

> B= 4.699 C= 0.76

					0.70
				Max. Storage Required (m ³)	133.83
t _c	i ₁₀	Q ₁₀	Q _{stored}	Peak Volume	Comments
(min)	(mm/hr)	(m ³ /s)	(m ³ /s)	(m ³)	Comments
15	101.30	0.180	0.141	126.866	
16	97.56	0.173	0.134	128.949	
17	94.12	0.167	0.128	130.787	
18	90.95	0.161	0.123	132.407	
19	88.02	0.156	0.117	133.831	***
20	85.30	0.151	0.113	135.077	
21	82.77	0.147	0.108	136.163	
22	80.40	0.143	0.104	137.102	
23	78.18	0.139	0.100	137.907	
24	76.10	0.135	0.096	138.589	
25	74.15	0.132	0.093	139.157	
26	72.31	0.128	0.090	139.621	
27	70.57	0.125	0.086	139.987	
28	68.92	0.122	0.083	140.263	
29	67.36	0.120	0.081	140.455	
30	65.88	0.117	0.078	140.568	
31	64.47	0.114	0.076	140.608	



176.091

176.634

On-Site Storage Calculator

29

30

79.56

77.83

0.141

0.138

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2D - 25 Years Storage			Post-	Development Condition	
R=	0.85		Δ	I = Rainfall Intensity (mm/hr)	
A =	0.75 ha		$i = \frac{A}{\left(t + B\right)^{C}}$	T = Time of Concentration (hr)	
Q _{release} =	0.040		A=1		1146.275
	40.01	L/s		B= 4.92	
					0.757
				Max. Storage Required (m ³)	164.09
t _c	i ₂₅	Q ₂₅	Q _{stored}	Peak Volume	Comments
(min)	(mm/hr)	(m ³ /s)	(m ³ /s)	(m³)	
15	119.04	0.211	0.171	154.141	
16	114.71	0.204	0.164	157.035	
17	110.72	0.197	0.157	159.638	
18	107.05	0.190	0.150	161.981	
19	103.64	0.184	0.144	164.091	***
20	100.48	0.178	0.138	165.989	
•				407.007	
21	97.53	0.173	0.133	167.695	
22	94.78	0.168	0.128	169.226	
23	92.19	0.164	0.124	170.597	
24	89.77	0.159	0.119	171.820	
25	87.49	0.155	0.115	172.908	
26	85.34	0.151	0.111	173.870	
27	83.31	0.148	0.108	174.716	
28	81.39	0.144	0.104	175.454	

0.101

0.098



On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Post- Development Condition

Table 2E - 50 Years Storage				Post- D	evelopment Condition	
Ī			Equati	on of IDF:		
	R=	0.85		. A	I = Rainfall Intensity (mm/hr)	
	A =	0.75	ha	$l = \frac{1}{(t+B)^C}$	T = Rainfall Intensity (mm/hr) T = Time of Concentration (hr)	
	Q _{release} =	0.040	m³/s			1236.152
		40.36	L/s		B=	4.699
					C=	0.751
L					Max. Storage Required (m ³)	186.11
	t _c	i ₅₀	Q ₅₀	Q _{stored}	Peak Volume	Comments
I	(min)	(mm/hr)	(m ³ /s)	(m ³ /s)	(m ³)	Comments
	15	131.81	0.234	0.194	174.225	
	16	127.00	0.225	0.185	177.642	

ι _c	I ₅₀	Q_{50}	Stored	Peak Volume	Comments
(min)	(mm/hr)	(m ³ /s)	(m ³ /s)	(m³)	Commonte
15	131.81	0.234	0.194	174.225	
16	127.00	0.225	0.185	177.642	
17	122.58	0.218	0.177	180.740	
18	118.50	0.210	0.170	183.555	
19	114.72	0.204	0.163	186.114	* * *
20	111.22	0.197	0.157	188.442	
21	107.95	0.192	0.151	190.560	
22	104.90	0.186	0.146	192.486	
23	102.04	0.181	0.141	194.238	
24	99.36	0.176	0.136	195.828	
25	96.84	0.172	0.132	197.270	
26	94.46	0.168	0.127	198.574	
27	92.21	0.164	0.123	199.752	
28	90.09	0.160	0.120	200.811	



On-Site Storage Calculator

Project: SHOELESS JOE'S RESTAURANT

Address: 1144 HUGEL AVENUE

City/Township/County: TOWN OF MIDLAND

Project No: n2137

Table 2F - 100 Years Storage - Post -Development Condition

Table 2F - 100 feats 3	I able 2F - 100 Years Storage - Post -Development Condition Equation of IDF:					
R=	0.85	·		I = Rainfall Intensity (mm/hr)		
A =	0.75 h	$a i = \frac{1}{(t-t)^3/s}$	<u>A</u>	T = Time of Concentration (hr)		
Q _{release} =	0.041 m	n^3/s (t	$+B)^{C}$	` ,	2193.1	
70,000	40.67 L				9.04	
			1	C=	0.871	
				Max. Storage Required (m ³)	214.87	
t _c	i ₁₀₀	Q ₁₀₀	Q _{stored}	Peak Volume	Comments	
(min)	(mm/hr)	(m³/s)	(m³/s)	(m³)		
15	137.49	0.242	0.201	181.275		
16	132.69	0.234	0.193	185.255		
17	128.24	0.226	0.185	188.842		
18	124.10	0.219	0.178	192.075		
19	120.24	0.212	0.171	194.990		
20	116.62	0.205	0.165	197.616		
21	113.24	0.199	0.159	199.978		
22	110.05	0.194	0.153	202.100		
23	107.05	0.188	0.148	204.002		
24 25	104.23	0.184	0.143	205.702		
	101.55	0.179	0.138	207.215		
26	99.02	0.174	0.134	208.557		
27	96.63	0.170	0.129	209.740		
28	94.35	0.166	0.125	210.775		
29	92.19	0.162	0.122	211.672		
30	90.13	0.159	0.118	212.442		
31	88.16	0.155	0.115	213.092		
32	86.29	0.152	0.111	213.630		
33 34	84.50 82.79	0.149 0.146	0.108 0.105	214.063		
35		0.146	0.103	214.398 214.641		
36	81.15 79.57	0.143	0.102	214.797		
36 37	79.57 78.07	0.140	0.099	214.797	MAX	
38	76.62	0.137	0.097	214.867	IVIAA	
39	75.23	0.133	0.094	214.789		
40	73.89	0.132	0.092	214.643		
41	73.69	0.130	0.089	214.431		
42	72.80	0.126	0.087	214.451		
43	70.17	0.120	0.083	213.823		
44	69.01	0.124	0.083	213.432		
49	63.80	0.122	0.001	210.725		
54	59.37	0.112	0.072	206.949		
59	55.55	0.103	0.057	202.307		
64	52.23	0.090	0.051	196.953		
69	49.30	0.092	0.031	191.004		
74	46.70	0.082	0.040	184.551		
79	44.39	0.002	0.042	177.667		
84	42.30	0.074	0.034	170.409		
89	40.42	0.074	0.034	162.825		
94	38.70	0.068	0.030	154.955		
99	37.14	0.065	0.027	146.831		
55	07.17	0.000	0.020	170.001		

Appendix E OGS Sizing Summary





Detailed Stormceptor Sizing Report – Shoeless Joe's

Project Information & Location			
Project Name	Shoeless Joe's	Project Number	n2137
City	Mindland	Mindland State/ Province	
Country	Canada Date 2/27/2023		2/27/2023
Designer Information		EOR Information (optional)	
Name	Abu Ziauddin	Name	
Company	n Engineering Inc. Company		
Phone #	905-597-5937	905-597-5937 Phone #	
Email	az@nengineering.com	Email	

Stormwater Treatment Recommendation

The recommended Stormceptor Model(s) which achieve or exceed the user defined water quality objective for each site within the project are listed in the below Sizing Summary table.

Site Name	Shoeless Joe's
Recommended Stormceptor Model	STC 1000
Target TSS Removal (%)	80.0
TSS Removal (%) Provided	80
PSD	Fine Distribution
Rainfall Station	BARRIE WPCC

The recommended Stormceptor model achieves the water quality objectives based on the selected inputs, historical rainfall records and selected particle size distribution.

Stormceptor Sizing Summary			
Stormceptor Model	% TSS Removal Provided		
STC 300	69		
STC 750	79		
STC 1000	80		
STC 1500	81		
STC 2000	84		
STC 3000	86		
STC 4000	88		
STC 5000	89		
STC 6000	91		
STC 9000	93		
STC 10000	93		
STC 14000	95		
StormceptorMAX	Custom		





Stormceptor

The Stormceptor oil and sediment separator is sized to treat stormwater runoff by removing pollutants through gravity separation and flotation. Stormceptor's patented design generates positive TSS removal for each rainfall event, including large storms. Significant levels of pollutants such as heavy metals, free oils and nutrients are prevented from entering natural water resources and the re-suspension of previously captured sediment (scour) does not occur. Stormceptor provides a high level of TSS removal for small frequent storm events that represent the majority of annual rainfall volume and pollutant load. Positive treatment continues for large infrequent events, however, such events have little impact on the average annual TSS removal as they represent a small percentage of the total runoff volume and pollutant load.

Design Methodology

Stormceptor is sized using PCSWMM for Stormceptor, a continuous simulation model based on US EPA SWMM. The program calculates hydrology using local historical rainfall data and specified site parameters. With US EPA SWMM's precision, every Stormceptor unit is designed to achieve a defined water quality objective. The TSS removal data presented follows US EPA guidelines to reduce the average annual TSS load. The Stormceptor's unit process for TSS removal is settling. The settling model calculates TSS removal by analyzing:

- Site parameters
- · Continuous historical rainfall data, including duration, distribution, peaks & inter-event dry periods
- Particle size distribution, and associated settling velocities (Stokes Law, corrected for drag)
- TSS load
- · Detention time of the system

Hydrology Analysis

PCSWMM for Stormceptor calculates annual hydrology with the US EPA SWMM and local continuous historical rainfall data. Performance calculations of Stormceptor are based on the average annual removal of TSS for the selected site parameters. The Stormceptor is engineered to capture sediment particles by treating the required average annual runoff volume, ensuring positive removal efficiency is maintained during each rainfall event, and preventing negative removal efficiency (scour). Smaller recurring storms account for the majority of rainfall events and average annual runoff volume, as observed in the historical rainfall data analyses presented in this section.

Rainfall Station			
State/Province	e Ontario Total Number of Rainfa		2595
Rainfall Station Name	BARRIE WPCC	ARRIE WPCC Total Rainfall (mm) 12897	
Station ID #	0557	Average Annual Rainfall (mm) 358.3	
Coordinates	44°23'N, 79°41'W	Total Evaporation (mm)	1266.6
Elevation (ft)	725	Total Infiltration (mm)	0.0
Years of Rainfall Data	36	Total Rainfall that is Runoff (mm)	11630.8

Notes

- Stormceptor performance estimates are based on simulations using PCSWMM for Stormceptor, which uses the EPA Rainfall and Runoff modules.
- Design estimates listed are only representative of specific project requirements based on total suspended solids (TSS) removal defined by the selected PSD, and based on stable site conditions only, after construction is completed.
- For submerged applications or sites specific to spill control, please contact your local Stormceptor representative for further design assistance.





Drainage Area			
Total Area (ha)	0.5		
Imperviousness %	100.00		
Water Quality Objective			
TSS Removal (%) 80.0			
Runoff Volume Capture (%)			
Oil Spill Capture Volume (L)			
Peak Conveyed Flow Rate (L/s)			
Water Quality Flow Rate (L/s)			

Storage (na-in)		rge (cms)		
0.000	.000			
Up Stream	Flow Diversi	on		
Max. Flow to Stormce	otor (cms)			
Design Details				
Stormceptor Inlet Inve				
Stormceptor Outlet Inve				
Stormceptor Rim E				
Normal Water Level Ele				
Pipe Diameter (r				
Pipe Materia				
Multiple Inlets (No			
Grate Inlet (Y/I	No			

Up Stream Storage

Particle Size Distribution (PSD)

Removing the smallest fraction of particulates from runoff ensures the majority of pollutants, such as metals, hydrocarbons and nutrients are captured. The table below identifies the Particle Size Distribution (PSD) that was selected to define TSS removal for the Stormceptor design.

Fine Distribution			
Particle Diameter (microns)	Distribution %	Specific Gravity	
20.0	20.0	1.30	
60.0	20.0	1.80	
150.0	20.0	2.20	
400.0	20.0	2.65	
2000.0	20.0	2.65	



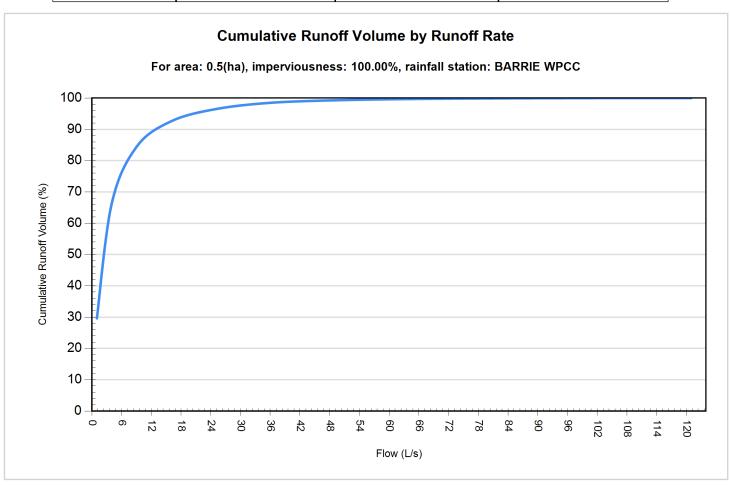


Site Name		Shoeless Joe's	
Site Details			
Drainage Area		Infiltration Parameters	
Total Area (ha)	0.5	Horton's equation is used to estimate infiltration	
Imperviousness %	100.00	Max. Infiltration Rate (mm/hr) 61.98	
Surface Characteristics	5	Min. Infiltration Rate (mm/hr) 10.16	
Width (m)	141.00	Decay Rate (1/sec) 0.00055	
Slope %	2	Regeneration Rate (1/sec) 0.01	
Impervious Depression Storage (mm)	0.508	Evaporation	
Pervious Depression Storage (mm)	5.08	Daily Evaporation Rate (mm/day) 2.54	
Impervious Manning's n 0.015		Dry Weather Flow	
Pervious Manning's n	0.25	Dry Weather Flow (Ips) 0	
Maintenance Frequency	y	Winter Months	
Maintenance Frequency (months) > 12		Winter Infiltration 0	
	TSS Loading	g Parameters	
TSS Loading Function			
Buildup/Wash-off Parame	eters	TSS Availability Parameters	
Target Event Mean Conc. (EMC) mg/L		Availability Constant A	
Exponential Buildup Power		Availability Factor B	
Exponential Washoff Exponent		Availability Exponent C	
		Min. Particle Size Affected by Availability (micron)	





Cumulative Runoff Volume by Runoff Rate				
Runoff Rate (L/s)	Runoff Volume (m³)	Volume Over (m³)	Cumulative Runoff Volume (%)	
1	17298	41226	29.6	
4	38821	19704	66.3	
9	49392	9133	84.4	
16	54168	4356	92.6	
25	56484	2040	96.5	
36	57628	897	98.5	
49	58130	394	99.3	
64	58367	158	99.7	
81	58472	53	99.9	
100	58518	7	100.0	
121	58524	0	100.0	

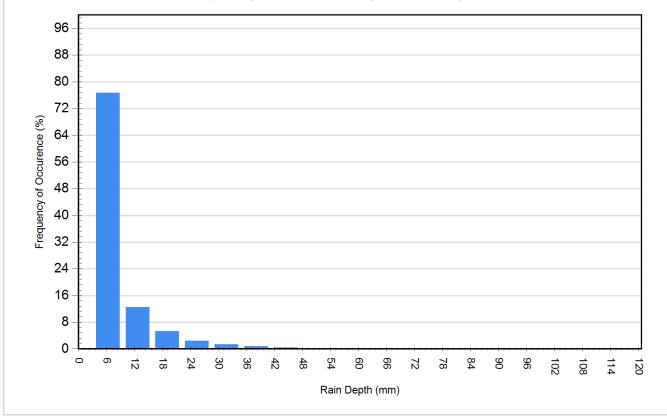






Rainfall Event Analysis				
Rainfall Depth (mm)	No. of Events	Percentage of Total Events (%)	Total Volume (mm)	Percentage of Annual Volume (%)
6.35	1991	76.7	3535	27.4
12.70	325	12.5	2942	22.8
19.05	137	5.3	2129	16.5
25.40	63	2.4	1420	11.0
31.75	36	1.4	1002	7.8
38.10	20	0.8	693	5.4
44.45	10	0.4	406	3.1
50.80	6	0.2	285	2.2
57.15	2	0.1	108	0.8
63.50	1	0.0	58	0.5
69.85	1	0.0	68	0.5
76.20	0	0.0	0	0.0
82.55	2	0.1	156	1.2
88.90	0	0.0	0	0.0
95.25	0	0.0	0	0.0
101.60	1	0.0	96	0.7
107.95	0	0.0	0	0.0
114.30	0	0.0	0	0.0

Frequency of Occurence by Rainfall Depths







For Stormceptor Specifications and Drawings Please Visit: http://www.imbriumsystems.com/technical-specifications

Appendix F Stormwater Infiltration Chamber



User Inputs

SC-310

n2137

Ontario

Metric

40%

153 mm.

153 mm.

37.50 cubic meters.

(6.01 m. x 20.01 m.)

Yes

N/A

Chamber Model:

Project Name:

Project Location:

Stone Porosity:

Measurement Type:

Required Storage Volume:

Stone Foundation Depth:

Stone Above Chambers:

Design Constraint Dimensions:

Engineer:

Outlet Control Structure:

Results

System Volume and Bed Size

Installed Storage Volume: 39.83 cubic meters.

Storage Volume Per Chamber: 0.42 cubic meters.

Number Of Chambers Required: 40 **Number Of End Caps Required:** 10

Chamber Rows: 5

Maximum Length: 19.34 m.

Approx. Bed Size Required:

104.73 square me-

ters.

5.42 m.

Average Cover Over Chambers: N/A.

System Components

Amount Of Stone Required: 58 cubic meters **Volume Of Excavation (Not Including** 75 cubic meters

Fill):

Total Non-woven Geotextile Required:294 square meters

Woven Geotextile Required (excluding 27 square meters

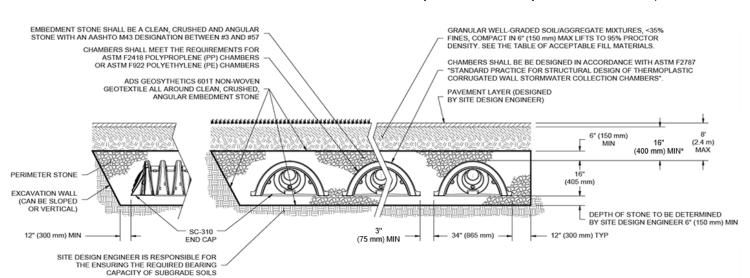
Isolator Row):

Maximum Width:

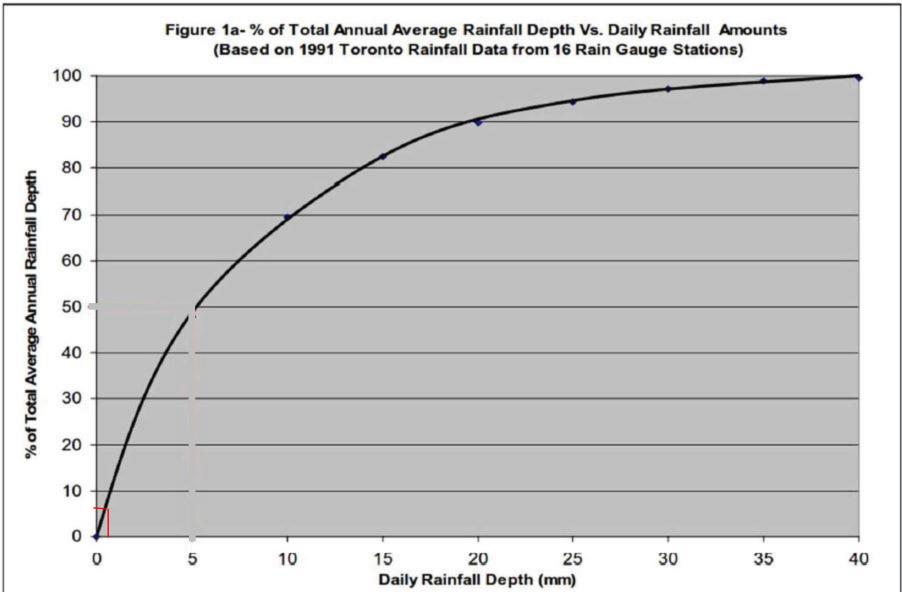
Woven Geotextile Required (Isolator 26 square meters

Total Woven Geotextile Required: 53 square meters

Impervious Liner Required: 0 square meters



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT, FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 22" (550 mm).



StormTech® SC-310 Chamber

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



Nominal Chamber Specifications

(not to scale)

Size (L x W x H)

85.4" x 34" x 16" 2170 mm x 864 mm x 406 mm

Chamber Storage

14.7 ft³ (0.42 m³)

Min. Installed Storage*

29.3 ft³ (0.83 m³)

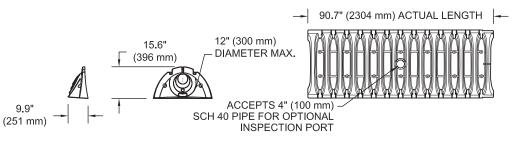
Weight

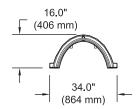
37.0 lbs (16.8 kg)

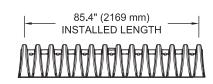
Shipping

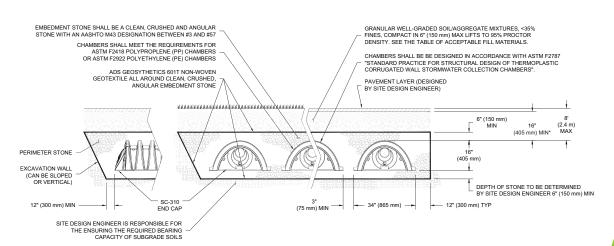
55 chambers/pallet 108 end caps/pallet 18 pallets/truck

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











StormTech SC-310 Specifications

Cumulative Storage Volumes Per Chamber

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

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
28 (711)	14.70 (0.416)	29.34 (0.831)
27 (686)	14.70 (0.416)	28.60 (0.810)
26 (660)	Stone 14.70 (0.416)	27.87 (0.789)
25 (635)	Cover 14.70 (0.416)	27.14 (0.769)
24 (610)	14.70 (0.416)	26.41 (0.748)
23 (584)	14.70 (0.416)	25.68 (0.727)
22 (559)	14.70 (0.416)	24.95 (0.707)
21 (533)	14.64 (0.415)	24.18 (0.685)
20 (508)	14.49 (0.410)	23.36 (0.661)
19 (483)	14.22 (0.403)	22.47 (0.636)
18 (457)	13.68 (0.387)	21.41 (0.606)
17 (432)	12.99 (0.368)	20.25 (0.573)
16 (406)	12.17 (0.345)	19.03 (0.539)
15 (381)	11.25 (0.319)	17.74 (0.502)
14 (356)	10.23 (0.290)	16.40 (0.464)
13 (330)	9.15 (0.260)	15.01 (0.425)
12 (305)	7.99 (0.227)	13.59 (0.385)
11 (279)	6.78 (0.192)	12.13 (0.343)
10 (254)	5.51 (0.156)	10.63 (0.301)
9 (229)	4.19 (0.119)	9.11 (0.258)
8 (203)	2.83 (0.081)	. ,
7 (178)	1.43 (0.041)	5.98 (0.169)
6 (152)	♦ 0	4.39 (0.124)
5 (127)	C	3.66 (0.104)
4 (102)	Stone 0	2.93 (0.083)
3 (76)	Foundation 0	2.19 (0.062)
2 (51)	C	1.46 (0.041)
1 (25)	₩ 0	0.73 (0.021)

Note: Add 0.73 ft^3 (0.021 m^3) of storage for each additional inch (25 mm) of stone foundation.

Storage Volume Per Chamber ft³ (m³)

	Bare Chamber	Chamber and Stone Foundation Depth in. (mm)		
	Storage ft³ (m³)	6 (150)	12 (300)	18 (450)
SC-310 Chamber	14.7 (0.42)	29.30 (0.83)	33.7 (0.95)	38.1 (1.08)

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

Amount of Stone Per Chamber

English Tons (vds3)	Stone Foundation Depth			
English Tons (yds³)	6"	12"	18"	
SC-310	1.9 (1.4)	2.5 (1.8)	3.1 (2.2)	
Metric Kilograms (m³)	150 mm	300 mm	450 mm	
SC-310	1724 (1.0)	2268 (1.3)	2812 (1.7)	

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

Volume Excavation Per Chamber yd³ (m³)

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

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

ADS StormTech products, manufactured in accordance with ASTM F2418 or ASTMF2922, comply with all requirements in the Build America, Buy America (BABA) Act.

Working on a project?
Visit us at adspipe.com and utilize the Design Tool

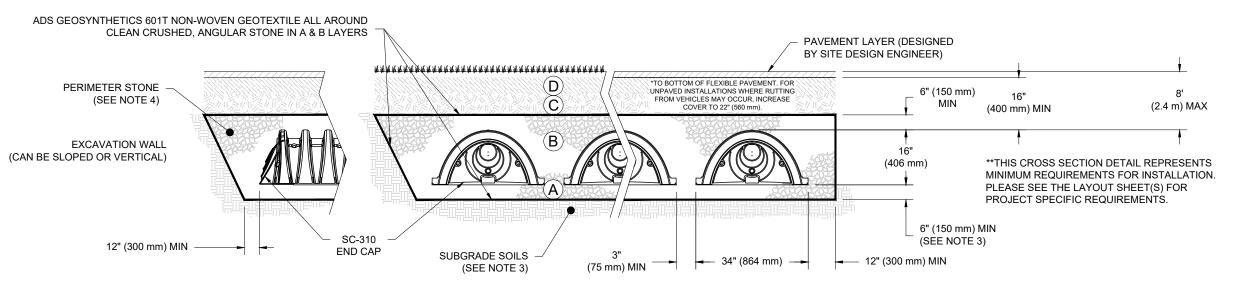


ACCEPTABLE FILL MATERIALS: STORMTECH SC-310 CHAMBER SYSTEMS

	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.	3.25	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
С	INITIAL FILL: FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 16" (400 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).
В	EMBEDMENT STONE: FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43¹ 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
А	FOUNDATION STONE: FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE ⁵	AASHTO M43 ¹ 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. ^{2,3}

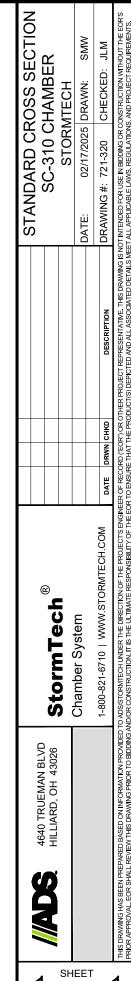
PLEASE NOTE

- 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.
- 5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

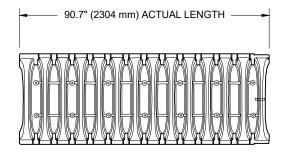
- 1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2922 (POLYETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
- 2. SC-310 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC 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. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
- 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 F2922 SHALL BE GREATER THAN OR EQUAL TO 325 LBS/FT/%. 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.

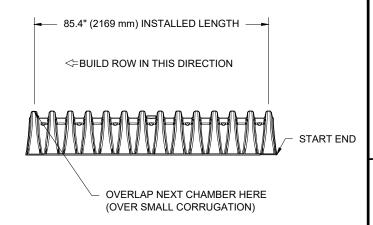


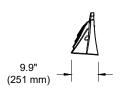
OF

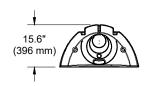
SC-310 TECHNICAL SPECIFICATION

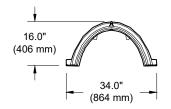
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH) CHAMBER STORAGE MINIMUM INSTALLED STORAGE* WEIGHT 34.0" X 16.0" X 85.4" 14.7 CUBIC FEET 29.34 CUBIC FEET

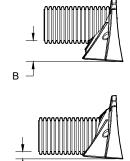
35.0 lbs.

(864 mm X 406 mm X 2169 mm) (0.42 m³)

(0.83 m³) (16.8 kg)

*ASSUMES 6" (150 mm) ABOVE AND BELOW CHAMBER; 3" (75 mm) BETWEEN CHAMBERS

PART #	STUB	В	С
SC310EPE06TPC	6" (150 mm)	5.8" (147 mm)	
SC310EPE06BPC	0 (13011111)		0.5" (13 mm)
SC310EPE08TPC	8" (200 mm)	3.5" (89 mm)	
SC310EPE08BPC	0 (200 11111)		0.6" (15 mm)
SC310EPE10TPC	10" (250 mm)	1.4" (36 mm)	
SC310EPE10BPC	10 (230 111111)		0.7" (18 mm)
SC310ECEZ*	12" (300 mm)		0.9" (23 mm)



ALL STUBS, EXCEPT FOR THE SC310ECEZ 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 SC310ECEZ THE 12" (300 mm) STUB LIES BELOW THE BOTTOM OF THE END CAP APPROXIMATELY 0.25" (6 mm). BACKFILL MATERIAL SHOULD BE REMOVED FROM BELOW THE N-12 STUB SO THAT THE FITTING SITS LEVEL.

NOTE: ALL DIMENSIONS ARE NOMINAL; PRE-CORED END CAPS END WITH "PC"



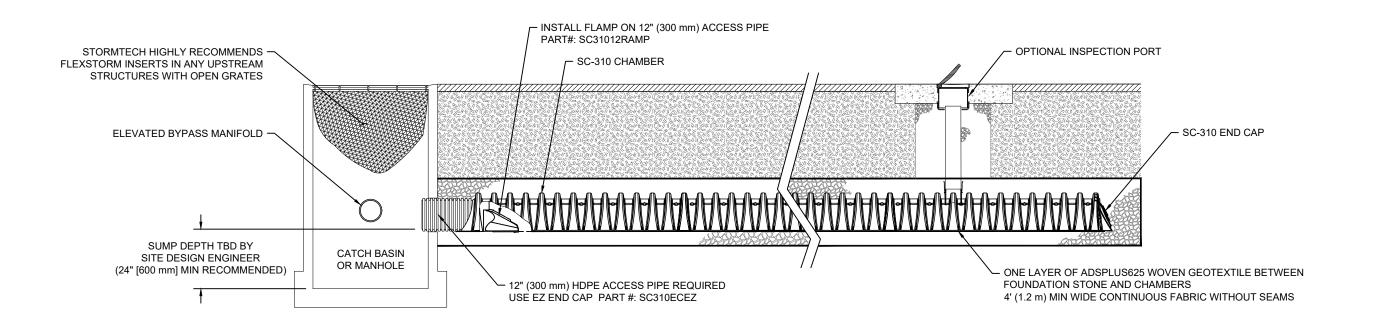
SMW	JLM
DRAWN:	CHECKED: JLM
01/15/25	721-310
DATE:	DRAWING #: 721-310
	ŌΣ

1-800-821-6710 WWW.STORMTECH.COM

StormTech Chamber System

4640 TRUEMAN BLVD HILLIARD, OH 43026





SC-310 ISOLATOR ROW PLUS DETAIL

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT

A. INSPECTION PORTS (IF PRESENT)

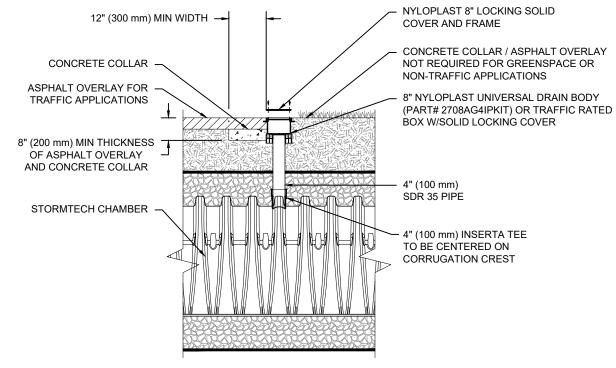
- A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
- A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
- A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
- A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
- A.5. 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
- 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
- IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
 - A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
 - B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
 - C. VACUUM STRUCTURE SUMP AS REQUIRED
- STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS
- STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

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



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

4" PVC INSPECTION PORT DETAIL
(SC SERIES CHAMBER)

NTS

PROJECT **StormTech®** Chamber System 4640 TRUEMAN BLVD HILLIARD, OH 43026 1-800-733-7473

OF

ISOLATOR ROW PLUS DETAILS

10/29/20

SC-310

AL

DRAWN: CHECKED:

Isolator® Row Plus

O&M Manual





The Isolator® Row Plus

Introduction

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

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, DC-780, SC-800, MC-3500, MC-4500 or MC-7200 models, are lined with filter fabric and connected to a closely located manhole for easy access. The fabric lined chambers provide for sediment settling and filtration as stormwater rises in the Isolator Row Plus and passes through the filter fabric. The open bottom chambers allow stormwater to flow vertically out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS Isolator Row and Plus fabric are placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole provides access to the Isolator Row Plus and 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 an elevated bypass manifold or a high-flow weir. This creates a differential between the Isolator Row Plus row of chambers and the manifold to the rest of the system, thus allowing for settlement time in the Isolator Row Plus. After Stormwater flows through the Isolator Row Plus and into the rest of the chamber system it is either exfiltrated into the soils below or passed at a controlled rate through an outlet manifold and outlet control structure.

The Isolator Row Plus Flamp™ is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end, or more difficult to remove and require confined space entry into the chamber area. It also serves to improve the fluid and solid flow into the access pipe during maintenance and cleaning and to guide cleaning and inspection equipment back into the inlet pipe when complete.

The Isolator Row Plus may be part of a treatment train system. The treatment train design and pretreatment device selection by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, StormTech recommend using the Isolator Row Plus to minimize maintenance requirements and maintenance costs.

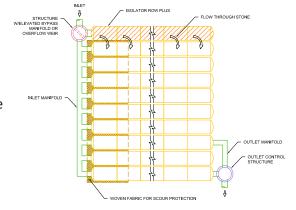
Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row Plus.



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



StormTech Isolator Row Plus with Overflow Structure (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

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

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

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

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3" (75 mm) throughout the length of the Isolator Row Plus, clean-out should be performed.

Maintenance

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

via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entry.

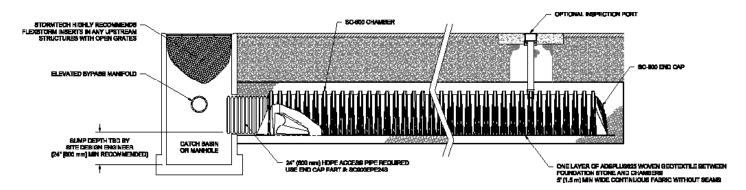
Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. JetVac reels can vary in length. For ease of maintenance, ADS recommends Isolator Row Plus lengths up to 200' (61 m). The JetVac process shall only be performed on StormTech Isolator Row Plus that have ADS Plus Fabric (as specified by StormTech) over their angular base stone.







StormTech Isolator Row Plus (not to scale)



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

- A) Inspection ports (if present)
 - i. Remove lid from floor box frame
 - ii. Remove cap from inspection riser
 - iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.
 - iv. If sediment is at or above 3 inch depth, proceed to Step 2. If not, proceed to Step 3.
- B) All Isolator Row Plus
 - i. Remove cover from manhole at upstream end of Isolator Row Plus
 - ii. Using a flashlight, inspect down Isolator Row Plus through outlet pipe
 - 1. Mirrors on poles or cameras may be used to avoid a confined space entry
 - 2. Follow OSHA regulations for confined space entry if entering manhole
 - iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches), proceed to Step 2.

If not, proceed to Step 3.

Step 2

Clean out Isolator Row Plus using the JetVac process.

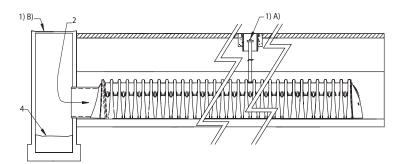
- A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
- B) Apply multiple passes of JetVac until backflush water is clean
- C) Vacuum manhole sump as required

Step 3

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

Step 4

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



Sample Maintenance Log

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

adspipe.com 800-821-6710



StormTech[®] Installation Guide SC-310/DC-780/SC-800



StormTech Installation Video

Required Materials and Equipment List

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

Important Notes:

- A. This installation guide provides the minimum requirements for proper installation of chambers. Non-adherence to this guide may result in damage to chambers during installation. Replacement of damaged chambers during or after backfilling is costly and very time consuming. It is recommended that all installers are familiar with this guide, and that the contractor inspects the chambers for distortion, damage and joint integrity as work progresses.
- B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.
- C. Care should be taken in the handling of chambers and end caps. Avoid dropping, prying or excessive force on chambers during removal from pallet and initial placement.

Requirements for System Installation



Excavate bed and prepare subgrade per engineer's plans.



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



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

Manifold, Scour Fabric and Chamber Assembly



Install manifolds and lay out ADS Plus Fabric at inlet rows. Place ADS Plus Fabric at each inlet end cap parallel to the row (min. 12.5 ft (3.8 m)). Place a continuous piece entire length of Isolator® Plus Row(s).



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



Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled "Lower Joint – Overlap Here" and "Build this direction – Upper Joint" Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 3" (75 mm) spacing between rows for SC-310 and SC-800, and 6" (150 mm) spacing for DC-780.

Attaching the End Caps



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

Prefabricated End Caps



24" (600 mm) inlets are the maximum size that can fit into a DC-780 or SC-800 end cap and must be prefabricated with a 24" (600 mm) pipe stub. SC-310 chambers with a 12" (300 mm) inlet pipe must use a prefabricated end cap with a 12" (300 mm) pipe stub. When used on an Isolator Row Plus, these end caps will contain a welded FLAMP (flared end ramp) that will lay on top of the ADS Plus fabric (shown above)

Isolator Row Plus

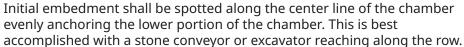


Place a continuous layer of ADS Plus fabric between the foundation stone and the Isolator Row Plus chambers, making sure the fabric lays flat and extends the entire width of the chamber feet.

Initial Anchoring of Chambers – Embedment Stone





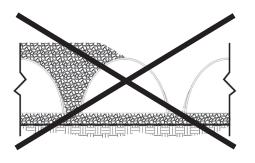


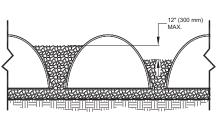




No equipment shall be operated on the bed at this stage of the installation. Excavators must be located off the bed. Dump trucks shall not dump stone directly on to the bed. Dozers or loaders are not allowed on the bed at this time.

Backfill of Chambers - Embedment Stone

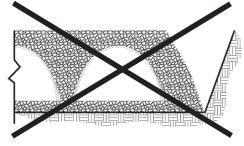




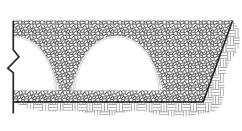
Uneven Backfill

Even Backfill

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







Perimeter Fully Backfilled

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



Backfill - Embedment Stone & Cover Stone



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



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

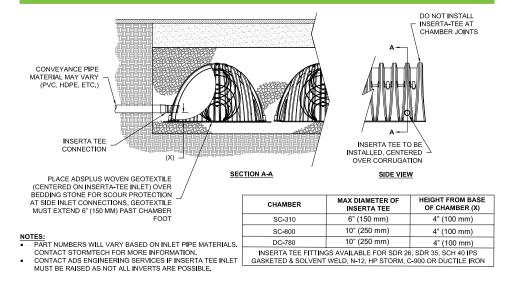
Final Backfill of Chambers - Fill Material





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

Inserta Tee Detail



StormTech Isolator Row Plus Detail

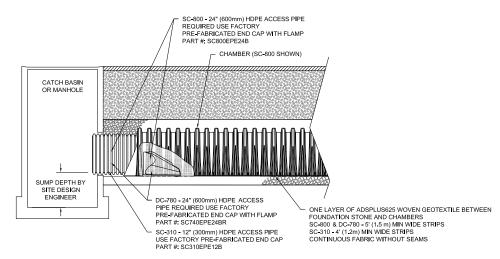


Table 1- Acceptable Fill Materials

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

Please Note:

- 1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
- 2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 6" (150 mm) (max) lifts using two full coverages with a vibratory compactor.
- 3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.
- 4. Where recycled concrete aggregate is used in layers 'A' or 'B' the material should also meet the acceptable criteria outlined in ADS Technical Note 6.20 "Recycled Concrete Structural Backfill".

Figure 2 - Fill Material Locations

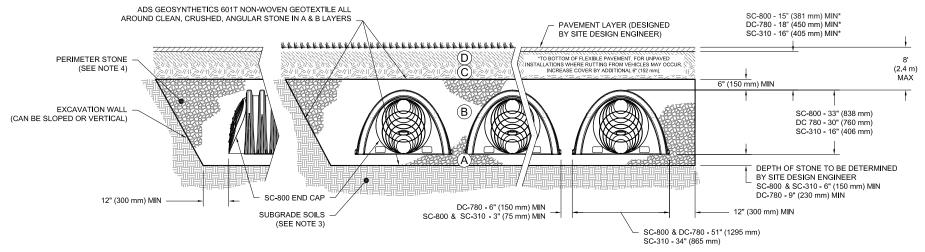
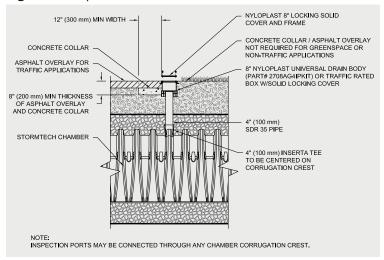


Figure 1- Inspection Port Detail



Notes:

- 1.36" (900 mm) of stabilized cover materials over the chambers is recommended during the construction phase if general construction activities, such as full dump truck travel and dumping, are to occur over the bed.
- 2. During paving operations, dump truck axle loads on 18" (450 mm) of cover may be necessary. Precautions should be taken to avoid rutting of the road base layer, to ensure that compaction requirements have been met, and that a minimum of 18" (450 mm) of cover exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
- Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
- 4. Mini-excavators (< 8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
- 5. Storage of materials such as construction materials, equipment, spoils, etc. should not be located over the StormTech system. The use of equipment over the StormTech system not covered in Table 2 (ex. soil mixing equipment, cranes, etc) is limited. Please contact StormTech for more information.
- Allowable track loads based on vehicle travel only. Excavators shall not operate on chamber beds until the total backfill reaches 3 feet (900 mm) over the entire bed.

Table 2 - Maximum Allowable Construction Vehicle Loads⁶

Material	Fill Depth		lowable Wheel oads		Allowable Loads ⁶	Maximum Allowable Roller Loads
Location	over Chambers in. (mm)	Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	3880 (186) 2640 (126) 2040 (97) 1690 (81) 1470 (70)	38,000 (169)
© Initial Fill Material	24" (600) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2690 (128) 1880 (90) 1490 (71) 1280 (61) 1150 (55)	20,000 (89)
	24" (600) Loose/ Dumped	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2390 (114) 1700 (81) 1370 (65) 1190 (57) 1080 (51)	20,000 (89) Roller gross vehicle weight not toexceed 12,000 lbs. (53 kN)
	18" (450)	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2110 (101) 1510 (72) 1250 (59) 1100 (52) 1020 (48)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
B Embedment Stone	12" (300)	16,000 (71)	NOT ALLOWED	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	1540 (74) 1190 (57) 1010 (48) 910 (43) 840 (40)	20,000 (89) Roller gross vehicle weight not to exceed 12,000 lbs. (53 kN)
	6" (150)	8,000 (35)	NOT ALLOWED	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	1070 (51) 900 (43) 800 (38) 760 (36) 720 (34)	NOT ALLOWED

Table 3 - Placement Methods and Descriptions

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



StormTech® Standard Limited Warranty

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

- (A) This Limited Warranty applies solely to the StormTech chambers and end plates manufactured by StormTech and sold to the original purchaser (the "Purchaser"). The chambers and end plates are collectively referred to as the "Products."
- The structural integrity of the Products, when installed strictly in accordance with StormTech's written installation instructions at the time of installation, are warranted to the Purchaser against defective materials and workmanship for one (1) year from the date of purchase. Should a defect appear in the Limited Warranty period, the Purchaser shall provide StormTech with written notice of the alleged defect at StormTech's corporate headquarters within ten (10) days of the discovery of the defect. The notice shall describe the alleged defect in reasonable detail. StormTech agrees to supply replacements for those Products determined by StormTech to be defective and covered by this Limited Warranty. The supply of replacement products is the sole remedy of the Purchaser for breaches of this Limited Warranty, StormTech's liability specifically excludes the cost of removal and/or installation of the Products.
- (C) THIS LIMITED WARRANTY IS EXCLUSIVE. THERE ARE NO OTHER WARRANTIES WITH RESPECT TO THE PRODUCTS, INCLUDING NO IMPLIED WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.
- (D) This Limited Warranty only applies to the Products when the Products are installed in a single layer. UNDER NO CIRCUMSTANCES, SHALL THE PRODUCTS BE INSTALLED IN A MULTI-LAYER CONFIGURATION.
- (E) No representative of StormTech has the authority to change this Limited Warranty in any manner or to extend this Limited Warranty. This Limited Warranty does not apply to any person other than to the Purchaser.

- (F) Under no circumstances shall StormTech be liable to the Purchaser or to any third party for product liability claims; claims arising from the design, shipment, or installation of the Products, or the cost of other goods or services related to the purchase and installation of the Products. For this Limited Warranty to apply, the Products must be installed in accordance with all site conditions required by state and local codes; all other applicable laws; and StormTech's written installation instructions.
- THE LIMITED WARRANTY DOES NOT EXTEND TO INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES. STORMTECH SHALL NOT BE LIABLE FOR PENALTIES OR LIQUIDATED DAMAGES, INCLUDING LOSS OF PRODUCTION AND PROFITS: LABOR AND MATERIALS: OVERHEAD COSTS: OR OTHER LOSS OR EXPENSE INCURRED BY THE PURCHASER OR ANY THIRD PARTY. SPECIFICALLY EXCLUDED FROM LIMITED WARRANTY COVERAGE ARE DAMAGE TO THE PRODUCTS ARISING FROM ORDINARY WEAR AND TEAR: ALTERATION, ACCIDENT, MISUSE, ABUSE OR NEGLECT; THE PRODUCTS BEING SUBJECTED TO VEHICLE TRAFFIC OR OTHER CONDITIONS WHICH ARE NOT PERMITTED BY STORMTECH'S WRITTEN SPECIFICATIONS OR INSTALLATION INSTRUCTIONS: FAILURE TO MAINTAIN THE MINIMUM GROUND COVERS SET FORTH IN THE INSTALLATION INSTRUCTIONS; THE PLACEMENT OF IMPROPER MATERIALS INTO THE PRODUCTS; FAILURE OF THE PRODUCTS DUE TO IMPROPER SITING OR IMPROPER SIZING: OR ANY OTHER EVENT NOT CAUSED BY STORMTECH. A PRODUCT ALSO IS EXCLUDED FROM LIMITED WARRANTY COVERAGE IF SUCH PRODUCT IS USED IN A PROJECT OR SYSTEM IN WHICH ANY GEOTEXTILE PRODUCTS OTHER THAN THOSE PROVIDED BY ADVANCED DRAINAGE SYSTEMS ARE USED. THIS LIMITED WARRANTY REPRESENTS STORMTECH'S SOLE LIABILITY TO THE PURCHASER FOR CLAIMS RELATED TO THE PRODUCTS. WHETHER THE CLAIM IS BASED UPON CONTRACT. TORT, OR OTHER LEGAL THEORY.









tion Separat

Confinement Reinford

ADS PLUS WOVEN GEOTEXTILE SPECIFICATION

For use with StormTech® Isolator® Row Plus

Scope

This specification describes ADS Plus woven geotextile.

ADS Plus woven geotextile fabrics are woven polypropylene materials offering optimum performance when used in stabilization applications. Produced from first quality raw materials, they provide the perfect balance of strength and separation in styles capable of functioning exceptionally well in a wide range of performance requirements.

Filter Fabric Properties

Property ¹	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)²
Weight	ASTM D5261	oz/yd² (g/m²)	8.0 (271.25)
Grab Tensile Strength	ASTM D4632	lbs (kN)	325 (1.45)
Grab Elongation	ASTM D4632	%	15
Trapezoidal Tear Strength	ASTM D4533	lbs (kN)	125 (0.89)
CBR Puncture Resistance	ASTM D6241	lbs (kN)	1,124 (5.0)

^{1.} The property values listed above are subject to change without notice.

Dimensions

ADS Plus shall be delivered to the jobsite in roll form with each roll individually identified and nominally measuring 12.5' (3.8 m) width x 360' (110 m) length for Plus125 and 6.25' (1.9 m) width x 360' (110 m) length for Plus625.



^{2.} Minimum Average Roll Values (MARV) is calculated as the average minus two standard deviations. Statistically, it yields approximately 97.5% degree of confidence that any samples taken from quality assurance testing will meet or exceed the values described above.







Drainag

Filtratio

ADS 0601T NONWOVEN GEOTEXTILE SPECIFICATION

Scope

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

Filter Fabric Requirements

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

Filter Fabric Properties

Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)
Grab Tensile	ASTM D4632	lbs (kN)	160 (0.711)
Grab Elongation	ASTM D4632	%	50
Trapezoid Tear Strength	ASTM D4533	lbs (kN)	60 (0.267)
CBR Puncture Resistance	ASTM D6241	lbs (kN)	410 (1.82)
Permittivity*	ASTM D4491	sec ⁻¹	1.5
Water Flow*	ASTM D4491	gpm/ft² (l/min/m²)	110 (4480)
AOS*	ASTM D4751	US Sieve (mm)	70 (0.212)
Melting Point	ASTM D276	Fahrenheit (Celsius)	320 (160)
UV Resistance	ASTM D4355	%/hrs	70/500

Packaging

Roll Dimensions (W x L) - ft. (m)	3.0/5.0/6.25/7.5/9.0/12.5 x 360 -15 x 300 (0.9/1.5/1.9/2.3/2.7/3.8 x 110 - 4.5 x 91)
Roll Square Yards (Square Meters)	120/200/250/300/360/500 - 500 (100/167/209/251/301/418 - 418)
Estimated Roll Weight - lbs (kg)	44/65/97.5/102/141/195 - 195 (20/29/44/46/64/88 - 88)

 $[\]mbox{\ensuremath{\mbox{*}}}$ At the time of manufacturing. Handling may change these properties.



Appendix G Water Demand & Fire Flow Calculations



TABLE 2 Water Demand Calculation

SHOELESS JOE'S RESTAURANT 1144 HUGEL AVENUE Project No. n2137

Average Consumption Rate	450	L/capita/day	1.Section 11.2.3
Max Day Factor	2		
Peak Hour Factor	4.5		
Domestic Demand(Ex. Motel)			
Pop: Equivallent	2	Person/unit	
Number of Unit	65		
Population	130	Person	
Average Domestic Water Deamnd	58500.00	l/day	Water demand for pre development condition
	0.68	L/sec	
Max Day Demand	1.35	L/sec	-
Max Hour Deamd	3.05	L/sec	
Commercial Demand- (Restaurant)			
Gross Commercial Area	0.0334	ha	Site Plan (Note 3)
Water Demand for Restaurant	20	m³/ha/day	2.Section 6.4 (Note 1)
Average Restaurant Water Deamnd	668.76	l/day	
	0.01	L/sec	
Max Day Demand	0.02	L/sec	
Max Hour Deamd	0.03	L/sec	

Total water demand from Hotel and Restaurant

Max Day Demand	1.37	L/sec	Water demand for Post
Max Hour Deamd	3.08	L/sec	development condition

Note:

- 1. Town of Innisfil, Engineering Design Standards and Specifications
- 2. MOE, Design Guidelines For Sewage Works
- 3. Site Plan, Preapred by n Architecture Inc.

TABLE 2. FIRE FLOW CALCULATION as per

FIRE UNDERWRITERS SURVEY (1999)

PROJECT: Shoeless Joe's Restaurant Date: 7/3/25

1144 Hugel Ave, ON

1. Fire Flow Equation

F = 220 C √ A

where F is the required fire flow [LPM]

C is the coefficient determined by type of construction [unitless]

A is the total protection area [sq.m]

2. Architecture Information

Restaurant

Type of Construction	Non-Combustible	A
Fire Rating	Non-Combustible]
Sprinkler Provided (Y/N)	NO]

Floor Area (Largest Unit)

	,	
Total Floor Area [sq.m]	334	В
Coefficient, C [1]	0.8	
Fire Flow, F [LPM]	3218	D

3. Combustible Product Risk

Occupancy Adjustment	75%	
Fire Flow, F [LPM]	2414	ÌΕ

4. Sprinkler Reduction

Sprinkler Reduction	0.00	
Sprinkler Reduction [LPM]	0	F

5. Exposure Adjustment

Exposure Adjustment [LPM]		2	G
	Total	0%	
West		0.05%	
South		0.00%	
East		0.00%	
North		0.00%	

6. Required Fire Flow, Duration & Volume

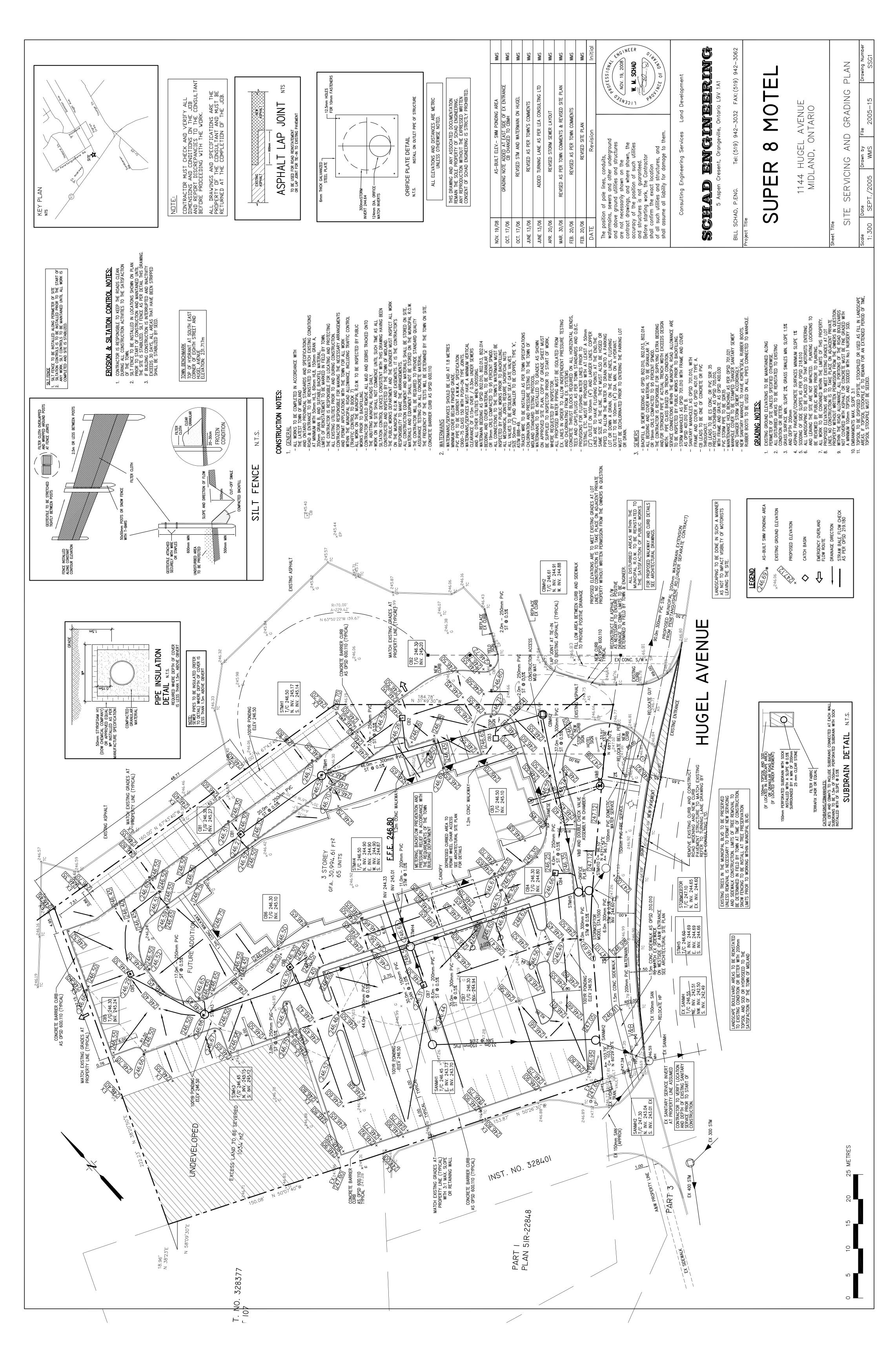
Fire Flow, F [LPM]	2415	
Sprinkler Reduction [LPM]	0	1
Exposure Adjustment [LPM]	2	
Required Fire Flow [LPM]	2417	Н
Required Fire Flow [LPM]	2000	*
Required Fire Flow [LPS]	33	

Appendix H Saniatry Demand & Capacity Analysis

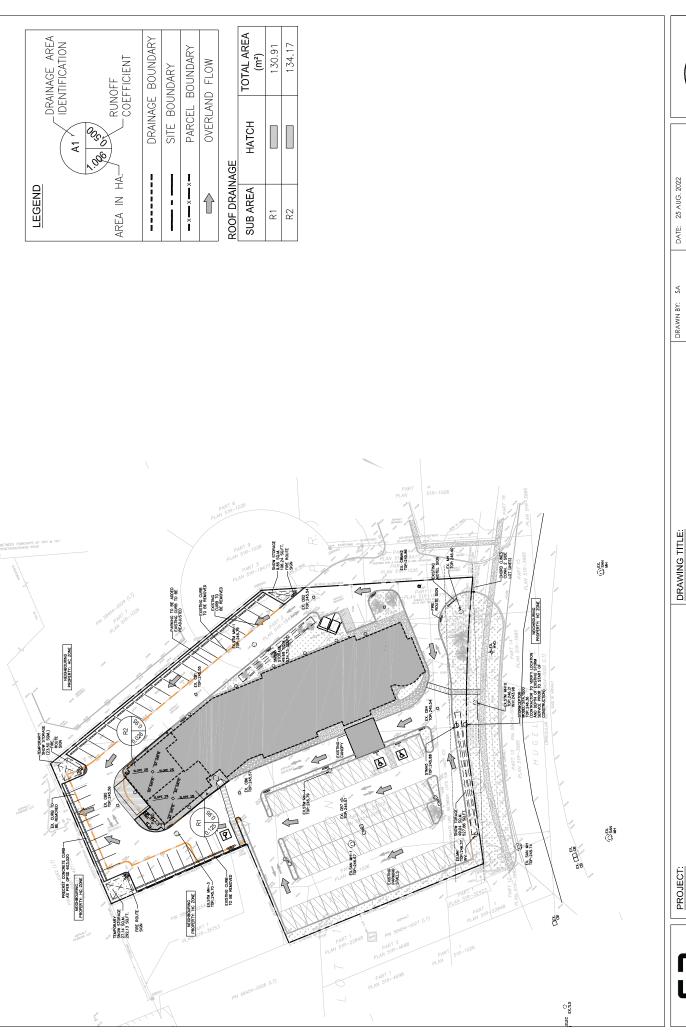
ADDRESS 1144 HUGEL AVENUE Town/Township/City TOWN OF MIDLAND CONSULTANT nengineering Inc. PROJECT NO. n2137 AREA UPSTREAM DOWNSTREAM (Land Use Type) MH		FLOW															
		FLOW															
n Engineering Inc. n2137 A UPSTREAM Type) MH		FLOW															
n 2137 A UPSTREAM Type) MH		FLOW												ı			
UPSTREAM		FLOW			DE	ESIGN CHAR	DESIGN CHART S1: SANITARY SEWER - Pre development condition	RY SEWE	R - Pre dev	lopment	conditio	_		u u	nglu	n Engineering Inc	J Inc
UPSTREAM					AVG FLOW	FLOW	PEAK FLOW	M	CUM. FLOW	MO				BIPE			
ΗМ		EQUIV. PEAK	.K AVG.	TOTA	TOTAL INFILTRATION TOTAL	N TOTAL	INFILTRATION TOTAL DESIGN EXTREME LENGTH SIZE GRADE CAP. LOSS 10 AP.	TOTAL	DESIGN	XTREME	LENGTH	SIZE	SRADE C	AP. INEC 14	CAB E		DES. EXTR.
	Alea (h)	POP. FACT.	T. FLOW	AREA	A FLOW	FLOW	FLOW	FLOW	FLOW	FLOW			4	ULL (1953.)			VEL.FULL VEL.
	(na.)		(r/s)	(ha.)	(r/s)	(r/s)	(r/s)	(r/s)	(L/s)	(L/s)	m		ľ	L/sec		(%)	(m/sec) FULI
Hotel Building Plug SAN MH-1	0.746	0.746 130 4.2	0.68	0.746	0.172	3.02	0.172	0.85	0.85	3.02	30.0	150	2.00	21.5	4% 14	14.0%	0.05
SAN MH-1 Ex. MH									0.85	3.02	33.0	150	2.00	21.5	4% 14	14.0%	0.05
EX. Municipal SAN MH	МН								0.85	3.02	10.0 150 2.00 21.5	150	2.00	1.5 4%		14.0%	0.05

PROJECT	SHOELESS JOE'S RESTAURANT	RESTAURANT																			L		
ADDRESS	1144 HUGEL AVENUE	ENUE																					
Town/Township/City TOWN OF MIDLAND	TOWN OF MIDLA	4ND																				.	
CONSULTANT	n Engineering Inc.	ڼ																			Fngine	n Engineering Inc	,
PROJECT NO.	n2137									۵	ESIGN CHA	DESIGN CHART S2: SANITARY SEWER- POST DEVELOPMENT CONDITION	ARY SEWER	- POST DEV	ELOPMENT	CONDITION	-			:	9	0	
			Flow from Restaurant	Restaurant		FLOW from Motel	Motel			AVG FLOW	W	PEAK FLOW	WC	CUM. FLOW	wo-				4	PIPE			
AREA	UPSTREAM	DOWNSTREAM Floor area (*Augusta	Floor area(*	Aros	EQUIV. PEAK		AVG.	TOTAL	INFILTRATION	TOTAL	INFILTRATION	TOTAL	DESIGN	EXTREME	LENGTH	SIZE	GRADE CAP.	-	G AVA	EXTR.	DES. E	EXTR.
(Land Use Type)	Ξ	¥	2, 2,	Flow(1/c)	(h)	POP. FACT.		FLOW	AREA	FLOW	FLOW	FLOW	FLOW	FLOW	FLOW			ď	, JULI (17)		CAP. VE	VEL.FULL	VEL.
				riow(L/s)	(na.)			(s/1)	(ha.)	(r/s)	(s/1)	(r/s)	(r/s)	(L/s)	(L/s)	£		T ₁	r/sec	(%)	(%) (n	(m/sec)	:UIT
	Building Plug	Building Plug SAN MH-1	334	0.010 0.746	0.746	130	4.2	89.0	0.746	0.172	98.0	0.172	3.06	98.0	3.06	30.0	150	2.00	21.5	4% 14	14.2%	0.05	0.17
Proposed Restaurant SAN MH-1	t SAN MH-1	Ex. MH												98.0	3.06	33.0	150	2.00 21.5		4% 14	14.2%	0.05	0.17
and Ex.Hotel		Ex. Municipal																					
	EX.MH	SAN MH												98.0	3.06	30.0	150	2.00	21.5	4% 14	14.2%	0.05	0.17
		* As per Town	n of Midland	* As per Town of Midland Engineering Development Design Standard section 6.1.4	evelopmen	t Design St	andard se	ection 6.1.	4														
						ĺ	ĺ	ĺ	ĺ		1						ĺ	ĺ	ĺ				l

Approved Site Servicing & Grading Plan



Appendix K Roof Storage





ROOF DRAINAGE PLAN POST-DEVELOPMENT

DRAWING NO.: SCALE: 1:1000 21-37 CHECKED BY: AZ PROJECT NO.:

DR-103

PROJECT NORTH

n Engineering Inc

MIDLAND, ONTARIO

1144 HUGEL AVE RESTAURANT

SHOELESS JOE'S

Project: SHOELESS JOE'S RESTAURANT

roject No.: n2137 Date: 3-Jul-25

Table 2M - 100 Years Storage (Roof Top) (R1 & R2)

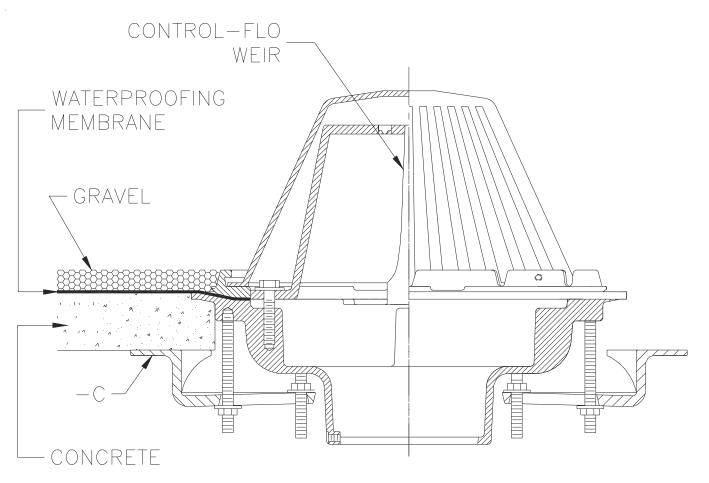
Table 2	M - 100 Years S	torage (Roof T			
			Equation of	IDF:	
	R =	1.00	. 4	A	I = Rainfall Intensity (mm/hr)
	A =	0.03 ha	$i = \frac{1}{(t+1)^n}$	$\frac{A}{(B)^C}$	T = Time of Concentration (hr)
	Q _{release} =	0.002 m ³ /s	(1+	ъ)	A= 2193.1
	(0 D	2.4 L/s	. (-)		B= 9.04
	(2 Root Drains @	1.20L/sec flow ra	ite)		C= 0.871 Max Storage Required (m³) 7.64
	•	i	Q ₁₀₀	0	Max Storage Required (m³) 7.64 Peak Volume
	t _c (min)	i ₁₀₀ (mm/hr)	(m ³ /s)	Q _{stored} (m ³ /s)	(m³)
	15	137.49	0.010	0.008	6.951
	16	132.69	0.010	0.007	7.076
	17	128.24	0.009	0.007	7.184
	18	124.10	0.009	0.007	7.277
	19	120.24	0.009	0.006	7.357
	20	116.62	0.009	0.006	7.425
	21	113.24	0.008	0.006	7.482
	22	110.05	0.008	0.006	7.529
	23	107.05	0.008	0.005	7.566
	24	104.23	0.008	0.005	7.595
	25	104.25	0.007	0.005	7.617
	26	99.02	0.007	0.005	7.631
	27	96.63	0.007	0.005	7.638
	28	94.35	0.007	0.005	7.640 ***
	20 29	94.35 92.19	0.007	0.003	7.635
	30	90.13	0.007	0.004	7.625
	31	88.16	0.006	0.004	7.611
	32	86.29	0.006	0.004	7.591
	33	84.50	0.006	0.004	7.567
	34	82.79	0.006	0.004	7.539
	35	81.15	0.006	0.004	7.508
	36	79.57	0.006	0.003	7.472
	37	78.07	0.006	0.003	7.433
	38	76.62	0.006	0.003	7.391
	39	75.23	0.006	0.003	7.346
	40	73.89	0.005	0.003	7.298
	41	72.60	0.005	0.003	7.247
	42	71.36	0.005	0.003	7.194
	43	70.17	0.005	0.003	7.138
	44	69.01	0.005	0.003	7.080
	45	67.90	0.005	0.003	7.019
	46	66.82	0.005	0.003	6.956
	47	65.78	0.005	0.002	6.892
	48	64.78	0.005	0.002	6.825
	49	63.80	0.005	0.002	6.757
	50	62.86	0.005	0.002	6.686
	51	61.95	0.005	0.002	6.614
	52	61.06	0.004	0.002	6.541
	53	60.21	0.004	0.002	6.466
	54	59.37	0.004	0.002	6.389
	55	58.57	0.004	0.002	6.311
	56	57.78	0.004	0.002	6.231
	57	57.02	0.004	0.002	6.150
	58	56.28	0.004	0.002	6.068
	59	55.55	0.004	0.002	5.985
	60	54.85	0.004	0.002	5.900
					3.333



TYPICAL INSTALLATION Z105-C (CANADIAN MARKET) CONTROL-FLO INSTALLED-CONCRETE ROOF



Dimensional Data (inches and [mm]) are Subject to Manufacturing Tolerances and Change Without Notice



Z105-C (CANADIAN MARKET) CONTROL-FLO INSTALLED-CONCRETE ROOF

Control-Flo roof drain. The Zurn Control-Flo roof drain can be used for almost any type roof design or installation where flow rates to the drainage system must be accurately controlled. The drain utilizes a unique weir designed that limits the flow through the drain.

- 1. Available with 1 to 6 inverted parabolic notches.
- 2. Allows linear relationship between depth of water on roof and flow rate through drain.
- Stores water on roof with controlled discharge so that drainage system and roof structural system will not be overloaded.
- May allow use of smaller diameter piping.

(For sizing, contact Zurn Engineering Department for details)

Form # RD100 Date: 04/19/13 C.N. No. 129165 Rev.

Selecta-Drain Chart



LOCATION	SQUARE METRE (SQUARE FOOT) NOTCH AREA RATING	ROOF LOAD FACTOR KGS. (LBS.)	TOTAL ROOF SLOPE											
			DEAD LEVEL		51mm (2") RISE			102mm (4") RISE			152mm (6") RISE			
			L.P.M. (G.P.M.) Discharge	Draindown Time Hrs.	mm (in.) Water Depth									
Ottawa, Ontario	232 (2,500)	4.7 (10.4)	45.5 (10)	7	51 (2)	59 (13)	6.5	66 (2.6)	77.5 (17)	4.5	86.5 (3.4)	86.5 (19)	3.2	96.5 (3.8)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	68 (15)	14	76 (3)	86.5 (19)	10	96.5 (3.8)	100 (22)	7.5	112 (4.4)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	75 (16.5)	23	84 (3.3)	93 (20.5)	16	104 (4.1)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	79.5 (17.5)	32	89 (3.5)	97.5 (21.5)	22	109 (4.3)	113.5 (25)	18	127 (5)
St. Thomas, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	68 (15)	7	76 (3.0)	86.5 (19)	5	96.5 (3.8)	104.5 (23)	4	117 (4.6)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	77.5 (17)	16	86.5 (3.4)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	7.1 (16.6)	68 (15)	29	76 (3.0)	82 (18)	26	91.5 (3.6)	102.5 (22.5)	18	114.5 (4.5)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	7.5 (16.6)	72.5 (16)	40	81.5 (3.2)	86.5 (19)	34	96.5 (3.8)	107 (23.5)	24	119.5 (4.7)	132 (29)	20	147.5 (5.8)
Timmins, Ontario	232 (2,500)	4.3 (9.4)	41 (9)	7	45.5 (1.8)	57 (12.5)	6	63.5 (2.5)	72.5 (16)	4	81.5 (3.2)	86.5 (19)	3.3	96.5 (3.8)
	465 (5,000)	5.7 (12.5)	54.5 (12)	16	61 (2.4)	63.5 (14)	14	71 (2.8)	82 (18)	9	91.5 (3.6)	97.5 (21.5)	7.5	109 (4.3)
	697 (7,500)	6.4 (14)	61.5 (13.5)	27	68.5 (2.7)	70.5 (15.5)	22	78.5 (3.1)	86.5 (19)	15	96.5 (3.8)	104.5 (23)	12	117 (4.6)
	929 (10,000)	6.6 (14.6)	63.5 (14)	36	71 (2.8)	72.5 (16)	30	81.5 (3.2)	91 (20)	21	101.5 (4.0)	109 (24)	17	122 (4.8)
Toronto, Ontario	232 (2,500)	5.7 (12.5)	54.5 (12)	8	61 (2.4)	66 (14.5)	7	73.5 (2.9)	82 (18)	4.5	91.5 (3.6)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.8 (15.1)	66 (14.5)	19	73.5 (2.9)	77.5 (17)	16	86.5 (3.4)	93 (20.5)	11	104 (4.1)	111.5 (24.5)	9	124.5 (4.9)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	84 (18.5)	26	94 (3.7)	100 (22)	18	112 (4.4)	120.5 (26.5)	14	134.5 (5.3)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	86.5 (19)	34	96.5 (3.8)	104.5 (23)	24	117 (4.6)	127.5 (28)	20	142 (5.6)
Windsor, Ontario	232 (2,500)	6.1 (13.5)	59 (13)	8.5	66 (2.6)	70.5 (15.5)	7.5	78.5 (3.1)	84 (18.5)	4.5	94 (3.7)	107 (23.5)	4	119.5 (4.7)
	465 (5,000)	7.1 (15.6)	68 (15)	20	76 (3.0)	79.5 (17.5)	16	89 (3.5)	97.5 (21.5)	11	109 (4.3)	118 (26)	9	132 (5.2)
	697 (7,500)	8.0 (17.7)	77.5 (17)	30	86.5 (3.4)	86.5 (19)	26	96.5 (3.8)	107 (23.5)	18	119.5 (4.7)	125 (27.5)	15	139.5 (5.5)
	929 (10,000)	8.7 (19.2)	82 (18)	42	91.5 (3.6)	91 (20)	36	101.5 (4.0)	113.5 (25)	26	127 (5.0)	129.5 (28.5)	20	145 (5.7)
Charlottetown, Prince Edward Island	232 (2,500)	4.9 (10.9)	47.5 (10.5)	7.5	53.5 (2.1)	57 (12.5)	6	63.5 (2.5)	68 (15)	3.8	76 (3.0)	79.5 (17.5)	3	89 (3.5)
	465 (5,000)	6.6 (14.6)	63.5 (14)	19	71 (2.8)	75 (16.5)	15.5	84 (3.3)	88.5 (19.5)	10	99 (3.9)	100 (22)	7.5	112 (4.4)
	697 (7,500)	7.8 (17.2)	75 (16.5)	31	84 (3.3)	86.5 (19)	26	96.5 (3.8)	102.5 (22.5)	18	114.5 (4.5)	113.5 (25)	13	127 (5.0)
	929 (10,000)	8.7 (19.2)	84 (18.5)	42	94 (3.7)	97.5 (21.5)	37	106.5 (4.2)	111.5 (24.5)	26	124.5 (4.9)	125 (27.5)	20	139.5 (5.5)
Montreal, Quebec	232 (2,500)	5.2 (11.4)	50 (11)	7.5	56 (2.2)	61.5 (13.5)	7	68.5 (2.7)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.36)
	465 (5,000)	5.9 (13)	57 (12.5)	17	63.5 (2.5)	70.5 (15.5)	15	78.5 (3.1)	88.5 (19.5)	10	99 (3.9)	109 (24)	8	122 (4.8)
	697 (7,500)	6.1 (13.5)	59 (13)	27	66 (2.6)	72.5 (16)	23	81.5 (3.2)	93 (20.5)	16	104 (4.1)	113.5 (25)	13	127 (5.0)
	929 (10,000)	6.4 (14)	61.5 (13.5)	36	68.5 (2.7)	77.5 (17)	31	86.5 (3.4)	95.5 (21)	22	106.5 (4.2)	120.5 (26.5)	19	134.5 (5.3)
Quebec City, Quebec	232 (2,500)	5.4 (12)	52.5 (11.5)	8	58.5 (2.3)	63.5 (14)	7	71 (2.8)	79.5 (17.5)	4.5	89 (3.5)	97.5 (21.5)	3.5	109 (4.3)
	465 (5,000)	6.4 (14)	61.5 (13.5)	18	68.5 (2.7)	70.5 (15.5)	15	78.5 (3.1)	84 (18.5)	10	94 (3.7)	104.5 (23)	8	117 (4.6)
	697 (7,500)	6.6 (14.6)	63.5 (14)	28	71 (2.8)	72.5 (16)	23	81.5 (3.2)	86.5 (19)	15	96.5 (3.8)	107 (23.5)	12	119.5 (4.7)
	929 (10,000)	7.1 (15.6)	68 (15)	37	76 (3.0)	77.5 (17)	31	86.5 (3.4)	88.5 (19.5)	20	99 (3.9)	109 (24)	17	122 (4.8)

Appendix K Limiting Condition of Assumptions

Statement of Limiting Conditions and Assumptions

- 1. This Report/Study (the "Work") has been prepared at the request of, and for the exclusive use of, the Owner, and its affiliates (the "Intended Users"). No one other then the intended users has the right to use and rely on the work without first obtaining the written authorization of n Engineering and its Owners.
- 2. The comments, recommendations and material in this report reflect n Engineering best judgment in light of the information available to it at the time of preparation of this report. It is not qualified to and is not providing legal or planning advice in this work.
- 3. n Engineering expressly excludes liability to any third party except the Intended Users for any use of, and/or reliance upon, the work.
- 4. n Engineering notes that the following assumptions were made in completing the work
 - a) The land use description(s) supplied n Engineer Inc. is correct;
 - b) The surveys and other data supplied to n Engineering by the Owner are accurate;
 - c) Market timing, approval delivery and secondary information are within the control of parties other then n Engineering;
 - d) There are no encroachments, leases, covenants, binding agreements, restrictions, pledges, charges, liens or special assessments outstanding, or encumbrances, which would significantly affect the use or servicing; Investigations have not carried out to verify these assumptions. n Engineering deems the sources of data and statistical information contained herein to be reliable, but we extend no guarantee of accuracy in these respect.
- 5. All the plans, photographs, and sketches prepared and presented in this report/study are included solely to aid the visualizing the location of the property, the boundaries of the site, and the relative position of the improvements on the said lands are based on information provided by Owner
- 6. n Engineering accepts no responsibility for legal interpretations, questions of survey, opinion of title, hidden or inconspicuous conditions of the property, toxic wastes or contaminated materials, soil or sub soil conditions, environmental, engineering or other factual and technical matters disclosed by the owner, the clients, or any public agency, which by their nature, may change the outcome of the work.
- 7. In the preparation of this report, n Engineering have made investigations from secondary sources as documented in the work, but did not checked compliance with by laws, codes, agency and government regulations, etc., unless specifically noted in the work.
- 8. The value of proposed improvements should apply only with regard to the purpose and function of the work, as outlined in the body of this work. Any cost estimated set out in the work based on construction averages and subject to change.
- 9. Neither possession of Work, nor a copy of it, carries the right of publication. All copyright in the work reserved to n Engineering and considered confidential by n Engineering. The Work shall not be disclosed, reproduced, quoted from, or referred to, in whole or in part, or published in any manner, without the express written consent of n Engineering and the Owner.
- 10. The work is only valid if it bears the Professional Engineer's seal and original signature of author, and if considered in its entity. Responsibility for unauthorized alteration to the Work is denied.

End of the Statement

