STORMWATER MANAGEMENT REPORT

FAIRGATE HOMES

35 GORDON COLLINS DRIVE, WHITCHURCH-STOUFFVILLE, ONTARIO

Prepared By:

J+B Engineering Inc.
25 Centurian Drive, Suite 201
Markham, Ontario
L3R 5N8

Revised February 28, 2025

Table of Contents

1 INTRODUCTION

1.1 Study Area

The study area is located at south-east quadrant of Brillinger Industrial Place and Gordon Collins Road. The civic address for this property is 35 Gordon Collins Drive, Whitchurch-Stouffville, Ontario and is shown in Figure 1-1.

The existing study area is undeveloped and is proposed to be developed as an Industrial Park which includes an Industrial building, with office space, and loading docks for trucks.

1.2 Background

This study addresses the Stormwater Management (SWM) requirements for the proposed facility and provides details for stormwater quantity and quality controls to ensure that the proposed development will not have any adverse effects on the existing drainage system.

1.3 Objectives of Drainage and Stormwater Management Study

The objectives of the stormwater management study are to develop a strategy for the project that will:

- Identify potential stormwater runoff (quantity and quality) impacts to the receiving watercourses from the proposed development area.
- Address concerns from the review agencies including the Town of Whitchurch-Stouffville, York Region, Toronto and Region Conservation Authority (TRCA), Ministry of Transportation (MTO), and Ministry of Environment, Conservation and Parks (MECP) for the preparation and design of the Stormwater Management system.

Figure 1-1: Study Area

2 SITE DRAINAGE CONDITIONS

General Stormwater Management guidelines and information was obtained from the Town of Whitchurch-Stouffville, York Region and the TRCA.

2.1 Existing Drainage Conditions

The existing study area is an undeveloped parcel of green land that is approx. 1.762ha in size. Under existing conditions, stormwater surface runoff flows in the southerly direction into the adjacent property (Farsight Homes) as well as northly and westerly direction towards the existing Gordon Collins Drive and the proposed Brillinger Industrial Place. *(Refer to Drainage Plan P-303, Pre-development Drainage Plan)*

A surface run-off coefficient=**0.25** was used for the pre-development condition as per the Town and Regional guidelines.

2.2 Allowable Release Rate

Considering this is a relatively small area the "Modified Rational Method" was used to generate the 5-year allowable target release rate for the project site as follows:

$$Q = 0.00278\ C\ I\ A \quad \leftarrow Equation\ (1)$$

$Where\ Q: = Maximum\ Runoff\ Rate\ (m^3/sec)$

$C: = Runoff\ Coefficient$

$I: = Rainfall\ Intensity\ (mm/hr)\ \ (5 - year\ storm\ event, tc = 10\ min) - Town$

$I: = Rainfall\ Intensity\ (mm/hr)\ \ (10 - year\ storm\ event, tc = 10\ min) - Regional$

$A: = Drainage\ Area\ (ha)$

Q_{target}= 0.00278 * 0.250 * 107.00 * 0.274

Q_{target}= 0.0204 m^3/sec → Target Release Rate (Town)

Q_{target}= 0.00278 * 0.250 * 134.94 * 1.487

Q_{target}= 0.1394 m^3/sec → Target Release Rate (Regional)

2.3 Proposed Drainage Conditions

The post-development hydrologic conditions for the site were established utilizing the Town's IDF curve 2-Year to 100-Year (located in appendix) for the flow towards Town ROW, and Regional's IDF curve will be utilized for the flow towards regional jurisdiction. A conservative surface run-off coefficient of 0.90 was used for impervious surfaces (i.e. Roof drainage, driveways, gravel and parking area) and 0.25 was used for landscaped areas (Refer to Pre/Post Drainage Plan P-303).

The study area is delineated into four sub-catchments (West uncontrolled, West controlled, East controlled, and Roof) for stormwater management purposes and are described below.

West Uncontrolled Sub-Catchment

The west uncontrolled sub-catchment contains 0.082ha of landscaped area draining into Brillinger Industrial Place flowing westerly out of the site, adjacent to the western limit of the site. It is flowing uncontrolled due to grading constraints towards the Brillinger Industrial Place (Town ROW).

The existing and proposed weighted runoff coefficients for the West Uncontrolled sub-catchment are shown below in table 2-1.

Surface Composition		Impervious	Pervious	Combined	Surface Composition		Impervious	Pervious	Combined
Proposed Condition	(m^2)	0.00	819.73	819.73	Existing Condition	(m^2)	0.000	819.73	819.73
	(ha)	0.000	0.082	0.082		(ha)	0.000	0.082	0.082
Runoff Coefficient		0.900	0.250	0.250	Runoff Coefficient		0.900	0.250	0.250

Table 2-1: Runoff Coefficients (Sub-Catchment – West Uncontrolled)

For estimating flows using the Rational Method for storms greater than the 10-year return storm, runoff coefficients are increased 10%, 20% and 25% for the 25-year, 50-year and 100-year storms respectively to account for additional runoff due to soil saturation and the reduced accuracy associated with larger storms.

Refer to Table 2-2 below for the adjusted Runoff Coefficients due to soil saturation.

St. Event	Existing	Proposed
	Runoff Coefficient	
2-Year	0.250	0.250
5-Year	0.250	0.250
10-Year	0.250	0.250
25-Year	0.275	0.275
50-Year	0.300	0.300
100-Year	0.313	0.313

Table 2-2: Adjusted Runoff Coefficients for 2-100 Years Events (West Uncontrolled Sub-catchment)

East Controlled Sub-catchment

The East Controlled sub-catchment (0.29ha) represents the area lying east of the proposed building which consists of paved/gravel parking areas and strips of landscaped area located along the easterly property limits which flow into a catchbasin on the graveled area.

The existing and proposed weighted runoff coefficients for the East Controlled sub-catchments are shown below in table 2-3.

Surface Composition		Impervious	Gravel	Pervious	Combined	Surface Composition		Impervious	Pervious	Combined
Proposed Condition	(m^2)	602.68	1964.04	356.75	2923.47	Existing Condition	(m^2)	0.000	2923.470	2923.47
	(ha)	0.060	0.196	0.036	0.292		(ha)	0.000	0.292	0.292
Runoff Coefficient		0.900	0.900	0.250	0.821	Runoff Coefficient		0.900	0.250	0.250

Table 2-3: Runoff Coefficients (Sub-Catchment – East Controlled)

The runoff coefficients for the proposed condition are increased for storms greater than the 10-year as in the preceding section.

St. Event	Existing	Proposed
	Runoff Coefficient	
2-Year	0.250	0.821
5-Year	0.250	0.821
10-Year	0.250	0.821
25-Year	0.275	0.903
50-Year	0.300	0.985
100-Year	0.3125	1.000

Table 2-4: Adjusted Runoff Coefficients for 2-100 Years Events (East Controlled Sub-catchment)

Roof Sub-catchment

The roof sub-catchment is located on the roof of the proposed industrial building. The paved roof has an area of 0.41 ha. The runoff from the roof gets stored in a cistern with an overflow outlet connected to the rest of the storm sewer network.

The existing and proposed weighted runoff coefficients for the Roof are shown below in Table 2-5.

Surface Composition		Impervious	Pervious	Combined	Surface Composition		Impervious	Pervious	Combined
Proposed Condition	(m2)	4069.30	0.00	4069.30	Existing Condition	(m2)	0.000	4069.300	4069.30
	(ha)	0.407	0.000	0.407		(ha)	0.000	0.407	0.407
Runoff Coefficient		0.900	0.250	0.900	Runoff Coefficient		0.900	0.250	0.250

Table 2-5: Runoff Coefficients (Sub-Catchment – Roof)

The runoff coefficients for the proposed are increased as in the preceding sections.

St. Event	Existing	Proposed
	Runoff Coefficient	
2-Year	0.250	0.900
5-Year	0.250	0.900
10-Year	0.250	0.900
25-Year	0.275	0.990
50-Year	0.300	1.000
100-Year	0.3125	1.000

Table 2-6: Adjusted Runoff Coefficients for 2-100 Years Events (Roof Sub-catchment)

West Controlled Sub-catchment

The west controlled sub-catchment consists of majority of the site area (0.98 ha) and the stormwater will be collected by various drains located around the proposed development and an underground storm storage chamber. The flow will be treated by an OGS (Up-Flo® UFF-18) and controlled by an orifice pipe installed at MH#04 prior to discharging into a storm manhole located on the southerly property line. That manhole is connected by a series of pipes and other manholes through the adjacent property to the south and conveyed into regional roadside ditch along Stouffville Road, ultimately into Berczy Creek. The existing and proposed runoff coefficients for the West Controlled sub-catchment are shown in table 2-7 below.

Surface Composition		Impervious	Gravel	Pervious	Combined	Surface Composition		Impervious	Pervious	Combined
Proposed Condition	(m^2)	7216.29	66.93	2516.58	9799.80	Existing Condition	(m^2)	0.00	9799.80	9799.80
	(ha)	0.72	0.01	0.25	0.98		(ha)	0.00	0.98	0.98
Runoff Coefficient		0.90	0.90	0.25	0.73	Runoff Coefficient		0.90	0.25	0.25

Table 2-7: Runoff Coefficients (West Controlled Sub-Catchment)

The proposed runoff coefficients are increased in the same manner as the above section.

St. Event	Existing	Proposed
	Runoff Coefficient	
2-Year	0.250	0.734
5-Year	0.250	0.734
10-Year	0.250	0.734
25-Year	0.275	0.808
50-Year	0.300	0.881
100-Year	0.3125	0.918

Table 2-8: Adjusted Runoff Coefficients for 2-100 Years Events (West Controlled Sub-catchment)

3 PROPOSED STORMWATER MANAGEMENT PLAN

3.1 Quantity Control

The drainage pattern is expected to change due to increase in impervious surfaces for the proposed development. In order to satisfy the Town, Region and TRCA requirements, we must provide quantity control to ensure the post development peak run-off is controlled to pre-development levels for the 2 – 100-year storm events.

Considering this is a relatively small area the "Modified Rational Method" was used to generate the surface runoff for each storm event as follows:

As established in section 2.2 the allowable release rate for Town ROW is 0.0204m^3/s and 0.1394m^3/s for the Regional ROW. The controlled flow from the roof and the East Controlled sub-catchment are upstream in the storm network from the West Controlled sub-catchment. Therefore, only the release rate from the West Controlled sub-catchment and West Uncontrolled sub-catchment need to be considered when attempting to meet the allowable release rate, as these are the only sources for runoff released out of the subject site. *(Please refer to Drainage Plan P-303 Post Development Detail)*.

West Uncontrolled sub-catchment

The results of peak flow rates (m^3/s) generated by the "Modified Rational Method" for existing and proposed conditions for the West Uncontrolled sub-catchment is shown in table 3-1.

Storm Event	Rainfall Intensity (mm/hr)				<Equation 1> Flow Rate (m^3/sec)		
	a	b	c	I	Existing	Proposed	Excess Flow
2-year	696.679	4.957	0.811	77.67	0.0044	0.0044	0.0000
5-Year	1015.963	5.255	0.826	107.00	0.0061	0.0061	0.0000
10-Year	1279.709	5.715	0.841	126.19	0.0072	0.0072	0.0000
25-Year	1546.810	5.746	0.845	150.60	0.0094	0.0094	0.0000
50-Year	1802.604	6.029	0.853	169.09	0.0116	0.0116	0.0000
100-Year	2051.707	6.230	0.860	186.74	0.0133	0.0133	0.0000

Table 3-1: Peak Flows 2 - 100 Year Events (West Uncontrolled Sub-Catchment) - using Town IDF

As per the Table above, the release rate for the West Uncontrolled sub-catchment is based on the 100-year storm event which has a flow rate Q= 0.0133m^3/s. This uncontrolled sub-catchment will flow towards the proposed Brillinger Industrial Place. The 5-year pre-development flow is Q= 0.0204m^3/s, which is greater than the 100-year designed flow.

East Controlled sub-catchment

The results of peak flow rates (m^3) generated by the "Modified Rational Method" for existing and proposed conditions for the East Controlled sub-catchment is shown in Table 3-2.

Storm Event	Rainfall Intensity (mm/hr)				<Equation 1> Flow Rate (m^3/sec)		
	a	b	c	I	Existing	Proposed	Excess Flow
5-Year	1045.410	4.900	0.830	111.06	0.0226	0.0730	0.0504
10-Year	1331.420	5.260	0.840	134.94	0.0274	0.0887	0.0613
25-Year	1045.410	4.900	0.830	154.37	0.0345	0.1116	0.0771
50-Year	1045.410	4.900	0.830	171.03	0.0417	0.1349	0.0932
100-Year	1045.410	4.900	0.830	187.68	0.0477	0.1525	0.1049

Table 3-2: Peak Flows 5-100 Year Events (East Controlled Sub-Catchment) - using Regional IDF

This catchment flows into a catchbasin located on the gravel portion of the proposed parking lot. The catchbasin is controlled by a 100mmø orifice pipe directly downstream in order to utilize a portion of the gravel/asphalt parking lot for storage via ponding. The maximum depth of ponding is 0.25m. Through trial and error, we obtain for equation (2):

$$Q = (0.80)\pi\left(\frac{0.10}{2}\right)^2\sqrt{2 * 9.81 * \left(259.70 - 258.00 + \left(\frac{0.10}{2}\right)\right)}$$

$$Q = 0.0368\, m^3/s$$

The resulting storage volume required is calculated and shown below in table 3-3:

Stm Event	Td	Id	Qpost	Qorifice	Excess Flow	Volume(cum)
100-year storm event	1	240	0.1947	0.0368	0.1579	9.475
	5	156	0.1267	0.0368	0.0899	26.972
	10	111	0.0903	0.0368	0.0534	32.065
	15	87	0.0710	0.0368	0.0342	30.753
	20	73	0.0589	0.0368	0.0221	26.543
	25	62	0.0506	0.0368	0.0138	20.722
	26	61	0.0493	0.0368	0.0125	19.423
	27	59	0.0480	0.0368	0.0112	18.088
	28	58	0.0468	0.0368	0.0100	16.719
	30	55	0.0445	0.0368	0.0077	13.889
	60	33	0.0266	0.0368	-0.0102	-36.740
				Max Volume Required	cum	**32.144**

Table 3-3: Required Storage Volume 100 Year Storm Event (East Controlled Sub-catchment)

The ponding area is 1109.1m^2 (refer to Appendix E - *Grading Plan*). The storage volume from this area can be calculated by approximating the area as a cone. Therefore, the storage volume from this ponding area is

$$Volume = 1109.1\text{m}^2 * 0.25m/3$$

$$V = 92.4m^3$$

Which is more than the required volume of 32.144m^3.

Roof sub-catchment

The results of peak flow rates (m^3) generated by the "Modified Rational Method" for existing and proposed conditions for the Roof Controlled sub-catchment is shown in table 3-4.

Storm Event	Rainfall Intensity (mm/hr)				<Equation 1> Flow Rate (m^3/sec)		
	a	b	c	I	Existing	Proposed	Excess Flow
5-Year	1045.410	4.900	0.830	111.06	0.0314	0.1131	0.0817
10-Year	1331.420	5.260	0.840	134.94	0.0382	0.1374	0.0992
25-Year	1045.410	4.900	0.830	154.37	0.0480	0.1729	0.1249
50-Year	1045.410	4.900	0.830	171.03	0.0580	0.1935	0.1354
100-Year	1045.410	4.900	0.830	187.68	0.0664	0.2123	0.1460

Table 3-4: Peak Flows 5 - 100 Year Events (Roof Sub-Catchment) - using Regional IDF

The release rate is controlled by 9 Zurn® Z-105 Control-Flo Roof Drains. The roof will be designed to have 0.203m of ponding (8"). Based on the Z-105's max flow rate of 0.315L/s for every inch of head, the total flow can be calculated as follows:

$$Q_{total} = Q_{drain}/h * H * n$$

$$= \frac{0.315L}{s * 1"} * 8" * 6$$

$$= \frac{23.04L}{S} = 0.0230m^3/s$$

$$Where\ Q_{total} := Flow\ Rate\ Through\ Entire\ Roof\ \left(\frac{m^3}{sec}\right)$$

$$Q_{drain} := Max\ Flow\ Rate\ For\ Z-105\ Drain\ for\ 1"\ of\ Head\ \left(\frac{m^3}{sec}\right)$$

$$h := Driving\ Head\ for\ Q_{drain}\ (1")$$

$$H := Maximum\ Pressure\ Head\ for\ Roof\ (3")$$

$$n := Number\ of\ Roof\ Drains$$

Table 3-5 shows the resulting storage volumes below:

Stm Event	Td	Id	Qpost	Qorifice	Excess Flow	Volume(cum)
100-year storm event	1	240	0.2710	0.0154	0.2557	15.341
	10	111	0.1256	0.0154	0.1103	66.163
	30	55	0.0620	0.0154	0.0466	83.927
	37	47	0.0533	0.0154	0.0379	84.137
	38	46	0.0522	0.0154	0.0369	84.057
	39	45	0.0512	0.0154	0.0359	83.954
	40	44	0.0503	0.0154	0.0349	83.829
	60	33	0.0370	0.0154	0.0217	78.046
	90	24	0.0270	0.0154	0.0117	62.965
	120	19	0.0215	0.0154	0.0062	44.289
	Max Volume Required cum					**84.226**

Table 3-5: Required Storage Volume 100 Year Storm Event (East Controlled Sub-catchment)

The flat roof will be designed to have 8" (0.203m) of ponding. There will be 6 drains with 314.16 m^2 surface area for ponding. The rooftop storage can be calculated by approximating the storage volume as cone.

ROOFTOP STORAGE VOLUME= AREA*DEPTH/3

Volume = (6*314.16m^2)*0.203m/3

Volume = 1884.96m^2*0.203m/3 = 127.55m^3

Therefore, the provided roof storage of 127.55m^3 exceeds the estimated volume of 84.23m^3 required to control the runoff from the roof. The runoff from the roof will collect in a 5,000L cistern with an overflow outlet towards MH#02.

West Controlled sub-catchment

The results of peak flow rates (m^3) generated by the "Modified Rational Method" for existing and proposed conditions for the West Controlled sub-catchment is shown below in Table 3-6. The East Controlled Sub-Catchment and Roof Sub-Catchment flows to the West Controlled Sub-Catchment. Subsequently, West Controlled Sub-Catchment will flow towards existing drainage of FarSight and ultimately discharge to the existing Regional ROW – Stouffville Road. Thus, Regional IDF – Southern Quadrant will be utilized to determine the designed discharge.

Storm Event	Rainfall Intensity (mm/hr)				<Equation 1> Flow Rate (m^3/sec)		
	a	b	c	I	Existing	Proposed	Excess Flow
5-Year	1045.410	4.900	0.830	111.06	0.076	0.222	0.146
10-Year	1331.420	5.260	0.840	134.94	0.092	0.269	0.178
25-Year	1045.410	4.900	0.830	148.82	0.111	0.327	0.215
50-Year	1045.410	4.900	0.830	171.03	0.140	0.410	0.270
100-Year	1045.410	4.900	0.830	187.68	0.160	0.469	0.309

Table 3-6: Peak Flows 5 - 100 Year Events (West Controlled Sub-Catchment) – Using Regional IDF

The target release rate will be the allowable release rate in section 2.2 for surface runoff draining towards Regional ROW, **Q= 0.1394 m^3/sec**. The target release rate will be achieved using an orifice pipe restrictor at the outlet of MH#04.
Sizing of the orifice is given by the formula:

$$Q = C\,A\sqrt{2\,g\,h} \quad \leftarrow Equation\ (2)$$

$$Where\ Q := Flow\ Rate\ Through\ Orifice\ (m^3/sec) = Q_{Allowable}$$

$$C := Contraction\ Coefficient = 0.80\ (For\ Orifice\ Pipe)$$

$$A := Area\ of\ Orifice\ Pipe\ (m^2)$$

$$g := Acceleration\ Due\ To\ Gravity\ (m/sec^2) = 9.81\ (m/sec^2)$$

$$h := Pressure\ Head\ To\ Be\ Dissipated\ (m)$$

By trial-and-error calculations, a 120mm orifice pipe is required to control the flow to the Target release rate.

$$Q = (0.80)\pi\left(\frac{0.120}{2}\right)^2\sqrt{2 * 9.81 * \left(257.73 - 256.00 + \left(\frac{0.120}{2}\right)\right)}$$

$$Q = 0.1394\ m^3/\sec \leq 0.0535\ m^3/\ sec\ (target\ release\ rate)$$

Based on the calculated orifice release rate of Q= 0.0535m^3/s the required storage for the 100-year storm event is calculated using the "Modified Rational Method" and is shown below in table 3-7.

Stm Event	Td	Id	Qsc	Qpost	Qorifice	Excess Flow	Volume(cum)
100-year storm event	1	240	0.5981	0.6503	0.0535	0.5968	35.809
	5	156	0.3893	0.4414	0.0535	0.3879	116.380
	15	87	0.2181	0.2702	0.0535	0.2167	195.060
	30	55	0.1368	0.1890	0.0535	0.1355	243.852
	36	48	0.1199	0.1721	0.0535	0.1186	256.169
	37	47	0.1175	0.1697	0.0535	0.1162	258.000
	38	46	0.1153	0.1674	0.0535	0.1139	259.778
	39	45	0.1131	0.1653	0.0535	0.1118	261.505
	40	44	0.1110	0.1632	0.0535	0.1097	263.184
	60	33	0.0817	0.1339	0.0535	0.0804	289.520
	90	24	0.0596	0.1118	0.0535	0.0583	314.884
					Max Volume Required	cum	**321.324**

Table 3-7: Required Storage Volume 100 Year Storm Event (West) Controlled Sub-catchment)

The 120mm orifice pipe at the outlet of MH#4 will generate a required storage of 321.32m^3. The required storage volume generated considers the flow generated from the controlled sub-catchments upstream.

The storage is met in part by an underground storm storage chamber system. The system is used is the StormTech® MC-3500, the bed size will be approximately 11.76m by 32.09 m with 58 chambers, 30 endcaps, 305mm of 40% porosity stone above the chambers and 375mm of the same type of stone below the chamber. This design provides 374.40m^3 of storage, of which 68.5 m^3 is uses for infiltration (please see section 3.5 Water Balance). Therefore, the chamber system will provide 305.9 m3 of quantity control. The rest of the required storage volume is met by Storm piping and structures as summarized in the table below. The pipe ID referenced is from *P-304: Storm Design Reference Sheet* in Appendix E.

Pipe ID	Diameter (mm)	Area (m^2)	Length (m)	Volume (m^3)
1	300	0.07	30.5	2.15
2	300	0.07	40	2.83
3	375	0.11	40.5	4.47
4	450	0.16	8	1.27
5	525	0.22	42	9.09
7	250	0.05	16.5	0.81
8	250	0.05	16.5	0.81
9	250	0.05	16.5	0.81
10	250	0.05	16.5	0.81
11	600	0.28	89	25.15
12	600	0.28	11.5	3.25
15	600	0.28	25.5	7.21
16	600	0.28	2	0.57
17	600	0.28	2	0.57
Sum				**59.79**

Structure	Diameter (mm)	Area (m^2)	Maximum. Water level	Invert (m)	Volume (m^3)
STMMH#1	1200	1.13	257.73	256.54	1.34
STMMH#2	1200	1.13	257.73	256.29	1.62
STMCBMH#1	1200	1.13	257.73	256.66	1.21
STMCBMH#2	1200	1.13	257.73	256.92	0.91
STMCBMH#3	1200	1.13	257.73	256.78	1.07
STMCBMH#4	1200	1.13	257.73	256.43	1.47
STMCBMH#5	1200	1.13	257.73	256.07	1.87
STMCB#1	1200	1.13	257.73	256.78	1.07
STMCB#2	1201	1.13	257.73	257.14	0.66
STMCB#4	1203	1.14	257.73	256.80	1.05
STMCB#5	1204	1.14	257.73	256.74	1.12
STMCB#6	1205	1.14	257.73	256.68	1.19
STMCB#7	1206	1.14	257.73	256.62	1.26
				Sum	**15.86**

Table 3-8: 100 Year Storage Volumes within Pipes and Structures

Storage Volume for 100-year Storm Event (m^3)	
Catch Basins and Manholes	15.86
Underground Conduits	59.79
Underground Chamber storage	305.90
Total Provided	**381.54**

Table 3-9: Total 100 Year Storage Volume

The above table summarizes the total 100-year quantity control volumes. The total is 381.54m^3 which is more than the required volume of 321.32m^3.

3.2 SWM Summary

The overall release rate for the site is divided into 2 flows portion of the site runoff flows towards the existing Gordon Collins and proposed Brillinger Industrial Place (Town ROW) and Southward of the site towards existing open ditch of Stouffville Road (Regional ROW).

Overall release rate for the Town ROW = West Uncontrolled Catchment

$Q_{allowable} > Q_{design}$

$0.0204 m^3/s > 0.0133 m^3/s$

Overall release rate for the Regional ROW = West Controlled Catchment

$Q_{allowable} > Q_{design}$

$0.1394 m^3/s > 0.0535 m^3/s$

Therefore, the designed release rate for both flow meets the allowable requirement as per calculations shown in section 2.2.

3.3 Receiving Outlet

The storm outlet for the subject development is located along the south property limits and the stormwater will discharge via. a 120mm orifice pipe into a Storm manhole located on the north side of the Farsight Parcel. The stormwater system from that manhole conveys water to a regional roadside ditch system at the northside of Stouffville Road. The ditch has been assessed to be of sufficient capacity, and the storm system from the outlet to the ditch is solely for the purpose of conveying our site runoff to the ditch. Please refer to Appendix D for ditch assessment report.

3.4 Quality Control

A treatment train approach has been adopted for this site by incorporating the following treatment methods:

- Installation of the Hydro International Up-Flo® Filter UFF-18 prior to discharge into the underground storm chamber storage tank. The Up-Flo® has ETV verification and a TSS removal rate of 80.8% which meets "Enhanced" level of quality control. Refer to the sizing report and ETV verification located in the appendix.
- Downstream of the Up-Flo® Filter is a proposed underground storm chamber storage tank – "StormTech® MC-3500" designed for both water quantity and quality treatment. For quality purposes, the StormTech® system incorporates an "isolator row" (x2 rows) where the stormwater will initially enter this system before the flow is distributed throughout the chamber. The NJDEP identifies the StormTech® chamber "isolator row" having a TSS removal of 50%.
- Therefore, based on BMP the above treatment train approach has an estimated TTS removal efficiency of 90.4% based on the following calculation:

  E = A + B – [(AxB)/100]

  Where,

  E = Total pollutant removal efficiency (%)
  A = Efficiency of the First or Upstream BMP
  B = Efficiency of the Second or Downstream BMP
  E = 80.8% + 50% - [(80.8% x 50%)/100]
  E = 90.4%

As defined by the MOE in the Environmental Compliance Approval (ECA) the operation and maintenance of the OWS is the responsibility of the owner which states:

"*The Owner shall design, construct and operate the oil/grit separator with the objective that no visible oil sheens occur in the effluent discharged from the oil/grit separator.*

The Owner shall carry out and maintain an annual inspection and maintenance program on the operation of the oil/grit separator in accordance with the manufacturer's recommendation.

After a two (2) year period, the District Manager of the MOE District Office may alter the frequency of inspection of the oil/grit separator if he/she is requested to do so by the Owner and considers it acceptable upon review of information submitted in support of the request."

3.5 Water Balance

The primary objective of the Water Balance Targets/Criteria is to capture and manage annual rainfall on the development site itself to preserve the pre-development hydrology through a combination of infiltration, evapotranspiration, landscaping, rainwater reuse and/or other low impact development practices. The water balance target for this site is to retain runoff from a **5mm, 24 hour event**. Table 3-8 shows the water balance requirement for the subject site.

Total Site Area =	**17612.30**	m2
Rainfall Depth to be retained =	5.00	mm
Volume at 5mm =	**88.06**	m3

Table 3-10: Water Balance Required Retention Volume

To achieve the required water balance of 88.06m^3, the site composition will be assigned an initial abstraction value as follows: 2mm (gravel), 5mm (grass/landscape), 0mm (hard surface -roof/asphalt).

Initial Abstraction:

Surface	Area (m^2)	IA (mm)	Volume	
Grass	3666.00	5.0	18.3	m^3
Driveway	7852.62	0.0	0.0	m^3
Roof	4069.30	0.0	0.0	m^3
Gravel	2024.38	2.00	4.0	m^3
Total	**17612.30**		**22.4**	**m^3**

Table 3-11: Water balance - Initial Abstraction

Infiltration will be achieved through the open bottom underground StormTech® MC-3500 chamber. Table 3-10 below shows the infiltration volume of the chamber. This is the volume below the elevation of the outlet from the chamber which would therefore be the volume guaranteed to infiltrate after any storm event. See appendix F for a cumulative storage spreadsheet.

Description	Dimensions	Volume	
Stormtech Chamber	353.5m2 @ 375mm from bottom of stone (256.00)	68.5	m3
Total		**68.5**	m3

Table 3-12: Infiltration Volume

As per the Geotechnical Investigation Report done by Canada Engineering Services Inc. on August 22, 2023, the water table in the nearest borehole measures at 254.73 masl. The Stormtech chamber has been designed to have a bottom of stone elevation at 255.57. Therefore, we have a separation of 0.84m. This separation has been accepted by the TRCA as adequate, please refer to Appendix G for TRCA correspondence between TRCA and J+B.

As a Best Management Practice, a 5,000L cistern has been proposed to retain stormwater from the roof for greywater reuse. It is not considered in the water balance calculations.

Total Water balance provided = **22.4 + 68.5 = 90.9m^3**

This is sufficient for the water balance requirement of 88.06m^3.

4 EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

The erosion potential of the study area was assessed using methods described in the *"Erosion and Sediment Control Guideline for Urban Construction"* of temporary erosion and sediment control measures suitable for construction sites close to highways.

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, temporary swales with check dams and mud-mats. Sediment traps have been designed with enough storage volume as per LSRCA guidelines of 125 m^3/ha. The total storage volume needed is 220m^3 which is satisfied by two sediment traps with storage volumes of 120m^3, in total this provides 240m^3. Please refer to ESC Plan P-302.

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.
- 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 north 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.
- Stockpile to be seeded to provide increased stability.

5 SUMMARY AND CONCLUSIONS

In summary, all required conditions for the Town of Whitchurch-Stouffville, York Region and the TRCA have been satisfied as follows:

- Stormwater flow is controlled to pre-development conditions.
- The proposed SWM facilities provide ENHANCED LEVEL of protection.
- The Sediment and Erosion Control Plan demonstrates how erosion and sedimentation will be managed during construction

This SWM Report satisfies all requirements for stormwater quantity, quality and erosion & sedimentation control.

James Sam, P.Eng

Tel (416) 229-2636 ext 205
Fax (416) 226-6965
j.sam@jandb-inc.com

Appendix A – Town IDF Curve and Regional IDF

Town IDF curve

Table D-3: Chicago Distribution Design Storm Parameters and Rainfall Amounts

Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	696.679	1015.963	1279.709	1546.810	1802.604	2051.707
B	4.957	5.255	5.715	5.746	6.029	6.230
C	0.811	0.826	0.841	0.845	0.853	0.860
24 hour rainfall (mm)	45.9	59.0	67.6	78.5	86.7	94.7

9.11 Intensity – Duration – Frequency (IDF) Curves

Southern Quadrant: (South of Bloomington Road)

$I_5 = \frac{1045.41}{(t+4.9)^{0.83}}$ mm/hr

where t = 10 minutes, then I =111.10 mm/hr

Use 10 minutes as an initial inlet time

$I_{10} = \frac{1331.42}{(t+5.26)^{0.84}}$ mm/hr

$I_{25} = \left| \frac{1045.41}{(t+4.9)^{0.83}} \right| * 1.39$ mm/hr

$I_{50} = \left| \frac{1045.41}{(t+4.9)^{0.83}} \right| * 1.54$ mm/hr

$I_{100} = \left| \frac{1045.41}{(t+4.9)^{0.83}} \right| * 1.69$ mm/hr

Northern Quadrant: (North of Bloomington Road)

$I_5 = \frac{2464}{t + 16}$

where t = 10 minutes, then I = 94.77 mm/hr

Use 10 minutes as an initial inlet time

$I_{10} = \left| \frac{2464}{t + 16} \right| * 1.18$ mm/hr

$I_{25} = \left| \frac{2464}{t + 16} \right| * 1.39$ mm/hr

$I_{50} = \left| \frac{2464}{t + 16} \right| * 1.54$ mm/hr

$I_{100} = \left| \frac{2464}{t + 16} \right| * 1.69$ mm/hr

Intensity – Duration – Frequency (IDF) Curve for 25mm Storm

$I_{25\ mm} = 722.949 / (T_c + 7.503)^{.862}$

Appendix B – Storm Sewer Design Sheet

MARKHAM (HEAD OFFICE)
25 CENTURIAN DR, SUITE 201, MARKHAM, ON L3R 5N8
T: 416 229 2636 F: 416 229 6965

CALGARY
707 – 10TH AVE SW, SUITE 150, CALGARY, AB, T2R 0B3
T: 403 355 2295 F: 403 355 2297

STORMWATER MANAGEMENT REPORT

TOWN OF WHITCHURCH-STOUFFVILLE

STORM SEWER DESIGN SHEET

Fairgate Homes, Whitchurch-Stouffville

Runoff Coefficient, C		Pervious Areas	0.25
		Landscape Areas	0.25
		Roof Areas	0.90
		Paved Areas	0.90
		Grave	0.90
		Other Impervious Areas	0.90
Rainfall:	A=	2051.707	
	B=	6.23	
	C=	0.86	

Time of Concentration, min: 10.00

Rainfall Intensity (mm/hr): 186.742 for 100 year storm

= indicates controlled flow

Drainage							
Catchment ID	*Drainage Catchment Area (m^2)*	*PAVED (m)*	*LAND*	*GRAVEL*	*Runoff Coefficient (100-yr Storm)*	*Intensity of 100yr storm at Tc=10min (mm/hr)*	*100 yr Storm flow @Tc=10 min (m^3/s)*
A	716.81	536.81	180.00	0.00	0.92	187.68	0.034
B	1451.26	1077.98	373.28	0.00	0.92	187.68	0.069
C	1033.10	838.90	194.20	0.00	0.97	187.68	0.052
D	1084.40	880.66	203.74	0.00	0.97	187.68	0.055
E	2058.38	1025.43	1032.95	0.00	0.72	187.68	0.077
F	2923.47	1004.56	409.69	1509.22	1.00	187.68	0.037
G	377.64	310.71	0.00	66.93	1.00	187.68	0.020
H	378.40	378.40	0.00	0.00	1.00	187.68	0.020
I	299.69	299.69	0.00	0.00	1.00	187.68	0.016
J	299.62	299.62	0.00	0.00	1.00	187.68	0.016
K	158.60	158.60	0.00	0.00	1.00	187.68	0.008
L	1941.60	1409.21	532.39	0.00	0.90	187.68	0.091
M (Roof)	4069.30	4069.30	0.00	0.00	1.00	187.68	0.015
TOTAL	**16792.27**	**12289.87**	**2926.25**	**1576.15**			

= indicates controlled flow

Pipe ID	Pipe Dia. (m)	Area (m^2)	Perimeter (m)	Hydraulic Radius (m)	Slope (m/m)	Roughness Coefficient	Velocity (m/s)	Max. Pipe Flow (M) (m^3/s)	Actual Pipe Flow (A) (m^3/s)	A/M	Servicing area
1	0.300	0.071	0.942	0.075	0.005	0.013	0.967	0.068	0.034	0.50	A
2	0.300	0.071	0.942	0.075	0.008	0.013	1.224	0.086	0.069	0.80	B
3	0.375	0.110	1.178	0.094	0.005	0.013	1.123	0.124	0.122	0.98	B+C
4	0.375	0.110	1.178	0.094	0.013	0.013	1.775	0.196	0.177	0.90	B+C+D
5	0.375	0.110	1.178	0.094	0.015	0.013	1.944	0.215	0.211	0.98	A+B+C+D
6	0.300	0.071	0.942	0.075	0.015	0.013	1.675	0.118	0.037	0.31	F (100mm Orifice Pipe)
7	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.020	0.47	H
8	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.016	0.37	I
9	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.016	0.37	J
10	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.008	0.20	K
11	0.375	0.110	1.178	0.094	0.010	0.013	1.587	0.175	0.116	0.66	F+G+H+I+J+K
12	0.450	0.159	1.414	0.113	0.011	0.013	1.880	0.299	0.207	0.69	F+G+H+I+J+K+L
13	0.150	0.081	0.471	0.075	0.020	0.013	1.219	0.022	0.015	0.70	M (roof)
14	0.300	0.071	0.942	0.075	0.020	0.013	1.935	0.137	0.015	0.11	M (roof)
15	0.450	0.159	1.414	0.113	0.010	0.013	1.793	0.285	0.222	0.78	F+G+H+I+J+K+L+M
16	0.600	0.283	1.885	0.150	0.010	0.013	2.172	0.614	0.511	0.83	A+B+C+D+E+F+G+H+I+K+L+M
17	0.600	0.283	1.885	0.150	0.010	0.013	2.172	0.614	0.511	0.83	A+B+C+D+E+F+G+H+I+K+L+M
18	0.300	0.071	0.942	0.075	0.020	0.013	1.935	0.137	0.053	0.39	D/S of Outlet (All Controlled Catchments)

STORMWATER MANAGEMENT REPORT

TOWN OF WHITCHURCH-STOUFFVILLE

DRAIN INLET CAPACITY ANALYSIS

Fairgate Homes, Whitchurch-Stouffville

Storm Inlet	Drainage									Drainage Inlet					
	Catchment ID	Drainage Catchment Area (m^2)	PAVED	LAND	GRAVEL	Runoff Coefficient	Intensity of 100yr storm at Tc=10min (mm/hr)	100 yr Storm flow @Tc=10 min (m^3/s)	Runoff Volume (m^3)	CB/MH Grate Area (m^2)	CB/MH Elev. (m)	Max. Ponding Elev. (m)	Depth/Head (m)	Inlet Capcity (m^3/s)	Inlet Capacity at 50% Blocked Condition (m^3/s)
CB#01	A	716.81	536.81	180.00	0.00	0.92	187.68	0.034	20.67	0.36	258.07	258.22	0.15	0.37	0.185
CB#02	B	1451.26	1077.98	373.28	0.00	0.92	187.68	0.069	41.62	0.36	259.63	259.70	0.07	0.25	0.127
CBMH#02	C	1033.10	838.90	194.20	0.00	0.97	187.68	0.052	31.45	0.36	258.63	258.70	0.07	0.25	0.127
CBMH#01	D	1084.40	880.66	203.74	0.00	0.97	187.68	0.055	33.01	0.36	258.40	258.45	0.05	0.21	0.107
CBMH#05	E	2058.38	1025.43	1032.95	0.00	0.72	187.68	0.077	46.22	0.36	258.20	258.29	0.09	0.29	0.144
CB#03	F	2923.47	1004.56	409.69	1509.22	1.00	187.68	0.153	91.52	0.36	259.70	259.95	0.25	0.48	0.239
CBMH#03	G	377.64	310.71	0.00	66.93	1.00	187.68	0.020	11.82	0.36	259.61	259.63	0.02	0.14	0.068
CB#04	H	378.40	378.40	0.00	0.00	1.00	187.68	0.020	11.85	0.36	259.08	259.37	0.29	0.52	0.258
CB#05	I	299.69	299.69	0.00	0.00	1.00	187.68	0.016	9.38	0.36	258.73	258.84	0.11	0.32	0.159
CB#06	J	299.62	299.62	0.00	0.00	1.00	187.68	0.016	9.38	0.36	258.23	258.34	0.11	0.32	0.159
CB#07	K	158.60	158.60	0.00	0.00	1.00	187.68	0.008	4.97	0.36	257.73	257.98	0.25	0.48	0.239
CBMH#04	L	1941.60	1409.21	532.39	0.00	0.90	187.68	0.091	54.84	0.36	258.00	258.19	0.19	0.42	0.209

Appendix C – Revised Stouffville Road Ditch Assessment Report

Regional Ditch Assessment

Temporary Ditch Assessment

Realigned Ditch Assessment

Fairgate Stormwater Outlet Report

MARKHAM (HEAD OFFICE)
25 CENTURIAN DR, SUITE 201, MARKHAM, ON L3R 5N8
T: 416 229 2636 F: 416 229 6965

CALGARY
707 – 10TH AVE SW, SUITE 200, CALGARY, AB, T2R 0B3
T: 403 355 2295 F: 403 355 2297

J+B ENGINEERING INC.
WWW.JANDB-INC.COM

Revised July 17, 2020

The Regional Municipality of York
17250 Yonge Street
Newmarket, ON L3Y 6Z1

ATTN: John Kazilis MPA, MCIP, RPP
Manager, Transportation Development Planning,
Transportation & Infrastructure Planning,
Transportation Services

RE: **Far Sight Homes, Head Office, Gormley Community**

Dear Mr. John Kazilis,

This letter is to confirm that J+B Engineering Inc. has conducted a review of the documents listed below to verify the capacity of the Stouffville Road roadside ditch (north side) is sufficient to accept the stormwater from the proposed FarSight Homes Head Office located at the North/East quadrant of Brillinger Industrial Place & Stouffville Road:

- As-Built drawings of the Stouffville Road Reconstruction and Road Widening from Woodbine Ave to McCowan Road prepared by SNC Lavalin dated July 2014.
- Detailed Stormwater Management Report for the Gormley Industrial Subdivision 19T-89032-Town of Whitchurch Stouffville prepared by Masongsong Associates Engineering Limited, revision date July 2007.
- Stormwater Management Report for the existing Husky gas bar located at the N/W quadrant of Woodbine Ave & Stouffville Road.
- Council Committee Report from the Town of Whitchurch-Stouffville dated March 2, 2010 in regards to the stormwater management of the existing Tim Horton's site north of the existing Husky Gas Bar
- Topographic Survey of the subject property prepared by J.D. Barnes, dated March 27, 2018.

Based on the review of the above documents the following sub-catchments are currently draining into the subject ditching system and is illustrated in the attached drainage plan.

- The section of Stouffville Rd from Brillinger Industrial Pl / Woodbine Ave (between St 7+680 to 7+990)
- Fairgate & Far Sight parcels
- Existing Husky gas bar
- Existing Tim Horton's

The table below compares the existing and proposed flow rates for the sub-catchments based on Town of Stouffville IDF curve, which are currently draining into the existing roadside ditch at section A-A where the proposed Farsight Outlet is located.

Parcel	Area (m^2)	I (100 YR)	I (5 YR)	Ex Flow m^3/s	Proposed Flow m^3/s
Farsight	19389.37	186.74	107.00	0.314 (100 YR)	0.104 (Release Rate)
Fairgate	18045.26	186.74	107.00	0.292 (100 YR)	0.292 (100 YR)
Husky	5235.60	186.74	107.00	0.0380 (5 YR)	0.038 (5YR)
Tim Hortons	4097.00	186.74	107.00	0.030 (5 YR)	0.030 (5YR)
Ditch Parcel	7355.05	186.74	107.00	0.119 (100 YR)	0.119 (100 YR)
Stouffville Road (7+680-7+990)	5834.00	186.74	107.00	0.302 (100 YR)	0.302 (100 YR)
			Total Flow	**1.032**	**0.885**

As indicated in the table above, the flow rate at section A-A is expected to decrease under proposed conditions considering SWM controls will be implemented on the FarSight parcel.

As illustrated in the attached cross-sections the ditch has capacity to convey a flow rate of 16.97 cu.m/s, however under proposed conditions the flow rate is estimate at 0.885 cu.m/s which is only utilizing 5.21% of the available capacity at section A-A.

In conclusion, the subject ditching system would have sufficient capacity to accept the flows from the FarSight parcel and at the same time improve the drainage conditions with the implementation of onsite SWM controls.

Should you require further information please contact me at (416) 229-2636 extension 205.

Sincerely,

James Sam, P.Eng
J+B Engineering Inc.
25 Centurian Drive, Suite 201
Markham, ON L3R 5N8

O: 416.229.2636 x 205
F: 416.229.6965
E: j.sam@jandb-inc.com

Regional Ditch Capacity Analysis under existing conditions

Channel Analysis

Type: Cross Section — Define...

Side Slope 1 (Z1): 0.0 H : 1V
Side Slope 2 (Z2): 0.0 H : 1V
Channel Width (B): 0.0 (m)
Pipe Diameter (D): 0.0 (m)
Longitudinal Slope: 0.014 (m/m)
Override Default
Manning's Roughness: 0.0250
Use Lining
Lining Type: Woven Paper Net

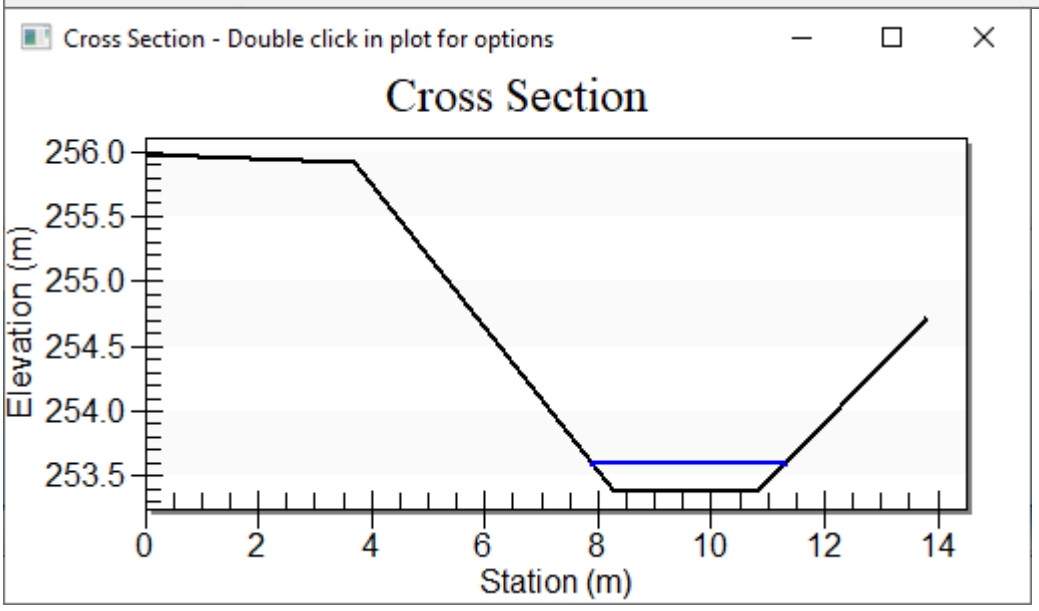
Enter Flow: 1.032 (cms)
Enter Depth: 0.224 (m)

Calculate

Plot... Compute Curves...

Parameter	Value	Unit
Flow	1.032	cms
Depth	0.224	m
Area of Flow	0.663	m^2
Wetted Perimeter	3.518	m
Hydraulic Radius	0.189	m
Average Velocity	1.556	m/s
Top Width (T)	3.412	m
Froude Number	1.127	
Critical Depth	0.242	m
Critical Velocity	1.427	m/s
Critical Slope	0.01081	m/m
Critical Top Width	3.483	m
Calculated Max Shear Stress	30.785	N/m^2
Calculated Avg Shear Stress	25.872	N/m^2
Composite Manning's n Equ...	Lotter ...	
Manning's Roughness	0.0250	

OK Cancel



Regional Ditch Capacity Analysis under proposed conditions

Channel Analysis

Type: Cross Section — Define...

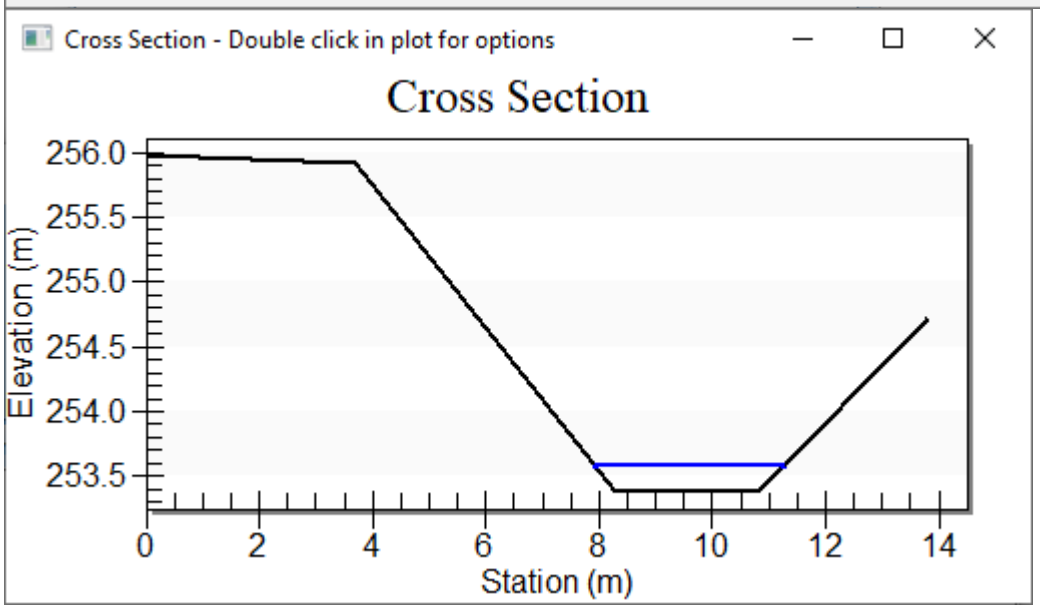
Side Slope 1 (Z1): 0.0 H : 1V
Side Slope 2 (Z2): 0.0 H : 1V
Channel Width (B): 0.0 (m)
Pipe Diameter (D): 0.0 (m)
Longitudinal Slope: 0.014 (m/m)
Override Default
Manning's Roughness: 0.0250
Use Lining
Lining Type: Vegetative-Class A

Enter Flow: 0.885 (cms)
Enter Depth: 0.205 (m)

Calculate

Plot... Compute Curves... OK Cancel

Parameter	Value	Unit
Flow	0.885	cms
Depth	0.205	m
Area of Flow	0.599	m^2
Wetted Perimeter	3.431	m
Hydraulic Radius	0.175	m
Average Velocity	1.478	m/s
Top Width (T)	3.335	m
Froude Number	1.113	
Critical Depth	0.220	m
Critical Velocity	1.368	m/s
Critical Slope	0.01109	m/m
Critical Top Width	3.393	m
Calculated Max Shear Stress	28.165	N/m^2
Calculated Avg Shear Stress	23.948	N/m^2
Composite Manning's n Equ...	Lotter ...	
Manning's Roughness	0.0250	



Regional Ditch Capacity Analysis at full depth

Channel Analysis

Type: Cross Section — Define...

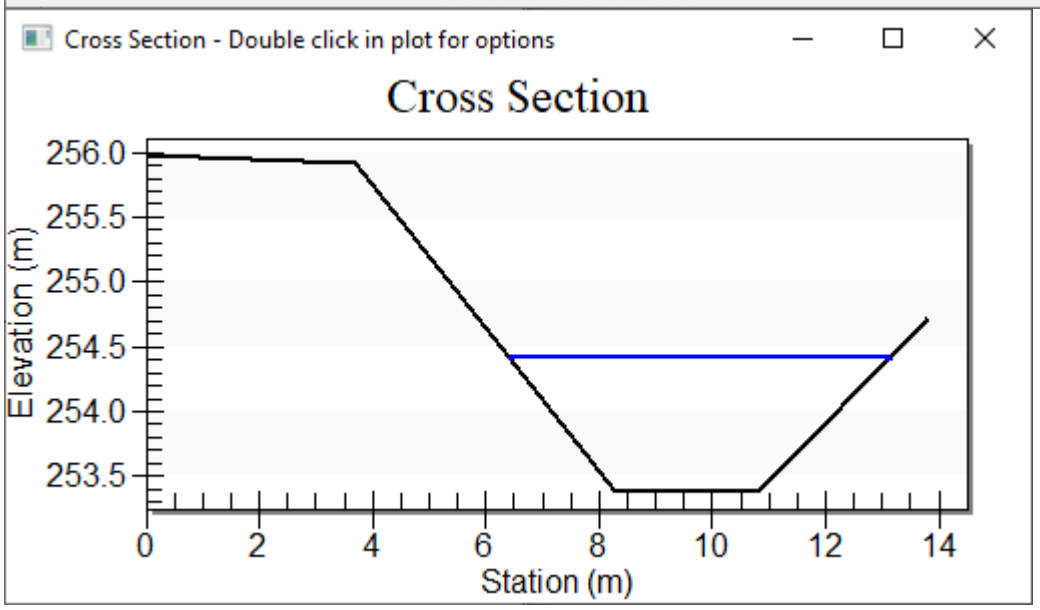
Side Slope 1 (Z1): 0.0 H : 1V
Side Slope 2 (Z2): 0.0 H : 1V
Channel Width (B): 0.0 (m)
Pipe Diameter (D): 0.0 (m)
Longitudinal Slope: 0.014 (m/m)
Override Default
Manning's Roughness: 0.0250
Use Lining
Lining Type: Woven Paper Net

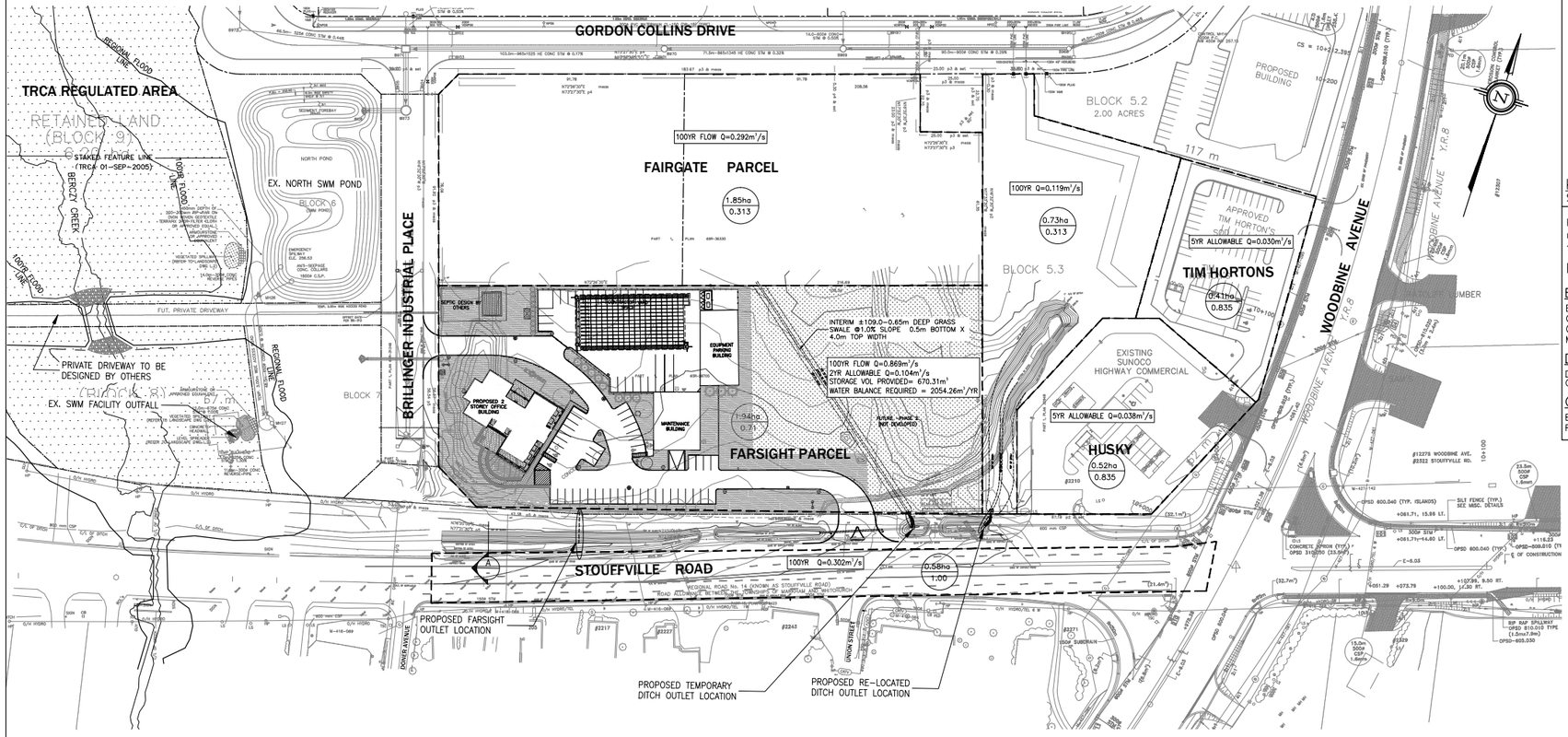
Enter Flow: 16.975 (cms)
Enter Depth: 1.030 (m)

Calculate

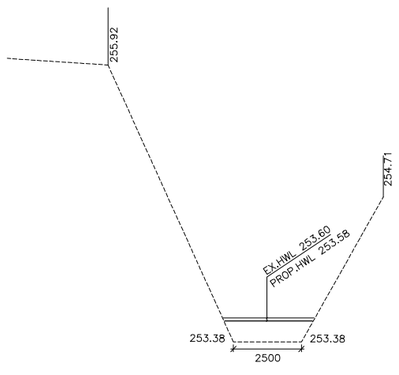
Plot... Compute Curves... OK Cancel

Parameter	Value	Unit
Flow	16.975	cms
Depth	1.030	m
Area of Flow	4.732	m^2
Wetted Perimeter	7.172	m
Hydraulic Radius	0.660	m
Average Velocity	3.587	m/s
Top Width (T)	6.689	m
Froude Number	1.361	
Critical Depth	1.212	m
Critical Velocity	2.820	m/s
Critical Slope	0.00726	m/m
Critical Top Width	7.430	m
Calculated Max Shear Stress	141.348	N/m^2
Calculated Avg Shear Stress	90.544	N/m^2
Composite Manning's n Equ...	Lotter ...	
Manning's Roughness	0.0250	





1 — OVERALL DRAINAGE PLAN
SCALE: 1:1000



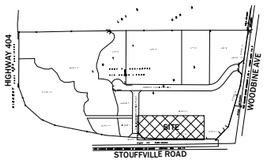
2 — EX.DITCH AT A
SCALE: V-1:100
H-1:25

TOWN OF STOUFFVILLE IDF

Return Period	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
A	696.679	1015.963	1279.709	1546.810	1802.604	2051.707
B	4.957	5.255	5.715	5.746	6.029	6.230
C	0.811	0.826	0.841	0.845	0.853	0.860
24 hour rainfall (mm)	45.9	59.0	67.6	78.5	86.7	94.7

FLOWS THROUGH REGIONAL DITCH

Parcel	Area (m^2)	I (100 YR)	I (5 YR)	Ex Flow m^3/s	Proposed Flow m^3/s
Farsight	19389.37	186.74	107.00	0.314 (100 YR)	0.104 (Release Rate)
Fairgate	18045.26	186.74	107.00	0.292 (100 YR)	0.292 (100 YR)
Husky	5235.60	186.74	107.00	0.0380 (5 YR)	0.038 (5YR)
Tim Hortons	4097.00	186.74	107.00	0.030 (5 YR)	0.030 (5YR)
Ditch Parcel	7355.05	186.74	107.00	0.119 (100 YR)	0.119 (100 YR)
Stouffville Road (7+680-7+990)	5834.00	186.74	107.00	0.302 (100 YR)	0.302 (100 YR)
			Total Flow	**1.032**	**0.885**



KEY MAP
SCALE NTS

PART OF LOT 1
CONCESSION 3
TOWN OF WHITCHURCH-STOUFFVILLE
REGIONAL MUNICIPALITY OF YORK

BENCHMARK

ELEVATIONS SHOWN ON THIS SKETCH ARE RELATED TO GEODETIC DATUM AND ARE DERIVED FROM BENCHMARK No. 00819698464, HAVING A PUBLISHED ELEVATION OF 256.351 METRES.

DISTANCES

DISTANCES AND SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

CAUTION

BOUNDARY INFORMATION HAS BEEN COMPILED FROM AVAILABLE RECORDS AND HAS NOT BEEN VERIFIED BY FIELD SURVEY.

GENERAL NOTES

1. VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. DO NOT SCALE DRAWINGS.
3. REPORT ALL DISCOVERIES OF ERRORS, OMISSIONS OR DISCREPANCIES TO THE DESIGN ENGINEER AS APPLICABLE.
4. USE ONLY LATEST REVISED DRAWINGS OR THOSE THAT ARE MARKED "ISSUED FOR CONSTRUCTION".
5. DESIGN AND CONSTRUCTION OF THIS PROJECT SHALL COMPLY WITH THE PROVINCIAL AND LOCAL BUILDING CODES LATEST EDITION.
6. ALL WORKS AND MATERIALS USED SHALL COMPLY AS REQUIRED BY THE BUILDING CODE LATEST EDITION.
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS & SPECIFICATIONS.
8. EVERYTHING IS TO BE CONSIDERED NEW UNLESS SPECIFIED EXISTING OTHERWISE.

LEGEND:

- EXISTING HYDRANT
- EXISTING VALVE AND BOX
- EXISTING CATCHBASIN
- EXISTING DOUBLE CATCHBASIN
- EXISTING SANITARY MANHOLE
- EXISTING STORM MANHOLE
- PROPOSED HYDRANT & VALVE
- NEW C.B.
- NEW C.B./M.H.
- NEW MANHOLE
- (0.110ha / 0.25) DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- CATCHMENT AREA

No.	Date	Description	Drawn	Checked
1	16 JUL '20	RE-ISSUED FOR SPA	EM	JS
0	08 APR '20	ISSUED FOR SPA	SK	JS

REVISIONS

J + B ENGINEERING INC.
TORONTO
20 CENTURIAN DR.
SUITE 201
MARKHAM, ON L3R 5N8
416 229 2636
CALGARY
707-10TH AVE. SW
SUITE 150
CALGARY AB T2R 0B3
403 355 2295

OWNER/CLIENT:
FARSIGHT HOMES™

Project:
STOUFFVILLE DITCH TRIBUTARY AREAS

STOUFFVILLE RD/WOODBINE AVE — STOUFFVILLE, ON

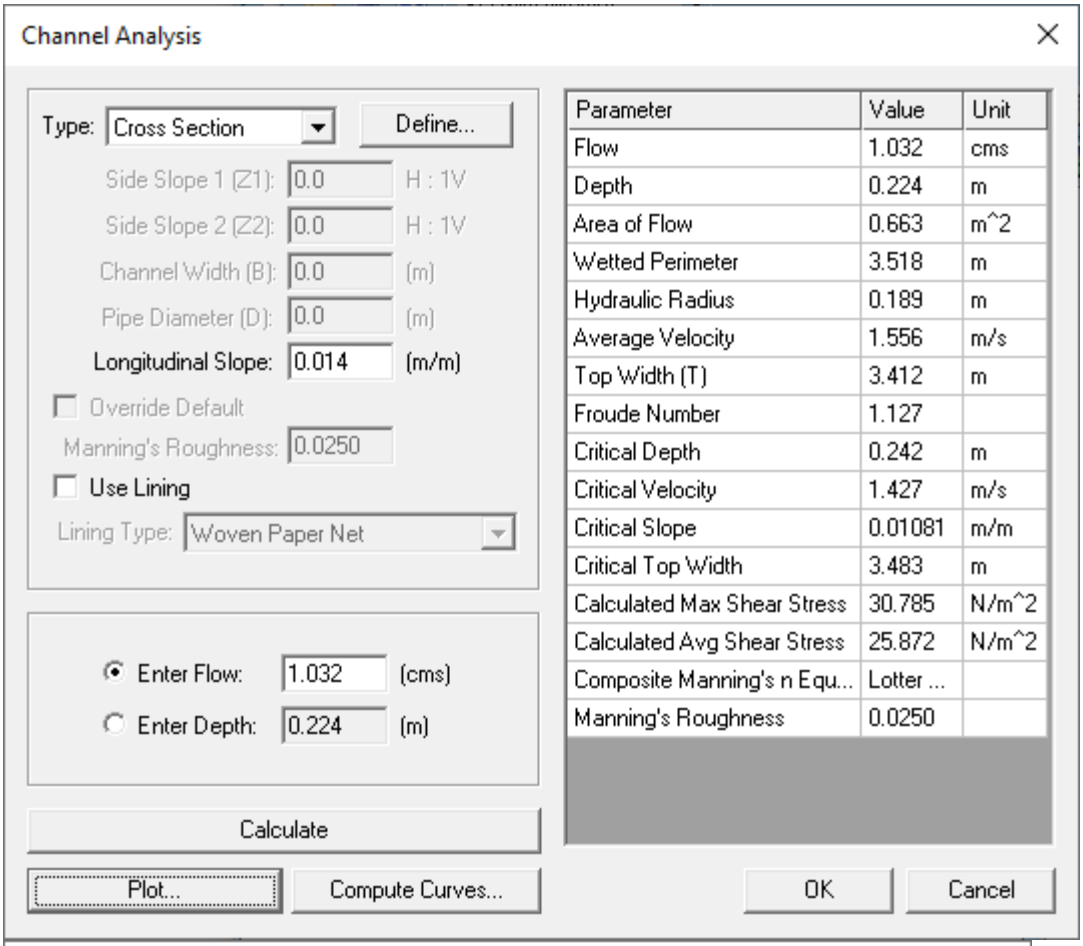
File No: 180390	Date: 23 SEP 2019	ACAD INFO	
Drawn By: SK	Scale: AS SHOWN	Dwg. File: 180390-P-400	
Checked By: JS	Sheet 1 of 1	Plotting Scale: 1=1	
Drawing No: P-400		Drawing Size: D	

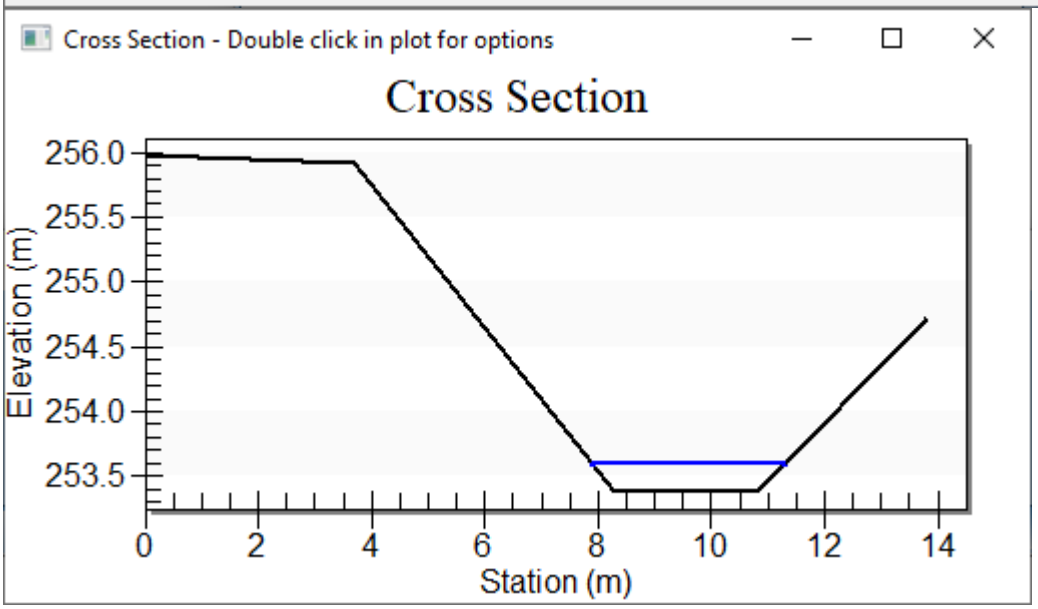
Ditch Assessment

MARKHAM (HEAD OFFICE)
25 CENTURIAN DR, SUITE 201, MARKHAM, ON L3R 5N8
T: 416 229 2636 F: 416 229 6965

CALGARY
707 – 10TH AVE SW, SUITE 200, CALGARY, AB, T2R 0B3
T: 403 355 2295 F: 403 355 2297

Regional Ditch Capacity Analysis under existing conditions





Regional Ditch Capacity Analysis under proposed conditions

Channel Analysis

Type: Cross Section — Define...

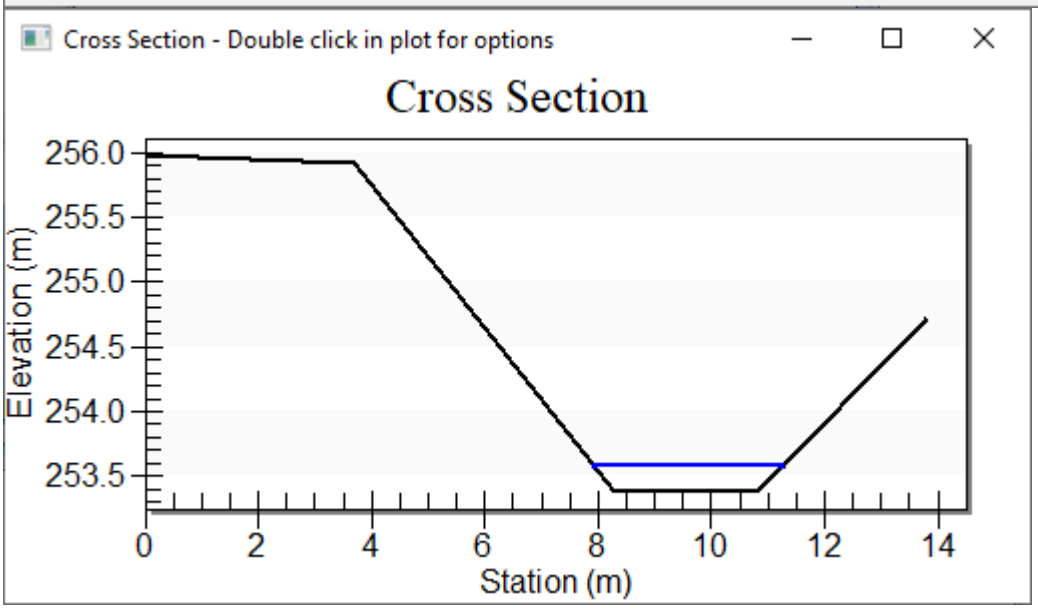
Side Slope 1 (Z1): 0.0 H : 1V
Side Slope 2 (Z2): 0.0 H : 1V
Channel Width (B): 0.0 (m)
Pipe Diameter (D): 0.0 (m)
Longitudinal Slope: 0.014 (m/m)
Override Default
Manning's Roughness: 0.0250
Use Lining
Lining Type: Vegetative-Class A

Enter Flow: 0.885 (cms)
Enter Depth: 0.205 (m)

Calculate

Plot... Compute Curves... OK Cancel

Parameter	Value	Unit
Flow	0.885	cms
Depth	0.205	m
Area of Flow	0.599	m^2
Wetted Perimeter	3.431	m
Hydraulic Radius	0.175	m
Average Velocity	1.478	m/s
Top Width (T)	3.335	m
Froude Number	1.113	
Critical Depth	0.220	m
Critical Velocity	1.368	m/s
Critical Slope	0.01109	m/m
Critical Top Width	3.393	m
Calculated Max Shear Stress	28.165	N/m^2
Calculated Avg Shear Stress	23.948	N/m^2
Composite Manning's n Equ...	Lotter ...	
Manning's Roughness	0.0250	



Regional Ditch Capacity Analysis at full depth

Channel Analysis

Type: Cross Section — Define...

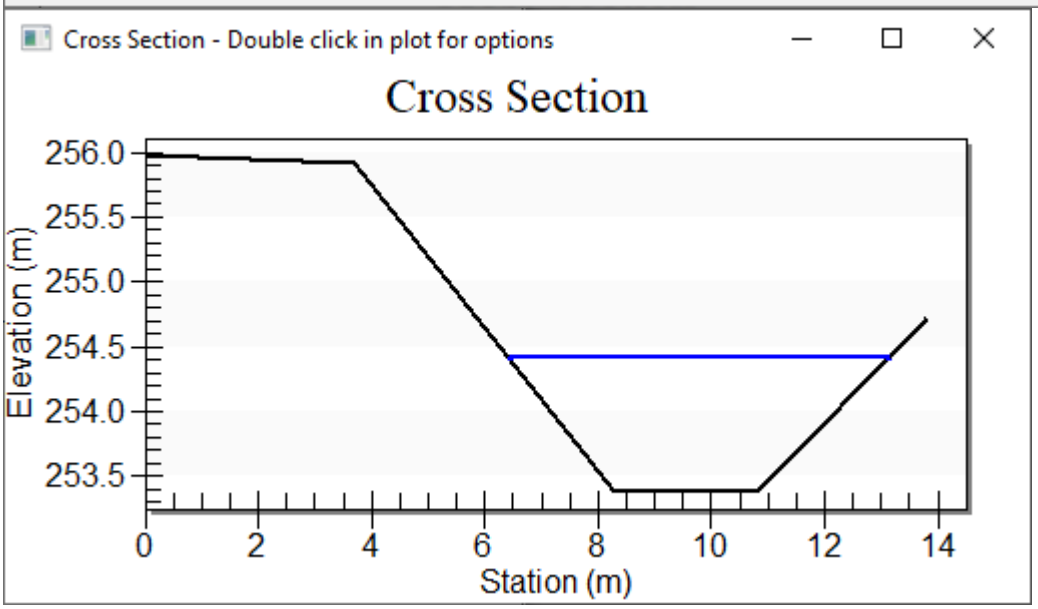
Side Slope 1 (Z1): 0.0 H : 1V
Side Slope 2 (Z2): 0.0 H : 1V
Channel Width (B): 0.0 (m)
Pipe Diameter (D): 0.0 (m)
Longitudinal Slope: 0.014 (m/m)
Override Default
Manning's Roughness: 0.0250
Use Lining
Lining Type: Woven Paper Net

Enter Flow: 16.975 (cms)
Enter Depth: 1.030 (m)

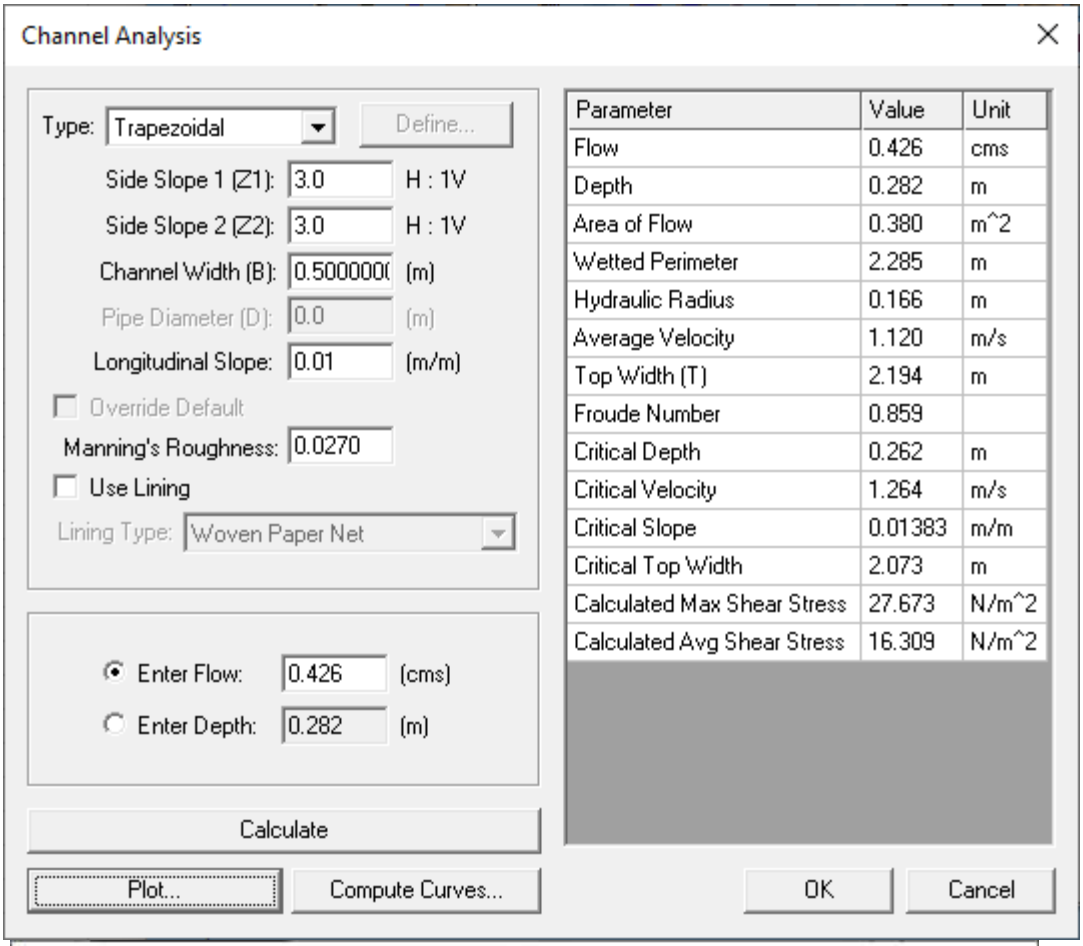
Calculate
Plot... Compute Curves...

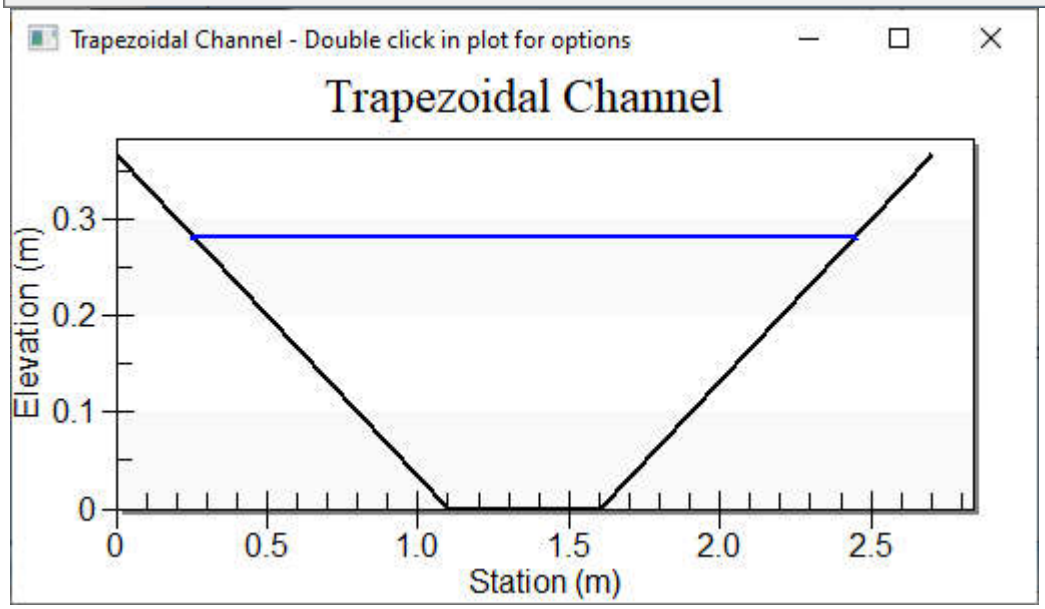
Parameter	Value	Unit
Flow	16.975	cms
Depth	1.030	m
Area of Flow	4.732	m^2
Wetted Perimeter	7.172	m
Hydraulic Radius	0.660	m
Average Velocity	3.587	m/s
Top Width (T)	6.689	m
Froude Number	1.361	
Critical Depth	1.212	m
Critical Velocity	2.820	m/s
Critical Slope	0.00726	m/m
Critical Top Width	7.430	m
Calculated Max Shear Stress	141.348	N/m^2
Calculated Avg Shear Stress	90.544	N/m^2
Composite Manning's n Equ...	Lotter ...	
Manning's Roughness	0.0250	

OK Cancel



Temporary Ditch Capacity Analysis





Relocated Ditch Capacity Analysis

Channel Analysis

Type: Cross Section — Define...

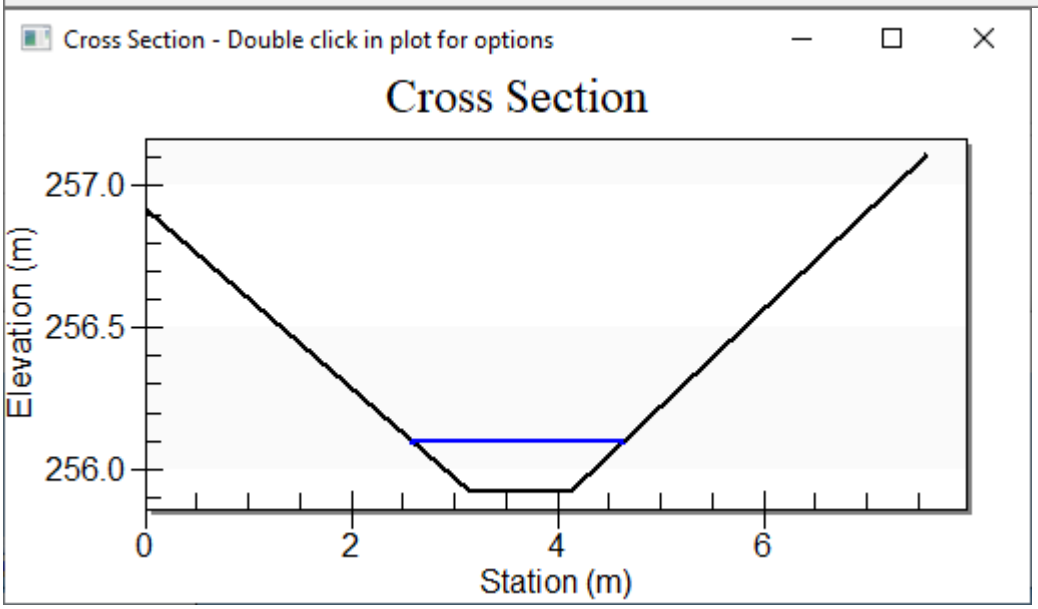
Side Slope 1 (Z1): 0.0 H : 1V
Side Slope 2 (Z2): 0.0 H : 1V
Channel Width (B): 0.0 (m)
Pipe Diameter (D): 0.0 (m)
Longitudinal Slope: 0.005 (m/m)
Override Default
Manning's Roughness: 0.0250
Use Lining
Lining Type: Woven Paper Net

Enter Flow: 0.189 (cms)
Enter Depth: 0.177 (m)

Calculate
Plot... Compute Curves...

Parameter	Value	Unit
Flow	0.189	cms
Depth	0.177	m
Area of Flow	0.265	m^2
Wetted Perimeter	2.091	m
Hydraulic Radius	0.127	m
Average Velocity	0.714	m/s
Top Width (T)	2.034	m
Froude Number	0.631	
Critical Depth	0.136	m
Critical Velocity	1.013	m/s
Critical Slope	0.01345	m/m
Critical Top Width	1.785	m
Calculated Max Shear Stress	8.673	N/m^2
Calculated Avg Shear Stress	6.210	N/m^2
Composite Manning's n Equ...	Lotter ...	
Manning's Roughness	0.0250	

OK Cancel



SITE VISIT REPORT

Project: 230258

Report Issued Date: July 26, 2024

				Discipline:
Project Name:	Fairgate Homes			☐ Structural
Owner:	Fairgate Homes	Visit Date:	June 27, 2024	☒ Civil
Location:	35 Gordon Collins Rd, Stouffville, ON	Arrived at:	10:00AM	☐ Mechanical
Contractor:		Departed at:	11:30 AM	☐ Electrical
Site Contact:		Site Condition:	Dry	☐ Architectural
		Weather:	Sunny, Humid, 28 deg. C	☐ Other

Inspection Type: ☐ Startup ☐ Progress Meeting ☐ Substantial ☒ Final

Note: This Site Review is issued to provide a record of observations on site at the time and date stated on this document. Confirmation and/or verification of construction items specified in the construction documents or to provide detail of changes to the construction documents. The Contractor is to proceed with the work contained in this instruction. If it is deemed that the instructions herein affect the contract amount, all costs shall be submitted to the client beforehand for approval to proceed. All costs shall be in detail, breaking out material, labour, equipment, sub-trades and overhead/profit in the form of a Change Order.

Observations:

1. Fairgate outlet stormwater system is complete

Comments: System installed correctly

Approvals:

Engineers Name:	James Sam, P. Eng.	*James Sam*	July 26, 2024
	Name	*Signature*	*Date*

SITE VISIT REPORT

Project: 230258

Report Issued Date: July 26, 2024

Description:

Figure 1: Storm Manhole# 21 sitting adjacent to southerly property line of Fairgate Parcel

Description:

Figure 2: Inside of Manhole #21

Description:

Figure 3: Stm MH #02

Description:

Figure 4: Inside STM MH 02

Description:

Figure 5: STM MH # 22

Description:

Figure 6: Inside STM MH #22

SITE VISIT REPORT

Project: 230258

Report Issued Date: July 26, 2024

Description:
Figure 7: STM MH # 23

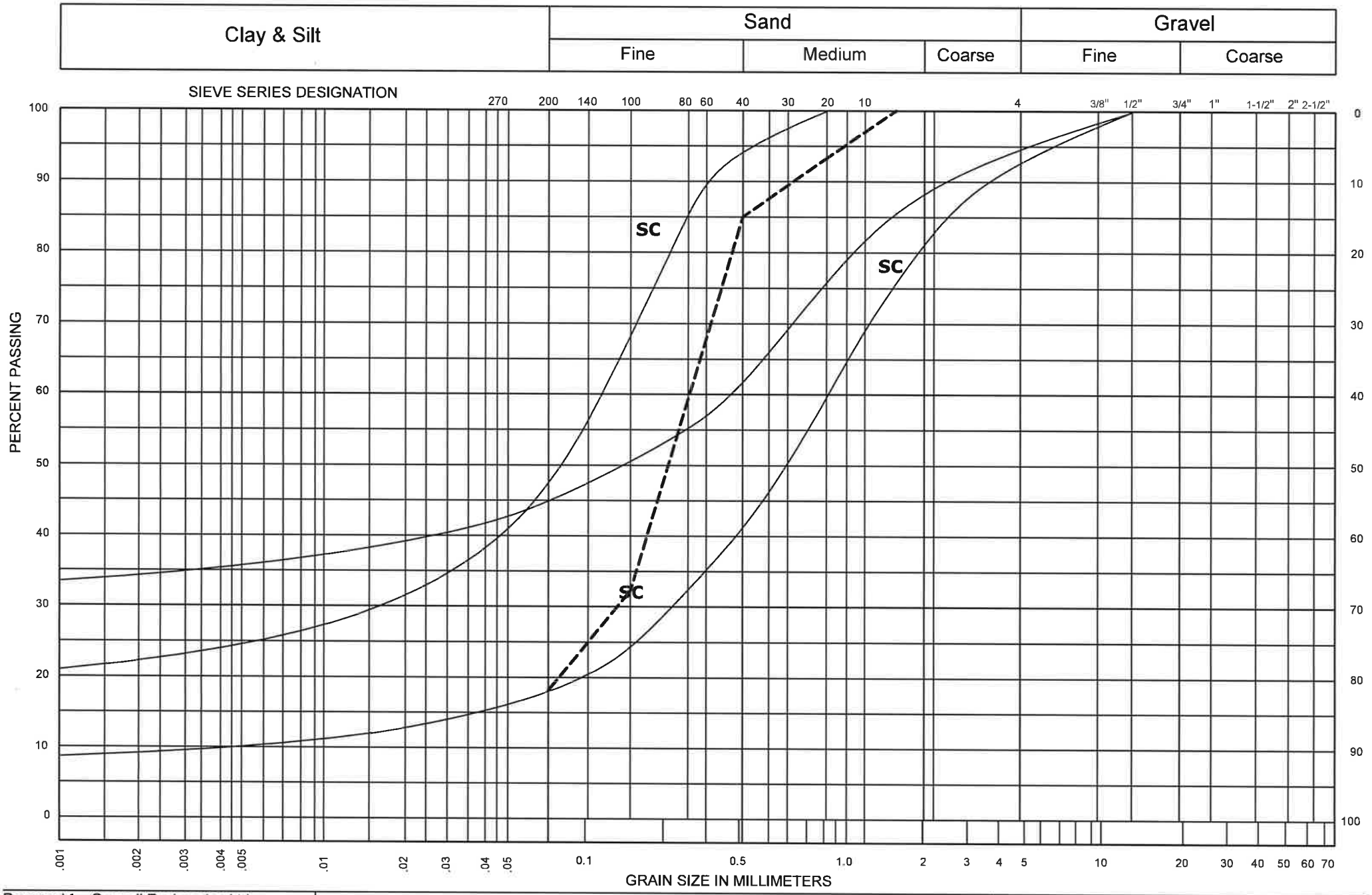
Description:
Figure 8:Inside STM MH 23.

Description:
Figure 9: STM MH 01

Description:
Figure 10: Inside STM MH 01

Appendix D – Geo-Technical Analysis (Percolation Rate)
Drawdown Calculation

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

Project: D2702
Sample: TP17-1
Depth: 1.83m
Date Sampled: NOV 30, 2017

USCS

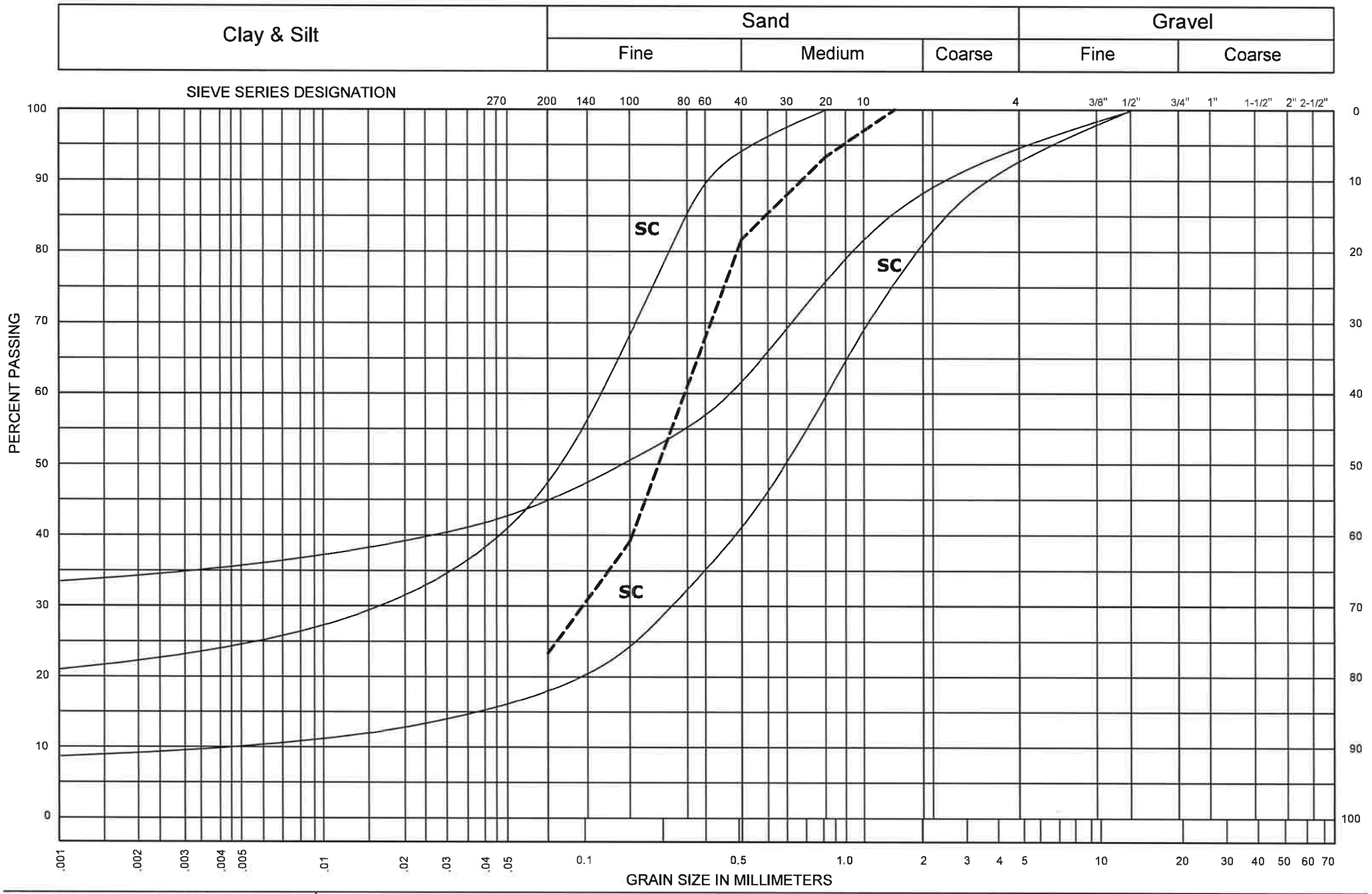
Coarse Grained Soils
Clayey Sands (SC)

Sand-clay mixtures
More than 12% finer than
No. 200 sieve (0.074mm)

Percolation Time

: T = 25 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

Project: D2702
Sample: TP17-5
Depth: 1.83m
Date Sampled: NOV 30, 2017

USCS

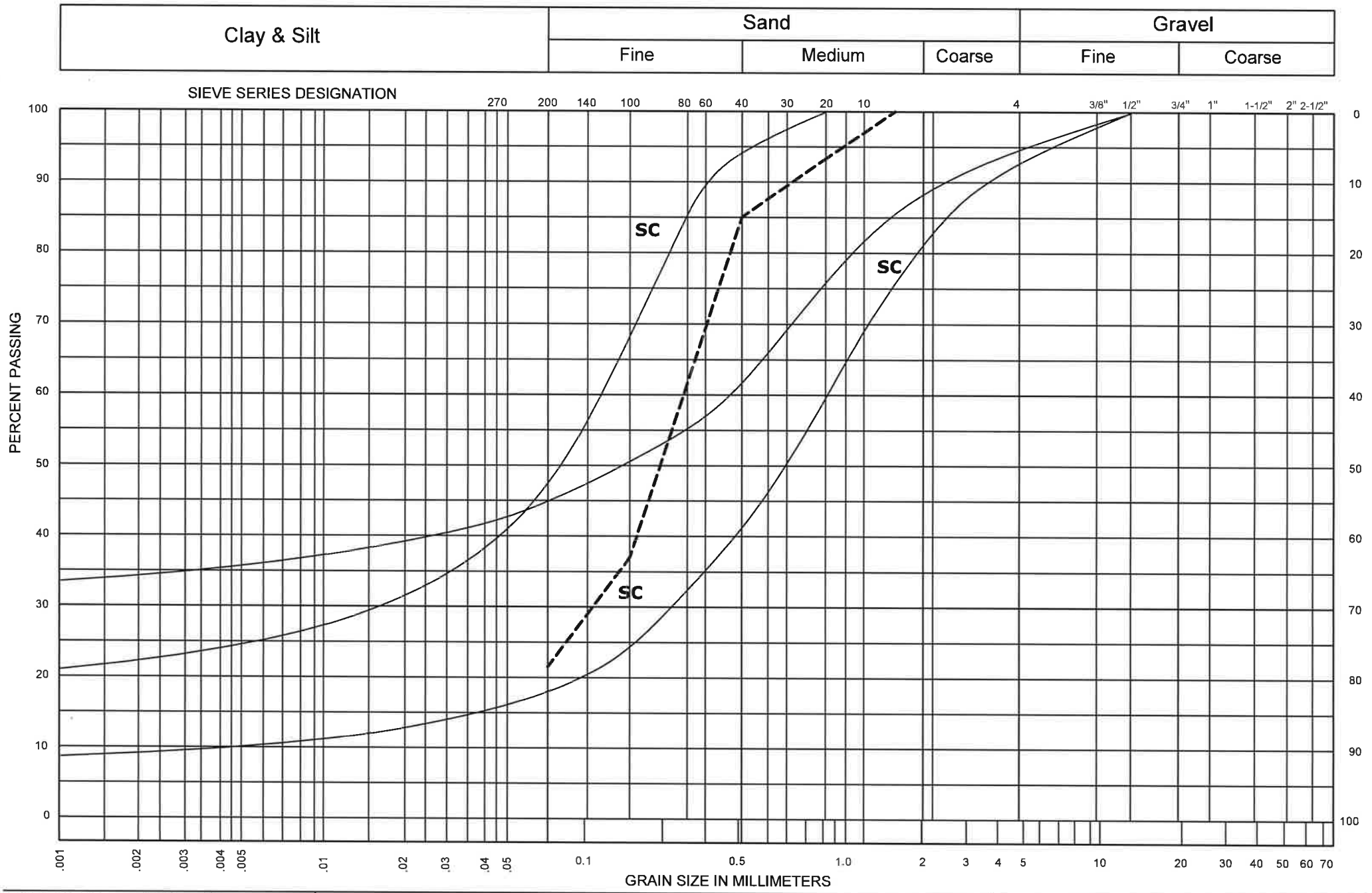
Coarse Grained Soils
Clayey Sands (SC)

Sand-clay mixtures
More than 12% finer than
No. 200 sieve (0.074mm)

Percolation Time

: T = 30 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

Project: D2702
Sample: TP17-2
Depth: 1.52m
Date Sampled: NOV 30, 2017

USCS

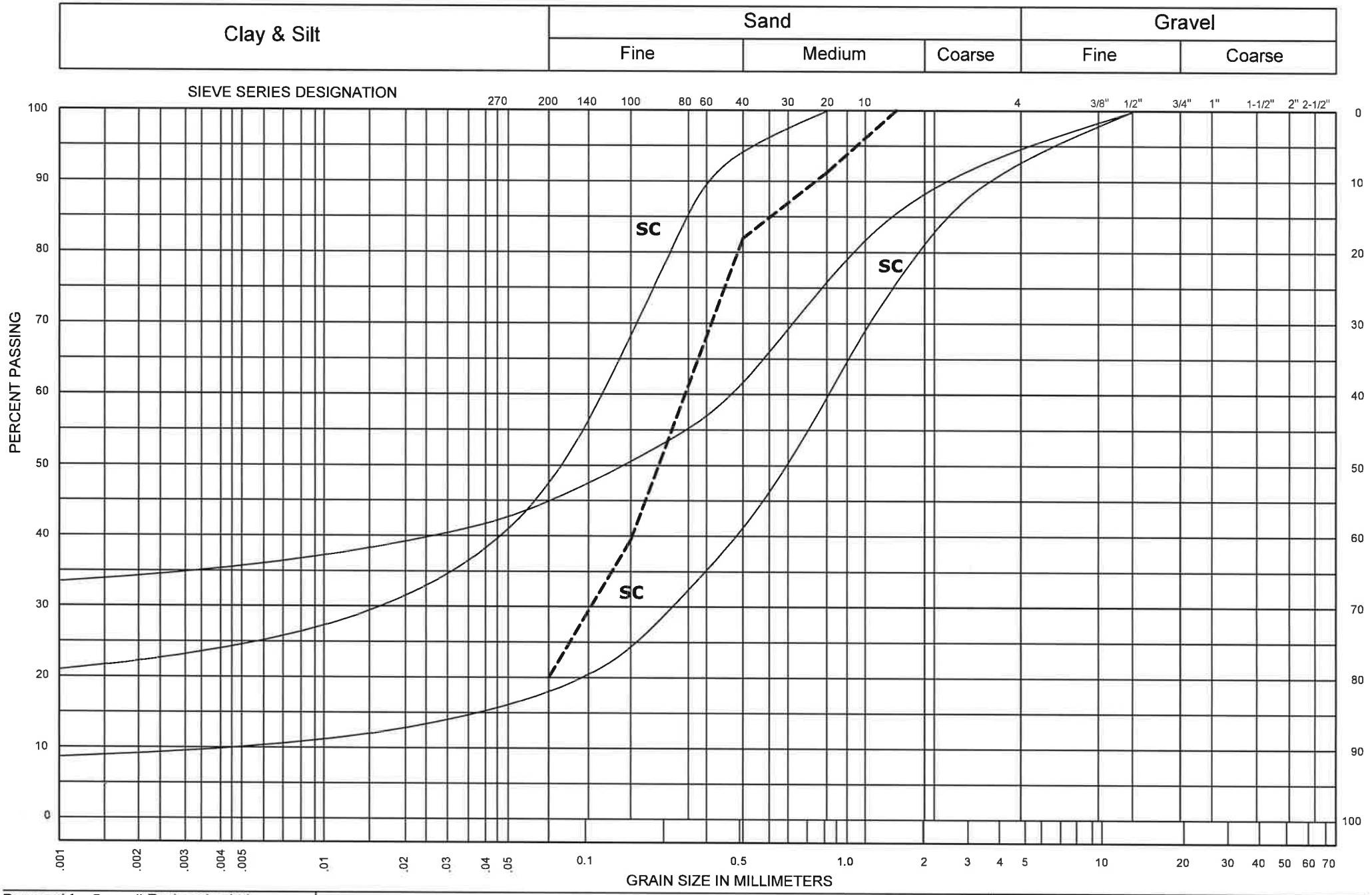
Coarse Grained Soils
Clayey Sands (SC)

Sand-clay mixtures
More than 12% finer than
No. 200 sieve (0.074mm)

Percolation Time

: T = 30 mins/cm

UNIFIED SOIL CLASSIFICATION SYSTEM



Prepared for Gunnell Engineering Ltd.

Project: D2702
Sample: TP17-7
Depth: 2.44m
Date Sampled: NOV 30, 2017

USCS
Coarse Grained Soils
Clayey Sands (SC)

Sand-clay mixtures
More than 12% finer than
No. 200 sieve (0.074mm)

Percolation Time
: T = 30 mins/cm

Total site area	**17612.30**	**sq. m**
Rainfall depth to be retained	25	mm
Volume at 25mm	**440.31**	**cu. m**

Infiltration sizing			
Maximum allowable infiltration depth			
d= PT/1000	Equation 4.2: MOE SWMP Manual, 2003		
P=	Percolation rate	30	mm/hr
T=	Drawdown time	48	hr
d=	Maximum allowable depth	**1.44**	m
Area of Infiltration trench to determine trench dimensions			
A=1000 V/ PnT	Equation 4.3: MOE SWMP Manual, 2003		
T=	Drawdown time	48	hr
V=	Infiltration volume	440.31	cu. m/yr
P=	Percolation rate	30	mm/hr
n=		0.40	Clear stone
A=	Maximum allowable area	764.42	sq. m

Stormwater Tank Infiltration Volume		
Stormtank area of infiltration	354.20	sq. m
Depth of base stone	0.38	m
Porosity of base stone	0.40	Clear stone
Volume within base stone	53.13	cu. m
Drawdown		
Infiltration storage volume	53.13	cu. m
Infiltration Rate	30.00	mm/hr
Infiltration	10.63	cu. m/hr
Drawdown time	5.00	hr

Appendix E– Site Servicing Plan

Storm Design Reference Sheet

Pre-Post Drainage Plan

MARKHAM (HEAD OFFICE)
25 CENTURIAN DR, SUITE 201, MARKHAM, ON L3R 5N8
T: 416 229 2636 F: 416 229 6965

CALGARY
707 – 10TH AVE SW, SUITE 150, CALGARY, AB, T2R 0B3
T: 403 355 2295 F: 403 355 2297

CROSSING 1
NEW STM OBV=256.86
NEW SAN INV=257.42
X CLEARANCE=0.56

CONTROL MH16
1200ø P.C.
S 675ø INV 256.12

CONTROL MH15
1200ø P.C.
S 600ø INV 256.55

CONNECTION TO BE INSTALLED VIA DIRECTIONAL DRILLING

CONNECT TO EX 300mmø VIA TAPPING SLEEVE AND VALVE

200mmø GATE VALVE & BOX AS PER WS-604

14.0m-675ø CONC STM @ 0.50%

14.0m-600ø CONC STM @ 0.50%

300ø PVC WATERMAIN C-150 DR-18 (FIRE)

103.0m-965x1525 HE CONC STM @ 0.17%

71.5m-865x1345 HE CONC STM @ 0.32%

90.0m-900ø CONC STM @ 0.29%

30.5m-300mmø PVC SDR35 STM PIPE @ 0.5% SLOPE (INSULATED)

8.0m-375mmø PVC SDR35 STM PIPE @ 1.3% SLOPE (INSULATED)

200mmø PVC FIRE WATERMAIN

PROP. FIRE HYDRANT CONNECT WITH 200x150 ANCHOR TEE & VALVE

EX. FIRE HYDRANT

90° BEND

90° BEND

90° BEND

90° BEND

CBMH#01
TOP=258.40
E.INV=257.04
SW.INV=256.96

CBMH#02
TOP=258.63
E.INV=257.19
W.INV=257.17

CB#01
TOP=258.07
E.INV=257.02

MH#01
TOP=258.52
S.INV=256.78
W.INV=256.86
NE.INV=256.86

CB#02
TOP=259.63
W.INV=257.51

40.0m-300mmø PVC SDR35 STM PIPE @ 0.8% SLOPE (INSULATED)

40.5m-375mmø PVC SDR35 STM PIPE @ 0.5% SLOPE (INSULATED)

PROP. DRILLED WELL (CONFIRM WELL LOCATION)

100mmø PVC DOMESTIC WATERMAIN

CROSSING 0.5m MIN

PROPOSED SEPTIC BED BY WSP

PROP. SAN TREATMENT TRAIN

WBF P AD

SAN E.INV=257.20

23.2m-150mmø PVC DR28 SAN PIPE @ 2.0% SLOPE (INSULATED)

CROSSING 1

42.0m-375mmø PVC SDR35 STM PIPE @1.5% SLOPE

FF=258.70

FF=258.95

FF=259.95

SAN W.INV=257.67

PLUG 200mmø FIRE WM INV=256.70
PLUG 100mmø DOM WM INV=256.70

FF=259.45

FF=260.30

ROOF STORAGE PONDING
6 X ZURN Z-105 CONTROL-FLO ROOF DRAINS
AREA=4069.30m²
DEPTH=200.3mm(8")
VOLUME=127.55m³
Q=0.0154m³/s (TOTAL)

25.5m-450mmø PVC SDR35 STM PIPE @1.0% SLOPE

2.5m-300mmø PVC SDR35 STM PIPE @2.0% SLOPE

STM S.INV=257.20 (FROM ROOF)

2.0m-150mmø PVC SDR35 STM PIPE @2.0% SLOPE

MH#02 W/RISER
TOP=258.61
W.INV=256.41
NE.INV=257.15
(DROP STRUCTURE RE'Q)
SE.INV=256.49

PUMP DESIGN FOR CISTERN TO BE SPECIFIED BY MECHANICAL

WILKINSON H5H
TOP=258.61
N.INV=257.16
SW.INV=257.20

CBMH#05
TOP=258.20
N.INV=256.15
E.INV=256.15
SW.INV=256.07

2.0m-600mmø CONC STM PIPE @ 1.0% SLOPE

UP-FLO (UFF-18)
TOP=258.23
WIER ELEV=256.80
NE.INV=256.05
SW.INV=256.02

2.0m-600mmø CONC STM PIPE @ 1.0% SLOPE

MH#03
TOP=258.27
NE.INV=256.00

CB#07
TOP=257.73
S.INV=256.61

CB#06
TOP=258.23
S.INV=256.82

CB#05
TOP=258.73
S.INV=257.02

CB#04
TOP=259.08
S.INV=257.24

16.5m-250mmø PVC SDR35 STM PIPE @ 0.5% SLOPE (INSULATED)

16.5m-250mmø PVC SDR35 STM PIPE @ 0.5% SLOPE (INSULATED)

16.5m-250mmø PVC SDR35 STM PIPE @ 0.5% SLOPE (INSULATED)

16.5m-250mmø PVC SDR35 STM PIPE @ 0.5% SLOPE

89.0m-375mmø PVC SDR35 STM PIPE @ 1.0% SLOPE (INSULATED)

3.0m-100mmø ORIFICE PIPE @ 1.5% SLOPE

CB#04
TOP=259.70
SW.INV=258.00

33.0m-300mmø PVC SDR35 STM PIPE @ 1.5% SLOPE

PROP STORMTECH MC-3500
VOL=374.40m³
DIMENSION 11.76m X 32.09m
AREA OF SYSTEM: APPROX. 353.46m²
TOP OF STONE = 257.39
TOP OF CHAMBER = 257.09
BOTTOM OF CHAMBER = 255.945
BOTTOM OF STONE = 255.57

STORMTECH TO BE INSTALLED IN ACCORDANCE WITH ADS INSTALLATION GUIDELINES

MH#04
TOP=258.14
S.INV=256.00

3.5m-120mmø ORIFICE PIPE @ 3.0% SLOPE

EX. STM MH
1200ø
TOP=258.10
N.INV=255.89
S.INV=255.86

26.0m-300mmø PVC SDR35 STM PIPE @ 2.0% SLOPE

CONNECT TO EX. STM MH AT N.INV = 255.89

CBMH#04
TOP=258.00
E.INV=256.69
NW.INV=256.61

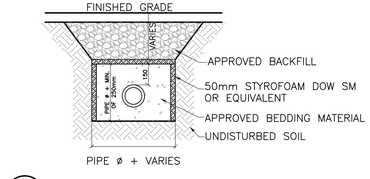
11.5m-450mmø PVC SDR35 STM PIPE @1.1% SLOPE (INSULATED)

INTERIM ±109.0-0.65m DEEP GRASS SWALE @1.0% SLOPE
0.5m BOTTOM X 4.4m TOP WIDTH

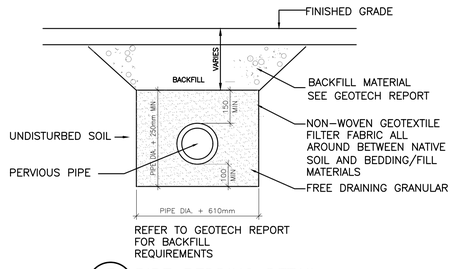
CBMH#03
TOP=259.61
W.INV=257.40
NE.INV=257.45

1 P-301 SITE SERVICING PLAN
SCALE 1:400

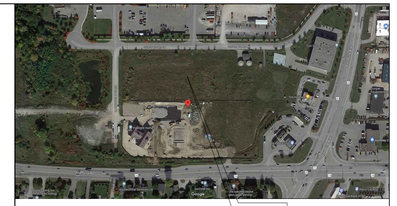
NOTE:
ALL INVERTS ASSOCIATED WITH STORMTECH DRAINAGE STRUCTURES (FILTERS, CHAMBERS, PIPES, MH'S) TO BE CONFIRMED BY THE MANUFACTURER DURING SHOP DRAWING STAGE PRIOR TO CONSTRUCTION



2 P-301 TYP. FROST PROTECTION DETAIL
SCALE: NTS



3 P-301 PIPE BEDDING DETAIL
SCALE: NTS



KEY MAP
SCALE NTS

SITE

GENERAL NOTES

1. VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. DO NOT SCALE DRAWINGS.
3. REPORT ALL DISCOVERIES OF ERRORS, OMISSIONS OR DISCREPANCIES TO THE DESIGN ENGINEER AS APPLICABLE.
4. USE ONLY LATEST REVISED DRAWINGS OR THOSE THAT ARE MARKED "ISSUED FOR CONSTRUCTION".
5. DESIGN AND CONSTRUCTION OF THIS PROJECT SHALL COMPLY WITH THE PROVINCIAL AND LOCAL BUILDING CODES LATEST EDITION.
6. ALL WORKS AND MATERIALS USED SHALL COMPLY AS REQUIRED BY THE BUILDING CODE LATEST EDITION.
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS & SPECIFICATIONS.
8. EVERYTHING IS TO BE CONSIDERED NEW UNLESS SPECIFIED EXISTING OTHERWISE.

LEGEND

- EXISTING CATCHBASIN
- EXISTING C.B./M.H.
- EXISTING MANHOLE
- OH — EXISTING OVERHEAD HYDRO LINE
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- UB — EXISTING UNDERGROUND BELL LINE
- S — EXISTING SANITARY LINE
- ST — EXISTING STORM LINE
- NEW C.B.
- NEW C.B./M.H.
- NEW MANHOLE
- NEW CISTERN
- NEW UP-FLO OIL GRIT SEPARATOR
- NEW WATER WELL
- NEW FIRE HYDRANT
- NEW WATER LINE
- W NEW WATER LINE
- NEW SANITARY LINE
- NEW STORM LINE
- PROPERTY LINE
- GRAVEL AREA

No.	Date	Description	Drawn	Checked
4	20 FEB '25	ISSUED FOR REVIEW	JP	JS
3	30 AUG '24	ISSUED FOR SPA	JM	JS
2	11 MAR '24	ISSUED FOR REVIEW	JM	JS
1	07 DEC '23	ISSUED FOR REVIEW	JM	JS
0	11 OCT '23	ISSUED FOR REVIEW	JM	JS

REVISIONS

J + B ENGINEERING INC.

TORONTO
25 CENTURIAN DR.
SUITE 201
MARKHAM, ON L3R 5N8
416 229 2636

CALGARY
638-11TH AVE. SW
SUITE 200
CALGARY AB T2R 0E2
403 355 2295

OWNER/CLIENT:

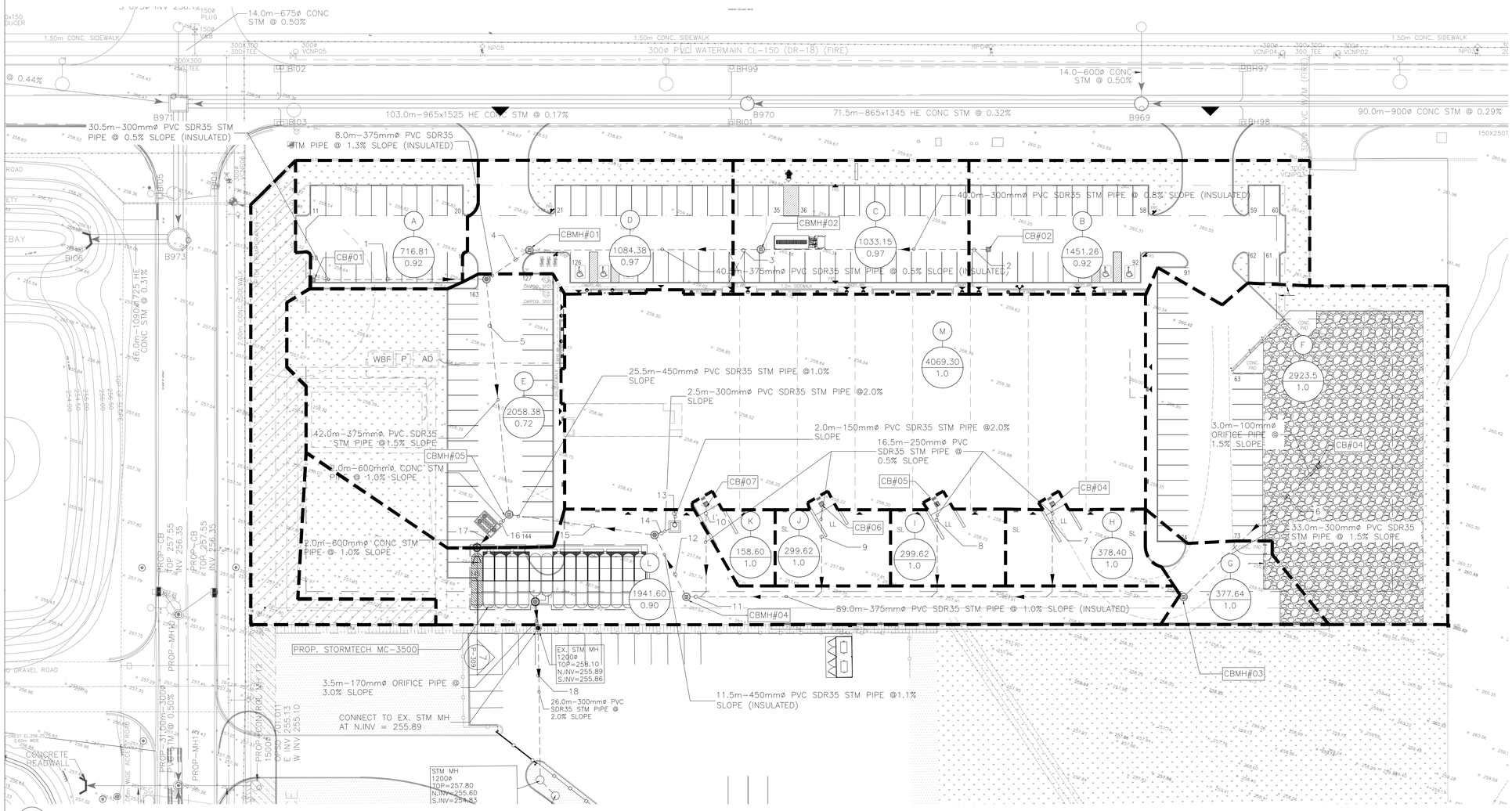
FAIRGATE HOMES

Project:

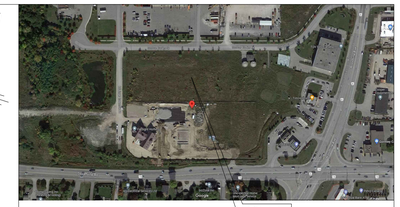
SITE SERVICING PLAN

35 GORDON COLLINS DRIVE — GORMLEY, ON

File No: 230258	Date: 11 OCT '23	ACAD INFO
Drawn By: JM	Scale: AS SHOWN	Dwg. File: 230258-P-301
Checked By: JS	Sheet 1 of 1	Plotting Scale: 1=1
Drawing No: P-301		Drawing Size: D



1 STORM DESIGN REFERENCE PLAN
P–304 SCALE: 1:400



KEY MAP
SCALE NTS

GENERAL NOTES

1. VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. DO NOT SCALE DRAWINGS.
3. REPORT ALL DISCOVERIES OF ERRORS, OMISSIONS OR DISCREPANCIES TO THE DESIGN ENGINEER AS APPLICABLE.
4. USE ONLY LATEST REVISED DRAWINGS OR THOSE THAT ARE MARKED "ISSUED FOR CONSTRUCTION".
5. DESIGN AND CONSTRUCTION OF THIS PROJECT SHALL COMPLY WITH THE PROVINCIAL AND LOCAL BUILDING CODES LATEST EDITION.
6. ALL WORKS AND MATERIALS USED SHALL COMPLY AS REQUIRED BY THE BUILDING CODE LATEST EDITION.
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS & SPECIFICATIONS.
8. EVERYTHING IS TO BE CONSIDERED NEW UNLESS SPECIFIED EXISTING OTHERWISE.

Pipe ID	Pipe Dia. (m)	Area (m^2)	Perimeter (m)	Hydraulic Radius (m)	Slope (m/m)	Roughness Coefficient	Velocity (m/s)	Max. Pipe Flow (M) (m^3/s)	Actual Pipe Flow (A) (m^3/s)	A/M	Servicing area
1	0.300	0.071	0.942	0.075	0.005	0.013	0.967	0.068	0.034	0.50	A
2	0.300	0.071	0.942	0.075	0.008	0.013	1.224	0.086	0.069	0.80	B
3	0.375	0.110	1.178	0.094	0.005	0.013	1.123	0.124	0.122	0.98	B+C
4	0.375	0.110	1.178	0.094	0.013	0.013	1.775	0.196	0.177	0.90	B+C+D
5	0.375	0.110	1.178	0.094	0.015	0.013	1.944	0.215	0.211	0.98	A+B+C+D
6	0.300	0.071	0.942	0.075	0.015	0.013	1.675	0.118	0.037	0.31	F (75mm Orifice Pipe)
7	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.020	0.47	H
8	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.016	0.37	I
9	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.016	0.37	J
10	0.250	0.049	0.785	0.063	0.005	0.013	0.857	0.042	0.008	0.20	K
11	0.375	0.110	1.178	0.094	0.010	0.013	1.587	0.175	0.116	0.66	F+G+H+I+J+K
12	0.450	0.159	1.414	0.113	0.011	0.013	1.880	0.299	0.207	0.69	F+G+H+I+J+K+L
13	0.150	0.018	0.471	0.038	0.020	0.013	1.219	0.022	0.015	0.70	M (roof)
14	0.300	0.071	0.942	0.075	0.020	0.013	1.935	0.137	0.015	0.11	M (roof)
15	0.450	0.159	1.414	0.113	0.010	0.013	1.793	0.285	0.222	0.78	F+G+H+I+J+K+L+M
16	0.600	0.283	1.885	0.150	0.010	0.013	2.172	0.614	0.511	0.83	A+B+C+D+E+F+G+H+I+K+L+M
17	0.600	0.283	1.885	0.150	0.010	0.013	2.172	0.614	0.511	0.83	A+B+C+D+E+F+G+H+I+K+L+M
18	0.300	0.071	0.942	0.075	0.020	0.013	1.935	0.137	0.053	0.39	D/S of Outlet (All Controlled Catchments)

2 STORM SEWER DESIGN SHEET
P–304

TOWN OF WHITCHURCH-STOUFFVILLE
STORM SEWER DESIGN SHEET
Fairgate Homes, Whitchurch-Stouffville

Runoff Coefficient, C

Pervious Areas	0.25
Landscape Areas	0.25
Roof Areas	0.90
Paved Areas	0.90
Gravel	0.90
Other impervious Areas	0.90

Using Regional IDF Rainfall:
A= 1045.41
B= 4.9
C= 0.83

$$Rate = \frac{1045.41}{(t+4.9)^{0.83}} * 1.69 \text{ mm/hr}$$

Time of Concentration, min: 10.00
Rainfall Intensity (mm/hr): 187.685 for 100 year storm

Storm Inlet	Drainage									Drainage Inlet					
	Catchment ID	Drainage Catchment Area (m^2)	PAVED	LAND	GRAVEL	Runoff Coefficient	Intensity of 100yr storm at Tc=10min (mm/hr)	100 yr Storm flow @Tc=10 min (m^3/s)	Runoff Volume (m^3)	CB/MH Grate Area (m^2)	CB/MH Elev. (m)	Max. Ponding Elev. (m)	Depth/Head (m)	Inlet Capcity (m^3/s)	Inlet Capacity at 50% Blocked Condition (m^3/s)
CB#01	A	716.81	536.81	180.00	0.00	0.92	187.68	0.034	20.67	0.36	258.07	258.22	0.15	0.37	0.185
CB#02	B	1451.26	1077.98	373.28	0.00	0.92	187.68	0.069	41.62	0.36	259.63	259.70	0.07	0.25	0.127
CBMH#02	C	1033.10	838.90	194.20	0.00	0.97	187.68	0.052	31.45	0.36	258.63	258.70	0.07	0.25	0.127
CBMH#01	D	1084.40	880.66	203.74	0.00	0.97	187.68	0.055	33.01	0.36	258.40	258.45	0.05	0.21	0.107
CBMH#05	E	2058.38	1025.43	1032.95	0.00	0.72	187.68	0.077	46.22	0.36	258.20	258.29	0.09	0.29	0.144
CB#03	F	2923.47	1004.56	409.69	1509.22	1.00	187.68	0.153	91.52	0.36	259.70	259.95	0.25	0.48	0.239
CBMH#03	G	377.64	310.71	0.00	66.93	1.00	187.68	0.020	11.82	0.36	259.61	259.63	0.02	0.14	0.068
CB#04	H	378.40	378.40	0.00	0.00	1.00	187.68	0.020	11.85	0.36	259.08	259.37	0.29	0.52	0.258
CB#05	I	299.69	299.69	0.00	0.00	1.00	187.68	0.016	9.38	0.36	258.73	258.84	0.11	0.32	0.159
CB#06	J	299.62	299.62	0.00	0.00	1.00	187.68	0.016	9.38	0.36	258.23	258.34	0.11	0.32	0.159
CB#07	K	158.60	158.60	0.00	0.00	1.00	187.68	0.008	4.97	0.36	257.73	257.98	0.25	0.48	0.239
CBMH#04	L	1941.60	1409.21	532.39	0.00	0.90	187.68	0.091	54.84	0.36	258.00	258.19	0.19	0.42	0.209

3 DRAIN INLET CAPACITY ANALYSIS
P–304

LEGEND

- STANDARD IRON BAR
- 100.00 EXISTING ELEVATION
- EXISTING CATCHBASIN
- EXISTING C.B./M.H.
- EXISTING MANHOLE
- NEW STORM LINE
- 6 STORM PIPE ID
- PROPERTY LINE
- NEW CATCHBASIN
- NEW C.B./M.H.
- NEW MANHOLE
- SUB–CATCHMENTS BOUNDARY
- GRAVEL SURFACE
- UNIT CONCRETE PAVING (REFER TO LANDSCAPE ARCH DWG FOR FURTHER DETAILS)
- LANDSCAPE + SOD (REFER TO LANDSCAPE ARCH DWG FOR FURTHER DETAILS)
- SHRUBS / PERENNIALS AND GROUNDCOVER (REFER TO LANDSCAPE ARCH DWG FOR FURTHER DETAILS)
- UNCONTROLLED SUB–CATCHMENT
- E CATCHMENT ID
- 3017 / 0.64 DRAINAGE AREA (m^2) / RUNOFF COEFFICIENT (100–YR STORM)

No.	Date	Description	Drawn	Checked
4	20 FEB '25	ISSUED FOR REVIEW	JM	JS
3	30 AUG '24	ISSUED FOR SPA	JM	JS
2	11 MAR '24	ISSUED FOR REVIEW	JM	JS
1	07 DEC '23	PRELIM FOR REVIEW	JM	JS
0	11 OCT '23	PRELIM FOR REVIEW	JM	JS

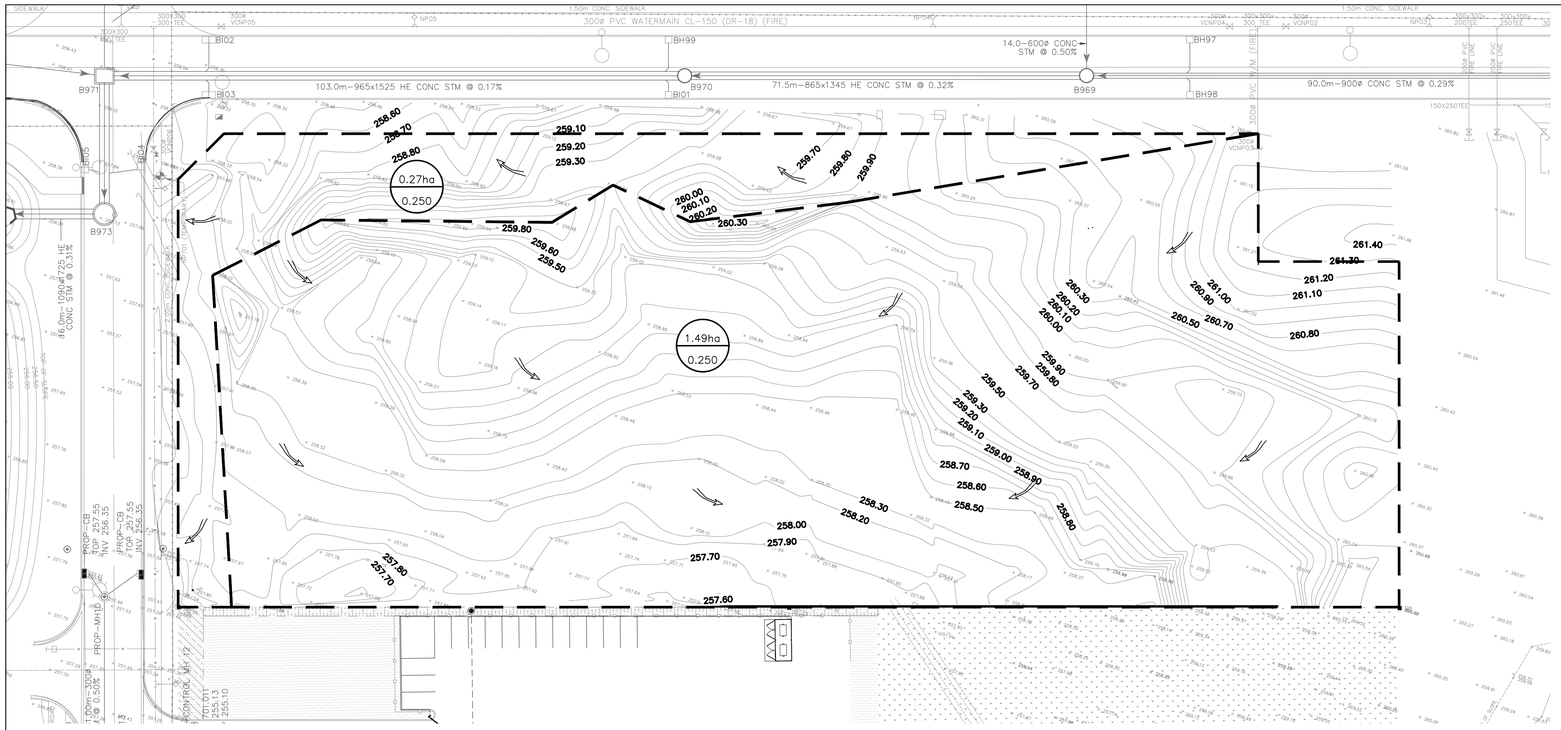
REVISIONS

J + B ENGINEERING INC.
TORONTO
25 CENTURIAN DR.
SUITE 201
MARKHAM, ON L3R 5N8
416 229 2636
CALGARY
838–11TH AVE. SW
SUITE 205
CALGARY AB T2R 0E2
403 355 2295

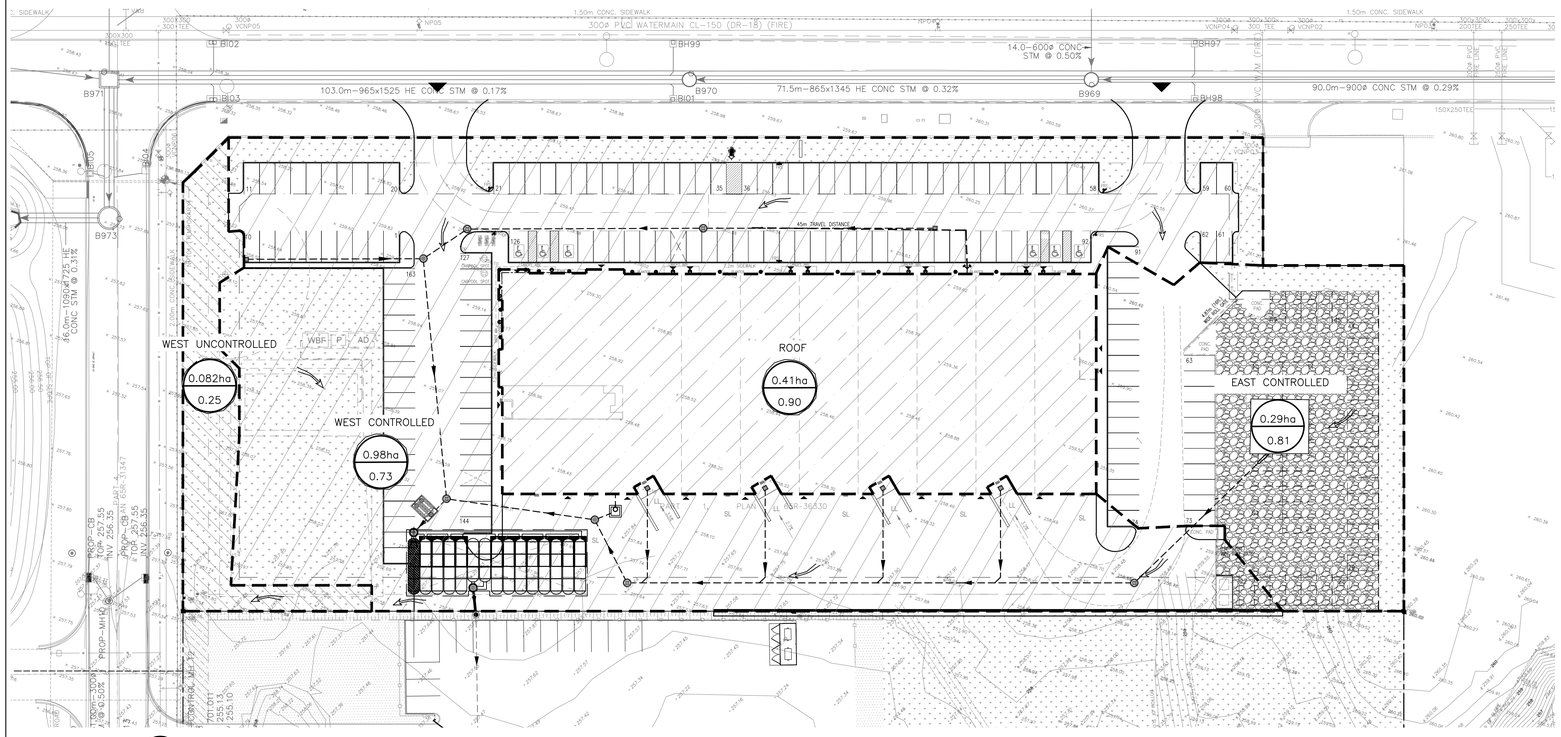
OWNER/CLIENT:
FAIRGATE HOMES

Project:
STORM DESIGN REFERENCE SHEET
35 GORDON COLLINS DRIVE GORMLEY, ON

File No: 230258	Date: 11 OCT '23	ACAD INFO	
Drawn By: JM	Scale: AS SHOWN	Dwg. File: 230258–P–304	
Checked By: JS	Sheet 1 of 1	Plotting Scale: 1=1	
Drawing No: P–304		Drawing Size: D	



1 P-303 **PRE-DEVELOPMENT**
SCALE: 1:500



2 P-303 **POST-DEVELOPMENT**
SCALE: 1:500

LEGEND

- STANDARD IRON BAR
- 100.00 EXISTING ELEVATION
- EXISTING CATCHBASIN
- EXISTING C.B./M.H.
- EXISTING MANHOLE
- OVERLAND FLOW ROUTE
- 0.110ha / 0.25 DRAINAGE AREA (ha) / RUNOFF COEFFICIENT
- NEW CATCHBASIN
- NEW C.B./M.H.
- NEW MANHOLE
- SUB-CATCHMENTS BOUNDARY
- GRAVEL SURFACE
- UNIT CONCRETE PAVING (REFER TO LANDSCAPE ARCH DWG FOR FURTHER DETAILS)
- LANDSCAPE + SOD (REFER TO LANDSCAPE ARCH DWG FOR FURTHER DETAILS)
- SHRUBS / PERENNIALS AND GROUNDCOVER (REFER TO LANDSCAPE ARCH DWG FOR FURTHER DETAILS)
- UNCONTROLLED SUB-CATCHMENT
- STORM DRAINAGE FLOW

KEY MAP
SCALE NTS

SITE

GENERAL NOTES

1. VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. DO NOT SCALE DRAWINGS.
3. REPORT ALL DISCOVERIES OF ERRORS, OMISSIONS OR DISCREPANCIES TO THE DESIGN ENGINEER AS APPLICABLE.
4. USE ONLY LATEST REVISED DRAWINGS OR THOSE THAT ARE MARKED "ISSUED FOR CONSTRUCTION".
5. DESIGN AND CONSTRUCTION OF THIS PROJECT SHALL COMPLY WITH THE PROVINCIAL AND LOCAL BUILDING CODES LATEST EDITION.
6. ALL WORKS AND MATERIALS USED SHALL COMPLY AS REQUIRED BY THE BUILDING CODE LATEST EDITION.
7. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS & SPECIFICATIONS.
8. EVERYTHING IS TO BE CONSIDERED NEW UNLESS SPECIFIED EXISTING OTHERWISE.

No.	Date	Description	Drawn	Checked
4	20 FEB '25	ISSUED FOR REVIEW	JP	JS
3	30 AUG '24	ISSUED FOR SPA	JM	JS
2	11 MAR '24	ISSUED FOR REVIEW	JM	JS
1	07 DEC '23	PRELIM FOR REVIEW	JM	JS
0	11 OCT '23	PRELIM FOR REVIEW	JM	JS

REVISIONS

J + B ENGINEERING INC.
TORONTO
25 CENTURIAN DR.
SUITE 201
MARKHAM, ON L3R 5N8
416 229 2636
CALGARY
639-11TH AVE. SW
SUITE 200
CALGARY AB T2R 0E2
403 355 2295

OWNER/CLIENT:
FAIRGATE HOMES

Project:

PRE/POST DRAINAGE PLAN

35 GORDON COLLINS DRIVE — GORMLEY, ON

File No: 230258	Date: 11 OCT '23	ACAD INFO
Drawn By: JM	Scale: AS SHOWN	Dwg. File: 230258-P-303
Checked By: JS	Sheet 1 of 1	Plotting Scale: 1=1
Drawing No: P-303		Drawing Size: D

Appendix F – Up-Flo® Sizing Report

Stormtech Cumulative Storage Spreadsheet

StormTech® Chamber

Inspection and Maintenance Manuals

Up-Flo® ETV Verification

MARKHAM (HEAD OFFICE)
25 CENTURIAN DR, SUITE 201, MARKHAM, ON L3R 5N8
T: 416 229 2636 F: 416 229 6965

CALGARY
707 – 10TH AVE SW, SUITE 150, CALGARY, AB, T2R 0B3
T: 403 355 2295 F: 403 355 2297

May 2, 2022

ADS UFF Sizing Summary

Project Name: Fargate Home
Consulting Engineer: J+B Engineering Inc
Location: Stouffville, ON
Sizing Completed By: Haider Nasrullah **Email:** haider.nasrullah@ads-pipe.com

Recommended Unit	
Recommended Model:	UFF-18
TSS Removal Percentage:	80.8%
Total Site Volume Treated:	90.0%

Site Details	
Site Area:	1.76 ha
% Impervious:	-
Rational C:	0.75
Rainfall Station:	Toronto, ONT
Particle Size Distribution:	ETV

Unit Specifications:	
Number of Filter Modules:	18
Maximum Treatment Flowrate:	28.8 L/s
Inlet - Outlet Drop:	240 mm*
Max. Pipe Diameter:	600 mm
Operating Head:	760 mm

* Drop across unit can be reduced when required.

Site Elevations:	
Rim Elevation:	PER SITE PLAN
Inlet Pipe Elevation:	PER SITE PLAN
Outlet Pipe Elevation:	PER SITE PLAN

Consult approved shop drawings for final elevations. Riser sections (and/or grade rings) may be required to reach final grade on site.

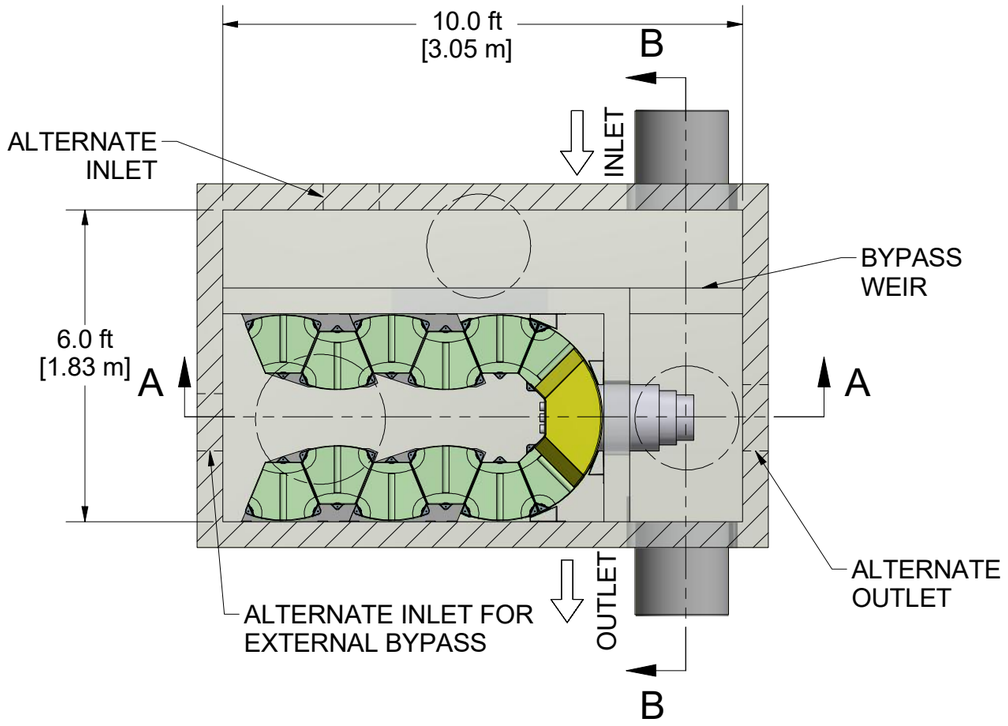
Rainfall Intensity[1]	Fraction of Rainfall[1]	Removal Efficiency[2]	Weighted Net-Annual Removal Efficiency
mm/hr	%	%	%
0.50	0.2%	92.3%	0.2%
1.00	14.8%	91.3%	13.5%
1.50	15.1%	90.4%	13.6%
2.00	13.6%	89.4%	12.2%
2.50	3.9%	88.5%	3.5%
3.00	1.3%	87.5%	1.1%
3.50	8.9%	86.6%	7.7%
4.00	5.3%	85.6%	4.5%
4.50	1.2%	84.7%	1.0%
5.00	5.2%	83.7%	4.3%
6.00	4.2%	81.8%	3.4%
7.00	4.6%	79.9%	3.7%
8.00	3.1%	78.0%	2.4%
9.00	2.3%	76.1%	1.7%
10.00	2.2%	74.2%	1.6%
20.00	9.3%	55.2%	5.1%
30.00	2.7%	36.2%	1.0%
40.00	1.1%	17.2%	0.2%
50.00	0.5%	0.0%	0.0%
100.00	0.6%	0.0%	0.0%
150.00	0.1%	0.0%	0.0%
Net Annual Treatment			**80.8%**
Total Runoff Volume Treated:			**90.0%**

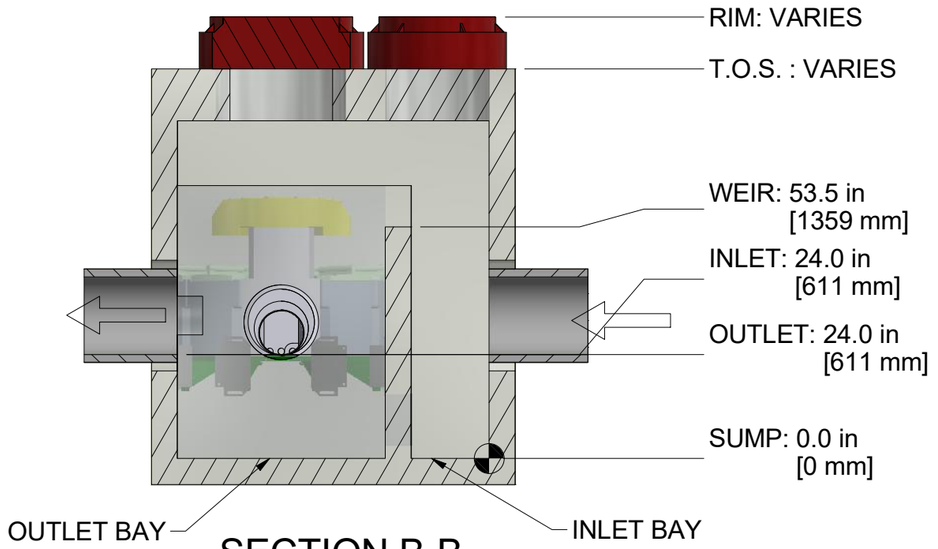
Rainfall Data: 1953:2007, HLY03, Toronto , ON, 6158350 & 6158355

Notes:

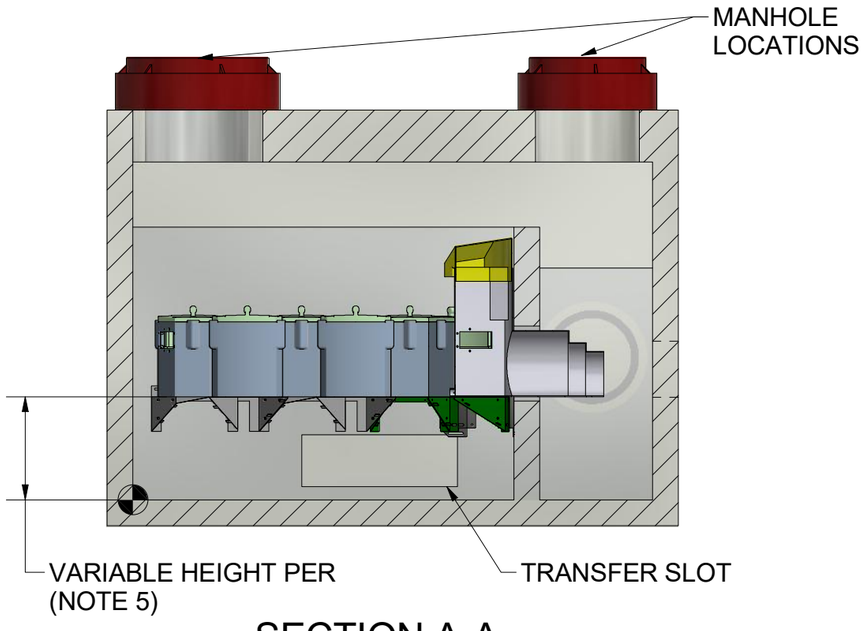
Removal efficiencies are based on NJDEP Test Protocols and independently verified.

All units supplied by ADS have numerous local, provincial, and international certifications (copies of which can be provided upon request). The design engineer is responsible for ensuring compliance with applicable regulations.

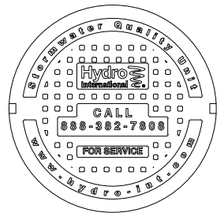




SECTION B-B



SECTION A-A



CAPACITIES:

- Minimum performance: 80% removal. Washington DOE/NJCAT verified at the peak treatment flow.
- Peak treatment flow:
  .033 CFS (0.9 LPS) (15 GPM) per module (Ribbons)
  .022 CFS (0.6 LPS) (10 GPM) per module (Long Ribbons)
  .056 CFS (1.6 LPS) (25 GPM) per module (CPZ)
- Maximum number of ribbon modules per outlet module: 36
- Maximum number of CPZ modules per outlet module: 18 (contract Hydro if more are required)

ADDITIONAL DESIGN INFORMATION:

- Normal operating W.S.E. is 26-30" (660-762mm) above the outlet invert
- Media Types Available: Ribbons, CPZ

DO NOT SCALE DRAWING

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.

TOLERENCES ARE:
FRACTIONS ± 1/16
DECIMALS:
X.X ± .06
X.XX ± .03
X.XXX ± .015
ANGLES: ± .5°

PROJECTION

COMMENTS:

1. STRUCTURE WALL AND SLAB THICKNESSES ARE NOT TO SCALE
2. CONTACT HYDRO INTERNATIONAL FOR A BOTTOM OF STRUCTURE ELEVATION PRIOR TO SETTING THE STRUCTURE
3. NOT FOR CONSTURCION CONTACT HYDRO FOR SITE SPECIFIC DRAWING
4. NOT ALL SIZES AVAILABLE IN ALL AREAS
5. SUMP DEPTH AVAILABLE IN 24" (610mm) CPZ, RIBBONS AND 36" (914mm) LONG RIBBONS DEPTH

REVISION HISTORY

REV	BY	DESCRIPTION	DATE
-	ER	FIRST RELEASE	3/8/2019

DATE: 3/8/2019
SCALE: 1:35
DRAWN BY: ER
CHECKED BY:
APPROVED BY

Title
UP-FLO FILTER
6ft (1829mm) X 10ft (3048mm)

12 MODULES MAX

Hydro International

94 Hutchins Drive
Portland, ME 04102
Tel: +1 (207) 756-6200
Fax: +1 (207) 756-6212
hydro-int.com

WEIGHT: N/A
MATERIAL:
NEXT ASSEMBLY: 6X10-1
DRAWING NO.: 6X10-UFF-1
SHEET SIZE: B
SHEET: 1 OF 1
Rev: -

Project:

Chamber Model -	MC-3500	
Units -	**Metric**	
Number of Chambers -	58	
Number of End Caps -	30	
Voids in the stone (porosity) -	40	%
Base of Stone Elevation -	255.57	m
Amount of Stone Above Chambers -	305	mm
Amount of Stone Below Chambers -	375	mm

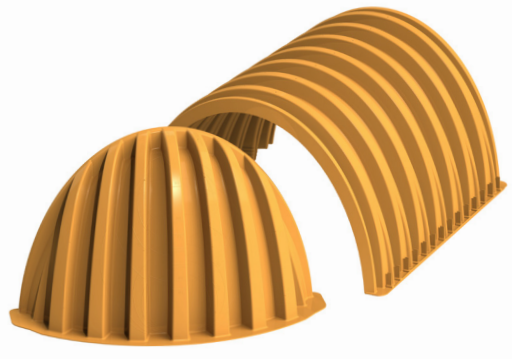
353.46 sq.meters Min. Area - 312.3 sq.meters

StormTech MC-3500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Ch, EC and Stone *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
1829	0.00	0.00	0.00	0.00	3.589	3.59	374.40	257.40
1803	0.00	0.00	0.00	0.00	3.589	3.59	370.81	257.38
1778	0.00	0.00	0.00	0.00	3.589	3.59	367.22	257.35
1753	0.00	0.00	0.00	0.00	3.589	3.59	363.63	257.33
1727	0.00	0.00	0.00	0.00	3.589	3.59	360.04	257.30
1702	0.00	0.00	0.00	0.00	3.589	3.59	356.46	257.27
1676	0.00	0.00	0.00	0.00	3.589	3.59	352.87	257.25
1651	0.00	0.00	0.00	0.00	3.589	3.59	349.28	257.22
1626	0.00	0.00	0.00	0.00	3.589	3.59	345.69	257.20
1600	0.00	0.00	0.00	0.00	3.589	3.59	342.10	257.17
1575	0.00	0.00	0.00	0.00	3.589	3.59	338.51	257.15
1549	0.00	0.00	0.00	0.00	3.589	3.59	334.92	257.12
1524	0.00	0.00	0.10	0.00	3.551	3.65	331.33	257.10
1499	0.01	0.00	0.32	0.02	3.454	3.79	327.68	257.07
1473	0.01	0.00	0.48	0.03	3.383	3.90	323.89	257.05
1448	0.01	0.00	0.66	0.04	3.307	4.01	319.99	257.02
1422	0.02	0.00	1.13	0.06	3.115	4.30	315.98	257.00
1397	0.03	0.00	1.69	0.07	2.884	4.65	311.68	256.97
1372	0.04	0.00	2.05	0.09	2.732	4.88	307.03	256.94
1346	0.04	0.00	2.34	0.11	2.612	5.06	302.16	256.92
1321	0.04	0.00	2.58	0.12	2.507	5.21	297.10	256.89
1295	0.05	0.00	2.80	0.14	2.412	5.35	291.89	256.87
1270	0.05	0.01	3.00	0.15	2.326	5.48	286.53	256.84
1245	0.05	0.01	3.18	0.17	2.248	5.60	281.05	256.82
1219	0.06	0.01	3.35	0.19	2.174	5.71	275.45	256.79
1194	0.06	0.01	3.51	0.20	2.107	5.81	269.74	256.77
1168	0.06	0.01	3.65	0.21	2.043	5.91	263.92	256.74
1143	0.07	0.01	3.79	0.23	1.984	6.00	258.01	256.72
1118	0.07	0.01	3.92	0.24	1.928	6.08	252.02	256.69
1092	0.07	0.01	4.04	0.25	1.874	6.16	245.93	256.67
1067	0.07	0.01	4.15	0.26	1.824	6.24	239.77	256.64
1041	0.07	0.01	4.26	0.27	1.776	6.31	233.53	256.61
1016	0.08	0.01	4.36	0.28	1.731	6.38	227.22	256.59
991	0.08	0.01	4.46	0.29	1.688	6.44	220.85	256.56
965	0.08	0.01	4.55	0.31	1.646	6.50	214.41	256.54
940	0.08	0.01	4.64	0.32	1.607	6.56	207.90	256.51
914	0.08	0.01	4.72	0.33	1.570	6.62	201.34	256.49
889	0.08	0.01	4.80	0.34	1.534	6.67	194.72	256.46
864	0.08	0.01	4.88	0.35	1.500	6.72	188.05	256.44
838	0.09	0.01	4.95	0.36	1.468	6.77	181.32	256.41
813	0.09	0.01	5.01	0.36	1.437	6.82	174.55	256.39
787	0.09	0.01	5.08	0.37	1.407	6.86	167.74	256.36
762	0.09	0.01	5.14	0.38	1.380	6.90	160.87	256.34
737	0.09	0.01	5.20	0.39	1.353	6.94	153.97	256.31
711	0.09	0.01	5.25	0.40	1.328	6.98	147.02	256.28
686	0.09	0.01	5.31	0.41	1.304	7.02	140.04	256.26
660	0.09	0.01	5.36	0.42	1.281	7.05	133.02	256.23
635	0.09	0.01	5.40	0.42	1.259	7.09	125.97	256.21
610	0.09	0.01	5.45	0.43	1.238	7.12	118.89	256.18
584	0.09	0.01	5.49	0.44	1.218	7.15	111.77	256.16
559	0.10	0.01	5.53	0.44	1.199	7.18	104.62	256.13
533	0.10	0.01	5.57	0.45	1.181	7.20	97.45	256.11
508	0.10	0.02	5.61	0.46	1.164	7.23	90.24	256.08
483	0.10	0.02	5.64	0.46	1.147	7.25	83.02	256.06
457	0.10	0.02	5.68	0.47	1.131	7.28	75.76	256.03
432	0.10	0.02	5.71	0.47	1.115	7.30	68.49	256.00
406	0.10	0.02	5.76	0.51	1.084	7.35	61.19	255.98
381	0.00	0.00	0.00	0.00	3.589	3.59	53.84	255.95
356	0.00	0.00	0.00	0.00	3.589	3.59	50.25	255.93
330	0.00	0.00	0.00	0.00	3.589	3.59	46.66	255.90
305	0.00	0.00	0.00	0.00	3.589	3.59	43.07	255.88
279	0.00	0.00	0.00	0.00	3.589	3.59	39.48	255.85
254	0.00	0.00	0.00	0.00	3.589	3.59	35.89	255.83
229	0.00	0.00	0.00	0.00	3.589	3.59	32.30	255.80
203	0.00	0.00	0.00	0.00	3.589	3.59	28.71	255.78
178	0.00	0.00	0.00	0.00	3.589	3.59	25.13	255.75
152	0.00	0.00	0.00	0.00	3.589	3.59	21.54	255.73
127	0.00	0.00	0.00	0.00	3.589	3.59	17.95	255.70
102	0.00	0.00	0.00	0.00	3.589	3.59	14.36	255.67
76	0.00	0.00	0.00	0.00	3.589	3.59	10.77	255.65
51	0.00	0.00	0.00	0.00	3.589	3.59	7.18	255.62
25	0.00	0.00	0.00	0.00	3.589	3.59	3.59	255.60

StormTech® MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for 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)
90” x 77” x 45”
2286 mm x 1956 mm x 1143 mm

Chamber Storage
109.9 ft³ (3.11 m³)

Min. Installed Storage*
175.0 ft³ (4.96 m³)

Weight
134 lbs (60.8 kg)

Shipping
15 chambers/pallet
7 end caps/pallet
7 pallets/truck

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

Nominal End Cap Specifications
(not to scale)

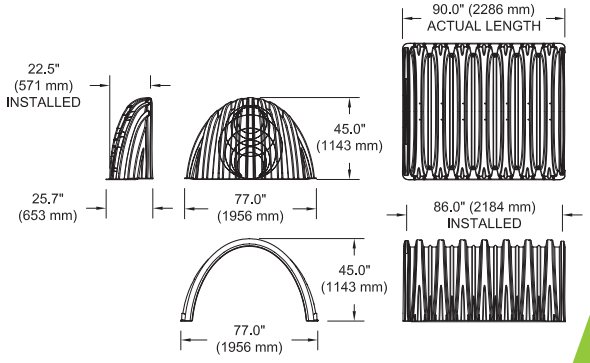
Size (L x W x H)
26.5” x 71” x 45.1”
673 mm x 1803 mm x 1145 mm

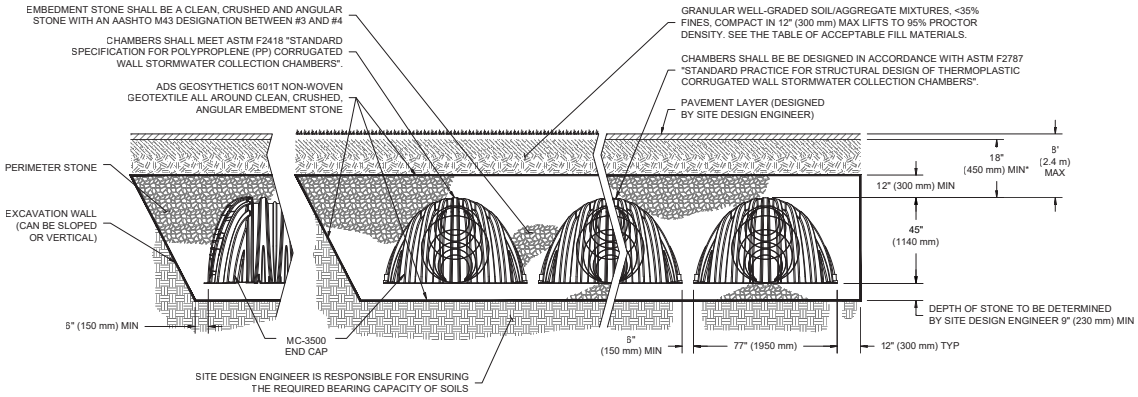
End Cap Storage
14.9 ft³ (0.42 m³)

Min. Installed Storage*
45.1 ft³ (1.28 m³)

Weight
49 lbs (22.2 kg)

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





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

ADS StormTech™

StormTech MC-3500 Specifications

Storage Volume Per Chamber

	Bare Chamber Storage ft³ (m³)	Chamber and Stone Foundation Depth in. (mm)			
		9 in (230 mm)	12 in (300 mm)	15 in (375 mm)	18 in (450 mm)
Chamber	109.9 (3.11)	175.0 (4.96)	179.9 (5.09)	184.9 (5.24)	189.9 (5.38)
End Cap	14.9 (0.42)	45.1 (1.28)	46.6 (1.32)	48.3 (1.37)	49.9 (1.41)

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

Amount of Stone Per Chamber

English Tons (yds³)	Stone Foundation Depth			
	9 in	12 in	15 in	18 in
Chamber	8.5 (6.0)	9.1 (6.5)	9.7 (6.9)	10.4 (7.4)
End Cap	3.9 (2.8)	4.1 (2.9)	4.3 (3.1)	4.5 (3.2)
Metric Kilograms (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
Chamber	7711 (4.6)	8255 (5.0)	8800 (5.3)	9435 (5.7)
End Cap	3538 (2.1)	3719 (2.2)	3901 (2.4)	4082 (2.5)

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

Volume Excavation Per Chamber yd³ (m³)

	Stone Foundation Depth			
	9 in (230 mm)	12 in (300 mm)	15 in (375mm)	18 in (450 mm)
Chamber	11.9 (9.1)	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)
End Cap	4.0 (3.1)	4.1 (3.3)	4.3 (3.3)	4.4 (3.4)

Note: Assumes 6" (150 mm) of separation between chamber rows and 24" (600 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/stormtech and utilize the Design Tool

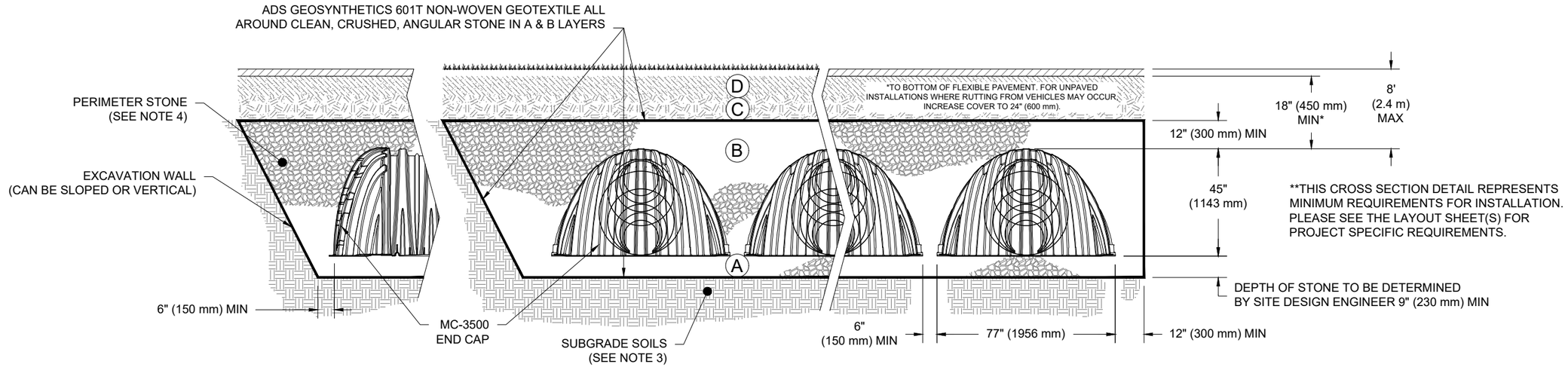
ADS StormTech™

adspipe.com
800-821-6710

ACCEPTABLE FILL MATERIALS: STORMTECH MC-3500 CHAMBER SYSTEMS

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

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



*FOR COVER DEPTHS GREATER THAN 8.0' (2.4 m) PLEASE CONTACT ADS

NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 45x76 DESIGNATION SS.
2. MC-3500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT AS DEFINED IN SECTION 6.2.8 OF ASTM F2418 SHALL BE GREATER THAN OR EQUAL TO 500 LBS/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.

MC-3500

STANDARD CROSS SECTION

DATE: 8/03/22 | DRAWN: KLJ | PROJECT #: | CHECKED: KLJ

DATE	DESCRIPTION	DRWN	CHKD

THIS DRAWING HAS BEEN PREPARED BASED ON INFORMATION PROVIDED TO ADS UNDER THE DIRECTION OF THE SITE DESIGN ENGINEER OR OTHER PROJECT REPRESENTATIVE. THE SITE DESIGN ENGINEER SHALL REVIEW THIS DRAWING PRIOR TO CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE SITE DESIGN ENGINEER TO ENSURE THAT THE PRODUCT(S) DEPICTED AND ALL ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.

StormTech® Chamber System

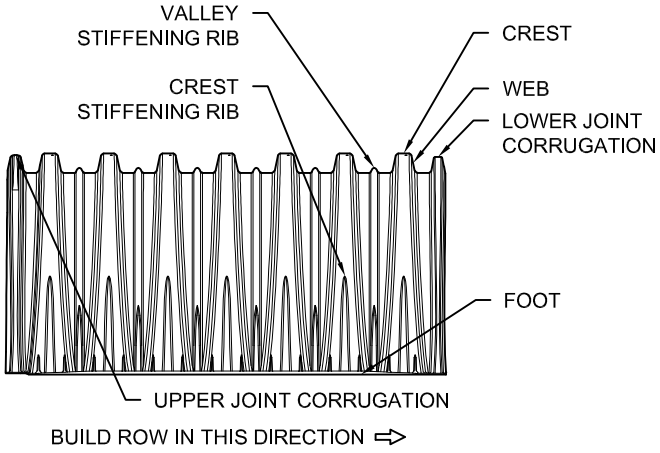
888-892-2694 | WWW.STORMTECH.COM

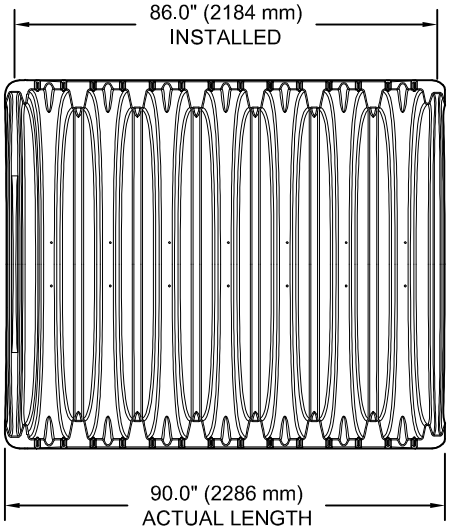
4640 TRUEMAN BLVD
HILLIARD, OH 43026

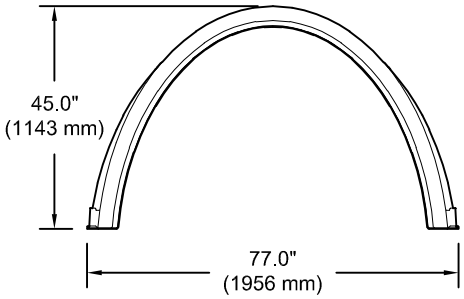
SHEET 1 OF 1

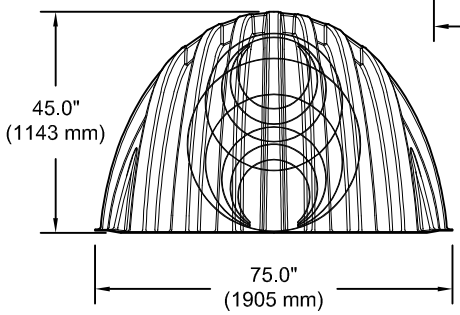
MC-3500 TECHNICAL SPECIFICATION

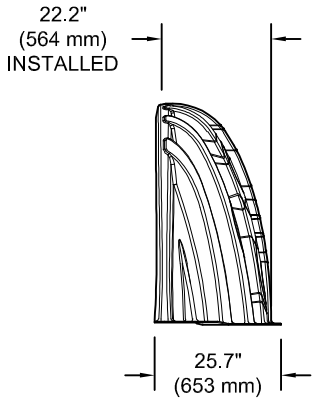
NTS











NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	77.0" X 45.0" X 86.0"	(1956 mm X 1143 mm X 2184 mm)
CHAMBER STORAGE	109.9 CUBIC FEET	(3.11 m³)
MINIMUM INSTALLED STORAGE*	175.0 CUBIC FEET	(4.96 m³)
WEIGHT	134 lbs.	(60.8 kg)

NOMINAL END CAP SPECIFICATIONS

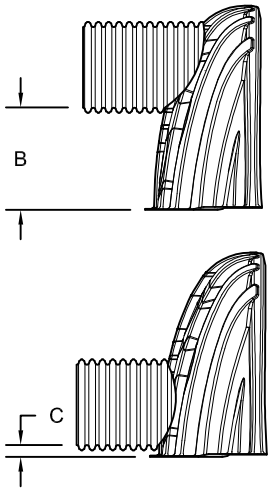
SIZE (W X H X INSTALLED LENGTH)	75.0" X 45.0" X 22.2"	(1905 mm X 1143 mm X 564 mm)
END CAP STORAGE	14.9 CUBIC FEET	(0.42 m³)
MINIMUM INSTALLED STORAGE*	45.1 CUBIC FEET	(1.28 m³)
WEIGHT	49 lbs.	(22.2 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION, 6" (152 mm) STONE BETWEEN CHAMBERS, 6" (152 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

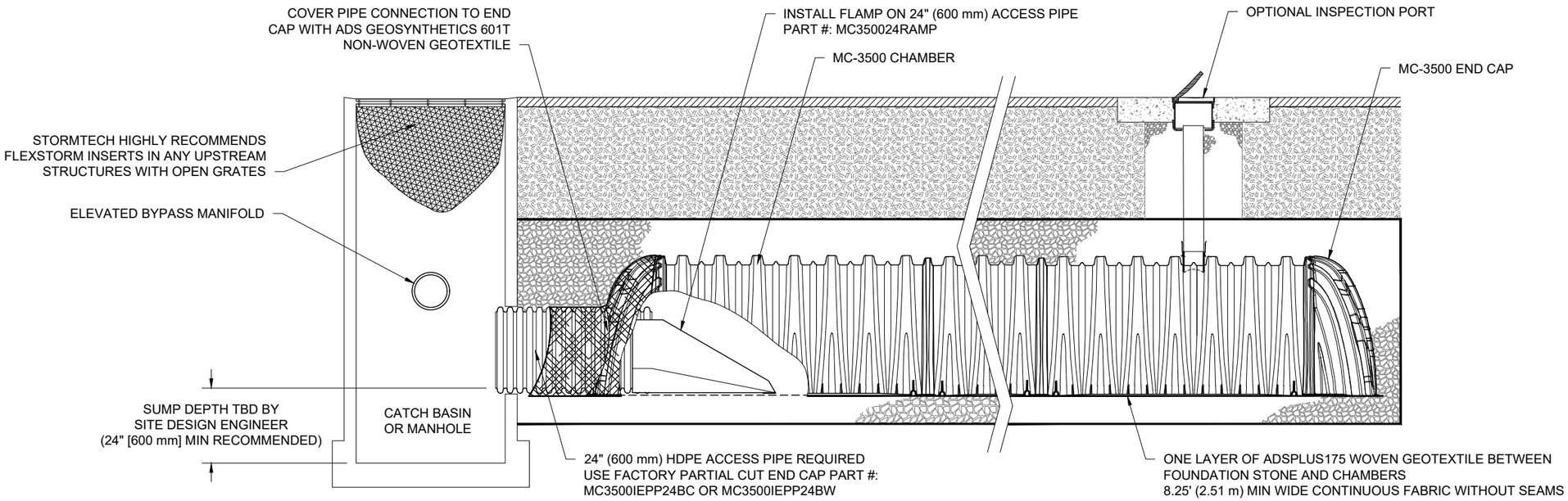
PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"
END CAPS WITH A WELDED CROWN PLATE END WITH "C"

PART #	STUB	B	C
MC3500IEPP06T	6" (150 mm)	33.21" (844 mm)	---
MC3500IEPP06B		---	0.66" (17 mm)
MC3500IEPP08T	8" (200 mm)	31.16" (791 mm)	---
MC3500IEPP08B		---	0.81" (21 mm)
MC3500IEPP10T	10" (250 mm)	29.04" (738 mm)	---
MC3500IEPP10B		---	0.93" (24 mm)
MC3500IEPP12T	12" (300 mm)	26.36" (670 mm)	---
MC3500IEPP12B		---	1.35" (34 mm)
MC3500IEPP15T	15" (375 mm)	23.39" (594 mm)	---
MC3500IEPP15B		---	1.50" (38 mm)
MC3500IEPP18TC	18" (450 mm)	20.03" (509 mm)	---
MC3500IEPP18TW			
MC3500IEPP18BC		---	1.77" (45 mm)
MC3500IEPP18BW			
MC3500IEPP24TC	24" (600 mm)	14.48" (368 mm)	---
MC3500IEPP24TW			
MC3500IEPP24BC		---	2.06" (52 mm)
MC3500IEPP24BW			
MC3500IEPP30BC	30" (750 mm)	---	2.75" (70 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PARTIAL CUT INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-3500 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.



MC-3500 ISOLATOR ROW PLUS DETAIL
NTS

INSPECTION & MAINTENANCE

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

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

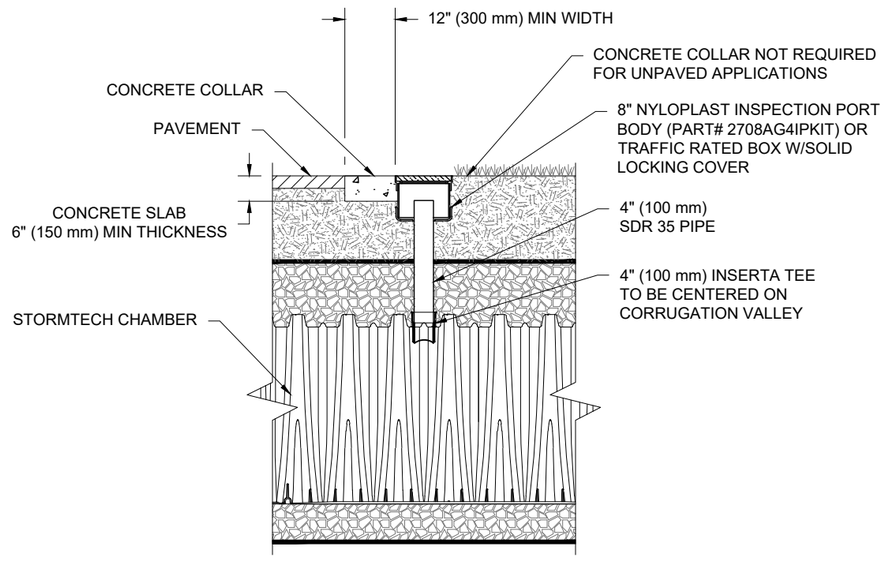
STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

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

NOTES

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

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



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

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

MC-3500
ISOLATOR ROW PLUS DETAILS
DATE: 8/03/22 | DRAWN: KLJ | CHECKED: KLJ | PROJECT #:

DATE	DRWN	CHKD	DESCRIPTION

StormTech® Chamber System
888-892-2694 | WWW.STORMTECH.COM
4640 TRUEMAN BLVD
HILLIARD, OH 43026

Isolator® Row Plus
O&M Manual

ADS StormTech™

The Isolator® Row Plus

Introduction

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

The Isolator Row Plus

The Isolator Row Plus is a row of StormTech chambers, either SC-160, SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-7200 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped 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 and perforated sidewalls (SC-310, SC- 310-3 and SC-740 models) allow stormwater to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row Plus protecting the adjacent stone and chambers storage areas from sediment accumulation.

ADS geotextile fabric is placed between the stone and the Isolator Row Plus chambers. The woven geotextile provides a media for stormwater filtration, a durable surface for maintenance, prevents scour of the underlying stone and remains intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the chamber's sidewall. The non-woven fabric is not required over the SC-160, DC-780, MC-3500 or MC-7200 models as these chambers do not have perforated side walls.

The Isolator Row Plus is designed to capture the "first flush" runoff and offers the versatility to be sized on a volume basis or a flow-rate basis. An upstream manhole 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.

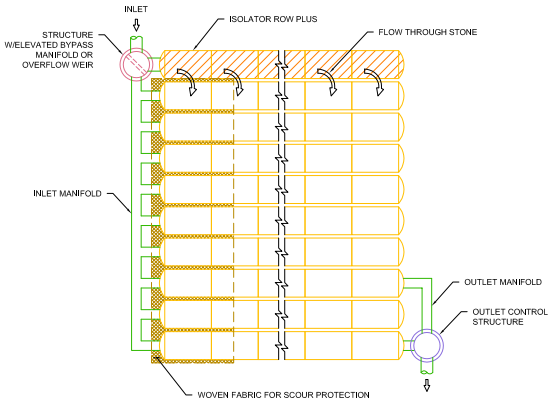
The Isolator Row FLAMP™ (patent pending) is a flared end ramp apparatus attached to the inlet pipe on the inside of the chamber end cap. The FLAMP provides a smooth transition from pipe invert to fabric bottom. It is configured to improve chamber function performance by enhancing outflow of solid debris that would otherwise collect at the chamber's end. 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 Spillway (not to scale)



Isolator Row Plus Inspection/Maintenance

Inspection

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

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

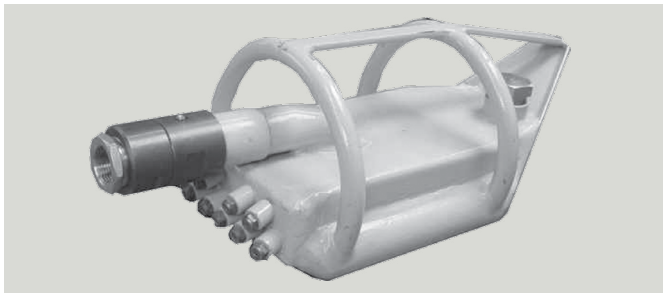
The Isolator Row Plus incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

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

Maintenance

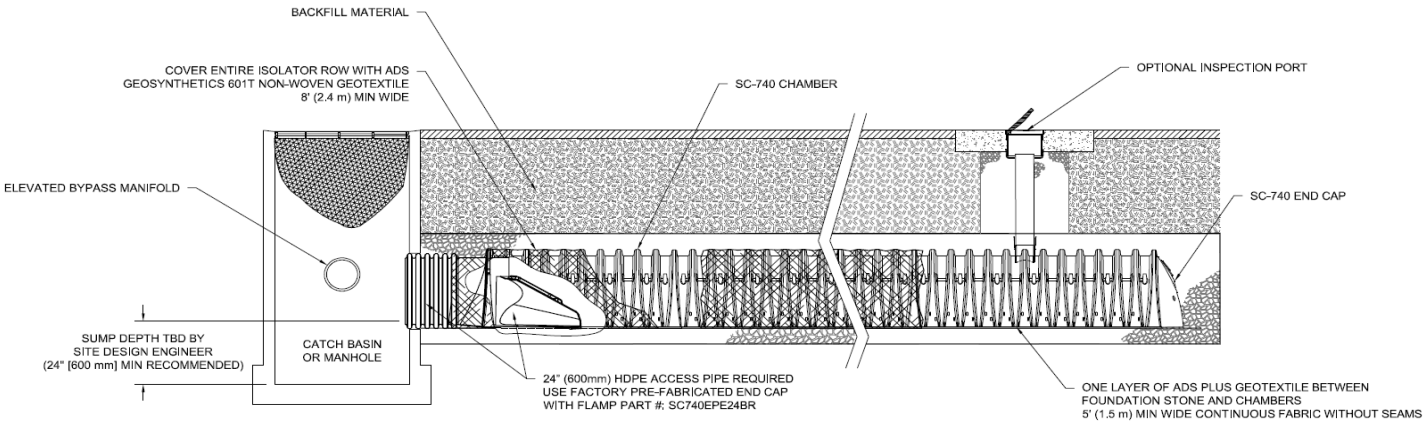
The Isolator Row Plus was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided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

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row Plus while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. StormTech recommends a maximum nozzle pressure of 2000 psi be utilized during cleaning. 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*)

Note: *Non-woven fabric is only required over the inlet pipe connection into the end cap for SC-160LP, DC-780, MC-3500 and MC-7200 chamber models and is not required over the entire Isolator Row PLUS.*



Isolator Row Plus Step By Step Maintenance Procedures

Step 1

Inspect Isolator Row Plus for sediment.

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

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

Step 2

Clean out Isolator Row Plus using the JetVac process.

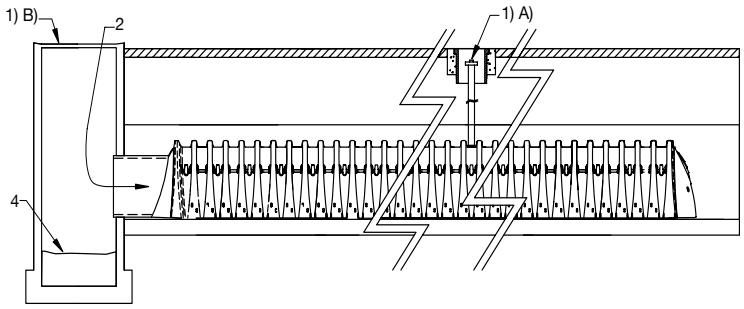
A) A fixed floor cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable
B) Apply multiple passes of JetVac until backflush water is clean
C) Vacuum manhole sump as required

Step 3

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

Step 4

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



Sample Maintenance Log

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

adspipe.com
800-821-6710

StormTech® Installation Guide
MC-3500 & MC-4500 Chamber

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, pre-cored and pre-fabricated end caps
- StormTech chambers, manifolds and fittings

Note: MC-3500 chamber pallets are 77" x 90" (2.0 m x 2.3 m) and weigh about 2010 lbs. (912 kg) and MC-4500 pallets are 100" x 52" (2.5 m x 1.3 m) and weigh about 840 lbs. (381 kg). Unloading chambers requires 72" (1.8 m) (min.) forks and/or tie downs (straps, chains, etc).

Important Notes:

A. This installation guide provides the minimum requirements for proper installation of chambers. Nonadherence 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.

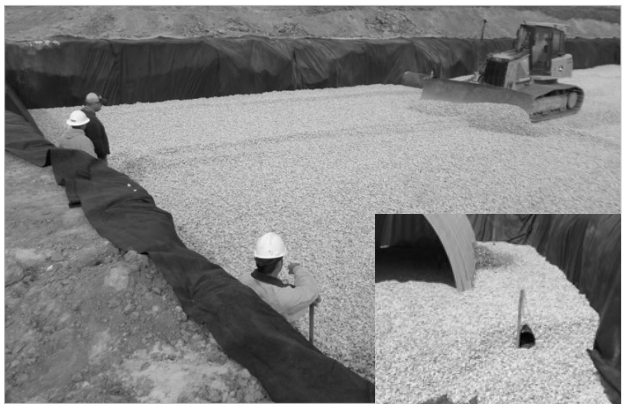
B. Use of a dozer to push embedment stone between the rows of chambers may cause damage to chambers and is not an acceptable backfill method. Any chambers damaged by using the "dump and push" method are not covered under the StormTech standard warranty.

C. Care should be taken in the handling of chambers and end caps. End caps must be stored standing upright. 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. Plans and specifications should include Best Management Practices (BMPs) to deter contamination of open pits during construction.

Place non-woven geotextile over prepared soils and up excavation walls.



Place clean, crushed, angular stone foundation 9" (230 mm) min. Install underdrains if required. Compact to achieve a flat surface.

Manifold, Scour Fabric and Chamber Assembly

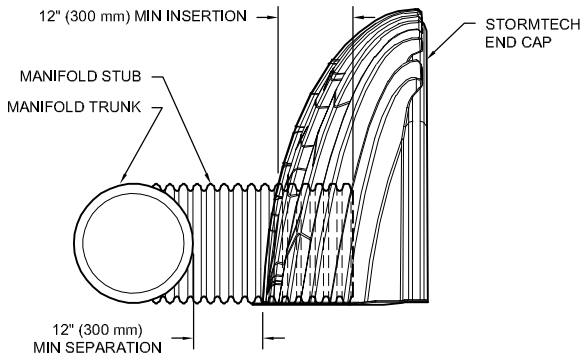
Install manifolds and lay out ADS PLUS fabric at inlet rows [min. 17.5 ft (5.33 m)] at each inlet end cap. Place a continuous piece (no seams) along entire length of Isolator® PLUS Row(s).

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

Continue installing chambers by overlapping chamber end corrugations. Chamber joints are labeled “Lower Joint – Overlap Here” and “Build this direction – Upper Joint” Be sure that the chamber placement does not exceed the reach of the construction equipment used to place the stone. Maintain minimum 6” (150 mm) spacing between MC-3500 rows and 9” (230 mm) spacing between MC-4500 rows.

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.
When used on an Isolator Row PLUS, a 24” FLAMP (flared end ramp) is attached to the inside of the inlet pipe with a provided threaded rod and bolt. The FLAMP then lays on top of the ADS PLUS fabric.

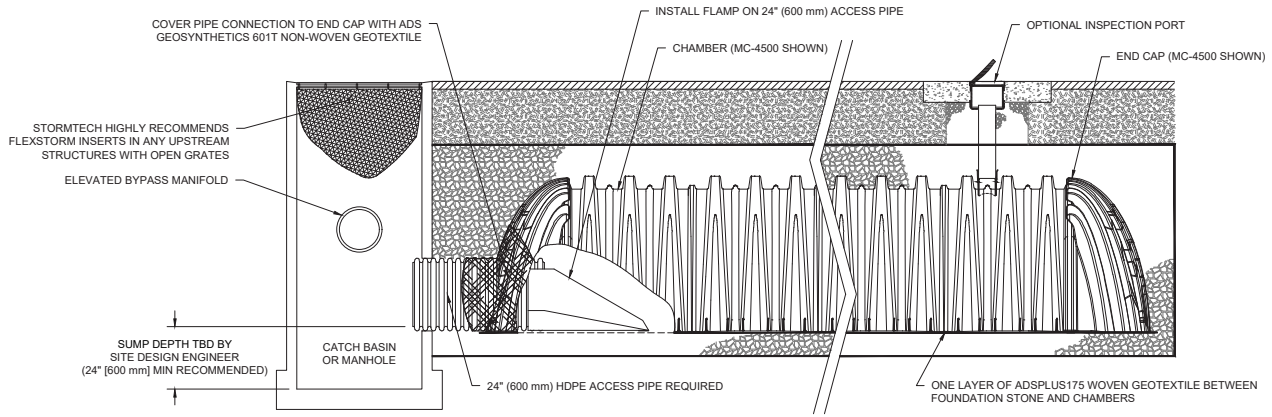
Manifold Insertion



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

Insert inlet and outlet manifolds a minimum 12” (300 mm) into chamber end caps. Manifold header should be a minimum 12” (300 mm) from base of end cap.

StormTech Isolator Row Plus Detail

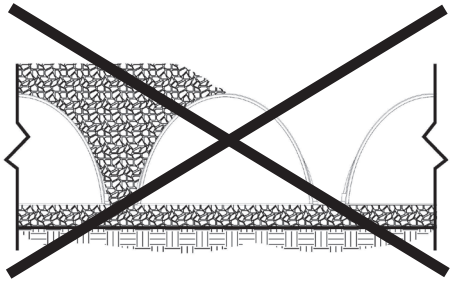


Initial Anchoring of Chambers – Embedment Stone

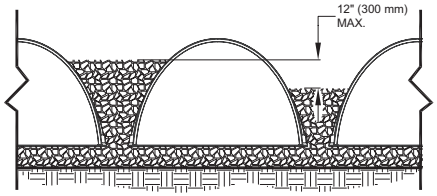
Initial embedment shall be spotted along the centerline of the chamber evenly anchoring the lower portion of the chamber. This is best accomplished with a stone conveyor or excavator reaching along the row.

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

Backfill of Chambers – Embedment Stone

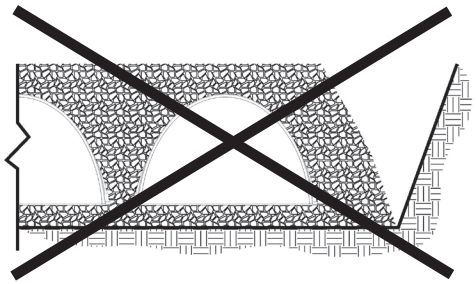


Uneven Backfill

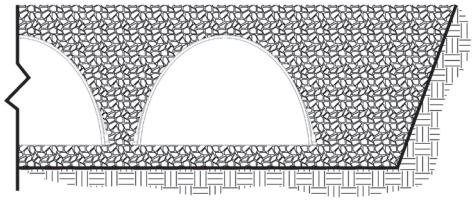


Even Backfill

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



Perimeter Not Backfilled

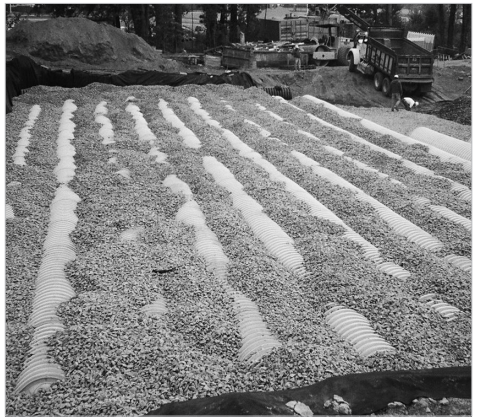


Perimeter Fully Backfilled

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

Backfill of Chambers – Embedment Stone and Cover Stone

Continue evenly backfilling between rows and around perimeter until embedment stone reaches tops of chambers and a minimum 12” (300 mm) of cover stone is in place. Perimeter stone must extend horizontally to the excavation wall for both straight or sloped sidewalls. The recommended backfill methods are with a stone conveyor outside of the bed or build as you go with an excavator inside the bed reaching along the rows. Backfilling while assembling chambers rows as shown in the picture will help to ensure that equipment reach is not exceeded.

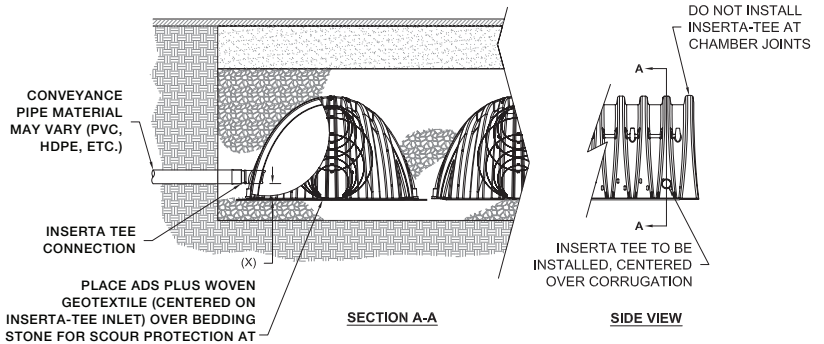


Only after chambers have been backfilled to top of chamber and with a minimum 12” (300 mm) of cover stone on top of chambers can skid loaders and small LGP dozers be used to final grade cover stone and backfill material in accordance with ground pressure limits in Table 2. Equipment must push material parallel to rows only. Never push perpendicular to rows. StormTech recommends the contractor inspect chamber rows before placing final backfill. Any chambers damaged by construction equipment shall be removed and replaced.

Final Backfill of Chambers – Fill Material

Install non-woven geotextile over stone. Geotextile must overlap 24” (600 mm) where edges meet. Compact at 24” (600 mm) of fill. Roller travel parallel with rows.

Inserta Tee Detail



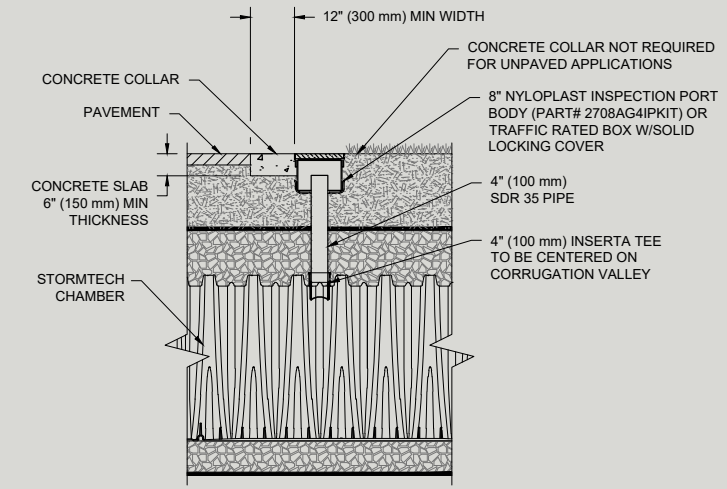
CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-3500	12” (250 mm)	6” (150 mm)
MC-4500	12” (250 mm)	8” (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

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

Table 1- Acceptable Fill Materials

Material Location	Description	AASHTO M43 Designation[1]	Compaction/Density Requirement
(D) **Final Fill:** Fill Material for layer 'D' starts from the top of the 'C' layer to the bottom of flexible pavement or unpaved finished grade above. Note that the pavement subbase may be part of the 'D' layer.	Any soil/rock materials, native soils or per engineer's plans. Check plans for pavement subgrade requirements.	N/A	Prepare per site design engineer's plans. Paved installations may have stringent material and preparation requirements.
(C) **Initial Fill:** Fill Material for layer 'C' starts from the top of the embedment stone ('B' layer) to 24" (600 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 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 compaction after min. 24" (600 mm) of material over the chambers is reached. Compact additional layers in 12" (300 mm) max. lifts to a min. 95% Proctor density for well-graded material and 95% relative density for processed aggregate materials.
(B) **Embedment Stone:** Fill the surrounding chambers from the foundation stone ('A' layer) to the 'C' layer above.	Clean, crushed, angular stone	AASHTO M43[1] 3, 4	No compaction required.
(A) **Foundation Stone:** Fill below chambers from the subgrade up to the foot (bottom) of the chamber.	Clean, crushed, angular stone,	AASHTO M43[1] 3, 4	Place and compact in 9" (230 mm) max lifts using two full coverages with a vibratory compactor.[2, 3]

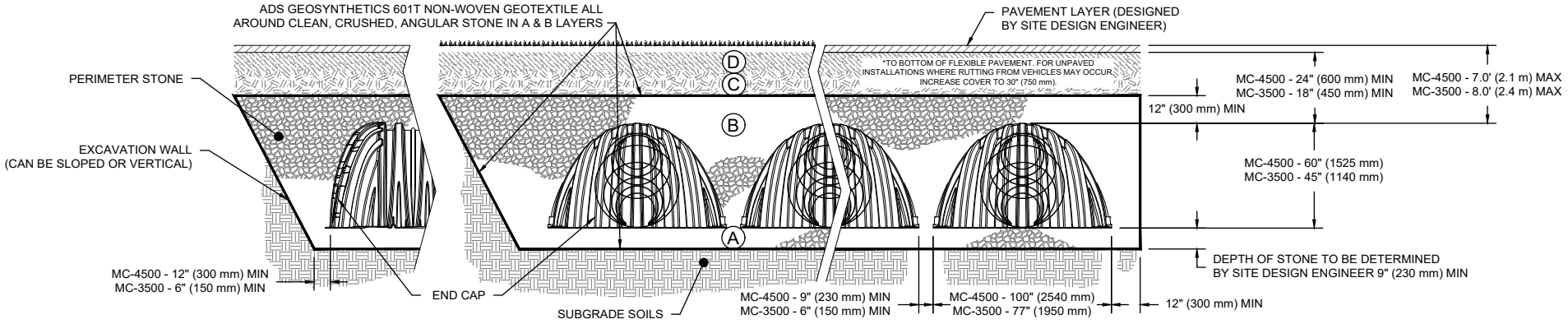
Figure 1- Inspection Port Detail



Please Note:

1. The listed AASHTO designations are for gradations only. The stone must also be clean, crushed, angular. For example, a specification for #4 stone would state: "clean, crushed, angular no. 4 (AASHTO M43) stone".
2. StormTech compaction requirements are met for 'A' location materials when placed and compacted in 9" (230 mm) (max) lifts using two full coverages with a vibratory compactor.
3. Where infiltration surfaces may be comprised by compaction, for standard installations and standard design load conditions, a flat surface may be achieved by raking or dragging without compaction equipment. For special load designs, contact StormTech for compaction requirements.

Figure 2 - Fill Material Locations



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" (450mm) of cover for MC-3500s 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" (450mm) of cover for MC-3500s exists over the chambers. Contact StormTech for additional guidance on allowable axle loads during paving.
3. Ground pressure for track dozers is the vehicle operating weight divided by total ground contact area for both tracks. Excavators will exert higher ground pressures based on loaded bucket weight and boom extension.
4. Mini-excavators (<8,000lbs/3,628 kg) can be used with at least 12" (300 mm) of stone over the chambers and are limited by the maximum ground pressures in Table 2 based on a full bucket at maximum boom extension.
5. StormTech does not require compaction of initial fill at 18" (450 mm) of cover. However, requirements by others for 6" (150 mm) lifts may necessitate the use of small compactors at 18" (450 mm) of cover.
6. 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.
7. 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.

Call StormTech at **888.892.2694** for technical and product information or visit www.stormtech.com

Table 2 - Maximum Allowable Construction Vehicle Loads[6]

Material Location	Fill Depth over Chambers in. (mm)	Maximum Allowable Wheel Loads		Maximum Allowable Track Loads[6]		Maximum Allowable Roller Loads
		Max Axle Load for Trucks lbs (kN)	Max Wheel Load for Loaders lbs (kN)	Track Width in. (mm)	Max Ground Pressure psf (kPa)	Max Drum Weight or Dynamic Force lbs (kN)
Ⓓ Final Fill Material	36" (900) Compacted	32,000 (142)	16,000 (71)	12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	4050 (194) 2760 (132) 2130 (102) 1770 (84) 1530 (73)	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)	2750 (131) 1920 (92) 1520 (73) 1310 (63) 1180 (56)	20,000 (89)
	24" (600) Loose/Dumped	MC-3500		12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2430 (116) 1730 (82) 1390 (66) 1210 (58) 1100 (52)	16,000 (71)
		32,000 (142)	16,000 (71)			
		MC-4500				
		24,000 (107)	12,000 (53)			
	18" (450)	MC-3500		12" (305) 18" (457) 24" (610) 30" (762) 36" (914)	2140 (102) 1530 (73) 1260 (60) 1120 (53) 1030 (49)	5,000 (22) (static loads only)[5]
		32,000 (142)	16,000 (71)			
		MC-4500				
		24,000 (107)	12,000 (53)			
Ⓑ Embedment Stone	12" (300)	Not Allowed	Not Allowed	12" (305) 18" (457) 24" (610) 30" (762)	1100 (53) 710 (34) 660 (32) 580 (28)	Not Allowed
	6" (150)	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed

Table 3 - Placement Methods and Descriptions

Material Location	Placement Methods/ Restrictions	Wheel Load Restrictions	Track Load Restrictions	Roller Load Restrictions
		See Table 2 for Maximum Construction Loads		
Ⓓ Final Fill Material	A variety of placement methods may be used. All construction loads must not exceed the maximum limits in Table 2.	36" (900 mm) minimum cover required for dump trucks to dump over chambers.	Dozers to push parallel to rows.[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 24" (600 mm) above top of chambers.	Small LGP track dozers & skid loaders allowed to grade cover stone with at least 12" (300 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 24" (600 mm) over chambers. Roller travel parallel to chamber rows only.
Ⓑ Embedment Stone	No equipment allowed on bare chambers. Use excavator or stone conveyor positioned off bed or on foundation stone to evenly fill around all chambers to at least the top of chambers.	No wheel loads allowed. Material must be placed outside the limits of the chamber bed.	No tracked equipment is allowed on chambers until a min. 12" (300 mm) cover stone is in place.	No rollers allowed.
Ⓐ Foundation Stone	No StormTech restrictions. Contractor responsible for any conditions or requirements by others relative to subgrade bearing capacity, dewatering or protection of subgrade.			

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."

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

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

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

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

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

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

ADS StormTech™

adspipe.com
800-821-6710

ADS 0601T/O NONWOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 0601T/O nonwoven geotextile.

Filter Fabric Requirements

ADS 0601T/O is an orange nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. ADS 0601T/O is inert to biological degradation and resists naturally encountered chemicals, alkali and acids. ADS 0601T/O conforms to the physical property values listed below:

Filter Fabric Properties

Property	Test Method	Unit	Typical Value[1] MD	Typical Value[1] CD
Grab Tensile Strength	ASTM D4632	lbs (N)	175 (779)	175 (779)
Grab Tensile Elongation	ASTM D4632	%	75	75
Trapezoid Tear Strength	ASTM D4533	lbs (N)	85 (378)	85 (378)
CBR Puncture Strength	ASTM D6241	lbs (N)	480 (2136)	480 (2136)
Permittivity	ASTM D4491	sec^{-1}	1.5	1.5
Flow Rate	ASTM D4491	gal/min/ft^2 (l/min/m^2)	105 (4278)	105 (4278)
UV Resistance (at 500 hours)[1]	ASTM D4355	% strength retained	80	80

Physical Properties

Property	Test Method	Unit	Typical Value[2]
Weight	ASTM D5161	oz/yd^2 (g/m^2)	6.5 (220)
Thickness	ASTM D5199	mils (mm)	65 (1.7)
Roll Dimensions (W x L)	-	ft (m)	15 x 300 (4.5 x 91)
Roll Area	-	yd^2 (m^2)	500 (418)
Estimated Roll Weight	-	lb (kg)	220 (100)

1 Modified, Minimum Test Value
2 ASTM D4439 Standard Terminology for Geosynthetics: typical value, n-*for geosynthetics*, the mean value calculated from documented manufacturing quality control test results for a defined population obtained from one test method associated with on specific property.

Separation

ADS 315W WOVEN GEOTEXTILE SPECIFICATION

Scope

This specification describes ADS 315W woven geotextile.

Filter Fabric Requirements

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

Filter Fabric Properties

Property	Test Method	Unit	M.A.R.V. (Minimum Average Roll Value)[2]
Tensile Strength (Grab)	ASTM D4632	lbs (N)	315 (1400)
Elongation	ASTM D4632	%	15
CBR Puncture	ASTM D6241	lbs (N)	900 (4005)
Puncture	ASTM D4833	lbs (N)	150 (667)
Mullen Burst	ASTM D3786	psi (kPa)	600 (4134)
Trapezoidal Tear	ASTM D4533	lbs (N)	120 (533)
UV Resistance (at 500 hours)	ASTM D4355	%	70
Apparent Opening Size (AOS)*	ASTM D4751	U.S. Sieve (mm)	40 (.425)
Permittivity	ASTM D4491	sec^{-1}	.05
Water Flow Rate	ASTM D4491	gpm/ft^2 ($l/min/m^2$)	4 (163)

* Maximum average roll value.

Packaging

Roll Dimensions (W x L) - ft. (m)	12.5 x 360/ 15 x 300 / 17.5 x 258 (3.81 x 109.8/ 4.57 x 91.5 / 5.33 x 78.6)

Inspection and Maintenance of Stormwater Management systems

Regular inspection and maintenance of the stormwater management system is required for maximum operation efficiency and for low operation and maintenance costs.

Inspection Required:

- Post-construction inspection is required prior to putting the Filtration and storage units into service.
- Routine inspections are recommended during the first year of operation to accurately assess pollutant accumulation.
- Inspection frequency in subsequent years is based on the maintenance plan developed in the first year.
- Inspections should also be performed immediately after oil, fuel, or other chemical spills.

Typical equipment required for inspection:

Following equipment, including but not limited to, are required for regular inspection

- Manhole access cover lifting tool
- Oil dipstick / Sediment probe with ball valve (typically ¾-inch to 1-inch diameter)
- Flashlight
- Camera
- Data log / Inspection Report
- Safety cones and caution tape
- Hard hat, safety shoes, safety glasses, and chemical-resistant gloves

Refer to attached manufacturer's Technical and Design Manuals for detailed operation and maintenance guide.

StormTech Chamber Inspection and Maintenance

1 Inspect isolator row 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 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 rows
B.1. Remove cover from structure at upstream end of isolator row
B.2. Using a flashlight, inspect down the isolator row through outlet pipe
i) Mirrors on poles or cameras may be used to avoid a confined space entry
ii) Follow osha regulations for confined space entry if entering manhole
B.3. If sediment is at, or above, 3" (80 mm) proceed to step 2. if not, proceed to step 3.

2 Clean out isolator row 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

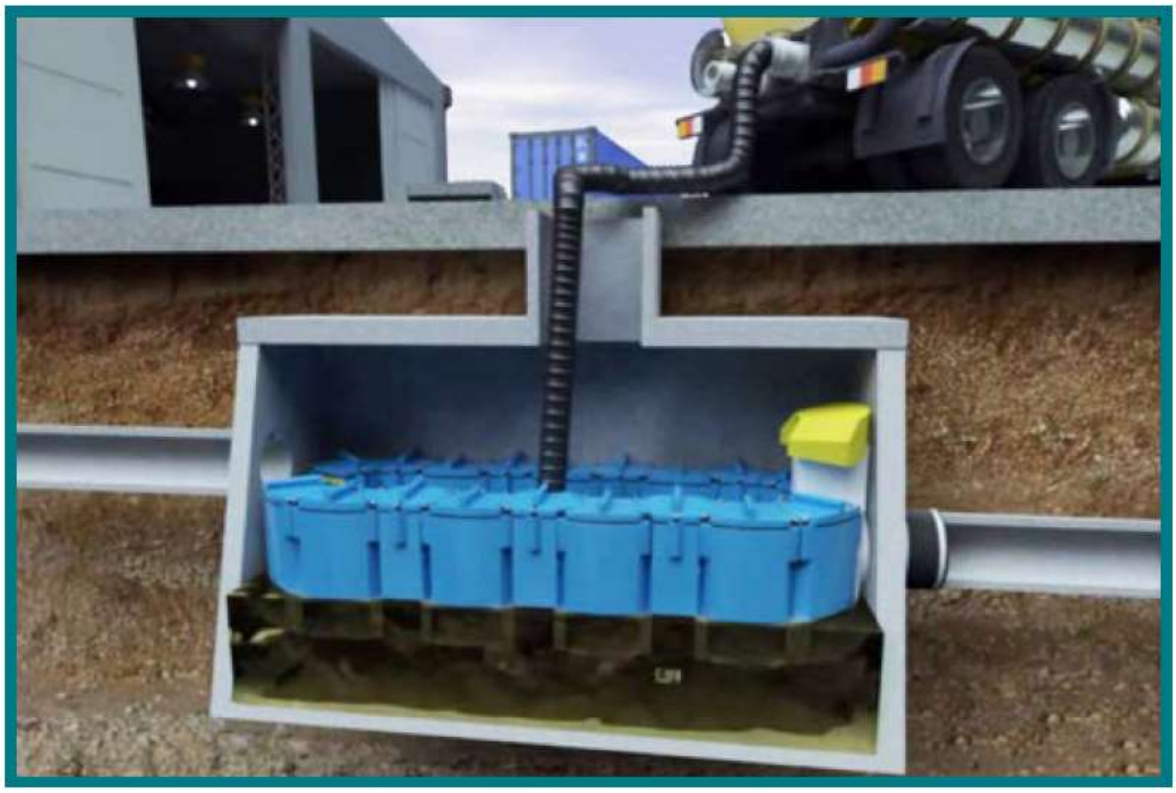
3 Replace all covers, grates, filters, and lids; record observations and actions.
4 Inspect and clean basins and manholes upstream of the stormtech system.

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.

Refer to attached manufacturer's Technical and Design Manuals for detailed operation and maintenance guide

Hydro International



Operation and Maintenance Manual

Up-Flo® Filter

Filtration System for Stormwater Treatment

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Overview & Product Description

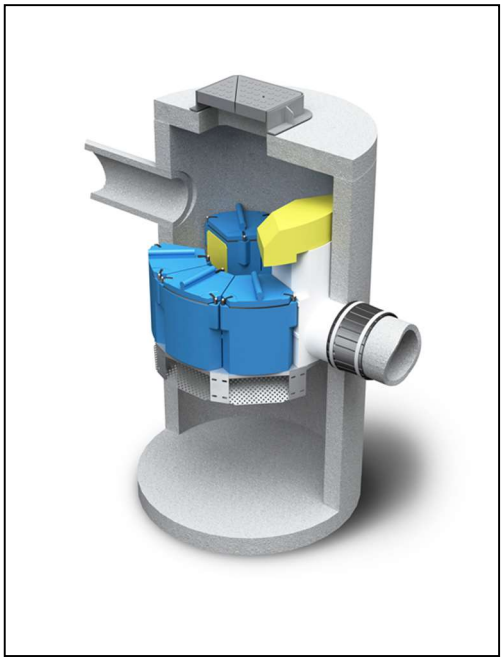
DON'T WANT TO GO IT ALONE? CALL HYDRO AND WE'LL TAKE CARE OF INSPECTION, REPLACEMENT MEDIA AND CLEANOUT.

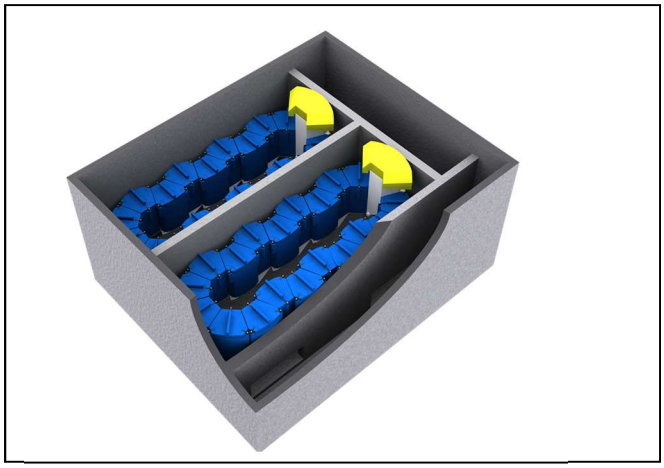
CALL 1 (888) 382-7808 FOR A QUOTE

The Up-Flo® Filter is a modular high-rate stormwater filtration device designed to capture trash, oil, sediment and remove fine pollutants such as dissolved and particulate metals and nutrients from stormwater runoff. In general, a minimum of two inspections are required per year to monitor sediment and gross pollutant accumulations.

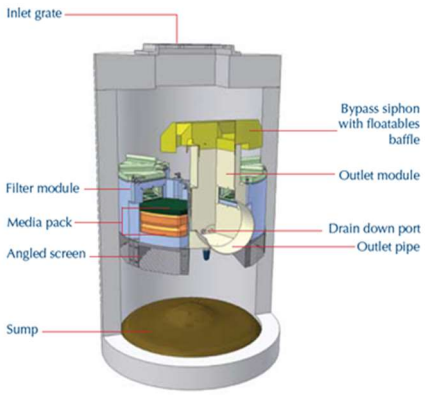
In order to sustain expected flow and removal rates for the Up-Flo® Filter, annual replacement of the Media Pack and removal of accumulated sediment from the sump is required. Depending on site use and pollutant characteristics, annual rainfall, design and functionality of the stormdrain conveyance system, annual replacement and clean out may be more or less often.

The Up-Flo Filter has modular components that connect together to form a ring of 1-6 Filter Modules or linearly to fit into rectangular precast structures with filter bays. Each filter bay can house 1-19 Filter Modules and precast structures can be constructed with multiple filter bays. Each Filter Module will have either a filtration Media Pack or filtration Ribbons.

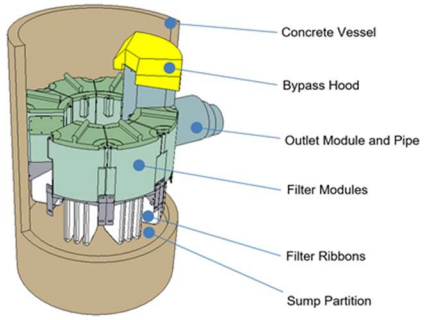




It does not matter what type of media is used, the Filter Modules house the filtration medium and the precast structure is used to suspend the Filter Modules to provide a sedimentation sump. Stainless steel support frames are used to support the Filter Modules and attach them to the precast structure. An Outlet Module (with hood) is used to connect the Filter Modules to a discharge pipe and convey filtered water away from the treatment area. A Draindown Filter and screen are provided when filtration media is used but not with filtration Ribbons.



Up-Flo with Filtration Media



Up-Flo with Filtration Ribbons

Maintenance activities can be categorized by those that can be performed from outside the Up-Flo® vessel and those that are performed inside the vessel. Maintenance performed from outside the vessel includes removal of floatables and oils that have accumulated on the water surface and removal of sediment from the sump. Maintenance performed inside the vessel includes removal and replacement of Media Packs (Filter Bags, flow Distribution Media and Draindown) or filtration Ribbons. A vactor truck is required for removal of oils, water, sediment, and to enter the vessel for performing inside maintenance. OSHA Confined Space Entry procedures need to be followed when entering the Up-Flo® vessel.

Inspection

The frequency of inspection and maintenance can be determined in the field after installation. Based on site characteristics such as contributing area, types of surfaces (e.g., paved and/or landscaped), site activities (e.g., short-term or long-term parking), and site maintenance (e.g., sanding and sweeping), inspection and maintenance should be conducted at intervals of no more than six months during the first year of operation. Typically, maintenance is recommended once per year thereafter.

By removing the manhole cover during a storm and monitoring the water level in the manhole or vault, site personnel can determine whether the filter is in bypass. A properly-sized filter that is in bypass during a storm that is producing runoff at, or below, the filter's design filtration rate needs maintenance. Otherwise, scheduled inspections will determine when one or more of the following maintenance thresholds have been reached:

- Sediment depth at sump storage capacity. Minimum 8" should separate the Draindown filter inlet from stored sediment in the sump or 6" should separate the bottom of the filtration Ribbons and sump floor. A simple probe, such as the Sludge-Judge®, can be used to determine the depth of the solids in the sump.
- Clogging of the Media Bags. Minimum filtration rate is generally reached when the Media Bags have accumulated approximately 20 lbs of sediment or when filtration Ribbons from one module have accumulated approximately 8 lbs. Determining the amount of accumulated sediment will be accomplished by removing both of the Media Bags from one of the Media Packs and weighing the bags separately or removing the filter Ribbon assembly as weighing. A spent Media Bag weighs approximately 50 lbs wet and a filter Ribbon assembly from one module weighs approximately 15 lbs spent .
- Draindown filter clogged. With modules supplied with filtration media, the Drain Down Filter is designed to lower the water level in the Up-Flo® vessel to an elevation below the bottom of the Filter Modules between storm events. If inspection one to two days after a storm event indicates otherwise, the Drain Down Filter has likely become clogged with sediment.
- Slime and debris covering the flow distribution media, angled screens or filtration Ribbons. After removal of the Media Bags or filtration Ribbons, the bottom flow distribution media should be removed and inspected to determine if it is coated with slime or debris. Similarly, the angled screen should be inspected for blockages and ragging.
- Oil forming a measureable thickness on the surface of the water. Since water in the Up-Flo® vessel drains down to an elevation below the bottom of the Filter Modules when the system is idle, the amount of accumulated oils must be minimized so that oils are not entrained into the Media Pack when stormwater begins to fill the vessel at the start of a storm event.
- Floatables completely covering the surface of the water. Similar to oils, the amount of accumulated floatables must be minimized to prevent trash and loose debris from becoming trapped on the angled screens when stormwater begins to fill the Up-Flo® vessel at the start of a storm event.

The site-specific solids loading rate in the sump and in the Media Packs will be determined during the first year of Up-Flo® Filter operation. Starting with a clean sump, the solids loading rate in the sump will be calculated by measuring the sediment depth in the sump and dividing the depth by the correlating interval of time since it was cleaned. Similarly, starting with fresh Media Bags or Ribbons, the solids loading rate in the Media Packs and Ribbons will be calculated by weighing the Media Bags or Ribbons and dividing the weights by the respective time interval since they were installed. The wet weight of the heaviest bag or Ribbon assembly from a single module will be used to determine the loading rate.

After completion of the first year of operation, the inspection and maintenance intervals for cleaning the sump and replacing Media Bags or Ribbons will be established to keep the solids loading within the respective limits of the sump and filter medium. Replacement of the Draindown Filter, replacement of flow Distribution Media, and removal of oils and floatables will occur at the same frequency unless the first year of operation indicates otherwise. Keeping to the established maintenance intervals will keep treatment flow rates at, or above, the design flow rate.

Maintenance

The access port located at the top of the manhole or vault provides access to the Up-Flo® vessel for maintenance personnel to enter the vessel and comfortably remove and replace Media Packs or Ribbon assemblies. The same access would be used for maintenance personnel working from the surface to net or skim debris and floatables or to vactor out sediment, oil, and water. Unless the Up-Flo® Filter has been installed in a very shallow unit, it is necessary to have personnel with OSHA-confined space entry performing the maintenance that occurs inside the vessel.

Maintenance activities include inspection, floatables removal, oil removal, sediment removal, Media Pack and Ribbon assembly replacement, and Draindown Filter replacement. Filtration medium housed in the Filter Modules is easily accessed by loosening three latches used to secure the Filter Module Lid. Maintenance intervals are determined from monitoring the Up-Flo® Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others. In the case of floatables removal, a vactor truck is not required. Otherwise, a vactor truck is normally required for oil removal, removal of sediment from the sump, and to dewater the vessel for replacement of the Media Packs and Draindown Filter. All inspection and maintenance activities would be recorded in an Inspection and Maintenance Log.

Good housekeeping practices upstream of the Up-Flo® Filter can significantly extend Media Bag life. For example, sweeping paved surfaces, collecting leaves and grass trimmings, and protecting bare ground from the elements will reduce loading to the system. Media Packs should not be installed in the Filter Modules until construction activities are complete and site stabilization is effective.

Up-Flo Filter Inspection & Maintenance Logs

SITE REFERENCE NAME OR NUMBER FOR THIS UP-FLO® FILTER LOCATION:	
SITE NAME:	
SITE LOCATION:	
OWNER:	SITE CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

CONFIGURATION (CIRCLE ONE): MANHOLE VAULT SYSTEM

TOTAL NUMBER OF UP-FLO® FILTER MODULES: _____

Hydro International

Up-Flo® Filter Inspection Log

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions*: _____

**(Stable, Under Construction, Needing Maintenance, etc.)*

Inspection Frequency Key: A=annual; M=monthly; S=after major storms

Inspection Items	Inspection Frequency	Inspected? (Yes/No)	Maintenance Needed? (Yes/No)	Comments/Description
Debris Removal				
Adjacent area free of debris?	M			
Inlets and Outlets free of debris?	M			
Facility (internally) free of debris?	M			
Vegetation				
Surrounding area fully stabilized? (no evidence of eroding material into Up-Flo® Filter)	A			
Grass mowed?	M			
Water retention where required				
Water holding chamber(s) at normal pool?	A			
Evidence of erosion?	A			
Sediment Deposition				
Filtration Chamber free of sediments?	A			
Sedimentation sump not more than 50% full?	A			
Structural Components				
Any evidence of structural deterioration?	A			
Grates in good condition?	A			
Spalling or cracking of structural parts?	A			
Outlet/Overflow Spillway	A			
Other				
Noticeable odors?	A			
Any evidence of filter(s) clogging?	M			
Evidence of flow bypassing facility?	A			

Inspector Comments: _____

_____

_____

_____

Overall Condition of Up-Flo® Filter**: ☐ Acceptable ☐ Unacceptable

***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

If any of the above Inspection Items are checked "Yes" for "Maintenance Needed", list Maintenance actions and their completion dates below or on the Maintenance Log provided on page 15 of the Up-Flo® Filter Operation & Maintenance Manual:

Maintenance Action Needed	Due Date

The next routine inspection is schedule for approximately: (date) _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Hydro International

Up-Flo® Filter Maintenance Log

Site Name: _____ Owner Change since last inspection? Y N

Location: _____

Owner Name: _____

Address: _____ Phone Number: _____

Site Status: _____

Date: _____ Time: _____ Site conditions: _____
**(Stable, Under Construction, Needing Maintenance, etc.)*

Estimated volume of oil/floatable trash removed: _____

Sediment depth measured in sump prior to removal: _____

Number of Filter Modules fitted with new media packs: _____

Inspector Comments: _____

_____

_____

_____

Overall Condition of Up-Flo® Filter: ☐ Acceptable ☐ Unacceptable
***"Acceptable" would mean properly functioning; "unacceptable" would mean damaged or required further maintenance.*

Maintained by: (signature) _____

Maintained by: (printed) _____

Do it Right the First Time

Learn more at hydro-int.com/service

CALL **1 (888) 382-7808** TO SCHEDULE AN INSPECTION

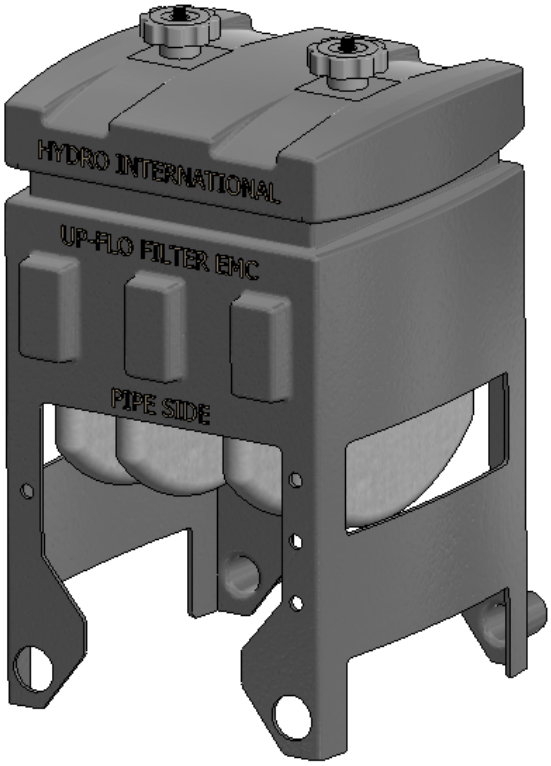
Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

Turning Water Around...®



Up-Flo Filter® Extended Maintenance Cartridge Operation and Maintenance Manual

October 2019
Rev. A

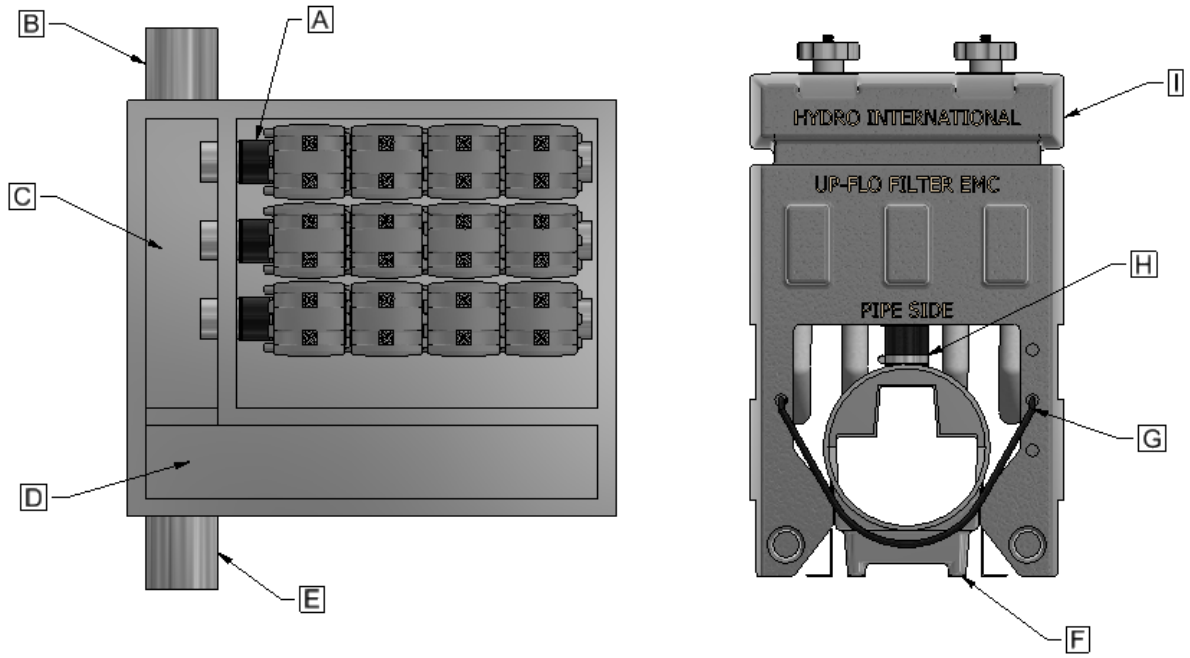
hydro-int.com

Hydro International®

Contents

Overview and Product Description

The Up-Flo® Filter is a modular high-rate stormwater filtration device designed to capture trash, oil, sediment and remove fine pollutants such as particulate metals and nutrients from stormwater runoff. Designed with efficiency, longevity and upkeep in mind, this high performance, low maintenance filter option that offers higher loading rates and longer membrane life for higher quality stormwater for longer periods between servicing. In general, a minimum of two inspections are required per year to monitor sediment and gross pollutant accumulations. In order to achieve an annual TSS removal rate of 80% for the Up-Flo® Filter, the minimum maintenance frequency specified in the maintenance section for replacement of the filter inserts and removal of accumulated sediment from the sump is mandatory.



System Components			
A.	Underdrain Coupling	F.	Underdrain
B.	Outlet Pipe	G.	Cartridge Restraining Cord
C.	Outlet Bay	H.	Cartridge Connection Boot
D.	Inlet Bay	I.	Filter Cartridge
E.	Inlet Pipe		

Figure 1: The Up-Flo® Filter EMC

Operation

Introduction

The Up-Flo® Filter operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirements and is fabricated with durable non-corrosive components. Personnel are not required to operate the unit and maintenance is limited to periodic inspections, sediment and floatables removal and cartridge replacement.

Pollutant Capture

The Up-Flo® Filter is designed to operate as a “treatment train” by incorporating multiple treatment technologies into a single device. Trash and gross debris are removed by sedimentation and screening before they are introduced to the filtration membranes, delaying surface blinding. The Up-Flo® Filter is a wet-sump device. Between storm events, oil and floatables are stored on the water surface separate from the sediment storage volume in the sump.

Best Practices

Good housekeeping upstream of the Up-Flo® Filter can significantly extend maintenance interval. For example, sweeping paved surfaces, collecting leaves and grass trimmings, and protecting bare ground from erosion will reduce loading to the system. The filter cartridges should not be installed until construction activities are complete and site stabilization is effective.

Damage Due to Lack of Maintenance

Delayed maintenance would result in clogged filters. In that situation, an Up-Flo® Filter could go into bypass and there would be no treatment of the incoming stormwater. Replacement of the filter cartridges and removal of sediment from the sump would restore the Up-Flo® Filter to its original treatment efficiency. Establishing and adhering to a regular maintenance schedule ensures optimal performance of the system.

Inspection & Maintenance

Overview

The Up-Flo® Filter protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the proper functioning of the Up-Flo® Filter.

Replacement of filter cartridges must be performed inside the vessel. A vactor truck is required for removal of oils, water, sediment, and to completely pump out the vessel to allow for maintenance inside. If you are not using Hydro International or a trained service provider, you must follow OSHA (or other regional) Confined Space Entry procedures when entering the Up-Flo® vessel.

The minimum required frequency for replacement of the filter cartridges is annually, whereas the minimum required frequency for removal of accumulated sediment from the sump is dependent on the Up-Flo® Filter configuration. Configurations with a larger sediment storage volume per module will require less frequent removal of accumulated sediment. Regardless, whenever sediment depth in the sump is found to be greater than 6 inches (15 cm), sediment removal is required.

Inspection and Maintenance

Routine Inspection

Inspection is a simple process that requires monitoring pollutant accumulations. Maintenance crews should be familiar with the Up-Flo® Filter and its components prior to inspection.

The following instructions are intended for non-Hydro maintenance service providers and/or those intending to maintain their own Up-Flo® Filter:

Routine Inspection Procedures

1. Set up any necessary safety equipment (such as traffic cones) to provide access to the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole or vault.
3. Without entering the vessel, look down into the chamber to inspect the inside and to make note of any irregularities.
4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the chamber.
5. Using a sediment probe such as a Sludge-Judge®, measure the depth of sediment that has collected in the sump of the vessel. Maximum sediment depth is 6 inches (15 cm).
6. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or a high standing water level.
7. Securely replace the grate or lid.
8. Remove safety equipment.
9. Contact Hydro International to discuss any irregularities noted during inspection.

Routine Maintenance

The access port located at the top of the manhole or vault provides access to the Up-Flo® vessel for maintenance personnel to enter the vessel and remove and replace filter cartridges. The same access would be used for maintenance personnel working from the surface to vactor out sediment, oil, and water (Figure 2). Unless the Up-Flo® Filter has been installed in a very shallow configuration, it is necessary to have personnel with OSHA Confined Space Entry training performing the maintenance that occurs inside the vessel.

Maintenance intervals are determined from monitoring the Up-Flo® Filter during its first year of operation. Depending on the site, some maintenance activities may have to be performed on a more frequent basis than others.

A vactor truck is normally required for oil removal, removal of sediment from the sump, and to dewater the vessel for replacement of the filter cartridges. All inspection and maintenance activities would be recorded in an Inspection and Maintenance Log.

The access port located at the top of the manhole provides unobstructed access for a vactor hose and/or skimmer pole to be lowered to the base of the sump.

Figure 2: Sediment is removed from the sump with a vactor hose. Confined space entry is not required for this step.

Maintenance Scheduling

- Call Hydro International to order replacement filter cartridges prior to scheduling maintenance.
- Because filter cartridge replacement requires entry into the Up-Flo® chamber, maintenance events should be scheduled during dry weather.
- Filter cartridge replacement should occur immediately after a contaminated spill in the contributing drainage area.

Recommended Equipment

- Safety Equipment (traffic cones, etc.)
- Crow bar to remove grate or lid
- Vactor truck (flexible hose preferred)
- Pressure nozzle attachment
- OSHA Confined Space Entry Equipment
- Replacement Up-Flo® Filter Cartridges (available from Hydro International)
- Hydro International Up-Flo® Filter Maintenance Log
- Screwdriver (flat head)

Surface Maintenance Procedure

1. Set up any necessary safety equipment (such as traffic cones) around the access of the Up-Flo® Filter. Safety equipment should notify passing pedestrian and road traffic that work is being done.
2. Remove the grate or lid to the manhole or vault.
3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.
4. Once all floatables and oil have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris from the sump floor.

5. Retract the vactor hose from the vessel.
6. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables, oils, and gross debris removed, and the depth of sediment measured. Note any apparent irregularities such as damaged components or blockages.
7. Securely replace the grate or lid. Remove safety equipment.
8. Dispose of sediment and gross debris following local regulations.
9. Dispose of oil and sump water at a licensed water treatment facility or following local regulations.
10. Contact Hydro International to discuss any irregularities noted during cleanout.

Filter Cartridge Replacement

1. Following OSHA or region specific Confined Space Entry procedures, enter the Up-Flo® Filter Chamber.
2. Starting at the end of the filter cartridge row furthest from the Outlet Bay (Figure 1, Item C) remove each Filter Cartridge (Figure 1, Item I) from the Underdrain (Figure 1, Item A) as described below:
    a. Unfasten Cartridge Restraining Cord (Figure 1, Item G)
    b. Loosen Cartridge Connection Boot (Figure 1, Item H) using flathead screwdriver
    c. Remove Filter Cartridge and transfer to surface.
3. Starting at the end of the Underdrain closest to the Outlet Bay, install new Filter Cartridges, supplied by Hydro International.
    - Orient Filter Cartridge with the labeled “Pipe Side” facing away from the Outlet Bay.
    - Tighten Cartridge Connection Boot using flathead screwdriver
    - Fasten Cartridge Restraining Cord
4. Exit the Up-Flo® Filter chamber and securely replace the grate or lid.
5. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables, oil and gross debris removed, and the depth of sediment measured. Note the number of filter cartridges replaced. Note any irregularities such as damaged components or blockages.
6. Remove safety equipment.
7. Return spent filter cartridges to Hydro International for refurbishment.
8. Contact Hydro International to discuss any irregularities noted during annual maintenance.

Up-Flo® Filter Installation Log

SITE REFERENCE NAME OR NUMBER FOR THIS UP-FLO® FILTER LOCATION:	
SITE NAME:	
SITE LOCATIONS:	
OWNER:	**SITE CONTRACTOR:**
CONTACT NAME:	**CONTACT NAME:**
COMPANY NAME:	**COMPANY NAME:**
ADDRESS:	**ADDRESS:**
TELEPHONE:	**TELEPHONE:**
FAX:	**FAX:**

INSTALLATION DATE: _____ /_____/_____

TOTAL NUMBER OF UP-FLO® FILTER CARTRIDGES: _____

Up-Flo® Filter Inspection Log

Site Name: _____

Location: _____

Owner Name: _____

Address: _____ Phone Number:_____

Site Status: _____

Date: _____ Time: _____ Site Conditions*: _____
*(Stable, Under Construction, Needing Maintenance, etc.)

Inspection Frequency Key: A=annual; M=Monthly; S=after major storms

	Inspection Items	Inspection Frequency	Inspected? (Y/N)	Maintenance Needed? (Y/N)	Comments/ Description
Debris Removal	Adjacent area free of debris?				
	Inlets and outlets free of debris?				
	Facility (internally) free of debris?				
Vegetation	Surrounding area fully stabilized?				
	Grass mowed?				
Water retention where required	Water holding chamber(s) at normal pool				
	Evidence of erosion?				
Sediment deposition	Filtration chamber free of sediments?				
	Sedimentation sump not more than 50% full?				
Structural components	Any evidence of structural deterioration?				
	Grates in good condition?				
	Spalling or cracking of structural parts?				
	Outlet/overflow spillway				
Other	Noticeable odors?				
	Any evidence of filter(s) clogging?				
	Evidence of flow bypassing facility?				

Inspector Comments: _____

_____

Overall Condition of Up-Flo® Filter**: Acceptable / Unacceptable

**Acceptable would mean properly functioning; unacceptable would mean damaged or required further maintenance

If any of the above Inspection Items are checked “Yes” for “Maintenance Needed”, list Maintenance actions and their completion dates below or on the Maintenance Log provided on page 11 of the Up-Flo® Filter Operation & Maintenance Manual:

Maintenance Action Needed	Due Date

The next routine inspection is scheduled for approximately: (date) _____

Inspected by: (signature) _____

Inspected by: (printed) _____

Up-Flo® Filter Maintenance Log

Site Name: _____

Location: _____

Owner Name: _____

Address: _____ Phone Number:_____

Site Status: _____

Date: _____ Time: _____ Site Conditions*: _____
*(Stable, Under Construction, Needing Maintenance, etc.)

Estimated volume of oil/floatable trash removed: _____

Sediment depth measured in sump prior to removal: _____

Number of Filter Cartridges replaced: _____

Inspector Comments: _____

_____

Overall Condition of Up-Flo® Filter**: Acceptable / Unacceptable

**Acceptable would mean properly functioning; unacceptable would mean damaged or required further maintenance

Maintained by: (signature) _____

Maintained by: (printed) _____

Verification Statement

Hydro International Up-Flo® Filter with CPZ™ Media

Registration number: (V-2019-06-01)
Date of issue: (2019-November-27)

Technology type	Stormwater Filtration Device		
Application	Technology to remove sediment, nutrients and metals from stormwater runoff		
Company	Hydro International	**Website**	https://www.hydro-int.com
Address	94 Hutchins Drive, Portland, Maine USA 04102		
E-mail	TechSupport@hydro-int.com	**Phone**	+1 (207) 756 6200

This Verification Statement was prepared by VerifiGlobal to summarize the results reported in the Verification Report for the Hydro International Up-Flo® Filter with CPZ™ Media, dated November 26, 2019. The Verification Report was prepared by Good Harbour Laboratories Inc. (GHL) for VerifiGlobal in accordance with the requirements of the International Organization for Standardization (ISO) 14034 Environmental Technology Verification (ETV) standard and the VerifiGlobal Performance Verification Protocol. All the information provided in this Statement are based on the independent, third-party review and verification of technical information, performance test reports, performance data and specific performance claims documented in the Verification Report.

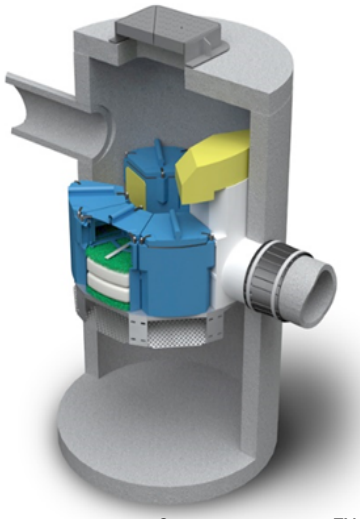


Figure 1: Up-Flo® Filter with CPZ™ Media

Technology Description

The Up-Flo® Filter with CPZ™ Media is a stormwater remedial device that incorporates gravitational separation of floating and settling materials, screening, and filtration of polluted stormwater to offer treatment train capabilities in a standalone device. Each Up-Flo® Filter consists of a highly configurable array of modules that are typically supplied as a complete system housed in a 4-ft (1.2 m) diameter manhole or precast vault. Manhole configurations consist of a single ring assembly containing one to six modules. Vaulted systems are highly configurable and may contain single or multiple arrays each consisting of one to 18 Filter Modules depending on availability of vault sizes.

Verified Performance Claims

Verification of the Hydro International Up-Flo® Filter with CPZ™ Media is based on existing performance test data from two different locations with different rainfall characteristics, catchment areas and pollutant loadings. Supporting data were obtained from three independent perfomance monitoring studies. One was conducted by Engineering School of Sustainable Infrastructure and Environment (ESSIE) at the University of Florida (UF) under the supervision of Dr. John Sansalone and two were conducted by Department of Civil, Construction, and Environmental Engineering (CCEE) at the University of Alabama (UA) under the supervision of Dr. Bob Pitt.

All three studies performance monitoring studies were conducted following the requirements of the New Jersey Department of Environmental Protection (NJDEP) Technology Acceptance Reciprocity Partnership (TARP) Tier II Protocol for Stormwater Best Management Practice Demonstrations (2003) and its 2006 and 2009 amendments. In total, there were 66[1] storms assessed to verify that an Up-Flo® Filter with CPZ™ Media achieves the performance listed in Tables 1 and 2, when designed to the following parameters:

- System hydraulic loading rate of 25 gpm (1.58 L/s) per filter module, with bypass of higher flows.
- Filter flux rate of 22.7 gpm/ft2 (15.4 L/s/m2)
- Operating head of ≤30 in. (76.2 cm)
- Effective Sedimentation/ Filtration Treatment Area (ESA/EFTA) –12.6/6.6 (1.91)
- Maximum sediment storage volume of 16.8 ft3 (0.476 m3) at a sediment depth of 16 inches (0.41m).

Table 1. Up-Flo® Filter with CPZ™ Media – Verified Concentration Removal Efficiency

Constituent	Lower 95% Confidence Interval	Median	Upper 95% Confidence Interval
SSC *	85.9%	92.8%	94.7%
SSC **	73.9%	82.8%	86.3%
TSS *	79.0%	89.2%	91.0%
TSS **	72.0%	78.3%	85.2%
TN *	90.0%	43.9%	50.9%
TP *	33.8%	28.5%	64.7%
Zn **	39.4%	50.0%	62.1%
Cu **	72.6%	80.7%	85.2%
* Based on ESSIE (UF) Performance monitoring results ** Based on CCEE (UA) Performance monitoring results			

Table 2. Up-Flo® Filter with CPZ™ Media – Verified Flow Weighted Mass Removal Efficiency

Constituent	ESSIE (UF) Performance monitoring results		CCEE (UA) Performance monitoring results
	6-month	12-month	12-month
SSC	93%	92%	86%
TSS*	89%	87%	87%
TN **	68%	39%	***
TP **	48%	48%	***
Zn	***	***	59%
Cu	***	***	70%
* TSS results for UF are a function of SSC. ** TN and TP load data was time dependent after 6-months *** No data submitted			

[1]Of the total 66 storms (16 storms from UF and 50 storms from UA), 62 were identified as qualifying events having quality data for TSS, and 59 for SSC. Fewer events with metals detected in the runoff limited the metals data sets. There were a total of 28 and 17 storms for Zn and Cu, respectively, solely from the UA data. Total Nitrogen and Total Phosphorous claims were based on the 16 storms recorded solely from the UF data.

Description of Test Procedure

Table 3 shows the target criteria as outlined by the TARP and TAPE programs as well as the results achieved at the two locations. Table 4 provides a more detailed description of the observed operating conditions over the testing period. At the time of testing, the TARP and TAPE programs both allowed for field testing data to be used to obtain certification in participating states. They were the most widely used protocols and were generally accepted as industry standards. The TARP program has since stopped accepting field data, but the TAPE program remains in effect and is currently referenced to benchmark the quality of data obtained from stormwater monitoring programs.

Table 3. Up-Flo® Filter with CPZ™ Media Performance Testing - Specified TARP & TAPE criteria, and achieved results, for storm selection and sampling

Description	TARP Criteria	TAPE Criteria	Achieved value	
			ESSIE - UF	CCEE - UA
Total rainfall/storm	≥2.5 mm (0.1”)	≥3.81 mm (0.15”)	>2.5 mm (0.1")	≥4.6 mm (0.18”)
Minimum inter-event period	6 h	6 h	≥ 6 h	≥ 6 h
Minimum flow-weighted composite sample storm coverage	70% including as much of the first 20% of the storm	75% including as much of the first 20% of the storm	100%	87.6%
Minimum influent/effluent samples	10, but a minimum of 5 subsamples for composite samples	12, but a minimum of 10 subsamples for composite samples	5, whole manual samples	11
Total sampled rainfall	≥ 381 mm (15”)	NA	195 mm (7.66”)	765 mm (30.07”)
Total sampled storms	≥ 20	≥ 12	16	29

Table 4. Up-Flo® Filter with CPZ™ Media Performance Testing - Observed operational conditions for events monitored over each performance test period

Operating parameter	Observed range	
	ESSIE - UF	CCEE - UA Total*
Storm duration	0.35-5.78 h	0.67-64.7 h
Previous dry hours**	6-213	> 6 hrs for the 20 storms in 1st study and 12-632 hrs for 30 storms in second study
Rainfall depth	0.10-1.64 in	0.18-2.44 in
Runoff volume	223-4095 gal (0.84-15.5 m^3)	2,065-61,131 gal(7.82-231 m^3)
Peak rainfall intensity (5 min)	1.2-5.4 in/h (3.0-13.7 cm)	0.24-4.68 in/h (0.61-11.9 cm)
Peak runoff flow rate	27.7-233 gpm (1.75-14.7 L/s)	68-1023 gpm (4.29-64.5 L/s)
Event median flow rate	2.4-21.4 gpm (0.15-1.35 L/s)	28-175 gpm (1.75-11.0 L/s)

* The UA data ranges cover the storms for both studies; ranges for individual studies might be narrower.
** This is the same as the time period between events, or time since it last rained a qualifying event.

For the UF study, performance monitoring was conducted at the Reitz Union surface parking lot, which had a drainage area of 0.12-0.20 acres (0.049-0.081 ha),which was 76% impervious, depending on storm intensity and wind direction. The area generated a flow rate in excess of the 150 gpm (9.55 L/s) maximum treatment flow rate (MTFR) in 3 of the 16 storms. The 4-ft diameter (1.2 m) test unit was installed above ground in a temporary installation at the bottom of a hill sloping down from the lot. An inlet catch basin conveyed runoff from the parking lot through a Pashall flume into the filter. Monitoring occurred over a period of 12 months and the UF team recovered the captured mass at the end of the perfomance monitoring study. No maintenance was required or conducted during the year long monitoring period from 12 September 2015 through 1 September 2016.

The UA perfomance monitoring studies covered a total of 50 storms, but not all of them yielded useful data for all parameters. The site used in both cases was the Riverwalk parking lot near the Bama Belle in Tuscaloosa, Alabama. The drainage area was about 0.9 acres (0.36 ha), 68% impervious. The unit was installed in a 4 ft. (1.2 m) diameter below-grade catch basin inlet manhole on the site. Monitoring occurred in two stages of approximately 12 months each over a total of 32 months. The first round of testing occurred from July 16, 2010 to April 11, 2011 and the second from May 31st, 2012 to March 30th, 2013.

The UA perfomance monitoring study used autosamplers to generate the flow-weighted composite samples and the event mean concentration data. This data was used to calculate removal efficiencies. However, in the UF performance monitoring study, sediment removal performance was assessed by taking full cross section samples of the influent and effluent streams at regular intervals for the duration of the storm and combining the samples into flow-weighted composites. The data was converted into event mean concentrations for the purposes of calculating removals.

The following approved analytical methods were used:

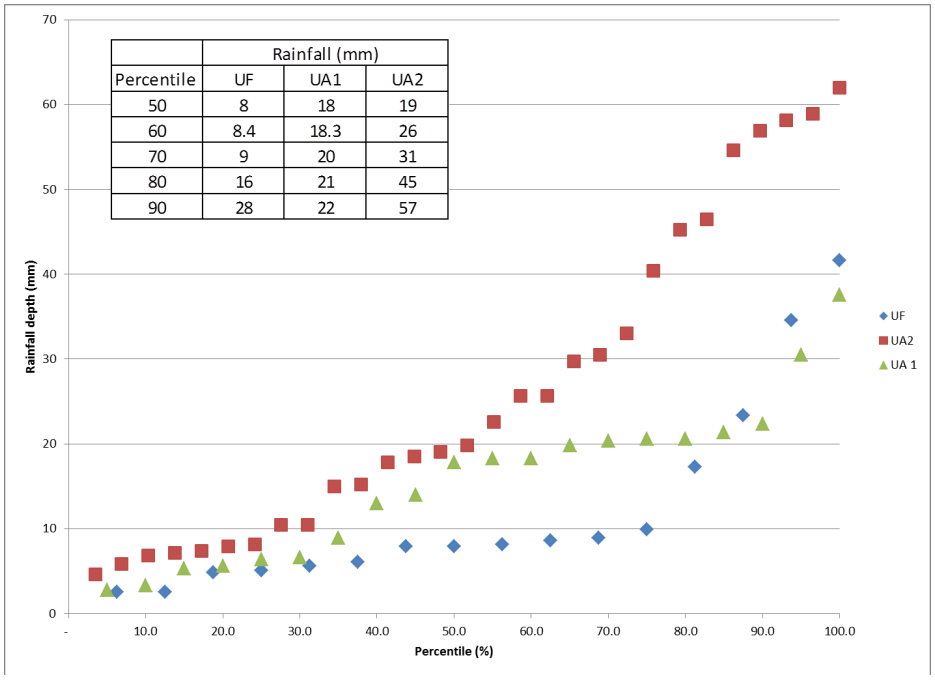
- TSS – ASTM D2540
- SSC – ASTM D3977-97(2013) Standard Test Methods for Determining Sediment Concentration in Water Samples
- PSD – ASTM D422 – 63 Standard Test Method for Particle-Size Analysis of Soils and ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
- PSD – ASTM 2560- C, D (UF used 2560D laser diffraction or light-scattering method and UA used 2560C Coulter Counter or light-blocking method)
- TP – S.M.4500-P-B Acid Hydrolysis
- TN – Persulfate Digestion Method
- Cu – EPA 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry
- Zn - EPA 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry

As part of the mass balance measurements, the UF team allowed all samples to sit for an hour and reported concentrations of suspended solids, measured using ASTM 2540D, as TSS, in addition to the usual SSC measurement using SM3977. In order to be able to report a TSS comparable to other perfomance monitoring studies, Dr. Sansalone developed a correlation equation for TSS* = f(SSC) as well as equations for the 95% confidence limits of TSS*.

Summary of Verification Results

The cumulative frequency of rainfall depths monitored during the three perfomance monitoring studies is presented in Figure 2. The median rainfall depths in the three perfomance monitoring studies were 0.31, 0.71, and 0.75 inches (8, 18 & 19 mm) while the 90th percentile rainfall depths were 1.1, 0.9 and 2.2 inches (28, 22 and 57 mm). Thus the data presented covers a comparatively wide range of rain events.

Figure 2. Rainfall depth frequency curves



	Rainfall (mm)		
Percentile	UF	UA1	UA2
50	8	18	19
60	8.4	18.3	26
70	9	20	31
80	16	21	45
90	28	22	57

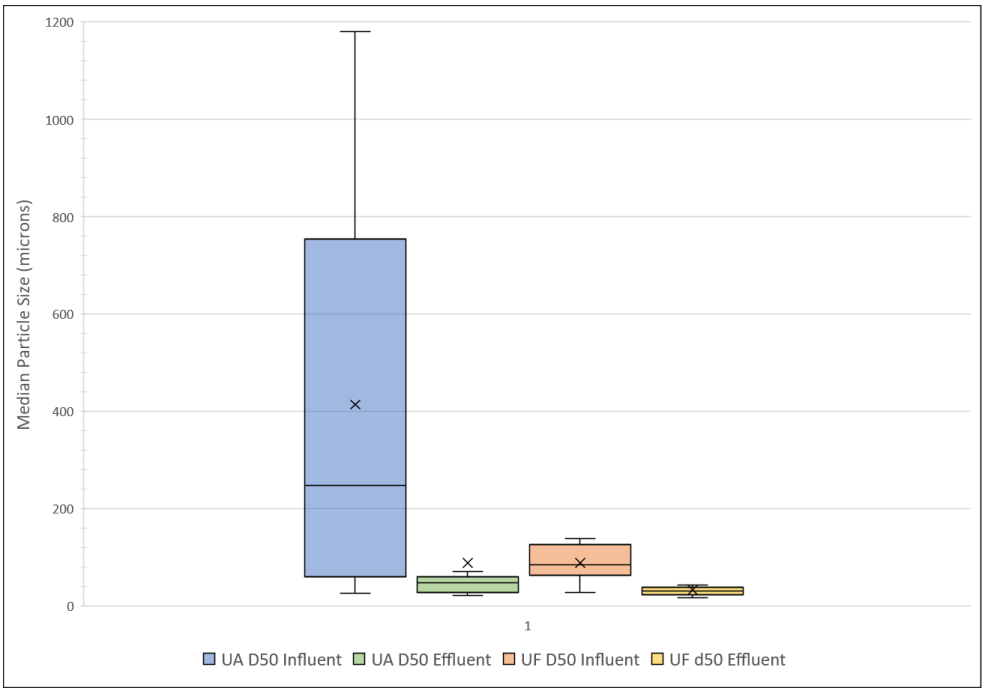
For UF monitoring, a total of 16 storm events, with varying rainfall intensity and runoff volume from event to event, were monitored. The cumulative rainfall depth was 7.66 inches (195 mm) and the cumulative influent runoff volume was 20,022 gallons (7.65 m^3). The entire volume was treated by the Up-Flo® Filter system. Of the 16 storms treated, three storms generated flow rates exceeding the MTFR of 150 gpm (9.55 L/s) but there was no bypass, because the excess was not sufficient to top the overflow weir, and all sampled flows passed through the filtration media. Median driving head difference for an event never exceeded 13.1 inches (33.3 cm) and peak driving head difference never exceeded 27.1 inches (68.8 cm), which indicates the media was not occluded.

For the UA site, all of the storm events from May 31st, 2012 to March 30th, 2013 were monitored for flow but only 30 events were sampled. The total rainfall depth for this period was 49 inches (124.5 cm) or 982,192 gal. (3,718 m^3) of runoff volume that was routed through the filter. Actual storm data from the monitoring period showed about 624,503 gal. (2,364 m^3) of runoff (from about 30 inches or 76.2 cm of rainfall) was treated by the media filter system. This included about 28.5 % of bypass flow volume, which was sampled and included in the performance results. Given that the total bypassed volume was almost three times the expected bypass volume at the UA site, the UA results are considered conservative.

Influent particle sizes varied considerably between the two monitored locations and between storm events. Catchment characteristics and available sources, sampling methods (auto sampling vs. grab sampling), storm intensities, duration and volumes all influence the particle size range. The particle size analyses were completed for just the median particle size for each storm. A comparison of statistical descriptive values for influent and effluent median particle sizes for the two monitored sites is illustrated with the Whisker-Box-Plot shown in Figure 3.

Due to larger storm events and curbside erosion, the median UA influent particle size range and d_{50} were substantially the larger of the two monitored sites. The interquartile range for the influent median particles sizes was 659 µm for UA compared to 59 µm for UF and the UA d50 was 247 µm compared to 85 µm for UF. However, despite the influent particle size differences between locations, the median UA and UF effluent particle size range and d50 were similar. The interquartile range for the effluent median particles sizes was 33 µm for UA compared to 13 µm for UF and the UA d50 was 48 µm compared to 30 µm for UF.

Figure 3. UF and UA Summary of Influent and Effluent Median Particle Sizes



Summary statistics for the influent and effluent concentration removal efficiencies as well as the overall mass load reductions are shown in Table 4 and Table 5 for UF and UA, respectively.

While the flow weighted removal efficiency for TP and TN were 48% and 39%, respectively, TP and TN reduction tended to decrease with the overall volume treated. Results showed that if the filter maintnenance cycle is limited to 6-8 months, the long-term load reduction for TP and TN would have been 50% and 70%, respectively.

Table 4: Up-Flo® Filter with CPZ™ Media Performance Testing - Summary statistics for influent and effluent event mean concentrations (EMCs) and the overall mass load reductions for selected constituents (UF Test)

Parameter	Sample Location	Min	Max	Median	SD	Mass Load Reduction
SSC	Influent	146	1584	487	360	92%
	Effluent	19.9	96.5	43.25	20.2	
TSS*	Influent	93.3	870	277	194	87%
	Effluent	25.0	66.4	37.6	10.9	
TP	Influent	0.79	6.05	1.9	1.70	48%
	Effluent	.56	2.19	1.1	0.56	
TN	Influent	.41	7.89	2.1	2.18	39%
	Effluent	.52	3.84	1.2	1.21	

Table 5. Up-Flo® Filter with CPZ™ Media Performance Testing - Summary statistics for influent and effluent event mean concentrations (EMCs) and the overall mass load reductions for selected constituents (UA Tests)

Parameter	Sample Location	Min	Max	Median	SD	Mass Load Reduction
SSC (mg/L)	Influent	23	879	88	166	86%
	Effluent	3	69	17	18	
TSS (mg/L)	Influent	11	571	89	128	87%
	Effluent	3	64	19	22	
Total Zn (µg/L)	Influent	7.0	157	22.0	0.71	59%
	Effluent	2.5*	72	14.0	0.68	
Total Cu (µg/L)	Influent	6	181	9	42	70%
	Effluent	1.3**	42	1.3	20.9	

* There was a single effluent value that was non-detect (ND). Since it was only 1 value ½ the detection limit 1.3 µg/L, was substituted when calculating statistics.
**The Cu data was highly censored (many non-detect, ND, effluents). Statistics were calculated by substituting ½ the detection limit, 1.3 µg/L, for all ND data then bootstrapping as usual.

As the independent third-party verifier, following the requirements of ISO 14034, GHL has confirmed that:

- The Hydro International Up-Flo® Filter with CPZ™ Media is based on sound scientific and engineering principles, providing a net environmental benefit.
- Performance testing of the Hydro International Up-Flo® Filter with CPZ™ Media was based on defined parameters and was conducted following the requirements of the NJDEP TARP Tier II Protocol for Stormwater Best Management Practice Demonstrations (2003) and its 2006 and 2009 amendments.
- Performance testing of the Hydro International Up-Flo® Filter with CPZ™ Media was performed by a qualified testing organization.
- Sample analyses were carried out as part of the test plan by a third-party analytical laboratory in a manner that meets the quality requirements of ISO 17025. Operating conditions and performance during each testing run were documented.
- Frequency of sampling and duration of each performance test were determined based on the specifications in a credible test plan and the requirements to produce sufficient data to support the performance claim at a 95% confidence level.
- Performance measurements and calculations were based on the technology application and relevant performance parameters as outlined in the Verification Plan.
- Performance calculations were done according to generally accepted test methods described in the test design, including the applicable mathematical and statistical principles and procedures.
- Data storage, transfer and control were adequate, carried out in accordance with the intent of ISO 9001 enabling control and retrieval of documents and records.
- Quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This confirmation included reviewing all data sheets and data downloads, as well as overall management of test system quality.

Quality Assurance

Performance testing and verification of the Hydro International Up-Flo® Filter with CPZ™ Media were performed in accordance with the requirements of ISO 14034:2016 and the VerifiGlobal Performance Verification Protocol. The verifier, Good Harbour Laboratories, has confirmed that quality assurance requirements were addressed throughout the performance testing process and in the generation of performance test results. This includes reviewing all data sheets and data downloads, as well as overall management of the test system, quality control and data integrity.

References

Technology Acceptance Reciprocity Partnership (TARP) Protocol and New Jersey Department of Environmental Protection (NJDEP amendments to the TARP Protocol, dated August 5, 2009 and Revised December 5th, 2009

"Development and Testing of Protocols for Evaluating Emerging Technologies for the treatment of Stormwater", Noboru Togawa, Dissertation, Department of Civil, Construction, Construction, and Environmental Engineering, Graduate School of the University Of Alabama, Tuscaloosa, Alabama, 2011.

"Up-Flo® Filter Verification Testing, Quality Assurance Project Plan, Bama Belle Field Verification Test Site", Tuscaloosa, AL, Hydro International, July 2012.

"Full-Scale Up-Flo® Filter Field Performance Verification Tests", Department of Civil, Construction, and Environmental Engineering University of Alabama, Tuscaloosa, AL 35487 USA - December 26, 2013.

"NJCAT Technology Verification Up-Flo® Filter", January 2015.

Hydro International Up-Flo® Filter with CPZ™ Media Specifications, Hydro International.

Up-Flo® Filter with CPZ™ Media - Performance Claims submitted by Hydro International, 2018-05-15.

"Physical Model Testing and Monitoring of a Hydro International (HI) Up-Flo® Filter Subject to Rainfall-Runoff Loading Events", University of Florida Engineering School of Sustainable Infrastructure and Environment (ESSIE), University of Florida, Gainesville, FL 32611 USA - Version 7-12-17.

Particulate Matter Fraction Analyses. (Sansalone & Kim: Transport of Particulate Matter Fractions in Runoff, Journal of Environmental Quality • Volume 37 • September–October 2008)

New Jersey Department of Environmental Protection Laboratory Protocol to Assess Total Suspended Solids Removal by a Filtration Manufactured Treatment Device, January 2013

2009 Urban Stormwater BMP Performance Monitoring Guidelines
http://www.bmpdatabase.org/contacts.html

Description of Up-Flo® Filter

Up-Flo® Filter Design Manual https://www.hydroint.com/sites/default/files/uff_dg_nashville_f1504.pdf

Up-Flo® Filter Verification Brochure

ISO/IEC 14034, Environmental management – Environmental technology verification

ISO/IEC 17025, General requirements for the competence of testing and calibration laboratories

ISO/IEC 9001, Quality Management Systems.

VerifiGlobal Performance Verification Protocol (Applying ISO 14034:2016)

VerifiGlobal Test Body Assessment – Guidance (2018)

What is ISO 14034?

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

Benefits of ETV

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

For more information on the Hydro International Up-Flo® Filter, contact:	For more information on VerifiGlobal, contact:
Hydro International 94 Hutchins Drive, Portland, ME USA 04102 t +1 (207) 756 6200 e: TechSupport@hydro-int.com w: www.hydro-int.com	VerifiGlobal c/o ETA-Danmark A/S Göteborg Plads 1, DK-2150 Nordhaven t +45 7224 5900 e: info@verifiglobal.com w: www.verifiglobal.com
Signed for Hydro International: *Original signed by:* Phillip Taylor Technical Product Manager, Americas Stormwater	Signed for VerifiGlobal: *Original signed by:* Thomas Bruun, Managing Director *Original signed by:* John Neate, Managing Director

Appendix G

TRCA Correspondence with J+B Regarding Stormtech and Water Table Separation

Justin Ma <j.ma@jandb-inc.com>

35/45 Gordon Collins Infiltration/Retention Tank Design

4 messages

Justin Ma <j.ma@jandb-inc.com> Mon, Feb 26, 2024 at 1:51 PM
To: "don.ford@trca.ca" <don.ford@trca.ca>
Cc: James Sam <j.sam@jandb-inc.com>, Elyse.dickson@trca.ca

Hello Don,

I am from the J+B Engineering Inc. We have been tasked with the civil design for 35/45 Gordon Collins Rd. in Stouffville.

We received the attached geotechnical report (Investigation completed in August 2023). The closest BH (BH#7) to our U/G storm chambers indicates a water table of 254.73. Our U/G storm chambers (Stormtech) is approx. 0.8m above the water table. Please confirm you are in agreement with our design or if you require any adjustments or additional information.

Kind regards,
Justin Ma, BASc | Civil Designer
J+B Engineering Inc.
25 Centurian Drive, Suite 201
Markham, ON L3R 5N8

O: 416.229.2636 x 219
E: j.ma@jandb-inc.com

2 attachments

GeoInvestigation.35GordonCollinsDrive.G2F.230082.pdf
1261K

230258-P-301-SITE SERVICING.pdf
1061K

Justin Ma <j.ma@jandb-inc.com> Mon, Mar 4, 2024 at 11:19 AM
To: "don.ford@trca.ca" <don.ford@trca.ca>
Cc: James Sam <j.sam@jandb-inc.com>, Elyse.dickson@trca.ca, Rachael Buccella <rachael@fairgatehomes.com>, Daniel Ronco <daniel@fairgatehomes.com>, Bruce Alexander <Bruce.Alexander@rjburnside.com>

Hello Mr. Don Ford,

We have not heard back from you. Please advise as this would impact our targeted submission date. Thank you.

Kind regards,
Justin Ma, BASc | Civil Designer
J+B Engineering Inc.
25 Centurian Drive, Suite 201
Markham, ON L3R 5N8

O: 416.229.2636 x 219
E: j.ma@jandb-inc.com

[Quoted text hidden]

Hamedeh Razavi <Hamedeh.Razavi@trca.ca> Tue, Mar 5, 2024 at 12:49 PM
To: Justin Ma <j.ma@jandb-inc.com>
Cc: Don Ford <Don.Ford@trca.ca>, James Sam <j.sam@jandb-inc.com>, Elyse Dickson <Elyse.Dickson@trca.ca>, Rachael Buccella <rachael@fairgatehomes.com>, Daniel Ronco <daniel@fairgatehomes.com>, Bruce Alexander

<Bruce.Alexander@rjburnside.com>

Hi Justin,

TRCA staff reviewed the materials and are satisfied that the proposed separation is sufficient.

Please let me know if you have further questions.

Regards,

Hamedeh Razavi MURP
Planner - York East Review Area
Development Planning and Permits | Development and Engineering Services

T: 437-880-1940
E: Hamedeh.Razavi@trca.ca
A: 101 Exchange Avenue, Vaughan, ON, L4K 5R6 | trca.ca

Toronto and Region Conservation Authority

From: Justin Ma <j.ma@jandb-inc.com>
Sent: Monday, March 4, 2024 11:19 AM
To: Don Ford <Don.Ford@trca.ca>
Cc: James Sam <j.sam@jandb-inc.com>; Elyse Dickson <Elyse.Dickson@trca.ca>; Rachael Buccella <rachael@fairgatehomes.com>; Daniel Ronco <daniel@fairgatehomes.com>; Bruce Alexander <Bruce.Alexander@rjburnside.com>
Subject: Re: 35/45 Gordon Collins Infiltration/Retention Tank Design

EXTERNAL SENDER

[Quoted text hidden]

James Sam <j.sam@jandb-inc.com> Tue, Mar 5, 2024 at 12:56 PM
To: Justin Ma <j.ma@jandb-inc.com>

Hi Justin,

Please file this correspondence in the project folder.
Will be used in our appendix.

James Sam, P.Eng | President
J+B Engineering Inc.
25 Centurian Drive, Suite 201
Markham, ON L3R 5N8

O: 416.229.2636 x 205
F: 416.229.6965
E: j.sam@jandb-inc.com

[Quoted text hidden]